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WATER-LEVEL DATA FROM WELLS AND TEST HOLES THROUGH 1991 AND POTENTIOMETRIC CONTOURS AS OF 1991 FOR YUCCA FLAT, NEVADA TEST SITE, NYE COUNTY, NEVADA

By Glenn S. Hale, Douglas A. Trudeau, and Charles S. Savard

Prepared in cooperation with
U.S. Department of Energy under
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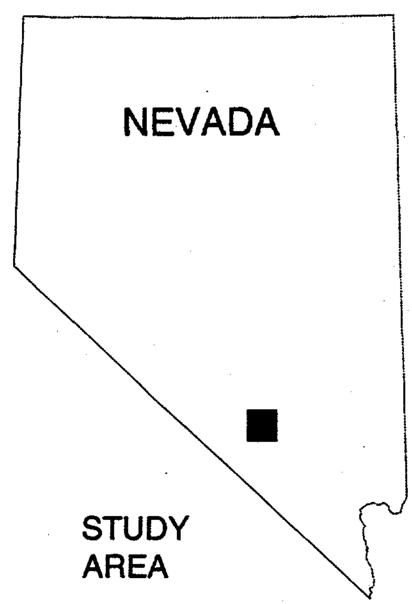

WATER-RESOURCES INVESTIGATIONS REPORT 95-4177
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INTRODUCTION

The underground nuclear testing program of the U.S. Department of Energy (USDOE) takes place at the Nevada Test Site (NTS), about 65 mi north-west of Las Vegas, Nev. Underground nuclear tests at Yucca Flat, one of the USDOE test areas at NTS, have affected hydrologic conditions, including ground-water levels (Knox and others, 1965; Garber, 1971, p. 207; Hawkins and others, 1987, 1990).

The purpose of this map report, prepared in cooperation with USDOE, is to present selected water-level data collected from wells and test holes through December 1991, and to show potentiometric contours representing 1991 water-table conditions in the Yucca Flat area. The more generic term, potentiometric contours, is used herein rather than "water-table contours" because the hydrologic units contributing water to wells and test holes may not accurately represent the water table. The water table is that surface in an unconfined water body at which the pressure is atmospheric (Lohman and others, 1972, p. 14). It is defined by the altitude at which non-perched ground water is first found in wells and test holes. Perched ground water is defined as unconfined ground water separated from an underlying body of ground water by an unsaturated zone (Lohman and others, 1972, p. 7). This map report updates information on water levels in some wells and test holes and the resulting water-table contours in rocks of Cenozoic and Paleozoic age shown by Doty and Thordarson (1983) for 1980 conditions. In this report, Doty and Thordarson's map is referred to as "the earlier map."

INFORMATION AND DATA SOURCES

Information used to prepare this map includes (1) the location and Raytheon Services Nevada (RSN) hole number that identifies wells and test holes at NTS; (2) water-level data from wells and test holes and dates of measurement; (3) the geologic contact between juxtaposed hydrologic units of Cenozoic and Paleozoic age near the water table; (4) the identity of hydrologic units contributing water to a well or test hole, except for dry holes and those with liner leaks, as indicated by the well and test-hole symbol; (5) the land-surface trace of major faults; and (6) the distribution of hydrologic units near the water table.

Well and test-hole locations and their RSN hole number are from drill-hole summaries by RSN (unpublished data on file at Mercury, Nev., 1960-91). Information regarding the nomenclature used in RSN hole numbering is described by Wood (1992, p. 2). Most water-level measurements were made by the U.S. Geological Survey using a steel tape or electrical cable device as described by Garber and Koopman (1968). Water-level data were obtained from Doty and Thordarson (1983), and U.S. Geological Survey and RSN files.

The contact between juxtaposed Cenozoic and Paleozoic hydrologic units (CZ-PZ contact) near the water table is from Doty and Thordarson (1983). The contact was modified near hole UE-4ab and Water Well C and additional contacts added near hole UE-14a and Water Well 4 on the basis of unpublished hydrologic information from James C. Cole (U.S. Geological Survey, written commun., 1992).

Information on the hydrologic units contributing water to a well or test hole is based on lithologic descriptions and well or test-hole construction data. Lithologic information is from U.S. Geological Survey and RSN files, Wagoner and Richardson (1986), Drellack and Thompson (1990), and Lawrence Livermore and Los Alamos National Laboratories files. Well and test-hole construction information is from Thordarson and others (1967), and U.S. Geological Survey and RSN files. Data from the wells and test holes that penetrated the saturated Cenozoic hydrologic unit can be qualified to indicate how closely the water level in a well or test hole represents the water table. Water levels in wells and test holes completed just below the water table and open to less than 25 percent of the total saturated thickness of the Cenozoic hydrologic unit, are more representative of water-table conditions than water levels in wells and test holes open to a larger percentage of saturated Cenozoic rocks. Emphasis was placed on selecting wells and test holes completed near the water table and open to a small percentage of saturated hydrologic units.

The surface traces of major faults in the map area are from Frizzell and Shulters (1990). The distribution of hydrologic units (fig. 1) near the water table is similar to that shown on plate 2 of Winograd and Thordarson (1975), but was modified on the basis of information from James C. Cole (U.S. Geological Survey, written commun., 1992).

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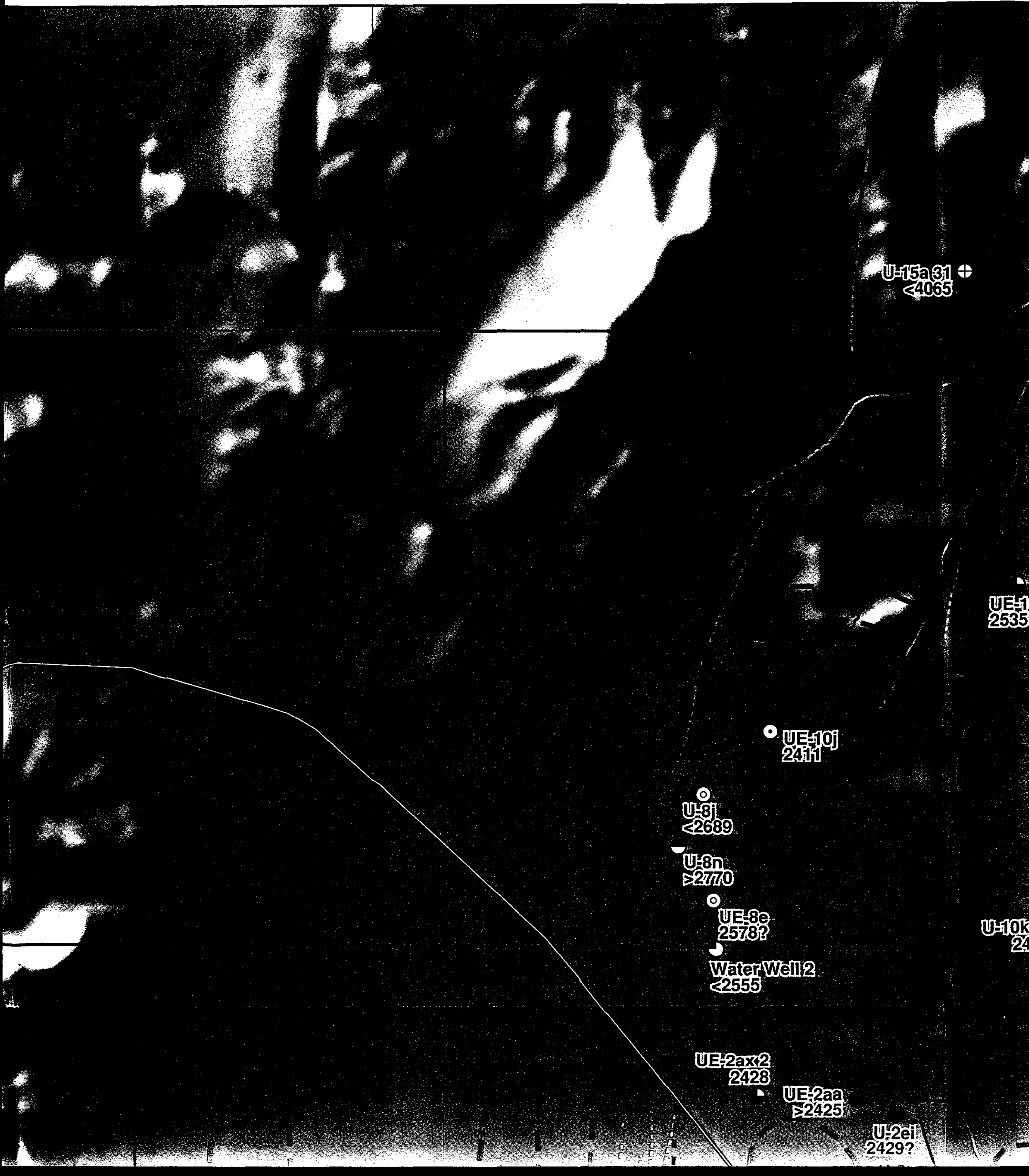

