Gary Rudholm, Senior Planner
County of Santa Clara Planning Office
County Government Center, East Wing
70 West Hedding Street, San Jose, CA 95110

May 29, 2012

Dear Gary Rudholm,

At last week's, May 24, Public Hearing on Lehigh Permanente's Reclamation Plan a request was made by a member of the Santa Clara County Planning Commission for documentation on my testimony that I believed there exists extensive connectivity in groundwater underflow from quarry site to the unconfined aquifer zone where prime drinking water wells are located, and that monitoring wells for contaminants are needed in zone.

The geology of this area is complex and there is not one map or study to illustrate groundwater trajectory but rather one must review a composite of water source data. Aside from State Department of Water Resources charts of South Bay's unconfined areas and sub areas, in particular the extent of Santa Clara Valley's prime deep aquifer, there are significant indicators such as CalWater's well cluster at intersection of #85 and #280 and high water depths of 5 to 15 feet downhill from quarry evident in Santa Clara Valley Water District study.

The first school in Santa Clara County was located here and if reliable water source was not Heney Creek then there must have been year-round springs. De Anza's party rested here and viewed the Bay from Signal Hill. The colony of red-legged frogs have historically relied on extensive wetlands here, east of the cemetary and downhill from quarry. This anecdotal background only gives credibility to referenced geological surveys.

There are two reference points to be located to assess the width of the unconfined zone adjacent to eastern terminus of quarry operations which should be discernible on USGS and Department of Water Resources maps. But then there is the more complex concept of the multi layers of aquifers which constitute the deep Santa Clara Valley aquifer, and which are fed by the groundwater cascade that lies along these foothills. As you review this configuration I think you would agree that monitoring wells need to be at upper edge of the unconfined zone adjacent to eastern edge of quarry and eastern materials storage area to accurately assess contaminant loads in groundwater. To test solely at CalWater wellheads would only catch a fraction of flows.

The high percolation in Permanente Creek is separate from this groundwater flow and is illustrated by there being little or no flow below Foothill Expressway, and none by SCVWD's gage, downstream at Berry Ave., for most of year. Have included data to show Permanente is a flashy intermittent creek and believe seleniium loaded pumping from quarry pits is absorbed in unconfined aquifer zone. The Regional Water Quality Control Board's monitoring would accurately show extent of contaminants here but measurements of creek water quality at Charleston Road will only reflect City of Mountain View urban runoff and irrigation of St. Francis H.S. playing fields, not benign residual flows from Lehigh Quarry that may be reaching San Francisco Bay.

In hopes that the attached maps and charts are sufficiently self-explanatory I will elaborate no further. Would like to express reservations on use of 63,000 tons of greenwaste, however, as understand it has more the properties of sawdust so is not likely to hold water from seeping down into quarry limesotne, and due to sterilization process to remove pathogens, it will not contain organic nutrients needed to establish plantings. Test plots need to be implemented before this major element of the reclamation plan is seriously considered.

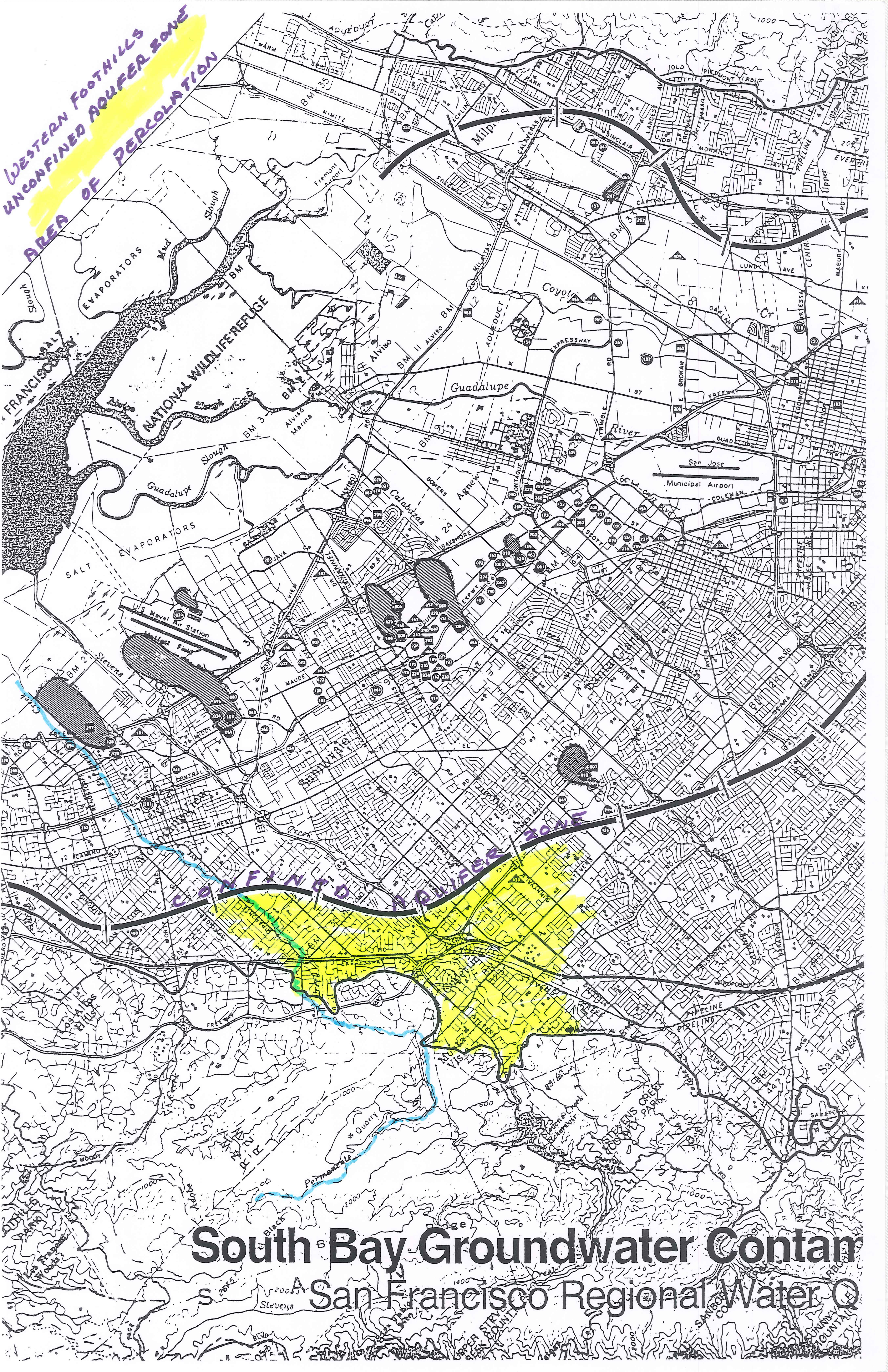
Thank you for your consideration of this protracted submittal of documentation for Permanente groundwater. I will hand deliver data Wednesday morning to the County Planning Office.

Sincerely,
Libby Lucas

Libby Lucas,
174 Yerba Santa Ave.,
Los Altos, CA 94022

RECEIVED
MAY 30 2012
COUNTY OF SANTA CLARA
PLANNING OFFICE

PS Original sources for this data were Ed Helley, USGS, and Tom Iwamura, SCVWD.



South Bay Groundwater Contan

San Francisco Regional Water Q

GEOTHERMAL STUDIES
(PROJECT COPY)

