STATE OF CALIFORNIA

DEPARTMENT OF PUBLIC HEALTH

BUREAU OF SANITARY ENGINEERING

A POLLUTION STUDY OF PETALUMA CREEK

(Code No. 52-2-6)

1951

A POLLUTION STUDY OF PETALUMA CREEK

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Prepared for the

San Francisco Bay Regional Water Pollution Control Board

By

State Department of Public Health

Bureau of Sanitary Engineering

1951

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WILTON L. HALVERSON, M.D.
DIRECTOR OF PUBLIC HEALTH

BUREAU OF
SANITARY ENGINEERING
FARM CREDIT BUILDING
2180 MILVIA STREET
BERKELEY 4, CALIF.

February 7, 1952

San Francisco Bay Regional Water
Pollution Control Board
364 - 14th Street
Oakland 12, California

Attention: John B. Harrison
Executive Officer

Gentlemen:

In accordance with the service agreement between this Department and the State Water Pollution Control Board, we are submitting our report entitled "A Pollution Study of Petaluma Creek" (Code No. 52-2-6).

This report has been reviewed by the Sonoma County Health Department.

Very truly yours,

BUREAU OF SANITARY ENGINEERING

By E. A. Reinke

E. A. Reinke, Chief

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SUMMARY

In response to a request by the San Francisco Bay Regional Water Pollution Control Board, the Bureau of Sanitary Engineering conducted a field survey of Petaluma Creek and adjacent land areas during the months of October and December, 1951. The purpose of the investigation was to determine the character of the major waste discharges in the region and the effect of the discharges on Petaluma Creek. Findings of this survey, supplemented by data obtained at earlier dates by the Bureau, are presented in this report.

FINDINGS CONCLUSIONS, AND RECOMMENDATIONS

1. Petaluma Creek, primarily a tidal slough, drains a small watershed in Sonoma and Marin Counties. Dry weather flow in the stream is negligible and during these periods the creek consists primarily of saline water from San Francisco Bay.

2. Beneficial uses of the creek consist of boating, swimming, water skiing, fishing, and navigation.

3. Significant waste discharges to the creek consist of effluent from the Petaluma sewage treatment plant, and industrial wastes from a tannery and two rendering plants.

4. High coliform densities were generally found in Petaluma Creek near the outfall sewer.

5. The dissolved oxygen content of Petaluma Creek at most sampling stations was above 5.0 ppm. Depletion below 5.0 ppm was noted at two locations, the greatest depletion being near the outfall sewer.

6. Sewage effluents discharged to Petaluma Creek should be adequately disinfected if its waters are to be satisfactory for bathing.

7. An upgrading in the quality of the effluent from the City of Petaluma sewage treatment plant is necessary if the oxygen content of the receiving waters is to be maintained at 5.0 ppm or above.

DESCRIPTION OF PETALUMA CREEK

Petaluma Creek receives the drainage from a small watershed in Sonoma and Marin Counties and discharges into San Francisco Bay about twelve miles south of the City of Petaluma (see Figures Nos. 1 and 2). Tidal effects extend upstream to the north city limits of Petaluma. This stretch of the creek has been maintained as navigable waters since 1933 by the U.S. Army Engineers, providing a minimum water depth of four feet at mean low tide. Above Petaluma the creek, also known as Willow Brook, is ephemeral, as are the tributaries to the creek above the city.

Terrain adjacent to the tidal section is interlaced with sloughs draining the surrounding marshlands which are submerged during flood tides. The valley, two to five miles wide in this region, is defined by grass covered rolling hills which are devoted primarily to cattle grazing. A portion of the tidelands, Hog Island, has been reclaimed for agricultural usage through construction of dikes and the installation of pumps to return infiltrated salt water to the creek.

Above Petaluma the creek follows its course through the narrow valley and gentle rolling hills. There are many farms producing poultry, cattle, milk, and crops.

