UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division

AVAILABILITY OF GROUND WATER,
POINT PEDERNALES AREA, CALIFORNIA,

By
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Prepared in cooperation with the
Department of the Navy

61-47
OPEN-FILE REPORT

Menlo Park, California
October 30, 1961
Retyped March 1968

CONTENTS

	Page
Summary and conclusions	1
Introduction	2
Purpose and scope	2
Location of the area	2
Acknowledgments	4
Well-numbering system	4
Geology	5
Stratigraphic units and their water-bearing properties	5
Espada formation of Dibblee (1950)	7
Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation	7
Cozy Dell shale member (Kerr and Schenck, 1928) of the Tejon formation	7
Sacate formation of Kelley (1943) and Gaviota formation of Effinger (1935)	8
Vaqueros sandstone	8
Rincon shale	8
Tranquillon volcanic rocks of Dibblee (1950)	9
Monterey shale	9
Sisquoc formation	10
Terrace deposits	10
Alluvium	10
Existing water supplies	11
Proposed additions to the water supply	12
Development of springs	12
Development of ground water	12
Test-well sites	13
Chemical quality	14
References	14

ILLUSTRATIONS

		Page
Figure 1.	Map of Santa Barbara County, Calif., showing location of the Point Pedernales area----------------------------	3
2.	Geologic map, Point Pedernales area, Calif. showing location of wells----------------------------	In pocket

TABLES

Table 1.	Stratigraphic units, Point Pedernales area, Calif---------	6
2.	Chemical analyses of water from wells, springs, and streams, Point Pedernales area, Calif------------------	15

AVAILABILITY OF GROUND WATER, POINT PEDERNALES AREA, CALIFORNIA

By R. E. Evenson

SUMMARY AND CONCLUSIONS

The principal aquifers of the Point Pedernales area, California, are alluvial deposits of Espada and Jalama Creeks, porous sandstone and conglomerate beds of the Vaqueros sandstone and the Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation, and fracture zones and porous sandstones in the Tranquillon volcanic rocks of Dibblee (1950) and the Monterey shale.

The yield of water to wells and the probable extent of the various aquifers tapped could be determined by drilling 5 to 10 test wells, ranging in depth from 50 to 500 feet. Samples of water for chemical analyses and the yield of various permeable zones within the aquifers could be readily obtained from 8- to 12-inch-diameter test wells drilled by the cable-tool method. If adequate, these test wells could be utilized also as water-supply wells.

Wells that tap fracture-zone aquifers may yield as much as 300 gpm (gallons per minute), but a yield of 100 gpm should be considered good. The amount of water in storage and the rate of recharge may be small; therefore, the available water supply may be small from wells tapping fracture-zone aquifers.

Wells that tap aquifers in the Vaqueros sandstone or the Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation may yield as much as 300 gpm, but a yield of 100 gpm should be considered good. Both the amount of water in storage and the rate of recharge in these aquifers may be larger than that in the fracture-zone aquifers.

Wells that tap aquifers in the alluvial deposits may yield as much as 500 gpm, but a yield of 200 gpm should be considered good. The rate of recharge to the aquifers in the alluvial deposits is relatively large; however, the amount of water in storage probably is rather small.

Ground water in the area probably is hard and may contain about 1,000 ppm (parts per million) dissolved solids and as much as 300 ppm chloride.

AVAILABILITY OF GROUND WATER, POINT PEDERNALES AREA, CALIF.

