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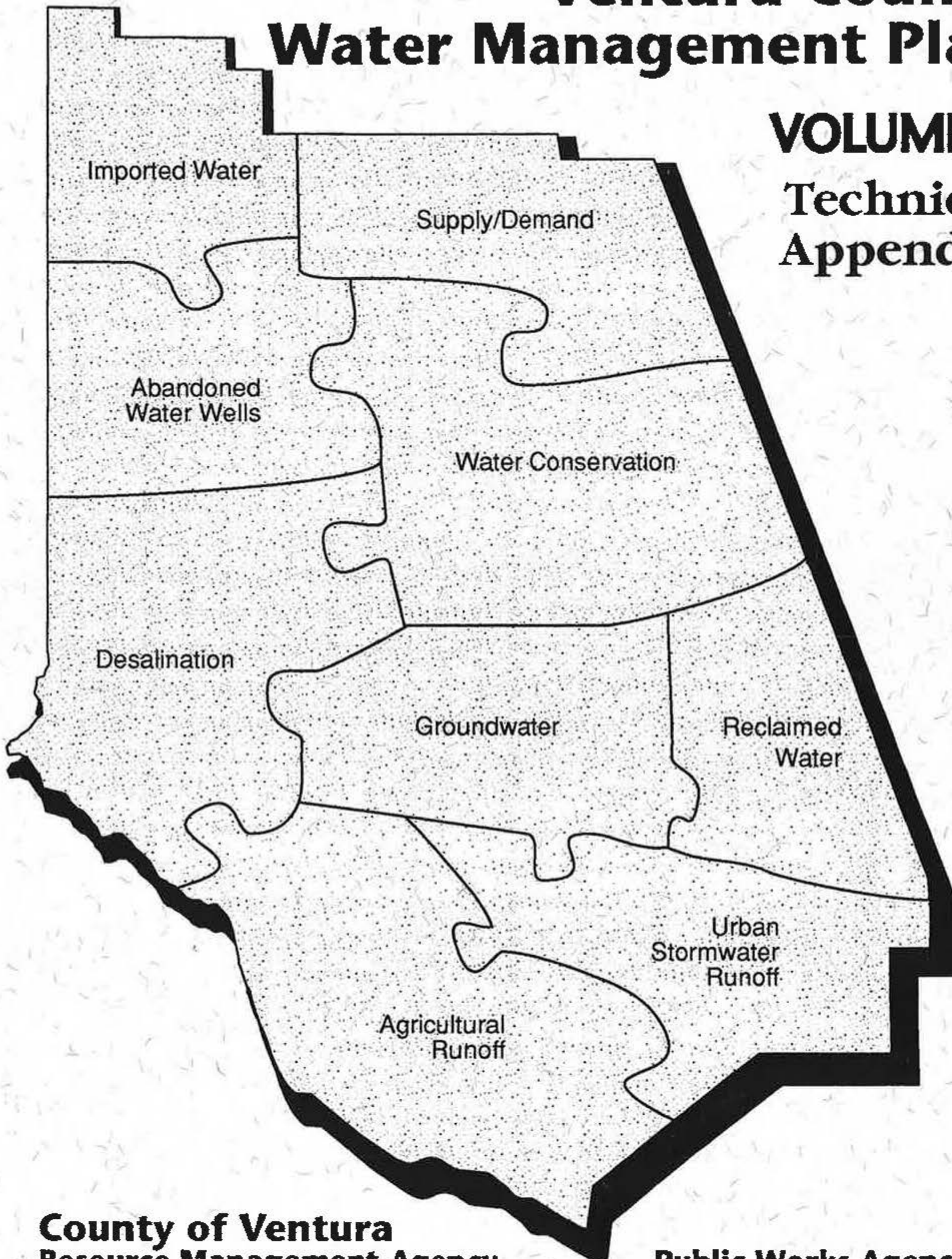
Ventura County Water Management Plan

VOLUME II

Technical Appendix



County of Ventura
Resource Management Agency
Public Works Agency

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FINAL

VENTURA COUNTY WATER MANAGEMENT PLAN

NOVEMBER 1994

VOLUME II
TECHNICAL APPENDIX

Prepared by
Ventura County Resource Management Agency
Ventura County Public Works Agency

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Chapter 1. LEGISLATION ESTABLISHING AND AFFECTING WATER MANAGEMENT PLANNING

I. WATER MANAGEMENT REGULATORY STRUCTURE

Regulations governing water in California cannot be found in any one source. Since water usage affects many areas of State concern, regulations are organized accordingly. Regulations can be found in the California Water Code, Health and Safety Code, Government Code, Administration Code, as well as in other Codes. Appendix A identifies many codes regulating water. The State Department of Health Services regulates drinking water standards, the Public Utilities Commission (PUC) regulates entities that serve water to the public in relation to rates and accounting procedures, the Corporations Commissioner regulates water service provided by water companies that do not fall under the jurisdiction of the PUC, and the Water Resources Control Board and its Regional offices regulate discharges of pollutants into navigable waters and water quality in general. Figure 1.1 illustrates the regulatory scope of these agencies.

The Dickey Act of 1949 provided the organization for the State of California's administration of water. The Act created nine geographical regions, each to be regulated by a Regional Water Quality Control Board. Ventura County, along with Los Angeles County, falls within Region 4. These nine Boards were granted the authority to establish and enforce water quality standards within watersheds under the direction of a main administrative body, the California Water Quality Control Board. In 1969, the Porter-Cologne Act expanded the supervisory and appellate powers of these Boards and required the formulation of specific water quality objectives and plans for their achievement.

Section 13001 of the Porter-Cologne Water Quality Control Act directs each Regional Board to formulate and adopt Water Quality Control Plans. These plans are referred to as Basin Plans. Basin Plans must also meet water quality requirements set out in the Federal Water Pollution Control Act, commonly known as the Clean Water Act. The Environmental Protection Agency oversees the State Water Resources Control Board's administration and compliance with federal regulations promulgated by the Clean Water Act.

II. WATER MANAGEMENT RELATED LEGISLATION

A. Federal Legislation

The Clean Water Act and Safe Drinking Water Act (SDWA) are both enforced by the Environmental Protection Agency (EPA) Office of Water.

1. The Clean Water Act

The Clean Water Act controls the discharge of toxic materials into surface water bodies. This Act was the result of the 1899 Rivers and Harbors Act, which prohibited discharges that could interfere with interstate transportation. In 1948, another water control act was passed to protect waterbodies by imposing effluent limitations at the source of pollution discharge. In 1972, the Act was amended with the primary purpose identified as "restoring and maintaining the chemical, physical and biological integrity of the nation's waters" and "to achieve a level of water quality by July 1983, which provides for recreation in and on the water, and for the propagation of fish and wildlife." The amendments provided for federal primacy (previously there was more State discretion), expanded the coverage of the legislation, changed pollution, control methodology and modified prior enforcement provisions. Figure 1.2 illustrates the regulatory structure and enforcement agencies of the Clean Water Act.

The Act can be broken down into six basic areas as follows:

1) Research projects and grants designed to clean up pollution and prevent further pollution;

2) Grant programs for construction of treatment works, waste water treatment planning and water quality management plans;

3) Effluent limitations on discharges into navigable waters, continuing revisions of water quality standards;

4) A National Pollution Discharge and Elimination System (NPDES) permitting discharge of point source pollutants; and

5) Limitations on dredge and fill material (Section 404)

6) Miscellaneous administrative provisions, definitions, EPA powers, provisions for judicial review.

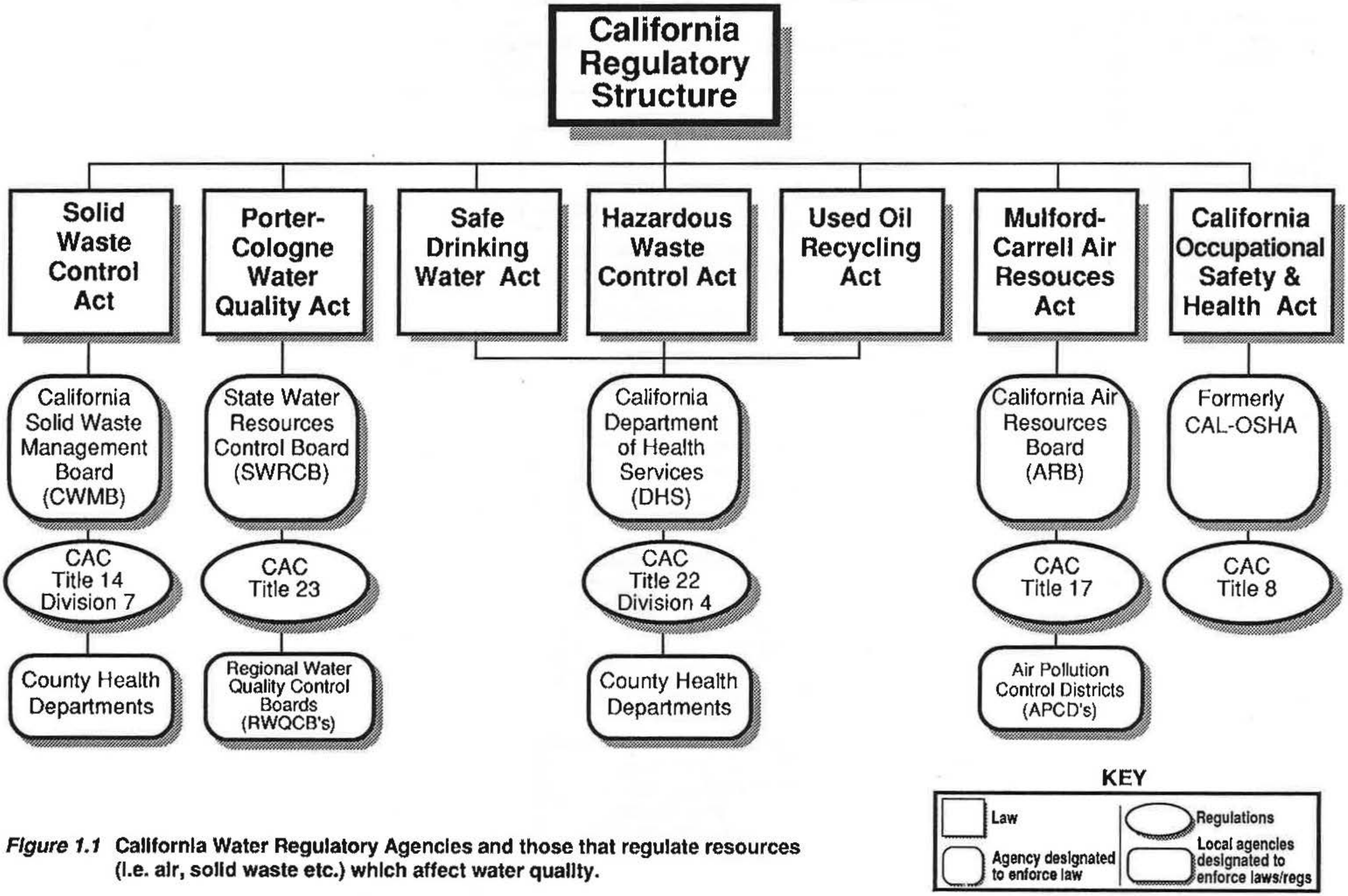

Figure 1.1 **California Water Regulatory Agencies and those that regulate resources (i.e. air, solid waste etc.) which affect water quality.**

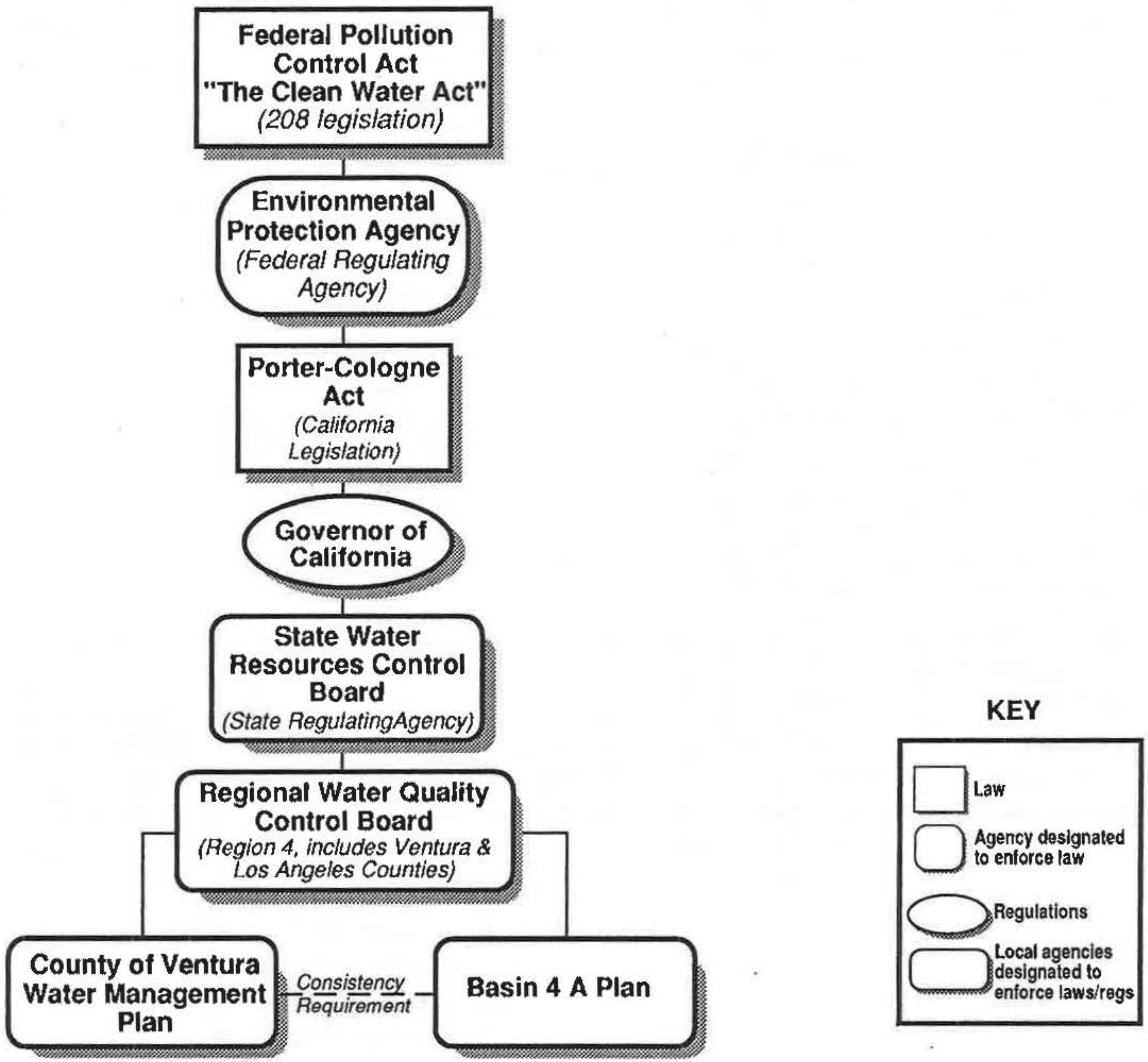

Figure 1.2 **Regulatory Structure**

Section 208

Under Section 208 of the 1972 amendments, the governor of each state was mandated to identify those areas in the state that had "substantial water quality control programs". Once identified, the governor was required to select "a single representative organization, including elected officials from local government" to operate "a continuing areawide waste treatment management planning process". Following State certification, plans prepared under the process were to be approved by the Environmental Protection Agency (EPA). The water management plan regulatory hierarchy is illustrated in Figure 1.2.

a. Federal Register Requirements

In January 1985, the EPA revised the federal regulations governing water quality planning and management activities outlined in Sections 106, 205(g), 205(j), 208, 303 and 305 of The Clean Water Act. These revisions addressed issues to water quality standards, water quality monitoring, the continuing planning process and water quality management plans:

> Under Section 130.6 - Water Quality Management Plans (WQM Plans), "continuing water quality planning shall be based upon WQM plans and water quality problems identified in the latest 305(b) reports". It further states that state water quality planning should focus annually on priority issues and geographic areas and on the development of water quality controls leading to implementation measures.
>
> Water quality management plans are to be updated "as needed" to reflect changing water quality conditions, results of implementation activities, new requirements or to remove conditions prior plan approvals. The updates need only involve elements of the plan that require modification due to changes in water quality conditions, new requirements or proposed control measures. If the plan is updated in only specific sections, the Governor must certify that the updates are consistent with the remainder of the Plan.

b. 1987 Amendments

In February 1987 Congress amended the Clean Water Act with amendments known as The Water Quality Act of 1987. Under these amendments and the EPA regulations, the State was required to identify, by February 1989, water segments impaired by pollutants (including toxic pollutants) even where technology-based limits are met.

Several lists are required. For each list there must be a control strategy/management plan developed to reduce pollution. The law requires that water quality standards be met within three years.

c. Clean Water Act Reauthorization

The Clean Water Act may be reauthorized in 1994. The reauthorization was introduced as the Water Pollution Prevention and Control Act (WPPCA), S.1114 in June 1993. As of February 1994, S.1114 was revised and designated as S.2093 after a bill involving wetlands protection was combined with the proposed S.1114. The WPPCA contains 10 titles addressing a number of water concerns, which include funding, toxic pollution, non-point pollution, wetlands, and interstate water programs. The four areas receiving the most attention are funding levels for wastewater treatment systems and facilities, non-point source pollution, wetlands protection, and enforcement.

Funds are needed by local communities to implement the requirements of the Clean Water Act. Federal funding for wastewater treatment plant construction under the CWA expires September 30, 1994. The WPPCA will expand funding for new wastewater treatment plants and other pollution control projects such as structures to control storm water and sewage overflow. The bill will provide $2.5 billion per year from 1995 through 2000. Each year, if Congress meets their deficit reduction target, additional funding up to $5 billion is authorized (Env. and PW Cte, 1994). The WPPCA expands the types of projects eligible for State Revolving Funds (SRF), and makes a more accurate and fair SRF allocation formula.

Non-point source pollution runoff accounts for more than half of the nation's surface water problem. Non-point pollution stems from various sources such as agricultural land, septic tanks, mining sites, and urban areas. S. 2093 would direct States to compile a list of waters adversely affected by non-point pollution, and require them to develop a non-point pollution management program based on that list. The goal of a State's non-point pollution management program would be to improve the quality of the listed waters. The list and programs would be reassessed every five years. Senate Environmental and Public Works Committee report on S.2093 notes that non-point source pollution was addressed in 1972 and Section 208 encouraged States and regions to plan to prevent the discharge of pollutants into the Nation's waters and to provide guidance for non-point source pollution management. However, the Committee which completed hearings on the proposed WPPCA in September 1993 claims that the 208 program's lack of support, delays in completion, and inadequate financing has caused mediocre success in some areas. There are five main components to the proposed State non-point management program, and they are: 1) a listing of sources of non-point pollution, 2) goals and milestones for a 10 year period, 3) a description of other programs controlling non-point sources, 4) a certification of assured implementation, and 5) a description of funding sources. The bill would authorize $300 million from fiscal year 1995 through 1998. Funding to be authorized for 1999 and 2000 would be $600 million. The money appropriated is intended for the development of the non-point source pollution management plans and for water pollution remediation.

The WPPCA also amends CWA §402(p) which pertains to permit requirements for stormwater discharges. The CWA placed a moratorium on permit requirements for separate municipal stormwater systems that serve a population less than 100,000. This moratorium will expire on October 1, 1994, but if S.2093 is enacted, it will repeal the permit requirements for those systems altogether. However, the permit requirements for systems serving over 100,000 people will remain in place.

Wetlands Protection

The proposed WPPCA bill would amend the CWA's wetlands management program which is contained in the Act's Section 404. As a result from growing discontent of landowners towards strict land-use regulations, the proposed bill would simplify permitting and compliance procedures (a 90-day deadline to issue permits would be set). The WPPCA raises the issue of "taking" by specifically prohibiting agencies from taking property without just compensation (a taking rarely occurs, but this provision is made to alleviate landowners' fears) (Camia, 1994).

WPPCA also establishes a "no net loss' policy on wetlands. This conservation scheme requires developers to dedicate wetlands in certain areas for conservation in exchange for approval of development on other wetland areas (ibid). Another change is that the Dept. of Agriculture's Soil Conservation Service would be given the sole authority for wetland determination. However, under this bill, the EPA's power to veto State issued permits would be taken away (ibid). Hence, the WPPCA would streamline the wetland permitting process, but in its aim to simplify, it may make wetlands more vulnerable to development. At the same time, the implementation of watershed management is encouraged in the reauthorization.

Enforcement

Enforcement, under the WPPCA, would be strengthened by raising the civil and criminal penalties for polluters. However, coordination with other laws such as CERCLA is made when regulating non-planned releases of hazardous waste in order to avoid duplication and overlapping. A bounty hunter provision, similar to the one in California's Prop. 65, is placed in the WPPCA. This provision allows citizens to sue for past violations of the law, providing that the injury or act occurred within the established five-year statue of limitations. S.2093 would allow the EPA to issue citations for minor violations, and would direct penalty fees collected towards financing regional water quality projects.

There are a few criticisms of S.2093: The most notable concern is the issue of funding. A number of officials have argued that while congressional mandates increase, the funding available does not [Pollution Engineering, 1994: p. 29]. Another complaint of S.2093 is that it places too much focus on point sources rather than non-point sources. Title II (Toxic Pollution), Title IV (Municipal Pollution) and Title VI (Program Management) all mandate point source requirements involving either discharge permitting, education and training, and treatment facility specifications. Robert Reich of DuPont's Water and Waste Management Group charges that "Point source discharge is a minor contributor to pollution today. The bill is still focusing most of its effort on the wrong sources--point sources--in the wrong manner--command and control [Pollution Engineering, 1993: p. 29]." This criticism rings true in Ventura County where as can be seen in Chapter 4 of this plan, point source discharge has established programs in place and is more easily subject to regulated control. Point source is not a significant problem, while a host of non-point sources being less closely regulated and some programs either never develop or still in the development stage can pose a greater threat to water quality.

The S.2093 is currently being debated in the Senate. Many believe that S.2093 will pass in some altered form this year in 1994.

d. Safe Drinking Water Act (1975)

The Safe Drinking Water Act of 1975 gave the EPA the authority to establish and enforce guidelines for the achievement of minimum national water quality standards for every public water supply system serving 25 people or more. The State's primary drinking water standards are based upon the National Interim Primary Drinking Water Regulations, 40 CFR Part 141. These standards specify the maximum allowable concentrations or contaminant levels of substances. The substances regulated by the National Primary Drinking Water Act Regulations are those known to cause illness, death or adverse physical effects to humans. These contaminants are referred to as "primary contaminants." The State's secondary drinking water standards are based on the National Secondary Drinking Water Regulations, 40 CFR Part 143. The secondary standards regulate "secondary contaminates". These contaminants tend to make the water undesirable. Objectionable odor, taste, particulate matter, hardness and corrosiveness are secondary contaminants. In 1988 and 1989, the Safe Drinking Water Act was amended. The amendments and the regulations for their implementation may be found in Title 22 of the Register, Chapter 15, Domestic Water Quality and Monitoring. These amendments require water purveyors to test for new types of organic and chemical contaminants. In addition, the testing procedures and techniques that are required have also been revised. These changes will impact all of the large and small public water purveyors of Ventura County.

B. <u>State Legislation</u>

1. The Porter-Cologne Water Quality Control Act, 1987 Amendments

The Porter-Cologne Water Quality Control Act provides the authority and method for the State of California to implement its water management program. The State's program is a comprehensive water quality control program that includes surface and ground water. The Porter-Cologne Act establishes waste discharge requirements for both point and non-point source discharges, affecting surface and ground water.

The State of California's Water Quality Assessment (305B) Report was prepared by the State Water Resources Control Board in September of 1988 in response to the Federal amendments. Within this Assessment were three lists required by the Federal government:

a. A list of water segments having quality problems due to point source discharges of any of the 126 priority toxic pollutants (Section 304(1) "B);

b. A list that identified freshwater and marine water areas affected by toxics, regardless of the source (point or non-point) (Section 311.11); and,

c. A list that identifies non-point source related surface water problems (Section 319).

To satisfy the requirements of Section 319 of the Clean Water Act, the State prepared a Non-point Sources Assessment Report which identifies surface waterbodies affected, describes the process by which best management practices to control non-point sources are developed and describes existing control programs.

2. Safe Drinking Water and Toxic Enforcement Act (1986)

The Safe Drinking Water and Toxic Enforcement Act of 1986 prohibits the discharge or release of any significant amount of chemical known to cause cancer or reproductive toxicity by any person in the course of doing business into the drinking water supply. Each year the Governor of the State must cause to be published a list of chemicals known to cause cancer or reproductive toxicity. Violation of the discharge provisions under this Act is subject to civil prosecution.

This Act also requires that government employees performing official duties which obtain information that there has been an illegal discharge of hazardous waste within the geographic area of his/her jurisdiction must report such incident within 72 hours to the Public Health Officer of the County or the Board of Supervisors. Violation of this requirement will subject the government employee to felony prosecution.

C. Financing Methods

1. 1987 Amendments

The changes of funding under the Water Quality Act (1987 amendments to the Clean Water Act) involved phasing out of the Construction Grant program by the end of fiscal year 1990. A new program was instituted in 1991 which the Federal government provided a total of 8.4 billion dollars to the states through 1994 to establish permanent, state-run revolving loan programs. These monies were designated to be used for the construction of sewage treatment systems.

New grant monies would become available to states that have EPA approved 305B reports and management programs. The amendments specified that the EPA give priority to programs that control difficult or serious non-point source pollution problems, programs that use innovative control methods, programs that address interstate non-point source pollution control problems and programs that address groundwater protection.

States with EPA approved 305B reports could also apply for grant monies to carry out groundwater protection activities that would help the state to achieve a comprehensive non-point pollution control program. The activities could include research, groundwater assessments, demonstration programs, enforcement, education, training and others.

The 1987 amendments expanded the scope of the governor's 20 percent discretionary fund used to fund construction projects that would not otherwise be eligible for federal funding to now implement non-point source pollution control programs.

2. Clean Water Act Reauthorization Funding

If reauthorized, the Clean Water Act would be referred to as the Water Pollution and Prevention Control Act (WPPCA) would provide $2.5 billion per year from 1995 through 2000 for wastewater plant construction. The bill would provide up to $500 million if Congress meets their deficit reduction. The WPPCA would also expand the types of projects eligible for State Revolving Funds. Until the bill is finalized exact appropriations are still somewhat speculative.

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Chapter 2 POPULATION, FORECASTS, WATER SUPPLY AND DEMAND

I. POPULATION FORECASTS AND WATER SUPPLY AND DEMAND

A. CURRENTLY ADOPTED POPULATION AND DWELLING UNIT FORECASTS

An important component of the Water Management Plan is the integration of currently adopted population forecasts and water demand and supply. The 1978 and 1980 Water Quality Management Plans (208) both included adopted forecasts to determine availability of supplies into the future. The same population forecasts are also utilized for the Air Quality Management Plan, County Integrated Solid Waste Management Plan, Transportation Plan and the County's General Plan. This ensures a comparison of expected population growth and the impact on resources, Countywide water supply and demand is also intended to show the "big picture" of water supply sources, options and timing for projects which can reasonably be expected to occur in the near future.

The 1980 208 Plan (Technical Appendix Volume IV, Chapter IV Page 20) provided water supply and demand information based on previously developed population forecasts and land use information. It was predicted that by the year 2000 about 365,000 acre feet per year would be needed to meet demands on a Countywide basis. Present calculations indicate that approximately 400,000 acre feet per year will continue to be needed by the year 2000.

Information on water demand and supply presented in chapter 3 of this volume in Tables 3.1, 3.2 and 3.3 is based on population forecasts, adopted by the Board of Supervisors in 1993 and information provided by the Water Districts. The Ventura County Board of Supervisors approved population and dwelling unit forecasts based on the 1990 Census on June 15, 1993. These were subsequently approved by the Ventura Council of Governments on June 24, 1993.

The most recently adopted population and dwelling unit forecasts are included in this Chapter in Tables 2.1 and 2.2 respectively. Table 2.3 provides information based on the most recent forecasts disaggregated by the service areas of the three major water wholesalers. Adopted forecasts project over 23,000 fewer people by the year 2010 than the previous forecast.

B. WATER SUPPLY AND DEMAND FORECASTS

Table 2.4 provides a summary of all the water demand and supply information provided in Chapter 3, Tables 3.7-3.9, of this volume. The deficit/supply figures provide some quantitative information based on a list of assumptions which have and could easily change. Water demand and supply figures seem to indicate that water supply will increase to keep pace and ultimately surpass water demand by the year 2000.

Various water supply assumptions, some with uncertain outcomes, have been included to show the water supply potential. Several of the more significant assumptions include:

- 15,000 acre feet State Water Project entitlement coming into the County by the year 2000.
- The entire volume of 53,000 acre feet/year available on average from the Vern Freeman Diversion.
- Delivery of approximately 25,000 acre feet/year additional water from reclaimed water projects (Thousand Oaks/Hill Canyon to Simi Valley Treatment Plant and Oxnard Wastewater Treatment Facility.

If these projects are not implemented by the year 2000 and the County experiences a series of less than average rainfall years, as has happened in the recent past, water demand would again greatly exceed safe yield supply. This would likely dictate a return to mandatory rationing, overdrafting groundwater basins and a resurgence of interest in desalination facilities. To forestall a crisis response, water conservation, wastewater reclamation, and other alternatives must continue to be pursued and implemented prior to the next series of drought years.

The Countywide water picture is a complex one and all existing water sources (local surface, imported, groundwater, reclaimed water) will continue to be subject to significant fluctuations. Since there are numerous purveyors and differing sources of water, one area of the County may be experiencing a drought while another has an adequate supply.

Additional water supplies will be needed, especially by the year 2000. Groundwater overdraft will continue to occur into the future at a rate of approximately 30,000 to 40,000 acre feet per year [Fox Canyon Groundwater Management Agency (GMA) projections to the year 2020, pers. comm. 8/94). This points to an increased need to maximize efficient use and management of existing water resources. Utilization of reclaimed water, groundwater banking, and conjunctive use projects (those listed in Table 3.6 and Table 3.15 in Chapter 3 of this volume) will require a high degree of initiative and cooperation to achieve results by the year 2000.

Table 2.1 1990-2010 Population Forecast

		VCOG	VCOG
	Census	Forecast	Forecast
Area	4/1/90	2000	2010
RSA 1	871	881	894
North Half NGA	871	881	894
RSA 2	155,485	174,824	191,568
Santa Paula GA	25,282	30,070	34,594
(Santa Paula City)	(25,062)	(29,700)	(34,200)
Santa Paula NGA	2,793	3,191	3,467
Ojai GA	9,650	9,638	9,780
(Ojai City)	(7,613)	(7,980)	(8,170)
Ojai NGA	2,671	2,776	3,079
Ventura GA	97,159	110,000	120,000
(Ventura City)	(92,575)	(103,575)	(113,500)
Ventura NGA	1,419	1,503	1,630
Ventura River GA	14,661	15,704	16,935
Ventura River NGA	1,850	1,942	2,083
RSA 3	245,286	268,739	295,440
Camarillo GA	58,719	67,916	76,070
(Camarillo City)	(52,303)	(61,500)	(69,500)
Camarillo NGA	4,912	6,237	7,607
Las Posas NGA	3,204	3,681	4,256
Oxnard GA	153,586	161,000	174,000
(Oxnard City)	(142,216)	(154,621)	(167,027)
Oxnard NGA	3,830	4,030	4,256
Port Hueneme GA	21,035	25,875	29,251
(Port Hueneme City)	(20,319)	(25,289)	(28,381)
RSA 4	131,226	163,671	197,693
Moorpark GA	26,174	39,591	53,340
(Moorpark City)	(25,494)	(38,500)	(52,000)
Moorpark NGA	499	542	634
Simi Valley GA	102,665	121,170	140,821
(Simi Valley City)	(100,217)	(119,200)	(137,000)
Simi Valley NGA	1,888	2,368	2,898
RSA 5	120,627	146,502	160,958
Oak Park GA	8,167	17,098	17,025
Ahmanson Ranch GA	899	5,203	8,060
Thousand Oaks GA	110,449	122,816	134,333
(Thousand Oaks City)	(104,352)	(115,800)	(128,000)
Thousand Oaks NGA	1,112	1,385	1,540
RSA 6	15,521	21,801	24,015
Fillmore GA	12,134	17,833	19,305
(Fillmore City)	(11,992)	(17,691)	(18,730)
Fillmore NGA	1,678	1,965	2,355
Piru GA	1,370	1,604	1,902
Piru NGA	339	399	453
(Unincorporated Total)	(86,873)	(102,562)	(114,060)
Ventura County Total	669,016	776,418	870,568

Table 2.2. 1990-2010 Dwelling Unit Forecast

Area	Census 4/1/90	VCOG Forecast 2000	VCOG Forecast 2010
RSA 1	311	325	340
North Half NGA	311	325	340
RSA 2	59,601	67,216	74,414
Santa Paula GA	8,138	9,990	11,847
(Santa Paula City)	(8,062)	(9,867)	(11,712)
Santa Paula NGA	780	875	1,006
Ojai GA	4,011	4,119	4,327
(Ojai City)	(3,130)	(3,381)	(3,583)
Ojai NGA	1,004	1,076	1,232
Ventura GA	38,847	43,651	47,619
(Ventura City)	(37,343)	(41,430)	(45,400)
Ventura NGA	683	744	836
Ventura River GA	5,451	6,017	6,720
Ventura River NGA	687	744	827
RSA 3	76,935	87,336	99,381
Camarillo GA	21,090	25,248	29,146
(Camarillo City)	(18,731)	(22,778)	(26,527)
Camarillo NGA	1,317	1,723	2,173
Las Posas NGA	1,032	1,227	1,463
Oxnard GA	45,221	48,788	54,545
(Oxnard City)	(41,247)	(46,294)	(51,552)
Oxnard NGA	641	695	760
Port Hueneme GA	7,634	9,655	11,294
(Port Hueneme City)	(7,481)	(9,579)	(11,130)
RSA 4	42,972	55,051	68,713
Moorpark GA	8,114	12,636	17,604
(Moorpark City)	(7,915)	(12,340)	(17,219)
Moorpark NGA	158	177	213
Simi Valley GA	34,007	41,355	49,760
(Simi Valley City)	(33,111)	(40,544)	(48,239)
Simi Valley NGA	693	897	1,136
RSA 5	43,954	55,614	63,001
Oak Park GA	3,303	7,154	7,338
Ahmanson Ranch GA	392	2,177	3,474
Thousand Oaks GA	39,639	45,487	51,272
(Thousand Oaks City)	(37,765)	(43,209)	(49,421)
Thousand Oaks NGA	620	796	917
RSA 6	4,705	6,783	7,739
Fillmore GA	3,576	5,420	6,070
(Fillmore City)	(3,528)	(5,361)	(5,763)
Fillmore NGA	543	655	812
Piru GA	457	551	674
Piru NGA	129	157	183
(Unincorporated Total)	(30,165)	(37,542)	(43,042)
Ventura County Total	228,478	272,325	313,588

TABLE 2.3 *POPULATION FORECAST BY MAJOR WATER WHOLESALER*			
YEAR	1990	2000	2010
Casitas MWD	50,878	55,060	59,147
United WCD	299,113	333,332	365,007
Calleguas MWD	316,347	385,120	443,247
TOTAL[1]	666,338	773,512	867,401

[1]Based on population estimates adopted by the Board of Supervisors and VCOG in 1993 and Water District estimates. Information taken from Tables 3.7-3.9.b from Chapter 3.

TABLE 2.4 *1990 POPULATION FORECAST & WATER SUPPLY AND DEMAND*			
CASITAS MWD	Demand	Supply	Deficit/Surplus
1990	30,883	34,745	2,196 Surplus
2000	31,852-32,272	33,235-40,235	-963 D - 7,963 S
2010	31,512-31,942	32,435-39,435	-493 D - 7,493 S
UNITED WCD	Demand	Supply	Deficit/Surplus
1990	268,035	281,554	13,519 Surplus
2000	226,912	217,900-291,000	-9,012 D - 64,088 S
2010	217,982	217,900-291,000	-82 D - 73,018 S
CALLEGUAS MWD	Demand	Supply	Deficit/Surplus
1990	143,949	151,356	7,407 S
2000	137,513	192,618	55,105 S
2010	149,002	211,224	62,222 S
COUNTYWIDE TOTAL	Demand	Supply	Deficit/Surplus
1990	442,867	467,656	24,790 S
2000	396,299-396,697	443,753-523,853	47,056 - 127,155 S
2010	398,496-398,896	461,660-541,659	62,674 - 142,763 S

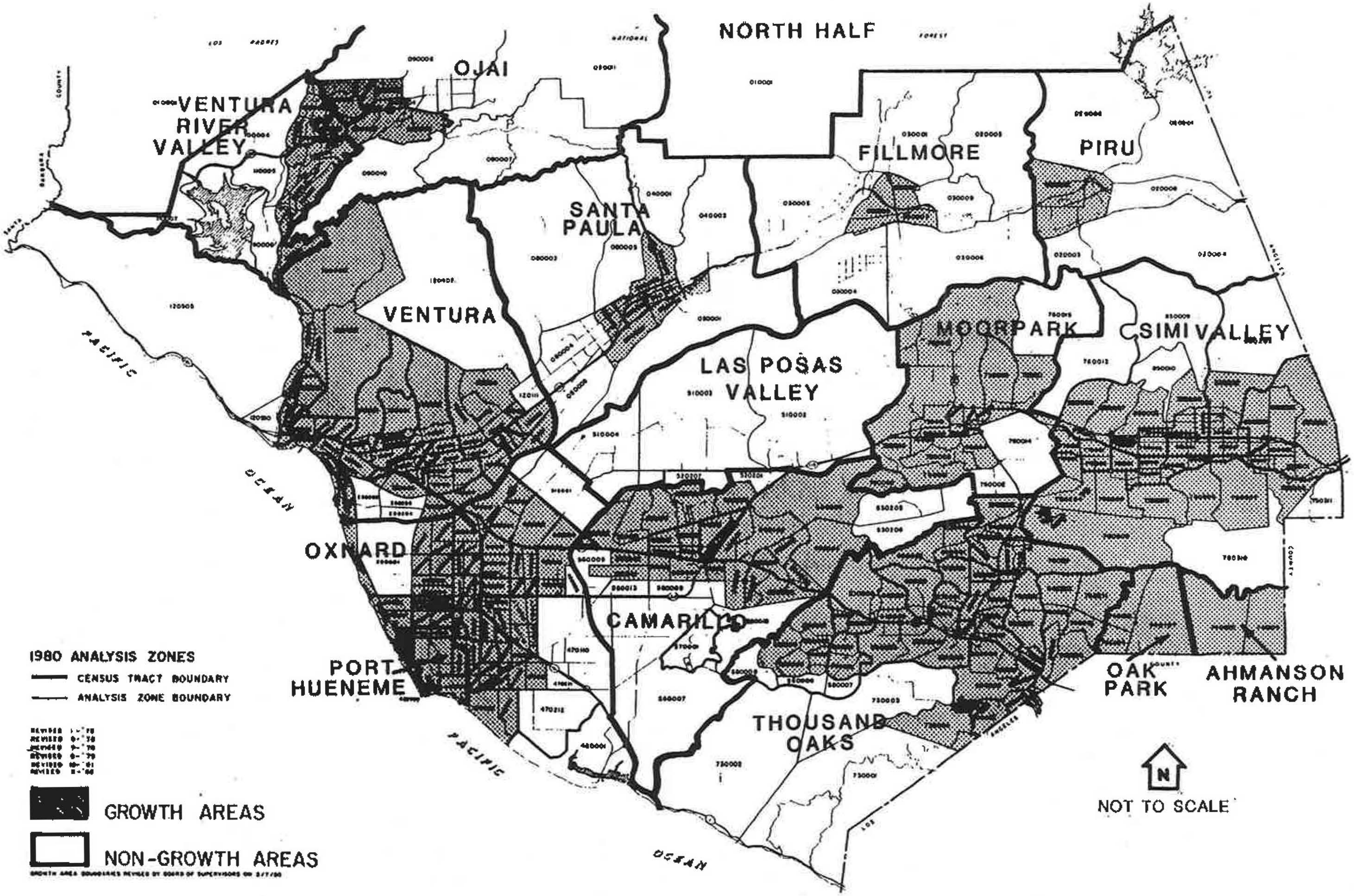


FIGURE 2.1 GROWTH AND NON-GROWTH AREAS

CHAPTER 2 REFERENCES

CALLEGUAS MUNICIPAL WATER DISTRICT, PERS. COMM. 7/94

CALLEGUAS MUNICIPAL WATER DISTRICT, PERS. COMM. 7/94

UNITED WATER CONSERVATION DISTRICT, PERS. COMM. 7.94

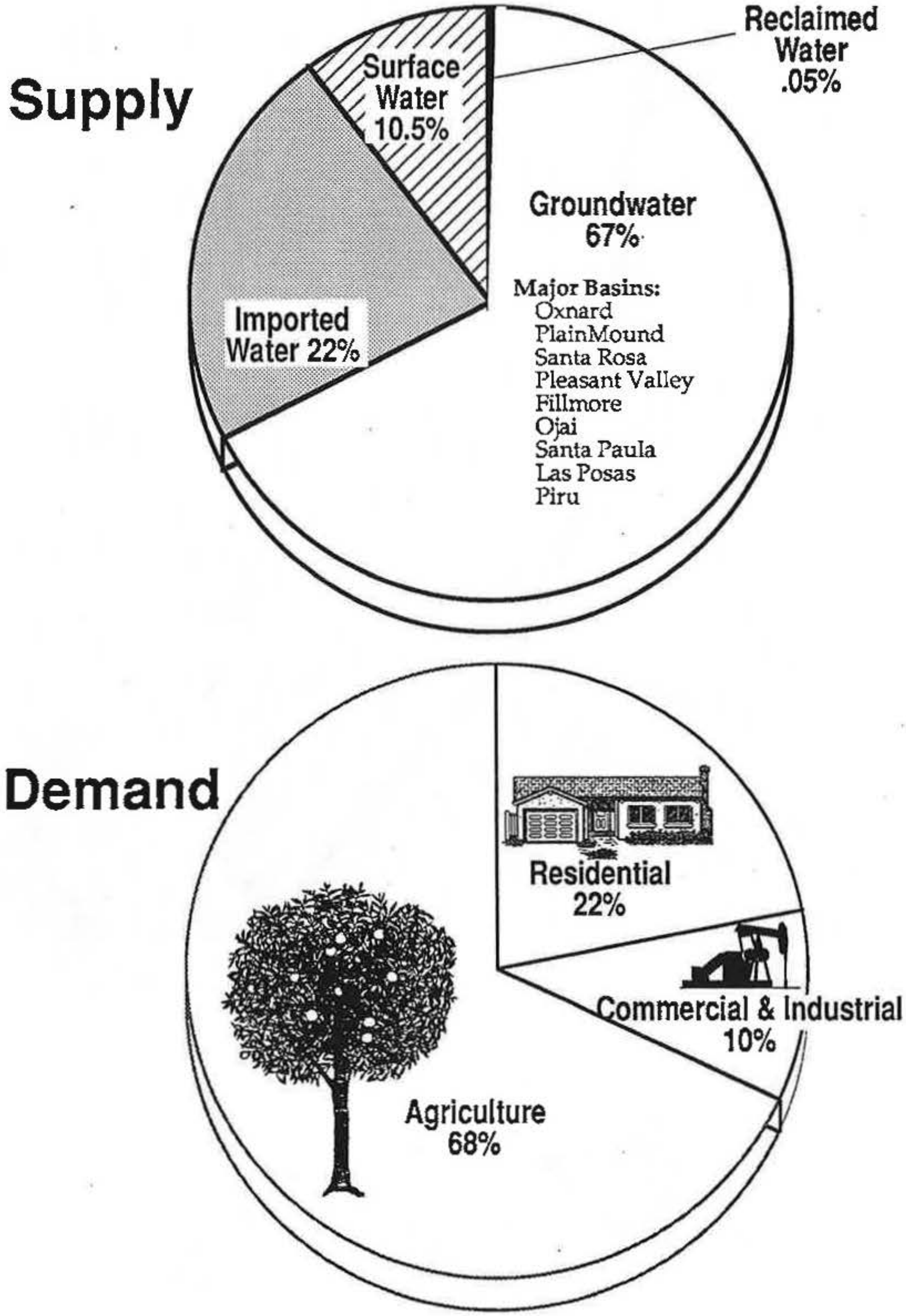
Chapter 3 WATER SUPPLY AND DEMAND

INTRODUCTION

Ventura County consumes more water than is locally available, which has resulted in an overdraft of groundwater resources and increasing dependence on imported water supplies. Ventura County's water supplies are primarily obtained from three sources: surface water, ground water and imported water. In 1992 ground water provided approximately 67% of the County water demand, surface water supplied 10.5%, imported water supplied 22%, and reclaimed water supplied approximately .5%. Countywide water demand is about 425,500 acre feet per year (AF/Y). In 1992 approximately 68% (289,340 AF/Y) was used by agriculture, 22% (93,610 AF/Y) was used by residential demands, and 10% (42,550 AF/Y) was used by commercial and industrial activities. Figure 3.1 illustrates Ventura County's water supply sources and demand pattern. As a result of the recent drought, County water users responded to the need to be water efficient. Countywide per capita water use in 1992 was approximately 58,680 gallons per year (.18 AF/Y) down from the 1989 per capita water use of 74,946 gallons per year (.23 AF/Y). Per capita water use includes residential, commercial, industrial and government use, divided by population.

Figure 3.2, Water Resources in Ventura County, illustrates the geographical locations of the surface and groundwater resources. Figure 3.2 also illustrates the boundaries of the three major water wholesale districts in the County: Casitas Municipal Water District, United Water Conservation District and Calleguas Municipal Water District. This chapter addresses the availability of current and potential water resources. Water demands generated by urban and agricultural users are addressed in Section II. Section III includes estimates of overdraft conditions for years 1985, 2000 and 2010 within the upper and lower aquifer systems of the Oxnard Plain, Las Posas basin, and Pleasant Valley. Section IV, Water Demand Management, commonly referred to as best management practices, examines current and potential new programs to promote the efficient use of water for both agriculture and urban demands. Alternative sources of water are discussed in Section V, including the importation of State Project water, reclaimed water projects, Santa Paula Basin Salt Balance Pumping, desalination, and conjunctive use. In Section VI, Conclusions and Recommendations, countywide water supply and demand is summarized, alternative supply projects and demand management programs are prioritized and methods to enhance the implementation of various project are recommended.

Figure 3.1-Ventura County's Water Supply & Demand



Total County Water Use = 425,500 AF/Y

With the exception of the use of reclaimed water. Overall water supply and demand patterns in the County have changed only slightly since 1980. However, water demand per capita in 1993 has declined in use is the result of water conservation efforts by citizens, industry and agriculture.

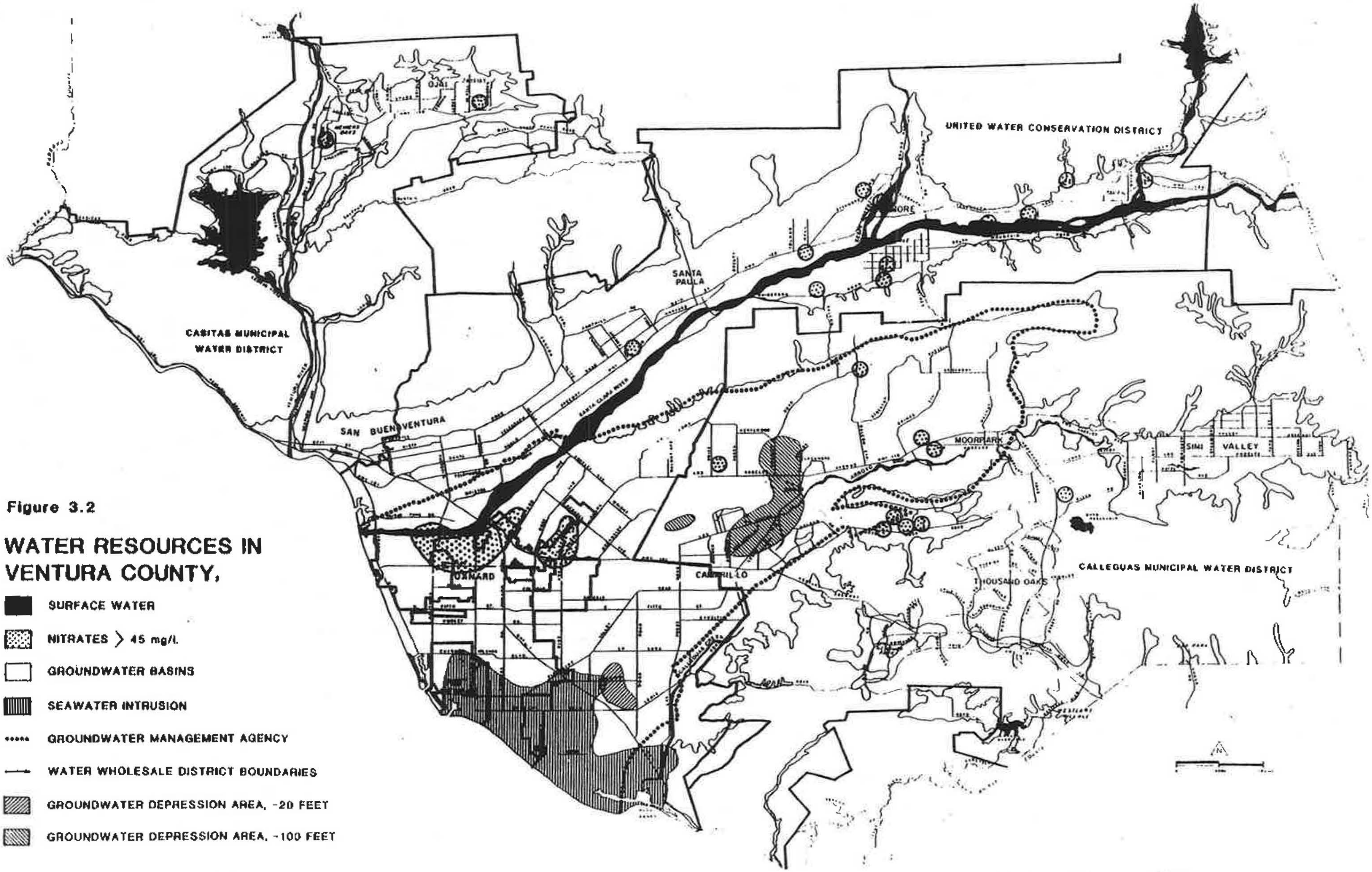


Figure 3.2

WATER RESOURCES IN VENTURA COUNTY.

SURFACE WATER

NITRATES > 45 mg/l.

GROUNDWATER BASINS

SEAWATER INTRUSION

GROUNDWATER MANAGEMENT AGENCY

WATER WHOLESALE DISTRICT BOUNDARIES

GROUNDWATER DEPRESSION AREA, -20 FEET

GROUNDWATER DEPRESSION AREA, -100 FEET

SOURCE: VENTURA COUNTY RESOURCE MANAGEMENT A... APRIL 19

I. WATER RESOURCES AND AVAILABILITY

A. Surface Water

Surface water resources in Ventura County include two major hydrologic units, and four smaller hydrologic units. The two major hydrologic units are the Ventura River and Santa Clara-Calleguas units (see Figure 3.2). The smaller hydrologic units include Rincon Creek, Cuyama, San Joaquin, and the Malibu hydrologic units. Reservoirs such as Lake Casitas and Lake Piru are also considered surface water resources. Streams that usually carry flow year round include Sespe Creek, Santa Paula Creek, Piru Creek, Ranger Creek, Matilija Creek, North Fork of the Ventura River, and Ventura River below Foster Park. The major surface water resource in Ventura County is Lake Casitas, followed by Lake Piru, Ventura River and the Santa Clara River. Combined, these surface water resources provided approximately 10.5% of the water used in Ventura County in 1992.

Within the Ventura River drainage area, which includes Lake Casitas, the Casitas Municipal Water District (Casitas MWD) has the primary responsibility for developing and maintaining delivery of surface runoff and flood waters. The district boundary of the Casitas MWD service area is shown in Figure 3.2. Casitas MWD wholesales water from Lake Casitas to retailers for municipal, industrial and agricultural use within the Ojai Valley and the City of Ventura. Casitas MWD also retails water directly to some users in the Ojai Valley and the North Coast of the County.

The Lake Casitas Reservoir has a capacity of 254,000 acre-feet of storage, with a "safe yield" of approximately 21,900 AF/Y. Safe yield is the amount of water which can safely be extracted on an ongoing basis without restriction of supply, even during dry periods. Lake Casitas is currently operating at safe yield. Approximately 45% of the inflow to the Casitas reservoir comes from runoff in the 34-square-mile surrounding drainage area. The remaining 55% is diverted to Casitas from the 74-square-mile Ventura River-Matilija Creek Watershed through the Robles-Casitas Canal. Approximately 6,000 AF/Y of water is obtained by the City of Ventura through a surface diversion (and groundwater extraction wells near Foster Park).

In June 1989, after experiencing several years of drought conditions, the Casitas MWD Board of Directors conducted a water demand analysis. The findings of that study indicated that the average annual demand for water from 1986 to 1991 exceeded the annual safe yield and since Casitas MWD was experiencing a continuing drought, the Board of Directors declared a water shortage emergency on April 11, 1990. The Board then adopted a resolution to regulate and restrict the delivery and consumption of water, including a delay on new service connections within Casitas MWD service area for one year or until the emergency ended, whichever occurred first. In March 1993, the Casitas MWD Board rescinded the water emergency due to reduced demands and full groundwater basins and reservoirs.

Lake Piru is operated as a storage reservoir by the United Water Conservation District (United WCD). United WCD is responsible for wholesale water distribution throughout most of the Santa Clara River Valley (United WCD's service boundary is illustrated on Figure 3.2). Lake Piru reservoir water is released to the Santa Clara River. Downstream the water is diverted to spreading grounds where the water percolates to underground aquifers for subsequent wholesale to various retail water surveyors and agricultural users. The capacity of Lake Piru is 88,000 AF, with an average annual safe yield of 15,000 AF/Y.

Santa Clara River water is diverted to the Freeman Diversion in Saticoy by United WCD for aquifer recharge and direct delivery. The diverted Santa Clara River flows are used for Oxnard Plain Basin recharge, subsequent use by retailers, delivery to the Pleasant Valley County Water District, and some Oxnard Plain agricultural use. Since the Spring of 1991 to March 1994, the Freeman Diversion has diverted 299,185 AF, an average annual of 74,796 AF. Theses diversion figures were higher than anticipated in part due to wet years and releases from Santa Felicia Dam. The Freeman Diversion Project has the capacity to divert approximately 53,000 AF/Y under normal runoff conditions. However, during drought conditions, diversions will decrease. It should be noted that only a portion of the diverted water becomes recharge. This project is further discussed in Section III. United WCD is also responsible for diversions from Piru Creek to recharge the Piru Basin.

In 1991, as we entered a fifth year of drought conditions, the small amount of rainfall which occurred in the County's southern watersheds was evident by low water levels at the Lake Casitas and Piru Reservoirs, and decreased flows in the Ventura and Santa Clara Rivers. Fluctuating climatic conditions appear to be a historic pattern. Because of this pattern and limited surface sources, the majority of County water users have historically relied on groundwater to meet water demands.

B. Groundwater

Groundwater is usually considered the single most important source of water in Ventura County. In 1992, it provided about 67% (285,100 AF/Y) of the water utilized in the County. Agricultural demand accounts for an estimated 86% of the total demand for groundwater in the County. Because it is estimated that the local groundwater basins can safely supply only about 242,000 AF/Y countywide, water users have been extracting at least 31,000 AF/more than is being naturally and artificially replenished. During drought years the overdraft rate has been as high as 72,000 AF/Y as it was during the 1988-1989 year. Groundwater is pumped extensively by individual well owners and purveyors. Purveyors either wholesale water to other purveyors or make deliveries directly to individual users.

The cost of groundwater consists of energy, annual maintenance, treatment, amortized well construction costs, and in some areas an extraction fee which is assessed by the

United WCD and the Fox Canyon Groundwater Management Agency (GMA). Typical groundwater costs on the Oxnard Plain are approximately $70.00 an AF. However, groundwater costs will vary greatly due to energy costs which will differ depending on depth to water, life of the well, and other expenditures. Costs will also vary due to financing fees, interests rates and other loan costs. Depending on depth of the well and financing costs, cost per AF of groundwater can be as much as 10 times the typical Oxnard Plain cost of $70.00 per AF. The $70.00 per AF cost, however, does not consider that the aquifers beneath the Oxnard Plain are being overdrafted. This overdraft has resulted in seawater intrusion, rendering portions of the aquifers degraded and therefore the true cost of pumping from the Oxnard Plain aquifers is not reflected in the $70.00 AF cost.

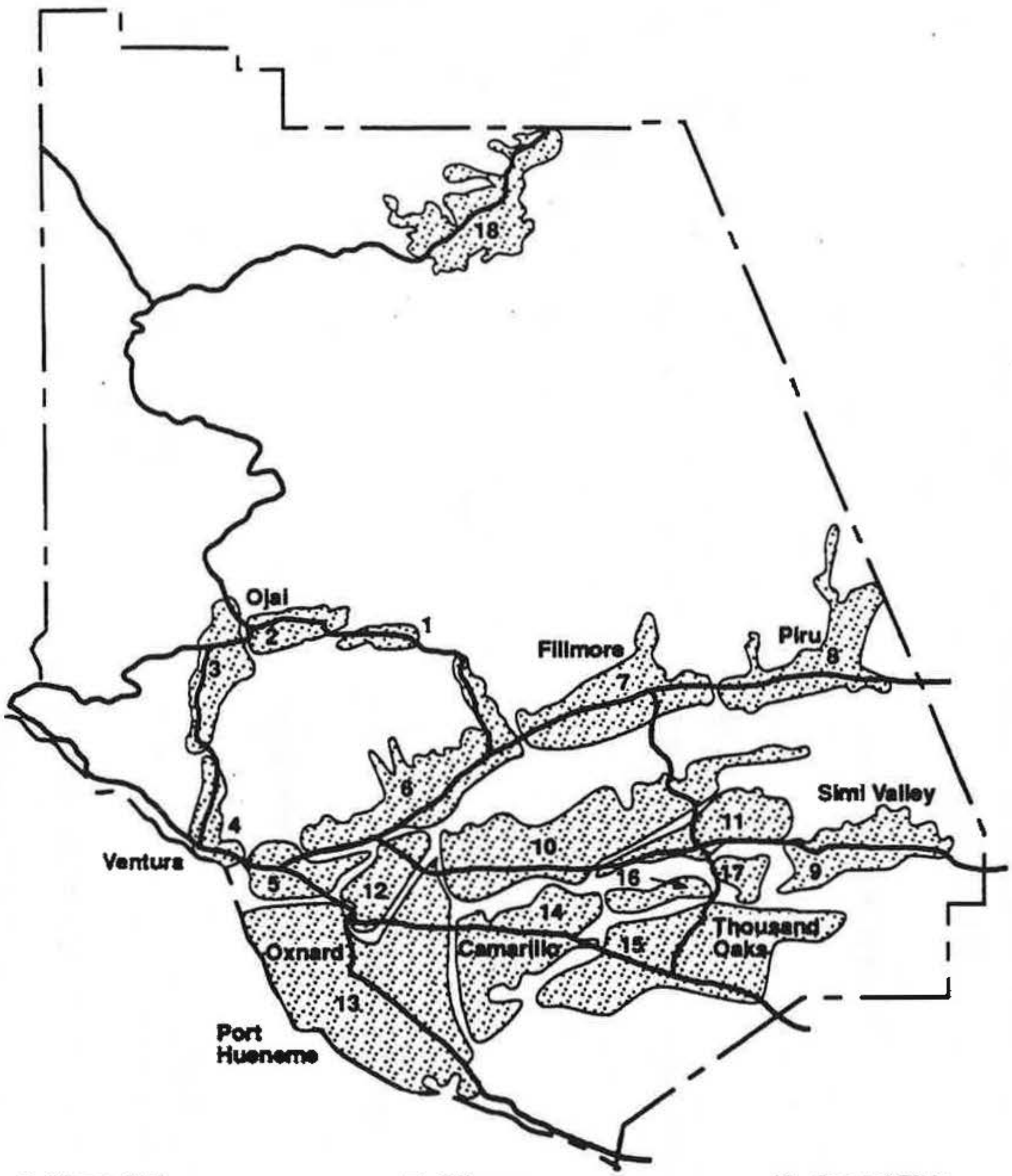
Water enters groundwater basins via watersheds. Rainfall within a watershed dictates the amount of water ultimately reaching a groundwater basin. The groundwater basins are illustrated on Figure 3.3, Groundwater Basins and Recharge Areas. Since more groundwater is used than is replaced, overall, the County's groundwater reserves are decreasing. When groundwater is pumped at a greater rate than basin recharge, an overdraft occurs. Overdraft, resulting problems, and proposed solutions are discussed in Section III of this chapter.

The largest groundwater sources in the County are contained within aquifers which underlie most of the Oxnard Plain, Las Posas and Santa Clara Valleys. Beneath the Oxnard Plain there are five aquifer zones. They are, in order of increasing depth, the Oxnard, Mugu, Hueneme, Fox Canyon and Grimes Canyon aquifers. Figure 3.4 Oxnard Plain Aquifers, illustrates a cross section of the above mentioned aquifers. These aquifers can most easily be visualized as lying horizontally on top of each other separated by clay layers in between. These aquifer systems are commonly referred to as the Upper Aquifer System (UAS) and the Lower Aquifer System (LAS). The UAS consists of the Oxnard and Mugu aquifers, while the LAS consists of the Hueneme, Fox Canyon and Grimes Canyon aquifers.

Beneath the Oxnard Plain, the UAS and LAS are currently being overdrafted. Because recharge rates are different between the UAS and LAS, estimating the overdraft for each of the aquifer systems is difficult to calculate. Several methods and many variables are used to estimate overdraft, therefore, for purposes of discussion, it should be noted that these estimates may not be precise. Section III of this chapter illustrates how overdraft of county water resources is calculated. A 1988-1989 County Public Works Study revealed that the UAS was calculated as having an overdraft of approximately 57,000 AF/Y. The LAS was calculated as having an overdraft of approximately 15,900 AF/Y. The combined UAS and LAS overdraft rate was much higher than previous years, which may have been due to the fifth year drought condition. Currently, due to several wet years the overdraft rate has declined. In past years, the combined overdraft has ranged between 30,000 to 40,000 AF/Y.

This overdraft condition has resulted in the intrusion of seawater into Oxnard Plain aquifers. The current rate of overdraft and seawater intrusion can be decreased. The Vern Freeman Diversion Project, the Fox Canyon Groundwater Management Agency, the prohibition of new Oxnard aquifer wells, and an extraction reduction ordinance are several programs in place to remedy the seawater intrusion problem. These projects and programs are discussed further in Section III of this chapter.

Figure 3.3- Ventura County Groundwater Basins & Recharge Areas



1. Upper Ojai
2. Ojai
3. Upper Ventura River
4. Lower Ventura River
5. Mound
6. Santa Paula
7. Fillmore
8. Piru
9. Simi
10. North Las Posas
11. South Las Posas
12. Oxnard Forebay
13. Oxnard Plain
14. Pleasant Valley
15. Conejo
16. Santa Rosa
17. Tierra Rejada
18. Lockwood Valley

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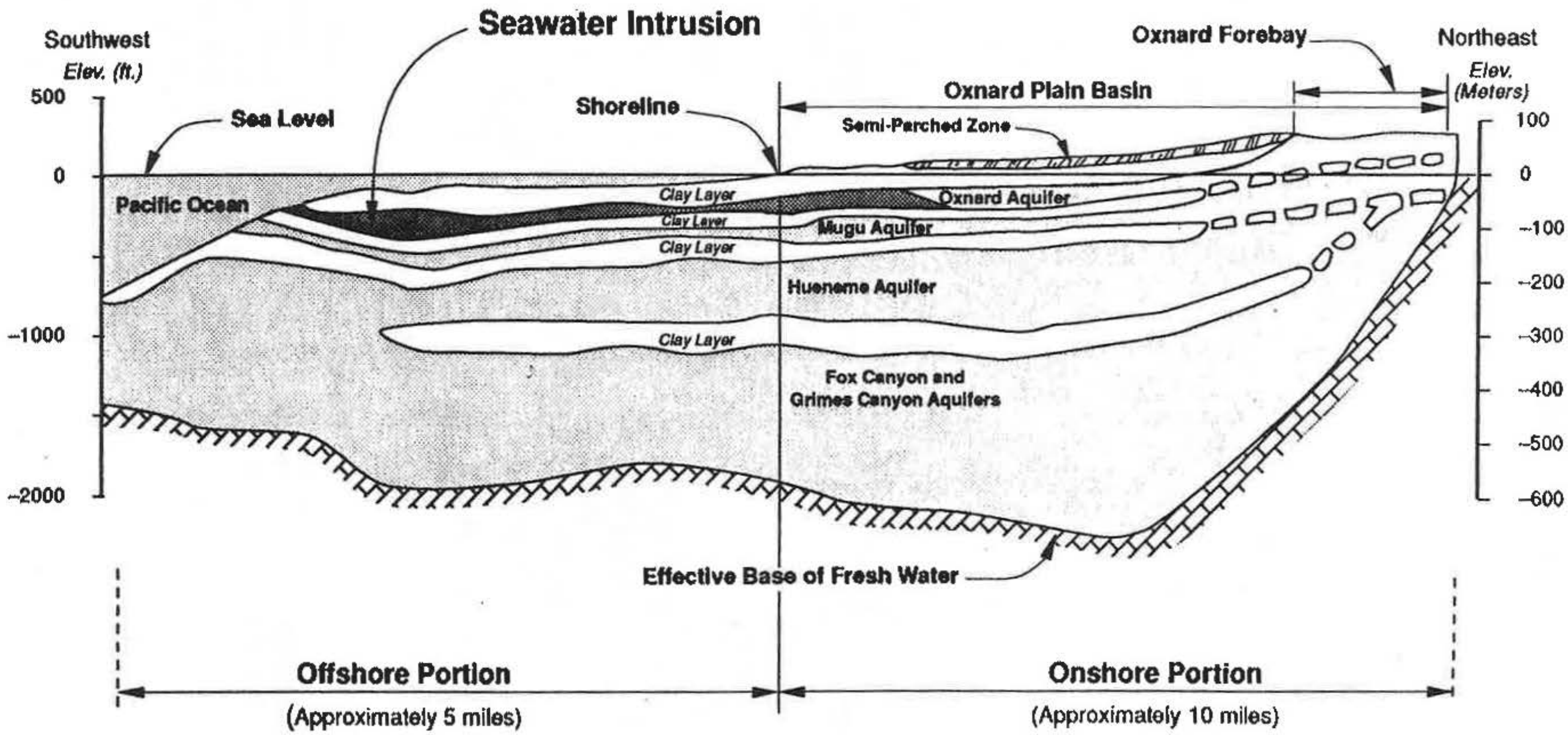
Figure 3.4- Oxnard Plain Upper & Lower Aquifer Systems



The Oxnard and Mugu Aquifers make up the Upper Aquifer System.

