LUHDORFF & SCALMANINI

MEMORANDUM

July 24, 1995
File No. 94-1-079

TO: Don Gilbert & Sandra Dunn
DeCuir & Somach

FROM: Joseph C. Scalmanini
Todd Bailey

SUBJECT: VWPA SUBSTANTIATION OF DAMAGES

In response to your request of June 30, 1995, Luhdorff and Scalmanini Consulting Engineers (LSCE) have assembled the information needed to further substantiate the claimed impacts. The assumptions and methodology used in the analysis have been indicated where applicable. Attachments 1, 2, and 3 have been updated and modified for clarity. The PG&E pump test data have been matched with the PG&E meter numbers and claimant well numbers (map numbers as shown on Table 1). The well description spreadsheet (Table 2) indicates the wells that broke suction in 1994 and the pumps that were converted to run on diesel. Also included is an updated summary of claims spreadsheet (Table 3).

Energy cost calculations have been modified to include additional PG&E pump-test and water-level data received since our initial assessment. The major tools for calculation of energy impacts include water-level hydrographs and contour maps, PG&E pump tests, summer energy billings, and land-use information. When the amount of applied water in acre-feet per acre was used in our analysis, the smallest value of the submitted range (shown on Table 4) was used to account for the fact that transfer pumping did not start until the month of June. For computations requiring an assumed PG&E billing rate, $0.10 per kwh was used. Our evaluations of specific claims are discussed below.

In the Durham area, energy claims for [redacted], [redacted], [redacted], and [redacted] were adjusted to better reflect the water-level impacts of the area as depicted on the contour map of

water-level change from fall 1993 to summer 1994 (Figure 1).

[redacted] The electrical claim was re-calculated based on examination of the recently obtained 1994 PG&E pump test results. In comparing the 1990 and 1994 pump tests, [redacted] average cost per acre-foot of water was slightly higher in 1994.

[redacted] The claim was recalculated based upon better correlation among pump test data and the 10-foot drop in head, as depicted on Figure 1. The resulting claim amounts were verified with PG&E pump test data.

[redacted] The electrical claim was adjusted by comparing the kilowatt-hours per acre-foot (kwh/af) in the 1978 PG&E pump test to kwh/af for 1994. For the latter, the value was estimated using Durham I.D's summer 1994 energy use for Well No. 3 and the total number of acre-feet pumped.

[redacted] The claim was adjusted based upon kwh/af from the 1985 PG&E pump test and the kwh/af computed based on the 20-foot drop in head.

In the Cherokee Strip, a value of 20 feet was used as the approximate water-level decline for wells which did not have PG&E pump test data prior to 1994. The 20-foot decline represents the smallest static water-level change in the Strip based on the fall 1993 to summer 1994 water-level change map (Figure 1). On the map, the water-level change ranges from 20 to 40 feet in the Cherokee strip.

[redacted] The summer 1993 and 1994 cost increase was used as a baseline for the claim (PG&E billings). PG&E pump tests were examined to confirm the claim amount. The increase in kwh/af between 1991 and 1994 was estimated using the pump-test information. The cost calculated from the pump-test data was higher than the billing cost increase between 1993 and 1994. The lesser value was used for the claim amount. The diesel impact was estimated using the 20-foot drop in water level to calculate the cost difference between non-impact and 1994 conditions.

[redacted] The claim for electrical impacts was determined using summer 1993 and 1994 PG&E billings. The cost difference between the two periods was checked to confirm that the amount was reasonable using the 1978 and 1994 PG&E pump-test information.

[redacted] The impact was calculated using 1992, 1993, and 1994 summer electrical usage records. The cost per acre-foot was determined for each well and year and the difference was reported as the claim amount. Neighboring well claim amounts were used to check the numbers.

[redacted] The diesel impact claim submitted by [redacted] was confirmed by calculating the 1994

and 1991 to 1993 average cost per acre-foot. The calculation was based on the amount of water applied for each year, the crop acreage, and the diesel cost per acre.

[redacted] - The cost increase from the summer 1993 to 1994 for [redacted] four pumps was used as a baseline value for the claim. This was checked by back-calculating to find the change in kwh/af based upon the cost increase submitted. The change was similar to that found for neighboring claimants and therefore appears reasonable.

[redacted] -- PG&E pump-test data were examined to establish the claim amount. Using 1980 and 1994 pump-test data, the percent increase in kwh/af was determined. It was assumed that the 1980 and 1992 electric use was the same (in 1992, Western Canal pumping did occur, but was not of the same magnitude as pumping in 1994). The cost increase for each well was estimated by coupling the energy records for the summer of 1992 and the computed percent increase in kwh/af.

No significant discrepancy in the amount of acres planted in 1994 versus previous years was identified. [redacted] submitted that in 1994, 17 acres of prunes were removed and thus not irrigated. [redacted] irrigated 20 acres of rice in 1993 and 25 acres in 1994 and the years preceding 1993.

