

171 C L N T Y R E

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
San Joaquin District

1964 INVESTIGATION
GUIJARRAL HILLS OIL FIELD

Office Memorandum

May 22, 1964

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1. Victor B. McIntyre
2. R. W. Meffley
3. Carl L. Stetson

May 22, 1964

1964 Investigation
Guijarral Hills Oil Field

Lawrence A. Burch

The Department of Water Resources was asked in February 1964 by the Executive Officer of the Central Valley Regional Water Pollution Control Board if the department would object to the use of unlined sumps for disposal of oil field waste water in the Guijarral Hills Oil Field. This study was undertaken to ascertain whether the quality of the ground water has been degraded or if the uncontrolled disposal of oil field waste water might lead to future deterioration of ground water quality.

Description of Area

The Guijarral Hills Oil Field is located in Fresno County along the western edge of the San Joaquin Valley. The Guijarral Hills lie on the axis of the Coalinga anticline and separate Pleasant Valley from the San Joaquin Valley. On both the northwestern and southeastern ends of the Guijarral Hills, gaps have been formed allowing the surface drainage to pass out of Pleasant Valley. Coalinga, located about 6 miles west of the Guijarral Hills, is the only community in Pleasant Valley.

Pleasant Valley is surrounded by several oil producing areas. The oil fields located in clockwise order are: Jacalitos on the southeastern edge of the valley in the Jacalitos Creek Canyon, the large Coalinga Oil Field in the northwestern corner of the valley, East Coalinga

May 22, 1964

Extension on the north, the Pleasant Valley Field on the northeast, and the Gujarral Hills Oil Field on the east. All of these fields either have used or are presently using unlined sumps for disposal of oil field waste water.

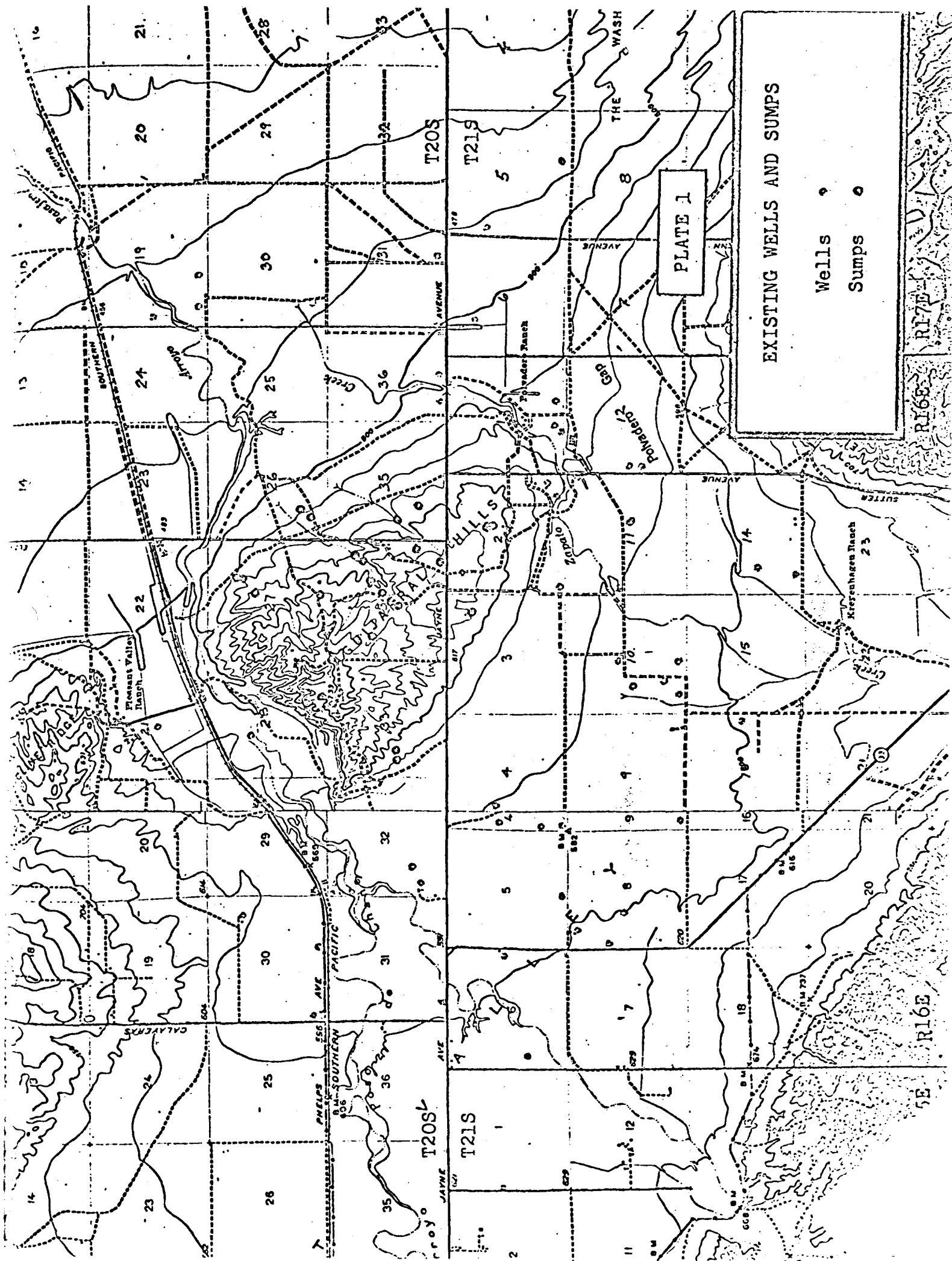
Land surrounding the oil field area is used primarily for irrigated farming. Pleasant Valley to the west, contains approximately 50,000 acres of which about 20,000 acres are presently under irrigation. Land in the adjacent portion of the San Joaquin Valley to the east of Gujarral Hills also is an important irrigated farm area.

More detailed descriptive information on the area is contained in the 1955 report to the Central Valley Regional Water Pollution Control Board (No. 5), "Geologic and Waste Disposal Investigation, Gujarral Hills Oil Field, Fresno County."

Plate 1 shows the locations of irrigation wells presently being used within approximately two miles of the waste discharges.

The average depth of wells in Pleasant Valley is approximately 400 to 600 feet, with the newer wells being drilled to depths of 700 to 900 feet. Wells located on the western edge of the San Joaquin Valley are 500 to 2000 feet deep, tapping the confined ground water to obtain water of fair quality.

Plate 1 also shows the locations of oil field waste water sumps located during the field inspection. It should be noted that many sumps were located that are not identified in the 1955 report and are outside of the area of waste disposal described by the Standard Oil Company in



EXISTING WELLS AND SUMPS

Wells
Sumps

PLATE 1

R16E

R17E

R16E

R17E

their report dated October 16, 1963. Several of the sumps not previously located are actively being used and receive significant waste discharges. A total of twenty-two sumps were located, seventeen of these being active or presently used. The average areal size of the sumps is approximately one acre.

