Testimony

by

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Antelope Valley

- Formed by motion of the Pacific Tectonic Plate over the past 20+ million years along the San Andreas Fault
- Pacific Plate has moved 195 miles north in 23 million years
- Evidence provided by the Neenach volcano which was split by the plate movement
- Motion has created some intra-valley stress cracks (faults), most notable the Garlock Fault and Willow Springs Fault

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Figure 1 – Infra-red satellite view of the Antelope Valley (Source: NASA , ca. 1970).

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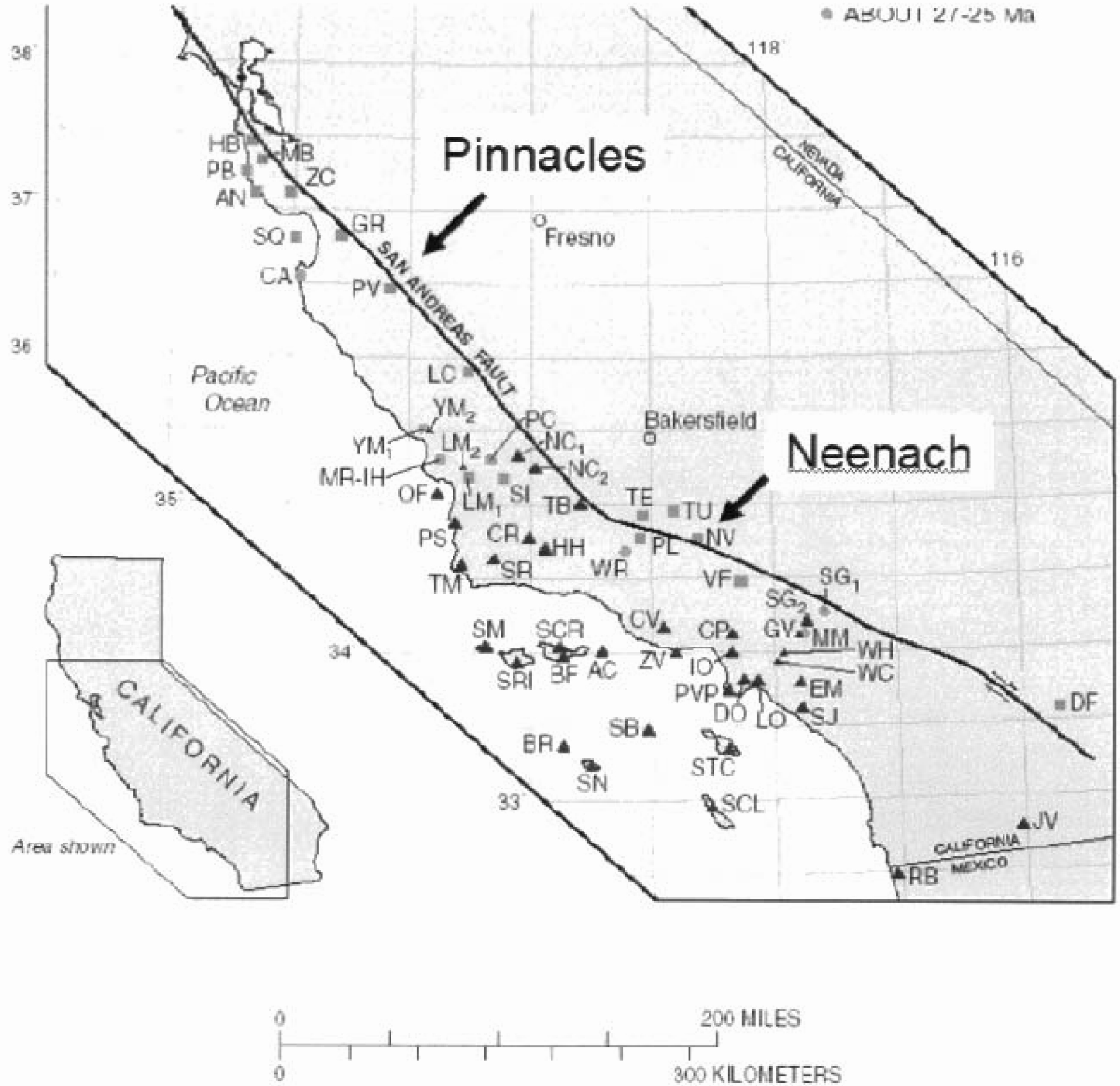
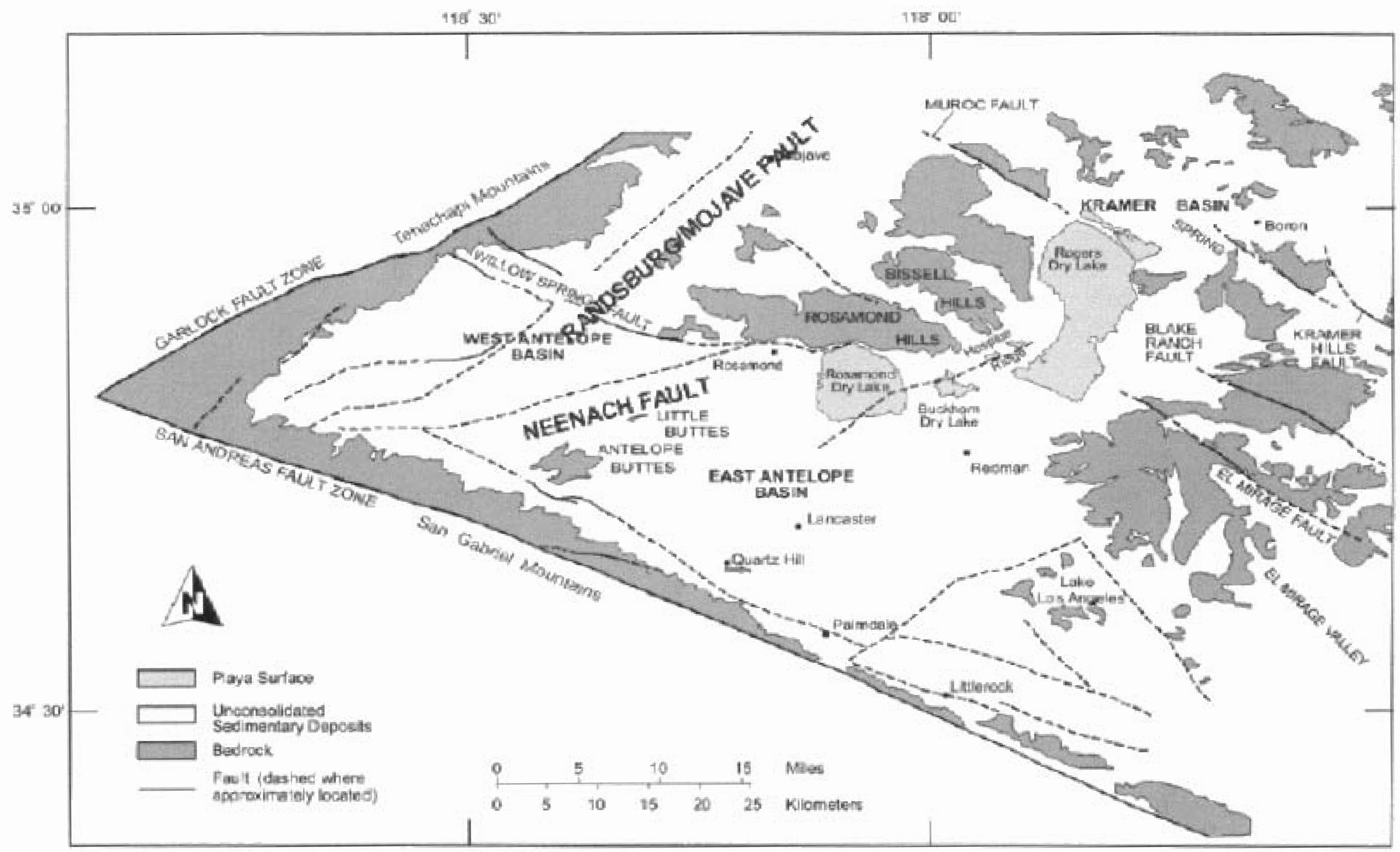


Source: Stanley et al., USGS Open-File Report 00-154

Figure 2 – Map illustrating movement of the San Andreas Fault.

C-22



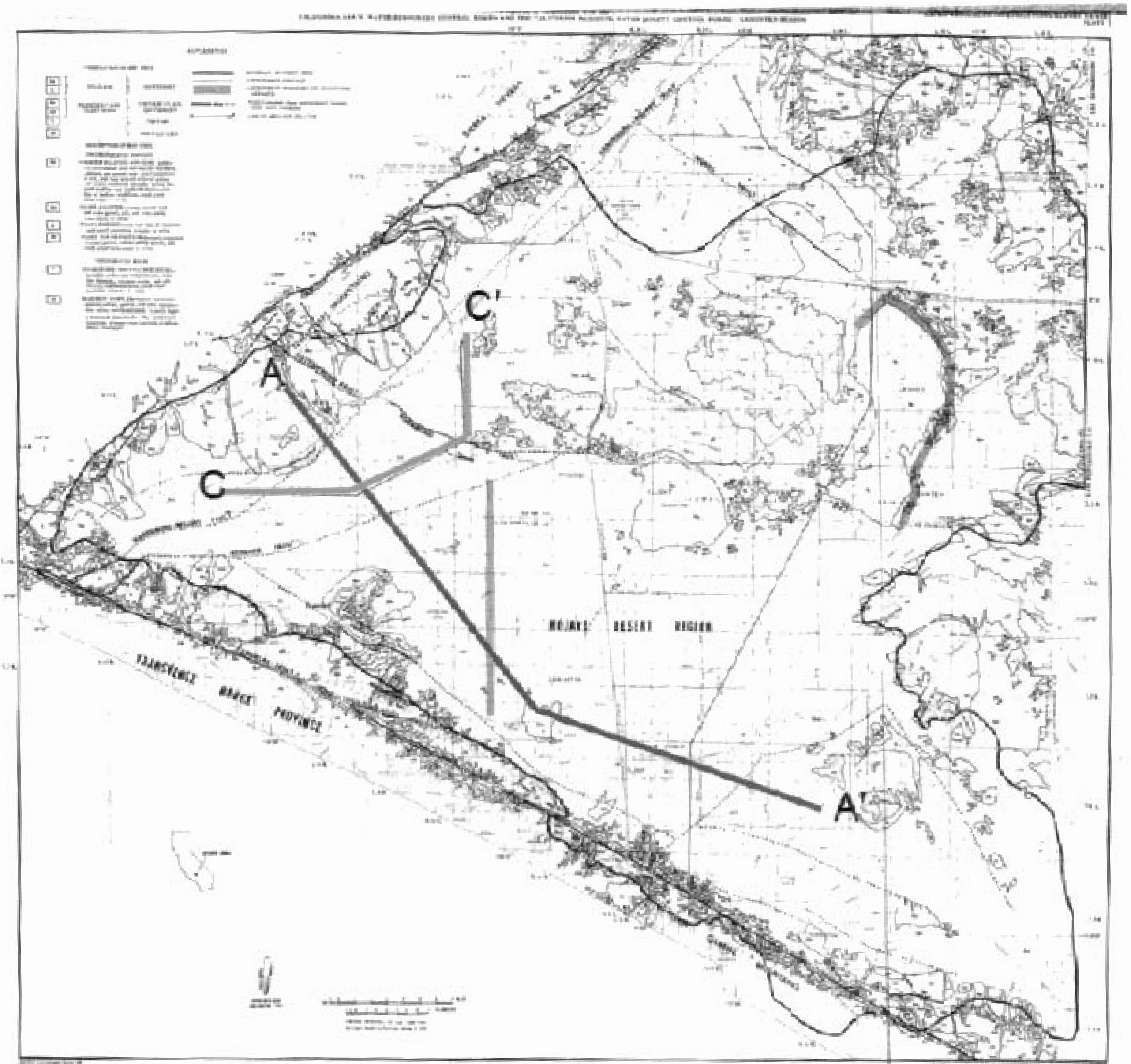
Source: Figure 2-5 at http://www.lacsd.org/Draft%20PWRP%202025%20Plan/Figures.htm

Figure 3 – Location of presumed intra-valley faults in the Antelope Valley.

