EIP Associates

Supplemental Draft
Environmental Impact Report/Statement II

Monterey Peninsula Water Supply Project

APPENDICES

Monterey Peninsula Water Management District

U.S. Army Corps of Engineers
Permit Application #16516 S09
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February 1993

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The Monterey Peninsula Water Management District (MPWMD) has examined 5 alternatives with the basic project purpose of providonga minicipal water supply to the Monterey Peninsula that would provide adequate drought protection for existing residents and meet the long term water supply needs of planned growth. The overall project purpose is to provide adequate instream flow to protect the public trust resources of the Carmel River. The 5 alternaitves studied are: a 24,000 AF New Los Padres Reservoir, either alone or combined with a 3 MGD desalination plant; a 15,000 AF Canada Reservoir&3 MGD Desal Plant; a 7 MGD desal Plant; and No project.

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TECHNICAL REFERENCE LIST

January 8, 1993

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
LIST OF ORIGINAL DOCUMENTS

DATE	AUTHOR	TITLE
1977	Hal Boudreau	Lessons Learned from Mandatory Water Rationing on the Monterey Peninsula 1977
August 1978	Carlton J. Clayton	Review of Studies & Reports for Supplemental for Water Supply for Zone 11 (MCFC&WCD)
March 1979	Bruce Buel	Final - Report to the California Coastal Commission
April 1979	USGS	Los Padres Sedimentation Study
November 1979	Clifford J.Cortright	Technical Feasibility Study (Carmel River Dam Sites)
November 1979	Robert C. Lewis	Proposed Dams on the Carmel River in Monterey County (Steelhead Release Reconnaissance)
1980	***	Map - Possible Off-Stream Storage Sites
January 1980	MPWMD Cal-Am	Draft - Position Paper Re Cal-Am Subcommittee Rate Application
February 1980	John Logan	Reconnaissance Study of Off-Channel Reservoirs, Carmel River Basin
April 1980	John G. Williams	Stream Flow & Reservoir Yield at the San Clemente Site Carmel River
July 1980	Clifford J. Cortright	New San Clemente Dam & Reservoir Cost Estimates
July 1980	Harold C. Fritts Geoffrey A. Gordon	Annual Precipitation for and California Since 1600 Reconstructed From Western North American Tree Rings
August 1980	Clifford J. Cortright	Chupines Creek Dam & Reservoir Reconnaissance Level Cost Estimate

October 1980	Robert Woodhouse	Physiological Ecology Reconnaissance Study
October 1980	Recht, Hausrath & Assoc.	Economic & Demand Projections
October 1980	Recht, Hausrath & Assoc.	Financing Mechanisms & Revenue Sources
October 1980	Kevin Walsh	Review of Seaside Ponding Project
October 1980	Robert C. Lewis	Flow Requirements in the Carmel River With the Proposed New San Clemente Dam
November 1980	U.C. Berkeley	Residential and Institutional Rainwater Collection Systems
February 1981	USGS	Groundwater in the Seaside Area
February 1981	SERL	Rainwater Collection System
May 1981	Bruce Buel	Standby Rationing Plan
May 1981	U.S. Army Corps of Engineers	Feasibility Report on Water Resources Development Carmel River (located on General Manager's bookshelf-very large document)
July 1981	Converse, Ward, Davis, and Dixon	Economic Feasibility Analysis & Comprehensive Water Supply Program
July 1981	John Logan	Reconnaissance of Alternatives for Recharging Seaside Aquifer
July 1981	Robert Curry and G. Mathias Kondolf	Carmel River Sediment Study
August 1981	Kenneth D. Schmidt	Ryan Ranch Water Supply
September 1981	D.W. Kelley & Associates	Reconnaissance of Water Development for the Carmel River
October 1981	Joan Beattie and Patti Murphy, USC	Vegetation of the Carmel River Valley
November 1981	Bruce Buel	Final - Investigation into Los Padres Reservoir Silt Release
November 1981	Hydro Data, Inc.	Evaluation of Bank Erosion Near Manor Well

November 1981	D.H. Dettman D.W. Kelley & Associates	Reconnaissance Report: Streambed Sedimentation and Steelhead Habit in the Carmel River Below Los Padres With Some Possible Solutions to the Problem
November 1981	John Logan	Seaside Monitor Wells
December 1981	Robert W. Curry	Sediment Transport Analysis Between Los Padres and San Clemente Reservoirs
January 1982	WWD Corporation John Logan	Seaside Recharge Predesign Study Coastal Barrier Experiment
February 1982	James Montgomery, Consulting Engineer	Carmel Valley Wastewater Study
March 1982	John Logan	The Estimated "Excess" Capacity of Canada Pipeline
March 1982	Bruce Buel	Carmel River Management Program
March 1982	WWD Corporation John Logan	Seaside Recharge Predesign Study Injection Trials at Plumas 2
May 1982	D.W. Kelley & Associates	The Probable Effect of Carmel River Water Supply Alternatives on Steelhead Resources
May 1982	MPWMD	Model Ordinance
June 1982	John Logan	Hydrogeology of the Seaside Area
June 1982	John Logan	Recharge of the Carmel Valley Aquifer: A Preliminary Assessment
June 1982	MPWMD	MPWMD Water Supply Project - Initial Study and Scope of Work
June 1982	John Logan	Percolation at Ryan Ranch
July 1982	USGS	Letter Report on Old Carmel Rating Curve
July 1982	Frances Krebs	Krebs and McClain - Operations Model Documentation for On-Channel and Off-Channel Reservoirs
August 1982	Recht, Hausrath & Associates	Draft Report - Economic & Demographic Forecasts

August 1982	Converse Consultants	New San Clemente Project Preliminary Design & Feasibility Study
September 1982	WWD Corporation	Pressurized Recharge at the Plumas Site, Seaside
September 1982	USGS, Ken Muir	Groundwater in the Seaside Area
October 1982	Converse Consultants	New San Clemente Project Conceptual Design & Cost Estimate of Fish Attraction Facilities
November 1982	G. Mathias Kondolf and Robert Curry	Seepage Investigations, Carmel River, 1982 Water Year
November 1982	Bruce Buel	Comparison of Water Supply Alternatives
December 1982	Converse Consultants	New San Clemente Project Conceptual Design and Cost Allowance of Diversion Alternatives
December 1982	Clifford J. Cortright	Arroyo Seco Dam Sites
December 1982	Bruce Buel	Applications Relating to the MPWMD Water Supply and Management Project
December 1982	Recht, Hausrath & Associates	Draft - Economic and Demographic Projections
January 1983	G. Mathias Kondolf	Recent Channel Instability and Historic Channel Changes of the Carmel River
January 1983	USGS, G.W. Kapple, M.J. Johnson, D.A. Van Schoten	Digital Flow Model of the Carmel Valley Alluvial Ground-Water Basin (draft)
January 1983	Robert Woodhouse	Baseline Analysis of the Riparian Vegetation in the lower Carmel Valley
January 1983	John Williams	Carmel River Watershed Management Plan Working Paper No. 1: Habitat Change in the Carmel River Basin
January 1983	Recht & Hausrath	Economic & Demographic Projections
February 1983	USGS	Sediment Data Collected in Carmel Valley

March 1983	Bruce Buel, MPWMD R. King, Anderson-Nichols	Engineer's Report, Carmel River Management Zone (MPWMD Zone #3)
March 1983	Federal Emergency Management Agency	Flood Insurance Study (preliminary)
Undated	San Diego Water Utilities Department	Municipal Sewage Treated to Potability Using Aquaculture Through Membranes
April 1983	John Williams	Carmel River Watershed Management Plan Working Paper No. 2: Water Supply Options for the Monterey Peninsula
April 1983	LAFCO	MPWMD Sphere of Influence
April 1983	John Logan	Final - The Carmel Valley Alluvial Aquifer: Bedrock Geometry, Hydraulic Parameters and Storage Capacity
May 1983	Recht, Hausrath & Associates	Draft Report - Economic & Demographic Forecasts
June 1983	D.W. Kelley	Draft - Assessment of Carmel Steelhead Resource: Its Relationship to Streamflow and to Water Supply Alternatives
June 1983	MPWMD	Revised Draft - Scope of Work - Water Supply Project Environmental Impact Report
June 1983	John Williams and G. Mathias Kondolf	Channel Stability & Fish Habitat Carmel River, CA - Symposium & Field Conference Guidebook
June 1983	Frances Krebs	Computation of Total Sediment Load of the Carmel River, CA
June 1983	William Snider, Calif. Dept. of Fish and Game	Reconnaissance of the Steelhead Resource of the Carmel River Drainage
June 1983	Converse Consultants	Draft - New San Clemente Project Conceptual Design & Cost Estimate of a Rollcrete Dam Alternate
July 1983	John Logan	Storage Calculations, Carmel Valley Alluvial Aquifer
August 1983	John Williams	Habitat Protection in the Carmel River Basin: Legal Issues CRWMP Working Paper No. 3
August 1983	Molly Williams	Avifauna of the Carmel River Riparian Corridor - CRWMP - Working Paper No. 4

August 1983	MPWMD	Carmel River Management Zone Assessment List
September 1983	Bruce Buel	Letter to Riverfront Property Owners re Permit Process
September 1983	John Williams	Legal Status of Carmel Valley Groundwater - CRWMP - Working Paper No. 6
October 1983	Molly Williams	Riparian Mammals and Herptofauna of Carmel Valley - CRWMP - Working Paper No. 4 and 1/2
undated	Russ Mount	Pumping Tests of Four Wells in Lower Carmel Valley, CA for California-American Water Company (Draft)
October 1983	Graham Matthews	Discharge & Sediment Load for Tributaries to the Carmel River - CRWMP - Working Paper No. 5
October 1983	Graham Matthews	A Summary of the Report Entitled: Discharge & Sediment Load for Tributaries to the Carmel River - CRWMP - Working Paper No. 5
Various	Fred Adjarian	Misc. Documents Relating to EIR
October 1983	Converse Consultants	New San Clemente Project Evaluation of Hydroelectric Power
Various	Fred Adjarian	EIR Segments
October 1983	Charles H. Wagner	Study of Upstream and Downstream Migrant Steelhead Passage Facilities for the Los Padres Project and New San Clemente Project
December 1983	R. Curry and Mathias Kondolf	Draft - Sediment Transport and Channel Stability, Carmel River, CA G.
December 1983	Herman Kimmel & Assoc	Traffic Engineering Analysis San Clemente Dam Project
December 1983	Cal-Am Water Company	Carmel Valley Well Scheduling Program
December 1983	WESTEC Services, Inc.	Cultural Resources Survey San Clemente Dam Enlargement Upper Carmel Valley
December 1983	John Logan	A Review of 1982 Pumping Tests of the Pearce, Cypress,San Carlos and Rancho San Carlos Wells, Carmel Valley

January 1984	WESTEC Services, Inc.	Noise Assessment San Clemente Dam Enlargement Upper Carmel Valley
January 1984	Dick Heuer	Draft - Re-Examination of Supply and Demand in the Monterey Peninsula Water Management District
March 1984	John Williams	Draft - Carmel River Watershed Management Plan
March 1984	Robert Curry	Observations on Quaternary and Recent Fault Activity, Central Coastal California
April 1984	MPWMD - John Benoit	Final Draft - Water Conservation Plan for Monterey County
April 1984	MPWMD-Gary Page and Graham Matthews	Final - Carmel River Management Plan
April 1984	MPWMD	Water Conservation Plan - Executive Summary
April 1984	DMA Consulting	Phase I Report, Irrigation Engineers System Design Lower Carmel Valley Wells
April 1984	MPWMD	1984 Drought Report
May 1984	Converse Consultants	New San Clemente Project Fish Passage Facilities
May 1984	MPWMD-Gary L. Page	Engineer's Report - Boronda Erosion Control Project (MPWMD Zone No. 4)
May 1984	DMA Consulting Engineers	Preliminary Design & Cost Estimate Boronda Project - Irrigation System Carmel River Management Program
May 1984	Converse Consultants	New San Clemente Project Geotechnical Studies for the EIR
May 1984	Wulff, Hansen & Co.	Boronda Erosion Control Project Zone (Zone No. 4) - Underwriting
June 1984	Richard W. King	Assessing the Use of Direct Recycle of Wastewater for Potable Water Supply in the Monterey Peninsula
June 1984	Linda Maloney	Aquifer-Stream Interaction in the Lower Carmel Valley July 1983-January 1984
June 1984	Recht, Hausrath & Assoc	Draft - Growth Impacts: Housing & Employment Forecasts With and Without the Proposed Project

June 1984	Recht, Hausrath & Assoc	Socioeconomic Impacts of the Proposed San Clemente Dam Working Paper No. 1 Growth Impacts: Housing & Employment Forecasts With and Without the Proposed Project
June 1984	MPWMD	MPWMD Responsibilities and Expenditure History
June 1984	USGS	Analysis of the Carmel Valley Alluvial Ground-Water Basin
July 1984	Rauscher, Pierce Refnes, Inc	Work Product No. 1 Pertaining to Financial Analysis of the San Clemente Dam Project
July 1984	Converse Consultants	New San Clemente Project Preappraisal Engineering Studies
July 1984	MPWMD	Contract Documents for the Drilling of Three Observation Wells and Fourteen Neutron Probe Access Tubes in Carmel Valley
July 1984	MPWMD-Gary L. Page	Analysis of Specific Works - Carmel Valley Trail & Saddle Club
July 1984	Prepared for the City of San Diego by the Health Advisory Committee	Proposed Workplan for the Evaluation of Potential Health Risk Associated with the San Diego Total Recovery Program
July 1984	John Logan	Draft - Increased Ground-Water Production in the Seaside Area
July 1984	Rogers E. Johnson & Assoc	New San Clemente Dam Geotechnical Investigation: Location of Faults Through or Near the Proposed Dam Site
August 1984	ESA	Carmel River Management Plan & Boronda Erosion Project EIR
August 1984	D.W. Kelley & Associates	Evaluation of Alternative Upstream Fish Passage Facilities Over San Clemente
August 1984	D.W. Kelley & Associates	Appendices to: Assessment of the Carmel River Steelhead Resource; Its Relationship to Streamflow; and to Water Supply Alternatives
August 1984	MPWMD-Bruce Buel	Network Analysis San Clemente Dam
August 1984	Engineering Science	Draf EIR - Pebble Beach Community Services District Wastewater Treatment and Disposal Project

September 1984	R.M. Woodhouse	Water Potential and Vegetation Survey of the Lower Carmel River
October 1984	MPWMD	Willow Planting Guidelines
October 1984	MPWMD	Response to Comments on CRMP DEIR
October 1984	EIP Associates	Proposal to Prepare a Water Supply Project EIR and Presentation Report
November 1984	MPWMD-Financial Advisory Committee	Final - Recommendation for the Financing of San Clemente
November 1984	MPWMD-Graham Matthews	Draft - Carmel River Research Program - 1984
December 1984	MPWMD-Henrietta Stern	Initial Study - Ord Village Reclamation Pilot Plant
December 1984	MPWMD-John Byrnes	Field Report Discharges of the Carmel River and Carmel Valley Water Table Levels
December 1984	Creegan & D'Angelo	Aquaculture Reclamation Program Ord Village Pilot Plant
December 1984	Linda McGlochlin	Aquifer-Stream Interaction in the Lower Carmel Valley
January 1985	MCFC&WCD	Flood Fighting and Erosion Control Manual
January 1985	DMA Consulting Engineers	Phase 3 Report - Irrigation System Riparian Corridor Lower Carmel Valley
January 1985	Converse Consultants	New San Clemente Project -- Joint Use Facilities Progress Report
January 1985	Rogers E. Johnson	New San Clemente Dam Geotechnical Investigation of Faulting in the Knothole Area
February 1985	Frances Krebs	An Analysis of the Sediment Discharged into the Carmel Bay from the Carmel River and the Carmel Sanitary District Outfall
March 1985	MPWMD-Bruce Buel	Summary - San Clemente Dam Project
March 1985	MPWMD	Guidelines for Performance Appraisal

March 1985	Recht, Hausrath & Assoc	Hotel Employee Projections as a Component of June 1984 Job Projections
April 1985	Michael Ricker	How are New Water Connection Fees Computed?
April 1985	Recht, Hausrath & Assoc	Draft - Working Paper No. 3 - Socioeconomic Impacts of Proposed San Clemente Dam
April 1985	Recht, Hausrath	Hotel Employee Projection & as Component of June 1984 Job Projections Under All Three Scenarios
April 1985	Graham Matthews	Portable Irrigation System Testing Report
April 1985	Rogers E. Johnson & Assoc	Investigation of Possible Fault Offsets in Stream Terraces along the Carmel River at Sleepy Hollow
April 1985	MPWMD-Graham Matthews	Summary of Boronda Erosion Control Project Erosion Control Project
May 1985	Geomatrix	Evaluation of Seismic Design Criteria New San Clemente Dam
May 1985	MPWMD-Bruce Buel	CAL-AM Allocation Summary
May 1985	MPWMD-Bruce Buel	1985-86 Water Supply Strategy
May 1985	Henrietta Stern	Draft - EIR Ord Village Reclamation Plant
May 1985	Converse Consultants	Phase 1 Final Report - Ground-Consultants Water Evaluation of the Seaside Aquifer
May 1985	Converse Consultants	Addendum to Phase I Final Report Ground-Water Evaluation of Seaside Aquifer System
May 1985	Converse Consultants	New San Clemente Project - Consultants Joint Use Studies Draft Report
June 1985	MPWMD	Carmel River Management Program Newsletter - Summer, 1985
June 1985	Henrietta Stern	Project Summary - Ord Village Pilot Reclamation Plant
June 1985	Anderson-Nichols & Company, Inc.	Final - Hydrology Study for Point Lobos Ranch (with Addendum of June 1985)

June 1985	California Public Utilities Commission - Public Staff	General Report on the Results of Cal-Am Water Company for Test Years 1986 and 1987 in Connection With: (four Division application numbers)
June 1985	California Public Utilities Commission - Public Staff	Report on the Operations of Cal-Am Water Co. in the Monterey Peninsula District for Test Years 1986 and 1987
July 1985	Yoram Litwin & John Davis	Review of the MPWMD Daily Simulation Model
July 1985	MPWMD-Graham Matthews	MPWMD Irrigation Program: Review of Its Development
July 1985	David Laredo	Irrigation License and River Corridor Access Permission
July 1985	California Public Utilities Commission - Public Staff Division Rate of Return Section	Report on the Cost of Capital and Rate of Return for Cal-Am Water Company
July 1985	Shirley J. Dreiss & Mark Reid, U.C. Santa Cruz	Data Analysis and Numerical Model Development for the Carmel Valley Aquifer
July 1985	Anderson-Nichols/West	Monterra Ranch Water Supply Study
July 1985	DMA Consulting Engineers	Phase 3 Report Irrigation System Riparian Corridor Lower Carmel Valley
July 1985	Robert M. Woodhouse	Analysis of the Phase 3 Report on 1984 Lower Carmel Production Well Pumping Data
July 1985	Henrietta Stern	Working Draft - Final EIR Ord Village
July 1985	Recht, Hausrath & Assoc Richard Recht	The Effect of Revised Connection Fees & Water User Charges on Development
August 1985	Joseph Oliver	Independent Review of Pumping Test Documentation in DMA Phase 3 Report
August 1985	Joseph C. Clark & Mary A. McKittrick	Reconnaissance Field Study of the Relationship Between Tularcitos & Navy Fault Zones
August 1985	R.M. Woodhouse	Analysis of the Phase 3 Report on 1984 Lower Carmel Production Well Pumping Data
August 1985	Converse Consultants	New San Clemente Project - Joint Use Studies Final Report

September 1985	Creegan & D'Angelo	Feasibility Analysis of Wastewater Reclamation for Groundwater Recharge
September 1985	Anderson-Nichols	Water Supply Study for Laguna Seca Ranch
September 1985	Henrietta Stern	Final EIR - Ord Village Pilot Reclamation Plant (plus David Shonman's Butterfly Report)
October 1985	MPWMD	Draft - Water Conservation Plan for Monterey County
October 1985	MPWMD	1985-86 District Goals & Objectives
October 1985	Joseph Oliver	MPWMD Research Program for 1985-86
October 1985	Yoram Litwin, Ph.D. Darby Fuerst	Phase II Review of the MPWMD Daily Simulation Model of the Carmel River System
November 1985	MPWMD	Summary of MPWMD Allocations, Adopted April, 1981
November 1985	MPWMD	Fisheries Restoration Act of 1985 - Proposal Number One
November 1985	Luhdorff & Scalmanini	Draft - Feasibility Study of Developing a Water Supply, Tularcitos Formation, Carmel Valley Ranch
November 1985	Luhdorff & Scalmanini	Final - Feasibility Study of Developing a Water Supply, Tularcitos Formation, Carmel Valley Ranch
December 1985	Aqua Terra	Proposal - Laguna Seca Ranch Water Supply
December 1985	DMA	Drawdown Simulation Lower Carmel Valley
January 1986	MPWMD-Michael Ricker	Final - Water Conservation Plan for Monterey County (see Augus 1987 for current revised version)
January 1986	MPWMD	Carmel River Management Program Schulte Restoration Projec
January 1986	Rogers Johnson & Assoc.	Preliminary Report of Landsliding in the Vicinity of the Proposed New San Clemente Reservoir
February 1986	Frank Dryden	Draft - Evaluation of Alternative Water Reuse Projects for the Monterey Peninsula
February 1986	U.S. Army Corps of Engineers	Long-Range Water Supply Development of for Fort Ord, Californi

February 1986	EIP Associates	Draft - New San Clemente Dam EIR
February 1986	G. Matthews III & G. M. Kondolf	Transport of Tracer Gravels on a Coastal California River
March 1986	Frank Dryden	Final - Evaluation of Alternative Water Reuse Projects for the Monterey Peninsula
April 1986	Charles McNeish	Draft - Effects of Production Well Pumping on Plant Water Stress in Riparian Corridor of Lower Carmel Valley; Volumes 1, 2 and 3
April 1986	Joseph Oliver & Yoram Litwin Ph.D.	Draft - Technical Memorandum 86-02 - Procedure Outline for Estimating P-Ratio Functions for Carmel Valley Aquifers
April 1986	Joseph Oliver & Yoram Litwin Ph.D	Draft - Technical Memorandum 86-03 - Compilation of Ground-Water Data for Calibration of the Carmel Valley Simulation Model
April 1986	Joseph Oliver	Draft - Technical Memorandum 86-01 - Carmel Valley Ground-Water Storage Calculation
May 1986	MPWMD	Draft - MPWMD Projections
May 1986	Bruce Buel	1986-87 Water Supply Strategy
May 1986	Sutro & Co., Inc.	San Clemente Water Revenue Bonds Finance Report
June 1986	D.W. Kelley & Associates	Report on Field Reconnaissance and Review of Downstream Fish Passage Facilities at Reservoirs on the Santiam and North Fork Clackamas Rivers in Oregon
June 1986	Converse Consultants	Draft - New San Clemente Project Preliminary Design and Cost Estimate
June 1986	Henrietta Stern	Application for 404 Permit and Draft Notice of Intent
July 1986	D.W. Kelley & Associates	Relationships Between Steelhead Sport Catch Angling Success and Stream flow
January 1987	Ken Greenwood	Appendices to Draft CRWMP
January 1987	Fort Ord	Department of the Army License for Fort Ord Monitor Wells
January 1987	Staal, Gardner & Dunne	Fort Ord Ground Water Monitoring Well Project

January 1987	Chairman Dick Heuer	Statement to Mayors' Select Committee
January 1987	Henrietta Stern	Final - Evaluation of Water Supply Alternatives for the Monterey Peninsula
February 1987	(From David Laredo's Office)	MPWMD Law (West's Annotated California Codes--Water Code Appendix--1983 Supplement to Supersede 1982 Version
April 1987	D.W. Kelley & Associates	Preservation of Carmel River Steelhead with Fish Passage Facilities Over San Clemente Dam or With a Hatchery Near Its Base
April 1987	Converse Consultants	Draft - New San Clemente Project Preliminary Design and Cost Estimate - Fish Conveyance Facilities
April 1987	Staal, Gardner & Dunne	Hydrogeologic Assessment, Monterey Sand Company, Metz Road Well, Sand City, California
May 1987	Converse Consultants	Final - New San Clemente Project Preliminary Design and Cost Estimate - Fish Conveyance Facilities
May 1987	Converse Consultants	New San Clemente Project Engineering Summaries of Additional EIR Alternatives
May 1987	Converse Consultants	New San Clemente Project Dam Break Study Report
May 1987	Henrietta Stern	Supplementary - Evaluation of Water Supply Alternatives For the Monterey Peninsula
May 1987	Archaeological Consulting Incorporated (ACI)	Archaeological and Historical Investigations for the San Clemente Dam EIR/EIS, Carmel Valley, Monterey County, California
May 1987	Staal, Gardner & Dunne	Hydrogeologic Investigation - Seaside Coastal Ground Water Basin, Monterey County, California
May 1987	Joseph Oliver	Technical Memorandum 87-09 - Summary of Seaside Coastal Ground-Water Basin Evaluation
June 1987	Henrietta Stern	Draft - Technical Memorandum 87-15 - Description of New San Clemente Project and "No Project" Conditions
June 1987	D.W. Kelley & Associates	Assessment of the Carmel River Steelhead Resource - Volume II - Evaluation of the Effects of Alternative Water Supply Projects on the Carmel River Steelhead Resource