STATE OF CALIFORNIA
The Resources Agency
Department of Water Resources

BULLETIN No. 118-1

EVALUATION OF GROUND WATER RESOURCES

SOUTH BAY

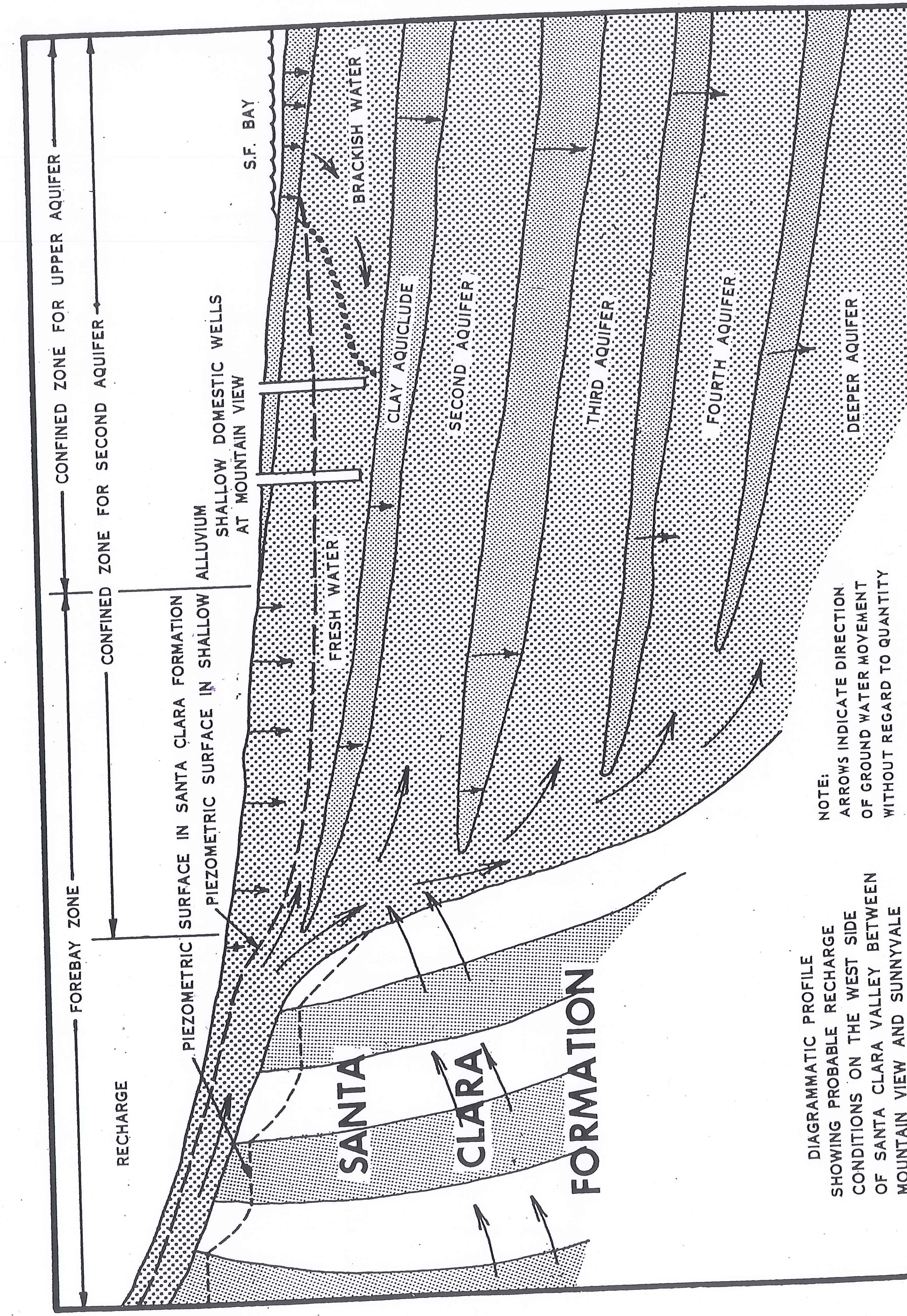
Appendix A: GEOLOGY

AUGUST 1967

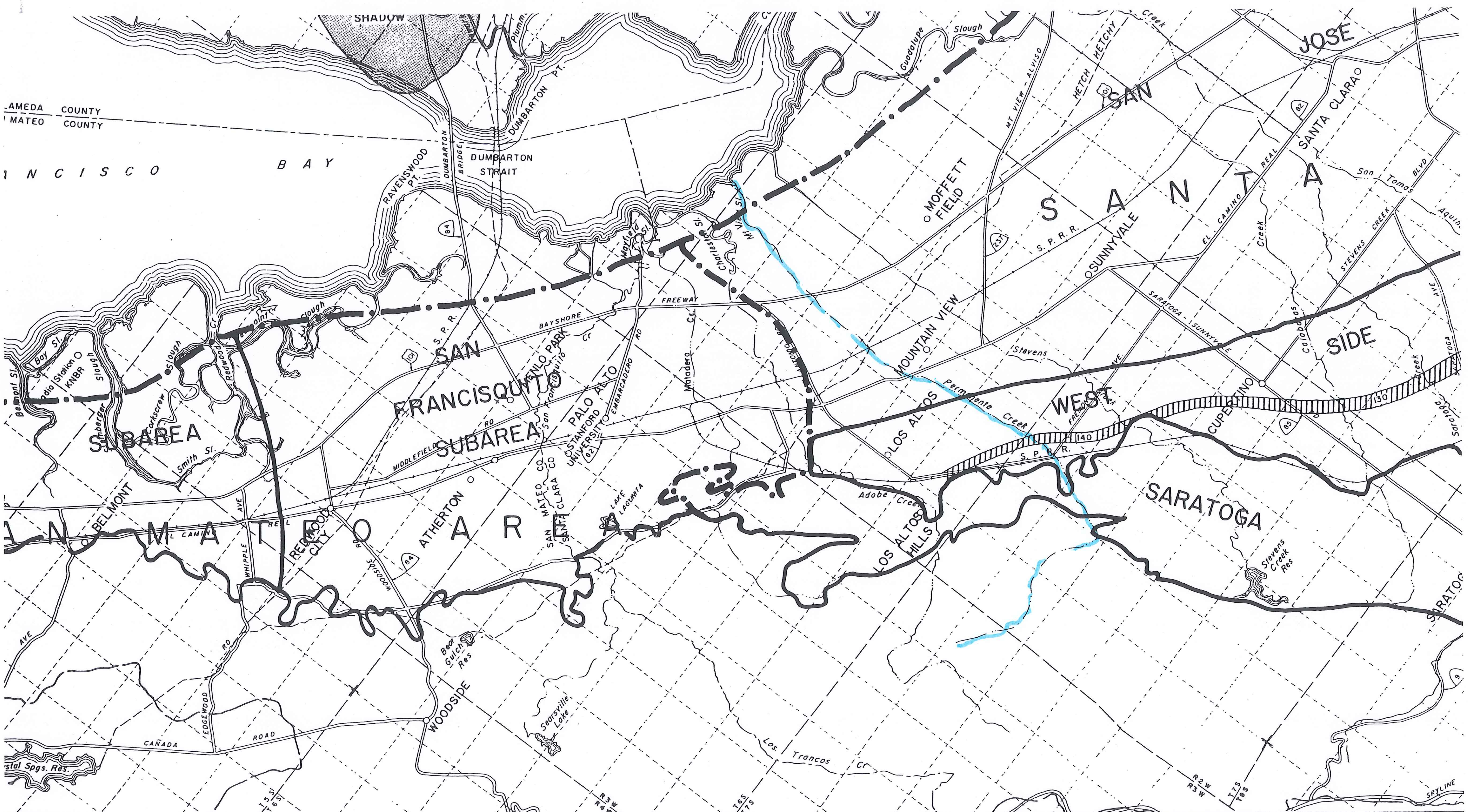
RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
Director
Department of Water Resources

FIGURE 13



DIAGRAMMATIC PROFILE SHOWING PROBABLE RECHARGE CONDITIONS ON THE WEST SIDE OF SANTA CLARA VALLEY BETWEEN MOUNTAIN VIEW AND SUNNYVALE



LEGEND

ZONE OF GROUND WATER CASCADE WITH THE WATER DIFFERENTIAL ACROSS ZONE SHOWN IN

BOUNDARY OF GROUND WATER AREA

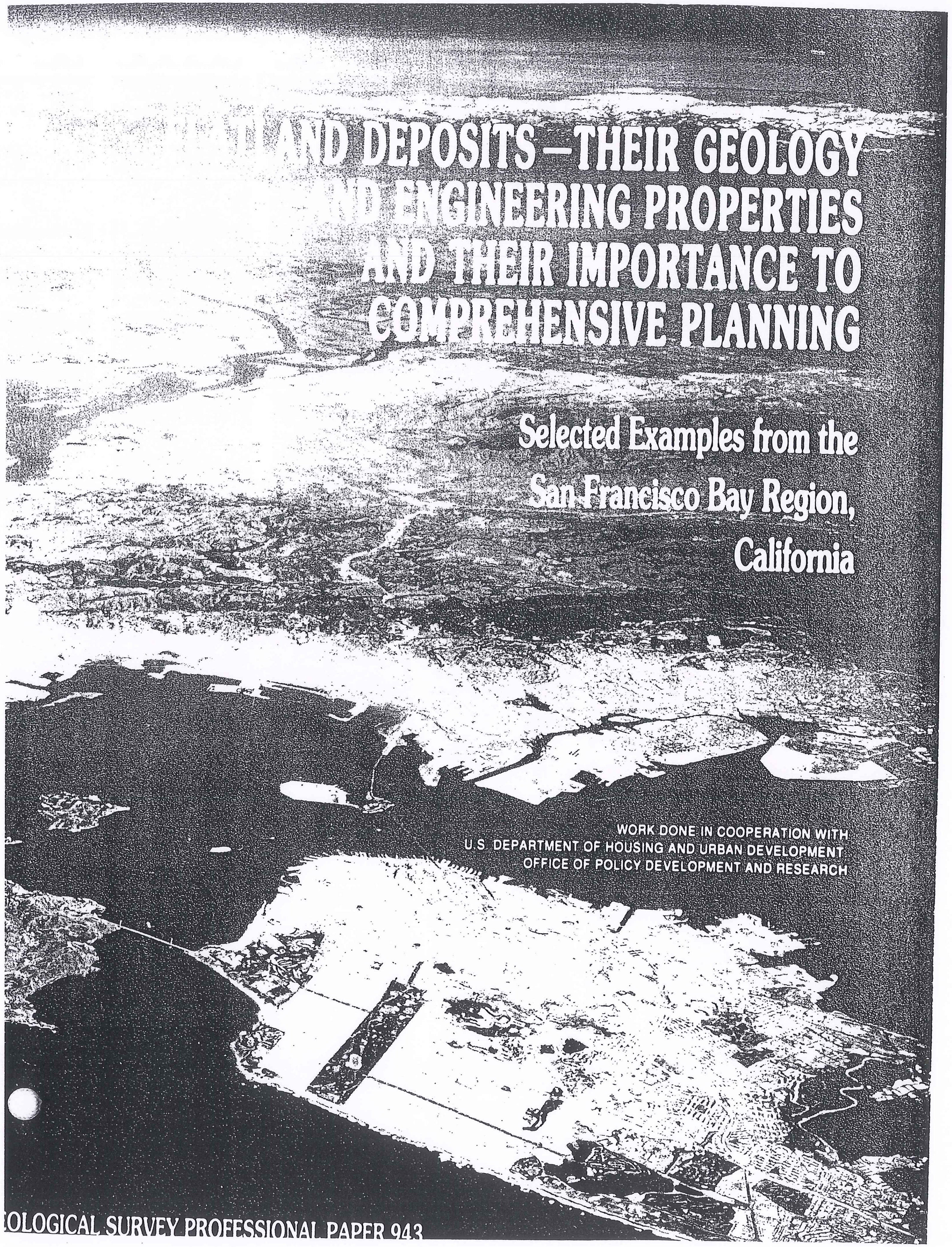
BOUNDARY OF GROUND WATER SUBAREA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT