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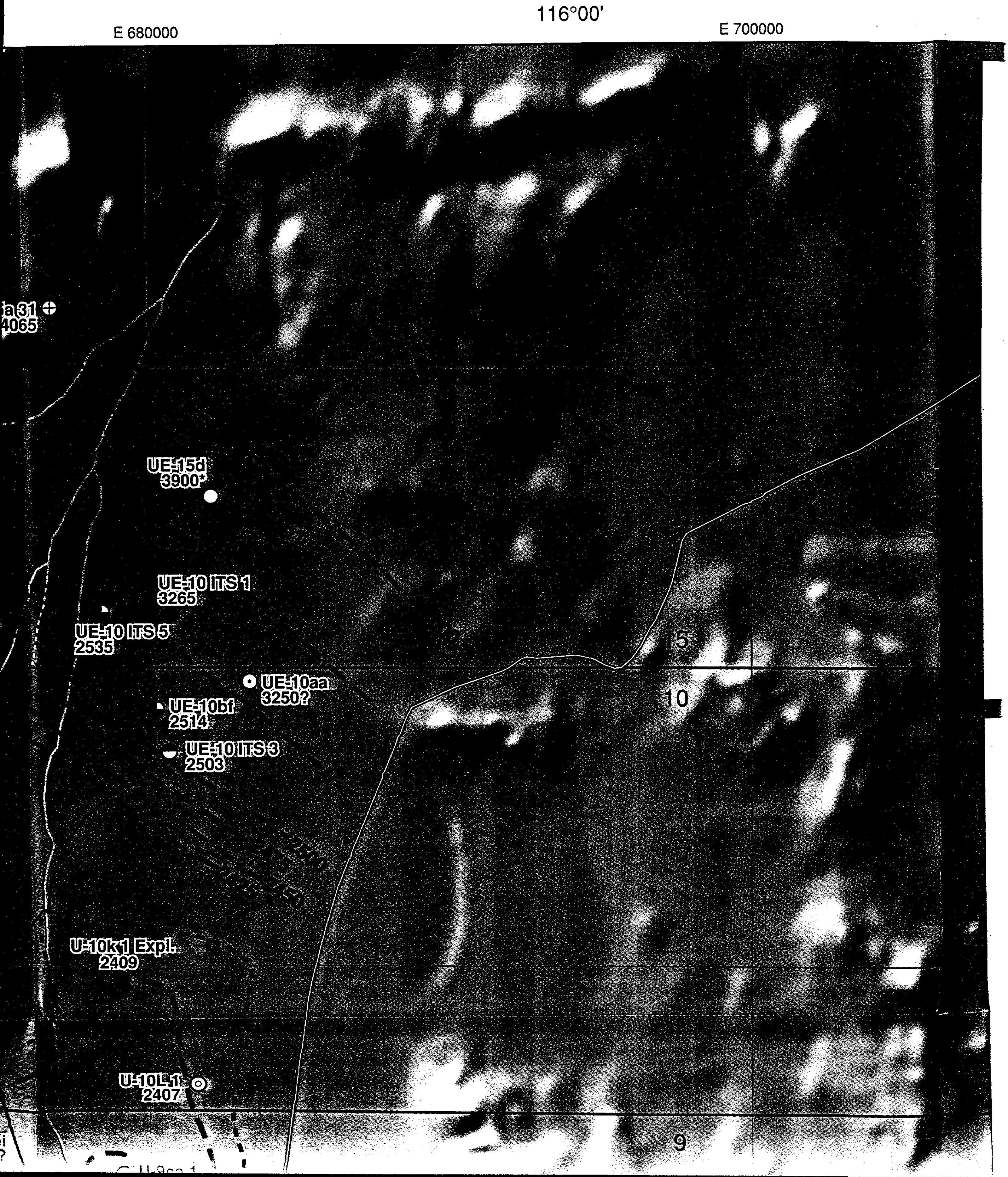

WATER-RESOURCES INVESTIGATIONS REPORT 95-4177

Hale, G.S., and others, 1995, Water-level data from wells and test holes through 1991, and potentiometric contours as of 1991 for Yucca Flat, Nevada Test Site, Nye County, Nevada

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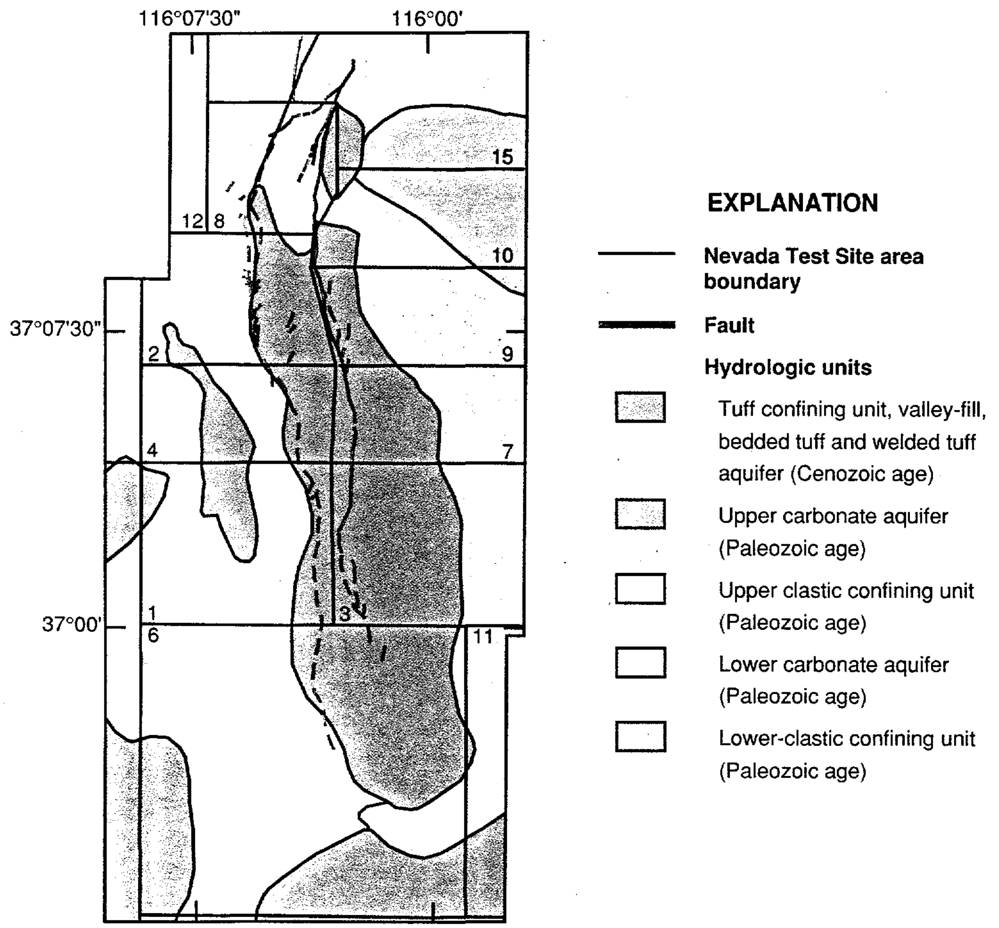

Figure 1. Generalized distribution of hydrologic units near water table.