June 1987	Joseph Oliver	Technical Memorandum 87-10 - Effects on the Upper Carmel Valley Aquifer from Additional Well Development
June 1987	Don and Robin Roberson	Carmel River Bird Survey
June 1987	Edward B. Thornton, PhD & Sadd Abdelrahman, PhD	Draft - Impacts on Carmel River State Beach Due to the New Dam at San Clemente
June 1987	Graham Matthews	Draft - Technical Memorandum 87-13 Evaluation of the Effects of the Feasible New San Clemente Project Alternatives on the Channel Stability and Sediment Transport of the Carmel River
July 1987	EIP Associates	Administrative Draft EIR/EIS - New San Clemente Project
August 1987	MPWMD-Michael Ricker	Water Conservation Plan for Monterey County (Current in Effect)
August 1987	D.W. Kelley & Associates	Assessment of the Carmel River Steelhead Resource - Supplement to Volume II
July 1987	Bruce Buel	Development of Distribution Concept Allotments for Allocation System EIR
September 1987	Henrietta Stern	New San Clemente Project Summary of Facts
September 1987	Darby Fuerst and Yoram Litwin, PhD	Overview of Carmel Valley Simulation Model
September 1987	EIP Associates	Draft EIR/EIS - New San Clemente Project
September 1987	EIP Associates	Draft EIR/EIS - Appendices
September 1987	EIP Associates	Summary - New San Clemente Project EIR/EIS
September 1987	Henrietta Stern	New San Clemente Project - Summary of Facts
September 1987	Darby W. Fuerst	Attachment A - Determination of Water Supply Categories for the Monterey Peninsula Water Resources System
September 1987	Staal, Gardner & Dunne	Draft - Hydrogeologic Investigation Phase II Point Lobos Ranch Water Supply Study
October 1987	Planning Analysis Development	Administrative Draft - Water Allocation Program Environmental Impact Report

October 1987	Staal, Gardner & Dunne	Phase II Point Lobos Ranch Water Supply Study
October 1987	D.W. Kelley & Associates	Final - Assessment of The Carmel River Steelhead Resource - Volume II - Evaluation of the Effects of Alternative Water Suppl[y] Projects on the Carmel River Steelhead Resource
October 1987	Joseph Oliver	Draft - Technical Memorandum 87-17: Procedures Simulatin[g] Water Level Drawdowns in the Carmel Valley Aquifer Unde[r] Different Water Supply System Production Conditions
November 1987	Henrietta Stern	Written and Oral Comments on New San Clemente Project Draf[t] EIR/EIS
November 1987	CESAND	Permit System Users Manual
November 1987	CESAND	Water Permit System Technical Documentation
January 1988	CAL-AM Water	Report on the Results of Operations and Revenue Requirements
February 1988	Henrietta Stern	Proposed Concept for Selection of Practicable Alternatives - Th[e] New San Clemente Project Supplementary Draft EIR/EIS
March 1988	PAD	Draft - Water Allocation Program EIR
March 1988	Henrietta Stern	Summary of Agency Comments on Alternatives Proposal an[d] District Responses
March 1988	Bruce Buel	Proposed Process for Screening of Monterey Peninsula Wate[r] Supply Alternatives
March 1988	Prepared for Interagency Group	Draft MPWMD Staff Recommendations RE: Alternatives fo[r] Further Analysis in Screening Process
April 1988	EIP Associates	Estimates of Housing and Employment at Buildout within th[e] Monterey Peninsula Water Management District
April 1988	Ken Greenwood	Conceptual Draft - Carmel River Watershed Management Plan
May 1988	Department of Water Resources	Report to the California Water Commission. Department of Wate[r] Resources Activities of April 1988
May 1988	J Laurence Mintier & Assoc	Draft - Water Supply and Water Distribution Options. Draf[t] Allocation Program EIR, Phase I

May 1988	MPWMD	Draft - Evaluation of Water Supply Alternatives for the New San Clemente Project Supplemental Draft Environmental Impact Report and Statement. Part I: Assessment of Practicability
June 1988	Bechtel Civil Inc.	New San Clemente Dam Project Evaluation of Slope Stability in the Reservoir Area
June 1988	Bechtel Civil Inc.	New San Clemente Dam Project Seismic Design Criteria Review of Previous Studies and Preliminary Recommendations
July 1988	EIP Associates	Final - Estimates of Housing and Employment at Buildout within the Monterey Peninsula Water Management District
August 1988	MPWMD	Draft 2 - Interim Relief Plan
August 1988	Charles McNiesh	Draft - A Methodology for Predicting Riparian Vegetation Impacts Due to Pumping the Carmel Valley Aquifer
September 1988	MPWMD	Interim Relief Plan
September 1988	EIP Associates	Riparian Habitat Assessment. Alternatives of the New San Clemente Dam Project
September 1988	MPWMD	Evaluation of Water Supply Alternatives for the New San Clemente Project Supplemental Draft Environmental Impact Report and Statement. Final - Part I: Assessment of Practicability
September 1988	Archaeological Consulting	Preliminary Cultural Resources Reconnaissance of Erosion Control Projects, Carmel River, Monterey County, California
September 1988	Staal, Gardner & Dunne	Draft Phase II Hydrogeologic Investigation Laguna Seca Subarea, Monterey County, CA
October 1988	J Laurence Mintier & Assoc	Revised Draft - Water Supply and Water Distribution Options. Draft Allocation Program EIR Phase II
October 1988	Charles M. McNeish	A Methodology for Predicting Riparian Vegetation Impacts Due to Pumping the Carmel Valley Aquifer
October 1988	DMC Energy, Inc.	Monterey Peninsula Water Corps Preliminary Summary

November 1988	MPWMD	Evaluation of Water Supply Alternatives for the New San Clemente Project Supplemental Draft Environmental Impact Report and Statement. Draft - Part II: Assessment of Performance
November 1988	DMC Energy, Inc.	Final Report - Monterey Peninsula Retrofit Program
November 1988	M. A. Matthews	Plant Survey, Carmel River, Mid Valley Area
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February 1989	Staal, Gardner & Dunne	Hydrogeologic Assessment--Ryan Ranch Mutual Water Company--Construction of Well Nos. 9 & 10 Monterey Research Park, Monterey County, California
February 1989	MPWMD-Graham Matthews	Technical Memorandum 88-03--Evaluation of Reservoir Sedimentation Rates in the Upper Carmel River Watershed
March 1989	J Laurence Mintier & Assoc Jones & Stokes Assoc D.W. Kelley & Assoc Water Resource Assoc	Draft Environmental Impact Report--Water Allocation Program
March 1989	Joseph C. Clark	Geologic Analysis of the Cypress Point Fault in the Vicinity of the Lower Carmel River Valley
March 1989	Bechtel Civil Inc.	New San Clemente Dam Downstream Migrant Collection Facilities. Job No. 19523--Pine Creek Fish Screening Structure
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March 1989	Denise Duffy & Associates	CSD/PBCSD Wastewater Reclamation Project Draft EIR
May 1989	Archaeological Consulting	Archaeological Literature Study and Mitigation Recommendations for the Cañada de la Segunda Reservoir, Carmel Valley, Monterey County, California

May 1989	MPWMD-Andrew Bell	Technical Memorandum 89-04--Analysis of New Los Padres Reservoir Rim Dam Concept
May 1989	Senator Henry Mello	Public Hearing on the MPWMD
May 1989	Staal, Gardner & Dunne	Hydrogeologic Investigation Carmel River Aquifer Coastal Portion Monterey County, CA
June 1989	Archaeological Consulting	Cultural Resources Literature Study and Mitigation Recommendations for Phase II of the New San Clemente Project EIR/EIS, Carmel Valley, Monterey County, CA
June 1989	Bechtel Civil, Inc.	Monterey Peninsula Water Supply Project New Los Padres, New San Clemente and San Clemente Creek Projects Preliminary Designs and Cost Estimates
June 1989	Bechtel Civil, Inc	Monterey Peninsula Water Supply Project New San Clemente Site Downstream Migrant Steelhead Screening Facility Collection Efficiency
June 1989	Denise Duffy & Associates	CSD/PBCSD Wastewater Reclamation Project Final EIR
July 1989	BioSystems Analysis, Inc.	Cañada Reservoir Project Preliminary Biological Assessment
July 1989	Norman Janke Associates	Evaluation of Regional and Local Seismicity for the Cañada Reservoir, Carmel Valley, CA
July 1989	Rivertech Inc.	Mechanics of Carmel River at Williams Ranch--A Reconnaissance Level Study
July 1989	Grice Engineering Inc.	Preliminary Evaluation of the Incorporated Embankment Site & Reservoir Area for Cañada Reservoir Phase 1A
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August 1989	Denise Duffy & Assoc	Preliminary Environmental Assessment of Cañada Reservoir
August 1989	MPWMD-Henrietta Stern	Technical Memorandum 89-06 Development of Water Demand Estimates at Buildout for the Monterey Peninsula Water Supply Project EIR/EIS
October 1989	Water Resource Assoc	Preliminary Hydrologic Study for Cañada Reservoir

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November 1989	MPWMD-David Dettman	Technical Memorandum 89-03, The Quantity of Steelhead Spawning Habitat Inundated or Blocked by Alternative Water Supply Projects in the Carmel River Basin
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November 1989	MPWMD-Joe Oliver	Technical Memorandum 89-08, Hydrology of the Carmel River Lagoon
November 1989	Donald Alley, Fishery Biologist	Preliminary Draft, Instream Flow Requirements, Steelhead Spawning and Rearing, Carmel River, Monterey County, 1989
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November 1989	Denise Duffy & Assoc	Preliminary Environmental Assessment of Cañada Reservoir Part II
December 1989	Grand Jury	Grand Jury Report 1989
January 1990	Grand Jury	Response to Grand Jury Report
January 1990	J Laurence Mintier Assoc, Jones & Stokes Assoc, D.W. Kelley & Assoc, and Water Resource Associates	Administrative Draft Final Environmental Impact Report - Volume 1 Appendices Water Allocation Program
January 1990	J Laurence Mintier Assoc, Jones & Stokes Assoc, D.W. Kelley & Assoc, and Water Resource Associates	Administrative Draft Final Environmental Impact Report - Volume 1 Water Allocation Program
January 1990	Parton & Edwards Construction, Inc.	Drinking Water Supply System for Monterra Ranch Project
January 1990	Bechtel Civil Inc.	Cañada Reservoir Project Analysis of Alternative Ownership Options
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April 1990	MPWMD	Water Allocation Program EIR - A summary of Issues, Impacts, & Process to be Followed
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September 1990	MPWMD-Jim Cofer	Proposed Five Year Capital Facilities Plan
September 1990	MPWMD Staff	Proposed Seawater Desalination Program
September 1990	Staal, Gardner & Dunne	Hydrogeologic Investigation Monterey Coastal Basin Monterey County, California
October 1990	John G Williams,PhD	Carmel River Lagoon & Wetland Enhancement Plan
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October 1990	Ad Hoc Water Committee	Report of Ad Hoc Water Allocation Committee
November 1990	Charles McNiesh	Projected Riparian Vegetation Impacts Under the Various MPWSP EIR//EIS Alternatives Draft
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March 1991	Charles McNiesh	Projected Riparian Vegetation Impacts Along The Carmel River Under Eleven Water Supply Project Alternatives
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June 1992	Ambessaw Assegued	The Carmel River Riparian Corridor Mgt. Plan - Vegetation Survey Mapping Project
July 1992	James M. Montgomery Consultant	Refinement of Preliminary Design for 7 mgd Desalination Facility at Sand City Site
July 1992	CH 2 M Hill	Monterey Peninsula Reclaimed Water Urban Reuse Project Feasibility Report
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APPENDIX 2-A
WATER DEMAND ESTIMATES
AT BUILDOUT (1988)

TECHNICAL MEMORANDUM 89-06

DEVELOPMENT OF WATER DEMAND ESTIMATES AT BUILDOUT FOR THE MONTEREY PENINSULA WATER SUPPLY PROJECT EIR/EIS

Prepared by
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August 8, 1989

I. BACKGROUND

The Monterey Peninsula Water Management District (MPWMD) has proposed a new dam and reservoir on the Carmel River, and is evaluating several alternatives in its Water Supply Project EIR/EIS. One of the major project purposes is to provide water to meet the future needs of planned growth in the community. Estimated water use at "buildout" was determined to be the best indicator of future needs. Buildout is defined as the planned growth, both residential and commercial, that could legally exist within MPWMD boundaries under the General Plans, zoning and other applicable land use policies of the jurisdictions within the District as of January 1, 1988. The buildout estimate is not meant to be a projection of the most likely housing and employment values at a particular future year; instead, it is an estimate of maximum development potential under existing (January 1988) policies.

EIP Associates (July 1988) prepared a final report entitled "Estimates of Housing and Employment at Buildout within the Monterey Peninsula Water Management District." Each jurisdiction within the District (six cities and Monterey County) previously reviewed the draft report, suggested changes and formally approved the corrected final report. Based on the housing and employment estimates in the EIP report, as well as water use factors for residential and commercial sectors, conservation, remodels, intensification and a District reserve, an estimate of total water use in a normal year at buildout was developed.

This technical memorandum summarizes the methods and data used to develop the water demand estimates at buildout expected during normal water year conditions. It also explains how the drought year performance standard that is used to evaluate water supply alternatives in the EIR/EIS was determined.

II. ESTIMATED NORMAL YEAR WATER USE IN THE CAL-AM SYSTEM AT BUILDOUT

Tables 1 and 2 show the District-wide summary of housing and employment, respectively, developed by EIP (1988). Note that estimates for the California-American Water Company (Cal-Am) system, the largest water purveyor in the District, and the non Cal-Am system are identified separately. This section focuses only on water use within the Cal-Am system. Cal-Am provides about 82%

of water used within the District and serves the areas where most development is expected to occur under current plans.

Table 3 shows how the estimated normal year Cal-Am demand of 23,080 acre-feet (AF) was developed, and is explained in the following subsections. In summary, 8,411 AF of estimated new water use from new construction, remodels and intensification was added to a normalized 1988 base of 18,040 AF to yield 26,451 AF of "gross demand." A reduction of 15% due to conservation was applied to the gross demand to yield a conserved demand of 22,483 AF. A District reserve of 600 AF was added to the conserved demand to yield a normal year buildout estimate of 23,083 AF. A rounded value of 23,080 AF is used for all calculations and simulation regarding buildout demand.

Table 4 presents the calculations used to determine the normalized base, various components of new development, intensification and remodels. It should be noted that a 15% reduction in water use through conservation by the year 2020 is the stated goal of the District's Water Conservation Program (MPWMD, 1989).

A. Normalized Base of 18,040 AF

Because water use in one year may not accurately reflect demand, a normalized base was selected for use in water supply estimates. Thus the average water use per Cal-Am customer was calculated for the stable four-year period between fiscal years 1984-1987, where there was only a 3.3 percent difference between the lowest and highest value. This value of 0.530 AF per customer was multiplied by the number of Cal-Am customers on June 30, 1987. More recent data are not used because demand has been affected by voluntary and mandatory rationing imposed by the District due to drought.

B. New Development

The number of homes, apartment units, barracks, hotel rooms and jobs of different types were gleaned from EIP's 1988 report on buildout estimates. Water use factors derived from Cal-Am data and water use surveys conducted by the District were applied to each component of new growth. Water demand from new construction is estimated at 7,231 AF at buildout.

Examination of Cal-Am data shows that water use for single-family homes in cities is significantly lower than that in the unincorporated county areas. This is likely due to larger lots, more extensive landscaping and warmer weather in many county areas, especially Carmel Valley and the Highway 68 corridor. Water use at Monterey Research Park was calculated on the basis of square feet due to restrictions imposed on the type of businesses that could occur there. Water use for employees in other areas of the District was based on the average water use per non-hotel/non-golf course employee.

C. Intensification

Intensification refers to increased water use per water meter, especially within the residential sector, that is not associated with remodeling or new growth. Commercial intensification and remodels were accounted for in EIP's employment estimates. Examples of intensification include infrequently used vacation homes being rented or sold for full-time use, grown children returning to the parental home, and shared housing among unrelated adults due to high housing costs in the area. Inspection of 1980 Census and 1987 State Department of Finance data revealed that an 8% intensification factor applied to the residential sector was a reasonable estimate of additional water use generated by the aforementioned activities. This results in an additional 820 AF expected by buildout.

D. Remodels

Data collected by the District indicate that the cumulative effect of remodels may increase the residential portion of the normalized base by about 3.5%, or 360 AF by buildout.

E. Demand Reductions due to Water Conservation

The District has implemented a comprehensive water conservation program, including an ordinance that requires mandatory installation of low-flow devices. The program's goal is a 15% overall reduction in water demand by the year 2020 (MPWMD, 1989). This report assumes that the conservation program goal will be achieved in two ways: (1) per capita water consumption for existing residents and businesses will be reduced over time due to retrofits and behavioral changes, and (2) per capita water use for new construction in the future will be lower than that in 1987. Thus the estimated "gross buildout demand" of 26,451 AF is reduced by 15% (3,968 AF) to a "conserved buildout demand" value of 22,483 AF. The interplay of existing demand, new water demands from construction, intensification and remodels, and the counterbalancing effect of conservation is shown in the first equation in Table 3.

F. District Reserve

As shown in the second equation in Table 3, a District reserve of 600 AF is added to the conserved water demand value of 22,483 AF. The reserve allows for possible failure of small water systems and consequent incorporation into the Cal-Am system. Twenty-four smaller water systems currently extract ground water within the District, with production ranging from 2 AF to over 200 AF per year. Some of these systems have experienced water quality or water delivery problems in the past. Use of a District reserve in demand calculations may also serve as an "insurance policy" in case intensification/remodel effects are underestimated or the conservation program is not as successful as planned.

III. ESTIMATED NORMAL YEAR WATER USE IN THE NON CAL-AM SYSTEM AT BUILDOUT

Water demand estimates for areas of the District not served by Cal-Am were developed using a similar methodology as to that described above. Examples of non Cal-Am systems include some golf courses in Carmel Valley, small mutual water systems and private farms or homes. It should be noted that only those systems that would receive project benefits or are dependent on the Carmel Valley alluvial aquifer and Seaside Coastal ground water subbasin are considered. Thus water demand in areas such as Cachagua or Laguna Seca, for example, are not included in this analysis. Their supply is derived from ground water systems that are not considered to be part of those under study.

The 1988 base for the non Cal-Am area was derived from the District's annual water use surveys of registered water wells. As shown in Table 5, water use is tracked in four Carmel Valley aquifer subunits, as well as in the Seaside coastal subbasin. Additional water use from intensification and remodels was applied, based on U.S. Census and State Department of Finance data for the census tracts involved. Future water use from new construction was based on EIP's housing and employment for unincorporated areas of the County (Carmel Valley, Highway 68) and water use factors for these areas. A 15% reduction to conservation was also applied. The result is 2,959 AF of non Cal-Am demand expected at buildout. Combined with the 23,080 AF of Cal-Am demand, a normal year District water use of 26,039 AF is estimated at buildout.

IV. DROUGHT YEAR PERFORMANCE STANDARD TO ASSESS ALTERNATIVES

The preceeding discussion focuses on water demand that is expected in a normal year. For the purposes of this discussion, a "normal" year is when weather and rainfall patterns are not unusually hot or dry. More detailed statistical definitions are discussed in the New San Clemente Project Draft EIR/EIS (MPWMD, 1987), which summarizes the CVSIM computer model used to assess water supply performance and other parameters. Because a major purpose of the District's water supply project is drought protection, both now and in the future, performance (yield) in one or more critically dry years is a key factor in determining whether an alternative is feasible or not.

The purpose of this section is to explain how the minimum (drought year) yield standard was developed for the Part II evaluation of alternatives, conducted in November 1988. It is based on the normal year information presented above and District policy at the time on the level of performance that the community should expect from a multi-million dollar facility at buildout. Table 6 summarizes the calculations used to determine the minimum yield standard (firm yield) that must be supplied in a "worst case" situation. In the simulated 86-year period of record (water years 1902-1987) that was used to assess projects in the Part II Evaluation, the future "worst case" would be like water year 1977, the second year of the severe two-year drought of 1976-1977.

As shown in the first equation in Table 6, unconserved water demand (the sum of the normalized base, water use from new development, intensification, remodels and the District reserve) is increased by 5% to result in a gross dry year demand (GDD) of 28,404 AF. The 5% increase was based on Cal-Am metered sales for the period 1983 through April 1988, which showed that non- rationed water use increases in dry and critically dry years. The District reserve was included in this equation because in a future worst case scenario, small non-Cal-Am systems would have failed or 15% conservation would not have been achieved; thus the Cal-Am system would need to produce more water.

The second equation in Table 6 reflects the Board's policy decision that a project should provide at least 75% of unconserved dry year demand at buildout in a future severe drought (i.e., a 25% annual shortfall). Because the District's long-term conservation program is an integral part of any water supply project, it is assumed that the first 15% reduction would result from the conservation program. The subsequent 10% reduction would result from mandatory rationing or other means above and beyond the ongoing conservation program. Reductions beyond 25% were not considered reasonable due to (1) the community's expectation that a multi-million dollar facility should provide significant drought protection, and (2) the hardship imposed to conserve additional water when most accepted means (e.g., ultra-low flow toilets, shower heads, sinks, drip irrigation, etc.) would have already been implemented via the District's long-term conservation programs and ordinances.

V. REFERENCES

EIP Associates, 1988. Estimates of Housing and Employment at Buildout within the Monterey Peninsula Water Management District--Final Report. Prepared for MPWMD, July 1988.

MPWMD, 1987. New San Clemente Project Draft EIR/EIS, Appendix A, "Overview of Carmel Valley Simulation Model." September 1987.

MPWMD, 1989. Water Conservation Plan for Monterey County. March 1989.

TABLE 1
DISTRICT-WIDE SUMMARY OF HOUSING

	Existing (Jan 1, 1988)[1]	Additional Potential	Buildout Total
Residential Units			
Single-Family Units			
Carmel-by-the-Sea	2,593	379	2,972
Del Rey Oaks	573	3	576
City of Monterey[2]	6,381	(313)	6,068
Pacific Grove	5,244	232	5,476
Sand City	74	0	74
Seaside (Cal-Am)[3]	4,901	295	5,196
Seaside (Non Cal-Am)[3]	620	0	620
County of Monterey (Cal-Am)	8,190	2,717	10,907
County of Monterey (Non Cal-Am)	868	887	1,755
Subtotal Single-Family	29,444	4,200	33,644
Multi-Family Units			
Carmel-by-the-Sea	619	506	1,125
Del Rey Oaks	9	151	160
City of Monterey[2]	6,721	5,089	11,810
Pacific Grove	2,769	2,661	5,430
Sand City	23	2,617	2,640
Seaside (Cal-Am)[3]	2,516	614	3,130
Seaside (Non Cal-Am)[3]	150	0	150
County of Monterey (Cal-Am)	1,955	279	2,234
County of Monterey (Non Cal-Am)	56	0	56
Subtotal Multi-Family	14,818	11,917	26,735
Total Dwelling Units	44,262	16,117	60,379
Population			
Carmel-by-the-Sea	4,978	1,589	6,567
Del Rey Oaks	1,520	402	1,923
City of Monterey[4]	31,397	10,922	42,319
Pacific Grove	16,367	5,909	22,276
Sand City	200	5,395	5,595
Seaside (Cal-Am)	21,808	2,673	24,481
Seaside (Non Cal-Am)[3]	2,264	0	2,264
County of Monterey (Cal-Am)	24,094	7,116	31,210
County of Monterey (Non Cal-Am)	2,195	2,107	4,301
Total Population at Buildout	104,823	36,112	140,937

[1] Population figures for January 1, 1988 differ slightly from those estimated by the California Department of Finance (DOF) because the dwelling unit counts used in this report differ slightly from those used by DOF.

[2] Excludes 2,520 existing and 396 future beds in military barracks.

[3] Excludes military housing at Fort Ord.

[4] Includes military population associated with 2,520 existing and 396 future beds in barracks.