INTRODUCTION

Purpose and Scope

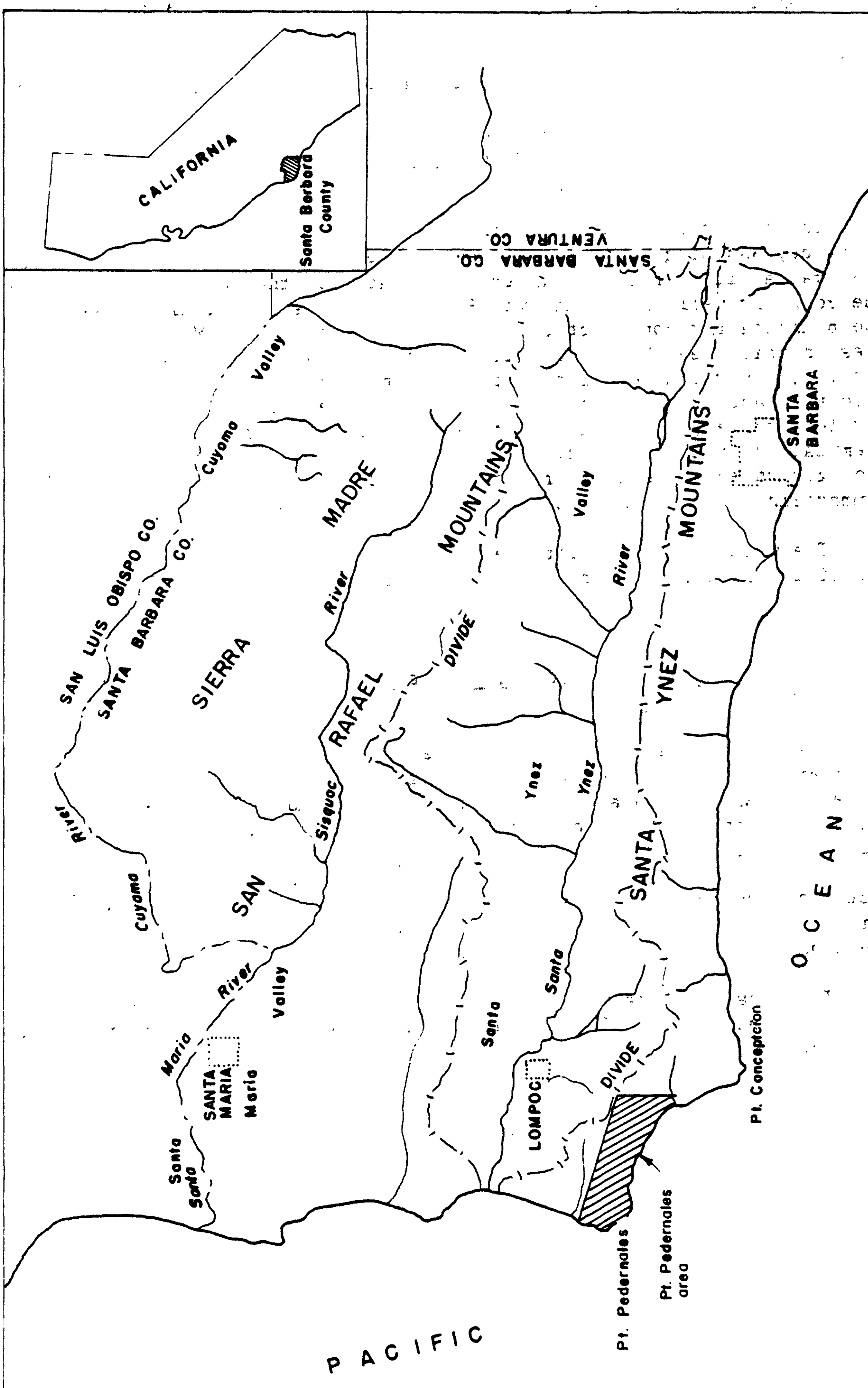
In October 1959, the District Public Works Office, Eleventh Naval District, San Diego, Calif., requested the U.S. Geological Survey to appraise the availability of ground water in the area of the Sudden Ranch adjacent to the Point Arguello Naval Missile Facility. This appraisal is essential to the planning for construction and operation of Pacific Missile Range facilities in this area, because, unless additional water supplies can be developed locally, several miles of pipeline will be required to bring water southward from the Santa Ynez Valley. Specifically, the work entailed a review of earlier studies, sampling of waters from springs, streams, and wells for chemical analyses, evaluating the hydrologic characteristics of the various geologic units, selection of test-well sites, and the preparation of a report summarizing the availability of ground water in the area.

The work was done under the general supervision of H. D. Wilson, Jr., district engineer in charge of ground-water investigations in California.

