The Potential for Developing Ground-Water Supplies in the Pescadero Area, San Mateo County, California

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UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

For additional information write to:

District Chief
Water Resources Division
U.S. Geological Survey
345 Middlefield Rd.
Menlo Park, Calif. 94025

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ILLUSTRATION

CONVERSION FACTORS

For those readers who prefer to use metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound units	By	To obtain metric units
foot (ft)	0.3048	meter (m)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
mile (mi)	1.609	kilometer (km)

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ABSTRACT

Adequate supplies of ground water for municipal use generally are not available within a 3-mile radius of Pescadero, San Mateo County, California. The required quantity of 100 gallons per minute probably could be obtained from one or more wells in the alluvium along Pescadero Creek; however, the quality of the water probably would deteriorate with time and might not be suitable for public supply for more than 20 or 30 years. Sand and gravel beds below 60 feet in the alluvium near the junction of Honsinger and Pescadero Creeks offer the best potential for developing domestic water supplies.

INTRODUCTION

Shallow wells in alluvium along Pescadero and Butano Creeks presently supply domestic water needs for individual homes in the town of Pescadero (fig. 1). This same alluvium, which is mostly farmed, is also the depository for septic-tank effluent from the individual homes. The effluent, combined with return water from irrigation, has contaminated the water in many of the shallow wells with coliform bacteria and nitrates and has created a public-health hazard. Some other source of water supply will probably have to be found for the town.

This study, undertaken in cooperation with San Mateo County, was an effort to determine if the aquifer in the vicinity of Pescadero can supply enough potable water for the domestic needs of the town. The county estimates that 100 gal/min, not necessarily all from one source, is needed to supply the population of about 600. Wells that might yield as much as 35 gal/min are of interest to the county.

