CHAPTER III

ENVIRONMENTAL SETTING

A. INTRODUCTION

This chapter describes the environmental setting for the Monterey Peninsula Water Management District's Water Allocation Program. The first part of the chapter outlines the institutional setting, describing those agencies, both governmental and non-governmental, affected by or concerned with the Water Allocation Program and its direct and indirect effects. Next the chapter describes the natural environmental setting, including the EIR's baseline conditions for natural resources. The chapter then discusses the conditions of drought to which the Monterey Peninsula is susceptible. This discussion is followed by a summary description of existing development within the district. The chapter next addresses the subject of water use, including a summary of historical water use patterns, the District's current allocation policy, and jurisdictional water use preferences. Finally, the chapter describes the Monterey Peninsula's existing public facilities and services and socioeconomic conditions.

B. INSTITUTIONAL SETTING

Numerous federal, state, regional, and local governmental agencies, and private organizations are concerned with the Carmel River watershed, the resources found there, and how water is used in the Monterey Peninsula area. The following is a description of the major agencies and organizations and their responsibilities.

1. Monterey Peninsula Water Management District

The Monterey Peninsula Water Management District (MPWMD), which is the lead agency for this EIR, was created by an act of the California Legislature in 1977 (MPWMD Law, Assembly Bill No. 1329) following the drought of 1976-77 and ratified by the voters of the Monterey Peninsula area in 1978. The District's boundaries encompass approximately 140 square miles and include the urbanized portion of the Monterey Peninsula and the contiguous unincorporated portions of Monterey County. This area experienced serious water shortages during the 1976-77 drought, and substantial resource degradation occurred along the Carmel River. The District was formed in response to a recognized need for conservation and augmentation of water supplies on the Monterey Peninsula area. The primary purposes of the District as articulated in its enabling legislation are to provide for the integrated management of ground and surface water supplies, to control and conserve storm and wastewater, and to promote the reuse and reclamation of water. The District's integrated management responsibilities include control over both water supply and demand, a unique combination which calls on the District to act both as a planning agency and as a regulatory body. The Legislature viewed this integration of management responsibilities as critical in light of the Monterey Peninsula's scenic, cultural, and recreational resources, which are particularly sensitive to the threat of environmental degradation. The MPWMD was thus established with boundaries encompassing the service area of the California-American Water Company, the largest supplier of water in the Monterey Peninsula area, and most of the watershed of the Carmel River.

In addition to MPWMD's enabling legislation, ordinances have been enacted by the District as part of its *Rules and Regulations* to guide the District's water management activities. The MPWMD has the ability to tax and raise the capital required to finance public works projects to augment existing water supplies. The MPWMD has permit authority over the creation or

expansion of water distribution systems (WDS). MPWMD staff works with state and Monterey County agencies to ensure that proposed or expanded water distribution systems will not adversely affect other nearby systems or the environment by the creation or exacerbation of overdraft conditions. Implementation of the *Water Conservation Plan* for Monterey County, as it concerns the Monterey Peninsula, is also coordinated through the MPWMD.

MPWMD is governed by a seven-member Board of Directors. Five of these members are elected at-large, one is appointed by the Monterey County Board of Supervisors, and one is appointed by a select committee of the mayors of all cities within Monterey County (including those outside of the MPWMD boundaries). The five elected directors serve four-year terms, and the two appointed directors serve at the pleasure of their appointing authorities.

2. Federal Agencies

United States Forest Service (USFS): USFS is charged with the management of federal lands within the national forest system. This has traditionally included water, timber, recreation, and wildlife habitat resources. Mineral leases and claims on USFS lands are administered by the Department of the Interior. Nearly one-third of the Carmel River watershed is within the Los Padres National Forest (LPNF) boundaries, ninety percent of which is in the Ventana Wilderness Area. The Wilderness Act of 1964 limits the level of management activity possible by this agency within the Carmel River watershed. The LPNF has recently completed a Forest Plan that outlines preferred management options for the Ventana Wilderness Area and the Chews Ridge area. Management objectives stress maintenance of hydrologic conditions through prescribed burning to prevent catastrophic wildfires.

United States Fish and Wildlife Service (USFWS): USFWS is responsible for management and protection of wild birds, mammals, and inland sport fisheries. Under authority of the Fish and Wildlife Coordination Act of 1936, USFWS staff reviews and comments on projects that could impact wildlife or fish populations in a project area. USFWS staff developed the Instream Flow Incremental Method used to determine streamflow release schedules below dams as mitigation to maintain fish habitat. USFWS studied the Carmel River to determine the impacts of the previously-proposed U.S. Army Corps of Engineers project and recommended an instream flow schedule for that project.

National Marine Fisheries Service (NMFS): NMFS is responsible for preserving and enhancing marine, estuarine, and anadromous fish resources and the habitats that support these resources. NMFS is particularly concerned with protecting and enhancing salmon and steelhead resources, including spawning and rearing habitats and migratory corridors.

Federal Energy Regulatory Commission (FERC): FERC is responsible for the licensing of hydroelectric projects. USFWS and other agencies work closely with FERC to analyze and determine instream flow needs as a condition of licensing.

Army Corps of Engineers: In addition to undertaking water supply and flood control projects, the Corps has a number of functions, including the protection of the nation's water resources. The Corps requires permits for work along rivers, beaches, and lakes through Section 404 of the Clean Water Act. The Corps proposed a flood control water supply dam on the Carmel River in 1981.

U.S. Geological Survey (USGS): The Water Resources Division of USGS provides information on quantity, quality, availability, and movement of the surface and underground water resources

of the nation. This information is published yearly in four volumes for California. USGS operates two gauging stations on the Carmel River.

Soil Conservation Service (SCS): SCS develops land use capability information through the National Cooperative Soil Survey. This program uses standardized criteria to classify and map soils and provides the information to planners and landowners. SCS also provides management guidance to landowners through a conservation planning program to improve productivity primarily through erosion control methods. SCS works closely with the Agricultural Stabilization and Conservation Service (ASCS) to provide documentation and planning assistance to qualify landowners for ASCS cost-share funding for projects. SCS has been active in streambank stabilization projects in the Carmel Valley. SCS also works closely with the local Resource Conservation District (RCD) to assist with ASCS funding programs. The Monterey Coast RCD encompasses the Carmel River watershed.

Environmental Protection Agency (EPA): EPA is an independent federal agency that coordinates governmental action to protect the environment by abating and controlling pollution on a systematic basis. Federal water laws enable EPA to assume responsibility for ensuring the availability of a water supply that is adequate in quality for all beneficial purposes. The State Water Resources Control Board (SWRCB) is the state agency responsible for disbursing funding and applying EPA water quality rules.

Federal Emergency Management Agency (FEMA): FEMA is responsible for coordinating all federal emergency preparedness, mitigation, and response activities, including hazard mitigation, preparedness planning, relief operations, and recovery assistance. Flooding is one of the agency's main concerns. FEMA has conducted a flood hazard study in the Carmel Valley to determine the 100-year floodplain and develop flood insurance rate maps.

3. State Agencies

California Department of Fish and Game (CDFG): CDFG manages the fish and wildlife resources of the state. The Fish and Game Commission establishes policies and regulations to be implemented by the Department. The *California Fish and Wildlife Plan* (1986) guides the overall management, and the *Fish and Game Code* is the regulatory guide. Specific management plans such as the *Santa Lucia Deer Herd Plan* (1984) have been developed to implement policy locally. CDFG has permit authority for streambed alteration and waste discharge activities. Four branches of CDFG interact with water resources agencies:

- Anadromous Fisheries Branch - provides management and research input for anadromous fish concerns.
- Environmental Services Branch - ensures that fish and wildlife resources are protected or enhanced in water development projects.
- Inland Fisheries Branch - manages fisheries in inland waters and operates the state hatchery system.
- Wildlife Protection Branch - carries out law enforcement work.

The *Carmel River Watershed Management Plan* is funded through a grant from CDFG. The CDFG also administers funding for various types of habitat improvement programs from several special state funding sources.

Department of Water Resources (DWR): DWR has a wide range of functions, including formulation of coordinated plans for the control, conservation, protection, and use of state water

resources. DWR collects information on the quality and quantity of surface and groundwater resources, including information for the Carmel River basin. DWR is guided by the State Water Plan and utilizes the Regional Water Quality Control Boards to carry out many functions. Water development plans prepared by others are reviewed by DWR. The State Water Project that delivers water to Southern California and the Central Valley is operated by DWR.

State Water Resources Control Board (SWRCB): The water resources of the state are a commonly-held resource and, therefore, subject to appropriation and protection. Together with the nine regional water quality control boards (see discussion below), SWRCB regulates California's water resources, including the Carmel River watershed, and has responsibility for water rights and pollution control. The state board directs regional boards to plan and enforce water quality standards within their boundaries.

Central Coast Regional Water Quality Control Board (CCRWQCB): This agency is one of nine sub-units of the State Water Resources Control Board and is responsible for evaluating and establishing discharge requirements to protect water quality in the Central Coast area. Several discharge permits have been granted within the Carmel River watershed.

California Department of Parks and Recreation: The California Department of Parks and Recreation acquires, develops, and operates units of the state park system, as well as coordinating recreational programs statewide. Carmel Beach State Park, encompassing the Lagoon area of the Carmel River, is under the jurisdiction of this agency.

California Department of Forestry and Fire Protection (CDF): CDF is responsible for regulation of forest practices on private land within the state and for fire prevention and suppression activities in "State responsibility areas." Little, if any, timber harvest activity has or will occur within the Carmel River watershed, whereas fire protection is an ongoing function. CDF provides fuel management programs to reduce wildfire severity, thereby reducing subsequent erosion.

California Department of Transportation (Caltrans): Caltrans is responsible for the maintenance and administration of the California highway system. Caltrans is responsible for ensuring that highway designs are not harmful to the environment, including water quality. The Hatton Canyon freeway project and Highway 1 maintenance are under the jurisdiction of Caltrans.

California Public Utilities Commission (CPUC): The CPUC regulates the service and rates of privately-owned water, sewer, gas, electric, telephone, and transportation utilities and/or companies (such as Cal-Am). Publicly-owned utilities, such as the Seaside Municipal System, are generally not regulated by the CPUC.

California Coastal Commission: The California Coastal Commission is responsible for administering the State's coastal management program in accord with the amended California Coastal Act of 1976, which declares that the coast is a resource to be protected through the cooperative efforts of State and local governments. Within the coastal zone, the Commission has regulatory responsibility for public access, development, land and water use, natural resources, energy, transportation, recreation, and agriculture. It also assists local governments in their enforcement of permit requirements, hears permit appeals, studies proposed amendments to local plans, and reviews entire plans at least once every five years for conformity with State policies. The Commission also monitors energy development within the coastal zone and is required to designate areas inappropriate for power plants.

4. Regional Agencies

Association of Monterey Bay Area Governments (AMBAG): AMBAG is a voluntary association of the cities and counties in the Monterey Bay Region. Its membership includes the Counties of Monterey and Santa Cruz and 14 cities in these counties. AMBAG is the State-designated Metropolitan Planning Organization for transportation, the Areawide Housing Organization, the Regional Water Quality Planning Organization, and the Metropolitan Clearinghouse. AMBAG acts as the areawide clearinghouse for grant applications and environmental documents for the tri-county region that includes Monterey, Santa Cruz, and San Benito Counties.

Monterey Bay Unified Air Pollution Control District (MBUAPCD): This agency serves Santa Cruz, San Benito, and Monterey Counties. The district is responsible for developing an implementation plan for attainment of ambient air quality standards for key pollutants, and monitoring and regulating stationary sources of regional air pollution. This agency also reviews water development projects to determine consistency with the regional air quality control plan.

Monterey Peninsula Regional Park District (MPRPD): MPRPD operates Garland Ranch Regional Park. Garland Park is the site of major streambank restoration projects and provides unique outdoor opportunities to the local urban population.

Pebble Beach Community Services District (PBCSD): The Pebble Beach Community Services District provides wastewater treatment services to the Del Monte Forest area. The PBCSD owns one-third the capacity of the CSD/PBCSD joint treatment plant.

Carmel Sanitary District (CSD): CSD operates and maintains sewage collection and treatment facilities for the City of Carmel-by-the-Sea and adjoining areas. CSD is also under contract to the Pebble Beach Community Services District (PBCSD) to provide sewage treatment for the Del Monte Forest area. The CSD plant is the site of the proposed wastewater reclamation project.

County Service Areas (CSAs): Within the Carmel River watershed there are 16 CSAs that provide a variety of services such as storm drainage, fire protection, street maintenance, and street lighting outside established city limits. The Monterey County Board of Supervisors governs CSA activities and the Director of Public Works administers them.

Monterey Regional Water Pollution Control Agency (MRWPCA): MRWPCA is the largest sanitary district within the MPWMD boundaries. It manages five treatment plants on the Monterey Peninsula that serve Monterey, Pacific Grove, Sand City, Seaside, and Del Rey Oaks.

5. County Agencies

Monterey County Flood Control and Water Conservation District (MCFCWCD): The MCFCWCD provides the following services countywide: water supply data collection, flood hazard investigation, liaison with other agencies, flood center operation, coordination of FEMA programs, and provision of plan checks for subdivisions and other projects with regard to hydrologic impacts. Special assessment zones are established to provide specific services. Zone No. 11 encompasses essentially the same boundaries as the MPWMD. Zone No. 11 and MPWMD staff work closely to provide water resource planning for the Monterey Peninsula and Carmel Valley.

Monterey County Environmental Health Division (MCEH): A subdivision of the Monterey County Health Department, the Environmental Health Division is responsible for the welfare of county residents with regard to sanitation issues such as septic system and water system permitting,

restaurant conditions, toxic waste emergency response, and water well permitting. Under State delegation, the MCEH enforces regulations found in the *California Administrative Code* relating to these issues.

6. Water Suppliers

As part of its water management responsibilities, MPWMD regulates water supply for the 26 water distributors within its boundaries. The following paragraphs describe those systems which extract water from the Monterey Peninsula Water Resource System.

California-American Water Company (Cal-Am): Water for domestic and commercial use by 33,000 customers in the Monterey Peninsula area is supplied by Cal-Am, a privately-owned and operated water company and the largest of the water distribution systems located within the MPWMD boundaries. With an annual production capacity limit of 20,000 acre-feet, Cal-Am supplies about 82 percent of the water managed by MPWMD. The system was purchased by Cal-Am in 1965 from the Monterey Water and Telephone Company. Cal-Am draws from Carmel River surface water, alluvial groundwater, and Seaside Coastal groundwater to supply customer needs. American Water Works Company, the parent company of Cal-Am, is the largest private water company in the United States. The CPUC regulates Cal-Am rates.

Seaside Municipal System: The City of Seaside operates the only publicly-owned water system within MPWMD boundaries. The Seaside System has an assumed total annual production capacity of about 500 acre-feet.

Water West Corporation (WWC): Until 1989, the Del Monte Division of Water West Corporation supplied water to customers in the Carmel Valley Village area from four alluvial wells. The total production capacity of WWC is assumed to be about 500 acre-feet. Cal-Am now owns Water West, but operates it as a separate water distribution system.

Mutual Water Companies (MWC): 23 mutual water companies, each serving 2 to 31 customers are located within MPWMD boundaries. Seven of these systems draw water from the Monterey Peninsula Water Resource System. Most of these companies pump water from non-alluvial aquifers.

Private Wells: Approximately 300 private wells are located within MPWMD boundaries. The MPWMD administers an annual water usage reporting program for private wells and is responsible for regulating these wells only during water supply emergencies.

Table III-1 lists the 1986-87 base production levels for water distribution systems and private wells within the District's boundaries and the source of water supply for each. The table includes not only those systems drawing from the Monterey Peninsula Water Resource System (MPWRS), but also those drawing from the Seaside Inland Groundwater Subbasin (except for the Fort Ord System, which is not regulated by the District) and wells in the Cachagua, Carmel Valley Upland, and Laguna Seca areas. Figure III-1 shows the location of each of the water distribution systems within the District's boundaries.

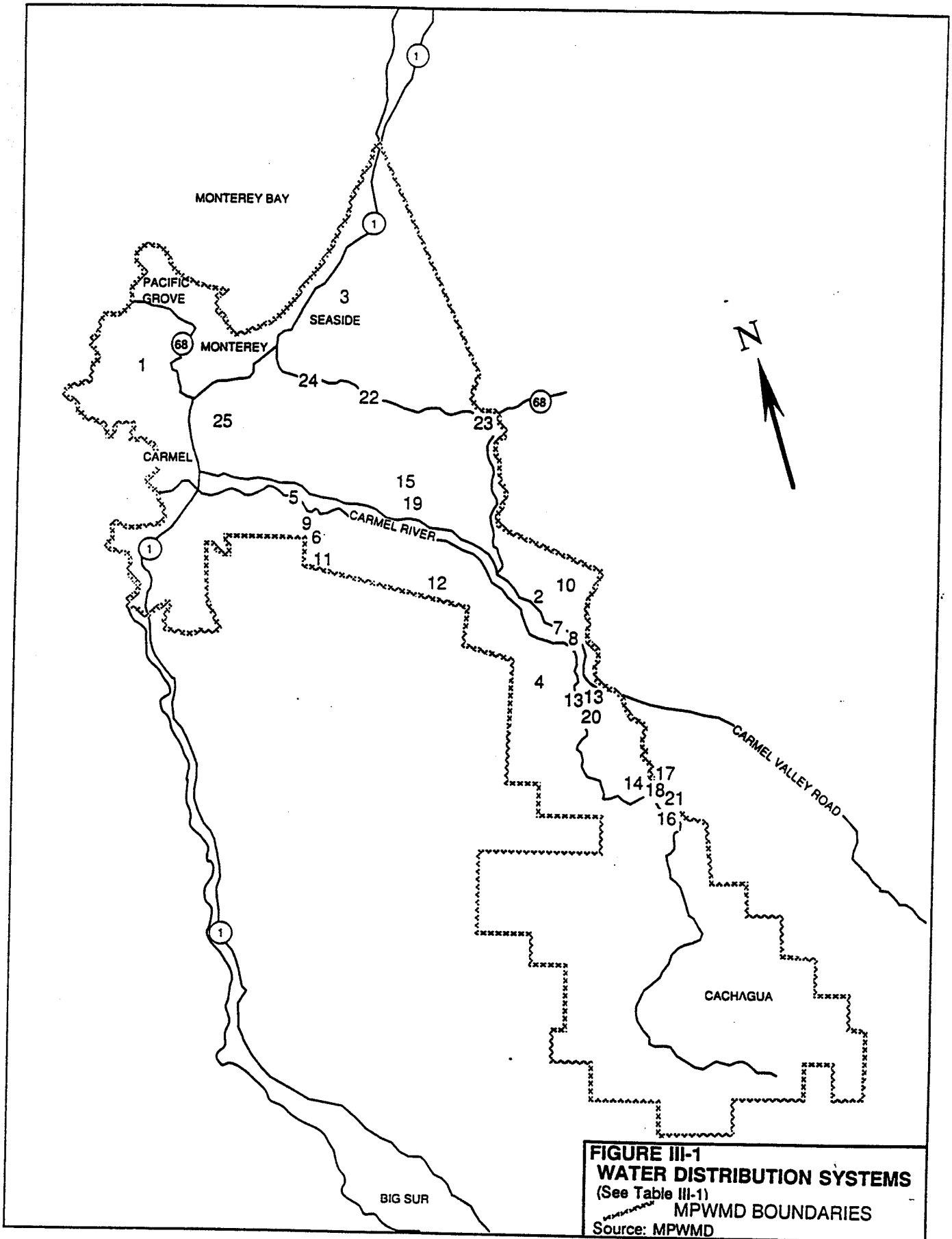


FIGURE III-1
WATER DISTRIBUTION SYSTEMS
(See Table III-1)
MPWMD BOUNDARIES
Source: MPWMD

TABLE III-1

WATER DISTRIBUTION SYSTEM AND PRIVATE WELL PRODUCTION
Monterey Peninsula Water Management District
July 1, 1986 to June 30, 1987

SYSTEM NAME	1986-87 PRODUCTION (Acre-Feet)	WATER SOURCE	MAP # (Figure II-1)
Within the Monterey Peninsula Water Resource System			
Cal-Am	17,828.3	CR/AQ1-4/SS	1
Seaside Municipal	490.8	SS	3
Water West	264.1	AQ2	2
Los Robles Road	7.0	AQ2	8
Rancho San Carlos Road	6.1	AQ3	5
Saddle Mountain	5.1	AQ3	6
Carmel Valley Road	2.6	AQ2	7
Riverside Park	2.0	AQ3	9
Rancho Fiesta Road 1 and 2	0.2	AQ2	19
Private Wells in AQ1	104.9	AQ1	
Private Wells in AQ2	98.4	AQ2	
Private Wells in AQ3	776.4	AQ3	
Private Wells in AQ4	1,045.2	AQ4	
Private Wells in Seaside Subbasin	334.2	SS	
Subtotal	**20,965.3**		
Outside of the Monterey Peninsula Water Resource System			
Bishop Water Company	127.0	LS	23
Carmel Valley Mutual	82.9	LS	22
P&M Ranch	76.3	CVU	13
Prince's Camp	36.9	CA	14
Sleepy Hollow	22.3	CVU	4
Moro Mini	17.3	CVU	20
Rancho Fiesta Mutual	10.2	CVU	15
Jensen Mobile Home	9.0	CA	16
Cachagua Road I: Brannan	6.0	CA	18
Schulte Road	3.1	CVU	11
Los Ranchitos De Aguajito	2.4	P	25
Tao Woods Mutual	1.4	CVU	12
Nason Road	1.4	CA	21
Country Club Road	0.7	CVU	10
Cachagua Road II: Jones	0.0	CA	17
Ryan Ranch	0.0	RR	24
Private Wells in Cachagua	70.1	CA	
Private Wells in the Carmel Valley Upland	21.4	CVU	
Private Wells in Laguna Seca Area	255.7	LS	
Miscellaneous Private Wells	11.1	P	
Subtotal	**755.2**		
TOTAL	**21,720.5**		

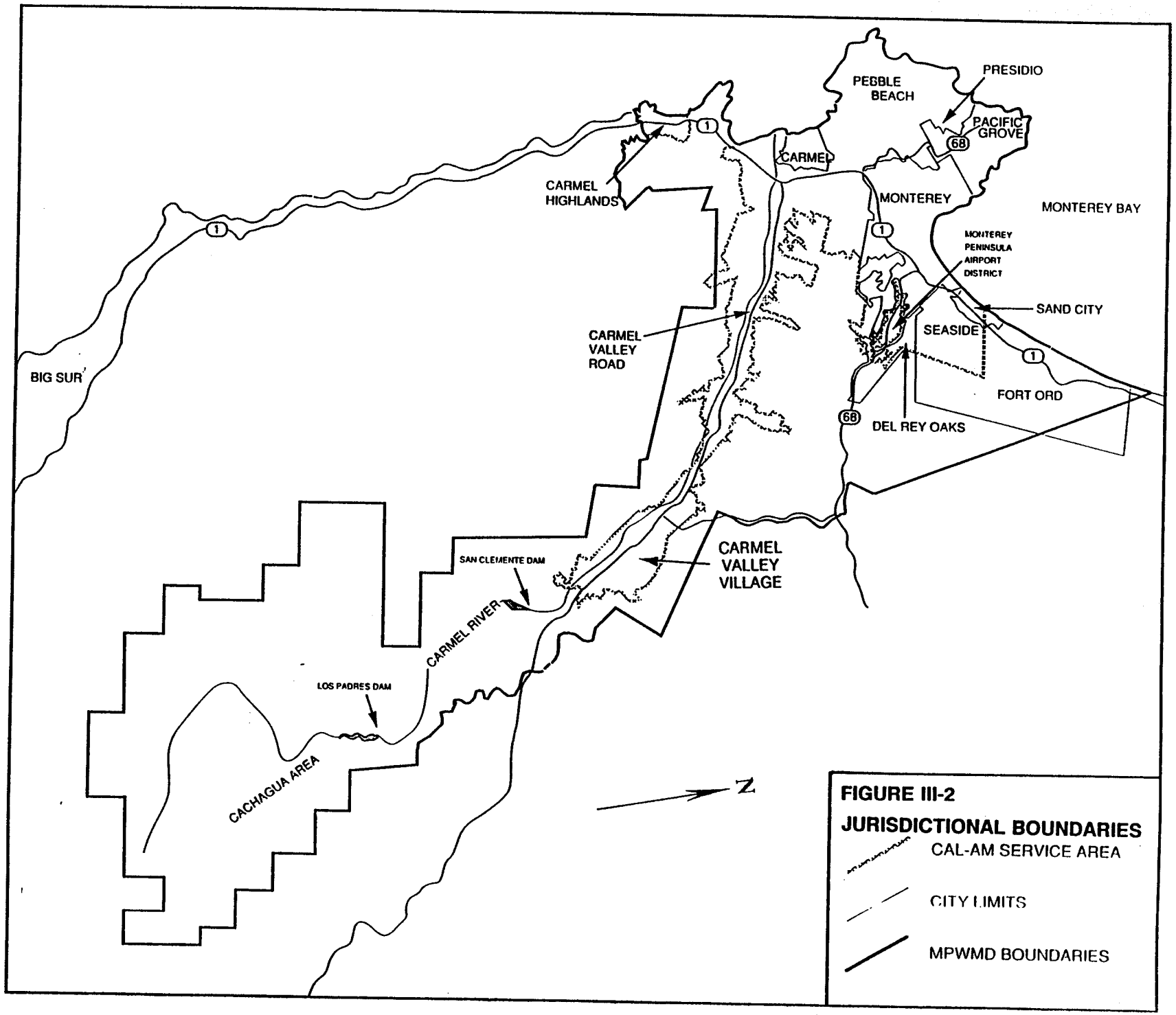
Key to Water Sources:

AQ1 San Clemente Dam to Esquiline Bridge
AQ2 Esquiline Bridge to the Narrows
AQ3 The Narrows to Via Mallorca Bridge
AQ4 Via Mallorca Bridge to the Ocean
CR Diversion from Carmel River
CA Cachagua Area
CVU Carmel Valley Upland
LS Laguna Seca Area
P Peninsula
SS Seaside Coastal Subbasin
RR Ryan Ranch

Source: *MPWMD 1986-87 Water Distribution System Report*, August 1988; *MPWMD 1986-87 Annual Well Reporting and Water Use Summary*, August 1987.