Table 1. Water-level measurements from wells and test holes at Yucca Flat through December 1991

[Symbols for depth to water: <, water level higher than measured value, or rising during period of record; >, water level lower than measured value, or declining during period of record, or below total depth of hole. Symbols for water-level altitude: <, water level lower than measured value, or declining during period of record, or below total depth of hole; >, water level higher than measured value, or rising during period of record. Symbols for depth to water and water-level altitude: ?, water-level data are uncertain; measurements were made soon after hole completion, whereas water levels commonly do not stabilize for a year or more]

Well and text hole number or site name	Land-surface altitude (feet above sea level)	Depth to water (feet below land surface)	Water-level altitude (feet above sea level)	Date (month-day year)
AREA 1				
UE-1L[1]	4,454.4	519.5	3,935	09-17-91
UE-1a[1]	4,303.2	545.6	3,758	09-17-91
UE-1b[1]	4,272.8	644.8	3,628	09-17-91
UE-1c[1]	4,205.8	1,297.4	2,908	09-17-91
UE-1d[1]	4,295.7	535.9 ?	3,760 ?	04-16-64
UE-1f[1]	4,277.1	628.5	3,649	04-16-64
UE-1h	3,995	1,556.8	2,438	09-17-91
UE-1k[1]	4,051	1,603.5	2,448	01-21-73
UE-1q[2]	4,081.6	1,553.4	2,528	09-17-91
UE-1r	4,041.8	1,626 ?	2,416 ?	01-28-84

Ground water beneath Yucca Flat is within different lithologic units, including alluvium, tuff, dolomite, limestone, argillite, sandstone, shale, and granite. These rocks have been classified as the following hydrologic units (Winograd and Thordarson, 1975, p. C47): valley-fill, welded-tuff, bedded-tuff, upper carbonate, and lower carbonate aquifers; and tuff, granitic-stock, upper clastic, and lower clastic confining units (fig. 1). These hydrologic units have been grouped on the basis of geologic age (Cenozoic or Paleozoic) to simplify the presentation of hydrologic units on this map and to be consistent with the earlier map. However, the Mesozoic granitic-stock confining unit is not shown on the map because it is limited in areal extent and only one (dry) hole, U-15a 31, is within this unit. The Cenozoic hydrologic unit includes the valley-fill, welded-tuff, and bedded-tuff aquifers and the tuff confining unit. The Paleozoic hydrologic unit includes the upper and lower carbonate aquifers, and the upper clastic and lower clastic confining units. The oldest part of the lower clastic confining unit is Precambrian in age, but is included on the map as the Paleozoic lower clastic confining unit.

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The Paleozoic upper clastic confining unit (fig. 1) is found near the water table in the western part of this map, west of the north-south Cenozoic-Paleozoic contact shown near holes U-8n,UE-4ab, UE-1h and Test Well D. This confining unit is overlain by saturated Cenozoic hydrologic units near holes UE-1b, UE-14a, and UE-14b, principally the tuff confining unit. Water levels in wells and test holes completed in the upper clastic confining unit are generally more than a thousand feet higher in altitude than water levels in wells and test holes in the eastern part of the study area (Winograd and Thordarson, 1975, p. C53). The Paleozoic upper carbonate aquifer (fig. 1) also is found near the water table in the western part of the study area, near holes UE-17a and UE-16d.

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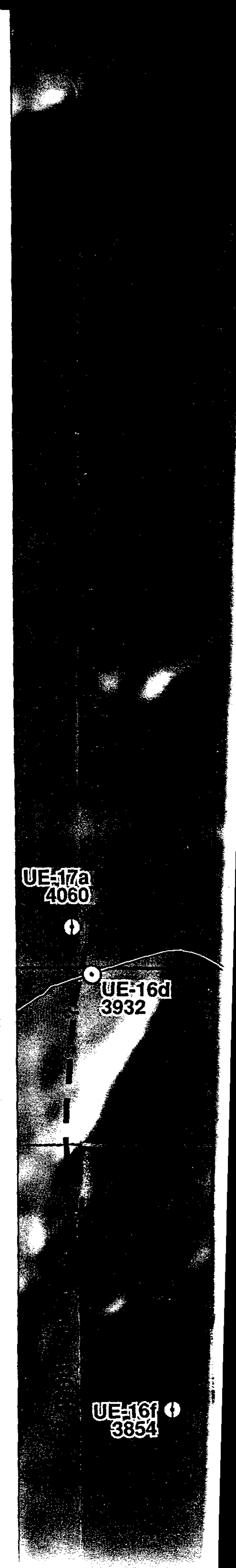
The Paleozoic hydrologic unit, east of the north-south Cenozoic-Paleozoic contact shown near holes U-8n, UE-4ab, UE-1h, and Test Well D is the lower carbonate aquifer. This aquifer is overlain by the Cenozoic hydrologic unit (fig. 1), principally the tuff confining unit, in the central part of this map. Water-level altitudes in the Cenozoic hydrologic unit are higher than those in the underlying and adjacent Paleozoic lower carbonate aquifer. This Paleozoic aquifer also is partly overlain by the Cenozoic tuff confining unit in the north-central part of the map near holes UE-10 ITS 5, UE-10bf, and UE-10 ITS 3, and in the south near Water Wells 4 and 4a.

The Paleozoic lower clastic confining unit (fig. 1) is found near the water table in the north-northeastern part of the map near holes UE-15d and UE-10aa. This hydrologic unit is partly overlain by the Cenozoic hydrologic unit, principally the tuff confining unit near hole UE-10 ITS 1. Water levels in wells and test holes in this area of the map are several hundred feet higher in altitude than water levels in wells and test holes farther south.

Perched ground water commonly is associated with confining units near or above the regional water table. Perched ground water occurs erratically at NTS (Winograd and Thordarson, 1975, p. C52) and is found locally within the Yucca Flat map area.

Ground-water flow originates in recharge areas outside the map area to the west and north-northwest. Ground water moves from these source areas through the Paleozoic confining units in the west and north-northwest and into the Paleozoic lower carbonate aquifer in the central part of Yucca Flat (see map). Ground water also may move through the Paleozoic lower carbonate aquifer underlying the Paleozoic upper clastic confining unit in the west, into the central part of Yucca Flat (Winograd and Thordarson, 1975, p. C66). Ground water also percolates downward to the Paleozoic lower carbonate aquifer in the central part of Yucca Flat from the Cenozoic hydrologic unit; the mechanism for this flow is not well known. Ground-water flow in the Paleozoic lower carbonate aquifer is toward the south-southeast beyond the map area (Winograd and Thordarson, 1975, pl. 1).



Although the actual ground-water flow system in Yucca Flat is much more complex than discussed above (see Winograd and Thordarson, 1975), the concept of the ground-water flow system is useful for interpreting potentiometric contours from water-level data.