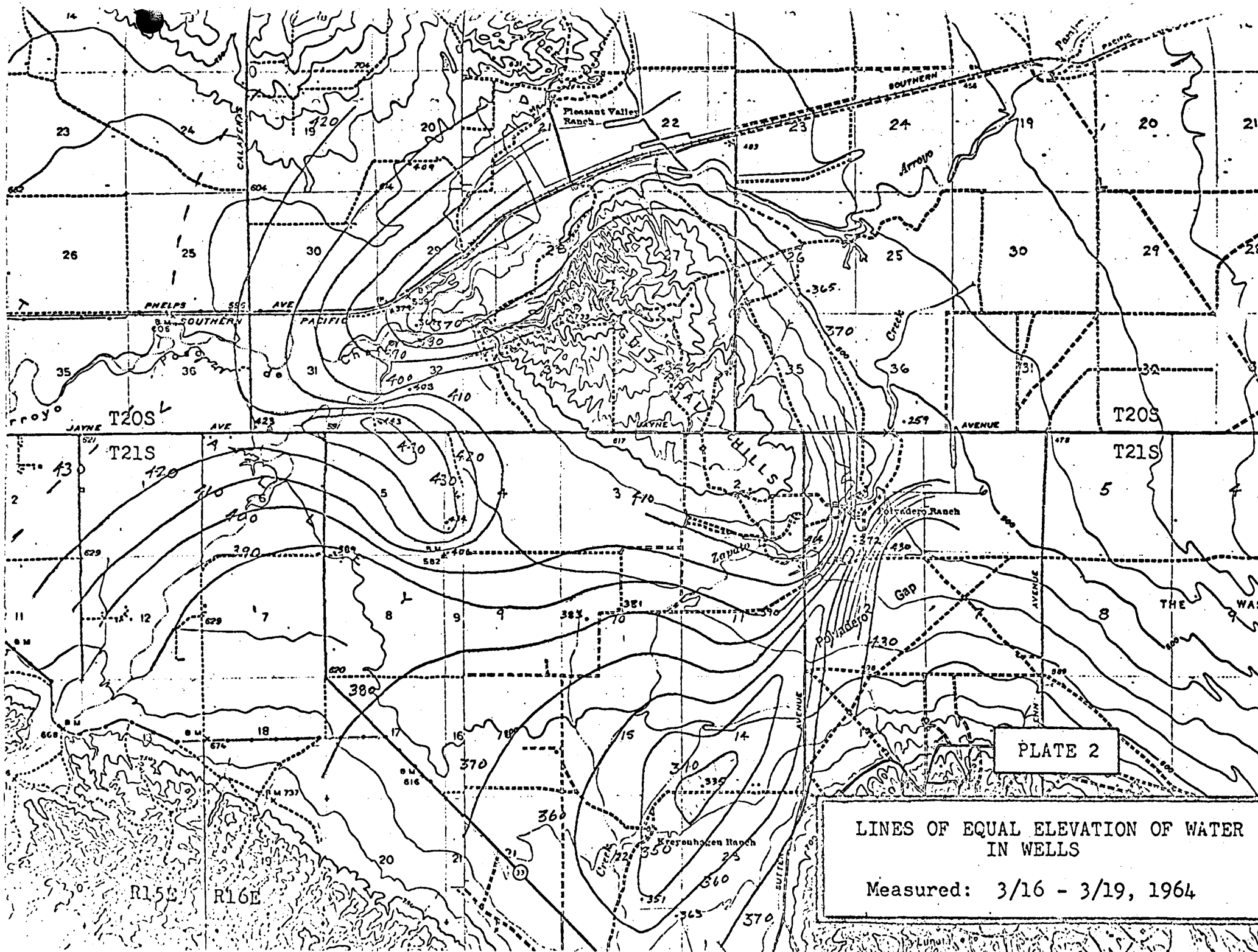
Ground Water Hydrology

Plate 2 illustrates the level of the ground water table in the area of Pleasant Valley adjoining the Gujarral Hills Oil Field. The lines of equal elevation were plotted from well measurements made during March 16-19, 1964.

Due to heavy pumping and a limited amount of recharge, the ground water level in Pleasant Valley generally has been dropping. During the eleven year period between 1950 and 1961, the average ground water level dropped approximately 70 feet.

By inspection of Plate 2 it will be noticed that a depressed area in the water table is located in the southeastern corner of the valley. In the three-year period since May 1961, the water level in Well 21S/16E-14N1 has dropped from 423 feet to 335 feet, a decline of over 90 feet. During the same period, the water level in Well 20S/16E-29N1 dropped approximately 20 feet.

A peninsula-like configuration of higher water levels has been located along Jayne Avenue for several years. Lately, the peninsula formation has changed to a mound, the uppermost water surface remaining



fairly constant in elevation. The heavy pumping in the southeastern portion of the valley appears to be drawing this mound of higher water levels eastward.

With the limited information obtained, it appears that a trough is located between the southern edge of Gujarral Hills and the north edge of Kettleman Hills. Both gaps at the ends of Gujarral Hills have been paths of ground water flow from the Pleasant Valley ground water basin into the San Joaquin Valley in the past. From the position of the ground water table as of March 1964, it would appear that no water passes out of Pleasant Valley through Polvadero Gap between Gujarral Hills and Kettleman Hills. Water does appear to still flow out of the other gap on the north.

A ground water divide appears to be located approximately along the alignment of Jayne Avenue. Ground water in the eastern portion of Pleasant Valley and north of Jayne Avenue (T20S, R16E) appears to flow out of the gap between Anticline Ridge and the north edge of Gujarral Hills much like the surface drainage through the Los Gatos Creek channel. The ground water in the southeastern portion of Pleasant Valley flows toward the depression area in Sections 14, 15, 22 and 23.

Along the western edge of the San Joaquin Valley adjacent to Gujarral Hills two aquifers exist, one confined and the other free water. The elevation of the piezometric head of the confined aquifer was approximately 80 feet in Well 21S/16E-1F2 and the water level of the unconfined ground water in Well 21S/16E-1P1 was 372 feet when measured

in March 1964. These wells are located approximately 120 feet apart. The unconfined ground water elevations on the San Joaquin Valley side of Gujarral Hills decrease rapidly from approximately 370 feet along the edge of the oil field to approximately 100 feet five miles to the east.

Ground Water Quality

The ground water in Pleasant Valley is highly mineralized, principally sodium-sulfate water generally considered to be of poor quality. In general, the ground water is a hard, Class 2 irrigation water suitable for most crops except possibly those of low salt tolerance. Farmers in Pleasant Valley transport drinking water from the city of Coalinga which demineralizes water for human consumption by ion-exchange treatment of local ground water.

The ground water quality of Pleasant Valley is affected by the quality of the recharge water, the principal sources being the intermittent streams which pass through the valley. The variations of mineral constituents in the ground water could be affected by the sporadic nature of these highly mineralized streams. Recharge through precipitation is negligible due to the semiarid climate of Pleasant Valley.

Plates 3 through 7 illustrate the pattern of chloride concentrations in the area surrounding the Gujarral Hills Oil Field. Each plate covers analyses made on ground water samples collected during various periods from 1945-46 to the present time.

1945-1946

Plate 3 indicates the chloride analyses made on the ground water during 1945 and 1946. The information is not complete but high chloride concentrations are evident in the area on the left edge of the plate. Moving eastward toward the gap on the northern edge of Gujarral Hills, the chloride concentration decreases. Based on chloride concentrations relatively good quality water existed in the southern portion of the valley. The wells sampled in the San Joaquin Valley were deeper wells, approximately 500 to 1500 feet, pumping water of lower chloride concentrations.

1951-1952

The chloride concentrations from analyses made during 1951 and 1952 are portrayed on Plate 4. Comparing the more complete record on Plate 4 with Plate 3 it can be noticed that high chloride concentrations were found further east. Higher chloride concentrations also can be noticed near Polvadero Gap. Chloride concentrations in Well 20S/15E-2501 decreased from 216 ppm to 133 ppm. The ground water in the southern portion of Pleasant Valley and adjacent deeper water of the San Joaquin Valley still remained relatively low in chlorides.