7. Affected Jurisdictions

Under MPWMD's Water Allocation Program, as proposed, eight local jurisdictions within the Cal-Am service area are allocated water. Each of these has authority to control land use within its boundaries. The agencies include the cities of Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City, and Seaside, Monterey County (only a portion of which is located within MPWMD boundaries and is subject to the District's Allocation Program), and the Monterey Peninsula Airport District. Figure III-2 shows the boundaries of these jurisdictions in relation to the Cal-Am service area and MPWMD boundaries.


PEBBLE BEACH
PRESIDIO
PACIFIC GROVE
CARMEL
CARMEL HIGHLANDS
MONTEREY
MONTEREY BAY
MONTEREY PENINSULA AIRPORT DISTRICT
SAND CITY
SEASIDE
CARMEL VALLEY ROAD
BIG SUR
FORT ORD
DEL REY OAKS
SAN CLEMENTE DAM
CARMEL VALLEY VILLAGE
CARMEL RIVER
LOS PADRES DAM
CACHAGUA AREA
N
FIGURE III-2
JURISDICTIONAL BOUNDARIES
CAL-AM SERVICE AREA
CITY LIMITS
MPWMD BOUNDARIES

C. NATURAL ENVIRONMENTAL SETTING

This section describes the natural environmental setting of the MPWMD, including the EIR's baseline conditions for natural resources.

1. Monterey Peninsula Water Resource System

The water resources of the Monterey Peninsula are complex and interrelated. They consist of both surface water (in the form of streams and reservoirs) and groundwater. These resources are used for recreation, irrigation, and municipal water supplies. Figure III-3 shows the hydrologic features of the Carmel River watershed.

Surface Water Resources

The 255-square-mile Carmel River watershed drains the rugged Santa Lucia Range and Sierra de Salinas Mountains (Figure III-3). Several small streams are tributary to the Carmel River, most of which enter in the upper watershed. Farther downstream, near Camp Stephani, the river enters the Carmel Valley. From here the river winds its way for 15 miles to the Pacific Ocean through a basin of well-developed river terraces. At the river's mouth lies a Lagoon created by entrapment of river flow behind coastal dunes.

Development of the river for water supply purposes around the turn of the century changed the hydrologic regime of this river. Regulation of streamflow began with the construction of water supply dams, the first of which, the old Carmel Dam, was constructed in the 1880s. San Clemente Dam, constructed in 1921, and Los Padres Dam, constructed in 1949, annually supply approximately 6,000 acre-feet of water to the Cal-Am service area. The reservoirs have a combined design capacity of 5,354 acre-feet, although siltation of the reservoirs has reduced this capacity to about 2,980 acre-feet. Since neither reservoir has flood control storage, they provide only a partial regulation of the river and have little impact on peak flows when the reservoirs are full. Peak streamflow is normally only affected by the dams during late fall or early winter when storage space is available due to summer drawdown for water supply (MPWMD, 1987).

Prior to development of dams and groundwater pumping in the watershed, the river was generally perennial (flowing year-round). Diversion of surface water and groundwater use have, however, transformed the hydrologic regime to that of an intermittent stream.

Streamflow in the Carmel River fluctuates widely in response to seasonal conditions. According to U.S. Army Corps of Engineers' estimates of monthly natural flow, surface runoff varies from essentially zero in summer to as much as 73,000 acre-feet per month in winter. It is not unusual to see the total annual flow of the Carmel River vary by 200 to 300 percent from one year to the next. The large fluctuation demonstrates the river's response to rainfall and to wet and dry years.

Estimates of unimpaired daily streamflows for the Carmel River at six locations--Los Padres, San Clemente, Robles Del Rio, Narrows, Near Carmel, and the Lagoon--were developed by MPWMD. These estimates were based on the Carmel River mainstem and tributary flows reconstructed by the MPWMD for use as input into CVSIM and covered the period October 1902 to September 1987. The estimates of unimpaired flow represent the Carmel streamflow that would have occurred without the influence of groundwater pumping, dams, and riparian evapotranspiration. A plot of these data, expressed as monthly flows at the Near Carmel site for water years 1930 to 1939 (Figure III-4), reflects the large monthly and annual variations described above. Also

depicted in this figure is the streamflow that was simulated with the Cal-Am production at 18,400 acre-feet per year (the current (1988) production rate).

In the Carmel Valley reach, late fall and early winter streamflow often seeps from the stream to the underlying aquifer in response to water table drawdown from pumping. During winter, the water table rises and seepage is reduced.

Erosion of the bed and banks has occurred along much of the Carmel River. The erosion is most likely a response to riparian vegetation die-offs due to groundwater extraction, extended drought, and a sediment imbalance due to the loss of sediment sources now trapped behind San Clemente and Los Padres dams.

Carmel River Lagoon: The Carmel River Lagoon is located at the mouth of the Carmel River where the river empties into Carmel Bay; the Lagoon retains water all year. During summer, a sand bar separates the Lagoon from the bay. The bar is formed when outflow from the Lagoon is insufficient to counteract the buildup of sand from wave action. During the rainy season, the County Public Works Department breaches the sand bar to reduce the flooding potential (Oliver 1989). During winter, the Lagoon outflow is usually sufficient to maintain the connection between the Lagoon and bay.

During summer, the Lagoon has a surface area of about six acres (Oliver 1989). Once the sand bar is breached and the Lagoon is contiguous with the bay, the surface area of the Lagoon fluctuates with the tides. Lagoon water level readings for 1988 and 1989 demonstrate the water levels during two drought years (Table III-2). The Lagoon is a brackish mixture of seawater, surface water, and groundwater. The salinity of the Lagoon water during winter is sometimes higher than in the summer, reflecting the salinity of the intruding ocean water (Table III-3 and Figure III-5).

Historical changes in the Lagoon were recently described by Philip Williams & Associates (1989). The report documents encroachment by development and agriculture into the wetlands. The Lagoon has experienced changes due to activities in the immediate vicinity of the Lagoon and also upstream. These changes have led to sedimentation of portions of the Lagoon, resulting in a shallow, narrow body of water.

Modifications to the Lagoon environment and to Carmel River flow have impacted the Lagoon. For example, diversions from the Carmel River for water supply have reduced the inflow to the Lagoon. A plan for the enhancement of the Lagoon is being prepared, and a draft report on Lagoon enhancement was released in 1989 (Oliver 1989).

Available data suggest a connection between the Lagoon and Carmel Valley Aquifer Subbasin AQ4 such that increased pumping in Subbasin AQ4 could affect water levels and freshwater inflow into the Lagoon (Staal, Gardner, and Dunne 1989).

The vegetation of the Lagoon is discussed further in Subsection C.2, "Vegetation."

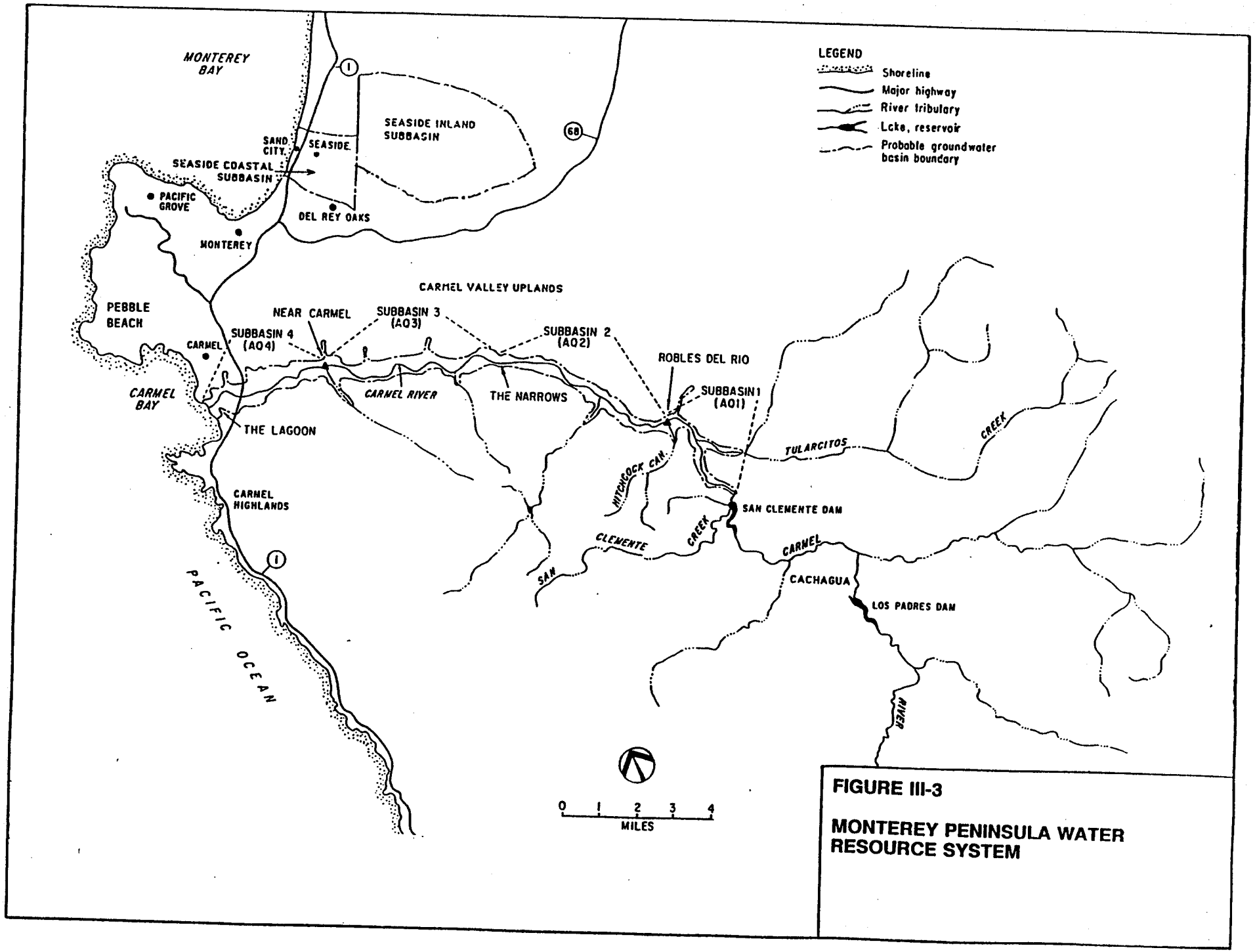
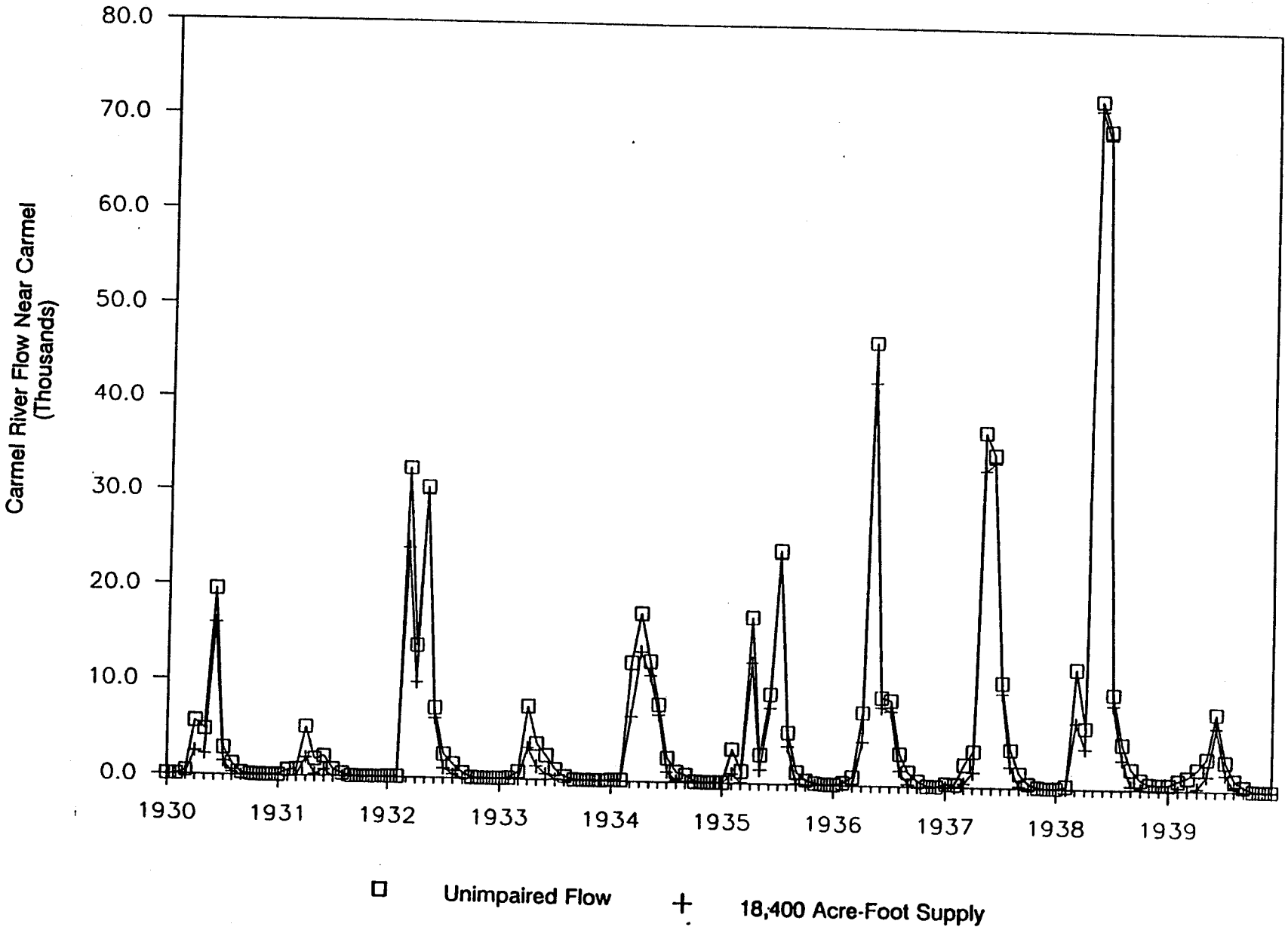


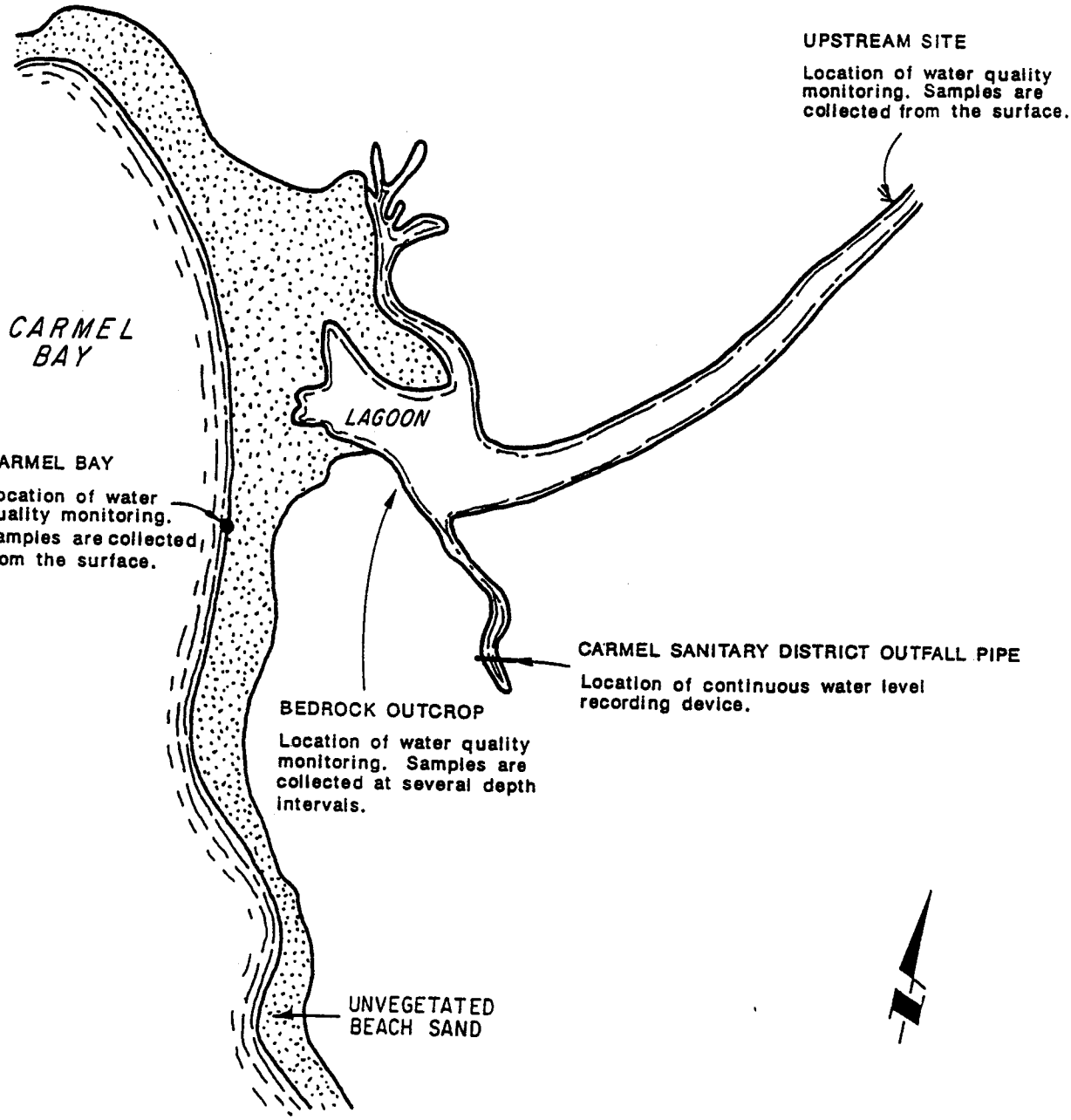
FIGURE III-3

MONTEREY PENINSULA WATER RESOURCE SYSTEM

FIGURE III-4
CARMEL RIVER FLOW NEAR CARMEL
Unimpaired Flow and Withdrawal-Affected Flow

1930 to 1940





Sketched from 1:6000 aerial photos flown on June 22, 1987

FIGURE III-5

MPWMD MONITORING LOCATIONS AT CARMEL RIVER LAGOON

Source: Adapted from Oliver, pers. comm.

TABLE III-2

CARMEL RIVER LAGOON WATER LEVEL READINGS

Date	Time	Water Level Elevation*	Notes
6/14/88	1030	4.72	
7/1/88	--	3.42	
7/15/88	0930	2.81	
7/21/88	--	2.62	
8/5/88	1245	2.63	
8/24/88	1015	2.58	
10/6/88	--	--	Notes indicate water level has risen since last reading
10/25/88	1645	2.92	
10/28/88	1045	2.94	
11/4/88	1500	3.26	
11/17/88	1300	4.18	
1/6/89	1045	4.93	
1/27/89	1445	4.56	
2/14/89	1510	4.29	Lagoon was breached at 1815 hours on 2/14/89
2/15/89	1625	3.81	
3/7/89	1230	3.89	Lagoon to be breached at 1600 hours on 3/8/89
3/8/89	0955	4.29	
4/7/89	1100	4.25	
6/2/89	1300	2.70	Water level is below transducer
6/13/89	1023	2.55	New recorder chip started at 1400 hours
7/4/89	--	--	
8/8/89	--	2.27	
8/11/89	--	2.27	Water is not continuous in South Arm
11/10/89	1015	3.27	

Note: -- = Data not collected.

*Based on 11/25/88 elevation survey of reference point on Carmel Sanitary District outfall pipe by G. Matthews. Elevation of blue line = 6.22 feet.

Source: Oliver pers. comm.