EVALUATION OF GROUND WATER RESO
SOUTH BAY

GROUND WATER AREAS

SCALE OF MILES
0 1 2 3



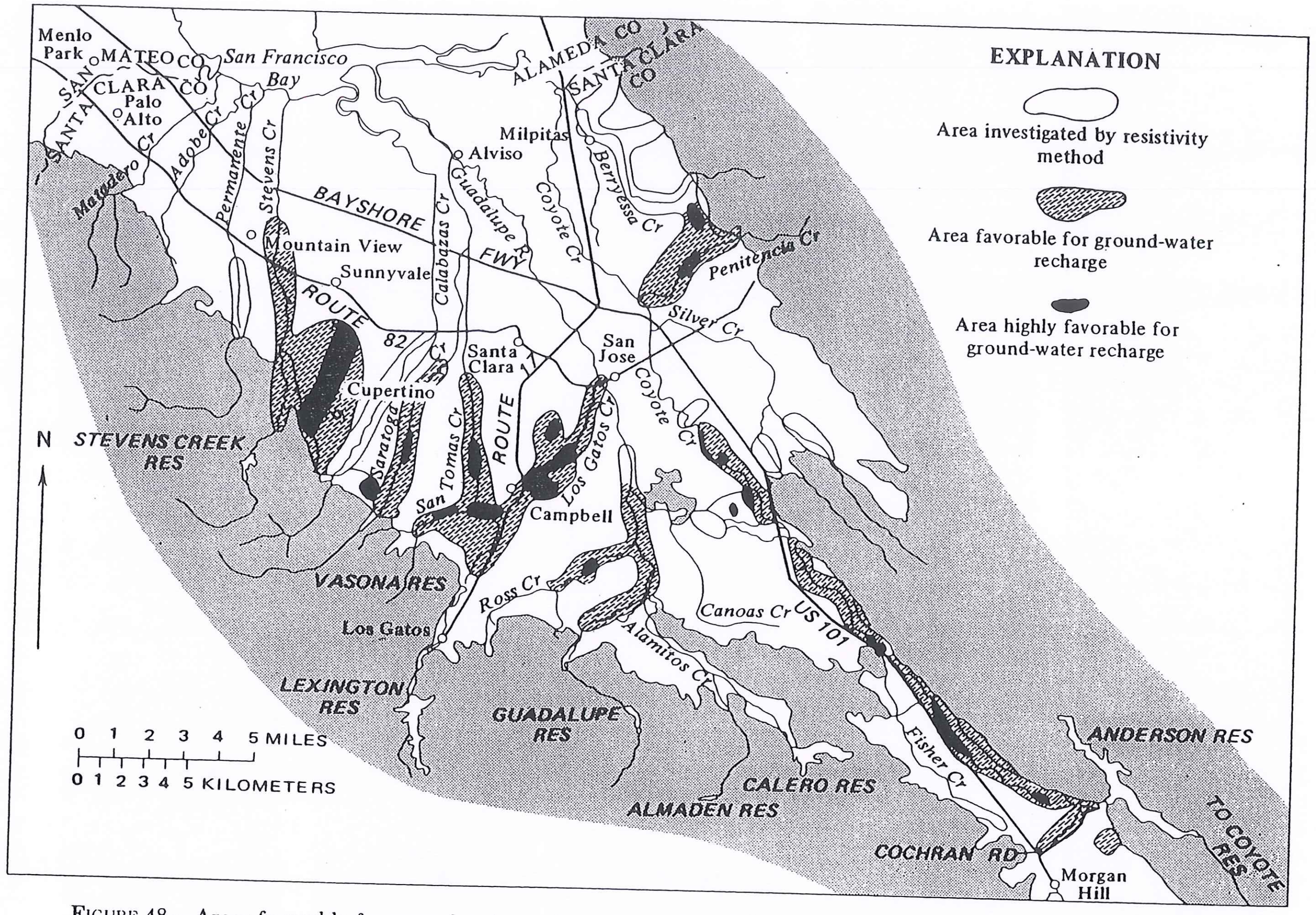


FIGURE 48.—Areas favorable for ground water recharge in southern Santa Clara County. After Page and Wire (1969).

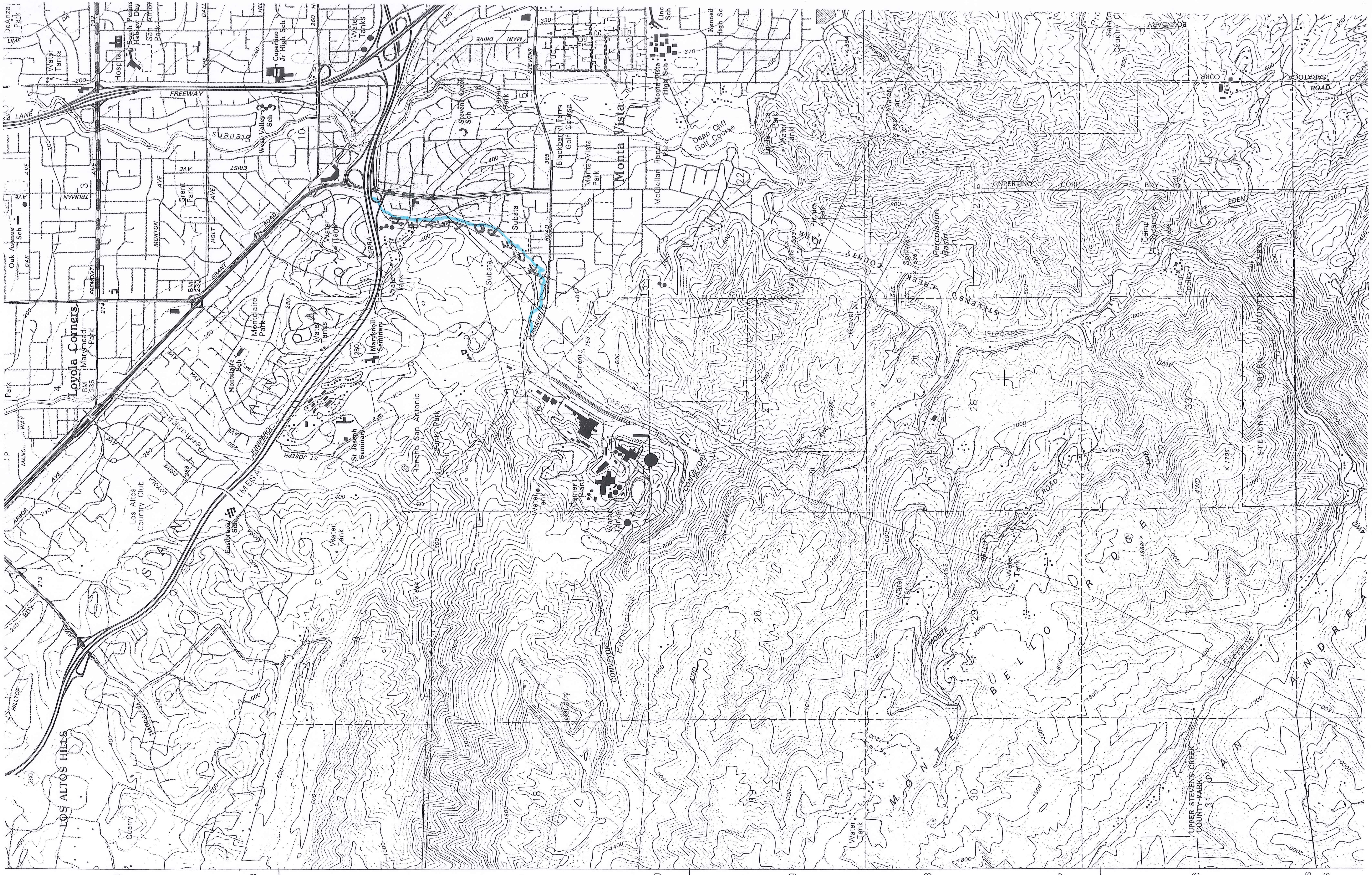
SAND AND GRAVEL

Though sand and gravel—basic construction materials—are widespread in the flatlands, they are not unlimited resources. Indeed, minable sand and gravel resources are small in terms of projected needs (Burnett and Barneyback, 1975). About half the sand and gravel used in the bay area is for aggregate in concrete and the rest for bituminous pavement, road base, and fill (Burnett and Barneyback, 1975).

