SDSU

DEPARTMENT OF GEOLOGICAL SCIENCES
COLLEGE OF SCIENCES
SAN DIEGO STATE UNIVERSITY
SAN DIEGO CA 92182-0337

(619) 594-5586

January 26, 1993

Mr. Brian Bilbray
Chairman, San Diego County Board of Supervisors
1600 Pacific Highway, Room 335
San Diego, CA 92101

Dear Mr. Bilbray:

Several residents and groups of Borrego Valley have expressed concern about the increase in groundwater use associated with the proposed expansion of the Borrego Springs Country Club that is coming before the County Board of Supervisors. As a result of this concern, I have reviewed the 1982 and 1988 U.S. Geological Survey reports on Borrego Valley, the 1984 California Department of Water Resources report on Borrego Valley, the staff report prepared for the January 8, 1993 Planning Commission meeting, and have had some discussions with John Peterson, the County Hydrogeologist, about the project.

It is clear to me that Borrego Valley is being overdrafted by groundwater production. Groundwater levels have been declining since 1945 and the water budget suggests that the majority of the groundwater withdrawal in the valley is derived from water in storage, not from recharge. The results of the U.S. Geological Survey studies suggest that 231,000 acre-ft of groundwater was depleted from Borrego Valley between 1945 and 1980, and that overdraft of the basin continued at a rate of 6200 acre-ft/yr as of 1979. Since 1979 consumptive use of groundwater has increased by an additional 5100 acre-ft/yr, so that overdraft in 1992 is about 11,300 acre-ft/yr. Current permit applications, including Borrego Springs Country Club, will further increase basin overdraft to about 18,300 acre-ft/yr, assuming the Board of Supervisors approves these requests without modification.

Now the amount of water stored in Borrego Valley is large - I estimate 1.9 million acre-ft - but not infinite. It is clear that an alternate supply of water must ultimately be supplied to the residents of the valley. If overdraft continues at a rate of 18,300 acre-ft/yr, significant water supply problems can be expected in about 70 years, and the aquifers would be effectively depleted in 156 years. That is a long ways off, but it assumes that overdraft will be limited to 18,300 acre-ft.

My concern, however, is that the annual overdraft has been increasing exponentially since 1979, with the overdraft doubling about every 14 years. Using an exponential model,

#8 Huntley

serious groundwater problems can be expected in the valley in only 30 years, and depletion of the aquifer in 40 years. From the standpoint of development of alternate supplies of water, that is just around the corner. Because of this, I think that a hard look has to be taken at the water supply picture of the Borrego Valley. Though I am not suggesting that the current permit applications be rejected, I do think the following steps should be taken:

1. All golf course irrigation should be reduced to the minimum viable. Use of state of the art moisture sensors and computer-controlled irrigation systems can reduce consumptive water use significantly. Golf courses should be limited to applied water use of five acre-ft/year per acre of irrigated turf. In addition, the acreage of irrigated turf should be limited. In Arizona, which is seeing similar depletion of groundwater aquifers, golf courses are being designed as "target courses", with limited fairway acreage.

2. A groundwater management plan should be put in place now. This groundwater management plan could be administered by one of the existing water districts within the valley, with minimal cost.

3. The U.S. Geological Survey numerical model of the valley should be updated and incorporated as a tool of the groundwater management plan. The impacts of future permit applications should be evaluated by incorporation into the groundwater model.

4. Efforts should be undertaken now to identify alternate sources of water for the valley.

If you have any questions, please feel free to contact me. I have supplied technical support for my concerns to John Peterson. Please forward copies of this letter to the other four Supervisors.

Sincerely,

David Huntley
Professor of Geological Sciences

cc.
Supervisor Diane Jacobs
Supervisor John MacDonald
Supervisor Pamela Slater
Supervisor Leon Williams

SDSU

DEPARTMENT OF GEOLOGICAL SCIENCES
COLLEGE OF SCIENCES
SAN DIEGO STATE UNIVERSITY
SAN DIEGO CA 92182-0337

(619) 594-5586

January 26, 1993

Mr. John Peterson
San Diego County Department of Planning

Dear Mr. Peterson:

As discussed previously, I was recently asked to look at the groundwater situation in Borrego Valley by several concerned residents and groups of Borrego Valley. Enclosed is a copy of the letter to the San Diego County Board of Supervisors summarizing my findings. The letter to the Board of Supervisors is brief and contains little or no technical support. The purpose of the present letter is to provide you with some technical support for my comments to the Supervisors.

I have reviewed the two U.S. Geological Survey reports, the Calif. Dept. of Water Resources (DWR) report, the staff report on the Borrego Country Club request to the Planning Commission, and the well hydrographs that you provided to me. It is clear from the simple water level measurements that Borrego Valley has been in overdraft since 1945, when groundwater production began to increase, and continues to be in overdraft today. By overdraft, I simply mean than groundwater discharge (natural plus manmade) exceeds groundwater recharge, resulting in a depletion of storage. Groundwater levels in Borrego Valley have declined as much as 100 ft between 1945 and 1980, and a decline of 40 to 50 ft is typical of areas away from the pumping centers. Indeed, the 1982 U.S.G.S. report suggests that there was a depletion of storage of 330,000 acre-ft between 1945 and 1980, or an average of 9400 acre-ft/yr (af/yr). It is interesting to compare this to the water use in the valley given by DWR (Table 4) between 1945 and 1980. Assuming linear increases and decreases in discharge, the total amount of water used in Borrego Valley in that period was 342,850 acre-ft, for an average of 9800 af/yr, only slightly more than the estimated overdraft. If these numbers are correct, it would suggest:

1. Most of the groundwater withdrawal in the valley comes from storage, and;

2. There is very little irrigation return flow.

The 1988 U.S.G.S report resolves some of these difficulties, however. This report describes the numerical model of the basin. Calibration of the model results in some better values of aquifer specific yield. The results of the model suggest that the specific yield of the upper, middle, and lower aquifers are 14%, 7%, and 3%, respectively. I feel that these

are better estimates of specific yield than those used in the staff report.

Using these lower values of specific yield modifies the conclusions of the 1982 U.S.G.S report. The depletion of storage in Borrego Valley between 1945 and 1980 would now appear to be only 231,000 acre-ft, for an average of 6600 af/yr. Indeed, the 1988 U.S.G.S. report suggests that basin overdraft in 1979 was 6200 af/yr. This fits better with water use figures, as table 4 in the DWR report suggests that consumptive water use between 1945 and 1980 averaged 6900 af/yr.

Based on these data, my best estimate of the situation in 1979 is that of the 1988 U.S.G.S. report; basin recharge is 4800 af/yr, basin overdraft is 6200 af/yr, and natural evapotranspiration and outflow have been decreased to small amounts (1100 af/yr). Superimposed on this are the increases in production between 1979 and 1992, and the proposed increases in discharge resulting from projects currently under review.

To calculate overdraft in 1992, I have added the 6200 af/yr 1979 overdraft to any increases in consumptive use. I have estimated the increase in golf course consumptive use at 2231 af/yr (your appendix 1 rate adjusted to 5 ft/yr consumptive use), the increase in municipal use at 1633 af/yr (your 1967 af/yr minus the 334 af/yr assumed by the U.S.G.S. in 1979), and the increase in agricultural use at 1210 af/yr (your 7,641 af/yr minus 1980 U.S.G.S. estimate of agricultural water use, excluding municipal, golf course, or native vegetation). This results in an estimated overdraft in 1992 of 11,274 af/yr.

To calculate the overdraft in 1995 (assumed date when all current requests go on-line), I added additional consumptive use to the 1992 overdraft. I have estimated an additional 1266 af/yr of consumptive use on golf courses (5 ft/yr, adjusted from your appendix 2), an additional 2314 af/yr of municipal use (from your appendix 2), and additional agriculture of 3,420 af/yr (from your appendix 2). This results in an estimated overdraft in 1995 of 18,274 af/yr.

To put this in context, we must evaluate the available groundwater in storage. Using the specific yields of 14% and 7%, respectively for the upper and middle aquifers, the available storage in 1980, based on your planimetering of the maps in the 1982 U.S.G.S. report, was 809,000 acre-ft in the upper aquifer and 1,090,600 acre-ft in the middle aquifer, for a total storage of 1,900,500 acre-ft. Thus given the 1992 rate of overdraft, the aquifer would be 50% depleted in 72 years (from 1992) and 100% depleted in 156 years (from 1992). Using the 1995 overdraft, the aquifer would be 50% depleted in 40 years and 100% depleted in 92 years.

This really doesn't tell the story, however. The increase in overdraft from 6200 af/yr in 1979 to 18,000 af/yr in 1995 represents an exponential increase in overdraft, with a doubling of the overdraft about once every 14 years. This exponential increase in overdraft can be modeled (see figures) to show both the overdraft (in af/yr) or the cumulative overdraft (which is just the depletion of storage). These calculations show that if overdraft