TABLE III-3

CARMEL RIVER LAGOON WATER QUALITY

		Carmel Bay				Bedrock Outcrop					Upstream Site			
Date	Time	Water Temperature(°C)	Conductivity (µmhos)	CO_2 (mg/L)	DO (mg/L)	Sample Depth(ft)	Water Temperature(°C)	Conductivity (µmhos)	CO_2 (mg/L)	DO (mg/L)	Water Temperature(°C)	Conductivity (µmhos)	CO_2 (mg/L)	DO (mg/L
3/16/88[1]	1030	--	--	--	--	0.5	--	14,500	--	--	--	--	--	--
3/17/88[2]	0950	--	--	--	--	0.75	--	26,500	--	--	--	--	--	--
3/18/88	1030	12.0	48,800	--	--	0.5	13.0	--	--	--	17.0	24,000	--	--
						1.0	13.5	27,200						
						2.0	14.0	31,000						
3/21/88[3]	1340	--	--	--	--	1.0	17.0	26,000	--	--	--	--	--	--
						2.0	16.5	25,800						
3/24/88[4]	1530	10.0	49,600	--	--	1.0	16.5	24,800	--	--	24.0	17,200	--	--
						2.0	16.5	24,800						
4/12/88	0930	12.0	48,500	--	--	0.0	15.5	12,000	--	--	--	--	--	--
						1.0	15.3	15,200						
						2.0	15.8	16,500						
4/28/88[5]	0930	11.0	49,900	--	--	0.0	17.0	17,900	--	--	19.0	16,600	--	--
						1.0	17.0	18,000						
						1.8	17.5	18,100						
5/3/88	1100	10.5	50,100	--	--	0.0	17.0	17,600	--	--	18.0	17,100	--	--
						1.0	17.5	18,100						
						1.8	17.5	18,100						
5/12/88	1030	11.0	51,500	--	--	0.0	20.0	15,500	--	--	21.5	16,500	--	--
						1.0	19.5	16,000						
						1.8	19.5	16,000						
8/24/88	1100-1230	19.3	2,300	--	4.4	0	21.9	6,450	--	8.7	25.0	4,000	--	8.4
						1	22.0	6,450	--	8.7				
						2	21.5	6,450	--	8.4				
10/6/88	1000-1200	16.1	2,380	82	4.7	0	17.9	3,050	16	9.3	--	--	--	--
						1	17.8	3,100	16	9.3				
					2	17.8	3,100	18	9.6					
10/28/88	1045-1245	13.7	2,100	112	2.3	0	13.9	2,500	28	8.7	14.5	2,280	37	10.3
						1	13.9	2,550	30	8.6				
						2	13.9	2,550	28	8.7				
11/17/88	1300-1500	12.8	3,300	83	6.1	0	13.9	5,500	44	9.9	15.2	3,300	60	4
						1	13.9	5,500	44	9.9				
						2	14.0	5,500	46	9.8				
1/6/89	1045-1250	8.2	5,650	51	8.4	0	8.9	5,750	51	9.3	--	--	--	--
						1	9.2	5,300	46	9.5				
						2	9.3	5,300	46	9.4				
						3	9.8	5,250	44	9.9				

TABLE III-3
(Continued)

Date	Time	South Arm[6]				Bedrock Outcrop					Upstream Site			
		Water Temperature(°C)	Conductivity (µmhos)	CO_2 (mg/L)	DO (mg/L)	Sample Depth(ft)	Water Temperature(°C)	Conductivity (µmhos)	CO_2 (mg/L)	DO (mg/L)	Water Temperature(°C)	Conductivity (µmhos)	CO_2 (mg/L)	DO (mg/L
1/27/89	1445-1650	12.0	5,250	96	9.6	0	11.0	5,300	42	10.8	14.2	3,800	55	7.6
						1	10.8	5,300	41	10.7				
						2	9.9	5,300	42	10.7				
2/14/89		13.8	4,200	74	7.7	0	11.2	4,100	35	10.7	–	–	–	--
						1	11.3	4,100	37	10.7				
						2	11.5	4,100	37	10.7				
						3	11.8	4,350	36	10.9				
2/15/89	1600-1715	13.1	4,200	81	7.8	1	12.2	5,800	38	10.2	–	–	–	--
2/16/89	1215-1245	–	–	–	–	1	11.9	5,700	30	9.9	–	–	–	--
3/7/89[7]	1030-1430	16.8	9,700	64	12.8	0	16.5	10,700	30	7.4	21.4	6,400	--	14.2
						1	16.2	10,700	32	8.0				
						2	15.0	10,700	30	8.5				
						3	17.0	10,600	–	6.2				
3/8/89	1000-1230	16.5	10,200	63	9.9	1	14.9	26,000	35	7.1	19.7	10,300	--	13.8
4/7/89	0945-1115	23.6	22,000	55	6.2	0	22.6	22,000	37	6.9	–	–	–	--
						1	21.2	24,000	38	6.8				
						2	21.2	22,000	39	6.7				
6/2/89	1300-1500	18.2	3,400	84	4.0	0	19.8	9,700	–	14.3	19.8	16,500	50	12.0
						1	19.9	9,700	72	14.1				
						2	20.0	9,700	–	14.5				
7/4/89	1100-1200	–	–	–	–	0	22.2	9,750	–	11.8	–	–	–	--
						1	21.3	9,800	10	9.6				
8/11/89	1040-1140	–	–	–	–	0	17.3	5,000	3	12.5	–	–	–	
						1	17.9	5,650	28	4.1			--	
10/11/89	0915	12.2	15,500	59	9.6	0	11.2	15,500	56	9.4	–	–	–	–
						1	11.0	15,500	54	9.4				
						2	11.0	15,500	56	9.2				
						2.5	11.0	15,500	52	9.2				

[1]Lagoon breached 15 Mar at 1200, now closed by waves.
[2]High tide at 0934.
[3]High tide at 1330.
[4]High tide at 1747.
[5]High tide at 0913.
[6]Carmel Bay measurements not taken.
[7]The salinity index may have been incorrectly set while adjusting the O_2 solubility to sample temperature; therefore, DO results for this day may have been in a range ± 4 mg/L of that value listed.

-- = Data not collected.

Source: Oliver, pers. comm.

Groundwater Resources

The Cal-Am water system derives its groundwater supplies from the Carmel Valley Aquifer and the Seaside Coastal Groundwater Subbasin.

Carmel Valley Aquifer: Over the last 10,000 years, Carmel River floods have deposited layers of boulders, gravel, sand, silt, and clay in the Carmel Valley. This material, averaging from 50 to 100 feet thick, is the principal water-bearing geologic formation of the valley.

The aquifer is unconfined, with about 85 percent of the inflow to the aquifer coming from the Carmel River. The remaining inflow comes from percolation, lateral inflow from tributaries, agricultural return flow, and septic tanks. The discharge from the aquifer includes groundwater pumping, flow to the ocean, and vegetative evapotranspiration.

Estimates of the total stored water volume of this unconfined aquifer range from 40,000 acre-feet to 80,000 acre-feet. The usable volume of the aquifer is much less, estimated at about 28,500 acre-feet (Oliver, pers comm). The aquifer is underlain by a bedrock surface which extends up to 180 feet below sea level. Uplift from the Cypress Point fault modifies the aquifer along the coastal portion of the aquifer. The uplift presents a partial barrier to groundwater movement and reduces the aquifer cross sectional width from about 3,000 feet to less than 500 feet (Staal, Gardner, and Dunne 1989). Estimates are that the coastal portion of the Carmel Valley Aquifer (west of Highway 1) has about 8,000 acre-feet of stored groundwater (Staal, Gardner, and Dunne 1989).

During summer months, when recharge is low, the aquifer is drawn down by pumping. The drawdown is often sufficient to fully deplete the Carmel River flow. The rate of recharge is, however, rapid and the aquifer is replenished under normal winter runoff conditions. This recovery is due to the high recharge rate as well as the fact that the depleted aquifer volume is small relative to the normal winter runoff available for percolation to the groundwater.

Groundwater extraction from the Carmel Valley Aquifer includes pumping by both Cal-Am and non-Cal-Am wells. Estimated non-Cal-Am well production from the Carmel Valley Aquifer for the 1986-87 base year is shown in Table III-4.

TABLE III-4

NON CAL-AM WELL PRODUCTION
Carmel Valley Aquifer
July 1, 1986 to June 30, 1987

Aquifer Subbasin	Number of Wells	Gross Production (Acre-Feet)
AQ1	2	104.9
AQ2	31	372.3
AQ3	67	789.6
AQ4	14	1,045.2
Total	**114**	**2,312.0**

Source: MPWMD Well Reporting Records

Seaside Coastal Groundwater Subbasin: The Seaside Groundwater Basin encompasses a 24-square-mile area that is subdivided into the Inland Subbasin underlying Fort Ord, the Laguna Seca Subbasin, and the Seaside Coastal Subbasin, underlying Seaside.

The Seaside Coastal Subbasin contains three formations of water-bearing strata: Aromas, Paso Robles, and Santa Margarita Formations. The groundwater basin has been studied extensively by several investigators, most recently by Staal, Gardner, and Dunne (1987). The Aromas formation is the upper water-bearing unit and is of minor importance in the basin. The Paso Robles formation is the middle aquifer and is the primary source of water supply for the Coastal Subbasin. The Paso Robles formation extends offshore and contains about 81,000 acre-feet of groundwater in the storage below sea level (Staal, Gardner, and Dunne 1987). The Santa Margarita formation is the deepest aquifer and has been developed only to a limited extent.

Cal-Am, City of Seaside, and private users extract water from the Seaside Coastal Subbasin (Table III-5). Pumpage from the basin averaged about 3,800 acre-feet per year during the 1970-86 period, with peak values as high as 5,600 acre-feet per year. About 322 acre-feet of water was pumped from the Seaside Coastal Subbasin in 1986 by private entities (Staal, Gardner, and Dunne 1987). Significant water level decline was experienced during the mid-1970s when pumping was high. Reductions in pumping in the early and mid-1980s allowed water levels to recover, but increased pumping during the late 1980s has resulted in water level declines in some areas.

TABLE III-5

SUMMARY OF GROUNDWATER PRODUCTION
Seaside Coastal Subbasin
(Acre-Feet)

Calendar Year	Northern Subbasin (Cal-Am)	Southern Subbasin (Cal-Am)	Fort Ord Subbasin (Fort Ord)	City of Seaside (Seaside Muni)	Private (Misc.)	Total
1955	198	0			200	398
1956	203	4			200	407
1957	243	1			200	444
1958	302	0	103		200	605
1959	438	225	6		200	869
1960	544	199	7		200	950
1961	708	260	13		200	1,181
1962	523	274	21		200	1,018
1963	444	273	54		200	971
1964	711	261	131		200	1,303
1965	692	229	125		200	1,246
1966	1,912	788	16	123	200	3,039
1967	2,459	179	139	176	200	3,153
1968	2,923	559	350	266	200	4,298
1969	2,400	222	353	332	200	3,507
1970	3,191	618	343	450	200	4,802
1971	3,967	342	246	450	200	5,205
1972	4,316	384	297	478	200	5,675
1973	3,607	369	294	488	200	4,958
1974	3,353	238	273	496	200	4,560
1975	3,243	157	292	514	200	4,406
1976	3,717	512	341	537	200	5,307
1977	2,580	113	310	233	200	3,436
1978	1,685	34	255	335	200	2,509
1979	1,660	0	282	436	200	2,578
1980	2,201	7	179	485	250	3,122
1981	2,300	30	45	457	250	3,082
1982	925	0.2	157	490	250	1,822
1983	1,658	5	357	514	250	2,784
1984	1,681	105	393	514	250	2,943
1985	2,045	106	456	492	250	3,349
1986	3,328	197	377	477	322	4,701
Avg. '82 to '86	1,927	83	348	497	264	3,119
Avg. '70 to '86	2,674	189	288	462	225	3,838

Source: Staal, Gardner & Dunne, Inc., 1987

The long-term yield of an aquifer is the rate at which the groundwater can be withdrawn without causing long-term decline in the water table or piezometric surface. The long-term yield is roughly equal to the recharge rate of the aquifer. Staal, Gardner, and Dunne (1987) estimated that the Seaside Coastal Subbasin could safely yield about 3,475 acre-feet per year. This value could be exceeded without damaging the aquifer, but only for short periods (Staal, Gardner, and Dunne 1987). Additional analysis and evaluation of the hydrology of the Seaside Coastal Subbasin is currently (1990) being conducted.

Seawater Intrusion

The Carmel Valley Aquifer and Seaside Coastal Subbasin discharge into the ocean. The steady groundwater outflow helps prevent seawater from intruding into the aquifers. If allowed to occur, seawater intrusion could render portions of the aquifer unusable as a water supply.

Staal, Gardner, and Dunne (1989) found that, although there is potential for seawater intrusion into the Carmel Valley Aquifer, the extent of such intrusion is likely to be restricted. Calculations of the depth to the freshwater/seawater interface suggest the interface is located below the bedrock outcrop. This makes the location of the interface relatively insensitive to minor pumping-induced perturbations in the aquifer. Furthermore, some level of protection from seawater intrusion is provided by the uplifted Cypress Point fault block, which greatly restricts the area of the freshwater/seawater interface. Staal et al. (1989) examined the addition of a single well in Subbasin AQ4 producing 1,000 acre-feet per year and found it had only a minor effect on the freshwater/seawater interface. The past and present water supply operation of the Carmel Valley Aquifer has allowed sufficient groundwater storage to prevent seawater intrusion. This water management is also assumed in the operation of CVSIM.

A few shallow wells located close to the coast and penetrating the Aromas formation of the Seaside Aquifer have shown evidence of seawater intrusion. These wells have been abandoned and presently no municipal wells draw their supply from this limited resource. There is, however, no evidence of seawater intrusion in the Paso Robles formation, partly due to the storage of water in the Paso Robles formation offshore (Staal, Gardner, and Dunne 1987).

The offshore storage serves as a buffer against encroachment of seawater during short-term periods of increased pumping demand from the subbasins. The subbasins' ability to meet pumping demands well in excess of the long-term yield for several years without negative effects on water quality was demonstrated during the 1970s. The Seaside Coastal Subbasin can effectively be utilized to offset short-term increased Cal-Am system demand during dry periods.

2. Vegetation

There are three principal vegetation communities on the Monterey Peninsula: the riparian communities along the Carmel River; a wetland community at the Carmel River Lagoon; and upland vegetation communities on the Monterey Peninsula and above the Carmel Valley.

Importance of Riparian Vegetation

Riparian vegetation communities, which are found along most portions of the Carmel River corridor, are adapted to wide yearly and seasonal fluctuations in flow volumes, an abundance of floodplain moisture, and a dynamic erosion-deposition cycle. These communities share the following features:

- Dependency on a relatively constant supply of water from surface water or groundwater.
- Conspicuous zonation parallel to the waterways on gravel bars, and low and high terraces.
- Marked contrast and abrupt transitions from riparian to adjacent terrestrial communities.
- Extensive ecotonal edge (i.e., transition between ecosystems) due to the linear distribution of riparian communities along river channels, and the interwoven mosaic of various riparian community types.

Riparian vegetation is important to a riverine system because of its many resource values. Riparian habitats support a wide diversity of plant and wildlife species whose numbers are disproportionately large relative to the areal extent of the habitat. They play an important ecological role, with many plant and animal species dependent on them, including a number of legally-protected species. Riparian habitats serve humans directly by forming a buffer between rivers and streams and intensively managed farmlands and urban landscapes; by enhancing water quality through filtration of surface runoff; by stabilizing stream banks; and by moderating flood flows. Riparian habitat is further enhanced in importance by its current scarcity relative to its historic extent and by the threat to remaining stands (Murray, Burns, and Kienlen 1978, Brice 1977, Katibah 1984, Groeneveld and Griepentrog 1985).

California's riparian forests originally covered several million acres, including the central coast riparian woodland found along the Carmel River (Roberts et al. 1980). The state's riparian forests have, however, been reduced to thousands of acres. California's Central Valley alone has lost 90 percent of its natural riparian corridors, with approximately half of what remains in a disturbed or degraded condition (Katibah 1984).

Carmel River Valley Riparian Vegetation

Historical Extent. Historically, riparian vegetation along the Carmel River was more extensive than it is today. Changes in the course of the Carmel River due to major flooding prior to 1911 and a degradation of the streambed since the construction of the San Clemente Dam in 1921 has resulted in a narrower, more sinuous stream channel with higher floodplain terraces. Riparian vegetation had encroached on the lower terraces in the lower 9 miles of the Carmel River by 1939, and by 1960 the lower 15 miles had developed extensive riparian forest cover (Kondolf and Curry 1984). Pre-1960 aerial photographs indicate that at that time the river supported a continuous cover of riparian forest (Groeneveld and Griepentrog 1985).

Most of this riparian vegetation in the lower nine miles has been markedly reduced. By analyzing a series of aerial photographs from 1956 to 1980, Groeneveld and Griepentrog documented the gradual loss of riparian forest cover. 1956 photos show extensive riparian forest cover. The river corridor from the ocean to approximately four miles inland still supports a continuous red willow forest. By 1980, however, this riparian forest had generally been reduced to a narrow strip lining the riverbank (Groeneveld and Griepentrog 1985). Upstream to the Narrows, the Carmel River riparian corridor has been reduced to an even greater extent.

Loss of riparian habitat can generally be attributed to human activities such as land clearing for agriculture and urban development and groundwater pumping, which lowers the water table. Groeneveld and Griepentrog reported that the decrease of the riparian corridor cover immediately adjacent to the Carmel River in portions of Aquifer Subbasin AQ3 coincided with the gradual development of the Monterey Peninsula and use of wells to export groundwater to meet the increasing demand for water.

Along this portion of the Carmel River (approximately from the Schulte Well to the Berwick Wells) tree pathogens, fire, and encroachment by man have been eliminated as possible causal agents for the decline of the riparian forest since 1956 (Groeneveld and Griepentrog 1985). Analysis of aerial photography provided by the MPWMD indicates that urban and agricultural encroachment are responsible for only a minor portion of the loss of riparian vegetation in this section of the Carmel River. Prior to 1956, however, loss of riparian vegetation beyond the immediate corridor lining the channel bank was primarily a result of agricultural development.

Natural causes, such as droughts, may also have contributed to the decline of riparian vegetation, although during the drought of 1976-1977 the riparian vegetation remained largely unaffected at locations where no producing wells were located (Kondolf and Curry 1984).

Floods can also affect riparian vegetation by eroding banks and creating new channels eliminating bank and channel vegetation. This occurred along the Carmel River upstream of the Schulte Road Bridge during the 1980 flood. This bank erosion appears, however, to be related to a decline in riparian vegetation health that coincided with groundwater pumping (Kondolf and Curry 1984, Groeneveld and Griepentrog 1985). Historical changes in channel pattern and form, and most likely in developing riparian vegetation due to floods, have been documented since 1858 (Kondolf and Curry 1985).

Upstream of the Narrows, the Carmel River has historically migrated laterally, continually changing the nature of the river. Much of the change in the upper Carmel River's channel and associated riparian vegetation may be due to the inherent instability of this steeper reach of the River (Kondolf and Curry 1986).

Relationship of Riparian Vegetation and Bank Stability. Severe riverbank failures have occurred recently along the Carmel River during relatively minor storm flows. Most of these failures were centered around areas of extensive vegetation loss. While it is clear that thriving vegetation along the channel promotes bank stability, especially along the lower and middle Carmel River banks (which are composed of unconsolidated sands and gravel lacking cohesive strength), the extent to which vegetation loss was responsible for Carmel River erosion problems has been disputed. Bank erosion in portions of subbasin AQ3 has been reported to be caused primarily by river downcutting due to entrapment of sediment behind San Clemente Dam and was not related to groundwater pumping (CH2M Hill 1978 and Hydro Data 1981, as reported by McNiesh 1986). As previously mentioned, some studies of historic river channel patterns indicate that groundwater pumping and consequent vegetation loss directly caused bank erosion (Kondolf and Curry 1984, Groeneveld and Griepentrog 1985).

Existing Vegetation. Three types of riparian communities have been mapped along the Carmel River: riparian forest, riparian woodland thicket, and riparian scrub. These plant communities are dominated by species that are hydrophytic (water loving) and phreatophytic (sending deep root systems into underground water sources).

The multistoried riparian forest consists of an overstory canopy (35 to 60 feet tall), a shrub layer 15 to 35 feet tall), and understory vine vegetation. Black cottonwood (*Populus trichorcarpa*) dominates the overstory canopy, which contains an occasional sycamore (*Platanus racemosa*). White alders (*Alnus rhombifolia*) and yellow and red willows (*Salix lasiandra* and *Salix laevigata*) occupy the riverbank at water's edge. The shrub layer on the higher terraces is dominated by red willows and yellow willows, with occasional boxelders (*Acer negundo*) and western dogwoods (*Cornus occidentalis*). Understory vegetation at most locations contains thick, tangled growths of wild blackberry (*Rubus ursinus*), poison-oak (*Toxicodendron diversilobum*) and wild rose (*Rosa californica*).

Riparian vegetation in the Carmel Valley draws on soil moisture and the Carmel Valley Aquifer. The Carmel Valley Aquifer has been divided into four subbasins for purposes of analysis (Oliver et al. 1987). Subbasin AQ1 extends westward from San Clemente Dam to Hitchcock Canyon; Subbasin AQ2 from Hitchcock Canyon to the Narrows; Subbasin AQ3 from the Narrows to Potrero Canyon; and Subbasin AQ4 from there to the river mouth (Figure III-3). Total and extractable water storage capacities are greatest in Subbasin AQ3, and existing commercial wells are concentrated in this subbasin.

Subbasin AQ1: Subbasin AQ1 is typified by steep canyon walls, perennial surface streamflow, and riparian vegetation restricted to a narrow floodplain. Recruitment of young willows and cottonwoods is evident in this portion of the Carmel River.

Subbasin AQ2: The river broadens in Subbasin AQ2 and varies between a perennial and intermittent stream depending on location and seasonal recharge. Riparian vegetation lining both river banks is generally continuous although it is occasionally disrupted where the channel broadens in more urban settings. Where streamflow is intermittent, riparian vegetation is dependent upon groundwater for growth and survival during dry periods.

Subbasin AQ3: Over the past 30 years, increasing commercial groundwater production has coincided with the loss of extensive sections of riparian woodlands in Subbasin AQ3. The correlation between groundwater pumping and vegetation loss has been documented repeatedly by ground survey (Zinke 1971, Kondolf and Curry 1984, Groeneveld and Griepentrog 1985). The extent of existing riparian vegetation around Cal-Am wells in Subbasin AQ3 is as follows:

San Carlos Well--relative to Subbasin AQ3, riparian vegetation is extensive at this site. A canopy of mature cottonwood, sycamore, and willow approximately 125 feet wide line both sides of the river. Approximately 8 acres of woodland thickets lie south of the river channel.

Cypress Well--a braided river channel with a wider stream bed is characteristic of the Carmel River at this location. Discontinuous riparian vegetation such as cottonwoods and sycamores, mixed with non-riparian species such as pines and cypress line the upper banks. Willows can be found on the upper terraces in the river channel. Revetment with tires has been used to control bank erosion.

Pearce Well--extensive urban development at this site has reduced the potential riparian habitat. Riparian vegetation of willows and isolated cottonwoods has been restricted to a narrow discontinuous corridor.

Schulte Well--the riparian corridor of willow thickets lining the river is very limited and discontinuous. Riverbank vegetation consists mainly of herbaceous cover in much of this area.

Manor Well--very little riparian vegetation can be found at this location. The remaining riparian corridor is dominated by red willow thickets. The MPWMD has begun an extensive revegetation program (the Schulte Restoration Project) to reestablish riparian woodland thicket on rocky terraces from this location downstream to the Schulte Well.

Begonia Well--downstream of this well the riparian vegetation is limited to small willows along the upper banks and on the rocky stream terraces. Non-wooded riverbanks are very common downstream from the Begonia Well. Upstream a narrow corridor of red willow and cottonwood lines the river's edge. A small riparian woodland thicket of several acres is located on the northern side of the river.

Berwick Wells--the riparian vegetation here is highly degraded. Steep river banks have been rip-rapped with rock and revegetated with willows to control erosion.

In response to the stress on the existing riparian vegetation caused by a reduction in available water, extensive irrigation practices have been initiated to supply adequate water to sustain the riparian corridor. Significant portions of the riparian corridor from the Scarlett Wells to the San Carlos Well are being irrigated with drip lines. Drip lines are also being used to irrigate existing riparian vegetation around the Cypress and San Carlos Wells as mitigation for permits Cal-Am received to drill these wells.