SOURCE: EIP Associates, 1988

TABLE 2

DISTRICT-WIDE SUMMARY OF EMPLOYMENT

	Existing (Jan 1, 1988)	Additional Potential	Buildout Total
Carmel-by-the-Sea	3,555	1,409	4,964
Del Rey Oaks	498	266	764
City of Monterey (excluding Monterey Research Park)	27,175	12,173	39,348
Monterey Research Park	0	8,404	8,404
Pacific Grove	4,444	1,323	5,767
Sand City	1,550	4,390	5,940
Seaside (Cal-Am)	3,960	4,320	8,280
Seaside (Non Cal-Am)	170	30	200
County of Monterey (Cal-Am)	4,824	1,935	6,759
County of Monterey (Non Cal-Am)	101	471	572
Total Employment	46,277	34,721	80,998

SOURCE: EIP Associates, 1988

TABLE 3: CALCULATIONS FOR CAL-AM WATER DEMAND AT BUILDOUT UNDER NORMAL WATER YEAR CONDITIONS

The estimated (rounded value) normal year water demand for the Cal-Am system at buildout is 23,080 acre-feet. This value was derived using the following equation:

$$[\ NB + ND + I + R\ ] \times .85 = CD$$

$$CD + DR = BD$$

Where:

NB = Normalized base of 18,040 AF

ND = New Development using 7231 AF

I = Intensification of 820 AF

R = Remodels using 360 AF

CD = Demand with 15% conservation reduction applied

DR = District reserve of 600 AF

BD = Buildout demand of 23,083 AF

TABLE 4: CALCULATIONS FOR COMPONENTS OF BUILDOUT WATER DEMAND UNDER NORMAL WATER YEAR CONDITIONS

A. NORMALIZED BASE

.530 AF/customer x 34,040 customers =	18,040 AF (rounded)

B. NEW DEVELOPMENT

New Single Family Homes

City: 596 units @ .251 AF each =	150 AF
County: 2773 units @ .416 AF each =	1,154 AF
SUBTOTAL =	1,304 AF

New Multiple Family Dwelling Units (du)

11,917 units @ .169 AF each =	2,014 AF

New Military Barracks

396 beds @ 100 gpd, including landscaping

396 beds x 100 gpd x 365 days / 325,851 gal/AF =	44 AF

New Hotel Rooms

3,517 rooms @ .151 AF each =	531 AF

New Employees (excluding Monterey Research Park)

23,098 non-hotel, non-golf @ .115 AF each =	2,656 AF
45 golf course @ 2.82 AF each =	127 AF
SUBTOTAL =	2,783 AF

New Employees at Monterey Research Park (restrictions warrant use of square feet)

3,277,890 sq.ft. @ .0002 AF/sq.ft. =	655.5 AF
subtract existing capacity limit of	-100.5 AF
Cal-Am Use =	555.0 AF

NEW DEVELOPMENT TOTAL = 7,231 AF

(continued)

Table 4, continued

C. INTENSIFICATION

Given: 57% of FY 1987 Cal-Am production is residential

Given: 1988 normalized base is 18,040 AF

Given: Residential intensification factor is 8%. This was determined from U.S. Census and State Dept. of Finance data on increasing numbers of persons per household.

Thus: (0.57 x 18,040) x .08 = 820 AF (rounded)

D. REMODELS

Given: 57% of FY 1987 Cal-Am production is residential

Given: 1988 normalized base is 18,040 AF

Given: Residential intensification factor is 3.5%, based on District water connection permit records

Thus: (0.57 x 18,040) x .035 = 360 AF (rounded)

TABLE 5: TOTAL DISTRICT WATER DEMAND AT BUILDOUT UNDER NORMAL YEAR CONDITIONS

(Excludes areas that will not receive project benefits or are not considered to be part of the Carmel Valley Alluvial Aquifer)

Cal-Am System:	23,080 AF
Non Cal-Am, Carmel Valley Aquifer Subunit 1:	89 AF
Non Cal-Am, Carmel Valley Aquifer Subunit 2:	363 AF
Non Cal-Am, Carmel Valley Aquifer Subunit 3:	785 AF
Non Cal-Am, Carmel Valley Aquifer Subunit 4:	949 AF
Non Cal-Am, Seaside Coastal Aquifer:	773 AF
SUBTOTAL:	2,959 AF
TOTAL DISTRICT DEMAND AT BUILDOUT:	26,039 AF

TABLE 6: CALCULATIONS FOR MINIMUM YIELD STANDARD FOR PART II ALTERNATIVES EVALUATION IN DROUGHT YEAR 1977, ASSUMING BUILDOUT DEMAND

The estimated (rounded value) drought year firm yield requirement for the Cal-Am system at buildout is 21,300 acre-feet. This value was derived using the following equations:

$$[\ NB + ND + I + R + DR\ ] \times 1.05 = GDD$$

$$GDD \times .75 = FYS$$

Where:

NB = Normalized base of 18,040 AF

ND = New Development using 7231 AF

I = Intensification of 820 AF

R = Remodels using 360 AF

DR = District reserve of 600 AF

GDD = Gross dry year demand of 28,404 AF, assuming a 5% increase in non-rationed demand in dry years

FYS = Firm yield standard of 21,300 AF (rounded), assuming that a project should produce at least 75% of gross dry year demand in a severe drought like years 1976-77.

APPENDIX 2-B
REVISED WATER DEMAND ESTIMATES AT BUILDOUT (1992)

Appendix 2-B

CHANGES TO WATER DEMAND ESTIMATES BASED ON REVISED BUILDOUT GROWTH ESTIMATES IN 1992

prepared by
Henrietta Stern, Senior Project Planner

December 1992

This memorandum provides a summary of how the water demand estimates used for the Supplemental Draft EIR/EIS-II were developed, based on revised growth estimates at buildout prepared by EIP Associates in May 1992. These changes are detailed in Appendix 19. This Appendix adopts the methodology for water demand estimates explained in Appendix 2-A, except where noted. The following chart summarizes the changes in buildout estimates from the 1991 SDEIR/EIS to those used in the 1993 SDEIR/EIS-II:

TYPE	OLD	NEW
Cal-Am	23,080 AF	22,750 AF
Non Cal-Am	3,296 AF	3,297 AF
TOTAL	26,376 AF	26,047 AF

CAL-AM PRODUCTION AT BUILDOUT:

The same methodology as that used in Table 4 of Appendix 2-A was employed, with the following changes:

SF homes-- add 20 in Sand City (city)
subtract 682 from Del Monte Forest (county)

(NET is 662 fewer homes)

MF apts -- add 59 in Del Monte Forest
subtract 709 in Sand City
subtract 174 in Monterey

(NET is 824 fewer units)

Hotel Rms-- subtract 487 rooms in Sand City

Reserve -- add 100 AF to District reserve due to possibility of separate allocation to federal government for military facilities presently within the City of Monterey, uncertainty about

Fort Ord privatization, and use of low-end estimates for Sand City employment potential.

The result of these changes is a decrease in the buildout estimate from 23,080 to 22,750, as shown in Table 1.

NON CAL-AM PRODUCTION AT BUILDOUT:

Non-Cal-Am production was based on 1991 Reporting Year data, adjusted upward due to the effects of 20% rationing during the reporting year (July 1, 1990 through June 30, 1991). Conservation assumptions are included, but water for remodels and intensification is only for non-turf or non-agricultural uses.

The result of these changes is coincidentally nil; the demand remains 3,297 AF/year though production from the different aquifer subunits would change, as shown in Table 2.

Note that compared to 1991, an additional 584.5 AF of demand on the system is coded in the CVSIM model due to evapotranspiration and diversions between San Clemente and Los Padres Dam.

CHANGES TO "NO PROJECT" DEMAND ESTIMATES:

In general, the No Project alternative in the SDEIR/EIS-II is meant to reflect the situation expected in 1993; this contrasts to the No project scenario developed for the 1991 SDEIR/EIS, which reflected a future scenario without a project. This change was requested by agency and other reviewers. The following table summarizes the changes to the No project demand estimates:

ELEMENT	OLD	NEW
Cal-Am	20,000 AF	17,359 AF
Non Cal-Am	3137 AF	3303 AF
TOTAL	23,137 AF	20,662 AF

There is a decrease of about 2,500 AF annually with these new assumptions.

The Cal-Am value assumes construction of Paralta Well with a new allocation of 17,359 AF/year (16,744 + 230 deficit + 385 new growth).

The non Cal-Am estimates are based on 1991 Reporting Year data, adjusted for 20% rationing, and conservation added. There would be no intensification or remodels due to near-term (year 1993) nature of the No Project scenario. Table 3 summarizes the changes based on newer data.

Note that the No Project value for non Cal-Am in Seaside (857.9) is 95 AF larger than the buildout estimate (762.7). This is because with a project, many of the Sand City users would be annexed into the Cal-Am system and are therefore included in the EIP buildout projections. In the short-term scenario, these were considered to remain as separate entities with a non Cal-Am development potential onsite. Values chosen were based on historical use and recent information on development plans.

u/hs/wp/eis/sd2/demand92

TABLE 1: PEVISED CALCULATIONS FOR COMPONENTS OF BUILDOUT WATER DEMAND UNDER NORMAL WATER YEAR CONDITIONS

A. NORMALIZED BASE

.530 AF/customer x 34,040 customers = 18,040 AF (rounded)

B. NEW DEVELOPMENT

New Single Family Homes

City:	616 units @ .251 AF each =	155 AF
County:	2091 units @ .416 AF each =	870 AF
	SUBTOTAL =	1,025 AF

New Multiple Family Dwelling Units (du)

11,093 units @ .169 AF each = 1,875 AF

New Military Barracks

396 beds @ 100 gpd, including landscaping

396 beds x 100 gpd x 365 days / 325,851 gal/AF = 44 AF

New Hotel Rooms

3,030 rooms @ .151 AF each = 458 AF

New Employees (excluding Monterey Research Park)

23,098 non-hotel, non-golf @ .115 AF each =	2,656 AF
45 golf course @ 2.82 AF each =	127 AF
SUBTOTAL =	2,783 AF

New Employees at Monterey Research Park (restrictions warrant use of square feet)

3,277,890 sq.ft. @ .0002 AF/sq.ft. =	655.5 AF
subtract existing capacity limit of	-100.5 AF
Cal-Am Use =	555.0 AF

NEW DEVELOPMENT TOTAL = 6,740 AF

(continued)

Table 1, continued

C. INTENSIFICATION

Given: 57% of FY 1987 Cal-Am production is residential

Given: 1988 normalized base is 18,040 AF

Given: Residential intensification factor is 8%. This was determined from U.S. Census and State Dept. of Finance data on increasing numbers of persons per household.

Thus: (0.57 x 18,040) x .08 = 820 AF (rounded)

D. REMODELS

Given: 57% of FY 1987 Cal-Am production is residential

Given: 1988 normalized base is 18,040 AF

Given: Residential intensification factor is 3.5%, based on District water connection permit records

Thus: (0.57 x 18,040) x .035 = 360 AF (rounded)

NEW DEMAND = [base + new demand + remodel + intensf.] x 0.85

= [25,960 AF] x 0.85

= 22,066 AF + 700 AF reserve

= 22,766 (round to 22,750 AF)

TABLE 2: CHANGES IN DEMAND FOR NON CAL-AM PRODUCTION AT BUILDOUT

COMPONENT	OLD	NEW
Aquifer 1	89.1	44.6
Aquifer 2	363.0	397.8
Aquifer 3	784.7	892.7
Aquifer 4	948.8	1198.8
SUBTOTAL	2185.6	2533.9
Seaside	1110.0	762.7
TOTAL	**3,296 AF**	**3,297 AF**

TABLE 3: CHANGES IN DEMAND FOR NON CAL-AM PRODUCTION IN NO PROJECT SCENARIO

COMPONENT	OLD	NEW
Aquifer 1	89.1	40.5
Aquifer 2	363.0	337.9
Aquifer 3	784.7	870.4
Aquifer 4	948.8	1196.0
SUBTOTAL	2185.6	2444.8
Seaside	1110.0	857.9
TOTAL	**3,296 AF**	**3,303 AF**

APPENDIX 2-C
ALLOCATION EIR MITIGATION PROGRAM

MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT
187 Eldorado • Suite E • P.O. Box 85 • Monterey, CA 93940 • (408) 649-4866

FINAL ENVIRONMENTAL IMPACT REPORT

WATER ALLOCATION PROGRAM

FIVE-YEAR MITIGATION PROGRAM FOR OPTION V -- 16,700 AF CAL-AM PRODUCTION

Adopted by the MPWMD Board

November 1990

Prepared by MPWMD Staff

FIVE-YEAR MITIGATION PLAN FOR OPTION V

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alloeir/mitcontents

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

FINAL FIVE-YEAR MITIGATION PLAN FOR OPTION V -- 16,700 AF CAL-AM PRODUCTION

November 1990

INTRODUCTION -- CEQA PROCESS

In April 1990, the Water Allocation Program Final EIR was prepared for the Monterey Peninsula Water Management District (MPWMD) by Larry Mintier and Associates. On November 5, 1990, the MPWMD Board certified the Final EIR, adopted findings which included the mitigations contained in this plan, and passed a resolution that set Option V (16,700 AF Cal-Am production) as the new water allocation limit for the Cal-Am system. This document is the final mitigation plan that was adopted by the District Board. It serves as the blueprint for a comprehensive mitigation program that will be carried out over the next five years.

According to the California Environmental Quality Act (CEQA), the basic purpose of an EIR is to (1) inform governmental decision-makers and the public about potential, significant environmental effects of proposed activities, (2) identify ways the environmental damage can be avoided or significantly reduced, and (3) prevent significant, avoidable environmental damage by requiring changes in projects through the use of feasible alternatives or mitigation measures.

When an EIR shows that a project (or program) would cause substantial adverse changes to the environment, a governmental agency must respond by either changing the proposed project, imposing conditions on its approval, adopting plans or ordinances to avoid adverse changes, choosing an alternative way of meeting the same need, or disapproving the project. CEQA states that projects that entail significant environmental effects should not be approved if there are feasible alternatives or mitigation measures available that would substantially lessen these adverse effects.

The definition of "feasible" is important, because an agency can find that changing or altering a project is not feasible. In deciding what "feasible" means, an agency may consider economic, environmental, legal, social, and technological factors. An agency can also find that a project with significant environmental effects may be approved if (1) it publicly discloses that there is no feasible way to lessen or avoid the adverse effects, and (2) it specifically identifies how expected benefits from the project outweigh the general policy to avoid or reduce significant environmental impacts. This is done via a "Statement of Overriding Considerations," which becomes part of the project approval record.

CEQA states that agency decision-makers have an obligation to balance environmental objectives with economic and social factors, "in particular the goal of providing a decent home and satisfying living environment for every Californian." The MPWMD Board weighed the environmental impacts of the water supply options and water distribution alternatives analyzed in the Water Allocation Program Final EIR against the socio-economic impacts of each alternative. Part of their consideration included the feasibility and economic ramifications of this mitigation plan.

This final mitigation plan is judged to be technically feasible by District staff. Based on the cost estimates and other information provided by staff at two public workshops in August and September 1990, the Board has determined that this final plan is feasible in light of economic, social and legal factors.

SUMMARY OF FINAL FIVE-YEAR MITIGATION PLAN

The following sections outline the final mitigation plan for Water Supply Option V (16,700 AF Cal-Am production). Each mitigation measure recommended by the authors of the Water Allocation Program Final EIR was assessed by District staff for technical accuracy and feasibility. Staff then developed specific mitigation programs that would be necessary to implement the mitigations recommended in the EIR. The District Board then determined whether the specific mitigation should be implemented or amended, based on socio-economic factors and institutional feasibility.

The mitigations described herein will be funded and implemented by MPWMD over a five-year period. After five years, the allocation program as a whole, including the mitigation program, will be reassessed, based on results of the mitigation monitoring studies, development of new water supplies, and other factors. Necessary amendments to the program would be made at that time.

It should be noted that most of the mitigations described for the 16,700 AF option would be identical for other water supply options. The main difference would be the greater frequency that a mitigation would be needed with larger water supply options. This would be especially true for fishery mitigations. Capital costs would remain the same, but O&M costs could be significantly higher for supply options greater than 16,700 AF Cal-Am production. Mitigations are recommended whenever the EIR states that a water supply option would have "potentially significant" or "significant" impacts. It should be noted that the consultant often designated an impact as "potentially significant" when the degree of the impact was unknown or when the success of a mitigation measure couldn't be predicted.

Exhibit 1 summarizes the major Board-approved mitigations for each impact topic. Exhibit 2 provides a rough estimate of capital costs and O&M costs for each program as approved by the Board. The total program costs include annual costs of existing District environmental programs in addition to capital and annual costs of new Board-approved mitigations stemming from the Allocation Program EIR. Capital costs for the comprehensive District program would total about $442,700. Annual costs would total about $638,100 per year for most of five years. The Board-approved mitigation program would entail hiring four new permanent staffmembers (riparian program manager; three fishery technicians at 75% time) in addition to several seasonal river maintenance workers. Two additional fishery technicians would be needed during drought years.

REPORT STRUCTURE

The following pages outline the different impact topics and mitigations. For each topic, an introduction provides a brief summary of the consultant's conclusions about impacts in the Water Allocation Program Final EIR and his recommended mitigations. A brief description of existing District programs that address the issue is provided. Key assumptions that were included in the allocation EIR analyses are also noted, where applicable. Staff comments on the consultant's recommendations are provided, and the specific mitigation measures that were approved by the Board are enumerated.

To the extent possible, mitigations for each impact topic are discussed as follows: (1) description of existing District activities, (2) brief description and purpose of the mitigation, (3) implementation and facilities, (4) frequency of use, (5) monitoring and reporting program, (6) permits required, and (7) preliminary cost estimates.

Exhibit 1

SUMMARY OF MPWMD FINAL FIVE-YEAR MITIGATION PROGRAM
November 1990

FISHERIES

Continue existing programs
Capture and transport emigrating smolts in spring
Prevent stranding of fall/winter juvenile migrants
Rescue juveniles downstream of Robles del Rio in summer
Modify spillway and transport smolts around Los Padres Dam

RIPARIAN VEGETATION AND WILDLIFE

Continue existing programs
Conservation and water distribution management
Prepare and oversee Riparian Corridor Management Plan
Implement Riparian Corridor Management Program
Expand soil moisture and vegetative stress monitoring

LAGOON VEGETATION AND WILDLIFE

Continue existing programs
Assist with lagoon enhancement plan investigations
Expand long-term lagoon monitoring program
Identify feasible alternatives to maintain adequate lagoon volume

AESTHETICS

Restore riparian vegetation (see above)

u/henri/wp/alloeir/intromit.finl

Exhibit 2

COST ESTIMATES FOR FINAL MITIGATION PROGRAM FOR OPTION V
November 1990

(Values shown are fully funded by MPWMD for five years.)

MITIGATION PROGRAM	CAPITAL COST			ANNUAL COST		
	Existing	New	Total	Existing	New	Total
Fisheries	$ 9,000	407,700	416,700	$ 12,800	200,100	212,900 (1)
Riparian Vegetation and Wildlife	$ 0	10,000	10,000	$295,000	121,000	416,000
Lagoon Vegetation and Wildlife	$ 26,000	25,000	51,000	$ 1,200	2,000	3,200
Aesthetics	$ 0	0	0	$ 6,000	0	6,000
GRAND TOTAL	$ 35,000	$442,700	$477,700	$315,000	$323,100	$638,100
ESTIMATED TOTAL COST OF BOARD APPROVED NEW PROGRAMS		$442,700				$323,100
ANNUAL FUNDS NEEDED TO CONTINUE EXISTING ENVIRONMENTAL PROGRAMS		N/A				$315,000
TOTAL MITIGATION PROGRAM COST		$442,700				$638,100

NOTE 1: Annual cost estimates for fishery resources are averages; the annual costs could be as high as $382,000 in individual critically dry years and as low as $78,700 in wet years.

u/henri/wp/alloeir.mitprog2

FINAL FIVE-YEAR MITIGATION PROGRAM FOR FISHERIES -- OPTION V

SUMMARY: The Water Allocation Program Final EIR found that all water supply options, including 16,700 AF Cal-Am production (Option V), would have significant adverse impacts to the fishery resource of the Carmel River without mitigations. Discussion of the mitigation program, which focuses on steelhead salmon, is found on page IV-91 of the document. The following mitigations were recommended by the consultant:

1. Juvenile rescue program downstream of Robles del Rio in summer and fall; includes holding facility near San Clemente Dam.

2. Partially reconstruct fish ladder and alter spillway gates at San Clemente Dam to facilitate adult and juvenile migrations.

3. Additional modifications to Los Padres Dam spillway to prevent fish injuries during emigration.

4. New wells in AQ4 to reduce pumping in AQ2, thereby preserving flow in this river reach.

5. Expand downstream smolt rescue and transport program in spring.

6. Capture and transport fall/winter migrants to prevent stranding in the lower river.

7. Attraction facility to capture and transport spawners to Narrows when there is insufficient flow at the river mouth, but adequate flow at the Narrows.

The consultant concluded that the impacts of Option V would be reduced to a less than significant level if these mitigations were implemented.

Existing District Programs: Ongoing District programs already address some of the environmental impacts of existing water supply practices on the steelhead resource of the Carmel River. The District engages in the following activities:

1. As part of the Interim Relief Program, employs half-time fisheries biologist to monitor steelhead status, conduct habitat assessments and coordinate rescue operations.

2. Rescues juvenile steelhead as waters recede, and transports them to safe habitat during critical flow periods.

3. As part of the Interim Relief Program, rescues smolts during critically dry years, transports them to

acclimation facilities, then releases them into the sea.

4. Designed and constructed emergency fish ladder in winter 1990 to attract spawning adults into the river for subsequent transport to safe habitat upstream.

5. Rehabilitates critical migration riffles.

6. As part of the Interim Relief Program, negotiates an agreement with Cal-Am and California Department of Fish and Game regarding diversion and releases from San Clemente Dam.

7. Submits annual report to State Water Resources Control Board on Interim Relief Program activities.

8. Works diligently towards a long-term water supply project that would result in improved streamflow conditions.

The existing fisheries program is modest in terms of cost, due partly to volunteer labor provided by the Carmel River Steelhead Association. About $45,200 was expended in FY 1989-90 for specific fisheries projects, including the experimental fish ladder described in District activity #4 above.

<u>Key Assumptions</u>: The fisheries analysis in the Allocation Program EIR was based on the following key assumptions:

1. A dredging program funded and implemented by Cal-Am would keep the Los Padres Reservoir at its existing usable storage of 1,968 AF.

2. Cal-Am's Carmel Valley filter plant could be operated at 1 to 3.5 cfs when inflow to San Clemente Dam is less than 8 cfs.

3. The existing practice of signing an annual agreement, with quarterly review and amendments, depending on the river inflow conditions, would be continued.

<u>Amendments to Consultant's Fisheries Mitigation Program:</u> Given that the text describing the fisheries mitigations in the Water Allocation Final EIR (page IV-91) was somewhat vague, District staff expanded on six of the seven mitigation measures recommended by the consultant. The facility design, cost estimates, and operations and maintenance are described in detail in the Draft Fisheries Mitigation Plan (Dettman, 1990).

Staff deleted the consultant's mitigation #4 (drilling new wells in aquifer subunit 4) because the results of CVSIM indicate the wells would have been needed only at the end of the 1976-77 drought. In addition, the new wells would exacerbate the environmental impacts identified for riparian vegetation in the lower Carmel Valley.

The District Board reviewed the staff interpretation of the consultant's mitigation program in terms of cost and institutional feasibility. It solicited comments on proposed mitigation facilities from regulatory agencies such as the California Department of Parks and Recreation (CDPR) and Fish and Game (CDFG), which would need to approve permits for these facilities. Based on their comments and other information, the Board deleted the consultant's mitigations #2 and #7, and modified mitigations #3 and #5.

The consultant's mitigation #2 (partially reconstruct the fish ladder and alter spillway gate operation at San Clemente Dam) was deleted by the District Board because it does not own and operate the dam. The District would consider contributing to a study of the effectiveness of passage at San Clemente Dam if such a study were deemed by CDFG as <u>essential</u> to maintaining the steelhead population. It should be noted that Cal-Am will be altering the spillway gates in the next few years to comply with the State Department of Water Resources -- Division of Safety of Dams requirements.

The consultant's mitigation #3 (additional modifications to the Los Padres Dam spillway) was amended by the Board to entail funding of a five-year study of the effectiveness of the spillway modifications made in 1986, based on a design by CDFG engineers. The District will request that CDFG help pay for the study as well. If the study indicates that additional modifications are necessary, the District assumes that construction will be funded by Cal-Am and CDFG.

The consultant's mitigation #5 (expand downstream smolt rescue and transport program) was altered slightly by the District Board. Instead of a formed, in-place (unmovable) concrete structure in the river, the smolt trap design was changed to consist of portable structures, which are less expensive. Also, the river channel itself has been known to move significantly after large storms; thus a portable unit would be more reliable. The effectiveness of the program would not be diminished by this change.

The consultant's mitigation #7 (attraction facility for spawning adults) was deleted by the Board due to questions about water availability, durability of the structure, institutional feasibility and cost. It is uncertain whether water could be appropriated to pump from an upstream location on the river to an attraction facility on the coast (especially in dry years); whether such diversions would be allowed if the State Water Resources Control Board (SWRCB) decides to adjudicate the basin in response to water rights complaints; and whether the diversion would impact aquatic habitat near the diversion site. The institutional feasibility appears unlikely, as CDPR (a key permitting agency) has indicated significant reservations about the concept. In a letter dated August 15, 1990, CDPR questioned whether "anyone wants to see an essentially wild run of fish becoming dependent upon the proper operation of a fish ladder at the mouth of the Carmel River." The cost of an attraction facility would be about $1.7 million, which is considered excessive, given questions about the durability of a fish ladder in the surf zone in winter.