1954-1955-1956

Turning to Plate 5, 1954-55-56 records indicate very little change in the upper left-hand portion of the plate since 1951-1952. In the ten-year period since 1945-1946, chloride concentrations in

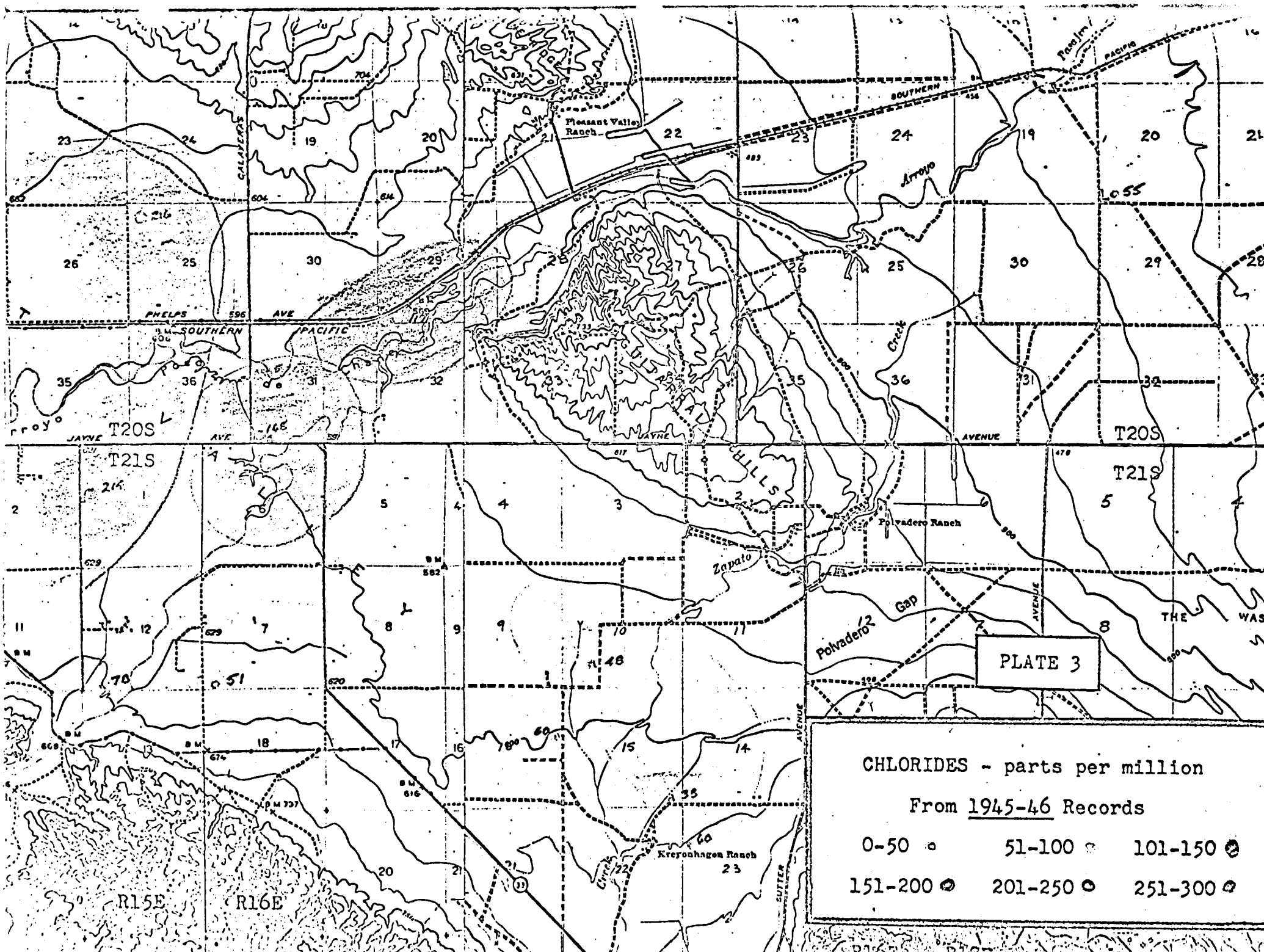


PLATE 3

CHLORIDES - parts per million

From 1945-46 Records

- | | | |
|---------|---------|---------|
| 0-50 | 51-100 | 101-150 |
| 151-200 | 201-250 | 251-300 |

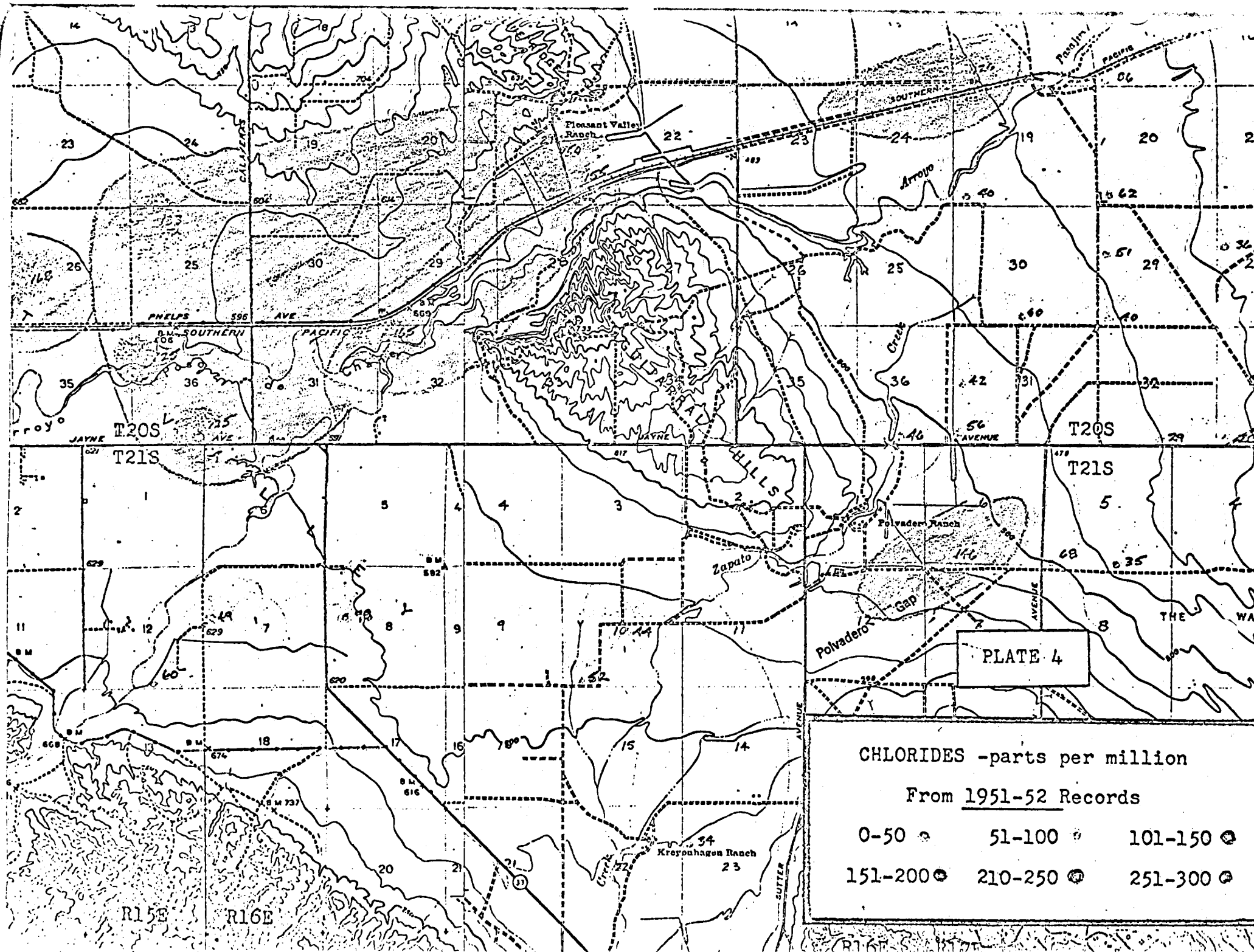
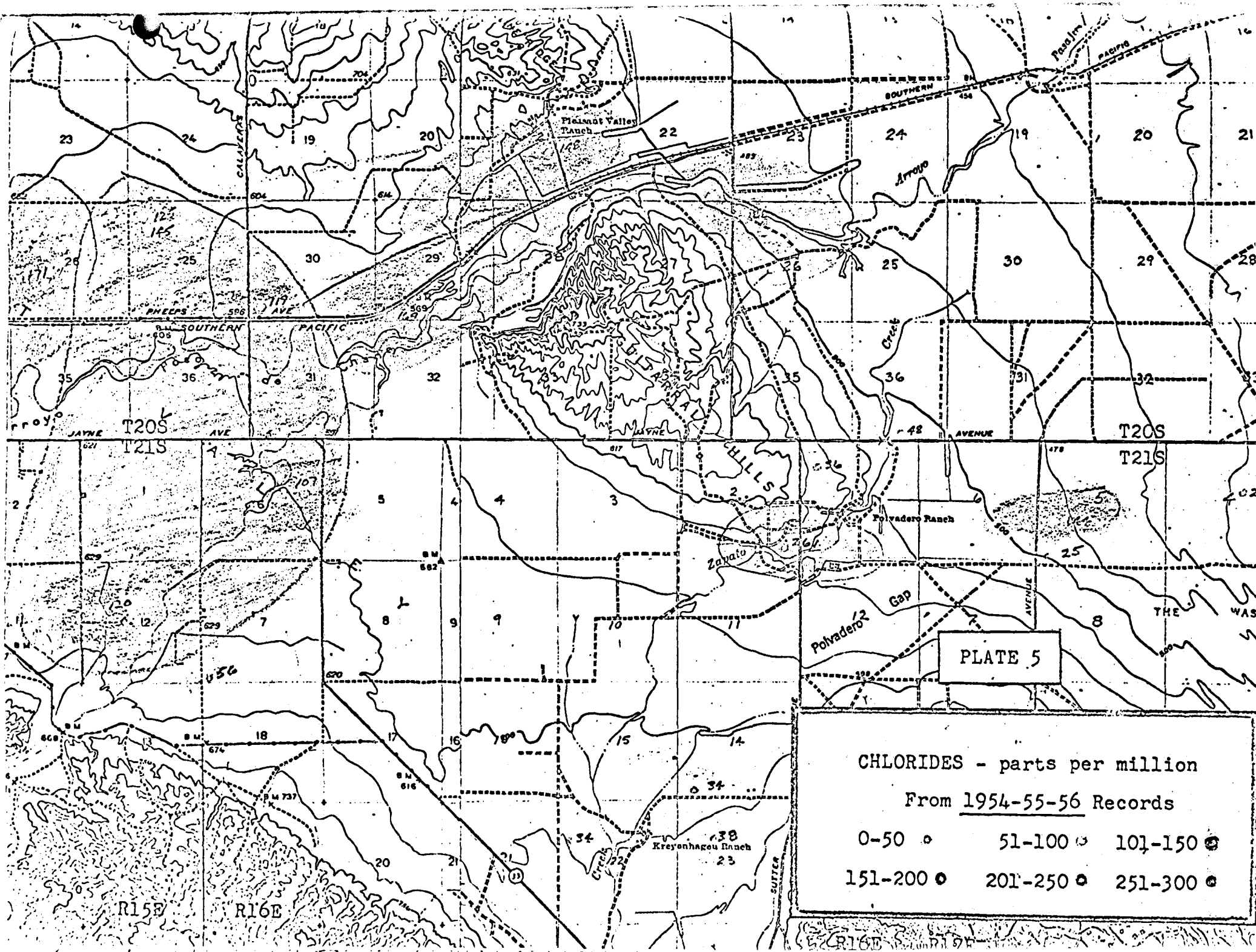