At the mouth of the creek, Black Point, a small community of cabins, some constructed on pilings over the marshlands, has been developed. About fifty permanent residents live there; on week ends an additional fifty persons who come to the area for recreation reside in the cabins. Sewage disposal for these cabins is by individual septic tanks, privies, or direct discharge onto marshlands. These lands drain into Petaluma Creek during outgoing tides.

Ben C. Gerwick, Incorporated, a construction firm, maintains an anchorage for barges and pile drivers at the lower end of Hog Island. There are no housing facilities at this anchorage, nor were any persons present in the vicinity during this survey. It is concluded that sewage discharges by transient visitors to this installation are the only ones likely to occur and are of little consequence.

Gilardi's, about midway between the mouth of the creek and Petaluma on the east bank of the creek, is a commercial development catering to sportsmen, and contains twenty cabins, boat rental facilities, bar and restaurant, and the dwelling of the owners. Sewage disposal for this development is effected without discharge to Petaluma Creek.

Lakeville is a small community consisting of a school, store and filling station, and several rural dwellings. It is situated about one mile north of Gilardi's and is over one-half mile from Petaluma Creek. Sewage is disposed of by individual systems and does not enter the creek.

Petaluma is the largest community on the watershed and the upstream limit of navigable waters. It lies on both sides of the creek about twelve miles from its mouth. A detailed description of the city and its waste disposal practices will be discussed later in this report.

It was observed that a number of homes in the rural region upstream from Petaluma were discharging septic tank and cesspool effluents to Petaluma Creek, known locally as Willow Brook. Also in this region it was observed that wastes from a dairy occasionally entered the creek. At Penngrove, a rural community about three miles upstream from Petaluma, numerous septic tanks were discharging into the creek. Figure No. 3 is a map of Penngrove showing the location of the septic tanks, the effluent lines, and the points of entry into the creek. These instances are known to the Sonoma County Health Department which is taking steps to bring about corrections.

WASTE DISPOSAL AT PETALUMA

The City of Petaluma incorporates an area of two and one-half square miles, and according to the 1950 census has a population of 10,390. It is anticipated by the local Chamber of Commerce that this population will increase to 15,000 persons by 1960.

The growth of Petaluma has followed the development of the poultry industry concentrated in this region. Several large plants in the city handle the produce from this industry which in 1949 amounted to 51 million dozen eggs and 18 million chickens.

The greatest industrial waste load on the city's treatment plant is that from the operation of three large milk processing plants. In addition to these plants, a meat packing plant, a soft drink bottling plant, and a textile mill use city facilities. Two rendering plants and a tannery are located near Petaluma, but are not connected to the city sewerage system.

A detailed survey of the industrial waste loadings was made by the Bureau of Sanitary Engineering during the summer of 1947. At that time it was estimated that the industrial waste loading was equivalent on a biochemical oxygen demand basis to a population of 12,500.

Prior to 1938 raw sewage and industrial wastes from the city were discharged through fifteen outfalls into Petaluma Creek. In 1938 a sewage treatment plant designed for a population of 10,000 persons was constructed. Plant facilities consist of a primary clarifier, two trickling filter units, final clarifier, and a chlorinator which is not used. Discharge of undisinfected plant effluent is through an outfall to Petaluma Creek or via a by-pass to reclaimed marshland.

The existing flow measuring device at the sewage treatment plant is not giving accurate measurements. It is estimated by the Director of Public Works that the average daily dry weather sewage flow through the plant is about 1,700,000 gallons per day. An eight-hour composite sample of the plant effluent collected on October 10, 1951 indicated an average 5-day, 20°C. biochemical oxygen demand of *66* ppm.

Four major waste producing industries were not connected to the city sewer system; however, one of these, Chris Beck Incorporated,

a slaughterhouse, was making such a connection to discharge its screened and settled waste to the treatment plant. At the time of this study this plant discharged its wastes into the dry bed of Willow Brook. Waste disposal practices at the other three industries are as follows:

Merner Tannery Company processes about 200 hides per month and produces about 25,000 gallons of waste daily. Fleshings and solids are removed from the liquid waste by screening and settling, and are sold to local rendering plants. The settled liquid waste is discharged to a shallow ditch which joins with Petaluma Creek about one-fourth mile from the tannery. Creek water enters the ditch on flooding tides and mixes with the waste. On extreme low tide, after recession of the creek waters, no flow was observed in the ditch. On the basis of information obtained at other tanneries in California, it is estimated that the daily discharge of waste from the Merner Tannery Company is equivalent to about 1,000 persons on a biochemical oxygen demand basis.