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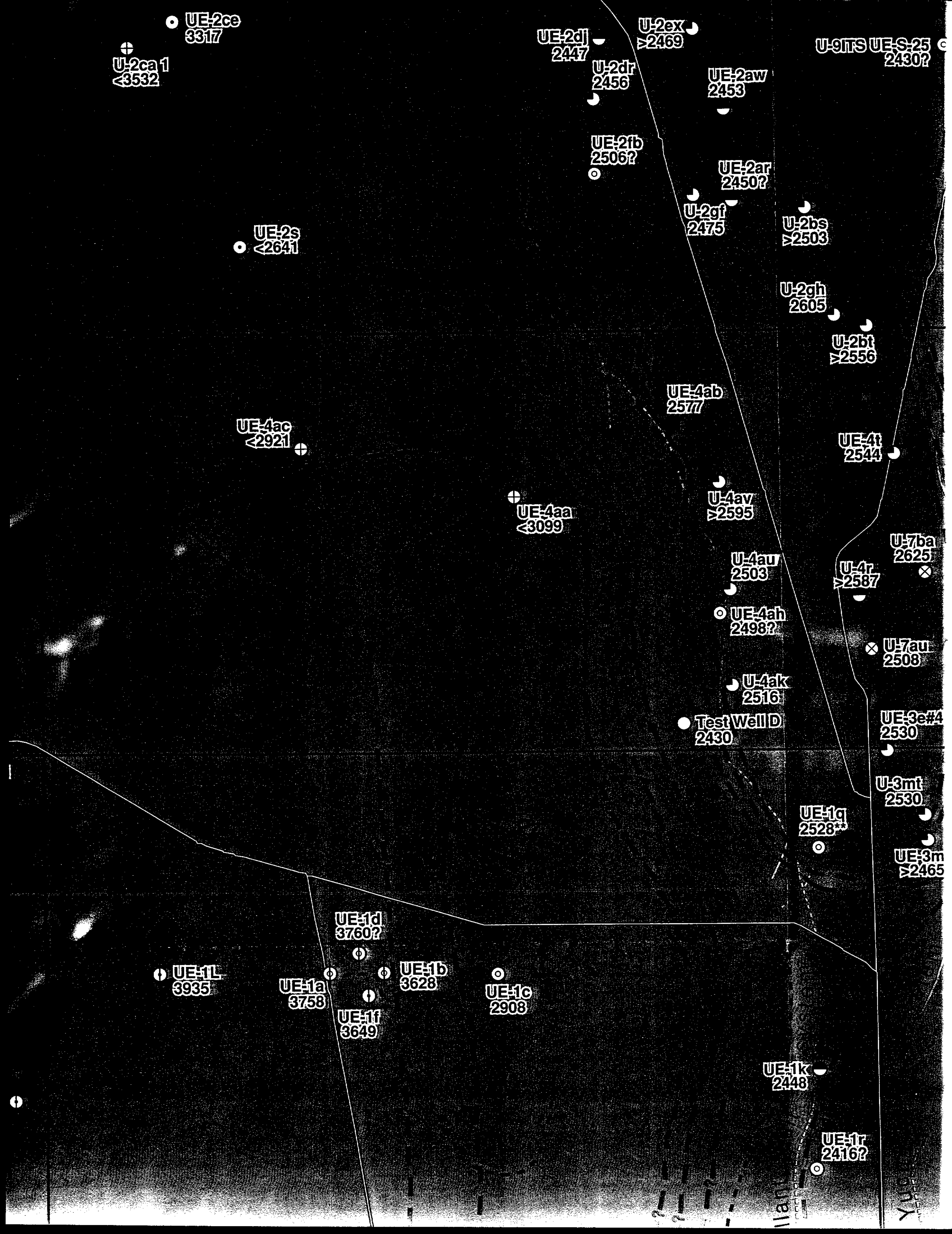
DISCUSSION OF WATER LEVELS

Water-level data from 91 sites, including information from 54 sites shown on the earlier map, are shown on this map and listed in table 1. Potentiometric contours are drawn from water-level data to represent the altitude of the water table. The water-level data were contoured considering the hydrologic setting, including the concept that water levels within the Cenozoic hydrologic unit in the central part of Yucca Flat are higher than those in the adjacent and underlying Paleozoic hydrologic unit. This hydrologic concept is illustrated by comparing the water levels in holes U-7ca, U-7cb, U-8n, and U-4ak completed in Cenozoic hydrologic unit, with water levels in nearby holes UE-7aa, UE-7nS, UE-10j, and Test Well D completed in Paleozoic hydrologic unit. Potentiometric contours in the Cenozoic hydrologic units in the central part of Yucca Flat were drawn to reflect this concept along the Cenozoic-Paleozoic contact in areas with little or no water-level data.

Water-level altitudes ranged from about 2,377 ft to 2,770 ft above sea level in the central part of Yucca Flat and from about 4,060 ft to 2,503 ft above sea level in the western and northern parts of Yucca Flat.

The most notable feature in the central part of Yucca Flat is the presence of four ground-water mounds. The central mound, defined by a closed 2,450-ft contour on the map, extends from hole U-9cal


UE-2ce
3317
U-2ca 1
<3532
UE-2dj
2447
U-2ex
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U-9ITS UE-S-25
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U-2dr
2456
UE-2aw
2453
UE-2fb
2506?
UE-2ar
2450?
U-2gf
2475
U-2bs
>2503
UE-2s
<2641
U-2gh
2605
U-2bt
>2556
UE-4ab
2577
UE-4ac
<2921
UE-4t
2544
U-4av
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U-7ba
2625
U-4au
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U-4r
>2587
UE-4ah
2498?
U-7au
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2516
Test Well D
2430
UE-3e#4
2530
U-3mt
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UE-1q
2528**
UE-3m
>2465
UE-1d
3760?
UE-1L
3935
UE-1b
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UE-1a
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UE-1c
2908
UE-1f
3649
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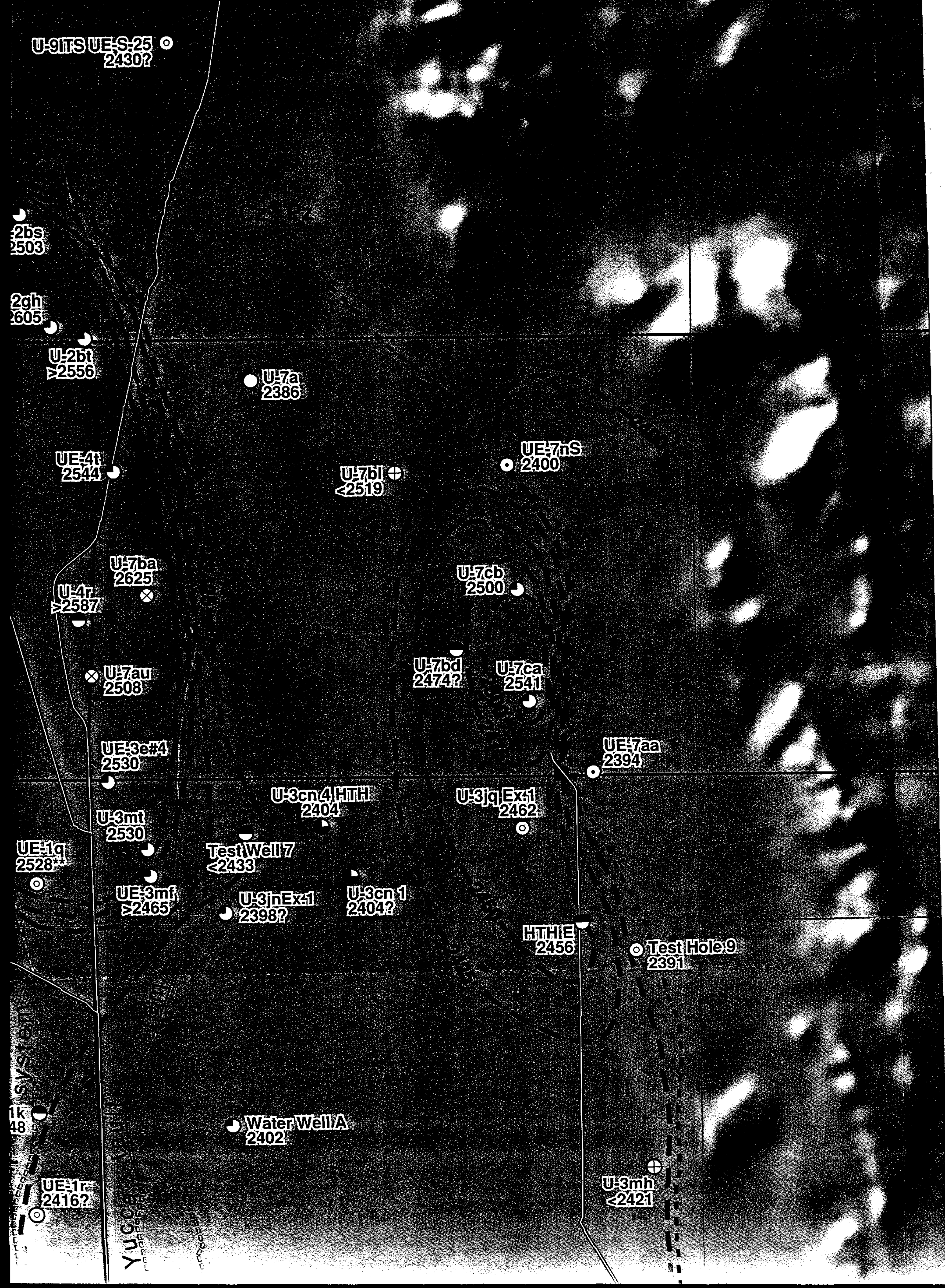
2416?