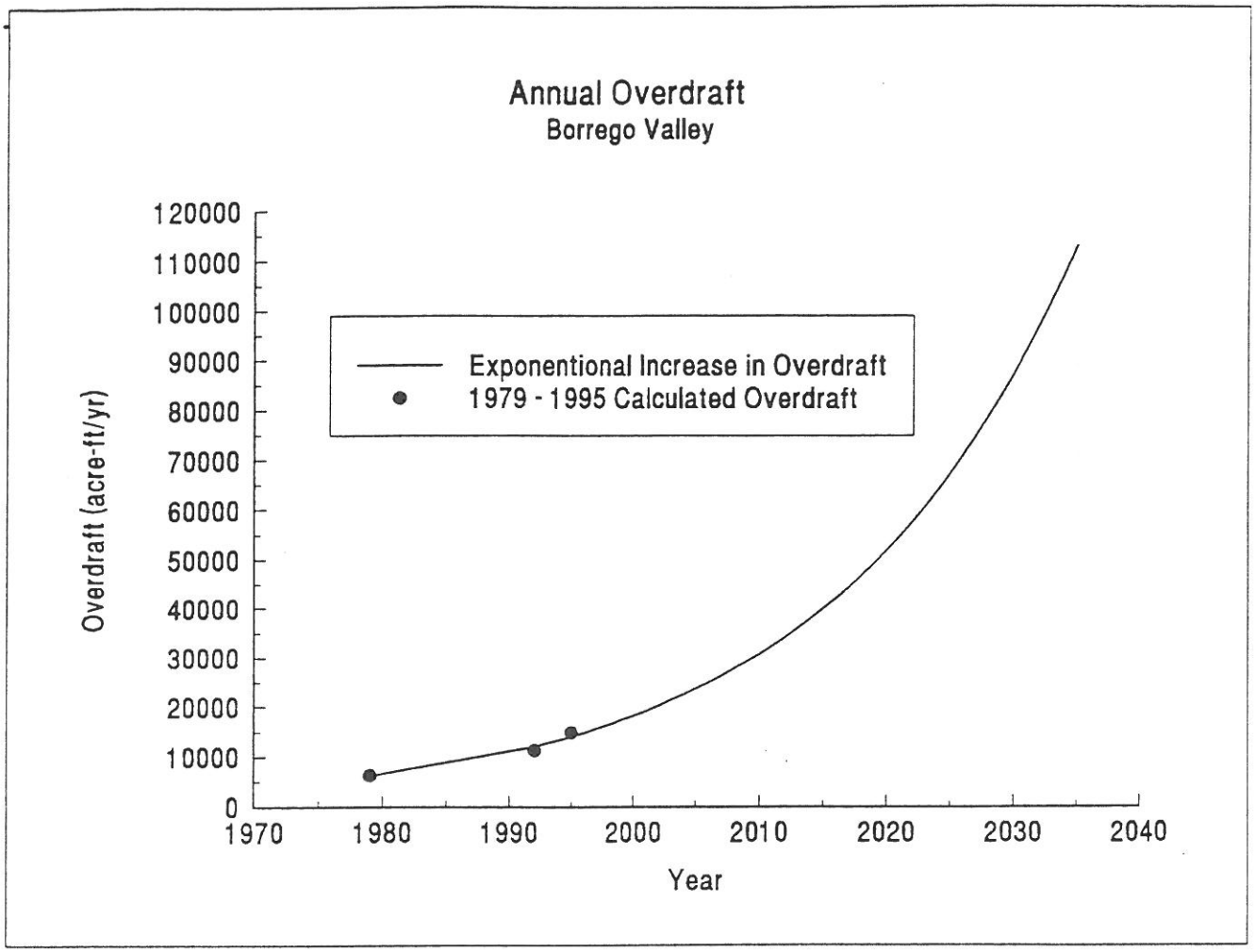
continues to increase as it has since 1979, the aquifer will be 50% depleted by the year 2022 (in 30 years) and 100% depleted by the year 2034 (in 40 years). This, of course is my concern, as discussed in the letter to the Board of Supervisors.

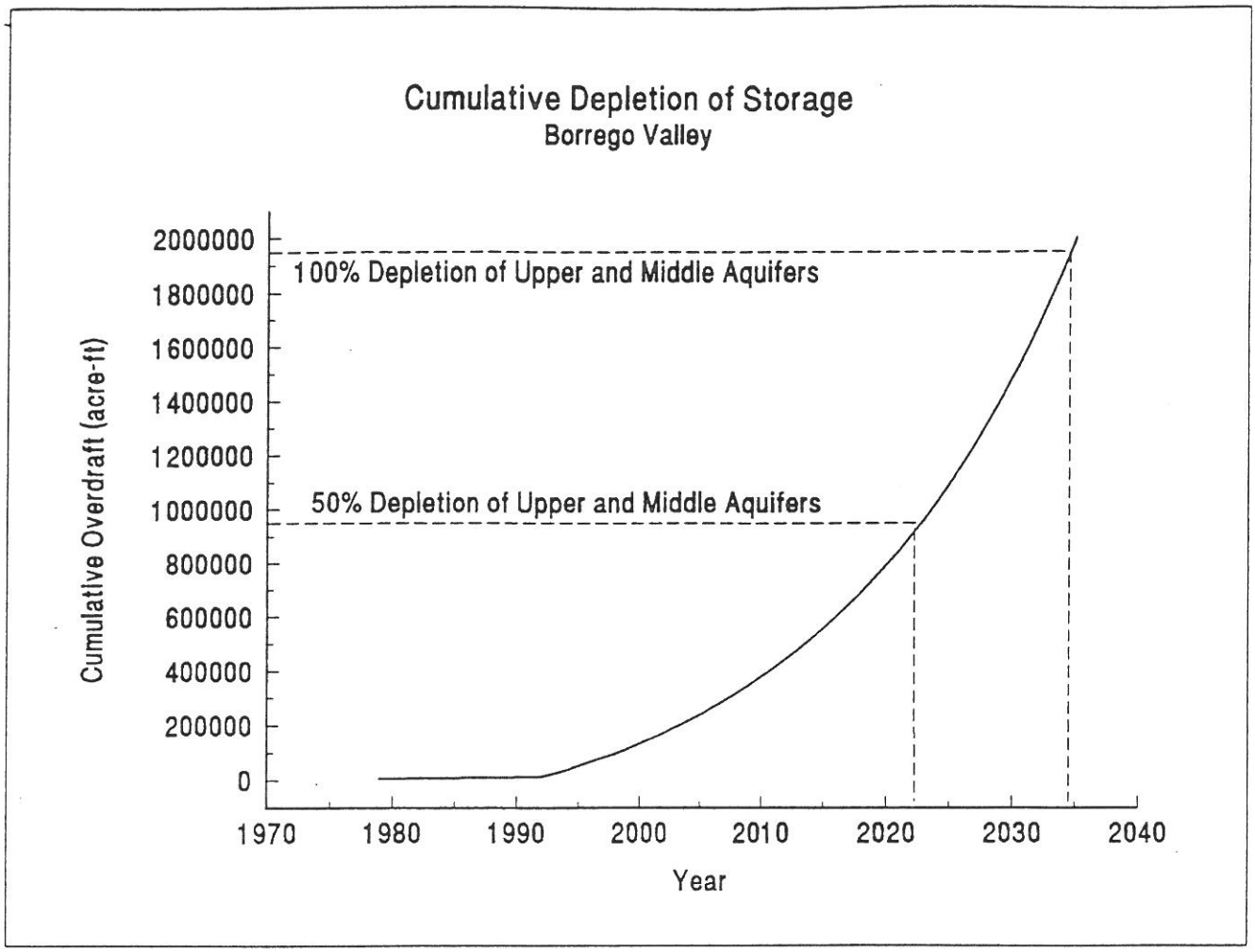
If you have any questions, please feel free to contact me.

Sincerely,

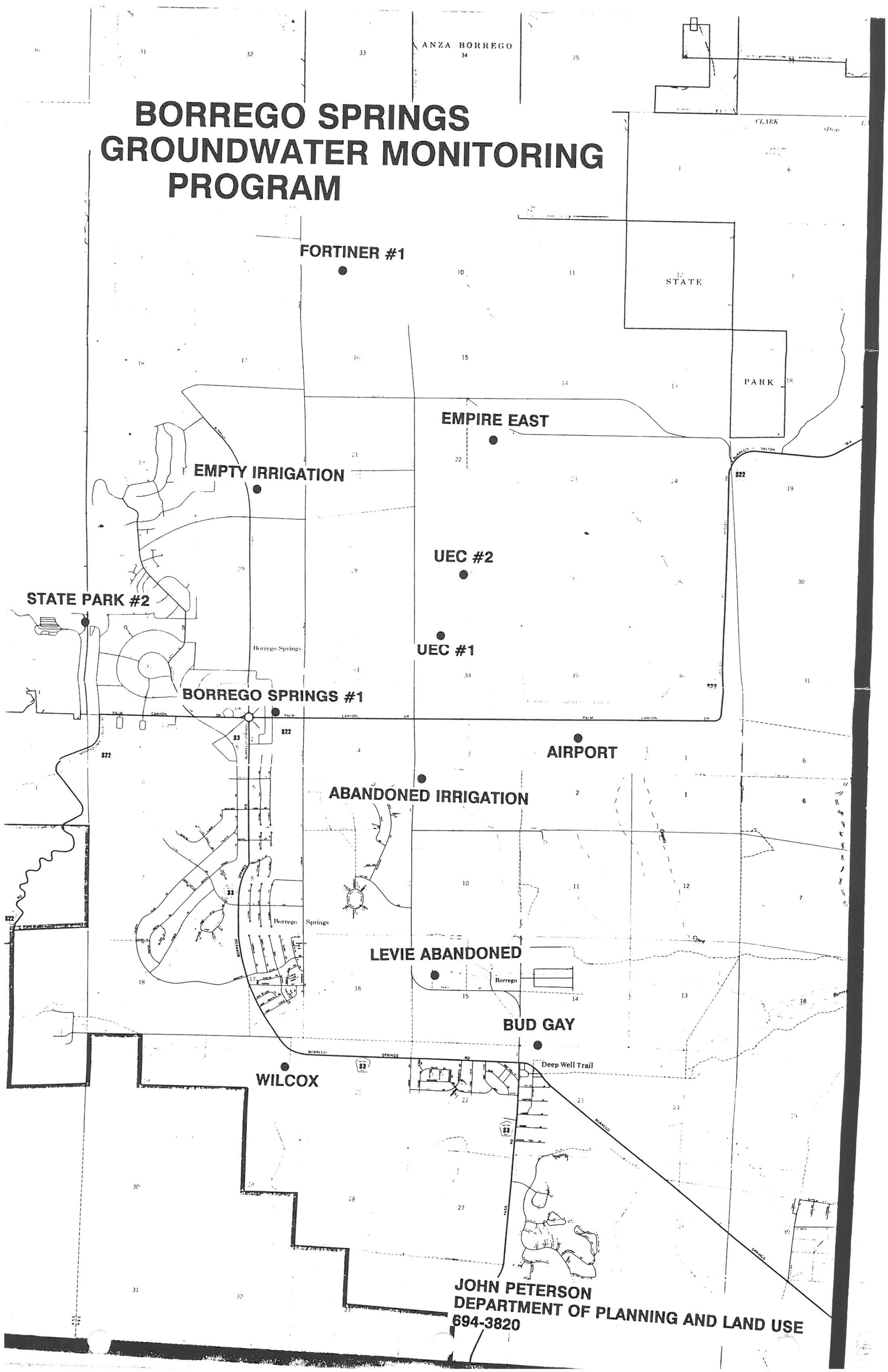
David Huntley

David Huntley
Professor of Geological Sciences


Annual Overdraft
Borrego Valley
120000
110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Overdraft (acre-ft/yr)
Exponentional Increase in Overdraft
1979 - 1995 Calculated Overdraft
1970
1980
1990
2000
2010
2020
2030
2040
Year