Structure Within the Valley

- Drilling records (oil and water) provide detailed information on the structure within the Valley
- Gravity, seismic and aeromagnetic surveys also provide geophysical information on the subterranean structure
- Geological cross-sections provide visualization of the structure
- Bedrock contour maps help in the interpretation of the aquifers

C-24

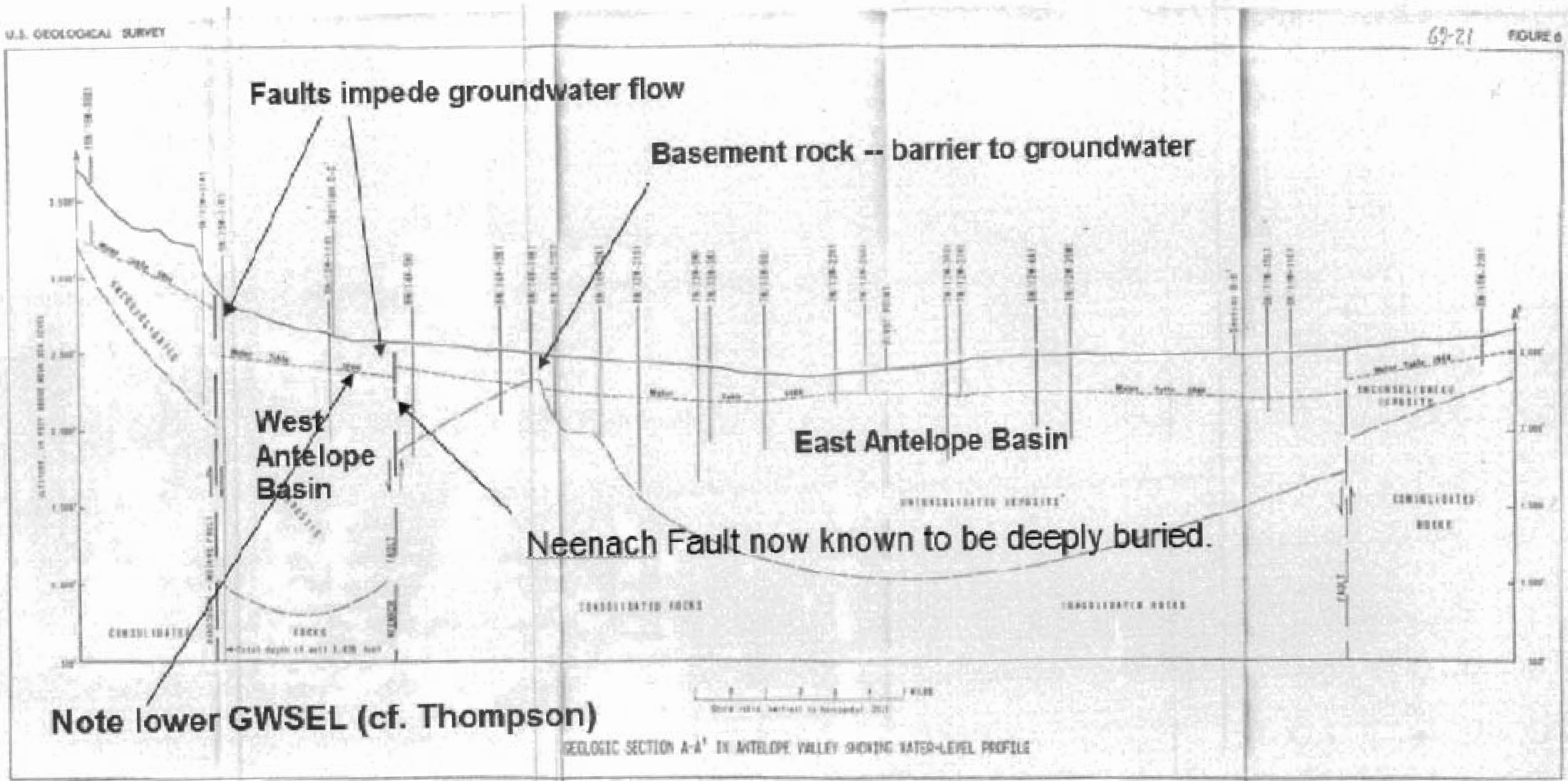


MAP SHOWING GENERALIZED GEOLOGY AND LINES OF GEOLOGIC SECTIONS IN ANTELOPE VALLEY, CALIFORNIA

Figure 4 – Plan of the two cross-sections presented below in Figures 5 and 6. (Source: Bloyd, USGS Open File Report 67-21)

C-25

Section AA′ Across West and East Antelope Basins



Source: USGS Open-File Report 67-21 Plate 6

Figure 5 – Annotated Section AA′ across the West and East Antelope Basins.

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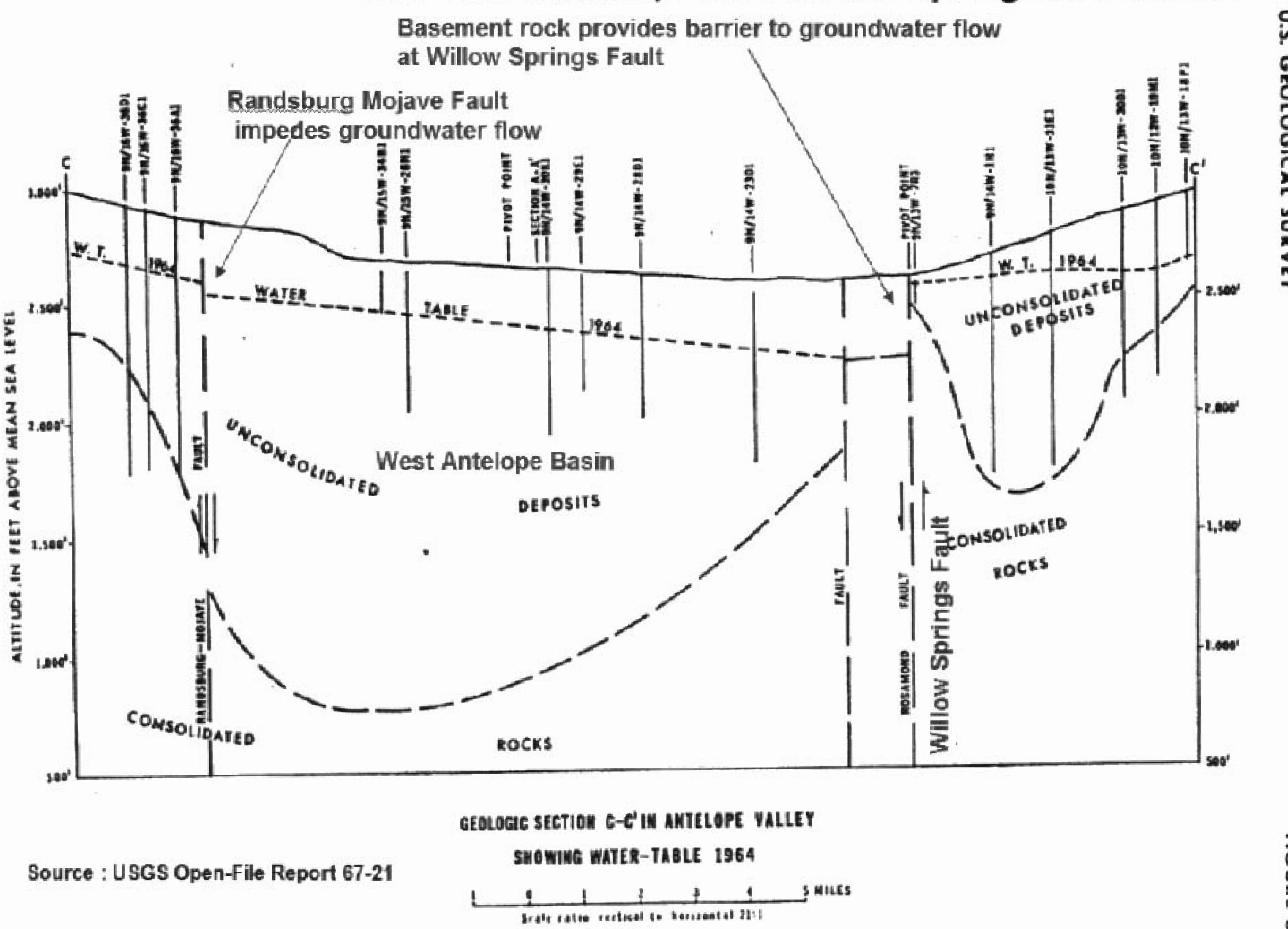
Section CC′ Across West Antelope and Willow Springs Sub-Basins



GEOLOGIC SECTION C-C′ IN ANTELOPE VALLEY

SHOWING WATER-TABLE 1964

Source : USGS Open-File Report 67-21

Figure 6 – Annotated Section CC′ across West Antelope Valley and Willow Springs Fault

C-27

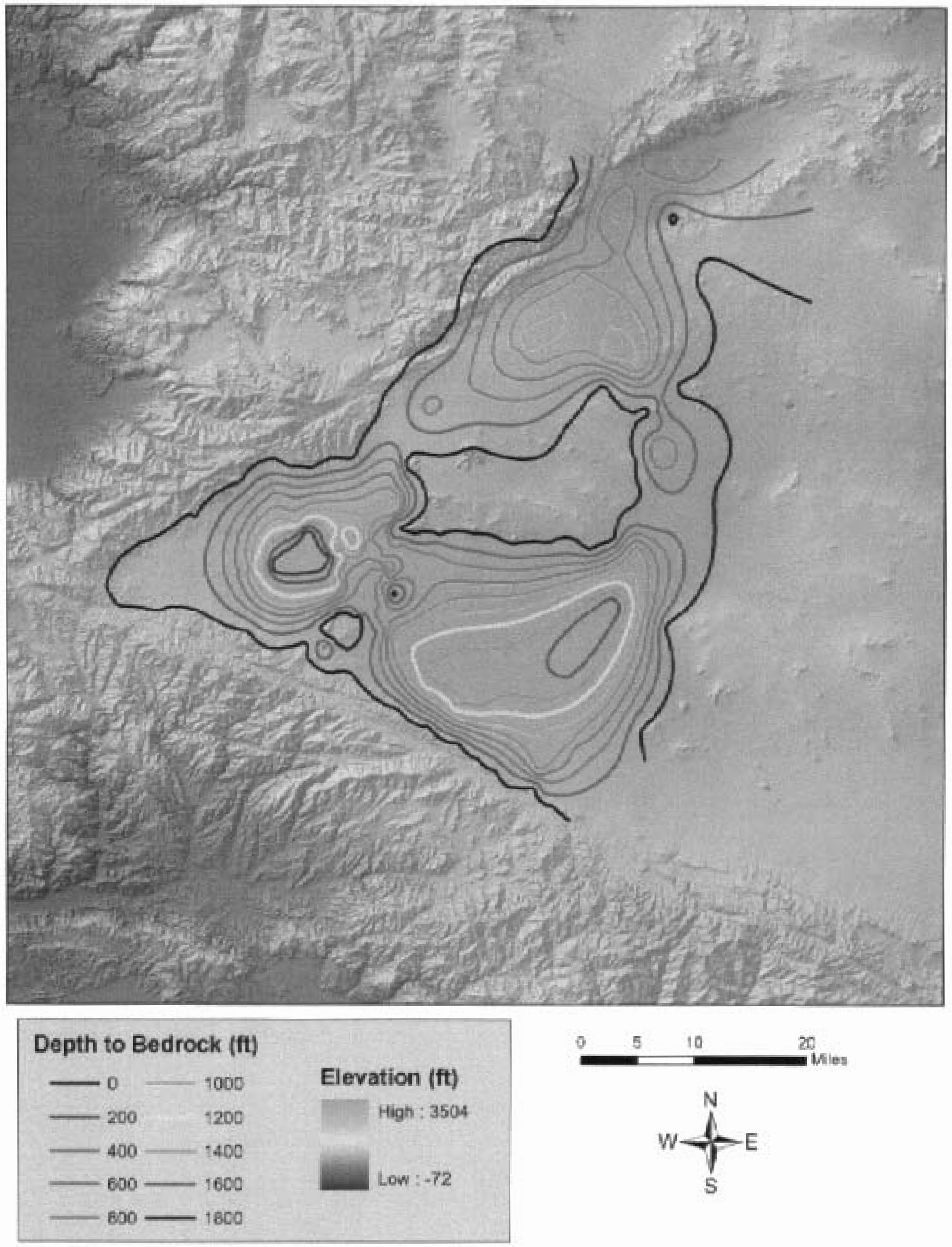


Figure 7 –Depth to basement rock contours developed from DWR well log data.