Location of the Area

The Point Pedernales area includes about 24 square miles between the Point Arguello Naval Missile Facility and the Pacific Ocean in the southwest corner of Santa Barbara County. It includes almost all the drainage area on the south slope of the Santa Ynez Mountains and extends south and east along the coast from the mouth of Canada Honda to the mouth of Jalama Creek. The northern boundary roughly follows the crest of the Santa Ynez Mountains southeastward from the coast for about 9 miles. From this point, about 1 mile east of Sudden Peak, the eastern boundary extends southward to Jalama Creek and then follows Jalama Creek to the ocean.

The area is contained within the U.S. Geological Survey Point Arguello (1959), El Tranquillon (1959), and Lompoc Hills (1959) 7-1/2 minute unedited quadrangles.



MAP OF SANTA BARBARA COUNTY, CALIFORNIA
SHOWING LOCATION OF THE POINT PEDERNALES AREA

Acknowledgments

Mr. Charles Sudden, Sudden Estate Co., supplied much information pertaining to water development for the ranch and to the surface and subsurface geology of the area. Chief Petty Officer Perry, U.S. Coast Guard, supplied background data on the water supply for the lighthouse at the Point Arguello Coast Guard Station.

Unpublished data on file in the subdistrict office of the Geological Survey, Ground Water Branch, in Santa Barbara, Calif., were useful in evaluating the water-bearing characteristics of the consolidated rocks and in providing a record of water levels and chemical analyses of water. Much of the unpublished data were from records on water-supply development at the U.S. Coast Guard lifeboat station, by Upson and LaRocque (written commun., 1942), and at the U.S. Coast Guard lighthouse, by Worts (written commun., 1945).

Well-Numbering System

Wells in the report area were numbered according to the system used for ground-water investigations in California by the Geological Survey and the California Department of Water Resources. This system, as explained below, is based on the rectangular subdivision of public land and serves to locate a well or spring within a 40-acre plot. Section lines have been projected into unsurveyed areas for reference only.

For example, the well at the Point Arguello Coast Guard lighthouse station has been assigned the number 6N/36W-26C1. The number and letter before the slash indicate that the well is in T. 6 N., and the number and letter between the slash and the hyphen indicate that the well is in R. 36 W. All townships in the area are north and west of the San Bernardino base line and meridian. The number after the hyphen indicates that the well is in section 26, and the letter "C" corresponds to the 40-acre plot, as shown in the following diagram.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

26

Wells are numbered serially within the 40-acre plot as indicated by the number following the letter.

A similar numbering system was used to designate springs and stream-sampling sites; however, the final digit was omitted. For example, the number 6N/36W-25H indicates the location of a spring.

GEOLOGY

Dibblee (1950) described the general geology of the area in detail, and his report was consulted freely throughout the preparation of this report. The geologic map (fig. 2) is taken largely from Dibblee's report.

Rocks exposed in the area are of sedimentary and volcanic origin and range in age from Jurassic to Recent. The sedimentary rocks consist of limestone, diatomite, conglomerate, gravel, sand, silt, shale, and clay, and the volcanic rocks are predominantly rhyolite. The areal distribution of the stratigraphic units is shown in figure 2, and their lithology, stratigraphy, and water-bearing properties are summarized in table 1.

In general, the rocks exposed along the steeper slopes of the mountains and almost continuously along the sea cliff from Point Pedernales to Jalama Parks are extremely well-indurated sediments that dip southward or southwestward toward the ocean. Locally, these sediments have been intensely deformed by folding and faulting. A more or less continuous terrace is formed by a relatively thin mantle of unconsolidated sediments between the steep slopes and the sea cliff.

Stratigraphic Units and their Water-Bearing Properties

Both unconsolidated deposits and consolidated rocks contain openings where ground water can be stored. In the unconsolidated deposits, particularly beds of gravel and sand, pores occur between rock particles; in the consolidated rocks the most common openings are fractures, although some rocks, such as sandstone, also contain pores. The openings in consolidated rocks generally are not as continuous or as large as openings in gravel or sand.