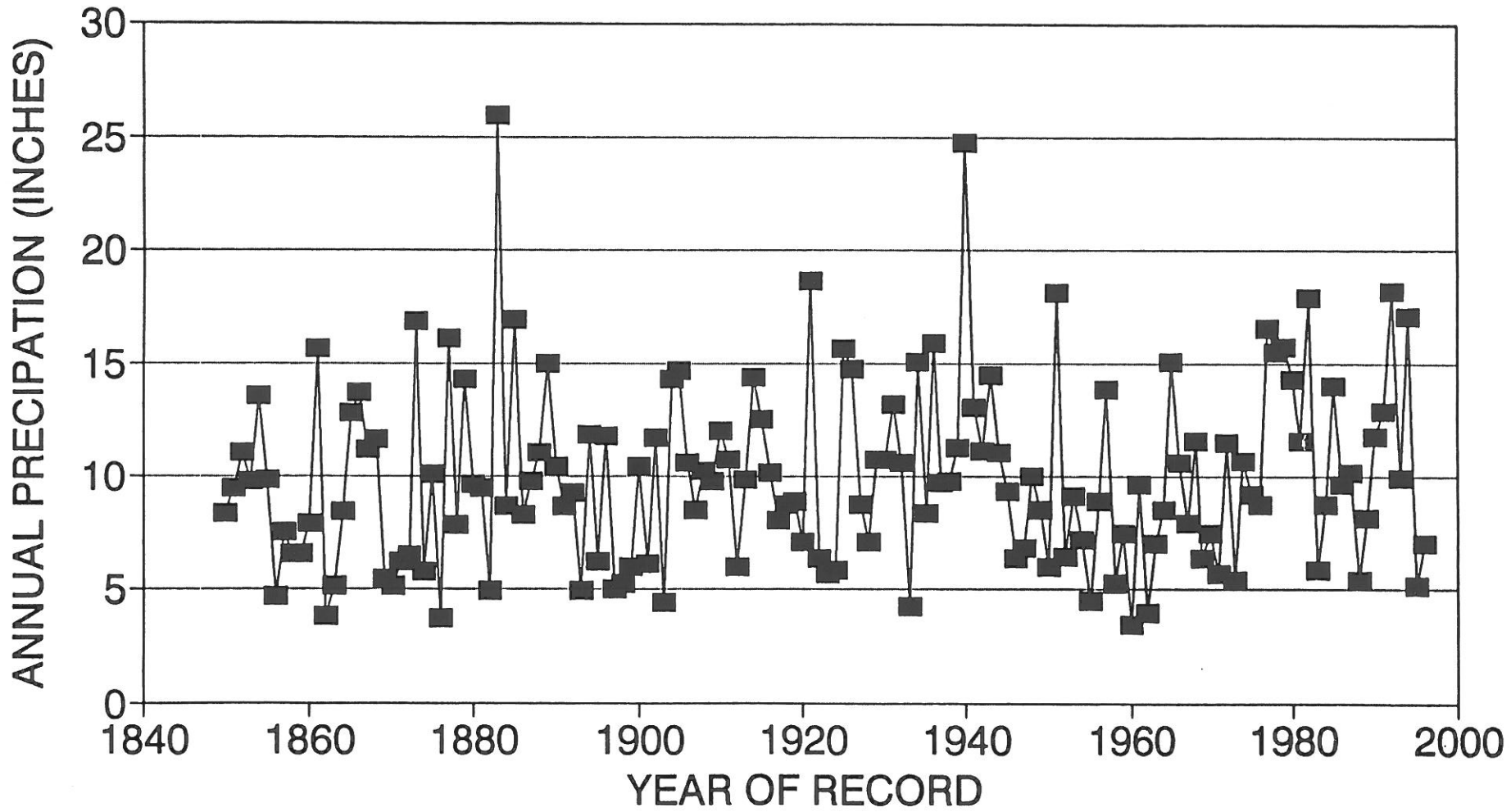

Cumulative Depletion of Storage
Borrego Valley
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Cumulative Overdraft (acre-ft)
100% Depletion of Upper and Middle Aquifers
50% Depletion of Upper and Middle Aquifers
1970
1980
1990
2000
2010
2020
2030
2040
Year

BORREGO SPRINGS GROUNDWATER MONITORING PROGRAM



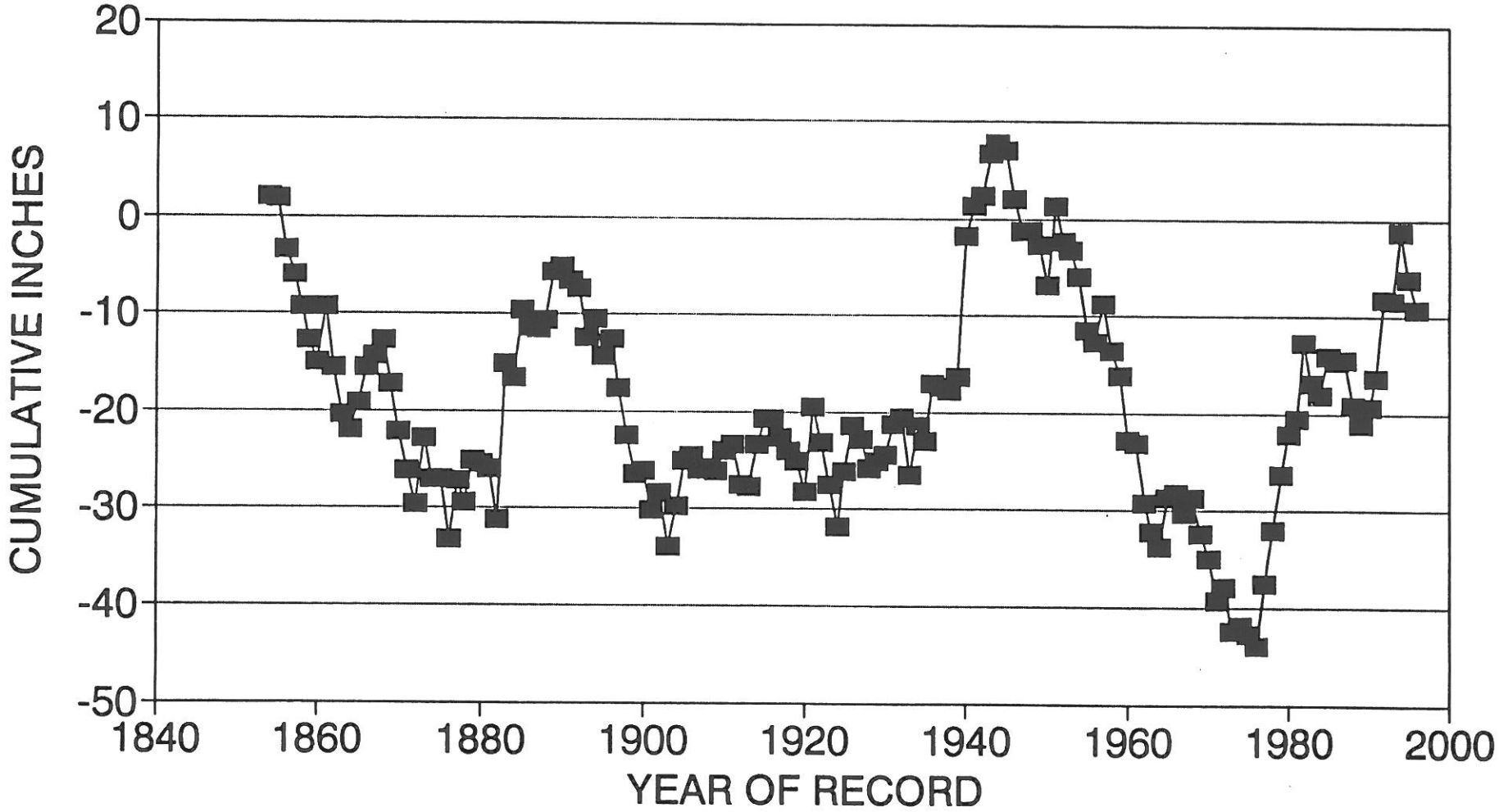
SAN DIEGO RAINFALL

ANNUAL RAINFALL



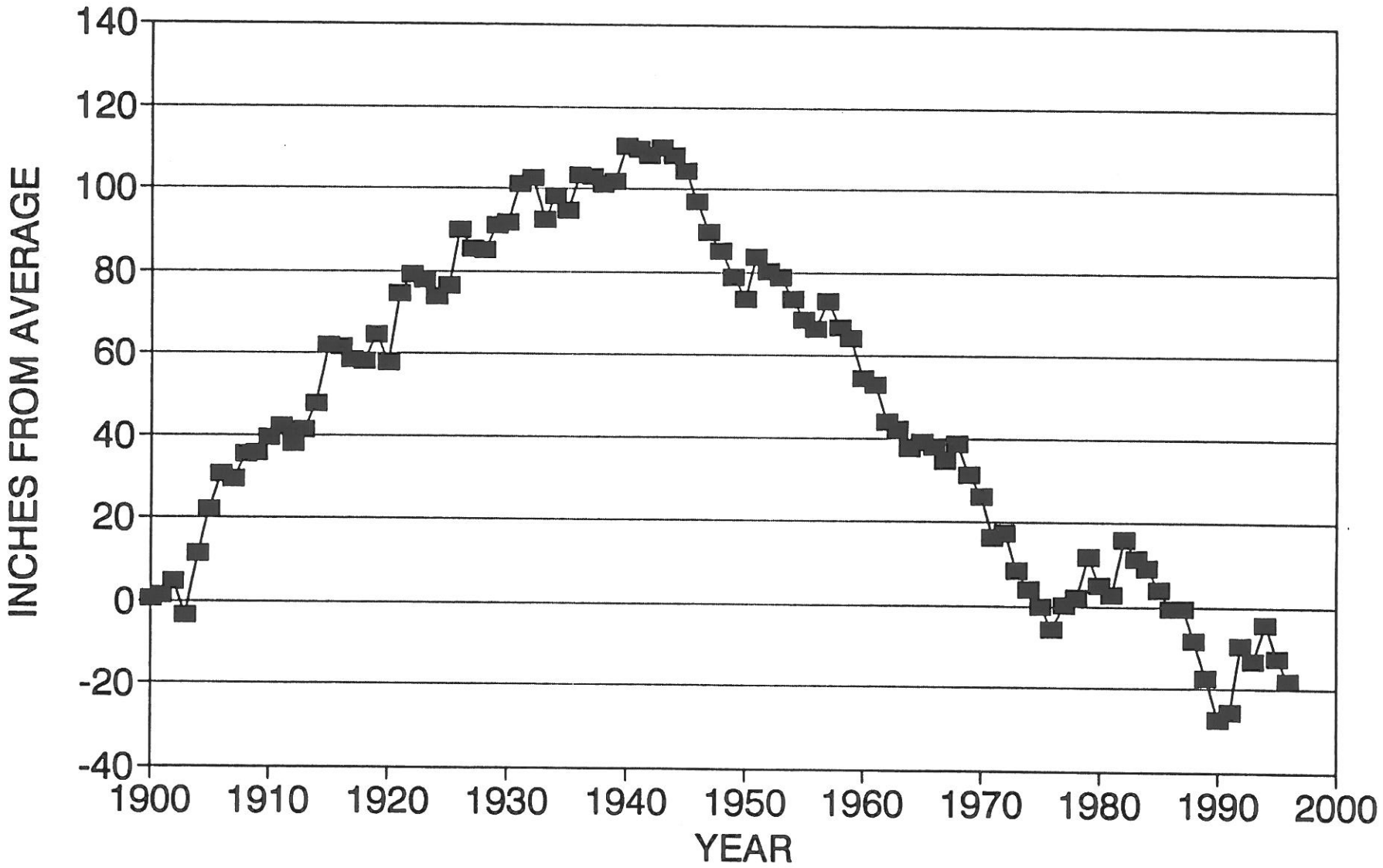
SAN DIEGO RAINFALL

CUMULATIVE DEPARTURE FROM AVE.