The assertion that the water table "started out 15 feet lower" in 1994 than the previous year is not supported by any of the available data. Hydrographs of static water levels, which can also be considered exhibits to illustrate the 1994 pumping impacts (as well as preceding pumping impacts in 1990, 1991, and 1992) as discussed in LSCE's accompanying memo dated July 24, 1995, all show the same basic status of the ground-water basin at the beginning of the 1994 pumping season: spring water levels were essentially identical to the preceding year, 1993 and were also essentially identical to the years immediately preceding 1993, as shown on the hydrographs of Wells 20N/2E-16P1, 20N/2E-23A1, and 20N/2E-23L1 (Figures 2, 3, and 4). On a longer term basis, this observation is consistent with historical water levels in the area. As illustrated on the hydrographs for Wells 20N/2E-9L1 and 20N/2E-6Q1 (Figures 5 and 6), ground-water levels in the area of concern did not fluctuate significantly, either seasonally or over a longer time period, and were generally constant at the start of each irrigation season.

Pumps that were converted to diesel have been identified as have those that broke suction in the summer of 1994 (see Table 2). It has been indicated that the horsepower for all pumps has remained the same, although the time period over which this holds true has not been precisely determined. Several wells with PG&E pump-test data dating back to the seventies show no change in pump horsepower.

Durham I.D. has abandoned or destroyed five wells since 1989. At present, Durham I.D. operates two wells: Well No. 3 and Well No. 4. Well No. 3 (constructed in 1957) served as the primary supply well until Well No. 4 was constructed in 1990. Well No. 4 has a 50-HP variable

frequency pump that maintains constant pressure and increases flow on demand. Well No. 3 is a stand-by well with a 30-HP pump which, during periods of high demand, runs continuously at constant flow. When Well No. 3 is operating, Well No. 4 automatically adjusts flow to maintain system pressure. In the summer of 1994, only Well No. 4 was operational because Well No. 3 broke suction. Note that less water was used in 1994 than in 1992 (300 acre-feet vs. 350 acre-feet). Note also that, at most, two wells were on line at the same time from 1990 to the present.

Regarding the water-quality problem, Durham I.D. Well No. 3 broke suction and pulled coliform bacteria located at the water table into the water system. Since EPA standards specify that no level of coliform bacteria is permitted, a chlorinator had to be installed.

Durham I.D. Abandoned Wells

Durham I.D. Well ID	Year Abandoned	Other
Well #1 (20HP)	1989	Destroyed
Well #2 (10HP)	1990	Monitored by DWR
Valley Estates (25HP)	1990	Destroyed, Never pumped by District.
Monte Vista (15HP)	1991	Destroyed
Vintage Estates (25HP)	1994	Destroyed, Never pumped by District.

[redacted] pumps that broke suction are indicated on the well description sheet. [redacted] owns all but three wells, map Well Nos. 17, 23, and 24 ([redacted] Well Nos. 11, 9, and 10). He does, however, own the diesel engines and gearheads on these wells.

[redacted], and all other applicable claimants, converted their pumps to diesel for economic and water supply reasons. The power cost for a diesel pump is less than that of an electric pump; and, with a diesel pump, flow can be increased by increasing the RPM. [redacted] installed the diesel pump to increase water production to compensate for the decreased discharge capacity of his wells due to water level impacts.

Note that, to the best of the claimants' knowledge, all pumps recently installed by Western Canal members are diesel.