TABLE 1.--*Stratigraphic units, Point Pedernales area, Calif.*

	Geologic age	Stratigraphic units	Maximum thickness (feet)	Lithologic character	Water-bearing properties
QUATERNARY	Recent	Alluvium	50±	Gravel, sand, silt, and clay.	Unconsolidated, but generally does not contain sufficient storage volume to warrant ground-water development. Test drilling necessary in Espada Creek and Jalama Creek.
QUATERNARY	Pleistocene	Terrace deposits	100±	Gravel, sand, silt, and clay.	Unconsolidated; test drilling necessary.
		Unconformity			
TERTIARY	Pliocene and Miocene	Sisquoc formation	500±	Diatomite and diatomaceous clay shale.	Consolidated; would not yield water to wells.
TERTIARY	Miocene	Monterey shale: Upper member of Dibblee (1950)	1,000±	Contorted siliceous shale and soft diatomaceous shale.	Consolidated; contains some water in fractures.
TERTIARY	Miocene	Monterey shale: Lower member of Dibblee (1950)	1,000±	Brittle siliceous shale, limestone, and some sandstone.	Consolidated; contains some water in fractures, solution channels, and porous sandstone.
TERTIARY	Miocene	Tranquillon volcanic rocks of Dibblee (1950)	700±	Rhyolite and rhyolitic agglomerate and tuff.	Consolidated; contains water in fractures and in porous tuffs.
		Unconformity			
TERTIARY	Miocene	Rincon shale	500±	Bentonitic and siliceous brown to gray claystone.	Consolidated; would not yield water to wells.
TERTIARY	Miocene	Vaqueros sandstone	300±	Sandstone and conglomerate.	Consolidated; contains water in porous sandstones and conglomerate.
		Unconformity			
TERTIARY	Oligocene and Eocene	Gaviota formation of Effinger (1935) and Sacate formation of Kelley (1943)	2,000±	Sandstone and thin conglomerate beds.	Consolidated; contains water in porous sandstones and conglomerates.
TERTIARY	Eocene	Cozy Dell shale member (Kerr and Schenck, 1928) of Tejon formation	700±	Gray and brown clay shale.	Consolidated; would not yield water to wells.
TERTIARY	Eocene	Matilija sandstone member (Kerr and Schenck, 1928) of Tejon formation	1,000±	Sandstone and conglomerate.	Consolidated; contains water in porous sandstones and conglomerates.
		Unconformity			
JURASSIC AND CRETACEOUS		Espada formation of Dibblee (1950)	2,000±	Dark greenish-brown shale and thin beds of sandstone	Consolidated; would not yield water to wells.

Espada Formation of Dibblee (1950)

The Espada formation of Dibblee (1950), of Jurassic and Cretaceous age, is exposed along the main ridge of the Santa Ynez Mountains west of Tranquillon Mountain and comprises a series of dark greenish-brown thin-bedded sandy shales with thin interbeds of sandstone. This formation probably does not store or transmit ground water in this area.

Matilija Sandstone Member (Kerr and Schenck, 1928) of the Tejon Formation

The Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation, of Eocene age, is exposed along the flanks of the mountains from Canada del Rodeo eastward about 2 miles and also in the area of Canada el Jolluru. It has been identified at depths of 1,200 to 1,400 feet in wildcat oil wells drilled in the southwest corner of the Sudden Ranch. The outcrop of this member of the Tejon formation consists of thick-bedded bluish-white medium-grained sandstone that is generally moderately well indurated. Locally some pebble conglomerates and cobble conglomerates crop out. The Matilija sandstone member unconformably overlies the Espada formation of Dibblee (1950) and is conformably overlain by the Cozy Dell shale member (Kerr and Schenck, 1928) of the Tejon formation.

Water in the porous sandstone and conglomerate of the Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation is obtained from springs on the Sudden Ranch and from wells in the mountainous area east of the ranch. Yields of springs are generally less than 5 gpm (gallons per minute, whereas the yields of wells are from 20 to 50 gpm. In the vicinity of Canada el Jolluru, the outcrop of the Matilija sandstone member appears to be highly permeable; however, test drilling would be necessary to determine the water-bearing characteristics of potential aquifers in the Matilija. Recharge may be appreciable in this area because of the relatively large volume of surface water that crosses the outcrop area of the Matilija in Canada el Jolluru.