U-9ITS UE-S-25
2430?
-2bs
2503
2gh
2605
U-2bt
>2556
U-7a
2386
UE-4t
2544
U-7bl
<2519
UE-7nS
2400
U-7ba
2625
U-4r
>2587
U-7cb
2500
U-7au
2508
U-7bd
2474?
U-7ca
2541
UE-3e#4
2530
UE-7aa
2394
U-3cn 4 HTH
2404
U-3jq Ex-1
2462
U-3mt
2530
UE-1q
2528**
Test Well 7
<2433
UE-3mf
>2465
U-3jnEx-1
2398?
U-3cn 1
2404?
HTH E
2456
Test Hole 9
2391
Water Well A
2402
UE-1r
2416?
U-3mh
<2421
Yucca
System

U-2ca 1[1,3]	4,871.1	>1,339	<3,532	05-29-65
U-2dr[1]	4,313.2	1,857	2,456	05-21-74
U-2ei[1]	4,327.4	1,898 ?	2,429 ?	04-16-77
U-2ex	4,311.3	<1,842	>2,469	07-22-83
U-2gf	4,248.8	1,774.1	2,475	06-24-87
U-2gh	4,177.2	1,572.1	2,605	09-01-89
UE-2aa[1]	4,347.6	1,922.6	>2,425	11-19-75
UE-2ar	4,240.7	1,791 ?	2,450 ?	07-07-75
UE-2aw[1]	4,272	1,819.3	2,453	03-19-73
UE-2ax 2[1]	4,396.4	1,968	2,428	02-23-73
UE-2ce[1]	4,764.4	1,447	3,317	12-04-91
UE-2dj[1]	4,341	1,894	2,447	08-06-71
UE-2fb[1]	4,274.1	1,768 ?	2,506 ?	10-01-77
UE-2s[1]	4,583.4	>1,942	<2,641	12-16-64
Water Well 2[1]	4,470	>1,915	<2,555	03-28-61
		AREA 3		
Test Well 7[1]	4,063.4	>1,630.2	<2,433	12-10-91
HTH "E"[1]	4,172	1,716.4	2,456	11-30-60
U-3cn 1[1]	4,074	1,669.7 ?	2,404 ?	06-14-63
U-3cn 4 HTH[1]	4,083.7	1,680.1	2,404	09-06-63
U-3jg[1]	3,961.5	1,549.8 ?	2,412 ?	09-09-72
U-3jn Ex. 1[1]	4,045.8	1,647.7 ?	2,398 ?	07-02-71
U-3jq Ex. 1[1]	4,174.5	1,712.6	2,462	02-03-72
U-3ks[1]	3,965.5	1,549	2,416	10-07-77
U-3kv	3,956.3	1,533.9	2,422	01-28-91
U-3mh[3]	4,091.6	>1,671	<2,421	03-20-86
U-3mi[2]	4,003.5	<1,572.5	>2,431	09-18-91
U-3mt	4.067.3	1,537.4	2,530	06-18-91
UE-3e#4	4,082.3	1,552.1	2,530	12-16-91
UE-3mf	4,066	<1,601	>2,465	10-02-86
Test Hole 9	4,176	1,785	2,391	01-17-69
Water Well A[1]	4,006	1,604	2,402	08-28-60
		AREA 4		
Test Well D[1]	4,152	1,721.9	2,430	09-18-91
U-4ak	4,130.5	1,615	2,516	07-10-81
U-4au	4,144.5	1,641.1	2,503	05-09-88
U-4av	4,177.6	<1,582.4	>2,595	08-20-91
U-4r	4,119.4	<1,532	>2,587	05-02-84
UE-4aa[1,3]	4,253.8	>1,155	<3,099	03-20-73
UE-4ab[1]	4,201	1,624	2,577	04-17-82
UE-4ac[1,3]	4,471	>1,550	<2,921	04-09-74
UE-4ah[1]	4,141.9	1,644 ?	2,498 ?	11-20-78
UE-4t	4,143.6	1,600	2,544	01-16-87
		AREA 6		
U-6e[3]	3,941.98	>1,489	<2,453	06-07-84
Test Well B Ex.[1]	3,929	1,504.4	2,425	09-18-91
UE-6d[1]	3,947	1,515.5	2,432	09-18-91
UE-6e[1, 2]	3,935.6	1,510.1	2,426	09-18-91
Water Well 4	3,601.5	835.3	2,766	12-11-91
Water Well 4A	3,606	835.2	2,771	08-23-91
Water Well 3[1, 4]	3,969	1,543.7	2,425	01-10-80
Water Well C[1]	3,921	1,544	2,377	10-18-75
UE-14a	4,339.1	1,646	2,693	09-14-83
UE-14b	4,353.4	1,666.7	2,687	09-25-91
		AREA 7		
U-7a[1]	4,254.9	1,868.4	2,386	08-26-63
U-7au	4,110.6	1,603	2,508	03-28-78
U-7ba	4,129.3	1,504	2,625	07-21-80
U-7bd[1]	4,223.5	1,749 ?	2,474 ?	06-25-78
U-7bl[3]	4,316.8	>1,798	<2,519	04-30-85
U-7ca	4,244	1,703	2,541	10-18-88
U-7cb	4,286.5	1,786	2,500	02-27-91
UE-7aa[1]	4,258.6	1,865	2,394	03-06-72
UE-7nS[1]	4,369.8	1,969.9	2,400	12-23-91
		AREA 8		
U-8j	4,556.3	>1,867	<2,689	09-19-84
U-8n	4,542	<1,772	>2,770	09-10-84
UE-8e[1]	4,488.5	1,910.8 ?	2,578 ?	04-11-75
UE-10 ITS 5[1]	4,522	1,987	2,535	05-13-77
UE-10j[1]	4,573.7	2,162.9	2,411	01-20-73
		AREA 9		
U-9 ITS UE-S-25[1]	4,222.1	1,729.1 ?	2,430 ?	04-27-71
[illegible]	4,244.1	1,779.9	2,464	03-09-78
		AREA 10		
[illegible]	[illegible]	1,863.5	[illegible]	[illegible]

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in areas with little or no water-level data.

Water-level altitudes ranged from about 2,377 ft to 2,770 ft above sea level in the central part of Yucca Flat and from about 4,060 ft to 2,503 ft above sea level in the western and northern parts of Yucca Flat.