The Hueneme, Fox Canyon and Grimes Canyon Aquifers make up the Lower Aquifer System.

Source: Modified from DWR Bulletin No. 104-8, November, 1976.

C. Imported Water

Imported water is water that originates outside an area's local watershed. Imported water in Ventura County is obtained by the Calleguas Municipal Water District (Calleguas MWD) a member agency of the Metropolitan Water District of Southern California. The imported water is State Water Project (SWP) water.

The water is delivered to purveyors in the southern and eastern portions of the county, which includes the cities of Thousand Oaks, Simi Valley, Moorpark, Camarillo and Oxnard. The Lake Bard Reservoir, with a capacity of 10,500 AF is used to stabilize delivery of imported water (Figure 3.2). Approximately 74% of the County's residents use imported water. This water provides about 22% (100,000 AF/Y) of the water used in the county. Beginning in 1991, following several years of below average snow pack and precipitation, DWR had to initiate cutbacks to MWD and their water wholesales including Calleguas MWD.

Until recently, Calleguas MWD was the only supplier of imported water in the County. Additional state water entitlements have been held Countywide for 20 years; however, none of the water had been received due to lack of delivery systems until recently. As an interim delivery option, the United WCD began ordering their yearly entitlement of 5,000 AF/Y with deliveries to start during the last quarter of 1990. Over a three month period, 5,000 AF was delivered to United WCD's Lake Piru Reservoir. The SWP deliveries occur through releases from the Pyramid Reservoir managed by the State Department of Water Resources. Following the release, water flows via Piru Creek to Piru Lake. Water is then released to the Santa Clara River and diverted by the Freeman Diversion Project to the Saticoy Spreading Grounds. Due to DWR cutbacks which began in 1991, United WCD received only 1,500 AF of their 1991 entitlement of 5,000 AF/Y. See Section IVA. for additional discussion of imported water in Ventura County.

The original SWP contract was held by the County but was transferred to Casitas MWD in 1971. Casitas MWD contracted portions of the 20,000 AF/Y entitlement to United WCD, and the City of Ventura. Casitas MWD and United WCD each have an entitlement of 5,000 AF/Y, while the City of Ventura holds a 10,000 AF/Y entitlement. Jointly, the districts and the city have studied the feasibility of obtaining the entitlements through a variety of delivery systems. These studies and the importation of State Project water are further discussed in this chapter in Section V, Alternative Resources.

D. Reclaimed Water

Water reclamation refers to the recycling or reuse of either treatment plant effluent (wastewater) or industrial process water. Reuse can occur on-site or be transferred to other uses off-site following treatment. The uses to which reclaimed water can be applied (e.g., landscape and agricultural irrigation, cooling, etc.) depend upon the quality of the treated water and the quality required for subsequent uses.

In 1992 reclaimed water provided approximately .5% of the Countywide water supply. Three of the 16 sewage treatment plants in Ventura County currently reclaim a portion of their effluent. These include the Camarillo Sanitary District Wastewater Reclamation Plant, Camrosa Wastewater Treatment Plant, and the Ventura Water Renovation Facility. In addition to the facilities located in Ventura County, reclaimed water is delivered via pipeline from a Los Angeles County treatment plant to Ventura County. Over a third of the Camarillo Sanitary District's effluent is being used for agricultural irrigation. The City of Ventura reclaims water for agricultural irrigation. A joint venture between the Triunfo County Sanitation District of Ventura County allows for reclaimed water deliveries to Ventura County from the Los Angeles County Tapia Treatment Plant. This reclaimed water is currently providing irrigation of the Lake Sherwood Golf Course in the Thousand Oaks area.

The City of Thousand Oaks Hill Canyon treatment plant and the Simi Valley Sanitation District treatment plant are currently negotiating plans with potential buyers for reclaimed water. The Moorpark Wastewater Treatment Plant has plans for tertiary treatment of approximately 1,200 AF/Y. These plans, and a discussion of potential water supplies provided by reclaimed water, are discussed in more detail in this chapter under Section V, Alternative Sources.

E. Wholesale Districts

Introduction

Within Ventura County, there are three major wholesale water districts: the Casitas Municipal Water District (Casitas MWD), the United Water Conservation District (United WCD), and the Calleguas Municipal Water District (Calleguas MWD). There are also about 175 retail water purveyors of various sizes. These include 6 city systems, 8 privately owned companies, 20 special water districts, 4 other public water purveyors, another 4 public water companies, and a variety of other public and private systems such as military bases, mobilehome parks, and small mutually owned water companies. An estimated 2,000 individual well owners obtain water directly from their wells. Most of the groundwater pumped in Ventura County is done so by individual well owners. Approximately one third of the groundwater is delivered by a public water system.

For the purpose of addressing water resources and availability, this plan will focus on the three major water wholesale districts in the County: Casitas MWD, United WCD, and Calleguas MWD. A general description of the water resources and district boundaries in which Casitas MWD, United WCD, and Calleguas MWD operate is illustrated in Figure 3.2. A more detailed description of water demand within the three wholesale districts and current and future overdraft are addressed in Sections II and III of this chapter.

1. Casitas Municipal Water District

The Casitas Municipal Water District (Casitas MWD) conserves surface runoff and flood waters within the Ventura River hydrologic unit. In the Ventura River Drainage unit, which includes Lake Casitas, and the smaller Matilija Reservoir, Casitas MWD is responsible for developing and maintaining delivery of these waters. Currently, total water demand in the Casitas district is approximately equal to the total available annual safe yield of 21,900 AF/Y.

The district boundaries of Casitas MWD, as illustrated on Figure 3.2, includes the Ojai Valley area, south along the Ventura River including the western portion of the City of Ventura northwest to the north coast of the County. Casitas MWD wholesales water to retailers serving municipal, industrial and agricultural uses within the Ojai Valley and City of Ventura. Casitas MWD also retails water directly to some users in Ojai Valley and the north coast of the County.

The Lake Casitas Reservoir has a storage capacity of 254,000 AF with a safe yield of approximately 21,900 AF/Y. The Lake Casitas Reservoir is presently at safe yield. Inflow to Casitas Reservoir includes approximately 45% from runoff within an adjacent 34-square-mile direct drainage area while the remainder of the flow is diverted to Casitas from the 74-square-mile Ventura River-Matilija Creek Watershed through the Robles-Casitas Canal. The City of Ventura is a retail customer of Casitas MWD, and can purchase water equal to the demand of customers within the district's boundaries.

2. United Water Conservation District

The United Water Conservation District (United WCD) conserves surface runoff and flood waters to recharge and manage groundwater basins within the Santa Clara River/Oxnard Plain System for agricultural and municipal uses. Although agricultural users make up most of United WCD's customers, United WCD also provides for all the water demands of the City of Port Hueneme, the U. S. Naval Construction Battalion Center, and Point Mugu as well as approximately one third of the City of Oxnard water demand, serving residential, and some commercial and industrial water users. The district's boundary, as illustrated in Figure 3.2 includes the Santa Clara River basin area from just east of Lake Piru, west along the river to the Oxnard Plain, including the eastern portion of the City of Ventura.

United WCD's operations include the use of Lake Piru as a reservoir. The reservoir water is released to the Santa Clara River for aquifer recharge or wholesale to various retail water purveyors and agricultural users. Capacity of Lake Piru is 88,000 AF with an average annual safe yield of 15,000 AF/Y.

United WCD also diverts Santa Clara River water at the Freeman Diversion for aquifer recharge and direct delivery. Aquifer recharge operations reduce the rate of seawater intrusion which has occurred in the Oxnard, Mugu, and Fox Canyon aquifers. Aquifer recharge involves releasing water to large holding ponds (commonly referred to as spreading grounds), where the subsurface material is mostly sand and gravel. Water then percolates rapidly into the large water holding aquifers underground. The Freeman Diversion Project has a capacity to divert 53,000 AF/Y during years of average runoff. More can be diverted during years of higher than average runoff and significantly reduced during drought conditions.

Long term overdrafting has caused serious seawater intrusion of the Oxnard aquifer. A Seawater Intrusion Abatement Project is currently underway to remedy this problem. The United WCD and County, with the support of local cities and growers, is carrying out this project which includes removal of wells from the intruded Oxnard aquifer and operation of the Freeman Diversion on the Santa Clara River. This, together with new wells in the Fox Canyon Aquifer and a new pipeline, will deliver water to users on the Oxnard Plain. More information regarding the overdraft of groundwater resources within United WCD's boundary and the Freeman Diversion Project are addressed in Section III of this chapter.

3. Calleguas Municipal Water District

The Calleguas Municipal Water District (Calleguas MWD) as a member agency of the Metropolitan Water District (MWD) of Southern California imports water into the County from the Colorado River/State Water Project. The service boundary in which water is delivered to purveyors includes the southern and eastern portions of the County, which consist of the cities of Thousand Oaks, Simi Valley, Moorpark, Camarillo and Oxnard (see Figure 3.2). Calleguas MWD supplies approximately two thirds of the City of Oxnard's water demand (the remaining one third is met by United WCD). Approximately 74% of the County's residents use some imported water. Without importation of State water, water demands in some areas of the county could not be met. In 1991 imported water provided approximately 22% (100,000 AF/Y) of the water used in the County. Calleguas MWD uses the Lake Bard reservoir as a terminal distribution reservoir with a capacity of 10,500 AF.

The Calleguas MWD, a purveyor of Metropolitan Water District, is currently implementing an Aquifer Storage Recovery (ASR) project in the North Las Posas Basin. The ASR project allows for the injection of water into groundwater basins when surplus water is available during winter months. The water would then be pumped out during summer months when water demands are high. Metropolitan provides financial incentives in the form of reduced water rates for Calleguas

MWD member agencies to store water under this program. Calleguas MWD is studying storage of water in the North Las Posas Basin on both a seasonal and long term basis. If storage in the basin proves feasible, Calleguas MWD and MWD of Southern California will jointly develop pipeline facilities, a treatment plant, injection and extraction wells.

II. WATER DEMAND

INTRODUCTION:

This section will address the water demand of agricultural and urban uses. The water resources that currently provide water for these land uses are discussed. A general discussion of expected future water needs by geographical area for various land uses is included. Information from water districts and the Water Conservation Program water use surveys (1992) were used. Some of the water use information by geographical area is from the Ventura County General Plan Resource Appendix, Water Supply Facilities Section (1988).

A. Agriculture

Agricultural water demand in water year 1989 to 1990 totaled approximately 68% (290,000 AF/Y) of the countywide water demand. The majority of this demand was met through local supplies. It is not expected that agricultural water demand patterns have increased significantly since 1990 because 1990 was a drought year and the last several years have been higher than average rainfall years. Groundwater supplied approximately 86% of the agricultural demand while surface water from Lake Casitas, Santa Clara River, Ventura River, Sespe Creek, Santa Paula Creek and Piru Creek supplied a large part of the remaining demand. Imported water and a small amount of reclaimed wastewater also met some of the agricultural demand. Most local farmers obtain groundwater from their own wells.

Groundwater use may increase or decrease, depending on a number of factors. Factors contributing to a reduction in groundwater use would include seawater intrusion abatement programs (which are expected to limit groundwater extractions by providing replacement supplies), increases in reclaimed water availability, and a reduction in agricultural irrigation due to more efficient irrigation practices and fewer acres in agricultural irrigation (unless high water use crops replace lower water use crops).

Increases in agricultural irrigation could occur from the replacement of low water use crop to high water use crops such as strawberries, celery or turf. Even if fewer acres are farmed, if higher water use crops are grown, overall agricultural water demand could increase. In addition, a trend toward agricultural cultivation on hillside and marginal lands may contribute toward an increase in agricultural irrigation. More efficient irrigation practices by agricultural growers are likely to increase as groundwater extraction reduction ordinances are implemented, water prices increase and water efficiency technology becomes more available and accepted by growers. Agricultural irrigation efficiency training by the University of California Cooperative Extension and the Resource Conservation District's Mobile Irrigation Management Laboratory is discussed in Section IV, Water Demand Management.

The availability and use of imported water for agriculture will depend on cost and policies of the water purveyors. Imported water is of high quality and would best be used to meet high quality water demands such as potable municipal uses.

1. Agricultural Water Demand by Geographical Area

The major geographical areas of the county and their agricultural water use are discussed below:

a. Oxnard Plain: At present, Oxnard Plain agricultural users obtain the majority of their water from the five aquifers that underlie the Oxnard Plain. The five aquifers are, in order of increasing depth, Oxnard, Mugu, Hueneme, Fox Canyon and Grimes Canyon (Figure 3.4). There is a County ordinance restricting drilling of any new Oxnard and Mugu Aquifer wells which could aggravate seawater intrusion. Surface water from the Santa Clara River is also used by farmers via the Freeman Diversion project to the Pleasant Valley County Water District and the Pumping Trough Pipeline. Over time, agricultural water demand on the Oxnard Plain is expected to decrease, due to the urbanization of agricultural land within the sphere of influence of the City of Oxnard. However, if more high water use crops such as strawberries and celery are grown, agricultural water demand may actually increase even if fewer acres are farmed.

Considerable potential exists for use of reclaimed water on the Oxnard Plain, particularly because wastewater from the Oxnard treatment plant is currently discharged to the ocean. This discharge is lost to the ocean; therefore, no recharge to groundwater basins occurs. Use of reclaimed water from the Oxnard Treatment Plant for agriculture could significantly decrease the amount of water extracted from groundwater systems beneath the Oxnard Plain in the 1990's and beyond. A reduction in groundwater extractions would help alleviate the existing overdraft condition. Reclaimed water is approved for all crop types, however, irrigation methods are regulated. A more detailed discussion of future reclaimed water resource availability is discussed in Section V, Alternative Resources.

b. Santa Clara River Valley: The Santa Clara River Valley's agricultural community depends primarily on groundwater for its water supply. In addition, a small amount of surface water is diverted annually from the Piru Creek, Sespe Creek, Santa Paula Creek and Santa Clara River. It is anticipated there will be some loss of agricultural land in areas adjacent to the cities of Ventura, Santa Paula, and Fillmore due to urbanization. By the year 2010 the major source of water for agriculture is expected to continue to be groundwater unless reclaimed water becomes available in sufficient quantities and quality. It should be noted that a large percentage of treated wastewater discharged to rivers percolates into local groundwater basins. Overall, any reduction in demand on groundwater from agriculture is expected to be offset by increased urban demand. In effect, total use of the Santa Clara River Valley's groundwater supply is expected to remain approximately constant to the year 2010.

c. Conejo-Calleguas Basin: This area includes that portion of Ventura County served by the Calleguas MWD with the exception of the City of Oxnard. In general, most of the agricultural land lies in the western portion of the Calleguas MWD service area around the Las Posas Valley, the Santa Rosa Valley, Moorpark, and adjacent areas (see Figure 3.2). Agricultural water users within the Calleguas MWD depend on groundwater to meet the majority of agricultural water demands. Often it is difficult to determine how much imported water is used to meet agricultural demands because water retailers cannot guarantee the accuracy of such records. However, for the year 1991, Calleguas MWD estimates that approximately 10,000 AF/Y of imported (or 10% of Calleguas MWD's imported supply) water would be used for agricultural use (Calleguas MWD, October 1991).

Potential demand for additional reclaimed water supplies, especially in the Las Posas area, is very high. The North Las Posas Basin was overdrafted by 11,900 AF/Y in 1989 (Ventura County Public Works Agency). Although water levels were up in mid-1990 due to increased availability of imported water, by the year 2000 overdraft is expected to increase to 14,600 AF/Y, due to increased agricultural pumping.

The Santa Rosa basin (Figure 3.3) has experienced quality problems. Due to the locations of a clay cap and fault, nitrates that enter the basin through septic tanks and agricultural activities are not flushed out. This and other quality related issues are discussed further in Chapter 4.

d. Ojai Valley: The major sources of water for agricultural water users in the Ojai Valley are Lake Casitas and groundwater within the Ojai basin. One or two small systems depend on naturally occurring springs. In addition to the local Ojai Valley demand on Lake Casitas supplies, agricultural users along the north coast of Ventura County also obtain water from Lake Casitas.

   Casitas MWD estimates that within their district boundary approximately 3,000 additional acres could come under irrigation by the year 2000 increasing agricultural water demand. Were this to occur, current local supplies may be insufficient to meet total demand. Importation of water would increase the ability of Casitas MWD to meet future demands. However, high quality imported water should be used to meet high quality water demand uses. Imported water could be used for potable uses while local surface and groundwater resources could be used for agricultural irrigation and/or other uses that do not require high quality water. Imported water is discussed further in Section V of this chapter.

e. North Coast: The North Coast area of Ventura County has no significant local groundwater. Water is supplied by Casitas. Most of the water delivered is used by farmers who have established avocado orchards in the area. The total water use in Zone 9 (Rincon) for fiscal year 1989-90 was 3,066 acre-feet, of which 2,678 acre-feet was used for agriculture.

2. Agricultural Water Use Summary: Currently, compared to residential, commercial and industrial water demands, countywide agricultural water demand appears to be decreasing. Future demand for agricultural water use is expected to decline by about 12% (35,000 AF/Y) by the year 2010. This projected decline is based on an expected reduction in agricultural acreage. However, if high water use crops such as strawberries, celery and the irrigation of turf replace low water use crops, agricultural water demand may actually increase even with fewer acres being farmed.

   Since most of the County's agricultural demands are met by groundwater, and that developed surface water supplies have actually increased due to the Pumping Trough Pipeline and Freeman Diversion projects, the decline in groundwater extractions for agriculture may be as high as 40,000 AF. To the extent reclaimed water is developed for irrigation use and more farmers become familiar with and implement efficient water use practices, a decrease in groundwater use may occur. Use of groundwater may remain somewhat constant or increase if high water use crops are grown.

B. Municipal and Industrial:

Municipal and industrial (M & I) water use encompass residential, commercial and industrial water uses. During water year 1990-91 countywide M & I water use accounted for approximately 32% (136,800 AF/Y) of the countywide water demand. It is not expected that this demand pattern would have changed significantly since 1990. Groundwater provided slightly less than one third of the water used for M & I uses countywide. The remaining two thirds was obtained primarily from imported supplies (State Water Project) and from surface water (primarily Lake Casitas). This ratio is expected to continue to the year 2010 unless additional imported supplies become available. Groundwater demand for M & I uses is expected to increase more slowly than demand on surface and imported water uses.

1. Municipal and Industrial Water Demand by Geographical Area: A discussion of current and expected M & I water use by geographical area is addressed below:

a. Oxnard Plain: On the Oxnard Plain, M & I users obtain most of their water from Calleguas MWD through imported water supplies and the United WCD which provides groundwater from the El Rio well field. A relatively small amount of M & I water is obtained directly by water agencies and individuals operating their own wells. In some portions of Oxnard, although groundwater meets State water quality standards, taste and odor are poor. Port Hueneme and the City of Oxnard maintain wells on the Oxnard Plain; however, Port Hueneme wells are used only in emergency situations. Total M & I demand on the Oxnard Plain is expected to increase significantly by 2010.

Due to poor quality of some local groundwater supplies, groundwater is sometimes blended with higher quality imported water to improve overall quality. The City of Oxnard presently blends city water supplies at a ratio of 1 part imported water to 1 part groundwater. Other water systems on the Plain (which rely entirely upon groundwater) are expected to collect and use approximately 12,600 to 14,500 AF/Y of groundwater. United WCD's Oxnard-Hueneme pipeline has a present design capacity of 16,500 AF/Y. Assuming this capacity is not expanded, water districts on the Oxnard Plain can be expected to increase imports from Calleguas MWD or improve water use efficiency in order to meet new water demands. Future use of Las Posas groundwater basins to store imported water will increase overall storage in the area for use during drought when supplies are limited.

Although M & I demand on Oxnard Plain groundwater supplies is increasing, it is undetermined whether demands from the agricultural section will increase or decline (see previous section on agricultural water demand). Some forecasts indicate that increases in M & I demand on the groundwater will be offset by decreases in agricultural demand even though M & I use may require treatment or blending. Other forecasts indicate that both M & I agricultural water demands will increase.

b. Santa Clara River Valley: The Santa Clara River Valley communities of Fillmore, Santa Paula and Piru depend entirely on groundwater to meet M & I demands. Increases in M & I demand due to population growth are expected to be approximately offset by declines in agricultural demand. Urbanization of the Santa Clara Valley communities is expected to take place almost entirely on agricultural land adjoining the communities. Overall, no net increases in water demand is expected.

c. City of Ventura: The City obtains water from five different sources: (1) Lake Casitas water via Casitas MWD, (2) Ventura River surface and groundwater from the Foster Park diversion in the Ojai Valley-Ventura River Basin (via a City pipeline), (3) wells in the Mound Basin, (4) Fox Canyon wells (located on the San Buenaventura Golf Course), and 5) wells in the Santa Paula Basin. These five sources supply water to different areas of the city.

The city of Ventura is expected to require additional water supplies. If the population grows in the eastern portion of the City, where water demand is met by wells perforated in the Mound and Fox Canyon Basins, the additional extractions from these basins may contribute to overdraft of the basins.

Although groundwater resources meet most State primary drinking water standards, much of the supplies have odor and taste problems. The motivation to import State water to the city of Ventura is two fold: to increase supply and improve quality by blending the higher quality imported water with poorer quality local groundwater resources. The City of Ventura has studied methods to import State water (see Section V, Alternative Resources, of this chapter). A water conservation ordinance approved by the City of Ventura in 1990 required residential, commercial and industrial users to conserve 30% and 15%, respectively. The ordinance reduced water demands and promoted water use efficiency. Due to increased rainfall, the ordinance was lifted in late March of 1992. Mandatory conservation of 10% is still being requested and it is expected that efficient water use will continue.

d. Conejo-Calleguas Basin: This area represents that portion of Ventura County served by Calleguas MWD. This includes the communities of Moorpark, Oak Park, Thousand Oaks, Camarillo and Simi Valley. (The City of Oxnard also receives Calleguas MWD water; their water needs are discussed as part of the Oxnard Plain discussion.) Most of the M & I demand is met through imported water sources provided by the Metropolitan Water District (MWD) of Southern California through facilities maintained by Calleguas MWD.

Some M & I demands are met by the Santa Rosa groundwater basin. The percentage of groundwater used for M & I purposes within the Conejo-Calleguas area is difficult to determine due to a lack of pumping records. However, by analyzing water supply sources and water demand factors within the Calleguas MWD service boundaries it appears that approximately 15% or less of M & I demands are met by local groundwater sources. Any future shortfalls are likely to be met by some combination of increased groundwater extraction, expanded efficient water use practices and/or accelerated development of additional local and imported supplies.

Historically, there has been some quality problems in the Santa Rosa Basin. Due to the location of a clay cap and a fault, nitrates from septic systems and agricultural activities are not flushed out. This and other quality issues are specifically addressed in Chapter 4.

Calleguas MWD and most cities within the Conejo-Calleguas basin have recently adopted conservation ordinances. Mandatory water conservation ordinances requiring reduction in water demands, are expected to result in decreased water demands and efficient water use practices.

e. Ojai Valley: M & I uses within the Ojai Valley depend on two primary sources for water: Lake Casitas and groundwater. Demands on Ojai Valley resources will increase in the future as population increases. However, the magnitude of increase will be less than in most other areas in the County as a result of new construction limitations via the Ojai Valley Clean Air ordinance. There will be relatively modest increases in water demand from the Ojai Valley on both surface and groundwater resources. During recent droughts Casitas MWD experienced difficulties meeting the combined M & I and agricultural demand. However, as discussed in the City of Ventura section, water demands can be reduced as they were in the late 1980's and early 1990's. The City of Ventura water conservation ordinance began in April 1990 requiring residential, and commercial and industrial users to reduce water use by 30% and 15%, respectively. The Casitas MWD conservation program goal of 25% to 30% reduction began July 1, 1990. By 1992, implementation of these conservation ordinances achieved a 38% reduction in M & I water demand. Moratoriums on new connections within the Casitas MWD were implemented, but have since been lifted due to increased rainfall and available water supplies. Although Casitas had been operating on safe yield for many years, these programs are assisting in sustaining water resources managed by Casitas MWD. Due to increased rainfall, in late March of 1992 the conservation ordinance was relaxed to a 10% voluntary reduction. Currently in 1994 water users are averaging at a 27% conservation savings.

2. Municipal and Industrial Water Use Summary: Residential, commercial and industrial water demands account for approximately 32% of Countywide water demand. Two thirds of the demand is met by imported State water and surface supplies (primarily Lake Casitas), while the remaining one third is provided by groundwater. Unless additional imported water supplies become available, the water supply ratio is expected to continue to the year 2010. M & I demands on imported and surface water resources are expected to increase faster than demands on groundwater. This is due to the overdrafting of and poorer quality of groundwater resources.

   Overall, M & I use is expected to increase from 128,000 in 1985, and 136,000 AF in 1990, to 174,000 AF in 2000 and 197,000 AF in 2010. Countywide, however, total groundwater extractions are expected to decline slightly, with decreasing agricultural demands being largely offset by increasing M & I use.

C. <u>In-Stream Uses</u>

1. Instream Flow Requirements

In addition to the "out of stream" agricultural and urban water demands described above, there are also "in-stream" uses that require water. In-stream beneficial uses include fish, wildlife habitat, and education, scientific and recreational activities which are dependent upon adequate water flow through rivers, streams, and wetlands. Instream flow influences fisheries by creating riffles and pools as habitat for game and nongame species. For wildlife, instream flow sustains the stream bank and flood plain riparian zones and provides sources of food such as fish, plants and invertebrates. Instream flow provides a corridor for migratory aquatic species to reach upstream spawning and rearing habitat. It helps maintain proper water temperatures and oxygen levels and to remove natural sediment and other wastes that can accumulate in the system (DWR, 1993). Although not easily quantified, a minimum streamflow is necessary to sustain certain plant and animal species populations.

Governor Wilson in his 1992 water policy made it clear that fish and wildlife protection must be an integral part of the States water management program and emphasized the need to balance the available water supply among often competing uses. Also, the Central Valley Project Improvement Act of 1992 requires the Secretary of the interior to provide firm water supplies to various wildlife refuges and habitat areas in the Central Valley. This new instream use requirement will reduce the availability of State Project water for other uses such as urban and agricultural uses. The recently published (1994) Draft California Water Plan identifies specific instream water flow requirements for specific water bodies in northern California. Instream water use requirements for water bodies in Ventura County have not yet been determined.

Identifying instream flow requirements for fish, wildlife habitat and other instream beneficial uses is a difficult task. Rivers, streams and wetlands are complex systems that contain diverse and interrelated physical, chemical and biological characteristics. Due to increasingly competitive demands for water, scientists have developed several methods for quantifying instream flow needs. Different methods are used depending on the specific characteristics of the water body in question. Such methods provide a somewhat standardized method for analyzing instream water needs. Most methods focus on the amount of habitat existing at different flow levels which can then be analyzed to assist in making flow recommendations. Such analysis is most commonly conducted to estimate fishery and recreation water needs but could prove to be an invaluable tool for water resource allocation negotiations. The State Department of Fish and Game's Stream Flow Evaluation Unit uses several methods for determining instream flow needs. Different methods are available depending on the specific characteristics of the water body under study.

Prior to the operation of United Water Conservation District's (United WCD) Freeman Diversion project, instream flow requirements of the Santa Clara River were determined by United WCDs water rights and conditions set by state and federal agencies. State Fish and Game issued a Streambed Alteration permit and the Federal Fish and Wildlife agency set the conditions in the 404 permit issued by the Army Corp of Engineers. Both permits set limits on the amount of water the Freeman Diversion project can divert from the river. However, these current instream flow requirements are considered minimum flows needed for steelhead to bypass the fish ladder, but do not consider sufficient upstream flows needed for habitat.

a. Steelhead trout

Steelhead trout, an anadromous fish, migrates from the ocean into freshwater for spawning. The Santa Clara River once supported thousands of steelhead trout and was one of many rivers along the Pacific Coast from Northern Mexico to Alaska with a thriving population of the anadromous fish. Currently steelhead no longer exist in Northern Mexico, and are now limited to very small populations in four Southern California streams; the Santa Clara River and Ventura River in Ventura County, Malibu Creek in Los Angeles County and the Santa Ynez River in Santa Barbara County. The California Department of Fish and Game consider steelhead to be on the verge of extinction south of San Luis Obispo, and are currently proposing the fish be considered for endangered species status along the Pacific Coast. The recent discovery of steelhead and smelt in the Freeman Diversion fish ladder has renewed interest in the species of the Santa Clara River locally. The Department of Fish and Game plans to have their Stream Flow Evaluation unit determine the instream flow requirements of the Santa Clara River and necessary tributaries within the next year or two to ensure sufficient habitat for the steelhead. In addition, State policy code as reflected in Section 6902 of the Fish and Game is to significantly improve salmon and steelhead population by year 2000.

b. Pacific lamprey

The Pacific lamprey, another anadromous fish also uses the Santa Clara River and its tributary Sespe Creek for its spawning area. The creek also supports a significant population of rainbow trout, cousin to the steelhead. Sespe Creek is designated as a "Wild Trout Stream" by the State of California which affords some protection of water flows and riparian vegetation, both threatened by water development projects and drought. The federal Los Padres Wilderness Act of 1992 permanently set aside 31.5 miles for steelhead trout protection and designated Sespe Creek as a

"Wild and Scenic River". Piru and Santa Paula Creeks, two other tributaries on the Santa Clara River, also support good steelhead habitats.

During low flow conditions, as part of their operating requirements the Casitas Municipal Water District does not collect the first 20 cubic feet per second (cfs) of flow at the Las Robles Diversion. This low flow bypass helps sustain a surface flow in the Ventura River from Casitas Springs to the Ventura River estuary.

c. Riparian vegetation

Riparian vegetation is found in wetlands along most of the permanent and ephemeral streams within the county. Extensive riparian growth exists along Piru, Sespe, and Santa Paula Creeks, and the Santa Clara and Ventura Rivers. Typical trees in these riparian communities include sycamores, willows, cottonwoods, and alders. The riparian vegetation provides essential habitat and migration corridors for wildlife in Ventura County. The vegetation provides shelter, food and nesting areas to create habitat for a wide variety of animal species. The riparian habitat is one of several plant communities in the county. Each community has different characteristics which support different species of wildlife, although an animal species may use various habitats at different times of the year or at various stages in the animal's life cycle.

Riparian areas support a great intensity and diversity of species. These species include the bank swallow, Western yellow-billed cuckoo, Southern Rubber boa, and migratory waterfowl. Populations of these species have greatly diminished as a result of human intrusion and degradation of animal habitats.

d. Wetlands

In August 1993, the California Wetlands Conservation Policy was adopted. The policy is designed to ensure no overall net loss in wetlands and to achieve a long-term net gain in the quantity, quality and permanence of wetlands acreage and values in California in a manner that fosters creativity, stewardship and respect for private property. Another goal is to encourage partnerships to create landowner incentive programs and cooperative planning efforts to focus on wetlands conservation and restoration. Such a policy will provide some strength behind developing and formulating local instream use requirements.

The coastal wetland and lagoons found along the south coast of the county provide shelter, forage and nesting areas for thousands of birds, fish, mollusks, crabs, seals, and many other marine organisms and plants. The wetland area with the richest diversity is the Mugu Lagoon, which shelters the remnants of many plant, bird, fish, and insect populations which once inhabited the coast from the Ventura River to the Santa Monica Mountains. Other wetlands include the McGrath Lake and Ormand Beach areas, and the mouths of the Ventura and Santa Clara Rivers. These are considered significant biological resources.

Locally, the California State Coastal Conservancy and the Ventura County Resource Conservation District has been preparing the Mugu Lagoon Watershed Local Implementation Plan. The plan's goal is to identify erosion and sedimentation factors which are contributing to the infilling of the Mugu Lagoon. The plan will propose treatment methods to reduce the sedimentation and erosion rates. Since 1990 a Mugu Lagoon Task Force, made up of representatives of the Soil Conservation Service, Resource Conservation District, State Coastal Conservancy, Ventura County Flood Control District, Ventura County Resources Management Agency, Regional Water Quality Control Board., U.S. Navy-Point Mugu and other have met to share information, develop the scope of the plan and provide input on the development of the document. Results of the plan should benefit the Mugu Lagoon, but may take many years to implement. Currently, erosion and sedimentation estimates indicate that the lagoon will become filled within 40 to 50 years.

2. Conclusions and Recommendations

Although fish and wildlife are generally renewable resources, the rates of renewal are usually very slow and are often impeded by the disruptive forces of urbanization, human harassment, predator control and pollution. The species and riparian habitat of the rivers, lakes, streams and other wetland areas in the county are of aesthetic, ecological, educational, historic, recreational and scientific value to the people of Ventura County and the nation.

Therefore, the following recommendations are made to address the issue of instream water uses.

a. Coordinate with the state Department of Fish and Game's Stream Flow Evaluation Unit to determine instream flow requirements to maintain and restore instream beneficial uses, such as fish, wildlife habitat, recreation, education and scientific interests.

b. Develop programs to prevent the transport of pollutants from entering receiving waters. See Chapter 4 program recommendations for urban stormwater runoff and agricultural runoff.

III. CURRENT AND FUTURE OVERDRAFT, SUPPLY AND DEMAND CALCULATIONS

A. Introduction

1. Definition of Overdraft

Overdraft occurs when long-term pumping exceeds replenishment. The concept of overdraft can be understood by thinking of a groundwater basin as a checking account and water in the basin as money in the account. If checks are written in excess of deposits, the account becomes overdrawn. Similarly, if more water is pumped out than is replenished (either through natural or artificial means) the basin becomes overdrafted.

2. Overdraft - A Critical Issue

The overdrafting of local groundwater basins and resulting seawater intrusion are critical problems threatening current and future countywide water resources. Overdrafting of a basin can cause short and long-term effects. Short-term effects of overdraft can result in the lowering of water levels and corresponding depletion of the supply. Continued overdrafting can cause long-term effects. The lowering of water levels can cause concentration of certain organic and inorganic constituents in the basin resulting in serious degradation of water quality to the point where groundwater becomes unusable.

The most serious result of overdraft along the coast is seawater intrusion. Continued overdrafting reduces basin pressure causing adjacent basins or seawater to migrate laterally into the area of reduced pressure. When seawater migrates into an overdrafted basin the condition is called seawater intrusion. Seawater intrusion can cause serious water quality degradation, in some cases rendering basins useless.

Today, much of the public is unaware of the seriousness of overdrafting and the resulting consequences. Water, although not available in sufficient amounts and with sufficient quality to meet long-term demands, is today still readily available at reasonable prices. Because the water is available today the practice of overdraft continues, further contributing to long-term impacts, many of which may be irreversible.

3. Overdrafted Basins in Ventura County

In Ventura County, the practice of overdrafting has resulted in the depletion of water supplies, lowering of water levels and water quality degradation from mineral concentration and seawater intrusion. Degraded water quality has caused some basins to become unusable, further reducing countywide water supplies.

The Department of Water Resources (DWR) Ground Water Basins in California report (January 1980) to the State identified groundwater basins subject to "critical conditions of overdraft." The definition of "critical conditions of overdraft." The definition adopted for use in the DWR report included the following: "A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social and economic impacts." Adverse impacts do not necessarily occur through an entire basin. Water levels may be rising in one portion of the basin, or in one aquifer, even though the basin is overdrafted or subject to critical conditions of overdraft. A good example of this is the rising groundwater levels that are being observed in some portions of the North Las Posas Basin while the eastern portion of the basin is being seriously overdrafted.

Within the South Coastal Hydrologic area, DWR identified 58 groundwater basins. Of these, the Ventura Central Basin was identified as subject to a critical condition of overdraft. On a state-wide basis it is one of 11 basins identified as subject to this critical condition of overdraft (see Figure 3.5).

The Ventura Central Basin includes four distinct drainage areas; they include the Santa Clara River Valley, Pleasant Valley, Arroyo Santa Rosa Valley and Las Posas Valley. These four drainage areas provide inflow to the Oxnard Plain. In 1980 the State Water Resources Control Board (SWRCB) studied the seawater intrusion beneath the Oxnard Plain proclaiming it the most serious intrusion in the State. They also provided the County and the United Water Conservation District (United WCD) with an $8 million grant to help build the first phase of a two phased seawater intrusion abatement project. This two-phased project included the Vern Freeman Diversion and Pumping Trough Pipeline Project are discussed further in Section C of this Chapter, Current Projects to Reduce Overdraft.

FIGURE 3.5 BASINS SUBJECT TO CRITICAL CONDITIONS OF OVERDRAFT OR WITH SPECIAL PROBLEMS

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B. History of Overdraft and Seawater Intrusion

Seawater intrusion of the Oxnard aquifer zone was first identified in the early 30's. This discovery was the first indication of the serious consequences of overdrafting practices. Intrusion of seawater into aquifer systems has been the most serious consequence of overdrafting in Ventura County. In 1989 the United States Geological Survey (USGS) began a four year Regional Aquifer System Analysis (RASA) study of the Oxnard Plain area. Although no official report has been published, the USGS has issued some preliminary information on results of the survey. The USGS constructed wells along the coast and at inland locations on the Oxnard Plain. Isotopic analyses of these and other wells indicated that the water at many locations had not been mixed with seawater as was previously thought. Many inland wells designated as intruded because of high chloride content were, in fact, yielding water from the perched zone because of failed well casings. The true seawater intruded area is probably between 11 and 16 square miles, considerably less than the 22 square mile area previously thought to be intruded by seawater from overdrafting. Additional data on this subject is addressed in Chapter 4.2.A, Water Quality, Non Point Sources, Seawater Intrusion. Seawater intrusion is discussed further in Chapter 4.2.A of this volume.

1. Calculating Overdraft

Overdraft occurs when long-term pumpage exceeds replenishment. This definition sounds much simpler than calculating overdraft. Pumpage and replenishment figures are not always readily available. Therefore, several methods are used to calculate overdraft. The ability to calculate future overdraft is important. If future overdraft can be projected, management strategies can be implemented to prevent or reduce overdraft. Below is a discussion of several methods currently used to estimate overdraft.

a. Department of Water Resources Model Study

The historical overdraft on the Oxnard Plain has been calculated annually by the County since 1982. Calculations are based on actual water levels and changes in groundwater storage. This method uses modeling data developed by the Department of Water Resources (DWR) in 1976. A DWR report, Planned Utilization of Water Resources in Ventura County (November 1976) describes the modeling method.

For a 7 year period from 1982 to 1989 (during a period of below average rainfall) overdraft on the Oxnard Plain averaged 26,500 AF/Y. Slightly more than half of this overdraft has occurred in the Upper Aquifer System (UAS) which includes the Oxnard and Mugu aquifer zones (Table 3.1).

Another procedure that has been used for calculating overdraft uses data on groundwater recharge and extractions. When extractions exceed recharge to the detriment of a basin, overdraft occurs. This approach can be used to calculate historical overdraft or used to calculate future overdrafts assuming normal (long term) weather conditions.

To calculate historical overdraft, for example, in 1970 the Santa Clara-Calleguas groundwater basins were replenished with approximately 194,000 AF of local water from deep percolation of streamflow, rainfall, irrigation return flow and wastewater. The pumpage for that year totaled an estimated 260,000 AF (DWR Bulletin 104-8). Consequently, extractions that year exceeded recharge by an estimated 66,000 AF resulting in an overdraft of 66,000 AF.

b. Fox Canyon Groundwater Management Agency Studies

In 1984, following its formation in 1982, the Fox Canyon Groundwater Management Agency (GMA) prepared a number of task reports on water supply, demand and projected overdrafts. Figure 3.2 illustrates the Fox Canyon Groundwater Management Agency boundaries. The GMA includes the overdrafted basins of the Oxnard Plain, Pleasant Valley and Las Posas Basins. All of these basins are within United WCD boundaries with the exception of the North Las Posas Basin. Only a small westerly portion of this basin is within the United WCD.

Using land use projections that show increased demands for groundwater, and the assumption that recharge would stay constant at 120,300 AF/Y, the GMA projected increased overdrafts from 31,100 AF/Y in 1980 to 41,300 AF/Y in 2010. All projected water demands from 1990 to 2010

TABLE 3.1

SANTA PAULA RAINFALL AND HISTORICAL RECORD OF OXNARD PLAIN OVERDRAFT IN UPPER AND LOWER AQUIFER SYSTEMS (WATER LEVEL AND STORAGE METHOD)

WATER YEAR* (July 1-June 30)	Santa Paula Rainfall (inches) Co. No. 245	Overdraft** (AF/Y) UAS[1]	LAS[2]	TOTAL
1982-83	35.72	+ 16,950	- 6,300	+ 10,650
1983-84	11.08	- 12,300	- 9,200	- 21,500
1984-85	11.16	- 17,500	-11,300	- 28,800
1985-86	23.53	+ 11,000	- 9,800	+ 1,200
1986-87	7.42	- 37,300	-14,000	- 51,300
1987-88	15.75	- 7,700	-14,900	- 22,600
1988-89	10.47	- 57,000	-15,900	- 72,900
7 yr Totals	115.33	-103,850	-81,400	-185,250
7 yr Average	16.48	- 14,840	-11,630	- 26,470

Source: United Water Conservation District, Hydrologic Condition Reports for years 1986-87, 1987-88, and 1988-89, January 1990. More recent data has not been made available.

*"Water Year" as defined by the Water Code, means July 1, of one calendar year to June 30 of the following calendar year.

**Positive (+) represents recharge surplus, and Negative (-) represents overdraft.

[1]UAS = Upper Aquifer System includes the Oxnard and Mugu Aquifers.

[2]LAS = Lower Aquifer System includes the Hueneme, Fox Canyon and Grimes Aquifers.

were adjusted to reflect the completion and operation of Phase I and Phase II seawater intrusion abatement projects. The GMA projections of overdraft are shown in Table 3.2. Table 3.1

c. Comparing Different Sources of Data

One of the difficulties with using data from different sources, in this case with the United WCD and GMA studies, is that different areas were studied during different periods of time using different procedures to calculate overdraft. The two studies are not comparable.

The work done for the GMA was based on average annual, "normal" rainfall conditions with estimated overdraft based on future projected changes in population, growth and land use as projected in the County's General Plan. Results from this type of study can be used for long-term planning purposes but can rarely be used to support technical work for specific projects.

TABLE 3.2

PROJECTED AVERAGE ANNUAL OVERDRAFT AND SURPLUS IN THE GMA (RECHARGE AND EXTRACTION METHOD)

(AF/Y)

Basin	1980	1985	1990	1995	2000	2005	2010
Oxnard Plain, Pleasant Valley & North Offshore Sub-basin	-23,700	-23,400	-25,500	-25,400	-25,200	-24,900	-25,200
North Las Posas Basin	- 8,400	-10,000	-11,400	-12,900	-14,600	-16,200	-17,800
South Las Posas Basin	+ 600	+ 700	+ 900	+ 1,100	+ 900	+ 1,300	+ 1,300
Santa Rosa	+ 400	+ 400	+ 400	+ 400	+ 400	+ 400	+ 400
GMA TOTAL	-31,100	-32,300	-35,600	-36,800	-38,500	-39,400	-41,300

Source: Ventura County Public Works Agency, Flood Control and Water Resources Department, Change in Groundwater Storage in the Fox Canyon Groundwater Management Agency from 1980 to Year 2010 (March 1984). GMA Task Reports 84-7 and 84-8

These estimates include Phase I and II of the Vern Freeman Diversion Project.

Note: - Denotes amount of overdraft, + Denotes surplus

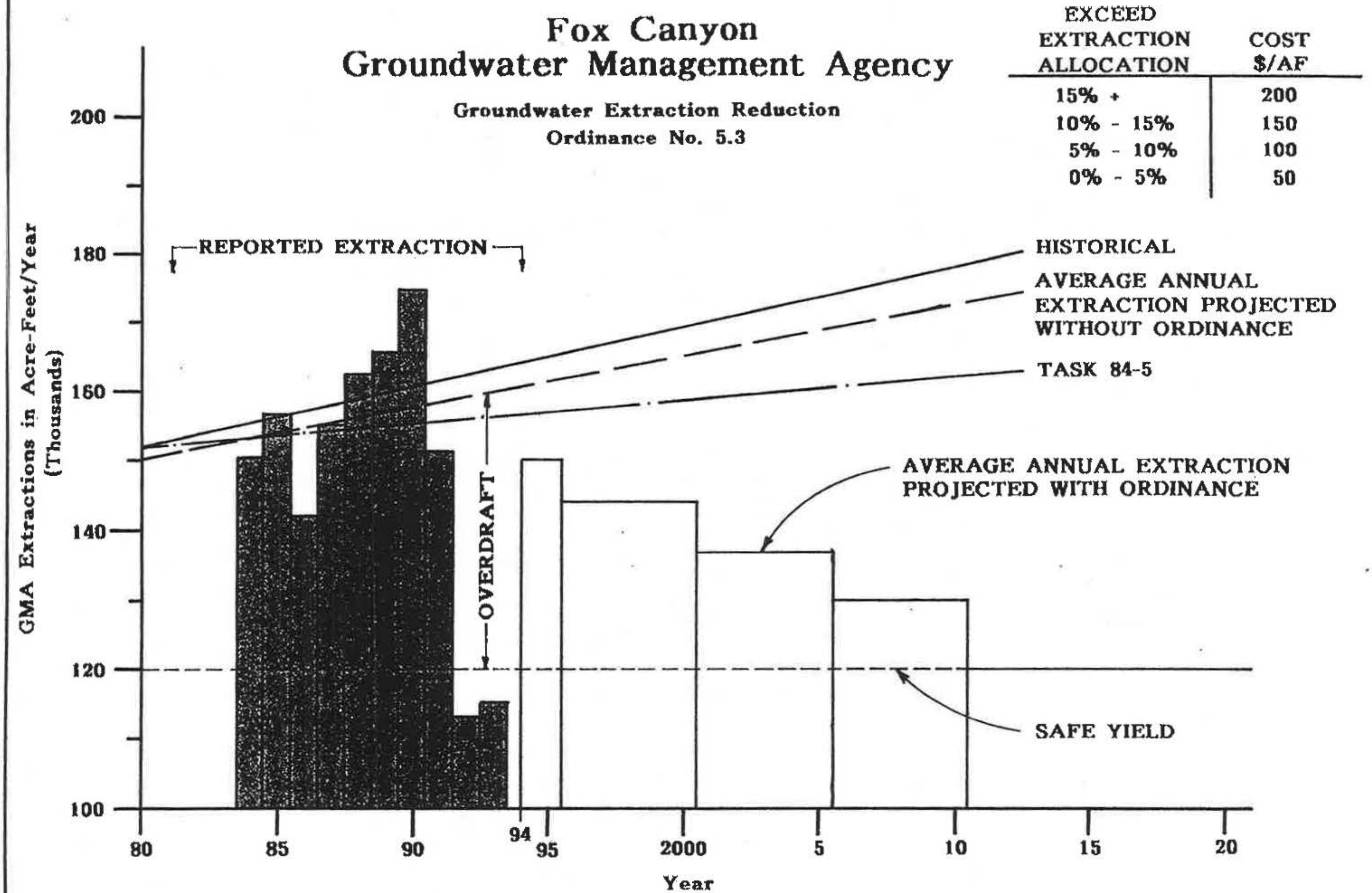


Figure 3.6 Projected GMA Extractions with and without Ordinance No. 5.3

5-3-94

The United WCD overdraft calculations shown in Table 3 are more technical and precise. They give the most accurate figure possible for overdraft at a specific point in time using actual water levels and a formula based on mathematical model studies that compute changes in storage within a basin.

2. Shift in Overdraft from Upper Aquifer System (UAS) to Lower Aquifer System (LAS)

A comparison of active well data from 1984-1989 indicates a trend from Upper Aquifer System (UAS) groundwater extractions to Lower Aquifer System (LAS) extractions. Well data reviewed include several task reports conducted by the Ventura County Public Works Agency for the Fox Canyon Groundwater Management Agency. These include a 1984 report, Identify Active Water Wells - Task 84-4 (June 1984), Evaluation of Upper and Lower Aquifer System Extractions in the Fox Canyon Groundwater Management Agency - Task 86-4 (Ventura, June 1986), and an update to the Active Water Well Map conducted in November of 1989 (unpublished). A shift in pumping from the UAS, to the LAS, could result in a shift in overdraft from the UAS to the LAS. This in turn could result in seawater intrusion into the LAS.

Several factors have influenced a trend toward LAS pumping. These include a recent ordinance prohibiting new UAS wells and the implementation of Phase I of the Seawater Intrusion Abatement Project. A County water well ordinance prohibits the drilling of new UAS wells on the Oxnard Plain where such extractions could cause more seawater intrusion. Because of the restriction on UAS extractions, permit applications for LAS wells have increased. As a result, the number of LAS well permits issued have increased. Implementation of Phase I of the Seawater Intrusion Abatement Project operated by United WCD has also played a major role in LAS pumping. The project included County construction of a Pumping Trough Pipeline (PTP) and LAS wells and the removal of forty-seven (47) UAS wells from service. The project has been in operation by United WCD since 1986 and is a major mechanism in preventing further seawater intrusion in the UAS.

Unfortunately, this shift in groundwater extractions from UAS to LAS has accelerated the rate of overdraft and seawater intrusion of the LAS. This became apparent for the first time in October 1989 when one of five new USGS/United WCD monitoring wells (CM-2) constructed in Port Hueneme showed evidence of lateral seawater intrusion.

a. Overdraft and Intrusion of the Lower Aquifer System

Earlier County studies for the Seawater Intrusion Abatement Project indicated that landward intrusion of the LAS wouldn't occur for 100 to 150 years. However, it is now apparent that the LAS is just as vulnerable to seawater intrusion as the UAS. Proper management of the LAS basin could render the basin a long-term but limited resource.

The following Tables, 3.3, 3.4 and 3.5 provide recent and projected overdraft conditions in the Upper Aquifer System (Table 3.3) the Lower Aquifer System (Table 3.4) and the combined systems (Table 3.5).

3. North Las Posas Basin Overdraft

In the North Las Posas Basin, water levels in the easterly portion of the basin, east of Balcom Canyon Road, continue to recede. A task report prepared by the GMA suggest that increased extractions in the basin will lower water levels from 200 to 300 feet between 1980 and 2010 (Ventura, Task 84-10, July 80). Such lowering of water level would cause some areas to become dewatered around the periphery of the east end of the basin. In the Fairview area, the static distance to water is projected to lower between 600 and 700 feet in 1980 to somewhere between 800 and 1000 feet in 2010.

Table 3.3: Overdraft in the Upper Aquifer System (UAS)

Year	UAS Groundwater Recharge (Af/Y) (1)		UAS Projected Extractions (AF/Y) (2)		UAS Overdraft (Af/Y) (3)	Surplus (AF/Y)
1985	67,600	-	73,300	=	-8,700*	
2000	100,300	-	79,400	=	0	(20,900)
2010	100,300	-	80,800	=	0	(19,500)

(1) The UAS receives approximately 100,000 Af/Y of the estimated 120,300 Af/Y total recharge (GMA Water Balance, 1989, Table 2) to the GMA area (GMA, pers. comm., 2/89). Recharge from the completed Freeman Diversion is included in this total. This assumes that recharge remains constant. This may not be the case, as factors such as drought could reduce recharge and factors such as increased reservoir/storage capacity could increase recharge by releasing water year round into the ground, rather than releasing it to the ocean only during the winter months.

(2) Based on 50% of the total projected extractions for the GMA area. Fifty percent is based on an average of 6 years of pumping data, assuming wells which perforate both the UAS and the LAS are actually LAS wells; and dividing unknown well extractions between the two aquifer systems (GMA Task 86-4, 1986, Table 5). Total projected extractions are 152,000 Af/Y in 1985, 158,000 Af/Y in the year 2000, and 161,600 Af/Y in the year 2010 (GMA Task 86-3, 1985, Table 1).

(3) The Freeman Diversion Project was not in full operation in 1985.
The Freeman Diversion Project was completed in early 1991.

Table 3.4: Overdraft in the Lower Aquifer System (LAS)

Year	LAS Groundwater Recharge (Af/Y) (1)		LAS Projected Extractions (AF/Y) (2)		UAS Overdraft (Af/Y) (3)	Surplus (AF/Y)
1985	20,000	-	76,300	=	-56,300	(0)
2000	20,000	-	79,400	=	-59,400	(0)
2010	20,000	-	80,800	=	-60,800	(0)

(1) The LAS receives approximately 20,000 of the estimated 120,300 Af/Y total recharge (GMA Water Balance, 1989, Table 2) to the GMA area (GMA, pers. comm., 2/89). Recharge from the completed Freeman Diversion is included in this total. This assumes that recharge remains constant. This may not be the case, as factors such as drought could reduce recharge, while factors such as increased reservoir/storage capacity could increase recharge by releasing water year round into the ground.

(2) Based on 50% of the total projected extractions for the GMA area. Fifty percent is based on an average of 6 years of pumping data as noted in Table A above (GMA Task 86-4, 1986, Table 5). Total projected extractions are 152,600 Af/Y in 1985, 158,000 Af/Y in year 2000, and 161,600 AF/Y in the year 2010 (GMA Task 86-3, 1985, Table 1). These projected pumping levels may be reduced in the future to reduce overdraft in the LAS.

Table 3.5: Combined (UAS + LAS) Overdraft in the GMA Area

Year	Groundwater Recharge (AF/Y) (1)		Projected Extractions (AF/Y) (2)		Overdraft (AF/Y)
1985	120,300	-	152,600	=	-32,300
2000	120,300	-	158,800	=	-38,500
2010	120,300	-	161,600	=	-41,300

(1) From GMA Water Balance (GMA, 1989, Table 2). This assumes that recharge remains constant. This may not be the case, factors such as drought could reduce recharge and factors such as increased dam capacity could increase recharge by releasing water year round into the ground rather than releasing it to the ocean only during winter months.

(2) From GMA (Task-3, 1985, Table 1). These pumping levels may be reduced in the future to reduce overdraft.

C. Current Projects to Reduce Overdraft

Currently, many projects to reduce overdraft are being implemented. The Vern Freeman Diversion Project, Fox Canyon Groundwater Management Agency (GMA) activities, and the Calleguas MWD - City of Oxnard-Injection Program, are all being implemented with the common goal to reduce overdraft by increasing supply and/or limiting groundwater extractions. The three programs are discussed below.

1. Vern Freeman Diversion Project

The Vern Freeman Diversion Project has been financed, constructed and implemented through coordination between the United WCD, the County Public Works Department and the State Department of Water Resources. The diversion structure is constructed on the Santa Clara River in Saticoy. The project diverts river flow which would otherwise eventually reach the ocean. The Diversion project diverts water from the Santa Clara River for delivery to users on the Oxnard Plain through the Pumping Trough Pipeline, Pleasant Valley County Water District or percolation into groundwater basins through spreading grounds. Diverted water from the river percolates into the aquifer to prevent further intrusion by seawater. It should be noted that not all of the diverted water acts as recharge, some is lost to evaporation. Pumping Trough Pipeline deliveries are used by those who have halted use of their shallow wells which previously pumped Oxnard UAS water.

Currently, the Vern Freeman Diversion project has the capacity to divert up to 53,000 AF/Y during years of average rainfall. From October 1991 to late March 1994, the Freeman Diversion diverted 299,185 AF. During drought conditions, diversions will be less than design capacity. During the fifth year drought condition, diversions were approximately 28 percent or 15,000 AF/Y of design capacity.

2. Fox Canyon Groundwater Management Agency Activities

The Fox Canyon Groundwater Management Agency (GMA) was created through State legislation in 1982 to manage groundwater resources in the area overlying the Fox Canyon Aquifer zone. The objective of the GMA is to control and reduce groundwater overdraft. The boundary of the GMA is shown in Figure 3.2. The GMA area of responsibility includes the Oxnard, Mugu, Hueneme, Fox Canyon and Grimes Canyon aquifers (see Figure 3.3 and 3.4). These aquifers collectively contain more than 18 million AF of fresh water in storage and supply about 70 percent of the area's total water demand (County of Ventura, Public Works Agency, December 1990). However, a portion of the water that meets that 70 percent water demand is causing an overdraft condition. The aquifer cannot continue to meet this demand into the indefinite future.

The GMA staff has prepared a groundwater management plan to be implemented by the GMA, County, cities and water agencies to control overdraft. A major element of the plan is an extraction reduction ordinance which was adopted by the GMA Board in September 1990. The ordinance requires pumpers within the Fox Canyon GMA boundaries to reduce their pumpage by 25% over the next 25 years beginning with a 5% reduction by 1992. If groundwater users can prove 80% efficiency, reductions may not be required. The plan has a variety of programs including groundwater extraction limitation ordinances, which includes the prohibition of drilling new wells in areas subject to seawater intrusion, encouragement of waste water reclamation and water conservation, seawater intrusion abatement, monitoring and meter programs. The Vern Freeman Diversion Project, the role of the GMA, and the prohibition of new UAS aquifer wells are further discussed in Chapter 4.2 of this volume.

3. Calleguas MWD-City of Oxnard, Oxnard Aquifer Injection Project

In October 1989, the City of Oxnard initiated an injection extraction project using 1717 AF of imported State Project Water from the Metropolitan Water District (MWD) of Southern California delivered through the Calleguas (Calleguas MWD) facilities. This program was designed to allow for the injection, as available, of high quality imported water into the Oxnard Aquifer during the winter months (October through April each year), and for extraction of the injected water during the summer months (May through September). Imported water was injected in the winter of 1989 and pumped back out during the summer of 1990 reducing the overdraft of the basin. The use of the Oxnard Aquifer as a storage reservoir eliminates the need for construction of an above ground reservoir, and provides for a good recovery rate (City of Oxnard, Public Works 1990). The injection project has been continued the last several years. Because of the flat gradient, the injected water does not appear to drift away from the injection point. This program appears to be successful and is planned to be continued.

4. Calleguas MWD-MWD of Southern California Las Posas Basin Injection-Extraction

Calleguas MWD and MWD of Southern California implemented an Injection and Extraction Project in the North Las Posas Basin beginning in mid March of 1991. Storage of water takes place through injection wells when surplus water is available, typically during winter months.

Extraction will occur during peak demands in summer months. Total available storage of the basin is estimated at 300,000 AF. Over the next year the capacity of the basin will be tested. Depending on results of capacity testing, the North Las Posas Basin may be used for annual or seasonal storage.

D. Future Solutions to Overdraft

Additional future plans and projects to reduce overdraft that will be completed in the foreseeable future are listed in Table 3.6. As illustrated in the table, these programs could provide 39,500 or more AF/Y of water. These plans and projects are briefly addressed below or referenced where in this document the projects are addressed.

1. Fox Canyon Groundwater Management Agency Groundwater Extraction Reduction Ordinance No. 5.3

   For more than two years, the GMA worked to develop a groundwater extraction reduction ordinance which was adopted in August 1990. Ordinance No. 5.3 was prepared to reduce groundwater extractions over an 18 year period starting in 1992. The reduction in pumpage is unknown because the ordinance doesn't mandate reductions, operators can continue pumping by paying surcharges. Irrigators can also avoid reductions by providing evidence that their irrigation efficiency is 80 percent or better. Without these provisions, Ordinance No. 5.3 would theoretically reduce pumpage by 30-40,000 Af/Y. Proposed reductions are illustrated in Figure 3.6 - Projected GMA Extractions With and Without Ordinance No. 5.3.

2. Water Demand Management (conservation) programs to encourage increased irrigation efficiency or other water use efficiency. Efficient water use would reduce water demands on groundwater basin currently experiencing overdraft and resulting seawater intrusion. These and other demand management programs are discussed later in this chapter in Section IV.

3. Conjunctive Use projects could provide a vehicle to conjoin water resources to provide water where and when it is needed. Such programs could ease demands on overdrafted basins. These programs are discussed later in this chapter in Section V.D, Alternative Sources.

4. Treatment of Poor Quality Basin Water

   Treatment of poor quality water would provide an additional water source which otherwise would not be available. The treatment of the Santa Paula basin is discussed later in this chapter in Section V, Alternative Sources, D. Santa Paula Salt Balance Pumping. Treatment of other basins which currently have poor quality water needs to be examined.

TABLE 3.6

MANAGEMENT PLANS AND PROJECTS TO REDUCE FUTURE OVERDRAFTS

Plan/Project*	Plan/Project Yield (AF/Y)	Implementation and/or Completion Date
1. GMA Ord. No. 5.3	Unknown (possibly 30,000 - 40,000).	1992/2010
2. Demand Management	Savings unknown. Depends on projects.	1980/continuing and new programs.
3. Conjunctive Use	Savings depend on project.	Some still need to be implemented.
4. Treatment of Poor Quality Basin water	up to 11,000	To be implemented.
5. State Project Water Importation	20,000	To be implemented.
6. Thousand Oaks-Hill Canyon Reclamation Project	7,000	1995
7. Oxnard Wastewater Treatment Plant	20,000 (Portion of which)	2000
8. Gravel Basin Storage	Unknown	1994
TOTAL	39,500	

*See previous page or below for brief program and project descriptions. The Demand Management Programs are discussed in more detail in the following Section IV Demand Management Alternatives.

. . . .

5. Importation of State Project Water entitlement of 20,000 AF/Y now under contract to the Casitas Municipal Water District (Casitas MWD), the City of Ventura, and the United Water Conservation District (United WCD).

6. The Thousand Oaks Hill Canyon Wastewater Reclamation project is designed to provide reclaimed water for agricultural use on the Oxnard Plain. The availability of this source will reduce groundwater extractions.

7. The United WCD is currently proposing a Gravel Basin Storage Pilot Project. If proved viable, this project could increase the efficiency of the Fox Canyon Seawater Intrusion Abatement project by providing additional spreading ground area to store Santa Clara River flows diverted by the Freeman Diversion Project.

E. Future Studies on Overdraft

The GMA will review the effectiveness of Ordinance No. 5.3 every five years. Status reports on the overdraft condition will be prepared. United WCD will also continue to monitor overdraft in their district as it varies from year to year.

As mentioned earlier in this document the most ambitious study now underway is a Regional Aquifer System Analysis (RASA) cooperatively being prepared by the U.S. Geological Survey and UWCD. Field study was conducted for four years from 1989-1993. Analysis of data is currently taking place and although no official document has been published, some data findings of the study have been released by the USGS. Results will provide management options and a great deal of information on supply, demand and the response of the groundwater basins to various management options.

F. Net Surplus/Deficit and Supply and Demand Calculations

The following pages include Tables 3.7, 3.8 and 3.9, which illustrate the net surplus/deficit of the three major wholesalers in the county: Casitas Municipal Water District, United Water Conservation District, and the Calleguas Municipal Water District. (Tables 3.7.a and 3.7.b, 3.8.a and 3.8.b, 3.9.a and 3.9.b provide the base data for conclusions made in Tables 3.7, 3.8 and 3.9, respectively). The tables summarize net surplus/deficit by subtracting demand from supplies for each district. Surplus and deficit are estimated for the years 1990, 2000 and 2010. The left column represents surplus/deficit based on current and known future supplies. This is the low supply figure from the supply tables (Tables 3.7.a, 3.8.a and 3.9.a). The right column represents surplus/deficit based on possible future supplies. This is the high supply figure from the supply tables. Both supply scenarios assume an average demand based on population and agricultural acreage projections as detailed in the demand Tables 3.7.a, 3.8.a and 3.9.a. Supplies which do not appear feasible due to economic or environmental constraints are not included. Tables 3.7.b, 3.8.b and 3.9.b provide demand figures. This demand may vary 10% or more due to annual or extended dry/wet periods.

Table 3.7: Casitas MWD (Supply and Demand Comparison)

Year	Supplies Minus Demand (Current Supplies-AF/Y)	Supplies Minus Demand With Additional State Water Supplies AF/Y
1990	2,842	2,842
2000	963	7,993
2010	493	7,493

Source: Table 3.7.a (average demand for years 2000 and 2010) and Table 3.7.b.

Table 3.8: United WCD (Supply and Demand Comparison)

Year	Supplies Minus Demand (Current Supplies-AF/Y)	Supplies Minus Demand With Additional Supplies-AF/Y (Local Transfers and Imported Water)
1990	27,841	27,841
2000	-9,012	64,088
2010	-82	73,018

Source: Tables 3.8.a and 3.8.b.

* Current and additional supplies will not be sufficient to eliminate overdraft in the LAS.

Table 3.9: Calleguas MWD (Supply and Demand Comparison)

Year	Supplies Minus Demand (Current Supplies AF/Y)	Supplies Minus Demand With Additional Supplies (AF/Y)
1990	11,704	11,714
2000	32,066	32,066+
2010	31,748	31,748+

Source: Tables 3.9.a and 3.9.b.

\+ Indicates that Calleguas has a greater capacity for State water, but that water is not a guaranteed supply.

Table 3.7.a: Casitas MWD Demand
(in Af/Y, including unaccounted water)

Year	Population (1)	AF/cap (2)	M/I	Ag/ac (3)	AF/ac (4)	Agric. Demand	Oil (5)	Unaccounted (6)	Total
1990	50,878	.22	11,193	7,050	2.0	14,100	4,430	1,160	30,883
2000	55,060	.18	9,910	8,160	2.0	16,320	4,320	1,302-1,722	31,852-32,272
2010	59,147	.18	10,646	8,160	2.0	16,320	3,280	1,266-1,686	31,512-31,942

(1) Figures based on the Countywide adopted population figures (Ventura Council of Governments, VCOG, July 1993).

(2) The 1990 per capita rates are based on an average of unit use factors from the Ventura County Water Conservation Program Water Use Survey, 1992. Year 2000 and 2010 are based on 1991 and '92 use factors which assumes continued implementation of efficient water use practices.

(3) 1990 figures based on actual crop report data received by Casitas MWD from Casitas customers and report on feasibility of importing water into Ventura County (1987). (Casitas MWD, 1/7/89, pers. comm.). Year 2000 and 2010 figures based on "firm estimates from developments in progress or planned" for agricultural land that could be developed within currently designated agricultural areas with soil class 1-4 (Montgomery, 1987, p. 2-8, Casitas MWD, 12/89, pers. comm.).

(4) Based on an average demand during normal rainfall from actual data in the Casitas district.

(5) Based on "the latest estimates furnished by the various oil companies" excluding the Petrochem facility (Casitas UWMP, 1985, p. 8). This is assumed more reliable than other estimates of "maximum potential demand", which included the currently idle petrochem facility (Montgomery, 1987, p. 2-80).

(6) Figures based on an estimated 3% in unaccounted water for water delivered by Casitas MWD (.03 x 20,350 AF/Y = 610 AF/Y) and 6% for water delivered by other purveyors and individuals (.06 x total supply - 20,350 Af/Y). These figures are based on records maintained by Casitas MWD and personal communications with the City of Ventura (2/89). This unaccounted water includes unmetered uses (firefighting, etc.) and water losses (leaks, illegal connections, etc.).

Table 3.7.b: Casitas MWD Supply (AF/Y)

Year	Ground (1)	Surface (2)	State Imports (3)	Local Transfers (4)	Reclaimed (5)	Total
1990	12,825	21,920	0	0	0	39,745
2000	11,535-13,535	21,700	0-5,000	Unknown	0	33,235-40,235
2010	10,935-12,935	21,500	0-5,000	Unknown	0	32,435-39,435

(1) Low range based on estimates from: (a) past average usage of 4,500 AF/Y from the Ojai Basin; (b) past average usage of 5,500 AF/Y from the Ventura Basin and other small basins (2,800 AF/Y from surface diversions and wells upstream from the Robles-Casitas Diversion Dam and Canal, 2,200 Af/Y from wells between the Robles Diversion Dam and the Foster Park facilities and 500 Af/y in incidental use from small groundwater basins); and (c) a declining quantity of water pumped by the Foster Park facilities which is used in the west end of the City of Ventura, within Casitas MWD. This Foster Park water totals 2,735 Af/Y for 1990, 1,535 AF/Y for the year 2000 and 935 AF/Y for 2010, and was determined by subtracting deliveries in the east end of the city from an average 6,000 Af/Y of water provided by the Foster Park facilities.