Cozy Dell Shale Member (Kerr and Schenck, 1928) of the Tejon Formation

The Cozy Dell shale member (Kerr and Schenck, 1928) of the Tejon formation of Eocene age consists of well-bedded gray and brown clay-shales that contain thin beds of sandstone. It probably does not store or transmit ground water in this area.

Sacate Formation of Kelley (1943) and Gaviota Formation of Effinger (1935)

The Sacate formation of Kelley (1943) and the Gaviota formation of Effinger (1935), of Eocene and Oligocene age, are exposed along the mountain crest in the northeastern part of Sudden Ranch, and they consist predominantly of massive, fine- to medium-grained, bluish-gray sandstone. The sandstone beds probably store and transmit ground water; however, their topographic position is not favorable for development of water supplies in the area of investigation.

Vaqueros Sandstone

The Vaqueros sandstone, of Miocene age, is exposed in a variety of topographic settings throughout the central part of the area. It also has been identified at depths of 600 to 1,000 feet in wildcat oil wells drilled in the southwest corner of the area. The Vaqueros sandstone consists of medium- to coarse-grained brown sandstone and small amounts of conglomerate. Where observed in outcrop, the sandstone ranges from soft to hard.

The Vaqueros sandstone stores and transmits ground water readily, as indicated by the several springs discharging from it on the Sudden Ranch and by wells that penetrate the Vaqueros sandstone in mountainous areas east of the Sudden Ranch. Yields of the springs are generally less than 20 gpm, and yields of the wells range from 20 to 100 gpm. Test drilling will be necessary to determine the yields that can be obtained from the Vaqueros sandstone in the area.

Rincon Shale

The Rincon shale, of Miocene age, consists of bentonitic and siliceous brown to gray claystone. This formation probably does not store or transmit ground water in the area.

Tranquillon Volcanic Rocks of Dibblee (1950)

The Tranquillon volcanic rocks of Dibblee (1950) of Miocene age are exposed extensively throughout the mountainous area, in the sea cliff near Point Pedernales, and in the sea cliff (and for several hundred feet at low tide) near the mouth of Canada del Rodeo. The Tranquillon volcanic rocks constitute the basal part of the Monterey shale, and they comprise a series of extrusive volcanic rocks that consist of rhyolite, rhyolitic agglomerate, and tuff.

Small springs and seeps yield ground water from fractures in this volcanic series; however, the quantities are generally less than 2 gpm. The quantity of ground water in storage and the quantity of recharge probably are small because the fracture systems are discontinuous.

Monterey Shale

The Monterey shale of Miocene age is subdivided by Dibblee (1950) into lower and upper members, as indicated in figure 2.

The lower member (Dibblee, 1950) of the Monterey shale is exposed extensively on the mountain slopes in the eastern and western parts of the area and almost continuously in the sea cliff from the Espada to the mouth of Canada Agua Vina and in a small area south of Point Pedernales. The lower member consists of hard laminated siliceous shale and some hard diatomaceous shale, soft silty shale, limestone, and small amounts of sandstone. Where the brittle siliceous shale and limestone have been folded or faulted, they are highly fractured. These fractured beds and the permeable sandstone beds are capable of storing and transmitting ground water. Most of the large springs, including that for the main water supply for the ranch headquarters and the railroad, occur in this lower member.

The upper member (Dibblee, 1950) of the Monterey shale is exposed along the mountains in the eastern and southwestern part of the area and along the sea cliff from just south of Point Pedernales to the mouth of Canada Agua Vina. This upper member consists of soft diatomaceous shale and hard laminated siliceous shale that commonly contain layers of extremely contorted chalcedonic chert. Where the upper member has been folded or faulted, the brittle siliceous shales are highly fractured and are capable of storing and transmitting ground water. However, because these fracture zones probably are predominantly lineal, decrease in width with depth, and are not continuous areally, the available quantity of ground water in storage may not be enough to sustain large yields from wells. Test drilling and test pumping would be necessary to appraise the potential supply from this source. A few springs occur in the upper member, and two or three wells probably have obtained water from fractures in the shale.