The most notable feature in the central part of Yucca Flat is the presence of four ground-water mounds. The central mound, defined by a closed 2,450-ft contour on the map, extends from hole U-9ca1 in the north to UE-1q in the south, and is bounded by the Yucca fault system on the east and the Carpetbag/Topgallant fault system on the west. This mound, which is more extensive than the two ground-water mounds shown on the earlier map, may be the result of underground nuclear tests (Hoover and Trudeau, 1987, p. 363). Other ground-water mounds are shown centered at hole UE-8e, defined by the closed 2,450-ft contour; at hole U-7ca, defined by the closed 2,425-ft contour; and at hole U-6e, defined by the closed 2,425-ft contour. The mounds near holes UE-8e and U-7ca may not be the result of underground nuclear testing, because elevated water levels may have existed there prior to underground nuclear testing. Water levels measured in Water Well 2 and HTH-E, which are located within the water-level mounds associated with UE-8e and U-7ca, respectively, pre-date the period of underground nuclear testing at or below the water table (see table 1).

The principal differences between the contours of the 1980 data and the 1991 data are reflected in the areal extent and number of ground-water mounds, the removal of the hydraulic sink in north-central Yucca Flat, the revised interpretation of the north-south trending 2,425- through 2,500-ft contours along the eastern side of Yucca Flat, and the addition of a 4,000-ft contour on the western side of Yucca Flat. These differences are attributed to additional water-level data and the hydrologic concept that water levels within the Cenozoic hydrologic unit are higher than those in adjacent and underlying Paleozoic hydrologic unit.

Potentiometric contours are interpreted from water-levels of several hydrologic units; interpretations of lateral flow between or across these units may not represent the dominant flow direction. Flow within the Cenozoic hydrologic unit in central Yucca Flat is not completely understood, but may have a downward component toward the underlying Paleozoic hydrologic unit not indicated by the contours.

The potentiometric contours were drawn to best represent water-table conditions, but care should be taken in using the map for interpretation because of limitations of the available data. Limiting factors in representing water-table conditions with the available data include an inadequate network for delineating contours using only 1991 water-level data; the effect of confining units in Yucca Flat, including the possibility that a well or test hole penetrates perched ground water; the use of composite water-levels (that is, both Cenozoic and Paleozoic hydrologic unit contributing water to a well or test hole) in areas with known vertical hydraulic gradients; and transient water levels in Yucca Flat caused by nuclear testing. In recognition of these limitations, only dashed (inferred) or dashed and queried (uncertain) potentiometric contour symbols are used.

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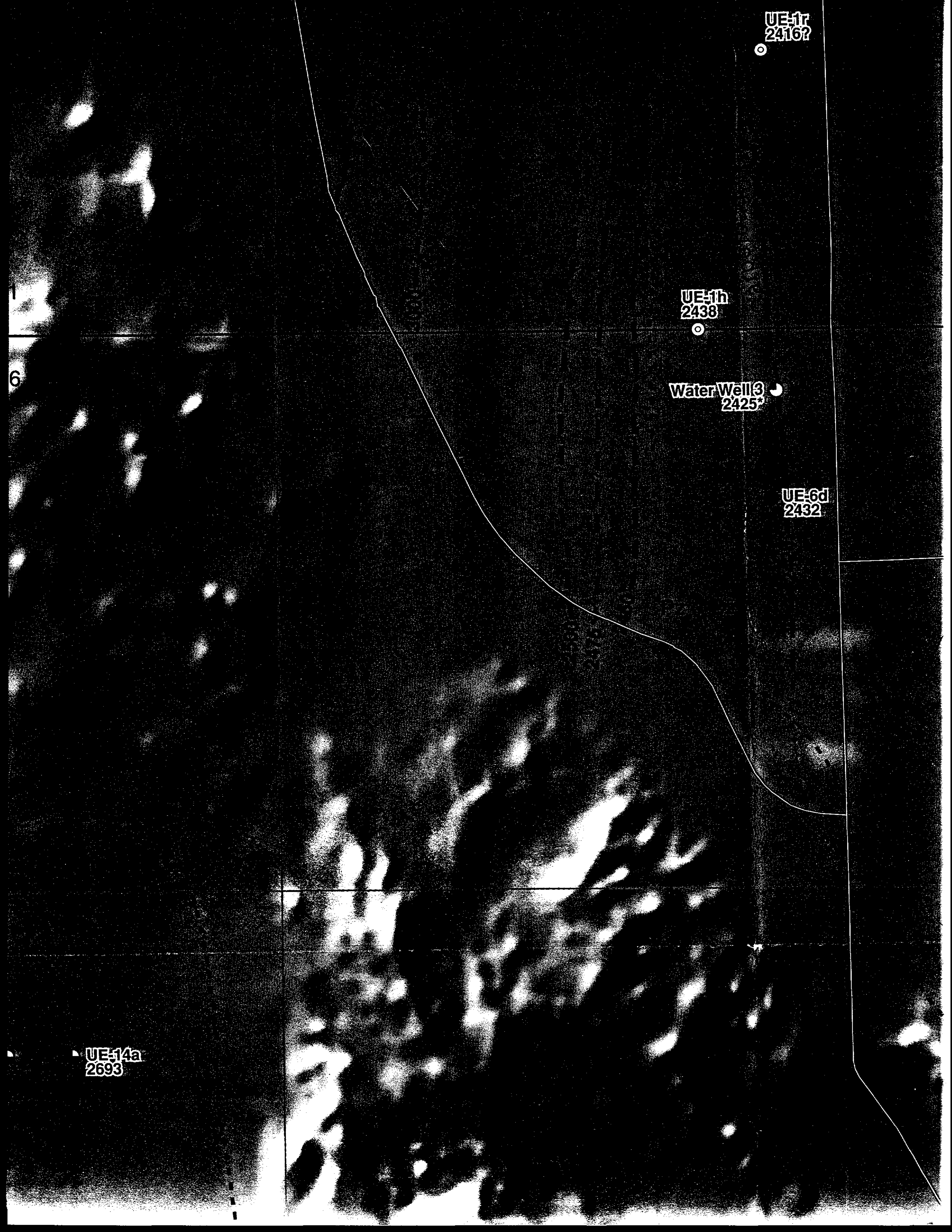
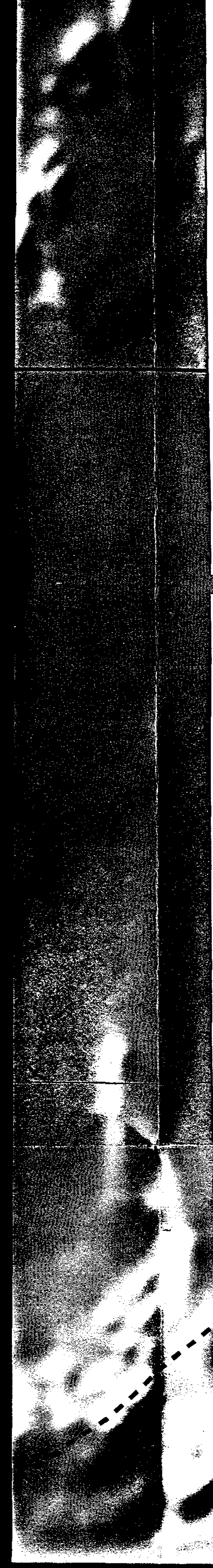

UE-1r
2416?
1
UE-1h
2438
6
Water Well 3
2425*
UE-6d
2432
UE-14a
2693

6?
<2421
U-3ks
2416
U-3jg
2412?
U-3kv
2422
U-3mi
>2431**
2425
U-6e
<2453
UE-6e
2426**
UE-6d
2432
Test Well B Ex.
2425
Yucca
Lake
Playa
Water Well C
2377
C
P
?