The high range assumes: (a) increased yield of 2,000 AF/Y will be obtained from the Ojai Basin through coordinated operation of Lake Casitas and the Ojai Basin and (b) a declining portion of the Foster Park water as outlined above.

"Safe yields for the Ojai, Ventura and other groundwater basins, are dependent upon how basin supplies and demands are managed in conjunction with Lake Casitas supplemental supply" (Casitas MWD, 6/94, pers. comm.). Under present conditions increased Ojai and Ventura River Basin pumping occurs during wet periods, there by reducing demands on Lake Casitas.

(2) Based on the estimated annual safe yield of Lake Casitas of 21,500 AF/Y in 1990 with an additional 420 AF attributed to Lake Matilija integrated operation (Bureau of Reclamation: Casitas MWD). This water can only be used in that portion of the City of Ventura within the Casitas District boundaries. It is estimated that Lake Matilija contribution for safe annual yield will be reduced to 200 AF in year 2000 and 0 AF in year 2010. It is assumed that no additional surface water projects identified in the 1980 Areawide Water Management (208) Plan (p. 23) and the Casitas UWMP (p. 10) will be developed due to high

cost and environmental impacts. These include additional surface water from the Upper Ventura River, San Antonio Creek, Robles Diversion Canal and Matilija Dam. Estimates also do not include the 6,000 Af/Y provided by the Foster Park facilities (owned and operated by the City of Ventura). This water is included under United WCD local transfers because the water is primarily used in the east end of the city.

(3) State water entitlement has been indefinitely postponed in favor of investigation of a desalination facility passed by a majority of the voters in the City of Ventura. Some volume of water may be available to the portion of the City of Ventura served by Casitas if facilities are constructed by 2010.

(4) No local transfers of water from other water districts into Casitas MWD currently occur. However, local transfers may occur in the future if a proposal for a pipeline intertie project between Casitas, City of Oxnard, City of Ventura, United WCD, and Calleguas MWD is successful.

(5) Previous estimates of 1,300 to 1,600 AF/Y from the Ojai Valley Sanitation Treatment facility are assumed to be impractical, and no other reclamation projects are anticipated (Casitas MWD, 12/88, pers. comm.). Water reclaimed by the City of Ventura is accounted under the United WCD reclaimed water because it is primarily used in the east end of the city within United WCD boundaries.

Table 3.8.a: United WCD Demand
(in AF/Y, including unaccounted water)

Year	Population (1)	AF/cap (2)	M/I	Ag/ac SCV (3)	Ag/ac Cp (4)	AF/acre (5)	Agric. Demand	Unacct. (6)	Total
1990	205,250	.22	45,155	32,065	30,560	3.10/3.80	209,417	13,463	268,035
2000	256,022	.18	46,083	31,810	29,695	2.41/3.07	167,826	13,003	226,912
2010	281,494	.18	50,669	28,915	27,525	2.41/3.07	154,187	13,126	217,982

(1) Based on countywide population forecasts adopted by the Board of Supervisors (6/93) and VCOG (7/93), which were assigned to the wholesale water districts according to analysis zones (Table 1-2 of the Ventura County Water Conservation Management Plan (VC WCMP), which was derived from 208 and Basin 4A plans and from Table 1-1 in the 1992 Annual Report of the WCMP. District-wide figures include one third of the Oxnard population (growth area and non-growth area) for 1990 and one half for 2000 through the year 2010, assuming the amount of water supplied to Oxnard by United and pumped by Oxnard stays constant at one half of their needs. The blending ratio for water in the City of Oxnard changed from 2:1 (imported/ground water) to 1:1 in July 1993. Figures from the Ventura Council of Governments (VCOG) Population Forecast, 7/14/93, minus one half of the population of Oxnard as follows:

1990 -- 299,113 (total pop.) - 93,863 (2/3 Oxnard) = 205,250
2000 -- 333,332 (total pop.) - 77,310 (1/2 Oxnard) = 256,022
2010 -- 365,007 (total pop.) - 83,513 (1/2 Oxnard) = 281,494

(2) The 1990, 2000, and 2010 water use factors are based on the Countywide Water Conservation Program's Water Use Survey of 1992. 1991 and 1992 use factors are used to project year 2000 and 2010 water use assuming water conservation is promoted and actively implemented in the County.

(3) Based on agricultural acreage from the draft Land Use Appendix and irrigated Farmland data from the Important Farmlands Inventory (VCGP EIR, 1988, p. 61).

(4) Ibid.

(5) Based on United's Annual Report (Montgomery, 1988, p. 2-10). Based on water use factors of 2.41 acre feet per acre per year for Santa Clara Valley and 3.07 acre feet per acre per year for Coastal Plain except for 1990 which is based on actual agricultural water use.

(6) Based on a constant 6% of the low total supply estimates in Table 3.8.b.

Table 3.8.b: United WCD Supply (AF/Y) (Calendar Year)

Year	Ground SCV (1)	Ground CP (2)	Surface SCV (3)	Surface CP (4)	State Imports (5)	Local Trans. (6)	Reclaimed (7)	Total
1990	106,781	143,890	9,552	11,900	4,836	3,865	0	281,554
2000	83,000 (safe yield)	103,600	12,500-65,500	11,900	0-15,000	6,000	900-6,000	217,900-291,000
2010	83,000 (safe yield)	103,600	12,500- 65,500	11,900	0-15,000	6,000	900-6,000	217,900-291,000

(1) 1990 figure is based on actual use data from pump charges in the Santa Clara Valley (SCV) for the Santa Paula, Fillmore, and Piru groundwater basins (UWCD, 1994 per comm.). Subsequent figures are based on UWCD Annual Groundwater data averaged over a thirteen year period 1980-1992 UWCD; United 1994 pers. comm.; VCPWA, Groundwater Section, 1994, pers. comm.).

(2) 1990 figure is based on actual use data (pump charges) for the United WCD in the Coastal Plain (CP) area, including portions of the Pleasant Valley, the Oxnard Forebay (Montalvo), Oxnard Pressure and North Las Posas groundwater basins from United's annual report on groundwater extractions (1994). Year 2000 and 2010 figures are based on GMA approximated projections (safe yield) for these basins, and the thirteen year average for Pleasant Valley and North Las Posas basins. GMA Task 86-3, based as a comparison of WCD water use records (1979-1992) versus GMA water use (1990) Tables 1 and 2, including an estimated 6,000 AF/Y from the Mound groundwater basin (United pumping report, 2/94). Figures include water pumped by the City of Oxnard. Boundaries for the three wholesalers, United WCD, Calleguas MWD and Casitas MWD are show in Figure 3.2. Groundwater basins are shown in Figure 3.3. Groundwater supply for 1990 and Year 2000 reflect actual supply available with "safe yield". Overdraft for Oxnard Plain, Pleasant Valley and North Las Posas Basins will still be occurring at a rate of 36,520 AF/Y (2000) and 35,300 AF/Y (2010).

(3) 1990 figure for the Santa Clara Valley (SCV) areas is based on surface water diversions. Subsequent years' supplies are based on projected surface water Piru Mutual Water Co. Project, Fillmore Irrigation, the King Diversion, and Santa Paula Water

Works. These figures assume that additional surface water projects identified in the 1980 208 Plan (with the exception of the Freeman Diversion Project which is now complete) (p. 24) will not be developed due to economic and environmental conditions. These include an El Rio Pumping Plant, a dam on the Sespe Creek and the Oat Mountain Pipeline. *The Freeman Diversion Project has the ability to divert 53,000 Af/Y of water during years of average rainfall, but may be much less during drought years.

(4) Based on the average annual yield for surface water delivered by the Pleasant Valley Pipeline (11,900 Af/Y). This figure includes the 5,900 AF/Y delivered by the Pumping Trough Pipeline (GMA, Task 86-3, Fig. 2).

(5) Based on potential importation of State water under entitlements of 10,000 AF/Y to the City of Ventura and 5,000 Af/Y to United WCD. This assumes all of the City of Ventura's entitlement would be used in the east end of the city, within the United WCD.

(6) Figures based on: (a) transfer of water produced by the Foster Park facilities to United, according to the following estimates by the City of Ventura: year 1990; 3,865 AF/Y: year 2000; 6,000 AF/Y: year 2010; 6,000 AF/Y and (b) a constant 2,000 AF/Y of water transferred from Los Angeles County to United WCD by the Camulos Ranch and Newhall Land and Farm.

(7) 1990 figure from water currently reclaimed by the City of Ventura for use in golf courses within UWCD boundaries. Year 2000 and 2010 figures are based on: (a) 900-6,000 AF/Y from the City of Ventura (which is used in the east end of the city) and (b) reclaimed water provided to the Pleasant Valley Reservoir in the Oxnard Plain for agricultural use by a proposed reclamation project at the Thousand Oaks/Hill Canyon Treatment Plant. Estimated total discharge for the year 2000 is 5,000 AF/Y (PWA Water Resources Division, 5/94).

Table 3.9.a: Calleguas MWD Demand
(in AF/Y, including unaccounted water)

Year	Population (1)	AF/cap (2)	M/I	Ag/ac (3)	AF/acre (4)	Agric. Demand	Unaccounted (5)	Total
1990	410,209	(Actual) .21	84,929	25,080	2.0	50,160	8,860	143,949
2000	462,430	.18	83,237	21,980	2.0	43,960	10,315	137,513
2010	526,760	.18	94,637	21,580	2.0	43,160	11,205	149,002

(1) Based on countywide population forecasts adopted by the Board of Supervisors and VCOG (7/14/93), which were assigned to the wholesale water districts according to analysis zones. Figures include two thirds of the Oxnard population (growth area and non-growth area) for 1990 and one half for year 2000 through the year 2010, and assumes the amount of water supplied to Oxnard by Calleguas will stay constant at one half of their needs. Figures from the VCOG population forecast, 7/14/93, as follows:

1990 -- 93,862 (2/3 Oxnard) + 316,439 (remaining Calleguas) = 410,209
2000 -- 77,310 (1/2 Oxnard) + 385,120 (remaining Calleguas) = 462,430
2010 -- 83,513 (1/2 Oxnard) + 443,247 (remaining Calleguas) = 526,760

(2) The 1990 per capita rate is based on 1992 Water Use Survey by the VC Planning Department (VC WCMP, 1992, Table 3-2). The year 2000 and 2010 per capita water use rates are based on the 1992 water use factors which assume continued efficient water use practices into the future. Note because of the reduced per capita water use factor M/I demand and projected to be less in the Year 2000 than 1990.

(3) Based on the Draft Land Use Appendix and Irrigated Farmland from the Important Farmlands Inventory (VCGP EIR, p. 63). Approximately 10% of Calleguas' deliveries supply agriculture demands (Calleguas MWD, pers. comm., 2/94).

(4) Based on the Ventura WCMP, 1992 (VCGP EIR, p. 63, 1988).

(5) Based on a constant 6% of the supply estimates in Table 3.9.b (1% unaccounted water by Calleguas MWD plus 5% unaccounted water by local purveyors of this and locally pumped water).

Table 3.9.b: Calleguas MWD Supply (AF/Y)

Year	Ground (1)	Surface (2)	State Imports (3)	Local Transfers (4)	Reclaimed (5)	Total
1990	39,102	0	109,888*	0	2,366	151,356
2000	41,057	0	124,000*	0	27,567 (21,000)	192,618
2010	45,163	0	134,000*	0	32,061 (25,000)	211,224

(1) 1990 figures based on actual groundwater pumped within Calleguas MWD by local water purveyors and individuals. Figure based on 31,418 AF/Y of pumpage within the GMA boundary in Calleguas (GMA summary of Fox Canyon Aquifer Extractions, 1990) plus 7,415 AF/Y of pumpage outside the GMA area within Calleguas (Ventura LAFCO Inventory of Public and Private Water Purveyors in Ventura County, 1989, updated information not available for 1990) plus 219 AF/Y for the City of Simi Valley (VC WCMP). It is assumed that all groundwater supplied to the City of Oxnard by United WCD or pumped by the City of Oxnard is accounted for under GMA estimated extractions (Task 86-3) as United groundwater because it is used to supply one-half of Oxnard's population. All groundwater extractions for the City of Camarillo are assumed to be part of Calleguas. Year 2000 figure assumes a 5% increase in groundwater pumpage districtwide over 1990 figure. Year 2010 figure assumes a 10% increase in groundwater pumpage districtwide over 2000 figure.

(2) Assumes the Tapo Canyon Reservoir (1980 208 Plan, p. 25) is not developed as an additional surface water supply (Calleguas MWD, pers. comm., 7/94). Bard Reservoir is not counted because it is a storage reservoir for imported State water.

(3) 1990 figure based on actual State water imported, including approximately 14,000 AF/Y supplied to the City of Oxnard by Calleguas MWD (Calleguas MWD, annual list of water supplied to purveyors, 1994). Subsequent years estimated by Calleguas MWD (Calleguas MWD, pers. comm., 7/94).

* An estimated 190,000 AF/Y is potentially available with existing importation facilities, assuming needed distribution system additions are constructed (208 Plan, 1980, Table 9, p. 26). Restrictions on State water, however, could affect delivery of this amount of water, and therefore, the figures estimated by Calleguas are used as a safe yield for imported water supplies.

(4) Potential local transfer of reclaimed water by Las Virgenes accounted for under reclaimed water.

(5) 1990 figure based on reclamation figures as follows:

(a) Camarillo Water Reclamation Plant: 1,404 AF/Y (1990-1993 average pers. comm. 7/94
(b) Camrosa Wastewater Treatment Facilities: 561.7 AF/Y (1990-1993 average) pers. comm. 7/94
(c) Triunfo Sanitation District/Tapia Treatment facilities: 400 AF/Y (Lake Sherwood) pers. comm. 7/94

2000 figures based on:

(a) Camarillo Water Reclamation Plant: 3,361 Af/Y (based on 50% [3.0 mgd] of plant capacity)
(b) Camrosa Wastewater Treatment Facilities: 1,200 Af/Y (pers.comm., 7/94)
(c) Triunfo Sanitation District/Tapia Wastewater Treatment Facilities: 2,000 AF/Y (Lake Sherwood, 500 AF/Y, Oak Park/North Ranch, 1,500 AF/Y)
*(d) Oxnard Wastewater Treatment Plant: 15,000 AF/Y (pers. comm., Plant Manager 7/94) possible for use within the Calleguas Service Area.
*(e) Simi Valley Reclamation Project: 1,000 AF/Y (pers. comm., Public Works Director, 7/94)
*(f) Hill Canyon Reclamation Project: 5,000 AF/Y

2010 figure based on:

(a) Camarillo: 3,361 AF/Y. No additional reuse volumes projected beyond year 2000 (pers. comm. 7/94)
(b) Camrosa: 1,200 AF/Y
(c) Triunfo Sanitation District: 2,500 AF/Y (Lake Sherwood, Oak Park, North Ranch and additional service areas)
*(d) Oxnard Wastewater Treatment Plant: 15,000 AF/Y
*(e) Simi Valley Reclamation Project: 6,000 AF/Y
*(f) Hill Canyon Waste Reclamation Project: 5,000 AF/Y

* These projects are in various stages of development from highly conceptual to approved for construction. The amount listed in parenthesis is the potential volume once projects are constructed.

IV. WATER DEMAND MANAGEMENT (BEST MANAGEMENT PRACTICES)

A. Introduction

1. Definition/Concept

Water demand management, best management practices and water conservation are all terms that refer to the efficient use of water. The goals of water demand management is to minimize demand and to eliminate waste.

The efficient use of water throughout the County reduces water demands on local and imported water sources. Urban, agricultural, business and industrial water demand management can save money, energy and valuable limited water resources. Demand management of water resources delays and/or prevents the need to develop new water supplies and projects. New water supply projects are usually expensive and can result in environmental impacts. For example, the development of a water supply project can involve the purchase of property, design and engineering plans, environmental reports, capital for construction and operation, permit fees, etc. Together all these costs can add up to an expensive new water supply, whereas demand management involves a variety of low cost methods of using water more efficiently. Simply put, the efficient use of water reflects sound resource management. Water demand management is a critical component of any strategic water management plan. Many efforts throughout the County have been and are being made to improve water use efficiency. Implementation of management practices in urban, agricultural, business and industrial uses hold great potential for water savings throughout the County.

B. Existing Countywide Programs

Existing programs designed to encourage the efficient use of water within the County focus on both urban and agricultural programs. Recently new programs have been developed to focus on business and industrial water use management. The Countywide Water Conservation Management Plan, adopted in 1983, identifies and describes the programs original components. Updates to the plan and program goals and activities are made in reports annually.

In addition to the County's program's regional approach, various cities and water purveyors have adopted and implemented their own programs including tiered water rates and voluntary programs. The University of California Cooperative Extension, the Resource Conservation District Mobile Irrigation Management Laboratory through Innovative Water Management and the Fox Canyon Groundwater Management Agency have also implemented urban and agricultural water conservation programs.

Background: County "208" Areawide Water Quality Management Plan and Programs

The efficient use of water was established as a goal for Ventura County in the 1980 "208" Areawide Water Quality Management Plan. Following the adoption of the 1980 Plan, many programs encouraging or requiring the efficient use of water have been developed, including the Countywide Water Conservation Management Plan. The County General Plan contains conservation goals and policies as well.

1. Countywide Water Conservation Management Plan and Program

In 1982 the County and the United Water Conservation District (United WCD) jointly received a grant from the State to construct the first phase of the Seawater Intrusion Abatement Project. The grant contained two conditions: development and implementation of a countywide water conservation plan and creation of a groundwater management agency to protect the Fox Canyon Aquifer. The Ventura County Water Conservation Management Plan was completed and adopted in 1983. Over 35 local agencies, including each of the cities, adopted the Plan and agreed to participate in implementation of water conservation programs.

Upon completion of the Water Conservation Management Plan, participating agencies agreed that effective implementation of regional water conservation measures would require cooperation. To accomplish this, the County hired staff to conduct and coordinate water conservation programs on a countywide level. From 1984 to 1992 the program was funded by a joint powers agreement among four agencies: the County of Ventura, Calleguas Municipal Water District (Calleguas MWD), Casitas Municipal Water District (Casitas MWD), and United Water Conservation District (United WCD). Due to financial reasons, Casitas MWD had to withdraw their support of the program in 1992. However, in 1993 several agencies began support of the program including the Channel Islands Beach Community District, Cal American Water, County Water Works Districts #1, 17 and 19, the City of Thousand Oaks and the Lake Sherwood Community Service District. The program is administered by County staff. Annual reports are submitted to the funding agencies outlining the accomplishments of the year and future program goals.

The Water Conservation Management Program addresses urban and agricultural water use in the County. The major focus of water conservation efforts is to eliminate wasteful or unnecessary use of water.

a. Urban Programs

The urban program includes public education to inform water users how to conserve water through a combination of methods. Simple behavioral changes such as washing only full loads of laundry, turning off the tap while brushing teeth, taking shorter showers, and many other conservation practices are promoted. Information on long-term plumbing fixture changes such as retrofitting with more efficient plumbing devices, for example, shower heads and toilets, is available. In-school education includes presentations and materials designed for use in local classrooms. Science fair awards help reward student awareness of water issues. Landscape water efficiency programs include information on drought tolerant plant material and efficient irrigation practices. Regulations requiring water efficient plumbing and landscapes have been adopted or considered. Urban water suppliers are encouraged to audit their systems to eliminate or minimize losses due to leaks or other malfunctions.

b. Agricultural Programs

The agricultural program involves the education of growers to use water efficient practices. Activities include providing information on efficient irrigation practices, evaluating on-farm irrigation systems, and using weather data to assist in irrigation scheduling. In addition, annual irrigation management seminars and field demonstrations are conducted.

These urban and agricultural programs reach the public through a variety of mediums. News releases, public service announcements, media interviews, video presentations, brochures, field demonstrations, seminars, presentation to classrooms and organizations, and displays at county, city and other public events are all used to provide water conservation information to the public. For further information, refer to the 1983 Water Conservation Management Plan (three volumes) and updates published annually. These documents can be obtained from the County Planning Division, Water Conservation Office.

c. Business-Industrial Programs

A Government/Utility/Private Industry (GUPI) Partnership was initiated in December 1990 to assist local businesses in becoming more water and energy efficient. Those involved include the city of San Buenaventura as the lead agency, the California Department of Water Resources, the County of Ventura, Southern California Edison Company and Southern California Gas Company. These government agencies and utilities are pooling their financial and staff resources to improve water and energy efficiency at the following facilities: Pepsi-Cola Bottlers of Ventura, the Doubletree Hotel, Ventura Coastal Corporation (a fruit juice and concentrate producer) and the County Medical Center. The four sites were surveyed in December 1991 to assess how water is used at each of the sites and the related energy used to heat, cool, pump,transport the water. Following analysis of water and energy use, recommendations will be made to improve efficiencies. Improvements will be implemented and monitored to provide a means of analyzing various efficiency measures.

In addition to improving water and energy efficiency at the four sites, the project will be used as a pilot demonstration project to provide educational material to be introduced to businesses and hospitals locally and statewide. Slide shows, brochures, seminars and other means of conveying information learned from this unique partnership will be distributed by county water conservation staff to employees at the four sites and the general public as well. The GUPI partnership is an ongoing program. Each year two or more businesses within the City of Ventura's water service area will be selected to participate in a water and energy conservation audit and evaluation. It is anticipated that the information assimilated through this partnership will motivate other businesses and hospitals to implement water and energy efficiency measures.

d. Factors Affecting Programs

Factors affecting countywide urban, agricultural and business/industrial programs include funding, difficulty in reaching the non-English speaking population, resistance to change and the inability to accurately measure program effectiveness in AF saved.

o Limited Funding

Limited funding and therefore, limited staff, prohibits these programs from realizing their full potential. During the last several years of drought, demands on the programs have increased dramatically. Staff has been able to respond to demands and implement programs but could create additional programs to assist in water awareness education if additional funding were available.

o Language Barriers

Language barriers can be an obstacle in educating the non-English speaking population of the County. Since 1990 several water brochures have been printed in Spanish and distributed to various communities throughout the county. Education of the general non-English speaking population is not believed to be a significant problem. However, due to the high turnover rate of the large, Spanish speaking farm worker population, education of farm workers has become a concern. Presentations to growers are effective; however, information may be lost in the translation from grower to farm worker due to language and cultural barriers.

o Resistance to Change

Water use efficiency can be accomplished through simple behavioral changes. Shorter showers, washing only full loads of dishes and clothes, and turning the tap off while brushing teeth are all easy methods of reducing water use. Although these methods appear easy, many people have difficulty changing their behavior. This resistance to change applies to the agricultural, government, utility and business/industry sectors as well.

Due to the relatively low cost of water, some do not want to make the necessary initial capital investment in efficient equipment or make simple changes in practices that would require initiative. Although the purchase and installation of more efficient equipment would require capital investment, in time, initial investment costs will be recovered in water savings. Changes in water use practices such as altering irrigation schedules do not require monetary investment, only effort and a willingness to change. Although such changes appear simple to achieve, the initiation of change can be difficult for some.

o Effectiveness of Programs

The effectiveness of the various urban, agricultural, and business/industry programs are difficult to determine. However, it is important to determine and monitor actual water use before effective water conservation and demand management can occur. Many programs disseminate information on water use efficiency, and it is difficult to accurately measure the effectiveness of any one program. However, the countywide program has been effective in reducing water use in Ventura County. The per capita usage trends in urban areas have stabilized or decreased in most cities, with only slight increases in drought years when irrigation demands have increased. Although difficult to measure with accuracy, the programs selected to be implemented are those considered to be the most cost effective and have the greatest water savings potential.

2. University of California Cooperative Extension

The University of California Cooperative (UC Coop) Extension Farm Advisor's Office educates growers primarily by conducting applied research projects and providing the findings of such projects to growers. Information is provided to growers through newsletters, seminars and field demonstrations. Professional advisors conduct agricultural research, disseminate University information, and consult with local farmers and ranchers on 5 major subjects: citrus, avocado and minor subtropicals, vegetable crops and strawberries, environmental horticulture (floriculture, nurseries, landscape, and turf), and integrated pest management. Currently, advisors are involved with several projects related to water conservation/efficiency and groundwater protection. These projects are discussed below.

a. Nitrogen and Water Application Assessment

One current project is a 50-acre avocado orchard. Various nitrogen and water application combinations will be used to develop best management practices (BMP's). The goals of this five year study which began in 1991, is to improve irrigation efficiency. The BMP's will determine the appropriate combination of, and minimum use of nitrogen and water to produce healthy crops at maximum yield.

b. Greenhouse Irrigation Practices

Coop staff are working with several greenhouse owners/farmers to improve irrigation systems and fertilizer application in greenhouses. The goal of the research project is to reduce water and fertilizer use in greenhouses while producing healthy plants and productive yields.

c. Field Study of Surge Irrigation

Surge irrigation is a computerized irrigation method which has great potential for reducing furrow irrigation water requirements. A small study has been proposed in Ventura with the Soil Conservation Service (SCS) and another study in the Santa Maria area sponsored by Pacific Gas and Electric (PG&E).

d. Evaluation of Area-Wide Irrigation Needs

The Ventura-Santa Barbara area has many microclimates and as a result there has been resistance on the part of the grower community to employ California Irrigation Management Irrigation Systems (CIMIS) weather information. A series of autometers, (a relatively inexpensive device for measuring evapotranspiration), will be purchased and stationed in different areas to determine the variability of irrigation needs in the counties. As more CIMIS information becomes available, comparisons can be made to improve the way the data is used for irrigation scheduling. For additional information on County CIMIS and weather stations, see discussion under Section 3, Resource Conservation District, c. Evapotranspiration, also see Figure 3.7 for locations of stations and specific microclimate zones. Testing of sprinkler and drip irrigation systems for uniformity of water distribution is also conducted. Increased uniformity increases irrigation efficiency. Also see discussion under Section 3. Resource Conservation District, a. Distribution Uniformity and b. Irrigation Efficiency for more information on irrigation.

e. Moisture Sensing Devices

A study on the use of moisture sensing devices was completed to determine water requirements of crops. Common moisture meters were evaluated and compared to tensiometers. Tensiometers measure tension in the soil, measuring the plant's ability to pull moisture out of soil and into plant roots. Results of the evaluation were provided to growers through newsletters and a seminar.

f. Nursery Irrigation System Evaluation

Two irrigation system evaluations have been conducted with the objective of evaluating methods to reduce water use and water and nutrient runoff in nurseries. Systems that were evaluated included systems controlled by soil moisture tension for potted plants.

g. Soil Salinity

In surveying soil salinity in strawberry fields, salinity was found to be high. This problem has been aggravated for all crops by low rainfall in recent years and attempts to conserve irrigation water. Limited water supplies prevents flushing of salinity out of the soil. Due to water conservation concerns, this issue must be studied further to develop solutions.

3. Resource Conservation District

By contracting with Innovative Water Management, the Ventura County Resource Conservation District (RCD) Mobile Irrigation Management Laboratory provides a variety of proactive educational services to growers within the County. The program has been funded by the State through the Resource Conservation District, United WCD, Calleguas MWD, Casitas MWD and the Metropolitan WCD. Water district funding has been withdrawn in recent years and the State funding via the RCD will be expired in July 1994. However, Innovative Water Management is still available to provide services for a fee. Approximately 200 farms had been audited as of early 1992, all on a voluntary basis. Increased funding would be required to audit the majority of 2,200 farmers in the County. Tests include Distribution Uniformity (D.U.), Irrigation Efficiency (I.E.), Evapotranspiration (E.T.), and soil moisture measuring devices.

a. Distribution Uniformity

Distribution Uniformity (D.U.) tests measure how evenly water is being applied to a given area. Most D.U. tests result in D.U. rates of 60-65%. A good D.U. rate is considered to be 80%. In most cases, simple improvements or proper maintenance of the irrigation system will elevate the D.U. rate to 80% efficiency.

b. Irrigation Efficiency

The Mobile Lab also determines Irrigation Efficiency (I.E.) ratios which calculate the ratio of water required to water applied. To date, it has been difficult to obtain historical water use records and therefore, compute I.E. ratios. The RCD is estimating water application based on data gathered during D.U. tests. Findings indicate that most growers have a good I.E. ratio of 80% during years of high evapotranspiration and low rainfall. However, as weather patterns are not consistent year to year, neither are I.E. rates. Once the I.E. ratio is evaluated, RCD staff educates the growers on how to achieve an I.E. of 80%.

c. Evapotranspiration

Evapotranspiration (E.T.) measures the amount of water used by plant material. E.T. is based on weather data such as temperature, humidity, rainfall, wind, and other factors. These climatic conditions affect how much water is used by plants. Knowledge of E.T. assists the farmer in determining plant water needs. E.T. data is currently available from two California Irrigation Management Information System (CIMIS) stations and from several weather stations in the County. The two CIMIS stations are funded by the State Department of Water Resources (DWR). One is located in Port Hueneme on the Naval Construction Battalion Center and one in Saticoy at the Piru spreading grounds within the United WCD boundaries. Three weather stations collect data which is converted to E.T. data. Two stations are located within the Casitas MWD boundaries; one at the bottom of the Rincon along the coast, the other in the Ojai Valley. The third weather station is located in the City of Ventura at Huntsinger Park. Figure 3.7 illustrates the locations of the CIMIS and the weather stations, and the respective microclimate areas which the stations represent. The RCD Mobile Lab established a network among these public and private stations to share available weather data. This network of E.T. data once available only by telephone, can now be found daily in local newspapers. This data enhances grower knowledge and, therefore, irrigation scheduling efficiency by reducing agricultural water demands. This E.T. data can also be used by County residents to determine landscape water requirements.

d. Soil Moisture Monitoring Devices

The RCD also provides information on soil moisture measuring devices. A variety of devices are available. The RCD evaluates the effectiveness, cost and ease of use of the devices and educates growers of the advantages of using soil moisture measuring devices to assist in irrigation scheduling.

4. Fox Canyon Groundwater Management Agency

As discussed in the previous section of this chapter, Section III, Current and Future Overdraft, Supply and Demand Calculations, the Fox Canyon Groundwater Management Agency (GMA) was created to manage groundwater resources in the area overlying the Fox Canyon Aquifer zone. The GMA area of responsibility includes the Oxnard, Mugu, Hueneme, Fox Canyon and Grimes Canyon aquifers (see Figures 3.2 and 3.4 at the beginning of this chapter). The objective of the GMA is to manage these resources which includes controlling overdraft. These aquifers supply about 70% of the annual countywide water demand. However, a portion of the water that meets the demand is being overdrafted. The aquifer systems will not be able to continue to meet this demand in the future.

a. Groundwater Extraction Reduction Ordinance No. 5

Groundwater Extraction Reduction Ordinance No. 5.3 was adopted in August 1990. The goal of the ordinance is to reduce groundwater extractions within the GMA boundaries 25% by year 2010. A 5% reduction is to be reached by 1992, with an additional 1% reduction (approximately) required each successive year. Water allocations will be based on historical water use. If water allocations are exceeded, surcharges and penalties will be assessed. However, proof of 80% or greater efficiency is acceptable and penalties will not be assessed.

Reductions in future pumpage as a result of Ordinance No. 5.3 are unknown because the ordinance does not mandate reductions. Those eligible to extract groundwater can continue pumping by paying surcharges and penalties. Without this provision and the 80% efficiency allowance, the ordinance would theoretically reduce pumpage by 30,000 to 40, 000 Af/Y. See Section III, Current and Future Overdraft-Supply and Demand Calculations, for further analysis of reduced groundwater pumping.

The implementation of Groundwater Extraction Reduction Ordinance No. 5.3 encourages water efficiency through economic disincentives. Assessment of surcharges and penalties are expected to encourage best management practices, thereby reducing water demand.

5. Mandatory Rationing

Mandatory rationing programs include tiered rate structures, water allocations and moratoriums. Tiered rate structures and water allocations limit water use by providing economic incentives to use water efficiently. By using water efficiently, water saved can be stored and available for use during drought. Also by using water efficiently, the need to develop costly additional water supplies can be postponed and/or prevented. Moratorium programs prohibit new connections, therefore preventing additional water demands and is recommended to be implemented only during a declared water shortage emergency.

a. Tiered Rate Structures

Tiered rate structures, sometimes referred to as increasing block rates, promote efficient water use by relating water use to cost. Tiered rates include a lower rate for the first specified number of units of water consumption (sometimes referred to as "lifeline" rates) and an increasing rate per unit for each subsequent tier. Below is an example of a tiered rate structure for residential use.

Tier	Quantity	Cost per hcf*
Tier 1 (base or lifeline rate)	0-12 hcf*	= $0.80
Tier 2	13-24	= $1.00
Tier 3	25 or more	= $1.20

*hundred cubic feet

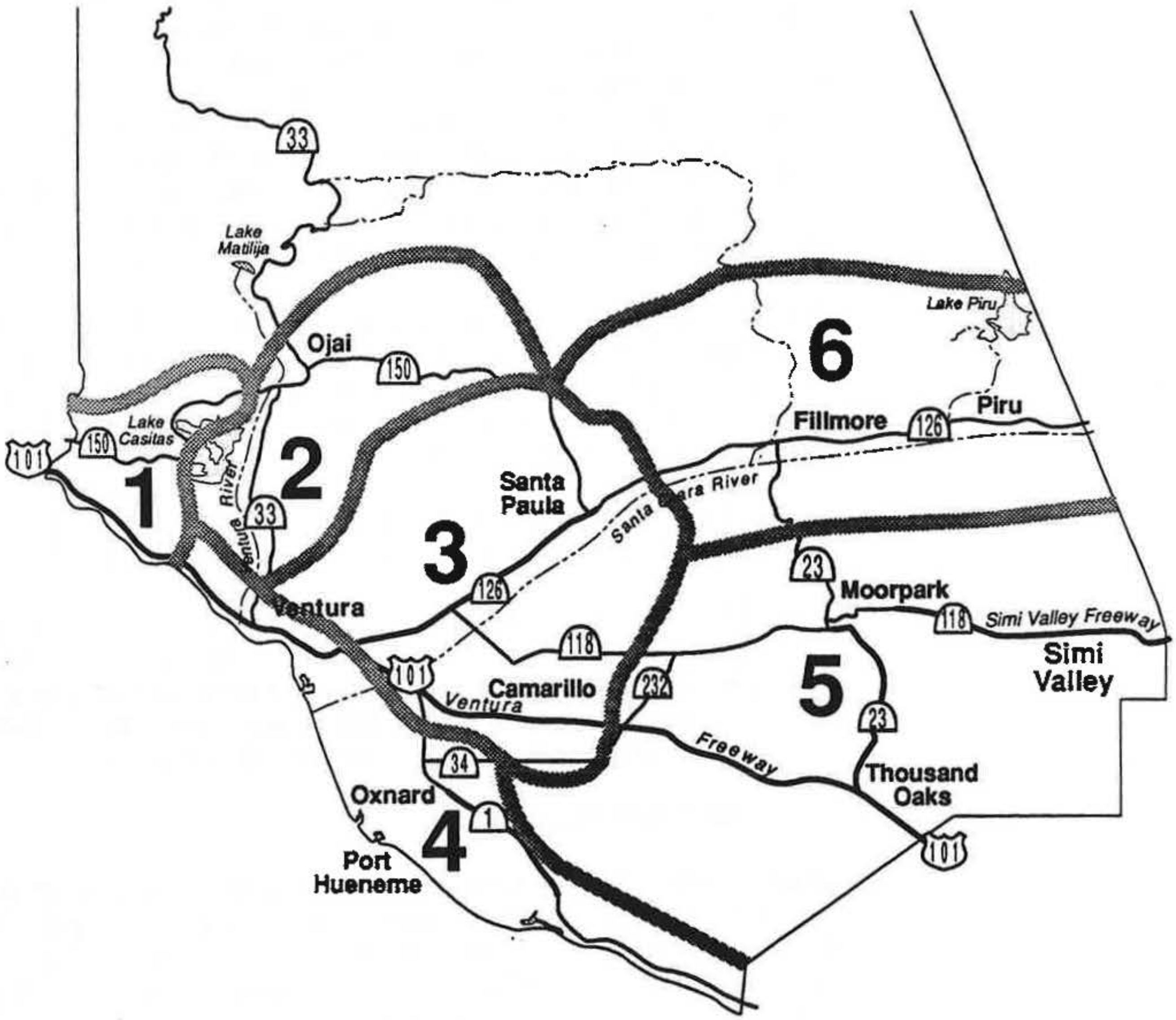
Tiered rate systems provide the opportunity to charge those who use more water, more per unit of water used. This rate structure encourages a decrease in water use by establishing an economic disincentive. Tiered rate systems currently implemented by several cities and water purveyors have been successful in reducing water demands.

Efforts need to be made Countywide to adjust the price of water to more accurately reflect the true cost of obtaining, treating, and distributing quality water to users.

b. Water Allocations

Several water purveyors in the county have implemented successful water allocation programs. Water allocations, commonly referred to as water rationing, limit the amount of water a customer can use. As a result of limiting water available to customers, the customer becomes a more efficient water user. Water allocations are usually determined by one of two methods; historical use or land use. Allocations based on historical use evaluate historical water use records and then recommend an allocation based on a percentage of the historical water used. For example, the water allocation could be 80% of the average historical water use over the past five years. Allocations based on historic use do not always consider efficient water use practices. An allocation based on a historic use that was wasteful would save water, however, usage may still be inefficient. Allocations based on land use and efficient water use

Figure 3.7 Ventura County Weather Stations and Respective Microclimate Zones



Microclimate Zones

Zone 1 - Rincon/Casitas Pass Area

Zone 2 - Ojai Valley Area

Zone 3 - East Ventura/West Santa Paula areas

Zone 4 - CBC Base/Coastal areas

Zone 5 - East County Area (Weather station available soon)

Zone 6 - Piru Area

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appear to be the most equitable method of determining allocations. However, due to acquired historical water rights, historical use based allocations are currently more commonly used. Water allocations based on land use consider the needs of different land uses types, such as residential, commercial, industrial and agricultural land uses. For example, a single-family residential unit would be allocated more water than a multi-family (i.e., condominium) unit. Such allocations are based on factors that a single-family unit has more residents and landscape area per unit than a multi-family unit. During severe drought, strict water rationing may be necessary to ensure a long-term water supply.

Allocation programs use economic disincentives to encourage customers to stay below their allocations. If allocations are exceeded, penalties are assessed. Penalties usually include a high unit charge for each unit of water over the allotment relative to the unit charge below the allocation. In addition to paying for the water used, sometimes a lump sum penalty for exceeding the allocation is assessed. If a customer repeatedly exceeds their allocation, penalties may be increased and/or a flow restrictor may be installed on the meter to limit water flow to the customer.

Allocation programs usually use tiered rate structures to encourage customers to use less than their allocation. Tiered rate structures encourage efficient use of water by providing a mechanism to charge more per unit of water used. For further discussion of tiered rate structures, see immediate previous discussion, a. Tiered Rate Structures.

c. Moratorium Programs

Moratorium programs prohibit new water connections. A moratorium is defined as a legally authorized suspension of activity. Water purveyors and/or governmental entities must declare a water supply emergency in order to institute a moratorium on new water hookups. Moratoriums are typically temporary measures implemented during severe drought conditions. Once a moratorium is adopted, water is not available for new development. As a result, no new development is permitted.

In communities with long-term supply deficit, new development may threaten long-term supplies. Moratoriums prevent new additional water demands, therefore, assisting to ensure a long-term dependable water supply. During local drought conditions, several water purveyors adopted moratoriums on new water connections. For example, in June 1989, after experiencing several years of drought, the Casitas MWD Board of Directors conducted a study that revealed that the average annual demand for water from 1986 to 1991 exceeded the annual safe yield. The Board declared a water shortage emergency in April 1990 and adopted a resolution to regulate and restrict the delivery and consumption of water, including a delay on new service connections for one year or until the emergency ended, whichever occurred first. In March of 1993 the Board rescinded the water emergency due to reduced demands and full reservoirs and groundwater basins and is now accepting requests for new hookups, and is permitting expansions of service.

Opposition by developers and property owners to moratoriums on new water hookups exists. The halting of water hookups may be perceived as inverse condemnation, causing property values to decline. As a result, moratoriums may cause adverse economic impacts while providing only short-term water savings. Programs that would prevent new water demands while allowing development may meet the same objectives as moratoriums on new hookups. Potential new programs to encourage water demand management are addressed below in Section C. A summary of the Drought Action Resource summary prepared in early 1991 to address.

C. <u>Demand Management Recommendations</u>

As witnessed during recent drought conditions, water supplies are limited. Even with the development of additional water supplies, population growth and ever-increasing water demands will continue. Therefore, demand management programs must be considered an important component in any strategic water management plan. The implementation of existing and new demand management programs and drought action plan options could help eliminate wasteful and unnecessary use of water. The efficient use of water would increase the ability to have reserves of water available during extended drought conditions and help ensure an adequate and reliable water supply in the short term and long term. The following demand management programs and drought action options are recommended below to enhance countywide water management.

1. Continue and Enhance Existing Programs

The water demand management programs previously addressed in this chapter are all considered effective programs to encourage efficient water use practices. These programs should be continued and enhanced in order to ensure the best use of limited water resources. The following are recommendations made in support of these programs.

- The Countywide Water Conservation Program efforts should continue to educate the urban, agricultural, business and industrial sectors of the county through current programs, and new programs should be encouraged.

- o The University Cooperative Extension Program and Resource Conservation District Mobile Lab efforts should continue and be enhanced to educate agricultural water users countywide. New funding sources should be sought.

- o The Fox Canyon Groundwater Management Agency should continue to implement Groundwater Extraction Reduction Ordinance #5.3.

- o Reasonable tiered rate structures should be implemented by all water purveyors in order to encourage efficient water use practices.

- o Water allocations should be established based on historical use and/or efficient water use for all land uses.

- o Moratoriums on new water hookups should be implemented only after the declaration of a water supply emergency.

2. County Drought Action Plan Summary - Potential New Programs

Many new programs could be implemented countywide to encourage water demand management. The Drought Action Resource Summary adopted by the Board of Supervisors in April, 1991, addresses many potential programs to encourage efficient water use practices and to maximize limited countywide water resources. These potential programs are summarized below. Potential program objectives, status and constraints are discussed. As part of this Water Quality Management Plan update, the following potential drought action options are recommended to enhance demand management programs.

a. General Purpose Government (non-water purveyor) Action Options

The ten cities and the County have authority as general purpose governments to take action to reduce water usage. Through their local land use power, new development can be conditioned to minimize impacts on water resources. Through local building and safety code authority, retrofit of existing structures to ultra-low-flow plumbing devices can be encouraged or mandated. Through local police powers, actions can be taken to outlaw water waste. Specific measures available to local general purpose governments are listed below. For a summary of each measure, including the objective, status and constraints of each measure, the County Drought Action Plan Summary and annual updates can be obtained from the County Planning Division or the Association of Water Agencies.

- o Require new development to offset additional water demand the new development would generate.
- o Require ultra-low-flow plumbing retrofits at time of property sale or improvement.
- o Subsidize an ultra-low-flow plumbing retrofit program.
- o Limit new discretionary and ministerial development
- o Initiate conservation programs and measures to reduce water use at city/county facilities.
- o Require specified new and existing uses (such as golf courses, cemeteries, etc.) to use only reclaimed or other non-potable water.
- o Defer installation of required landscape until drought ends.
- o Prepare analysis on graywater.

b. Water Purveyor Action Options

All agencies which purvey water can significantly affect water usage. Pricing, strategies, public information/education, and technical assistance can help reduce water usage. Specific measures all water purveyors should consider are listed below. For a summary of each measure, including the objectives, status and constraints of each measure, refer to the County Drought Action Plan.

- o Require tiered water rate system.
- o Mandate limits on water use.
- o Mandate water conservation/water waste ordinance.
- o Subsidize ultra-low-flow plumbing retrofit.
- o Halt or limit water hookups for the duration of the drought.
- o Provide water audits for agricultural and residential users.
- o Require meters on all connections.

- Provide water usage information on water bills.
- Provide leak detection and repair program for water distribution systems.
- Blend water with lower quality sources to supplement potable and non-potable supplies.

V. ALTERNATIVE SOURCES

Currently, countywide water demands exceed available supplies. Several alternative sources may be available to supplement existing water supplies. Alternative sources include importation of State Project water, reclaimed water, Santa Paula Basin Salt Balance Pumping, Conjunctive use, desalination and a Gravel Basin Storage Pilot Project. Although best management practices (the efficient use of water) would significantly reduce demand (see previous Section IV, Water Demand Management), most water authorities agree that additional water resources are necessary to ensure adequate water supplies are available on a long-term basis. This section of the chapter addresses the cost, quality and possible quantities of alternative water sources.

A. Importation of State Project Water

1. Introduction

As previously discussed, water imported from the Colorado River/State Water Project (SWP) by Calleguas MWD provides approximately 22% of the total Countywide water demand. Imported supplies provide some or all of the existing residential water demands for 74% of the county population. In addition to Calleguas MWD's imported water supply, the County of Ventura has an entitlement to 20,000 AF/Y of SWP water. In 1963, the Ventura County Flood Control District contracted with the State of California Department of Water Resources (DWR) to obtain entitlement to water from the SWP. The SWP conveys water from Northern California through a system of reservoirs, canals, pump stations and power generation facilities to Southern California. The contract specifies 1980 as the initial year of water delivery with a beginning entitlement of 1,000 AF/Y. From 1980 to 1990 the entitlement increased incrementally until it reached the maximum entitlement of 20,000 AF/Y under the current contract. Table 3-10 illustrates the phased entitlement schedule, as well as the annual charges assessed to maintain the right to utilize the annual entitlement.

a. Cost

The contract with the state requires a phased payment schedule for the County's share of the construction, operation, and maintenance of the State Water Project and annual principal and interest payments (Table 3.10, Delta Water charges). Additional fees are assessed when water is delivered (Table 3.10 Water Delivery Charges). Since 1963 through the year 1991, approximately $18.2 million dollars was paid to DWR for the County's share of

TABLE 3-4 SWP WATER DELIVERY AND PAYMENT SCHEDULE

YEAR	Ventura County Annual Entitlement (AF/Y)	Delta Water Charges 1. ($/Y)	Water Delivery Charges 2. ($/Y)	Total Charges ($/Y)
1960	0	0	0	0
1961	0	0	0	0
1962	0	0	0	0
1963	0	0	0	0
1964	0	14.716	0	14.716
1965	0	28.855	0	28.855
1966	0	25.354	0	25.354
1967	0	50.733	0	50.733
1968	0	143.291	0	143.291
1969	0	228.261	0	228.261
1970	0	282.331	0	282.331
1971	0	278.925	0	278.925
1972	0	394.637	0	394.637
1973	0	477.900	0	477.900
1974	0	476.823	0	476.823
1975	0	477.710	0	477.710
1976	0	500.420	0	500.420
1977	0	500.856	0	500.856
1978	0	509.786	0	509.786
1979	0	555.845	0	555.845
1980	1.000	663.463	0	663.463
1981	2.000	738.491	0	738.491
1982	3.000	668.771	0	668.771
1983	4.000	968.152	0	968.152
1984	5.000	1.096.687	0	1.096.687
1985	6.000	868.887	0	868.887
1986	8.000	1.014.363	0	1.014.363
1987	10.000	1.099.387	0	1.099.387
1988	13.000	1.139.863	0	1.139.863
1989	16.000	1.418.396	0	1.418.396
1990	20.000	1.360.551	398.905	1,759,456
1991	20.000	1.714.316	309.079	2,023,395
1992	20.000	1.757.150	295.069	2,052,219
1993	20.000	1.787.688	293.773	2,081,461
1994	20.000	1.764.915	277.067	2,041,982
1995	20.000	2.244.646	888.999	3,133,645
1996	20.000	2.294.435	901.777	3,196,212
1997	20.000	2.390.759	915.309	3,306,068
1998	20.000	2.468.936	905.613	3,374,549
1999	20.000	2.668.856	846.307	3,515,163
2000	20.000	2.781.240	835.220	3,616,460
2001	20.000	2.853.655	796.936	3,650,591
2002	20.000	2.920.916	758.585	3,679,501
2003	20.000	3.157.137	721.431	3,878,568
2004	20.000	3.386.949	659.872	4,046,821
2005	20.000	3.342.664	643.096	3,985,760
2006	20.000	3.447.440	601.382	4,048,822
2007	20.000	3.629.679	559.524	4,189,203
2008	20.000	3.687.392	525.936	4,213,328
2009	20.000	3.847.474	468.887	4,316,361
2010	20.000	3.888.772	444.914	4,333,686
2011	20.000	3.913.162	407.053	4,320,215
2012	20.000	3.920.750	370.875	4,291,625
2013	20.000	3.945.530	96.023	4,041,553
2014	20.000	3.960.462	177.009	4,137,471
2015	20.000	4.065.483	58.144	4,123,627
2016	20.000	3.932.181	26.645	3,958,826
2017	20.000	3.899.259	5.721	3,904,980
2018	20.000	3.824.898	5.725	3,830,623
2019	20.000	3.754.681	5.733	3,760,414
2020	20.000	3.657.199	5.741	3,662,940
2021	20.000	3.620.134	5.750	3,625,884
2022	20.000	3.549.997	5.758	3,555,755
2023	20.000	3.583.499	5.768	3,589,267
2024	20.000	3.478.745	11.316	3,490,061
2025	20.000	3.418.766	0	3.418.766
2026	20.000	3.406.358	0	3.406.358
2027	20.000	3.393.766	0	3.393.766
2028	20.000	3.387.186	0	3.387.186
2029	20.000	3.376.967	0	3.376.967
2030	20.000	3.350.837	0	3.350.837
2031	20.000	3.316.187	0	3.316.187
2032	20.000	3.296.324	0	3.296.324
2033	20.000	3.271.063	0	3.271.063
2034	20.000	3.248.414	0	3.248.414
2035	20.000	3.266.270	0	3.266.270
TOTAL	968.000	161.937.912	14.226.924	176,164,836

Source: Derived from State Department of Water Resources, Statement of Charges, July 2, 1990.

1. Delta Water Charges include capital costs of State Water Project (SWP) transportation facilities, operation and maintenance, and annual principal and interest payments.
2. Water Delivery Charges are based on operation and maintenance costs of aqueduct power facilities. Charges shown are estimates.

construction, operation, and maintenance of the State Water Project, including principal and interest fees. The county had not ordered delivery of the entitlement water until late 1990 and therefore, was not billed water delivery charges under the contract. Due to the delivery method, deliveries for 1990 through 1994 have been limited to only a portion of the entitlement.

There are no refund provisions under the entitlement contract. Payments made by the County have been used to finance the County's share of the SWP as described in the entitlement contract and above. Because these were the terms under which the contract was agreed to and the funds have already been spent, no funds are available to be refunded.

Due to a lack of distribution facilities to connect Ventura County to the SWP, no SWP water had been delivered to Ventura County until late 1990 when the United Water Conservation District (United WCD) began obtaining a portion of their entitlement. (See Section 3. Status of SWP Importation). In 1971, the administration of the entitlement contract was subcontracted by the County to the Casitas Municipal Water District (MWD). Of the 20,000 AF/Y entitlement, Casitas MWD and the United WCD each have a 5,000 AF/Y share and the City of San Buenaventura has a 10,000 AF/Y share. The districts and the city have financed several feasibility studies examining a variety of delivery systems to obtain the State Project Water. Approximately $422,000 has been spent on such studies.

b. Quality

SWP water is considered high quality and would be best used for potable urban purposes. The total dissolved solid (TDS) level of the SWP water is $\leq$300 mg/l. The recommended state TDS drinking water standard is $\leq$1000 mg/l. The quality of SWP water for drinking is considered very good. Use of SWP water for potable uses could partially replace surface and groundwater extractions for potable uses. Once used, the SWP water could be reclaimed to provide a high quality source for agricultural irrigation and/or as a blending source for other beneficial uses. See Section B, reclaimed water discussion.

c. Storage

Facilities to store SWP water once delivered to the county need to be developed. During drought years when surface reservoirs and groundwater basins are below maximum capacity, these storage reservoirs and basins could be used to store SWP water. However, during years of average or above average rainfall, additional storage facilities may be necessary. Several potential storage facilities need to be identified and studied.

2. Summary of Feasibility Studies

A 1987 report, Feasibility of Importing State Project Water to Ventura County (Montgomery, 1987) evaluated four alternatives. These alternatives included delivery of SWP water via Lake Casitas, two methods using Lake Pyramid, and the use of projects in conjunction with water development on Sespe Creek. The study recommended one of the methods using Lake Pyramid releases to Piru Creek for collection in the Lake Piru reservoir as the preferred alternative. From the Piru reservoir, water would be released to the Piru spreading grounds. The preferred delivery system was chosen based on an analysis of costs, technical feasibility and environmental impacts.

A 1988 study, Evaluation of Alternatives Involving a Castaic Lake Delivery Point, Importation of State Water Project Water to Ventura County (Montgomery, 1988) focused on the Castaic Lake alternative evaluated in the 1987 study and analyzed additional methods of using the lake as a delivery point. Alternatives investigated included a combination of MWD turnout locations and identified where treatment facilities would be located. The study recommended delivery of the water from Lake Castaic through a pipeline along State Highway 126. The study also recommended expanded storage facilities to accommodate up to 34,000 AF in the event that an increased SWP entitlement became available.

A 1990 study, Optimization Study of State Water Importation, (Kennedy, Jenks, Chilton, 1990) approached the feasibility analysis by studying the use of existing water supplies and facilities with the importation of SWP water to optimize all resources. The recommended alternative proposed delivery of SWP water from Lake Castaic via pipelines to Piru, Fillmore, Santa Paula, and Ventura, with connection to a proposed blending station and hook-up to the Oxnard-Hueneme pipeline.

3. Status of SWP Importation

a. Interim Delivery Option

The recommended alternative in the 1987 study Feasibility of Importing State Project Water to Ventura County, (Montgomery 1987) to obtain SWP water through Pyramid reservoir releases has been recently implemented on an interim basis. The United WCD ordered their yearly entitlement to be delivered during the last quarter of 1990. Over a three month period, 5,000 AF was delivered to United WCD's Lake Piru reservoir. Since 1990, United WCD has taken delivery of all or a portion of their entitlement. The SWP deliveries occur through releases from the Pyramid Reservoir managed by the State Department of Water Resources. Following release, water flows via Piru Creek to Piru Lake. Water is then released to the Santa Clara River and diverted by the Freeman Diversion Project to the Saticoy spreading grounds. Prior to release to the Santa Clara River, the water is stored at the Lake Piru reservoir until sufficient rainfall occurs to fill the groundwater basins between Piru Lake and the Saticoy spreading grounds. Following winter and/or spring storms, if the basins are determined full enough, releases are made from Lake Piru to the spreading grounds with minimum losses due to percolation into the groundwater basins.

b. Long Term Delivery Options

Heightened by the five year drought condition and continuing groundwater overdraft, obtaining the SWP entitlement had become an increasingly attractive alternative. During the early 1990's plans to obtain the SWP Water entitlement for the long term were being actively pursued by all three agencies holding entitlements.

In 1991 the City of Ventura and Casitas MWD had sought to obtain SWP water by using Lake Castaic releases and a pipeline delivery system. This method reflects the recommendation in the 1990 optimization study. Delivery through a pipeline system, although costly, would provide control of the water avoiding losses to percolation. In 1991 the citizens of Ventura voted between two alternative water source options; desalination or State water and opted for a desalination plant. Currently, obtainment of the entitlement is no longer being actively pursued while other options, such a desalination are evaluated. As discussed above, the United WCD has received all or portion of their 1990 through 1993 entitlements of 5,000 AF. Losses due to percolation have proved to be minimal, United WCD may use the Pyramid Lake release method as a long-term delivery option (see above section 3.a.).

B. Reclaimed Water

1. Introduction

Reclaimed water in Ventura County holds great potential as an alternative water source. Reclaimed water is treated wastewater that is suitable for beneficial uses such as wetlands, agriculture, parks, golf courses, other landscape irrigation and industrial uses. Sources of water for reclamation usually include treated urban wastewater but can also include industrial process water. The wastewater is treated to remove harmful constituents, to make it suitable for reuse. The reclamation process includes three levels of treatment; primary, secondary and tertiary treatment. Primary treatment is the first stage of sewage treatment. Wastewater is held in settling tanks or basins. A large portion of the suspended solids are removed. Secondary treatment uses bacteria to treat and remove wastes. Tertiary treatment is the third stage of treatment in which filtration is used to screen out remaining solids. Clarification incorporates the use of disinfectants to eliminate remaining bacteria. Complete reclamation project systems require treatment to the tertiary level, sludge disposal as well as distribution lines to deliver the water to the point of use.

Although water conservation practices may reduce wastewater generation, wastewater is a somewhat "drought resistant" water source because urban wastewater production remains fairly constant regardless of weather. The use of reclaimed water for agricultural irrigation could significantly decrease groundwater extractions.

A substantial quantity of treated effluent is currently discharged to rivers and arroyos resulting in indirect reuse. This effluent benefits surface water and groundwater basins through recharge. However, once discharged, it is often difficult to determine how much is lost to evaporation, which downstream users benefit, and where the recharge takes place. If the effluent percolates into a degraded basin, the treated effluent will become degraded. Some treated effluent is discharged to the ocean and therefore becomes unavailable for reuse.

In addition to substantial in-river and groundwater basin recharge, direct delivery of reclaimed water has provided approximately 0.5% of the countywide annual water supply (see section I.D.). Treated wastewater from three of the sixteen treatment plants in the county is currently reused. The three plants include the Camarillo County Sanitation District plant, the City of Ventura Wastewater Treatment Plant and the Camrosa Water District Plant. In addition, effluent from the Tapia Treatment plant (in Los Angeles County) is delivered for use in Ventura County. The reclaimed water is used for agricultural irrigation, landscape irrigation (parks, golf courses and median strips), and instream uses such as estuary enhancement and groundwater recharge.

The remaining thirteen treatment plants and potential increased deliveries from Tapia plant offer possible future additional use of reclaimed water. Table 3.11, Ventura County Wastewater Treatment Plant Survey (MGD) illustrates current and projected effluent discharge from treatment plants throughout the County and identifies direct and indirect uses of reclaimed water.

a. Reclaimed Water Treatment Requirements

National Pollutant Discharge Elimination System (NPDES) permits require a certain level of wastewater treatment prior to discharge. Treatment typically consists of either primary or secondary treatment processes. Primary treatment involves the use of settling tanks or basins. Approximately two-thirds of the suspended solids are removed. Secondary treatment uses bacteria to treat the wastes. This process removes approximately 90 percent of the suspended solids left after primary treatment. Requirements for discharge into some rivers are more stringent, requiring a third (tertiary) level of treatment. Tertiary treatment usually consists of a filtration and clarification system. The filtration system is used to capture remaining particles. Clarification incorporates the use of chlorination to eradicate any remaining bacteria.

b. Cost

Reclamation projects require initial capital investment; however, the costs of reclaimed water will vary depending on water quality required for reuse, size of project (AF/Y generated), location of treatment plant, necessary improvements and/or construction costs, and the extent of distribution facilities needed to transport reclaimed water to the point of use. Current costs for reclamation projects range from $425 to $650 per AF. These costs are based on existing projects, therefore, reflecting specific conditions of each project, therefore, other projects may cost more depending on the specific characteristics of the project. At the end of this Chapter, Section VI, Conclusions and Recommendations, alternative water resource costs are compared.

Table 3.5 - Ventura County Wastewater Treatment Plant Survey (MGD)

Plant	Current Capacity (MGD)	Current Discharge (MGD)	Planned Expansion as of 2/92 (MGD)	Year 2000 Discharge (MGD)	Total Dissolved Solids (MG/L)	Level of Treatment	Amount Reclaimed (MGD)	Direct Use	Indirect Use Discharge Location	Sludge Volume Tons/Year	Sludge Disposal
Camarillo	6.00	4-4.20	8.75 by 2015	5.80	850-875	Secondary	3.00 contracted	Crop irrigation & landscaping	Discharged to Conejo Creek	1460 Dry	Composted for Santa Clara soil amendment
Camrosa	1.50	1-1.20	1.00	<1.50	600-700	Secondary	1.20 (max)	Crop Irrigation & landscaping	None	200 Dry	Compost at plant, intends to sell as compost in future
East Valley Sheriff's Substation	(not in use – all flows in sewage line to Simi Valley)										
Fillmore	1.33	0.90	2.20	1.50	1300	Secondary	0	None	Recharge via percolation ponds Santa Clara River	200 @ 50% solids	Composted for Bailard soil amendment
Montalvo	0.70	0.20	None	0.20	1600	Secondary	0	None	Recharge via percolation ponds	23 @ 15% solids	LWTF #1
Moorpark	2.00	1.70	3.00 by 11/91	3.50	Av 650; max 850	Sec. now; tertiary by 1992	0	None	Recharge via percolation ponds	2000 10% moisture; 200 @15% solids	Composted for Bailard soil amendment; sludge used on site for landscaping
Nyeland Acres	0.22	0.20	None	0.20	1650	Secondary	0	None	Discharged to Beardsley Wash, Lagoon	25 @ 15% solids	LWTF #1
Ojai	3.00	2.00	None	2.90	830	Secondary	0	None	Wetland habitat, discharged to Ventura River	200 dry	Compost free to public
Oxnard	22.60	17.50 av. dry weather	31.70 by 7/91 39.60 by 1999	27-28.00	1600	Secondary	0.30	Treatment plant washdown & on-site landscaping	Discharged to ocean	18,000	Sludge to Simi and Bailard. Begin 9/91-617 tons to Simi, 866 tons to Bailard as cover (3 year program)
Piru	0.25	0.10	None	0.15	1300	Secondary	0	None	Recharge via percolation ponds	40 @ 50% solids	Toland Road Landfill
Santa Paula	2.60	1.9-2.0	None	2.40	1400	Secondary	0.10	Irrigation	Recharge via percolation ponds Freeman Diversion/ discharged to Santa Clara River	500 @ 50% solids	Composted for Toland soil amendment
Saticoy	0.24	0.10	None	0.12	1800	Primary	0	None	Recharge via percolation ponds	20 @ 15% solids	LWTF #1
Simi Valley	12.50	9.20	14.50 by 1995 17.50 by 2014	15.50	850	Tertiary	0.30	Treatment plant on site; landscaping & crop irrigation	Crop irrigation discharged to Arroyo Simi	2000 @ 80-90% dry	Simi Valley Landfill as fill
Thousand Oaks											
a. Hill Canyon	10.80	8.72-9.70	14.0 by 2000	14.00	400-700	Tertiary	0.60	Crop irrigation future pipe to Oxnard Plain	Discharged to Arroyo Conejo/Mugu Lagoon.	3650 @ 15% solids	Composted for Bailard soil soil amendments
b. Olsen Road	0.75	0.25-0.30	None	0.50	500-600	Secondary	0.	None	Crop irrigation discharged to Calleguas-Conejo Creek	1200 composted & combined with Hill Cyn	Composted for Bailard soil soil amendment
Ventura	14.00	10.5 early 1990, 8.50 after wtr ration	None	13.00	1400-1500	Tertiary	0.80-1.80	Golfcourse landscaping Marina Park; Park District; dust control	5.6 MGD required for estuary/discharge to Ventura River	9500 dry 450 @ 15% solids	Composted for Simi soil amendment; sludge to Ventura Coastal as fill
Triunfo	2.50	Flows Tapia Wastewater Treatment Plant L. A. County (not in total)						1.50	Golfcourse landscaping	3.00 available for use	
North Coast	0.05	Flows into City of Ventura Wastewater Treatment Plant (not in total)									
Thomas Aquinas College	0.03	0.008-0.010	None	0.008-0.010	480-610	Tertiary	0	None	Recharge via percolation ponds	30 @ 15% solids	To LWTF #1
TOTAL	78.5	56.3-59.8	NA	88.3-88.4	NA	NA	7.8-8.8	NA			

PLN844-4/92 (1)

c. Quality

The proposed uses of reclaimed water determines the level of treatment required. Some use of reclaimed water include: agricultural irrigation, landscape irrigation, groundwater recharge, estuary enhancement and non-contact recreational use. Water quality requirements for agricultural irrigation vary based on crop type. Reclaimed water is approved for use on all crop types; however, irrigation methods are regulated. Water quality standards for spray irrigation are more restrictive than those for surface irrigation of row crops, while surface irrigation of orchard and vineyard crops are the least restrictive. Exceptions to the quality requirements may be considered by the State Department of Health on an individual basis when the food crop will be undergoing extensive processing. Extensive processing involves commercial, physical, or chemical processing of food crops sufficient to destroy pathogenic agents before suitable for human consumption (Stat, 1978). Row crops are usually more sensitive to high concentrations of TDS or other constituents than are orchard crops. Landscape irrigation, however, can tolerate a lower level of treatment.

In 1987, the Monterey Wastewater Reclamation Study for Agriculture was published. The study, conducted over a five year period, examined the health risks of using filtered secondary treated water for agricultural use. The study resulted in a positive outcome. It was found that the use of reclaimed water posed no risk to human health. The study recommended use of reclaimed water for agricultural use as an alternative water resource.

d. Distance from Point of Use

The distance between the point of wastewater discharge and area of use is another major influence on the cost and availability of reclaimed water. Pipelines and natural water courses offer two alternatives for reclaimed water delivery. Pipeline installation, operation and maintenance are more costly but provide release and pumping control. Pipelines and pumping facilities are sometimes necessary if the point of use is uphill from the point of treatment. Waterways, such as rivers, can serve as conveyance systems. The use of rivers can be less costly, and in some cases can result in fewer environmental impacts. However, some water losses due to percolation (although a direct benefit to groundwater) can be particularly high during drought years, resulting in a higher per acre foot cost.

e. Storage

Another cost and factor to consider of a reclaimed water delivery system is storage. During summer months when irrigation demands are high, more reclaimed water would be needed. Wastewater produced in winter months, when demand is lower, could be stored for future use in peak summer months. Such a storage system either in tanks or reservoirs would need to be designed to balance supply and demand of reclaimed water. Groundwater basins could be used for storage of reclaimed water presumably at a lower cost than facilities that would have to be constructed.

f. Other Factors Affecting Reclaimed Water Use

Other factors can affect implementation of a reclaimed water project; jurisdictional and institutional issues must be addressed by all project participants. The determination of water rights, and agreements among wastewater treatment plant operators, sanitation districts, and water purveyors must be resolved. Cooperation of all project participants is essential for the successful planning, implementation, completion, and maintenance of reclamation projects.

2. Summary of Feasibility Studies

Following is a summary of feasibility studies which have evaluated reclaimed water as an alternative water source:

A 1973 study initiated by the Bureau of Land Management, Ventura County Water Management Project: Emphasis on the Reclamation and Reuse of Municipal Wastewater, recommended reclamation as a method to solve the overdrafting of groundwater resources. Using reclaimed water for agricultural irrigation would help reduce extractions from groundwater basins. The decrease in use of groundwater would reduce the rate of seawater intrusion.

The 1978 Areawide Water Quality Management Plan (208) also identified reclaimed water as a major source to help solve the county's water quality and quantity problems. The study identified reclaimed water as a long term renewable resource that should be actively pursued.