Royal Tallow and Soap Company, Incorporated, operates a rendering plant south of the Petaluma city limits and processes about 2,000,000 pounds per year of dead animals and offal. In 1938 plant wastes discharged onto adjacent land caused nuisance complaints and resulted in orders for abatement by city and county. At the present, wastes from this plant flow through a settling tank with grease recovery appurtenances. Liquid wastes are then discharged via pipeline to Petaluma Creek. Flow through this pipeline was estimated to be 20 gpm and the waste discharged was indicated by grab sample to have a 5-day, 20°C. biochemical oxygen demand of 480 ppm. On this analysis the daily waste discharge

from this plant contains about 50 pounds of 5-day, 20°C. biochemical oxygen demand or equivalent to 300 persons.

In addition to its rendering plant this company has nearly 2,000 hogs which are kept in barns behind the plant and feed on garbage collected from Petaluma and the vicinity. Manure is piled in the open fields. The topography of the land in this region makes it appear probable that this manure is carried into the creek by storm water run-off. It has also been reported that the stench from the hog farm is carried into the City of Petaluma on days of unfavorable winds.

Cader Brothers Tallow and Soap Company, a smaller company than the above, discharges its settled liquid wastes to oxidation ponds set well back from Petaluma Creek. There is no direct connection between these ponds and the creek, nor have there been any complaints regarding this method of disposal.

BENEFICIAL USES

Major uses of Petaluma Creek include navigation and recreational activities.

Navigation

In 1933 a Federal project was completed to provide a navigable channel to within the City of Petaluma. The channel width and depth at the mouth of the creek were respectively 100 feet and 8 feet; these dimensions tapered in stages to the headwaters at a point 935 feet above the Washington Street bridge where the terminal width was 40 feet and the

depth 4 feet. Since completion it has been maintained from time to time.

A survey recently conducted by U.S. Army Corps of Engineers revealed that the original project depths with reduced widths still exist to the oil terminal facilities below Petaluma. Above here the channel depths became more critical until a controlling depth of 1.5 feet is encountered at the facilities of the Poultry Producers of Central California which are at the head of the navigation project.

Until recently, movement of petroleum products, sand, gravel, and crushed stone constituted about 70 percent of the total river commerce which amounted to 249,777 tons in 1949. However, the conversion, of two barges has permitted shipment of bulk grain to the head of navigation during favorable phases of the tide. The mean range of tides at the mouth of the creek is 6.1 feet and at Petaluma it is 6.6 feet.

The following table shows tonnage movement over the river in recent years:

Year	Tons
1937	308,567
1938	251,601
1939	284,808
1940	245,590
1941	248,975
1942	248,968
1943	224,685
1944	203,433
1945	275,551
1946	271,851
1947	186,495

Recreational Usage

Boating, swimming, water skiing, and fishing are popular pastimes in the tidal portion of Petaluma Creek. About 75 pleasure boats are launched at the Petaluma Yacht Harbor, and about 25 rowboats are available for rent at Gilardi's. Other pleasure boats cruise into the creek from nearby harbors in San Francisco Bay. Water skiing is rapidly becoming a major sport in Petaluma Creek.

The Department of Fish and Game is of the opinion that although Petaluma Creek is still a popular area for striped bass fishing it apparently has suffered from pollution, and does not support the numbers of striped bass that it formerly did many years ago. During the survey made on June 3, 1951 about 100 fishermen were noticed between Haystack Landing and Lakeville.