PLATE 4

CHLORIDES -parts per million

From 1951-52 Records

0-50 ●	51-100 ●	101-150 ●
151-200 ●	210-250 ●	251-300 ●



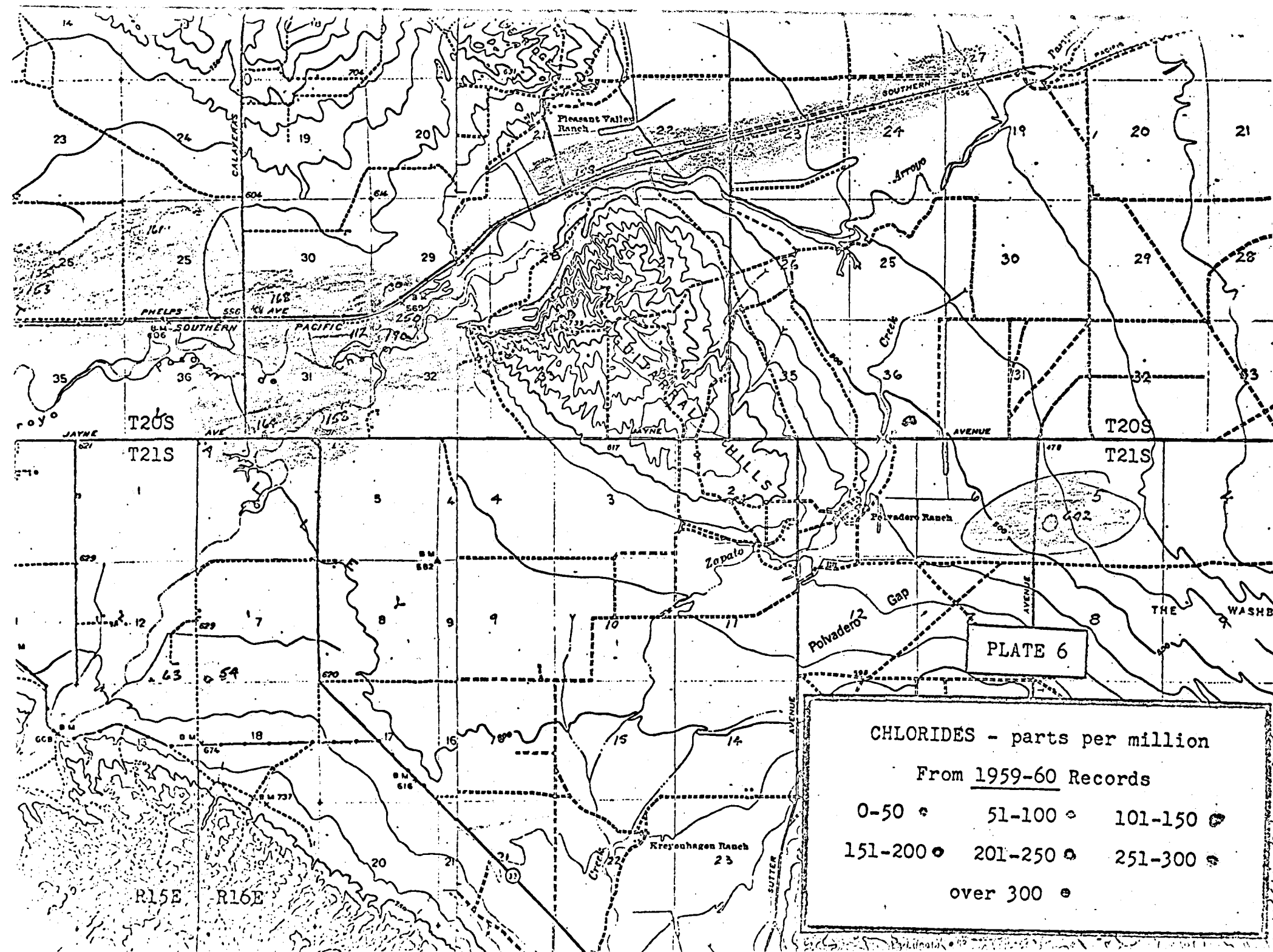
Well 20S/16E-29N1 increased from 117 ppm to 169 ppm. During this period analysis of water from the Polvadero Country Club Well 21S/16E-2R1 showed a high chloride concentrations of 261 ppm, and the high chlorides noticed in 1951-1952 were found further extended to the east.