C-28

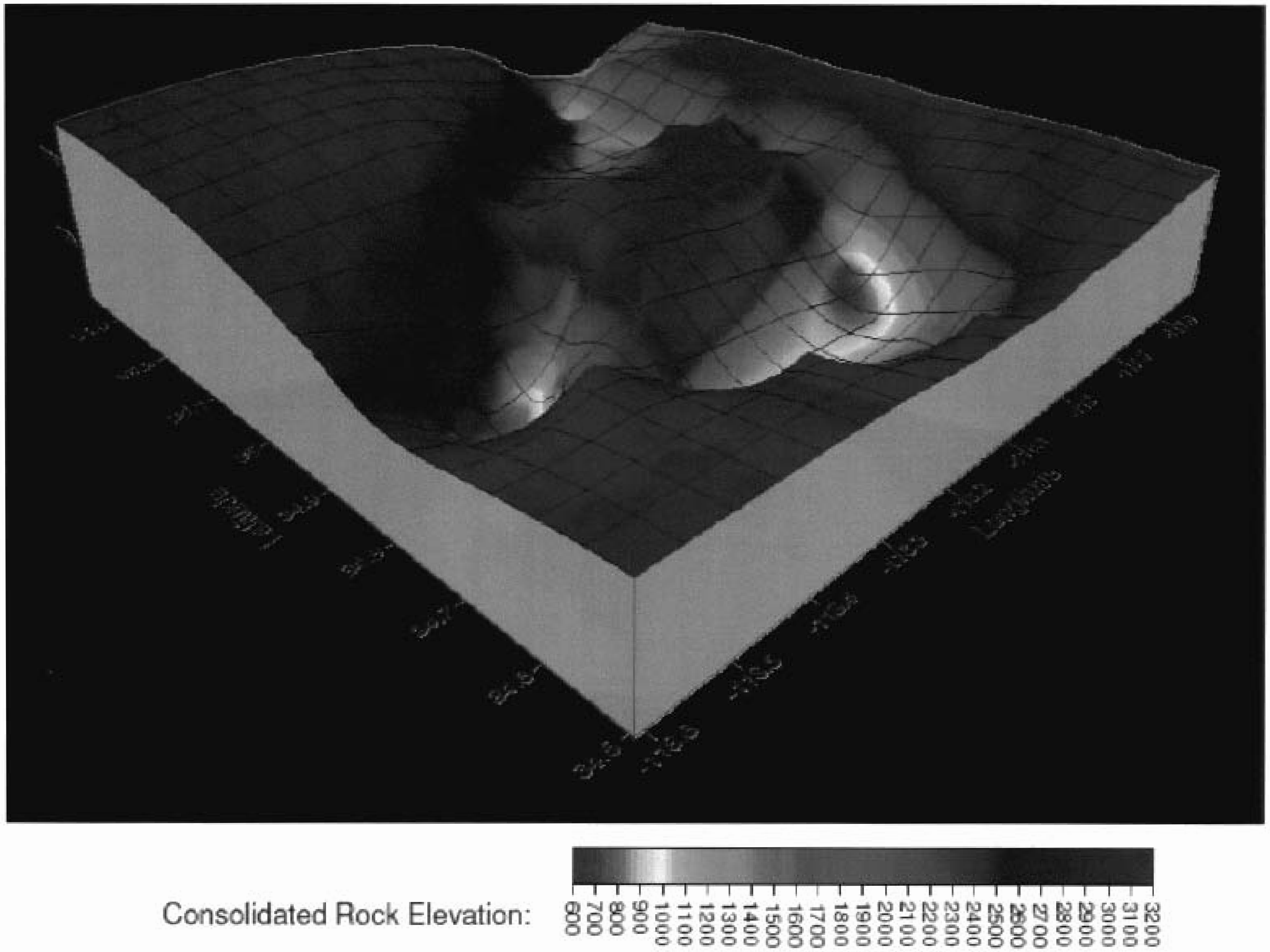


Figure 8 – An oblique view of bed rock contours as seen from the South West.

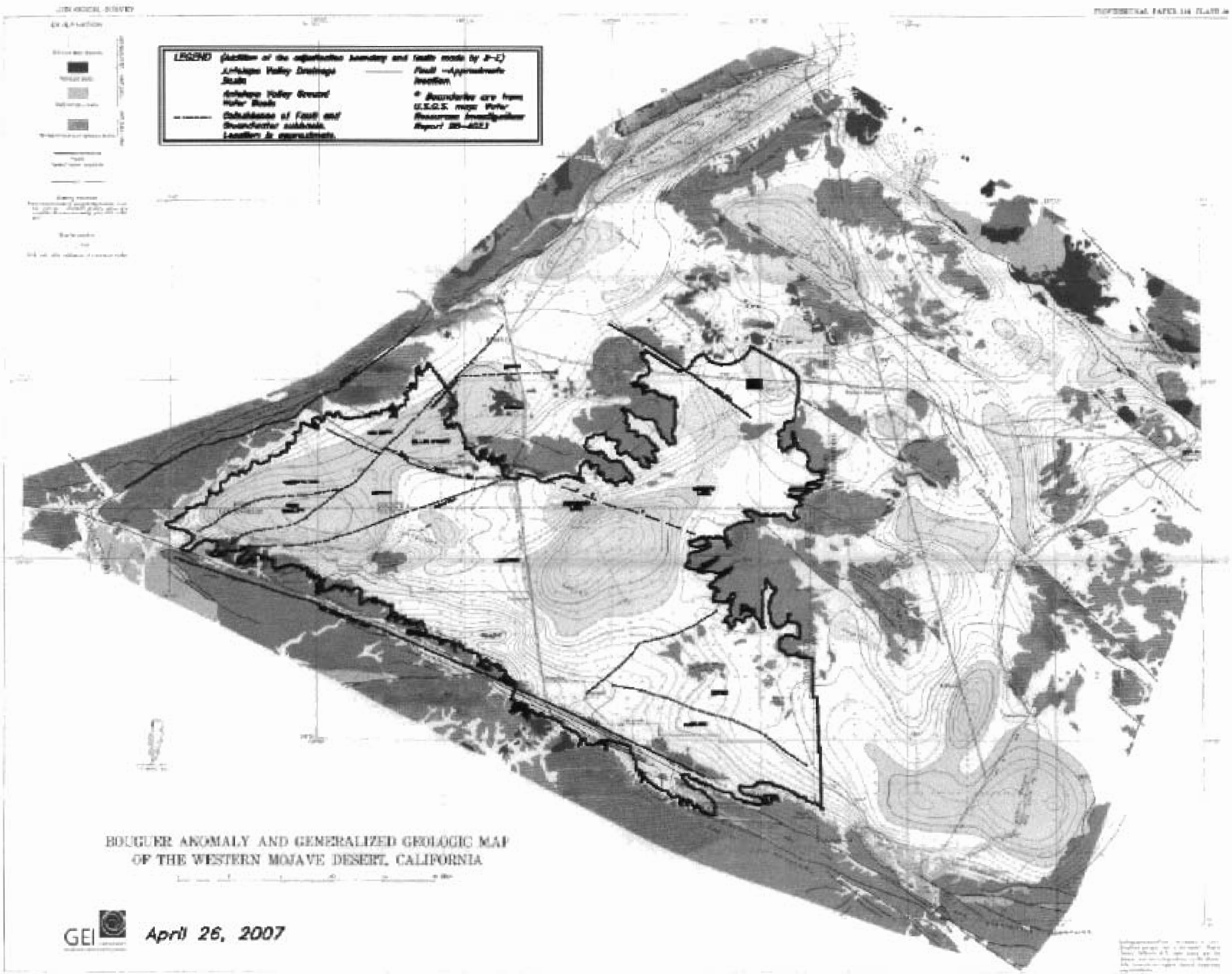


Figure 9a – Bouguer Gravity anomaly map for the Antelope Valley (Mabey, 1960). Faults and adjudication boundary superimposed by GEI.

C-30

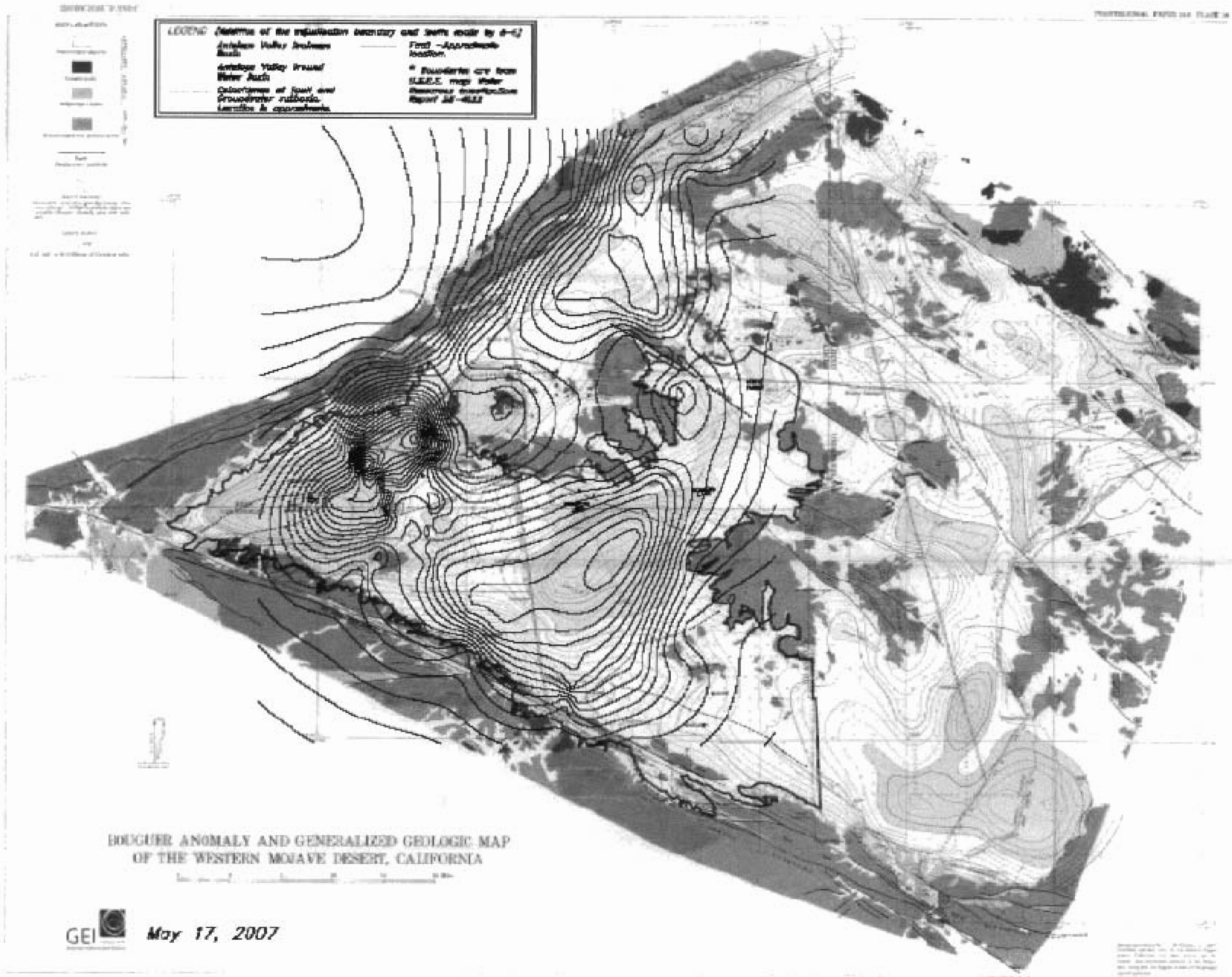


Figure 9b – Bed rock contour map super-imposed on gravity anomaly map.