Item #2

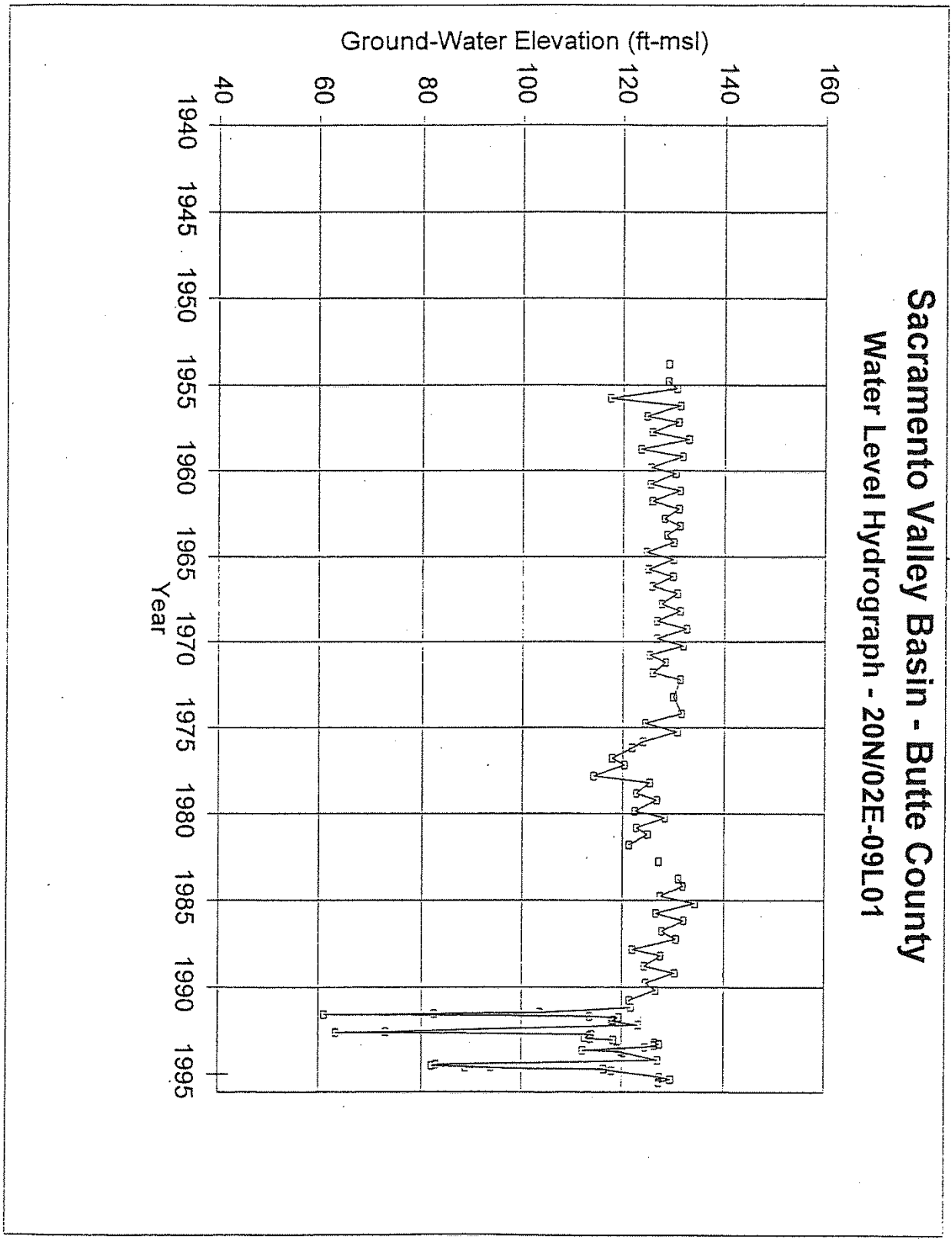

Sacramento Valley Basin - Butte County
Water Level Hydrograph - 20N/02E-09L01
Ground-Water Elevation (ft-msl)
160
140
120
100
80
60
40
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Year

FIGURE 1

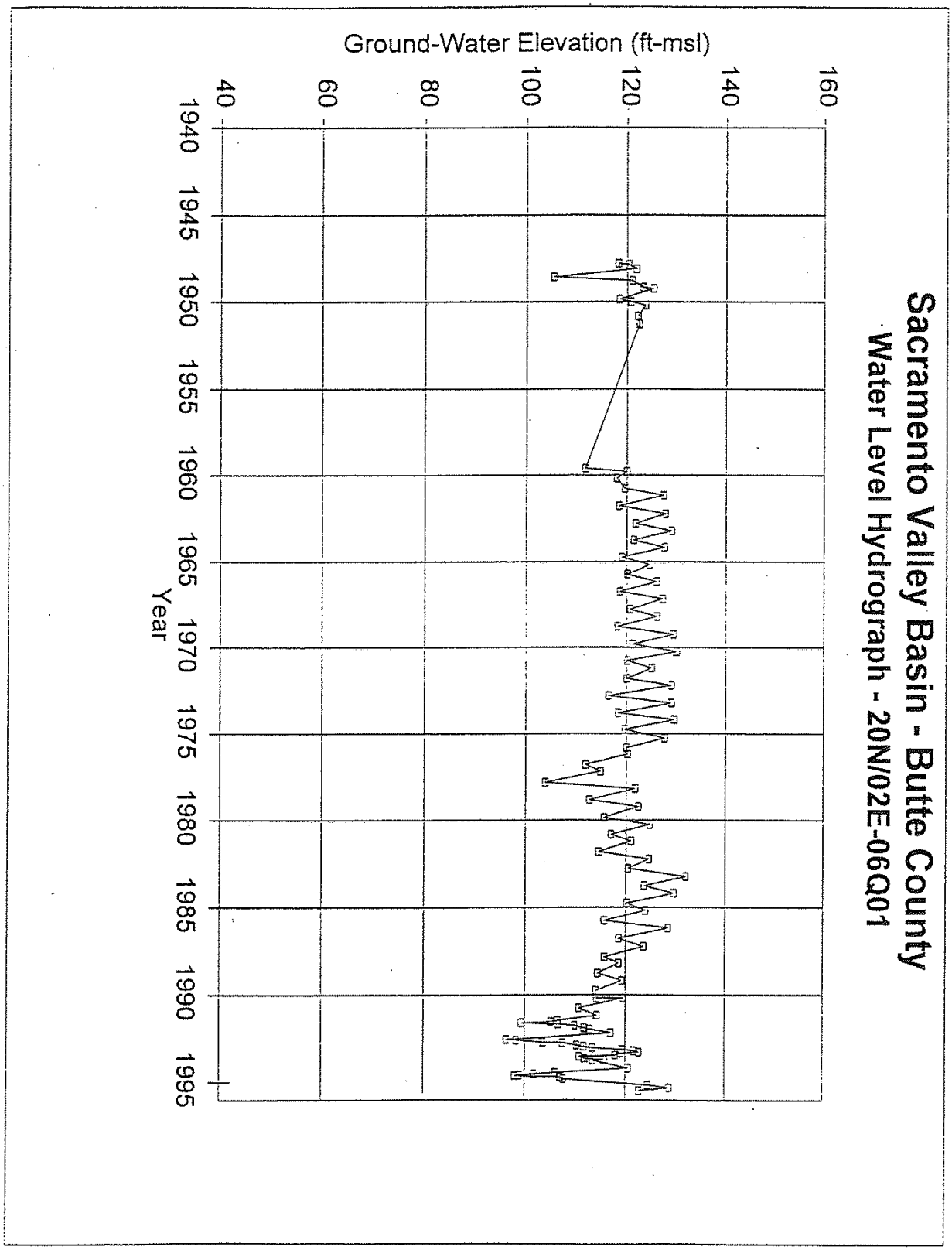

Sacramento Valley Basin - Butte County
Water Level Hydrograph - 20N/02E-06Q01
Ground-Water Elevation (ft-msl)
160
140
120
100
80
60
40
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
Year