Existing riparian vegetation in Subbasin AQ3 is at least partially due to recent restoration projects. In response to the severe erosion losses in the storms of 1978, 1980, and 1983, the MPWMD, on the recommendation of a citizens' advisory committee, formed the Carmel River Management Program (CRMP) to provide erosion control assistance to property owners. The CRMP called for a series of comprehensive restoration projects proceeding along the river in a downstream direction. In fall 1984, the CRMP began to plant willows as a low-cost solution for erosion control. The interim relief plan for the Carmel River also includes an irrigation component to protect riparian vegetation in Subbasin AQ3.

Subbasin AQ4: Subbasin AQ4 is the broadest section of the Carmel River Valley near the mouth of the river. The upper canopy of the narrow, continuous riparian corridor in this subbasin consists of black cottonwoods and an occasional sycamore. Understory red and yellow willow are found along the river's edge. The riparian corridor is reduced at the upper reach of this subbasin due to the Rancho Canada Golf Course.

Throughout the lower and middle Carmel River reaches where streamflow is intermittent, (i.e., AQ3 and AQ4) riparian vegetation must rely on groundwater for growth and survival. Pumping groundwater depresses the water table. The degree to which this lowering of the groundwater stresses riparian vegetation during the growing season is influenced by several interrelated biological and physical site factors.

The relationship between groundwater levels, riverbank erosion, and the health of the riparian woodlands along the Carmel River has been a topic of substantial controversy for nearly 25 years (McNiesh 1986). A detailed study was designed by McNiesh (1986) to address the issue

of whether normal operation of the four "new" Cal-Am wells (Rancho Canada, San Carlos, Cypress, and Pearce) damaged nearby riparian vegetation.

The study findings indicated that the 1985 pumping schedule of the wells did result in sufficient groundwater drawdown to induce elevated water stress in the riparian vegetation. Results also indicated long-term operation of the wells at current pumping levels is likely to severely damage and endanger the stability of the present riparian community. Irrigation is suggested as an appropriate management strategy to mitigate vegetation losses.

In the event that production well pumping ceased and water was not extracted from the aquifer system, existing riparian vegetation may become unstressed, and riparian cover may stabilize and have the potential to increase if groundwater levels rise to the existing rooting zone of the riparian vegetation. McNiesh (1986) indicates riparian vegetation growing at a site where groundwater remained close to the surface, not exposed to well pumping, was not subjected to the summer, midday, and seasonal water stress levels as did riparian vegetation growing near Cal-Am production wells.

Williams (1988) summarizes the history of the riparian vegetation stress monitoring program along the Carmel River by the MPWMD and the complications involved with correlating stress to groundwater pumping.

Lagoon Vegetation

The Carmel River Lagoon, containing freshwater and salt marsh vegetation, is found at the mouth of the river and immediately adjacent to the sand bar which separates the wetland area from the Pacific Ocean. It lies within the Carmel River State Beach and is protected by the State. Currently, this high quality wetland area is a natural preserve in the State Park system.

Wetlands are important ecologically because they perform many functions, including water quality protection, flood control, sediment trapping, and shoreline stabilization (Washington State Department of Ecology 1988). Wetlands are also important for their habitat value to dependent plant and wildlife species and because of the current scarcity of wetlands relative to historic extent.

Before the Gold Rush began in the 1840s, California had five million acres of permanent and seasonal wetland habitat; approximately 450,000 acres currently remain (Reisner 1987).

Coastal salt marsh is one of the most fragile and rapidly-disappearing wetland habitats in California. The Carmel River wetland contains some of the last remaining habitat of this type on the Central California coast (Point Lobos State Reserve Citizen's Advisory Committee 1985). This wetland area supports several plant communities typical of coastal wetlands. Large areas are occupied by dense stands of California tule (*Scirpus californicus*) which are rooted in seasonally inundated muds. Slightly higher ground is occupied by a variable mosaic of shorter vegetation dominated by pickleweed (*Salicornia virginica*), fleshy jaumea (*Jaumea carnosa*), saltgrass (*Distichlis spicata*), spike-sedge (*Eleocharis macrostachya*), and three-square bulrush (*Scirpus americanus*). High marsh is dominated by silverweed (*Potentilla ededii* var. *grandis*), baltic rush (*Juncus balticus*), and fleshy jaumea.

Transition zones between wetland and upland at the northeastern edge of the marsh contain a variety of native and non-native herbaceous plants, including curly dock (*Rumex crispus*), wild radish (*Raphanus sativus*), bur-clover (*Medicago hispida*), cutleaf plantain (*Plantago coronopus*),

gum plant (*Grindelia sp.*), soft chess (*Bromus mollis*), and wild barley (*Hordeum leporinum*) (Point Lobos State Reserve Citizens' Advisory Committee 1985).

Upland Vegetation

Upland vegetation types and dominant plant species found on the Monterey Peninsula are shown in Table III-6. Of special interest is Del Monte Forest, a closed-cone conifer forest in the central portion of the Peninsula. This is the only known area where Monterey and Bishop pines occur together, and one of only two known areas where Monterey and Gowen cypress occur naturally (Griffin 1972).

Special Status Plant Species

Special-status plant species are defined to include species that are:

- Federally-listed, proposed, or candidates for threatened and endangered status (50 CFR 37958-37967);
- Listed by the State of California as threatened and endangered species or are candidates for listing (California Department of Fish and Game 1987);
- California Native Plant Society (CNPS) rare and endangered species (Smith and Berg 1988).

Special-status plants potentially occurring in the Cal-Am service area are listed in Table III-7. The Cal-Am service area includes the Carmel River Valley, Carmel River Lagoon and wetland, and potentially impacted upland areas.

TABLE III-6

VEGETATION TYPES AND DOMINANT SPECIES OF UPLAND AREAS WITHIN THE CAL-AM SERVICE AREA

Vegetation Type	Dominant Species	
	Common name	**Scientific name**
Coastal scrub	Coyote bush	*Baccharis pilularis*
	Sagebrush	*Artemisia* sp.
	Sage	*Salvia apiana*
	Buckwheat	*Eriogonum* sp.
Hardwood forest	Interior live oak	*Quercus agrifolia*
	Scrub oak	*Quercus dumosa*
	Madrone	*Arbutus* sp.
Coastal dune	Sea rocket	*Cahile maritina*
	Yellow sand verbena	*Abronia latifolia*
	Beach sagewort	*Atrtemisia pycnocephala*
	Evening primrose	*Oenothera cheiranthifolia*
	Douglas' bluegrass	*Poa douglassii*
	Black pea	*Lathyrus littoralis*
	Beach morning-glory	*Calystegia soldanella*
Closed-cone conifer forest	Bishop pine	*Pinus muricata*
	Monterey pine	*Pinus radiata*
	Monterey cypress	*Cupressus macrocarpa*
	Gowen cypress	*Cupressus Goveniana*
	Hooker manzanita	*Arctostaphylos hookeri*
	Salal	*Gaultheria shallon*
Chaparral	Chamise	*Adenostoma fasiculatum*
	Toyon	*Heteromeles arbutifolia*
	Ceanothus	*Ceanothus* sp.
	Coffeeberry	*Rhamnus californica*
	Scrub oak	*Quercus dumosa*
	Manzanita	*Arctostaphylos* sp.
	Sage	*Salvia* sp.

TABLE III-7

SPECIAL-STATUS PLANT SPECIES POTENTIALLY OCCURRING IN THE CAL-AM SERVICE AREA

Species	Status* Fed/State/CNPS	Habitat	Location (Within Cal-Am Service Area)
Gowen cypress *Cupressus Goveniana*	C2/ /1B	Closed-cone conifer forest	Carmel Highlands, Pebble Beach Area
Monterey cypress *Cupressus Macrocarpa*	C2/ /1B	Closed-cone conifer forest	Pebble Beach Area
Hickman's onion *Allium Hickmanii*	C1/ /1B	Closed-cone conifer forest	Monterey, Carmel-by-the-Sea, Del Rey Oaks, Carmel River Valley, Pebble Beach Area
Hutchinson's Larkspur *Delphinium Hutchinsoniae*	C2/ /1B	Hardwood forest	Pacific Grove, Carmel Highlands
Menzies wallflower *Erysimum Menziesii*	C1/Endangered/1B	Coastal dunes	Pacific Grove, Pebble Beach Area
Sandmat manzanita *Arctostaphylos Pumila*	C2/ /1B	Coastal dunes and closed-cone conifer forest	Monterey, Pebble Beach Area, Sand City, Carmel Highlands
Sand gilia *Gilia Tenuiflora* ssp. *Arenaria*	C1/Threatened/1B	Coastal dunes	Monterey, Del Rey Oaks, Sand City, Pebble Beach Area
Pacific Grove clover *Trifolium polyodon*	C2/Rare/1B	Closed-cone conifer forest	Pacific Grove, Pebble Beach Area
Seaside Bird's Beak *Cordylanthus Rigidus* ssp. *Littoralis*	C1/Endangered/1B	Closed-cone conifer forest, and chaparral	Monterey, Carmel-by-the-Sea
Hickman's cinquefoil *Potentilla Hickmanii*	C2/Threatened/1B	Coastal bluff and closed-cone conifer forest,	Pebble Beach Area, Pacific Grove
Tidestromes lupine *Lupinus Tidestromii* var. *Tidestromii*	C1/Endangered/1B	Coastal dunes	Pebble Beach Area, Pacific Grove
Monterey clover *Trifolium trichocalyx*	C2/Endangered/1B	Closed-cone conifer forest	Pebble Beach Area, Pacific Grove
Coastal dune milk vetch *Astragalus tener var. Titi*	C2/Endangered/1B	Coastal dunes	Pebble Beach Area
Jone's Layia *Layia Jonesii*	C2/ /1B	Chaparral	Pebble Beach Area

Continued.

TABLE III-7
(Continued)

Species	Status* Fed/State/CNPS	Habitat	Location (Within Cal-Am Service Area)
Santa Cruz microseris *Microseris Decipens*	C2/ /1B	Hardwood forest and closed-cone conifer forest	Del Rey Oaks
Central Valley malcothrix *Malcothrix Saxatilis* var. *Arachnoidea*	C2/ /1B	Chaparral	Carmel River Valley
Eastwood's ericameria *Ericameria Fasciculata*	C1/Endangered/1B	Closed-cone conifer forest	Pacific Grove, Carmel-by-the-Sea, Monterey, Carmel River Valley

*Federal: U.S. Fish and Wildlife Service
C1,C2 = Categories 1 and 2 are candidate species under review for federal listing for which the USFWS presently has information indicating that listing is probable, but for which further biological research is needed to determine threat. This category is administered by the amount of information available and not necessarily the status of the species.
State: California Department of Fish and Game (1988).
Endangered = endangered under the State Endangered Species Act
Rare = rare under the State Endangered Species Act
Threatened = threatened under the State Endangered Species Act
CNPS: California Native Plant Society (Smith and Berg 1988).
1B = rare and endangered.

3. Wildlife

Riparian communities along the length of the Carmel River and the Carmel River Lagoon wetland, described above, provide habitat for a diverse group of resident and migratory wildlife, including invertebrates, amphibians, reptiles, raptors, shorebirds, waterfowl, songbirds, and mammals. Wildlife species abundance and diversity is further enhanced by adjacent upland habitat. The significant decline, however, in California's riparian and wetland habitat at local, regional, and statewide levels, makes remaining riparian and wetland areas extremely valuable. Appendix D contains a listing of the common and scientific names of the species mentioned in this section.

Riparian Habitat

The habitat of most value to wildlife is the multistoried riparian forest. The tall cottonwoods and sycamores provide nesting habitat for cavity-nesting species such as the American kestrel and purple martin. Deer forage on poison-oak berries located in the riparian forest understory. Bird species such as the rufous-sided towhee and white-crowned sparrow use the cover of understory vegetation for foraging and nesting. Deer and many species of birds forage in the willows located in the riparian woodland and scrub habitat.

The Carmel River and its pools, as well as adjacent riparian habitat, provide food and shelter for numerous aquatic and terrestrial invertebrates. Invertebrates, in turn, are a food source for amphibians and reptiles, insectivorous birds such as dippers, warblers, northern flickers, downy woodpeckers, flycatchers, phoebes, and small mammals such as shrews, voles, bats, and mice.

Amphibians and reptiles represent important ecological components of riparian communities. In California it is estimated that riparian systems provide habitat for 83 percent of the amphibians and 40 percent of the reptiles (Brode and Bury 1984).

At least nine species of amphibians are reported to occur within the Carmel River riparian zones (Williams 1983a, Stebbins 1985). Three of these, the red-legged frog, foothill yellowlegged frog, and bullfrog, occur in riparian systems throughout their lives. The California newt, western toad, and Pacific treefrog utilize riparian systems primarily for breeding, but may leave the riparian zone as adults. The ensatina, California slender salamander, and arboreal salamander inhabit riparian zones, but are less dependent on these areas than the species above (Brode and Bury 1984).

Reptiles dependent on riparian areas include the common garter snake, western aquatic garter snake, and western pond turtle. The western skink, northern alligator lizard, and ringneck snake depend on riparian systems in portions of their range, preferring moist habitats. The western fence lizard, striped racer, gopher snake, and western rattlesnake use riparian systems for cover and foraging.

Bird species abundance and diversity along the Carmel River varies directly with the abundance and diversity of riparian vegetation. Williams (1983b) observed 62 different species of birds along the Carmel River riparian corridor, 38 of which were considered dependent on riparian vegetation. Typical avian species occurring in the corridor include great blue heron, belted kingfishers, black-crowned night heron, northern flicker, scrub jay, chestnut-backed chickadee, Wilson's warbler, warbling vireo, and song sparrow. The mouth of the Carmel River is a well known "vagrant trap" based on the regular occurrence of disoriented bird species that occur in spring and fall (Roberson 1985).

Raptors that commonly frequent these riparian habitats include the turkey vulture, red-tailed hawk, kestrel, and black-shouldered kite. The Cooper's hawk (see "Special-Status Wildlife Species") utilizes riparian habitats for roosting, foraging, and nesting. Wintering raptors that may occur in the area include the sharp-shinned hawk, northern harrier, osprey, and bald eagle. The osprey and the bald eagle are winter residents on Lake San Antonio.

Mammals such as the striped skunk, raccoon, gray fox, coyote, and bobcat range through the area and use the riparian system for foraging as well as for cover and travel. Black-tailed deer inhabit the riparian vegetation, which provides food and cover as well as fawning areas and travel routes.

Carmel River Lagoon

Wetlands are one of the most valuable wildlife habitats in California. The Carmel River Lagoon contains freshwater and salt marsh vegetation habitats, which have declined substantially throughout the state. There has been a 70 percent decline in acres of coastal salt marsh statewide since the turn of the century (U. S. Fish and Wildlife Service 1979).

The Carmel River Lagoon wetlands provide drinking, foraging, bathing, and breeding areas for a variety of wildlife. An abundant supply of invertebrates provide food for wading birds such as herons, egrets, rails, and ducks. Insectivorous birds such as swallows feed on the insect populations. Tule stands provide cover and nesting habitat for species such as the Virginia rail, American bittern, sora, red-winged blackbird, and song sparrow.

Amphibian and reptile populations are low in the Lagoon wetlands. The black legless lizard (see "Special-Status Wildlife Species") occurs in the sandy area between the parking lot and the open water adjacent to the marsh (California Department of Parks and Recreation 1985).

Upland Habitat

The area within the MPWMD boundaries includes several upland wildlife habitats based on the plant communities described in Subsection C.2.,"Vegetation Setting," and in Table III-2. The plant communities include conifer and hardwood forest, coastal scrub, chaparral, and coastal dune.

Conifer and hardwood forests support the greatest number of species, most of which are birds. Accipiters, owls, woodpeckers, nuthatches, and Stellar's jays use the forest for foraging and cover. Salamanders may spend their entire life cycle within the forest. Species such as cavity nesters, gray squirrels, and band-tailed pigeons require the forest for nesting. Black-tailed deer use the forest for resting and feeding.

Coastal scrub habitat provides food and cover for a number of wildlife species, including rufous-sided towhees, pocket gophers, ground squirrels, and meadow voles. Gray foxes, coyotes, and red-tailed hawks prey on birds, rodents, and reptiles also found in coastal scrub.

Chaparral habitat has relatively little structural diversity and therefore supports fewer wildlife species. Wildlife commonly inhabiting chaparral include Merriam's chipmunk, desert cottontails, brush mice, California thrasher, and poor-wills.

Coastal dune habitat provides foraging, cover and nesting for several wildlife species, including gulls, shorebirds, northern harriers, and California black legless lizards.

Special-Status Wildlife Species

Special-status wildlife species are defined to include species that are:

- Federally-listed threatened and endangered species (50 CFR 17.11)
- Federal candidates for listing as threatened or endangered (54 FR 554-579)
- Listed by the State of California as threatened or endangered species (*California Administrative Code*, Title 14, §670.5)
- Identified by the DFG as species of special concern (Remsen 1978 and Williams 1986)
- Identified by the DFG as fully-protected species in California

There are no known occurrences of state-listed or federally-listed endangered wildlife species in riparian habitats of the Carmel River (U. S. Fish and Wildlife Service 1986, California Department of Fish and Game 1988). Several federal candidates, state species of special concern, and California fully-protected species, however, are present, or may be present, in the Carmel River area (Table III-8).

TABLE III-8

SPECIAL-STATUS WILDLIFE SPECIES

Species Common Name/Scientific Name	Status	Habitat
Bald eagle *Haliaeetus leucocephalus*	FE, SE	Ocean shore, freshwater lakes, large streams
Peregrine falcon *Falco peregrinus anatum*	FE, SE	Vicinity of sea cliffs and inland cliffs
Least Bell's vireo *Vireo bellii pusillus*	FE, SE	Multicanopied riparian
Sharp-shinned hawk *Accipiter striatus*	SSC	Deciduous or coniferous woodlands at edges or where broken
Cooper's hawk *Accipiter cooperii*	SSC	Woodland nesting on riparian growth deciduous areas
Northern harrier *Circus cyaneus*	SSC	Coastal salt and freshwater marshes coastal salt grasslands
Osprey *Pandion haliaetus*	SSC	Oceanshore, freshwater lakes and large streams
Purple martin *Progne subis*	SSC	Riparian, rivers and streams, nests in cavities of large trees
Black-shouldered kite *Elanus caeruleus*	CP	Open grasslands, marshes and dense topped trees
California red-legged frog *Rana aurora draytoni*	FC2,SSC	Streams and ponds, freshwater marsh
Western pond turtle *Clemmys marmorata*	FC2,SSC	Streams and ponds, freshwater marsh
California black legless lizard *Anniella pulchra nigra*	FC2, SSC	Loose sand, loam along beaches, rivers
American badger *Taxidae taxus*	SSC	Open-plains, farmland and edges of woods
Ringtail *Bassariscus astutus*	CP	Forest and brushy, rocky slopes
Mountain Lion *Felix Concolor*	GS	Forest and Chaparral

FE = Federally-listed as endangered.
FC2 = A candidate species under review for federal listing.
SE = State-listed as endangered.
SSC = State species of special concern.
CP = California-protected.
GS = Game Species

Bald eagle and peregrine falcon are both wide-ranging species. No critical habitat or known nesting sites for either species is present in the Carmel River area (Roberson 1985).

Least Bell's Vireo: A survey for least Bell's vireo, a state- and federally-listed endangered species, was conducted in and around the Carmel River riparian zones. (Roberson and Roberson 1987). No vireos were located in the area, although suitable riparian habitat is present. The authors reported high densities of the parasitic cowbird at the mouth of the Carmel River, which would have a negative impact on least Bell's vireo populations. Based on this survey and no known historical records of its occurrence, it is unlikely that the least Bell's vireo occurs within the Carmel River area.

Sharp-Shinned Hawk: The sharp-shinned hawk is primarily a woodland species with former nesting reports for upper Carmel Valley and at Point Lobos near the mouth of the Carmel River (Roberson 1985). Sharp-shinned hawks could occur in the Carmel River area during fall, winter and early spring in riparian sites and potentially nest in the upper Carmel River woodland habitat.

Cooper's Hawk: The Cooper's hawk frequents habitat edges (Verner and Boss 1980). The species may occur during winter, spring, and fall migration; small numbers may also breed in the Carmel River area (Roberson 1985). Potential roosting, foraging, and breeding habitat is available in the riparian corridor.

Northern Harrier: The northern harrier forages in open fields, meadows, grasslands, and marshes, and nests on the ground, usually in wetter habitats (Clark 1987). The Carmel River Lagoon marsh provides suitable winter foraging and nesting habitat.

Osprey: Osprey inhabit areas along large streams, freshwater lakes, and ocean shores where they forage on fish. Ospreys have been observed in winter along the upper Carmel River and at San Clemente Reservoir (Dettman pers. comm.). The Carmel River and Carmel River Lagoon provide suitable foraging for this winter visitor.

Purple Martin: Purple martin were once common throughout the Coast Ranges. Severe declines in their numbers have recently been attributed to both nest depredation by introduced European starlings and loss of suitable nest trees (Remsen 1978). Suitable habitat is present in the riparian woodlands and forest and beneath bridges.

Black-Shouldered Kite: The black-shouldered kite is a resident in the Carmel River area. The kite forages in open grasslands, meadows, and marshes, using nearby treetops for perching and nesting sites. Riparian cottonwoods and willows along the Carmel River provide suitable roosting and nesting habitat. Foraging habitat occurs at the mouth of the Carmel River and in the narrow strips of non-native grasses adjacent to the river.

California Red-Legged Frog: The California red-legged frog occurs in permanent freshwater habitats, including streams, ponds, and marshes. Suitable habitat for the red-legged frog occurs along the Carmel River. The red-legged frog occurs along the Carmel River between the Narrows and the confluence of Miller Fork with the Carmel River (Dettman pers. comm.).

Western Pond Turtle: The western pond turtle requires permanent freshwater ponds, streams, rivers, or lakes (Verner and Boss 1980). The Carmel River and the freshwater marsh provide suitable habitat for the pond turtle.

California Black Legless Lizard: The California black legless lizard requires loose soil for burrowing, and frequents sparsely-vegetated beaches, chaparral, and streamside growths of sycamores, cottonwoods, and oaks (Stebbins 1985). The lizard is present on sandy, sparsely-vegetated lands in the immediate vicinity of the Carmel River Lagoon (California Department of Parks and Recreation 1985). The lizard may also occur on sandy banks along the Carmel River where vegetation is sparse.

American Badger: The American badger occupies a variety of habitats in California, preferring grasslands, savannas, and mountain meadows near timberline (Williams 1986). Agriculture and urban development have been the primary causes of decline for the badger. The Carmel River riparian zone is not their preferred habitat. Foraging may be enhanced where riparian areas are adjacent to grasslands with larger numbers of prey species. Open grasslands are limited to narrow strips between the Carmel River and urban development.

Ringtail: The ringtail primarily occurs in boulder-strewn chaparral, chaparral interspersed with oak woodland, and scrub vegetation of various types. The highest recorded ringtails densities occur in riparian forests with dense midstory vegetation (Belluomini and Trapp 1984). Ringtails have the potential to occur along the Carmel River in multistory riparian forests as well as at higher elevations along the Carmel River in chaparral and oak woodland habitat.

Mountain Lion: The mountain lion is currently classified as a game species and is subject to regulated take by the State Department of Fish and Game (*California Fish and Game Code §3950*). Public concern resulted in moratorium on the sport hunting in 1971. Although the mountain lion is classified as a game species, there has not been a regulated hunting season since 1971 because of litigation concerning the adequacy and compliance with environmental laws and regulations regarding potential impacts of sport hunting.