Deposits of sand and gravel occur in all bay area counties, but much of this material is unusable because it is of poor quality. Minable deposits occur in half the bay counties in both modern and ancient stream-channel, flood-plain, and alluvial-fan deposits (fig. 51). Small quantities of sand have been mined from the beach and dune deposits along the coast. Much of the originally available sand and gravel is not presently minable because of urbanization.

Much of the sand and gravel in the alluvial lowlands cannot be used for concrete because of certain undesirable physical or chemical properties. The most stringent quality requirements apply to sand and gravel used for concrete aggregate. This material should consist of durable minerals, such as quartz and feldspar, and should contain minimal amounts of unstable minerals (dark minerals or clay, for example) and reactive minerals (opal, zeolites, and glass). Unweathered hard tough dense well-rounded rock granules are the most desirable for concrete aggregate. This type of material is commonly found in the stream beds and on the alluvial fans of streams draining terrain underlain by old volcanic rocks and highly indurated sedimentary rocks.

The particle size distribution is also important in concrete aggregate, particularly in the sand fraction (Price, 1966; in Burnett and Barneyback, 1975). In general, the largest grain size of aggregate consistent with practical limitations is desirable. The grain-size distribution of an aggregate is controlled by processing, but the primary ratio of various sizes is important in determining the feasibility of exploiting a particular sand and gravel deposit. Therefore, depos-



FREEWAY
Hospital
Cupertino Jr High Sch
West Valley Sch
Oak Avenue Sch
Loyola Corners
Marymead Park
Grant Park
Montclaire Park
Montclaire Sch
Water Tank
Water Tanks
Maryknoll Seminary
St Joseph Seminary
Rancho San Antonio County Park
Los Altos Country Club
Eastbrook Sch
LOS ALTOS HILLS
Quarry
Stevens Creek Sch
Monta Vista
Monta Vista Park
Monta Vista High Sch
Blackberry Farm Golf Course
Deep Cliff Golf Course
McClellan Ranch Park
Substa
PERMANENTE
Cement Plant
CONVEYOR
Percolation Basin
Gravel Pit
CUPERTINO CORP BDY
STEVENS CREEK COUNTY PARK
Camp Cooley
MONTE BELLO RIDGE
UPPER STEVENS CREEK COUNTY PARK
SAN ANDREAS
Kennedy Jr High Sch
FREMONT
TRUMAN
GRANT ROAD
JUNIPERO SERRA
STEVENS CREEK
SARATOGA ROAD
MT EDEN

GROUNDWATER AND SURFACE WATER MONITORING - PERMANENTE

EFFECTS OF LIMESTONE QUARRYING AND CEMENT-PLANT OPERATIONS ON RUNOFF AND SEDIMENT YIELDS IN THE UPPER PERMANENTE CREEK BASIN, SANTA CLARA COUNTY, CALIFORNIA

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations
Report 89-4130

Prepared in cooperation with the
SANTA CLARA VALLEY WATER DISTRICT

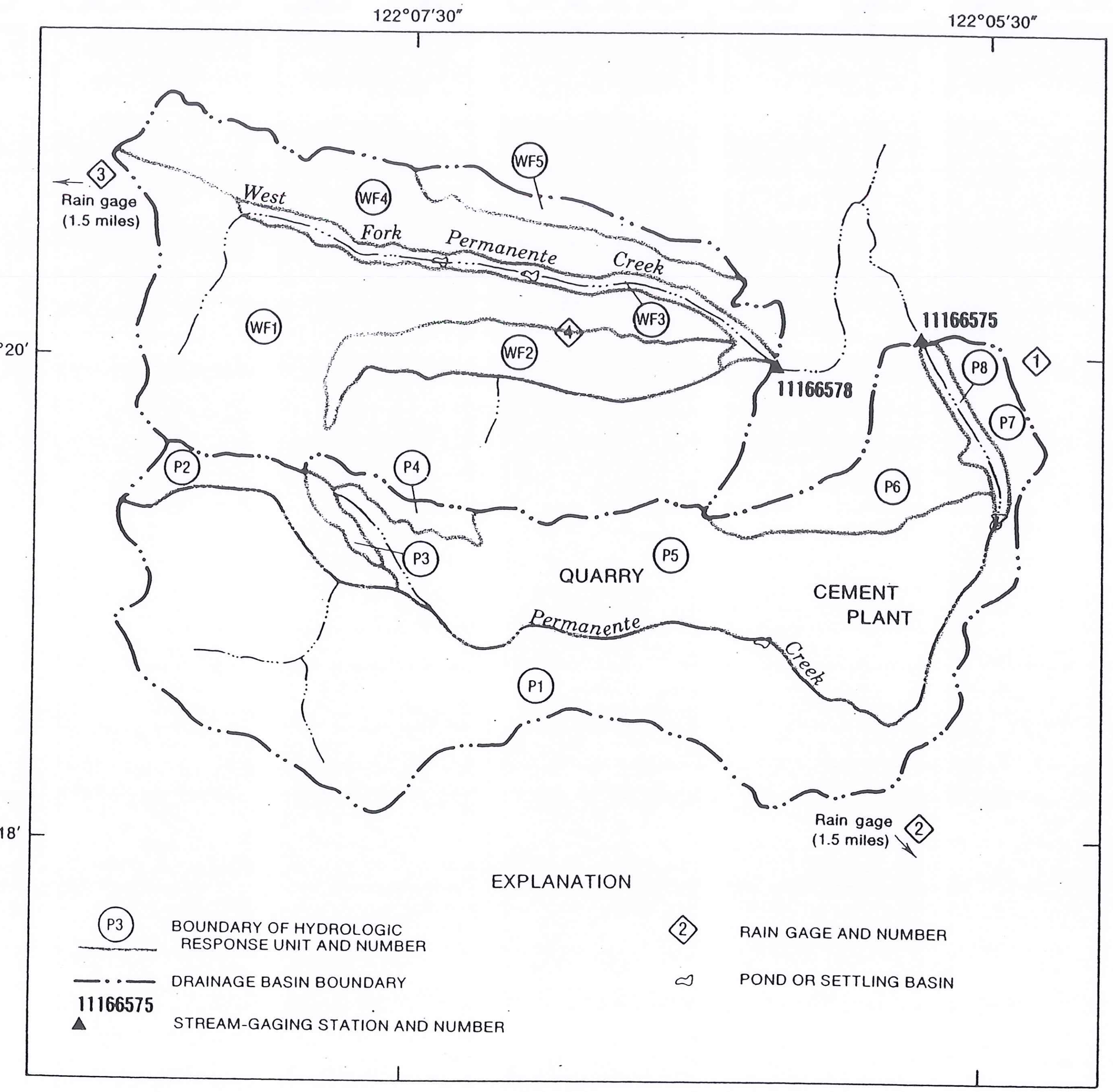


FIGURE 2.— Location of stream-gaging stations, rain gages, hydrologic response units, ponds, and settling basins in the Permanente Creek and West Fork Permanente Creek basins.

available to augment peak flows. PRMS simulations are in basic agreement with the findings of Harr and others (1975), Harr (1976), and Ziemer (1981), which were discussed earlier in this report.

PRMS results indicate that by removing much of the native vegetation in HRU P5, land use in Permanente Creek may have increased subsurface and ground-water flow during dry periods. The ground cover of HRU P5 was described as bare ground because, in addition to the many impervious surfaces, a high percentage of HRU P5 is covered by spoil piles, rilled areas, and other areas where vegetation has been removed or buried (fig. 3). The increased transpiration that occurs when bare soil is replaced with shrubs in the PRMS simulation results in a significant decrease in subsurface and ground-water flow during some periods. Effects of this additional transpiration are particularly pronounced during dry years, when increased transpiration apparently removes sufficient water from the upper soil zone to reduce significantly the number of days the soil zone fills with water. This, in turn, reduces the flow of water from the soil zone to the subsurface and ground-water reservoirs.

move this!