FIGURE 2

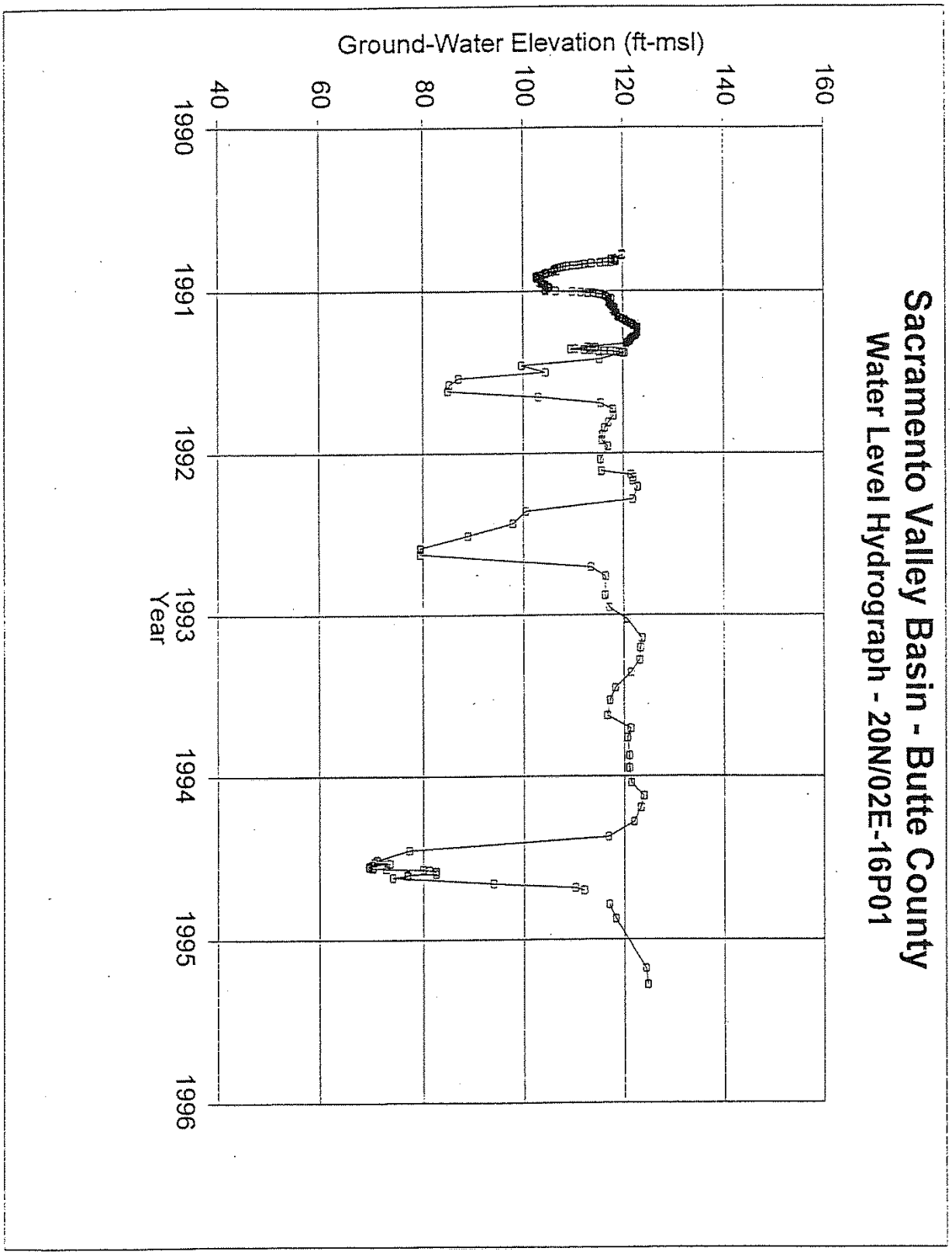

Sacramento Valley Basin - Butte County
Water Level Hydrograph - 20N/02E-16P01
Ground-Water Elevation (ft-msl)
160
140
120
100
80
60
40
1990
1991
1992
1993
1994
1995
1996
Year