The mountain lion prefers dense vegetative cover or rocky terrain. The Coast Range, including Monterey County, and the southern Sierra Nevada have high densities of mountain lions. The primary food source of these lions is deer, but they also select other prey species. Mountain lions have potential to occur at high elevations along the Carmel River in chaparral and forested areas.

4. Existing Fish Resources

The Carmel River supports populations of steelhead (*Oncorhynchus mykis*), brown trout (*Salmo trutta*), Pacific lamprey (*Entosphenus tridentatus*), Sacramento hitch (*Lavinia exilicauda*), several species of sculpin (*Cottus sp.*), starry flounder (*Platichthys stellatus*), and shiner perch (*Cymatogaster aggregata*) (in the Lagoon), threespine stickleback (*Gasterosteus aculeatus*), goldfish (*Carassius auratus*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*). Occasionally a striped bass (*Morone saxatilis*) enters the Lagoon, but there is no evidence of a spawning run. There are probably other marine fishes which enter the Lagoon during the relatively short period when it is open and contains brackish water.

Of these fishes, the steelhead is considered the most important, and extensive investigations have been done to define its ecology in the river. The steelhead is the most demanding and, as such, the most threatened. Maintenance of conditions suitable for the continuation of the steelhead run in the Carmel River will benefit the other fishes as well.

The Carmel River supports what the California Department of Fish and Game (CDFG) (Snider 1983) described as the state's largest self-sustaining steelhead resource and the second largest fishery for this species south of San Francisco. California state law stipulates that healthy steelhead populations shall be protected or restored by controlling the harvest of adults, providing suitable spawning grounds, and maintaining rearing habitat for juvenile steelhead.

Steelhead Life Cycle

Adult steelhead live in the ocean and migrate into the Carmel River to spawn. As indicated by adult counts at San Clemente Dam, the migration of adults historically started with the beginning of major storms in the late fall or early winter and continued through March and, in some years, April (Table III-9). Following upstream migration, the female steelhead establish territories, dig nests in the bottom of the stream, and deposit eggs which are then fertilized by one or more males. In the Carmel River adults have been observed spawning from February through March (Dettman and Kelley 1986), but they probably spawn from as early as mid-January to as late as early April. The eggs which have been buried in nests incubate three to eight weeks, depending on water temperature, and hatch in late winter or early spring. The newly-hatched fry reside in the gravel up to two weeks, emerge from the nest, and disperse into quiet areas along the margin of the river where they begin to feed. Throughout the spring they grow rapidly and soon move into swifter, deeper water in riffles and the upstream and downstream ends of pools. Throughout the late spring, summer, and fall the juveniles feed on immature aquatic insects or on terrestrial insects that fall into the river. Beginning with the first rains of the fall, some juveniles move downstream and during the spring many change into smolts (juveniles that have adapted to seawater) and emigrate into the ocean. Other juveniles remain in freshwater for one or two more years before they leave the stream. Steelhead from the Carmel River spend one to four years in the ocean before returning to spawn. Some of the larger and older adults are called "repeat spawners" because they survived the migration upstream and downstream for spawning in previous years.

Habitat Needs and the Status of Steelhead in the Carmel River

Maintenance of a large, vigorous steelhead population in the Carmel River depends upon sufficient habitat and flows for the upstream migration and spawning of adults, the incubation of eggs, the rearing of juveniles, emigration of smolts from freshwater into the ocean, and the passage of adults upstream and juveniles downstream over San Clemente and Los Padres dams. The present steelhead run is believed to be supported mainly by habitat in the Carmel River and tributaries *above* San Clemente Dam where permanent, year-round streamflows and good substrate conditions rear the juveniles throughout the summer. Some adults spawn in the Carmel River *below* San Clemente Dam, but the progeny of those fish have, in many years, been destroyed when the river below San Clemente Dam dried up during the summer. Presently, adults climb through a 84-foot high ladder over San Clemente Dam. At Los Padres Dam adults climb a short ladder, enter a trap, and are trucked to the top of the dam where they are released into Los Padres Reservoir. There are no downstream passage facilities at Los Padres or San Clemente Dams. At Los Padres the juvenile fish pass over the dam through the spillway. At San Clemente they pass over the spillway and through the fish ladder when it is operating.

TABLE III-9

STEELHEAD MIGRATING PAST SAN CLEMENTE DAM AND STEELHEAD TRAPPED OR PASSED OVER LOS PADRES DAM (1949 to 1952, 1962 to 1977, 1982 to 1989)

Year	Monthly Counts at San Clemente Dec	Jan	Feb	Mar	Apr	Total	Los Padres Trap Annual Total
1949			no data available				147
1950			no data available				124
1951			no data available				154
1952			no data available				86
1962			no data available				558
1963			no data available				
1964	0	113	118	327	201	759	
1965	203	814	152	181	0	1,350	
1966	76	319	451	69	0	915	
1967	0	546	275	493	0	1,314	
1968	0	153	93	0	0	246	
1969	0	205	818	313	0	1,336	
1970	0	206	51	105	0	362	
1971	0	244	168	265	92	769	
1972	0	0	77	17	0	94	
1973	0	390	444	188	0	1,022	
1974	16	69	39	224	47	395	
1975	0	0	285	1,002	0	1,287	
1976*	0	0	0	0	0	0	0
1977*	0	0	0	0	0	0	0
1982			no data available				125
1983			no data available				160
1984	1	3	24	289	63	380	51
1985			no data available				27
1986			no data available				42
1987			no data available				
1988*	0	0	0	0	0	0	0
1989*	0	0	0	0	0	0	0
Average	17	171	180	211	24	603	99

*Total counts in 1976, 1977, 1988, and 1989 assumed to be zero, as no outflow to the ocean occurred in these years.

Sources: Snider, W.M., 1983 (1965 to 1975); Dettman, 1986 (1984)

The most recent estimate of the total steelhead run in the Carmel River was 860 adults during 1984. Of the total, an estimated 480 or 56 percent of the run was harvested in the lower river, and about 380 migrated past San Clemente Dam (Dettman 1986). During 1984 only 51 adults were captured at the base of Los Padres Dam and transported upstream, and an unknown, but probably small, number of adults spawned in the river downstream of Sam Clemente Dam. Previous estimates of the run at San Clemente Dam were 395 in 1974 and 1,287 in 1975. Kelley, Dettman, and Reuter (1987) estimated the Carmel River could support an average total run of about 3,500 adults upstream of San Clemente Dam. A comparison of this estimate to the run of 860 in 1984 indicates the river produced only 25 percent of its full potential in that year. Snider (1983) concluded the run had declined by the same percentage.

Factors Associated with the Decline of Steelhead in the Carmel River

Past reviews of the environmental problems in the Carmel River (Kelley and Dettman 1981; Kelley, Dettman, and Turner 1982; Snider 1983; and Dettman and Kelley 1987) have led to general agreement about the principal factors which constrain the steelhead population in the Carmel River. These include:

- Inadequate passage facilities for adults and juveniles at Los Padres Dam.
- Diversion of surface flows at San Clemente Dam.
- Subsurface diversion of streamflows which percolate into the Carmel River Aquifer between San Clemente Dam and the Lagoon.
- Reduction in the number of trees and canopy of the riparian forest downstream of Robles del Rio.
- Increased erosion of sand and gravel from denuded riverbanks by high winter flows which leads to a widening of the channel in some reaches and the deposition of sand and gravel throughout the river channel downstream of Robles del Rio. The widening of the channel reduces summer habitat for juvenile steelhead. The sand deposited in pools reduces the habitat needed by adults during the winter between storms and reduces the amount of food available for juvenile steelhead. Excess gravel deposits immediately downstream of the eroded banks on some riffles and creates temporary barriers to upstream migration of adults.
- The interruption of streamflow at San Clemente Dam and temporary or permanent blockage of the smolt movement past San Clemente Dam in some dry years when flashboards are raised during the spring. Each spring flashboards or gates are raised at Sam Clemente Dam to provide 480 acre-feet of additional surface water storage. March 15th is normally the earliest date that the flashboards can be completely raised. In wet and normal water years the installation is often delayed until April, May, or June.
- Deposition of sand in the Lagoon reduces the habitat in it for adults during the winter, for smolts during the spring, and for juveniles during the summer and fall months.

D. DROUGHT CONDITIONS

The Monterey Peninsula area is dependent upon local rainfall for the replenishment of Los Padres and San Clemente surface water reservoirs as well as the Carmel Valley Aquifer and, less directly, the Seaside Coastal Groundwater Subbasin. The Peninsula area's water supply is susceptible to prolonged dry periods, as evidenced by the droughts of 1976-77 and 1987-89. The back-to-back low-rainfall years of 1976 and 1977 represent the driest two-year period on record, and resulted in a severe water shortage for the Monterey Peninsula area.

1. Historic Background

The first formal indication of possible water shortage problems in the Cal-Am service area was contained in a 1973 decision of the California Public Utilities Commission (CPUC). In reviewing an application for expanded water service by Cal-Am, the CPUC found that Cal-Am production capacity was about 1,000 acre-feet short of the projected water requirements for 1975 and accordingly imposed a water meter connection ban. In 1976, the CPUC further found the Cal-Am system to have inadequate water transmission line capacity to meet peak summer water demands. By CPUC Decision 86051, the CPUC instituted a four-phase water rationing plan. This rationing plan focused public attention on local water supply problems just prior to a severe drought period. In response to the water problems, the Cities of Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City, and Seaside, together with Monterey County, formed the Monterey Peninsula Water Management Agency.

In January 1977, the Water Management Agency devised and implemented a water rationing plan to replace the CPUC program previously in effect. The rationing plan was aimed at reducing consumption levels below the production capacity of Cal-Am wells, and focused on mandatory water rationing for residential and non-residential users. Residential users were allocated water on a gallons-per-capita basis, and a percentage reduction was prescribed for non-residential users. The water rationing efforts in 1977 proved to be very effective; a systemwide reduction in consumption of 51 percent was achieved during the period of February to December 1977, as compared with the same period in 1976. Violations of mandatory water limits occurred, with non-residential users being the worst offenders. A graduated penalty scale, as opposed to a flat penalty fee, was subsequently recommended to minimize the gross violations in the event of future rationing.

In 1977, following the drought of 1976-77, the Monterey Peninsula Water Management District was created by an act of the California Legislature and ratified by the voters of the Monterey Peninsula area in 1978. The District was formed in response to a recognized need for conservation and augmentation of water supplies in the Monterey Peninsula area. The District's new role was established as the integrated management of water resources, including control over both water supply and demand. The Legislature viewed this integration of management responsibilities as critical in light of the Monterey Peninsula area's scenic, cultural, and recreational resources.

2. Drought and Emergency Planning

Anticipating and planning for drought and emergency conditions is an important element of water supply management. To address this on a continuing basis, the District has devised a strategy for implementing water rationing, and has incorporated this strategy into its Carmel Valley Simulation Model (CVSIM). This model, used for water supply planning, is described in Appendix

A. Under this strategy, municipal demand would be rationed during dry periods in order to provide protection against a severe and sustained drought. Rationing decisions are made based on a comparison of expected demand and supply.

E. LAND USE, POPULATION, AND HOUSING

This section summarizes existing development within the MPWMD boundaries. Most of this information is taken from EIP Associates' *Estimates of Housing and Employment at Buildout Within the Monterey Peninsula Water Management District*, which was completed in July 1988. The information in Table III-10 reflects development as of January 1, 1988, which was the baseline for EIP's report and is the baseline for this EIR.

The cities of Monterey, Pacific Grove, and Seaside form the urban center of the Monterey Peninsula. As Table III-10 indicates, in 1988 these three cities contained 69.3 percent of the District's population base, 77.3 percent of its employment base, and 67.0 percent of the district's housing units. The other cities in the district (Carmel-by-the-Sea, Del Rey Oaks, and Sand City) are physically much smaller. For the most part, the cities in the district have very little vacant land available for development. The unincorporated portion of the district contains most of the district's open space and vacant land.

TABLE III-10

EXISTING HOUSING, EMPLOYMENT, AND POPULATION
Within the Cal-Am Service Area
January 1, 1988

Jurisdiction	Single Family Units	Multi-Family Units	Total Units	Employees	Population
Carmel-by-the-Sea	2,593	619	3,212	3,555	4,978
Del Rey Oaks	573	9	582	498	1,520
Monterey	6,381	6,721	13,102	27,125	31,397
Pacific Grove	5,244	2,769	8,013	4,444	16,367
Sand City	74	23	97	1,550	200
Seaside[1]	4,901	2,516	7,417	3,960	21,808
Monterey County	8,190	1,955	10,145	4,424	24,094
MPAD	--	--	--	400	--
Non-Cal-Am	1,488	206	1,694	270	4,458
Total	**29,444**	**14,818**	**44,262**	**46,226**	**104,822**

[1]Does not include totals for land within the city which is outside of the Cal-Am service area.

Source: EIP Associates, *Estimates of Housing and Employment at Buildout within the Monterey Peninsula Water Management District*, July 1988

F. WATER USE TRENDS AND PREFERENCES

1. Historical Trends by Jurisdiction

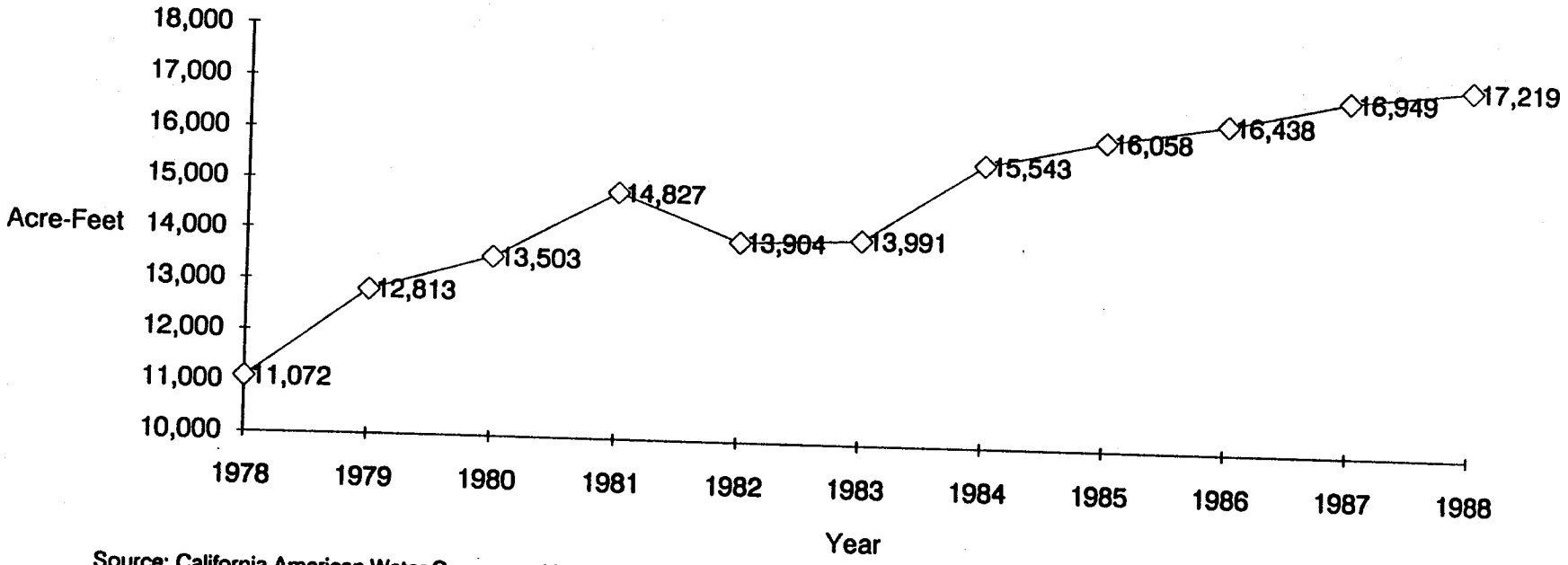
Historical metered water consumption by jurisdiction is summarized in Table III-11. As noted, the data for 1978 through 1983 are by calendar year, and the data for 1984 through 1988 are by fiscal year (i.e., July 1st to June 30th). These data are depicted graphically in Figures III-6 and III-7.

Figure III-6 shows how the total metered water consumption for the jurisdictions served by Cal-Am has gradually increased since 1978. It should be noted that the growth depicted in Figures III-6 and III-7 at least partially reflects recovery from the drought of 1976-77. The average annual increase between 1984 and 1988 was about 420 acre-feet per year, or an average of 2.6 percent per year.

Metered water consumption for each of the jurisdictions within the district is shown in Figure III-7. The average annual increases in consumption for unincorporated Monterey County and for the city of Monterey were about 180 and 240 acre-feet per year, respectively, for the period 1978 to 1988. The increase was about 3.1 percent for unincorporated Monterey County and 5.5 percent for the city of Monterey. The growth in consumption by Seaside and Pacific Grove has been very slight since 1980. The increase in water consumption in Del Rey Oaks and Sand City has been relatively low. For Carmel-by-the-Sea, the annual increase from 1980 through 1988 was nine acre-feet per year, or about 1.4 percent per year.

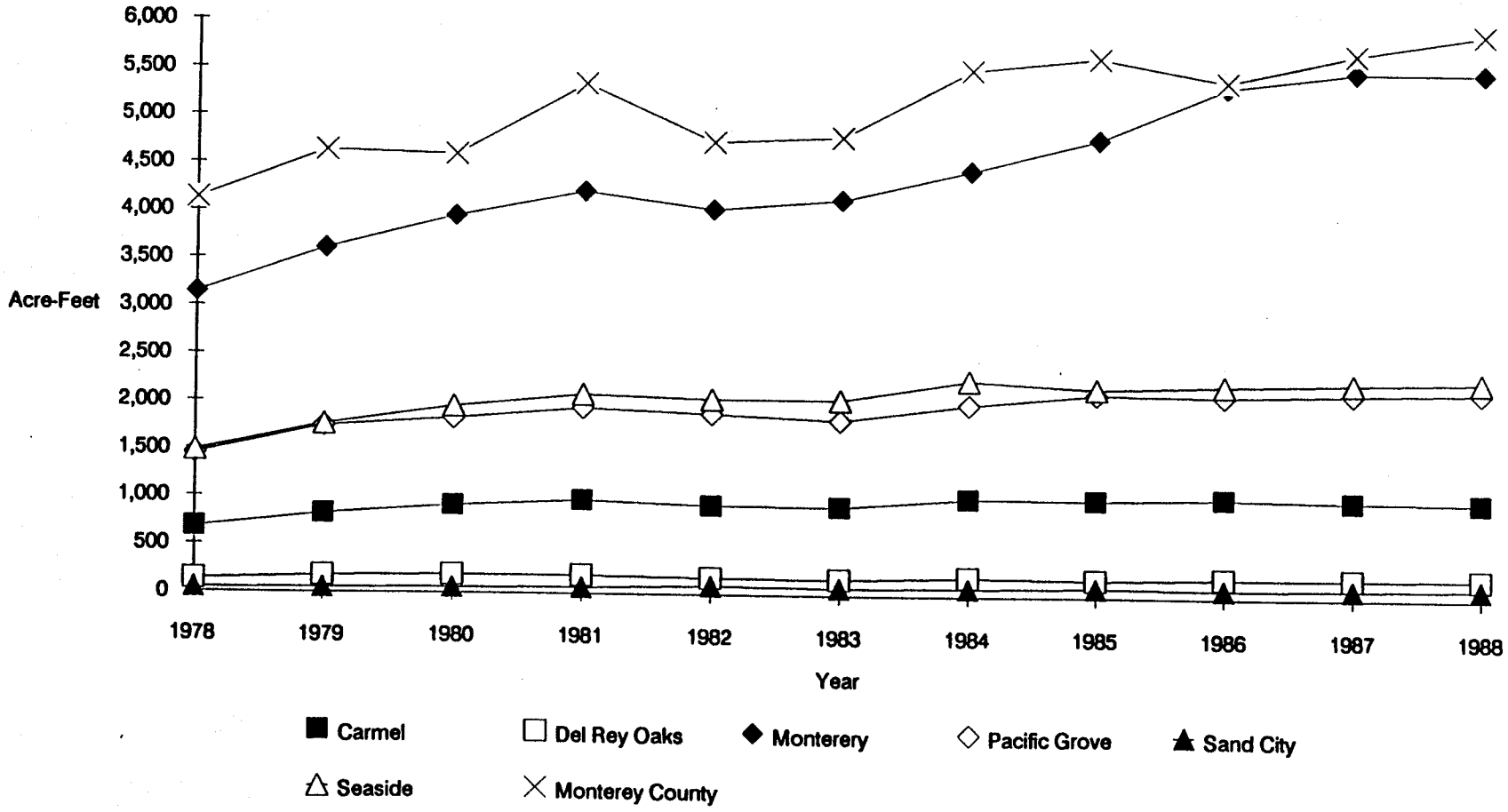
Unaccounted-for water is the difference between the amount of water supplied to a system (i.e., water production) and the amount of water sold as metered consumption. The difference, which is attributable largely to system losses due to leakage, fire flows, and meter error, is usually stated as a percentage of total water production. Table III-12 summarizes unaccounted-for water in the Cal-Am system for the period 1978 to 1988. As Table III-12 shows, the average has been eight percent for the 11-year period. Because system losses are expected to decline over time due to replacement of faulty meters and other system improvements, this EIR assumes system losses of seven percent as the basis for correlating water production for each water supply option with estimated metered consumption.

FIGURE III-6
TOTAL METERED WATER CONSUMPTION
Cal-Am Service Area



Source: California-American Water Company, 1989.

FIGURE III-7
TOTAL METERED WATER CONSUMPTION
By Jurisdiction



Source: California-American Water Company, 1989.

TABLE III-11

SUMMARY OF HISTORICAL WATER USAGE
(in Acre-Feet)

JURISDICTION	WATER USE BY CALENDAR YEAR						WATER USE BY FISCAL YEAR (JULY TO JUNE)				
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Carmel-by-the-Sea	678.83	825.82	910.75	970.78	923.55	921.61	1,017.64	1,008.84	1,035.20	1,010.36	1,000.86
Del Rey Oaks	138.98	175.71	188.88	191.93	173.45	168.96	197.25	181.20	200.98	200.81	206.93
Monterey	3,146.38	3,609.79	3,954.53	4,222.41	4,040.17	4,150.55	4,465.79	4,806.13	5,359.91	5,529.62	5,528.58
Pacific Grove	1,448.67	1,747.16	1,830.54	1,942.24	1,891.24	1,829.10	2,001.09	2,123.42	2,109.32	2,138.18	2,165.45
Sand City	47.47	50.31	58.62	67.73	90.17	74.39	82.06	95.97	89.18	93.21	104.35
Seaside	1,480.40	1,765.57	1,955.18	2,085.01	2,042.90	2,042.40	2,257.10	2,181.39	2,224.15	2,254.85	2,276.26
Monterey County MPAD[1]	4,131.02	4,638.51	4,604.30	5,346.75	4,742.55	4,803.80	5,522.23	5,660.58	5,418.84	5,721.82	5,936.52
TOTAL	**11,071.75**	**12,812.87**	**13,502.80**	**14,826.85**	**13,904.03**	**13,990.81**	**15,543.16**	**16,057.53**	**16,437.58**	**16,948.85**	**17,218.95**

[1]The Monterey Peninsula Airport District is now considered a separate jurisdiction. However, water use data are not available for the years shown.