As a result of the 1978 plan recommendations, the Countywide Wastewater Reuse Study (201) was prepared in 1980. The 201 study was the first in the county to explore multi-jurisdictional reclaimed water projects involving different sellers, users and distributors. The importance of legal, institutional and health issues, and the need for participant cooperation was stressed.

Volume I of the water reuse study assessed the potential for use of water in the county. A subsequent Facilities Plan, EIR, and Issue Papers further evaluated the highest ranking projects. The study identified twelve wastewater treatment facilities in the county. Analysis included a description of treatment methods and reuse potential for each plant. Beneficial uses such as agricultural irrigation, groundwater recharge, landscape irrigation, industrial uses, oil recovery, fire protection, estuary enhancement and creation, and non-contact recreational were examined.

A wide range of factors were examined to determine the feasibility of reclaimed water projects, including acceptability of reclaimed water by potential users, capital construction, engineering, administrative and legal costs, operation and maintenance costs.

Costs for reclaimed water were compared to freshwater sources in the Ventura Countywide Wastewater Reuse Study Facilities Plan prepared in 1981. The facility plan concluded that the economic costs for the development of freshwater alternatives would be greater than reclaimed water alternatives. For example, year 2000 projections compared reclaimed water projects for use on the Oxnard Plain at $36 to $225 (1983 dollars) per AF to freshwater costs at $553 to $679 per AF. Corresponding costs for reclaimed water use in the Los Posas Valley were estimated at $106 to $309 per AF compared to freshwater costs of $446 per AF. Costs were based strictly on capital and labor expenditures. Specific project costs will vary due to a variety of factors such as size of project, level of treatment, location of facility, required infrastructure, environmental and engineering studies and environmental impact mitigation.

a. Recommended Projects

The 1978 (201) Countywide Wastewater Reuse Study recommended two projects for funding and implementation.

One project involved delivering treated wastewater from the Thousand Oaks/Hill Canyon Treatment Plant to the growers on the Oxnard Plain via the Pleasant Valley County Water District (PVCWD). Due to the high quality of the imported water, the resulting reclaimed water would be expected to be of high quality.

The use of this water could replace Oxnard Plain extractions which have been, and are currently overdrafting the upper and lower aquifer systems, resulting in extensive seawater intrusion. The proposed price of the water, based on the 1981 study and 1983 dollars, ranged from $36 AF to 89 AF in 2000. Current (1994) costs are estimated at $425 to $650 per AF.

The second project proposed to use reclaimed water from the Simi Valley Treatment plant for agricultural irrigation in the Las Posas Valley. Costs for pipeline installation, operation and maintenance were projected. The proposed price of this reclaimed water was estimated to range from $106 to $306 an AF (in 1983 dollars) for the year 2000. Current 1994 costs are estimated to range from $425 to $650 per AF. Issues that were considered for both projects included quality and quantity of wastewater, desired quality of reclaimed water, delivery and distribution.

Figures 3.8 and 3.9 illustrate the location of both recommended project treatment plants, delivery mechanisms and service area boundaries. Figure 3.8 Thousand Oaks/Hill Canyon Reclaimed Water Project (H-AGR-4) and Figure 3.9 Simi Valley Reclaimed Water Project (SM-AGR-4) were derived from 1981 Ventura County Wastewater Reuse Study Facilities Plan. These projects still represent an economical mechanism to develop alternative water resources. Together these projects represent an initial addition of 15,000 AF/Y to the countywide water supply. The following section provides a status report on the two projects.

3. Status of Reclamation Projects

As the discussions above indicate, reclaimed water in Ventura County is virtually an untapped resource. Reclaimed water has the potential to provide a substantial amount of water to be used for a variety of uses. The use of reclaimed water throughout the county could replace or partially offset the use of higher quality resources. The higher quality water could then be used for uses that require high quality water. Reclaimed water could also replace or partially offset extractions of overdrafted groundwater resources which are currently resulting in seawater intrusion. A commitment to support and implement reclaimed water projects is essential to the responsible management of countywide water resources.

The following section gives an update on the current status of reclamation projects in Ventura County. Four wastewater treatment plants and one sanitation district are currently preparing to implement reclaimed water projects. These include the Thousand Oaks Hill Canyon Treatment Plant, Moorpark Wastewater Treatment Plant, Simi Valley Sanitation Plant, Oxnard Wastewater Treatment Plant and the Triunfo County Sanitation District. In addition, the Ojai Valley Sanitation District is currently preparing preliminary plans.

a. Thousand Oaks/Hill Canyon Treatment Plant

As reported by the 1980 wastewater reuse study, the Thousand Oaks/Hill Canyon Treatment Plant has the capacity to generate 10,000 AF/Y of reclaimed water. However, current plans have put the amount of water available for purchase closer to 6,000 - 7,000 AF/Y. The original source of water to be reclaimed is imported water. Development of the reclamation project is currently being negotiated. Facility plans have been completed. Camrosa Water District will sell water to instream water users (approximately 7,000 AF/Y) and build a pipeline to sell an unspecified amount, approximately 6,000 to 7,000 AF/Y (whatever remains after instream uses) to the Pleasant Valley County Water District where it will be distributed for agricultural irrigation on the Oxnard Plain. Negotiations are currently taking place to implement the project.

b. Moorpark Wastewater Treatment Plant

Plans are underway to upgrade the Moorpark Wastewater Treatment Plant to tertiary treatment. Plans for reclaiming some of this water are being studied. A master plan is currently being prepared. Reports indicate the initial yield would be 1300 AF/Y. The original source of water to be reclaimed would be imported water to be blended with high quality Lower Aquifer System (LAS) groundwater, thereby generating high quality reclaimed water. The water would be used for agricultural and landscape irrigation, including golf courses, parks, and other similar uses. The reclaimed water would offset additional demand on imported water and LAS water.

c. Simi Valley Treatment Plant

As suggested in the 1980 Wastewater Reuse Study, county staff actively pursued a reclamation project to produce reclaimed water from the Simi Valley Treatment Plant for use in the Las Posas

Valley. Although coordination efforts by county staff did not result in final negotiation plans for the project, the city has prepared a master plan for reclaimed water use in Simi Valley. The water would be used for agricultural and landscape irrigation and some possible industrial uses. An EIR has been prepared on the project and is currently being circulated for public review. Initial reclaimed water yield for the project is designed to be 4,618 AF/Y. Availability of the reclaimed water would help offset demands on potable water sources which are currently being used to meet demands that do not require high quality water.

d. Tapia Treatment Plant

The Triunfo County Sanitation District (located in Los Angeles County) operates the Tapia Treatment Plant. The water supply section 3.1 in this chapter addresses the deliveries currently made. The existing water reclamation project yield will be expanded by 1,300 AF/Y in 1993. This expansion will provide reclaimed water to Oak Park and North Ranch in the eastern portion of the County. Costs for the new distribution systems have been assessed, seasonal storage facility options are being explored and sale price estimates of the water have been made. Sale price estimates of the water are $436/AF. Planned deliveries include 700 AF/Y to the North Ranch Golf Course for irrigation and 600 AF/Y to Oak Park to be used to irrigate parks, schools and common areas. Deliveries will directly replace use of imported water. Imported water can then be put to better uses which require high quality potable water.

e. Ojai Valley Sanitation District Wastewater Treatment Plant

Although in the preliminary stages, the Ojai Valley Sanitation District (OVSD) is examining the implementation of a reclaimed water project at their facility. The OVSD discharges effluent from the plant to Ventura River. The State Water Quality Control Board (SWQCB) has recently increased standards for effluent discharge into Ventura River. Increased standards will require the OVSD to upgrade the plant from secondary to tertiary treatment. Required upgrades and need for additional water in the Ventura and Ojai communities are factors encouraging reclamation of water at the OVSD facilities. Discussions regarding where the water would be used, i.e., Ojai, Ventura, or a combination of both, are currently taking place. Initial deliveries are projected at 1,000

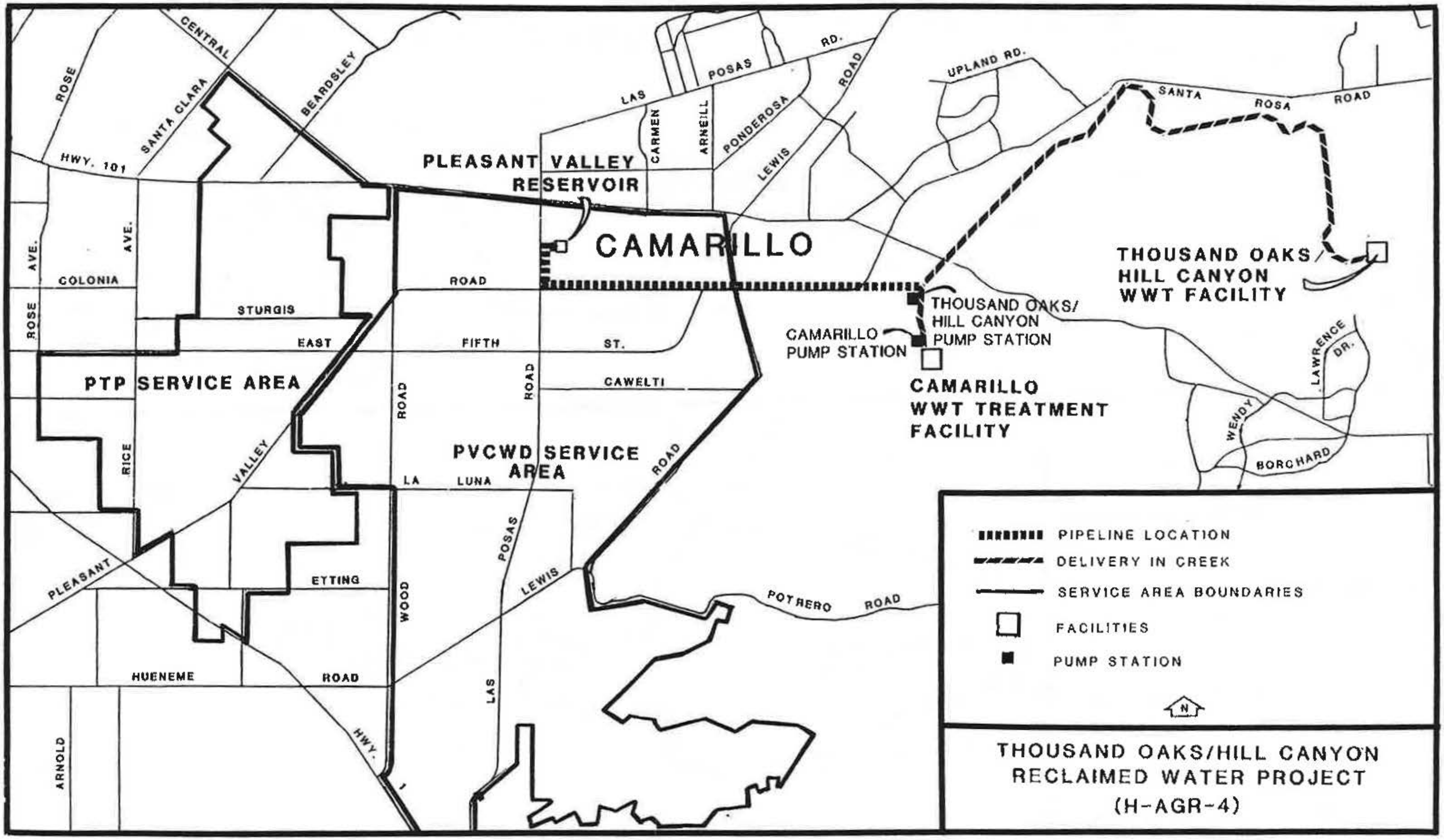
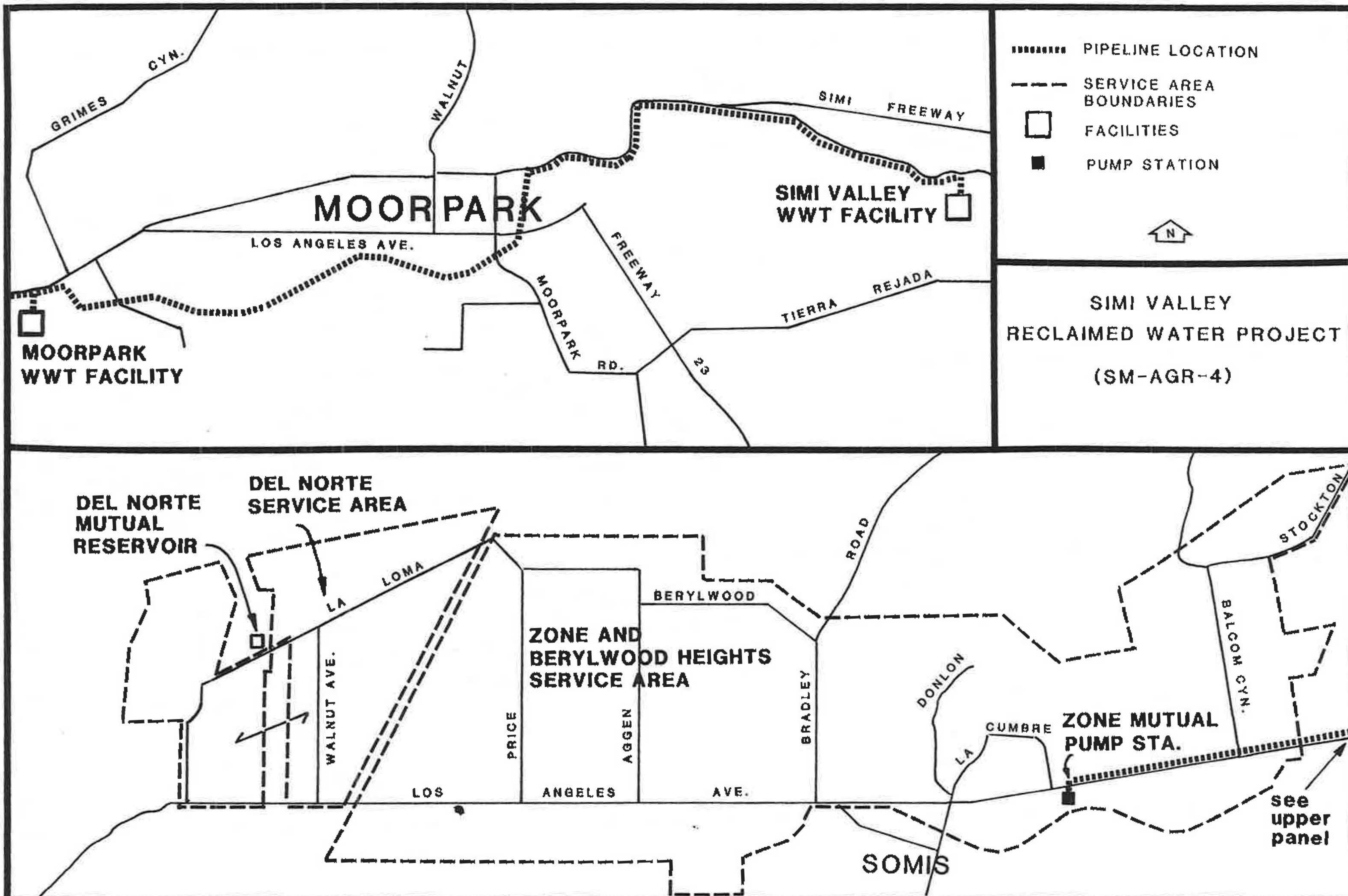

PLEASANT VALLEY RESERVOIR
CAMARILLO
PTP SERVICE AREA
PVCWD SERVICE AREA
THOUSAND OAKS/ HILL CANYON WWT FACILITY
THOUSAND OAKS/ HILL CANYON PUMP STATION
CAMARILLO PUMP STATION
CAMARILLO WWT TREATMENT FACILITY
CENTRAL
BEARDSLEY
ROSE
SANTA CLARA
HWY. 101
LAS POSAS RD.
CARMEN
ARNEILL
PONDEROSA
LEWIS
ROAD
UPLAND RD.
SANTA ROSA ROAD
ROSE AVE.
AVE.
COLONIA
ROAD
STURGIS
EAST FIFTH ST.
CAWELTI
ROAD
ROAD
RICE
VALLEY
LA LUNA
ROAD
LAWRENCE DR.
WENDY
BORCHARD
PLEASANT
ETTING
WOOD
LAS POSAS
LEWIS
POTRERO ROAD
HUENEME ROAD
HWY. 1
ARNOLD
PIPELINE LOCATION
DELIVERY IN CREEK
SERVICE AREA BOUNDARIES
FACILITIES
PUMP STATION
N
THOUSAND OAKS/HILL CANYON
RECLAIMED WATER PROJECT
(H-AGR-4)

Figure 3.8


PIPELINE LOCATION
SERVICE AREA BOUNDARIES
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SIMI VALLEY
RECLAIMED WATER PROJECT
(SM-AGR-4)
GRIMES CYN.
WALNUT
SIMI FREEWAY
MOORPARK
SIMI VALLEY WWT FACILITY
LOS ANGELES AVE.
FREEWAY 23
MOORPARK RD.
TIERRA REJADA
MOORPARK WWT FACILITY
DEL NORTE SERVICE AREA
DEL NORTE MUTUAL RESERVOIR
LA LOMA
ROAD
STOCKTON
BERYLWOOD
BALCOM CYN.
ZONE AND BERYLWOOD HEIGHTS SERVICE AREA
WALNUT AVE.
PRICE
AGGEN
BRADLEY
DONLON
LA CUMBRE
ZONE MUTUAL PUMP STA.
LOS ANGELES AVE.
SOMIS
see upper panel

Figure 3.9

AF/Y. Probable uses include agricultural and landscape irrigation, industrial uses (secondary oil recovery), and estuary enhancement.

f. Oxnard Wastewater Treatment Facility

The City of Oxnard has completed their Final Water Reclamation Master Plan (Pirmie/Montgomery, 1993) to reclaim water at the Oxnard Wastewater Treatment Facility. Such changes could provide a substantial volume of reclaimed water. Currently the effluent is discharged to the ocean where no direct or indirect benefits occur. Implementation of a water reclamation program would negate the potential need to expand or modify the existing ocean outfall which has been estimated to cost $20 million to $50 million, depending on improvements required by the RWQCB. If these improvements are avoided by a reclamation project it could lower the unit reclamation costs to $440 to $640 per AF (Pirnie/Montgomery).

Plant upgrades would provide substantial benefits to the surrounding area. As Table 3.11 illustrates, the Oxnard facility generates approximately 18,000 AF/Y of effluent with the capacity of accommodate increased flows up to 31.7 MGD with future planned expansion to 39.6 MGD. Reclamation plans are to reclaim 20 MGD. A portion of this water is from imported sources. Reclaimed water could be used for agricultural irrigation on the Oxnard Plain, landscape irrigation, groundwater recharge by surface spreading or direct injection. This use would replace groundwater extraction that are currently overdrafting the upper and lower aquifer systems resulting in extensive seawater intrusion beneath the Oxnard Plain (See Section IV of this Chapter and Chapter 4, Section II.A. Seawater Intrusion).

C. Santa Paula Basin Salt Balance Pumping

1. Introduction

The Santa Paula Groundwater Basin is located beneath the Santa Clara River Valley from Santa Paula west to Saticoy in east Ventura (see Figures 3.2 and 3.3). Within an area of 7,200 acres in the Santa Clara River Valley approximately 97,000 AF of groundwater is stored within the first 200 feet of the saturated zone. However, due to poor water quality in the lower Santa Paula Basin, only a small portion of the water is currently extracted for agricultural uses. Improving groundwater quality of the Basin has the potential to increase basin yield. A thirty year old study indicates the safe yield of the Basin to be

18,500 AF/Y (Mann, 1959). New studies may need to be prepared to determine the feasibility of treating the basin groundwater and estimate the basins safe yield.

Groundwater degradation is attributable to four factors: (1) Minerals leach into groundwater from surrounding sedimentary formation. (2) Percolation and runoff from agricultural, municipal and industrial uses. (3) Minerals left behind in soil due to agricultural practices and evapotranspiration. (4) High groundwater levels prevent flows lower in TDS from percolating into the Basin.

a. Cost

The cost of pumping the Santa Paula Basis to improve salt balance of the basin will depend upon many factors. Further analysis to determine details of the project will need to be conducted. Costs to implement the project will include well and distribution facilities, equipment needs, installation, operation and maintenance requirements. Until further studies are conducted, the cost of implementing the project will not be known.

b. Quality

As addressed in the introduction, the current quality of the Basin water is poor. In addition to a high TDS content, high concentrations of sulfate, chloride and nitrates also occur. Generally, deeper wells in the Santa Paula Basin have better quality because of lower TDS content. However, toward the western portions of the basin, water quality worsens as TDS levels increase. Salt balance pumping would improve Basin water quality and render it useful for agricultural, municipal and industrial (M & I) and possible potable uses. Water pumped out of the Basin would be blended with other higher quality water sources, rendering it useful for agricultural irrigation and possibly other uses as well. Several studies have been conducted to assess the problem and develop methods to improve Basin water quality and permit more effective use of the groundwater.

2. Summary of Salt Balance Studies

In 1968, a Santa Clara River Valley Salt Balance Study was conducted by the California Department of Water Resources (DWR). The report concluded that poor water quality in the Santa Paula Basin is a serious problem. The study recognized leachate, runoff, residues left behind in soil after evapotranspiration, and a high groundwater table as the primary causes (as addressed above), of the quality problem. The study recommended a detailed investigation be conducted to evaluate methods of salt balance control.

A 1973 study, Ventura County Water Management Project: Emphasis on the Reclamation and Reuse of Municipal Wastewater, was initiated by the Bureau of Reclamation. The study recommended pumping Santa Paula Basin groundwater to improve groundwater quality and to blend the water with another source to render it usable.

In 1980, a Seawater Intrusion Study was prepared as part of the 208 Areawide Water Quality Management Plan to evaluate the feasibility of extracting highly mineralized groundwater to improve the quality of the Basin, to provide supplemental water, and to assist in resolving the seawater intrusion problem beneath the Oxnard Plain. The study suggested pumping Santa Paula Basin water and transporting it via the Santa Clara River, to Pleasant Valley County Water District (PVCWD) facilities for distribution to the Oxnard Plain. There the water would be blended with Lower Aquifer System (LAS) groundwater or reclaimed wastewater. Blended water would then be used for agricultural irrigation, directly replacing extractions from the overdrafted Upper and Lower Aquifers. A reduction in pumping would reduce the rate of overdraft and resulting seawater intrusion.The study suggested pumping 8,000 AF/Y from five wells at a depth of 200 feet. Wells would be pumped at a rate of 1000 gallons per minute (gpm) throughout the year. The TDS of the water in 1980 was 1,924 mg/1. To reduce the TDS to a target level of 1,000 mg/1, blending sources of sufficient quantity and quality would be required. As mentioned above the study evaluated LAS groundwater and reclaimed wastewater as two potential blending sources. The study concluded that the project was not feasible at that time because adequate amounts of good quality, affordable water for blending were not available. The study recommended that the project be reconsidered when water such as Sespe Creek and/or reclaimed water become available for blending.

The studies mentioned above are available for review from the Ventura County Public Works Agency.

3. Status of Santa Paula Basin Salt Balance Pumping

The Santa Paula Basin Salt Balance Pumping project has not been implemented as of early 1994 due to lack of blending sources. However, with the probable operation of the Thousand Oaks/Hill Canyon Wastewater Reclamation Project, a partial blending source may become available in several years.

a. Preliminary Evaluation and Proposed Modification of the 1980 Study

As part of this Water Management Plan Update, the 1980 Salt Balance Study has been re-evaluated. Other potential sources which could be used to blend with the Santa Paula Basin water are now being considered. These include: reclaimed water from Thousand Oaks/Hill Canyon

Treatment Plant, Lower Aquifer System (LAS) extractions, and Santa Clara River water from the Freeman Diversion Project. Table 3.12, Santa Paula Basin Salt Balance Pumping Calculations, illustrates annual salinity removal calculations, and recommended blending ratios. These sources are proposed to be blended at the Pleasant Valley County Water District facilities. The blended water could then be used for agricultural irrigation, replacing groundwater extractions which aggravate the overdraft and resulting seawater intrusion problem.

A reassessment of the 1980 study suggests the implementation of the original components of the plan is still substantiated with only slight modification. Modifications to the Basin pumping schedule include pumping at a higher rate; 2,000 gpm, with additional wells; 8 to 10 total, for a shorter and specific period of time; 4 months prior to the storm season. This approach is expected to provide optimum benefits by achieving a maximum drawdown of the Santa Paula Basin prior to the storm season beginning in November. Once the basin is drawn down, storm runoff (with lower TDS) would be able to percolate into the basin reducing TDS and other mineral constituents.

Initial evaluation of the 1980 study suggests it may take a total of 11 years of pumping and resulting percolation to render the groundwater basin usable for agricultural and urban uses. Preliminary calculations indicate an annual TDS reduction of 79 mg/1 throughout the Basin (Table 3.12.a). In the interim, once blended with a higher quality water source, the 8,000 AF/Y to be pumped will become a usable source of water, increasing the Basin yield and the total countywide water supply. Once the Basin water quality is improved to an acceptable level, potential safe yield of the basin may be 18,500 AF/Y. Further analysis of the basin safe yield will be necessary.

Table 3.12 Santa Paula Basin Salt Balance
Pumping Calculations

3.12.a Annual Salinity Removed

8,000 AF / 97,000 AF	(Proposed annual extractions) / (capacity of basin)	= 8.2% annual salinity removed
Annual Salinity Increase		= 1.0
Annual Salinity Removed		= 7.2%
.073 (Annual Salinity Removed) X 1924 TDS mg/1		= 139 mg/1
139 mg/1 X 1100 mg/1 (TDS of runoff) / 1924 mg/q (TDS of Basin)		= 79 mg/1 net decrease

3.12.b Proposed Potential Blending Ratios

Ratio 1	Santa Paula Basin Hill Canyon Reclaimed Water Lower Aquifer System Extractions	2,000 AF 8,500 AF 10,000 AF
Ratio 2	Santa Paula Basin Freeman Diversion (Santa Clara River)	6,000 AF maximum available diversions

The Salt Balance Pumping Project needs to be studied further to refine details of well locations, distribution facilities, operation and maintenance. In addition, current cost benefit analysis should be prepared. A salt balance pumping project represents a potentially valuable water management tool.

b. Other Factors Affecting Implementation of a Salt Balance Pumping Project

Other factors affecting the implementation of a salt balance pumping project include institutional and jurisdictional coordination. Cooperation among all agencies involved in the project would be necessary. Agencies involved would include sanitation districts, cities, water districts, and water purveyors. Cooperation among these agencies will be essential to implement the proposed blending, delivery, and distribution portions of the project.

D. Conjunctive Use

1. Introduction

In Ventura County water is not always located where it is needed and water use practices do not always consider the highest and best use based on water quality. Water districts within Ventura County rely on a variety of water sources for supply. Some districts rely on local groundwater and surface water resources, while other districts depend on imported water. Distribution of water resources among the districts vary. Conjunctive management of water supplies throughout the county would enhance the ability to manage local water resources and, therefore, provide water where it is needed.

a. Definition/Concept

A broad definition of conjunctive use of water is the practice of conjoining a variety of water resources for use by various water users. The term conjunctive use is frequently used for a number of water management practices including groundwater banking and storage, and sharing or blending of surface, groundwater or imported water supplies.

Conjunctive management of water supplies may be an effective mechanism to eliminated disparities among supply and demand. One form of conjunctive use is water banking. Water banking among districts could prove beneficial by allowing districts to borrow water from each other when needed with the understanding that the water would be "paid back". This concept appears simple, however, delivery systems require to distribute the "water loans" back and forth may not currently exist.

Ideally, if water management practices were aggressively pursued to an optimum countywide; a variety of groundwater banking, surface water storage and blending systems could be managed and various distribution networks established. These could be managed to balance water supplies and water deficit countywide, and assure adequate supplies for water users in times of drought.

Drought conditions can significantly reduce local groundwater and surface water supplies. Severe water shortages can result in cut backs on water use or even restrictions on new water connections. Such is the case with the Casitas MWD that depends on local surface runoff to meet water demands. Although the drought is statewide, and MWD reductions of SWP water use are currently required, the reductions are less than local water rationing programs. Drought conditions, although statewide, affect water districts and customers who rely on local sources more severely. Conjunctive use projects would benefit those districts who rely on surface and groundwater sources, especially during drought. Conjunctive use could provide the instrument necessary to manage water resources more efficiently.

b. Cost

Because each project is different, cost of implementing conjunctive use projects will vary project to project. Costs to be incurred could include injection and extraction, well construction and maintenance, storage facilities, quality of water required for end use, treatment and distribution facilities.

c. Quality

Another consideration of conjunctive use involves the most appropriate use of water based on water quality. Water quality will vary greatly depending on the source of water for conjunctive use projects. Water quality should be matched with the desired use. High quality water should be used where most needed; for potable urban uses. Where lower quality water is acceptable for agricultural and landscape irrigation, industrial process water or other uses, reclaimed water or groundwater should be used. The practice, however, is not simple; water of a certain quality is not always located where that level of water quality is needed. It is not always cost effective to transport water so it could be put to the most appropriate use. As additional alternative sources, such as reclaimed water and facilities to obtain SWP entitlement water are developed, and a more sophisticated water distribution system occurs countywide, the practice of conjunctive use is likely to increase.

d. Storage

Storage is a critical consideration. During times of above average rainfall, local groundwater and surface water sources may reach their storage capacity. If facilities were available at other districts to bank the surplus water, it could be stored to supply peak summer demands. Additional storage facilities throughout the County, either in tanks, reservoirs or groundwater basins, would assist in balancing water supply and demand needs throughout the year. Another potential resource for water storage could be reclaimed sand and gravel mining sites. The United WCD will be conducting a pilot project to determine the efficiency and effectiveness of using a reclaimed mining site as a storage and recharge basin (see Chapter 3.V, Alternatives Sources).

2. Status of Conjunctive Use Projects Examples

a. Metropolitan Water District of Southern California-Calleguas MWD-City Of Oxnard Injection-Extraction Project

In October 1989, the City of Oxnard initiated a pilot injection/extraction project using 1717 AF of imported State Project Water from the Metropolitan Water District (MWD) delivered through Calleguas Municipal Water District (Calleguas MWD) facilities. Oxnard contributed capital improvement costs with financial incentives in the form of rate structures from MWD and Calleguas MWD, this project was made possible. This program is designed to allow for the injection, as available, of excess high quality imported water from Calleguas MWD and MWD of Southern California into the Oxnard Aquifer during winter months (October through April each year), and extraction of injected water during summer months (May through September).

Imported water was injected in winter of 1989 and pumped out during summer of 1990 reducing overdraft of the basin. Use of the Oxnard Aquifer as a storage reservoir would eliminate need for construction of an aboveground reservoir, and would provide a good recovery rate (Oxnard, 1990). Because of the flat gradient, the injected water does not appear to drift away from the injection point. This program appears to be successful and is planned to be continued with injections increasing to 6,000 AF/Y when water is available.

b. Metropolitan Water District of Southern California, City of Oxnard, Casitas Municipal Water District, Calleguas Municipal Water District and the County of Santa Barbara - Water Wheeling Project.

Emergency water was being delivered to Santa Barbara County to help supplement its limited resources and ease the impact of the continuing five year drought. Because of the cooperative efforts of the Metropolitan Water District (MWD) of Southern California, Calleguas Municipal Water District (Calleguas MWD), the City of Oxnard, Casitas Municipal Water District and Santa Barbara City, the emergency water was delivered. All of the agencies and cities exhibited exemplary effort towards this cooperative goal. The success of these efforts illustrate the significance of multi-agency cooperation in times of need to assess and solve a critical problem. Deliveries, which began in January 1991, were limited to winter months when supplemental water was available. A minimum of 2,400 AF/Y to a maximum of 3,600 AF/Y was delivered each year from 1991 to 1993.

Deliveries occurred through the following process: State imported water delivered to the City of Oxnard, (which is within the Calleguas MWD service area) was then transported via a new pipeline from Oxnard to the City of Ventura. Casitas MWD, which serves the City of Ventura, delivered Lake Casitas reservoir water to Carpinteria via a new pipeline from Casitas reservoir. All agencies and cities involved in this project should be commended for their efforts.

c. Calleguas Municipal Water District and Metropolitan Water District of Southern California - Las Posas Injection and Extraction Project.

In mid March 1991, the Calleguas Municipal Water District (Calleguas MWD) and the Metropolitan Water District of Southern California (MWD of Southern California) implemented an Injection and Extraction project in the North Las Posas Basin. Storage of Calleguas MWD water purchased from MWD of Southern California is taking place by injecting surplus water into the North Las Posas groundwater basins (see Figure 3.3). Total available storage of the basin is estimated at 300,000 AF; under this project, about 1,000 AF of water will be injected into the well during selected months over the next year and extracted during peak demand periods to test the basin's capacity.

E. Desalination

1. Introduction

Desalination is the removal of dissolved salt from brackish or seawater to produce water of a quality acceptable for urban or agricultural use. Currently, desalination is used where supplies of fresh water are limited and brackish or seawater is abundant and fuel costs are low. Two basic methods of desalination include distillation and membrane processes. Distillation is predominantly used for the treatment of seawater. A multiple stage evaporator system is used to evaporate out the salts. Membrane processes, commonly referred to as reverse osmosis, is used to treat brackish water, municipal and agricultural wastewater. Complete desalination systems require pretreatment, desalting, post treatment and brine disposal.

a. Costs

Many variables effect desalination costs; capital recovery time, quality of water desired for end use, level of treatment required based on original water quality, (i.e., brackish or seawater), energy and environmental costs. Capital investment costs that need to be recovered quickly result in increased costs to customers. Preliminary analysis suggests the use of reverse osmosis to treat brackish groundwater as the most cost effective and technologically feasible over distillation methods.

Depending on the quality of water being treated and the quality desired for reuse, costs per AF can vary from $600 for brackish water and $1,800 to $2,500 an AF for testing seawater. For comparison, other high energy sources of water include imported water which consumes energy through the SWP delivery system. State water costs range from $300 to $600 an AF. The high use of energy required for distillation processes pose two disadvantages; direct costs and environmental impacts. In neighboring Santa Barbara County where drought conditions have significantly reduced the safe yield of local surface water sources, desalination has been approved as an interim measure. Environmental impacts, including air quality, noise, marine habitat sensitivity and disposal of brine, however, must be mitigated. Inevitably, costs to mitigate such impacts will be incurred, either through financial costs of implementing and monitoring mitigation measures to a level of insignificance, or the cost of environmental impacts.

b. Quality

The quality of desalinated water varies depending on the quality desired for use. Water quality of desalinated water can be very good, however, as quality increases, so do treatment costs. Completely purified desalinated water is not economically worthwhile. Desalinating water to meet state drinking water quality standards can also be extremely expensive. If other sources are available to meet potable drinking water demands, those sources should be used to meet such demands, while those of lesser quality should be used for irrigation or industrial uses.

2. Status of Desalination Projects

a. County of Ventura Activities

Following several years of drought, Ventura County formed a Desalination Task Force to assess the possibility of developing such a facility in the County and keep up to date on desalination activities in neighboring Santa Barbara County and throughout the state. The Desalination Task Force began meeting in early 1991. Members included city, county water district, Southern California Gas and Edison Company representatives. Several committees were formed; the Policy committee which included all the members met almost monthly for two years to investigate the feasibility of a countywide Desalination Facility by coordinating and formulating plans with the joint efforts of representatives throughout the County. A technical subcommittee was formed to conduct a detailed review of technical data concerning desalination and to report findings and make recommendations to the Policy Committee. A finance subcommittee was formed to identify, evaluate and rank potential funding financing options available for a Countywide Desalination Facility. After meeting for two years the consensus of the committee was that desalination would be a component of future water resources, but that since rainfall had replenished local supplies the urgency of developing a countywide facility would be put on hold until the respective roles of conservation, reclamation, conjunctive use and banking are established. Because Ventura County has had access to less expensive water sources, desalination had not been considered an alternative water resource until recently. As costs of other water sources increase, and technological advances in desalination reduce the associated costs and environmental impacts, desalination has the potential to be considered a possible future water supply alternative.

b. City of Ventura Activities

After several years of drought it became apparent that the City of Ventura did not have adequate water resources to meet the needs of the community. In November 1992, Ventura voters chose desalination to provide supplemental water for the city. In response to the vote several technical tasks were implemented in 1993. The hydrogeologic conditions of the city's coastline were evaluated to determine the potential use of beach wells or other methods as part of the seawater intake system. A physical inspection of an abandoned wastewater effluent outfall pipe to determine its potential for use as part of the brine disposal system. A series of pre-application consultation meetings with a variety of regulatory agencies to identify ciritcal issues that would need to be addressed in the development of the project. Also, financing and funding options available to the city have been investigated. Rainfall in 1992 and 1993 filled reservoirs and rivers in Ventura and began replenishing local groundwater basins. Such conditions have provided Ventura City decision makers with more time to evaluate potential desal options in order to plan and implement the most advantageous seawater desalination project as possible. Issues that still need to be resolved include whether to design and build the facility as a municipal facility, privatized or a combination of the two, whether the facility operates continuously or only during periods of drought or high demand, and what type of desalination processes will be used.

c. Channel Island Beach Community District Activities

The Channel Islands Beach Community District (CIBCD) is currently evaluating several alternative water supply sources, including desalination of seawater and brackish water projects. The CIBCD may act alone or in conjunction with the City of Port Hueneme and the Naval Construction Battalion Center as part of a sub-regional project.

d. Santa Barbara County Activities

Following several years of drought, Santa Barbara County initiated the development of an emergency desalination facility. Due to the drought, surface supplies became critically low in Santa Barbara where water supplies depend on surface sources. The facility became operable in early March 1992, producing potable water. Because the facility is financed to recover capital costs within five years, the water produced is very expensive; approximately 1,800/AF.

F. United Water Conservation Gravel Basin Storage (Fox Canyon Seawater Intrusion Abatement Pilot) Project

1. Introduction

The United Water Conservation District (United WCD) is currently proposing a pilot project to use a reclaimed sand and gravel mining site as a ground water recharge and storage basin. For purposes of this plan, the project is referred as the Gravel Basin Storage (Fox Canyon Seawater Intrusion Abatement Pilot) Project instead of the Fox Canyon Seawater Intrusion Abatement Project so as not to confuse it with the existing Seawater Intrusion Abatement Projects that benefit the Fox Canyon aquifer. It should be noted that this proposed project has not yet been approved and will need to be studied to determine if negative impacts to surface and groundwater quantity and quality could occur. The discussion here is provided to illustrate a possible alternative method of increasing locally available water resources. Initially, the proposed project would be used as a spreading ground while the long term goal of the proposed project is to recharge the lower groundwater aquifers. The purpose of the proposed project is to improve water quality by limiting and/or halting the advance of seawater intrusion into the Lower Aquifer System. Also, by providing additional spreading grounds, the proposed project area could be used for spreading diverted water when other spreading areas are undergoing periodic desilting processes to remove silt that builds up over time.

The proposed project area is the Noble Pit, a 132 acre sand and gravel mining pit. Approximately 112 acres of the proposed project area had been, up until recently, reclaimed in strawberries while the remainder of the site was used for parking, maintenance, and the collection of agricultural and sand and gravel mining runoff. Currently, no agricultural related activities are occurring at the site. The site is located adjacent to the south side of the Santa Clara River approximately 2 miles downstream of the Freeman Diversion project in Saticoy. The Noble Pit is bounded by Los Angeles Avenue to the northwest, Vineyard Avenue to the northwest, the proposed Rose Pit, which is currently in agriculture to the southeast, and additional agricultural uses to the southwest.

The proposed project would ultimately convert the site to a spreading ground for the purpose of groundwater recharge and storage of future surface water deliveries. The existing agricultural uses will be removed, on site agricultural wells will be capped, and any contaminated soils will be removed from the pit and disposed in accordance with current regulations. Groundwater recharge and surface water deliveries would be accomplished by connecting the Noble Pit to the existing Saticoy Spreading Grounds by a pipeline beneath Los Angeles Avenue, which currently separates the two areas. Water stored in the Noble Pit for surface water deliveries would replace pumping from the lower aquifer system.

United WCD is currently purchasing the proposed project site from Calmat and is expecting ownership of the property and subsequent construction to begin in late Summer of 1994.

a. Costs

Costs are presently unknown. The purpose of the proposed pilot project is to determine recharge capabilities and storage yield which will enable United WCD to calculate per acre foot costs. The proposed pilot project will reveal the basin recharge capabilities and storage yield.

b. Quality

Based on the proposed project excavation depth and floor elevation plans, the theoretical annual evaporation losses would result in an increase of 0.7mg/l mineralization. This is not considered a significant water quality impact. The quality of the diverted surface water would be of sufficient quality for agriculture use.

c. Storage

Once the proposed pilot project is underway, the storage capacity of the basin will be determined. United WCD water conservation activities include storage and diversion of surface water and recharge of groundwater. United WCD stores water in Lake Piru and recharges groundwater at the Saticoy and El Rio Spreading Grounds. The initial seasonal recharge capacity of the Saticoy Spreading Grounds and El Rio Spreading Grounds are 450 acre-feet and 300 acre-feet per day respectively. These volumes equate to flow rates of approximately 225 cubic feet per second (cfs) and 150 cfs. As such, use of the entire surface area of both spreading basins simultaneously requires the accommodation of 375 cfs to which United WCD is entitled from the Santa Clara River.

Over time the spreading grounds lose their recharge capability due to the occurrence of a clogging layer on the basin floor. To correct this problem, the spreading grounds periodically need to be desilted. Desilting involves drying and reworking along the sides and bottom of the area to reactivate adequate recharge abilities. The frequency of this procedure depends upon the amount of water available for recharge. The procedure must occur every several months in portions of the spreading ground. During these maintenance periods, the recharge capability of the spreading grounds is substantially reduced and the grounds cannot accept the full 375 cfs diversion capacity. When flows contain high levels of suspended sediment, United WCD cease to divert water allows the flow and bypass the Freeman Diversion. This project would provide additional spreading grounds to be used when existing spreading grounds are desilted approximately four times a year.

2. Summary of Feasibility Studies

In 1992 the United WCD Lower River Reservoir Project (Gravel Basin Recharge) Final Report was prepared by Penfield and Smith to investigate several matters; 1) the feasibility of increasing the diversion flow rates from the Santa Clara River, and 2) the conveyance of these additional diversion flows to one or more excavated gravel basins that currently cannot be efficiently used within the existing United WCD boundaries. The report concluded that it would be appropriate to initiate the pilot project to determine per acre foot costs of developing the gravel pit as a storage and recharge basin. The feasibility report included many assumptions and design criteria which were used to arrive at project parameters.

3. Status of Gravel Basin Projects

United WCD plans to take ownership of the proposed project property in the late Summer of 1994. Construction of the storage basin pipelines would begin immediately. The construction period is expected to take six months. Once the pilot project is implemented it will be analyzed to determine recharge and storage capabilities. If the proposed pilot project is successful, additional reclaimed mining pits may be reclaimed as water recharge and storage basins. Currently, several similar projects are being considered by mining companies in the same area. However, it should be noted that these projects will require environmental review.

G. Summary of Supply Project Alternatives

As described above, a variety of water supply project alternatives could be implemented to obtain additional water supplies for Ventura County. State Project water, reclaimed water, treatment of poor quality water, conjunctive use and the desalination of brackish and seawater and UWCD's Gravel Basin Storage project (Seawater Intrusion Abatement Pilot Program) are all potentially valuable water supply sources which could provide for a more diverse network of countywide water resource. However, in most cases the project would be subject to CEQA requirements to determine potential significant environmental impacts and will be judged on a case by case basis. The alternatives range from those that could provide high quality water for potable uses to lower quality water sources suitable for agricultural and industrial uses. Each of the projects have advantages and disadvantages whether the cost, quality, ease of implementation, environmental or other issues. Table 3.13 lists the supply project alternatives, and summarizes the potential yields, quality and potential uses of alternatives.

Table 3.13 Summary of Supply Project Alternatives

Source	Potential Yield (AF/Y)	TDS[1] Level (mg/1)	Potential Uses
SWP Entitlement	20,000	300	Potable Municipal
Reclaimed Water: Hill Canyon	7,000	630[2]	Agriculture and Seawater intrusion abatement
Simi	5,000	750[2]	Agriculture and landscape
Moorpark	1,300	700[2]	Agriculture and landscape
Tapia	1,300	600[2]	Landscape
Gravel Basin Storage Pilot Project	Unknown	Varies	Agricultural, seawater intrusion abatement
Santa Paula Basin Salt Balance Pumping Annual Pump Yield for 11 years	8,000	1,100 (following blending with other sources)	Agriculture and Seawater Intrusion abatement
Improved Santa Paula Basin (following 11 years of salt balance pumping)	18,500	1000-1100	Agriculture and Industrial
Conjunctive Use	Depends on project	Varies	Varies
Desalination of Brackish or Seawater	Unknown - depends on project.	Depends on level of treatment of seawater or brackish water.	Agriculture and Industrial
Oxnard	20,000	Depends on determined end use.	Indirect - Groundwater recharge Direct - Agricultural and landscape irrigation
TOTAL →	62,600 - 73,100		

1. Total Dissolved Solids (TDS) levels are used to determine potential uses. Drinking Water quality standards for TDS are 1000 mg/1.

2. Although reclaimed water TDS levels are less than 1000 mg/1, current health regulations prohibit the use of reclaimed water for potable uses.

VI. CONCLUSIONS AND RECOMMENDATIONS

1. Summary of Countywide Water Supply and Demand

The following is a summary of the basic supply and demand figures and issues as addressed in the previous section of this chapter. Ventura County's water supplies are obtained primarily from three sources: surface water, groundwater, and imported water. Surface water supplies approximately 10.5% of the countywide water demand, groundwater 67%, imported water 22% and direct reuse of reclaimed water .5%. Countywide water demand is about 425,500 acre feet per year (AF/Y), per capita use in approximately .23 AF/Y. Approximately 74% of the county's residents receive some or all of their water from imported supplies. In 1991, approximately 68% of the water demand was used by agriculture, 22% by residential and 10% by commercial and industrial uses.

Currently, countywide water demand is greater than locally available water. This condition has resulted in the overdraft of groundwater resources and increasing dependence on imported water supplies. Overdrafted groundwater aquifers have resulted in seawater intrusion of aquifers, rendering portions of the local aquifer system degraded, useless and/or in need or expensive treatment. State imported supplies depend on snowpack and rainfall. As witnessed in the fifth year of drought, state water purveyors had no choice but to mandate cutbacks, making state water a somewhat unreliable source. Local surface water supplies also suffer during drought and cannot supply water at volumes previously supplied. These conditions point to the fact that even several water sources cannot be relied upon to meet countywide water demands during drought. Efforts to increase water supplies to meet current and future demands are essential. However, increasing supplies to keep up with population growth and an ever increasing water demand will prove to be a challenge that will not cease. In addition to creating additional water supplies, water demand management must play a vital role in planning efforts to ensure an adequate and reliable water supply in the short term, long term and during drought conditions. Current conditions illustrate the need to prioritize and act on the demand management and supply project alternatives available to provide for current and future water demands.

2. Prioritize Demand Management Programs and Supply Project Alternatives

The following lists of demand management programs and supply projects could provide for a diverse network of water resources and demand management techniques to meet the varied water needs of the county. Proposed demand management programs and supply projects are listed in columns side by side to illustrate the distinct differences between demand management programs and water supply development projects. Demand management programs have evolved dramatically in recent years and are considered separate and distinct elements of short and large range water management planning. Demand management programs can prevent and/or delay the need to develop new water supply projects, which can be expensive and take years to complete. The efficient use of water can result in immediate water savings and eliminate wasteful and unnecessary use of water. Due to the simplicity of demand management programs, most are less expensive, easier and faster to implement than the development of water supply projects. In addition, demand management programs usually don't require exhaustive engineering studies or environmental review. Developing additional supplies is of vital importance, however, creating additional water sources alone is not enough to ensure an adequate supply of water. Demand management is also a critical component in any strategic water management plan. Therefore the need to balance the supply and demand factors of water resource management is essential.

The order in which the supply projects and demand management program alternatives are listed is designed to provide a general priority list. One alternative listed above another indicates only that the project or program would "overall" be more easily, inexpensively or in some manner better at meeting a water quantity or quality need. Therefore the list should not be rigidly interpreted. These projects were evaluated subject to a variety of factors including cost, quality, storage and other factors. These factors were addressed in previous sections of this chapter. Because it can take years to complete many of the alternatives, new projects and programs are listed first to illustrate the need to implement new solutions in order to increase the diversity of supply and demand alternatives and does not indicate that new projects and/or programs would solve problems better than continuing or enhancing existing projects and/or programs. Table 3.14 summarizes the priority demand management programs and supply project alternatives.

Table 3.14 Priority Demand Management Programs and Supply Project Alternatives

DEMAND MANAGEMENT PROGRAM ALTERNATIVES	SUPPLY PROJECT ALTERNATIVES
DROUGHT PLANNING Programs to be implemented during drought to reduce water demands, including new development offsets, plumbing retrofits, require new development to use reclaimed water, water efficient landscaping, etc. Costs are paid back through water savings. Tiered rate structures and water allocations limit water use by providing an economic incentive to use water efficiently. Moratoriums prohibit new water connections, preventing additional water demands and are considered temporary measures to be implemented during declared water shortage emergencies only.	CONJUNCTIVE USE Conjoining resources, includes sharing, storage and banking. Usually considers highest and best use of water based on quality. Costs vary, less than new projects. Quality will vary depending on project. Requires cooperation among water districts and applicable agencies. RECLAIMED WATER Treated wastewater suitable for beneficial uses such as wetlands, agriculture, golf course, park and other landscape irrigation. Costs and quality vary depending on source. Requires distribution infrastructure. Requires cooperation among water treatment agencies, end users and others.
OVERDRAFT AND SEAWATER INTRUSION ABATEMENT PROGRAMS To reduce overdraft and seawater intrusion, groundwater pumpers in the Oxnard Plain are required to reduce extraction, allocation are based on historic use. An 80% efficiency is acceptable. Pumpers could pay fines and still use water inefficiently.	DESALINATION Desalination of brackish or seawater removes salt to produce water of a quality acceptable for urban, agricultural or industrial use. Costs vary - can be high. Quality depends on required end use. Requires disposal of brine.
COUNTYWIDE WATER CONSERVATION PROGRAM The Conservation program consists of public education programs to encourage efficient use of water for urban, agricultural, business and industrial uses. Information disseminated through a variety of mediums; school presentations, news releases, seminars, etc. Program reaches all sectors. No fees.	STATE PROJECT WATER Current imported water entitlement of 20,000 AFY. A high quality source could meet potable water demands. Cost high due to required delivery system. Not a reliable source during drought.
U C COOP Assists farmers in learning about efficient irrigation practices through seminars, pilot demonstration projects and other mediums. Program reaches farmers countywide. Requires change in practices. No fees.	UWCD GRAVEL BASIN STORAGE PILOT PROJECT This proposed pilot project would use a reclaimed sand and gravel site as a groundwater recharge and storage basin. May increase spreading ability and assist in abating seawater intrusion.
RESOURCE CONSERVATION DISTRICT Provides water audits, assists farmers in efficient irrigation practices through a variety of mediums. Program reaches farmers countywide. No fees.	GROUNDWATER TREATMENT (i.e., Salt Balance Pumping) Treatment of groundwater currently not used due to poor quality (high salt or other mineral content). Costs vary. Quality depends on end use required. Yields limited due to basin size.
INSTREAM USE - ENVIRONMENTAL DEMAND Determine instream flow requirements to restore and maintain the instream beneficial uses, such as fish, wildlife and other uses.	

As illustrated in above table, many projects and programs could be implemented to provide a diverse network of supply sources and demand management programs to provide a comprehensive approach to countywide water resource management.

NOTE: The Vern Freeman Diversion Project was completed in early 1991.

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A. WASTEWATER TREATMENT PLANTS

I. Description of Problem

Wastewater treatment plants may pose significant water quality problems if a plant does not comply with their National Pollutant Discharge Elimination System (NPDES) permit or if the plant's design capacity is inconsistent with locally adopted population forecasts. NPDES permits which are issued by the Los Angeles Regional Water Quality Control Board (LARWQCB) require a certain level of wastewater treatment prior to discharge. The wastewater treatment process usually includes three levels of treatment; primary, secondary and tertiary. In some cases, treatment to the secondary level is sufficient to meet discharge requirements. Primary treatment is the first stage of treatment in which wastewater is held in settling tanks or basins where a large portion of suspended solids are removed. Secondary treatment uses bacteria to treat and remove wastes. Tertiary treatment uses filtration to remove remaining solids. Clarification uses disinfectants to eliminate remaining bacteria.

A substantial quantity of treated effluent is currently discharged to rivers, arroyos and the ocean in the County. Only a small percentage of treated effluent discharge has not complied with NPDES permit requirements. This noncompliance has occurred at only one of sixteen treatment plants in the County. This wastewater treatment plant is currently proposed for an upgrade in treatment levels from secondary to tertiary treatment in order to rectify the effluent discharge quality problem.

Population forecasts adopted by the Board of Supervisors and the Ventura Council of Government (VCOG) are used to plan for expected growth in the County. Wastewater treatment plants must plan for and increase plant capacity to provide for expected growth. Additional discussion of treatment plant flow and projections and related tables are addressed in Section III of this Chapter.

II. 208 Plan Summary (1980)

The 1980 plan estimated flows and wasteloads to each wastewater treatment plant using information on projected sewer service areas, population and land use estimates and area specific loading factors. Point source flows were compared with existing (at that time) treatment plant capabilities to determine potential capacity problems. The analysis identified those plants that would need to be expanded by or before year 2000. Population and land use forecasts were used to project flows and wasteloads for each sewer area. This data was used to project domestic, commercial and industrial flows. Wastewater flow, Biological Oxygen demand (BOD) and Suspended Solids (SS) loading factors were obtained from each service area. It was found that in only one instance were State (grant eligibility) standards exceeded. Non compliance with the standard prohibits the plant from receiving grants during exceedance of the standard.

III. Current Status

Wastewater Treatment Plant Flow and Projections

Section 208 of the Clean Water Act requires that states and localities establish programs to control point sources of pollution. Pollutants which enter the water from any discernable, confined, and discrete conveyance are point sources.

Following is a review and update of Treatment Plant flow, quality and expansion needs. The County wide population and dwelling unit forecasts, which were adopted by the Board of Supervisors on June 15, 1993 and subsequently the Ventura Council of Governments (VCOG) on July 12, 1993 were used as the basis for the Sanitation District service area population forecasts.

The adopted forecasts were disaggregated by Analysis Zone (AZ), then reaggregated by sewer service area. Local Agency Formation Commission (LAFCO) adopted Sphere of Influence boundaries for each sewer district were used. The sphere boundaries, which represent the ultimate service areas boundaries, are a more accurate indication of future areas to be served. The steps in determining wastewater flows for each sewer service district area are listed below:

1. Determine Population by Sewer Service Area.

   The population forecast for each sewer service district was obtained by adding or subtracting the AZ forecasts from Growth/Nongrowth Area totals or aggregating the Analysis Zones.

2. Determine Industrial Acreage for Sewer Service Areas.

   The industrial acreage forecast for the year 2010 was obtained by determining future acreages for individually designated lands, as shown on the general plan and contact with each jurisdiction.

3. Determine Domestic/Commercial Wasteload Flow.

   Domestic/commercial loading factors (expressed in gallons per capita per day) were obtained by dividing 1990 average influent flow volumes for domestic/commercial flows by the 1990 population. The loading factors differ from district to district due to differences in the amount of commercial activity. Flow factors may also be affected by infiltration of the collection system. Total flow from domestic/commercial uses was forecast by multiplying the population forecast by the domestic/commercial loading factor.

4. Determine Industrial Wasteload Flow.

   Industrial loading factors (expressed in gallons per acre per day) were determined by dividing 1990 average industrial inflow volumes by the 1990 industrial acreage estimate. Total flow from industrial uses was forecast by multiplying the industrial acreage forecast by the industrial loading factor.

Wastewater flow, Biological Oxygen Demand (BOD) and Suspended Solids (SS) loading factors were obtained from the agency responsible for treatment plant operations. The purpose of this point source review and projection is to predict future flows as accurately as possible, so that capacity problems can be reliably predicted. Tables 4.1 through 4.9 provide information on each wastewater treatment facility.

Information presented in the tables indicates that treatment plants flows and projections are less than in the previous projection. As a result of this, treatment plant expansion needs are shown to be delayed into the future for an additional three to five years in some cases. There are two reasons for this. The first is that 1990 was a drought year and wastewater flows were less for a majority of the plants surveyed. The second is that the adopted population forecast shows over 23,000 fewer people in the County by the year 2010 than the previous forecast.

Although the drought most significantly affected flows in 1990, it has been observed that conservation practices throughout the County are still affecting water use and wastewater discharge. In addition, the control numbers for the projections are based on the 1990 Census, which provides the most accurate count. For this reason, 1990 was used as the base year for determining long range projections.

Population forecasts and treatment plant capacities are also used for determining the consistency of major projects with the Water Management Plan. Further discussion of the procedures for consistency determination is provided in Volume I, Goals, Policies and Programs, Chapter 1.

In the final analysis, the 1990 flow projection versus the previous projection contained in the 1980 208 Plan and the Ventura County General Plan (1987 update) do not vary significantly. Treatment plant expansion is needed for the Moorpark and Camrosa facilities prior to the year 2000 and Santa Paula prior to the year 2010 while other planned expansions appear to be keeping pace with the projected flows up to and past the year 2010.

Additional information on wastewater treatment plants is contained in Chapter 3, Water Supply and Demand of this Volume, in Section V.B. Alternative Resources, Reclaimed Water. A survey of all the wastewater treatment plants and reclamation use is summarized in Table 3.5 of that Section. The table provides information on expected expansions, capacity, reclaimed water and use and quality.

Table 4.1

POPULATION FORECAST BY SEWER SERVICE AREA

Sanitation District Service Area *	1990	1995	2000	2005	2010
Camarillo Sanitary District	45,065	48,595	52,124	55,254	58,383
Camrosa County Water District	20,942	23,570	26,197	28,742	31,292
County Service Area No. 30 (Nyeland Acres)	2,196	2,249	2,302	2,395	2,488
County Waterworks District No. 1 (Moorpark)	25,494	32,205	30,500	45,521	52,000
County Waterworks District No. 16 (Piru)	1,370	1,487	1,604	1,753	1,902
Fillmore Sanitary District	12,134	14,984	17,833	18,569	19,305
Montalvo Municipal Improvement District	4,362	4,650	4,938	5,163	5,387
Ojai Valley Sanitary District	24,311	24,827	25,342	26,029	26,715
Oxnard Sewer District (Includes Port Hueneme)	169,036	173,505	187,973	196,068	204,163
Santa Paula Sanitary District	25,282	32,136	30,070	32,332	34,594
Saticoy Sanitary District	745	794	844	863	880
Simi Valley County Sanitary District	102,665	111,918	121,170	130,996	140,821
Thousand Oaks Municipal Sewer District No.1					
a. Hill Canyon Plant	97,703	103,143	108,583	113,669	118,755
b. Olsen Road Plant	2,712	2,864	3,016	3,157	3,298
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	20,319	27,678	35,036	37,045	39,053
Ventura Sanitary District	93,402	99,575	105,747	110,565	115,382

Source: Ventura County Planning Division, 1994
*Includes Sphere of Influence

Table 4.2

INDUSTRIAL ACREAGE BY SEWER SERVICE AREA

Sanitation District	1990	1995	2000	2005	2010
Camarillo Sanitary District	514	609	705	800	896
Camrosa County Water District	26	43	60	77	127
County Service Area No. 30 (Nyeland Acres)	5	5	6	6	6
County Waterworks District No. 1 (Moorpark)	521	532	543	555	566
County Waterworks District No. 16 (Piru)	37	38	38	39	39
Fillmore Sanitary District	154	197	239	281	323
Montalvo Municipal Improvement District	3	3	4	5	6
Ojai Valley Sanitary District	121	148	174	199	225
Oxnard Sewer District (Includes Point Mugu, NCBC, and Port Hueneme)	1,494	1,885	2,271	2,657	3,046
Santa Paula Sanitary District	205	259	314	368	423
Saticoy Sanitary District	49	49	49	49	49
Simi Valley County Sanitary District	436	522	630	737	845
Thousand Oaks Municipal Sewer District No.1					
a. Hill Canyon Plant	565	575	585	630	700
b. Olsen Road Plant	0	0	0	0	0
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon) Portion City of Thousand Oaks	120	122	123	137	150
Ventura Sanitary District	442	638	833	1,028	1,227

Source: Ventura County Planning Division, 1994

Table 4.3
SEWAGE TREATMENT PLANT LOADING FACTORS

Sanitation District	Domestic/Commercial*		Industrial**	
	Previous (General Plan) 1987	Proposed (1990)	Previous (General Plan) 1987	Proposed (1990)
Camarillo Sanitary District	93	78	1,399	778
Camrosa County Water District	70	70	6	6
County Service Area No. 30 (Nyeland Acres)	95	68	500	500
County Waterworks District No. 1 (Moorpark)	88	***71 (1990) 80 (1995)	1,070	N/A
County Waterworks District No. 16 (Piru)	63	70	517	405
Fillmore Sanitary District	101	63	885	454
Montalvo Municipal Improvement District	69	48	3,333	3,333
Ojai Valley Sanitary District	78	75	984	124
Oxnard Sewer District (Includes Port Hueneme)	102	96	3,427	2,677
Santa Paula Sanitary District	90	77	372	372
Saticoy Sanitary District	149	149	217	217
Simi Valley County Sanitary District	87	82	2,285	390
Thousand Oaks Municipal Sewer District No.1				
a. Hill Canyon Plant	99	89	980	708
b. Olsen Road Plant	100	92	0	0
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	100	118	1,030	1,030
Ventura Sanitary District	98	114	654	475

*Gallons per capita per day (GPCD). **Gallons per acre per day(GPAD). ***1990 GPCD based on influent volumes divided by population and includes industrial flow. Subsequent years based on District projection of 80 GPCD (pers. comm. 9/13/94 Moorpark Treatment Plant District staff).
Source: Based on estimates of current average influent flow volumes, divided by 1990 population and industrial acreage estimates. Where current flow volumes not available 1987 General Plan loading factors were used.

Table 4.4

FLOW FROM DOMESTIC/COMMERCIAL USES

(All Figures in 1,000 Gallons Per Day)

Sanitation District	1990	1995	2000	2005	2010
Camarillo Sanitary District	3,515	3,740	4,066	4,309	4,553
Camrosa County Water District	1,465	1,649	1,833	2,011	2,190
County Service Area No. 30 (Nyeland Acres)	149	152	156	162	169
County Waterworks District No. 1 (Moorpark)	18,100	2,576	3,080	3,642	4,160
County Waterworks District No. 16 (Piru)	95	104	112	122	133
Fillmore Sanitary District	764	943	1,123	1,169	1,216
Montalvo Municipal Improvement District	209	223	237	247	258
Ojai Valley Sanitary District	1,823	1,862	1,900	1,951	2,003
Oxnard Sewer District (Includes Port Hueneme)	16,227	16,656	18,045	18,822	19,599
Santa Paula Sanitary District	1,946	2,474	2,315	2,489	2,663
Saticoy Sanitary District	111	118	125	128	131
Simi Valley County Sanitary District	8,418	9,177	9,935	10,741	11,547
Thousand Oaks Municipal Sewer District No.1					
a. Hill Canyon Plant	8,695	9,179	9,663	10,116	10,569
b. Olsen Road Plant	249	263	277	290	303
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	2,397	3,266	4,134	4,371	4,608
Ventura Sanitary District	10,647	11,351	12,055	12,604	13,153

Source: Population forecast time domestic/commercial loading factor. For 1990, actual flow estimates are shown (where available).

Table 4.5
FLOW FROM INDUSTRIAL USES
(All Figures in 1,000 Gallons Per Day)

Sanitation District	1990	1995	2000	2005	2010
Camarillo Sanitary District	400	473	549	622	697
Camrosa County Water District	.16	.26	.36	.46	.76
County Service Area No. 30 (Nyeland Acres)	2.50	2.50	3.00	3.00	3.00
County Waterworks District No. 1 (Moorpark)*	---	---	---	---	---
County Waterworks District No. 16 (Piru)	15	15.39	15.39	15.80	15.80
Fillmore Sanitary District	69	89	108	127	146
Montalvo Municipal Improvement District	10	10	13	16	20
Ojai Valley Sanitary District	15	18	22	25	28
Oxnard Sewer District (Includes Port Hueneme)	4,000	5,046	6,079	7,113	8,154
Santa Paula Sanitary District	76	96	117	137	157
Saticoy Sanitary District	11	11	11	11	11
Simi Valley County Sanitary District	170	204	246	287	330
Thousand Oaks Municipal Sewer District No.1					
a. Hill Canyon Plant	400	407	414	446	496
b. Olsen Road Plant	0	0	0	0	0
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	124	126	127	141	155
Ventura Sanitary District	210	303	396	488	582

Source: Industrial acreage forecast times industrial loading factor. For 1990, actual flow estimates are shown (where estimates are available).
*Moorpark includes their industrial flow into their domestic/commercial flow estimates.

Table 4.6

EXISTING CAPACITY AND PROJECTED FLOW FOR SEWAGE TREATMENT PLANTS TO YEAR 2010

(All Figures in 1,000 Gallons Per Day)

Sanitation District	1994 Treatment Plant Capacity	Project Flow				
		1990	1995	2000	2005	2010
Camarillo Sanitary District	6,000	3,915	4,263	4,615	4,931	5,250
Camrosa County Water District	1,500	1,465	1,649	1,833	2,011	2,191
County Service Area No. 30 (Nyeland Acres)	220	151	155	159	165	172
County Waterworks District No. 1 (Moorpark)	3,000	18,100	2,576	3,080	3,642	4,160
County Waterworks District No. 16 (Piru)	250	110	119	127	138	149
Fillmore Sanitary District	1,330	833	1,032	1,231	1,296	1,362
Montalvo Municipal Improvement District	700	219	233	250	263	278
Ojai Valley Sanitary District	3,000	1,838	1,880	1,922	1,976	2,031
Oxnard Sewer District (Includes Port Hueneme)	31,700	20,227	21,702	24,124	25,955	27,753
Santa Paula Sanitary District	2,600	2,022	2,570	2,432	2,626	2,820
Saticoy Sanitary District	240	122	129	136	139	142
Simi Valley County Sanitary District	1,250	8,585	9,381	10,181	11,028	11,877
Thousand Oaks Municipal Sewer District No. 1 a. Hill Canyon Plant b. Olsen Road Plant	 10,800 750	 9,095 249	 9,586 263	 10,077 277	 10,562 290	 11,065 303
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	10,000	2,521	3,392	4,261	4,512	4,763
Ventura Sanitary District	14,000	10,857	11,654	12,451	13,092	13,735

Source: Flow from domestic/commercial uses, plus flow from industrial uses. For 1990, actual average daily flow estimates are shown (where estimates are available) Ventura County Planning Division, 1994

Note: Information shown is for the Triunfo County Sanitation District portion of the Tapia Wastewater Treatment Plant located in Los Angeles County. The projected flow for the Triunfo County Sanitation District includes Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon. The wastewater from Oak Park, North Ranch, Lake Sherwood and Westlake is treated at the Tapia Wastewater Treatment Plant while the City of Los Angeles treats wastewater from Bell Canyon. The balance of the wastewater treated at the Tapia Wastewater Treatment Plant is from Las Virgenes Sanitation District in Los Angeles County.