Elements of District's Fisheries Mitigation Program: The above alterations and deletions to the consultant's fishery mitigation concepts by the District staff and Board result in the following specific fisheries mitigation measures that would be carried out by MPWMD. These mitigations would supercede most of the existing District programs:

1. Expansion of the existing program to capture emigrating smolts and transport them downstream during critical years; includes trapping and holding facilities.

2. A program to prevent stranding of early fall and winter migrants by capturing and transporting them to permanent habitat or a temporary holding facility, whenever a risk of stranding exists.

3. A permanent, fully funded program to rescue juveniles from the reach downstream of Robles del Rio to transplant them into permanent habitat or a holding facility below San Clemente Dam.

4. An experimental program to trap and transport steelhead smolts around Los Padres Reservoir to test the effectiveness of modifications to the spillway, and to measure mortality of fish that migrate through Los Padres Reservoir and over Los Padres Dam.

The following pages include a brief description of each mitigation measure and its purpose, implementation or facilities needed, the frequency of use with Option V, monitoring and reporting program, permits needed and preliminary cost estimates for the construction and operation of each measure. A more detailed description of the facility designs and operations is found in the Draft Fisheries Mitigation Plan (Dettman, 1990).

The total estimated capital cost of this Board-approved fisheries mitigation program would be $407,700 for the first five years. Average annual O&M costs for the first five years are estimated at $212,900 per year. Annual costs for individual critically dry years could be as high as $382,200, and as low as $78,700 in wet years. The fisheries mitigation program costs include funding for the existing fisheries biologist plus three permanent 75% time resource technician positions and two intermittent 100% time resource technicians during drought years. This cost information is summarized in Exhibit 3.

It should be noted that the fisheries mitigation program for the Allocation Program EIR would supercede and expand upon the existing

Interim Relief Program fisheries activities.

The MPWMD Board has adopted a Statement of Overriding Considerations in relation to the fisheries mitigations proposed by Larry Mintier and Associates as interpreted by the District fisheries biologist. With the four Board-approved measures, most impacts to the steelhead population would be reduced to a less than significant level. However, the overall impact of Water Supply Option V on the population will be significant because the impacts to the spawning adults will remain unmitigated (see discussion of consultant's mitigation #7 above). The run of returning adults would be denied access to the Carmel River in parts of January, February and March when flows upstream of the Narrows are suitable for adult migration, and when fish would have migrated in earlier decades with lower levels of municipal water demand and production. This scenario would occur in 21 out of 30 years (two-thirds of the time) for an average of 21 days per year, according to CVSIM output with 16,700 AF of Cal-Am production (Option V). The main effect would be compression of the run in time, which would lead to increased competition by adults and fry, lower survival rates, and a reduced steelhead population.

Exhibit 3

COST ESTIMATES FOR FINAL FISHERIES MITIGATION PROGRAM -- OPTION V
November 1990

(Values shown are fully funded by MPWMD for five years. These mitigations would encompass and supercede existing efforts for each measure.)

MITIGATION PROGRAM		CAPITAL COST			ANNUAL COSTS		
		Existing	New	Total	Existing	New	Total
1.	Expand program to capture emigrating smolts in spring	$ 9,000	110,200	119,200	$ 6,200	49,100	55,300
2.	Prevent stranding of early fall and winter migrants	$ 0	95,200	95,200	$ 3,600	75,300	78,900
3.	Rescue juveniles downstream of Robles del Rio in summer	$ 0	173,100	173,100	$ 3,000	54,600	57,600
4.	Experimental smolt transport at Los Padres Dam	$ 0	29,200	29,200	$ 0	21,100	21,100
	TOTAL COST	$ 9,000	407,700	416,700	$ 12,800	200,100	(1) 212,900
ESTIMATED TOTAL COST WITH BOARD-APPROVED PROGRAM			$407,700				$212,900

NOTE 1: Annual cost estimates are averages. Individual dry years may cost up to $382,200 per year, while wet year annual costs may be as low as $78,700 per year.

u/henri/wp/alloeir/mitprog3

FISHERIES MITIGATION #1: EXPAND PROGRAM TO CAPTURE EMIGRATING SMOLTS IN SPRING

Existing District Program

Under terms of the Interim Relief Program agreement, the District rescues and transports smolts during critically dry years. During the past two years, District staff, members of the Carmel River Steelhead Association (CRSA) and CDFG staff have rescued about 500 smolts from the lower Carmel River. The fish were transported to the ocean, to an acclimation facility at the Monterey Bay Aquarium or to a rearing facility at CDFG's Granite Canyon Marine Laboratory. District costs for this program totalled about $15,200 during FY 1989-90. Three District staffmembers were involved in this program for two months at one-quarter time.

Description and Purpose

The program to capture emigrating smolts and transport them to the ocean during critical years would be expanded to include all years when March, April and May flows are too low for successful smolt emigration. In addition to expanding the number of years when the program operates, the District would design, construct, and operate several facilities to improve the operation and overall success of the program. These include a seasonal trapping facility near Schulte Road or the Scarlett Narrows, and holding facilities near Schulte Road and at the Carmel River Lagoon. The purpose of the program is to increase the survival of steelhead smolts and the number of smolts which successfully emigrate to the ocean.

Implementation and Facilities

The District would improve the current program for transporting and holding smolts by designing and operating three facilities: (1) a smolt trap in the river near Schulte Road or the Scarlett Narrows, (2) holding facilities near Schulte Road and (3) holding facilties in the Carmel River Lagoon. Conceptual designs for these facilities are discussed in the Draft Fisheries Mitigation Plan (Dettman, 1990). As noted in the introduction of this section, the smolt traps have been changed to portable, rather than the in-place concrete structures described in the Draft Fisheries Mitigation Plan.

Frequency of Use

Studies have shown that the survival of emigrating of smolts is jeopardized as flows decline below 20 cfs. For this reason the District plans to trap and transport smolts during March, April, and May, when flows recede below 20 cfs at the USGS Near Carmel gage. Based on this plan and daily streamflows simulated by CVSIM, the District would operate the smolt emigration facility an average of 40 days per year. During extreme droughts, such as 1976-77, the facility would operate for a maximum of 92 days (March 1 - May 31).

Monitoring and Reporting

A marking program would test the effectiveness of rescuing and transporting juvenile steelhead downstream. As fish are captured at the facility near Schulte Road, District personnel will mark groups of juveniles with coded wire nose tags and release them at several locations and times to compare the survival of rescued, non-rescued, transported and non-transported fish. These comparisons will be made by sampling outmigrating juveniles at the mouth of the Carmel River as well as marked fish upon their return as adults. Annual monitoring reports will be provided to CDFG, SWRCB and the U.S. Fish and Wildlife Service (USFWS).

Permits Required

To construct and operate an expanded smolt trapping program, permits will be needed from Monterey County, CDFG, SWRCB, CDPR and the California State Coastal Commission (CSCC).

Preliminary Cost Estimates

The estimated costs for constructing a facility to trap, temporarily hold, and transport smolts to the ocean totals $110,200 (costs are shared with Mitigation #2). Operating costs would average about $55,300 per year and range from zero to $115,500 per year. These costs include the existing District activities, which would be superceded by this mitigation measure. On average, staff would be needed to run this program for 40 days per year, and up to 98 days (including clean-up) in dry years.

FISHERIES MITIGATION #2: PREVENT STRANDING OF EARLY FALL AND WINTER MIGRANTS

Existing District Program

There is no formal District program to prevent stranding of early fall and winter migrants. However, staff recognized this problem in the Carmel River, and as time allowed, staff conducted several rescues or coordinated CRSA rescues. District costs for this minimal program during FY 1989-90 were $3,600. Two staffpersons spent a total of 2-3 weeks on this program.

Description and Purpose

As in other Central California streams, juvenile steelhead in the Carmel River move downstream into lower reaches of the river well ahead of the peak emigration of smolts. There is a high risk that presmolts and other juvenile steelhead will be stranded following early fall and winter storms, which increase flows and stimulate the fish to move downstream into habitat that is subsequently dewatered after the storm peak passes. This risk could be reduced by a program to trap and capture downstream migrants during the high risk period of October through February.

Implementation and Facilities

A program to capture juvenile steelhead before they are stranded would rely on a combination of methods. During and following small fall and early winter storms, the trap and holding facilities for the smolt transport program would be used to intercept fish before they move into habitat that will dry up. Following larger storms that produce flows in excess of 40 cfs at the Schulte trapping facility, District staff will electrofish with backpack and streamside shockers to capture fish in the reach below the trap.

Frequency of Use

With Option V (16,700 AF production) the facility would operate an average of 57 days per year. The most frequent use would occur during and following dry periods. For example, during the simulated 1961-64 period the facility would have operated 94 days in 1961, 79 days in 1962, 126 days in in 1963, and 101 days in 1964.

Monitoring and Reports

Monitoring for this program would entail tabulating the annual number of fish rescued from drying reaches of the Carmel River downstream of the Narrows. The District would also initiate a marking program to test the effectiveness of rescuing and holding juvenile steelhead which migrate downstream into drying reaches. The protocol of this marking program would follow the monitoring design for smolts as described in Mitigation #1 above. As fish are rescued, District staff will mark groups of juveniles with coded wire nose tags and release them at several locations and times to compar the survival of rescued, non-rescued, held and non-held juveniles. Tallies of the number of marked fish which outmigrate at the mouth of the Carmel River will be the basis for comparing the survival of different groups. Annual monitoring reports will be provided to CDFG, SWRCB and USFWS.

Permits Required

To construct and operate a program to prevent stranding of early juvenile emigrants, permits will be needed from Monterey County, CDFG, and SWRCB.

Preliminary Cost Estimates

The estimated costs for constructing a facility to trap, temporarily hold, and transport juveniles totals about $95,200. Operating costs would average about $78,900 per year and range from zero to $188,000 per year. These costs include the existing program, which would be superceded by this mitigaiton measure. On average, staff would be needed to run this program for 57 days per year, and up to 151 days in dry years.

FISHERIES MITIGATION #3: RESCUE JUVENILES DOWNSTREAM OF ROBLES DEL RIO IN SUMMER

Existing District Program

There is no formal MPWMD program to rescue juvenile steelhead during summer months. CRSA has rescued several thousand juveniles during the past five years when water withdrawals isolated juvenile steelhead in pools throughout the lower river. In recognition of this problem, staff conducts rescues whenever conditions and time allow. During the summer of 1989, District staff, CDFG and CRSA rescued 130 juvenile steelhead and released them in safe habitat upstream of Robles del Rio. The District costs for these activities in FY 1989-90 totalled about $3,000. Two District staffmembers worked about two weeks on the rescues.

Description and Purpose

About 1.8 miles of juvenile rearing habitat between Boronda Road and Robles del Rio dry up nearly every summer. The District has proposed a program to rescue, transplant, and rear juvenile steelhead that are stranded during the dry season from June through December. The purposes of the program are to rescue juvenile steelhead from drying reaches, to transplant juveniles to permanent habitat below San Clemente Dam (if it is available), and to rear young-of-the-year steelhead in a facility below San Clemente Dam.

It should be noted that CVSIM results in the Allocation EIR determined that flows could be maintained at the Narrows in all years, except at the end of the most extreme droughts. However, this finding is based on two important assumptions: (1) Cal-Am would maintain the existing storage in both reservoirs via a dredging program, and (2) the Carmel Valley Filter Plant could be operated between 1.0 and 3.5 cfs.

Implementation and Facilities

Pending approval and agreement with Cal-Am, the District would construct a facility to hold and rear wild juvenile steelhead below San Clemente Dam, near the Sleepy Hollow Weir. The preliminary design consists of several holding pools and an artifical stream channel. The facility could hold and rear a maximum of 64,000 fish to a weight of about 13 grams, equivalent to the size of fish reared under natural conditions in the Carmel River. The fish would be allowed to naturally emigrate out of the holding facility, if habitat is available in the river.

Frequency of Use

The program to rescue and transplant juvenile steelhead will be used every year because a 1.8 mile reach between Boronda Road and Robles del Rio and the 9-mile reach between Highway 1 and the Narrows dry up about 97 percent of the time.

Monitoring and Reports

The program to rescue juveniles stranded in the Carmel River will be monitored by keeping accurate records of the number and size of fish rescued. Groups of juveniles will be marked, weighed and their survival to the smolt stage and returning adults will be compared to naturally reared smolts. Annual monitoring reports will be provided to CDFG, SWRCB and USFWS.

Permits Required

To construct and operate a program to rescue and rear stranded juvenile steelhead, permits will be needed from Monterey County, CDFG, SWRCB, and ACE. A focused EIR may be required.

Preliminary Cost Estimates

The District purchased most of the equipment for capturing and transporting juvenile steelhead as part of the Interim Relief Program, so no major capital expenditures are needed for fish capture equipment. Preliminary estimates of costs for construction of the holding and rearing facility total $173,100. Annual operating costs are expected to total about $57,600 per year. The O&M costs include the existing program, which would be superceded by this mitigation measure. This program would run from June through December each year, and staff would be needed for 214 days per year.

FISHERIES MITIGATION #4: EXPERIMENTAL SMOLT TRANSPORT PROGRAM AT LOS PADRES DAM

<u>Existing District Program</u>

No District program is presently in place to measure the survival of smolts past Los Padres Dam. The District fish biologist and other biologists and engineers have visited the dam, and have noted that conditions over the spillway may reduce survival of emigrating smolts.

<u>Description and Purpose</u>

No downstream fish passage facilities were built at Los Padres Dam when it was constructed in 1949. The situation is probably detrimental for emigrating smolts because the rough spillway abrades fish, and at low flows, fish fall onto the rocks below. In 1986 the spillway at Los Padres was modified to improve passage conditions. To date, no experimental releases of fish have been made to test whether these improvements reduce mortality. Recent photographs indicate that mortality still may occur at low flows.

The purpose of this program is to assess how well the previous spillway modifications are functioning. The mortality of fish emigrating over the spillway and through the reservoir versus the mortality of fish transported around the reservoir would be compared. Depending on the outcome of the experiments, a permanent program could be implemented to transport fish around the reservoir and past the dam.

<u>Implementation and Facilities</u>

The experiments to test mortality of emigrating smolts would be similar to a 1988 USFWS study of salmon smolts in the Sacramento - San Joaquin Delta. Groups of marked smolts are released at different locations and intensively sampled at a point downstream. The number of smolts from the upper release site divided by the number from the lower site is an index of survival. With the proposed experiments at Los Padres Dam, three groups of fish would be marked. Groups would be released at the head of the reservoir, at the top of the spillway and at the base of the spillway. The population of smolts would be intensively sampled at the Bedrock Chutes and at Syndicate Camp, located about 0.5 miles and 2.0 miles downstream of Los Padres Dam, respectively. A survival index would be developed based on the sampling data.

<u>Frequency of Use</u>

The experiments to determine mortality of emigrating smolts would extend over a period of 5 years. If a smolt transport program is needed, it would occur annually from late February through May.

Monitoring and Reporting

Monitoring will consist of annual reports to CDFG, USFWS, National Marine Fisheries Service and Cal-Am which describe the experimental results. After five years of study, a final report will identify whether additional modifications to the spillway are needed, and if so, the nature of the modifications. If modifications are made to the spillway, the monitoring should be extended to determine the success of the modifications. It should be noted that this information is also applicable to the long-term water supply project.

Permits Required

A permit from CDFG will be needed to trap and experimentally mark steelhead.

Preliminary Cost Estimates

Estimated capital costs for conducting mortality experiments would total $29,200 and annual O&M costs would total $21,100 for each of the five years. The smolt experiments would occur between late February and May each year. On average, staff would be needed to run this program for 30 days per year.

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FINAL FIVE-YEAR MITIGATION PROGRAM FOR RIPARIAN VEGETATION AND ASSOCIATED WILDLIFE -- OPTION V

SUMMARY: The Water Allocation Program Final EIR found that all water supply options, including 16,700 AF Cal-Am production (Option V), would have significant adverse impacts to the lower Carmel River (AQ3 and AQ4) riparian resource without mitigations. Option V would result in potentially significant effects in AQ2 in dry years, but adverse effects would be expected only near the Los Laureles wells. It should be noted that wildlife dependent on riparian vegetation would be similarly affected without mitigations. Discussion of the mitigation program is found on pages IV-52 through IV-54 of the Final EIR. The following mitigations were recommended by the consultant:

1. Implement a conservation program that retains water in the river and increases ground-water storage available to riparian vegetation. Entails inspection of yearly allocation amounts.

2. Identify existing riparian areas of greatest extent, and control drawdown to minimize the onset of water stress. Guarantee that no more than 10% would be lost due to drawdown. If plants die, replace with 300 trees/acre and ensure 70% survival. If 70% standard not met after 3 years, replant again. Identify and inspect sites at least two times per year.

3. Prioritize existing stands to be irrigated; continue and expand the present irrigation program. Guarantee no loss greater than 10%; replant if standard not met with standards in #2. Identify and preserve areas that may be destroyed or disturbed by urban or agricultural development.

4. Implement revegetation plan by creating new riparian habitat to replace lost habitat in lower terraces. Use 70% survivorship standard in 3 years; replant as necessary; monitor results as needed, and continue quarterly inspections after first three years; use qualified personnel for all these tasks.

5. As part of revegetation plan, purchase conservation easements on upper floodplain terraces for riparian revegetation of sycamores and valley oaks. Planting densities of 200 trees/acre with 70% survival. Inspections as noted above.

6. Identify sites where non-riparian/non-natives can be removed without threatening bank stability, and replant with riparian species as part of the above plans.

7. In droughts, increase irrigation to meet plant demands. Deep irrigation would be an objective. Where feasible, increase irrigated area in droughts. Replace vegetation that dies in a drought.

The EIR consultant stated that it was unknown whether these mitigations would reduce impacts to a less than signficant level. Based on this uncertainty, the consultant concluded that the mitigations would result in a potentially significant impact to riparian vegetation and dependent wildlife.

Existing District Programs: Ongoing District programs already address the environmental impacts of existing water supply practices on the riparian resource of the Carmel River. The District engages in the following activities:

1. Installs, operates and maintains drip irrigation systems to irrigate all major stands of riparian vegetation along nearly 6 miles of river between Via Mallorca Bridge and Cal-Am's Scarlett well. To date, about 450,000 lineal feet of drip irrigation line have been installed under the auspices of the Interim Relief Program and Irrigation Program, totalling about 75 acres of riparian land under irrigation.

2. Expands and renovates previously installed riparian irrigation systems.

3. Implements the Carmel River Management Program, which entails extensive vegetative plantings and irrigation of willows associated with erosion control projects.

4. Has retained a consulting agronomist to test the effectiveness of the District's irrigation system, assess application rates and refine irrigation schedules.

5. Installs permanent standpipes to monitor soil moisture profiles in several areas.

6. Has expanded the Emergency Irrigation Program to cover much of the 2-mile reach from near the Carmel River lagoon to Rancho Canada. Another 130,000 lineal feet of drip line are anticipated to irrigate vegetation in this reach. Four additional seasonal employees were hired in 1990 to implement the expansion.

7. Regularly monitors water levels, riparian plant stress, and soil moisture.

8. Implements comprehensive conservation program to reduce per capita use by 15% by the year 2020; develops annual MOA with Cal-Am and CDFG, and conducts the Water Supply Strategy and budget process to retain water in the river as much as possible.

9. Works diligently towards development of a long-term water supply project that would provide improved streamflow conditions.

As shown in Exhibit 4, the existing riparian programs are substantial in terms of cost. About $295,000 is expended annually by the District to fund the Carmel River Management Program, the Interim Relief Program (emergency irrigation), the annual MOA and Water Supply Strategy and Budget process, and irrigation around four Cal-Am wells in lower Carmel Valley. The latter program, which costs about $50,000 per year, is partially funded by Cal-Am (up to $7,000 annual contribution) as part of the permit conditions for the four wells. Four members of District staff are involved in existing programs, including the District Engineer, two river maintenance workers, and an Associate Hydrologist.

Amendments to Consultant's Riparian Mitigation Program: District staff assessed the recommended mitigations for technical accuracy and feasibility. Based on this work, the seven mitigations recommended by the consultant have been altered as follows:

The consultant's mitigation #1 is already in effect as part of the District's comprehensive water conservation program. The recommendation to carry out "inspections of yearly allocation amounts" was unclear. Staff interprets this to mean "monitor yearly production amounts," which is already done by the District.

The consultant's mitigation #2 entails control of drawdown near sensitive riparian areas. MPWMD cannot control drawdown from wells. It can, however, work with Cal-Am to develop pumping schedules that better regulate the rate of drawdown, which is the critical factor for riparian health. This is done through the Water Supply Budget and Strategy process, in addition to well rotation of the four lower Carmel Valley wells.

The consultant's mitigation #3 includes a provision for MPWMD to identify and preserve riparian areas that may be destroyed or disturbed by urban development. Staff disagrees with the consultant for two reasons: (1) land preservation is an appropriate function for a park district, city or county -- not the MPWMD, and (2) given county zoning regulations and FEMA insurance constraints, it is very unlikely that future development would occur along the riparian corridor.

The consultant's mitigation #4 entails creation of new riparian habitat (by revegetation and irrigation) to replace vegetation losses in lower terraces along the Carmel River. The consultant does not identify a revegetation rate (acres per year) or total acreage that should be revegetated. Staff believes that creation of new riparian habitat is not as desirable as preservation of existing stands for two reasons. First, riparian habitat loss in Carmel Valley has occurred primarily due to farming and existing development, rather than withdrawal of ground water and diversion of surface flows. Second, survival of new riparian plantings in the lower terraces cannot be assured. Vegetation would be planted on the unconsolidated alluvium that makes up the lower terraces. This material is subject to erosion and removal during even moderate stormflows. Due to the high potential of loss in major storms, revegetation of denuded areas will not be an integral part of the riparian mitigation program approved by the District Board. The District efforts will focus on protection and enhancement of existing riparian habitat.

The consultant's mitigation #5, which entails purchase of conservation easements on upper floodplain terraces for riparian revegetation, is not warranted. The Water Allocation Program Final EIR does not identify damage to riparian vegetation on upper terraces due to any water supply option, nor any connection between vegetation on the upper terraces and lower terraces along the river.

The consultant's mitigation #6 entails removal of non-riparian and non-native species along the river unless bank stability would be threatened by the removal. Given that many private property owners have planted and maintain such species on their land, this mitigation should include replacement/removal of non-riparian and non-native species <u>only if</u> their presence threatens bank stability.

The consultant's mitigation #7 entails increased irrigation of riparian vegetation during droughts, which is already done by the District. Thus, this mitigation is not considered as a separate measure in the Board-approved final mitigation program.

<u>Elements of the District's Riparian Mitigation Program:</u> The above alterations and deletions to the consultant's riparian mitigation concepts by the District staff and Board result in the following specific measures that would be carried out along with existing District programs:

1. Conservation and water distribution management to retain water in the river.

2. Prepare and oversee Riparian Corridor Management Plan; design projects; obtain access agreements.

3. Implement Riparian Corridor Management Programs; expand irrigation and planting programs; drill wells

4. Expand monitoring program for soil moisture and vegetative stress.

The following pages provide a brief description of each mitigation measure and its purpose, implementation and facilities needed, the frequency of use, monitoring and reporting program, permits needed, and preliminary cost estimates. New programs resulting from the Allocation EIR would total $10,000 in capital costs and $121,000 in annual costs. The total estimated capital cost of the Board-approved riparian mitigation program would be about $10,000. The total annual costs (including continuation of existing programs at a cost of $295,000 per year) would be about $416,000. Exhibit 4 summarizes the riparian mitigation cost data. The riparian mitigation program would entail hiring one additional full-time staffperson (program manager) and several additional seasonal river maintenance workers.

The four Board-approved mitigations, in addition tc existing riparian programs, would reduce impacts of Supply Option V to riparian vegetation, but it is unknown whether impacts would be reduced to a less than significant level. Thus, the District program would result in potentially significant impacts to riparian vegetation and dependent wildlife.

Exhibit 4

COST ESTIMATES FOR FINAL RIPARIAN MITIGATION PROGRAM -- OPTION V
November 1990

(Values are fully funded by MPWMD for five years)

MITIGATION PROGRAM		CAPITAL COST			ANNUAL COSTS		
		Existing	New	Total	Existing	New	Total
1.	Conservation and water distribution management to retain water in river	$ 0	0	0	$ 3,000 (1)	0	3,000
2.	Prepare and oversee Riparian Corridor Management Plan; design projects; obtain access agreements	$ 0	0	0	$ 0	60,000	60,000
3.	Implement Riparian Corridor Management Program; expand irrigation and planting programs; secure irrigation water	$ 0	0	0	(2) $287,000	(3) 60,000	347,000
4.	Expand monitoring program for soil moisture and vegetative stress	$ 0	10,000	10,000	$ 5,000	1,000	6,000
	TOTAL COST	$ 0	10,000	10,000	$295,000	121,000	416,000
ESTIMATED TOTAL COST WITH BOARD-APPROVED PROGRAM			$10,000				$416,000

NOTE 1: The District conservation program entails annual costs on the order of $300,000. Given that its purpose is broader than riparian vegetation mitigation, only activities associated with retaining water in the river are itemized here.

NOTE 2: Existing programs include the Carmel River Management Program, irrigation around four Cal-Am wells, and Interim Relief Program irrigation activities (emergency irrigation).