Source: California-American Water Company

TABLE III-12

UNACCOUNTED-FOR WATER IN CAL-AM SYSTEM
in Acre-Feet

Calendar Year	Metered Consumption	Water Production	Percentage Unaccounted-for
1978	11,071.75	12,043.80	8.1%
1979	12,812.87	14,181.10	9.6
1980	13,502.80	15,371.80	2.2
1981	14,826.85	15,886.40	6.7
1982	13,904.03	15,346.70	9.4
1983	13,990.81	15,820.50	11.6
Fiscal Year	**Metered Consumption**	**Water Production**	**Percentage Unaccounted-for**
1984	15,543.16	16,666.50	6.7%
1985	16,057.53	17,465.40	8.1
1986	16,437.58	17,937.40	8.4
1987	16,948.85	17,826.90	4.9
1988	17,218.95	17,685.20	2.6
Average			**8.0%**

2. Current Jurisdictional Water Allocation Policy

The MPWMD is the only water agency in California that allocates water supply among local agencies within its jurisdiction. The District's Water Allocation Program is intended to distribute available water equitably so that each jurisdiction can plan its land use and develop its own priorities for water use.

In April 1981 the District Board adopted an allocation policy based on the assumption that the Cal-Am system had a supply capacity of 20,000 acre-feet, of which 18,600 acre-feet (factoring in system losses) could be allocated to jurisdictions within the Cal-Am service area. The 20,000 acre-feet did not include approximately 2,000 acre-feet reserved for private wells and about 1,700 acre-feet which had been dedicated to other small water suppliers within the MPWMD boundaries.

The District's 1981 policy allocated Cal-Am's 20,000 acre-feet (18,600 acre-feet net) among the jurisdictions in the Cal-Am service area according to a projected Year 2000 need. Each jurisdiction's projected need was determined according to growth projections prepared by Recht Hausrath & Associates. The allocation for each jurisdiction was simply that jurisdiction's percentage of the total Year 2000 projected need. At the time this allocation policy was established, the District assumed that 20,000 acre-feet would more than adequately provide for growth projected by Recht Hausrath to occur by the year 2000. This resulted in what appeared to be a surplus of water above that needed to satisfy each jurisdiction's growth potential.

In 1987, Cal-Am conducted a comprehensive audit of their water meters serving customers within the boundaries of the MPWMD. The audit concluded that the locations of 128 of the water-

meters used to determine the District's 1981 allocations had been miscoded. The District Board therefore amended the 1981 allocations in January 1987 to reflect the findings of Cal-Am's audit. Table III-13 shows both the pre- and post-audit allocation percentages for each jurisdiction.

The District will continue to implement the post-audit allocation percentages on an interim basis until the Allocation Program is comprehensively revised based on a review of the findings of this EIR.

TABLE III-13

CURRENT PERCENTAGE ALLOCATION SYSTEM
Pre- and Post-1987 Cal-Am Meter Audit

Jurisdiction	Pre-Audit Percentage Allocation	Post-Audit Percentage Allocation
Carmel-by-the-Sea	5.542%	5.543%
Del Rey Oaks	1.318	1.326
Monterey	30.890	32.933
Pacific Grove	12.641	12.685
Sand City	1.799	1.800
Seaside	12.858	12.858
Monterey County	34.952	32.855

Source: MPWMD Board of Directors, Resolutions 86-06 and 87-1

3. Jurisdictional Water Use Preferences

To assess development and related impacts, such as traffic, associated with the various water distribution options, assumptions have to be made in the EIR about how jurisdictions will allocate their water to various types of development. In a May 30, 1988 letter, Mintier & Associates requested that each jurisdiction provide an estimate of how it might use future water supplies, depending on the amount of water that might be made available under the Water Allocation Program. The request specifically called for each jurisdiction's estimate of how it might allocate future water supplies to various types of new development, given availability thresholds of 25, 50, 75, and 100 percent of the total water estimated to be needed to satisfy buildout of the community, based on current land use policies. The results of this survey are summarized in Table III-14.

The "Total Water" column in Table III-14 shows the estimated total amount of water that each jurisdiction would need for full buildout. The buildout calculations in this table were developed by EIP Associates based on a review of current land use policies and discussions with staff of each jurisdiction's planning agency. The findings of this research were published in *Estimates of Housing and Employment Buildout Within the Monterey Peninsula Water Management District*, July 1988. Mintier & Associates converted EIP Associates' buildout calculations into water demand estimates using water use multipliers developed by the District for water supply planning.

TABLE III-14

WATER NEEDED TO SATISFY POTENTIAL NEW GROWTH WITHIN CAL-AM'S SERVICE AREA[1] (in Acre-Feet)

Jurisdiction	Single-Family[3] DUs[2]	Single-Family[3] Water	Multi-Family[4] DUs[2]	Multi-Family[4] Water	Employment[5] Jobs	Employment[5] Water	Hotel[6] Rooms	Hotel[6] Water	Golf Course[7] Emp	Golf Course[7] Water	Total Water	% of Total
Carmel-by-the-Sea	379	86.41	506	77.92	1,409	149.35	–	–	–	–	313.69	5.19%
Del Rey Oaks	3	0.68	151	23.25	135	14.31	164	22.47	–	–	60.72	1.00%
Monterey	(313)	(71.36)	5,089	783.71	11,754	1,245.92	699	95.76	–	–	2,054.03	33.97%
Pacific Grove	232	52.90	2,661	409.79	1,188	125.93	169	23.15	–	–	611.77	10.12%
Sand City	–	–	2,617	403.02	3,194	338.56	1,495	204.82	–	–	946.40	15.65%
Seaside	295	67.26	614	94.56	3,920	415.52	500	68.50	–	–	645.84	10.68%
Monterey County	2,717	1,029.74	279	42.97	398	42.19	490	67.13	45	115.47	1,297.50	21.46%
MPAD	–	–	–	–	1,100	116.60	–	–	–	–	116.60	1.93%
Total	**3,313**	**1,165.63**	**11,917**	**1835.22**	**23,098**	**2,448.39**	**3,517**	**481.39**	**45**	**115.47**	**6,046.54**	**100.00%**

[1]Reflects development potential within Cal-Am's service area as of January 1, 1988
[2]DUs = Dwelling units
[3]0.228 acre-feet per unit in incorporated areas; 0.379 acre-feet per unit in unincorporated areas
[4]0.154 acre-feet per unit
[5]0.106 acre-feet per employee; excludes hotel and golf course employment
[6]0.137 acre-feet per room
[7]2.566 acre-feet per employee

Sources: EIP Associates, Estimates of Housing and Employment at Buildout Within the Monterey Peninsula Water Management District, July 1988; Monterey Peninsula Water Management District, September 1989

In preparing their responses, the respective jurisdictions relied primarily on current internal water allocation policies to develop projections for the smaller increments. Estimation of future water use at the higher levels in most cases required either extrapolation from existing policies or speculation as to how future preferences might evolve. It should be emphasized that the estimates provided here are *not* policy commitments to particular distribution formulas; rather, they are "best guesses" as to what each jurisdiction's future water use priorities might be.

Each jurisdiction was asked to provide their future preference estimates according to the following categories: single family; multi-family; employment; hotel; and golf course. In cases where current allocation policies have been established according to different categories, the District and its consultants assigned water to the most similar categories (e.g., public use allocations were assigned to employment). In the case of Pacific Grove, which allocated a portion of its water to reserve, this small amount was redistributed to the other categories as a percentage of each category's share of the remaining non-reserve allocation. In the two cases (the City of Monterey and Monterey County) in which estimates were not available, the District and its consultants simply applied the full buildout distribution percentages for each category to the respective increments of total buildout.

The following pages summarize the information provided by the various jurisdictions, and Table III-15 illustrates each jurisdiction's assumed water use priorities at the 25, 50, 75, and 100 percent levels. In Chapters IV and V of this EIR, this information is correlated with the various water supply options and water distribution alternatives for each jurisdiction and for the entire Cal-Am service area to estimate development potential as the basis for assessing land use and development-related impacts.

TABLE III-15

JURISDICTIONAL WATER USE PREFERENCES
(Acre-Feet)

	Single-Family	Multi-Family	Employment	Hotel	Golf Course	Total
Carmel-by-the-Sea						
25 Percent	78.42	0.00	0.00	0.00	0.00	78.42
50 Percent	86.41	49.00	21.43	0.00	0.00	156.85
75 Percent	86.41	77.92	70.93	0.00	0.00	235.27
100 Percent	86.41	77.92	149.35	0.00	0.00	313.69
Del Rey Oaks						
25 Percent	0.68	14.50	0.00	0.00	0.00	15.18
50 Percent	0.68	23.25	6.42	0.00	0.00	30.36
75 Percent	0.68	23.25	10.37	11.23	0.00	45.54
100 Percent	0.68	23.25	14.31	22.47	0.00	60.72
City of Monterey						
25 Percent	-17.84	195.93	311.48	23.94	0.00	513.51
50 Percent	-35.68	391.85	622.96	47.88	0.00	1,027.01
75 Percent	-53.52	587.78	934.44	71.82	0.00	1,540.52
100 Percent	-71.36	783.71	1,245.92	95.76	0.00	2,054.03
Pacific Grove						
25 Percent	20.69	57.13	53.53	21.59	0.00	152.94
50 Percent	31.43	174.68	77.66	22.11	0.00	305.89
75 Percent	42.16	292.24	101.80	22.63	0.00	458.83
100 Percent	52.90	409.79	125.93	23.15	0.00	611.77
Sand City						
25 Percent	0.00	108.84	66.25	61.52	0.00	236.60
50 Percent	0.00	217.67	132.50	123.03	0.00	473.20
75 Percent	0.00	310.34	235.53	163.92	0.00	709.80
100 Percent	0.00	403.02	338.56	204.82	0.00	946.40
Seaside						
25 Percent	28.87	8.45	89.89	34.25	0.00	161.46
50 Percent	28.87	8.45	210.10	75.50	0.00	322.92
75 Percent	28.87	51.88	328.13	75.50	0.00	484.38
100 Percent	67.26	94.56	415.52	68.50	0.00	645.84
Monterey County						
25 Percent	181.99	7.59	7.46	11.86	115.47	324.37
50 Percent	464.57	19.38	19.03	30.29	115.47	648.75
75 Percent	747.16	31.18	30.61	48.71	115.47	973.12
100 Percent	1,029.74	42.97	42.19	67.13	115.47	1,297.50
Monterey Peninsula Airport District						
25 Percent	0.00	0.00	29.15	0.00	0.00	29.15
50 Percent	0.00	0.00	58.30	0.00	0.00	58.30
75 Percent	0.00	0.00	87.45	0.00	0.00	87.45
100 Percent	0.00	0.00	116.60	0.00	0.00	116.60
Districtwide						
25 Percent	292.81	392.43	557.76	153.16	115.47	1,511.63
50 Percent	576.28	884.30	1,148.41	298.81	115.47	3,023.27
75 Percent	851.76	1,374.60	1,799.25	393.82	115.47	4,534.90
100 Percent	1,165.63	1,835.22	2,448.39	481.83	115.47	6,046.54

Source: Mintier & Associates

Carmel-by-the-Sea

Carmel-by-the-Sea Planning and Community Development Department staff provided future water use estimates based on General Plan Land Use and Conservation Element policies establishing single-family residential development as the highest priority for allocation of water resources. Accordingly, the City's allocation estimate provides first for the water necessary to build-out land set aside for single-family uses. The formula then provides for multi-family development and for commercial development. The City also identified a set-aside for public projects such as parks and recreation and cultural facilities. The District assigned this water to employment-generating uses. No water is allocated for hotel uses.

Del Rey Oaks

The City Clerk of Del Rey Oaks provided the District with as estimate based on the anticipated sequence of development. It should be noted that water shown in the Hotel category has been split between the 75 and 100 percent availability levels, although this represents a single hotel project. All water in the Multi-Family category will be used for a single residential project.

City of Monterey

City of Monterey Community Development Department staff was unable to provide the District with an estimate of future allocation preferences, stating that determination of internal water allocation is a City Council policy matter and that such policy is subject to changing conditions. In the absence of a City-provided estimate, the District simply applied buildout percentages for each land use category to the 25, 50, and 75 percent water availability levels. It should be noted that the negative values in the Single-Family category reflect replacement of existing single-family homes with new multi-family developments.

Pacific Grove

Pacific Grove Community Development Department staff recommended that the District use the City's current internal allocation policy as the basis for determining future allocations. This approach proved problematical in light of the full buildout estimates shown in Table III-14. For instance, the 100 percent Hotel allocation would have been 82.8 acre feet based on the allocation formula, whereas full buildout of hotels would require only 23.15 acre feet according to the estimates in Table III-14. Conversely, the 100 percent allocation for the Multi-Family category would be 238.5 acre feet based on the allocation formula, whereas full buildout has been estimated to result in multi-family water demand of 409.8 acre feet. The District therefore applied the City's current allocation distribution only to the 25 percent level.

Sand City

Sand City Planning Department staff estimated that future water would be allocated as follows: 46 percent to residential; 26 percent to hotel development; and 28 percent to employment-generating uses. The District used this distribution to calculate the City's allocations at 25 and 50 percent. In order to allow for a transition between the City-provided distribution and the estimated distribution at buildout, for the 75 percent level, the District simply split the difference between the 50 percent allocation and the full buildout water demand estimate. It should be noted that the allocation shown for multi-family uses includes all residential development, including single-family units.

Seaside

Seaside Community Development Department staff outlined an internal water allocation scheme which first allocates water for projects with development approvals, then for additional multi-family residential uses, and finally for employment-generating uses (aside from the City's large hotel project).

Monterey County

Monterey County Planning Department staff was unable to provide the District with an estimate of future allocation preferences. Because the County's golf course development potential was realized with the opening of the Links at Spanish Bay in December 1987, the District assumed that all of the water allocated to the Golf Course would be exhausted at the 25 percent level. The District then simply applied buildout percentages for each of the remaining categories to the 25, 50, and 75 percent water availability levels.

Monterey Peninsula Airport District

Since the only use category that the Monterey Peninsula Airport District contains is employment, the District simply allocated all of the water available at each level to that category.

G. PUBLIC SERVICES AND FACILITIES

This section inventories the existing public facilities and services on the Monterey Peninsula. The conditions described in this section are the baseline conditions used in this EIR for assessing Water Allocation Program impacts.

1. Traffic

Existing Regional Roadway Network

The existing regional roadway network in the Monterey Peninsula area consists of State Route (SR) 1, SR 68, and SR 218 serving the urban areas of Monterey County.

State Route 1: The SR 1 alignment parallels the coast, generally extending northeast to southwest through the Monterey Peninsula region. It is mainly a four-lane freeway providing regional access to all of the major jurisdictions in the area.

State Route 68: Two separate alignments of SR 68 serve the Monterey Peninsula. SR 68 from SR 1 north to Monterey and Pacific Grove (Holman Highway) is a two-lane highway that provides the major access to the Monterey Peninsula. SR 68 from SR 1 south along the Monterey Salinas Highway is generally a two-lane highway that provides the major linkage between Monterey and Salinas.

State Route 218: SR 218 is an approximately 2.5 to 3-mile-long, two-lane highway that links SR 68 (Monterey Salinas Highway) to the south with SR 1 to the north. SR 218 provides access mainly to Del Rey Oaks, Seaside, and Monterey.

Existing Traffic Volumes and Level of Service

Existing daily traffic volumes were obtained from an updated traffic analysis prepared for the New San Clemente Dam EIS (EIP Associates 1988). The existing regional roadway network and average daily traffic (ADT) volumes for selected freeway segments are shown in Figure III-8. The freeway segments are described in Table III-16.

The freeway segments on the Monterey Peninsula and their respective volumes were evaluated according to their ability to operate at acceptable levels of service (LOS). LOS is a quantitative measure of traffic-operating characteristics defined as the ratio of volume to capacity on the arterial, collector, or local street. Roadway segments are assigned a letter grade A through F, representing progressively worsening traffic conditions. Monterey County considers LOS C and better to be acceptable traffic conditions. Table III-17 defines each LOS category, and Table III-18 lists the ADT capacity according to each LOS category for various freeway sizes.

TABLE III-16

1986 LEVELS OF SERVICE FOR SELECTED FREEWAY/ROADWAY SEGMENTS (Under Existing Conditions)

Segment[1]	Route	Location	1986 LOS[2]
1	SR 1	Carmel Valley Road to Carmel Hill	F
2	SR 1	Carmel Hill to Sloat Undercrossing	F
3	SR 1	Sloat Undercrossing to SR 68	D
4	SR 1	SR 68 to Ord Village	D
6	CV Rd	SR 1 to Carmel Rancho Boulevard	E
7	SR 68	Holman Highway: Stuart to W. Jet. SR 1	E/F
8	SR 68	E. Jct. Sr 1 to SR 218	F
9	SR 68	SR 218 to Los Laureles Grade	D

[1]Segment defined in Figure III-8.
[2]See Table III-17

Source: EIP Associates, 1988

TABLE III-17

LEVEL OF SERVICE DEFINITIONS

Level of Service	Freeway	Volume to Capacity Ratio
A	Free flow vehicles unaffected by other vehicles in the traffic stream.	0.00-0.35
B	Higher speed range of stable flow.	0.36-0.54
C	Stable flow with volumes not exceeding 78 percent capacity.	0.55-0.77
D	Upper end of stable flow conditions. Volumes do not exceed 95 percent of capacity.	0.78-0.93
E	Unstable flow at roadway capacity. Operating speeds 30 to 25 mph or less.	0.94-1.00
F	Stop-and-go traffic with operating speeds less than 30 mph.	>1.00

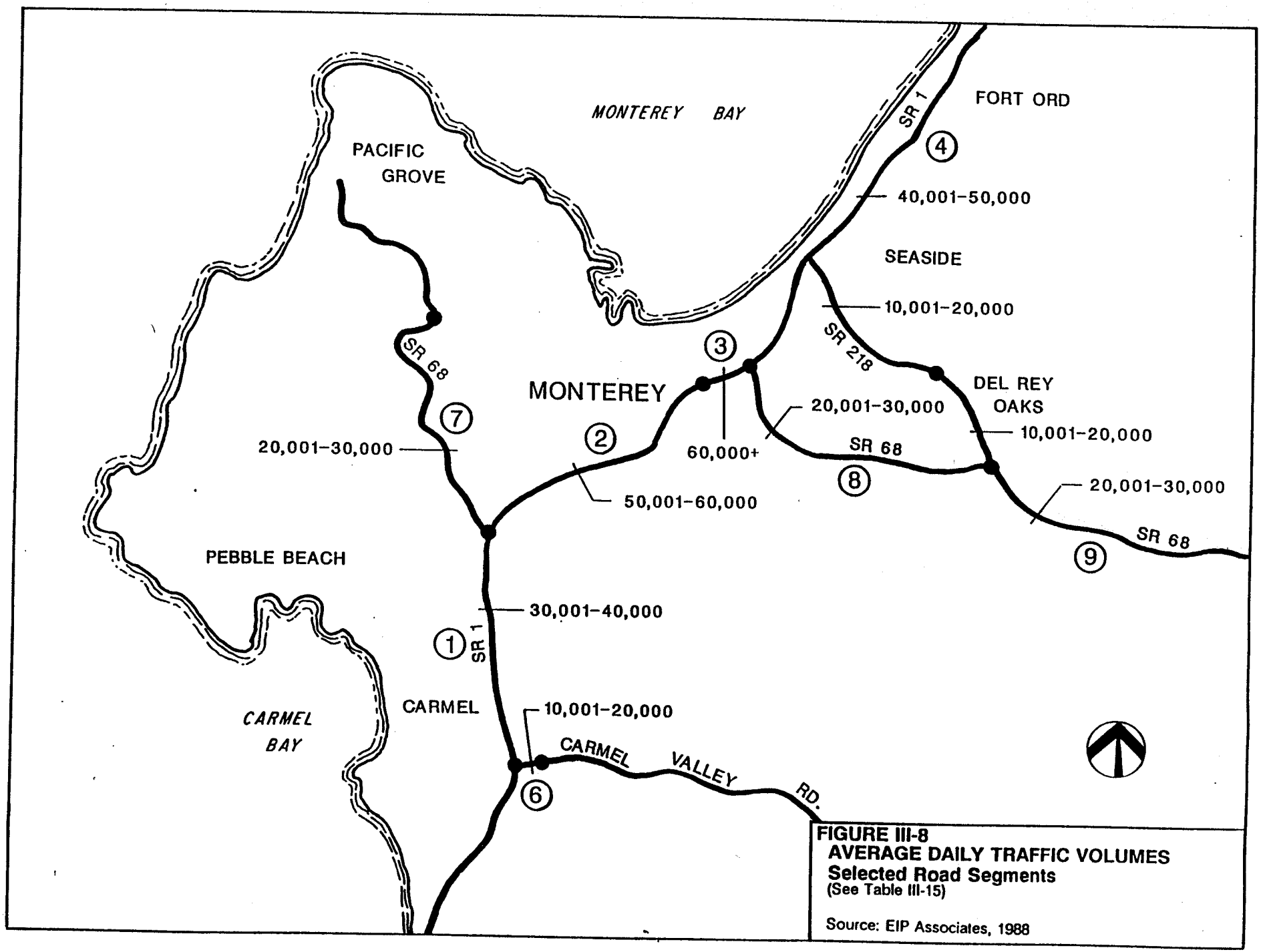


FIGURE III-8
AVERAGE DAILY TRAFFIC VOLUMES
Selected Road Segments
(See Table III-15)

Source: EIP Associates, 1988

TABLE III-18

EVALUATION CRITERIA FOR LEVEL OF SERVICE
(Daily Traffic Volumes)

Facility Type	LOS C ADT Traffic Volumes	LOS D ADT Traffic Volumes	LOS E/F ADT Traffic Volumes
Urban streets	V/C = 0.71 - 0.80	V/C = 0.81 - 0.90	V/C = 0.91 - 1.00
Two-lane	10,700 - 12,000	12,000 - 13,500	13,500 - 15,000
Four-lane	21,300 - 24,000	24,000 - 27,000	27,000 - 30,000
Six-lane	32,000 - 36,000	36,000 - 40,500	40,500 - 45,000
Eight-lane	42,600 - 48,000	48,000 - 54,000	54,000 - 60,000
Freeway	V/C = 0.55 - 0.77	V/C = 0.78 - 0.93	V/C = 0.94 - 1.00
Four-lane	44,000 - 62,000	62,000 - 74,000	74,000 - 80,000
Six-lane	66,000 - 94,000	94,000 - 112,000	112,000 - 120,000
Eight-lane	88,000 - 125,000	125,000 - 149,000	149,000 - 160,000
Ten-lane	110,000 - 156,000	156,000 - 186,000	186,000 - 200,000
Twelve-lane	132,000 - 187,000	187,000 - 223,000	223,000 - 240,000

Sources: Transportation Research Board, 1980 and 1985; and Highway Research Board, 1965.

Existing traffic conditions on the Peninsula are generally at LOS D or worse on eight of the selected freeway segments. LOS D for freeways is defined as the upper end of stable flow conditions with volumes not exceeding 95 percent of the segment capacity. LOS E is defined as unstable flow at roadway capacity, and LOS F is defined as stop-and-go conditions with operating speeds of less than 30 miles per hour.

A number of streets in the cities on the Monterey Peninsula are operating at poor conditions. These streets have not been analyzed specifically in this EIR, but it is important to recognize that as traffic increases on freeways in the Peninsula area, conditions on these surface routes will continue to worsen. Streets that are known to be operating at or above capacity are listed below:

- Del Monte Avenue in Seaside,
- Fremont Street in Seaside, and
- Carmel Valley Road between Los Laureles Road and Ford Street.