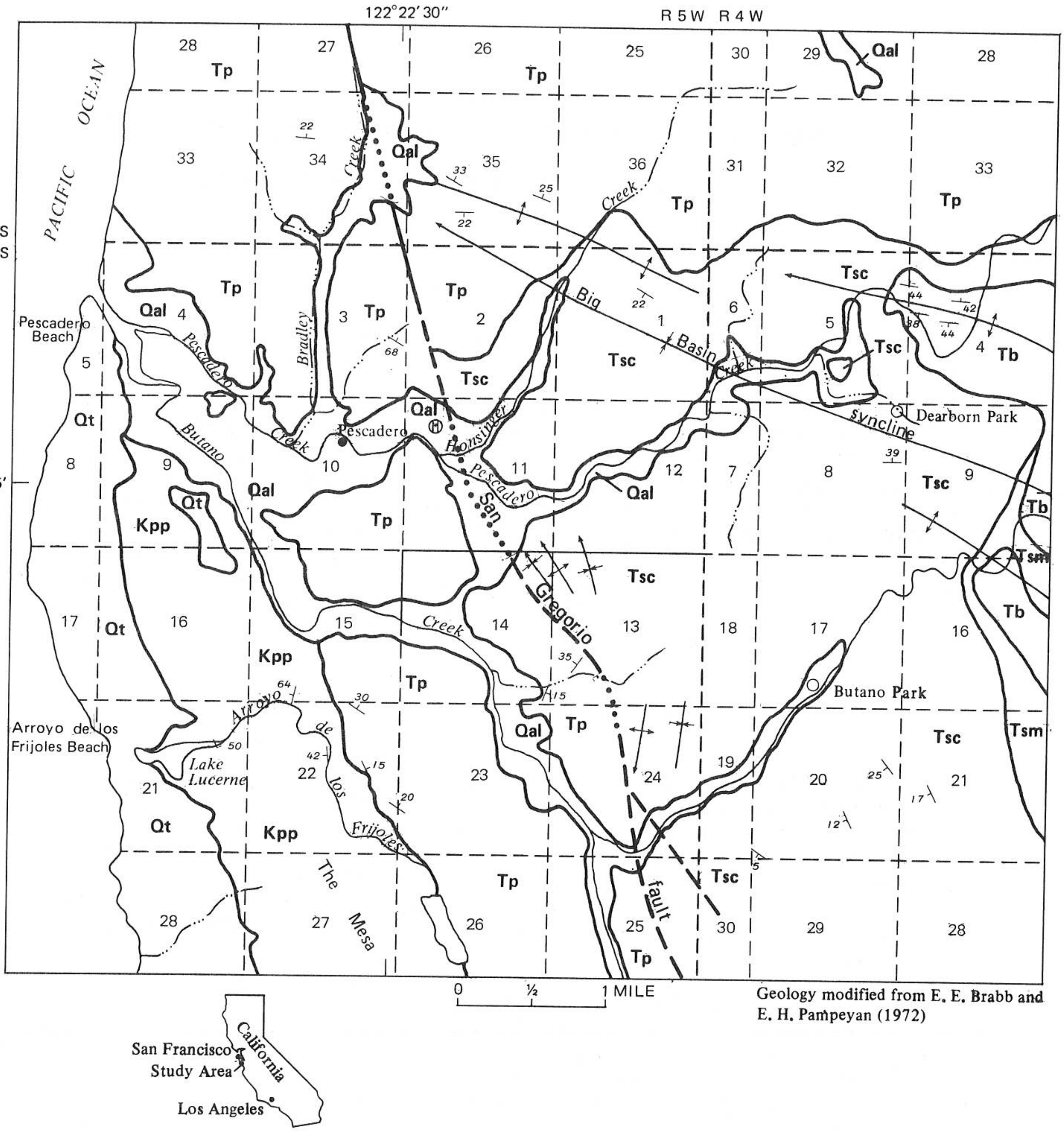

FIGURE 1.--Geologic map of the Pescadero area.

INTRODUCTION

CORRELATION OF MAP UNITS

Qal	Holocene and Pleistocene	QUATERNARY
Qt		
Unconformity		
Tp	Pliocene and Miocene	TERTIARY
Tsc	Miocene	
Tsm		
Unconformity		
Tb	Eocene	
Unconformity		
Kpp	Upper Cretaceous	CRETACEOUS

DESCRIPTION OF MAP UNITS

Qal ALLUVIUM (HOLOCENE AND PLEISTOCENE)—Gravel, sand, silt, and clay

Qt TERRACE DEPOSITS (HOLOCENE AND PLEISTOCENE)—Predominantly sand; some silt, clay, and gravel

Unconformity

Tp PURISIMA FORMATION (PLIOCENE AND MIOCENE)—Siltstone, mudstone, sandstone, and conglomerate

Tsc SANTA CRUZ MUDSTONE (MIOCENE)

Tsm SANTA MARGARITA SANDSTONE (MIOCENE)

Unconformity

Tb BUTANO FORMATION (EOCENE)—Predominantly sandstone, minor shale and conglomerate

Unconformity

Kpp PIGEON POINT FORMATION (UPPER CRETACEOUS)

EXPLANATION

Contact—Approximately located

Fault—Dashed where approximately located; dotted where concealed

17 Strike and dip of beds. Number is dip, in degrees

Anticline—Showing direction of plunge

Syncline—Showing direction of plunge

Proposed test well site

FIGURE 1.--Continued.

The area studied (fig. 1) is roughly within a radius of 3 mi from the town of Pescadero. Geologic formations that underlie the area but crop out beyond a 3-mile radius were examined.

The area is a sparsely populated, hilly terrain that has been deeply dissected by Pescadero and Butano Creeks and their tributaries. The larger creeks flow in fairly wide, flat-bottomed, alluviated valleys and drain into the Pacific Ocean. The lower one-half mile of Pescadero Creek valley bottom is a marsh. The flat bottom land is dotted with farms and homes.

Data on existing wells, including depth, yield, and water-bearing formations, were collected and evaluated, as were data on ground-water quality. The lithology, thickness, and distribution of the formations and the geologic structure were studied in relation to their effect on the occurrence and movement of ground water.