NOTE 3: Costs for implementation of the Riparian Corridor Management Program are anticipated to start in the second or third year, after the plan has been developed.

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RIPARIAN MITIGATION #1: CONSERVATION AND WATER DISTRIBUTION MANAGEMENT TO RETAIN WATER IN RIVER

Existing District Program

The District has carried out a comprehensive, long-term conservation program successfully for several years. The goal of this $300,000 per year program is 15% reduction in per capita water use by the year 2020. Long-term savings of about 9% have already been achieved. Aspects of the program include extensive public education, water saving kit distribution, drought tolerant landscape seminars and other activities. In order to retain water in the river, the District forges a Memorandum of Agreement (MOA) with Cal-Am and CDFG and develops a Water Supply Strategy and Budget for the Cal-Am system. In addition, Ordinances #19 and #41 limit diversions from San Clemente Dam to allow more water to flow downstream. The MOA and Budget processes cost about $3,000 per year in staff time and entail the work of several staffmembers for a few days each quarter in dry years (only once a year in normal years).

Description and Purpose

This mitigation would focus on aquifer subunit 2 (AQ2), where relatively small production from wells may have an impact on riparian vegetation during dry periods. The District would continue its conservation program, and its work with Cal-Am via the MOA and Water Supply Strategy and Budget processes to reduce production and/or the rate of drawdown in AQ2. This region would also be considered when developing a protocol for rationing in droughts. The purpose of this mitigation would be to maximize ground-water levels and river flows in the AQ2 region. CVSIM analysis has shown that conservation would not yield similar benefits in other aquifer subunits.

Implementation and Facilities

General conservation would be implemented via the Water Conservation Plan. Production reduction in AQ2 would be implemented as part of the annual MOA process with Cal-Am and CDFG. One component would be quarterly audits of Cal-Am operations, and management strategies that reduce pumping or the rate of drawdown in AQ2. The District would develop a specific rationing protocol that describes the mechanisms for when rationing would be initiated. An integral component or criterion would be the potential impact of water use on AQ2. Another would be a specific drought reserve that would be necessary to preclude rationing. The need for rationing would be assessed annually or quarterly in the District's Water Supply Strategy and Budget review, and monthly during droughts via a Water Supply Status Report.

Frequency of Use

General conservation and protection of the AQ2 area would be continual, with most attention during dry periods. Rationing would occur only during extended dry periods. Detailed statistics are not available.

Monitoring and Reporting

Monitoring would consist of annual reporting of water conservation activities and results, and monthly review of water production data from AQ2.

Permits Needed

No permits would be required to implement this program.

Preliminary Cost Estimate

This mitigation would not result in significant additional costs because elements are already part of ongoing programs. Thus, the total cost would remain at $3000 per year. Staff time would be necessary to develop the rationing criteria and mechanism.

RIPARIAN MITIGATION #2: PREPARE AND OVERSEE RIPARIAN CORRIDOR MANAGEMENT PLAN

Existing District Program

Several District programs that address the riparian corridor of the Carmel River are described in the following section (Riparian Mitigation #3). There is presently no Riparian Corridor Management Plan, although the Carmel River Management Plan (CRMP) addresses several riparian concerns.

Description and Purpose

Most of the mitigations proposed in the Allocation EIR (as described and amended above) would form the basis of a Riparian Corridor Management Plan along the Carmel River. The purpose of the plan would be to coordinate the many mitigation activities that are required so that they can be implemented in an orderly, cost-effective manner. An additional District staffperson with a background in botany/revegetation/irrigation would be hired to write and implement the plan.

Subcomponents of the Riparian Corridor Management Plan would include the existing erosion control program (CRMP), the new riparian mitigation projects described in the Water Allocation Program Final EIR (as amended herein) and continued irrigation around four Cal-Am wells and in other areas. Only the costs for the new mitigation activities are shown below.

Implementation and Facilities

The Riparian Corridor Management Plan would (1) identify and prioritize the existing vegetation that must be protected, (2) determine the location and design of irrigation systems, and (3) identify areas in which to selectively remove vegetation from the active channel bottom to reduce the risk of bank erosion, as well as water loss due to evapotranspiration. Agreements with property owners would be obtained to allow mitigation projects on their land. The District staff would be responsible for the completion of the plan and the necessary agreements to begin implementation.

Frequency of Use

Development of the plan is anticipated to require 1-2 years, depending on the level of cooperation by property owners and regulatory agencies.

Monitoring and Reporting

During development of the plan, progress would be reported annually. Once the plan is developed, monitoring would be carried out as described under Riparian Mitigation #3.

Permits Required

Permits would not be required for development of the plan. Permits from Monterey County, CDFG and/or the U.S. Army Corps of Engineers (USACE) may be required for specific activities recommended in the plan.

Preliminary Cost Estimates

No capital cost is listed for this mitigation. The annual cost is estimated to be $60,000 per year for an additional District staff person (program manager), including salary and benefits. The new program manager would work closely with existing District staff who are responsible for Carmel River management activities. Other costs for plan development would be included in ongoing District programs.

RIPARIAN MITIGATION #3: IMPLEMENT RIPARIAN CORRIDOR MANAGEMENT PROGRAM

Existing District Programs

As noted in the introduction of the riparian mitigation section, there are several ongoing District programs that address the environmental impacts of existing water supply practices on the riparian resource of the Carmel River. The District has installed and maintains drip irrigation systems for all major stands of riparian vegetation along nearly 6 miles of river between Via Mallorca Bridge and Cal-Am's Scarlett well. To date, about 450,000 lineal feet of drip irrigation line have been installed under the auspices of the Interim Relief Program and Irrigation Program, totalling about 75 acres of riparian land under irrigation. Previously installed riparian irrigation systems have also been expanded and renovated.

The Carmel River Management Program, which began in 1984, entails extensive vegetative plantings and irrigation of willows associated with erosion control projects in several areas along the river. These projects prevent loss of riparian habitat due to erosion.

Due to the severity of the current drought, the Emergency Irrigation Program was expanded to cover much of the 2-mile reach from near the Carmel River lagoon to Rancho Canada. Another 130,000 feet of drip line are anticipated to irrigate vegetation in this reach in 1990, and four additional seasonal employees were hired to implement the expansion. A consulting agronomist was also hired in 1990 to assess the effectiveness of the District's riparian vegetation programs to date, as well as refine irrigation rates and application schedules.

These existing programs total about $287,000 annually, and entail 6-8 staffmembers (4 full-time, and 2-4 parttime or on an intermittent basis).

Description and Purpose

Once a Riparian Corridor Management Plan (RCMP) is developed, the next step is implementation of the plan to carry out the recommended projects in order of priority. Note that existing programs will become subcomponents of the RCMP.

Implementation and Facilities

The Riparian Corridor Management Program will consolidate and expand upon existing MPWMD programs. The principal new activities being proposed initially are to increase the areas of riparian vegetation under irrigation, especially during droughts, and to maintain adequate channel capacity by selective removal of vegetation from the channel bottom. Given the extent of this program, combined with existing vegetation and irrigation programs, the District should consider drilling small irrigation wells in AQ3 and AQ4 instead of purchasing treated or untreated Cal-Am water. The water would be filtered to avoid clogged drip emitters. The District could secure an area along the river to establish a cottonwood and willow nursery for the projects. Alternatively, existing commercial nurseries could be contracted to provide a certain number of plants each year. Several seasonal river maintenance staff would be hired to assist the program manager. In areas where vegetation has encroached on the active channel bottom, vegetation would be selectively removed to reduce the risk of bank erosion, as well as water loss due to evapotranspiration.

Frequency of Use

This program would likely begin in the second or third year, after completion of the Riparian Corridor Management Plan. This program would be carried out annually until a new water supply project that provides improved streamflow conditions is developed.

Monitoring and Reporting

An annual report would be prepared on activities under the Riparian Corridor Management Plan, in accordance with the recommendations in the Allocation EIR. Parameters include number of plantings, nursery activities, survival rates, acreage irrigated, irrigation water applied, inspection results and vegetation removal data.

Permits Required

Permits from several agencies, including Monterey County, CDFG and/or USACE, may be required for some aspects of the program.

Preliminary Cost Estimates

No capital costs would be incurred for this mitigation. Annual O&M, including funds for seasonal river maintenance workers, overhead, vehicles, irrigation water and irrigation maintenance is estimated at $60,000 per year. These annual costs are anticipated to begin in the second or third year. This estimate includes $10,000 per year for irrigation water, an amount that could be reduced if wells are drilled. If it becomes necessary to acquire land or easements for the program, additional costs could be significant. The combined cost of existing and new programs would total $347,000 per year.

RIPARIAN MITIGATION #4: EXPAND MONITORING PROGRAMS FOR SOIL MOISTURE AND VEGETATIVE STRESS

Existing District Program

The District has installed permanent access tubes to monitor soil moisture profiles in selected areas in lower Carmel Valley. The District regularly monitors water levels, riparian plant stress and soil moisture. These activities cost about $5,000 per year and entail one staffmember working intermittently.

Description and Purpose

This mitigation entails an expanded monitoring program with additional locations for neutron probe access tubes, pressure bombing sites and canopy rating sites. This will allow the District to better assess the impact of prolonged depression or rapid drawdown of the water table. Conversely, the beneficial impacts of the mitigation programs described above could be documented.

Implementation and Facilities

The expanded monitoring program would entail analysis of data already collected and identification of new sites for continuous baseline data collection. In addition to measurements of soil moisture and vegetative moisture stress, the expanded program would include data analysis, weather monitoring and irrigation scheduling for drip lines already in place in the riparian corridor.

Frequency of Use

Once the new sites are located, monitoring and data analysis would be an onoing program. The frequency and location of monitoring would be determined in the Riparian Corridor Management Plan.

Monitoring and Reporting; Permits Required

An annual report on the results and findings of this monitoring program would be prepared and made available to interested agencies or members of the public. No permits would be required for this program.

Preliminary Cost Estimates

An estimated capital cost of $10,000 would be needed for new monitoring sites, equipment and calibration, and infrared photographs. Annual costs are expected to increase from $5,000 to $6,000 per year for the monitoring program. Additional personnel are not expected to be needed for this mitigation measure.

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FINAL FIVE-YEAR MITIGATION PROGRAM FOR LAGOON VEGETATION AND WILDLIFE -- OPTION V

SUMMARY: The Water Allocation Program Final EIR found that all water supply options would have potentially significant impacts on lagoon vegetation and dependent wildlife, even though a reduced impact is recognized for 16,700 AF production (Option V). Discussion of the mitigation program for lagoon vegetation is found on page IV-54 and IV-55 of the document. It should be noted that Option V would result in less than significant impacts to lagoon hydrology. The following mitigations for vegetation and wildlife were recommended by the consultant:

1. Reduce production from the MPWRS by providing additional supplies of water, thus allowing additional surface inflow into the lagoon. Pump water from the aquifers for release into the lagoon during the dry seasons. Additional volume into the lagoon should be recorded and should equal conservation savings.

2. An extensive monitoring program is described that entails vegetation mapping, ordinary high water mark, and soil salinity measurements. Monitoring would be performed every two years to compare status to the baseline. If more than 10% increases in vegetation type or coverage occurred, additional measures would occur (see #3-5). If these measures are not successful, implement a wetland restoration project with a goal of 110% of baseline acreage.

3. Increase reinvestment of conserved water to the lagoon.

4. Injection wells to recharge AQ4.

5. Grout curtain near lagoon to create a coastal barrier.

The consultant could not determine whether the above mitigations would lessen impacts to a less than significant level. The consultant concluded that the impacts would remain as potentially significant with mitigations.

<u>Existing District Programs:</u> Ongoing District programs already address the environmental impacts of existing water supply practices on the Carmel River lagoon. MPWMD activities include:

1. Provides $25,000 to co-fund Carmel River Lagoon Enhancement Plan, which is in progress. The plan entails detailed mapping of vegetation, soils and survey data, lagoon history and compares alternative enhancement activities. Cosponsors include County Flood Control, State Parks, and California Coastal Conservancy.

2. Conducts regular monitoring of lagoon water quality parameters and other data.

3. Actively seeks major new water supply that would provide year-round river flow to the lagoon in most years.

4. Implements comprehensive long-term water conservation program, which would reduce overall demand on the water resource system.

As shown in Exhibit 5, the existing lagoon programs are modest in temrs of cost. About $1,200 is expended annually for lagoon monitoring, primarily by two District staff on a intermittent basis. In addition to the monitoring activities, the District has contributed $25,000 to the Carmel River Lagoon Enhancement Plan ($15,000 cash and $10,000 as in-kind services), and $1,000 towards monitoring. Thus, capital costs expended to date total $26,000.

Amendments to Consultant's Lagoon Mitigation Program: District staff evaluated the consultant's proposals for technical merit and feasibility. Staff concluded (and the Board agreed) that the recommended mitigations should be amended or deleted as follows:

The consultant's mitigation #1 entails pumping water from the lower Carmel Valley aquifers into the lagoon during dry seasons to maintain freshwater levels. District staff notes that this mitigation may exacerbate impacts to riparian vegetation and is not consistent with riparian mitigations. It also entails "reducing production in the MPWRS by providing additional supplies of water," which makes sense only if importation or desalination are water sources. The District has pursued importation and desalination as water supply alternatives, but they have not proven to be institutionally feasible to date. For these reasons, the District will not pursue this mitigation concept.

The consultant's mitigation #2 entails monitoring every two years. Due to the significant fluctuations in year-to-year weather patterns and streamflow, the baseline survey will be repeated during the next normal year and every five years thereafter.

The consultant's mitigation #3 entails increased reinvestment of conserved water to the lagoon if monitoring shows significant changes. This assumes that conservation savings would equal a specific volume of water to the lagoon, which would not be true. Instead, the District will determine the amount of water needed to maintain an adequate habitat for fish and wildlife, and explore alternative means to transport it to the lagoon. Preliminary studies indicate that the amount would be relatively small.

The consultant's mitigation #4 entails injection wells to recharge AQ4. A reliable source of injection water was not identified by the consultant. Unless a reliable source can be identified, the effectiveness of this mitigation is questionable. It should be noted that reclaimed wastewater could be an injection source if institutional constraints did not exist.

The consultant's mitigation #5 entails a grout curtain near the lagoon to create a coastal barrier. This would be a very expensive solution to the problem and has attendant technical concerns. A comprehensive engineering assessment would be needed prior to implementation of this measure. A more reasonable alternative would be to determine how to bring in the small amount of water that the lagoon needs to provide adequate habitat.

<u>Elements of Lagoon Mitigation Program:</u> The above alterations and deletions to the consultant's lagoon mitigation concepts by the District staff and Board result in the following specific measures that would be carried out in addition to existing District programs:

1. Assist with lagoon enhancement plan investigations.

2. Expand long-term monitoring program.

3. Identify feasible alternatives to maintain adequate lagoon volume.

The following pages include a brief description of the mitigation measure and its purpose, implementation and facilities needed, frequency of use with Option V, monitoring and reporting, permits required and a preliminary cost estimate. New programs resulting from the Allocation EIR would total $25,000 in capital costs and $2,000 in annual costs. The total estimated capital cost of the Board-approved program would be $25,000. Annual costs would be $3,200 per year. No additional staff would be needed to implement these mitigations. This information is summarized in <u>Exhibit 5.</u>

The three Board-approved mitigations, in addition to the existing lagoon programs, would reduce the impacts of Supply Option V, but it is unknown whether impacts would be reduced to a less than significant level. Thus, the District program would result in potentially significant impacts to lagoon vegetation and wildlife.

Exhibit 5

COST ESTIMATES FOR FINAL LAGOON MITIGATION PROGRAM -- OPTION V
November 1990

(Values are fully funded by MPWMD for five years)

MITIGATION PROGRAM		CAPITAL COST			ANNUAL COSTS		
		Existing	*New*	*Total*	*Existing*	*New*	*Total*
1.	*Assist with Lagoon enhancement plan investigations*	(1) $ 25,000	0	25,000	$ 0	0	0
2.	Expand long-term monitoring program	$ 1,000	20,000	21,000	$ 1,200	2,000	3,200
3.	Identify feasible alternatives to maintain lagoon volume	$ 0	5,000	5,000	$ 0	0	0
	TOTAL COST	$ 26,000	25,000	51,000	$ 1,200	2,000	3,200
ESTIMATED TOTAL COST WITH BOARD-APPROVED PROGRAM			$ 25,000				$ 3,200

NOTE 1: The District has contributed a one-time amount of $25,000 for the completion of the Lagoon Enhancement Plan.

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LAGOON MITIGATION #1: ASSIST WITH LAGOON ENHANCEMENT PLAN INVESTIGATIONS

Existing District Program

The District, County Flood Control, State Parks and the Coastal Conservancy presently co-fund the Carmel River Lagoon Enhancement Plan. The District will contribute $25,000 to this effort by the completion of the plan ($15,000 in cash and $10,000 as in-kind lagoon water quality monitoring services). The Plan, which is in preparation, is being written by Phillip Williams and Associates. District staff participate on a plan review committee, which meets on an as-needed basis.

Description and Purpose

A key aspect of the Lagoon Enhancement Plan is to identify alternative means to restore and enhance the lagoon environment. As part of the lagoon mitigation program, the District would continue to contribute staff expertise for enhancement plan investigations, and assistance in developing a final plan.

Implementation and Facilities

PWA is scheduled to complete a final Lagoon Enhancement Plan in 1991. The document would entail extensive review and input by District and other agency staff, as well as the public. Once a final plan of action is selected, the District could contribute staff expertise to implement the plan.

Frequency of Use

Completion of the Plan and implementation of projects would occur once, though other enhancement activities could be spread over a series of years.

Monitoring and Reporting; Permits Required

This mitigation would not entail monitoring. No permits would be required.

Preliminary Cost Estimates

No capital or annual costs are anticipated for this mitigation.

LAGOON MITIGATION #2: EXPAND LONG-TERM MONITORING PROGRAM

Existing District Program

The District has an existing program to monitor water quality, streamflow, sediment transport and changes in bedrock geometry in the lagoon on a monthly basis when the Carmel River flows into the lagoon. Water quality measurements (dissolved oxygen, carbon dioxide, specific conductance and temperature) are taken on a quarterly basis when there is no flow into the lagoon. This has been the case in the past three drought years. The annual cost in these years has been about $1,200 in staff time.

Description and Purpose

The lagoon habitat would be monitored as described in the Allocation EIR (mitigation #2) to quantify its existing status and the long-term response to ground water pumping. Major studies such as vegetative mapping and soil surveys would occur every five years. The purpose of the monitoring is to determine if specific changes in plant species distribution, diversity, acreage etc occur over time, and to implement additional mitigations if vegetative changes begin to occur.

Implementation and Facilities

Monitoring performed by District staff would be continued and expanded. Consultants would be retained to perform the detailed mapping and surveys similar to those being performed for the Lagoon Enhancement Plan.

Frequency of Use

Monitoring would be performed on a regular basis. Major mapping and survey studies would be performed every five years after an initial survey during the next normal water year.

Monitoring and Reporting; Permits Required

Annual reports with the findings of the monitoring program would be provided to interested agencies and members of the public.

Preliminary Cost Estimate

The cost for consultant mapping and surveys would be $20,000 every five years. Annual costs for monitoring by District staff would be increased by $2,000 per year from $1,200 to $3,200 annually.

LAGOON MITIGATION #3: IDENTIFY FEASIBLE ALTERNATIVES TO MAINTAIN ADEQUATE LAGOON VOLUME

Existing District Program

There is no existing program to calculate adequate lagoon volume.

Description and Purpose

In conjunction with mitigation #2 above, the volume required to keep the lagoon in a stable situation that can adequately support plants and wildlife would be identified. Alternative means to achieve and maintain the desired volume would be compared, and the most cost-effective means selected.

Implementation and Facilities

Identification of the needed volume would be done in conjunction with the monitoring studies noted above and the findings of the Lagoon Enhancement Plan. Development of alternative means to provide adequate volume would be coordinated with the implementation of the selected alternative in the final Lagoon Enhancement Plan. It should be noted that construction of a large surface reservoir would provide inflow to maintain adequate lagoon volume in most years. The District is pursuing construction of a dam as soon as possible.

Frequency of Use

This study would not begin until the end of 1992, or whenever a final lagoon enhancement program is determined.

Monitoring and Reporting; Permits Required

No monitoring or permits are associated with this mitigation.

Preliminary Cost Estimates

The one-time capital costs within the first five years to assess the volume of water needed to maintain adequate habitat in the lagoon would be $5,000. No annual costs are anticipated.

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FINAL FIVE-YEAR MITIGATION PROGRAM FOR AESTHETICS -- OPTION V

SUMMARY: The Water Allocation Prorgam EIR found that all water supply options, including 16,700 AF Cal-Am production (Option V) would have significant impacts to aesthetics associated with riparian vegetation. According to the consultant, Option V would have potentially significant impacts due to the "brown lawn effect" if water supplies were limited. Discussion of this issue is found on page IV-107. The following mitigations were recommended:

1. For aesthetic impacts related to riparian vegetation, implement the riparian mitigations described previously.

2. For the brown lawn effect, plant drought-resistant landscaping and vegetation.

The consultant determined that, with these mitigations, there would still be potentially significant asthetic impacts associated with riparian vegetation. Aesthetics associated with the brown lawn effect would be reduced to a less than significant level.

<u>**Existing District Programs:**</u> Ongoing District riparian programs are described in the riparian vegetation section. Programs relating to landscaping aesthetics include:

> As part of the District's comprehensive water conservation program, seminars, educational materials and resource lists are provided to the public about drought-tolerant plants and water conserving irrigation techniques (e.g., drip, cisterns). This program costs about $6,000 annually.

<u>**Amendments to Consultant's Aesthetics Mitigation Program:**</u> District staff evaluated the consultant's recommendations for technical accuracy and feasibility, and found that mitigation #2 entails reasoning that is unclear. A reduction in the amount of water available for growth would result in <u>fewer</u> instances of brown lawn in droughts because fewer people will be using the water supply. The brown lawn danger would occur only if all conservation savings went to new growth, thus increasing drought vulnerability. The EIR recommends that this not occur, and the District Board has adopted policies to preclude such action. Thus, this mitigation concept will not formally be part of the Board-approved mitigation program. It should be noted, however, that this mitigation is actually being performed as part of the District's ongoing conservation program.

<u>**Elements of District's Aesthetics Mitigation Program:**</u> The following Board-approved mitigations will be carried out by the District to mitigate aesthetic impacts of Option V:

1. Implement riparian mitigation programs discussed above.

The costs for this program are described in the riparian mitigation section. They would reduce aesthetic impacts relating to riparian vegetation from significant to a potentially significant level.

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APPENDIX 3
INITIAL EVALUATION OF ALTERNATIVES

APPENDIX 3: INITIAL EVALUATION OF ALTERNATIVES

3.1 INTRODUCTION

In compliance with federal and state law, the District investigated a broad spectrum of water supply alternatives to its originally proposed project, the 29,000 AF New San Clemente Dam. From 1988 and through mid-1990, alternatives were considered that might, at least conceptually, be able to meet two project purposes: (1) provide drought reserve for existing residents and supply for planned growth, and (2) provide year round Carmel River flow at the USGS "near Carmel" gage at least in normal and wetter years. On August 8, 1990, the Board amended the project purpose to include only one element: water supply to provide adequate drought reserve and meet the need of planned growth. This change did not affect the final results; it actually broadened the possibilities.

A multi-phase selection process that spanned several years was used to assess which alternatives should be analyzed in this Supplemental Draft EIR/EIS. The criteria, methodology and results of each phase are summarized in Chapter 3. This appendix describes the first phase, the Part I Evaluation of Alternatives, which was conducted in 1988.

A broad range of alternatives that could produce more water was explored, including (1) new dams on the Carmel River or its tributaries, (2) offstream storage reservoirs, (3) infiltration basins for recharge, (4) additional ground water development, (5) sediment removal from existing reservoirs, (6) importation of water and (7) desalination. In addition, the District considered alternatives that would more efficiently use existing resources, such as (7) wastewater reclamation and (8) additional components to the District's existing conservation program.

State and federal law require analysis of the No Project alternative, defined here as existing facilities and conservation efforts, with additional of new wells in the Seaside Coastal ground water subbasin. The No Project alternative is fully described in Chapter 4 of the Supplemental Draft EIR/EIS.

3.2 DESCRIPTION OF ALTERNATIVES CONSIDERED

The following sections briefly describe the numerous water supply alternatives that were examined by the District in the Part I Evaluation.