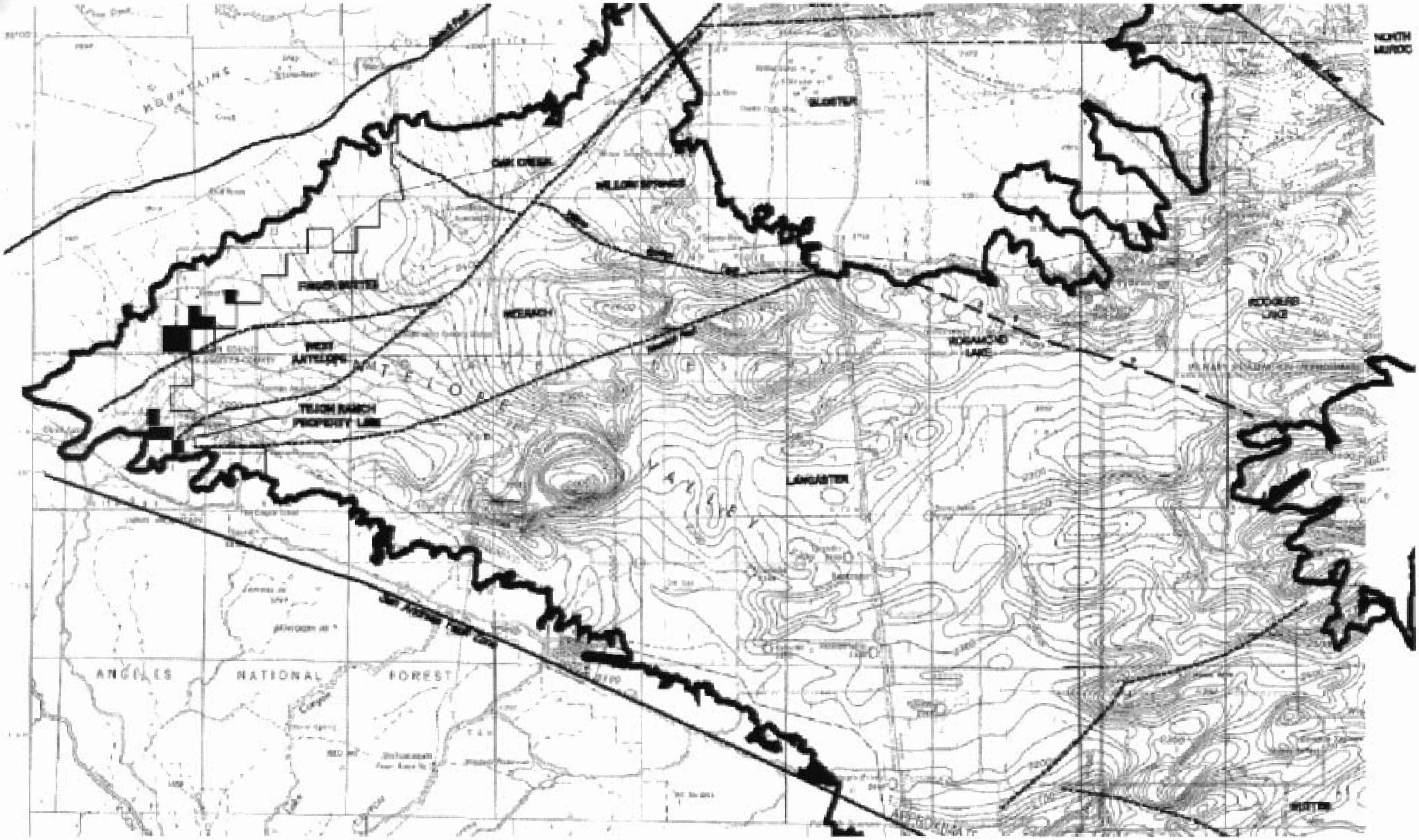


Figure 10 – Part of an aero-magnetic survey of the Antelope Valley (USGS Map GP-65); adjudication boundary superimposed by GEI.

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Well ID

A-58209
B-1085210
C-1085151
D-935623
E-35531
F-159723
G-40921
H-35125
I-328208
J-124607
K-37005
L-40918
M-61528

14W 13W

9N

8N

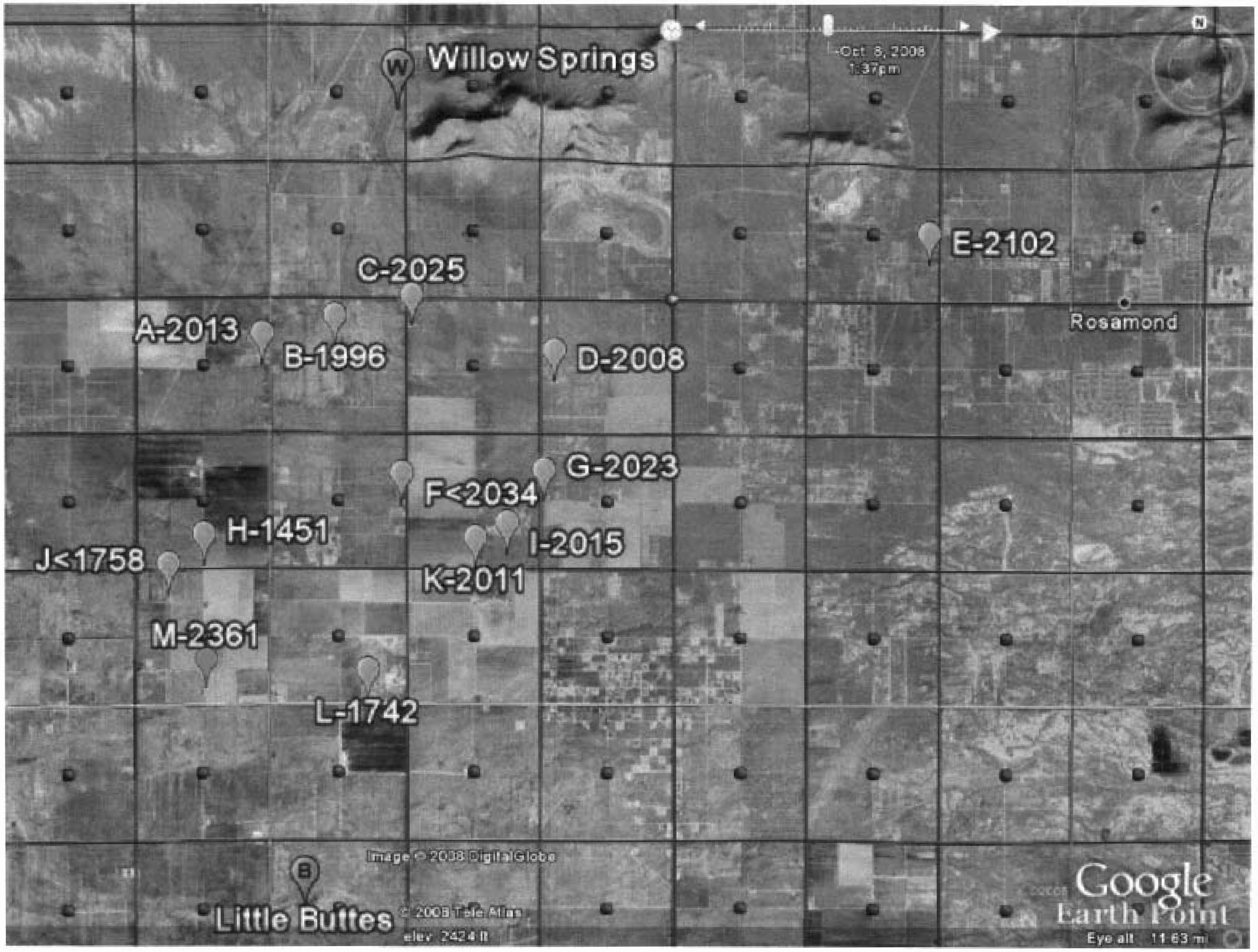


Figure 23 – Location of wells showing bedrock elevations

c-33

Figure 24 –
Well log (M in Fig. 23) identifying bedrock layer

Ground Elevation 2470

ORIGINAL
File with DWR

MAY 31 1972

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

09N14W36

Do Not Fill In

№ 61528

State Well No.

Other Well No.

(1) OWNER:

Name [redacted]

Address

(2) LO

County Los Angeles

Township, Range and Section T-9-N R-11-W Sec. 36 (Well #2)

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☒
Cable ☐
Other ☐

(6) CASING INSTALLED:

STEEL: SINGLE ☐ DOUBLE ☐ OTHER:

If gravel packed

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	111	8 5/8"	.188	12 1/4"	0	111

Size of gravel: No. 4

Type of joint: Welded

(7) PERFORATIONS OR SCREEN:

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
10	101	6	8	2 1/8 x 1/8"

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☐

(9) WATER LEVELS:

Depth at which water was first found, if known 8 ft.

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Rottman Drilling Co.

Was electric log made of well? Yes ☐ No ☒

(11) WELL LOG:

Total depth 111 ft. Depth of completed well 111 ft.

0 - 35' Soil & large sand
35 - 55' Large to medium sand
55 - 75' Fine sand
76 - 84' Fine to med. sand, boulders
85 - 88' Medium sand to coarse sand, boulders
89 - 98' Small rocks (rounded) & large sand
99 - 101' Large sand & small quantity of small rocks.
101 - 103' Medium-sand (rock drilling) decomposed granite with clay streaks.
103 - 111' Solid rock

"WATER PERFORMANCE"

40 GPM @ 199'

CONFIDENTIAL - NOT FOR PUBLIC RELEASE

Cement top 50'

Work started 3/24 19 72 Completed 19 72

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Rottman Drilling Company

Address 121-W. Avenue I
Lancaster, Calif. 93534

[SIGNED]

License No. C-117561 Dated 4/28 19 72

SKETCH LOCATION OF WELL ON REVERSE SIDE

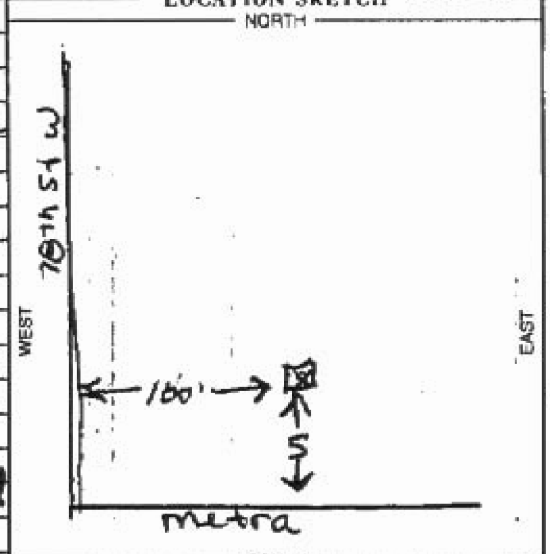
DWR 188 (REV. 9-98)

20	60	fine to medium Sand and gravel with 20% Brown Clay
60	80	White Clay
80	100	brown and white Clay
100	120	brown Clay with 40% Coarse Sand
120	160	Brown and White Clay
160	260	Brown Clay with fine Sand
260	300	partially decomposed rock
300	320	Brown Clay with fine Sand
320	340	Brown Clay with Coarse Sand
340	400	Partially decomposed rock with fine to Coarse Sand streaks
400	408	Solid rock

TOTAL DEPTH OF BORING 408 (Feet)
TOTAL DEPTH OF COMPLETED WELL 408 (Feet)

County: Kern
APN Book 374 Page 342 Parcel 08
Township 9N Range 13W Section 21
Lat ___ N DEG. MIN. SEC. Long ___ W DEG MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)
✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

USES (✓)
WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 213' (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 213' (Ft.) & DATE MEASURED 9/28/06
ESTIMATED YIELD * 50 (GPM) & TEST TYPE air
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 0 (Ft.)
* May not be representative of a well's long-term yield.

Figure 25 – Well log D in Fig. 23 showing bedrock (Ground at EL 2408)