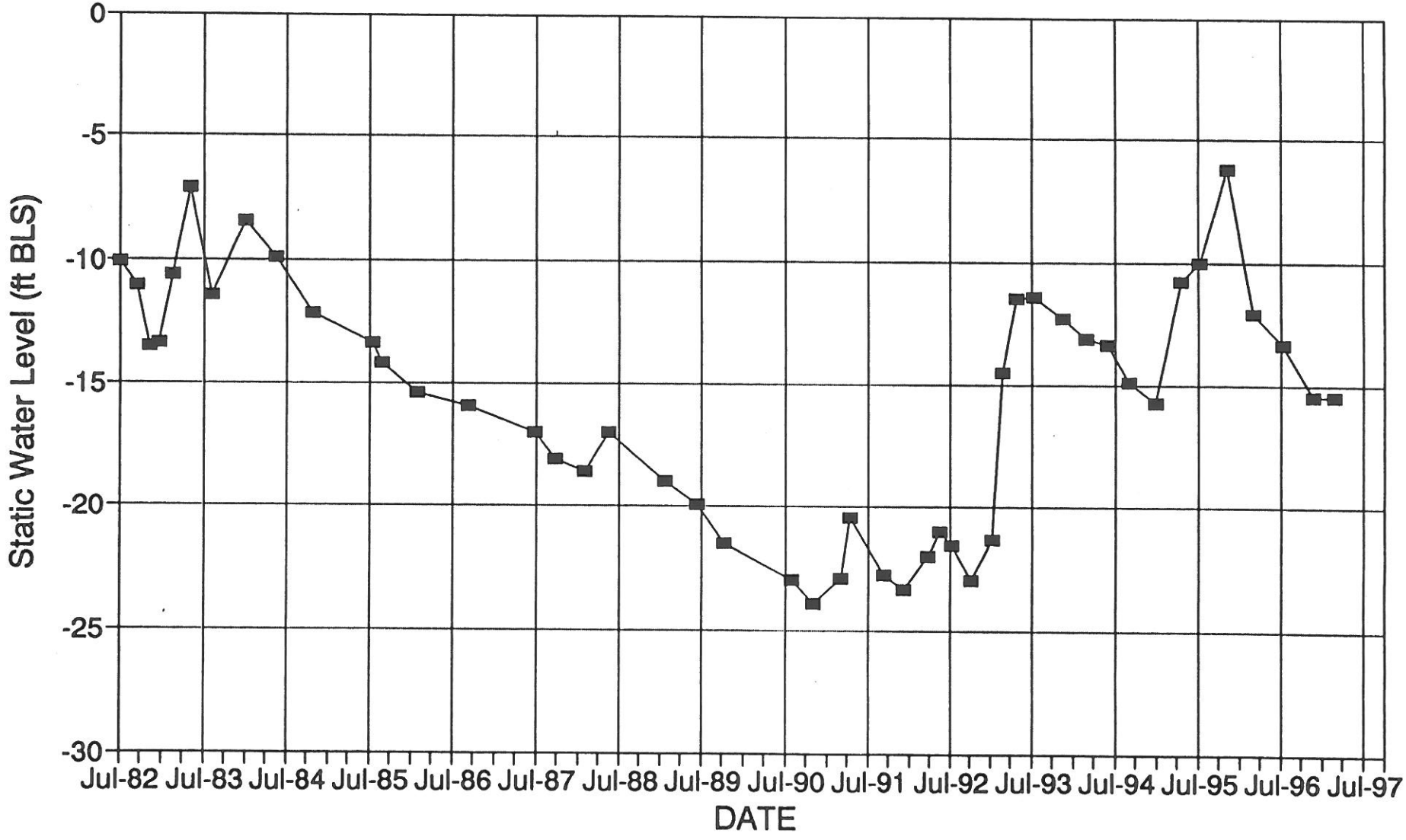


CAMPO 1900 TO 1996

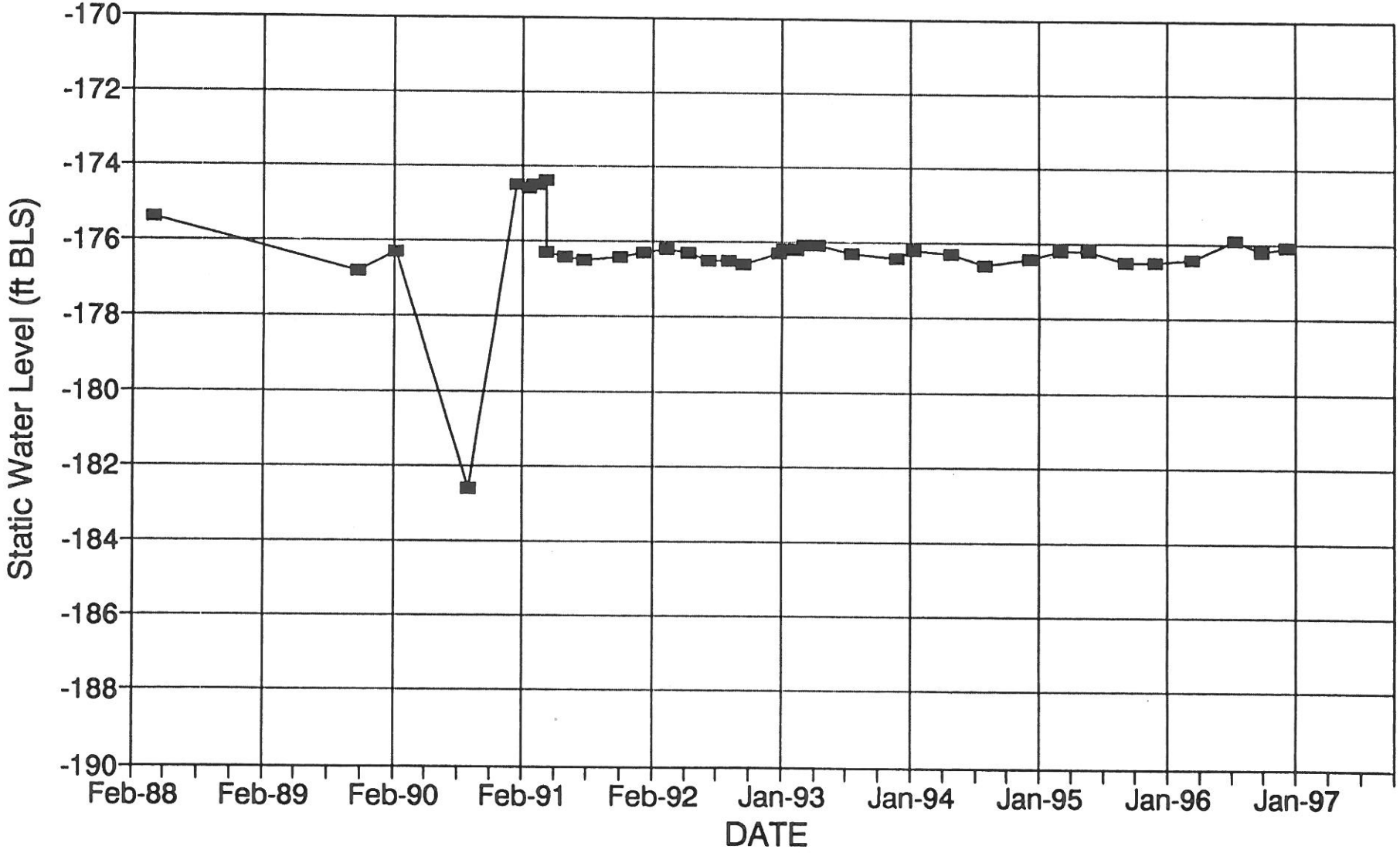
CUMULATIVE DEPARTURE FROM AVE.