		AREA 9		
U-9 ITS UE-S-25[1]	4,222.1	1,729.1 ?	2,430 ?	04-27-71
U-9ca 1[1,2]	4,244.1	1,779.9	2,464	03-09-78
		AREA 10		
U-10k 1 Expl.[1]	4,272.3	1,863.5	2,409	01-19-65
U-10L 1[1]	4,264.4	1,857.3	2,407	01-14-80
UE-10 ITS 3[1]	4,352.7	1,849.4	2,503	09-01-89
UE-10aa	4,401.3	1,151.2 ?	3,250 ?	01-14-80
UE-10bf[1]	4,387	1,873	2,514	04-05-82
		AREA 15		
U-15a 31[3]	5,112	>1,047	<4,065	04-29-59
UE-15d[1,4] (water well)	4,586.2	686.3	3,900	01-13-83
UE-10 ITS 1	4,486.2	1,221.4	3,265	07-14-86
		AREA 16		
UE-16d (water well)	4,684.2	752	3,932	05-23-77
UE-16f	4,651.5	798	3,854	08-26-77
		AREA 17		
UE-17a	4,696.5	636.7	4,060	09-23-91

[1] Wells and test holes shown by Doty and Thordarson (1983).

[2] Composite water level is at altitude comparable to water-level altitudes in surrounding wells and test holes completed in Cenozoic units.

[3] Yucca Flat hole with water level below bottom of hole.

[4] Pumping status was unknown at time water level was measured; water level may have been affected by recent pumping.

N 820000

37°00'

EXPLANATION

Fault–Shows land-surface trace of major fault. Dashed where concealed

Cz / Pz — **Contact between hydrologic units of Cenozoic (Cz) and Paleozoic (Pz) age near water table**–In region labeled Cz, water table is within Cenozoic hydrologic unit; underlying Paleozoic hydrologic unit is saturated. In region labeled Pz, water table is within Paleozoic hydrologic unit; overlying Cenozoic hydrologic unit is unsaturated, except for local perched water

— ? –2400– **Potentiometric contour**–Shows approximate altitude of water table, 1991. Queried where uncertain. Contour intervals 25 and 500 feet. Datum is sea level. Potentiometric contours are interpreted from water-levels of several hydrologic units; interpretations of lateral flow between or across these units may not represent dominant flow direction

Nevada Test Site boundary

16 — **Nevada Test Site area boundary and number**

N 800000

Wells and test holes–Wells and test holes used for water-level control. Upper alphanumeric description is Raytheon Services Nevada hole number or site name. Lower number is water-level altitude, in feet above sea level. Symbols: <, water level lower than measured value, or declining during period of record, or below total depth of hole; >, water level higher than measured value, or rising during period of record; ?, water level uncertain (measurement made soon after hole completion); *, pumping status in water well was unknown at time water level was measured–water level may have been affected by pumping; **, composite water level is at altitude comparable to those in surrounding wells and test holes completed in Cenozoic units

U-3ks 2416 — Hole penetrates 25 percent or less of saturated Cenozoic hydrologic unit

Test Well 7 <2433 — Hole penetrates 26 to 50 percent of saturated Cenozoic hydrologic unit

U-3cn 1 2404? — Hole penetrates 51 to 75 percent of saturated Cenozoic hydrologic unit

UE-2aa >2425 — Hole penetrates more than 75 percent of saturated Cenozoic hydrologic unit

Test Well D — [illegible] Water level in overlying Cenozoic

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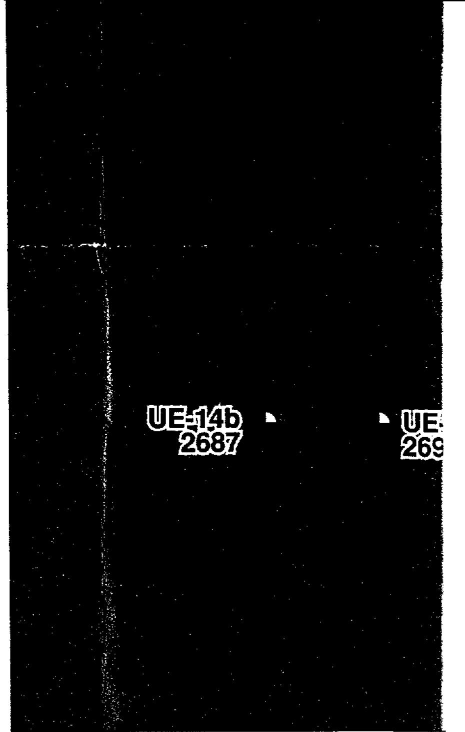
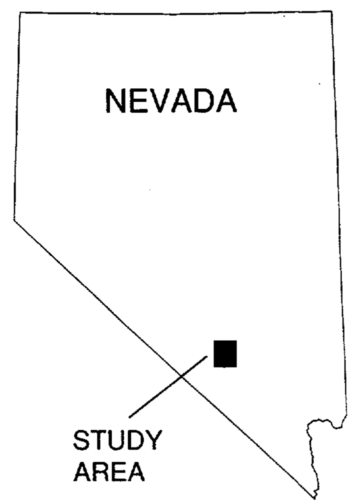


SEA LEVEL: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called "Sea-Level Datum of 1929"), which is derived from a general adjustment of the first-order leveling networks of the United States and Canada.



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000

30"

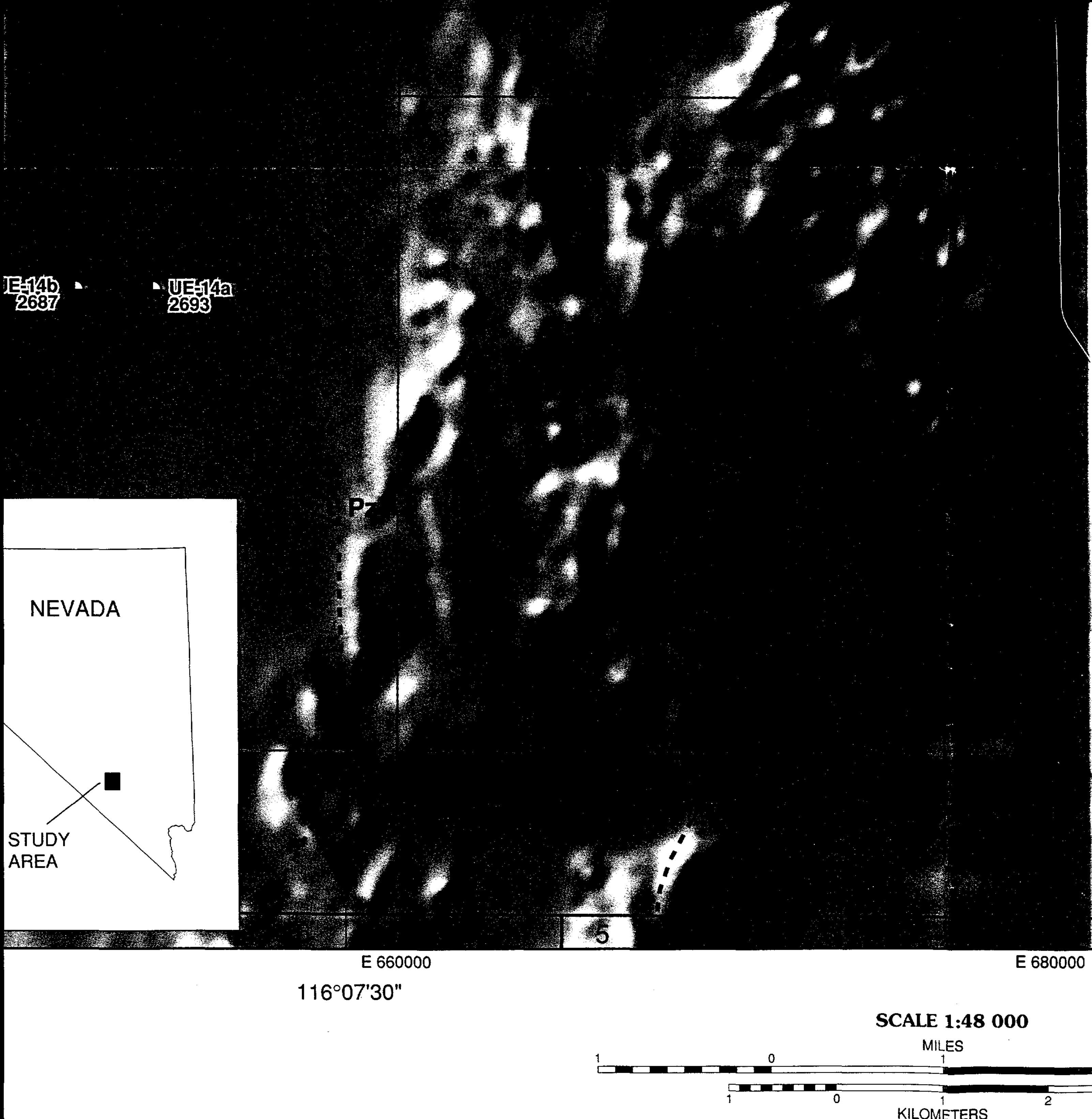
E 640000

16°15'00""