Antelope Valley, CA
Depth to Bedrock Contours and Cross-Section Locations

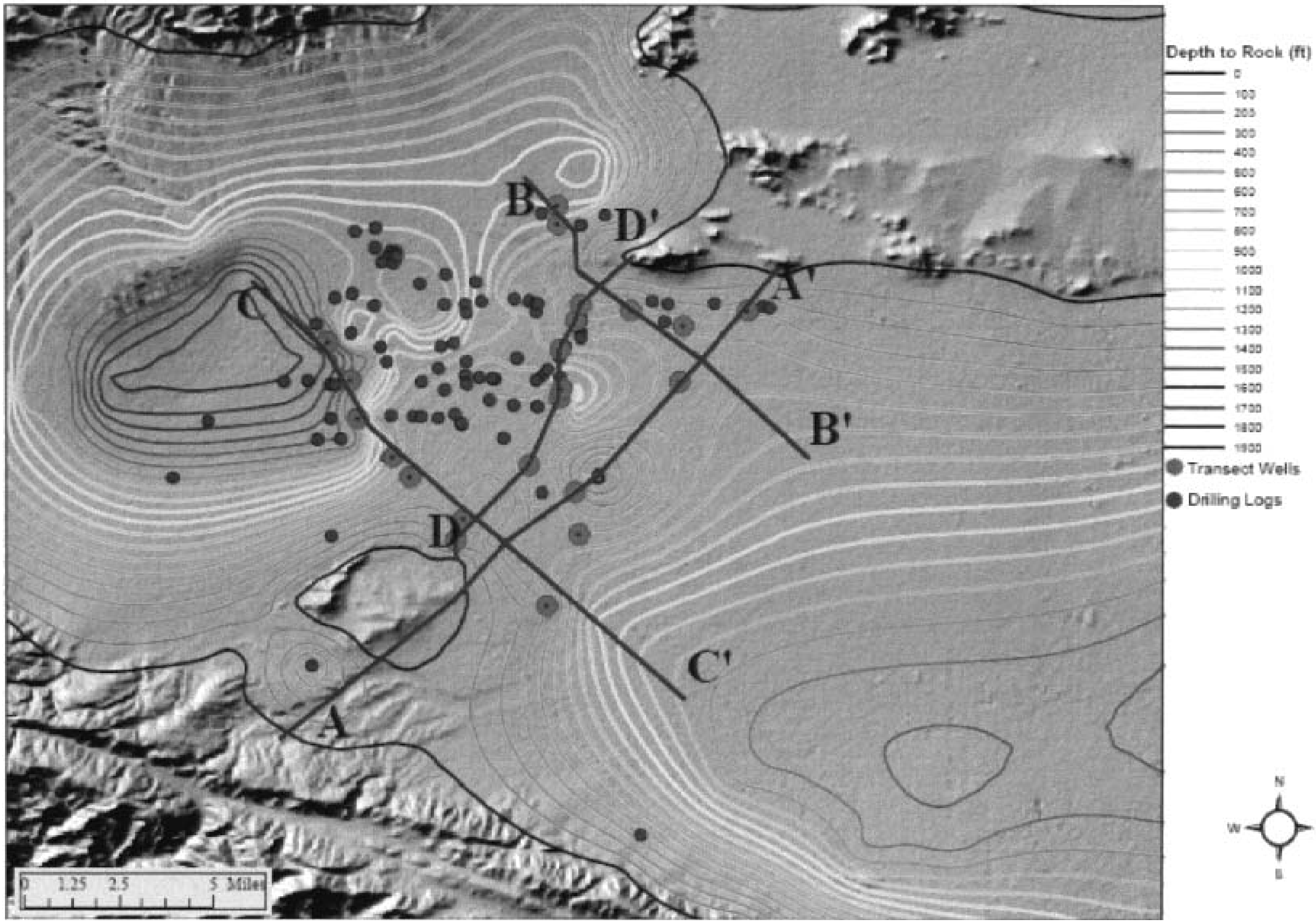


Figure 11 – Planform for sections shown in Figures 12 through 15 showing DWR well data used to develop transects.

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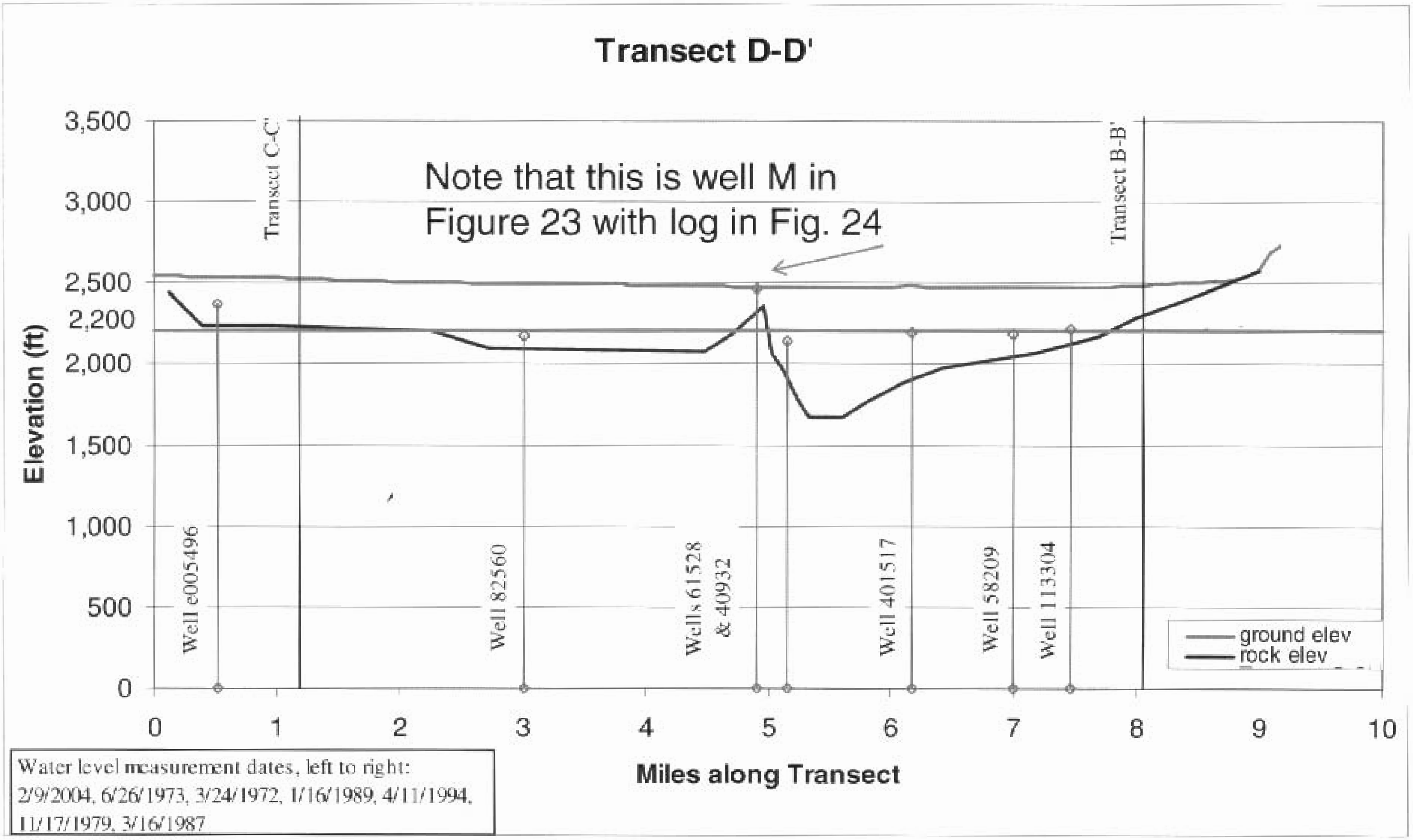