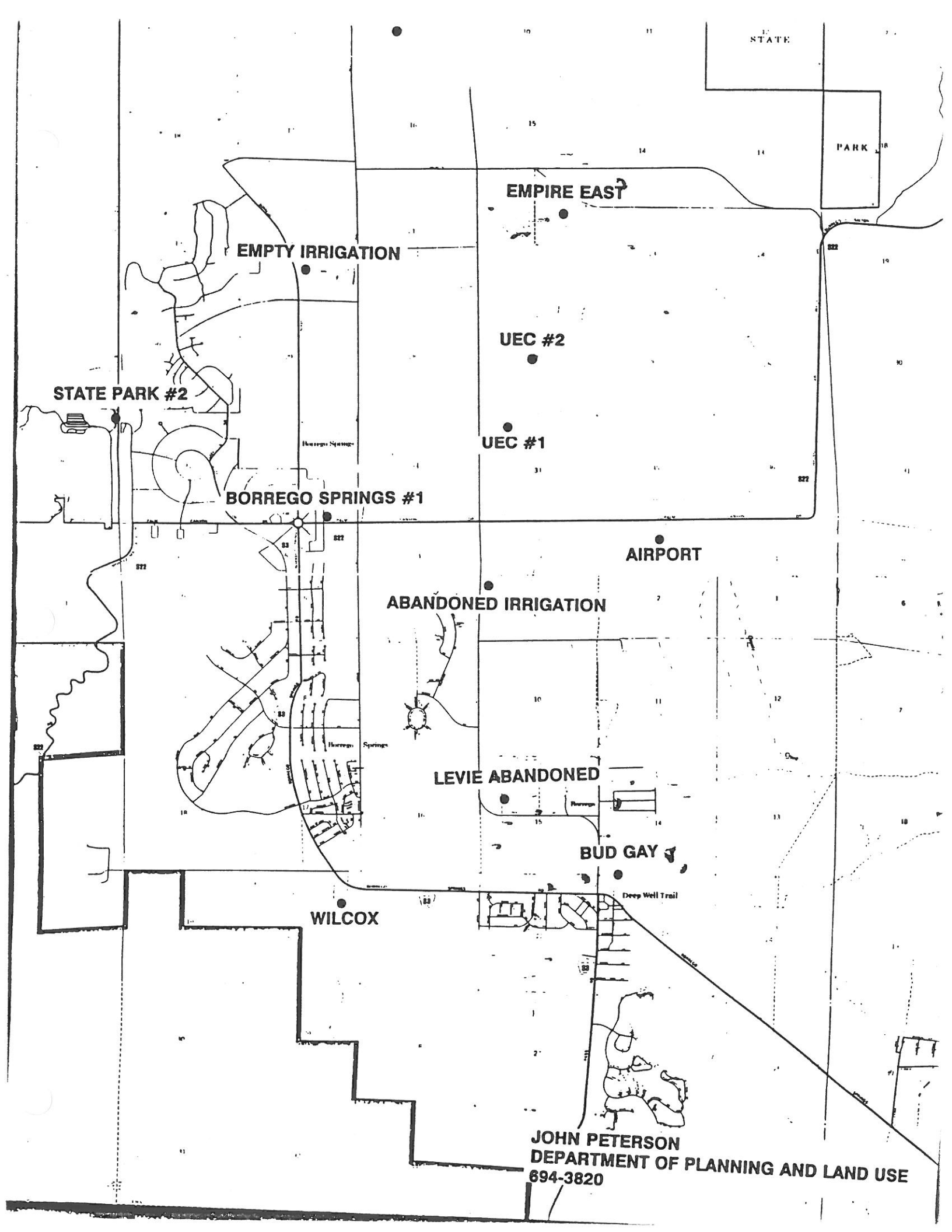


HONEY SPRINGS WATERSHED
Rental Well Hydrograph



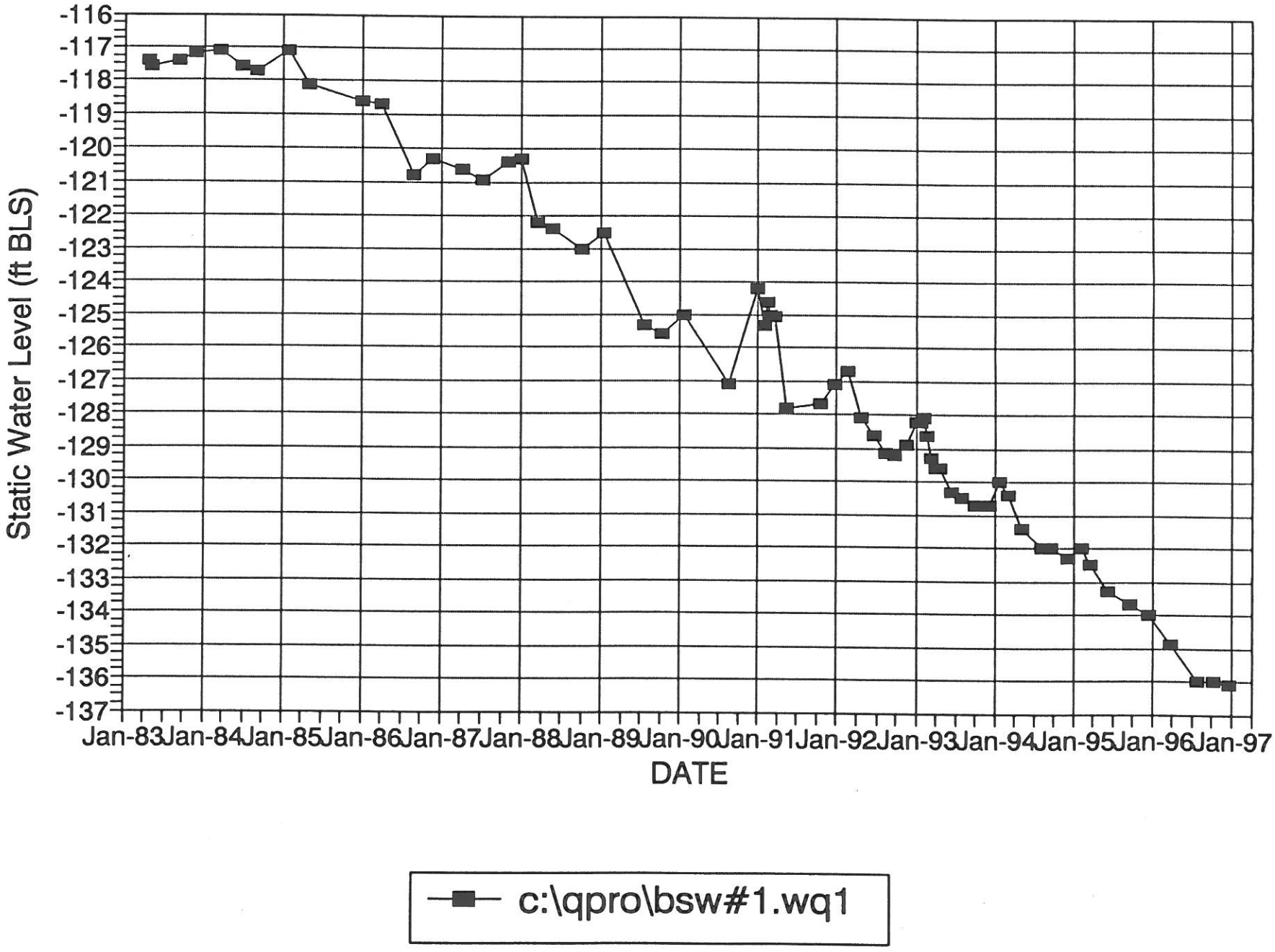
SHELTER VALLEY
Southern Hydrograph



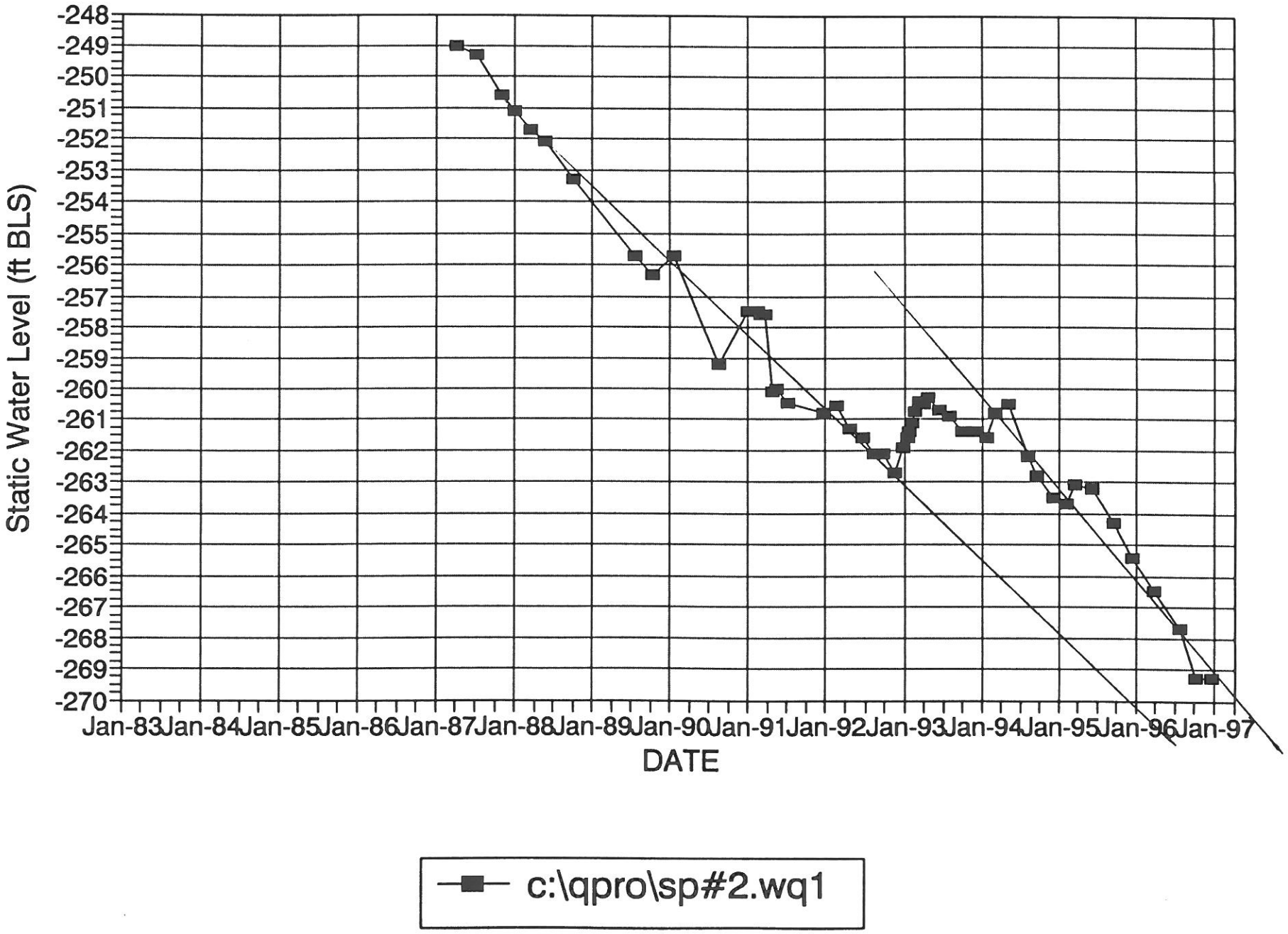

STATE
PARK
EMPIRE EAST
EMPTY IRRIGATION
UEC #2
STATE PARK #2
UEC #1
BORREGO SPRINGS #1
AIRPORT
ABANDONED IRRIGATION
LEVIE ABANDONED
BUD GAY
Deep Well Trail
WILCOX
JOHN PETERSON
DEPARTMENT OF PLANNING AND LAND USE
694-3820