SEDIMENT YIELD

Measured Sediment Discharge

Total sediment discharge was measured at stations 11166575 and 11166578 during water years 1985-87 using standard practices of the U.S. Geological Survey (Guy and Norman, 1970). At station 11166575, total sediment discharge was measured during low and moderate flows using a DH-48 hand-held sampler on the downstream side of the weir installed to stabilize the stage-discharge relation at that site. These samples represent total sediment discharge because the sampler nozzle could be lowered to the bottom of the weir. When water discharges were larger and material that was too coarse to enter the DH-48 nozzle was moving, suspended-sediment discharge and bedload discharge were measured separately upstream of the weir. Suspended-sediment samples were collected using a DH-48 suspended-sediment sampler, and bedload samples were collected using a Helley-Smith bedload sampler. Bedload discharge for the peak discharge in 1986 was estimated using the Meyer-Peter and Mueller bedload equation (U.S. Bureau of Reclamation, 1960). Daily values of sediment discharge for 1985, 1986, and 1987 for both stations are published by the U.S. Geological Survey (Anderson, Markham, Shelton, Trujillo, and Grillo, 1987, 1988; Anderson, Markham, Shelton, and Trujillo, 1988). Total sediment loads and yields for individual water years are summarized in table 5. The average annual yield from the Permanente Creek basin was almost 15 times higher than the average annual yield measured from the West Fork basin.

TABLE 5.--*Measured sediment load and sediment yields at gaging stations Permanente Creek near Monta Vista (11166575) and West Fork Permanente Creek near Monta Vista (11166578)*

[Data are summarized from reports by Anderson, Markham, Shelton, Trujillo, and Grillo, 1987, 1988; Anderson, Markham, Shelton, and Trujillo, 1988. ton/mi^2, tons per square mile]

Water year (1)	Station 11166575 Sediment load (tons) (2)	Station 11166575 Sediment yield (ton/mi^2) (3)	Station 11166578 Sediment load (tons) (4)	Station 11166578 Sediment yield (ton/mi^2) (5)
1985	796	206	1.2	0.4
1986	53,240	13,792	2,870	963
1987	140	36	0	0
Total	54,176	14,034	2,871	963
Average	18,100	4,680	957	321

(high sediment load on East Fork Permanente under storm event high flows

TABLE 18.--*Mean daily values of total sediment yield measured during days when mean daily streamflow exceeded 1 cubic foot per second per square mile at the Permanente Creek and West Fork Permanente Creek gaging stations*

[(ft^3/s)/mi^2, cubic feet per second per square mile. (ton/d)/mi^2, tons per day per square mile]

flashy flows

Date	Streamflow [(ft^3/s)/mi^2]	Sediment yield [(ton/d)/mi^2]	Date	Streamflow [(ft^3/s)/mi^2]	Sediment yield [(ton/d)/mi^2]
Permanente Creek near Monta Vista (11166575)					
11-12-84	2.41	32.6	3-11-86	5.95	61.9
11-13-84	2.41	18.4	3-12-86	5.18	113
11-27-84	2.49	54.9	3-13-86	4.92	114
2- 8-85	2.85	31.9	3-14-86	4.14	85.2
3-26-85	2.23	17.4	3-15-86	6.48	154
12- 2-85	1.89	5.96	3-16-86	8.29	128
1-31-86	2.59	50.5	3-17-86	5.70	42.2
2-12-86	2.25	2.41	3-18-86	4.40	21.2
2-14-86	21.2	1,560	3-19-86	4.40	19.2
2-15-86	36.0	2,430	3-20-86	4.40	18.9
2-16-86	17.1	598	3-21-86	3.89	16.1
2-17-86	42.0	2,095	3-22-86	3.89	15.8
2-18-86	37.8	1,873	3-23-86	3.63	14.2
2-19-86	45.3	2,520	3-24-86	3.37	13.2
2-20-86	12.4	387	3-25-86	2.85	12.2
2-21-86	6.74	177	3-26-86	2.85	11.9
2-22-86	4.92	134	3-27-86	2.85	11.9
2-23-86	3.89	93.0	3-28-86	2.46	1.67
2-24-86	3.37	78.8	3-29-86	2.85	2.07
2-25-86	2.85	39.9	3-30-86	2.85	2.05
2-26-86	2.43	38.1	3-31-86	2.41	1.24
2-27-86	2.15	29.5	4- 1-86	2.20	.73
2-28-86	1.96	22.3	4- 2-86	2.05	.60
3- 1-88	1.89	16.3	4- 3-86	1.92	.54
3- 2-86	1.81	10.9	4- 4-86	1.86	3.11
3- 3-86	1.73	5.70	4- 5-86	1.81	4.15
3- 6-86	1.81	.98	4- 6-86	1.84	3.37
3- 7-86	1.99	25.4	4- 7-86	1.97	.83
3- 8-86	5.44	91.71	4- 8-86	2.07	1.84
3- 9-86	4.14	105	4- 9-86	2.15	2.85
3-10-86	11.1	438	4-10-86	1.71	3.11

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

HYDROLOGIC DATA

FOR

NORTH SANTA CLARA VALLEY

1938-61
SEASONS OF 1961-62 TO 1965-66

JUNE, 1967

VOLUME IV

Subj: **Santa Clara Valley Conservation District Historic Permanente Creek Flow Data**
Date: 2/6/2012 11:31:39 AM Pacific Standard Time
From: JLucas1099@aol.com
To: administration@losaltos.ca.gov, administration@losaltosca.gov
CC: dpedro@losaltoshills.ca.gov

Attachment 1 - Permanente Quarry letter submitted by Libby Lucas

Not sure if it helps discussion, but did review old Santa Clara Valley Water Conservation District Permanente Creek flow records for period 1938 through 1961 and daily flow rate of 8 cfs or above occurred less than 10 % of time, and it looks as if there is no daily flow to record at all in a third of these months.

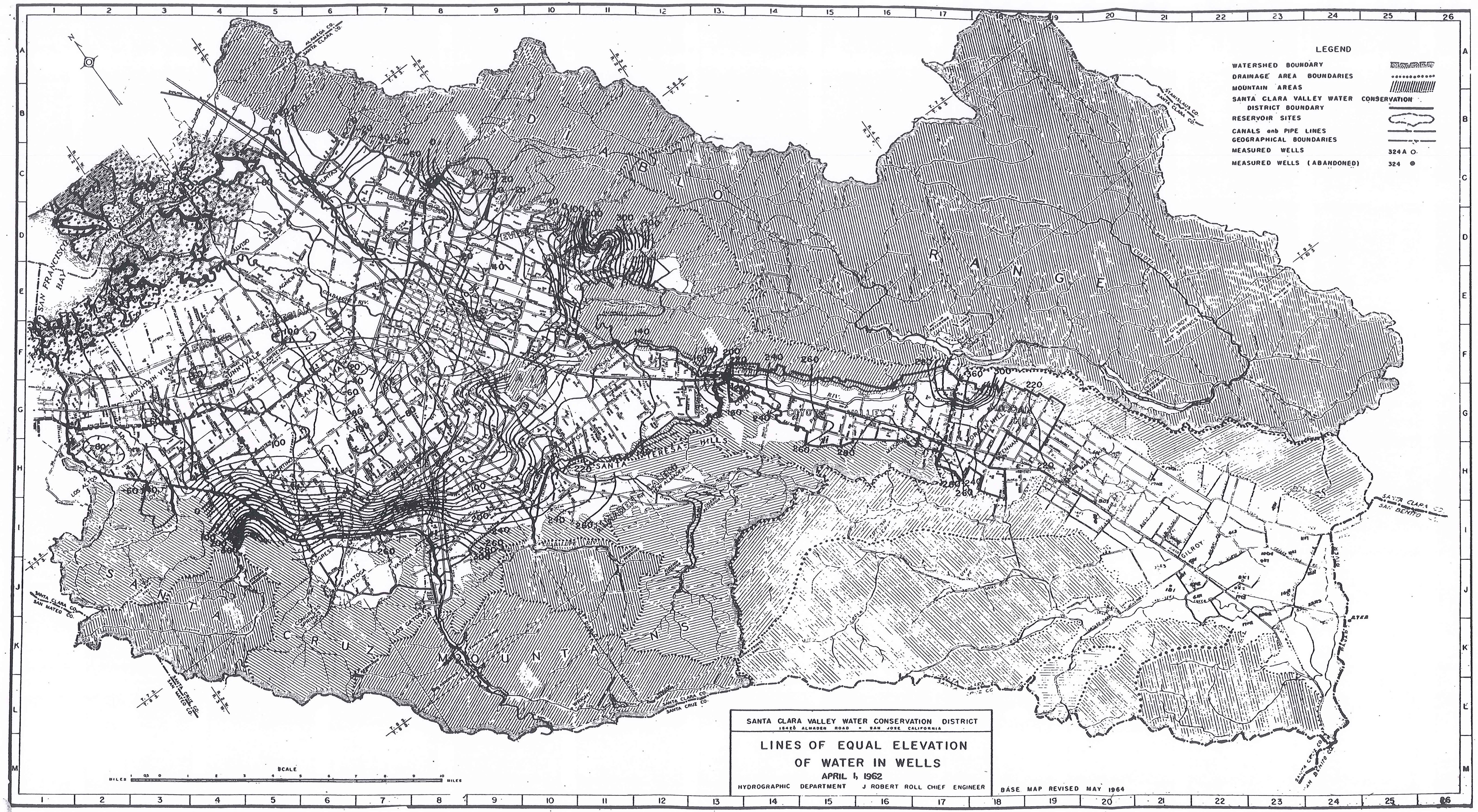
If you would like a break down, here goes: Loyola Corners