EFFECT OF WASTE DISCHARGES ON PETALUMA CREEK

On October 15 and 16, 1951 and also on December 10 and 11, 1951 surveys were made to determine conditions of the tidal waters in Petaluma Creek. Water samples were collected for determination of dissolved oxygen, chlorides, and most probable numbers of coliform organisms. The samples were collected at periods of high tide on ebb and in flood at a series of sampling stations from the creek mouth to the upper tidal limits. Figure 1 shows the sampling stations and points of major discharges to the creek.

Sampling Station	Location
No. 1	Upper tidal limits, foot of Payran Street, Petaluma
2	At Hopper Street, Petaluma
3	At Washington Street, Petaluma
4	At "D" Street, Petaluma
5	Upper end of ship channel, Petaluma
6	Lower end of ship channel, Petaluma
7	Below Petaluma treatment plant outfall
8	2 miles below city
9	3 " " "
10	3.5 " " "
11	4.8 " " "
12	Below Gilardi's Pier
13	0.8 mile below Gilardi's Pier
14	7.3 miles below Petaluma
15	8.5 " " "
16	At Ben C. Gerwick Inc. anchorage
17	10.3 miles below Petaluma
18	Highway bridge at Black Point
19	Railroad bridge near creek mouth

Tables I and II present the results of the field tests and bacteriological analyses of samples collected at these stations during October and December, 1951. During these periods there was no visual evidence of Industrial wastes or domestic sewage in the creek. Additional data on the bacteriological quality of the creek water determined at earlier dates are also presented in Table II.

DISCUSSION OF RESULTS

Resolution No. 79 of the San Francisco Bay Regional Water Pollution Control Board prescribing requirements as to the nature of waste discharge from the City of Petaluma into Petaluma Creek includes the following statements:

"BE IT FURTHER RESOLVED, that the waters of Petaluma Creek shall not be caused by this waste discharge to contain more than ten coliform organisms per milliliter in eighty percent of the samples analysed during periods of recreational use;

"BE IT FURTHER RESOLVED, that the dissolved oxygen content of the waters of Petaluma Creek in the vicinity of the discharge point shall not be depleted below 5.0 p.p.m. as a result of this waste discharge; ..."

Referring to Table I, it may be noted that the dissolved oxygen content of the creek waters was consistently less than saturation. In the main channel of the creek, dissolved oxygen values ranged from 43 to 98 percent of saturation, representing real values of from 3.4 to 7.6 ppm oxygen. At the time these tests were made there was no surface flow of fresh water in the creek, and the chloride content of the water at sampling stations indicates that bay water alone was providing dilution for the wastes. Tidal stages during this period varied from a high of 6 feet to a low of -0.5 feet, which are close to the maximum range of tides in this area. It appears, therefore, that during periods of minimum tidal fluctuations and low upland flow, that even more serious depletion of dissolved oxygen will occur, particularly during the warmer months when water temperatures are higher.

Referring to Table II, it will be noted that rather extreme variations in the bacteriological quality of the receiving waters have been found. It is our opinion that disinfection of the effluent from the Petaluma sewage treatment plant is necessary during periods of recreational use of Petaluma Creek.

TABLE NO. I

DISSOLVED OXYGEN IN PETALUMA CREEK

Sample Station	Date	Time	Temp. °C.	Chloride ppm	Dissolved Oxygen	
					ppm	% Sat.
1	Oct. 16	1:20 P	19	18,000	7.6	98
2		1:15 P	19	18,000	6.4	82
3		1:10 P	18	18,000	6.4	82
4		1:00 P	18	18,000	5.6	72
5		11:35 A	19	18,000	6.8	87
6		11:50 A	19	18,000	3.4	43
7		12:00 M	19	18,000	6.2	80
8	Oct. 15	2:30 P	19	17,800	6.0	78
9		2:20 P	19	18,000	5.8	74
10		1:15 P	19	18,000	6.0	77
11		12:55 P	19	16,400	6.0	76
12		8:15 A	18	15,800	5.8	73
		12:05 P	18		5.8	73
13		8:45 A	18		5.8	73
		11:50 A	18		5.8	73
14		8:50 A	18	16,200	4.8	60
		11:40 A	18		5.8	72
15		9:15 A	18		5.8	72
		11:30 A	18		6.0	76
16		9:25 A	18	15,400	5.2	65
		11:20 A	18		6.4	80
17		9:50 A	18	15,000	5.8	71
		11:10 A	18		6.0	73
18		10:20 A	18	14,800	5.8	71
		10:45 A	18		6.4	78
19		10:30 A	18	13,800	6.6	80

TABLE NO. II

PETALUMA CREEK
Most Probable Number Coliform Organisms per ml.