Figure 12 – Transect D-D' shown in Figure 11

C-36

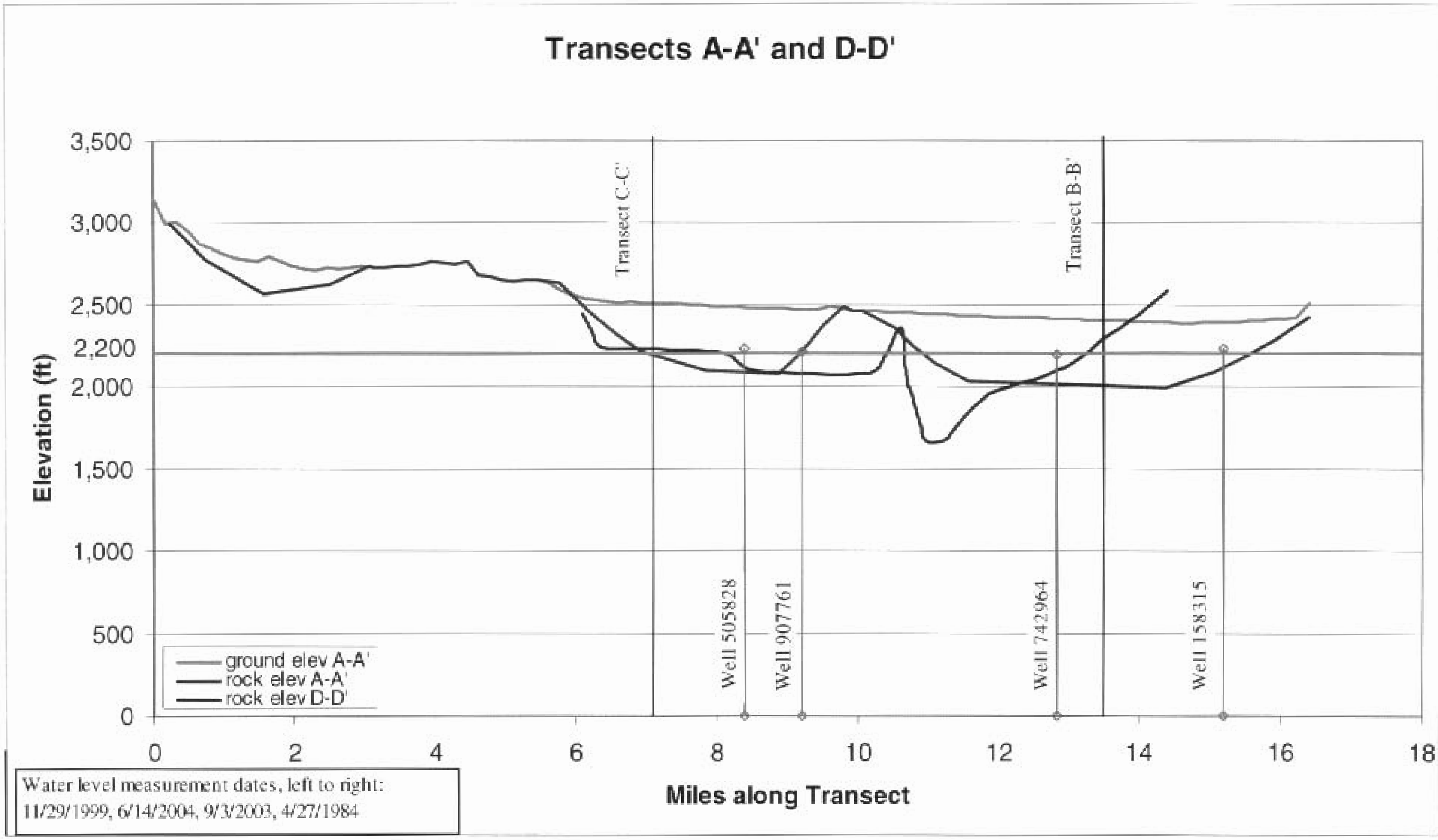

Figure 13 – Transects A-A' and D-D' shown in Figure 11

c-37

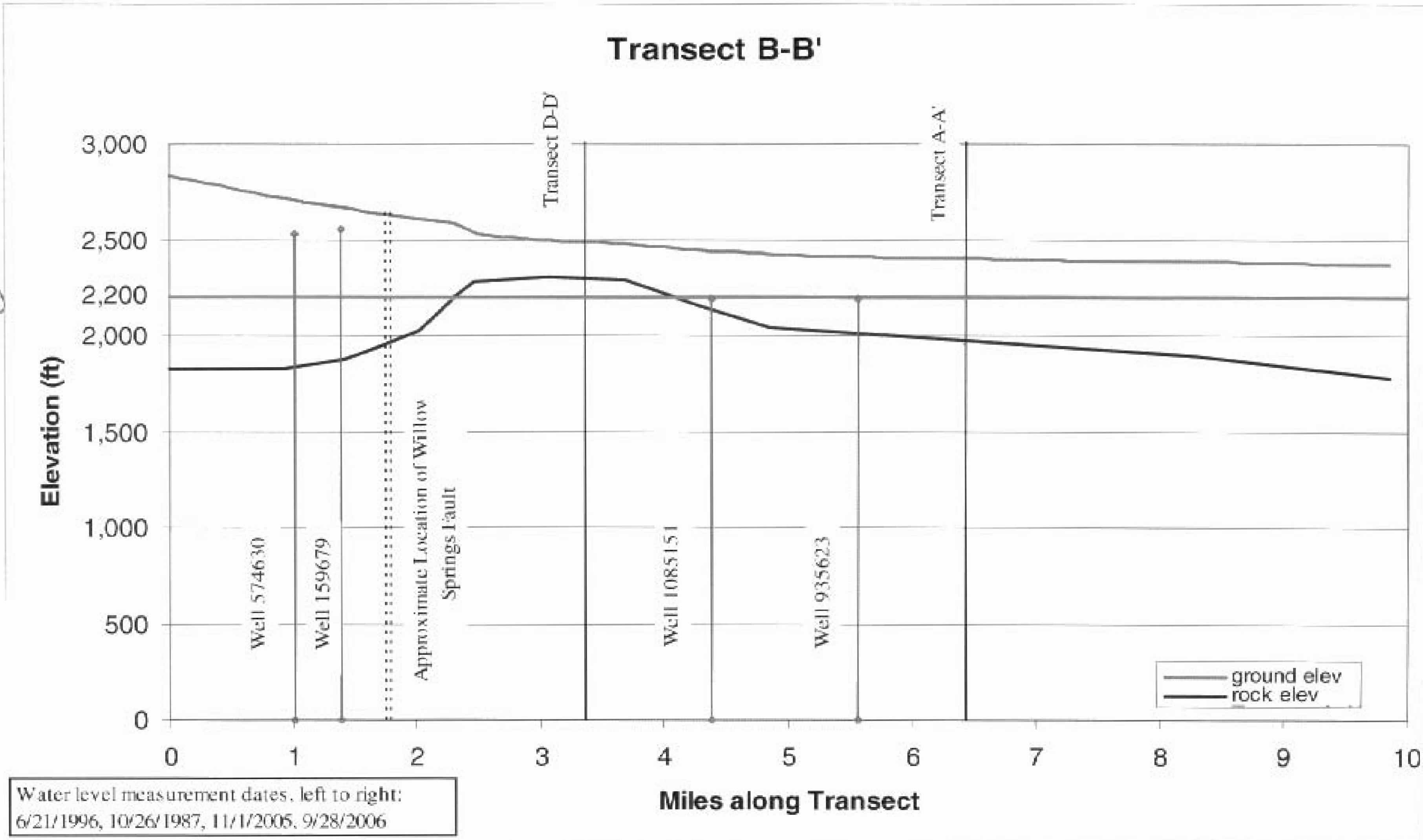

Figure 14 – Transect B-B' shown in Figure 11

C-38

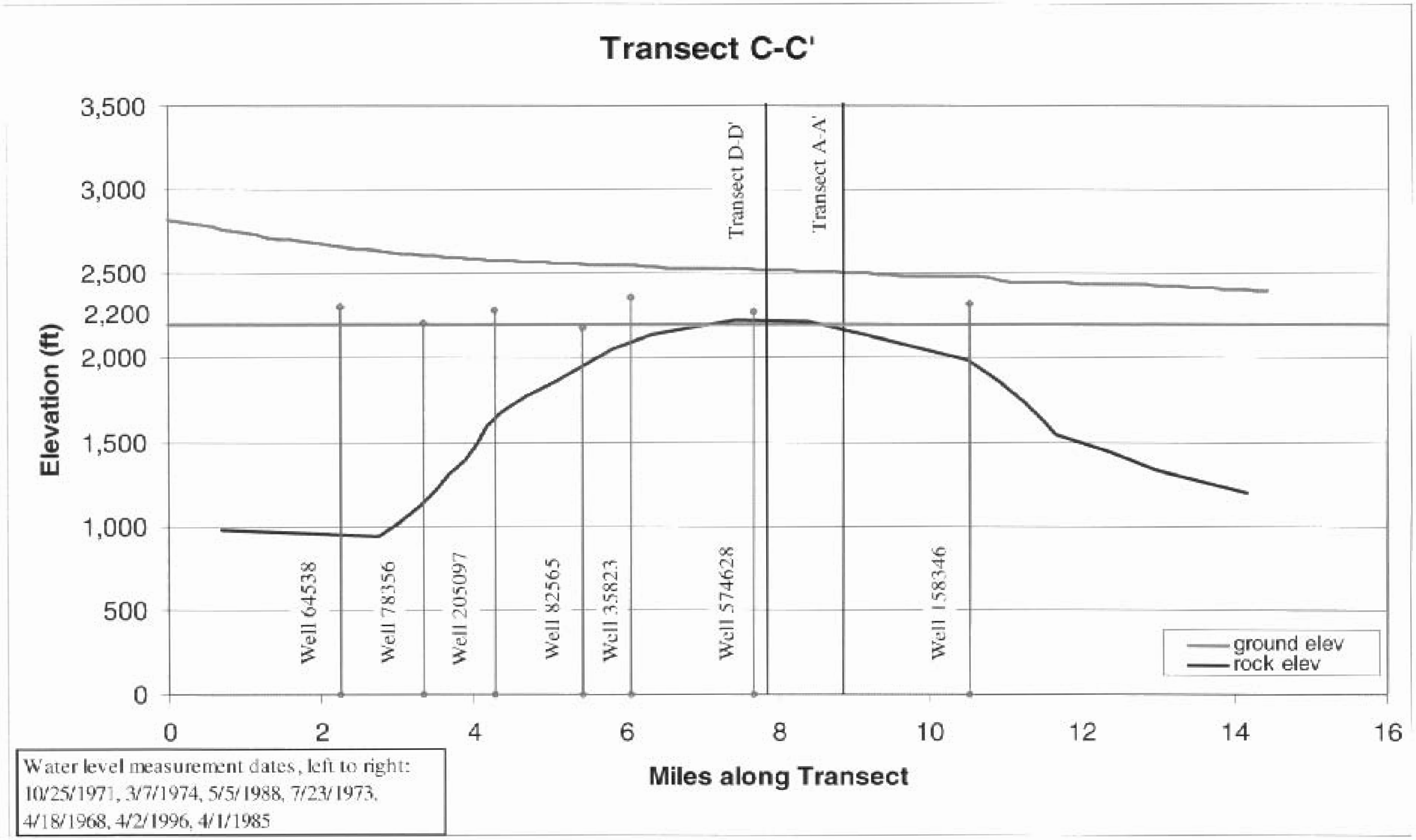

Figure 15- Transect C-C' shown in Figure 11

Bedrock Ridge Divides the Valley

- Geophysical and well log data indicate that a bedrock ridge separates the Antelope Valley into two deep sedimentary basins
- The East and West Basins are connected by approximately 200 feet of saturated alluvium overlying the bedrock ridge
- Groundwater flow across the ridge is controlled by the water surface elevations on each side of the ridge