1938 - 39	92 acre feet flow for year	0 days of flow 8 cfs or over	10 months no flow	" "
1939 - 40	4170 acre feet flow " "	70 days of flow " " " "	6 months " "	" "
1940 - 41	8803 acre feet " " "	145 days of flow " " " "	3 mth" ", 1 mth 2.0cfs, 1 mth 1.0cfs	
1941 - 42	5159 acre feet " " "	88 days of flow " " " "	2 mth" ", 4 mth 2.0cfs daily average	
1942 - 43	3117 acre feet " " "	68 days of flow " " " "	2 mth. 1.0 cfs, 2 mth 0.5 cfs av flow	
1943 - 44	516 acre feet " " "	2 days of flow 8 cfs or over	3 mth 0.5 cfs, 7 mth 0.25 cfs	" "
1944 - 45	1426 acre feet " " "	15 days of flow " " " "	6 mths record flows Loyola Corners	
1944 - 45	289 acre feet " " "	0 days of flow " " " "	5 mths record " "	Holly Ranch
1945 - 46	1039 acre feet " " "	8 days of flow " " " "	50 days no flow	" "
1946 - 47	282 acre feet " " "	0 days of flow " " " "	5 mths no flow	" "
1947 - 48	69 acre feet " " "	0 days of flow " " " "	9 mths no flow	" "
1948 - 49	599 acre feet " " "	7 days of flow 8 cfs or over	8 mths no flow	" "
1949 - 50	305 acre feet " " "	0 days of flow " " " "	7 mths no flow	" "
1950 - 51	2603 acre feet " " "	41 days of flow " " " "	4 mths no flow	" "
1951 - 52	4353 acre feet " " "	92 days of flow " " " "	4 mths no flow	" "
1952 - 53	2028 acre feet " " "	38 days of flow " " " "	4 mths no flow	" "
1953 - 54	498 acre feet " " "	0 days of flow " " " "	5 mths no flow	" "
1954 - 55	207 acre feet " " "	0 days of flow " " " "	5 mths no flow	" "
1955 - 56	5000 acre feet " " "	87 days of flow " " " "	4 mths no flow	" "
1956 - 57	371 acre feet " " "	5 days of flow " " " "	4 mths no flow	" "
1957 - 58	6279 acre feet " " "	98 days of flow " " " "	2 mths no flow	" "
1958 - 59	166 acre feet " " "	0 days of flow " " " "	1 mth no flow	" "
1959 - 60	382 acre feet " " "	4 days of flow 8 cfs or over	2 mths 0.1 cfs average flow	" "
1960 - 61	61 acre feet " " "	0 days of " " " " "	5 mths no flow	" "

If any questions on this data please do not hesitate to reply.

Main concern I continually find in routine white-wash assessments of stream flows is that they average out overall data when we know California has flashy streams that will only become flashier with global warming.