BORREGO SPRINGS

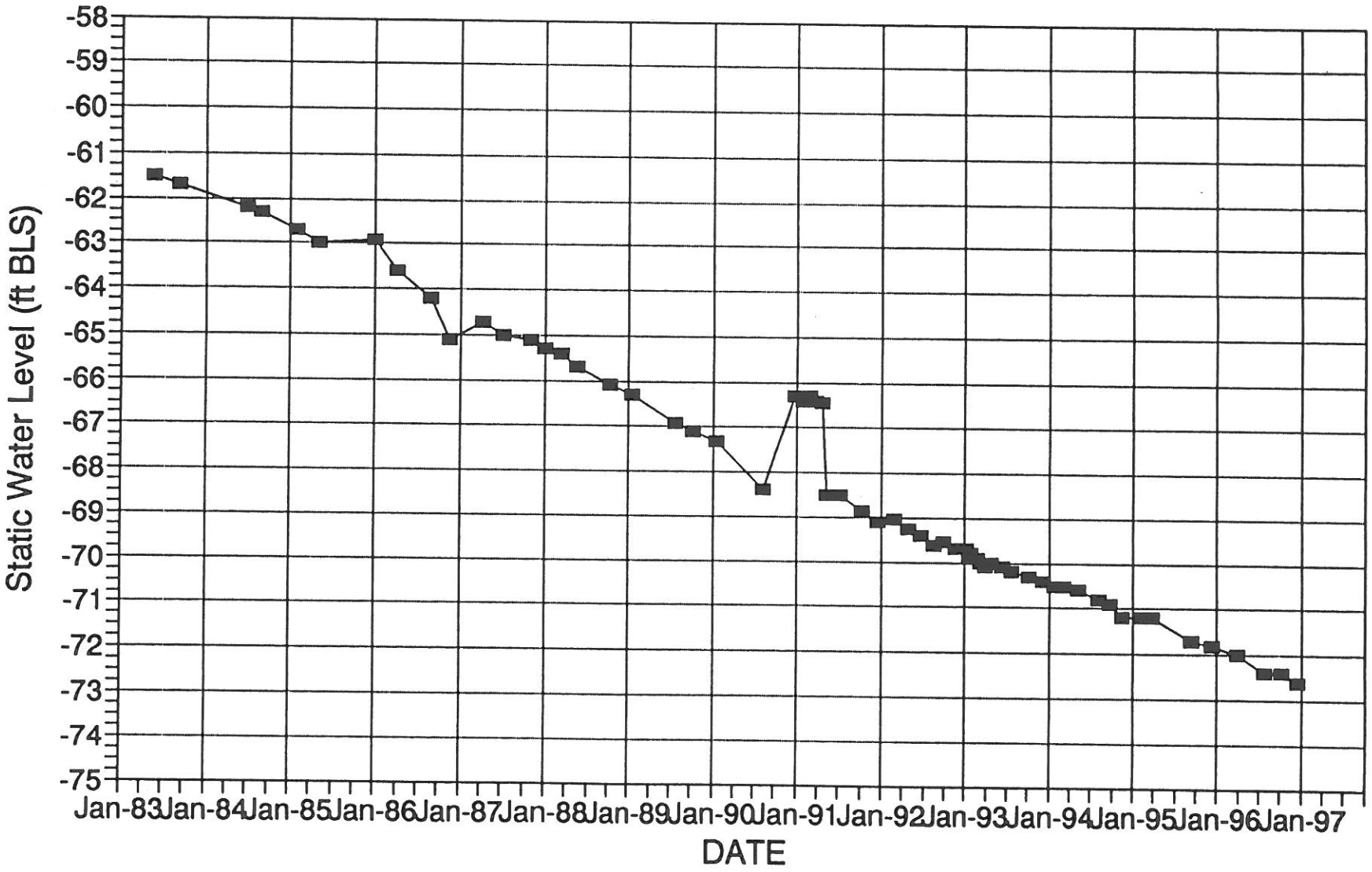
Borrego Springs #1 Well Hydrograph



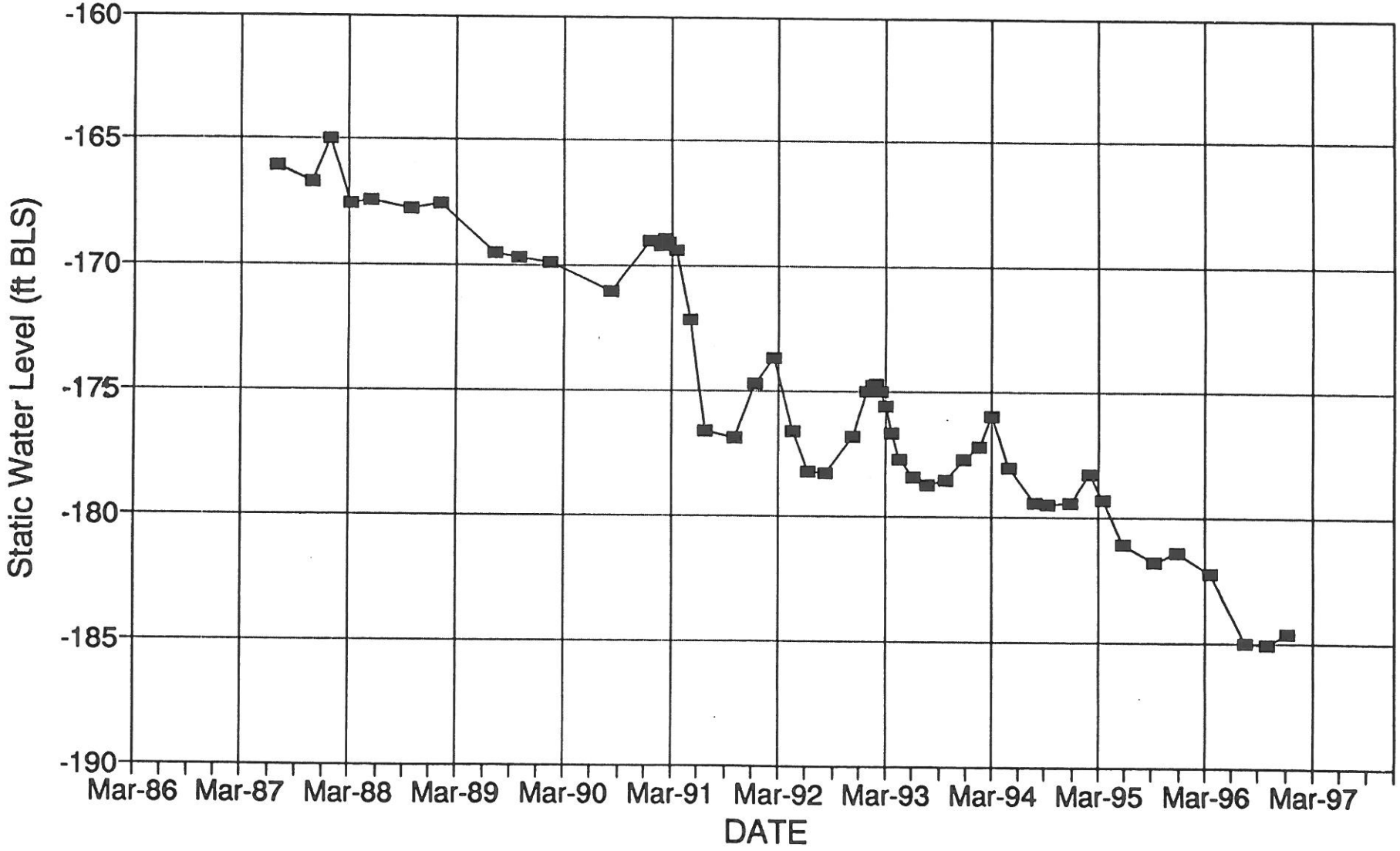
BORREGO SPRINGS
State Park #2 Well Hydrograph



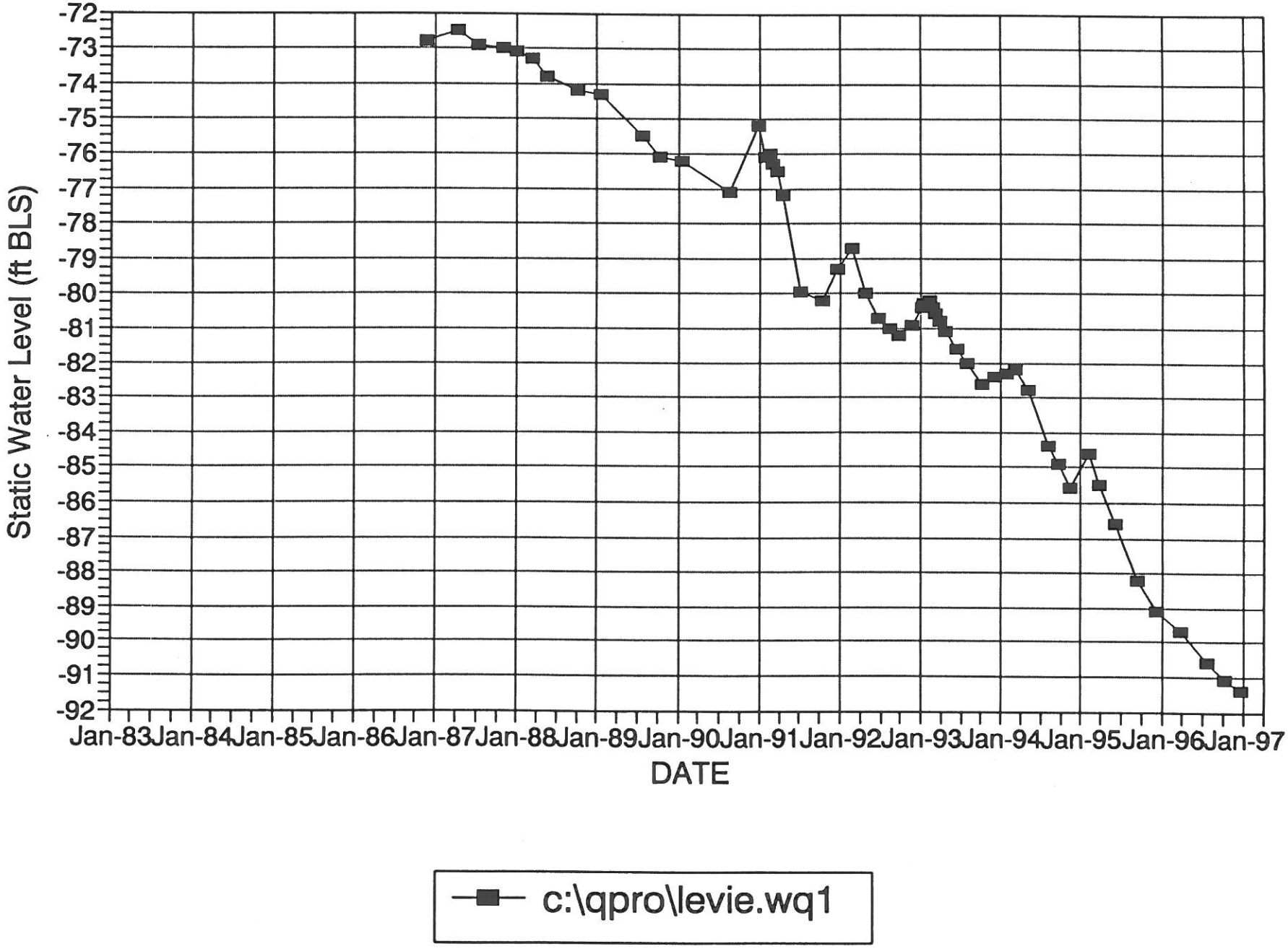
BORREGO VALLEY
Abandoned Irrigation Well Hydrograph