C-40

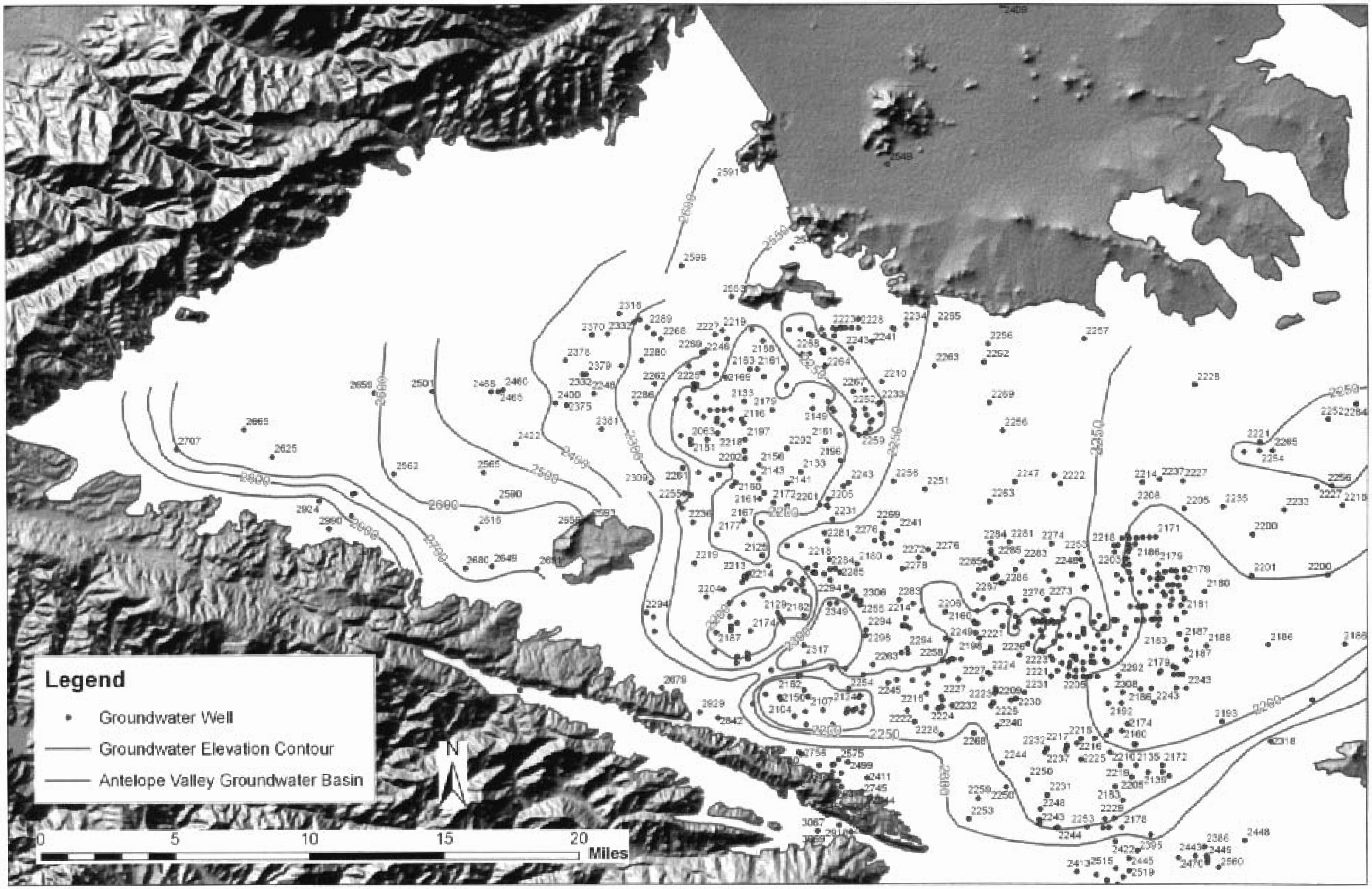

Figure 16 - Antelope Valley Groundwater Contours – 1965 Based on USGS Well Data

http://nwis.waterdata.usgs.gov/nwis/gw

C-41

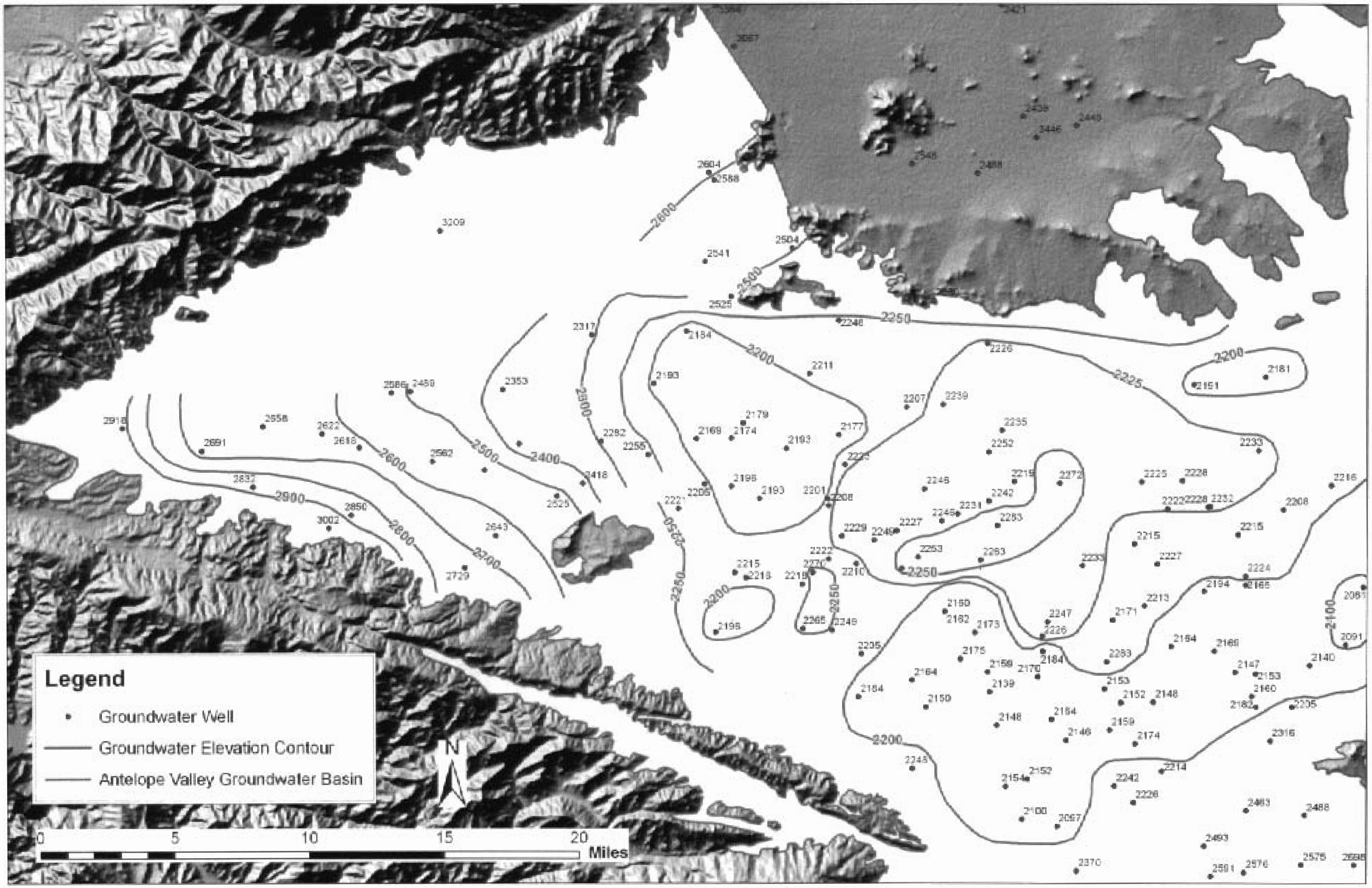

Figure 17 - Antelope Valley Groundwater Contours – 1985 Based on USGS Well Data

http://nwis.waterdata.usgs.gov/nwis/gw

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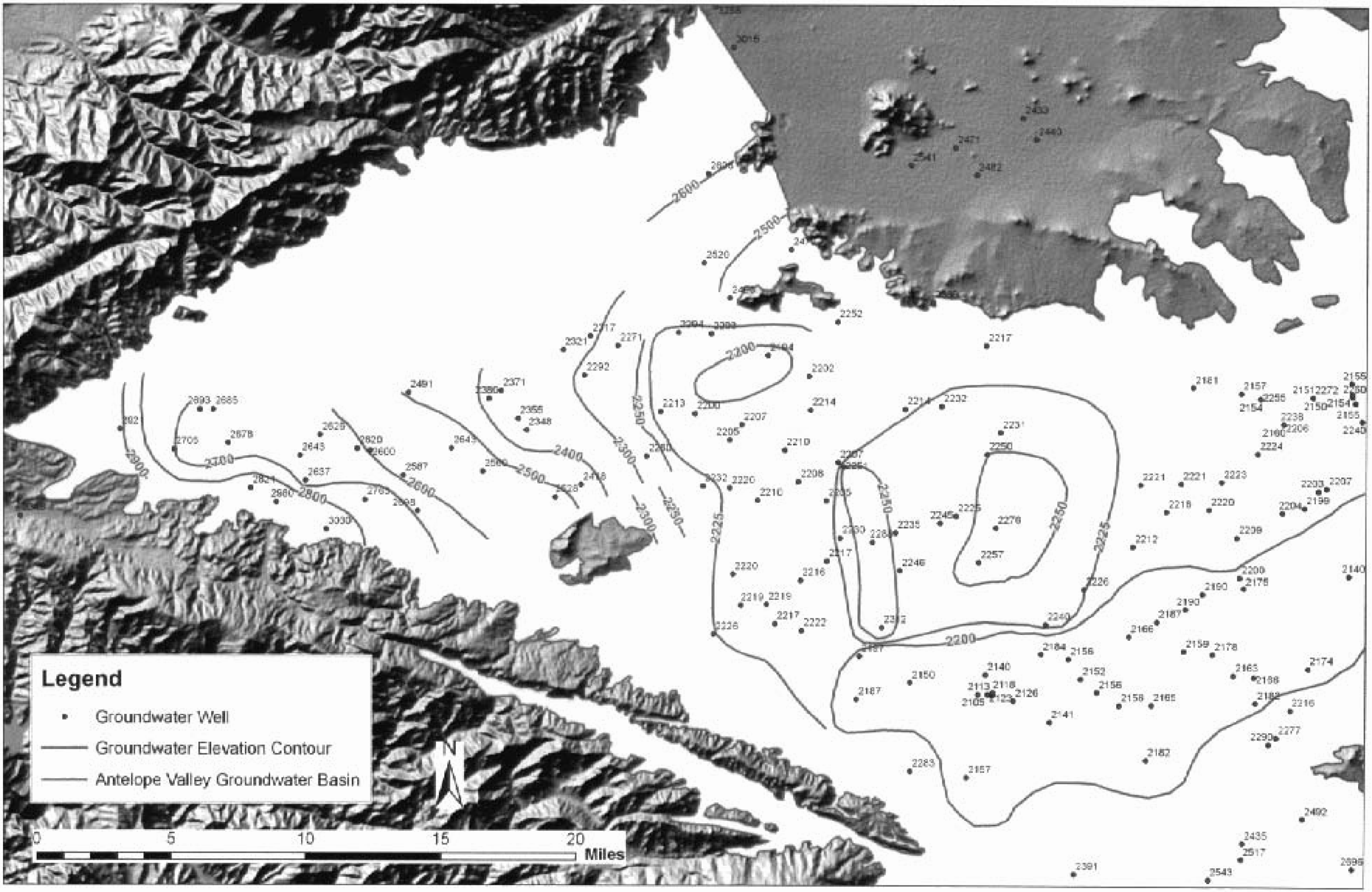

Figure 18 - Antelope Valley Groundwater Contours – 2005 Based on USGS Well Data

http://nwis.waterdata.usgs.gov/nwis/gw

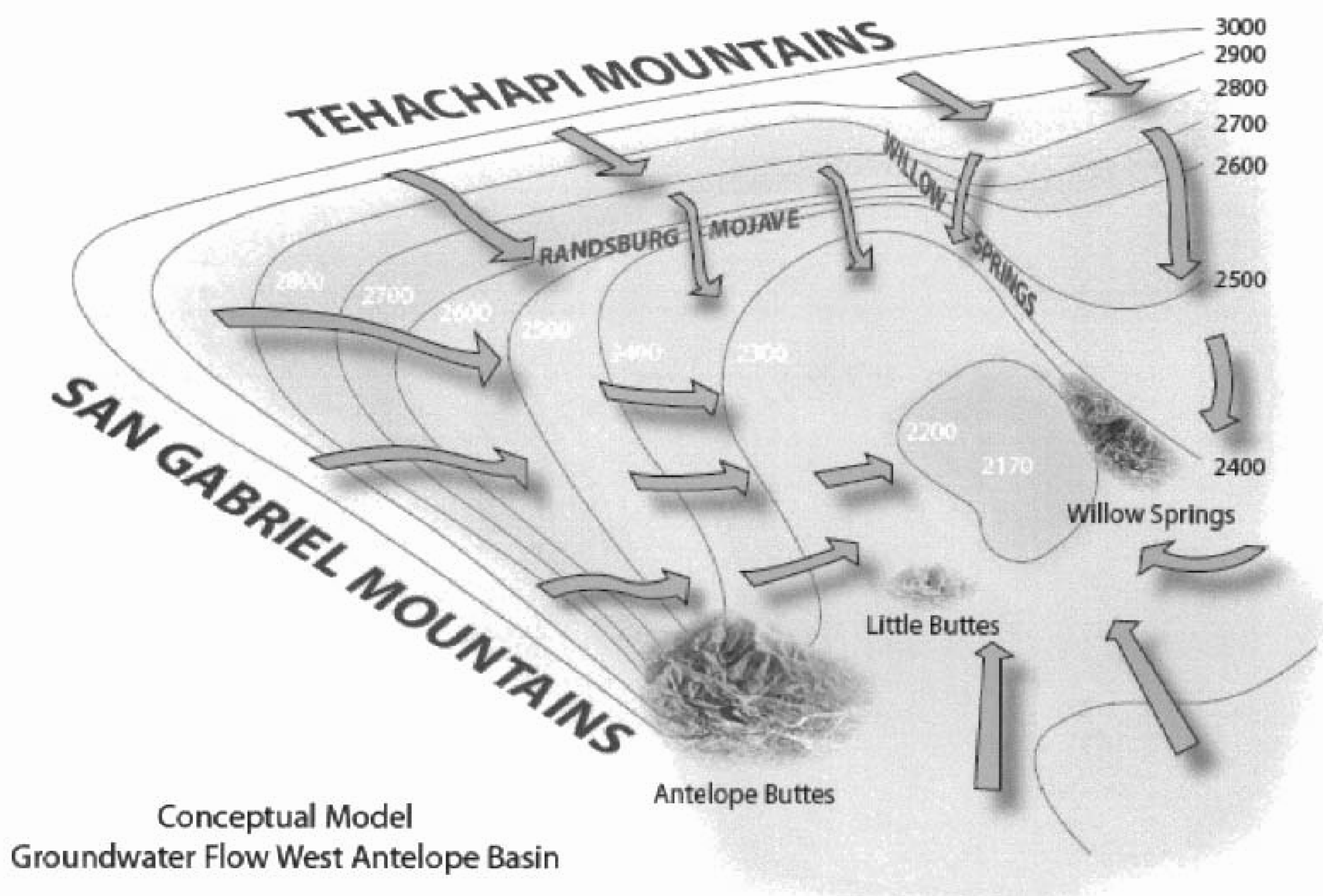

Figure 22 – Conceptual Model of West Antelope Basin Groundwater Flow Based on Extrapolation of Available Well Data

Groundwater Contour Maps

- Groundwater contour maps clearly show that little groundwater can have crossed the bedrock ridge in the last 40+ years
- The groundwater contours form a closed loop over the ridge and the area of the 2200 ft contour has shrunk significantly in 40 years
- A shrinking contour is indicative of a groundwater aquifer that is replenishing.

Aquifer Subsidence

- Ground and satellite surveys show that the aquifer east of the bedrock ridge has subsided significantly
- There is no apparent subsidence west of the bedrock ridge.
- The areas of subsidence correspond to regions of intensive land use and irrigation prior to the 1960s.

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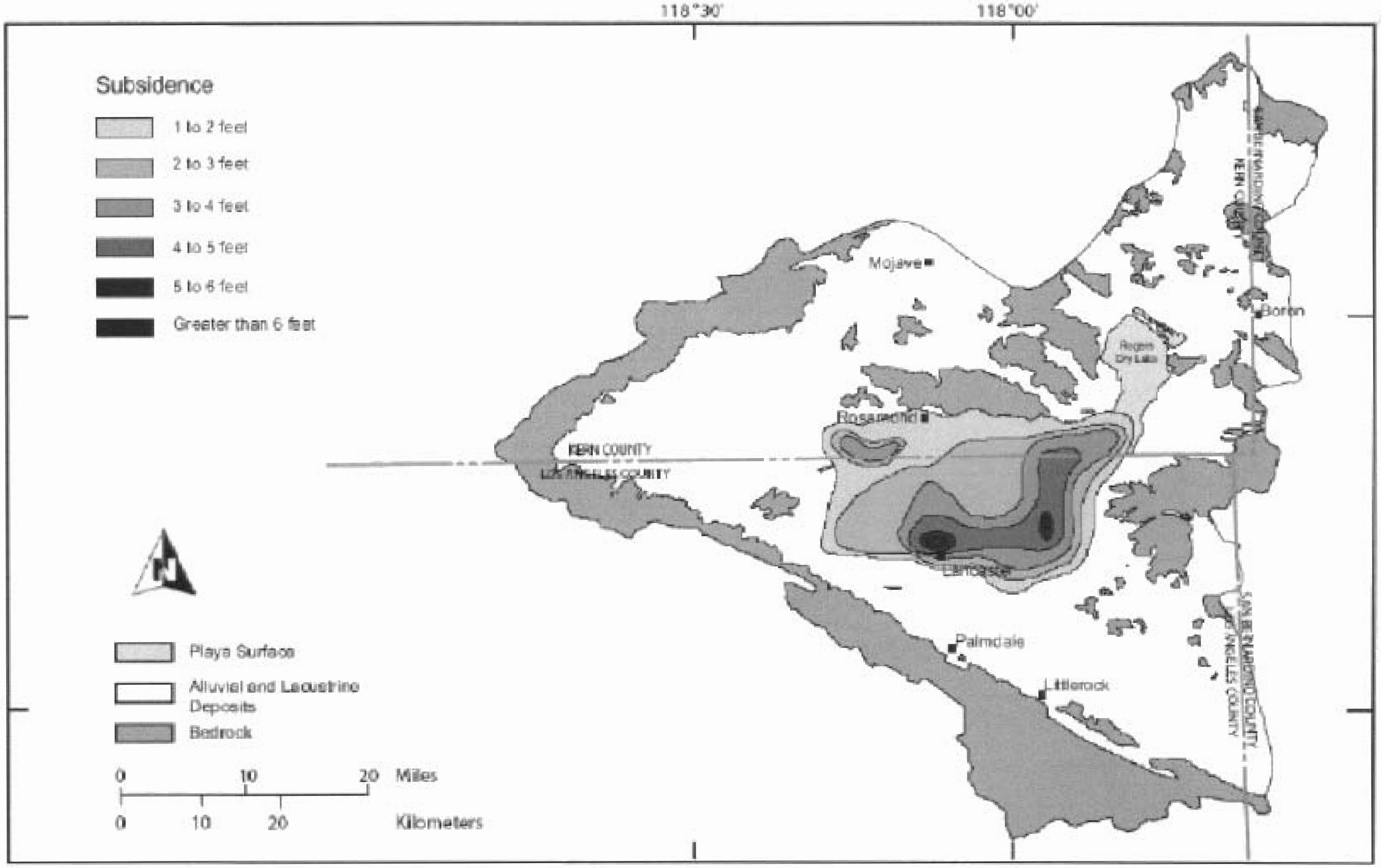

Source: Sneed, 2000.