Table 4.7

BIOLOGICAL OXYGEN DEMAND (BOD) AND SUSPENDED SOLIDS (SS) LOADING FACTORS AND PROJECTIONS

Sanitation District	Influent Loading Factor (MGL)[1]		1990 16 day average (lbs./day		Projections (lbs./day)			
					2000		2010	
	BOD	SS	BOD	SS	BOD	SS	BOD	SS
Camarillo Sanitary District	245	190	7,976	6,186	9,402	7,291	10,696	8,295
Camrosa County Water District	250	250	3,045	3,045	3,810	3,810	4,555	4,555
County Service Area No. 30 (Nyeland Acres)	250	250	313	313	339	339	357	357
County Waterworks District No. 1 (Moorpark)	250	175	2,697	1,885	4,590	3,208	6,170	4,333
County Waterworks District No. 16 (Piru)	245	273	224	249	258	288	303	337
Fillmore Sanitary District	220	233	1,549	1,542	2,292	2,280	2,471	2,522
Montalvo Municipal Improvement District	*250	250	455	455	519	519	579	579
Ojai Valley Sanitary District	292	336	4,460	5,134	4,664	5,510	4,928	5,673
Oxnard Sewer District (Includes Port Hueneme)	292	216	49,086	35,935	58,543	42,858	67,349	49,096
Santa Paula Sanitary District	242	302	4,010	5,044	4,872	6,067	5,649	7,035
Saticoy Sanitary District	260	300	262	304	293	339	305	354
Simi Valley County Sanitary District	261	243	18,497	17,199	21,935	20,396	25,590	23,794
Thousand Oaks Municipal Sewer District No.1								
a. Hill Canyon Plant	264	255	19,939	19,252	22,092	21,330	24,058	23,422
b. Olsen Road Plant	238	206	451	389	544	471	595	515
Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	217	261	4,478	5,431	7,570	8,452	8,461	10,262
Ventura Sanitary District	403	363	36,114	32,421	41,749	37,181	45,678	41,015

Source: Treatment Plant Survey Spring 1994

*Previous Data Used

[1]Loading factors combined commercial, industrial and resident loading factor

Table 4.8

EXISTING CAPACITY OF SEWAGE TREATMENT PLANTS AND FUTURE EXPANSION PLANS

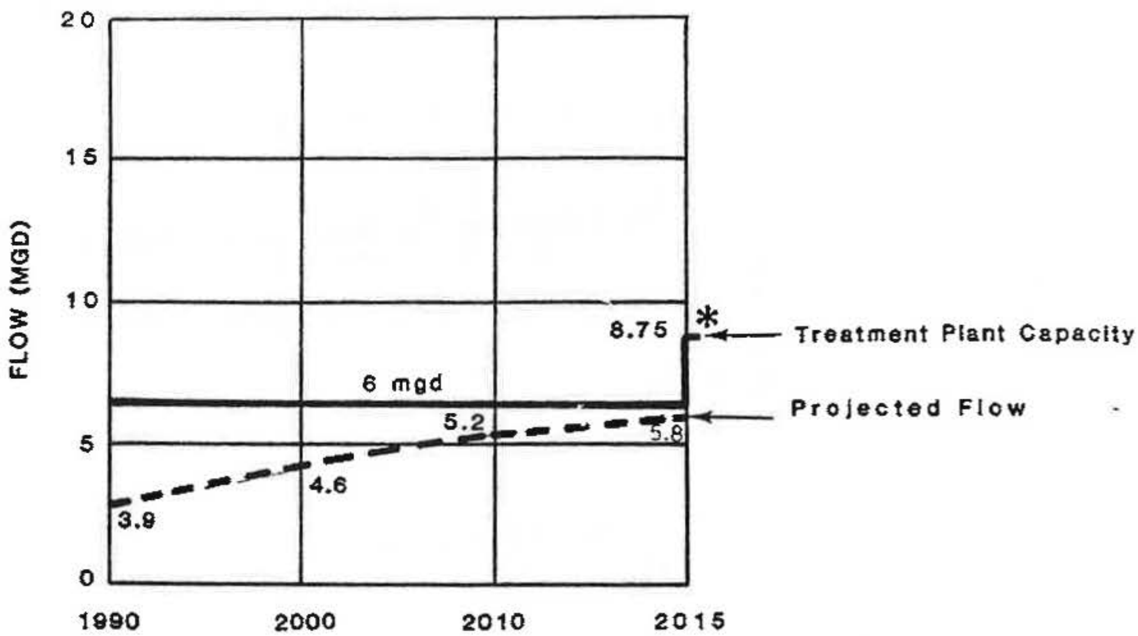
(All Figures in Million Gallons Per Day)

Sanitation District	Future Expansion Plans
Camarillo Sanitary District	8.75 by 2015
Camrosa County Water District	There are no current expansion plans. The plant will have to utilize a portion of the Camarillo Sanitary District Water Reclamation Plant capacity by 2010. Presently have 0.75 MGD reserved.
County Service Area No. 30 (Nyeland Acres)	There are no current expansion plans for this plant. 1.5 MGD
County Waterworks District No. 1 (Moorpark)	Expansion planned to 5.0 MGD before year 2000.
County Waterworks District No. 16 (Piru)	There are no current expansion plans for this plant. 0.10 MGD
Fillmore Sanitary District	Work is in progress to expand the facility to 2.2 MGD.
Montalvo Municipal Improvement District	There are no expansion plans at this time. 0.7 MGD
Ojai Valley Sanitary District	There are no current expansion plans for this plant. 3.0 MGD
Oxnard Sewer District (Includes Port Hueneme)	Expansion plans will bring facility to 39.6 MGD capacity after year 2000.
Santa Paula Sanitary District	The City of Santa Paula plans to expand their plant to 2.65 MGD capacity in 1995 and 2.75 MGD in 2005. These expansions can be done earlier if flow demand warrants. A major expansion project will be needed about the year 2005.
Saticoy Sanitary District	The Saticoy Sanitary District Wastewater Treatment Plant has several options including expansion at the site, conversion to different types of treatment process or connection to the City of Ventura Waste Water Reclamation facility. 2.4 MGD
Simi Valley County Sanitary District	Ultimate expansion to 17.5 MGD by 2014.
Thousand Oaks Municipal Sewer District No. 1 a. Hill Canyon Plant b. Olsen Road Plant	 14.0 MGD by 2000. There are no current expansion plans for this plant.
*Triunfo County Sanitary District (Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon)	Ultimate 16.0 MGD expansion.
Ventura Sanitary District	14.0 MGD. There are no immediate expansion plans but the City of Ventura may need to consider expansion of this facility by the year 2010.

Source: Flow from domestic/commercial uses, plus flow from industrial uses. For 1990, actual average daily flow estimates are shown (where estimates are available) Ventura County Planning Division, 1994

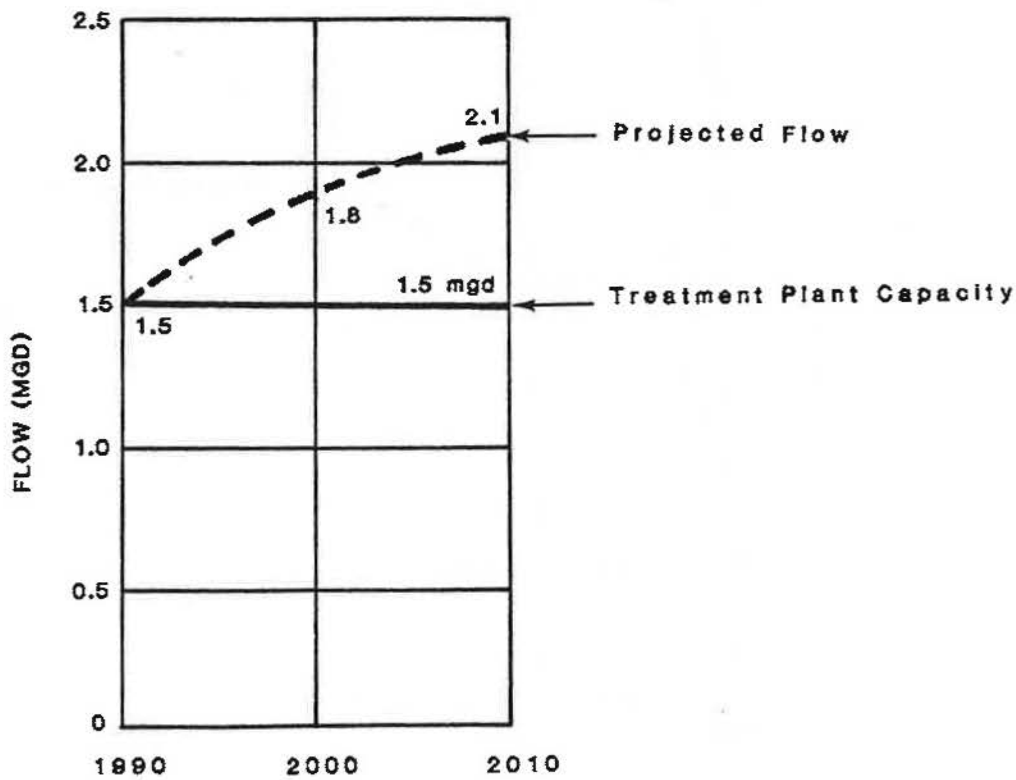
*Note: Information shown is for the Triunfo County Sanitation District portion of the Tapia Wastewater Treatment Plant located in Los Angeles County. The projected flow for the Triunfo County Sanitation District includes Oak Park, North Ranch, Westlake, Lake Sherwood and Bell Canyon. The wastewater from Oak Park, North Ranch, Lake Sherwood and Westlake is treated at the Tapia Wastewater Treatment Plant while the City of Los Angeles treats wastewater from Bell Canyon. The balance of the wastewater treated at the Tapia Wastewater Treatment Plant is from Las Virgenes Sanitation District in Los Angeles County.

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



CAMARILLO SANITARY DISTRICT WATER
RECLAMATION PLANT

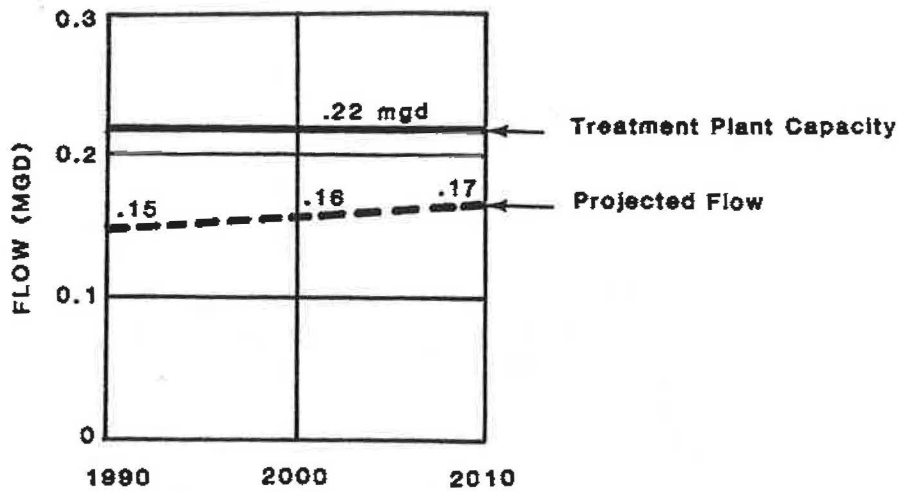
* 2015 Figures are included for Camarillo because of the planned explansion for that date.



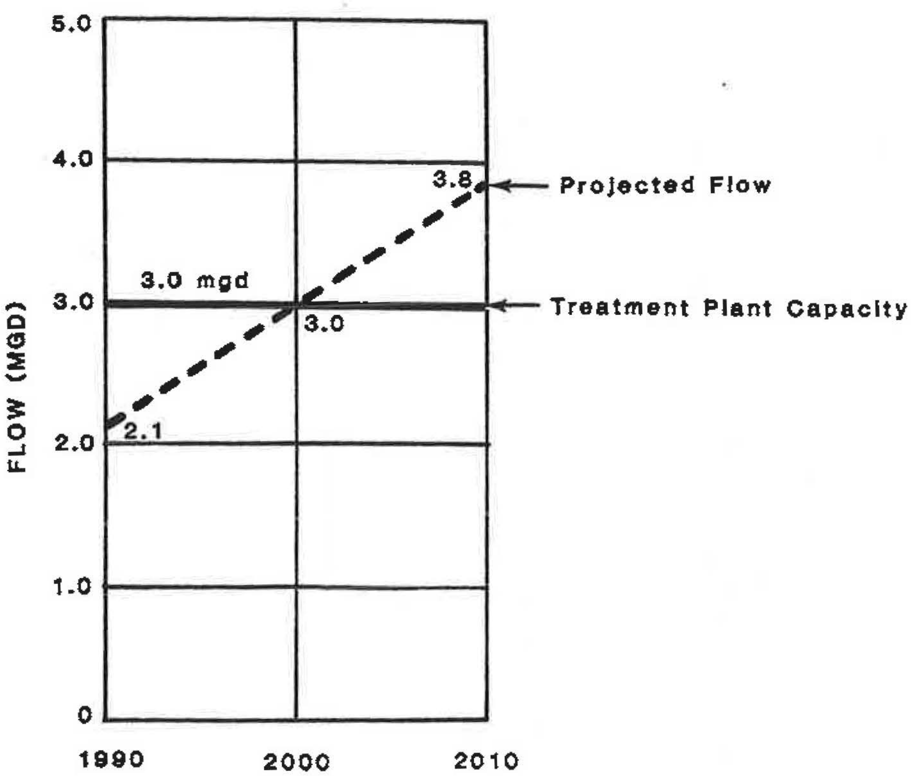
CAMROSA WASTEWATER TREATMENT PLANT
(CAMROSA COUNTY WATER DISTRICT)

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



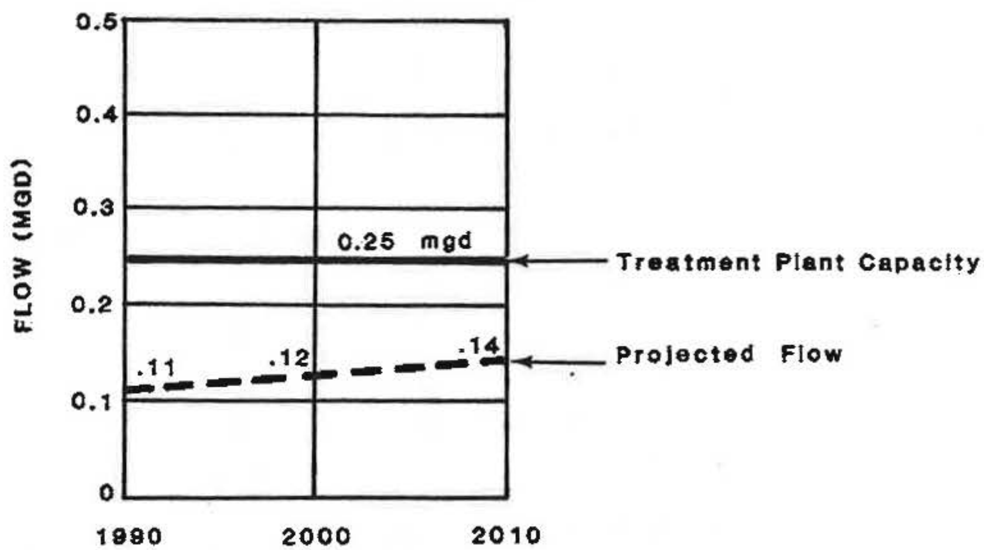
NYELAND ACRES WASTEWATER TREATMENT PLANT
(COUNTY SERVICE AREA NO. 30)



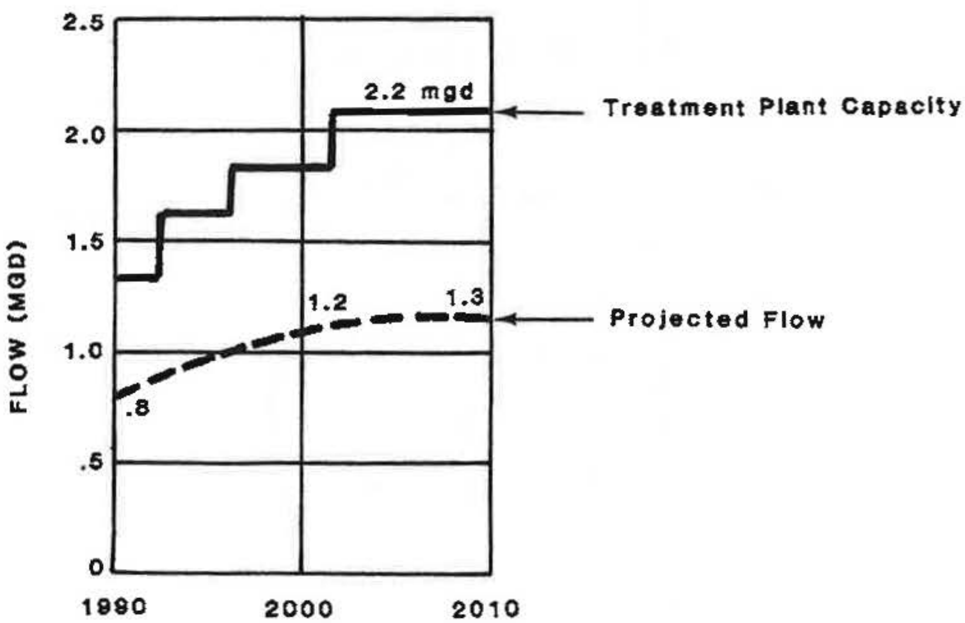
MOORPARK WASTEWATER TREATMENT PLANT
(COUNTY WATERWORKS DISTRICT NO. 1)

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



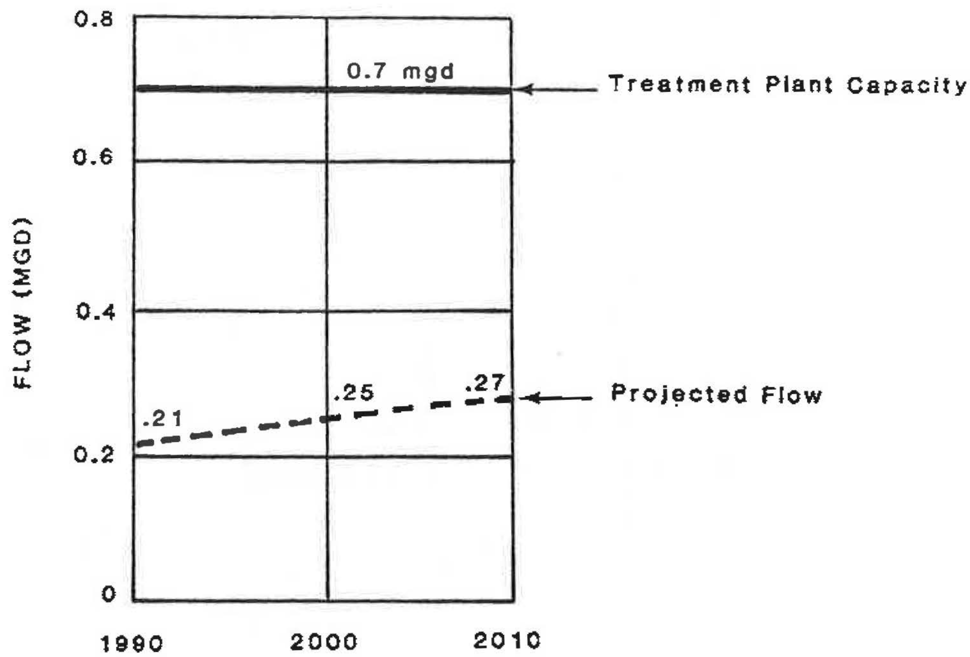
PIRU WASTEWATER TREATMENT PLANT
(COUNTY WATERWORKS DISTRICT NO. 16)



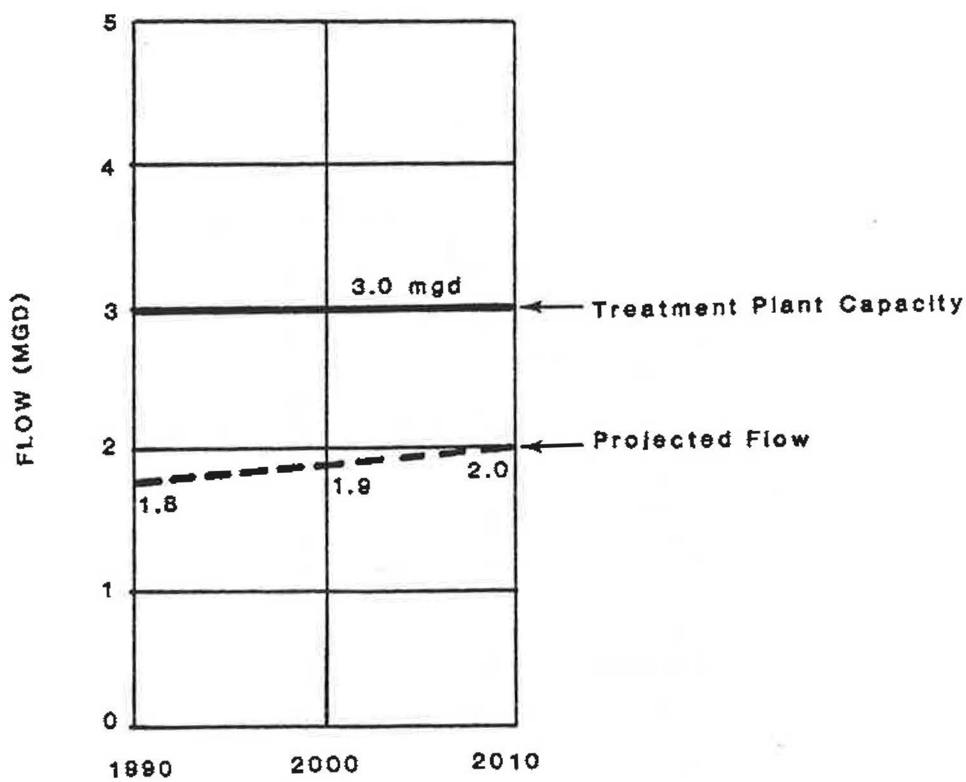
FILLMORE WASTEWATER TREATMENT PLANT
(FILLMORE SANITARY DISTRICT)

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



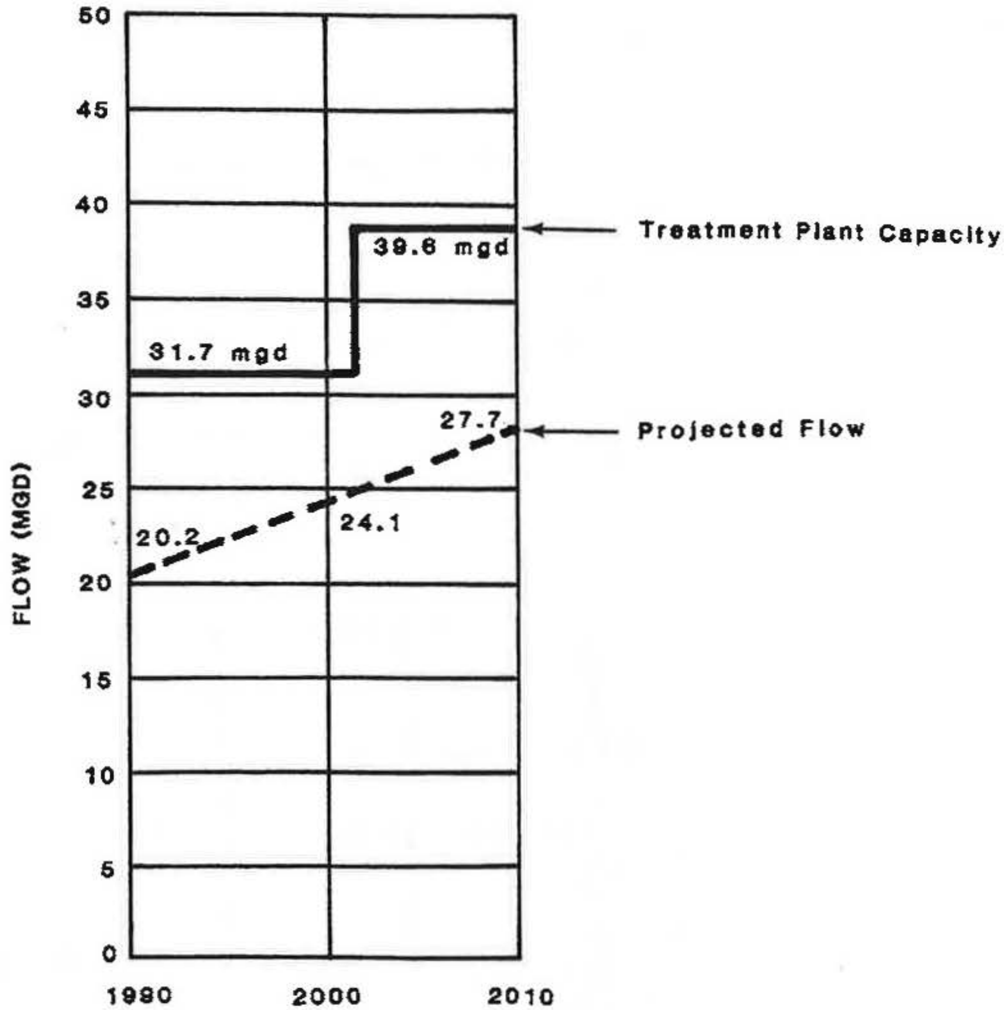
MONTALVO MUNICIPAL IMPROVEMENT DISTRICT
TREATMENT FACILITY



OJAI VALLEY SANITARY DISTRICT WASTEWATER
TREATMENT PLANT

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

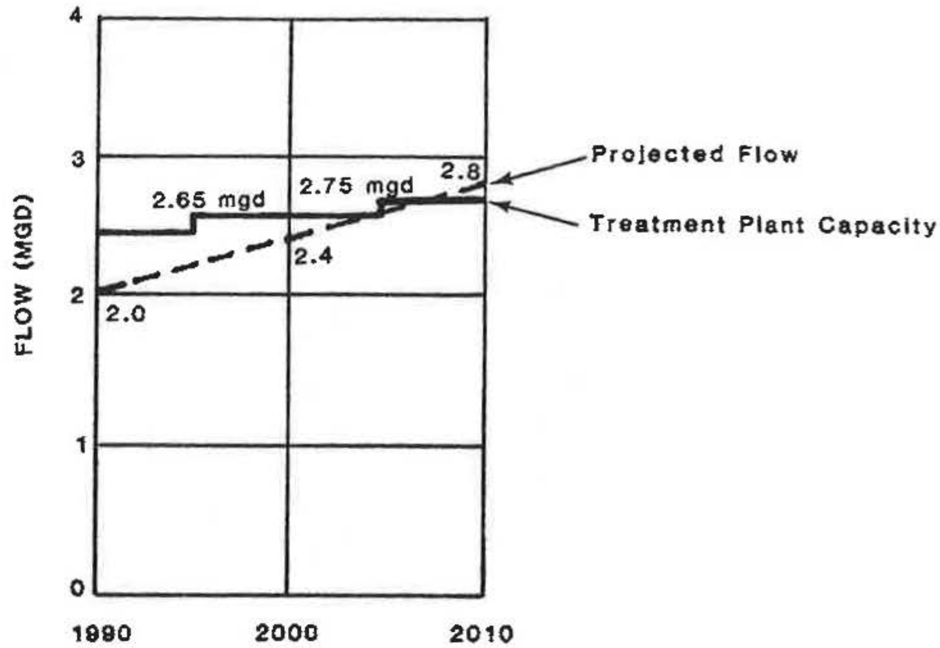
TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



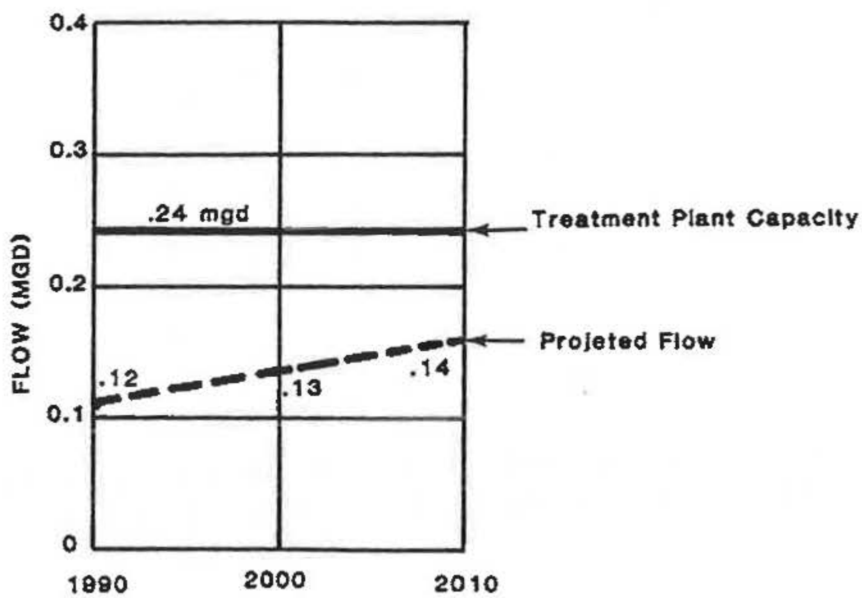
CITY OF OXNARD WASTEWATER TREATMENT FACILITY
(OXNARD SEWER DISTRICT INCLUDES PORT HUENEME)

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



CITY OF SANTA PAULA WASTEWATER TREATMENT PLANT
(SANTA PAULA SANITARY DISTRICT)

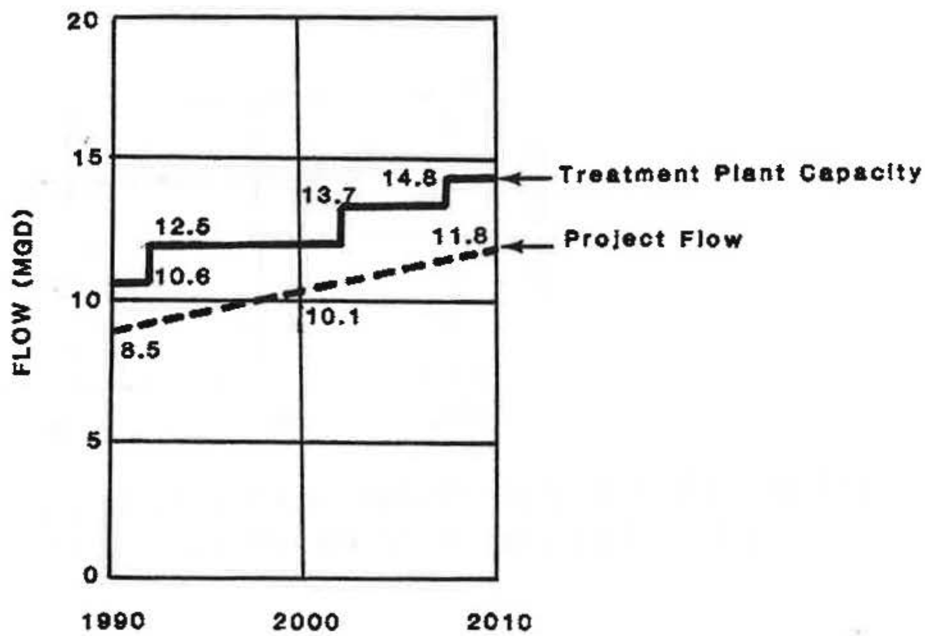


SATICOY SANITARY DISTRICT WASTEWATER
TREATMENT PLANT

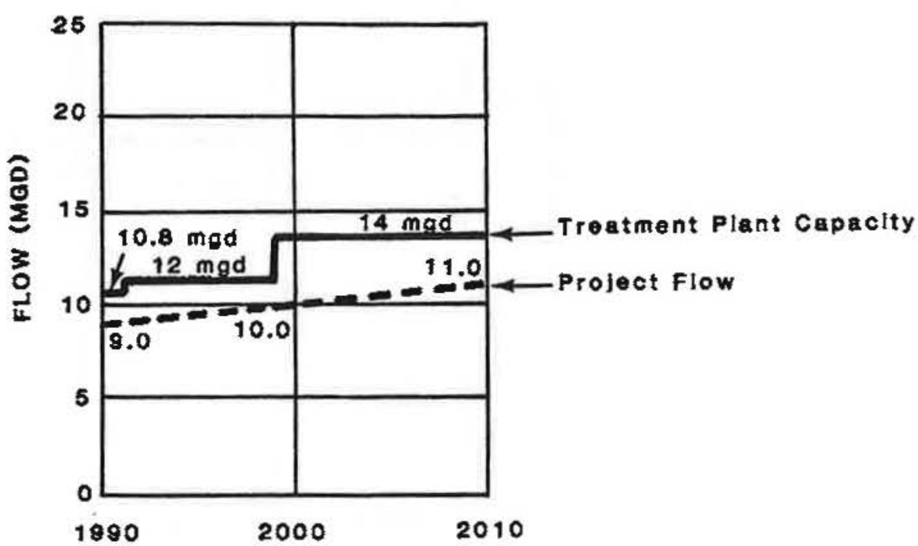
R.12/10/94

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



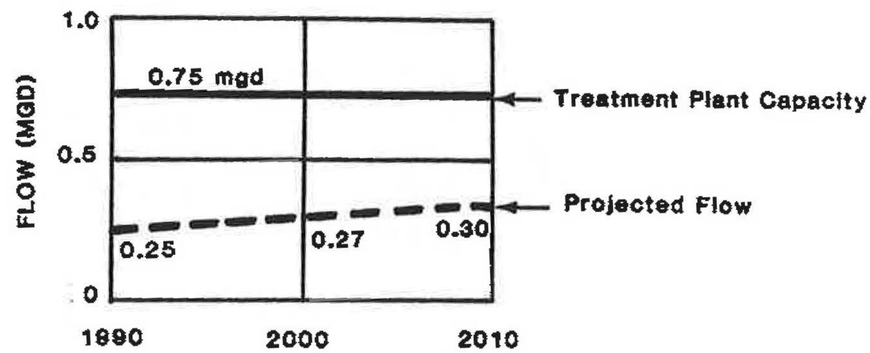
SIMI VALLEY COUNTY SANITATION DISTRICT
WATER QUALITY CONTROL PLANT



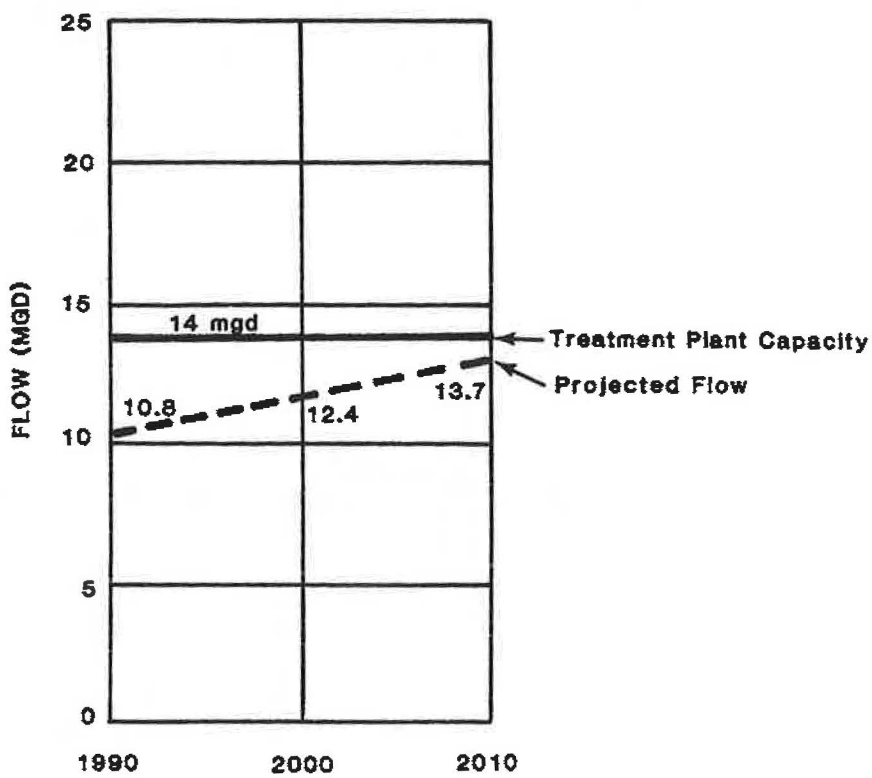
CITY OF THOUSAND OAKS-HILL CANYON WASTEWATER TREATMENT PLANT
THOUSAND OAKS MUNICIPAL SEWER DISTRICT NO. 1

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

TABLE 4.9 WASTEWATER TREATMENT PLANT STAGING



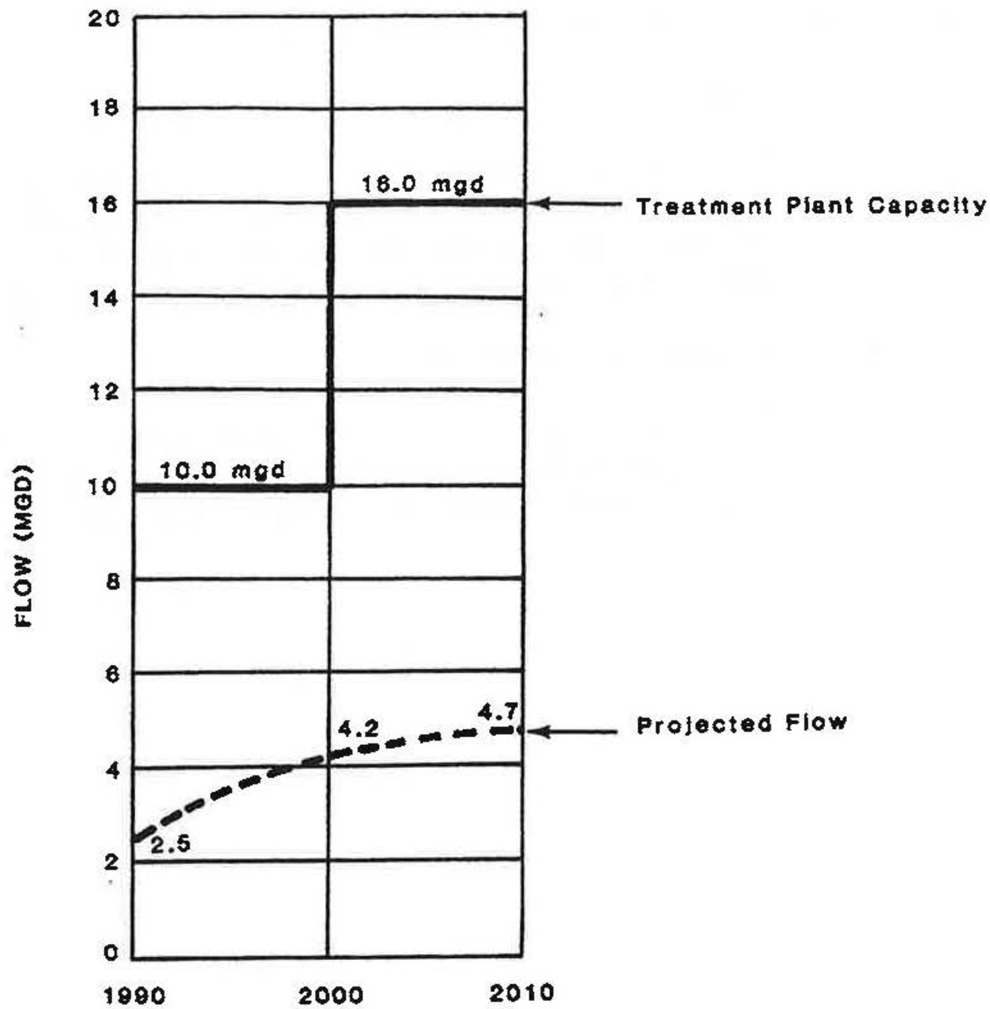
CITY OF THOUSAND OAKS-OLSEN ROAD WATER RECLAMATION PLANT
(THOUSAND OAKS MUNICIPAL SEWER DISTRICT NO. 1)



VENTURA WATER RENOVATION FACILITY
(VENTURA SANITARY DISTRICT)

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

SEWAGE TEATMENT PLANT STAGING



TRIUNFO COUNTY SANITATION DISTRICT
(FOR OAK PARK,NORTH RANCH,WESTLAKE AND BELL CANYON)

SOURCE: VENTURA COUNTY PLANNING DIVISION, 1994

NOTE: Projected flow shown is for the wastewater from the Triunfo County Sanitation District, which includes Oak Park, North Ranch, Westlake and Bell Canyon. Total treatment plant capacity is shown for the Tapia Wastewater Treatment Plant located at Calabasas in Los Angeles County. The Tapia Wastewater Treatment Plant also treats wastewater from the Las Virgenes Sanitation District located in Los Angeles County. Wastewater from Oak Park, North Ranch and Westlake is treated at the Tapia Wastewater Treatment Plant while the City of Los Angeles treats the wastewater from Bell Canyon.

IV. Conclusions and Program Recommendations

A. Conclusion

Excluding one wastewater treatment plant all other treatment plants in the County are in compliance with their respective NPDES permits. As illustrated in the previous tables, treatment plant flows and projections are less than in previous projections and are consistent with adopted population forecasts to the year 2010.

B. Program Recommendations

1. Encourage and assist where feasible, the upgrade of wastewater treatment plant facilities to effect wastewater discharge effluent quality improvement to comply with NPDES permit requirements.

Chapter 4.1.A Wastewater Treatment Plants References

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B. PACKAGE WASTEWATER TREATMENT PLANTS

I. Description of Problem

Package wastewater treatment plants are stand alone manufactured units capable of serving schools, single residences, small groups of homes or capable of serving agricultural communities that have developed in such a way as to resemble and function as a small town. The difference between conventional wastewater treatment plants and package treatment plants are that package treatment plants have a much smaller capacity, generally no more than 100,000 gallons per day. Basic treatment steps are similar. The advantages of package plants include the provision of sanitary sewer services to relatively remote areas without the need for extending costly sewer lines. Package plants can also serve areas where septic tanks are no longer an appropriate means of sewage disposal. However, package plants can also create some disadvantages. Such plants may induce urban growth in open space and rural areas by providing such a service. Package plants which need to be monitored daily, may also duplicate existing services.

A. Commonly Used Types of Package Plants

Currently, package wastewater treatment plants are in operation at the Happy Valley School, Thomas Aquinas College and at the Limoneira Company in Santa Paula. Another plant is being planned for Thacher School in the East Ojai Valley.

Imhoff tank. The Imhoff tank consists of a two-story tank in which sedimentation is accomplished in the upper compartment and the digestion of solids is accomplished in the lower compartment. In terms of effluent quality the performance of such units is about the same as achieved using a separate primary sedimentation tank with external solids processing facilities. Sludge is removed periodically from the digestion compartment and spread to air dry, usually on sand beds.

Rotating biological-disk process. In this process a series of circular disks, constructed of various materials, are mounted on a central shaft. The disks are then partially submerged and rotated in a tank containing the wastewater to be treated. Treatment of the organic material is accomplished by bacteria that become attached to the disks. Biological solids that slough from the disks are removed by settling before the treated wastewater is discharged.

In its usual configuration this process would be preceded by a primary settling tank. Waste biological solids from the secondary settling tank can be thickened in the primary settling tank or in a separate thickener. Solids are usually digested to reduce their organic contents so that they may be dewatered or air dried more easily. The digestion process can be either aerobic or anaerobic depending on local conditions. Although easier to operate, aerobic digestion has the disadvantage of requiring a continuous power input.

Trickling-filter processes. In the trickling-filter processes the liquid to be treated is applied over solid media to which microorganisms have become attached. Rock, slag, plastic, and redwood slats have been used for this purpose. Conventional filters filled with rock or slag vary in depth from 4 to 10 feet, whereas plastic media and redwood slats are employed in tower filters that very in height from 20 to 40 feet. The process flowsheet most often used is essentially the same as that described above for the rotating biological-disk process.

Activated-sludge processes. The five processes included in this grouping are similar, with the exception that the first two are assumed to be used with external digestion. In the last three it is assumed that the biological solids produced during treatment are digested internally and discharged periodically to drying beds or sludge lagoons.

Although the last three processes are often used without secondary settling, it is not recommended; the quality of the effluent will vary because solids will carryover and generally fail to meet discharge requirements established by state pollution control agencies. With the addition of secondary settling and solids return, the latter three processes are fundamentally the same as the first two with the exception of solids handling. If used without secondary settling, these processes can be followed by aerobic stabilization ponds for the removal of solids. Such ponds are often called "maturation ponds" and are lightly loaded (5 to 15 lb. BOD/acre/day) to achieve the required effluent quality. Such ponds are also used to polish or upgrade the effluent from conventional activated sludge and trickling filter processes.

B. Package Plant Applications

PROCESS	*APPLICATION*
Imhoff tank	Very small communities, housing tracks, and small institutional facilities where primary treatment is acceptable.
Rotating biological disks	Domestic wastes; small communities; may be covered for odor control; where growth of filamentous organisms may be a problem.
Trickling-filter processes Conventional (low rate) Conventional (high rate) Tower filters	Domestic wastes; low application rates are necessary to achieve high removal efficiencies; nitrification can be achieved with very low loading rates; can be used where growth of filamentous organisms may be a problem.
Activated-sludge processes Complete mix	General application; resistant to shock loads; package plants.
Contact stabilization	Treatment of wastes where BOD is colloidal or suspended; package plants; recreational areas.
Extended aeration	Small communities; package plants; housing developments recreational areas; industrial wastes.
Aerated lagoon (with settling) Oxidation ditch (with settling)	General application; lower efficiencies during cold weather because of temperature sensitivity.

Jewell, W. and Swan R., 1985, <u>Water Pollution Control in Low Density Areas, Wastewater Treatment for Small Communities</u>

C. Ventura County Package Plant Applications

In Ventura County the following package treatment plant systems have been employed where sewage treatment needs have outgrown conventional septic system use. The Limoneira Company uses an Imhoff tank. This type of treatment system typically consists of a two-story tank in which sedimentation occurs in an upper compartment while the digestion of solids is accomplished in the lower compartment. Treated effluent is then pumped to a lagoon for aeration and percolation. Limoneira also has a new extended aeration system employing surface discharge by means of a three acre sprinkler field. Both systems appear to be successful.

Happy Valley School use an extended aeration process. After extended aeration, the processed effluent is pumped to evapotranspiration beds for final processing. This particular system appears to be working well, but would not likely be selected as a system of choice due to climatic conditions which are generally not arid enough to ensure total evapotranspiration. Thomas Aquinas College also uses an extended aeration process. However, the treated effluent is surface discharged via a sprinkler system. This system, as well as others of this type, appear to be relatively successful, but could pose a potential health problem if human contract with the sprayed effluent cannot be successfully controlled. Although not applied for, the Thacher School is considering the use of a package plant to accommodate future school expansion plans.

D. Estimated Treatment Performance

1. System Survey

ITEM	ROTATING DISK	TRICKLING FILTERS	ACT. SLUDGE EXTERNAL DIGESTION	ACT. SLUDGE INTERNAL DIGESTION
		PROCESS		
Process characteristics Reliability with respect to Basic process Influent flow variations Influent load variation Presence of Industrial waste Industrial shock loadings Low temperatures (20°C) Expandability to meet increased plant loadings	Good Fair Fair Good Fair Sensitive Good, must add additional disk module	Good Fair Fair Good Fair Sensitive Limited	Good Fair Fair Good Fair Good Fair to good if designed conservatively	Very good Good Good Good Good Sensitive Good, ultimately more volume will be required
More stringent discharge require-ments with respect to Suspended solids	Good, add filtration or polishing ponds	Good, add filtration or polishing ponds	Good, add filtration or polishing ponds	Good, add filtration or polishing ponds
BOD	Improved by filtration	Improved by filtration	Improved by filtration	Improved by filtration
Nitrogen	Good, denitrifi-cation must be added	Good, denitrifi-cation must be added	Good, denitrifi-cation must be added	Good, denitrifi-cation must be added
Operational complexity	Some	Some	Moderately complex	Some
Ease of operation and maintenance Power requirements Waste products Potential environmental impacts Site considerations Land area requirements	Very good Low Sludges Odors Moderate plus buffer zone	Very good Relatively high Sludges Odors Moderate plus buffer zone	Fair High Sludges — Moderate plus buffer zone	Excellent Relatively high Sludges — Large plus buffer zone

Jewell, W. and Swan R., 1985, Water Pollution Control in Low Density Areas, Wastewater Treatment for Small Communities

2. Performance by Process Type

	PROCESS	*PERCENT*	*REMOVAL*
Rotating Disk	BOD 85-95	SS 70-90	P 10
Trickling filter	85-95	70-90	10
2-story activated sludge	90-95	95	10
Trickling filter and activated sludge	90-95	90	10

Jewell, W. and Swan R., 1985, Water Pollution Control in Low Density Areas, Wastewater Treatment for Small Communities

In addition to the above processes, tertiary treatment including either sedimentation with coagulation, filtration, carbon absorption, ion exchange, reverse osmosis, electric dialysis and distillation can remove up to 95 percent of BOD, 98 percent of suspended solids and 90 percent of phosphorus. Tertiary processes using biological denitrification can also be employed in areas where groundwater has high nitrate levels.

II. 208 Plan Summary (1980)

A. Existing Criteria

The current 208 Plan does not explicitly prohibit package plants, nor does it contain explicit policies or criteria on how such plants should be evaluated. New package plants could be approved under the current 208 Plan, even though they are not specifically identified in the Plan, if they meet four criteria:

1. Package plants would not cause the current population limits of the 208 Plan to be exceeded;
2. Package plants are a cost-effective and equitable means of distributing public services;
3. Package plants would not result in a duplication of public services; and
4. Package plants would reinforce existing policies and plans for orderly, controlled, and phased development, and would not encourage step-out development.

B. Post 208 Plan Policies

During the years following adoption of the 208 Plan, the Ventura County Division reformatted and updated its General Plan. Policies relating to the use of package wastewater treatment plants were included in the Coastal Area Plan. This Plan prohibited the siting of package plants in all zoning districts except in the "C-M" (Coastal Manufacturing) zone. The use of package plants in other areas of the County, although less restrictive, still required a General Plan Amendment to include the plant's siting on the General Plan's Wastewater Facilities Map. Few such facilities have been added to the map due to general concerns about growth inducing impacts.

III. Current Status

Simply stated, package wastewater treatment plants can be feasible alternatives to the use of septic systems in rural areas. However, their use often strains local government's ability to wisely plan and direct urban growth to areas where urban services are already available. Unrestrained growth also compromises government's ability to provide cost efficient urban services.

Additionally, the disposal of sludge (bio-solids) is currently a problem faced by operators of package plants as well as wastewater treatment plants. EPA Rule 503 prohibits the spreading of raw sludge to dry in some areas and requires composting.

The ease in which a small plant can be maintained and operated is also of vital importance. A small package plant operator must be able to ensure safe and efficient operation on a 24 hour basis with a minimum of laboratory testing. If this cannot be achieved within a normal working schedule, the plant is likely to fail putting a burden on the operator and possibly governmental agencies if the plant should fail.

Small plants must be budgeted for repairs and improvements over its lifetime. If funds are not secure to facilitate its proper operation, governmental agencies could be forced to manage the plant's operation in spite of all other efforts to the contrary.

In summary, package plants for rural areas should exhibit reliability without skilled help, be efficient under variable qualities and quantities of flow, blend into the countryside without unsightly features, generate little solids for further handling and be relatively free from odors. Such package plants could be operated by a public agency. Currently, the Ventura Regional Sanitation District (VRSD) operates a small plant in the Nyeland Acres area.

IV. Conclusions and Program Recommendations

A. Conclusions

The advantages of a package plant are: (1) it can provide sanitary sewer services to relatively remote areas without the need for extending costly (and probably growth-inducing) sewer trunk lines; and (2) it can also provide sanitary sewer service to existing developed areas, where septic tanks are no longer an appropriate means of sewage disposal.

The disadvantages of a package plant are: (1) it may induce urban growth in open space and rural areas by providing sewer service to potential urban uses, and by establishing land-use precedents in open space and rural areas; (2) it may duplicate services presently being provided; (3) such a plant may have adverse water quality impacts at the point of discharge; (4) it can be easily expanded and thus enhance growth inducement; (5) it can cause the County to have to provide "urban" services to relatively remote areas; and (6) it must be monitored on a daily basis to ensure proper functioning.

B. Program Recommendations

1. Require use of package plants to replace existing septic systems where septic systems are contributing to public health and safety problems.

2. All proposed package plants would have to be consistent with the goals and policies of the County General Plan;

3. Package plants should be sized and explicitly restricted to serve only the single-purpose site and its facilities; and

4. The water quality impacts of proposed package plants shall be analyzed as part of the environmental document prepared for projects on a case by case basis.

5. Continue to use existing criteria for package plant evaluation.

Chapter 4.1.B References

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A. SEAWATER INTRUSION

I. Description of Problem

Seawater intrusion of local ground water aquifers is a critical problem in the Oxnard coastal plain area. The degradation of these aquifers which provide significant water supply and storage capabilities seriously threatens local groundwater availability and quality. In Ventura County, the overdrafting of aquifers has resulted in the depletion of water supplies, lowering of water levels and causing water degradation from seawater intrusion. Degraded water quality has caused groundwater in some areas to become unusable, further reducing water supplies. In the Oxnard Coastal Plain, aquifers extend beyond the coastline and outcrop on the ocean floor. Historically, fresh water entered these aquifers via percolation near Saticoy and El Rio, flowed through aquifer zones and reached the ocean at offshore outcrops. When well extractions began to exceed the seaward flow of fresh water, seawater was drawn into aquifers causing lateral seawater intrusion. Seawater intrusion causes serious water quality degradation, in some cases resulting in significant adverse environmental, social and economic impacts and/or rendering significant areas useless resulting in long term irreversible impacts.

In 1982, following the possibility of State Adjudication, the Fox Canyon Groundwater Management Agency (GMA) was formed to oversee the groundwater basins of the Oxnard Plain, Pleasant Valley and North Las Posas. State and local agencies have long recognized that continued lateral seawater intrusion will cause irreparable damage to intruded aquifer zones and all other underlying aquifer zones. The intruded Oxnard aquifer can leak downward through improperly sealed and/or abandoned wells through areas of aquifer mergence and through leaking clay caps (aquitards) contaminating the lower useful aquifers.

A. History of Seawater Intrusion

The first Oxnard aquifer zone water wells were completed in 1870. Properly constructed wells were capable of delivering artesian water under natural pressure to the second floor of homes such as those on the Colonia Rancho. Because of low rainfall and the use of artesian water to leach salts from large areas of farm land after the turn of the century, many wells ceased to deliver sufficient artesian flows and above ground centrifugal pumps were installed. During the 1920's water levels fell below the suction limit of many of the pumps. These pumps were replaced by deep-well turbine pumps similar to those in use today.

During a period of low rainfall in the 1930's, water levels in the Oxnard aquifer zone were down as much as five feet below sea level and wells located at the head of the Mugu and Hueneme submarine canyons became the first wells to exhibit abnormally high chloride ion concentrations indicative of seawater intrusion. A wet period from 1937-1945 returned Oxnard aquifer zone water levels to above sea level. In the spring of 1946, because of increased pumping water levels again began to decline and a pumping trough was detected in the Oxnard aquifer zone about three miles from the coast southeast of the City of Oxnard. A pumping trough is an area in which water levels in wells are lowered because water is being withdrawn from the aquifer at a higher rate than it is being replenished.

By 1951, the Department of Water Resources (DWR) identified active seawater intrusion in Oxnard aquifer zone wells in two areas near the coast: Port Hueneme Harbor, where seawater intrusion was estimated to have invaded approximately 9.2 square miles on land, and Point Mugu, where the intrusion was estimated to cover about 1.3 square miles. By summer 1963, forty-two wells near Port Hueneme and two wells at Point Mugu had been removed from service because of the advance of seawater intrusion into the Oxnard aquifer zone. At that time, onshore seawater intrusion occurred in 4.3 square miles near Port Hueneme and 7.4 square miles near Point Mugu, for a total of approximately 11.7 square miles.

DWR tested Oxnard aquifer zone wells for chloride ion content each year through 1965, and published a report in 1968 presenting the advance of seawater beneath the Oxnard Plain. Their report concluded that intrusion would bring seawater to the Oxnard Forebay by 1990, if it continued to advance at the observed rate. Figure 1 illustrates the extent of seawater intrusion described in the DWR report for years 1951, 1959, 1963, and 1965, along with the results of the County of Ventura Public Works Agency (PWA) survey in 1974. PWA continued to sample study area wells annually after 1974, publishing the results in Oxnard Plain seawater intrusion reports each year through 1991 (see Table 4.10). PWA sampled the same wells as had been tested by DWR, where possible, and included new Oxnard aquifer zone wells as they became available. Intrusion was determined to have reached a well when the chloride ion content reached 100 milligrams per liter (mg/l). Native quality groundwater in the area contained only about 50 mg/l chloride.

The chloride ion content of shallow wells in the coastal area between the two intrusion fronts had increased to greater than 100 mg/l when PWA began sampling wells in 1974, so it was assumed that the two fronts had merged. In subsequent years the chloride level in wells further inland

TABLE 4.10

*HISTORIC EXTENT OF SEAWATER INTRUSION OXNARD AQUIFER ZONE

YEAR	CHLORIDE CONCENTRATION AT FRONT (mg/l)	ONLAND INTRUDED AREA (SQUARE MILES) PORT HUENEME	POINT MUGU	TOTAL
1951	500 (established standard)	.02	1.3	1.5
1955	500	1.5	2.2	3.7
1959	500	2.6	5.5	8.1
1963	100 & 500 (two-fronts mapped)	4.3	7.4	11.7
1965	100 (new lower standard)	5.5	8.5	14.0
1968	100	5.8	7.0	12.8
1974	100	Intrusion Fronts Merged		17.9
1975	100			18.4
1976	100			17.7
1977	100			20.6
1978	100			20.8
1979	100			20.8
1980	100			21.3
1981	100			21.0
1982	100			20.9
1983	100			20.9
1984	100			22.7
1985	100			22.7
1986	100			22.5
1987	100			22.8
1988	100			22.8
1989				
1990				
1991				
1992				
1993				
1994				

*In 1989 the United States Geological Survey (USGS) began constructing wells along the coast and at inland locations on the Oxnard Plain. Isotopic analysis performed on samples from these and other wells indicated that the water at many locations had not been mixed with seawater. Although the USGS has not yet published results of the Regional Aquifer System Analyses study evidence indicates that **the current seawater intruded area is probably between 11 and 16 square miles** considerably less than the area previously thought to be intruded. Many of the wells designated as intruded because of high chloride content were in fact yielding water from the perched zone due to failed well casings. Elevated chloride levels caused by leakage through failed well casings is a serious source of aquifer degradation, even if it is not seawater intrusion.

toward Pleasant Valley Road increased to greater than 100 mg/l. The area of seawater intrusion appeared to grow to include 22.8 square miles in 1987. No increase or decrease in chloride ion in wells close to the front was observed after 1987, so the reported area was not changed after that year. It appears that the increase in surface water for groundwater recharge provided by the Improved Vern Freeman Diversion above Saticoy, the reduction in pumping of shallow wells on the Oxnard Plain, and the direct deliveries by the Pumping Trough Pipeline and by the Oxnard-Hueneme pipeline to the lower Oxnard Plain area have stabilized the intrusion or contamination of the aquifer through repressurization.

In 1989, the United States Geological Survey (USGS) began constructing nested piezometer wells along the coast and at inland locations on the Oxnard Plain. Isotopic analyses performed on samples from these and other wells indicated that the water at many locations had not been mixed with seawater. Many of the inland wells designated as intruded because of a high chloride content were, in fact, yielding water from the perched zone because of failed well casings. The USGS identified three sources of chloride ion in wells that could cause investigators to believe that seawater had reached the well. The USGS has not yet published a seawater intrusion report, but it has determined that active seawater intrusion has not advanced beyond Hueneme Road. The true seawater intruded area is probably between 11 and 16 square miles considerably less than the area previously thought to be intruded. However, the USGS has found evidence that some seawater intrusion also occurs in the Mugu aquifer and the Fox Canyon aquifers, at least at the coastline.

The elevated chloride level caused by leakage through failed well casings is a serious source of aquifer degradation, even if it is not seawater intrusion. This degradation can be controlled by identifying and properly destroying the failed wells that are the conduits of movement of poor quality water from the perched zone into the Oxnard aquifer zone. Well ordinance 3991 requires the destruction of wells after no more than one year of disuse. However, hundreds of abandoned wells exist on the Oxnard Plain. Both the downward leakage through wells and lateral seawater intrusion are a consequence of overdraft of the aquifers. The well ordinance has prohibited the construction of new UAS wells that would contribute to seawater intrusion since 1980, and in 1990 the Ordinance was amended to prohibit the repair of existing shallow wells completed in UAS. New wells constructed on the Oxnard Plain must be sealed in up to three zones to control interaquifer transfer of water. Abandoned wells to be destroyed must be sealed wherever the casing penetrated interaquifer zones.

Since seawater intrusion began to invade shallow wells in the 1950's, much of the demand for irrigation water on the Oxnard Plain has been transferred from the Upper Aquifer system (UAS) to the Lower Aquifer System (LAS). The USGS discovery of active seawater intrusion in the Mugu Aquifer and in the Fox Canyon Aquifer Zone has shown that all of the aquifers beneath the Oxnard Plain are in a condition of overdraft during most years and must be managed together to prevent the degradation of groundwater caused by seawater mixing.

II. Current Status

A. Post 208 Plan

The initial 208 study recognized seawater intrusion as a problem and recommended several projects and programs to eliminate or reduce seawater intrusion. Currently, those projects and programs are being implemented. Phases I and II of the Seawater Intrusion Abatement Program and Fox Canyon Groundwater Management Agency (GMA) activities are currently being implemented successfully and are discussed below. Phase I of the project consisted of Lower Aquifer System (LAS) Wells and a Pumping Trough Pipeline. Phase II includes the Vern Freeman Diversion Project. Table 4.2 illustrates the LAS Contingency Plan as recommended by the initial 208 Plan. Currently, planning stage 1 is being implemented due to indications of seawater intrusion in the LAS.

1. LAS Wells and Pumping Trough Pipeline

Phase I of the Seawater Intrusion Abatement Project consists of a Pumping Trough Pipeline to deliver water diverted from the Santa Clara River for irrigation of crops in the pumping trough area. The average annual overdraft in the Oxnard aquifer had been determined to range from 8,400 AF/Y in 1980 to 11,200 AF/Y in year 2000. It was believed that by reducing the Oxnard aquifer zone extractions by 12,700 AF/Y, seawater could be repelled. LAS wells were drilled along the pipeline route to provide irrigation water when surface water is unavailable. Thirty-seven Upper Aquifer System (UAS) wells in the pumping trough area were removed from service to decrease the demand on the UAS. The 37 wells had been pumping an average of 12,700 AF/Y annually.

2. Improved Freeman Diversion Project

Phase II of the Seawater Intrusion Abatement Project includes the Improved Freeman Diversion Project. The diversion project has been financed, constructed and implemented through coordination between the

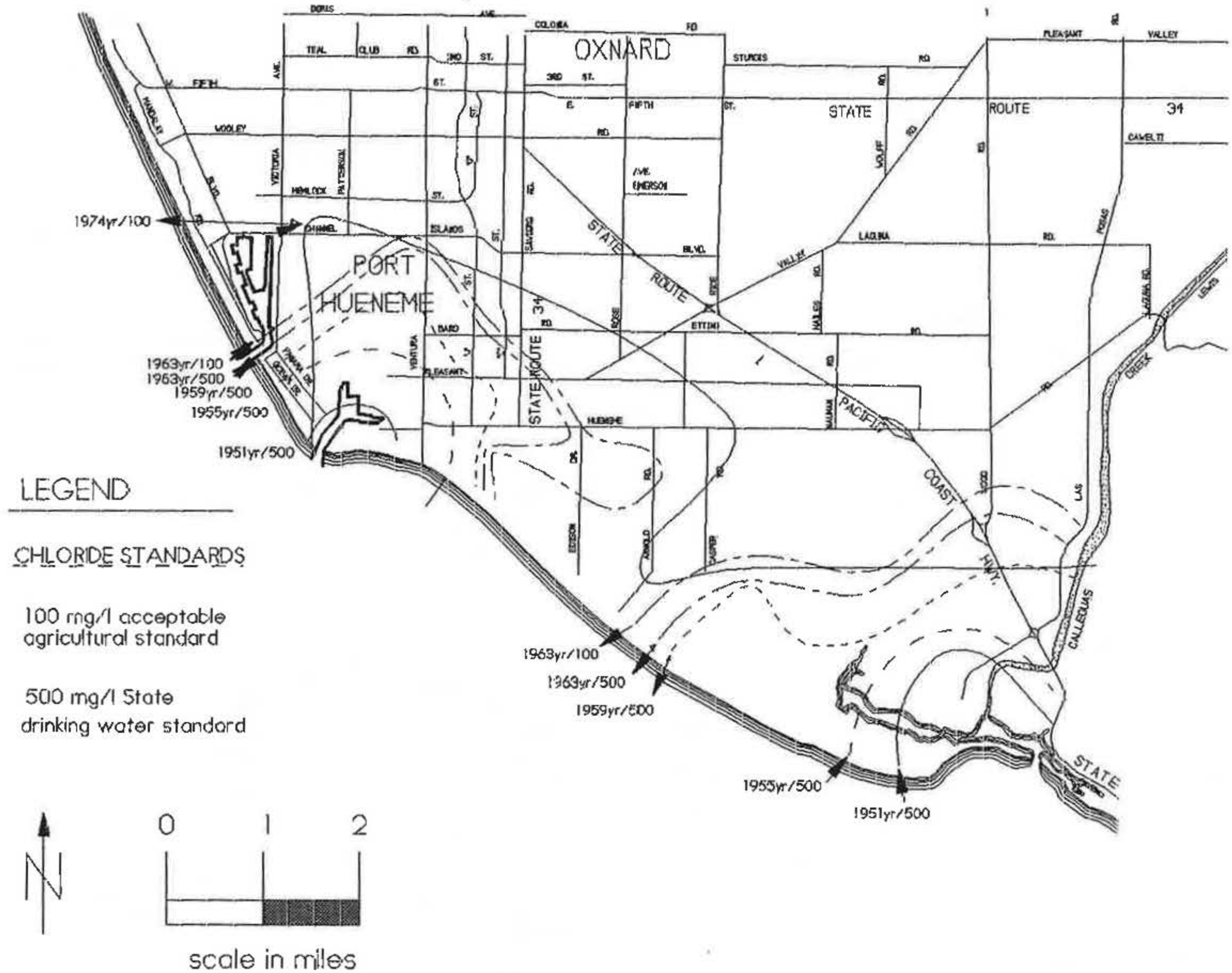
United Water Conservation District (UWCD), the County Public Works Agency, State Department of Water Resources and the Bureau of Reclamation. The diversion structure is constructed on the Santa Clara River above Saticoy. The project diverts river flow which would otherwise eventually reach the ocean. Water is diverted from the Santa Clara River for delivery to users on the Oxnard Plain through the Pumping Trough Pipeline, or percolation into groundwater basins through spreading grounds. Diverted water from the river percolates into the aquifer to prevent further intrusion by seawater. A portion of the diverted water is delivered to those who have halted use of their shallow wells which previously pumped UAS water.