September 29, 1939			May 26, 1949		
Sampling Point	Time	MPN Coliform per ml.	Sampling Point	Time	MPN Coliform per ml.
Poultry Produce Dock (2)*	1015	25	"D" St. Bridge (3)	1035	110+
	1315	70			
	1700				
			Poultry Produce Dock (2)	1045	110+
Sewer Outfall (7)	0915	60		1350	110+
	1100	700+			
	1450	250	Yacht Club (8)	0935	110+
	1615	1100+		1415	110+
Union Oil Dock (7A)	0830	70	NWP Dock	1125	70
	1110	70			
	1500	110+	Union Oil Dock (7A)	1150	110+
	1605	110+			
Low Tide	0310		Assoc. Oil Dock (9)	1135	110+
High Tide	1430				
Low Tide	2040				
			Haystack Ldg. (8)	1425	110+
			Sounding Board "B" (16)	1445	0.6
			Low tide	0706	
			High tide	1403	
			Low tide		

* Numbers in parentheses show approximate location with respect to sampling stations used in the study of October and December, 1951.

TABLE NO. II (Cont.)

June 3, 1951			October 15, 1951		
Sampling Point	Time	. MPN Coliform per ml.	Sampling Point	Time	MPN Coliform per ml.
Near Outfall (7)	1250	23	8	1430 1545	0.45- 2.3
Yacht Club (8)	1300	6.2	9	1420	0.6
			10	1415	0.45-
Haystack Ldg. (8)	1313	6.2	11	1255 1630	0.45- 0.6
8	1320	2.3	12	0815	0.45-
9	1330	2.3	14	0850	2.3
10	1340	2.3	16	0925	0.6
11	1350	2.3	17	0950	0.6
13	1415	0.45-	18	1020	0.6
Low tide	0817		19	1030	0.45-
High tide Low tide	1517 2022		Low tide High tide Low tide	0813 1432 2112	

TABLE NO. II (Cont.)

December 10, 1951			December 11, 1951		
Sampling Point	Time	MPN Coliform per ml.	Sampling Point	Time	MPN Coliform per ml.
1	1122	62	1	1115	230
	1405	23		1340	230
2	1128	230	2	1110	62
	1410	230		1345	230
3	1131	62	3	1105	60
	1413	2*00		1350	230
4	1136	130	4	1100	230
	1417	62		1355	200
5	1115	1300	5	1030	23
	1422	230		1400	230
6	1144	230	6	1055	62
	1429	1300		1405	500
7	1150	620	7	1050	620
	1432	230		1410	500
7A	1442	620	7A	1045	62
				1415	1300
12	1500	62	12	1015	23
				1440	13
Low tide	0440				
High tide	1110				
Low tide	1831		Low tide	0530	
			High tide	1149	
			Low tide	1910	