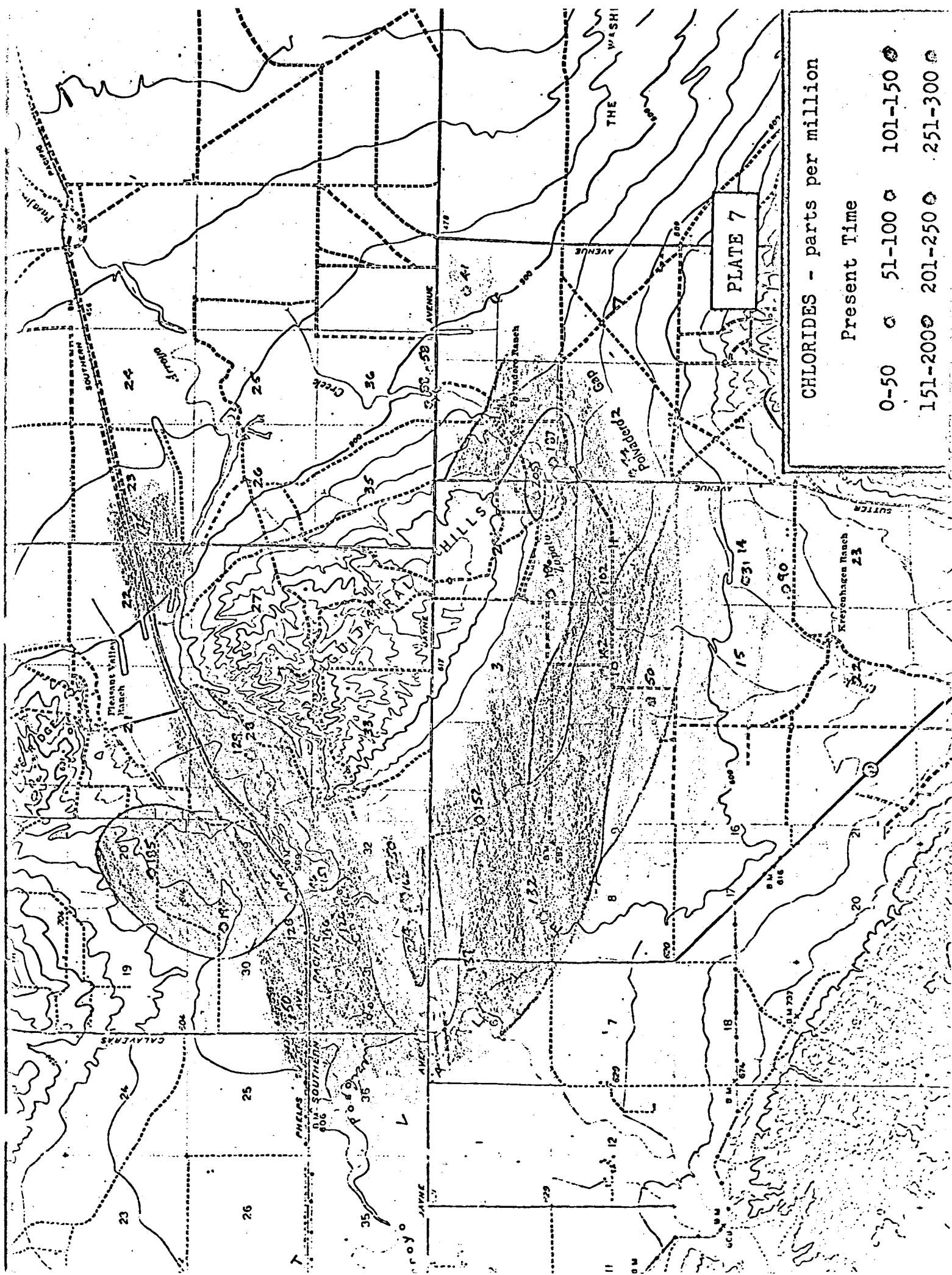
1959-1960

The analyses of 1959-1960 shown on Plate 6 indicate a general increase of chlorides in the upper left-hand portion of the plate. Typical of this change is the increase from 119 ppm to 210 ppm in Well 20S/16E-30N1. Extremely high chlorides were noticed in the area east of Polvadero Gap. Well 21S/17E-5M1 increased in chloride concentration from 144 ppm to 602 ppm in four years. This well has now been abandoned and destroyed.

Present Conditions

Plate 7 illustrates chloride concentrations in the ground water surrounding the Guijarral Hills Oil Field at the present time. Low chloride content waters are still present in the adjacent portion of the San Joaquin Valley and also in the southeastern portion of Pleasant Valley. Recent analyses indicate a general area of high chloride water along the southwestern perimeter of Guijarral Hills. The high chloride values taper off moving out into Pleasant Valley. Three wells in this zone of high chlorides contain very high levels of chlorides, ranging from 205 to 250 ppm. Another noticeable area of high chloride concentrations is located west of the gap between Anticline Ridge and Guijarral





CHLORIDES - parts per million

Present Time

0-50 51-100 101-150 151-200 201-250 251-300

Hills. This area is in the vicinity of the waste water disposal area of the East Coalinga Extension Oil Field.

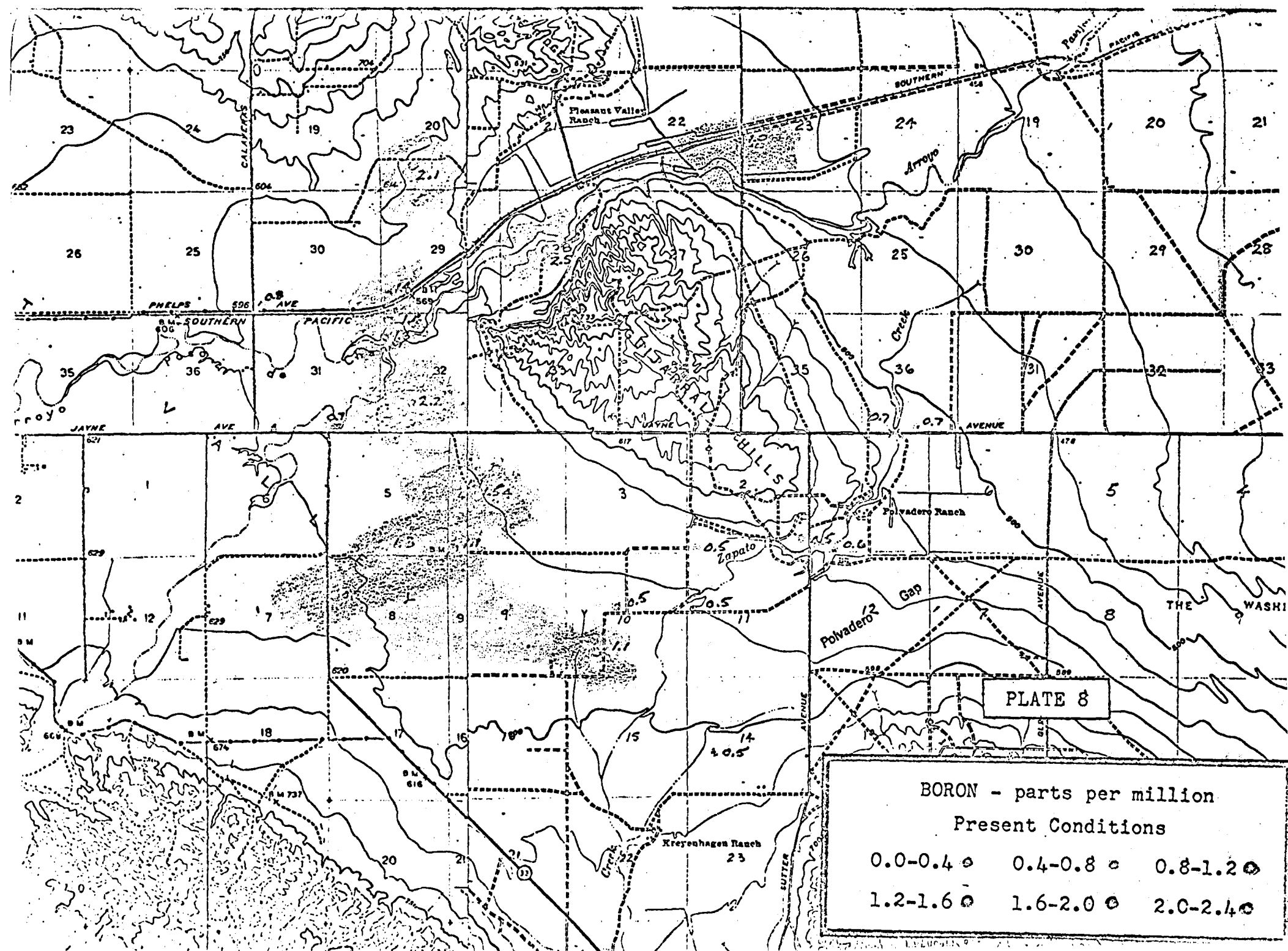
Plate 8 illustrates the boron concentration in ground water of the eastern portion of Pleasant Valley. This plate indicates relatively high amounts of boron are present near the gap on the northern edge of Gujarral Hills, and southeast through the valley, the boron concentrations decrease. Analyses of samples collected in the past indicate this pattern has existed for a period of years.