Base from U.S. Geological Survey digital elevation data,1:100,000, 1979-88; Universal Transverse Mercator projection, Zone 11. Shaded-relief base from 1:250,000-scale Digital Elevation Model; sun illumination from northwest at 30 degrees above horizon

WATER-LEVEL DATA I

DISCLAIMER

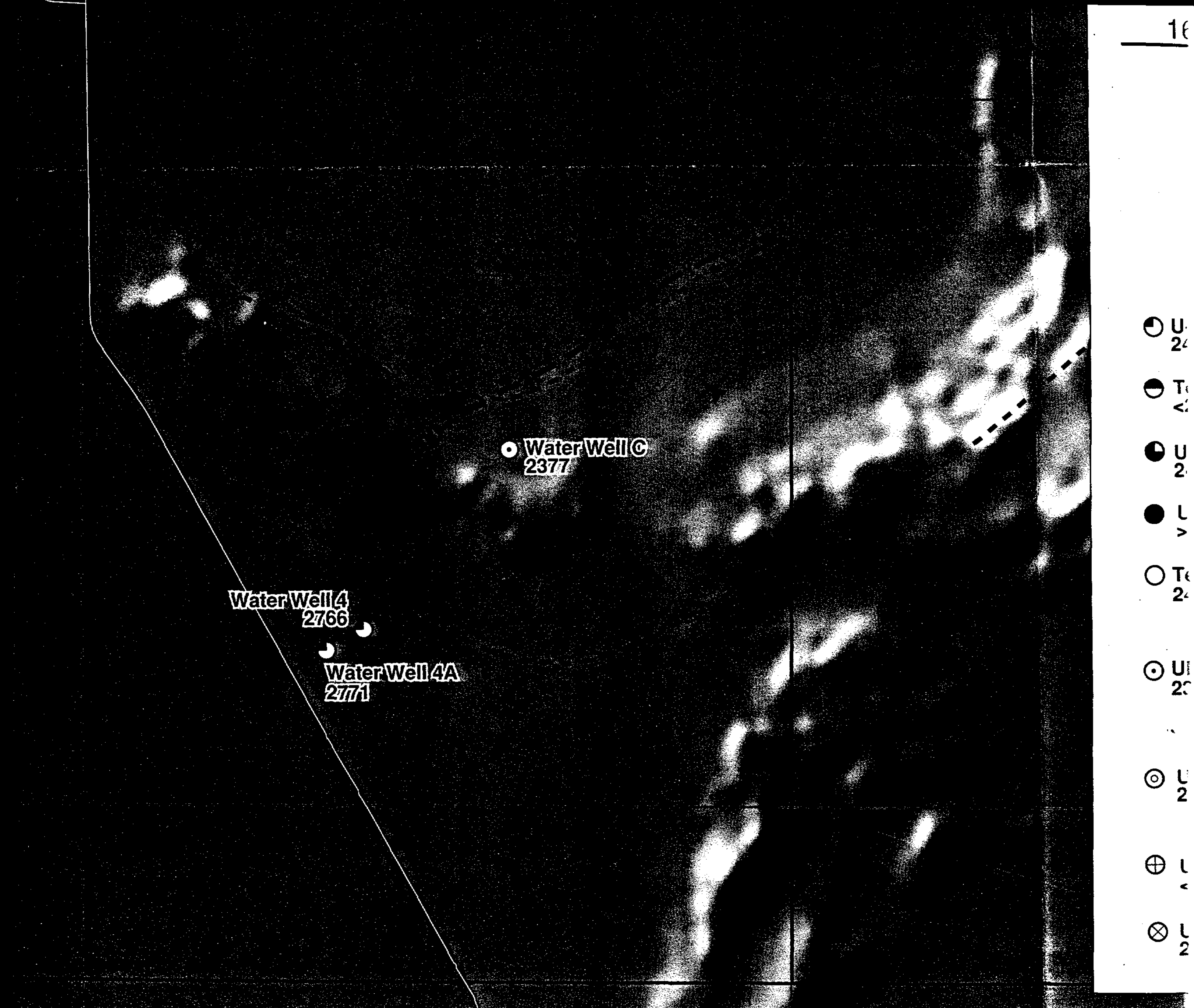


EVEL DATA FROM WELLS AND TEST HOLES THROUGH 1991, AND PO
NEVADA TEST SITE, NYE COUN

by

Glenn S. Hale, Douglas A. Trudeau, and

1995



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2 3

2 3

ND POTENTIOMETRIC CONTOURS AS OF 1991 FOR YUCCA FLAT, COUNTY, NEVADA

au, and Charles S. Savard

16 Nevada Test Site area boundary and number

Wells and test holes–Wells and test holes used for water-level control. Upper alphanumeric description is Raytheon Services Nevada hole number or site name. Lower number is water-level altitude, in feet above sea level. Symbols: <, water level lower than measured value, or declining during period of record, or below total depth of hole; >, water level higher than measured value, or rising during period of record; ?, water level uncertain (measurement made soon after hole completion); *, pumping status in water well was unknown at time water level was measured–water level may have been affected by pumping; **, composite water level is at altitude comparable to those in surrounding wells and test holes completed in Cenozoic units

U-3ks **2416**	Hole penetrates 25 percent or less of saturated Cenozoic hydrologic unit
Test Well 7 **<2433**	Hole penetrates 26 to 50 percent of saturated Cenozoic hydrologic unit
U-3cn 1 **2404?**	Hole penetrates 51 to 75 percent of saturated Cenozoic hydrologic unit
UE-2aa **>2425**	Hole penetrates more than 75 percent of saturated Cenozoic hydrologic unit
Test Well D **2430**	Hole penetrates Paleozoic hydrologic unit. Water level in overlying Cenozoic hydrologic unit is higher than measured water levels in Paleozoic hydrologic unit
UE-7aa **2394**	Hole penetrates Paleozoic hydrologic unit under water-table conditions. Overlying Cenozoic hydrologic unit is unsaturated except for local perched water. Vertical line through symbol indicates hole that penetrates saturated Paleozoic upper clastic confining unit
UE-1r **2416?**	Hole penetrates Cenozoic and Paleozoic hydrologic units. Measured water level is composite. Vertical line through symbol indicates hole that penetrates saturated Paleozoic upper clastic confining unit
UE-4aa **<3099**	Hole penetrates unsaturated Cenozoic hydrologic unit
U-7au **2508**	Hole has reported liner leak or flow over top of liner in area where high water pressures are found. Measured water level probably is not representative of water-table altitude

N 800000

N 780000

36°52'30"

E 720000

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1995

115°52'30"

Geology from Doty and Thordarson, 1983;
Frizzell and Shulters, 1990; and James C. Cole
(U.S.Geological Survey, written commun., 1992)

YUCCA FLAT,