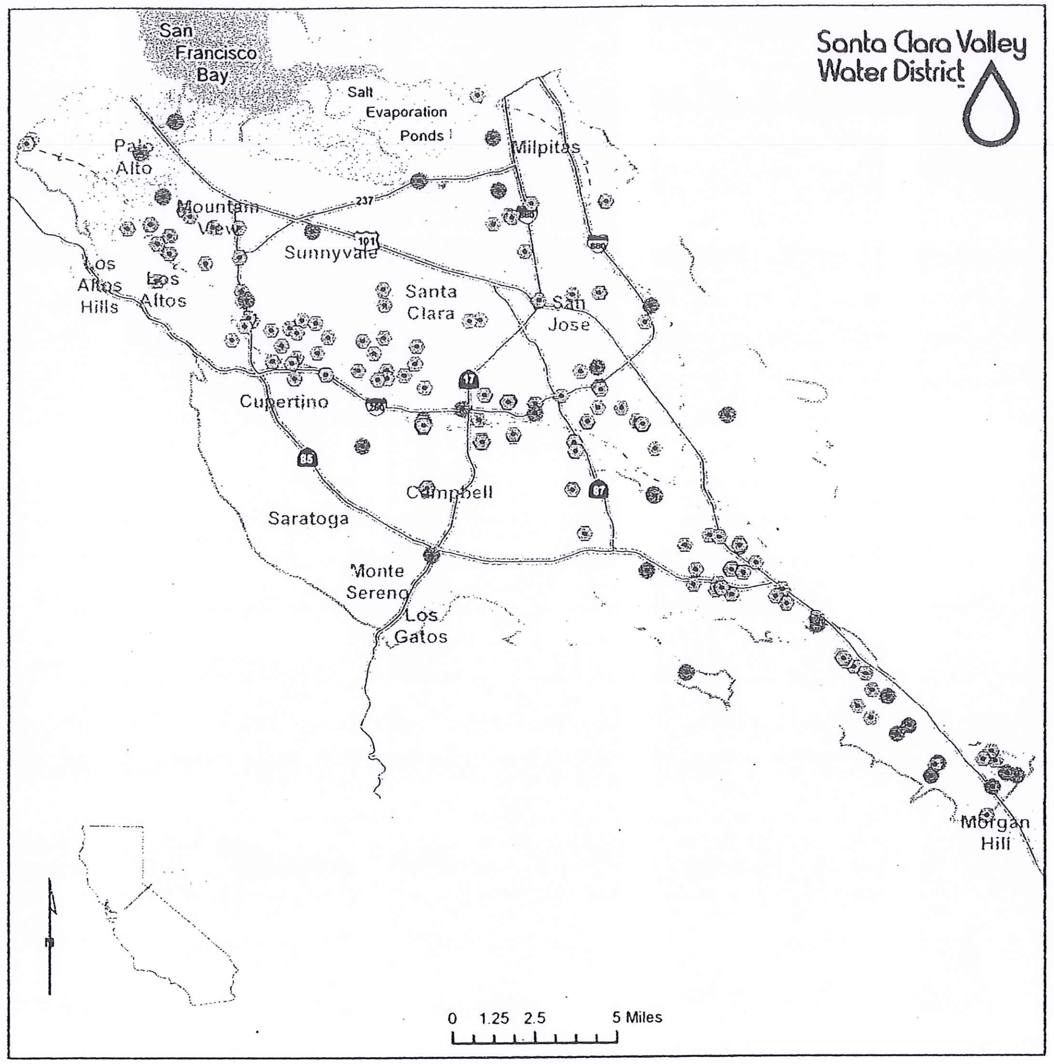
Libby Lucas



high well water levels
in Stevens - Permanente Creek
Sector

PLATE 18

CAL WATER WELLS - CLUSTER AT #280 + #85



Explanation

Well Sampled by Water Supplier

Well Sampled by Santa Clara Valley Water District

Santa Clara Plain

Coyote Valley

Approximate Extent of Confined Zone

Limit of Groundwater Subbasin

Figure 2-3. Location of Wells Sampled in 2010, Santa Clara Subbasin

WELLHEAD TESTING

Primary Drinking Water Standards

						Cal Water Los Altos		Santa Clara Valley WD		
Radiological	Year Tested	Unit	MCL (SMCL)	PHG (MCLG)	Exceeded Standard?	Range	Average	Range	Average	Source of Substance
Gross alpha particle activity	2006–2010	pCi/L	15	(0)	No	ND–7.1	1.37			Erosion of natural deposits
Radium 228	2009–2010	pCi/L	5	0.019 (0)	No	ND–1.3	0.14			Erosion of natural deposits
Uranium	2006–2010	pCi/L	20	0.43	No	ND–12.08	1.34			Erosion of natural deposits
Inorganic Chemicals	Year Tested	Unit	MCL (SMCL)	PHG (MCLG)	Exceeded Standard?	Range	Average	Range	Average	Source of Substance
Aluminum	2010	ppm	1 (0.2)	0.6	No			ND–0.061	ND	Erosion of natural deposits; residue from some surface water treatment processes
Barium	2008–2010	ppm	1	2	No	ND–0.18	0.08			Discharges of oil-drilling waste and from metal refineries; erosion of natural deposits
Fluoride	2010	ppm	2	1	No	ND–0.28	0.12	ND–0.2	ND	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories
Nitrate (as nitrate)	2010	ppm	45	45	No	5.19–39	29.23	ND–5	2	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
	Year Tested	Unit	MCL (SMCL)	PHG (MCLG)	Exceeded Standard?	Highest Level	Lowest Monthly Percent	Highest Level	Lowest Monthly Percent	Source of Substance
Turbidity	2010	NTU	TT	n/a	No			0.09	100	Soil runoff
Disinfection Byproducts	Year Tested	Unit	MCL (SMCL)	PHG (MCLG)	Exceeded Standard?	Range	Highest Annual Average	Range	Highest Annual Average	Source of Substance
Total haloacetic acids	2010	ppb	60	n/a	No	ND–44	19.8	ND–44	19.8	Byproduct of drinking water chlorination
Total trihalomethanes	2010	ppb	80	n/a	No	ND–68	41.5	ND–68	41.5	Byproduct of drinking water chlorination
Disinfectant and DBP Precursor	Year Tested	Unit	MRDL	MRDLG	Exceeded Standard?	Range	Average	Range	Average	Source of Substance
Chlorine	2010	ppm	4	4	No	ND–2.16	0.64	ND–2.16	0.64	Drinking water disinfectant added for treatment
Chloramine	2010	ppm	4	4	No	ND–2.2	1.36	ND–2.2	1.36	Drinking water disinfectant added for treatment

How to Read This Table

Cal Water tests your water for more than 140 regulated contaminants and dozens of unregulated contaminants. A list of regulated contaminants can be found in the Water Quality section of calwater.com. The table in this report lists only those contaminants that were detected.

In the table, water quality test results are divided into two main sections: "Primary Drinking Water Standards" and "Secondary Drinking Water Standards and Unregulated Compounds." Primary standards protect public health by limiting the levels of certain constituents in drinking water. Secondary standards are set for substances that could affect the water's taste, odor, or appearance. Selected unregulated substances (hardness and sodium, for example) are listed for your information.

µS/cm = measure of specific conductance
n/a = not applicable
ND = not detected
NTU = nephelometric turbidity unit
pCi/L = picoCuries per liter (measure of radioactivity)
ppb = parts per billion (micrograms per liter)
ppm = parts per million (milligrams per liter)
ppt = parts per trillion (nanograms per liter)
SMCL = secondary maximum contaminant level

General Minerals and Metals

Compared to nearby areas, the Permanente Creek watershed likely has more naturally occurring mineralized rock outcrops and these could be contributing to the relatively high concentrations of some constituents in background water (SES, 2011). Based on surface water samples from locations on Permanente Creek adjacent to and just downstream of the Quarry site (see **Figure 4.10-2**), surface water quality parameters generally meet relevant objectives within the *San Francisco Bay Basin (Region 2) Water Quality Control Plan* (Basin Plan) (RWQCB, 2007c), with the exception of TDS, sulfate, nickel, mercury, and selenium (**Table 4.10-2**).[7] Further, water quality monitoring conducted by the RWQCB (2007a) and the SCVURPPP (2007) has also shown that selenium concentrations in Permanente Creek, in the reaches adjacent to and near the Quarry, are generally greater than the water quality objective presented in the Basin Plan. The RWQCB (2007a) reported that, at their upstream Permanente Creek monitoring site (PER070; see Figure 4.10-2), which is just downstream of the Quarry, the selenium concentration in water was greater than the Basin Plan water quality objective for aquatic life during all three seasons sampled (i.e., dry, wet, and spring). In general, measured dissolved selenium concentrations in Permanente Creek have ranged from 1.7 to 81 micrograms per liter (µg/l) in the vicinity of the Quarry (Table 4.10-2); the (4-day average) Basin Plan objective for selenium is 5 µg/l (RWQCB, 2007c).

Various water quality parameters have been measured within runoff from the EMSA, the Quarry pit, and the WMSA. The WMSA contains the same type of overburden and waste rock that is and would be placed within the EMSA as well as within wall-washing samples (Table 4.10-2).[8] Sampling of surface runoff from the EMSA area, which included flowing, concentrated runoff (e.g., within a ditch/gully and from detention pond inlet pipes) as well as still water from detention ponds, found levels of selenium and mercury that were almost always in excess of the Basin Plan objectives. The vast majority of the selenium detected in each sample was in the dissolved form, rather than being associated with suspended sediment and measured only as the total recoverable selenium. Similar to the general surface water characteristics, a sample of runoff from the WMSA met the relevant water quality objectives within the Basin Plan, with the exception of TDS, sulfate, molybdenum, and selenium. Also, wall-washing samples from the Quarry pit further indicate that selenium is likely readily dissolved and transported from the exposed limestone rock surfaces by surface runoff.

rationale?

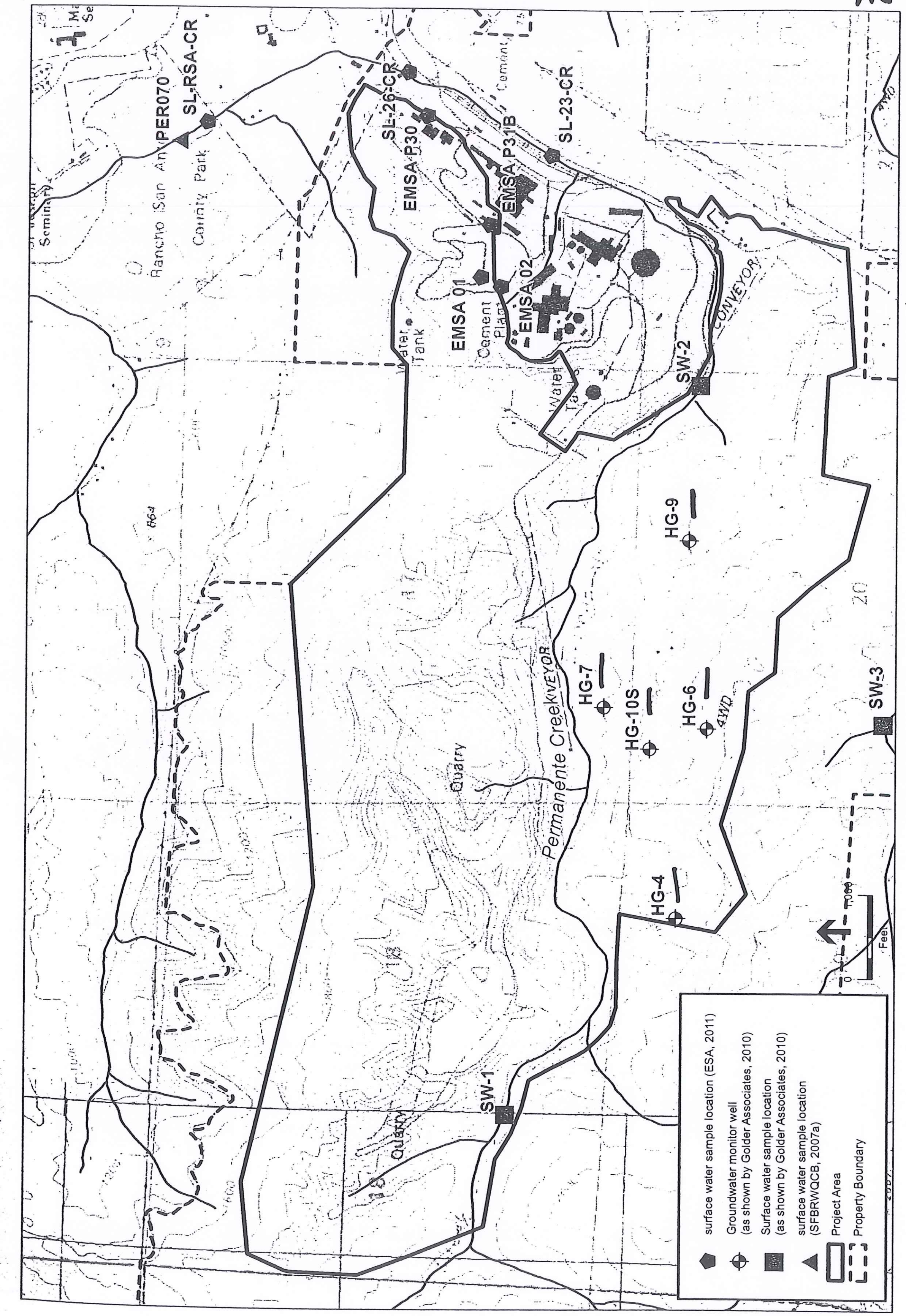
Waterborne selenium concentrations in the Project Area can be compared with background conditions (described above) and also with standards for surface water as established by the RWQCB in the current Basin Plan (RWQCB, 2007c) or with other promulgated values such as

where will selenium concentrations be assessed in groundwater below quarry?