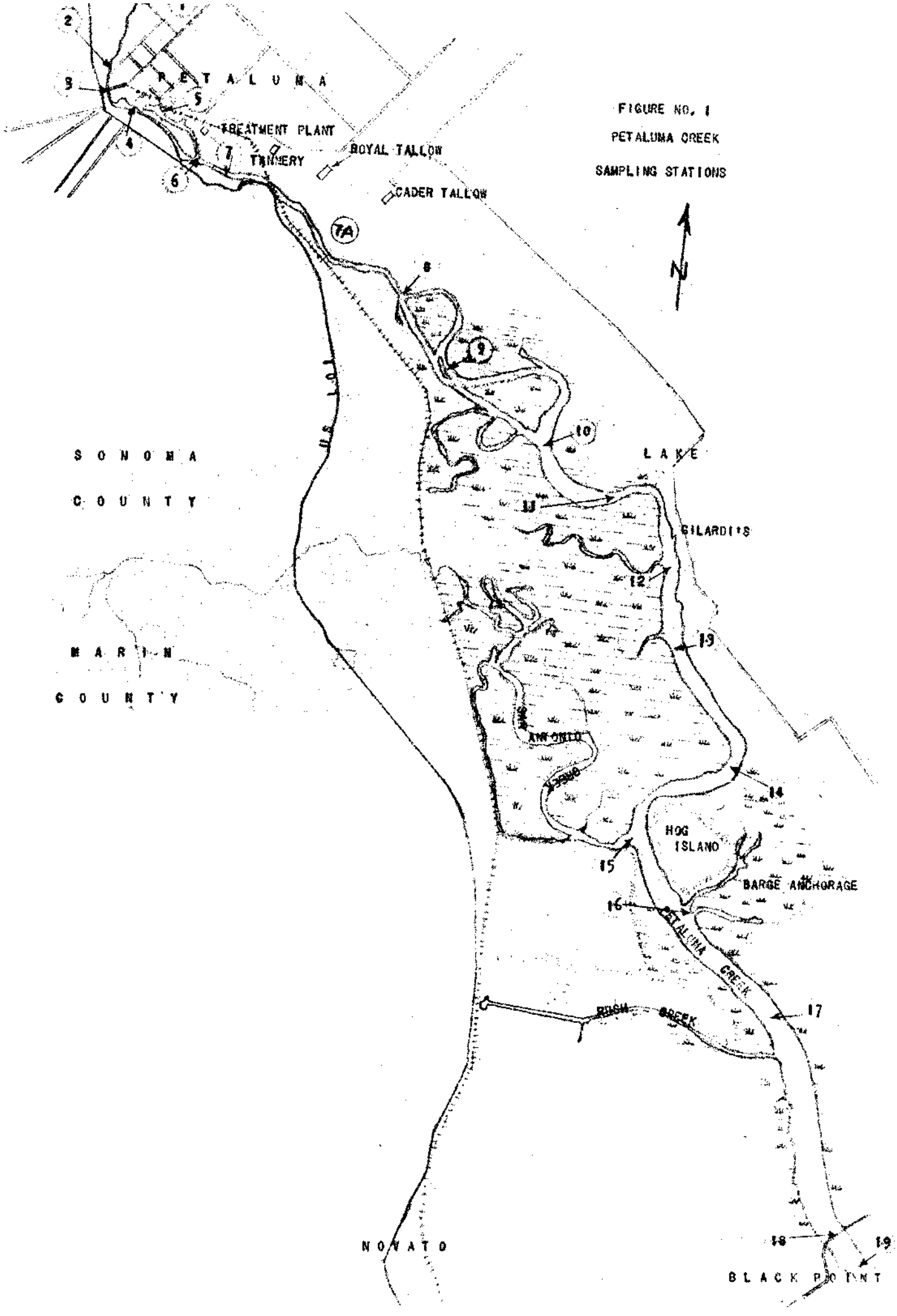
FIGURE NO. 1
PETALUMA CREEK
SAMPLING STATIONS
PETALUMA
TREATMENT PLANT
TANNERY
ROYAL TALLOW
CADER TALLOW
SONOMA
COUNTY
MARIN
COUNTY
LAKE
GILARDI'S
HOG
ISLAND
BARGE ANCHORAGE
PETALUMA CREEK
RUSH CREEK
NOVATO
BLACK POINT
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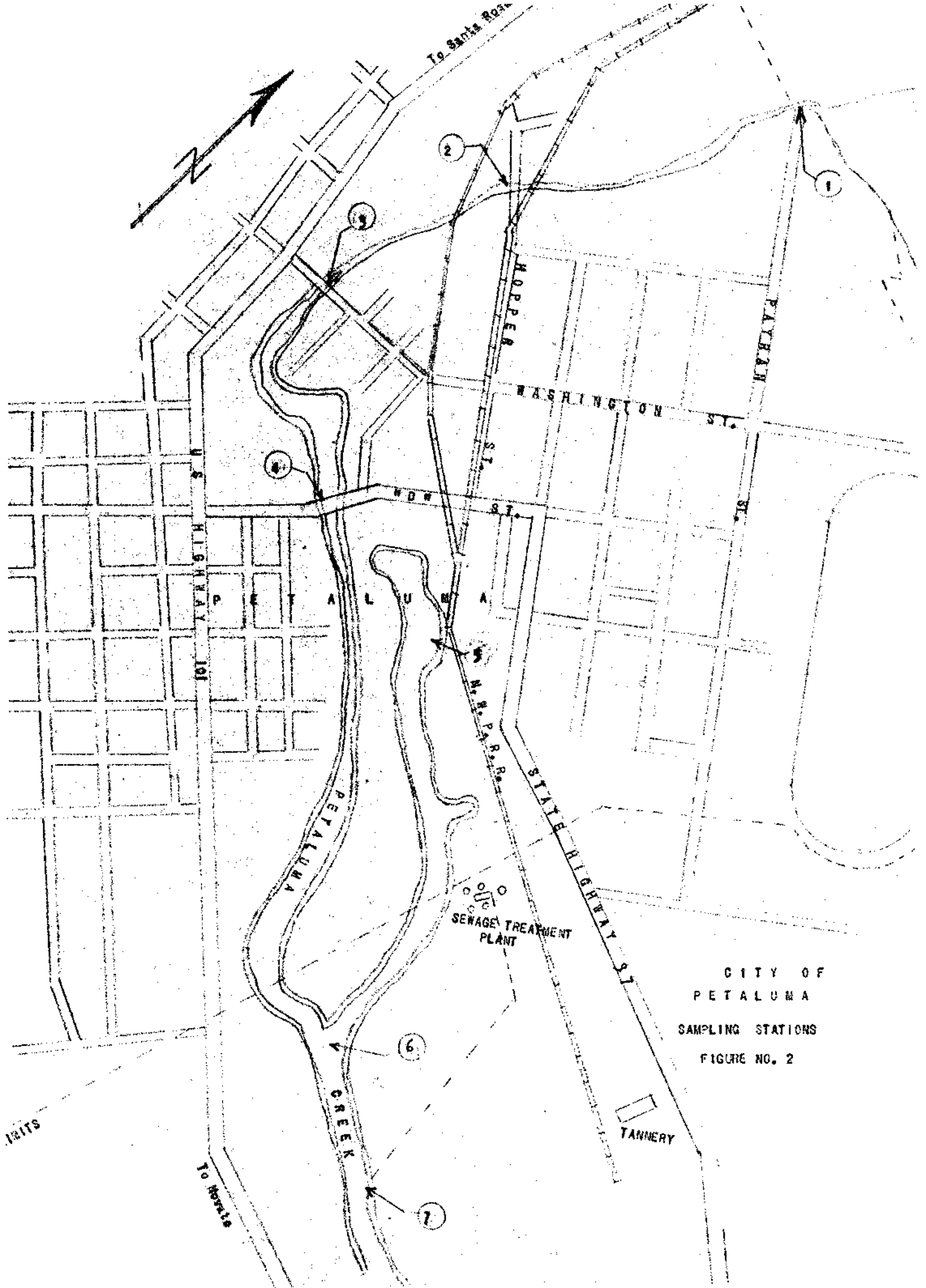
To Santa Rosa
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PARK ST.
WASHINGTON ST.
WDW ST.
P E T A L U M A
U.S. HIGHWAY 101
N.W.P.R.R.
STATE HIGHWAY 116
PETALUMA CREEK
SEWAGE TREATMENT PLANT
TANNERY
To Novato
CITY OF PETALUMA
SAMPLING STATIONS
FIGURE NO. 2