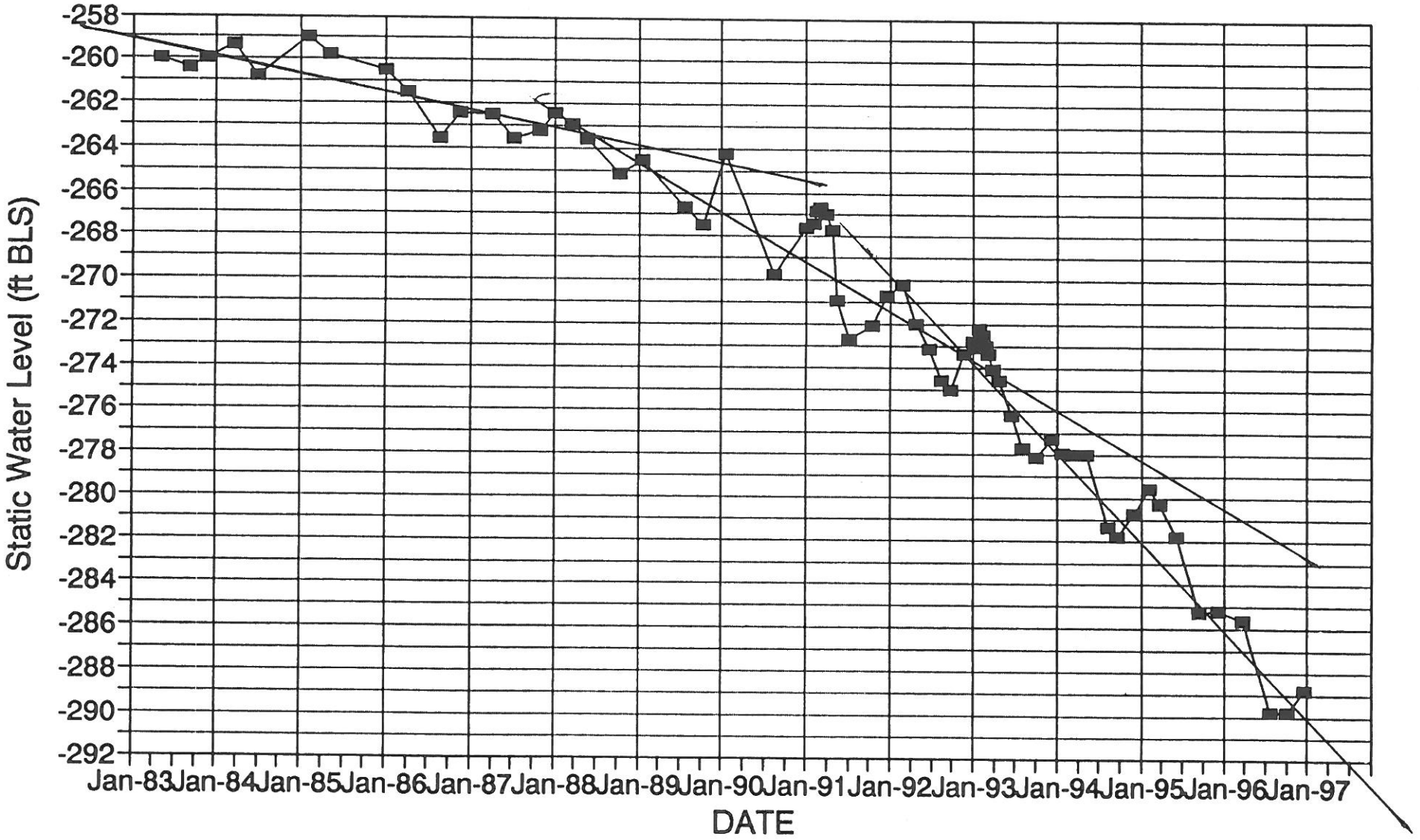
BORREGO SPRINGS
Empty Irrigation Well Hydrograph



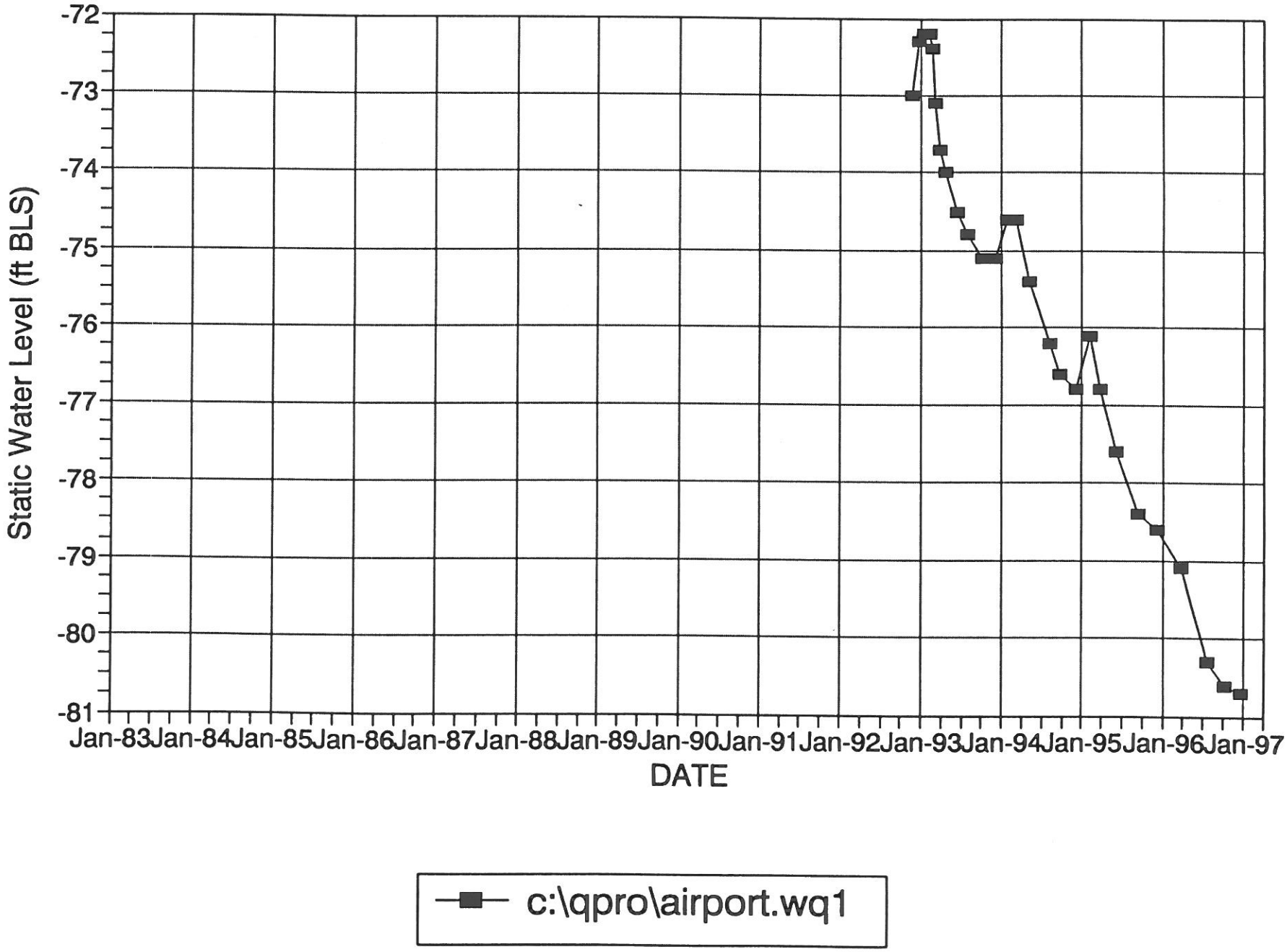
BORREGO SPRINGS
Levie Abandoned Well Hydrograph