FIGURE 3

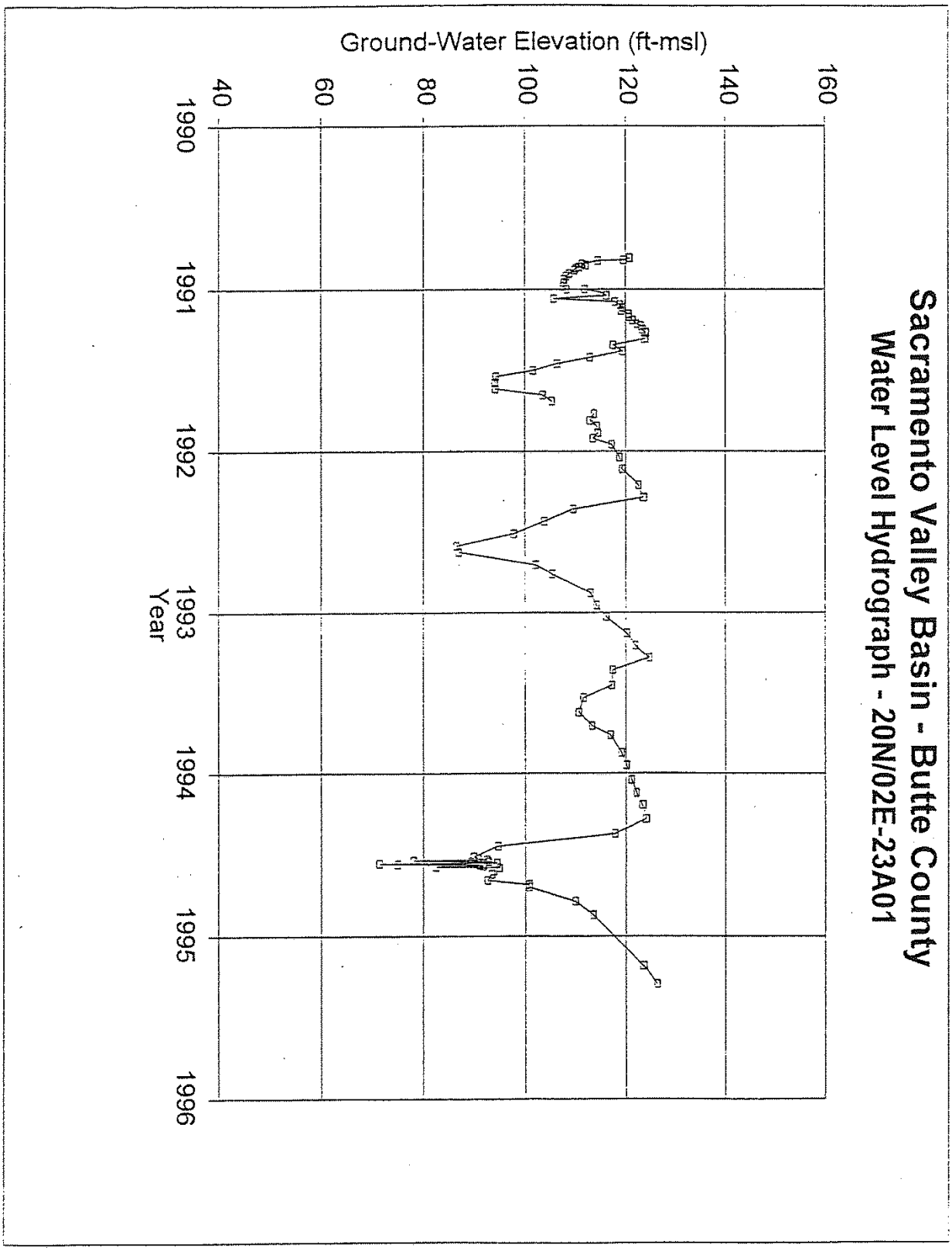

Sacramento Valley Basin - Butte County
Water Level Hydrograph - 20N/02E-23A01
Ground-Water Elevation (ft-msl)
160
140
120
100
80
60
40
1990
1991
1992
1993
1994
1995
1996
Year