2. Schools

Public schools in the Monterey Peninsula are operated by three school districts: Monterey Peninsula Unified School District (MPUSD), Pacific Grove Unified School District (PGUSD), and Carmel Unified School District (CUSD). These districts operate 14 elementary schools, five middle schools, three high schools, and three continuation schools. Only schools located within the Cal-Am service area are considered in this discussion, although MPUSD enrollment and capacity figures also include schools in Fort Ord and Marina. Figure III-9 shows school district boundaries on the Monterey Peninsula.

In addition to the public schools on the Peninsula, there are several private schools serving the area, including Briarcliff, Junipero Serra, All Saints, RLS, and Santa Catalina.

School Enrollment and Capacity

The 1988 enrollments, remaining capacity, and the percent of utilization of MPUSD, PGUSD, and CUSD schools are presented in Table III-19. Capacity information is based on school design and student space requirements. Remaining capacity indicates that classroom space is available if school enrollment increases, but in many cases this available space is used for special programs. If enrollments increase substantially, some special programs may be cut or relocated to accommodate additional students.

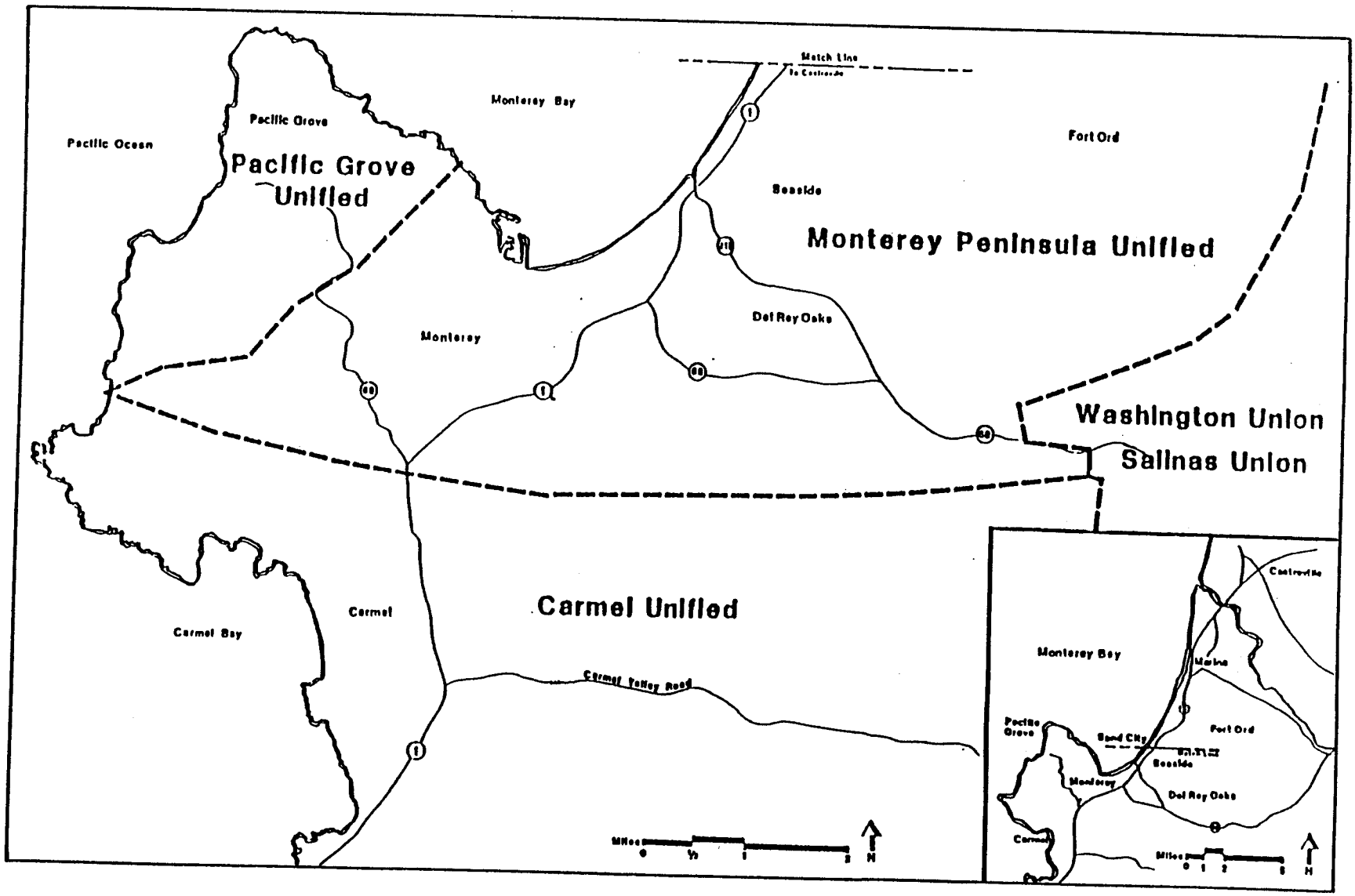


FIGURE III-9

SCHOOL DISTRICT BOUNDARIES

Source: EIP Associates, 1988

TABLE III-19

SCHOOL DISTRICT ENROLLMENT AND CAPACITY

	Capacity	1986-87 Enrollment	Remaining Capacity	Percent Utilized
Monterey Peninsula Unified School District[1]				
Elementary Schools[2]	10,135	7,856	2,279	77.5
Middle Schools[3]	3,600	2,666	934	74.1
High Schools[4]	3,100	2,862	238	92.3
MPUSD Totals	**16,835**	**13,384**	**3,451**	**79.5**
Pacific Grove Unified School District				
Elementary Schools	1,351	1,131	220	83.7
Middle School	600	486	114	81.0
High Schools	1,000	620	380	62.0
PGUSD Totals	**2,951**	**2,237**	**714**	**75.8**
Carmel Unified School District				
Elementary Schools	1,150	948	202	82.4
Middle School	910	416	494	45.7
High Schools	1,050	790	260	75.2
CUSD totals	**3,110**	**2,154**	**956**	**69.3**
Total				
Elementary School Totals	12,636	9,935	2,701	78.6
Middle School Totals	5,110	3,568	1,542	69.8
High School Totals	5,150	4,272	878	83.0
Grand Totals	**22,896**	**17,775**	**5,121**	**77.6**

[1]Data for MPUSD also includes schools in Fort Ord and Marina that are outside the Cal-Am service area.
[2]Elementary schools for all districts include kindergarten and grades 1-5 unless otherwise noted.
[3]Middle schools for all districts include grades 6-8.
[4]High schools for all districts include grades 9-12; continuation high school includes grades 10-12.

Source: EIP Associates, 1988

Enrollment trends for the MPUSD, PGUSD, and CUSD systems from 1980-1984 indicate a general enrollment decline despite an increase in the number of households in the area. This trend indicates that average household size during this period was declining. Since 1985, the trend has been toward a slight increase in enrollments. The 1988 combined enrollment for the three districts serving the Monterey Peninsula was 17,775 students. Capacity of all schools combined during 1988 was 22,896 students.

Monterey Peninsula Unified School District: The MPUSD serves Monterey, Del Rey Oaks, Fort Ord, Marina, Seaside, Sand City, and a portion of the Pebble Beach community with a total enrollment of approximately 13,384 students. Schools in Fort Ord and Marina, however, are outside the Cal-Am service area. In recent years, the MPUSD has had an annual growth

rate of approximately one percent or about 130 new students per year. The enrollment and capacity data presented in Table III-19 indicate that MPUSD elementary schools have adequate capacity, with surplus capacity for 2,279 students. Middle schools in the MPUSD have remaining capacity for 934 additional students. MPUSD high schools are operating at 92 percent of capacity.

The MPUSD has no immediate plans to expand school facilities, although facility expansion could occur in the Fort Ord area.

Pacific Grove Unified School District: The PGUSD serves the City of Pacific Grove and the northern part of Del Monte Forest, with a total districtwide enrollment of 2,237 students. No PGUSD schools are over capacity; the district is operating at 76 percent of capacity. PGUSD elementary schools have remaining capacity for approximately 220 additional students. Pacific Grove Middle School is at 81 percent of capacity. Pacific Grove High School and continuation school have remaining capacity for 380 students.

Carmel Unified School District: The CUSD provides school services for Carmel-by-the-Sea, Carmel Valley, and portions of Pebble Beach, with a total district enrollment of 2,154 students. Elementary schools have remaining capacity for 202 students; middle schools have remaining capacity for 494 students; and high schools have capacity for 260 students. The CUSD recently reopened Carmelo School, using five classrooms for its child development program and leasing the remaining four classrooms to an nonprofit theater group. Reopening the four classrooms would ensure adequate district capacity in future years.

3. Wastewater

Three sanitary districts serve the Monterey Peninsula: Monterey Regional Water Pollution Control Agency (MRWPCA), Carmel Sanitary District (CSD), and Pebble Beach Community Services District (PBCSD). Figure III-10 shows the service area of each district. Areas that are not currently served by a sanitary district use septic systems or package sewer systems.

Treatment Services

Monterey Regional Water Pollution Control Agency: MRWPCA is the largest sanitary district on the Peninsula. It manages five treatment plants that serve Monterey, Pacific Grove, Sand City, Seaside, and Del Rey Oaks. Use of these five plants plus treatment facilities at Fort Ord will be eliminated upon completion of the MRWPCA's 29.6-million-gallons-per-day (MGD) regional treatment plant. Operations of the regional treatment plant will be restricted under terms of a Monterey County conditional use permit that limits the maximum amount of sewage that can be treated to 25 MGD. The plant will also be restricted in that it will not be allowed to serve a greater population than is forecast in the MBUAPCD's Air Quality Plan for the Monterey Bay region. Population projections to be used in this plan are forecast by AMBAG. The remaining average dry weather flow (ADWF) capacity of the regional plant is estimated at approximately 8.0 MGD.

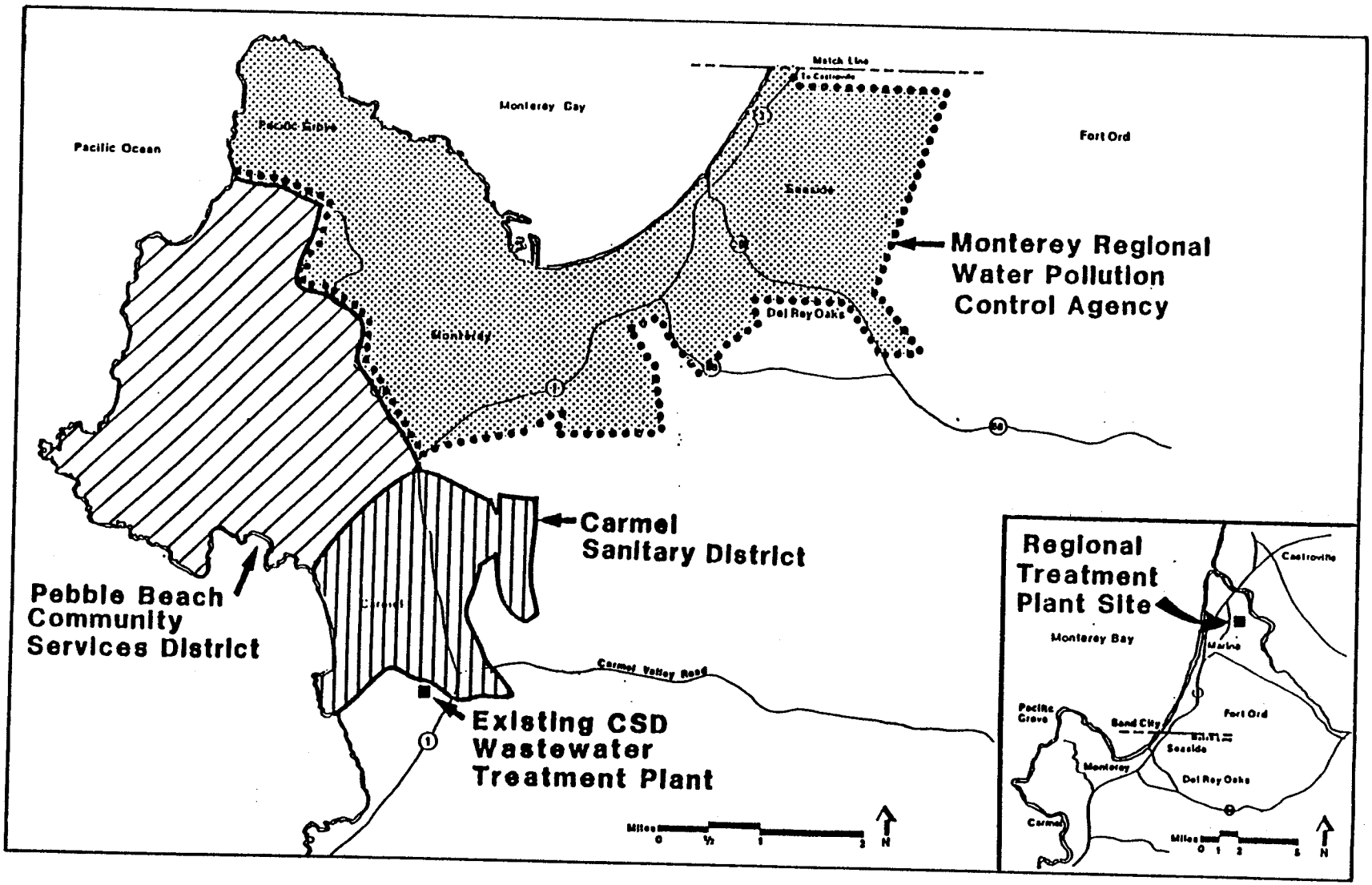


FIGURE III-10

SANITATION DISTRICT SERVICE AREAS

Source: EIP Associates, 1988

Carmel Sanitary District: The CSD serves Carmel-by-the-Sea and contiguous unincorporated county lands south to Highlands Inn and east to Valley Greens Drive in the Carmel Valley. The CSD treatment plant has a total design capacity of 4.0 MGD. The Regional Water Quality Control board has restricted use of this plant to 3.0 MGD. The CSD retains ownership of two-thirds of the plant capacity; the remainder is used by PBCSD. The ADWF for the plant is approximately 2.2 MGD, with 0.8 to 1.8 MGD of remaining capacity available for future development (Zambory pers. comm.). The CSD treatment plant outfall discharges to Carmel Bay.

Pebble Beach Community Services District: The Pebble Beach Community Services District serves the Del Monte Forest Area (Figure III-10). As noted above, the PBCSD owns one-third the capacity of the CSD/PBCSD joint treatment plant. PBCSD officials note that growth consistent with current general plans and the coastal plan will be served adequately by the expanded facility through buildout (Andrews pers. comm.). Capacity problems could occur, however, if there is extensive construction of "granny flats" in the future. Such construction would be regulated by County ordinance and is currently not authorized under county zoning regulations.

Septic Systems: Much of the Carmel Valley area is served by septic systems. A 1982 Montgomery Consulting Engineers' report detailed potential problems with groundwater contamination due to overuse of septic systems in the valley (Montgomery Consulting Engineers 1982). This report stated that septic system capacity problems could be avoided by limiting dwelling units in the valley to 9,540, by avoiding development in the most sensitive areas, and by supplementing septic systems or tie-ins to existing systems where necessary. As long as development of environmentally-sensitive areas is avoided, it is not likely that there would be septic system capacity problems in the Carmel Valley. It should be noted that in addition to Carmel Valley, septic systems are being used in Sand City. It appears that these systems function properly at this time.

4. Air Quality

Pollutants, Standards, and Regulatory Framework

The federal Clean Air Act establishes air quality standards for several pollutants and requires areas that violate these standards to prepare and implement plans to achieve the standards by certain deadlines. State and federal air quality standards are divided into primary standards designed to protect public health, and secondary standards intended to protect the public welfare from effects such as visibility reduction, soiling, nuisance, and other forms of damage. The three major pollutants addressed in this section are identified below.

Ozone: Ozone is a major component of photochemical smog and is considered the major regional pollutant. Photochemical smog is a complex mixture of secondary pollutants created by chemical reactions that take place in the presence of sunlight. These chemical reactions involve nitrogen oxides (NO_x), nitrogen dioxide, various organic compounds, ultraviolet light, and normal components of the atmosphere. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, photochemical smog is primarily a summer air pollution problem.

Ozone is a public health concern because it is a respiratory irritant that also increases susceptibility to respiratory infections. It causes significant damage to leaf tissues of crops and natural vegetation and damages many materials by acting as a chemical oxidizing agent.

Because the time frame for photochemical smog reactions involves several hours, emissions of precursor compounds become mixed and spread over a large area, producing a regional pollution problem. The highest ozone concentrations typically occur several miles downwind of densely developed areas. Ozone problems result from cumulative regional development patterns, rather than from a few incrementally significant emission sources.

Pollutant transport studies conducted in 1980 (Dabberdt 1983) demonstrated ozone transport from the San Francisco Bay area into the Monterey Bay region. Two major pollutant transport routes were identified: offshore transport southward along the coast with subsequent inland movement due to sea breeze circulation patterns, and transport into the San Benito Valley from the Santa Clara Valley. Offshore transport from the San Francisco Bay area appears to be the dominant transport route.

Table III-20 summarizes ozone monitoring data for all stations in the North Central Coast Air Basin. As this table shows, the basin is in nonattainment for the state and federal ozone standards. Several violations of the California ozone ambient air quality standard have been recently recorded at the Pinnacles National Monument Station. In 1987, the federal ozone standard at the Pinnacles Station was violated on eight separate days and the California ozone standard on 50 separate days totaling 177 hours, based on these data. The EPA, on March 31, 1989, denied the MBUAPCD's request for redesignation from nonattainment to attainment status.

Carbon Monoxide: Carbon monoxide (CO) levels are a public health concern because CO combines readily with hemoglobin, thus reducing the amount of oxygen transported in the bloodstream. Even relatively low concentrations of CO can significantly reduce the amount of oxygen in the bloodstream because CO binds to hemoglobin 220 to 245 times more strongly than does oxygen. Both the cardiovascular system and the central nervous system can be affected when 2.5 to 4.0 percent of the hemoglobin is bound to CO rather than to oxygen. State and federal ambient air quality standards for CO have been set at levels intended to keep CO from combining with more than 1.5 percent of the blood's hemoglobin (U. S. Environmental Protection Agency 1979; California Air Resources Board 1982).

Particulate Matter: Health concerns associated with suspended particles focus on those particles small enough to reach the lungs when inhaled (generally those particles smaller than 10 microns in diameter). Consequently, both the federal and state air quality standards for particulate matter have been revised to apply only to these small particles (designated as PM_{10}).

State and federal PM_{10} standards have been set for 24-hour and annual averaging times. The state 24-hour PM_{10} standard is 50 micrograms per cubic meter (μ/m^3) and the federal 24-hour standard is 150 μ/m_3. The state annual PM_{10} standard is 30 μ/m^3 on an annual geometric mean, whereas the federal annual PM_{10} standard equals 50 μ/m^3 on an annual arithmetic mean. Federal and state 24-hour PM_{10} standards are not to be exceeded more than one day per year, whereas both annual standards are not to be exceeded.

Table III-21 summarizes recorded violations of the state PM_{10} standard for the North Central Coast Air Basin from 1986 through 1988. Prior to 1986, monitoring was conducted for total suspended particulates rather than for PM_{10}. As Table III-21 indicates, the North Central Coast Air Basin is in nonattainment for PM_{10}.

TABLE III-20

SUMMARY OF OZONE MONITORING DATA - NORTH CENTRAL COAST AIR BASIN

	Monterey County				San Benito County								Santa Cruz County					
	Carmel Valley		Monterey		Gonzales High School		Salinas II		Hollister		Davenport		Santa Cruz		Aptos		Scotts Valley	
Year	Peak 1-hour Value (ppm)	Days above State Standard	Peak 1-hour Value (ppm)	Days above State Standard	Peak 1-hour Value (ppm)	Days above State Standard	Peak 1-hour Value (ppm)	Days Above State Standard	Peak 1-hour Value (ppm)	Days Above State Standard	Peak 1-hour Value (ppm)	Days Above State Standard	Peak 1-hour Value (ppm)	Days Above State Standard	Peak 1-hour Value (ppm)	Days Above State Standard	Peak 1-hour Value (ppm)	Days Above State Standard
1980	0.14	4	0.10	1	--	--	0.12	1	0.14	10	--	--	--	--	0.11	4	0.11	5
1981	0.08	0	0.09	0	--	--	0.08	0	0.14	7	--	--	--	--	0.09	0	0.10	3
1982	0.08	0	0.11	1	--	--	0.08	0	0.10	1	--	--	--	--	0.09	0	0.09	0
1983	0.10	1	0.09	0	--	--	0.08	0	0.11	5	--	--			0.10	1	--	--
1984	0.09	0	0.08	0	--	--	0.07	0	0.10	6	--	--	0.08	0	0.08	0	--	--
1985	0.11	1	--	--	--	--	0.09	0	0.11	11	--	--	0.11	2	--	--	--	--
1986	0.08	0	--	--	0.08	0	0.08	0	0.10	1			0.09	0	--	--	--	--
1987	0.09	0	--	--	0.08	0	0.08	0	0.12	7	0.08	0	0.09	0	--	--	--	--
1988	0.09	0	--	--	0.06	0	0.07	0	0.07	0	0.07	0	0.08	0	--	--	--	--

Notes: The Monterey ozone monitoring station was discontinued after 1984.
The Aptos ozone monitoring station was discontinued after 1984.
The Scotts Valley ozone monitoring station was discontinued after 1982.
State 1-hour ozone standard is 0.09 ppm, not to be exceeded.
The National Park Service began operating a monitoring station at Pinnacles National Monument in April 1987.
After the first year data had been collected, violations of the state and federal ozone standards were recorded on 8 days with a concentration of 0.

-- = No data collected.
Source: California Air Resources Board, 1981-1988.

TABLE III-21

RECORDED VIOLATIONS OF THE CALIFORNIA AMBIENT AIR QUALITY STANDARDS FOR PM_{10} IN THE NORTH CENTRAL COAST AIR BASIN (1986-1988)

Station	Date	Concentration ($\mu g/m^3$)
Hollister	February 25, 1986	52
Santa Cruz	April 21, 1987	58
Salinas	June 2, 1987	52
Santa Cruz	September 6, 1987	54
Hollister	September 6, 1987	50
Salinas	September 18, 1987	52
Santa Cruz	September 30, 1987	52
Hollister	September 30, 1987	58
Santa Cruz	October 6, 1987	82
Salinas	October 6, 1987	54
Hollister	October 18, 1987	53
Santa Cruz	November 11, 1987	52
Santa Cruz	January 26, 1988	50
Santa Cruz	August 25, 1988	56
Santa Cruz	September 30, 1988	52
Santa Cruz	October 30, 1988	50
Salinas	December 5, 1988	51
Hollister	December 5, 1988	58
Santa Cruz	December 5, 1988	64

Source: Monterey Bay Unified Air Pollution Control District, 1989.

Air Quality Management Plan: Air quality management plans (AQMP) required by the Federal Clean Air Act are generally prepared for entire air basins. In California, local agencies have generally had the primary responsibility for preparing these plans. In the North Central Coast Air Basin, the air quality management plan was prepared jointly by MBUAPCD and AMBAG. The first air quality plan was prepared in 1979 and addressed prospects for achieving the federal ozone standard by 1982. That plan was revised in 1982. The 1982 air quality plan was limited in time frame to the 1987 deadline for achieving the federal air quality standard for ozone.