Sisquoc Formation

The Sisquoc formation of Miocene and Pliocene age is exposed in the extreme southeastern part of the area and consists of diatomite and diatomaceous shale that probably do not store or transmit ground water in the area.

Terrace Deposits

The terrace deposits are of Pleistocene age and underlie the comparatively level topography between the sea cliff and the steeper mountain slopes. These deposits are a mixture of gravel, sand, silt, and clay that could in places exceed the maximum observed thickness of 80 feet.

The permeable terrace deposits may or may not contain ground water, depending on the configuration of the underlying bedrock. For example, water cannot be stored in terrace deposits that overlie a bedrock surface that slopes toward the sea; conversely, water can be stored in terrace deposits that overlie a depression in the bedrock surface. Test wells have been drilled on some of the nearly level terraces in the eastern part of the area in the hope of developing ground water, but these wells did not yield quantities adequate for irrigation.

Alluvium

The alluvium of Recent age consists of gravel and sand that is only a few feet thick in most stream valleys. In the few places where it is thicker, it is composed of fine-grained sand, silt, and clay that will not yield water readily. Sediments are coarser, however, in Espada and Jalama Creek valleys. Test drilling in these valleys should delineate potential aquifers. Recharge to any aquifer in these valleys would be greater and more rapid than elsewhere in the area because both creeks drain relatively large areas.

EXISTING WATER SUPPLIES

The Sudden Ranch is used primarily for raising cattle, and water supplies adequate for 1,000 to 2,000 head have been developed on the ranch. In almost every canyon a small spring has been developed to supply water to stock. The yields of these springs range from 1 or 2 gpd (gallons per day) to as much as 30 gpm. Many of the springs reportedly dry up during July and August; however, springs that are perennial and flow 5 gpm or more have been developed extensively. These springs supply water to storage tanks or reservoirs, which in turn supply one or more watering troughs. The largest spring (5N/35W-1F) yields about 20 to 30 gpm to a large covered reservoir that supplies water to the residents of the ranch, the Southern Pacific Co. maintenance station, and several watering troughs.

Two wells, 6N/36W-23R1 and R2, obtain water from the lower member of the Monterey shale. Well 23R1 was drilled in 1924 to a depth of 135 feet, and in 1943 the yield was 500 to 600 gpd from 4 feet of coarse water-bearing sand. The well was abandoned in 1943 and replaced by a new well (23R2) about 10 feet east of the old well. Well 23R2 was drilled to a depth of 300 feet and was perforated opposite limestone and brecciated shale between 127 and 146 feet. The yield of this well, when drilled, was 215 gpm, and the drawdown was 7.5 feet after about 6 hours of pumping. The well is used only occasionally, because it generally goes dry after about 24 hours of pumping at 30 gpm.

Water-level and pumpage records for wells 23R1 and 23R2 indicate that the water table in this area has declined 38 feet in the period 1924-59 despite the fact that withdrawals by pumping have been relatively small. The marked decrease in the yields of the wells and the declining water table indicate that the ground-water reservoir probably is small and that, as of 1960, it has been virtually depleted.

Well 6N/36W-26G1, 219 feet deep, was used to supply water for stock until about 1947, when the water reportedly became so bad that cattle would not drink it. The well had a static depth to water of 60 feet in 1927 and a yield of about 8 gpm, but in December 1959 the well was dry at 219 feet.

Well 6N/36W-26C1 is 476 feet deep and supplies water for the Coast Guard lighthouse station at Point Arguello. The water probably comes from fractures in the upper member of the Monterey shale. The well is adequate to supply the Coast Guard facilities with about 1,700 gpd, or slightly more than 1 gpm.

Well 6N/35W-31M1 penetrates both the terrace deposits and the underlying Monterey shale to a depth of 196 feet. This well apparently obtains water from the fractured shale. The yield of well 6N/35W-31M1 in 1942 was 120 gpm with a 3-foot drawdown and a static level of 59 feet; from 1942 to 1960 the static level had not changed significantly. The quality of water is poor--635 ppm (parts per million) chloride--and it is not used for drinking.

PROPOSED ADDITIONS TO THE WATER SUPPLY

The results of this investigation show that the geologic formations in the Point Pedernales area are not capable of supplying large amounts of water to wells; however, small to moderate supplies probably can be obtained from the larger springs and from wells drilled into selected Sandstone and fractured beds.