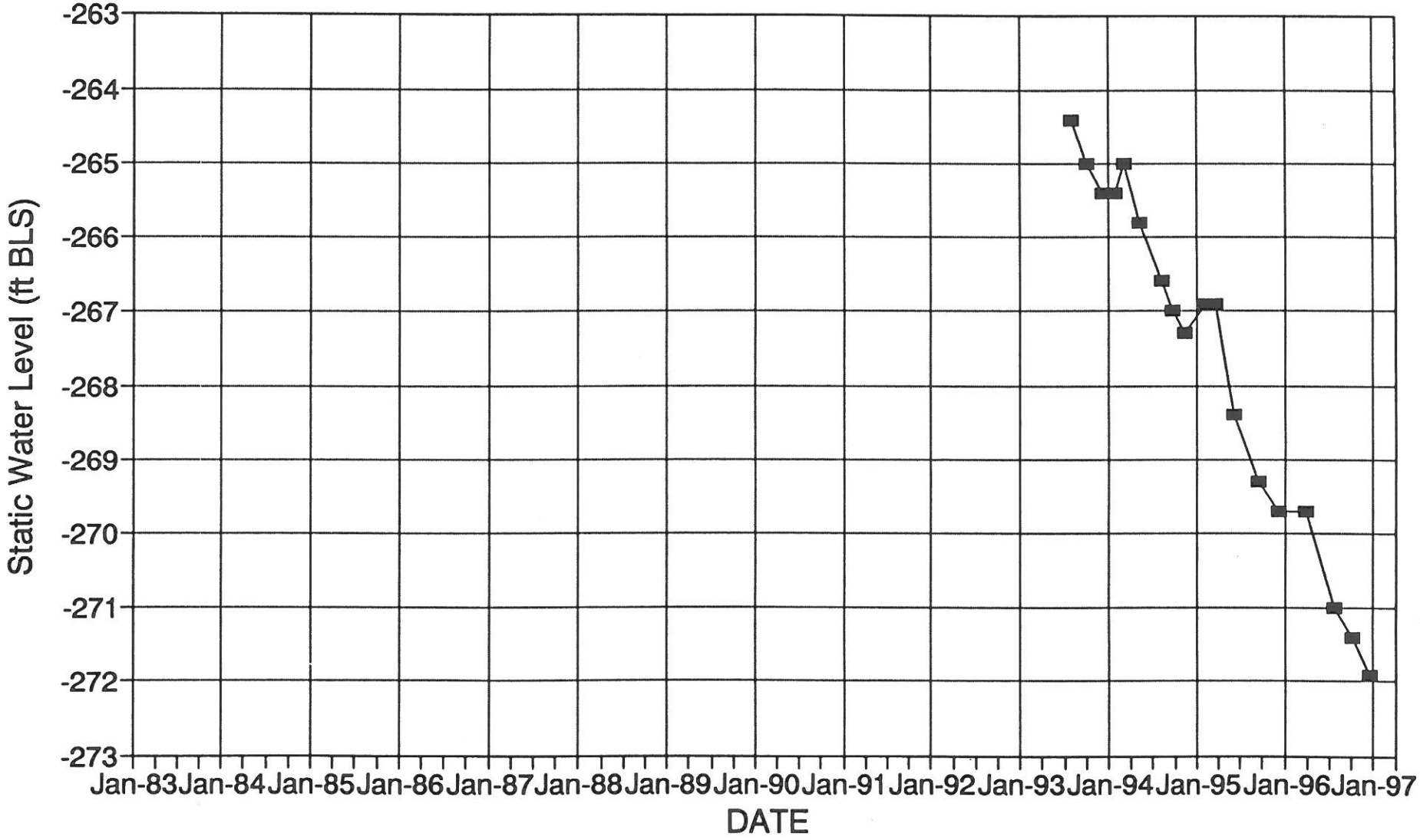
BORREGO SPRINGS
Fortiner #1 Well Hydrograph



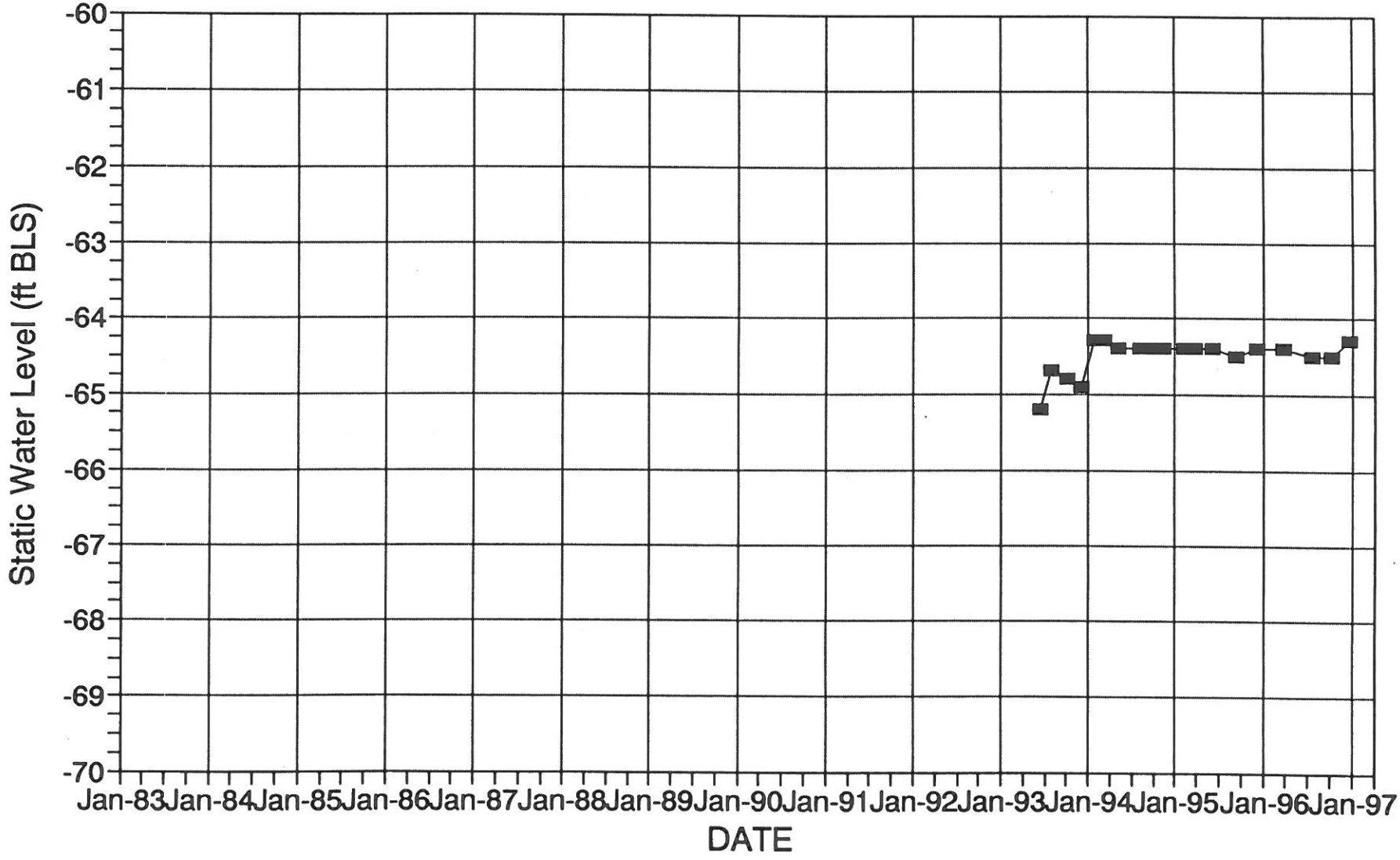
BORREGO SPRINGS
Airport Well Hydrograph



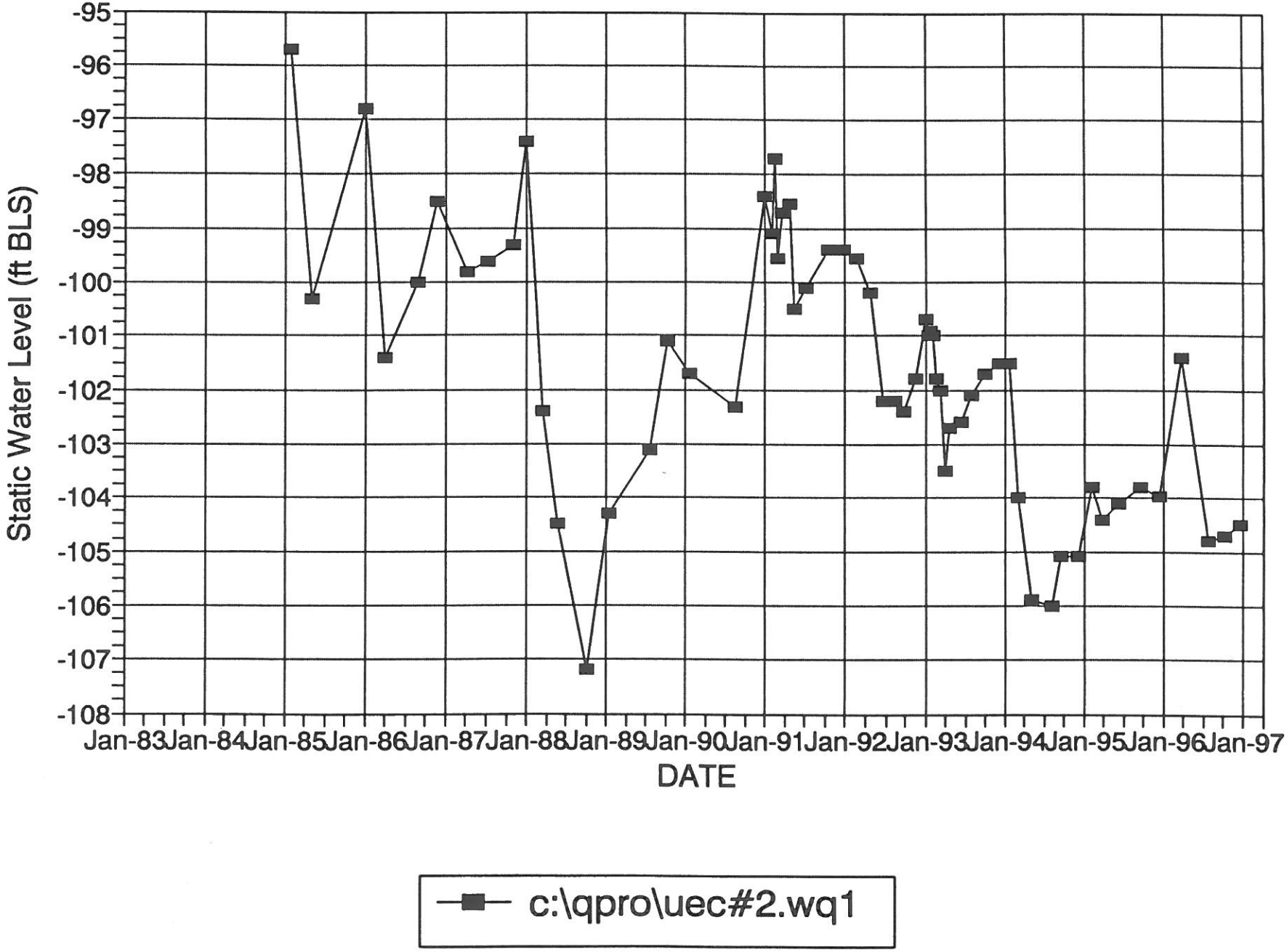
BORREGO SPRINGS
WILCOX WELL HYDROGRAPH



BORREGO SPRINGS
Bud Gay Well Hydrograph



BORREGO VALLEY
UEC #2 Well Hydrograph



BORREGO SPRINGS
UEC #1 Well Hydrograph