The 1982 AQMP indicated a marginal situation for attainment of the federal ozone standard by 1987. The plan predicted slight reductions in both reactive organic compounds and NO_x emissions for the 1981-1987 period. These emission projections indicated a limited potential for occasional violations of the federal ozone standard through 1987.

The 1989 AQMP, issued in June 1989, addresses federal planning requirements and establishes the basis for meeting the state ozone standard. This plan updates the 1982 air quality plan and includes the most current data available to estimate and forecast the emissions inventory. The 1989 plan does not attempt to estimate compliance with the state and federal ozone standards. That analysis is left to the 1991 AQMP.

Pesticide use, motor vehicle emissions, fuel evaporation, and solvent use are identified in the 1989 AQMP as the major contributors to organic compound emissions in the Monterey Bay region. Electric utility fuel combustion and motor vehicle emissions are the dominant sources of NO_x emissions.

Both the 1982 and 1989 AQMPs recognize that ozone problems in the North Central Coast Air Basin might be significantly influenced by pollutant transport from the San Francisco Bay Air Basin. Studies were conducted in 1980 to clarify whether pollutant transport was affecting the Monterey Bay area. Results of the pollutant transport study (Dabberdt 1983) demonstrated instances of ozone transport from the San Francisco Bay Area. That study does not, however, fully clarify the relative importance of pollutant transport versus direct pollutant emissions from sources in the air basin. Additional studies are currently attempting to determine the relative impacts of ozone and its precursors on the North Central Coast Air Basin.

On June 9, 1989, the Air Resources Board formally designated the North Central Coast Air Basin as a nonattainment area for state ozone and PM_{10} ambient air quality standards. Once designated as an ozone nonattainment area, the steps required by the California Clean Air Act (CCAA) to bring an area into attainment vary according to the severity of the air pollution problem within each district. One purpose of the 1989 AQMP is to maximize the reduction of ozone precursor emissions in order to minimize the severity of controls that will be needed for the 1991 AQMP. The 1988 CCAA requires submittal of a plan in July 1991 which addresses attainment of the state ozone standard.

The 1989 AQMP recommends adoption of a vehicle inspection and maintenance program, specific transportation control measures, indirect source review and limiting of the volatile organic compound content of architectural coatings and consumer products. In addition, the 1989 AQMP recommends the adoption of four control measures that were recommended by the 1982 AQMP but never adopted. These include marine vessel ballasting, petroleum dry cleaners, leather finishing, and furniture staining.

Four major transportation control measures (TCM) have been carried forward from the 1982 plan to the 1989 plan. They include:

- Improved public transit
- Ridesharing and flextime promotion
- Bicycle facility improvements
- Traffic flow improvements

The TCMs are discussed in detail in the 1989 AQMP.

Several public agencies are responsible for implementing various actions related to the AQMP. The EPA and the Air Resources Board are responsible for setting limits on the amount of emissions that motor vehicle engines may produce. MBUAPCD is responsible for limiting the amount of emissions from industrial and other fixed sources of pollutants. AMBAG and MBUAPCD share responsibilities for the major planning program conformity assessments. Cities, counties, and transit agencies are responsible for land use and transportation measures to reduce the amount of vehicle travel in the region.

Existing Air Quality Conditions

Most federal air quality standards have never been violated in the North Central Coast Air Basin. Federal ozone standards were occasionally violated through the early 1980s but no violations have been recorded in the air basin since 1982. As evidenced by Table III-21, seven violations of state ozone standards in Hollister were recorded in 1987. No violations have been recorded in the Carmel Valley or the Monterey area since 1985.

The existence of high CO concentrations is a concern along heavily traveled roadways and intersections where traffic congestion persists for long periods. CO levels in the Carmel Valley have been a particular concern because the geography of the valley and its relationship to prevailing air currents makes it especially prone to pollutant concentration during temperature inversions. These temperature inversions prevent upward dispersion of CO and other air pollutants. There are no monitoring data available for CO in the Monterey Bay region.

H. SOCIOECONOMIC CONDITIONS

1. Construction Industry

The level of construction industry activity within an area is typically measured by the number and value of building permits granted for construction projects. As shown in Table III-22, the value of new construction within the MPWMD boundaries between 1980 and 1986 totaled approximately $719.2 million, with the value of construction averaging $102.7 million per year. Approximately 81 percent of the districtwide construction value was generated by construction projects in unincorporated portions of Monterey County (41 percent) and the city of Monterey (40 percent). The remainder was divided among Pacific Grove (9 percent), Seaside (5 percent), Carmel-by-the-Sea (5 percent), Del Rey Oaks (1 percent), and Sand City (1 percent).

Approximately $195.1 million, or 27 percent of the districtwide construction value, was generated by the construction of single family residential units. As shown in Table III-22, single family unit construction within the district's boundaries between 1980 and 1986 was dominated by housing developments in unincorporated portions of Monterey County. Housing construction in unincorporated Monterey County accounted for 991 of the 1,593 single family units constructed within the district, and 71 percent of the construction value, between 1980 and 1986.

The construction of multi-family residential units accounted for approximately $51.4 million, or seven percent, of the value of districtwide construction between 1980 and 1987. Multi-family unit construction in the city of Monterey accounted for 823 of the 1,334 units constructed districtwide, and 61 percent of the total value of multi-family unit construction during the seven-year period.

Commercial construction projects generated approximately $235.2 million in districtwide construction value between 1980 and 1986, accounting for 33 percent of all construction value. Again, projects in Monterey County and the city of Monterey accounted for most of the districtwide commercial construction. Commercial construction projects in Monterey County and the city of Monterey generated 36 and 32 percent, respectively, of the total value of commercial construction districtwide.

TABLE III-22

VALUE OF NEW CONSTRUCTION WITHIN THE MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
1980-86
(Based on Building Permit Applications)

Jurisdiction	Single-Family Residential				Multi-Family Residential				Commercial				Other/a		Total Value of New Construction	
	Units	Total Value ($1,000)	Percent of Total Value	Average Value/ Unit	Units	Total Value ($1,000)	Percent of Total Value	Average Value/ Unit	Projects	Total Value ($1,000)	Percent of Total Value	Average Value/ Project	Total Value ($1,000)	Percent of Total Value	Total Value ($1,000)	Percent of Total Value
Carmel-by-the-Sea	78	$9,465	5%	$121,346	18	$1,182	2%	$65,667	0	$0	0%	N/A	$22,393	9%	$33,040	5%
Del Rey Oaks	1	34	0%	34,000	0	0	0%	N/A	7	2,690	1%	$384,286	2,585	1%	5,309	1%
Monterey	315	30,045	15%	95,381	823	31,218	61%	37,932	94	150,871	64%	1,605,011	76,224	32%	288,358	40%
Pacific Grove	163	12,578	6%	77,166	240	3,127	6%	13,029	28	10,516	4%	375,571	35,485	15%	61,706	9%
Sand City	0	0	0%	N/A	0	0	0%	N/A	22	2,669	1%	121,318	1,048	0%	3,717	1%
Seaside	45	3,678	2%	81,733	164	7,525	15%	45,884	27	9,788	4%	362,519	14,444	6%	35,435	5%
Monterey County/b	991	139,311	71%	140,576	89	8,346	16%	93,775	95	58,641	25%	617,274	85,362	36%	291,660	41%
District totals	1,593	$195,111	100%	$122,480	1,334	$51,398	100%	$38,529	273	$235,175	100%	$861,447	$237,541	100%	$719,225	100%

/a Includes the construction of public buildings, remodels, small structures, wells, fences, private roadways, garages, and other miscellaneous projects.

/b Includes an area that extends beyond the Cal-Am service area. Area includes unincorporated portions of Monterey County south of Laureles Grade and excludes the unincorporated portions of county lands.

Note: Values represent construction cost estimates provided by the applicants for building permits. Per-unit and per-project values were estimated based on total valuations and total units/projects. Construction values for commercial projects can vary substantially.

Source: Planning Analysis and Development (1988) based on "Annual Building Permit Summaries, 1980-1986" provided by the Cities of Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City, and the County of Monterey.

2. Tourism

Tourism is second only to the military in its impact on the Monterey Peninsula economy (Monterey County Planning Department 1985). Tourists are attracted to the area because of its natural beauty and amenities. The area is a primary destination for people who enjoy beaches, rivers, parks, golf courses, convention facilities, restaurants, galleries, museums, and the aquarium.

Tourists' dollars generate employment and income for residents and are an important source of revenues for local governments. Purchases by travelers, including expenditures for accommodations, food, gasoline, and entertainment affect business receipts and thus benefit the local economy.

Monterey County is consistently ranked in the top 10 counties in California in terms of travel-related expenditures (California Office of Tourism 1982).

As shown in Table III-23 travel-generated expenditures in Monterey County totaled over $684 million in 1986. These expenditures generated approximately $127 million of local income and created more than 12,000 jobs. Local tax receipts attributed to tourists totaled more than $21 million. Tourists spend the most money in eating and drinking places, followed by accommodation and retail sales (California Department of Commerce 1988.)

Transient occupancy taxes (hotel "bed taxes"), which can be levied by cities and counties, are an indirect measure of the importance of tourism to a jurisdiction. Del Rey Oaks and Sand City are the only cities within the district which do not levy transient occupancy taxes. The other cities charge a tax equivalent to 10 percent of the hotel room rate. For many jurisdictions the transient occupancy tax is an important revenue source. For example, in 1986, for the Cities of Carmel-by-the-Sea and Monterey, the transient occupancy tax was the largest single revenue source, constituting 27.6 and 24.1 percent, respectively, of their total budgets. Pacific Grove is also very dependent on transient occupancy taxes for City operations, with these taxes being the second largest source of revenue, contributing 11.4 percent to the total budget. The transient occupancy tax accounts for 3.6 percent for the general revenues for the City of Seaside.

TABLE III-23

1986 TRAVEL-GENERATED VISITOR IMPACTS IN MONTEREY COUNTY
By Type of Business

Type of Business	Travel Expenditures ($000s)	Payroll ($000s)	Employment (Jobs)	Tax Receipts (Local) ($000s)	Tax Receipts (State) ($000s)
Accommodations	$177,213	$38,688	3,105	$16,683	$ 1,450
Eating/drinking places	211,578	53,155	6,143	2,486	11,417
Grocery stores	27,277	3,091	194	320	1,347
Auto repair/transportation	86,441	5,138	380	396	5,298
Recreation	55,205	10,588	835	0	405
Retail sales	126,767	16,072	1,410	1,489	6,320
Total	**$684,481**	**$126,732**	**12,067**	**$21,374**	**$26,237**

Source: California Department of Commerce, 1988.

3. Recreation

There are numerous park and recreation facilities within the boundaries of the MPWMD. These facilities contribute to the unique character of the region by preserving areas of natural beauty and by providing opportunities for outdoor recreation. The park and recreation resources of the region make the area an attractive and healthful place to live, and serve to attract tourists.

The park and recreation facilities within the district can be classified by their operating agencies (Table III-24). While in most cases their functions overlap, operating agencies serve different groups and have slightly different goals.

Parks operated by the State of California are areas that contain unique resources, exhibit natural beauty, or have statewide significance. State parks within the district include Asilomar State Beach, Carmel River State Beach, Monterey State Historic Park, Monterey State Beach, and Point Lobos State Reserve (Monterey County Planning Department 1981).

County-operated parks are generally areas that provide recreation on a larger scale than can usually be provided locally. County parks within the district include Laguna Seca, Jack's Peak Park, and Del Mesa Carmel (Monterey County Planning Department 1981).

Regional parks within the district have been developed by special districts to meet the needs of all people within each special district. These parks include Laguna Grande Park, Del Rey Park, and Garland Ranch Regional Park (Monterey County Planning Department 1981).

TABLE III-24
EXISTING PARK AND RECREATION ACREAGES
Within the Cal-Am Service Area by Operating Agency

Operating Agency	Number of Facilities	Acres
California Department Parks and Recreation	5	1,555
Monterey County	3	1,093
Monterey Peninsula Regional Park District	3	3,222
City of Carmel-by-the-Sea	6	62
City of Del Rey Oaks	2	34
City of Monterey	15	176
City of Pacific Grove	15	179
Sand City	0	0
City of Seaside	21	25
Privately-Owned Golf Courses	9	N/A
Total	**79**	**6,346**

Source: Monterey County Planning Department, 1981; Salinas Area Chamber of Commerce, 1987.

City parks, too numerous to list here, are generally smaller parks that serve a subpopulation within a community. According to the *Parks and Recreation Element Background Study* (Monterey County Planning Department 1981), the cities of Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, and Seaside all contain city parks. Sand City, however, does not have any city parks.

Recreation is also provided by private institutions. The district contains many privately operated golf courses. (These facilities are operated as either private clubs or are available to the general public.) These include Carmel Valley Golf and Country Club, Carmel Valley Ranch, Monterey Peninsula Country Club, Pebble Beach Golf Links, Laguna Seca Golf Club, Spyglass Hill Golf Course, Rancho Canada Golf Links, Poppy Hills Golf Course, and the Links at Spanish Bay (Monterey County Planning Department 1981, Salinas Area Chamber of Commerce 1987).

Park and recreation facilities located adjacent to the Carmel River include Carmel River State Beach, Del Mesa Carmel County Park, Garland Ranch Regional Park, Rancho Canada Golf Links, Carmel Valley Golf and Country Club, and Carmel Valley Ranch. Most river recreation at these facilities is water-enhanced recreation (not requiring physical contact with the water, but enhanced by the presence of water). Water-enhanced recreation in the Carmel River corridor includes picnicking, hiking, golfing, nature study, and birdwatching. The presence of water either aesthetically enhances or directly improves these activities. Water contributes to vegetation diversity which attracts wildlife, nature study, and birdwatching. Thus, these activities are directly improved by the presence of water. A reduction in water would cause a reduction in vegetation, which in turn would reduce the recreation use of the river by adults and children.

Water-dependent recreation, such as boating, fishing, and swimming, requires direct contact with water. Low flows in recent years have greatly diminished opportunities for water-dependent recreation in the Carmel River (primarily swimming and fishing) (McGowan pers. comm.).

The impact of low flows on fishing is less than might be expected because there is a major steelhead sport-fishery in the Carmel River. The river is open to angling from its mouth to Robles del Rio, 15 miles upstream. Access is relatively easy and the stream is often wadable along its entire length. To prevent overfishing, the season is restricted to the period from November 15 through February 28. Most of the fish are taken in January and February. When streamflow is low, fish tend to crowd into a dozen or so large pools which sometimes become ringed with anglers. This diminishes the pleasures and aesthetic values of the steelhead fishing and increases the risk of overfishing. The problem has been reduced since 1985 through prohibition on angling when streamflow is below 200 cubic feet per second at the Near Carmel gauge. In 1984, a year of a relatively good run and excellent conditions for angling, an estimated total of 1,442 angler days were spent on the Carmel River in January and February and an estimated 478 adult steelhead were caught (D.H. Dettman 1986).

4. Military

Five military facilities are located within the MPWMD. Four of these, the Presidio of Monterey, the Naval Postgraduate School, the local Coast Guard facility, and the Naval Reserve Station, are subject to MPWMD regulation. The first three of these are located within Monterey and the fourth is in Pacific Grove. Following are brief descriptions of these operations based on information contained in previous environmental documents.

Fort Ord, the fifth military facility located within the MPWMD boundaries, is not regulated by the MPWMD.

Presidio of Monterey

The Presidio of Monterey, operated by the U. S. Army, houses the Defense Language Institute, a military foreign language training facility that currently includes 2,224 dormitory rooms, 72 bachelor quarters, and 99 single family units.

The U.S. Army recently completed a new master plan for the 400-acre installation that would consolidate its military language institutes nationwide at the Presidio of Monterey. Under buildout of the new master plan, total personnel at the installation would increase from approximately 3,600 to 5,800. The increase in personnel is being accommodated by the construction of additional dormitory facilities and residential units. At completion of the housing projects, total housing will increase to approximately 3,000 two- and three-person bachelor rooms and 99 single family residential units. Development under the new master plan will also include installation of a 500,000-gallon water tank and distribution system to serve the new development.

Naval Postgraduate School

Operated by the U.S. Navy, the Naval Postgraduate School includes educational facilities and a residential compound. Current enrollment at the Postgraduate School totals approximately 1,850. A recently adopted master plan calls for the expansion of classroom, library, and child care facilities to accommodate current enrollment pressures.

The onsite La Mesa Village residential compound currently includes 877 single family units. The demand for onsite housing currently exceeds the available housing, resulting in a large number of the installation's personnel living in housing in the surrounding area. The master plan does not call for the future development of additional onsite housing; long-range plans are, however, reportedly being discussed for the development of 400 new residential units at La Mesa Village.

Naval Reserve Station

The U.S. Naval Reserve Station is a single-building facility in Pacific Grove that provides administrative and training services for the Naval Reserve program. For 28 days each month the facility serves as an administration center, staffed by one officer, six enlisted personnel, and one civilian (Taylor pers. comm.). For two days each month the facility serves as a training center for approximately 100 Naval Reserve officers.

The approximately 11,000 square-foot facility includes no overnight rooms or housing units. The facility has no current expansion plans.

Coast Guard Group

The U.S. Coast Guard presence in Monterey totals approximately 100 personnel. These personnel provide administrative support for both the Naval Postgraduate School and Coast Guard operations. Coast Guard personnel live throughout the area. No expansion plans are being considered for Coast Guard operations.

5. Fiscal Conditions

Revenues

As shown in Table III-25, city and county revenues have been categorized according to four broad revenue sources: taxes, charges for current services, intergovernmental revenues, and other revenue. Tax revenues include property taxes, sales taxes, transportation taxes, transient occupancy taxes, franchise taxes, and other locally-imposed taxes. Communities rely to varying degrees on tax revenues, which are very sensitive to the level of development and consumer spending within a community. Sand City, Carmel-by-the-Sea, and Monterey all rely heavily on tax revenues to fund public programs, with tax revenues accounting for 59 to 76 percent of all revenues. Del Rey Oaks and Monterey County rely to a lesser degree on tax revenues, which account for approximately one-quarter of all revenues received by these jurisdictions.

Revenues generated by charges for current services include planning-related fees, park and recreation fees, parking facility fees, public utility connection fees, and other fees for services provided by the local jurisdiction. These revenues are collected to offset the costs of providing specific local services. The relative level of revenues generated by charges for current services varies among jurisdictions because of the number and magnitude of fees imposed by the local government. Monterey and Pacific Grove generate 20 and 17 percent, respectively, of total revenues through the imposition of service charges, while Sand City and Carmel-by-the-Sea receive only two and three percent, respectively, of total revenues through service charges.

Intergovernmental revenues are received from county, state, and federal agencies, and include revenues from the state motor vehicle in lieu tax, the state cigarette tax, the state gasoline tax, and county, state, and federal grants. Intergovernmental funds are usually provided for specific local programs and purposes. Revenue levels vary according to population levels and demonstrated need for targeted grants and funds. Monterey County receives substantial intergovernmental revenues to help offset the provision of County health and welfare services and transfer payments.

Revenues from other sources include licenses and permit fees, fines and forfeitures, use of money and property, and special benefit assessments. As shown in Table III-25, these revenues typically generate from 10 to 17 percent of total revenues.

Expenditures

As shown in Table III-25, city and county expenditures have been loosely categorized according to four expenditure types. Expenditures on general government and community development services include general legislative and management expenditures, and expenditures on planning, building regulation enforcement, redevelopment projects, community promotion, and other community housing and employment programs. Expenditures in this category typically account for 20 to 30 percent of all government expenditures; these costs, which are somewhat constant because of the need to provide minimum levels of legislative and planning services, account for a relatively larger portion of the overall budgets of smaller cities such as Sand City and Del Rey Oaks.

Expenditures on public safety programs, including police, fire, emergency medical services, and animal control, account for a large portion of local government budgets. As shown in Table III-25, these costs, as a percentage of total expenditures, range from 22 percent in Carmel-by-the-Sea to 45 percent in Del Rey Oaks, with the average approaching 40 percent.

The public works and utilities budget includes expenditures on street and storm drainage construction and maintenance, parking facilities, public transit facilities, solid waste and sewer facilities, and other public utilities. Expenditure levels are relatively constant among jurisdictions within the district, with most jurisdictions spending between 13 and 22 percent of their total budgets on public works and utilities. Only in Sand City and Monterey County do expenditures on public works and utilities drop below 10 percent of total expenditures.

Other expenditures include spending on parks and recreation facilities and programs, libraries, museums, golf courses, community centers and related programs, and health and welfare programs. Expenditure levels among jurisdictions vary depending on the types of facilities and programs offered by the jurisdictions. Monterey County, with large expenditures allocated for health and welfare programs, spends approximately 47 percent of its total budget on "other" programs.

TABLE III-25

COMPARISON OF REVENUE AND EXPENDITURES FOR JURISDICTIONS WITHIN THE MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
Fiscal Year 1986-87

Jurisdiction	Revenue									Expenditures									Fiscal Year Balance ($1,000)
	Taxes		Charges for Current Services		Intergovernmental		Other/a		Total Revenue ($1,000)	General Government /Comm. Development		Public Safety		Public Works and Utilities/b		Other/c		Total Costs ($1,000)	
	Total ($1,000)	Percent of Total Revenue	Total ($1,000)	Percent of Total Revenue	Total ($1,000)	Percent of Total Revenue	Total ($1,000)	Percent of Total Revenue		Total ($1,000)	Percent of Total Costs	Total ($1,000)	Percent of Total Costs	Total ($1,000)	Percent of Total Costs	Total ($1,000)	Percent of Total Costs		
Carmel-by-the-Sea	$5,234.1	61%	$238.2	3%	$326.9	4%	$2,809.3	33%	$8,608.5	$1,671.7	21%	$1,792.5	22%	$1,029.2	13%	$3,583.1	44%	$8,076.5	$532.0
Del Rey Oaks	328.4	24%	155.1	12%	637.1	47%	227.2	17%	1,347.8	277.7	32%	387.6	45%	123.1	14%	66.2	8%	854.6	493.2
Monterey	17,742.4	59%	5,879.6	20%	2,131.7	7%	4,385.5	15%	30,139.2	5,596.2	22%	7,271.8	28%	5,654.3	22%	7,484.0	29%	26,006.3	4,132.9
Pacific Grove	4,180.6	48%	1,500.6	17%	1,973.5	22%	1,122.1	13%	8,776.8	1,809.0	22%	3,422.0	41%	1,301.7	16%	1,714.8	21%	8,247.5	529.3
Sand City	400.7	76%	11.3	2%	60.9	12%	51.2	10%	524.1	263.2	53%	212.4	43%	15.7	3%	5.0	1%	496.3	27.8
Seaside	4,943.5	46%	588.9	6%	3,450.4	32%	1,668.2	16%	10,651.0	2,496.7	28%	3,970.6	44%	1,249.0	14%	1,353.1	15%	9,069.4	1,581.6
Monterey County/d	39,028.6	25%	15,545.9	10%	80,033.0	52%	19,022.5	12%	153,630.0	26,079.2	18%	41,182.9	29%	9,328.7	6%	66,937.8	47%	143,528.6	10,101.4

Note: Revenue figures include functional and general revenues. Expenditure figures include operating and capital outlay expenditures.

/a Includes revenues from licenses and permits, fines and forfeitures, use of money and property, special benefit assessments, and other revenue and financing sources.

/b Includes expenditures on transportation-related programs and facilities.

/c Includes expenditures on health facilities and programs, culture and leisure facilities and programs, and other miscellaneous programs.

/d Represents fiscal year 1985-86 (Hornor 1988).

Source: Office of the Controller (1988)