3.2.1 CARMEL RIVER MAINSTEM DAMS

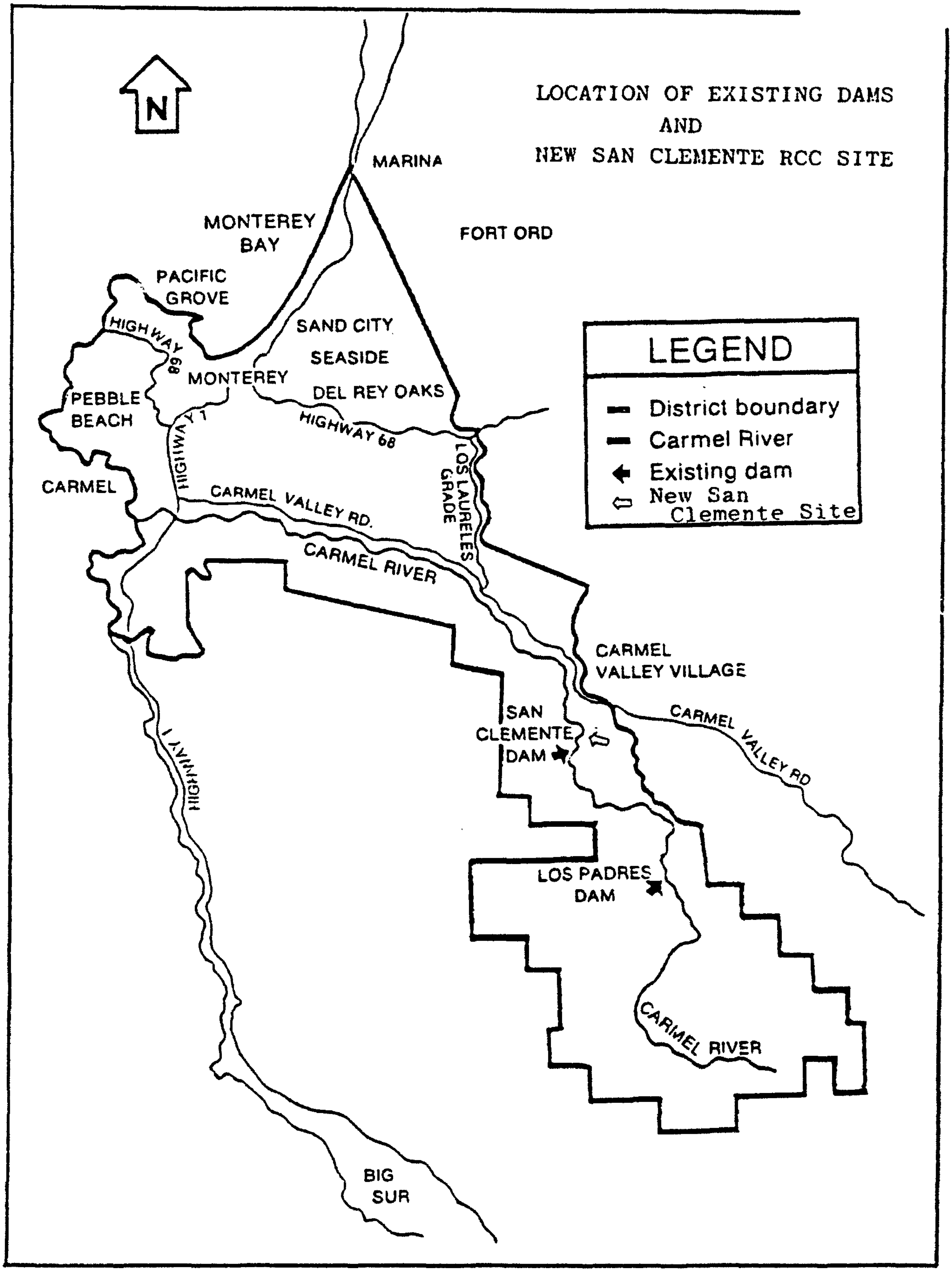
MPWMD New San Clemente Project – RCC Dam

The MPWMD New San Clemente alternative originally entailed a roller compacted concrete (RCC) dam sized to create a storage reservoir of up to 29,000 acre-feet (AF). The MPWMD issued a Notice of Preparation for a 29,000 AF project in June 1982 and a Notice of Intent for the same sized project in August 1986. Project sizes of 16,000 AF, 20,000 AF and 29,000 AF were described in the 1987 Draft EIR/EIS.[1]

The New San Clemente Dam would be located on the Carmel River 18 miles upstream from the river's mouth and about 3.5 miles south of Carmel Valley Village (Figure 3-1). The new dam would be about 3,600 feet downstream of the existing San Clemente Dam and would inundate the existing dam and reservoir. The maximum sized dam would be 300 feet high with a crest length of 900 feet. The 29,000 AF reservoir would inundate about 345 acres.

Other facilities include a spillway and stilling basin at the downstream toe of the dam to prevent erosion. Trap and truck facilities would be built to pass steelhead spawners migrating upstream; downstream facilities would most likely consist of a set of screens to trap fish before they enter the reservoir for transport to a release site below the dam. Dam features would include a multiple level intake structure and two regulating valves at the outlet works for low flow and normal releases. A permanent access road would be constructed for the project that would be linked to Carmel Valley Road via San Clemente Drive.

FIGURE 3-1


LOCATION OF EXISTING DAMS
AND
NEW SAN CLEMENTE RCC SITE
N
MARINA
MONTEREY BAY
FORT ORD
PACIFIC GROVE
HIGHWAY 68
SAND CITY
SEASIDE
MONTEREY
DEL REY OAKS
PEBBLE BEACH
HIGHWAY 1
HIGHWAY 68
LOS LAURELES GRADE
CARMEL
CARMEL VALLEY RD.
CARMEL RIVER
LEGEND
District boundary
Carmel River
Existing dam
New San Clemente Site
CARMEL VALLEY VILLAGE
SAN CLEMENTE DAM
CARMEL VALLEY RD
HIGHWAY 1
LOS PADRES DAM
CARMEL RIVER
BIG SUR

Management of the proposed reservoir would be coordinated with the Carmel Valley and Seaside ground-water basins on a conjunctive use basis to maximize municipal and in-stream benefits. The basic operations goal is to keep the Carmel Valley aquifer as full as possible and maintain the maximum amount of water in the Carmel River for fish and vegetation. Operations also entail a schedule of minimum release targets for steelhead, varying with the type of water year.

A 29,000 AF project was evaluated assuming a January 1988 construction capital cost estimate of $44.9 million with O&M costs of $533,000 per year. Total annual costs to finance and operate a 29,000 AF project were estimated at $6.5 million per year.

In March 1989, the MPWMD Board chose to no longer designate the 29,000 AF New San Clemente Project as the proposed project, based on state and federal agency concerns. Its size was also reduced to 23,000 AF. Chapter 4 of the EIR/EIS provides more detailed, recent cost estimates for a 23,000 AF New San Clemente project, which will be analyzed in this EIR/EIS.

MPWMD New San Clemente Dam-- Rockfill Type

The New San Clemente rockfill alternative would be a 29,000 AF concrete faced rockfill dam located 1,200 feet downstream of the existing dam (Figure 3-1). This dam was considered as a "fall-back" alternative if geotechnical studies showed that a roller- compacted concrete dam is not appropriate. It would be 300 feet high at crest elevation 726 with a crest length of 1,200 feet.[2] About 340 acres would be inundated. Associated facilities would similar to those described for the RCC dam.

This project was evaluated assuming a January 1988 construction capital cost of $50.8 to $61.9 million with O&M costs of $454,000 to $495,000 per year. Total annual costs would be $8.6 to $10.3 million per year.

MPWMD New San Clemente Dam -- Joint Use with Fort Ord and Marina

This concept consists of a jointly funded 45,000 AF New San Clemente Reservoir (Figure 3-1) covering 460 acres that would provide water to residents within MPWMD, Fort Ord and Marina. Facilities would include a 320-foot high RCC dam with a crest length of 1,200 feet and a diversion weir and pumping station near the Scarlett Road Narrows. A 135,000 foot (25.6 mile) pipeline would convey untreated water to Fort Ord; a treatment plant would be built at Fort Ord near Marina. Connections would be made to the Fort Ord pumping station and the Marina Well No. 10. Treated water would be distributed to the existing systems of Marina and Fort Ord via these two points.[3]

This project was evaluated assuming a January 1988 construction cost of $56.5 million for the dam and $62.1 million for the pipeline and water treatment. O&M costs for the dam and transmission facilities would be $645,000 and $905,000 per year, respectively. Depending on the cost sharing plan selected, the low and high end of the cost allocation would be:

MPWMD	–	$17 to $36.4 million capital cost; $2.0 to $4.0 million O&M
Fort Ord	–	$48 to $59.3 million capital cost; $5.3 to $6.5 million O&M
Marina	–	$34.3 to $42.3 million capital cost; $4.0 to $4.8 million O&M

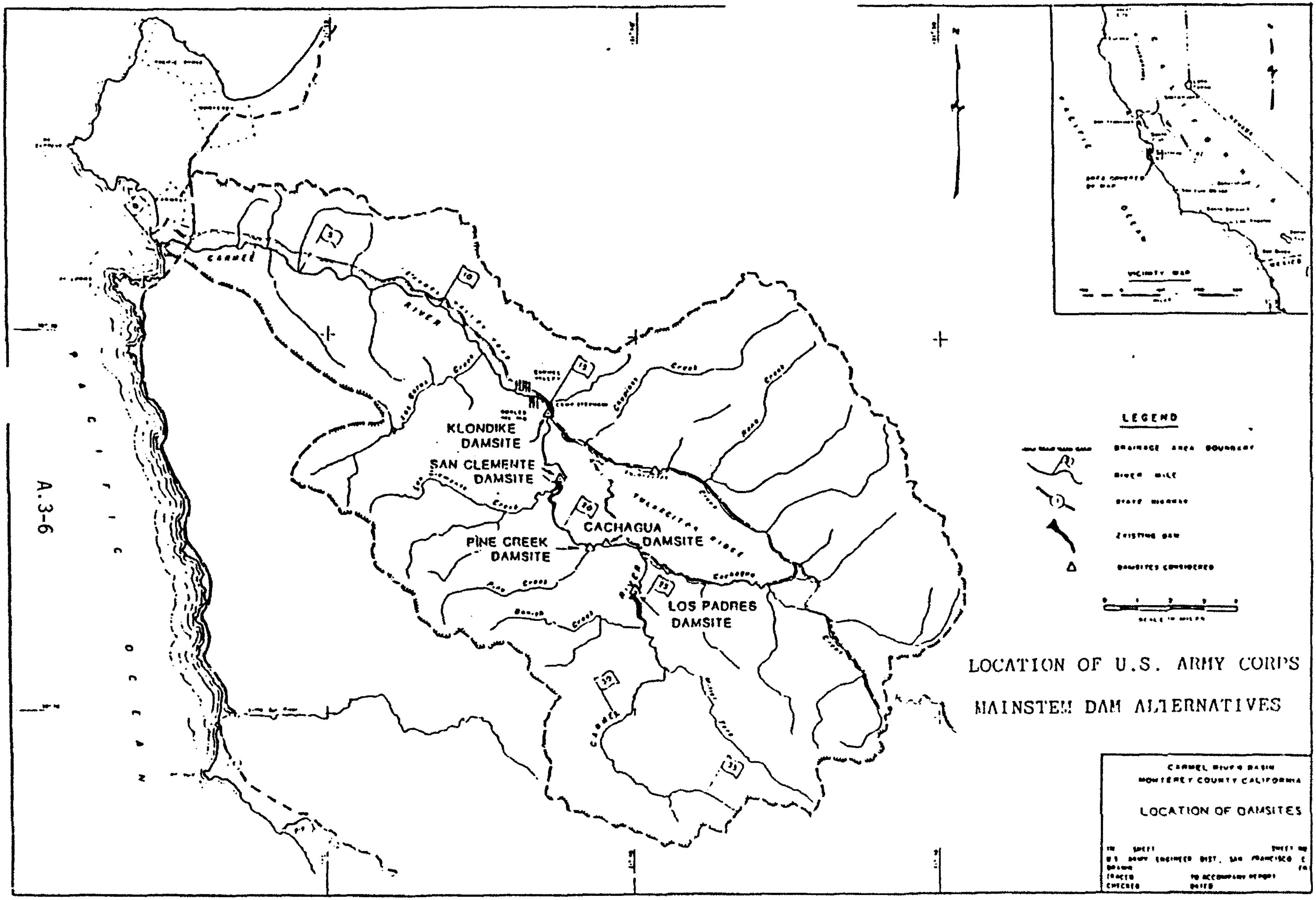
<u>U.S. Army Corps of Engineers Proposals</u>

In 1971, the U.S. Army Corps of Engineers (Corps) began evaluating means to solve flood problems in Carmel Valley and municipal water supply needs for the Monterey Peninsula, Fort Ord and Marina. A variety of solutions, including five mainstem dams shown in Figure 3-2, were considered. The Corps sites included New San Clemente, Cachagua (Upper Syndicate), Pine Creek (Lower Syndicate), Klondike and Los Padres.[4]

The Corps evaluated each site as a single-purpose flood control project, a single-purpose water supply project and a multiple purpose project. The Corps believed that the Wilderness Act of 1964 would preclude construction of any reservoir that inundated any portion of the Ventana Wilderness. Thus project sizes were limited to the point at which inundation encroached upon Wilderness lands.

The basic concept for all mainstem dams was to store excess runoff in reservoirs along the river. The Corps assumed that the most economical construction would be a rockfill embankment, an open cut abutment spillway in undisturbed earth, and a tunnel outlet works to release stored water. The dams would be sized and operated to maintain a storage reserve to carry over from year to

FIGURE 3-2



LOCATION OF U.S. ARMY CORPS
MAINSTEM DAM ALTERNATIVES

Source: Corps of Engineers, May 1981

year to meet demands during extended dry periods. Fish passage facilities were not envisioned; instead, hatcheries would be built to offset fishery resource losses.

In the Corps' 1981 Main Report and Environmental Impact Statement, the 154,000 AF San Clemente Dam and Reservoir was determined as the best means of developing additional water supplies and providing flood protection. This proposal was later abandoned by the Corps due to lack of community support, which was necessary to fund the dam. The local community would be responsible for 84% of the cost.

The District reviewed the Corps Draft EIS and reevaluated the sites with the MPWMD project purposes in mind. Its findings are summarized in Section 3.3.

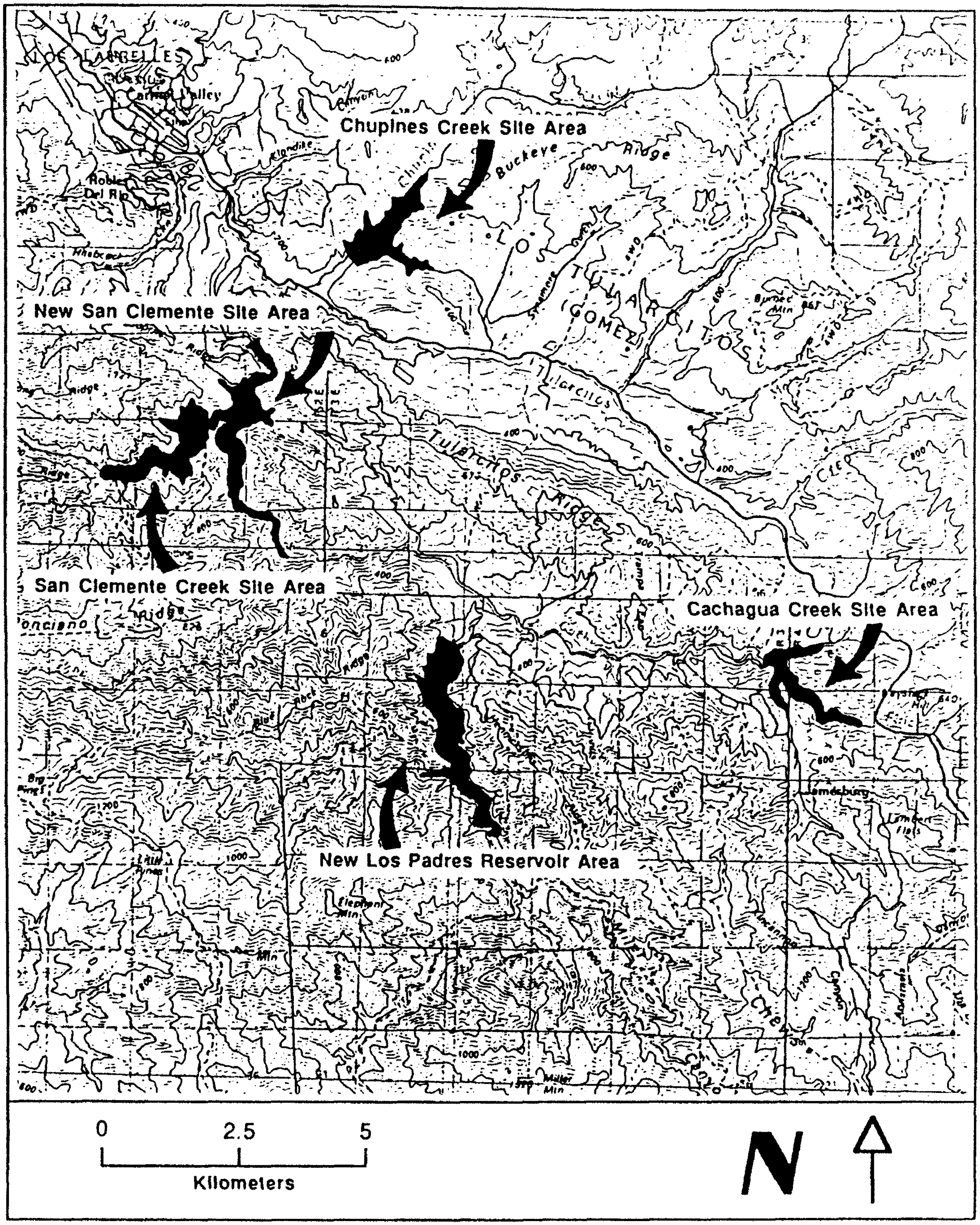
MPWMD New Los Padres Reservoir

The original MPWMD concept was to enlarge the existing Los Padres Dam (or build a new dam downstream) to create a reservoir of up to about 19,000 AF. This concept was evaluated in the Part I and Part II evaluations of alternatives. The 19,000 AF project was later amended to the 24,000 AF New Los Padres Dam and Reservoir, which was selected as the District's proposed project for the Section 404 Permit in March 1989.

The New Los Padres project would be an RCC dam located near river mile 24, about 3,400 feet downstream of the existing dam (Figure 3-3). A 24,000 AF reservoir would require a 261-foot high dam with a crest elevation of 1,120 feet,[5] and would inundate the existing Los Padres Dam. The 24,000 AF reservoir would inundate about 273 acres, including four acres of the existing Ventana Wilderness near the confluence of Danish Creek and the Carmel River. In November 1990, Public Law 101-539 was signed, which would amend the wilderness boundary if this alternative receives a 404 permit. District considered the concept of constructing a dike on Danish Creek to prevent the new reservoir from encroaching onto the Ventana Wilderness, but found it to be infeasible.

Facilities also include a spillway and stilling basin at the toe of the dam to prevent erosion. Trap and truck facilities would be built to pass steelhead spawners migrating upstream; downstream facilities would consist of either a fish attraction device and trapping facility near the face of the

FIGURE 3-3



SOURCE: ACI

dam or a set of screens to trap fish before they enter the reservoir for transport to a release site below the dam. A multiple level intake structure would be built near the upstream face of the dam. Regulating valves would be installed at the outlet works for low flow and normal releases. Access roads to the dam already exist, but additional roads may need to be built for fish screens.

Management of the proposed reservoir would be coordinated with the existing San Clemente Reservoir and the Carmel Valley and Seaside ground-water basins on a conjunctive use basis to maximize municipal and instream benefits. The basic operations goal is to keep the Carmel Valley aquifer as full as possible and maintain the maximum amount of water in the Carmel River for fish and vegetation. A schedule of minimum release targets for steelhead, varying with the type of water year, was developed in conjunction with resource agencies.

Project cost estimates for a 24,000 AF project (in 1989 dollars) are a construction capital cost of $61.2 million with total annual costs of $8.7 million per year. The revised cost estimates and project design are described in Chapter 4 of the EIR/EIS.

3.2.2 CARMEL RIVER TRIBUTARY DAMS

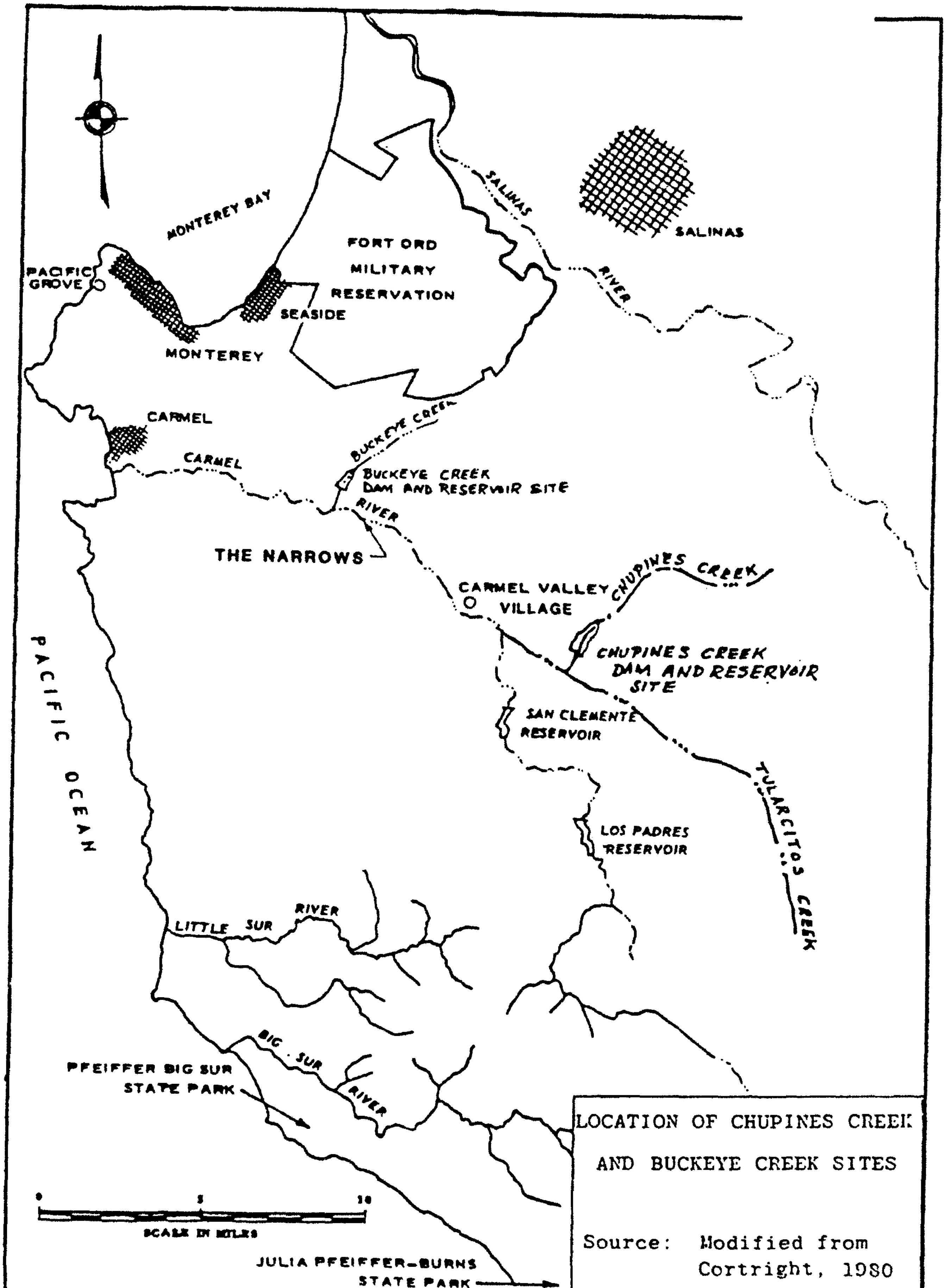
Buckeye Creek Dam

This alternative includes a dam and 2,000 AF reservoir on Buckeye Creek, which joins the Carmel River northwest of Carmel Valley Village about one mile downstream of the Narrows (Figure 3-4). A 2,000 AF Buckeye Creek reservoir would inundate 50 acres of land.[6]

There are two basic concepts for this alternative, both of which use Buckeye Creek Reservoir as a pumped storage impoundment. In one variation, water would be diverted from the existing San Clemente Reservoir utilizing excess capacity of the Cal-Am filter plant. This excess production would be transmitted through Cal- Am's existing Carmel Valley main as far as Buckeye Canyon. A new pipeline and pumping plant would boost water from this point to Buckeye Creek Reservoir, approximately 1.1 miles north of Carmel Valley Road.

In the second variation, water would be either diverted from surface flows at the Narrows or pumped from new wells in the Carmel Valley alluvial aquifer, then boosted to Buckeye Creek

FIGURE 3-4



LOCATION OF CHUPINES CREEK AND BUCKEYE CREEK SITES

Source: Modified from Cortright, 1980

Reservoir. With both variations, water from Buckeye Creek Reservoir would be treated and introduced into Cal-Am's main Carmel Valley pipeline when needed to meet municipal demands. A cost estimate has been made only for the San Clemente Reservoir diversion variation of the Buckeye Creek alternative. This project was evaluated using a January 1988 capital construction cost estimate of $10 million with O&M costs of $410,000 per year. Costs to finance this project would total $1.8 million per year. More detailed information is provided in Appendix C1.