Draft PWRP 2025 Facilities Plan and EIR

Figure 5-4

Areas of Land Subsidence Due to Groundwater Overdraft

Figure 19 – Subsidence in the Antelope Valley.

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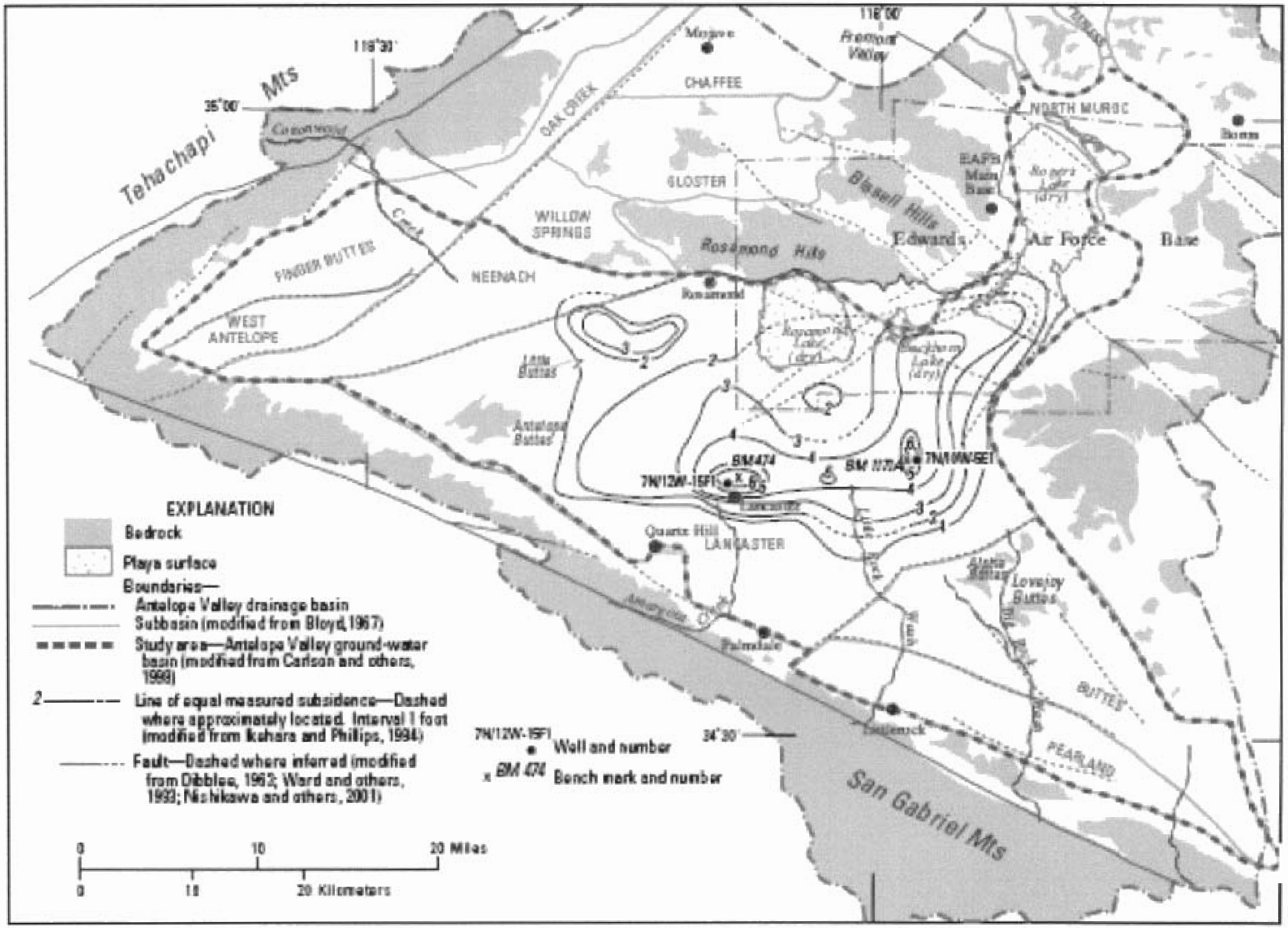
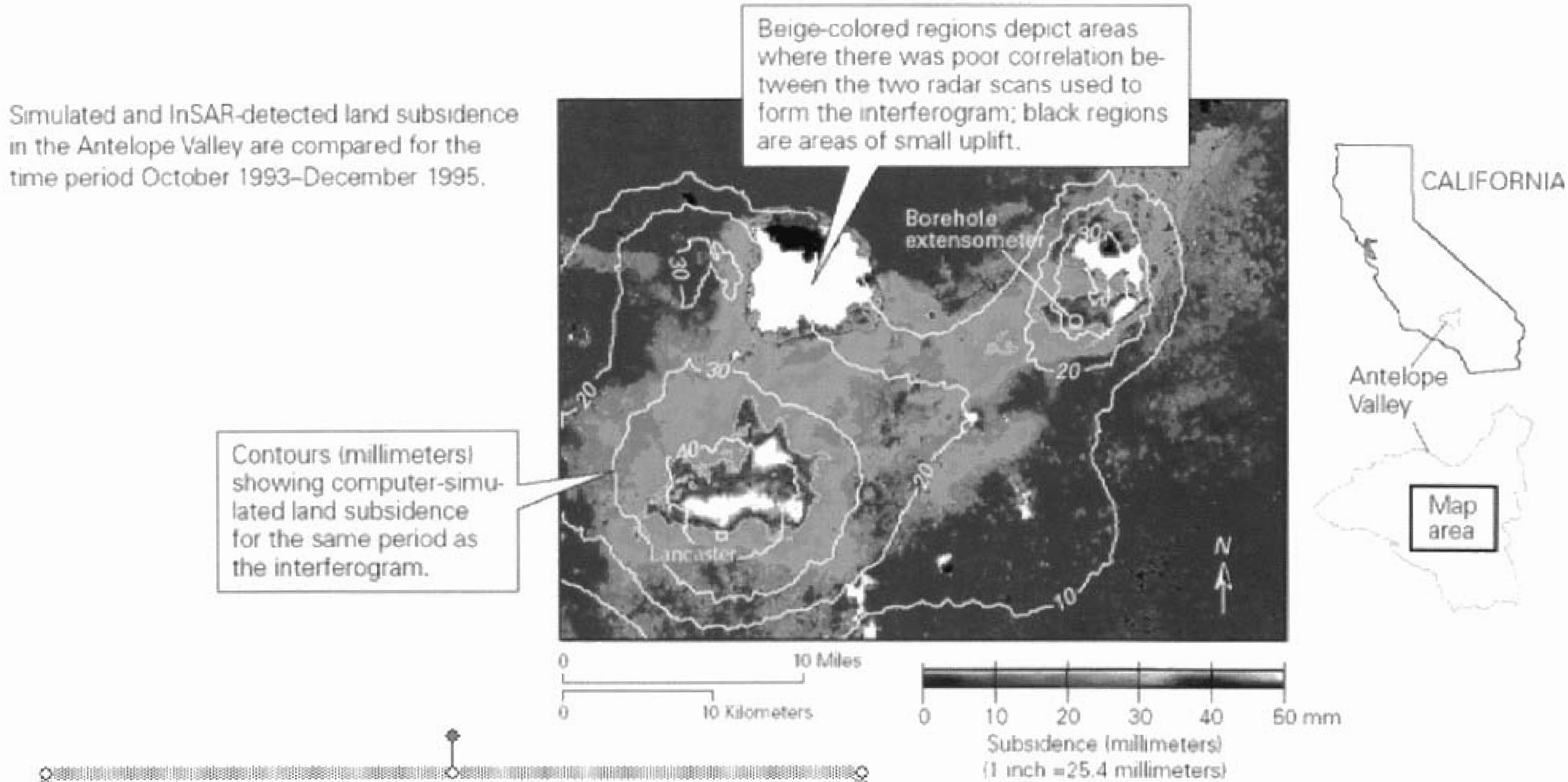


Figure 8. Measured subsidence in the Antelope Valley ground-water basin, California, 1930–92.

Source: USGS WRIR 03-4016

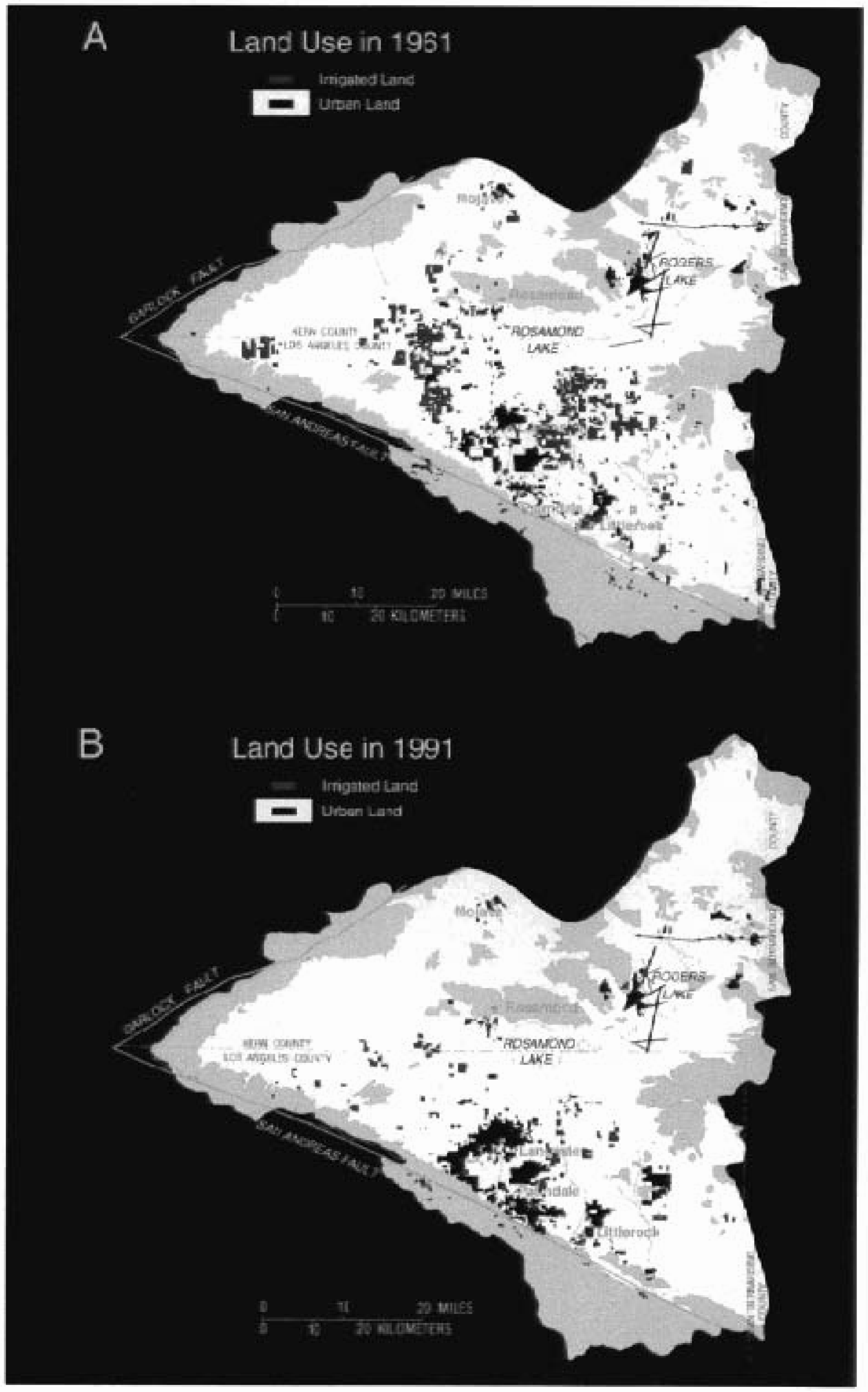
Figure 20 – Measured subsidence in Antelope Valley 1930-1982.



Source: Galloway et al at http://pubs.usgs.gov/fs/fs-051-00/

Figure 21 – Synthetic aperture radar measurement of subsidence between October 1993 and December 1995.

Chapter from **Current Research and Case Studies of Land Subsidence: Proceedings of the Dr. Joseph F. Poland Symposium**, Association of Engineering Geologists Special Publication No. 8, Published by Star Publishing Company, Belmont, CA 94002-0068



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Conclusion

The bedrock ridge and the associated groundwater pattern in the neighborhood of the ridge form an effective hydraulic barrier between the East and West Antelope Basins.

For an activity in one basin to have any effect in the other basin would require that the activity draw the groundwater elevation below EL 2200 at the bedrock ridge.