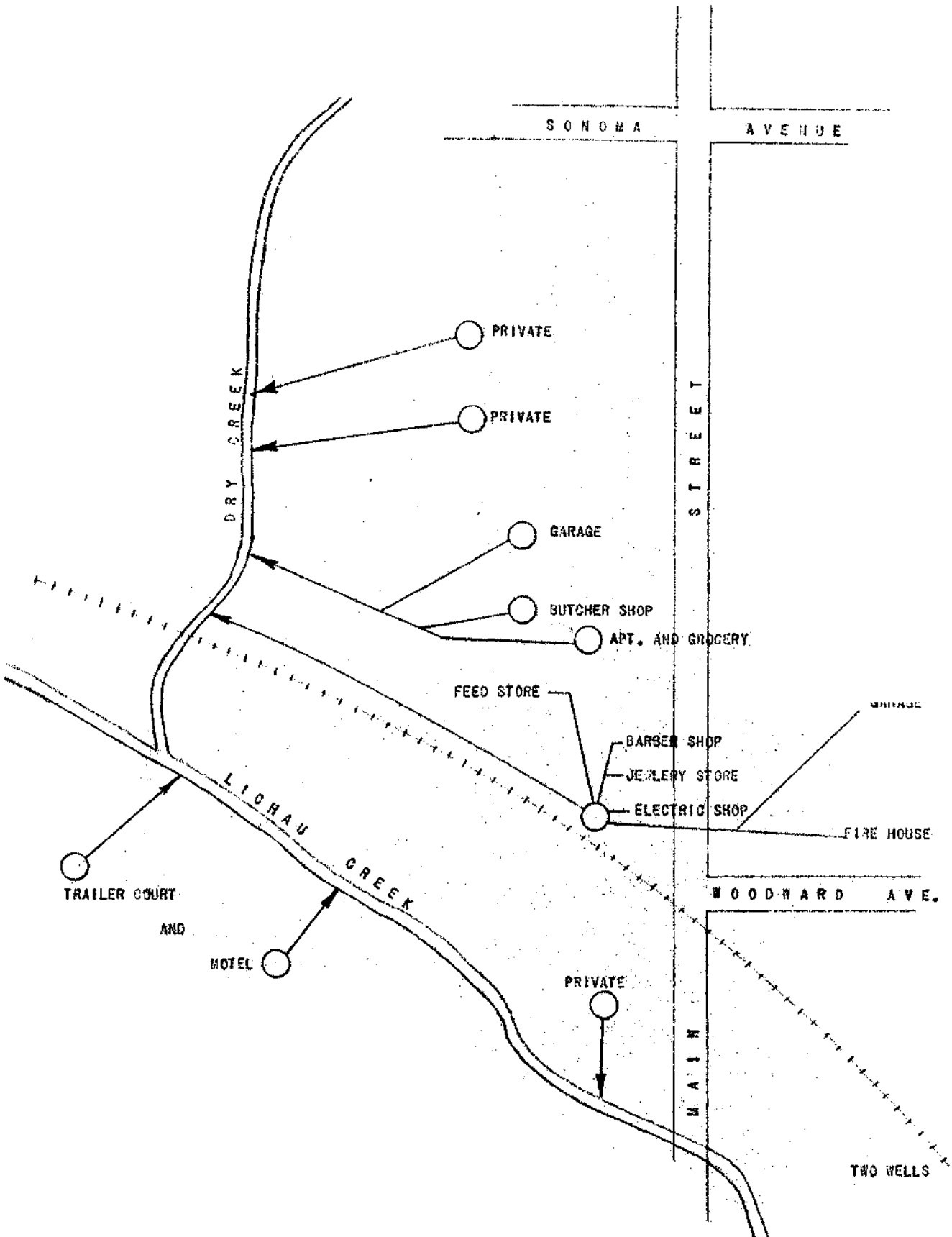

Figure No. 3 - Sewage disposal into Lichau Creek at Pengrove, California