7 The objective for nickel is based on hardness, and the objective value assumes a hardness of 100 mg/l calcium carbonate ($CaCO_3$) (RWQCB, 2007c). For example, higher hardness values would result in higher concentration values for the water quality objective according to the equations presented by the RWQCB (2007c). The referenced surface water samples (i.e., at SW-1 and SW-2) also reported relatively high hardness values (i.e., between 600 and 800 mg/l, on average). Therefore, the reported nickel concentrations, though high in some instances, would likely not exceed the Basin Plan water quality objectives.

8 Wall-washing refers to tests that were performed on exposed rock faces within the Main Pit. The tests involved washing an approximately one square meter area of rock face with a known volume of water. The resultant water was analyzed for dissolved and total metal concentrations and general minerals. The amount of wash water used in the tests was approximately equivalent to a 0.25-inch rain event (SES, 2011).

PERMANENTE QUARRY GROUNDWATER MONITORING WELLS - UPLAND SITES HG 4, 6, 7, 9, 10S



Lehigh Permanente Quarry Reclamation Plan Amendment. 211742
Figure 4.10-2
Project Area Monitoring and Sampling Locations

SOURCE: Golder Associates, 2010; SFBRWQCB, 2007a; Sowers et al., 2005; ESA, 2011

TABLE 4.10-2
MONITORED POLLUTANT CONCENTRATIONS IN PROJECT AREA

	TDS (mg/l)		sulfate (SO_4) (mg/l)		Metals (dissolved fraction unless otherwise indicated): iron (µg/l)		manganese (µg/l)		mercury (µg/l)		molybdenum (µg/l)		nickel (µg/l)		selenium (µg/l)	
	range	average	range	average	range	average	range	average	range	average	range	average	range	average	range	average
Surface Water																
Permanente Creek																
SW-1[b]	350 - 1,800	1,110	450 - 1,110	578	**(<7.2) - 9.7	6.6	0.3 - 1.9	0.9	0.0008 – 0.055	0.015	1.8 - 5.7	3.8	2.2 - 4.7	3.1	1.7 - 11.0	7.2
SW-2[b]	1,000 - 1,100	1,067	550 - 600	570	(<9.3) - 18.0	8.0	2.1 - 3.9	2.8	0.0013 – 0.07	0.0187	83 - 750	440.8	27 - 110	62.8	13 - 81	62
SL-23-CR[i]	--	--	--	--	--	--	--	--	--	0.056[j]	--	120[j]	--	29[j]	--	24
SL-26-CR[i]	--	--	--	--	--	--	--	--	--	0.052[j]	--	110[j]	--	27[j]	--	22
SL-RSA-CR[i]	--	--	--	--	--	--	--	--	--	(<0.025)[j]	--	120[j]	--	24[j]	--	23
PER070[a]	720 - 850	765	326 - 379	347	--	--	--	--	--	--	--	--	1.6 - 30.9	13.5	5.1 - 18.8	9.9
ZOMB-1[l]	310	--	--	--	--	--	--	--	0.00026	--	ND<5	--	ND<5	--	ND<10	--
SL-4A3-PD[m]	930	--	--	--	--	--	--	--	0.00678	--	340	--	110	--	48	--
PERMUS[n]	720	--	--	--	--	--	--	--	0.00731	--	140	--	33	--	19	--
Monte Bello Creek																
SW-3[b]	340 - 360	353	18 - 28	22.8	ND (<9.3)	ND(<7.2)	0.11 –1.4	0.6375	<0.0002—0.00089	0.0006	0.91 - 24	9.63	0.87 – 1.4	1.14	ND (<0.38) - 0.71	0.366
Upland Runoff																
EMSA 01 (road)[i,k]	--	--	--	--	--	--	--	--	--	8.9[j]	--	31[j]	--	3400[j]	--	33
EMSA 02 (ditch/gully)[i]	--	--	--	--	--	--	--	--	--	0.062[j]	--	96[j]	--	14[j]	--	38
EMSA P31B-IN (pond inlet)[i]	--	--	--	--	--	--	--	--	0.091 -- 0.11	0.105[j]	12 --160	86[j]	49 --180	115[j]	8.3 -- 36	22
EMSA P31B (pond)[i]	--	--	--	--	--	--	--	--	0.037 -- 0.099	0.068[j]	19 -- 74	47[j]	19 --110	65[j]	12 --18-	15
EMSA P30-IN (pond inlet)[i]	--	--	--	--	--	--	--	--	<0.025 -- 0.36	0.031[j]	6.3 -- 70	38.1[j]	18 -- 150	84[j]	7.1 -- 22	15
EMSA P30 (pond)[i]	--	--	--	--	--	--	--	--	-0.073 -- 0.039	0.056[j]	20 -- 47	34[j]	20 -- 49	35[j]	13 --19	16
WMSA[g]	--	900	--	550	--	(<9.3)	--	14	--	--	--	120	--	3.4	--	20
Groundwater																
HG-4[b]	880 - 1,500	1,220	380 - 770	605	(<7.2) – 33	16.4	19 – 120	85	0.011 – 0.023	0.015	31 – 45	38	1.3 – 24	9	0.27 – 3.9	1.4
HG-6[b]	460 – 490	470	8.6 – 16	13	(<7.2) – 46	26	33 – 58	45	0.001 – 0.006	0.002	1.3 – 3.6	2.5	0.47 – 2.1	1	(<0.4)	(<0.4)
HG-7[b]	530 - 580	547.5	29 - 31	30.3	290 - 330	310	320 - 330	325	0.014 – 0.068	0.032	0.54 – 0.81	0.68	1.7 – 3.1	2.28	--	(<0.38)
HG-9[b]	450 - 490	470	26 - 48	35.8	--	(<9.3)	0.19 - 17	6.6	0.001 – 0.024	0.008	0.93 – 3.7	2.5	1.6 – 2.9	2.33	(<0.38) – 0.9	0.6
HG-10S[b]	340 - 400	370	29 - 30	29.5	(<9.3)	(<9.3)	0.16 - 85	42.6	0.063	0.063	5 - 16	10.5	1.7 - 10	5.9	(<0.38) – 2.8	1.5
Wall Washing																
*Limestone (MHG)[f]	--	65	--	61	--	11	--	2.6	--	--	--	6.7	--	0.91	--	14
*Limestone (MLHG)[f]	--	91	--	15	--	160	--	1.2	--	--	--	14	--	4.9	--	0.7
Greywacke[f]	--	61	--	4.9	--	720	--	8.6	--	--	--	2.6	--	1.7	--	(<0.38)
Chert[f]	--	67	--	2.6	--	1,400	--	7.9	--	--	--	1.4	--	5.9	--	(<0.38)
Greenstone[f]	--	100	--	3.3	--	970	--	11	--	--	--	0.37	--	3.5	--	(<0.38)
Basin Plan Objective	--	**500[c]**	--	**250[c]**	--	**300[c]**	--	**50[c]**	--	**0.025[d]**	--	**50[e]**	--	**52[d,h]**	--	**5.0[d]**

a As reported in RWQCB (2007a); samples collected in Jun 02, Apr 02, and Jan 03.
b As reported in Golder Associates (2011) and SES (2011); samples collected in Feb 09, Apr 09, Sep/Oct 09, and Jan 10 (HG-10S only sampled in Sep/Oct 09 and Jan 10).
c Water quality objective for municipal supply, secondary Maximum Contaminant Level (MCL) (RWQCB, 2007c).
d Water quality objective for freshwater water quality, 4-day average (RWQCB, 2007c).
e Water quality objective for agricultural supply (RWQCB, 2007c).
f As reported in SES, (2011); sampled on November 24, 2009.
g As reported in SES, (2011); sampled on January 13, 2010.
h The objective for nickel is based on hardness. The objective value assumes a hardness of 100 mg/l calcium carbonate ($CaCO_3$).
i As reported in ESA (2011); samples collected on February 16, 2011 and March 24, 2011.
j Value represents the TOTAL metal concentration for the sample.
k Sample represents shallow, concentrated sheet flow from a Quarry road; the sample is not representative of non-road areas within the EMSA and, for this location, there are additional probable sources of metals and other inorganic constituents besides the waste rock (e.g., fluids/residues from heavy machinery and trucks).
l Violet creek Tributary, south of WMSA. Sampling conducted by Lehigh, April 7, 2010 (Lehigh, 2010)
m Pond 4 retention pond, adjacent to Quarry pit. Sampling conducted by Lehigh, April 7, 2010 (Lehigh, 2010)
n County Access Road Bridge. Sampling conducted by Lehigh, April 7, 2010 (Lehigh, 2010)

mg/l = milligrams per liter
µg/l = micrograms per liter
ND= not detected

* MHG = Medium to High grade limestone; MLHG = High and Medium/low grade limestone
** Values in ( ) are non-detect with indicated detection limits.

SOURCE: ESA, 2011; SES, 2011; Golder Associates, 2011; RWQCB, 2007c