FIGURE 4

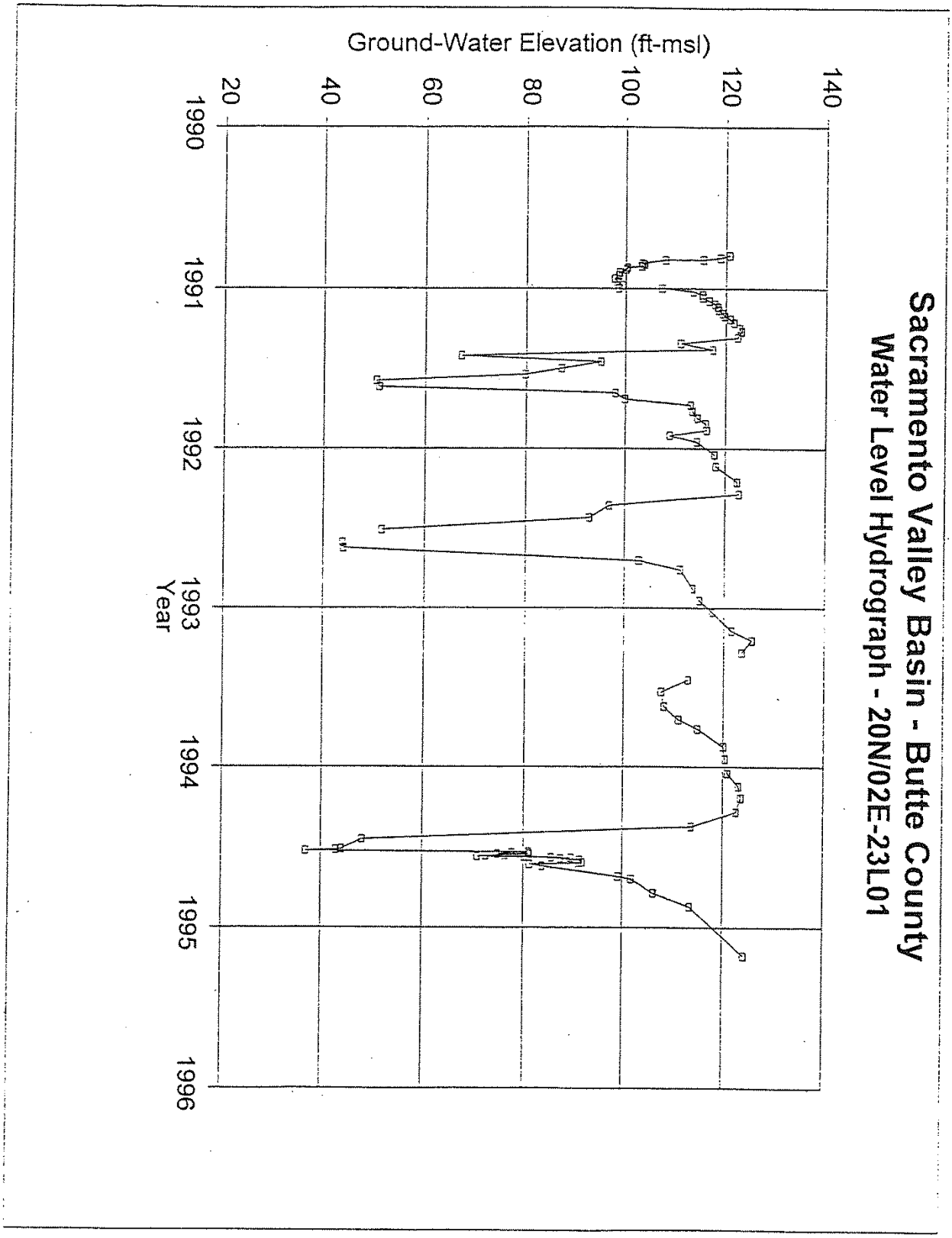

Sacramento Valley Basin - Butte County
Water Level Hydrograph - 20N/02E-23L01
Ground-Water Elevation (ft-msl)
140
120
100
80
60
40
20
1990
1991
1992
1993
1994
1995
1996
Year