Recent analyses indicate a change in the vicinity of Polvadero Gap. Well 21S/16E-2R1 shows a decrease from 1.0 ppm boron in 1956 to 0.5 ppm at the present time. Presently, a general belt of lower boron content waters exist through this gap. Past records show the adjacent area of the San Joaquin Valley to have ground water containing approximately 0.5 to 0.7 ppm boron.

Waste Water Quality

The oil field waste waters are extremely highly mineralized, sodium-chloride water, much poorer in quality than the ground water in Pleasant Valley or the adjacent portion of the San Joaquin Valley. It also contains excessive concentrations of boron, calcium, bicarbonates, and percent sodium.

During the field investigation eight oil field waste water sumps were sampled. Waste water from one sump was not analyzed because it was temporarily used during a recent well drilling operation and did



not contain oil production waste water. Tabulated below are the range and averages of selected constituents of the seven waste water samples:

<u>Constituent</u>	<u>Range</u>	<u>Average</u>
Specific conductance (micromhos per centimeter at 25° C)	4,900-62,500	33,464
Chloride in ppm	1,050-26,559	13,070
Boron in ppm	18.2-75.0	41.5
Sodium in ppm	1,480-9,400	5,311

The Standard Oil Company, in compliance with the Central Valley Regional Water Pollution Board's memorandum dated February 8, 1957, maintains a periodic monitoring program of the local ground water in the vicinity of the Pleasant Valley Oil Field. The Pleasant Valley Oil Field is located immediately north of the Gujarral Hills Oil Field. Under this program an annual record of the water quality in certain wells has been obtained.

Information obtained through this program is of limited value since the wells sampled under the program are not strategically distributed throughout the area and the waters produced are of deep origin. Waters from shallower wells would be a better index of pollution since they would probably be more susceptible to initial degradation.

Tabulation of Analyses

Tabulated in Table 1 are the analyses of samples of ground water and waste water collected during the investigation. Plate 9 illustrates the locations of the wells and oil field waste water sumps which were sampled.