Development of Springs

Two springs (6N/36W-25H and 6N/35W-30R), if properly developed, might show marked increases in their yields. Their development might be as simple as removing the trees and shrubs that surround the springs, excavating the orifices to a depth of several feet, and building a suitable structure over them. More involved techniques of development might include concrete structures to collect the spring waters, pumping systems to distribute the water, and preventive measures to guard against pollution.

Development of Ground Water

Potential aquifers may be explored systematically by test drilling at sites selected on the basis of current knowledge concerning the geology. A minimum of 5 and a maximum of 10 sites have been selected for exploratory drilling and are shown in figure 2. These sites have been selected with the intent of encountering fresh water in fracture zones or pores of the consolidated rocks or in the permeable sand and (or) gravel lenses in the unconsolidated deposits.

Test drilling by the cable-tool method would simplify collection of water samples during drilling operations and would enable bail tests to be made to determine the yield of aquifers. Yields of wells may range from zero (dry hole) to 300 gpm, but it is expected that the average yield would be roughly 100 gpm.

Test-well sites suggested herein have been numbered from 1 to 5 from west to east; the capital letters, A, B, or C, added to the number represent additional sites that may be drilled under certain circumstances described in the section following.

Test-Well Sites

Test-well sites 1 and 1A are 1,500 feet and 4,500 feet, respectively, north of the junction of the roads to the Coast Guard lighthouse station at Point Arguello and to Sudden Ranch. They have been selected on the basis of a fracture zone in the Monterey shale that trends N. 10° W. This fracture zone is well defined on the surface for 1 mile and may extend for an additional 2.5 miles. It is one of the most favorable fracture zones for ground-water development in the area and should be test drilled.

Drilling at site 1 to a depth of about 400 feet below the land surface should be sufficient for preliminary exploration of this fracture zone. If the quality and quantity of water are adequate, then the possibility of obtaining an additional supply from the fracture zone might be determined by drilling a second exploratory hole at site 1A.

Wells at these sites probably would penetrate siliceous shale, chert, limestone, and some sand and soft shale, and drilling may be difficult. On the basis of data from wells penetrating similar formations in the nearby area, yields of wells at these sites may be as great as 300 gpm, but a yield of 100 gpm should be considered good.

Test-well sites 2, 2A, and 2B are in the west-central part of the area, in the vicinity of Canada del Rodeo and Canada de los Sauces. These sites are downdip from outcrops of conglomerate and sandstone of the Vaqueros sandstone, where drilling may be expected to provide data on the water-bearing character of the terrace deposits and the Vaqueros sandstone. Site 2 should be drilled to a depth of 400 to 500 feet, where the hole should bottom in shale. The deposits to be penetrated probably include clay, sand, gravel, boulders, shale, and sandstone. The yield of wells in this area might be between 10 and 300 gpm, but a yield of 100 gpm should be considered good. If water of suitable quality and quantity is discovered at site 2, sites 2A and 2B should be drilled to determine the subsurface extent of the aquifer.

Test-well sites 3 and 3A are in Canada el Jolloru, approximately 1,000 feet and 2,200 feet north of the main road through the Sudden Ranch. These sites are on the valley fill, but the Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation should lie at a relatively shallow depth. A well at site 3 should be drilled to a depth of about 300 feet and developed to determine the water-bearing character of the Matilija sandstone member. Drilling may be slow, but should not be difficult. If the well at site 3 does not penetrate at least 200 feet of sandstone, a well should be drilled at site 3A. These wells may yield from 10 to 200 gpm, but a yield of 50 gpm should be considered good.

Test-well stie 4 is in the valley of Espada Creek, and sites 5 and 5A are in the valley of Jalama Creek at the southern end of the area. These sites are in areas where the alluvium may be thick enough and permeable enough to store and transmit water in significant quantities. Because the alluvium probably is thin, the depth of the wells should be less than 100 feet and may not exceed 50 feet. Yields between 10 and 500 gpm may be attained, but 100 gpm should be considered good.