Currently, the Vern Freeman Diversion project has the capacity to divert up to 55,000 AF/Y during years of average rainfall. Diversions from the Freeman project are limited in order to preserve the anadromous fish populations of the Santa Clara River and associated water bodies. From October 1991 to March of 1994, the Freeman Diversion diverted 299,185 AF. Not all of the diverted water percolates into the groundwater basin to recharge the aquifer much of it is lost to evaporation. During drought conditions, diversions will be less than design capacity. During the fifth year drought condition, diversions were approximately 15,000 AF/Y or 28 percent of design capacity.

3. Fox Canyon Groundwater Management Agency Activities

The Fox Canyon Groundwater Management Agency (GMA) was created through State legislation in 1982 to manage groundwater resources in the area overlying the Fox Canyon Aquifer zone. The objective of the GMA is to control and reduce groundwater overdraft and resulting seawater intrusion. These aquifers collectively contain more than 14 million AF of fresh water in onshore storage and supply about 70 percent of the area's water demand (County of Ventura, Public Works Agency, December 1990). However, a portion of the water that meets that 70 percent demand is overdrafted. The aquifer cannot continue to meet this demand in the future without causing serious seawater intrusion impacts to the aquifers.

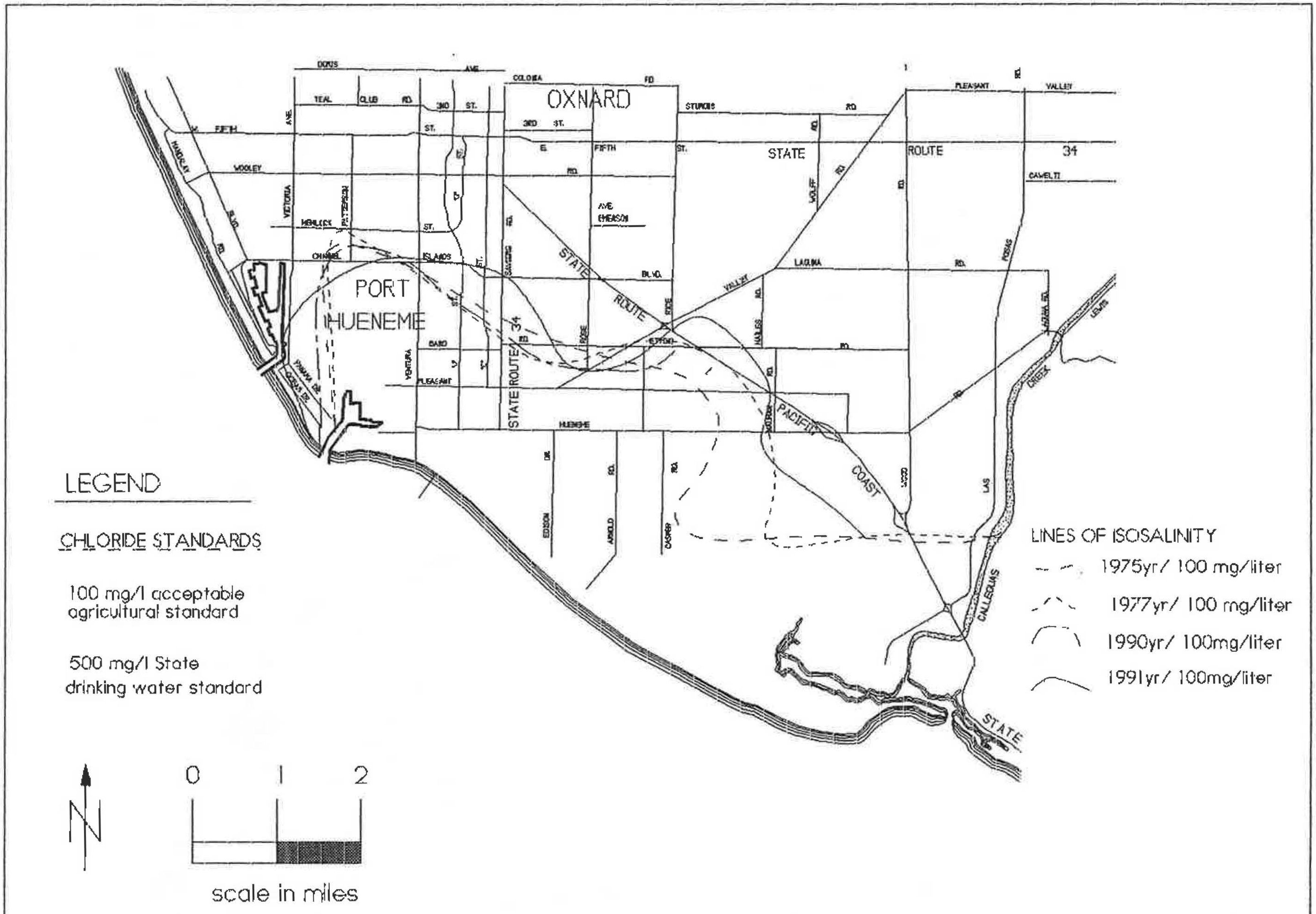
The GMA staff has prepared a groundwater management plan to be implemented by the GMA, County, cities and water agencies to control overdraft and prevent further seawater intrusion. A major element of the plan is an extraction reduction ordinance which was adopted by the GMA Board in September 1990. The ordinance requires pumpers within the Fox Canyon GMA boundaries to reduce their pumpage by 25% over the next 25 years beginning with a 5% reduction by 1992. If groundwater



VENTURA COUNTY
PUBLIC WORKS AGENCY
WATER RESOURCES DIVISION

UPPER AQUIFER SYSTEM
HISTORICAL SEAWATER INTRUSION FRONT
1951 TO 1974

FIGURE 4.1
DATE: 8 AUGUST 94



VENTURA COUNTY PUBLIC WORKS AGENCY WATER RESOURCES DIVISION	UPPER AQUIFER SYSTEM HISTORICAL SEAWATER INTRUSION FRONT 1975 TO 1991	FIGURE 4.2 DATE: 8 AUGUST 94

TABLE 4.11

LOWER AQUIFER SYSTEM CONTINGENCY PLAN

Monitoring Results	Physical Conditions	Planning Stage	Additional Monitoring (Policy)	LAS Drilling Moratorium (Ordinance)	Conservation-Reclamation (Policy)	Pumping Restrictions (Ordinance)	Alternate Water and Emergency Supply (Policy)
Onland intrusion in LAS	First indication of LAS problem	1	Request UWCD & County to increase frequency of monitoring in intruded area & require metering. Drill additional LAS monitoring wells.	Consider LAS drilling restrictions. Define areas	Request voluntary conservation - reclamation	Implement voluntary conservation. Consider Ag. pumping restriction and restriction areas.	Review legislation and ways to fund other agency waters projects. Review and plan for alternative water supplies. Assist agencies with project construction.
Expanded intrusion with some LAS wells out of service	Problem serious for some LAS owners.	2	Request UWCD & County to expand monitoring. Consider drilling additional monitoring wells.	Enforce drilling restrictions on new wells. Allow replacement wells only.	Request cities & County to expand conservation efforts. Hold workshop sessions. Require wastewater reclamation for Ag.	Implement Ag. pumping restrictions in identified areas. Consider M&I conservation restrictions.	
5 mi.^{2} intruded 5% of LAS wells (10-15 wells) intruded and out of service	Problem becomes severe. Without effective controls intrusion will spread.	3	Request UWCD & County to expand monitoring. Drill additional wells.	Expand drilling restriction area. Allow replacement wells only.	Request cities & County to develop and implement mandatory conservation plans with fines.	Implement M&I restrictions. Implement GMA water duty on Ag. Prepare GMA-wide restrictions.	Assist agencies to apply for grant funding and implement new water projects.
10 mi.^{2} intruded 10% of LAS wells (20-25 wells) intruded and out of service	Problem very severe. Intrusion nearly out of control.	4	Request UWCD & County to expand monitoring. Drill additional monitoring wells.	Expand drilling restriction to entire GMA area. Allow replacement wells only.	Request cities & County to prohibit new construction and new water line connection.	Enforce GMA-wide pumping restrictions for Ag. and M&I.	Assist other agencies with emergency plans, projects and grant funding.
Extensive LAS intrusion. Many LAS wells out of service.	Very severe economic impacts. Intrusion out of control.	5	Request UWCD & County to expand monitoring. Drill additional monitoring wells.	Complete ban on all new M&I and Ag. wells.	Prohibit all new construction and new water service connections.	Enforce GMA-wide pumping restrictions for Ag. and M&I.	

users can prove 80% efficiency, reductions may not be required. The plan has a variety of programs including groundwater extraction limitation ordinances, which includes the prohibition of drilling new wells in areas subject to seawater intrusion, encouragement of waste water reclamation and water conservation, seawater intrusion abatement, monitoring and meter programs. The Vern Freeman Diversion Project, the role of the GMA, and the prohibition of new Oxnard aquifer wells are further discussed in Chapter 4.1 of Volume I and Chapter 4.2 of this volume.

B. Results

In addition to the programs above that have been implemented as part of the initial 208 plan in 1978, the Ventura County PWA and UWCD have conducted a monitoring program to track seawater intrusion. Approximately 80 to 120 wells are measured annually to monitor seawater intrusion throughout the Oxnard Plain. During this period the rate of onland seawater intrusion in the Oxnard aquifer zone has stabilized, however, lateral seawater intrusion has been detected in the Mugu aquifer and Fox Canyon aquifer zone. The following three sections describe seawater intrusion activity in the Oxnard, Mugu and Lower Aquifer systems.

1. Oxnard Aquifer Zone

As mentioned earlier in this Chapter, preliminary results from the USGS Regional Aquifer System Analyses study indicates that the seawater intrusion conditions may not be as extensive as previously thought and it does appear that the rate of seawater intrusion has decreased. However, based on data available at the time it appeared that from 1977 to 1991, the onland area of seawater intrusion had increased 2.2 square miles (sq.mi.) a 10% increase from 20.6 sq.mi. in 1977 to 22.8 sq. mi. in 1991 (Table 4.1, Figure 4.2). Since 1984 the seawater front appeared to remain almost static even though precipitation was significantly below normal during six years from 1985 to 1991 (Table 4.1). The rate of seawater intrusion is believed to have stabilized during this period due to the implementation of Phase I and Phase II of the Oxnard Plain Seawater Intrusion Abatement Project. The project, recommended by the initial 208 Plan, consisted of the removal of upper aquifer system wells and construction of the Pumping Trough Pipeline and LAS wells. Although 37 UAS wells were removed from service, many of the wells were simply abandoned and not properly destroyed. Some of these wells are contributing to the degradation of the upper as well as other lower aquifers by acting as conduits allowing the interchange of groundwater from various aquifers. Abandoned water wells are discussed in more detail in Section E of this Chapter. Another factor which has decreased the rate of seawater intrusion in the Oxnard Aquifer zone is Ventura County Well Ordinance No. 3991. The ordinance prohibits new well construction in the UAS which would cause additional overdraft or seawater intrusion.

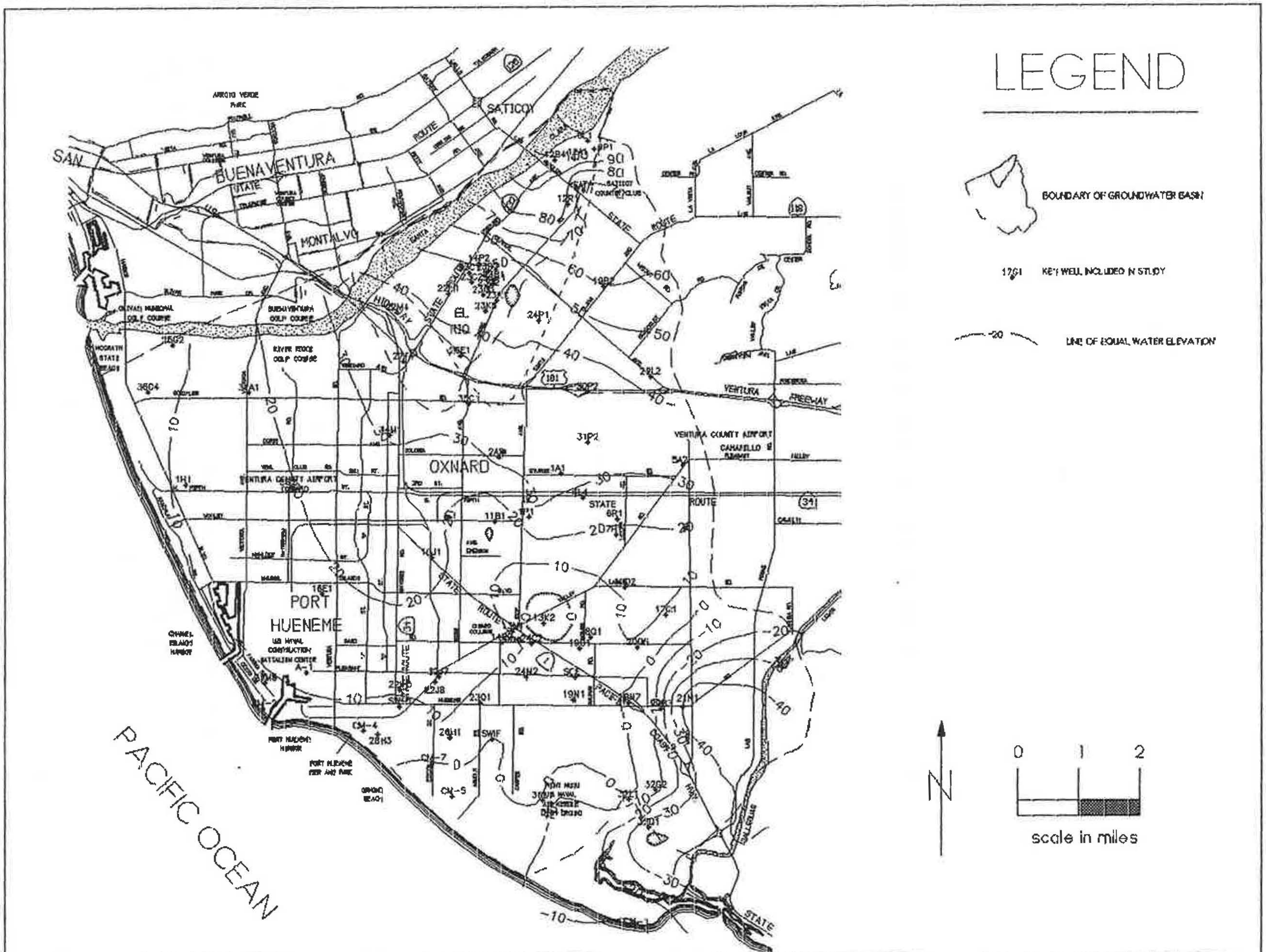
Phase II of the Seawater Intrusion Abatement Project was the completion of the Improved Freeman Diversion which became operational in the spring of 1991. Figure 4.2 illustrates the seawater intrusion front from 1977 to 1991. Increased rainfall and the increased aquifer recharge capability of the Improved Freeman Diversion assisted in the recovery of water levels in 1991 as illustrated in Figure 4.3.

2. Mugu Aquifer

Seawater intrusion in the Mugu aquifer has been suspected in the Point Mugu area near the Mugu Forebay for many years. Monitoring well IN/21W-32Q1 has shown an almost continuous increase in chloride and total dissolved solid (TDS) content since 1976 (Figure 4.4). During a summer 1990 survey, the chloride level was 4,557 milligrams per liter (mg/l) and the TDS increased to 9,188 mg/l as illustrated in Figure 4.4.

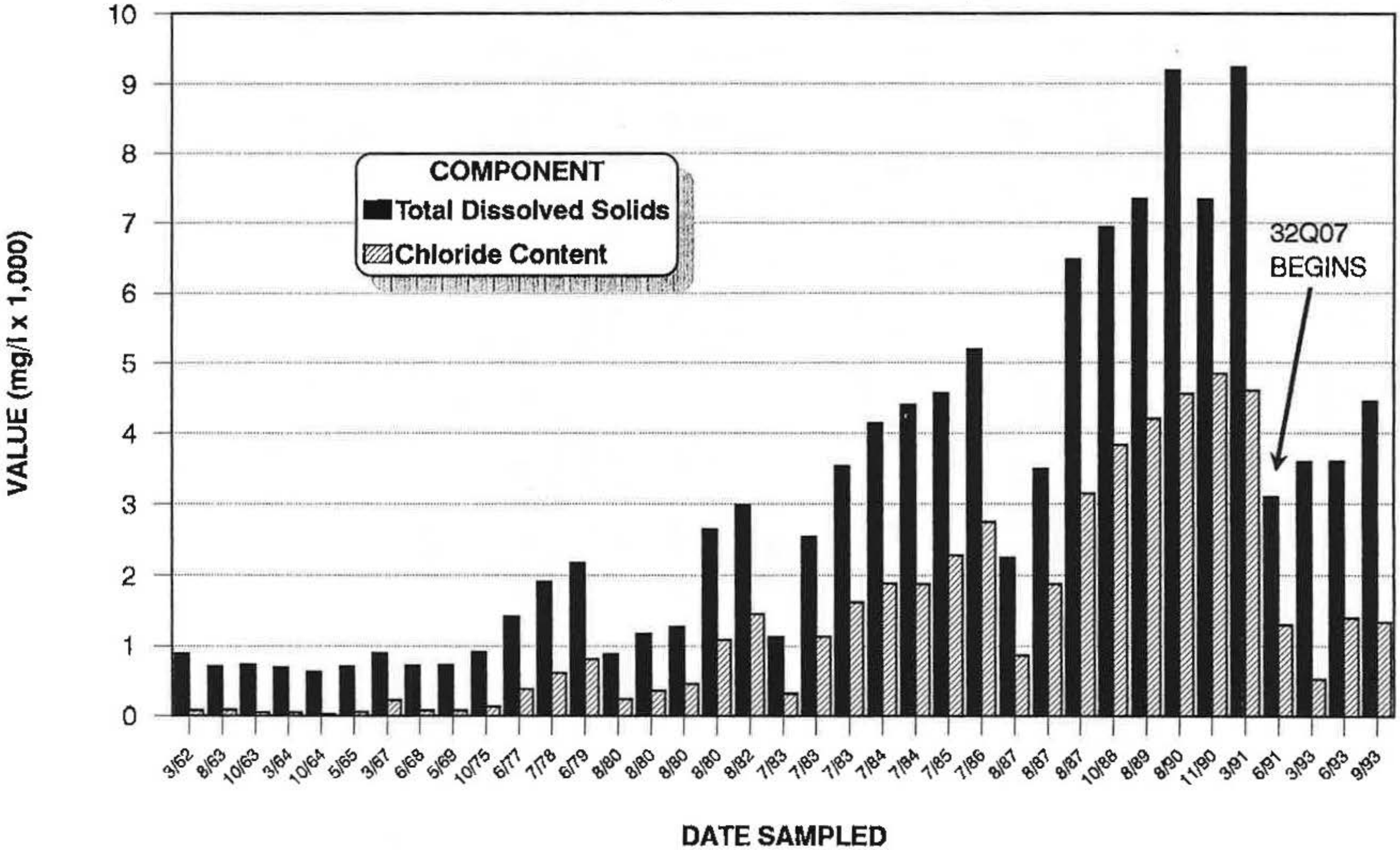
These chloride and TDS levels greatly exceed State drinking water standards and acceptable agricultural use standards. Drinking water standards for chloride and TDS are 500 mg/l and 1,000 mg/l respectively. Acceptable levels of chloride for agricultural use varies for annual (row) and permanent (orchard) crops. Annual crops can tolerate 500 mg/l of chloride and 2,000 mg/l TDS. Permanent crops accumulate chloride over time and, therefore, can only tolerate approximately 100 mg/l of chloride and 2,000 mg/l of TDS. In 1991 one of two newly constructed USGS monitoring wells (IN/21W-32Q07) showed that although the Mugu aquifer is intruded to some extent, the poor quality water extracted from the previous monitoring wells were primarily from the intruded perched aquifer zone. The 1991 chloride and TDS levels were surveyed at approximately 1300 and 3090, respectively (Figure 4.4). These levels still far exceed State drinking water standards and acceptable agricultural use standards.

Coastal monitoring well CM-4, located near the south end of Perkins Road in Oxnard, was constructed during December 1989 by the USGS and produced a high chloride concentration (4,900 mg/l) from the Mugu aquifer. No other wells are completed in the Mugu aquifer within a distance of at least one mile of this well. The source of this high chloride water has been proven to be seawater by stable isotope analysis. The USGS is monitoring this well and developing a Seawater Intrusion Model to determine the source of the seawater.



VENTURA COUNTY PUBLIC WORKS AGENCY WATER RESOURCES DIVISION	UPPER AQUIFER SYSTEM GROUNDWATER ELEVATIONS FALL 1993	FIGURE 4.3

Figure 4.4 TDS and CHLORIDE CONTENT
Wells 1N/21W-32Q01 & Q07



3. Lower Aquifer System

The chloride ion concentration in LAS wells within the annual seawater intrusion report study area (5th Street to the north, Wood Road to the east and the coast to the southwest) generally range between 35 and 45 mg/l, except for the southeastern area including the Point Mugu Naval Air Station (NAS) and the Ventura County Game Preserve. Some native chloride ion levels in that area are as high as 240 mg/1. Deep wells in this near-coastal portion of the study area have shown elevated chloride readings since 1987. Possible sources of this chloride ion, as determined by analysis of Fall 1989 and 1990 samples, may include downward migration from the overlying (intruded) Oxnard and/or Mugu aquifer zones via improperly sealed multiaquifer wells or an incomplete clay cap, or upward migration of high chloride Grimes Canyon aquifer water.

In the Port Hueneme area one of the monitoring wells (CM-2) drilled by the USGS clearly showed the presence of seawater in the Fox Canyon aquifer at a depth of about 700 feet. The aquifer is exposed to the ocean in the wall of Hueneme submarine canyon a short distance from the coast. A stable isotope analysis performed by the USGS verified that lateral seawater intrusion is responsible for the 6,700 mg/l chloride concentration in the Fox Canyon aquifer zone of the LAS. Additional inland monitoring wells (well AI) were drilled by the USGS during 1990 and 1991 to determine migration of seawater (Figure 4.5). Samples have revealed that seawater intrusion has not reached these wells.

Figure 4.6 shows groundwater levels in wells perforated in the LAS for the Fall 1990. Within the LAS pumping trough area (near Wood Road and Hueneme Road northeast beyond Camarillo to the intersection of Bradley Road and Berylwood Road) the 1990 water level reached depths greater than 160 feet below sea level. Levels in the pumping trough area in 1993 were about 70 feet higher than 1990 levels. See Figure 4.7. Water levels in this area were generally lower during Fall 1990 than the previous record lows of 1965 primarily due to increased ground water extraction as a result of 5 years of drought. Water levels in the LAS recovered during 1993 due to increased precipitation and decreased irrigation extractions because of the generally cool, overcast weather on the Oxnard Plain.

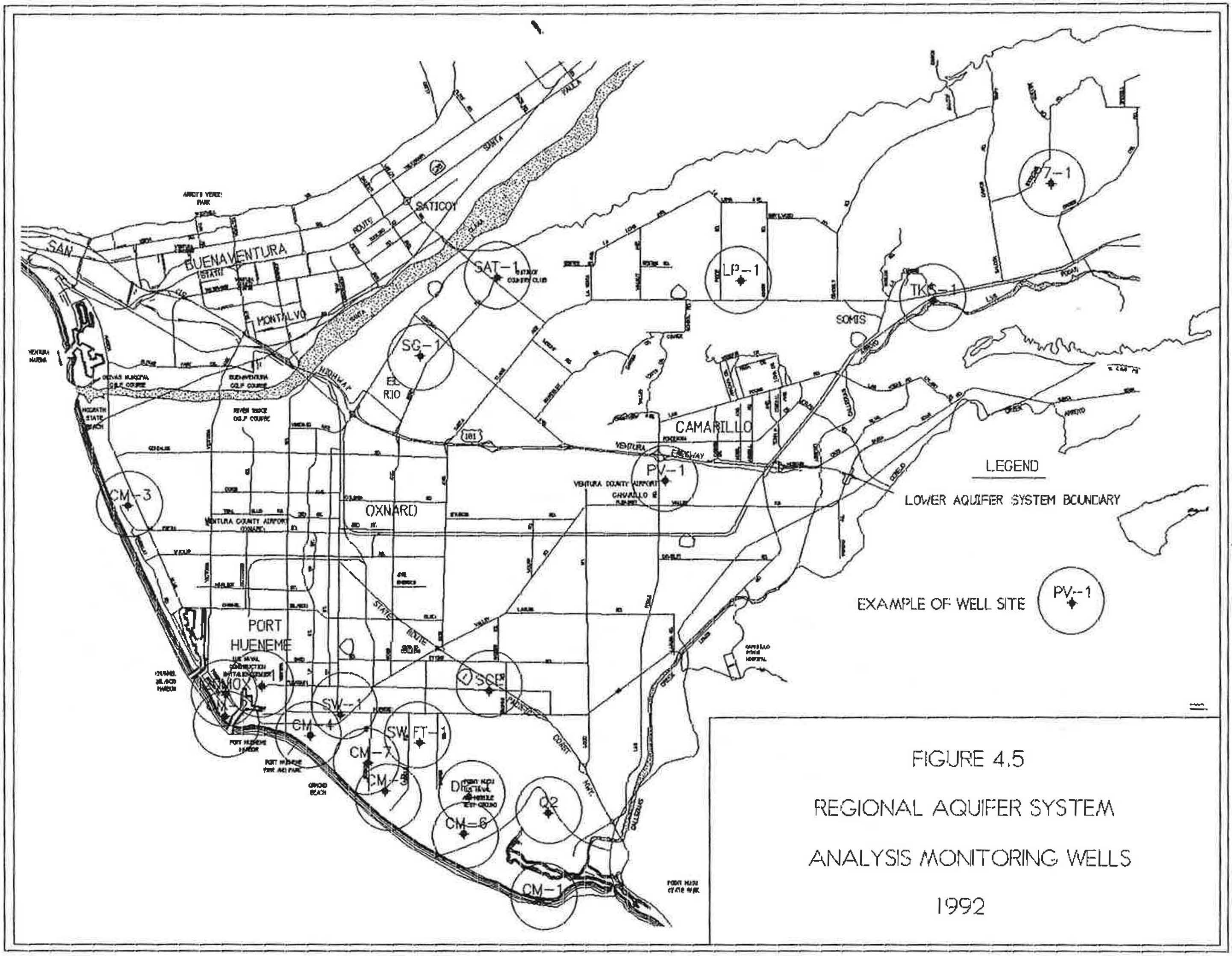
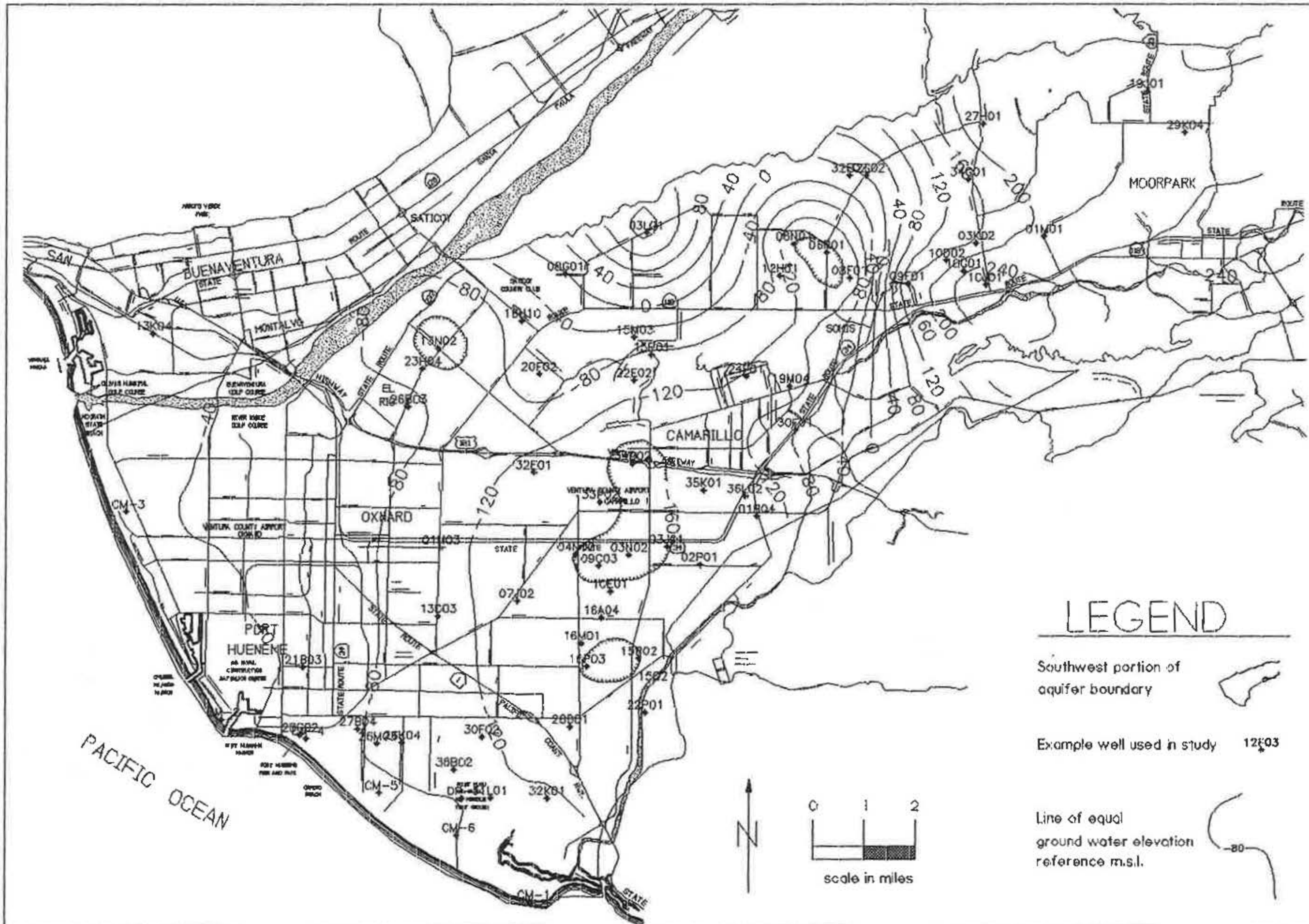


FIGURE 4.5

REGIONAL AQUIFER SYSTEM

ANALYSIS MONITORING WELLS

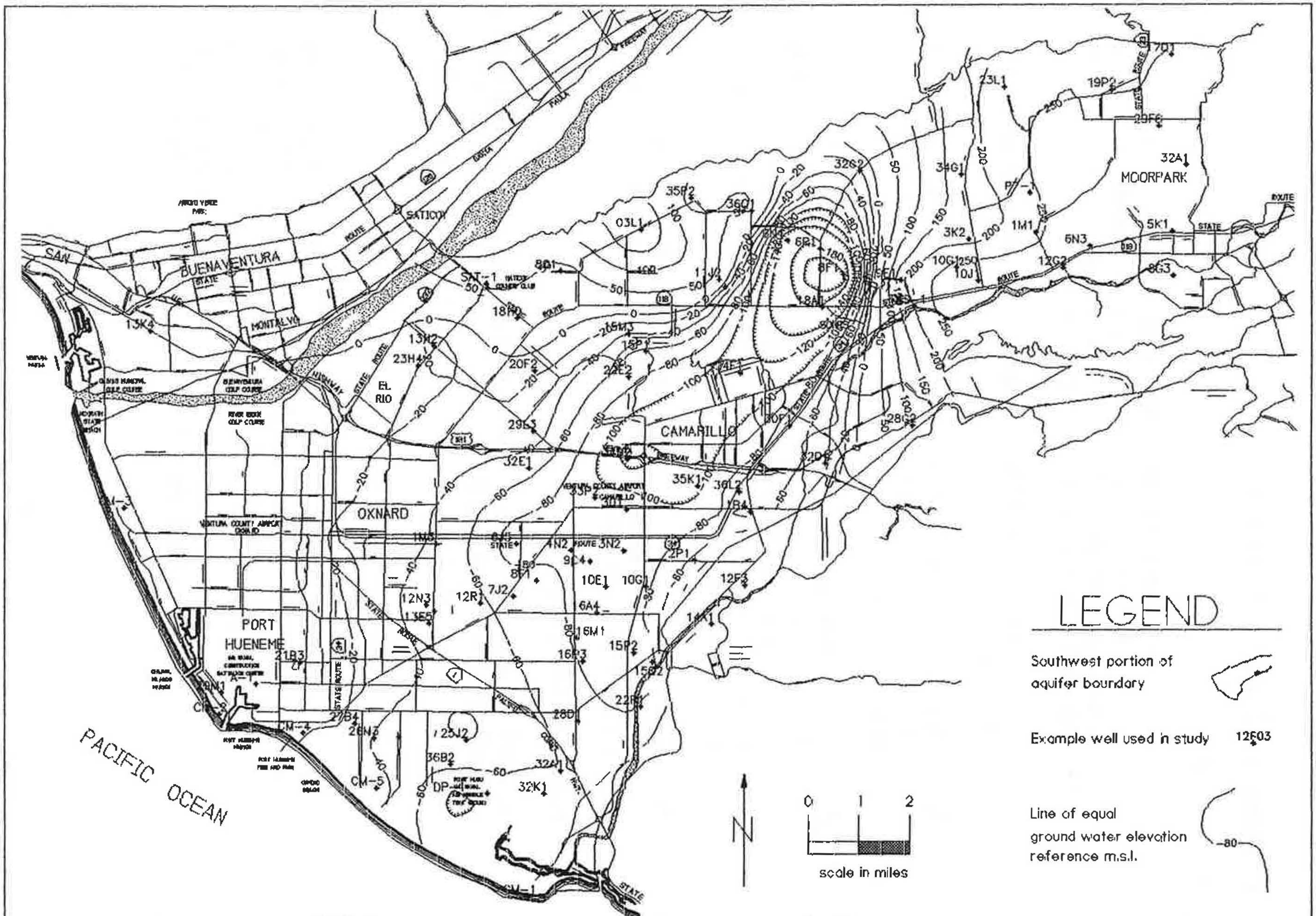
1992



VENTURA COUNTY
PUBLIC WORKS AGENCY
WATER RESOURCES DIVISION

LOWER AQUIFER SYSTEM
GROUNDWATER ELEVATIONS
MOORPARK CAMARILLO AND OXNARD AREAS
FALL 1990

FIGURE 4.6
DECEMBER 1993



VENTURA COUNTY
PUBLIC WORKS AGENCY
WATER RESOURCES DIVISION

LOWER AQUIFER SYSTEM

GROUNDWATER ELEVATIONS

MOORPARK CAMARILLO AND OXNARD AREAS

FALL 1993

FIGURE 4.7

DECEMBER 1998

III. Conclusions and Program Recommendations

A. Conclusions

1. The rate of seawater intrusion in the Oxnard aquifer zone of the UAS has stabilized in recent years. This decrease is probably due to the implementation of Phase 1 of the Oxnard Plain Seawater Intrusion Abatement Project and County Well Ordinance 3991.

2. Lateral seawater intrusion into the Mugu aquifer of the UAS was recently confirmed.

3. During the years 1985 to 1990 water level elevations in the LAS declined significantly because of increased ground water extractions in response to drought conditions.

4. Onland lateral seawater intrusion has now been confirmed in three of the five aquifer zones beneath the Oxnard Plain: the Oxnard, Mugu and Fox Canyon aquifers. Although the rate of intrusion has slowed in the Oxnard aquifer zone, onland seawater intrusion has been verified in the Mugu aquifer and discovered in the Fox Canyon aquifer zone.

5. If the seawater intrusion problem is not resolved, a large portion of the 14 million acre-feet of existing fresh ground water reserves stored beneath the Oxnard Plain may be lost for future use.

B. Program Recommendations

Overdraft and seawater intrusion must be resolved in all aquifer zones to prevent irreparable damage to groundwater resources. To accurately monitor the status of seawater intrusion and reduce extractions with a goal of eliminating ground water overdraft, the following programs are recommended:

1. Continually Assess the Seawater Intrusion Conditions

   a. Continue County and UWCD groundwater monitoring programs including the annual seawater intrusion monitoring study. These agencies should increase the water level and water quality monitoring in coastal areas. Where necessary, additional monitoring wells should be constructed. Where lateral seawater intrusion is suspected, stable isotope analysis of samples should be performed.

b. Monitor progress on the USGS RASA and seawater intrusion modeling studies scheduled for completion in 1993-94 and develop and implement necessary follow-up programs.

2. Conserve Existing Water Supplies

   a. Continue to support all water conservation programs and encourage full implementation of best management practices for urban, agricultural and industrial uses.

   b. Support the beneficial recycling of wastewater and appropriate water conservation measures while recognizing the extent to which some treated wastewater is already recycled following discharge.

3. Protect and Enhance Existing Water Supplies

   a. Support County and UWCD full implementation of the Oxnard Plain Seawater Intrusion Abatement Project according to adopted operating criteria.

   b. Continue to enforce Ventura County Well Ordinance No. 3991 which prohibits construction of UAS wells in areas where they would cause overdraft or seawater intrusion. Enforce ordinance 3991 which requires the proper destruction of wells. See Section D on Abandoned Water Wells for recommendations which are also applicable to the seawater intrusion problem.

   c. Support the Fox Canyon Groundwater Management Agency adopted groundwater Management Plan and Ordinances designed to eliminate overdraft and seawater intrusion.

   d. Support projects which will provide supplemental water and/or assist in stabilizing safe yield extractions while at the same time with due regard for environmental concerns including:

      - The five stage Lower Aquifer System Contingency Plan (Table 2).

      - GMA Ordinance 5 which limits and controls groundwater pumping with the goal of eliminating groundwater overdraft by year 2010.

Also see Volume I, Chapter 3, Sections III C and D for discussion of current projects to reduce overdraft and future solutions to reduce overdraft and resulting seawater intrusion.

Chapter 4.2.A Seawater Intrusion References

California Department of Public Works, Division of Water Resources. "Ventura County Investigation". Bulletin No. 46. 1933.

California Department of Water Resources. "Seawater Intrusion-Oxnard Plain of Ventura County". Bulletin No. 63-1. October 1965.

---, "Oxnard Basin Experimental Extraction-Type Barrier", Bulletin No. 147.6. September 1970.

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Bulletin No. 12. Volumes I and II. October 1953.

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---, "History of Seawater Intrusion on the Oxnard Plain. 208 Areawide Waste Treatment Management Planning Study, Task 3, Subtask B (Part 3). August 1977.

B. INDIVIDUAL SEWAGE DISPOSAL SYSTEMS/COUNTY SERVICE AREA 32 (SEPTIC TANKS)

I. Description of Problem

A. Definition and Sources

Individual Sewage Disposal Systems, commonly known as septic systems, are used throughout the unincorporated areas of Ventura County. A typical septic system uses a septic tank to treat and store settlable and floatable solids. Bacteria in the tank anaerobically breaks down and digests up to 40 percent of the solids entering the tank. The partially treated wastewater then leaves the tank and enters a series of perforated plastic pipes installed in a trench on a bed of crushed rock or gravel and backfilled with the excavated earth. This area is commonly called a leach field. The soil in this absorption area provides an environment where highly efficient aerobic bacteria living in the soil further biodegrade proteins, fats, carbohydrates and vegetable wastes remaining in the wastewater.

B. Responsible Agencies

The State Water Resources Control Board and its Regional Water Quality Control Board that oversees the Los Angeles and Ventura Counties area, is responsible for studies and maintenance of surface and groundwater water quality.

Ventura County Flood Control District is responsible for the collection, tabulation and analyses of hydrological data defining the extent of seawater intrusion, defining fluctuations in groundwater levels and determining the quality of water in our streams, lakes and groundwater basins.

The Ventura County Resource Management Agency and its Environmental Health Division are responsible for the review and approval of septic system applications to ensure that they are suitably sited and functioning. The Environmental Health Division is also responsible for interpretation and enforcement of the County's sewer policy and for overseeing County Service Area 32 (CSA 32) to ensure that septic systems function properly and repairs are made when necessary.

C. Potential for Pollution

When wastewater is constantly applied to the soil, a crust forms at the surface creating a barrier to liquid flow restricting the movement of water into the soil by closing the soil pores. Such conditions are beneficial to a point by providing enhanced treatment of wastewater by creating unsaturated soil conditions below the crust, thus slowing absorption and enabling more contact with the soil and its resident population of beneficial bacteria. If, however, flow is very rapid as in a gravelly soil or through large cracks in bedrock, very little time is available for purification to occur. This situation has long been recognized and related to severe groundwater pollution.

Some bacteria and viruses added to the wastewaters are pathogens. Their movement during unsaturated flow is expected to be limited to within a meter from the base of the absorption area. The bacteria and viruses are trapped in the clogging layer of the soil, die-off by attrition or are killed by antibiotics or lack of nutrients. Bacterial activity in the soil is very important to the operation of a system because they degrade considerable amounts of organic materials. However, statistical analysis suggests that septic tank effluents could be a source of bacterial contamination to wells.

Nitrogen contained in the effluent is added to the soil in the form of NO_3-N if the soil is aerobic. If a carbon source and/or an anaerobic zone is lacking below the zone of NO_3-N formation, denitrification is generally very limited under soil absorption systems allowing the NO_3-N to pass with percolating waters to the groundwater. The movement of the groundwater will determine the dilution of NO_3-N and the density of the population contributing waste will determine the loading. Very little is known about the amount of NO_3-N reaching groundwater from septic systems and much more work is needed. Particularly in well aerated sandy areas, groundwater conditions need to be evaluated.

A considerable amount of Phosphorus is absorbed and precipitated in the soil system. Its movement, however, may exceed 50 cm a year in "clean" sands. Except in rare cases, Phosphorus and other substances such as the heavy metals are not expected to be a problem because of the small amounts present and the high retention in the soil.

Though the soil does not do a perfect job of treating septic tank effluents, proper design and management of soil absorption systems allows the soil to remove a very high percentage of the organisms and substances potentially harmful to human health or the environment.

Failure of the soil absorption area may result in a health or environmental hazard or a public nuisance. Inability of the soil to accept the septic tank effluent results in surfacing or "backing-up" into the house, a commonly recognized failure. However, often unnoticed rapid transport through large cracks in the underlying materials such as creviced bedrock, or for short distances to high groundwater because of poor siting also constitutes failure. In evaluating the effectiveness of the soil as a treatment medium it is necessary to consider the fate of bacteria, viruses, organic substances and the nutrients Nitrogen and Phosphorus.

Industrial contamination of groundwater poses another potential threat. While most industries are law abiding and restrict the use of individual sewer disposal systems for domestic use only; the threat of accidental or purposeful chemical contamination through introduction of toxic chemical wastes and solvents to groundwater resources is both possible and difficult to protect against. While such an event has not occurred in Ventura County, as yet, the specter of danger, especially in areas where high groundwater is present, constitutes a serious concern.

D. Problem Areas Originally Identified in the 208 Plan

The 1980 208 Plan identified a number of areas where Individual Sewage Treatment Systems where either failing on a regular basis or causing some degree of off site pollution. These areas included Nyeland Acres, the North Coastal area, Kelly Estates/Ventu Park, Santa Susana Knolls, Live Oak Acres, Oxnard Plain (Cypress Road), Lake Sherwood, North Avenue, the Santa Monica Mountains and South Coastal Region. Since the adoption of the 208 Plan, the County of Ventura has made a determined effort to ensure these areas were either served with sewers or provided with technologically advanced sewage disposal systems instead of the older soil absorption method which may be prone to failure if suitable conditions are not available.

The Santa Monica Mountains and the South Coastal region still remain on septics, but the use of advanced sewage disposal systems has generally reduced failures to a minimum. Further, the County has established County Service Area 32 in case of septic system failure. However, monitoring of these systems is still a necessity.

E. 208 Plan Summary (1980)

The County's Environmental Health Division determined the Santa Monica Mountains area had severe limitations for the use of septic systems. It was found that much of the area's bedrock was fractured and creviced, further compounding already severe conditions and complicating the use of traditional septic systems.

Additionally, investigation of the area's soil deposits revealed that they were often too shallow or limited in area to permit adequate leaching and filtration of the sewage effluent prior to eventual dissipation into the groundwater. It was also found that wells are scattered throughout the area and drilled to depths ranging from about 100 feet to 500 feet or more. The effectiveness of seals on these wells was also a matter of concern since the wells could easily become contaminated by incompletely treated liquid wastes flowing through the bedrock fractures. To combat this problem, the 208 Plan advised that wells should be adequately sealed to beneath any fissured rock and that septic systems be not only installed in strict adherence to permeability rates and minimum distance requirements from domestic wells, but also in suitable areas where the natural soil was of sufficient depth and type for efficient wastewater treatment.

With intensified development, the chance that wells and septic systems will share the same hydrologic unit increases. It is this potential that must be protected against at attainable levels and in acceptable terms for contamination or interruption at any one point in the cycle may lead to immediate, severe and irreversible damage. The affects may be far reaching, since the partially treated wastewater can travel long distances through fractured or creviced bedrock contaminating the larger regional groundwater table. Once contamination occurs, rehabilitation or reclamation of the water quality becomes more expensive to the consumer. However, if reclamation costs are prohibitive, a replacement source must be sought putting a burden on existing limited domestic supplies.

There is a high likelihood that the detection of coliform bacteria and surfactants in some of the drinking water wells resulted from sewage effluent that had traveled through fractured bedrock infiltrating the well. In addition, the literature points out that fractured bedrock is a contributing factor to early septic system malfunction and failure. And, as development intensifies, these effects can be expected to occur at even greater frequency.

1. Recommended Programs (1980)

On July 8, 1980, the Ventura County Board of Supervisors made the following recommendations to decrease contamination problems relating to septic system use.

a. Directed staff to initiate proceedings to expand County Service Area (CSA) 27 to encompass those areas of the Santa Monica Mountains experiencing septic tank problems. The basic concept in organizing the CSA was to abate public nuisances and enforce proper septic system maintenance procedures to include regular pumping, repairs and redesign of failing septic systems.

b. Directed staff to include specific consideration of opportunities to minimize future septic tank problems in the County's ongoing revision of the Plumbing Code.

2. Post 208 Plan Septic System Control Activities

During the years following adoption of the 208 Plan, the Ventura County Board of Supervisors created CSA 32. CSA 32 superseded CSA 27 mentioned above and currently serves the entire County of Ventura. CSA 32 is authorized to inspect and repair septic systems in the event of failure.

Additionally, the County updated its building codes to allow technologically advanced individual sewage disposal systems. Advanced systems including the sand filter and mound technologies that are now used in areas where traditional systems are known to fail.

Since adoption of the 208 Plan, Ventura County has actively implemented the above policies and encouraged the sewering of areas previously served by septic systems. It should be noted that the Cypress Road area (Oxnard), Live Oak Acres (Oak View), Ventu Park (Newbury Park), Santa Susana Knolls area, Nyeland Acres and the Lake Sherwood area have all been sewered. Additionally, the North Avenue was sewered upon annexation to the City of San Buenaventura. Currently, the City of Camarillo is extending sewer lines to the Camarillo Heights area. Accordingly, numerous septic systems are no longer contributing to the overall degradation of groundwater quality.

II. Current Status

A. More Intensive Permit Review

The Environmental Health Division has also expanded its Liquid Waste Section and uses computerized programs to evaluate septic system performance and to ensure a uniform system review.

B. Additional Restrictions for Septic System Use

The Resource Management Agency and the Regional Water Quality Control Board have identified areas where high nitrate concentrations in local groundwater basins have exceed State drinking water standards. In this regard groundwater basins in Santa Rosa and Tierra Rejada Valleys and the Community of El Rio have been identified as problem areas where the use of septic systems coupled with agricultural fertilization are thought to degrade in groundwater quality. In response to the growing nitrate problem, the Regional Water Quality Control Board (RWQCB), Los Angeles Region, have established an "Interim Policy Regarding The Use For Septic Tanks". In essence, this jointly coordinated policy precludes the installation of septic systems on lots of less that 1 acre, except for subdivisions creating 2 or less lots. The policy also recommends the installation of dry sewers in areas where plans for future sewer construction have been adopted. Currently, the Environmental Health Division has prepared County Sewer Policy amendments including the above changes and expects Board of Supervisors consideration by June 1993. Additionally, waste discharge requirements must also be issued by the RWQCB for subdivisions that can potentially contribute to groundwater pollution.

C. Current Problem Areas

In the El Rio/Nyeland Acres area, nitrate concentrations from groundwater well samples have varied significantly over the last two decades. Nitrate concentration time-history graphs for groundwater from several wells shows the nitrate concentrations in samples from United's El Rio wells, from 1976 to 1987. A peak in nitrate concentrations occurred during 1977, at the height of the last major California drought and again in 1986, 1987 during the recent drought. The nitrate concentrations for groundwater from several wells which are located northwest of El Rio, within 3,000 feet north of the intersection of Vineyard Avenue and U.S. Highway 101, were monitored from 1972 to 1988. These wells are within the area where nitrate concentrations are regularly above the Maximum Contaminant Level (MCL) established by State Drinking Water standards. These wells show that there was a similar peak of nitrate concentrations, generally during 1977 and more recently since 1985 to the present. Some of the well samples indicate that nitrate concentrations vary significantly, both seasonally and from year to year. However, the nitrate concentrations data from wells in this area may not be truly representative of the groundwater conditions, according to the Environmental Health Division (EHD), because water samples that were analyzed may have been obtained when the well pumps had only been operated for a few minutes, rather than after a longer period of time. The experience of the EHD representative for this area indicated that nitrate concentrations for wells were usually relatively high initially, and declined to a stable concentration after a period of time of pumping (EHD, 1990).

The areas with high nitrate concentration groundwater, are presently located generally west of the community of El Rio and west of the community of Nyeland Acres. In these areas, the significant potential sources of nitrate in the groundwater appear to be residential and industrial/commercial wastewater disposal, through septic systems, and return water from agricultural land use. (Agricultural runoff is addressed in Section E of this Chapter). Each of these land use activities are estimated to contribute approximately equal amounts of nitrate loading per acre to the groundwater. Based on surface and groundwater quality data, groundwater recharge at the Saticoy and El Rio facilities does not appear to contribute nitrate loading in the study area. Soils in the area have high to moderate infiltration rates, potentially assisting in the movement of nitrates to groundwater. Although not identified in the study area at the time, historic land use involving dairies and animal feedlots may have also contributed to the nitrate loading to the groundwater in the study area.

The hydrogeologic conditions, historic changes in groundwater quality, and land use in the area suggest that the nitrate concentrations in the groundwater will continue to be a problem. The high to moderate infiltration rates exhibited by the soils, in combination with shallow depths to groundwater, suggests that wastewater in septic system leach fields and agricultural return water may rapidly percolate to the groundwater table resulting in a build-up of nitrate in the groundwater.

In the Santa Rosa Valley, residential and agricultural activities contribute to high nitrate levels in the local groundwater. Nitrate concentrations are now sufficiently high to render the water extracted from groundwater wells unpotable.

Ingestion of nitrate contaminated water by infants younger than one year old can result in methemoglobinemia, an occasionally fatal blood disease sometimes given the term "blue baby." State Drinking Water Standards limit nitrate-nitrogen concentrations to 10 milligram per liter (and 45 milligrams per liter as nitrate, NO_3) in an effort to prevent this disease in infants.

A review of available information indicates that the storage capacity for the Santa Rosa Basin is 103,600 AF with 16,900 AF recoverable and an overall surplus in water storage of 400 AF based upon 1985 usage estimate. In 1988, Stall, Gardner & Dunne reported that groundwater level data showed a decline throughout the basin as a result of deficient rainfall and some increased use. The amount of long-term storage will depend upon the Hill Canyon Wastewater Treatment Facility and future alternatives selected for discharge of water (i.e., continue as is or pipe the water to other areas for use). Presently, effluent from the Hill Canyon Wastewater Treatment Facility recharges the Santa Rosa Ground Water Basin. This recharge has created a mound in the groundwater elevation in the vicinity of the Arroyo Conejo. As a result hydraulic gradients are decreased in the eastern portion of the valley and may result in differential groundwater flow in the basin. As a result, higher dissolved salts may accumulate in the eastern portion of the basin reducing the efficiency of the groundwater flushing. This in turn, has resulted in nitrate accumulation.

Currently, the deterioration of water quality in the Basin is attributed to three major pollution sources - agricultural activities, the Hill Canyon Wastewater Treatment Plant, and individual septic systems; all of these sources produce largely unquantifiable increments of TDS, nitrates, and other minerals and chemicals that are absorbed by the Basin. To determine how these different sources contribute to the problem a program of continuous groundwater quality monitoring should be implemented.

III. Conclusions and Program Recommendations

A. Conclusion

The County of Ventura has been successful in identifying and sewering areas where septic system failures were common. Further, the County has upgraded its septic system review process to ensure the installation of systems that will function efficiently under difficult conditions. And lastly, the County has created CSA 32 to inspect and repair septic systems throughout the County where system failure is possible. However, there are areas in the Santa Rosa Valley and the El Rio/Nyeland Acres area where groundwater degradation due to high nitrate concentrations were identified, resulting in part, from septic system use. Additional control measures may be necessary to ensure further degradation of groundwater supplies does not occur.

B. General Program Recommendations

1. Update the County's sewer policy to include the latest Regional Water Quality Control Board policies regarding the use of septic systems on subdivided lots.

2. Continue to monitor areas where septic system problems exist and encourage public sewering wherever feasible.

3. Clearly identify areas when septic systems directly or indirectly contribute to groundwater contamination and determine methods to eliminate and/or reduce the introduction of nitrates to groundwater.

C. Specific Area Program Options

1. Santa Rosa Valley

- Discourage individual disposal systems and require future discretionary development to connect to a sewage treatment plant;
- Consider larger minimum lot sizes where individual septic systems are permitted in areas where groundwater is used as a drinking water sources.

2. El Rio/Nyeland Acres

- Designation of a groundwater protection area
- Collection, treatment and disposal of domestic wastewater
- Construction and use of new lower aquifer system wells
- Obtain imported State Water supplies from Oxnard for drinking water, will require annexation
- Obtain use of additional areas for groundwater recharge to increase locally available water supplies
- Determine sources, implement blending of high and low nitrate well waters
- Tie nitrate blending system to the Oxnard-Hueneme water system

Section 4.2.B. Individual Sewage Disposal Systems References

American Society of Agricultural Engineers 1977, Home Sewage Treatment

Geraghty and Miller, Inc. April 24, 1991, prepared for United Water Conservation District, Feasibility Study for Abatement of Nitrate in Groundwater

LAFCO October 1985, Study of Special Districts in Ventura County

The Planning Corporation of Santa Barbara, prepared for the Resource Management Agency, Planning Division, November 1990, Caston Trust Final Environmental Impact Report

Ventura County Resource Management Agency and Public Works Agency 1980, 208 Areawide Water Quality Management Plan

William Jewell and Rita Swan, Editors 1975, Water Pollution Control in Low Density Areas

C. URBAN STORMWATER RUNOFF

I. Description of Problem

A. Definition and Sources

Urban stormwater runoff consists of stormwater and other sources of flowing water, which carry pollutants that had been previously deposited on urban surfaces through the stormdrain system directly to our waterways and the ocean. Sources of pollution in urban runoff include oil and grease, diesel emissions and leakage, car exhaust, pesticides and fertilizers, animal waste, street litter, road surface abrasion by traffic, vehicle tire wear, sedimentation from construction, and the illegal disposal of toxic wastes by business, industry and individuals. Stormwater runoff is collected by a network of drainage structures which collect runoff from Ventura County streets, parking lots and other surfaces and is discharged into rivers, creeks, streams, lagoons, bays and eventually the ocean. The runoff results in the contamination of these receiving waters.

The main purpose of the flood control system is to prevent flooding in urban areas. The system was built separate from the sewer system, and unlike the sewer system, the flood control system has no capacity to treat the water it carries. In recent years, evidence has accumulated indicating that in most urbanized areas urban stormwater runoff is one of the most significant sources of water pollution. A recent study by the Aquatic Habitat Institute suggests that urban runoff accounts for one-third of the Polychlorinated Biphenyls (PCB's) and Polyaromatic Hydrocarbons (PAH's) found in the San Francisco Bay, in addition to one-sixth of the hydrocarbons, one-fourth of the mercury and one-tenth of the lead. Nonpoint pollution experts at UCLA estimate that about 50% of the oil and grease pollutants in Southern California oceans and bays originate from urban runoff.

Historically, water pollution control measures have focused on reducing pollutants in discharges of industrial process wastewater and municipal sewage. As control measures were developed for these discharges, attention was focused on the more diffuse sources of water quality problems. Under the sponsorship of the Association of State and Interstate Water Pollution Control Administrators and the United States Environmental Protection Agency (USEPA), the states conducted a comprehensive study of diffuse pollution sources, resulting in the report "America's Clean Water - The States' Nonpoint Source Assessment, 1985." This report indicated that 38 states identified urban runoff as a major cause of beneficial use impairment, and 21 states identified construction site runoff as a major cause of use impairment.

In a later study, the states submitted information published as the "National Water Quality Inventory, 1988 Report to Congress" which concluded that pollution from diffuse sources such as runoff from urban areas, agriculture and resource extraction is the leading cause of water quality impairment. Agricultural runoff and the effects of aggregate mining on water quality are addressed in other chapters of this plan.

B. Responsible Agencies

The Federal Clean Water Act requires states to develop a statewide nonpoint source assessment program describing the measures the state will take to address nonpoint source pollution, however, federal funding for the program has been eliminated. The State of California has proceeded, without funding, and has developed a draft assessment plan and a management plan. Efforts toward cleaning up pollution from urban runoff will require local government action to control urban runoff.

Section 405 of the 1987 Clean Water Act amendments required municipalities to acquire National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges from publicly owned stormdrain systems. The County of Ventura, the Ventura County Flood Control District (VCFCD) and the ten cities within Ventura County (Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, San Buenaventura, Santa Paula, Simi Valley and Thousand Oaks) submitted an application to the Los Angeles Regional Water Quality Control Board (LARWQCB) in April 1994 to be covered by a single NPDES permit. The permit application for the City of Oxnard had already been submitted in two parts in May 1992 and May 1993. As approved by the LARWQCB, the VCFCD is the responsible agency and will act as the principal permittee and the County and the ten cities of Ventura County are named as co-permittees. The permit was issued on August 22, 1994. The NPDES program and the responsibilities of the permittee and co-permittees are discussed further in Section II, Current Status A., Ventura County Flood Control District Activities.

C. 208 Plan Summary (1980)

The 1980 208 Water Quality Management Plan (WQMP) concluded that while urban runoff was not a major source of water quality pollution on a countywide basis, as some other sources, increasing urbanization could result in potential problems. When the 1980 208 WQMP was prepared only a small percent of the total drainage area of the County was urban, urban runoff was not considered a problem of countywide significance. During the preparation of the 1980 208 WQMP effort, an attempt was made to gauge the magnitude of the urban stormwater runoff problem in three major hydrologic areas in the county, including the Ventura, Santa Clara and Calleguas-Conejo River systems and related tributaries. At the time, it was anticipated that due to their near natural condition, it would be many decades before the Ventura River or Santa Clara River systems would show any significant deterioration attributable to urban runoff. Based on significant forecasted increases in urbanization, along with a reduction in the self cleaning effect of the natural channels due to scheduled (at the time) concreting of the channels it was believed that urban runoff would perhaps create future problems in the Calleguas-Conejo River system and its major tributaries.

1. Recommended Programs

The following recommendations were made as part of the 1980 208 plan to decrease the pollutant load of urban stormwater runoff.

a. Public Awareness Program and Litter Ordinance

b. Improved Street Cleaning and Resumption of Street Cleaning of Urban County Roads

c. Improved Roof, Sidewalk, and Drainage Facility Cleaning

d. Reduced Fertilizer and Pesticide Applications

e. Reduction of Vehicle Miles Traveled

f. Development of Increased On-Site Infiltration through Storage (Ponding)

Due to several factors, the above recommendations were not implemented. As a result of Proposition 13, funds were no longer available for public awareness, litter and street sweeping programs. Also at the time, urban stormwater runoff was not considered a priority problem compared to other water quality issues such as seawater intrusion, overdrafting of groundwater basins and other problems.

2. Post 208 Plan Urban Runoff Control Activities

Although the recommendations above were not implemented, with the adoption of the 1980 Water Quality Management Plan, the County Board of Supervisors did direct VCFCD staff to implement three actions as described below. The results of these actions are explained following each prescribed action item.

a. Direct staff to enter into a cooperative agreement with other agencies such as the Chemistry Department of Moorpark College to create a voluntary water sampling and testing program and to consider the expansion of existing budget requests for VCFCD Sampling Programs to specifically include this program.

The VCFCD had an informal agreement with the Chemistry Department of Moorpark College to carry out a sampling program. Three students volunteered to take samples in Moorpark and from the Arroyo Simi. To obtain an accurate "urban runoff" sample, samples need to be taken before the first .35 of an inch of rain falls. This amount is referred to as the "first flush" and is believed to be the amount of rainfall necessary to flush the storm water system of accumulated debris and pollution. Unfortunately, the first storms began during the night while the volunteers were asleep and did not collect samples during the first flush. The volunteer program using unpaid students was considered unsuccessful so the agreement was canceled. Additional attempts by staff were more successful when hydrographers collected Ventura County Government Center Parking lot samples. In addition, since 1992 many streams have been sampled and tested for "ag complete" minerals with varying values. General conclusions have been that during low flow there is high TDS and during high flow TDS levels are low.

Ventura Countywide Stormwater Quality Management, a program is now in place to collect urban runoff samples at five land use characterization sites in the County. The program began in early 1993 and is discussed in more detail later in this chapter in Section II. Current Status: A. Ventura County Flood Control District Activities Stormwater Runoff NPDES Permit Program Stormwater Runoff Monitoring Plan.

b. The Board of Supervisors directed staff to coordinate with the National Urban Runoff Program (NURP).

The National Urban Runoff Program began in the late 1970's and evolved into what is known today as the National Pollutant Discharge Elimination System (NPDES) Program. It took approximately 10 years for the law to be written. The program rules were approved by the EPA in 1990. The VCFCD is currently in the beginning stages of implementing the program. The program is explained in more detail below under the heading, B. Ventura County Flood Control District Activities, 1. Stormwater Runoff NPDES Permit Program.

c. The Board of Supervisors directed staff to incorporate consideration of impacts from urban runoff on Mugu Lagoon and other areas whenever decisions regarding concreting of stormwater channels are made.

The VCFCD immediately began analyzing urban runoff impacts whenever stormwater channel modification may have an affect on Mugu Lagoon and any other area. This analysis is conducted through the environmental review process.

II. Current Status

A. Ventura County Flood Control District Activities

1. Current Legal Authority

Under the EPA storm water permitting regulations at 40 CFR § 122.26(d)(2)(i), the co-permittees must demonstrate the existence of adequate legal authority to control discharges to their municipal storm drain systems. Under this regulation, the co-permittees must have, or commit to have, the legal authority to: (1) control industrial pollutants; (2) prohibit illicit discharges; (3) control non-storm water spills and dumping; (4) control inter-system pollutant discharges; (5) require regulatory compliance; and (6) inspect and monitor for noncompliance. The existing legal authority for each of the co-permittees is made up from a number of different federal, state and local laws:

a. The California Constitution allows cities and counties freedom to select one of two forms of government. The City of San Buenaventura operates under a local charter, while the other co-permittees operate under the "general laws" of the State legislature. Both forms of government are granted broad authority to enact and enforce local regulatory ordinances. Ordinances of "General Law" cities must not conflict with state law, while ordinances of chartered cities may conflict with state law if the ordinance is for a "municipal affair." Storm water pollution control is consistent with state law, thus no co-permittee is limited in their legal authority to impose adequate regulation.

b. California Statutory Law encompasses a broad range of legal authorities that can be used for storm water pollution control. Among these are the Ventura County Flood Control act, the Zoning and Planning Law, the Subdivision Map Act, enabling legislation for local agency pretreatment programs, authority to abate nuisances, authority over drains and sewers, the California Environmental Quality Act, regulation of hazardous waste, and pesticide applicator certification requirements.

c. Co-Permittee Ordinance Codes. Many chapters or section or Co-Permittee Ordinance Codes pertain either directly or indirectly to control of storm water discharges. Although none of these ordinances are written to specifically control all aspects of storm water quality, runoff and drainage; the combination of a variety of different ordinances, for the most part, creates adequate legal authority to control the discharge of pollutants into the storm water systems within Ventura County.

d. Limits in Authority/Resolution in Short-Term. Ultimately, all co-permittees desire similar legal authority to control storm water discharges, and seek uniform inspection and enforcement of these controls. Therefore, VCFCD will develop, and all co-permittees will be encouraged to adopt, a model ordinance. This model ordinance will be prepared as each co-permittee's storm water management program is developed, to ensure that the legal and technical aspects of each co-permittee's program are compatible.

was this done?

2. Existing Management Practices

VCFCD and the cities in the County currently have programs in place that contain, directly or indirectly, elements of effective storm water quality protection. The following examples include:

a. Programs for Residents and Businesses. The co-permittees conduct public outreach and education programs directed at both individual citizens and businesses. Programs include solid waste source reduction; water conservation regulations; local development standards and conditions; and hazardous waste recycling and disposal procedures. Weekly curbside recycling is practiced and promoted by all co-permittees resulting in a 15% reduction in solid waste disposed at landfills. All co-permittees operate in-house programs to recycle automotive fluids, paint, car batteries, and tires. The Ventura County Regional Sanitation District has conducted 12 household hazardous waste collection/recycling events since 1987. The Ventura County Solid Waste Management Department collected 112 tons of household hazardous waste at 4 collection events in 1993. They promote municipal recycling programs and recycling centers throughout the county. Thousand Oaks has a permanent household hazardous waste collection center. Ventura County Environmental Health Division inspects 1,325 businesses each year for proper use, storage and disposal of hazardous materials. Local fire departments also inspect hazardous material storage and handling facilities. All local sanitation districts/agencies aggressively enforce pre-treatment/source control regulations at many local businesses through inspections and monitoring. Source control inspectors in Simi Valley and Oxnard have begun inspections for storm water pollutants at these businesses.

b. Programs for Municipal Infrastructure. VCFCD owns and maintains regional flood control channels in the county. The other co-permittees own and maintain the local storm drain systems sand catch basins. All co-permittees regularly inspect their systems, usually before and during the rainy season. Co-permittees clean catch basins and culvert inlets at least once or twice each year, and provide erosion protection at culvert outlets. Some co-permittees, and the VCFCD, currently employ debris basins for sediment removal which provides some level of storm water pollution control.