Cachagua Creek Dam

This alternative consists of a dam and reservoir on Cachagua Creek, located approximately ten miles southeast of Carmel Valley Village, between the existing Los Padres and San Clemente Dams (Figure 3-3). A dam in the 5,000 - 7,000 AF range was envisioned to be operated in conjunction with the existing Los Padres and San Clemente Reservoirs. A 1982 design included the dam, spillway, outlet works, intake structure, and road relocations.[2] No provision was made for fish passage facilities. A 7,000 AF Cachagua Creek reservoir would inundate 116 acres of land, including approximately 2.8 miles of stream channel.

A reservoir in Cachagua Creek would be operated in conjunction with the existing Los Padres and San Clemente reservoirs and the Carmel Valley and Seaside groundwater basins. The operation would be similar to that of a new mainstem reservoir, with the exception that an offstream reservoir would have a much smaller storage capacity, and inflow to the reservoir would be much less. Excess winter and spring flows would be stored for later release for instream and municipal uses.

An earthfill embankment dam with a reservoir storage capacity of 7,000 AF was evaluated assuming a January 1988 capital construction cost of $33 million with O&M costs of $530,000 per year. Total annual costs for the project would be $5.0 million per year. A 6,000 AF Cachagua Creek reservoir combined with a 3 MGD desalination plant was selected for analysis in this EIR/EIS. Additional information about this project, including revised cost estimates, are provided in Chapter 4 of the EIR/EIS.

Chupines Creek Dam

This alternative consists of a dam and reservoir on Chupines Creek, a tributary of Tularcitos Creek, which in turn joins with the Carmel River about 1.5 miles southeast of Carmel Valley Village

(Figure 3-3). A reservoir in the 10,000 - 15,000 AF size range was envisioned, as well as a spillway, intake and outlet works, pumping station, surge tank, a pipeline between the existing San Clemente Reservoir and a reservoir on Chupines Creek, and a pipeline connecting this latter pipeline to Cal-Am's existing Carmel Valley filter plant.[7] Fish passage facilities would not be included. A 10,000 AF Chupines Creek reservoir would inundate 174 acres of land, including approximately 2.6 miles of stream channel.

The Chupines Creek Dam would be operated as a pumped storage project in conjunction with the existing San Clemente Reservoir. Excess winter and spring flows of the Carmel River would be diverted at the existing San Clemente Dam and pumped to Chupines Creek Reservoir. Water stored in Chupines Creek Reservoir would be routed via a pipeline to the Carmel Valley filter plant for municipal uses. Flows of Chupines Creek would not be regulated and would be released downstream as outflow from the Chupines Creek Reservoir.

A 10,000 AF earthfill embankment was evaluated assuming a January 1988 capital construction cost of $53 million with O&M costs of $930,000 per year. Costs to finance the project would total $8.1 million per year. A 10,500 AF reservoir was selected for analysis in this EIR/EIS, as described in Chapter 4, along with revised cost estimates.

San Clemente Creek Dam

This alternative consists of a dam and reservoir on San Clemente Creek, a tributary to the Carmel River, that enters the existing San Clemente Reservoir (Figure 3-3). An upper and lower site were evaluated as follows: (1) a dam at the upstream site without pumped storage; (2) a dam at the downstream site without pumped storage; and (3) a dam at the downstream site with pumped storage. Size variations considered at both sites included reservoir storage capacities up to 11,700 AF. For this reservoir capacity, the downstream site would require a dam approximately 300 feet high, with a reservoir surface area of about 115 acres. At the upstream site, an 11,700 AF reservoir would require a dam approximately 275 feet high and would have a 135-acre surface area.

Spillway, outlet works, access roads, and other major features would vary depending on the site and size variation. A pumped storage project would require a large diameter pipeline approximately 3,000 feet long, pumping facilities, a surge tank, and valves and other controls.[2]

A reservoir on San Clemente Creek would be operated in conjunction with the existing Los Padres and San Clemente Reservoirs. The basic operation would be similar to that of a new mainstem reservoir, with the exception that no increase in steelhead attraction flows in January through March would be provided from storage. Releases to maintain a flow of 20 cfs at the Carmel River lagoon would be made in April and May. In the pumped storage variations, excess Carmel River flows would be pumped from the existing San Clemente Reservoir and stored in the new reservoir for later release.

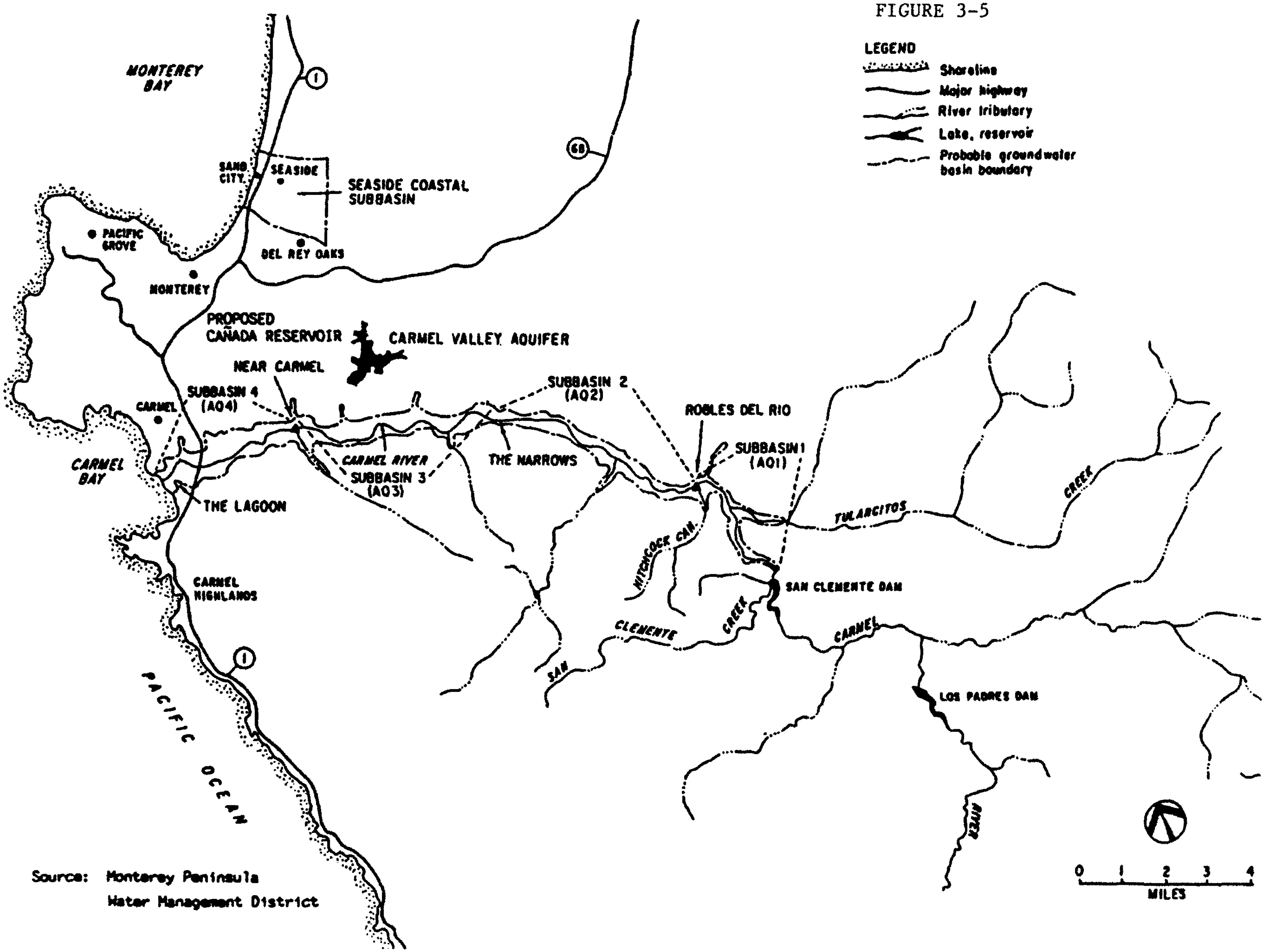
Reservoirs ranging in size from roughly 8,000 - 12,000 AF were evaluated assuming a January 1988 capital construction cost of $40 million to $72 million for a pumped storage project. The O&M costs would range from $530,000 to $930,000 per year. Thus total annual costs would range from $5.9 - $7.8 million per year. An 11,000 AF reservoir at the lower site with pumped storage was selected for analysis in this EIR/EIS. Additional information, including revised cost estimates are provided in Chapter 4 of the EIR/EIS.

Cañada Reservoir

On February 13, 1989 a consortium of private landowners and the California-American Water Company (Cal-Am) made a presentation to the District Board on their intention to separately pursue construction of Cañada Reservoir. This project entails diversion of water from the Carmel River, preferably via an infiltration gallery, during high flow periods and pumping to an offstream reservoir of about 25,000 AF in size. The reservoir would be built in Cañada del la Segunda, a canyon on the north side of the Carmel River, about 5 miles upriver from Carmel Bay (Figure 3-5). The reservoir would be used primarily for base demand, and ground water in lower Carmel Valley would be used as drought reserve. Preliminary cost estimates performed in 1989 indicate that the capital cost of the reservoir, infiltration gallery/pumping facilities and Cañada filter plant would range from $73 - $113 million.[8] Annual O&M costs would be about $1.5 million per year.

The Cañada site was not evaluated by the District in its Part I and Part II alternatives evaluations because an early investigation of potential reservoir sites performed by Logan 1980 dismissed a dam in Cañada de la Segunda.[6] Logan's assessment was based primarily on the poor ratio of dam height to storage volume ratio, assuming a reservoir size range of 3,000 to 5,000 AF. Other

FIGURE 3-5



Carmel River Watershed

technical concerns related to the presence of the Navy earthquake fault and the suitability of native fractured shale with which to build an embankment dam.

A 1989 assessment performed by Grice Engineering[9] shows that the height-to-volume ratio is much better than Logan's earlier assessment when the currently proposed reservoir sizes of 20,000 to 28,000 AF are considered. Preliminary engineering and geologic data provided by Grice Engineering[10] indicate that construction of a dam from native materials appears to be questionable.[11] Thus, additional studies were performed by Brown and Caldwell in late 1989 and early 1990 to confirm the site feasibility, assess potential seepage rates, address identified geotechnical and hydrologic concerns, and develop more accurate cost estimates.[12,13]

The MPWMD assisted Cal-Am to develop a more definitive project description and operations scenario by January 1991, based on simulations from the District's CVSIM computer model. In addition, Cal-Am requested that the District be the lead agency for the EIR/EIS on the Cañada project in 1990. The Cañada Project is analyzed in this EIR/EIS; additional information on the project description and revised cost estimates are provided in Chapter 4 of the EIR/EIS.

3.2.3 SEDIMENT REMOVAL FROM EXISTING RESERVOIRS

This alternative consists of dredging or excavating accumulated sediment in the existing Los Padres and/or San Clemente Reservoirs (Figure 3-5). Based on analyses performed in 1988, storage capacity in Los Padres Reservoir has been reduced from 3,032 AF to 2,179 AF; capacity in San Clemente Reservoir has been reduced from 2,136 AF to 796 AF. Assuming both reservoirs could be returned to full capacity, there would be a 2,193 AF increase in reservoir storage, bringing the total to 5,168 AF.

Dredging or excavation equipment would be required to remove sediment. Depending on the disposal method, facilities to dewater the sediment would be necessary prior to transport and placement. The reservoir would need to be lowered or drained with the excavation method, and resident fish relocated and the river diverted to the dam outlet works. Disposal of the spoils would entail about 270,000 truck trips to a landfill or transport to a nearby canyon, perhaps via conveyor belt. Work could occur only in the summer and early fall to avoid storm flows and water quality impacts.

This project was evaluated assuming a January 1988 construction capital cost of $14 million for Los Padres Reservoir and $15 million for San Clemente Reservoir. O&M costs would be $50,000 and $75,000 for each reservoir, respectively. Total annual costs to finance the project would be $1.9 million per year for Los Padres Reservoir and $2.0 million for San Clemente Reservoir. A long-term maintenance dredging program to keep the reservoirs free of sediment would add approximately $100,000 per year to the total annual cost.

3.2.4 STORAGE AND INFILTRATION BASINS/RECHARGE

Fort Ord Depressions/Reservoir Sites

Several natural depressions and valleys exist in and adjacent to the U.S. Army's Fort Ord Military Reservation (Figure 3-4). The concept is to fill them with water imported via pipeline from Carmel Valley, when available. The proposed facilities consist of either lined depressions with possible small saddle dams (if used as storage basins) or unlined depressions (if used as infiltration basins). In addition, water treatment facilities, monitoring facilities, and a transmission system would be required for lined depressions; and additional recovery wells may be required for use with unlined depressions.

Two operational schemes have been identified: (1) water could be stored in lined depressions for later release to meet demands, or (2) water could infiltrate into unlined depressions for eventual recovery from new or existing wells located downgradient from the depressions.

Cost estimates have been developed only for the scheme that would use unlined depressions as infiltration basins with recovery by existing wells in the Seaside Coastal ground-water subbasin. Based on 1981 a report,[14] the construction capital cost was $1.6 million, with total annual cost of $838,000. Impermeable liners for the depressions would raise these costs by an undetermined but considerable amount.

Seaside Groundwater Recharge - Coastal Barrier

This alternative entails trenches, small diameter wells or large diameter wells that would be installed near the coast. Reclaimed water from a sewage treatment facility or fresh water from the Cal-Am system could be injected to create an artificial barrier to sea-water intrusion. This barrier would allow for additional production from wells in the Seaside Coastal groundwater subbasin (Figure 3-6) while protecting against seawater intrusion. The barrier also could be operated in combination with an inland recharge system with wells to further increase the amount of water available. Water could be allowed to infiltrate into the coastal dunes through open, unlined trenches, or could be injected via small diameter wells or larger diameter wells. Several possible recharge barrier schemes have been studied, and are summarized in Appendix C1.

Based on a 1981 report,[14] capital costs for various barrier recharge schemes ranged from $210,000 for Cal-Am water to $1.7 million for treated wastewater. Annual costs ranged from $134,000 to $332,000 per year.

Seaside Coastal Groundwater Subbasin – Recharge with Wells

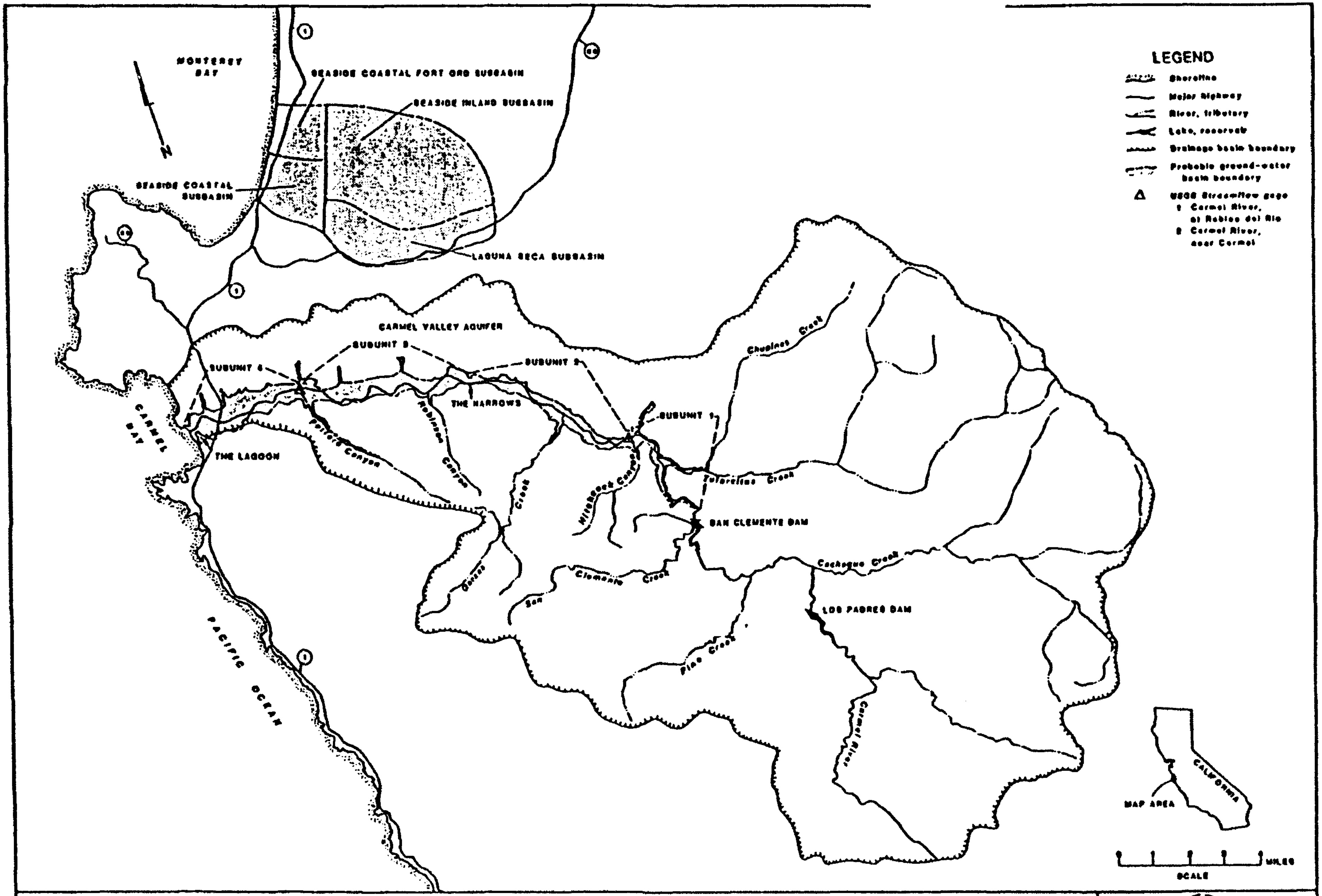
This alternative scheme considers recharge and recovery of water through existing and new wells in the Seaside Coastal Groundwater Subbasin (Figure 3-6). When available, water would be diverted from Carmel Valley via the Cañada de la Segunda pipeline to serve as a local source for recharge. Cal-Am and Seaside Municipal wells could conceivably be used for injection and later recovery of water imported into the coastal subbasin. Also, an additional well or wells could be installed to more effectively recover the injected water. This recharge and recovery system could be combined with a coastal recharge barrier facility to further increase the yield available from the coastal subbasin.

Based on a 1981 report,[14] the capital construction cost estimate in 1988 dollars is $458,000 with annual operations and maintenance costs of $703,000.

3.2.5 GROUND WATER DEVELOPMENT

Seaside Coastal Groundwater Subbasin Well Development

This alternative entails increased municipal well production capacity in the Seaside Coastal ground-water subbasin (Figure 3-6). Cal-Am's existing well network has an estimated operational capacity of about 3,780 gallons per minute (16.7 AF/day). A net 600 gpm increase in production capacity is planned by Cal-Am through replacement of existing wells and installation of an additional well or wells. Assuming an operational efficiency loss of 13 percent, the adjusted



Water Resources System for the Monterey Peninsula Area increase in capacity would be 522 gallons per minute. Production from new and existing wells in coastal Seaside would be managed to offset short-term increased Cal-Am system demands during dry periods while maintaining the long-term yield of the coastal subbasins. The short-term annual production maximum would be less than 5,000 AF/year.

This project was evaluated using a January 1988 capital construction cost of $240,000 (two new wells at $120,000 each) with annual O&M costs of $40,000 ($20,000 per well). Costs to finance this alternative would total $72,000 per year. It should be noted that the District and Cal-Am have been cooperatively developing new wells in the Seaside Coastal area in 1990; a new well that could provide an additional 1000 AF/year is scheduled to be on-line in mid-1991.

Seaside Inland Groundwater Subbasin Well Development

This alternative entails groundwater development from the Seaside Inland subbasin for use within the District (Figure 3-6). Depending on the quantity that is available from this largely unexplored area, the additional production could be used to meet annual and/or drought reserve needs of the District. Because much of the inland subbasin is utilized by the U.S. Army as light artillery firing ranges, the area has limited access for the purpose of water supply exploration and development.

The quantity and type of facilities necessary for this alternative have not been determined. However, a ground-water supply system in the inland subbasin would likely entail a well field, transmission and treatment facilities, as the water locally contains excess total dissolved solids, iron and/or manganese.

This project was evaluated in January 1988 based on cost projections made for a 1985 proposal.[15] These cost estimates include exploration, testing, well construction, water transmission, treatment and other appurtenant facilities. The construction capital cost would be $5.7 million with annual O&M costs of $614,000. Costs to finance the project would total $1.4 million per year.

Upper Carmel Valley Well Development

This alternative involves the construction of new Cal-Am water supply wells in the upper Carmel Valley aquifer, which extends from below the existing San Clemente Dam downstream to the Scarlett Road Narrows (Figure 3-5). One or two new wells with a total anticipated production capacity of 1,200 gpm have been proposed by Cal-Am for the Boronda area. The new wells would increase production capabilities in an area where wells do not exist and would increase the efficiency of service to users in this area of the Carmel Valley. These wells would be operated similar to other Cal-Am wells in upper Carmel Valley in that they would only be pumped during winter months when significant flow exists in the river or during dry periods when system demands cannot be met by other sources.

This project was evaluated in January 1988 assuming a capital construction cost of $240,000 (construction of one well, materials, land acquisition, transmission system) with annual operation and maintenance cost of $10,000. Costs to finance the project would total $42,000 per year.

Lower Carmel Valley Well Development

This alternative involves ground-water development in the lower Carmel Valley aquifer, that area of the aquifer from the Narrows to Carmel Bay (Figure 3-5). New wells could be installed in areas where Cal-Am wells currently do not exist, or existing wells could be relocated to more optimal locations, thereby increasing the overall production capacity of the Cal-Am water supply system. Water in lower Carmel Valley must be treated at the Begonia Treatment Plant to remove excess iron and manganese.

Additional groundwater development in lower Carmel Valley has been discussed but not formally proposed. The most likely area would be in Aquifer Subunit 4 downstream of the Cal-Am Rancho Cañada well, where an additional well or wells could be drilled. Additional or expanded treatment facilities may be required. No new wells are proposed for Aquifer Subunit 3.

Assuming for discussion purposes only an additional well capacity of 2,400 gallons per minute (two wells at 1,200 gallons per minute each), continuous production over a six month period would translate to approximately 2,000 acre feet. Operating conditions for any new wells in Aquifer Subunit 4 have not been determined.

Costs for new wells in lower Carmel Valley are assumed to be similar to those in upper Carmel Valley, except that costs would be somewhat higher due to water quality monitoring and to the additional treatment requirements. A January 1988 evaluation assumed a construction capital cost of $480,000 with an annual O&M of $20,000. Costs to finance the project would total $84,000 per year.

3.2.6 IMPORTATION OF WATER

Importation from Arroyo Seco River

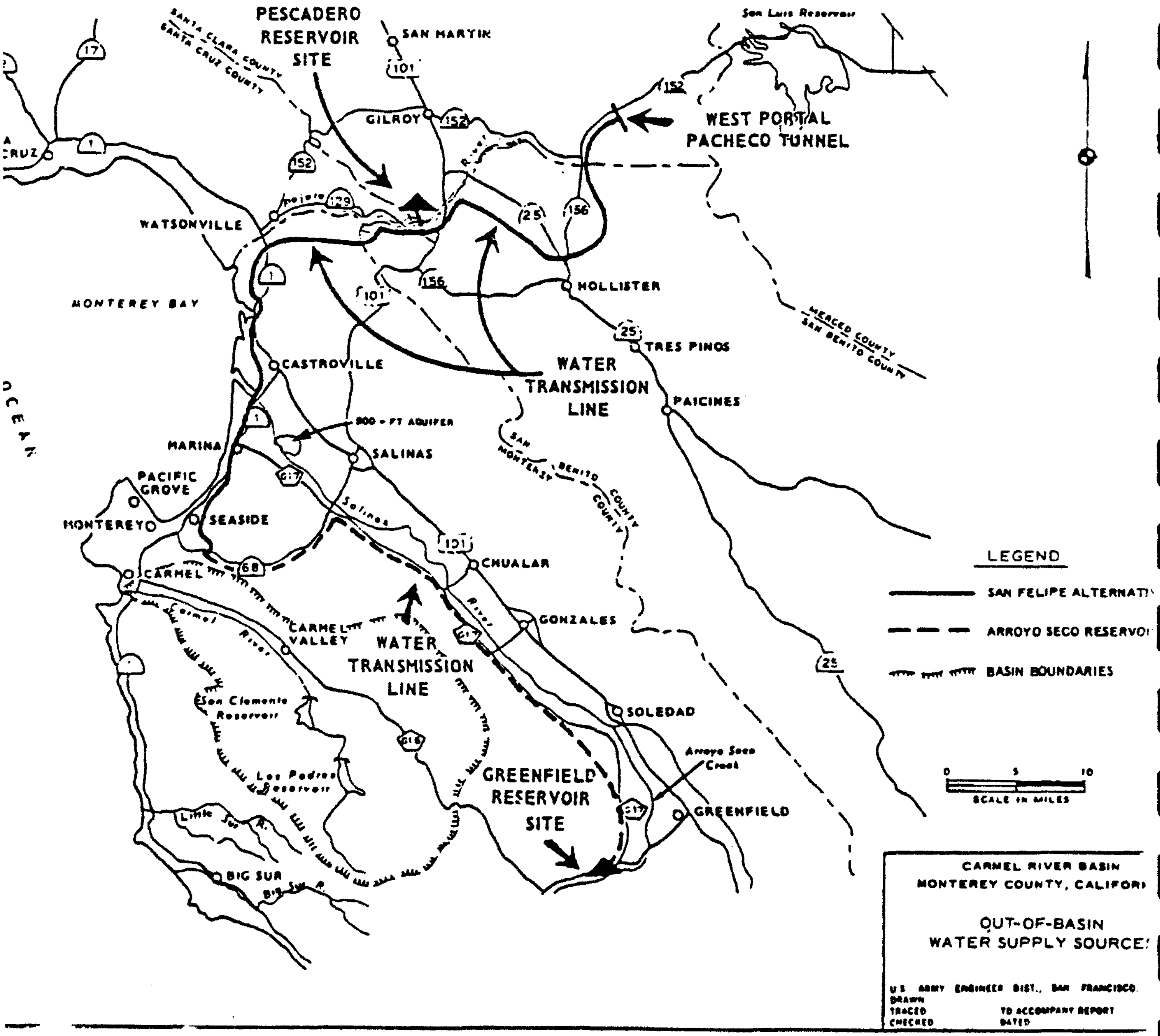
In 1981 and 1982, Monterey County Flood Control and Water Conservation District studied a multiple-use dam and 100,000 AF reservoir for water supply, flood control, hydroelectric power and recreation at one of two sites on the Arroyo Seco River, a tributary to the Salinas River, in southern Monterey County.[16] The two sites included the Pools site, located in the Los Padres National Forest, and the Greenfield site, located at the mouth of the canyon just above the Greenfield bridge (Figure 3-7). The primary beneficiaries would have been farmers in the Salinas Valley, but a 56-mile lined canal was envisioned to provide water for Fort Ord, Marina, parts of North County, Toro and the Seaside areas.