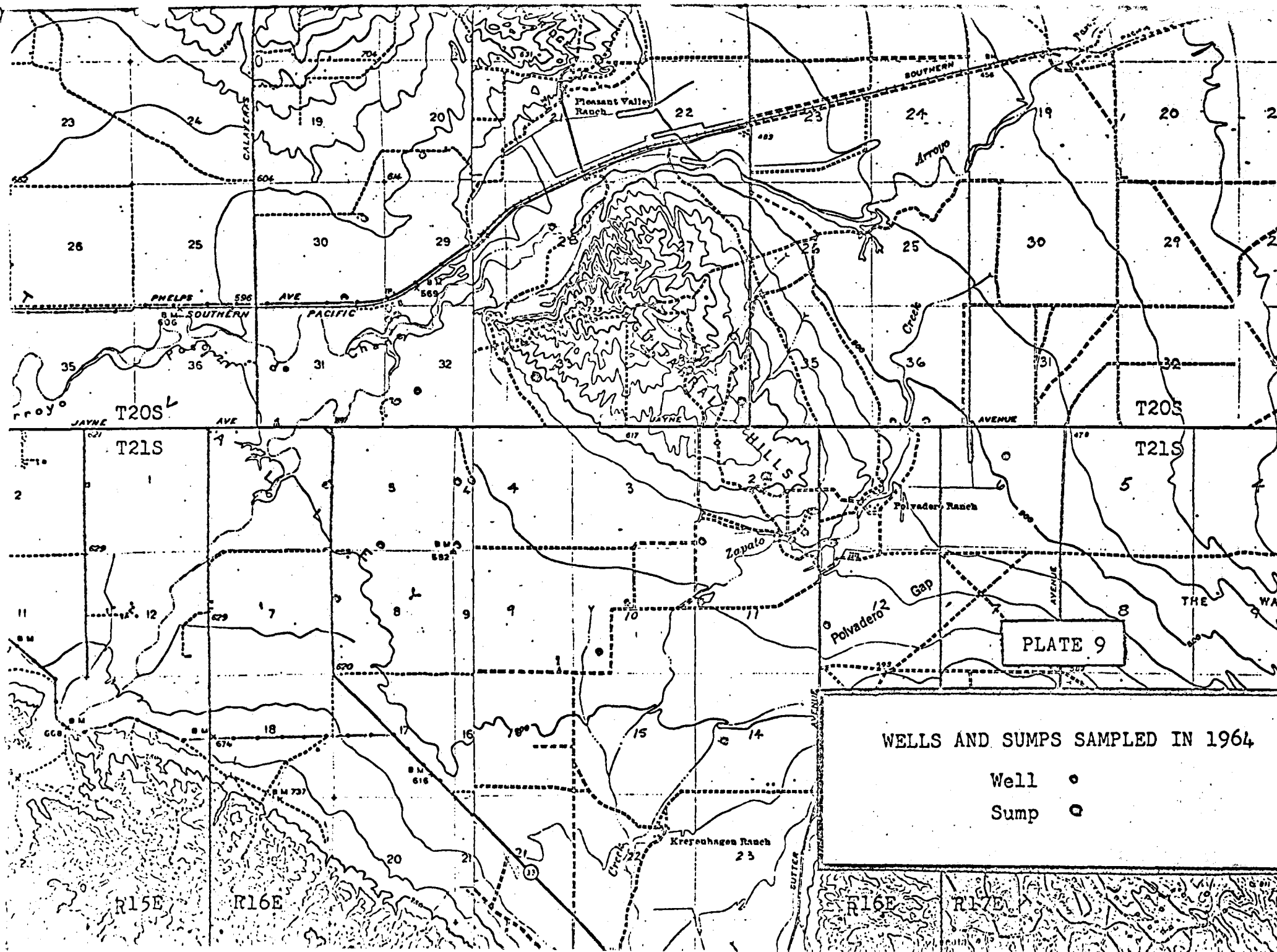


TABLE 1
GROUND WATER ANALYSES

<u>Well</u>	<u>B</u>	<u>EC</u>	<u>SO₄</u>	<u>Cl</u>	<u>Depth</u>	<u>Perforation</u>
20/16						
20L1	2.1	2,366	968	185	300	150-300
28F1	2.5	2,116	952	129	283	107-283
30H2	-	3,048	1,400	194	400*	
30Q1	-	1,902	725	128	700*	
31Q1	-	1,267	1,350	224	-	-
32D1	1.4	2,321	1,049	146	217	80-217
32D2	-	2,490	1,125	146	477	190-477
32D3	-	2,337	1,050	126	700*	
32D4	-	2,557	1,200	151	541	
32H1	2.2	3,750	1,918	249	450	184-450
32H2			1,175	162	546	150-546
36N1	0.7	1,678	719	88		-
36Q1	0.7	1,480	531	-	1,500	-
21/16						
1N1	0.6	2,250	1,192	187	165	105-165
2N1	0.5	2,657	1,371	186	427	160-426
2R1	0.5	2,453	1,140	205	523	320-523
2R2	-	1,918	850	134	1,250	800-1,250
4E1	1.1	1,860	803	-	358	
4E2	1.5	2,526	1,243	152	470	200-470
4N2	1.1	1,800	770	-	597	180-547
5P1	1.3	2,100	1,014	182	650	200-650
6H1	-	1,993	775	137	260	
8E1	0.9	1,950	675	-	463	323-463
10F1	0.5	2,150	961	142	961	286-961
10N1	0.6	1,250	503	50	326	170-326
11E1	0.5	1,750	864	102	540	160-540
12H2			400	44	700	250-700
14M1	0.5	1,110	417	31		
14N1	-	1,387	463	90	326	-
21/17						
6B1			450	41	1,000*	

* Approximate Depth

WASTE WATER ANALYSES

<u>Sump</u>	<u>B</u>	<u>EC</u>	<u>SO₄</u>	<u>Cl</u>	<u>Ca</u>	<u>Na</u>
20/16						
33M	70.0	31,350	29.2	12,012	911	
34E		4,282				
34G	35.5	17,500		7,080	764	4,060
34G	41.8	60,500		25,992		7,462
34H	26.9	12,500	64.2	4,300	372	3,090
34K	23.6	62,500		26,559		6,375
34R	18.2	4,900	25.9	1,050	14.2	1,480
21/16						
2G	75.0	45,000	31.1	14,503	321	9,400
Avg.	41.5	33,464	37.6	13,070	476	5,311

CONCLUSIONS:

1. The operators in the Gujarral Hills Oil Field dispose of the waste water produced through oil field operations by storage in unlined earthen sumps for evaporation and percolation.
2. The oil field waste waters are highly mineralized and much poorer in quality than adjacent ground water.
3. Any commingling or intermixing of the oil field waste waters with the ground water would tend to degrade the quality of adjacent ground water and be detrimental to its beneficial uses.
4. The water levels in the Pleasant Valley have been dropping approximately seven feet per year necessitating the abandonment of many wells and the deepening and drilling of others.

5. Due to heavy pumping in the southeastern corner of Pleasant Valley and the negative slope of the ground water gradient, waste waters percolated on Gujarral Hills might possibly flow toward this area.
6. The ground water along the southwestern perimeter of Gujarral Hills contains high amounts of boron and chlorides, perhaps attributable to the disposal of Gujarral Hills Oil Field waste waters.
7. The high amounts of boron and chlorides in local ground water could be due to: (a) natural conditions through recharge of the ground water basin by the highly mineralized streams periodically running through the valley, and (b) infiltration of the high boron and chloride content oil field waste waters.
8. Inadequate records of the ground water quality in the past and lack of strategically located sampling points do not allow specific determination that the Gujarral Hills Oil Field waste water disposal practices definitely deteriorate the quality of the ground water.
9. The effects of disposal practices in the various oil fields surrounding Pleasant Valley probably affect the quality of the ground water more as a total grand effect than individually.
10. In the future, it is anticipated that water will be imported into Pleasant Valley from the California Aqueduct to supplement ground water supplies and improve ground water quality.

References

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Branch, June 1954.

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L. K. Burch

Joseph S. Gorlinski, Colonel, USA (Ret.)
Executive Officer
Central Valley Regional Water Pollution
Control Board (No. 5)
1232 F Street
Sacramento 14, California

July 21, 1964

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Guajarral Hills Oil
Field Waste Discharges,
Fresno County

This memorandum contains additional comments relative to the effects of waste water discharges from the Guajarral Hills Oil Field on adjacent ground waters. Specifically contained herein is our review of the January 31 report by the operators in the oil field and a summary of conditions reported by them which are contrary to our information.

The operators' report indicates that percolated waste waters are penetrating the surface dry sands to approximately 150 feet with these sands being separated from the better quality ground water by impervious shale beds. The extent of these beds and their competence as aquacludes are unknown and hence questionable due to the lack of well logs or other geologic information in the immediate area of the discharges.

From the oil and gas production reports of the Division of Oil and Gas, we find that the amount of waste water produced daily has increased instead of decreased as was the contention of the operators. Listed in the table below are published figures on waste water production:

<u>Month</u>	<u>Barrels Waste Water</u>	<u>Bls/day</u>	<u>Gals/day</u>
Nov. 1963	52,920	1,764	74,088
Dec. 1963	67,263	2,170	91,140
Jan. 1964	84,754	2,734	114,828
Feb. 1964	72,180	2,489	104,538
Mar. 1964	97,733	3,153	132,426
Apr. 1964	98,524	3,284	137,429

It is stated in the operators' report that the shallow ground waters are of such poor quality that they cannot be used for domestic purposes and some are toxic to vegetation. They state these waters occur in the Guajarral Hills area in the upper Tulare formation below the shallow dry sands or from 180 to 290 feet. Assuming these figures to be depth below the ground surface, corresponding elevations of shallow ground water would be 350 to 470 feet above sea level. During our investigation this last spring we determined the water table in the area around Guajarral Hills to lie approximately between 370 feet elevation on the north and east sides and 410 feet elevation on the south and west sides. This is the top surface of the ground water body being extensively used for irrigation in Pleasant Valley. This statement implies that the inferior quality shallow water contended by the operators to be excluded from the usable ground water is in actuality the same ground water being pumped for crop irrigation.

May 1964	95,871	3,093	129,906
JUNE 1964	95,648	3,188	133,896
JULY 1964	85,930	2,772	116,424
AUG 1964	94,352	3,044	127,827
SEPT 1964	83,092	2,770	116,540

Joseph S. Gorlinski,
Colonel, USA (Ret.)

-2-

July 21, 1964

The operators also state that the quality of the Eocene waste waters is higher than the shallow ground water. As stated in our memorandum of June 9 the average specific conductance of samples collected from waste water sumps was 33,500 micromhos as compared to 2,500 micromhos for ground water adjacent to Gujarral Hills.

The statement that poorer quality water exists in the upper Tulare formation and good quality water is found in the lower Tulare formation is basically true. Generally, ground water quality in Pleasant Valley improves with depth within the fresh-water bearing zone. The statement that the bad quality water existing in the upper Tulare formation has not been able to seep down into the better quality water may be of doubt. Through our recent investigation it appears that some quality degradation is occurring in the ground water of Pleasant Valley south of Gujarral Hills.

Due to the disaccordance of information in the operators' report with that found during our investigation and also considering the findings reported in our June 9 memorandum, we still believe our prior recommendations should be adopted. Since the extent and continuity of the purported shale beds are subject to question; because lateral movement between the shale beds is possible; and due to the possible ground water movement down-gradient toward the heavily pumped portion of Pleasant Valley; we feel that degradation of the quality of the ground water may occur and therefore preventative measures should be taken.