Every co-permittee either operates aggressive street sweeping programs and/or requires property owners/homeowners associations to clean streets. See Table 4.12, Ventura County and Cities Street Sweeping Activities. In 1992 approximately 4.4 tons of material were collected per mile of street in the county. pesticide and herbicide use on public land is restricted to trained, certified applicators, and solid waste facilities comply with appropriate environmental laws.

c. Programs for Land Development and Construction Sites. Control of new development is fairly standardized throughout the county. Under the California Environmental Quality Act (CEQA), development presenting significant environmental impacts, including storm water quality impacts, must prepare Environmental Impact Reports which define environmental impact mitigation measure. Every co-permittee reviews development and construction proposals, defines conditions of development that address environmental issues, and inspects the work during construction to ensure that the development is constructed in accordance with the approved plans/conditions of development and that erosion protection measures are effective.

d. Programs for Illicit Discharge Control. The Ventura County Environmental Health Division supervises emergency spill response and cleanup. Co-permittee fire departments, police departments, and public works departments usually assist with rapid response, containment, and cleanup of toxic spills. Known wildcat dump sites are regularly inspected and promptly controlled. Water conservation programs of most co-permittees reduce illicit discharges through education, promotion of general water use efficiency, irrigation efficiency, drought tolerant landscaping and tiered water rates.

3. Stormwater Quality Management - NPDES Permit Program

As described in the beginning of this chapter, as approved by the LARWQCB, the Ventura County Flood Control District (VCFCD) is the responsible agency to act as permittee while the County of Ventura and the ten incorporated cities within the County are co-permittees for the Ventura Countywide Stormwater Quality Management Program as required by its National Pollution Discharge Elimination System (NPDES) permit. The permit was issued August 22, 1994.

The VCFCD encompasses the entire Ventura County and is divided into four drainage zones. Each zone is basically a separate major watershed consisting of incorporated cities and unincorporated lands, with the major drainage system for each under the jurisdiction of the VCFCD. Zone 1 is the Ventura River watershed, which contains the city of Ojai, a portion of the city of Ventura, and unincorporated county lands. Zone 2 is the Santa Clara River basin containing the cities of Oxnard, Port Hueneme, Santa Paula, Fillmore, portions of the city of Ventura, and unincorporated county lands. Zone 3 is the Calleguas Creek watershed containing the cities of Simi Valley, Moorpark, Thousand Oaks, Camarillo, and unincorporated county lands. Zone 4 is the remaining unincorporated portions of the county not contained in the other zones; part of the City of Thousand Oaks is in Zone 4 which drains outside of Ventura County.

Table 4.12 Ventura County and Cities
Street Sweeping Activity

CITY	FREQUENCY	STREETS OR CURB MILES SWEPT	VOLUME OF MATERIAL
Camarillo[1]	2/month Residential 4/month Commercial	All streets 288 miles	1,500 tons/yr.
Fillmore[2]	2/month Residential & Commercial	All streets N/A	N/A
Moorpark[3]	2/month Residential 4/month Commercial	All streets 150 miles	676 cubic yards/yr.
Ojai[1]	2/month Residential 4/month Commercial	All streets 65 miles	546 tons/yr.
Oxnard[1]	1/month Residential 1/month Commercial .33/month 63 parking lots	All Streets 775 miles	3,300 tons/yr.
Port Hueneme[1]	4/month Residential & Commercial	All streets 65 miles	463/tons/yr.
Santa Paula[4]	2/month Residential 4/month Commercial	All streets N/A	1,296 cubic yards/yr.
Simi Valley[5]	1/month Residential 2/month Commercial	700 curb miles	4,800 tons/yr.
Thousand Oaks[6]	1/month Residential 4/month Commercial	1,100 miles	1,200 cubic yds/yr. or 480-576 tons/yr.
Ventura[7]	1.5/month Residential except Keys due to parking problems (1 month) 2/month Commercial 8/month downtown and shopping areas	550 miles	2,500 tons/yr.
Ventura County Unincorporated Areas			
Lynn Ranch[1]	2/month Residential	20 curb miles	101 tons/yr.
Casa Conejo[1]	2/month Residential	20 curb miles	101 tons/yr.
Oak Park[1]	2/month Residential	58 curb miles	144 tons/yr.

[1] Venco Power Sweeping, Inc., Linda Burr, February 1993.
[2] City of Fillmore, Public Works, Beverly Brisby, February 1993.
[3] Pacific Power Sweep, David Hopkins, February 1993.
[4] City of Santa Paula, Art Rodriques, February 1993.
[5] City of Simi Valley, Street Superintendent, Jay Seidemann, March 1993.
[6] City of Thousand Oaks, Joe Bravo, February 1993.
[7] City of San Buenaventura, John Ryder, February 1993.

N/A - Information not available.

In February of 1992, VCFCD, Ventura County, and the cities in Zone 3 formed a task force to discuss obtaining a single NPDES permit for the zone. The Ventura County and VCFCD Board of Supervisors and the various city councils signed a Cooperative Agreement to explore this regional concept. This cooperative agreement provides for the County of Ventura, VCFCD and the cities to request that the Los Angeles Regional Water Quality Control Board (LARWQCB) issue a single NPDES permit for Zone 3, and that each agency will send a representative to task force meetings. As all the cities in the County became aware of this process, they expressed interest and thus, the task force has been expanded to include all ten cities and the proposal to the LARWQCB is now for a county-wide permit. To date, the task force has developed an Implementation Agreement which Ventura County VCFCD and all of the cities in the County have signed. In this Implementation Agreement, the VCFCD is named as the principal permittee and the county and the cities are named as co-permittees. It also states the general responsibilities of each agency under a regional permit, and how costs are to be shared.

a. Funding

The financing for this program will be VCFCD's Benefit Assessment Program, which was established on June 14, 1988, and additional funding as required from each city. Additional funds may be generated through permit fees. The Implementation Agreement discusses how the Benefit Assessment Program will be used to finance the NPDES program. The assessment will be in two parts: A district-wide fee will be established to fund the coordinated and/or shared efforts directed by VCFCD; and each city may also request an additional assessment to fund some or all of their individual municipal responsibilities under the NPDES program.

b. Overview of Regulations

The Water Quality Act of 1987 added section 402(p) to the Federal Clean Water Act, which requires the USEPA to establish regulations setting forth NPDES permit application requirements for storm water discharges. These requirements are directed at urban runoff from municipal stormwater systems as well as storm water discharges associated with industrial activity and construction sites of five acres or greater. The LARWQCB required the County of Ventura permittees to prepare a permit application to include existing data on the municipal stormwater systems receiving waters, storm water management programs, and the preparation of a monitoring plan to characterize stormwater discharges and an implementation plan for a comprehensive Municipal Storm Water Management Program (MSWMP).

At the April 15th meeting, the LARWQCB staff stated that Ventura County and its cities must comply with these USEPA permit application regulations, either by a permit application or under the terms of a permit. They further stated that a county-wide permit must be issued according to Oxnard's regulatory schedule but that the permit application and implementation schedule for the remainder of the county could be phased over the entire five-year permit term. The permit conditions may be modified when the permit is renewed for subsequent five (5) year terms.

c. Current Permitting Status

Thousand Oaks was designated by the LARWQCB to obtain its own NPDES permit for that portion of the city, and Ventura County was named as a co-permittee on the existing Los Angeles County NPDES permit. In March of 1992, existing information similar to a permit application was submitted by Thousand Oaks. A Storm Water Management Program Implementation Plan was then submitted in March of 1993.

Ventura County and Thousand Oaks have requested of the LARWQCB that this implementation plan be incorporated into the County-wide NPDES permit when issued and that those areas within Ventura County draining to Santa Monica Bay be removed from the Los Angeles County permit at that time. At the April 15, 1992 meeting, the LARWQCB agreed to consider this concept, as long as Thousand Oaks and Ventura County would comply with conditions similar to and compatible with Los Angeles County's permit requirements for the Santa Monica Bay watershed.

d. Schedule of Activities

The proposed schedule for the county-wide NPDES stormwater program is shown on the following page. This schedule consists of two major phases: Initial Implementation Phase and Full Implementation Phase.

Initial Implementation Phase.

As part of the NPDES permit application, a proposed schedule of programs has been developed. These programs will be implemented as pilot projects in the Initial Implementation Phase of the permit. Once implemented, the programs will be analyzed and if determined a successful program, the program will be continued and/or enhanced as part of the Full Implementation Phase. Listed below are the proposed Initial Implementation Phase programs.

Initial Implementation Phase

Programs for residents -General public information/participation Displays Stenciling (No Dumping) Presentations Refuse disposal	Program for illicit discharge control -Illicit discharge investigations Programs of construction sites -Education/outreach
Programs for industrial/commercial businesses -Specific business outreach Automotive service Restaurants Programs for public infrastructure -Education for public agencies/employees	Program for land development -Education/outreach to land developments Land use planning and zoning XX Zoning /zoning ordinance X X X Infrastructure planning Development stds. and reviews Permit and inspections

Full Implementation Phase. As addressed above, depending on the success of the programs in the Initial Implementation Phase, the programs may be carried over to the Full Implementation Phase as continued programs. In addition, other long term requirements of the NPDES permit must be met. Listed below are the programs/plans scheduled to be implemented as part of the Full Implementation Phase.

Full Implementation Phase

Program work plans
Countywide program approaches and materials
Initial implementation (See Initial Phase above)
Co-permittee work plans
Program implementation

e. Stormwater Runoff Monitoring Plan

As part of the NPDES application, a monitoring plan to characterize stormwater runoff is required by the NPDES program. The monitoring/reporting program will include discharge characterization, pollutant source identification, receiving water monitoring, analysis of program effectiveness, data analysis, interpretation and reporting to the LARWQCB. Currently five sites have been chosen as sample collection sites. Table 4.13 describes the five locations, identifies the drain to which the site is a tributary and identifies the type of land use sample the site is considered; industrial, commercial, or residential. Figure 4.8 illustrates the five locations. These sites are considered representative of land use in the county. Monitoring began in January 1993 following the first storms of the year. It is expected that one additional characterization monitoring site and two receiving water monitoring sites will be required with permit issuance.

Table 4.13 National Pollution Discharge Elimination System (NPDES) Stormwater Collection Site Descriptions

Site R-1	Swan Street and Macaw Avenue in Ventura. The drainage area consists of 65 acres of residential neighborhood with a mixture of 15-20 year old single-family homes, schools, churches and parks. The stormdrain is tributary to the Harmon Barranca.
Site R-2	Lawrence Way and Hill Street in Oxnard. The drainage area consists of 134 acres of residential neighborhood. There appears to be significant drainage from Marina West Park and an adjacent school yard (approximately 10-15%) with the balance of the drainage area being a combination of newer single-family and multi-family residential. The stormdrain is a tributary to the West Wooley Drain.
Site I-1	Via Pescador and Avenida Acaso in Camarillo. The drainage area consists of 30 acres of newer industrial park. The stormdrain is a tributary to the Somis Drain with the nearest major channel being Calleguas Creek.
Site I-2	Ortega Street between Eastman Avenue and Palma Drive. The drainage area consists of 189 acres of light manufacturing, newer industrial parks and a few undeveloped lots. The stormdrain is a tributary to the La Palma Drain with the nearest major channel being the Santa Clara River.
Site C-1	Via Del Norte and Los Olivas in Oxnard. The drainage area consists of approximately 200 acres of newer strip malls and auto dealerships. The stormdrain is a tributary to the Nyeland Drain.

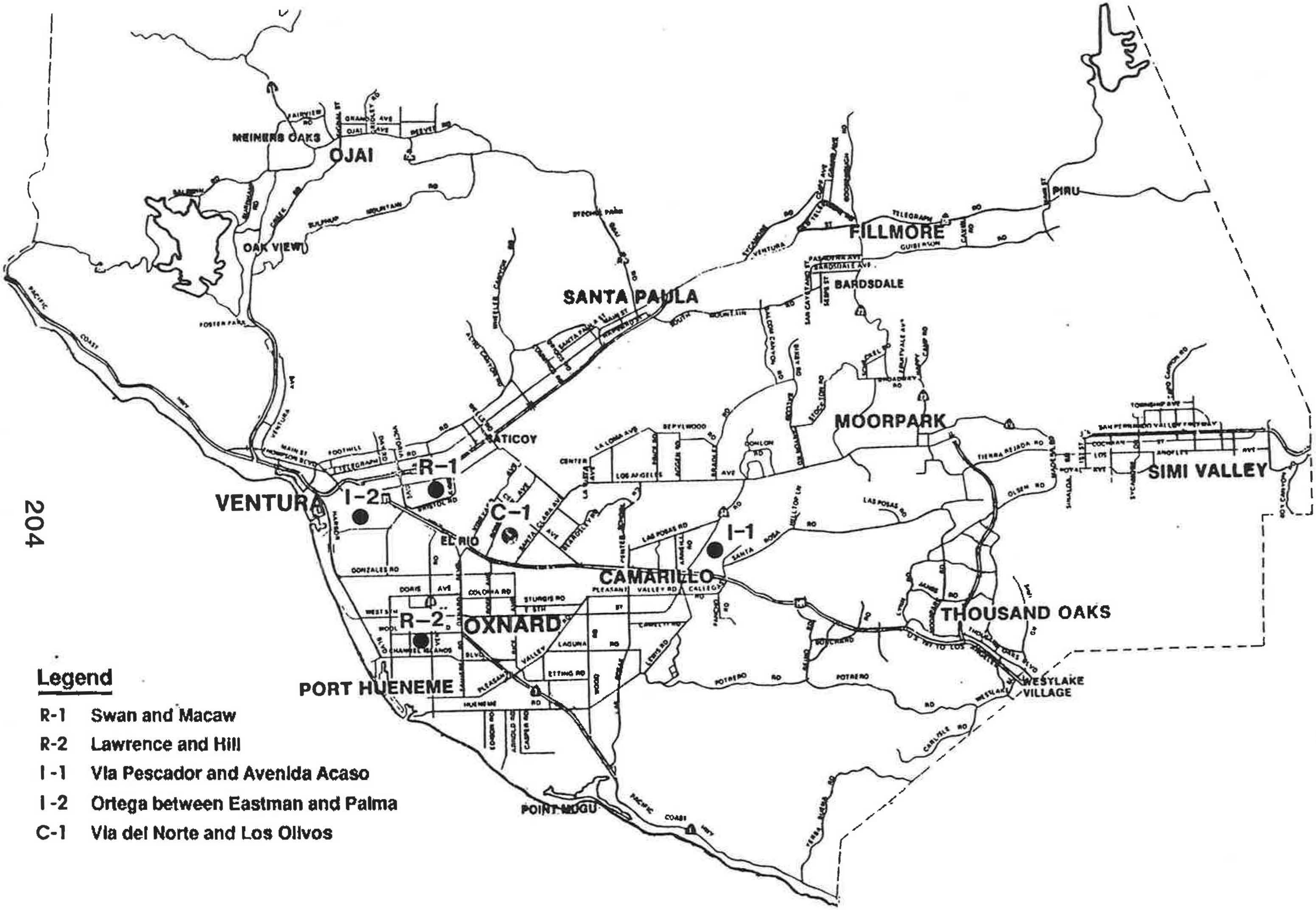

Figure 4.8 • National Pollution Discharge Elimination System (NPDES) Permit Stormwater Sample Collection Sites

III. Conclusions and Program Recommendations

A. Conclusion

Urban Stormwater Runoff

Urban stormwater runoff is now considered one of the most significant sources of water pollution. Sources of pollution in urban runoff can include oil and grease, diesel emissions, car exhaust, pesticides, fertilizer, animal waste, litter, sedimentation and other undesirable constituents. This runoff enters rivers, creeks, streams, lagoons, bays, and eventually the oceans. Actions need to be taken to reduce these pollution sources. The improvement of receiving water quality, enhancement and maintenance of beneficial uses, which in the 208 planning area are related primarily to fish and wildlife habitat and groundwater recharge (which serves domestic and agricultural use) will require control of this nonpoint source pollution source. The reduction of these pollution sources would also reduce overall human exposure as well.

Since the passage of the Federal NPDES Stormwater Regulations, local municipalities are responsible for complying with the legislation requirements. The VCFCD, the County of Ventura and the 10 cities in the County are currently in the beginning stages of implementing the Initial Implementation Phase program. The Countywide NPDES application requires compilation of existing data in the Municipal Separate Storm Sewer System (MS4), receiving waters, storm water management programs, and the preparation of a monitoring plan to characterize the stormwater discharges. The application also requires the preparation of an implementation plan for a comprehensive Municipal Stormwater Management Program (MSWMP). All of these requirements were addressed in the Ventura Countywide Stormwater Quality Management Program which was presented to the LARWQCB as the County's permit applicant in April 1994. The Countywide permit was issued on August 22, 1994.

The following recommendations are recommendations included in the Countywide Stormwater Quality Management Program.

B. Program Recommendations

The following recommendations are programs included in the NPDES permit application filed by the County of Ventura and cities of Ventura County for the Countywide Stormwater program for fiscal year 1994/95.

1. General Public Outreach and Education using VCFCD prepared material through: displays at community events, stenciling of a "No Dumping" message on catch basins by municipal staff and volunteer groups, speaking

at engagements, and incorporating a stormwater message into educational materials on existing programs. For cost reduction, the NPDES permit seeks to achieve stormwater pollution control through modifications to existing programs whenever possible.

2. Initiation of a "Clean Business" Approach to Pollution Control including: on-site field investigations of automobile service businesses and restaurants, on-site education about observed pollutant sources and control measure, on-site feedback from the business owners/employees, follow-up inspections, awards and incentives for businesses that achieve adequate pollutant control, and development of new ordinances, if necessary, to enforce practicable controls.

3. Development of standard reporting and evaluation procedures for existing infrastructure management practices to determine the effectiveness of the existing programs and better track observations of illicit discharge.

4. Each co-permittee has identified priority areas within their jurisdiction for controlling illicit discharges to the storm drain system. These areas will be investigated, dischargers will be educated, and if necessary, enforcement action for control will be taken. Simi Valley and Oxnard have begun inspections for stormwater pollutants in some of their priority areas.

5. Implementation of planning procedures for development projects to address pollutant sources during development. Educational material will be prepared and workshops conducted for the land development community as the procedures are revised.

6. Development of model stormwater pollution prevention plan (SWPPP) for construction sites as a training tool to educate contractors, their employees, and public agency inspectors on proper steps to take to reduce pollution entering the storm drain system at construction sites.

7. During three storms per year, outfall monitoring will be conducted at selected sites to characterize stormwater runoff from different urban land uses in Ventura County. Results of the sampling will be analyzed to produce pollutant load estimates, identify long-term runoff quality trends, evaluate receiving water quality impacts, and assess management program effectiveness. The monitoring program is recently being conducted at five urban locations. Three additional locations will be required by the permit for fiscal year 1994/95.

8. Financing for Resource Conservation District (RCD) for the administration of the Ventura County Hillside Erosion Program.

9. Program administration, financial accounting and preparation of annual reports and other documents for submittal to the Los Angeles Regional Water Quality Control Board (LARWQCB) by VCFCD as required by the permit.

10. Planning for full implementation phase - Preparation of Countywide program approaches and material for use in implementing the NPDES program in subsequent years (after 1994-1995) for the duration of permit.

Chapter 4.2.C Urban Runoff References

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Musgrove, Vicki, Ventura County Flood Control District, personal communication
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Ibid, Volume II, Enviro-Socio-Economic Assessment, July 1980.
Ibid, Volume III, Background Appendix, July 1980.
Ibid, Volume IV, Technical Appendix, July 1980.

D. ABANDONED WATER WELLS

I. Description of Problem

Although abandoned well leakage has long been recognized as a contributor to local groundwater quality problems, only recently has the magnitude of the problem been realized. Recent preliminary results from independent studies by the United States Geological Survey (USGS), the United Water Conservation District (UWCD), and the Ventura County Public Works Agency Water Resources Division have identified improperly sealed wells as significant contributors to the degradation of local groundwater quality.

Abandoned water wells have the potential to degrade groundwater quality, cause localized flooding and create public health and safety hazards. Improperly sealed abandoned wells can act as conduits for surface and subsurface pollutants and poor quality groundwater to enter usable aquifers. In addition, abandoned wells can become artesian wells possibly creating flood problems. Such conditions create safety hazards and if undetected prior to building construction can cause structural damage. This section summarizes the 1980 Areawide Water Quality Management Plan abandoned water well study and describes how abandoned wells degrade groundwater quality and create hazards. The status of the abandoned water well problem is updated and program recommendations are made to address these issues.

A. Summary of 1980 Areawide Water Quality Management Plan

The 1980 Areawide Water Quality Management Plan (208) included an abandoned water well assessment. The assessment was designed to estimate the extent of abandoned well related problems on the Oxnard Plain. The Oxnard Plain was selected because the area was believed to have the greatest potential for groundwater pollution for a variety of reasons. Due to a long history of agricultural activities on the plain it was thought that there might be a significant number of abandoned wells. Pesticide, herbicide and fertilizer use posed danger by possibly entering groundwater via abandoned wells. Aquifers beneath the Oxnard Plain included areas intruded by seawater. Some wells were thought to be perforated in both the upper intruded aquifer and the lower uncontaminated aquifers. Perforation of a well in both aquifers could create the potential for the well to act as a conduit for seawater to enter the lower aquifers resulting in degradation of groundwater quality. These conditions, both separately and together created a great potential for contamination of the groundwater basins. Unfortunately, these conditions still exist today.

As suspected, the study determined that the Oxnard Plain contained a large number of improperly abandoned wells. A 1977 Active Well survey map was used to determine study area boundaries. Within the study boundary, 1,447 water wells were identified (although more were believed to exist because wells drilled prior to the late 1920's were never recorded and therefore not included in the base maps). Not all of the wells could be surveyed within the time frame of the study. A total of 408 wells were selected at random to be included in the survey. The Active Well Survey map identified 150 of the wells as active, the remaining 258 wells were included in the survey. Fifteen, or 5.8 percent were destroyed under County permit. Of the remaining wells, fifty or 19 percent of the wells were actually located, and seven wells were found to be active. The remaining 43 wells or 16 percent were classified as abandoned according to the County Ordinance definition.

Although none of the wells surveyed appeared to be an immediate safety hazard, the wells were considered potentially dangerous to water quality, public health and safety. The study examined four possible approaches to addressing the abandoned water well problem; 1) further study and identify abandoned water wells in the Oxnard Plain, 2) study and identify other areas in the county where abandoned water wells may cause problems, 3) implement an aggressive county program to abate abandoned water wells as soon as discovered, and 4) a no project alternative. Each of the four alternative approaches were examined by assessing beneficial and adverse impacts, mitigation measures to minimize adverse impacts, the relationship between short term use and long term productivity of the project, irreversible commitment of resources, environmental changes and growth inducing impacts. Based on the potential beneficial effects and long term productivity of the Oxnard Plain Aquifers, the evaluation indicated the need for future study of abandoned water wells in the Oxnard Plain where aquifers intruded with seawater threaten adjacent aquifers. More intensive identification methods to locate wells such as using metal detectors was recommended. The report suggested exploration of additional mitigation measures to minimize negative impacts resulting from abandoned water wells. Assessment of the four possible alternatives and additional background information on the abandoned water well report can be found in the 1980 Areawide Water Quality Management Plan Enviro-Socio-Economic Assessment (Volume II) and Technical Appendix (Volume IV).

B. Degradation of Water Quality and Safety Hazards

1. Pollution Mechanisms

Water wells that have been improperly located, constructed or destroyed can cause the impairment of groundwater quality through a variety of ways. Figures 4.9 and 4.10 illustrate the five principle physical conditions which can cause abandoned wells to act as conduits for pollution or degraded water to enter groundwater aquifers and are listed below.

- When the well is located too close or downstream from surface or underground pollution sources aquifers perforated by the well can be directly affected as Figure la illustrates. Sometimes the source of pollution is a nearby abandoned well.

- When the surface portion of the well is constructed without protective features, contaminated or polluted waters can flow directly into the well through one or more openings in or under the pump (Figure 4.9-b and 4.9-c). Under such conditions usually only the water in or adjacent to the well is affected, however, if the well casing is defective or other problems exist, one or more aquifers may be affected.

- When the annular space (the space between the outside of the casing and the wall of the hole) lacks an adequate vertical seal surface or shallow subsurface water can flow into the well. Although the annular space may be filled with granular filter material (gravelpack), no seal exists and polluted or poor quality water can move downward and/or laterally (Figure 4.9-d). This type of defective well is particularly susceptible to contamination.

- If during well construction or the destruction of an abandoned well, aquifers that produce poor quality water are ineffectively sealed off, creating a physical connection between the aquifers (Figure 4.10). Such a condition can significantly impair the quality of water in those aquifers.

- When the well is used intentionally, accidentally, or carelessly for the disposal of waste causing direct contamination of groundwater. Such disposal is prohibited by law.

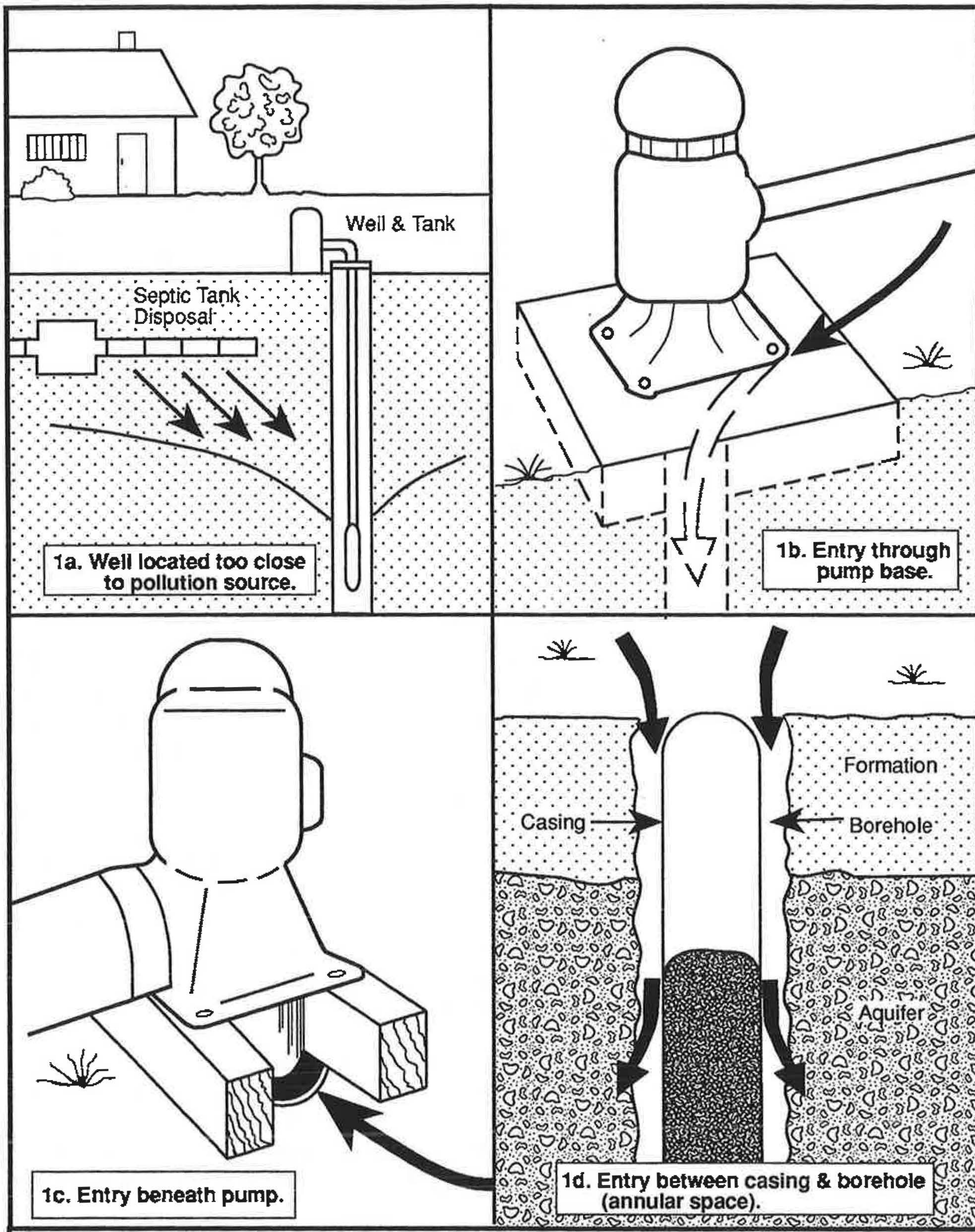

Figure 4.9 • Avenues of entrance for pollutants to wells and groundwater.

PLN881 9/94 (1a, b, c, d)

Source: Department of Water Resources - Water Well Standards Bulletin 74-81, December 1981.

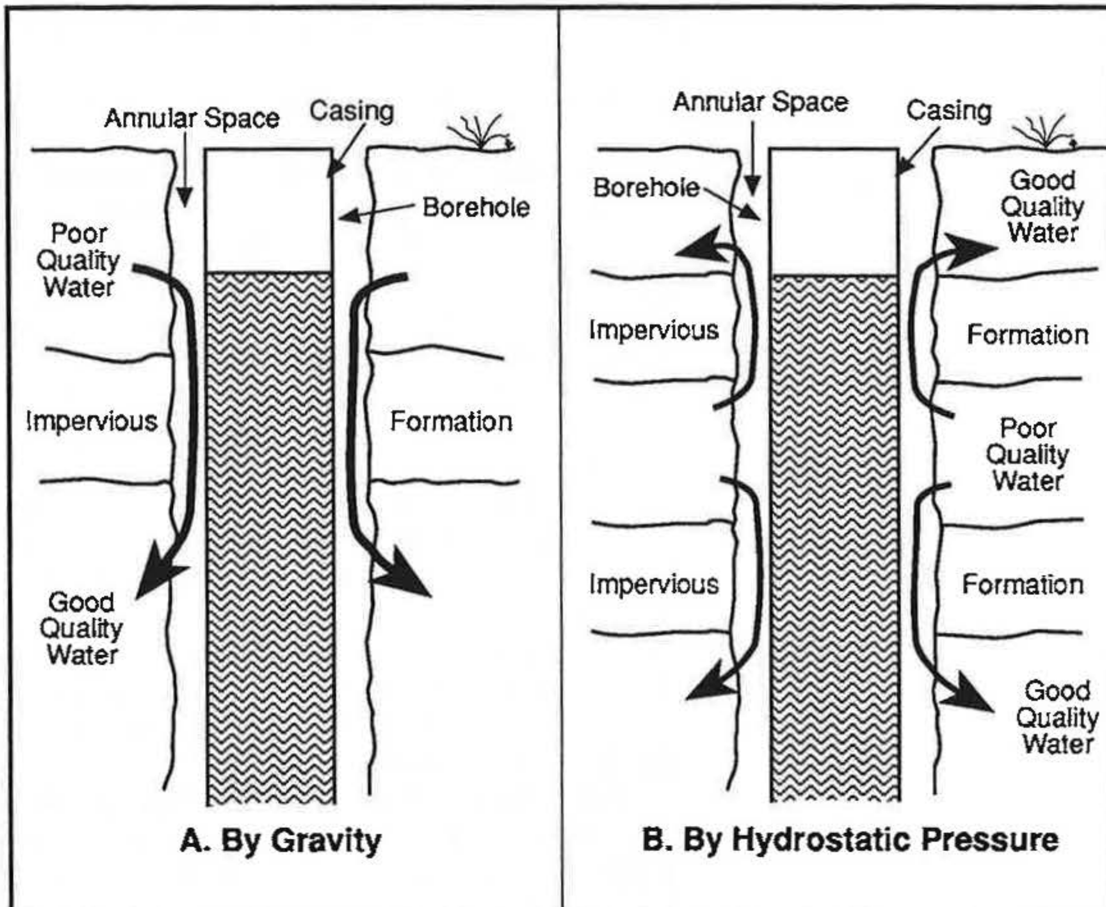

Figure 4.10 Interchange of Water Between Formations Via

PLN881-4.10(a,b) 10/94

Source: Department of Water Resources - Water Well Standards Bulletin 74-81, December 1981.

The above section described and illustrated several physical conditions that can cause abandoned wells to act as conduits for pollution and poor quality water to enter groundwater aquifers. The following section describes the types of pollution and poor quality groundwater that can degrade groundwater quality.

a. Seawater or Poor Quality Groundwater Contamination

Seawater and poor quality groundwater are two subsurface sources that can potentially contaminate underground aquifers. In coastal areas where aquifers are in close proximity to the ocean, the overpumping of aquifers reduces pressure in the aquifer causing seawater to be pulled into the aquifer, degrading water quality and sometimes rendering groundwater basins useless or in need of expensive treatment. This condition is called seawater intrusion and can be further worsened where multiple aquifers exist. If a well is perforated in an intruded aquifer and one or more aquifers, the poor quality water from the intruded aquifer can enter the other aquifer(s) via the abandoned water well. This condition occurs on the Oxnard Plain where multiple aquifers exist and the southwestern area beneath the plain is intruded with seawater. Such circumstances pose great potential for the degradation of local groundwater supplies. Specific problem areas, such as the Oxnard Plain are addressed in later sections of this chapter. The seawater intrusion problem is discussed further in Chapter 4.2, Section A, of this Volume.

b. Agricultural, Industrial and Domestic Pollutants

Agricultural, industrial and domestic activities have the potential to generate pollutants that can enter groundwater aquifers through abandoned water wells, resulting in the degradation of groundwater quality. Agricultural activities often involve the use of pesticides, herbicides and fertilizers that contain high concentrations of inorganic and organic material. These substances are typically applied in areas where agricultural water wells are located. If not properly used these substances can act as pollutants that can degrade water quality. The improper use of and\or disposal of industrial and commercial wastewater that may contain solvents and hydrocarbons can also contaminate local groundwater. Domestic sewage disposal systems installed too close to wells can enter aquifers and raise bacteria and nitrate levels in groundwater. All of these potential pollutants can degrade the quality of local groundwater resources and potentially threaten public health and safety.

2. Flowing Abandoned Well Problems

A flowing abandoned water well condition occurs as a result of the well no longer being pumped and/or large amounts of precipitation causing the aquifer to become recharged to the extent that the aquifer overflows. An abandoned well provides a route for the water, creating a flowing well condition. If potential flooding conditions are undetected and buildings or other structures are erected, structural damage can occur. Flowing wells can also damage paved roadways. These conditions can create a public safety hazard. Flowing water well conditions exist in Simi Valley and infrequently on the Oxnard Plain. These problems are addressed in Section II Current Status, C. Specific Problem Areas of this Chapter.

3. Safety Hazards

In addition to water quality problems, abandoned uncapped wells are a serious safety hazard to people and domestic and wild animals. Several types of abandoned uncapped wells exist. These include older unmarked wells with open casings at ground level and clearly visible above ground wells with open casings on concrete pump bases. Well casings generally range from 4 to 16 inches in diameter. These holes are large enough for people and animals to fall into or trip over. Hand dug wells have been known to be as large as twenty five feet square, and were common in shallow water bearing areas prior to the use of modern well drilling rigs. Once covered with vegetation, the wells become hidden creating hazardous conditions.

a. Uncapped Casings

Abandoned wells created many safety hazards. Well openings can result in tripping and/or falling on the surface or into the well causing abrasions, broken bones or more serious injuries. Small children can fall into uncapped wells and become trapped from a few feet to several hundred feet below the ground surface. If water is in the well, drowning could occur. The same hazards exist for domestic and wild animals.

b. Caving and Collapsed Wells

Caving and collapsed wells can cause ground settling, producing depressed areas around the abandoned well. Further problems can result when attempts are made to destroy the well properly. Placing a drilling rig over an abandoned well site can cause additional settling around and to the hole. If an abandoned well collapses under an existing building, structural damage to the foundation and building could occur.

II. Current Status

A. Ordinance Requirements

The Ventura County Water Well Ordinance was adopted in 1970 by the Board of Supervisors. The ordinance is designed to ensure public safety and groundwater quality by regulating the construction, modification, and destruction of water wells and requiring abandoned water wells to be properly destroyed. A permit is required to undertake these activities. Permits are issued by the County Public Works Agency. The permit process is designed to ensure that wells will not act as conduits for pollution to enter groundwater, to prevent poor water quality conditions or in any way create a public health or safety hazard. All wells are inspected to assure compliance with the ordinance and any applicable conditions required as part of the permit.

The ordinance requires all abandoned wells to be properly destroyed. Abandoned wells are defined as those where the pump has been removed for more than thirty days, wells that have been in continuous disuse for one year, or those in such disrepair that the well cannot function. Test and exploratory holes are considered abandoned if 24 hours after construction and testing work have been completed the hole has not been properly sealed.

The well ordinance was last revised in April of 1987. Revisions were made to registered inspector requirements, and in regard to monitoring wells, engineering testholes, and well inspection reports. Only professional engineers or registered geologists currently registered in California and approved by the Public Works Director are allowed to inspect the drilling of new wells and the sealing operations of abandoned wells.

The ordinance requires abandoned water wells to be destroyed unless the property owner requests in writing to reuse the well(s). If after examination it is determined that an abandoned well would not result in pollution or contamination of groundwater or a public health hazard, a Certificate of Exemption (re-use permit) can be granted. A Re-use permit expires three years after issuance but may be revoked at any time to prevent pollution and contamination of groundwater, and prevention of public health and safety hazards. Successive reuse permits may be issued in the same manner as the original reuse permit.

Abandoned wells are to be destroyed in compliance with Section 23 of the Department of Water Resources (DWR) Water Well Standard Bulletin 74-81 and its supplement, DWR Water Well Standard Bulletin 74-91. Proper destruction of the well consists of sealing the well casing, the annular space and any voids that may exist. This process involves clearing the casing of foreign material and perforation of the well casing at intervals set by conditions of the permit. Cement is pumped into the well under pressure, the pressure is maintained until the cement has hardened. The casing is then cut off five feet below ground, and the area backfilled with clean soil. This method of destruction is designed to provide an adequate cap over the well to prevent surface pollutants from entering the well and to seal the interior of the well to prevent movement of potential pollutants into the well below the surface.

B. Post 208 Plan

The most recent abandoned water well survey was conducted in mid 1981 by the Ventura County Environmental Health Department as part of the last 208 Water Quality Management Plan. The survey resulted in the proper destruction of a half a dozen abandoned wells and an update of an active well map. Although no other additional programs have been implemented to properly destroy abandoned water wells, approximately 531 permits have been issued in the last fourteen years for the proper destruction of wells. The destroyed wells include those identified by the Public Works Agency Water Resources Division as a result of unrelated field work, reports to the agency from the public and those issued to well owners following the normal application process.

The Active Water Well Map that was started in 1977 has been kept up to date by the Public Works Agency Water Resources Division. Because wells have a limited useful life, the map assists in identifying wells that will eventually become inactive and need to be properly destroyed.

1. Groundwater Quality and Water Level Monitoring

Since the last study, some abandoned water wells have been converted to serve a useful purpose in the Ventura County water level data collection program. Once determined not to be a pollution source to groundwater, abandoned wells can serve as monitoring wells to identify groundwater levels and groundwater quality. Abandoned wells on the Oxnard Plain provide key water quality data for the annual seawater intrusion report prepared by the County PWA Water Resources Division.

C. Specific Problem Areas

1. Oxnard Plain

Abandoned water wells on the Oxnard Plain have resulted in degraded groundwater quality and some infrequent flowing groundwater conditions. Preliminary review of a recent USGS survey indicates that improperly sealed wells act as major contributors to the degradation of local groundwater resources. The total dissolved solid (TDS) content of groundwater resources beneath the Oxnard Plain have been rising over the years. Although much of the degradation is caused by direct seawater intrusion, it has now become evident that abandoned wells are worsening the seawater intrusion conditions. Abandoned wells act as conduits creating an interzonal connection between freshwater and brackish (seawater intruded zones). The poor quality water (in the seawater intruded basins) can leak into freshwater aquifers above and/or below the intruded basin (see Figure 4.10) causing groundwater quality degradation. This is especially adverse for aquifers when the abandoned well is perforated in several aquifers.

Some infrequent flowing groundwater conditions have occurred on the Oxnard Plain. When large amounts of precipitation occur, the aquifer in the Oxnard Plain pressure basin becomes recharged. This condition causes abandoned water wells located in low elevation coastal areas to flow. This occurred in the winter of 1983. Such events can create localized flooding hazards.

2. Simi Valley

Western Simi Valley also experiences flowing water wells. Flowing conditions at ground surface have occurred since 1973. Historically, agricultural use of the aquifer kept water levels low. As urban development replaced agricultural land uses, a demand for higher quality water occurred. The demand was met through the importation of high quality State Project water. The availability of State water resulted in the discontinued use of the aquifer causing the basin to fill. As a result, a flowing well condition was created.

III. Conclusions and Program Recommendations

A. Conclusions

As identified in recent preliminary studies by the USGS, UWCD and the County Public Works Agency Water Resources Department, abandoned water wells have been identified as a major contributor of TDS and the resulting poor quality groundwater conditions of Oxnard Plain area aquifers.

Because these local aquifers provide significant water supply and storage capabilities, efforts to resolve problems created by abandoned wells is recommended as a priority project. The Fox Canyon Groundwater Management Agency has applied for an Environmental Protection Agency grant for $100,000 dollars to assist in resolving the problem. The GMA plans to implement an abandoned water well destruction program regardless if the grant monies are issued. The program objectives are to locate and order the destruction of abandoned or non-performing wells within 5 miles of the Pacific Coast between Point Mugu and the Ventura River. Wells that are abandoned but considered unharmful could be used as monitoring wells for use by the Ventura County PWA Water Resources Department, USGS, the UWCD or other interested agencies.

Resolving the flowing well conditions in western Simi Valley is recommended as the second priority. If the well water can be treated to reduce TDS content, the water could be used. The use of these wells would reduce groundwater levels thereby providing an opportunity for percolation to occur following rainfall.

B. Program Recommendations

In addition to recommendations made in the 1980 Water Quality Management Plan, as addressed in the beginning of this Chapter, the following recommendations are made to address local abandoned water well problems.

1. Revise existing well ordinance 3991 to strengthen county policy authority to enforce the timely destruction of wells in violation of the ordinance. The revised ordinance should include the following elements:

    a. Provide the authority to require well destruction as a condition upon sale of property or change of ownership.

    b. Process new well applications only after the applicant has demonstrated that all existing wells on the property they own are not in violation of the well ordinance.

    c. Assess penalties if compliance with the ordinance is not met within a reasonable time frame.

    d. Institute property liens if compliance with ordinance is not met within a reasonable time frame.

    e. Prioritize wells for destruction.

C. Beneficial Uses of Abandoned Wells

Some abandoned wells could serve a useful purpose in the Ventura County water level data collection program. Safely capped, with pumps removed, selected abandoned wells that are determined not to be a pollution source to groundwater, may be retained. These wells could be used for static water level measurement and collecting water quality data. Abandoned wells on the Oxnard Plain provide key water quality data for the annual seawater intrusion report prepared by the County PWA Water Resources Division.

Chapter 4.2.D Abandoned Water Wells References

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Ventura County, Information Agenda for Board of Supervisors, February 1983, Status of 208 Abandoned Water Well Program, Environmental Health Division

Ventura County, Ordinance 3809, Chapter 8-Water, Article 1-Groundwater Conservation, Repealed/Reacted April 28, 1987

Ventura County, Ordinance 3991, Chapter 8-Water, Article 1-Groundwater Conservation, Repealed/Reenacted January 17, 1992

Ventura County 208 Areawide Water Quality Management Plan, Volume IV, Technical Appendix, July 1980

E. AGRICULTURAL RUNOFF

I. Description of Problem

A. Definition, Sources

Agriculture is a vital part of Ventura County's economy and character. The total value of County agriculture production in 1991 was approximately $4 billion. Of the $4 billion, an estimated $1 billion of the revenue was generated directly from agricultural production and provided 20,000 jobs, while approximately $3 billion was generated from indirect agricultural support services such as transportation, canning and packing houses and other agricultural related businesses. Ventura County ranks 10th in California agricultural production and 17th in the United States.

Approximately 100,000 acres of farmland in the county is considered irrigated agriculture and therefore, may be contributing to the agricultural runoff problem. Agriculture runoff is water used for agricultural irrigation that runs off the irrigated land into receiving waters and/or percolates into groundwater basins. Receiving waters can include creeks, rivers, bays, lagoons and eventually the ocean. Agricultural runoff is considered a nonpoint pollution source due to the pesticides, fertilizers and sediment the water carries with it from many agricultural sites throughout the county. In addition to irrigation runoff, a substantial portion of agricultural runoff is a result of storm flows which can carry tons of sediment. Some studies have identified sediment from stormwater runoff the largest pollutant in runoff. This polluted water can degrade groundwater and surface resources that provide water for a variety of uses, including urban, commercial, agricultural, recreational and environmental uses such as wetlands. Once contaminated, these water bodies may require expensive treatment or cause a loss of beneficial uses if treatment is not a feasible alternative. Mugu Lagoon, a wetland, which provides life sustaining habitat for certain plant and animal species (including several threatened and endangered species) is a prime example of a contaminated area that cannot be treated. Dredging to remove pesticides, fertilizers and sediment would cause further environmental damage to the habitat.

Agriculture activities such as farming steep hillsides that are contributing to the pollution and runoff problem appears to result from the over application of nitrogen fertilizers and irrigation water, leaching of salts, erosion and the past and present use of pesticides and herbicides. These activities and resulting effects are discussed in more detail below in section C. 208 Plan Summary, 1. Agricultural Water Quality in Ventura

County, Specific Problem Area Study - Revolon Slough - Mugu Lagoon Watershed. Nitrogen is also generated from individual sewage disposal system such as septic tanks and is addressed earlier in this document in Chapter 4.2.B.

B. Responsible Agencies

1. State Water Resources Control Board

The State Water Resources Control Board is responsible for protecting all beneficial uses of water. The Board sets water quality standards which limit the amount of various materials that can be in water and issue waste discharge requirements to specific dischargers. The State Board, along with the Regional Water Quality Control Boards which govern specific geographical areas in the State can take enforcement action against those who pollute water.

The Los Angeles Regional Water Quality Control Board (LARWQCB) is the state agency responsible for overseeing surface and ground water quality in Ventura and Los Angeles Counties. The LARWQCB have been monitoring water resources in Ventura County through several programs and studies. The Toxic Substances Monitoring Program, State Mussel Watch Program and a 1987 Sediment Study are addressed in section II Current Status, A. Regional Water Quality Control Board Activities.

2. United States Department of Agriculture Soil Conservation Service

The Soil Conservation Service (SCS) is a division of the United States Department of Agriculture (USDA) and is responsible for controlling soil erosion, water quality and irrigation management. SCS provides technical assistance to farmers and government agencies on agricultural erosion, flooding and the protection of prime, important and unique agricultural lands. The SCS is responsible for administering the County's Hillside Erosion Ordinance. The SCS reviews proposed erosion control maps. USDA SCS efforts are addressed in Section II. Current Status, Sections C and D.

3. State Department of Health Services

The State Department of Health Services (DOH) implements an extensive toxic control program, but is mostly directly involved in pesticides in groundwater and protection of public health. The Ventura County Environmental Health Division oversees those water purveyors with 200 or less hookups while larger water purveyors are responsible for ensuring compliance with State DOH Services requirements.

4. Ventura County Public Works Agency

The Ventura County PWA is responsible for implementing the Ventura County Hillside Erosion Control Ordinance for Agricultural Land Use (Ordinance No. 3539) in order to reduce soil erosion, stream bank and channel erosion to prevent sedimentation. The formation of the ordinance took place following a recommendation by the 1980 208 Plan. The Hillside Erosion Control Ordinance applies only in designated critical erosion areas defined on the Official Erosion Maps, Southern Ventura County, which are available for review at the Public Works Agency, Development Services Department. The Ordinance governs new agricultural developments and changes in agricultural use in these critical areas to prevent serious hazardous agricultural runoff conditions and erosion problems. Depending on the proposed agricultural land uses, an erosion control plan may be required. For additional information regarding the Ordinance, contact the Public Works Agency, Development Services Department.

The PWA, Flood Control Department oversees activities to prevent various flood related damages, including sedimentation, and stream and channel bank erosion which can contribute to the agricultural runoff problem. The Flood Control Department is currently exploring a variety of projects to reduce sedimentation, channel erosion and stream bank losses within the Calleguas Creek watershed area.

C. 208 Plan Summary (1980)

The 1980 Ventura County 208 Water Quality Management Plan (WQMP) contains an evaluation by the Soil Conservation Service (SCS) on the effects of agricultural runoff from surface and subsurface flows into the Revolon Slough and downstream to Mugu Lagoon. The SCS was directed to choose sampling sites, collect water samples, conduct analysis, evaluate the samples based on sediment and chemical constituent content. SCS projected the effects agricultural runoff from the entire drainage area would have on Revolon Slough and to determine if projected impacts on

Mugu Lagoon could be mitigated through the use of best management practices indicated in the 208 Plan. The study completed by SCS in May 1982, was entitled Agricultural Water Quality in Ventura County. SCS recommendations included a program to promote implementation of the suggested best management practices (BMP's), which are reviewed below in Section 2. Recommended Programs.

1. Agricultural Water Quality in Ventura County, Specific Problem Area Study - Revolon Slough and Mugu Lagoon, Watershed 1980 Study

Revolon Slough, Calleguas Creek and Conejo Creek are all water bodies which drain into Mugu Lagoon. These water bodies have been and continue to be affected by agricultural runoff generated by surrounding agricultural land. The study area included 730 acres of vegetable and field crops with the southern portion in lemons. The crops and soils of the area were considered representative of agricultural land within the Revolon Slough watershed. Sources of irrigation supply water in the study area were groundwater and diverted Santa Clara River water. These water sources were tested prior to irrigation use to establish a baseline water quality value. Testing revealed that the source water met most standards for drinking water. Drinking water standards are much more restrictive than standards used for irrigation water.

Following agricultural irrigation use, water was sampled at the five sites. Each site was sampled 13 times from late October 1980 to late July 1981. Monthly samples were taken from October through April and biweekly samples from May through July. Sample dates were selected to reflect dated and concentrated constituent quantities. The sample constituents tested for in the study were selected by the Ventura County Community Planning Program (CPP) Committee. Their selection was based on recommendations for testing agricultural return water (runoff) made by the United States Environmental Protection Agency and the California State Regional Water Quality Control Board. Problem constituents are addressed below.

a. Pollution Sources

The study conducted by SCS concluded that possible sources contributing to the agricultural runoff problem included the over application of nitrogen fertilizers, the over application of irrigation water, the leaching of salts pesticides, herbicides, and sedimentation.

High levels of nitrates were found in Revolon Slough and other agricultural drainages. Sources of nitrates appeared to be from over applications of nitrogen-rich fertilizer on crops in the area. The study estimated that high nitrate levels may have contributed to algae blooms in Mugu Lagoon. High nitrate levels interfere with normal oxidation processes and can harm humans, plants, and animals. The State standard for drinking water for nitrate is 45 mg/l.

The over application of irrigation water was determined to cause several agricultural runoff problems. Over use of water increases erosion and therefore increased sedimentation, high levels of Total Dissolved Solids (TDS) and the leaching of solids from the soil. The over use of water causes the unabsorbed water to run off site, carrying with it sediment, soil constituents and particles attached to the soil, such as pesticides, herbicides and fertilizers. In addition, the over watering causes these constituents to leach out of the soil. The presence of various soil constituents and minerals in the runoff increases the TDS level which can produce excessive salts in agricultural runoff preventing the reuse of water for agricultural irrigation, degrading groundwater resources and causing excess turbidity that may interfere with plant and animal life in receiving waters. Over application of irrigation water was also considered to be the cause of high levels of sodium, calcium, magnesium, selenium, chloride and sulphate found in the drainage area.

Turbidity was not recognized as a problem in the area based on test results, however, maintenance activities required for debris basins and channels in the county and sedimentation in Mugu Lagoon indicated that sediment is a problem constituent in the area. Highest sediment concentrations occur during winter runoff when sediment is flushed from the channel systems in the watersheds. As a result, the Ventura County Resource Conservation District targeted land treatment work on hillside orchards, gullied land, brush control (to reduce wildfire hazards which can denude hillsides and significantly increase erosion and sediment rates) and drainage control to reduce accelerated erosion and sedimentation.

The pesticides and herbicides tested for in the SCS study had previously been banned from use on cropland in the area. None of the levels encountered in the test appeared to exceed levels allowed for drinking water. It was recommended that future testing be done for chlorinated hydrocarbons that are used in the area. These include Treflan (Trifluranlian), Lasso (Alachlor), Kerb (Pronamide), Caparol (Prometryne) and Telon. It was also recommended that an instrument capable of measuring chlorinated hydrocarbons to parts per billion be used for all future sample analysis.

The SCS Study also recommended that if further testing is to be done to monitor agricultural water quality, that several considerations be made. It was recommended that coordinated testing be done on source waters at the same time as drainage waters and that more localized testing and time intensive testing be done. In addition, more adequate identification of land use and farming practices being used at the time sampling is done was recommended. These recommendations would help more adequately assess the impacts of irrigation techniques and practices on agricultural runoff water quality.

2. 1980 Recommended Programs (SCS)

In conclusion, the 1980 SCS Study recommended the implementation of a Resource Management Systems (RMS) for irrigated cropland which included the following components; a Soil Management Subsystem, Irrigation Subsystem, Water Management Subsystem and an Excess Water Removal Subsystem. These RMS's were specifically designed to address local soil capabilities and land uses and most have been implemented. The RMS approach is a combination of conservation practices that will protect the resource base by meeting tolerable soil losses, maintaining acceptable water quality, and maintaining acceptable ecological and management levels for soil and water. The individual conservation practices within the RMS's were adopted in the Ventura County 208 Plan as Best Management Practices (BMP) are summarized briefly below. The complete RMS descriptions can be found in the Agricultural Water Quality in Ventura County Study conducted by SCS.

a. Soil Management Subsystem

Conservation Cropping System: The purpose of this system is to improve or maintain good physical condition of the soil and protect soil during periods when erosion occurs. BMPs that are a component of this system include chiseling and subsoiling to loosen restrictive soil layers, Crop Residue Use to supplement the soil, Appropriate Fertilization application so as to not over use nitrate fertilizers, and Conservation Tillage Systems to reduce disruptive (noninversion) soil tillage as much as possible.

b. Irrigation Subsystem

There are several component practices to this subsystem. Irrigation Land Leveling for more efficient furrow irrigation. Irrigation Pipeline is the use of main underground pipelines as a water conservation measure to replace the use of open ditches and laterals to deliver water as required by the system design. Irrigation System Sprinkler - (or sprinkler irrigation) is used for preplanting irrigation and once or twice after, before beginning irrigation with furrows. Irrigation System - Surface, (furrow irrigation) was the most common method of water application in the area at the time of the Study and probably still is. Furrow-systems designed and managed properly are more efficient than sprinklers.

c. Water Management Subsystem

Irrigation Water Management: This is the only component practice of this subsystem but it may be the single most important management practice available for use in irrigated agriculture. The purpose of Irrigation Water Management (IWM) is "to effectively use available irrigation water supply in managing and controlling the moisture environment of crops to promote the desired crop response, minimize soil erosion and loss of plant nutrients, control water loss, and protect water quality." This practice applies to all irrigated crops. IWM pulls together all of the BMP's and all of the subsystems. However, under IWM, some runoff is necessary to carry off salts that could harm the crop which conflicts with agricultural runoff reduction goals. The irrigator must have the knowledge and capability to manage and apply irrigation water in such a manner that the objectives mentioned above can be reasonably attained. The knowledge should include:

- How to determine when irrigation water should be applied, based on rate of water used by crops and stages of plant growth.

- How to measure or estimate the amount of water required for each irrigation, including the leaching needs.

- The normal time needed for the soil to absorb the required amount of water and how to detect changes in intake rate.

- How to adjust stream size, application rate, or irrigation time to compensate for changes in such factors as intake rate or the amount of water to be applied.

- How to recognize erosion caused by irrigation.

- How to estimate the amount of irrigation runoff from an area.

- How to evaluate the uniformity of water application.

Gathering some of this information can be complicated but many irrigators are capable of doing this or can seek assistance from UC COOP, or SCS.

d. Excess Water Removal Subsystem

The two BMPs listed as components of this subsystem applicable in the study area were Drainage Field Ditch and Subsurface Drain. The Drainage Field Ditch components function is to pick up excess runoff water and transport it away from the fields. The Subsurface Drain components uses Tile drains to keep the natural water table from rising up into the root zone and to catch water not used by the crop and carry it away. The study indicated an existing water table problem and called for tile drains as a solution. Without these drains, productive soils could not be used for growing vegetable crops. The leaching away of salts is necessary to ensure productivity of the soil.

Implementation of RMS's and BMP's

The SCS recommended that the University of California Cooperative Extension, (UC COOP), the Ventura County Resource Conservation District (RCD) and the SCS present workshops and other methods to educate growers. The Study also mentioned the Water Conservation Plan that was being written at the time by the Ventura County Resource Management Agency, Planning Division which cited the UC COOP, the RCD and SCS or agencies to provide on-farm technical assistance in irrigation water management. These agencies are discussed above in Section B, Responsible Agencies and Section II, Current Status A., C. and D.

II. Current Status

A. Post 208 Plan Agricultural Runoff Activities

Since the adoption of the 1980 208 Plan, there has been a tremendous effort on the part of a variety of agencies to implement the recommendations made in the 208 Plan.

1. Countywide Water Conservation Program and Management Plan.

One of the recommendations was to develop a Countywide Water Conservation Program and Management Plan. Both were developed and are still in existence today promoting urban and agricultural water conservation. The Water Conservation Program uses a regional approach by working in cooperation with the efforts of the University of California Cooperative Extension (UC COOP), The Resource Conservation District (RCD) Mobile Irrigation Management Laboratory and the Fox Canyon Groundwater Management Agency (GMA) in implementing agricultural water conservation programs. For additional information on the Water Conservation Program, see Chapter 3 Water Supply and Demand Section IV Water Demand Management. Efforts by the UC COOP, RCD and the GMA are also addressed in Chapter 3 Water Supply and Demand section IV Water Demand Management and are described briefly below.

2. University of California Cooperative Extension

The University of California Cooperative (UC COOP) Extension Farm Advisor's Office educates growers primarily by conducting applied research projects and providing the findings of such projects to growers. Information is provided to growers through newsletters, seminars, and field demonstrations. Currently advisors are involved with several projects related to water conservation/efficiency and groundwater protection. These projects can provide information and/or results that would reduce the agricultural runoff problems. These projects are discussed in more detail in Chapter 3 Water Supply and Demand, Section IV Water Demand Management and addressed briefly below.

a. Nitrogen and Water Application Assessment

Various nitrogen and water application combinations are being studied to develop best management practices (BMP's). The BMP's will determine the appropriate combination of, and minimum use of nitrogen and water to produce healthy crops at maximum yield.

b. Greenhouse Irrigation Practices

Coop Staff are working with several greenhouse owners/farmers to improve irrigation systems and fertilizer applications in greenhouses.

c. Field Study of Surge Irrigation

UC COOP is working in cooperation with the SCS on a surge irrigation project, a computerized irrigation method that has a great potential for reducing furrow water requirements.

d. Evaluation of Area-Wide Irrigation's Needs

A series of autometers, a relatively inexpensive device for measuring evapotranspiration are being purchased and stationed in different areas in the County to determine viability for irrigation needs. As more California Irrigation Management Irrigation Systems (CIMIS) Stations become available to provide weather information, comparisons will be made to improve the way the data is used for irrigation scheduling.

Testing of sprinkler and drip irrigation system for uniformity of water distribution is also conducted. See discussion in RCD activities and Chapter 3., for distribution uniformity and irrigation efficiency discussions.

e. Moisture Sensing Devices

A study on the use of moisture sensing devices was completed to determine water requirements of crops.

f. Nursery Irrigation System Evaluation

Two irrigation system evaluations have been conducted to evaluate methods to reduce water use, and water nutrient runoff.

g. Soil Salinity

Soil salinity in strawberry fields has been found to be high, while during recent drought years, this problem was aggravated for many other crops. Limited water supplies prevents flushing of salinity out of soil. However, due to water conservation and agricultural runoff concerns, this issue is being studied further by the UC COOP.

3. Resource Conservation District/Soil Conservation District

The Ventura County Resource Conservation District (RCD) Mobile Irrigation Management Laboratory provides a variety of proactive educational services to growers within the County. The program is funded by the RCD, United WCD, Calleguas MWD, Casitas MWD and the Metropolitan WCD. The program is voluntary and free of charge to those that are audited. Approximately 200 farms have been audited as of early 1992, all on a voluntary basis. Increased funding would be required to audit the majority of 2,200 farmers in the County. The Mobile Irrigation Management Laboratory, more commonly referred to as the Mobile Lab, which began in 1985, travels to growers to conduct a variety of farm tests and education. The Mobile Lab has provided valuable assistance to County growers on proper management and irrigation scheduling. The RCD program is phasing out, but the service will be available through the private sector. These activities are addressed in Chapter 3, Water Supply and Demand in detail, and are listed briefly below.

a. Distribution Uniformity

Distribution Uniformity (D.U.) tests measure how evenly water is being applied to a given area and recommendations to improve D.U. rates are made if necessary.

b. Irrigation Efficiency

The Mobile Lab determines Irrigation Efficiency (I.E.) ratios which calculate the ratio of water required to water applied. Once the I.E. ratio is evaluated, RCD staff educates the growers on how to achieve an acceptable I.E. ratio.

c. Evapotranspiration

Evapotranspiration (E.T.) measures the amount of water used by plant material. E.T. is based on weather data such as temperature, humidity, rainfall, wind, and other factors. These climatic conditions affect how much water is used by plants. Knowledge of E.T. assists the farmer in determining plant water needs. The RCD Mobile Lab established a network of CIMIS and several other weather stations in the County to share available weather data.

d. Soil Measuring Devices

The RCD provides information on soil moisture measuring devices following evaluation of effectiveness, cost and ease of use of the devices.

4. Fox Canyon Groundwater Management Agency

The Fox Canyon Groundwater Management Agency (GMA) was created to manage groundwater resources in the area overlying the Fox Canyon Aquifer Zone. The GMA area of responsibility includes the Oxnard, Mugu, Hueneme, Fox Canyon and Grimes Canyon Aquifers. GMA activities which promote reduced groundwater extraction also act to reduce the agricultural runoff problem by encouraging efficient use of water. Some GMA activities are briefly discussed below. For additional information on these and other GMA activities, see Chapter 3 - Water Supply and Demand, Section IV Water Demand Management.

a. Groundwater Extraction Reduction Ordinance No. 5

Groundwater Extraction Reduction Ordinance No. 5 was adopted in August 1990 to reduce groundwater extractions within the GMA boundaries 25% by year 2010. It is expected that this ordinance will act as an incentive for water users to use water more efficiently. With less waste, less agricultural runoff will occur.

b. Mandatory Rationing

Mandatory rationing programs that can be implemented by water management agencies and water purveyors can include tiered rate structures and water allocations that limit water use by providing economic incentives to use water efficiently. Tiered rates include a lower rate for the first specified number of units of water consumed and an increasing rate per unit for each subsequent tier. Water allocations, commonly referred to as water rationing, limit the amount of water a customer can use resulting in more efficient use of water.

5. Ventura County Drought Action Plan Summary

The County of Ventura Resource Management Agency, Planning Division, provided staff to develop the Drought Action Plan Summary, adopted by the Board of Supervisors in April 1991. The Summary addresses many potential voluntary programs to encourage efficient water use practices and to maximize the limited countywide water resources. Although too numerous to address here, these programs are addressed in Chapter 3, Water Supply and Demand, Section IV, Water Demand Management. Several programs that could assist in reducing agricultural runoff include the following:

a. Required tiered water rate structures
b. Mandate limits on water use
c. Mandate water conservation and/or a water waste ordinance
d Provision of water audits for agricultural uses

For additional information, the Drought Action Resources Summary is available for overview from the County Resource Management Agency, Planning Division.

B. Los Angeles Regional Water Quality Control Board Activities (Region 4)

The Los Angeles Regional Water Quality Control Board (LARWQCB) is the state agency responsible for overseeing surface and groundwater quality in Ventura and Los Angeles Counties. As part of this surveillance, two ongoing monitoring projects are being conducted in Mugu Lagoon and its tributaries: The Toxic Substances Monitoring Program (TSM) and the State Mussel Watch (SMW) Program. In addition, a 1987 Sediment Study was conducted by LARWQCB staff. These programs and studies are conducted by the LARWQCB because Mugu Lagoon, via Callegaus Creek and Revolon Slough receive all drainage water from the entire Oxnard Plain area. The programs and studies are described below. Although the programs began in 1985, no annual LARWQCB approved reports have been released since 1987. Most of the information describing these programs were derived from a report entitled Pesticide Contamination in Mugu Lagoon and its tributaries by Shirley Birosik a environmental specialist with the LARWQCB. Information presented here is limited to data available from 1988 to 1989 for the TSM program and 1985 to 1987 for the SMW program. The LARWQCB may release a five year update to address available data.

1. Toxic Substances Monitoring Program

The purpose of the annual Toxic Substances Monitoring Program (TSMP) which began in the legion in 1985, is to monitor contaminants in freshwater bodies of the State. The collection and analysis of fish tissue helps to establish human health and fish predator risks. Fish collected from both Revolon Slough and Calleguas Creek have contained concentrations of several pesticides in excess of National Academy of Science (NAS) guidelines of 100 parts per billion (ppb) for predator protection. Monitoring conducted in 1988 revealed that fish collected from Revolon Slough contained considerably more pesticides than those caught in Calleguas Creek, while limited sampling in the lagoon itself revealed little evidence of contamination except for low levels of DDT. Figure 4.11 illustrates stations locations and results for years 1988 and 1989.

Defining a trend with three years of data is difficult since no clear trend appeared to exist. One complication is that mosquitofish were collected during previous years. Mosquitofish appear to accumulate considerably more pesticides than goldfish, but results may be misleading since different parts of the fish were studied.

It appeared that the pesticide toxaphene may be on the decrease since much less was found in the mosquitofish during the 1987 sampling than were found in goldfish from previous sampling years.

2. State Mussel Watch Program

The purpose of the State Mussel Watch (SMW) program is to provide long-term monitoring of toxic trace metals and synthetic organic compounds in coastal marine waters. The Ventura County component of the SMW program began in 1985. For this purpose, the program utilizes the common Bay Mussel, Mytilus edulis, and the California Mussel, M. californianus, because they stay in one place, are long lived, can be transplanted easily to areas they do not normally occur in, and concentrate toxic pollutants from the water. In areas with low salinities, such as estuaries and freshwater tributaries, freshwater clams, Corbicula fluminea, are used.

Information presented here is limited to data available from 1985 to 1987 samples. SMW stations located in the Mugu Lagoon have shown high concentrations of many pesticides, while stations locate up Revolon Slough and Callegaus Creek, tributaries of the Lagoon, have shown, in most cases, even higher levels of pesticides, along with high levels of PCB's. No maps were available for reprinting to illustrate the station locations.

With only several years of data for any one station (as of 1987 LARWQCB released data) it is difficult to determine specific trends, however, several observations have been made. Callegaus Creek levels appeared to be decreasing for several banned pesticides, including toxaphene, chlordane, p,'-DDT, and o,p'-DDT. While levels for these banned pesticides in Callegaus were decreasing, levels at the Laguna Road Station were increasing slightly. This may be due to periodic washout into the Lagoon which could be pushing newly exposed sediments farther into the Lagoon.

Total DDT for the Revolon Station exceeded the National Academy of Science (NAS) guidelines for predator protection (in freshwater clams) of 1000 parts per billion (ppb).