HYDROGEOLOGY

Exposed bedrock formations in the area are the Pigeon Point Formation of Cretaceous age, the Santa Cruz Mudstone of Miocene age, and the Purisima Formation of Miocene and Pliocene age (fig. 1). These formations are offset by the San Gregorio fault which trends north-northwest through the center of the area. Two folds, the Big Basin syncline and an associated anticline about half a mile to the north, trend west-northwest across the northeast quadrant of the area. The fault and the folds, to some degree, locally control the direction of ground-water movement.

The Pigeon Point Formation forms the western part of "The Mesa" in the southwest part of the study area. This formation consists of several hundred feet of conglomerate, sandstone, siltstone, and mudstone. These materials are not well sorted. They are generally well consolidated and have a low permeability. However, in local areas the conglomeratic and sandy units are fractured extensively and transmit water slowly to wells.

"The Mesa" is characterized by numerous seeps which give rise to small perennial streams. The seeps indicate a measure of recharge to and ground-water storage in the Pigeon Point Formation. However, most of the seeps are on topographically high areas, suggesting that not much of the recharged water moves very far downward into the Pigeon Point Formation. Most of the water that sustains the seeps is probably from shallow fracture systems or from soil. Most, if not all, of the wells in the Pigeon Point yield less than 10 gal/min, and some contain a high concentration of iron. A 220-foot well in the southern part of sec. 16, T. 8 S., R. 5 W., reportedly penetrated only sandstone of the Pigeon Point Formation, yet it yielded only slightly more than 5 gal/min.

A proposed farm-worker housing site is in sec. 9, T. 8 S., R. 5 W., near the north end of the outcrop of the Pigeon Point Formation. Wells drilled at this site would penetrate the Pigeon Point Formation and probably would yield less than 5 gal/min of water that might contain an excessive concentration of iron.

The Santa Cruz Mudstone, exposed only east of the San Gregorio fault (fig. 1), is a thick sequence of indurated, fractured claystone and mudstone. This formation transmits water only through fractures and seldom yields more than 5 gal/min to wells. The quality of water from the Santa Cruz Mudstone is generally poor. Chances of obtaining an adequate supply of good water for public use from the Santa Cruz Mudstone are poor.

The Purisima Formation consists of a thick sequence of siltstone, sandstone, and conglomerate. In this area of study, only the lower part of the formation, mostly the Tahana Member of Cummings (1962), is present. Some of the sandstone beds within the Purisima contain water and may be permeable enough to yield 50 to 100 gal/min in the area south of Pescadero Creek and west of the San Gregorio fault. The log of a well in sec. 24, T. 8 S., R. 5 W. indicates that a 45-foot sandstone bed occurs in the Purisima at depths ranging from 200 to 500 ft below the surface. Strata in this area dip 15 to 60 degrees to the east and abut the San Gregorio fault a short distance to the east. Because of the steep dip, the depth to the sandstone bed increases rapidly eastward and is greatest at the fault.

Water from the deeper sandstone beds in the Purisima Formation in the area east of Butano and Little Butano Creeks is not suitable for domestic use or irrigation of some crops. The water contains a concentration of chloride about 3½ times the recommended Public Health Service standard of 250 milligrams per liter (mg/L) (National Academy of Sciences and National Academy of Engineering, 1973, p. 61). The quality may be somewhat better in the area west of these creeks nearer the area of recharge, but probably it still would not meet Public Health standards for drinking water.

Sandstone beds in the Purisima probably have the only potential, of all the bedrock in the study area, to supply enough ground water for the community of Pescadero. However, it might require two or more wells to produce a total of 100 gal/min, and the water quality would preclude the use of these beds for a domestic supply.

If 100 gal/min were pumped from the Purisima Formation, water levels in the water-bearing bed would be lowered over a fairly broad area. Water in the Purisima occurs under artesian, or confined, conditions. The effect of pumping from artesian systems is more far reaching than for unconfined systems such as those in the alluvium.

Surficial deposits in the Pescadero area include three levels of terrace deposits and the alluvium along the major creeks. The terrace deposits, mostly clay, sand, and gravel, yield water but rarely more than enough for a single family. The water usually occurs in sandy beds immediately overlying the Pigeon Point Formation upon which the terraces were carved. The terrace deposits have little potential as a water supply for Pescadero.