Carl L. Stetson

Carl L. Stetson, Chief
San Joaquin Valley Branch

LABurch:an

cc: Department of Public Health
Bureau of Sanitary Engineering
First Floor, 631 J Street
Sacramento, California

Department of Public Health
Bureau of Sanitary Engineering
5545 East Shields Avenue
Fresno, California

Department of Fish and Game
1234 East Shaw Avenue
Fresno, California

SJVB 267	NOV 1964	74,411	2420	106,640
	DEC 1964	71,396	2393	99,029
	JAN 1965	68,795	2219	93,198
	FEB 1965	65,104	2325	97,650
	MAR 1965	65,322	2110	86,300
	APR 1965	67,722	2260	92,500

Memorandum

DEPARTMENT OF WATER RESOURCES
SAN JOAQUIN VALLEY BRANCH
POST OFFICE BOX 2335
FRESNO, CALIFORNIA

Date : 19 JUNE 1964

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Central Valley Regional Water Pollution Control Board
1232 F Street, Sacramento, California 95814

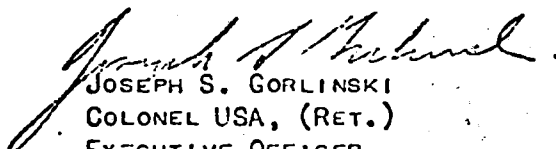
Subject: GUIJARRAL HILLS OIL FIELD WASTE DISCHARGES

ON 7 FEBRUARY 1964, MR. TOWNSEND OF STANDARD OIL COMPANY REPRESENTING THE OPERATORS OF GUIJARRAL HILLS OIL FIELD MET WITH REPRESENTATIVES OF THE WATER POLLUTION CONTROL BOARD AND THE DEPARTMENT OF WATER RESOURCES RELATIVE TO THE SUBJECT DISCHARGES. ENCLOSED IS A COPY OF THE REPORT PRESENTED BY MR. TOWNSEND WHICH INDICATES THAT THERE IS NO THREAT OF POLLUTION TO USABLE GROUND WATERS FROM THE DISPOSAL OF THESE WASTE WATERS BECAUSE OF AN AQUIFER OF POOR QUALITY WATER IN THE UPPER TULARE FORMATION ABOVE ANY USABLE GROUND WATER AND SEPARATED THEREFROM BY AN IMPERMEABLE SHALE BED.

OUR

IT WAS (OUT) UNDERSTANDING THAT ENGINEERS AND GEOLOGISTS FROM YOUR DEPARTMENT WOULD REVIEW THIS REPORT AND THE SUBSTANTIATING DATA AVAILABLE FROM MR. TOWNSEND AND SUBMIT YOUR COMMENTS TO THIS OFFICE. HOWEVER, YOUR MEMORANDUM OF 9 JUNE 1964 RELATIVE TO THIS SUBJECT DOES NOT APPEAR TO CONTAIN ANY REFERENCE TO THIS REPORT. CONSEQUENTLY, THE ESTABLISHMENT OF WASTE DISCHARGE REQUIREMENTS WITH THE LIMITATIONS RECOMMENDED IN YOUR MEMORANDUM DOES NOT APPEAR REALISTIC AT THIS TIME.

ANY ADDITIONAL COMMENTS YOU MAY HAVE RELATIVE TO THIS SUBJECT SHOULD BE SUBMITTED TO THIS OFFICE BY 20 JULY 1964 IN ORDER THAT THEY MAY BE CONSIDERED BEFORE THE MATTER IS PRESENTED TO THE CENTRAL VALLEY REGIONAL WATER POLLUTION CONTROL BOARD.


JOSEPH S. GORLINSKI
COLONEL USA, (RET.)
EXECUTIVE OFFICER

ENC.

T. 1. 442 367
7-12-64

Joseph S. Gorlinski, Colonel, USA (Ret.)
Executive Officer
Central Valley Regional Water Pollution
Control Board (No. 5)
1232 F Street
Sacramento 14, California

June 9, 1964

Guijarral Hills Oil
Field Waste Discharges,
Fresno County

This memorandum summarizes a cursory investigation of the effects of waste water discharges from the Guijarral Hills Oil Field on adjacent ground waters. The department was asked to reconsider its previous recommendation on limiting concentrations for requirements to govern the disposal of waste water to unlined sumps.

During the investigation, a total of twenty-two sumps were located within the boundaries of the oil field. Waste waters contained in the sumps were found to be highly mineralized and much poorer in quality than the adjacent ground water. Listed below are the average specific conductance (EC), chlorides, and boron for the oil field waste water, the ground water in Pleasant Valley adjacent to Guijarral Hills, and the ground water in the area of Pleasant Valley more remotely located from the perimeter of Guijarral Hills.

	<u>EC</u> <u>micromhos</u>	<u>Chloride</u> <u>ppm</u>	<u>Boron</u> <u>ppm</u>
Oil Field Waste Water	33,500	13,100	41.5
Adjacent Ground Water	2,500	170	1.0-1.5
Valley Ground Water	1,500	80	0.5-0.7

In the past high concentrations of chlorides and boron have been found in samples of ground water at scattered locations in Pleasant Valley. It is believed that this scattering is due to natural recharge of the ground water basin by the highly mineralized streams which run sporadically through the valley and/or infiltration to the ground water basin by oil field waste water.

Some wells have been abandoned and others deepened because water levels in Pleasant Valley have been receding about seven feet per year. Heavy pumping in the southeastern corner of the valley is presently creating a depression in the water table. It is possible that oil field waste waters percolated in the relatively permeable Tulare formation on the Guijarral Hills might flow toward this heavily pumped area due to the negative slope of the ground water gradient.

June 9, 1964

In our November 7, 1963 comments regarding tentative waste discharge requirements for the Guajarral Hills Oil Field, we indicated that in the future water may be imported into Pleasant Valley. The United States Bureau of Reclamation is currently conducting studies in regard to providing supplemental water service to Coalinga, Avenal, and Pleasant Valley. Preliminary information from these studies indicates that approximately 72,000 acre-feet per year could be percolated in ponds adjacent to natural stream channels. The recharging of the valley ground water basin would alleviate the present annual overdraft estimated to be 50,000 acre-feet. Irrigation service in the valley would continue from individually-owned wells.

Samples collected during this investigation indicate that the ground water along the southwestern perimeter of the Guajarral Hills contain unusually high amounts of both boron and chlorides. Incomplete records of ground water quality in the past and lack of strategically located sampling points do not allow the specific determination that the Guajarral Hills Oil Field waste water disposal practices definitely cause these conditions.

Due to the wide scale spread of high concentrations of boron and chlorides in the ground water and lack of real evidence of gross chemical pollution, the present and past disposal practices of the various oil fields surrounding Pleasant Valley probably affect the quality of the ground water more as a total effect rather than any specific field does individually.

It is the intent of the Department of Water Resources to maintain the highest possible water quality. Reference was made in our letter of November 7, 1963 to Section 2164 of the California Administrative Code which applies to conditions in the vicinity of the Guajarral Hills. For this reason and because of the possibility that the ground water basin will be recharged by future imports thereby improving both the quality and quantity of water in the ground water basin, it is believed that the limits previously recommended by this department for waste water discharged to unlined sumps in the Guajarral Hills Oil Field should be established. Our recommendations for limiting concentrations are:

Total Dissolved Solids	1,000 ppm
Chloride	175 ppm
Boron	1.0 ppm

It is also the recommendation of the Department of Water Resources that a ground water monitoring program be established in Pleasant Valley. We would be willing to cooperate with the oil field operators and the Board in planning a monitoring program which would provide realistic surveillance to detect ground water degradation.

for *Carl L. Stetson*

Carl L. Stetson, Chief
San Joaquin Valley Branch

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