CHEMICAL QUALITY

Water samples from 4 wells, 8 springs, and 1 stream were collected and analyzed by the Geological Survey. Table 2 shows the analyses of these 13 samples collected during this study and 5 samples collected during 1942 and 1943.

Ground water from fractures or porous rocks in the Monterey shale in the western part of the area (test-well sites 1 and 1A) may contain about 300 ppm chloride, 1,000 ppm dissolved solids, and have a hardness of 500 ppm. Water from the porous sandstones and conglomerates of the Vaqueros sandstone (test-well sites 2, 2A, and 2B) and from the Matilija sandstone member (Kerr and Schenck, 1928) of the Tejon formation (test-well sites 3 and 3A) may contain about 150 ppm chloride, 1,000 ppm dissolved solids, and have a hardness of from 500 to 1,000 ppm. Water from the alluvium of Espada and Jalama Creeks (test-well sites 4, 5, and 5A) may contain about 100 ppm chloride, 500 ppm dissolved solids, and have a hardness of 500 ppm.

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TABLE 2.--*Chemical analyses of water from wells, springs, and streams, Point Pedernales area, Calif.*

[Analyses by Quality of Water Branch, U.S. Geological Survey; in parts per million]

Location number	Description and locality	Date sampled	Temperature (°F)	Specific conductance (micromhos at 25°C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness: Total	Hardness: Noncarbonate	Percent sodium	pH
5N/34W-7E	Spring from lower member of Monterey shale	12- 2-59		1,240			126	68	62	3.5	520		116			0.1		595	169	18	8.1
18H	Spring from Espada Creek alluvium	12- 2-59		1,100			90	71	58	4.3	441		94					515	153	19	8.2
18J	Jalama Creek	12- 3-59		1,670			168	84	96	4.1	532		185					765	329	21	8.2
18L1	Well--Jalama County Park	12- 3-59		2,670			146	94	313	25	414		608			1.0		750	411	47	7.7
5N/35W-1F	Spring from lower member of Monterey shale	12- 2-59		997			102	54	42	2.7	450		85			.1		478	109	16	8.2
1N	Spring from lower member of Monterey shale	12- 2-59		2,080			126	99	184	5.0	422		390			.2		720	348	36	8.4
2D	Spring from Vaqueros sandstone Sudden Canyon	12- 2-59		1,410			100	53	128	4.8	222		248			.2		465	283	37	8.2
6N/35W-28C	Spring from Vaqueros sandstone Canada de los Lsdrones	12- 2-59		2,290			248	106	184	14	308		130			.7		1,060	807	27	8.1
30R	Spring from volcanic rocks Canada Agua Vina	12- 1-59	65	1,920			140	89	158	9.2	468		318			.2		715	331	32	8.2
31M1	Well--U.S. Coast Guard Lifeboat Station	10-20-42[1]				3	197	158	161[2]			264	570	0			1,880	1,160			6.9
31M1	Do	12- 1-59		2,860		.01	178	130	272	25	566		635			.2		980	516	37	8.2
6N/36W-23R1	Well--drilled in 1927	12- 2-43[3]			24	.05	122	66	159[2]		315	271	252	0.5	0.2	.2	1,150	576	294		7.6
23R2	Well-drilled in 1943	12-30-43[3]			27	.10	125	66	160[2]		399	226	266	.4	.4	.3	1,150	585	256		7.2
23R2	Do	12- 3-59		2,340		.01	188	125	188	16	409		254			.2		985	650	29	7.6
25H	Spring from lower member of Monterey shale Oil well canyon	12- 2-59		1,880			160	79	158	7.2	476		274			.1		725	335	32	---
26C1	Well--U.S. Coast Guard light	8- -43[4]			6.6	.1						30	560					416			7.6
26C1	Do	12- 1-59		2,370		0	168	122	179	13	504		432			.2		920	507	29	8.2
26G1	Well-Sudden well	2- -43[4]				4						188	580					978			6.9

[1] Analyzed by California Department of Public Health.
[2] Includes potassium.
[3] Analyzed by War Department, U.S. Engr. Lab., Los Angeles, Calif.
[4] Analyzed by the Permotit Co., New York, N. Y.