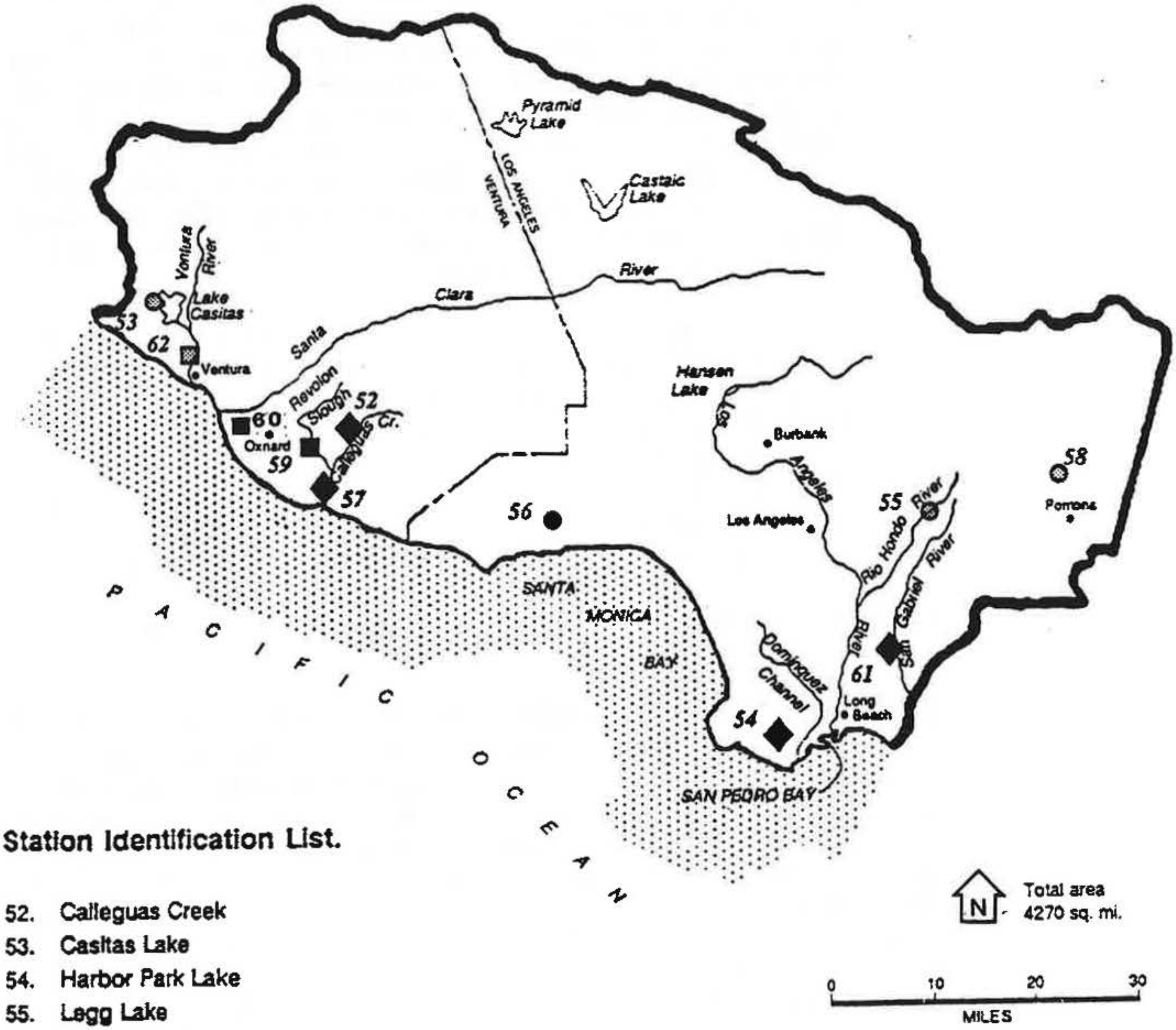
3. 1987 Sediment Study

A 1987 Sediment Study was conducted in the Mugu Lagoon area by Regional Board staff. Samples were collected from the top two centimeters (cm) of sediment at several sites in the lagoon and its tributaries. Due to lab difficulties, only DDT data is available.

The study revealed considerably more p,p'-DDT, p,p'-DDD in Revolon Slough than in either Calleguas (upstream of the confluent with Revolon) or the seven sampling points within the lagoon (including the inflow point of Calleguas into the lagoon).

P,p'-DDT was found only in Revolon Slough where p,p'-DDE and p,p'-DDD were found in nearly equal proportions. The SMW program addressed above conducted sampling much farther up both Calleguas and Revolon revealed p,p'-DDT in fairly high amounts (Revolon 100 ppb and Calleguas 52 ppb). While no p,p'-DDT was found in the lagoon, both DDE and DDD (mostly the former) were found fairly evenly dispersed in the lagoon except at the mouth of the lagoon which is quite sandy.

Figure 4.11. Toxic Substances Monitoring Program Stations and Results 1988-89 (Region 4)



Station Identification List.

52. Calleguas Creek
53. Casitas Lake
54. Harbor Park Lake
55. Legg Lake
56. Malibu Creek
57. Mugu Lagoon
58. Puddingstone Reservoir
59. Revolon Slough
60. Rio de Santa Clara/Oxnard Drain
61. San Gabriel River
62. Ventura River

LEGEND

Sampled	*Exceeded Criteria*
● 1988	● 1988
■ 1989	■ 1989
◆ 1988 &1989	◆ 1988 &1989

Source: State Water Resources Control Board and California Environmental Protection Agency, June 1991.

The relative amounts of DDE at each site was similar to the relative amounts of DDD. The higher concentrations were found at the point where Calleguas enters the lagoon. The lowest concentrations were in general found farther away from the inflow of Calleguas. Sampling site #6 (which is located somewhat distant from the Calleguas influence) is one exception; here concentrations were higher than might be expected. This might be explained by the fact that station #6 is located some distance from the river. Heavy flows in Calleguas in 1983 may have helped to bury some of the contaminated sediment around the inflow with cleaner sediment. Those areas not impacted may still continue to reveal high levels of DDT breakdown products.

A review of the data presented by the SMW, TSM programs and 1987 Sediment Study shows that Revolon Slough, and to a lesser extent Calleguas Creek, contain and are conveying pesticides into Mugu Lagoon. RWQCB staff suspect that historical and current inputs from nearby agricultural lands are suspected of being the sources of these pollutants. Potentially, predators, particularly birds, that are seasonal nesters or permanent residents of the lagoon may be consuming fish which contain pesticides in excesses of NAS guidelines for predator protection.

C. United States Department of Agriculture, Resource Conservation District's Soil Conservation Service Activities

The Soil Conservation Service (SCS) is responsible for technical assistance related to soil and water conservation, natural resource surveys, cost-sharing programs, and for rural community protection and development related to natural resources conservation. The SCS is involved in a variety of programs and studies that directly or indirectly relate to agricultural runoff. SCS works to meet national goals for water quality by helping land users install conservation practices that control erosion, reduce runoff and manage wastes. These practices improve water quality by reducing pollutants such as sediments, nutrients, pesticides, organic wastes, salts, leachate from saline soils from reaching waterways. The current proposed Mugu Lagoon Watershed Plan that the SCS is involved in is a joint project with another agency and is addressed in the following section.

D. Joint Study by the United States Department of Agriculture Resource Conservation District's Soil Conservation Service and the California State Coastal Conservancy

The Ventura County division of the United States Department of Agriculture Resource Conservation District's Soil Conservation Service and the California State Coastal Conservancy are jointly developing the Mugu Lagoon Watershed Local Implementation Plan to address resource problems impacting Mugu

Lagoon. The cooperative study is authorized and partially funded through provision of the Watershed Protection and Flood Prevention Act. Additional funding is provided through grant money from the State Coastal Conservancy.

Significant sediment loads carried by flood flows and agricultural runoff are resulting in rapid filling of the Mugu Lagoon thereby endangering the longevity of this vital fish and wildlife habitat. The SCS has estimated that the lagoon will fill with sediment within fifty years unless substantial erosion and sedimentation control measures are implemented in the watershed.

The focus of the study is to identify the contributing sources of erosion and sedimentation to Mugu Lagoon using existing data. This information will then be used to develop an environmentally sound, technically feasible, economically viable and locally acceptable implementation plan for high priority land uses and subwatersheds to enhance Mugu Lagoon, minimize land losses, maintain agricultural production, reduce property damage and enhance the environment.

E. United Water Conservation District Activities

The United Water Conservation District (UWCD), contracted with Gerahty and Miller, Inc., to perform a study of nitrate problems within the UWCD boundaries. A draft study entitled Feasibility Study for Abatement of Nitrate in Groundwater was completed in April 1991. The purpose of the study was to evaluate the magnitude and extent of nitrate contamination of groundwater within the Oxnard Plain area of UWCD, identify and evaluate potential sources of nitrate contamination of the groundwater, and to evaluate and recommend solutions to abate the contamination. Review of available well data indicated that the nitrate problem exists mainly in the shallow aquifer in the El Rio area, although not all wells in the aquifer produced groundwater that exceeded drinking water standards.

Potential sources of nitrate contamination in the study included wastewater from septic system, return flows from agriculture (runoff), and infiltration from recharge basins. Septic tanks and agricultural activities were estimated to potentially contribute approximately equal amounts of nitrate per acre. Chapter 4.B addresses contamination from septic tanks, while Chapter 3 addresses recharge basins. Data indicated that groundwater quality and groundwater levels are related, with groundwater quality improving as groundwater levels increase seasonally or over long periods. Therefore, diversions to contaminated aquifers would improve water quality.

Agricultural land uses in the study area were composed or row, field and truck crops, citrus and avocados. The study determined that a variety of variables exist that determine the amount of nitrate that may potentially reach groundwater in an agricultural area varies by type of soils, type of activity, crops grown, fertilizer type and methods of application, and the intensity of land use.

Alternatives evaluated for mitigating the nitrate problem in the study area included three categories: reducing nitrate loading to groundwater supplies; removal or dilution of nitrate before delivery as domestic supplies; and restricting or controlling specific land uses. Specific program recommendations that the study suggested are included in the following Conclusions and Recommendation section.

III. Conclusions and Program Recommendations

A. Conclusions

Agricultural runoff appears to be one of the most significant sources of pollution to Mugu Lagoon, a vital and rare wetland. Agricultural runoff also poses potential degradation to Ventura County's limited water resources, specifically groundwater resources which can be threatened by the percolation of agricultural runoff into underground aquifers (Nitrates from septic tanks are addressed in Chapter 4.2.B). There is a potential for sediment, pesticides, herbicides, fertilizers, leachate and stormwater to act as pollutants threatening vital natural resources.

As addressed in Sections I and II above, many government agencies and private organizations have been, and continue to study, the agricultural runoff problem, promote best management practices (BMPs) and work to develop future BMPs or other methods to reduce agricultural runoff. These activities should continue and should be enhanced through support, cooperation and financial means. Although many BMPs exist to address the problem and agencies are available to educate growers to implement the BMPs that exist, it appears one obstacle remains; ensuring that the BMPs are actually used. No enforcement mechanism exists to ensure the use of BMPs. A variety of programs are supported and implementation measures are addressed below to better assure the use of BMPs.

B. Program Recommendations

The water demand management programs addressed earlier in this Chapter and in Chapter 3, Water Supply and Demand, Section IV, should continue to be promoted to encourage water use efficiency and therefore less agricultural runoff. The existing programs and BMPs promoted by the various agencies addressed above in Section II, Current Status, should continue to be promoted as well as development of new programs. The following recommendations are made in support of these programs.

1. Continue to support the Countywide Water Conservation Program efforts to educate the agricultural sector of the county through current programs, and new programs should be encouraged. (RMA Planning Division)

2. The University Cooperative Extension Program and Resource Conservation District Mobile Lab efforts should continue and be enhanced to educate agricultural water users countywide. (UC Coop Resource Conservation District)

3. The Fox Canyon Groundwater Management Agency should continue to implement Groundwater Extraction Reduction Ordinance #5 and water allocations. (Fox Canyon GMA)

4. Explore development of reasonable tiered rate structures to be implemented by water purveyors in order to encourage efficient water use practices where practical (Cities, County Water Districts).

5. Recommendations in the County Drought Action Plan Summary should be implemented by government agencies and water purveyors.

6. The County should encourage the RWQCB to release five year studies summarizing the results of the State Mussel Watch and Toxic Substances Monitoring Programs so this information can be utilized to determine necessary measures to reduce pollutants contributing to agricultural runoff and develop measures to assist in the enhancement of Mugu Lagoon and related tributaries (RWQCB).

7. The County should encourage and promote the enhancement of activities conducted by the Soil Conservation Service Resource Conservation District's (RCD).

8. The County should encourage the joint Mugu Lagoon Implementation Plan currently being conducted by the Soil Conservation Service and California State Coastal Conservancy. The County could assist in implementing measures that will be developed as a result of the Plan (SCS).

In addition to the above recommendations that mostly relate to the BMP's for water conservation and improved agricultural practices, the County should investigate methods of ensuring these BMPs are implemented.

9. Promote the use of BMPs.

10. Increased frequency of hazardous waste material disposal events for growers to dispose of pesticides and herbicides that are no longer legal (RMA Planning, Environmental Health, Solid Waste Department).

11. Create a receiving water protection are to discourage land and water uses that would adversely impact receiving water quality (PWA Water Resources, VCFCD, RMA Planning).

Chapter 4.2.E Agricultural Runoff References

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F. AGGREGATE RESOURCE MANAGEMENT (SAND AND GRAVEL MINING)

Aggregate resources, including sand, gravel and crushed rock represent a significant volume of mineral resources extracted within the county. Aggregates are used for fill, construction-grade concrete, riprap and other uses. Although many sand and gravel sites exist throughout the county, historically, most of the mining sites are located in and around the Santa Clara riverbed. The County uses a Conditional Use Permit (CUP) process to regulate mining operations. All discretionary permits for mining include conditions to mitigate potential environmental impacts including water quality degradation and water losses. Although the CUP process appears effective, it may be necessary to strengthen the monitoring capabilities of the County to ensure compliance with imposed conditions. If mining operations are not properly conditioned and/or monitored, water quality degradation and water losses can occur.

Aggregate resource areas are designated based on Mineral Resource Zone maps developed by the State Division of Mines and Geology. These maps were prepared in response to the Surface Mining and Reclamation Act (SMARA) of 1975. SMARA's basic objectives are to ensure proper reclamation of mined land and to safeguard access to mineral resources of regional and statewide significance in the face of competing land uses and urban expansion. The Act mandated that aggregate resources throughout the state be mapped so local governments could make appropriate land use decisions considering SMARA's objectives. The SMARA Act County goals, policies and programs and the County Conditional Use Permit (CUP) process are addressed as they apply to mineral resources in the Current Status Section of this chapter.

Figure 4.12 illustrates the locations of proposed and existing mining permits in unincorporated Ventura County and Table 4.15 provides specific information on each proposed and existing site.

This chapter will describe potential problems that may result due to aggregate extraction activities, the current status of existing regulations and recommendations to mitigate water quality degradation and losses associated with mining activities.

I. Description of Problem

Aggregate resources including sand, gravel and crushed rock play an important role in surface and groundwater hydrology and quality. The aggregate material acts as a sponge and filter to hold water in the riverbed as it percolates into groundwater basins below, cleansing the water as it percolates. The mining of these resources can cause water quality degradation of groundwater and the loss of water resources. Water losses and quality problems related to aggregate mining typically fall within one of the following four categories of impacts; 1) rising water losses and evaporation 2) mineralization and contamination, 3) reduction of recharge capacity, and 4) post-mining groundwater degradation. These potential impacts and some specific problem areas are addressed in more detail below.

SOURCE: Plan. Div. Permit Files

Table 4.15 EXISTING AND PROPOSED MINING PERMITS IN UNINCORPORATED VENTURA COUNTY

March 1994

Location Map Number	Permit Status	Permit No.	Operator	Permit Size (Acres)	Mining Area (Acres)	Permit Expiration Date	Post-Reclamation Use	Material to be Removed (tons)	Principal Products	Type of Mine	Asphalt Batch Plant?	Concrete Batch Plant?
1	Proposed Renewal	CUP-3489-2	Schmidt Construction	177	TBD[1]	applicant requests 5 years	natural state	40,000/year	stone (base, rip rap)	rock quarry	no	no
2	Closed[2]	CUP-1088-4	S.P. Milling	153	N/A	reclaiming	natural riverine state	50,000-250,000/yr	sand & gravel (P.C.C., base)	open pit	no	no
3	Existing	V-2	Ventura Aggregates	75	68	status uncertain	natural state	0 at present	clay/shale	open pit	no	rotary kiln
4	Existing	CUP-4096	VRSD	180	100	12/9/92 Permit Extension being processed	natural state	150,000-240,000/yr	Landfill cover material	sand bar skimming	no	no
5	Existing	CUP-2425	S.P. Milling	48	None	3/22/99	golf course/related uses	none authorized	process site for CUP-1942	NA	yes	yes
6	Existing	CUP-1942	S.P. Milling	400	360	undergoing review for admin. extension	golf course/ related uses	1 million/year	sand & gravel (P.C.C., base)	open pit	no	no
7	Existing	CUP-2006	Calmat	495	452	12/06/99	natural state	1.6 million/year	sand & gravel (P.C.C., base)	open pit	yes	no
8	Existing	CUP-4294	Calmat	241	204	4/3/2016	agriculture	290,000/year 8.7 million total	sand & gravel (P.C.C., base)	open pit	no	no
9	Existing	CUP-3785	Calmat	142	135	reclamation completed	agriculture	0 at present	sand & gravel (P.C.C., base)	open pit	no	no
10	Existing	CUP-4623	Calmat	118	102	04/15/2002	agriculture	3.72 million total	sand & gravel (P.C.C., base)	open pit	no	no
11	New Proposal	CUP-4596	S.P. Milling	160	120	applicant requests 20 years	natural state	15.4 million total	Low permeability soil for landfill uses	open pit	no	no
12	Existing	CUP-4391	S.P. Milling	20	10	10/22/97	natural state/agriculture	1.18 million total	soil & rock	borrow pit	no	no
13	Existing	CUP-1524	S.P. Milling	659	300	12/06/99	natural state/agriculture	1 million total	sand & gravel (P.C.C., subbase)	gravel bar skimming	no	no
14	Existing	CUP-245-3	S.P. Milling	190	80	9/10/99	natural state	800,000/year 6-8 million total	sand & gravel (P.C.C., base)	open pit	yes	yes
15	Existing	CUP-1812-2	S.P. Milling	261	184	9/10/99	natural state	1 million/year	sand & gravel (P.C.C., base)	open pit	no	no

[1]To be determined during review.
[2]In process of reclamation.

1C83-2.9/1

SOURCE: Plan. Div. Permit Files

continued table 4.15 EXISTING AND PROPOSED MINING PERMITS IN UNINCORPORATED VENTURA COUNTY

March 1994

Location Map Number	Permit Status	Permit No.	Operator	Permit Size (Acres)	Mining Area (Acres)	Permit Expiration Date	Post-Reclamation Use	Material to be Removed (tons)	Principal Products	Type of Mine	Asphalt Batch Plant?	Concrete Batch Plant?
16	Closed[2]	CUP-3390-4	Granite Construction	280	125	reclaiming	natural state	115,333/year 1.73 million total	sand & gravel (P.C.C.0	open pit	no	no
17	Existing	CUP-4185	Sespe Rock	240	99	11/14/2015	natural state	400,000/year	sand & gravel (P.C.C.)	open pit	no	no
18	Existing	CUP-4571	Quality Rock	80	71	8/11/2012	natural state	250,000-1 mil/year	sand & gravel (P.C.C., base)	open pit	yes	yes
19	Existing	CUP-4158	TMC (Fruitvale)	164	30	3/1/2004	natural state	250,000-1 mil/year	sand & gravel	open pit	no	no
20	New Proposal	CUP-4633	TMC (Moorpark)	553	291	applicant requests 50 years	open space/ ag./recreation	1.6-2.4 million/yr	sand & gravel (P.C.C., base)	open pit	yes	yes
21	Existing	CUP-3451-3	Best Rock Products	160	21	7/21/2000	grazing	250,000-300,000 total	decorative rock	quarry	no	no
22	Existing	CUP-4171	Best Rock Products	80	70	2/28/2000	natural state	300,000/year 2-5 million total	sand & gravel (P.C.C., base)	open pit	no	no
23	New Proposal	CUP-4517	Ortega Quarry	160	60	applicant requests 18 years	open space	250,000/year 4.5 million total	sand & gravel (P.C.C., base)	open pit	no	no
24	Existing	CUP-1367-3	C.Z.S. Corp.	1117	553	10/30/2020	open space/grazing	1-1.5 million/year	sand & gravel (P.C.C., subbase)	open pit	yes	yes
25	Existing	CUP-4609	Tapo Rock & Sand	98	32	12/16/2008	natural state/grazing	100,000-250,000/yr	sand & gravel (base)	open pit	no	no
26	Proposed Renewal	CUP-3817	A.J. Sanders	102	62	TBD[1]	natural state	86,000/year	stone (base, rip rap)	rock quarry	yes	no
27	New Proposal	CUP-4681	Rancho Guadalasca	47	33	applicant requests 40 years	agriculture	50,000-250,000/yr 8.39 million total	rock (roadbase & fill)	open pit	no	no
*	Existing	CUP-43	Calaveras Cement	320	160	6/21/94	natural state	50,000-250,000/yr	gypsum & anhydrite	rock quarry	no	no
*	Existing	CUP-212	Pacific Lightweight Products	260	100	none, applicant anticipates closure in 2008	natural state	100,000/year	clay (bentonite), shale	open	no	rotary kilns

*Not included on map--located in the north half of Ventura County.

[1]To be determined during review.
[2]In process of reclamation.

1C83-2.9/2

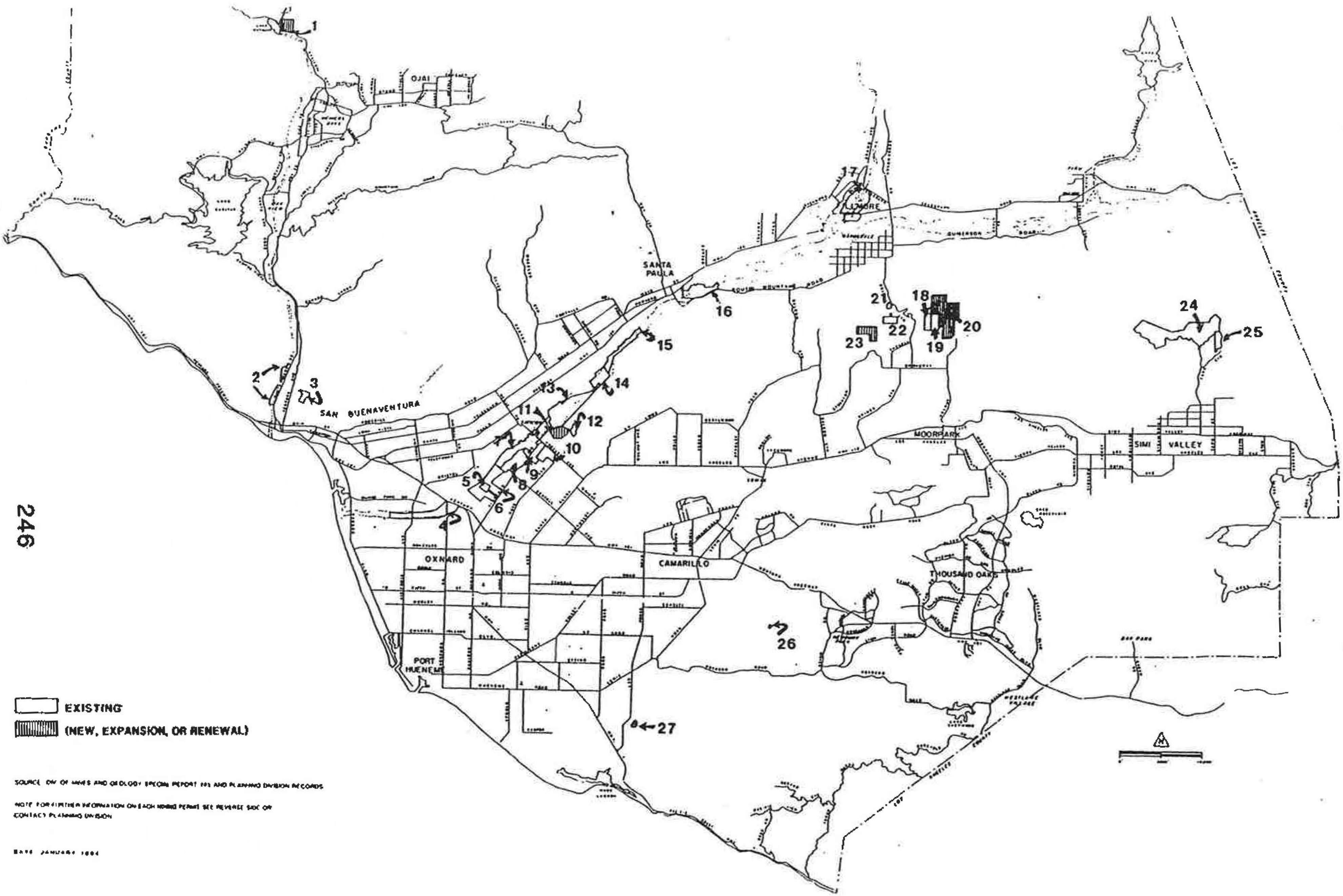

Figure 4.12 MINING PERMITS IN UNINCORPORATED VENTURA COUNTY

A. Rising Water Losses and Evaporation

1. Rising Water Losses

The removal of aggregate material from the riverbed below the present or projected high groundwater level (red line) can cause rising groundwater and/or surface water to be lost to the river and/or ocean. Mining is prohibited from below the red line, but occasionally occurs despite CUP conditions. When groundwater is exposed to the surface, depending on the topography of the riverbed, groundwater may flow downstream and be lost to evaporation and/ or to the ocean. If such conditions exist during a storm, surface runoff that would have normally been captured by the riverbed material and percolated into the groundwater basin would be lost downstream.

2. Evaporation

In addition to groundwater and river losses, water is also lost due to evaporation. Exposure of groundwater to the surface causes water molecules to evaporate into the atmosphere resulting in water losses. Evaporation losses also occur during the use of water on-site. The processing of sand and gravel requires water for washing aggregate product, the washing out of trucks, and the wetting of aggregate material prior to transport off-site. Such activities can result in additional evaporation. In addition to the mining, other related uses such as concrete batch plants and asphalt plants sometimes established on-site can also degrade water quality.

B. Mineralization and Contamination

1. Mineralization

Degradation of groundwater and surface water quality can occur as a result of mineralization. As addressed above, groundwater exposure to the surface results in evaporation. The evaporation process causes mineralization to occur. As water evaporates, the mineral content in the remaining water becomes concentrated. This concentration of minerals causes the total dissolved solid (TDS) content to increase degrading the water quality. In addition, return water from mining operations and other related activities which re-enter the groundwater table, can increase TDS levels.

2. Contamination

Groundwater can be contaminated from partial or complete surface exposure and to the mining activities conducted as part of the mining operations. Wash water, petroleum hydrocarbons, solvents and septic system discharges and other potential contaminants at the mining site can come into contact with the groundwater basin significantly degrading water quality. Wash water as described above is used on aggregate materials and trucks. Petroleum hydrocarbons and solvents may be generated from on-site maintenance of and operation of trucks. Accidental discharge of on-site septic system waste can also occur. The potential impacts of wash water and accidental spills are compounded by the removal of aggregate material and subsequent exposure of the groundwater table. Consequently, the capacity of the aggregate material to retard the migration of contaminants is reduced. Without safety precautions and adequate conditions, these contaminants pose a possible degradative potential to groundwater basins.

C. Reduction of Recharge Capacity

Water losses can also occur as a result of disturbance to recharge areas. The disturbance of aquifer recharge areas not only interferes with the current recharge capability of the basin but also future recharge capability, especially if the site is not properly reclaimed.

The effective storage capacity of a groundwater basin may potentially decrease if excavation activities occur below the historic high groundwater level. A thick layer of sand overlying the normal water table can capture a larger volume of water than a thin layer of sand. The total or even partial uncovering of aquifer recharge areas will interfere with the recharge capabilities of the aquifer. Aggregate material acts to temporarily store water as it percolates into the groundwater basin. The removal of aggregate from the riverbed interferes with this storage capability thereby reducing recharge capacity of the basin. Following excavation, the covering of recharge areas with nonpermeable material will interfere with recharge by preventing water from percolating into the aquifer. Reclamation plans must include specifications for permeable material to be used to allow for recharge.

D. Post Mining Water Quality Problems

Post mining water quality problems refers to the degradation of groundwater and/or surface water after mining closure, typically following reclamation and subsequent uses of the site. The subsequent use of reclaimed mining sites play a significant role in the long term water quality of the underlying basins. Mining sites are required to be reclaimed to the original state including the restoration of percolation capabilities. The goal of this SMARA requirement is to ensure the long-term recharge capability and quality of the groundwater basin. Such reclamation enables (where applicable) the site to function as it did prior to mining activities. While this is an admirable goal, without assurances of appropriate subsequent land uses, water quality of the groundwater basins may be degraded. Recharge areas, those with highly permeable soil, are especially sensitive to inappropriate land uses. The subsequent uses of these areas must be carefully decided. Land uses that could contribute to the degradation of underlying basins should be strictly prohibited. Such prohibited uses would include those that require the heavy application of pesticides and/or fertilizers to prevent the percolation of those substances into the groundwater basin.

E. Specific Problem Areas

1. Historic Permits

Early sand and gravel mining activities in the Santa Clara River were transferred to off-river sites adjacent to Vineyard Avenue during storm periods when in-river mining was not possible and later to avoid mining below the designated base of excavation imposed by the CUP. This has resulted in the creation of several deep pits extending over large areas on both sides of Vineyard Avenue north of Oxnard. The intention had been to use the pits for the disposal of unsalable material accumulated due to the processing of mined sand and gravel for Portland cement aggregate. However, CUP conditions specified the permeability requirements for pit material placement to avoid impacting aquifer recharge capabilities of the sensitive Forebay area. The pits have still not been refilled, due to the lack of agreement between County and industry representatives as to an acceptable solution to this problem.

2. Santa Clara River

The majority of sand and gravel mining in Ventura County has been surface mining of riverbed material from the Santa Clara River between Santa Paula and Oxnard. The riverbed in this area has been lowered by more than ten feet, resulting in the exposure of the water table during extended high rainfall periods. This condition has caused the loss of groundwater to the ocean. Because the Santa Clara River is in a significant groundwater basin recharge area, special attention should be given to this area in assuring condition compliance of local mining operations to prevent water quality degradation and further water losses.

II. Current Status

A. Surface Mining and Reclamation Act of 1975 and 1992 Amendments

As addressed at the beginning of the chapter, the objective of the Surface Mining and Reclamation Act (SMARA) is to ensure proper reclamation of land that is mined and to safeguard access to mineral resources of statewide and regional significance. The County's mechanism for carrying out SMARA's objectives of safeguarding access to mineral resources is the designation of appropriate areas as Mineral Resource Areas on Resource Protection Maps. The mapping of the resources enables local governments to make the appropriate land use decisions regarding surrounding property in order to assure that the areas are not committed to alternative uses, to provide adequate access to aggregate resources or to be within a city's viewshed.

The County General Plan includes goals, policies and programs that apply to mineral resource management. In summary, the goals reflect SMARA's objectives of safeguarding access to and development of mineral resources while ensuring that extraction operations are conducted in a manner which protects the environment, public health, safety, and welfare. Policies include provisions for environmental review to assure mineral disturbance to the environment and the reclamation of mined areas for appropriate future uses.

B. County Conditional Use Permits

During the past twenty-five years, sand and gravel mining operations have been regulated by Ventura County through Conditional Use Permits (CUPs). All discretionary permits for mining operations include conditions which act as mitigation measures to reduce potential specific individual, environmental and cumulative impacts resulting from project operations.

In the interest of groundwater protection, more recent permits have included increasingly stringent requirements. In-river CUPs prohibit mining below the average high groundwater table (referred to as the red line) to prevent groundwater loss due to surface exposure during high water table conditions. In river conditions include mining depth and profile standards, establishment of a river corridor, slope and setback restrictions, buffer zones, and other protection methods to ensure water quality, water loss prevention and recharge capability protection. The objective of the depth and profile standards for the Santa Clara River are to stabilize the riverbed, to protect major structures and promote downstream transport of sediment from the upper reaches of the river to the degraded lower reaches of the river. Other conditions include measures to regulate wash water, truck cleaning and other on-site water uses. Excavation, grading and reclamation plans are submitted as part of the CUP application process. The depths at which excavation will occur during mining operations and final grading elevations must be referenced in the site reclamation plan. These plans are then reviewed as part of the CUP process.

Failure to comply with the conditions set by the permit can result in the revocation of the permit, thus requiring all on-site activities to cease. Although only recently has legislation been approved to require regular and long-term monitoring of conditions, the CUP process is considered an effective method of ensuring environmental protection. Public Resources Code Section 21081.6 known as the Cortese Monitoring Program, requires the preparation of a mitigation monitoring program that identifies conditions (mitigation measures) to be monitored, monitoring frequency including start and finish dates, responsible reporting agencies, and standards of success to be used to measure the effectiveness of the conditions.

The various agencies responsible for monitoring their applicable conditions report condition compliance or noncompliance to the Resource Management Agency's Planning Division, which is responsible for maintaining the Cortese reporting files.

Conditional Use Permits (CUPs) are processed individually as applications for renewal are submitted. CUPs are normally issued for a period of twenty years, so there are significant discrepancies between the conditions imposed on older permits and those of newer permits. Many older CUPs did not address groundwater quality protection or have fewer groundwater protection conditions than newer CUPs. Older permits focused primarily on protection of riverbanks, levees and bridge footings. A "red line" policy was developed to provide a uniform gradient in the riverbed. However, some older CUPs allowed mining below the water table. Newer permits include water resource protection conditions. Often the conditions are protested by the applicant with the argument that competing (older permitted) aggregate mining sites do not have to comply with the same conditions.

III. Conclusions and Program Recommendations

A. Conclusions

Although the development of sand and gravel supplies have the potential to be incompatible with the protection of groundwater and groundwater recharge areas, in most instances the project can be properly conditioned to allow for a commercially viable operation and the protection of water resources. During the history of the CUP process in Ventura County, much knowledge has been gained in determining how much material can be harvested within a given site without significantly impacting water resources. Although the CUP process appears to be an effective method of permitting such uses, some measures to further strengthen the ability to protect groundwater quality should be enacted.

B. Program Recommendations

1. Consider the revision of the "red line" to reflect the historic high water table (not just the average) and prohibit mining below this line.

2. Enhance monitoring and condition compliance of Conditional Use Permit condition requirements identified in the CEQA review process.

3. Discourage subsequent land uses within reclaimed recharge areas that would adversely impact groundwater quality or recharge capabilities. For example, uses that require the heavy application of fertilizers and/or pesticides that could percolate into the groundwater basin should be discouraged. This could be accomplished through creation of an aquifer recharge overlay zone which would identify appropriate and inappropriate land uses.

4. Identify alternative upland mining sites to be developed where feasible, to reduce sand and gravel mining activities in riverbeds and recharge areas.

   Not all significant mining areas for sand and gravel production are located within or adjacent to rivers. Usually upland sites can be operated with fewer impacts to groundwater. Notable sites of this type within Ventura County include the hillside exposure of gravel northwest of Moorpark and the northern and southern hillsides of Simi Valley. Hard rock mining also occurs in the Conejo volcanics east of Camarillo and in sandstone deposits northwest of Ojai. In the north half of Ventura County, gypsum mining occurs in Quatel Canyon near the Cuyama River Valley and expansible shale mined in Lockwood Valley. Deposits of decorative rock are mined in Grimes Canyon Between Moorpark and Fillmore.

   Impacts to groundwater supplies at these sites would be minimal in part because the average annual rainfall at most of the sites is small and because floodwaters do not concentrate for possible entry into the ground at these sites.

Chapter 4.2.F Aggregate Resource Management References

California Department of Conservation, Division of Mines and Geology, Surface Mining and Reclamation Act of 1975

Ibid, 1993 1992 Amendments to the Surface Mining and Reclamation Act of 1975

Hoffman, LaVern, Ventura County Public Works Agency, Water Resources and Development Division, personal communication

Luscombe, Glen, Ventura County Public Works Agency, Water Resources and Development Division, personal communication

Painter, Beth, Ventura County Resource Management Agency, Planning Division, personal communication

Turner, John, Ventura County Public Works Agency, Water Resources and Development Division, personal communication

Ventura County Resource Management Agency, Planning Division, Permit Files, March 1994, Existing and Proposed Mining Permits in Unincorporated Ventura County, including Environmental documents

G. NATURALLY OCCURRING CONTAMINANTS

I. Description of the Problem

A. Introduction

Unlike man-made types of contamination, naturally-occurring groundwater contaminants are not a recently generated problem. The majority of County areas identified as having this condition have existed for thousands of years or more. This chapter will describe the problem, identify prominent areas where naturally-occurring contaminants exist and suggest recommendations to resolve the problem.

Groundwater quality is the focus of naturally-occurring contamination studies. As greater amounts of chemical elements are dissolved in groundwater, quality falls outside potable limits. Highly mineralized groundwater is unsuitable for many human uses. Mineralization is measured in "total dissolved solids" or TDS. The actual volume of minerals contained in the water is very small and measured in milligrams per liter (or its equivalent of parts per million). TDS is not a measurement of actual solids such as sand, silt or clay in the water, but rather chemical elements dissolved in solution. California State standards for community drinking water limits TDS to 1,000 milligrams per liter (mg/l) per California Title 22. Unusable or highly mineralized groundwater is often in the 1,500 to 4,000-plus mg/l range.

B. Alluvial Groundwater Basins

Groundwater is contained in two general subsurface environments: alluvial aquifers and bedrock aquifers. The term aquifer denotes an underground material, usually sand and gravel, capable of holding and moving water so that wells can produce water. Of primary concern are the ten alluvial groundwater basins in Ventura County (see Table 4.16 below and Figure 3.3 of Chapter 3). These basins are composed of geologically "recent" sands and gravels deposited by rivers and oceans within the last 10,000 years. Generally, water movement, or permeability, is rapid in these so called aquifer materials. Over thousands of years of impurities in the form of highly mineralized water have been flushed from the basins leaving clean potable water.

TABLE 4.16 *MAJOR ALLUVIAL GROUNDWATER BASINS IN VENTURA COUNTY*
Ojai Valley (under the City of Ojai and extending east)
Simi Valley (largely unused due to high TDS)
Upper/Lower Ventura River (area north/south of Oak View)
South Las Posas (overlain by the City of Moorpark)
Santa Rosa (east of the City of Camarillo)
Santa Clara River (Santa Paula, Fillmore and Piru)
North Las Posas (north of and including the Somis area)
Oxnard Plain Pressure (containing several aquifers)
Oxnard Plain Forebay or Montalvo (near El Rio)
Pleasant Valley (overlain by the City of Camarillo)

C. Bedrock Groundwater Basins

Bedrock groundwater basins (Table 4.17) generally possess a much slower rate of groundwater movement than alluvial basins. Therefore, impurities still present in bedrock aquifers are being removed slowly, and most often, introduced into alluvial groundwater basins. This occurrence is especially notable along the margins of alluvial basins where TDS levels are elevated by the mixing of highly mineralized bedrock groundwater with cleaner alluvial basin waters. Normally, near the center of the basin, where relatively large quantities of water occur and flow rates are significantly higher, mixing dilutes the mineralization to less detectable levels as illustrated in Figure 4.13.

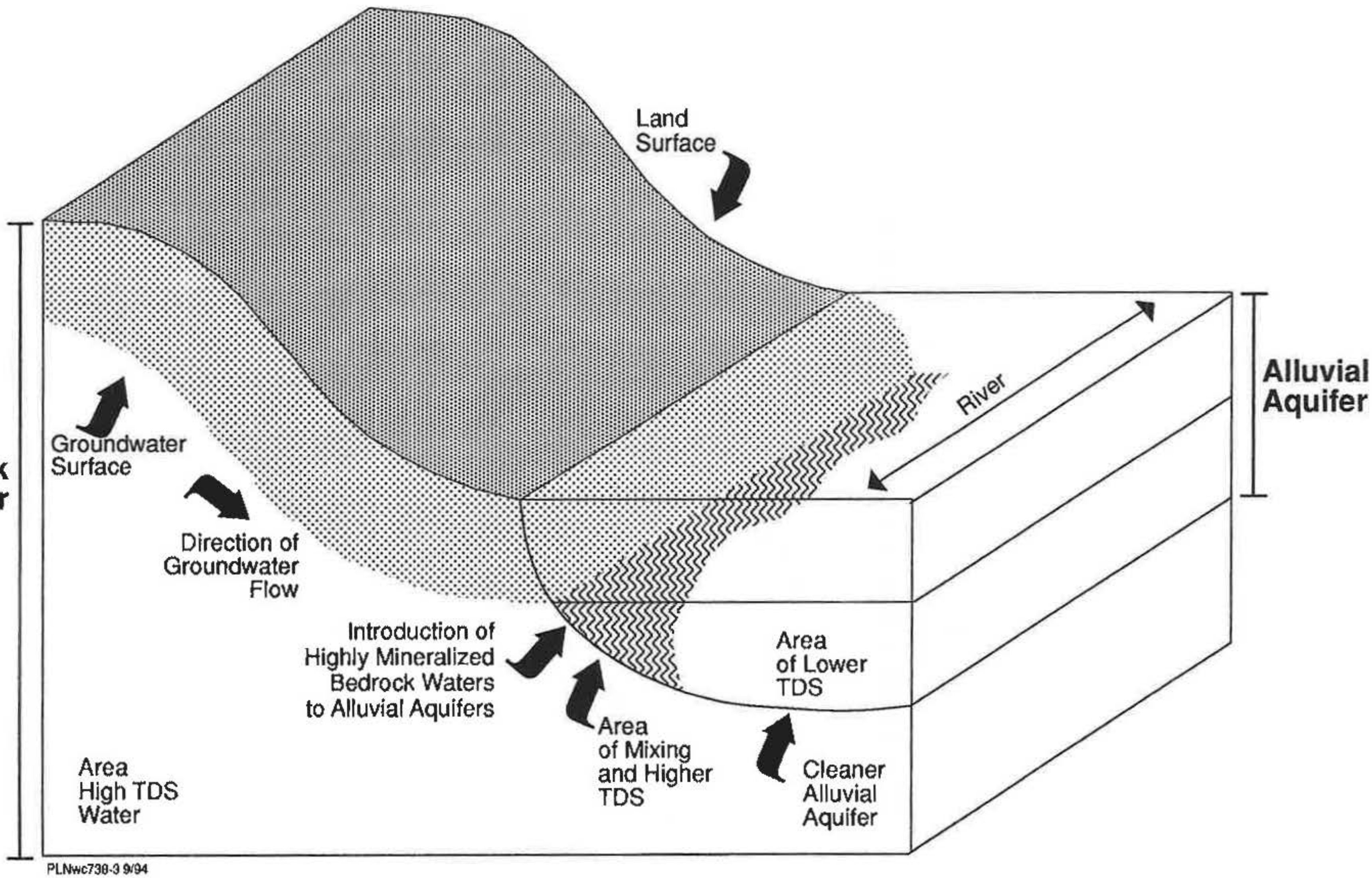

Figure 4.13 • Introduction of Highly Mineralized Bedrock Waters Groundwater Into Alluvial Aquifer

TABLE 4.17 *COMMONLY USED BEDROCK AQUIFERS IN VENTURA COUNTY*
Santa Monica Mountains (area between the City of Thousand Oaks and the ocean)
Sulphur Mountain (area south of Ojai/Upper Ojai)

D. Mineralization and Groundwater

TDS is a composite value normally broken into smaller components expressed as chemical elements. The seven "major" constituents of groundwater include sodium, calcium, magnesium, bicarbonate, sulfate, chloride and silica. There are also seven "secondary" constituents and longer lists of "minor" and "trace" constituents (Table 4.18). What is referred to as the "chemical character" of the groundwater describes the one or more constituents which occur in larger amounts. For example, a particular water may possess a calcium sulfate character, indicating the TDS contains especially high percentages of calcium and sulfate.

Rain water is extremely low in TDS and thus represents a water with almost no dissolved minerals. Mineralization occurs after pure rain water has penetrated the earth's crust and subsequently dissolves minerals by moving through permeable rock or aquifers. If the rock through which the water flows has been previously flushed of available minerals, local groundwater will be low in TDS. This condition is commonly found in alluvial basins (but can occur in some bedrock basins). If this water, instead, flowed through rock not previously flushed, many minerals still remain available for dissolution. This last condition is commonly found in bedrock areas and will generate groundwater containing higher TDS values. Therefore, higher TDS water develops in bedrock aquifers with slower moving water and is introduced along the margins of "cleaner" formal groundwater basins.

TABLE 4.18				
*NATURALLY DISSOLVED CONSTITUENTS IN GROUNDWATER**				
1.	Major Constituents (normal mg/l range: 1.0 to 1,000)			
	** Sodium	** Bicarbonate	** Calcium	** Sulfate
	** Chloride	Magnesium	Silica	
2.	Secondary Constituents (normal mg/l range: 0.01 to 10)			
	Iron	Carbonate	** Nitrate	** Boron
	** Fluoride	Potassium	Strontium	
3.	Minor Constituents (normal mg/l range: 0.00001 to 0.1)			
	Antimony	Chromium	Lithium	Selenium
	Aluminum	Cobalt	Manganese	Titanium
	** Arsenic	Copper	Molybdenum	Uranium
	Barium	Germanium	Nickel	Vanadium
	Bromide	Iodide	Phosphate	Zinc
	Cadmium	Lead	Rubidium	
*	SOURCE:	William Walton, Groundwater Resource Evaluation, McGraw-Hill, 1970.		
**	Denotes constituents found in certain Ventura County groundwater basins.			

II. Current Status

Generally, high TDS groundwater is avoided by well drillers and water users unless no other water sources are available. This condition could mean that existing well data points are limited or non-existent and, in turn, any assessment could suffer from insufficient data. However, enough areas of the County do have data to indicate several basins of high TDS. For this investigation, these areas were determined initially by reviewing Ventura County Public Works Agency's (PWA) Quadrennial Report of Hydrologic Data: 1981-1984 prepared by PWA Flood Control and Water Resources Department. The data used to draft the contour maps is collected by County PWA staff. Older data presented on the maps was verified against newer information which is collected and processed annually. Four areas of concern are addressed below and include the Santa Clara River Valley aquifers (Piru, Fillmore and Santa Paula), the Simi Valley Basin, the South Las Posas Basin, and the Lockwood Valley area. Determination of basins to review is based on data finding of greater than 1,000 mg/l TDS or unusually high components of TDS, such as fluoride, boron or arsenic.

A. Santa Clara River Valley Groundwater Basins

Of concern in the Santa Clara River Valley region are three specific groundwater basins: Piru, Fillmore and Santa Paula. These three basins comprise an elongated, nearly east-west trending alluvial valley bounded by bedrock materials. Although the bedrock areas contain few wells and are not considered reasonably water bearing, they do produce a limited high TDS source to the alluvial basin.

This situation is particularly noticeable in one stretch running from Piru to an area about two miles east and a second area at the mouth of, and including, Hopper Canyon located about two miles west of Piru. TDS values of over 4,000 mg/l are recorded for these two areas. One analysis (well 4N/18W-20J1) shows TDS at 4,120 mg/l for the area east of Piru and in Hopper Canyon, west of Piru, values climb to over 4,800 mg/l (well 4N/19W-23J1). In comparison, less that one mile to the south of Hopper Canyon TDS levels have dropped to less than one-fourth of these amounts to about 800 mg/l (well 4N/19W-25L4). The origin of higher TDS water appears to be from continuous flushing of minerals from the bedrock aquifers along the northern boundary of the basin.

The individual elements which contribute the highest percentages of the TDS are sulfates and bicarbonates. Sulfates alone comprise 60% of the entire TDS readings, while bicarbonates contribute about 20%. Removal of these two would result in a TDS level of under 1,000 mg/l.

The Fillmore area receives the benefit of surface and underflows from Sespe Creek on the northern margin which nearly eliminates the effect of high TDS groundwater contamination. However, in a few limited pockets, located within ¼ mile of bedrock, higher TDS levels have been recorded. On the southern margin of the Fillmore Basin higher TDS values have been recorded, but most are in the 1,500 mg/l range.

Within the Santa Paula Basin TDS levels in excess of 1,000 mg/l are the rule for the basin. Two areas, one near Saticoy (well 2N/22W-2G1) and another in the center of the basin (well 3N/21W-21E3), show TDS in excess of 2,000 and 2,700 mg/l., respectively. The primary constituents showing high values are the same as occur in the Piru area: sulfates and bicarbonates. These two components makeup about 68% of the total TDS, using the two areas listed above.

B. Simi Valley Groundwater Basin

The Simi Valley Groundwater Basin is composed of a roughly oval-shaped valley which is recharged from the surrounding surface drainage during wet times and from the surrounding bedrock all the time. Prior to the 1960's, this farming area utilized poor quality underlying groundwater for all uses. No other supply was available. Since the early 1960's, however, the valley's dependence on better quality imported State water from northern California has allowed the poorer local water to become largely unused. The basin is now full, having returned to pre-1940's conditions (well 1N/18W-8C2).

Within the Simi Groundwater Basin high TDS waters dominate. Generally, TDS levels vary between 1,000 and 2,000 mg/l. As a result of these poorer quality groundwaters and the availability of imported water, there are presently no major groundwater users in the basin (although some minor domestic uses do occur in the southeast portion of the basin). Pumping, however, still occurs in the western end of the valley for dewatering purposes. An ongoing program, operated by the City of Simi, is designed to rid this area of the valley from high-water problems.

Specific basin-wide water quality data has been difficult to collect since the late 1960's due to advancing urbanization. However, the few recent samples that are available seem to be consistent with older evaluations. For example, one well (2N/18W-8B3) in the western valley shows a TDS range of 1,650 to 1,930 mg/l from 1975 to 1987, which is typical. In the eastern valley, some wells can be found with TDS just slightly below 1,000 mg/l (2N/17W-7J2). Since so few recent water quality data points exist in the valley, specific high TDS patterns cannot be reliably mapped.

C. South Las Posas Groundwater Basin

Within the South Las Posas Groundwater Basin, higher TDS water may be related to transfers of water from the Simi Basin. Since the early 1970's, the City of Simi has been discharging excess water containing TDS values above 1,000 mg/l (from their dewatering program) down the Arroyo Simi into the South Las Posas Groundwater Basin near Moorpark. It is believed that some of the "new" water introduced into the South Las Posas infiltrates into the basin as groundwater thus raising local TDS levels. It is not clear whether both the shallow waters (called the Upper Zone aquifer) and the deeper waters (the Lower Aquifer System) are affected. An analysis for the shallow aquifer (2N/19W-6N3) from years 1973 and 1985 shows that TDS has doubled from 777 to 1,583 mg/l.

Sulfates and chlorides displayed the largest jump from 251 to 650 mg/l and 58 to 166 mg/l, respectively. Curiously, these two elements are both very high and have remained unchanged since 1975 in Simi Basin analyses (sulfates have hovered in the 850 mg/l range and chloride in the 150 mg/l range). This indicates that South Las Posas groundwater in the Upper Zone has taken on the chemical characteristics of Simi groundwater over the past decade.

Another well (2N/19W-6F1) which is perforated 200 feet deeper (in the Lower Aquifer System), shows a similar trend yet the affect is less pronounced. A look at mineralization basin-wide shows higher TDS values (greater than 1,500 mg/l) exist along the southern margin which progressively decrease toward the northern boundary (less than 1,000 mg/l). The higher TDS water trends along the Arroyo Simi, west of Moorpark. This provides further evidence that Simi Basin's high TDS water is entering the South Las Posas Basin and making its way into the groundwater, especially along the riverbed of the Arroyo Simi.

D. Lockwood Valley Groundwater Area

The Lockwood Valley area suffers more from high concentrations of individual elements. TDS values average from 250 mg/l to 1,550 mg/l which is not overly high for TDS, but elements of arsenic, boron and fluoride exceed California Drinking Water Standards in some areas.

In 1978 the County of Ventura PWA prepared a detailed study of northern Ventura County groundwater resources, entitled North Half Hydrologic Balance Study. The study was implemented after a large community was proposed for the area. The County wanted to determine water availability in the Lockwood Valley. Due to the quantity and quality of water resources in the Lockwood Valley, the proposed community was denied. The study contained maps showing the location and extent of specific contaminants.

Arsenic contamination was found to be restricted to two areas, one in the central northwestern Lockwood Valley and another in the central eastern valley. Samples collected for the 1978 study show a range from 0.0 to 0.2 mg/l, with one well water sample twice the State's recommended upper limit of 0.1 mg/l for drinking water.

Boron concentrations, which are not listed by the State as harmful to humans, can be devastating to agriculture. Although boron is detectable throughout the entire Lockwood area, it occurs primarily in a northwestern to southeastern diagonal trend through the center of the valley. Concentrations of Boron range from 0.0 to 104.0 mg/l. According to Table 3, the highest values of over 100 are ten times what is listed as the "normal" range. During the 1978 study, nearly one-half of the well samples exceeded the recommended State limit of 2.0 mg/l.

Elevated fluoride levels are recorded for most of the Lockwood area with ranges from 0.2 to 5.5 mg/l. Drinking water is limited to 1.2 mg/l. During the 1978 study, it was found that slightly over 20% of the wells sampled exceeded State limits for drinking water.

III. Conclusions and Programs Recommendations

A. Conclusions

Several recommendations can be presented as alternatives to mitigate the problem of naturally-occurring contaminates, but none will actually "solve" the problem of highly mineralized water being introduced from bedrock aquifers to alluvial aquifers. Recommended alternatives, then, must be limited in scope to converting presently unusable groundwater to usable groundwater. Below are several recommendations.

B. Program Recommendations

1. Identify and develop projects to blend highly mineralized groundwater with existing good quality sources of water to create additional useable water supplies.

   Blending or combining highly mineralized groundwater with existing good quality sources would create a supply with a TDS content of less than 1,000 mg/l to comply with California State Drinking Standards for public uses. This alternative would actually "create" new local water by utilizing presently useless supplies. The best example of this type of alternative is seen in Simi Valley where excess water is presently pumped with no specific use other than to rid the basin of high groundwater problems. This water could conceivably be combined with existing imported or other water resources to produce augmented drinking water supplies. State water is very low in TDS, unusually 250 mg/l. By blending the two water sources, previously unused ground- water could become useable.

2. Identify and develop, where practical, the desalination or other treatment methods to reduce the mineral content of currently unusable groundwater to increase available water supplies.

An alternative of this type would require direct treatment of high TDS water in order to reduce the mineral content to comply with State standards. This alternative would require substantial capital investment to build the necessary facilities to generate lower TDS water which could be blended with other existing supplies or used directly. A project of this type, like blending, would begin to utilize presently unused groundwater. The desalinated water could be used directly, without mixing it with other supplies, making use of nearly 100% of the currently unusable groundwater. Some losses would occur during the desalination process.

Chapter 4.2.G Naturally Occurring Contaminants References

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State of California, 1978 California Administrative Code, Title 22, Division 4,

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GLOSSARY OF TERMS

Acre-foot (AF): A quantity or volume of water covering one acre to a depth of one foot; equal to 43,560 cubic feet or 325,851 gallons.

Alluvial Aquifer: Earth, sand, gravel or other rock or mineral materials laid down by flowing water, capable of yielding water to a well.

Anadromous: Pertaining to fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

Aquifer: A geologic formation that stores and transmits water and yields significant quantities of water to wells and springs.

Arid: A term describing a climate or region in which precipitation is so deficient in quantity or occurs so infrequently that intensive agricultural production is not possible without irrigation.

Artificial Recharge: The addition of surface water to a groundwater reservoir by human activity, such as putting surface water into spreading basins. See also Groundwater Recharge, Recharge Basin.

Bedrock Aquifer: Solid rock, usually granite, overlain by soil or other unconsolidated material, containing fractures capable of yielding water to a well.

Beneficial Uses: Include fish, wildlife habitat, and education, scientific and recreational activities which are dependent upon adequate water flow thorough rivers, streams and wetlands. The Regional Water Quality Control Board's Basin 4A Plan categorizes beneficial uses per water quality standards.

Best Management Practice (BMP): An urban water conservation measure that the California Urban Water Conservation Coalition agrees to implement among member agencies. The BMP's are intended to reduce long term urban water demand.

Brackish Water: Water containing dissolved minerals in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses. Considerably less saline than seawater.

Confined Aquifer: A water bearing subsurface stratum that is bounded above and below by formations of impermeable, or relatively impermeable, soil or rock.

Conjunctive Use: The sharing of a water resource, the operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the groundwater basin for later use by intentionally recharging the basin during years of above-average water supply.

Desalination: A process than converts seawater or brackish water to freshwater or an otherwise more usable conditions through removal of dissolved solids. Also called Desalting.

Distribution Uniformity (DU): The ratio of the average low-quarter depth of irrigation water infiltrated to the average depth of irrigation water infiltrated, for the entire farm field, expressed as a percent.

Drainage Basin: The area of land from which water drains into a river; as, for example, the Sacramento River Basin, in which all land area drains into the Sacramento River. Also called, "watershed".

Efficient Water Management Practice (EWMP): An agricultural water conservation measure that water suppliers could implement. EWMPs are organized into three categories: 1) Irrigation Management Services; 2) Physical and Structural Improvements; and 3) Institutional Adjustments.

Effluent: Waste water or other liquid, partially or completely treated or in its natural state, flowing from a treatment plant.

Estuary: The lower course of a river entering the sea influenced by tidal action where the tide meets the river current.

Evapotranspiration (ET): The quantity of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces. Quantitatively, it is expressed in terms of depth of water per unit area during a specified period of time.

Forebay: A storage basin for regulating water for percolation in groundwater basins. Also, a reservoir or pond situated at the intake of a pumping plant or power plant to stabilize water levels.

Groundwater: Water that occurs beneath the land surface and completely fills all pore spaces of the alluvium, soil, or rock formation in which it is situated.

Groundwater Basin: A groundwater reservoir, defined by all the overlying land surface and the underlying aquifers that contain the water stored in the reservoir. In some cases, the boundaries of successively deeper aquifers may differ and make it difficult to define the limits of the basin.

Groundwater Overdraft: The condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin. Over a period of years, if continued, the groundwater supply could be exhausted or degraded from mineralization or seawater intrusion as a result of the overdraft.

Groundwater Recharge: Increases in groundwater storage by natural conditions or by human activity. See also Artificial Recharge, Recharge Basin.

Groundwater Reservoir: An aquifer or an aquifer system in which groundwater is stored.

Groundwater Table: The upper surface of the zone of saturation (all pores of subsoil filled with water), except where the surface is formed by an impermeable body.

Instream Use: use of water that does not require diversion from its natural watercourse. For example, the use of water for navigation, recreation, fish and wildlife, esthetics, and scenic enjoyment.

Irrigation Efficiency: The efficiency of water application. Computed by dividing evapotranspiration of applied water by applied water and converting the result to a percentage. Efficiency can be computed at three levels: farm, district, or basin.

Irrigation Return Flow: Applied water that is not transpired, evaporated, or deep percolated into a groundwater basin, but that returns to a surface water supply.

Leaching: The flushing of salts from the soil by the downward percolation of applied water.

Milligrams per Liter (MG/L): The quantity, expressed in units of 0.001 grams, of a dissolved substance contained in a one liter volume of solution. One liter of pure water has a mass of 1000 grams. For dilute solutions where water is the solvent medium, the numerical value of milligrams per liter is very close to the mass ratio expressed in parts per million.

Mineralization (of Groundwater): The addition of inorganic substances, usually dissolved from surface or aquifer material, to ground water.

Naturally Occurring Contaminants (in Groundwater): A deleterious substance present in ground water which is of natural origin, i.e., not caused by human activity.

Net Water Demand: The amount of water needed in a water service area to meet all requirements. It is the sum of evapotranspiration of applied water (ETAW) in an area, the irrecoverable losses from the distribution system, and the outflow leaving the service area.

Nonpoint Source: Waste water or polluted water discharge from sources which are difficult to locate and/or identify. See Point Source.

Parts Per Million (PPM): A ratio of two substances, usually by mass, expressing the number of units of the designated substance present in one million parts of the mixture. For water solutions, parts per million is almost identical to the milligrams per liter.

Perched Groundwater: Groundwater supported by a zone of material of low permeability located above an underlying main body of groundwater with which it is not hydrostatically connected.

Per-capita Water Use: The amount of water used by or introduced into the system of a water supplier divided by the total residential population; normally expressed in gallons per-capita-per-day (gpcd).

Percolation: The downward movement of water through the soil or alluvium to the groundwater table.

Permeability: The capability of soil or other geologic formation to transit water.

Point Source: Any discernable, confined and discrete conveyance site from which waste or polluted water is discharged into a water body, the source of which can be identified. See also Nonpoint Source.

Pollution (of water): The alteration of the physical, chemical, or biological properties of water by the introduction of any substance into water that adversely affects any beneficial use of water.

Potable Water: Water suitable for human consumption without undesirable health consequences. Drinkable. Meets Department of Health Services drinking water requirements.

Recharge Basin: A surface facility, often a large pond, used to increase the infiltration of surface water into a groundwater basin. See also Artificial Recharge, Groundwater Recharge.

Reclaimed Waste Water: Waste Water that becomes suitable for a specific beneficial use as a result of treatment. See also Waste Water Reclamation.

Reverse Osmosis: Method of removing salts from water by forcing water through a membrane.

Reuse: The additional use of previously used water.

Riparian: Of, or on the banks of, a stream or other of water.

Riparian Vegetation: Vegetation growing on the banks of a stream or other body of water.

Runoff: The surface flow of water from an area; the total volume of surface flow during a specified time.

Safe Yield: The maximum quality of water that can be withdrawn from a groundwater basin over a long period of time without developing a condition of overdraft. Sometimes referred to as sustained yield.

Salinity: Generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity, or osmotic pressure. Where seawater if known to be the major source of salt, salinity is often sued to refer to the concentration of chlorides in the water. See also Total Dissolved Solids.

Seawater Intrusion: Occurs when extractions exceed replenishment of groundwater basins and causes seawater to travel laterally inland into aquifers.

Secondary Treatment: In sewage, the biological process of reducing suspended, colloidal, and dissolved organic matter in effluent from primary treatment systems. Secondary treatment is usually carried out through the use of trickling filters or by the activated sludge process.

Spreading Basin: See Recharge Basin.

Spreading Grounds: See Recharge Basin.

Tertiary Treatment: In sewage, the additional treatment of effluent beyond that of secondary treatment to obtain a very high quality of effluent.

Total Dissolved Solids: A quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter. Abbreviation: TDS. See also Salinity.

Water Reclamation: The treatment of water of impaired quality, including brackish water and seawater, to produce a water of suitable quality for the intended use.

Water Right: A legally protected right to take possession of water occurring in a natural water way and to divert that water for beneficial use.

TABLE OF CITATIONS TO CALIFORNIA WATER POLLUTION CONTROL STATUTES AND REGULATIONS

A. CALIFORNIA WATER CODE

1. Sections 174-188.5. Provisions dealing with the State Water Resources Control Board.

2. Sections 230-231, 12617.1, 12923.1. DWR - Water reclamation and groundwater investigations.

3. Sections 1242.5-1244. Provisions dealing with beneficial use, including water quality.

4. Sections 1257-1259. Considerations of water quality in the appropriative process.

5. Sections 2100-2102. Adjudications to protect groundwater quality.

6. Sections 13000-13998. State policy regarding water quality.

7. Sections 13020-13992. Porter-Cologne Water Quality Control Act.

8. Sections 13100-13174. State water quality control.

   (a) State Water Resources Control Board.

   (b) State policy for water quality control.

   (c) Other powers and duties of the State Board.

9. Sections 13200-13284. Regional water quality control.

   (a) Organization.

   (b) General provisions.

   (c) Regional Water Quality Control Plan.

(d) Waste discharge requirements.

(e) Individual disposal systems.

10. Sections 13300-13361. Enforcement and Implementation.

(a) Administrative enforcement and remedies Regional Boards.

(b) Administrative enforcement and remedies State Board.

(c) Judicial review and enforcement.

(d) Summary judicial abatement.

(e) Civil monetary remedies.

(f) General provisions.

11. Sections 13370-13389. Compliance with the provisions of the Federal Water Pollution Control Act as amended in 1972.

12. Sections 13400-13442. State financial assistance.

13. Sections 13500-13551. Water reclamation.

14. Sections 13600-13612. Federal Assistance for Treatment Facilities.

15. Sections 13625-13634. Municipal waste.

16. Sections 13700-13806. Water wells.

17. Sections 13900-13908. Discharges from houseboats.

18. Sections 13950-13952. Lake Tahoe -- Special water quality provisions.

19. Sections 13953-13953.4. Drain -- San Joaquin Valley agricultural drain.

20. Sections 13955-13969. Clean Water and Water Conservation Bond law.

21. Sections 13970-13983. Clean Water Bond Law of 1970.

22. Sections 13985-13998. Clean Water Bond Law of 1974.

B. <u>CALIFORNIA FISH AND GAME CODE</u>

1. <u>Sections 5650-5655</u>. Prohibitions on water pollution.

C. <u>GOVERNMENT CODE</u>

1. <u>Sections 8574.1-8574.4 and 54307.1</u>. Oil spills.

2. <u>Sections 66700-66765</u>. Solid waste management. Resource, recovery and recycling.

D. <u>HARBORS AND NAVIGATION CODE</u>

1. <u>Sections 135-152</u>. Oil deposits.

2. <u>Sections 775-786</u>. Marine sanitation.

E. <u>HEALTY AND SAFETY CODE</u>

1. <u>Sections 44500-44563</u>. Pollution control financing.

2. <u>Sections 6950-6981</u>. On-site wastewater disposal zones.

3. <u>Section 25145</u>. Hazardous waste control.

F. <u>PUBLIC RESOURCES CODE</u>

1. <u>Sections 21060-21174</u>. CEQA.

2. <u>Sections 30000-30900</u>. California Coastal Act.

G. <u>REGULATIONS - TITLE 23, CALIFORNIA ADMINISTRATIVE CODE</u>

1. <u>Sections 455 et seq</u>. California Safe Drinking Water Bond Law of 1976.

2. <u>Section 668.5</u>. Defines "use" as including water for water quality.

3. <u>Section 761(b)</u>. Water quality objectives as condition in permits.

4. <u>Section 763</u>. Waste discharge requirements as condition in permits.

5. <u>Sections 1050-1060</u>. Procedures for protecting instream beneficial uses.

6. <u>Sections 2050-2068</u>. Review of State Board of action or inaction by Regional Board.

7. Sections 2205-2235.4. Waste discharge reports and requirements.

8. Sections 2240-2245. Enforcement procedures.

9. Sections 2304-2336. Licensing and regulation of use of oil spill cleanup agents.

10. Sections 2500-2567. Waste disposal to land. [Will be revised. Revisions may already have been approved.]

11. New Subchapter 16. Underground Tanks [will be Sections 2610-2648]

12. Sections 2815-2829. Standards for removal of sewage from vessels.

13. Sections 3580-3598. Loans to public agencies from State Water Quality Control Fund.

14. Sections 3610-3663. Clean Water Grant Program.

15. Sections 3670-3705. Classification of wastewater treatment plans and operation certification.

16. Sections 3720-3782. Regulations for implementation of CEQA.

17. Sections 3830-3869. Procedures regarding certification under various state and federal statutes and regulations.

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