FIGURE 5

FIGURE 6

GROUND–WATER ELEVATION CONTOURS
July–August 1994

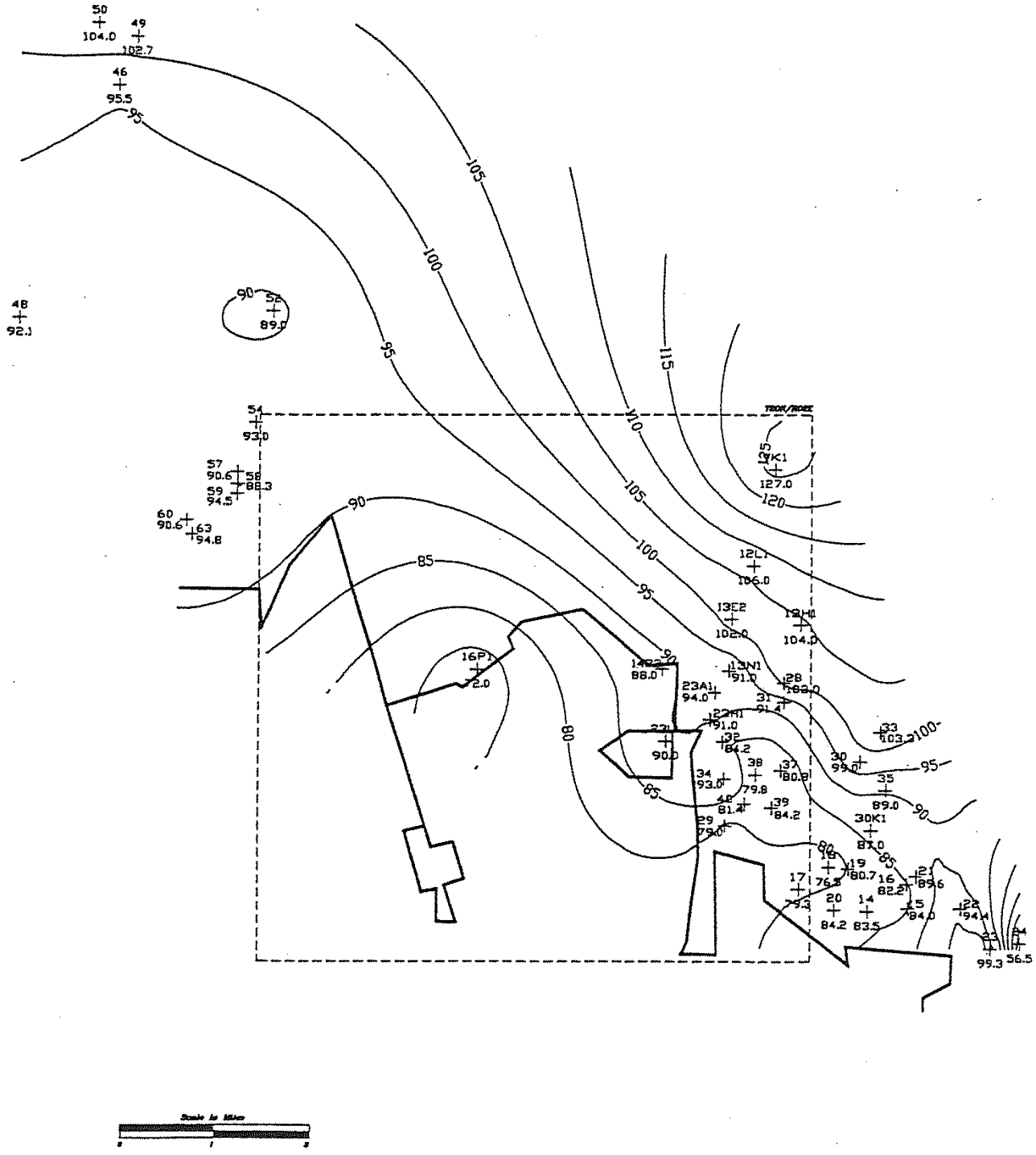


FIGURE 7

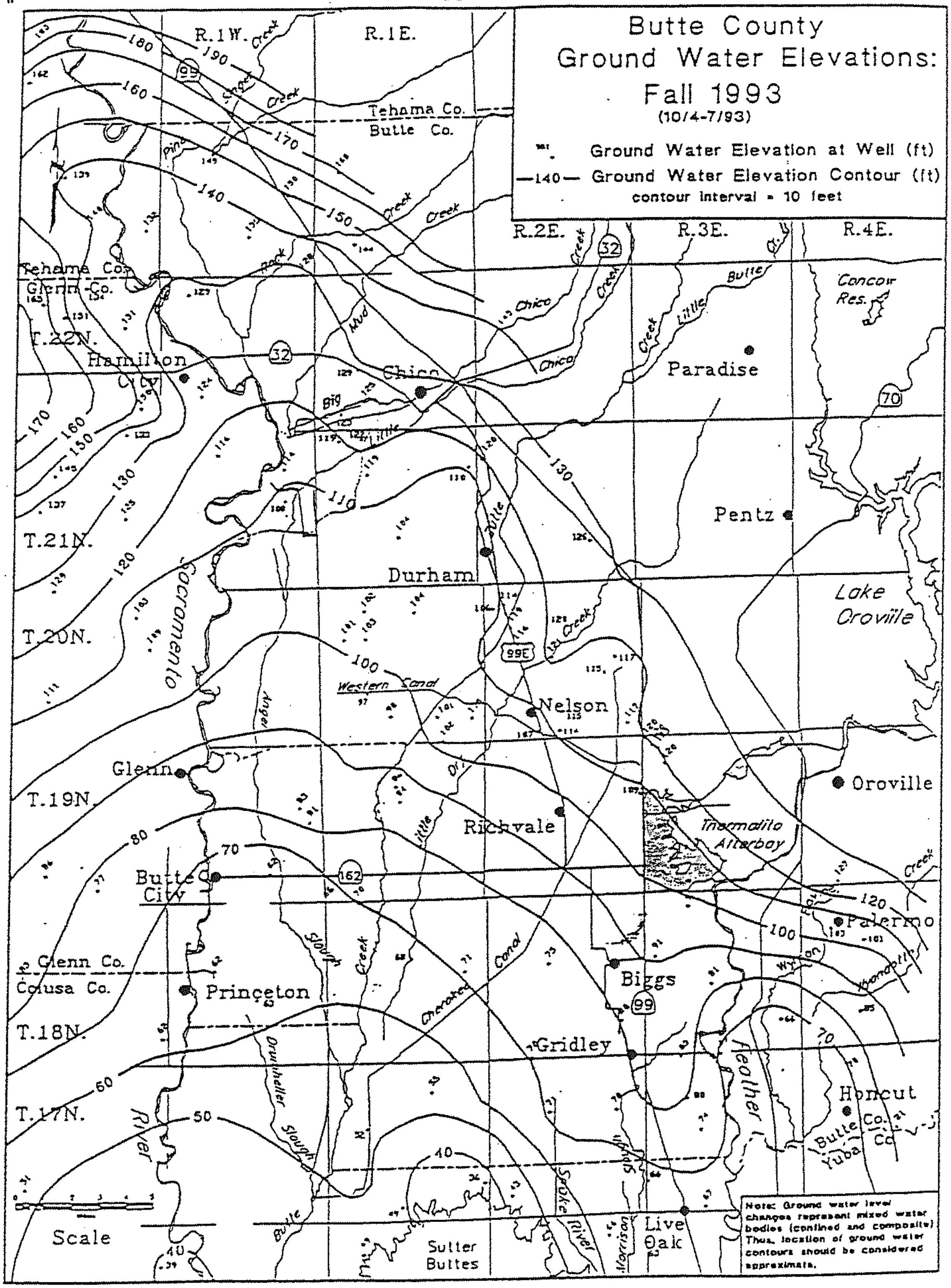
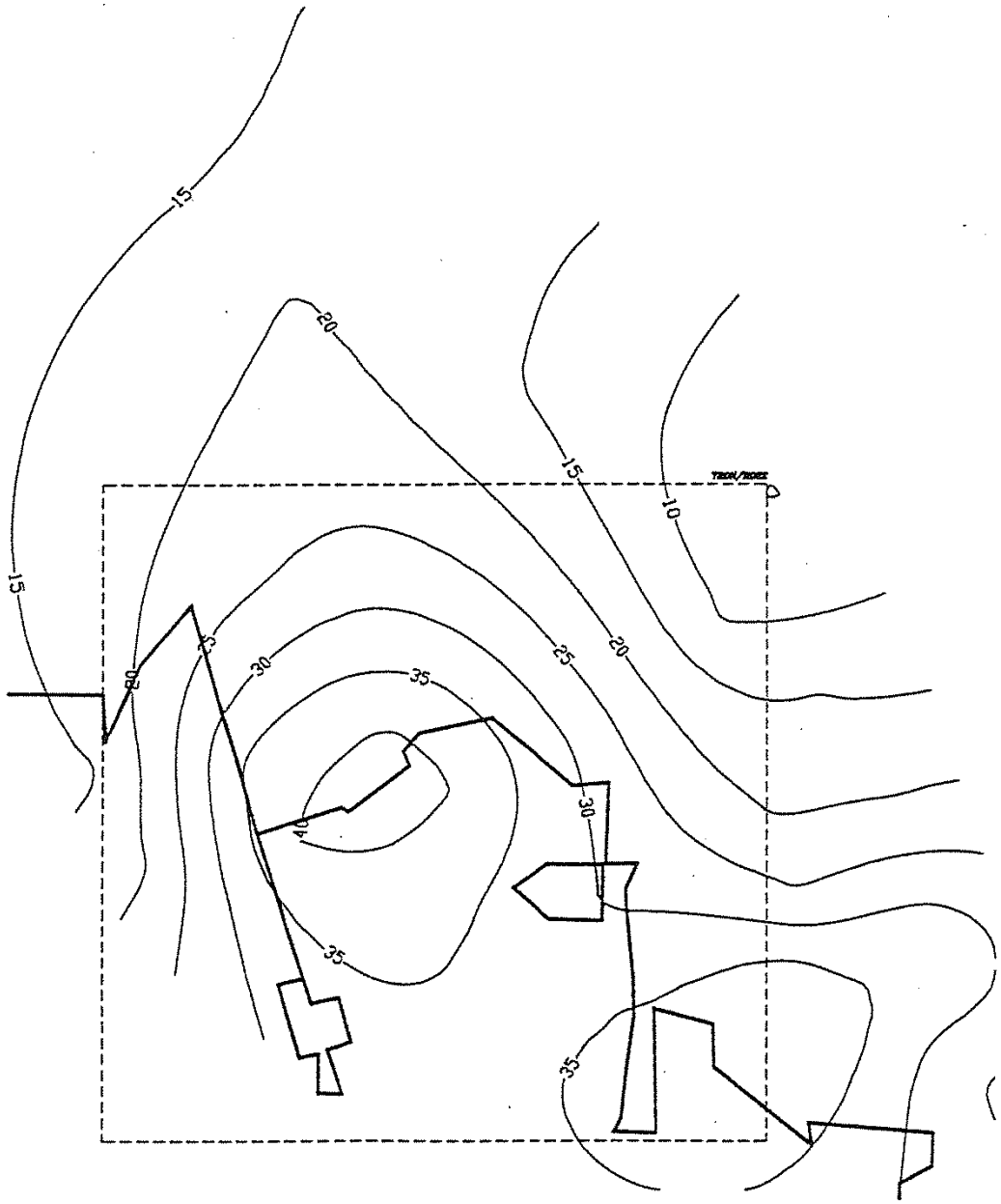

Butte County
Ground Water Elevations:
Fall 1993
(10/4-7/93)
Ground Water Elevation at Well (ft)
—140— Ground Water Elevation Contour (ft)
contour interval = 10 feet
R.1W.
R.1E.
R.2E.
R.3E.
R.4E.
Tehama Co.
Butte Co.
Glenn Co.
T.22N.
T.21N.
T.20N.
T.19N.
T.18N.
T.17N.
Hamilton City
Chico
Paradise
Pentz
Durham
Nelson
Oroville
Richvale
Glenn
Butte City
Princeton
Biggs
Gridley
Palermo
Honcut
Live Oak
Sutter Buttes
Colusa Co.
Yuba Co.
Lake Oroville
Concow Res.
Thermalito Afterbay
Sacramento River
Feather River
Western Canal
Cherokee Canal
Scale
Note: Ground water level changes represent mixed water bodies (confined and composite) Thus, location of ground water contours should be considered approximate.

FIGURE 8

Contours of Equal Ground-Water Change
Fall 1993 - Summer 1994



Note: Positive values indicate water level decline from Fall '93 to Summer '94