The alluvium, as much as 120 ft in thickness near Pescadero, is capable in places of yielding the required 100 gal/min; but its water locally contains nitrate, chloride, iron, or other constituents in concentrations excessive for domestic use. The thicker, coarser-grained deposits of alluvium occur just northwest of the junction of Honsinger and Pescadero Creeks. Several wells in that area are reported to yield more than 50 gal/min.

Logs of wells in the thicker alluvium commonly indicate that permeable gravel and sand beds occur at considerable depth--below 60 ft--and that lenticular clay beds commonly occur between 20 and 40 ft. Because of these relations it may be possible to partly seal off shallower water above the clay that contains most of the high nitrate and bacteria concentrations.

Water samples taken in March and April 1979 from wells that obtain part, if not most, of their water from the deeper gravels generally east of Pescadero provided the following analyses:

Location[1]	Nitrate (as nitrogen)	Chloride	Iron	Manganese	Hardness	Specific conductance (µmho/cm) at 25°C)
	Milligrams per liter					
1 mi east of Pescadero.	0.42	263	5.9	1.2	383	1436
Near east end of North Road.	5.9	94	.45	<0.02	230	829
Pescadero High School.	7.2	58	1.7	.08	170	659

[1]Wells are in T. 8 S., R. 5 W., sec. 11.

CONCLUSIONS

The water from the well 1 mi east of Pescadero contains excessive chloride, iron, and hardness. The other two wells contain water that is very hard but suitable chemically for drinking.

Inasmuch as sources of domestic water supplies of acceptable quality are limited in the Pescadero area, it would be desirable to have a test well drilled in the alluvium to a depth of 125 ft at the site shown in figure 1. Drilling with a cable-tool rig would facilitate obtaining water samples as drilling progresses. To determine the potential for a safe water supply the well should be cased, perforated, and gravel-packed below a depth of 40 ft, and the strata above the gravel pack sealed off. Provision should be made for testing the yield over a period of several consecutive hours at a rate of not less than 50 gal/min.

Even if the required quantity and quality of water is obtained from the alluvium, heavy pumping could, in time, induce downward movement of water of poor quality from shallower zones, resulting in continuous degradation of the water at depth.

The effect of the seal might be tested by installing a small observation well a few feet from the production well in the shallow alluvium above the clay. If the pumping well is perforated only below the seal and drawdown in the observation well is insignificant, then the rate of downward movement may be so low that the producing zone will not become polluted, as long as the source of recharge to this zone remains unpolluted.

Pumping a municipal well or well field in the alluvium at a rate of 100 gal/min would lower water levels locally and seasonally. The significance of this lowering for nearby wells would depend on their distance from the pumped wells. However, there probably would be no continuing trend of lowering; the water levels should recover virtually completely during the rainy, high-runoff season.

The more significant effect of pumping would be the accelerated downward movement of the shallow, polluted water into deeper permeable beds that may now contain water of marginal quality for domestic use.

CONCLUSIONS

The required quantity of 100 gal/min probably could be obtained from one or more wells in the alluvium along Pescadero Creek; however, the quality of the water probably would deteriorate with time and might not be suitable for public supply for more than 20 or 30 years. Sand and gravel beds more than 60 feet deep in the alluvium near the junction of Honsinger and Pescadero Creeks offer the best potential for developing supplies of ground water.

REFERENCES CITED

Brabb, E. E., and Pampeyan, E. H., 1972, Preliminary geologic map of San Mateo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-328 (scale 1:62,500).

Cummings, J. C., Lauring, R. M., and Brabb, E. E., 1962, Geology of the northern Santa Cruz Mountains, California: California Division of Mines and Geology Bulletin 181, p. 179-220 (scale 1:48,000).

National Academy of Sciences and National Academy of Engineering, 1973 [1974], Water quality criteria 1972: U.S. Environmental Protection Agency, EPA R3-73-033, 594 p.