Project costs for the Pools site dam and conveyance facilities to Salinas would be $66.1 million (January 1988 dollars). An additional $13.4 million would be required for water delivery in the Fort Ord-Monterey Peninsula area. County consultants estimated that annual costs for the Fort Ord-Monterey Peninsula area would be about $2.8 million per year. In 1983, the Monterey County Board of Supervisors voted not to proceed with the project. This concept was included in a County-wide capital facilities feasibility study,[17] but was not selected as a likely option.

Importation from Lower Salinas Basin

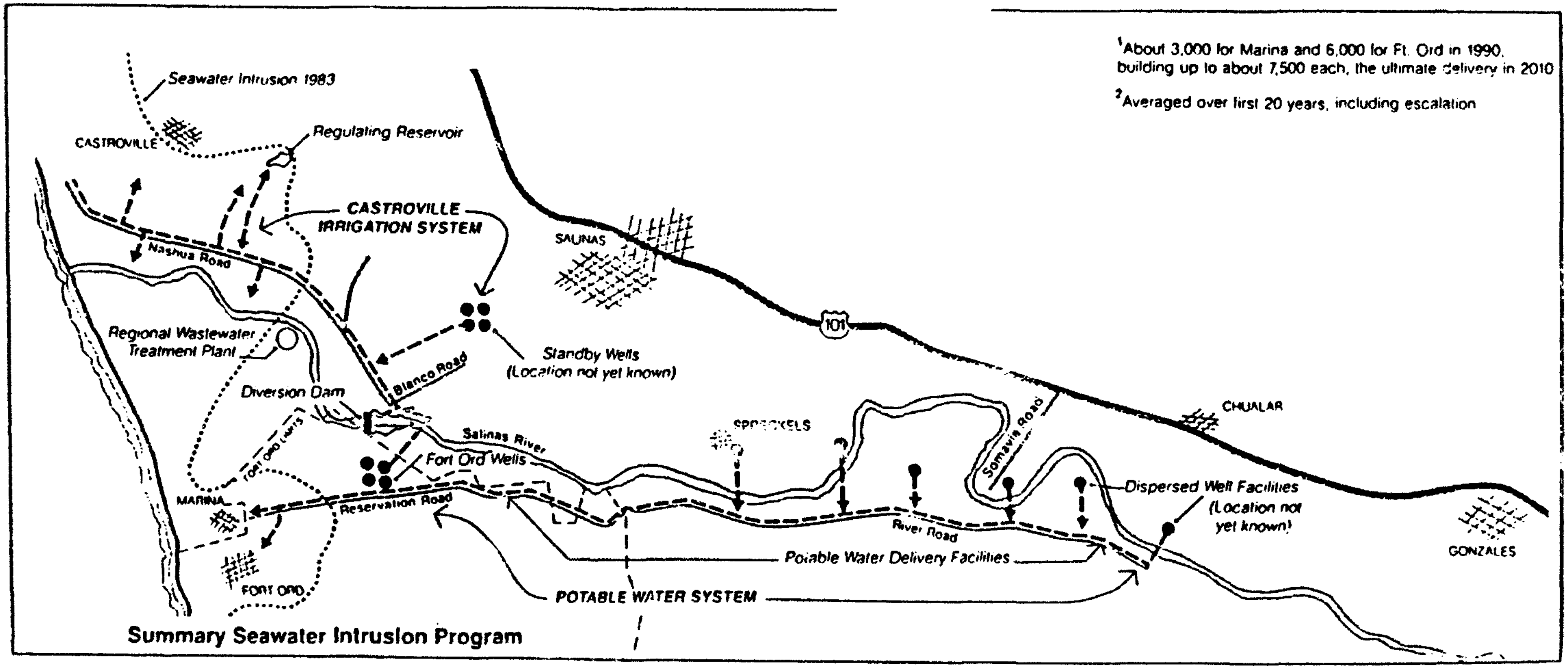
Monterey County developed this proposal as an alternative to the Arroyo Seco project. Water for agricultural use would be released from the existing San Antonio and Nacimiento reservoirs down the Salinas River to a diversion dam near Salinas. The dam would create a small pool of water of sufficient depth to allow operation of pumps to lift water for transmission to one or more small regulating reservoirs. The reservoirs would store water for peak, short-term irrigation needs of about 10,000 acres of land. In addition, a series of dispersed wells would be drilled near Salinas and water would be conveyed to Fort Ord and Marina via pipeline for municipal supply (Figure 3-8).[18]

FIGURE 3-7



Source: Corps of Engineers, May 1981

FIGURE 3-8



SCHEMATIC OF

SALINAS SEAWATER INTRUSION PROGRAM FACILITIES

Source: Seawater Intrusion Committee, January 1937, The Salinas Valley Seawater Intrusion Program

The Lower Salinas project was not designed to yield water to the Monterey Peninsula. Eligibility for water is contingent on having riparian rights along the Salinas River and on being located within the zone that funded Nacimiento and San Antonio dams. Neither of these criteria are met by MPWMD. The County is presently preparing an EIR/EIS in cooperation with the Bureau of Reclamation for this project as a solution to salt water intrusion problems experienced by Fort Ord, Marina and North County agriculture.

Importation from San Felipe Project

The San Felipe Project refers to a joint venture of the U.S. Bureau of Reclamation and the State of California. Sacramento-San Joaquin Valley water that is pumped from the Delta to San Luis Reservoir in Merced County during high flow periods is then conveyed to Santa Clara and San Benito Counties via the Pacheco tunnel and other facilities. The project service area also includes the Pajaro River Valley, which straddles the boundary between Monterey and Santa Cruz Counties (Figure 3-7). The San Felipe Division, a tunnel through the Diablo Range, has a design capacity of 216,000 AF per year. Santa Clara and San Benito Counties have contracted for 152,500 AF/year and 43,800 AF/year, respectively. The remaining 19,700 AF/year was allocated to the Pajaro Valley area, which is now served by the Pajaro Valley Water Management Agency. Monterey and Santa Cruz Counties previously shared the responsibility for the Pajaro Valley area.[19]

The MPWMD explored the possibility of purchasing and importing water from the Pajaro Valley area, if water were available. A 30-40 mile pipeline would be built from Watsonville to the Monterey Peninsula at an estimated cost of $64 million. A reservoir to store off-peak supply would also need to be built as no yield would be available during peak demand periods. A 5,000 to 10,000 AF reservoir would cost an additional $30 million. Total annual costs, including the cost of purchasing water, would easily exceed $10 million per year. As described in Section 3.3, the feasibility of this project is unlikely due to the lack of available water and excessive cost.

Importation from Big or Little Sur Rivers

The Big and Little Sur Rivers are coastal streams with drainage areas of 47 and 38 square miles, respectively, which are located south of, and adjacent to,the Carmel River Basin (Figure 3-7). No detailed studies have been made for these two watersheds as possible sources for water importation to the Carmel River basin and its water service area. Although no designs or cost estimates were prepared, it is believed that obtaining water from either of these two basins would be very expensive in comparison with other importation solutions. Because of the high mountain ridge over, or through, which water from the Big or Little Sur rivers would need to be transmitted into the water service area, the cost of conveyance facilities can be expected to be high. Both rivers have been designated under the California Protected Waterways Program and are considered for protection under the Wild and Scenic Rivers Act. It is unlikely that permission would be granted to import water from either of these streams.[20]

3.2.7 DESALINATION

Desalination is the separation of water from dissolved impurities whereby nearly pure water is recovered from influent such as wastewater, brackish water or seawater. Large desalination plants occur mainly in water starved areas such as the Middle East, and smaller systems are used in areas in the U.S. where local needs exceed economically available fresh water supplies. Desalination is presently being investigated by the Metropolitan Water District of Southern California, Marin County, the City of Santa Barbara and other communities to augment existing supplies.

The District concept will likely entail reverse osmosis (RO) to force pure water molecules through a semi-permeable membrane under high pressure. Most of the dissolved impurities remain behind and are discharged as brine. No specific desalination project proposal was assessed in the alternatives evaluation process. It was assumed that a 3-7 MGD desalination plant could be constructed at an abandoned Monterey wastewater treatment plant with beach wells. Hydrogeological studies performed in 1990 indicated that this site was poor for beach wells.[21] In 1991, the District, PG&E and the Marine County Water District conducted a feasibility study of seven desalination sites. Two sites -- one at the PG&E Moss Landing Power Station, and one at the MRWPCA Regional Wastewater Treatment Plant -- were selected for further analysis in a separate EIR.

Capital costs for a 3 MGD plant are in the $34-41 million range.[22] Costs for desalination are highly sensitive to energy costs and project operations. The maximum annual O&M cost could exceed $2.5 million, resulting in a total annual cost of over $7.1 million for a seawater desalting plant operated continuously. The total cost per acre-foot would be in the $2,400-3,300/AF range for the facility. A 7 MGD desalination plant was selected for analysis in this EIR/EIS. In addition, a 3 MGD plant is combined with three reservoir alternatives. More information, including detailed cost estimates, may be found in Chapter 4 of the EIR/EIS.

3.2.8 RECLAMATION

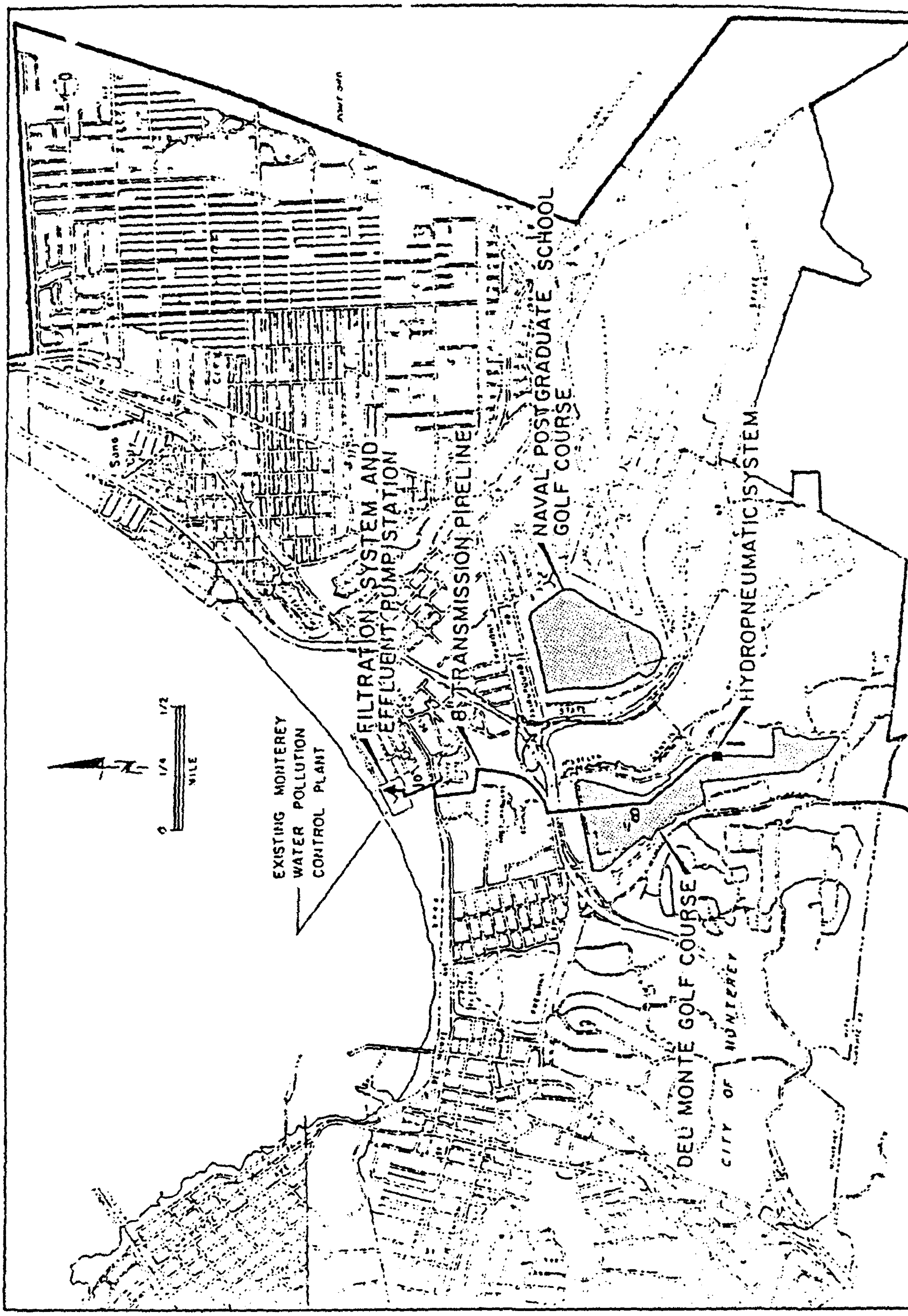
Reclamation for Ground-water Recharge

This concept entails reclamation for injection into the Seaside Coastal ground-water subbasin to form a barrier to seawater intrusion or to recharge the aquifer (Figure 3-6). Potential facilities include the existing Monterey and Fort Ord treatment plants, which are scheduled for demolition when a new regional system is completed. The project concepts are modeled after the Orange County Water District's Water Factory 21 Advanced Water Treatment Plant and San Diego's use of aquaculture for wastewater reclamation. A reclamation volume of 3 MGD was assumed.

The MPWMD conducted several studies to determine the feasibility and cost effectiveness of both conventional advanced treatment and use of aquaculture.[23] The studies indicated that reclamation could be technically feasible, although the cost of the water produced would be relatively high when compared to other sources. As noted in Section 3.2.4.1 (Seaside Ground-water Recharge -- Coastal Barrier), the technical feasibility of ground-water injection is questionable.

Use of Monterey Treatment Facility

The Monterey Regional Water Pollution Control Agency plans to abandon the existing 6 MGD Monterey wastewater treatment plant (Figure 3-9) when its new regional plant becomes operational. The project concept is to convert the Monterey plant into a 1 mgd reclamation facility to produce 415 AF in a dry year. The water would be used to irrigate the Del Monte Golf Course (170 AF/yr) and the Naval Post Graduate School grounds and golf course (245 AF/yr). Force mains would be constructed to Del Monte Lake and would continue to the Del Monte Golf Course. The Navy would use its existing pumping and distribution system located at Del Monte Lake to deliver water into its irrigation system. A 10,000 gallon hydropneumatic tank will be required at the golf course to handle surges in flow.[24] Participation by the Navy, which is critical to the project's success, is not confirmed. In addition, the treatment plant site is presently the proposed site for a desalination project.



SCHEMATIC OF MONTEREY TREATMENT PLANT RECLAMATION PROJECT

Source: Dryden, April 1988

This alternative was evaluated assuming an April 1988 capital cost totaling $1.9 million with annual O&M costs of $325,000. Total annual costs to finance the project would be $579,300.

Irrigation of Turf in Del Monte Forest

Since 1985, MPWMD has coordinated a joint public agency and private sector reclamation project to irrigate nine golf courses in the Del Monte Forest and other turf areas. The basic features of the proposed project include 1.3 MGD tertiary treatment facilities at the Carmel Sanitary District plant, a 22,000-foot force main through the City of Carmel to the Poppy Hills Golf Course, a small regulating reservoir, a distribution system to the nine golf courses, and revising the existing golf course irrigation systems to provide a dual system as per public health requirements (Figure 3-10).[25] A market of about 800 AF per year requirements for golf course irrigation exists; this amount of potable water would be "freed up" due to the reclamation project.

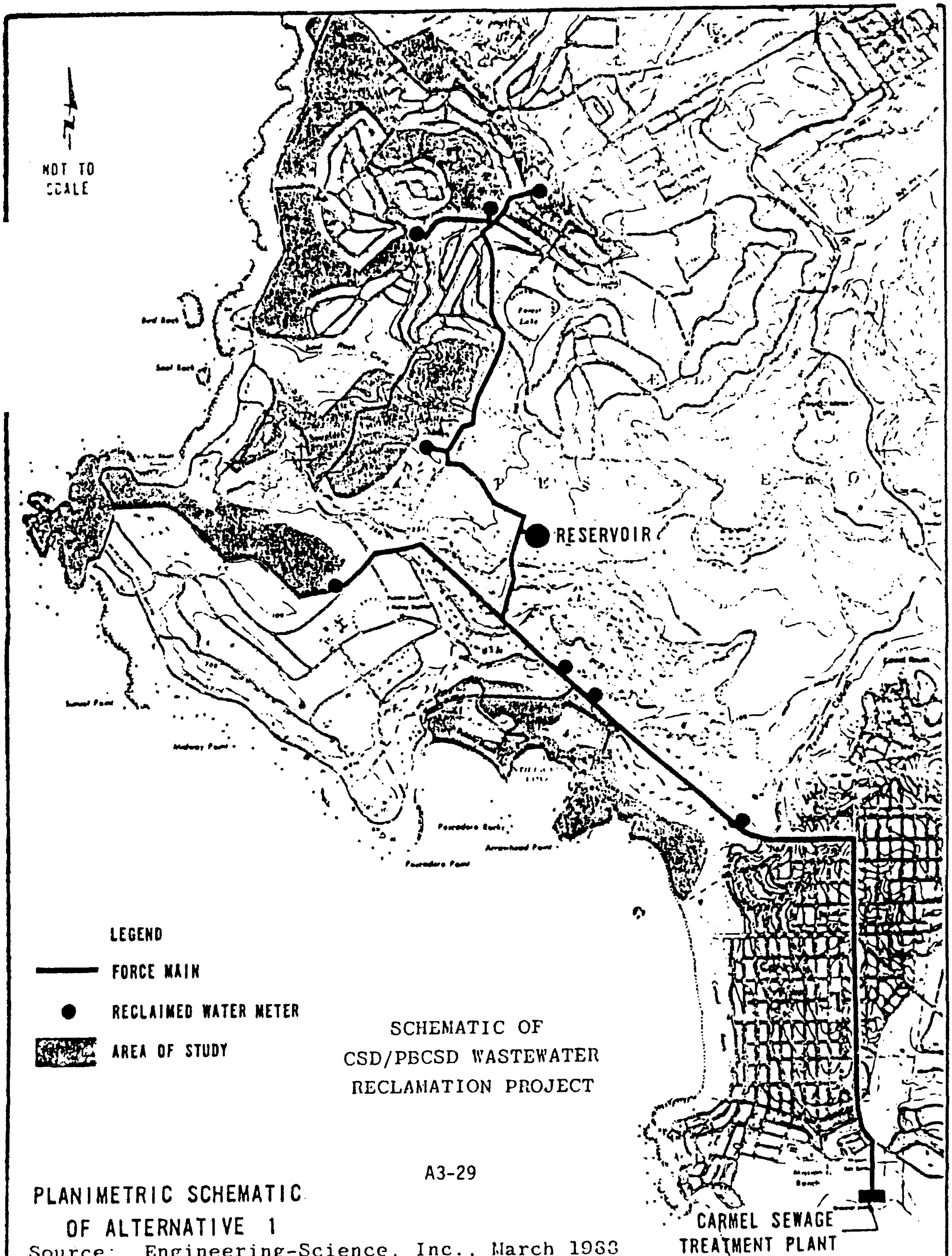
A preliminary cost estimate for the 1.3 mgd facility totaled $11.3 million (1984 dollars) for capital costs and $185,000 for O&M. Total annual costs (1988 dollars) would be $1.8 million. An unusual feature of this project is that a private sponsor is willing to fund the project. Formal agreements were signed in Fall 1989 and the project should be completed by late 1992. The MPWMD has included this alternative in the "No Project" description for this EIR/EIS, as part of ongoing conservation efforts.

3.2.9 CONSERVATION

Residential and Institutional Cisterns

Cisterns entail collection of rainwater from roofs, then transmission via gutters to various sized tanks. The stored water is then used for garden, turf or landscape irrigation. The feasibility and cost effectiveness of residential and institutional cisterns on the Monterey Peninsula was studied, using homes and a middle school in Pacific Grove as models.[26] The performance and cost per gallon of numerous combinations of roof size, tank volume and garden area was modeled based on historic rainfall near Pacific Grove.

The construction cost of a residential tank was estimated at $.50 per gallon; a typical residential gutter system was estimated to cost $500. The cost of water for the median combination of roof



PLANIMETRIC SCHEMATIC
OF ALTERNATIVE 1

Source: Engineering-Science, Inc., March 1983 size and tank size was $66/1,000 gallons, or $22,000/AF. For the institutional cisterns, the most efficient use of a 50,000 gallon tank cost $32 per 1,000 gallons, or $10,000/AF. For the 300,000 gallon tank, the most efficient use cost $51 per 1,000 gallons, or $17,000/AF.

Comprehensive Conservation Program with Mandatory Retrofit Ordinance

The MPWMD has adopted a water conservation goal of a 9% reduction in projected use by the year 1990 and a 15% reduction in projected use by the year 2020. A comprehensive water conservation plan has been adopted and a rigorous ordinance was enacted in August 1987. The requirements of the ordinance include installation of ultra-low flow toilets and water saving showerheads and faucet aerators in all new construction, mandatory replacement of toilets with ultra-low flow models at the time of sale of any home or business, and installation of water saving kits for all commercial establishments. In addition, the District distributed free toilet dams, low-flow showerheads and faucet aerators to every residence within the MPWMD boundaries. Other elements of the conservation plan include a turf management program and seminars, seminars on leak detection for water purveyors and numerous public awareness and educational programs. This alternative is included in the "No Project" description in this EIR/EIS.

According to the 1987 AMBAG Systems Capacity Analysis[27] a water conservation program meeting the 9% goal by 1990 would save about 1,700 AF per year at a total cost of $513,000 to the District. Ongoing administrative costs are about $25,000 annually. The free kit program should reduce yearly consumption by about 1,000 AF at an annual cost of about $100/AF. The water conservation ordinance should reduce consumption by about 725 AF per year at an annual cost of about $33/AF. Costs do not include consumer costs for new fixtures or energy and water cost savings.

3.3 PART I EVALUATION OF ALTERNATIVES

3.3.1 PURPOSE

Section 404 of the federal Clean Water Act requires that all practicable alternatives that could achieve the project purposes be investigated. "Practicable" is defined as "available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes."[28] The federal intent is for the project proponent to "consider those alternatives that are reasonable in terms of the overall scope/cost of the proposed project"[29] California state law also requires that potential environmental effects be assessed for reasonable alternatives to the proposed project, even if, to some degree, they do not achieve the project goals or may be more costly than desired.[30]

The Part I evaluation was conducted in 1988 and completed in September of that year. Subsequent research in 1989 clarified the status of questionable alternatives. The Part I evaluation considered all of the water supply alternatives described in Section 3.2 and summarized in Table 3-1. The purpose of the Part I analysis was to determine feasible alternatives on a primarily qualitative basis, based on preliminary information, and identify those with serious cost, technological, logistical, availability or environmental constraints.

Five criteria were used to assess alternatives in the Part I evaluation:

- Total annual cost limit of $8.64 million (includes capital cost, interest and other bond charges, and annual O&M). This limit reflected the Board's desire to impose no more than a 30 percent increase to the average Cal-Am residential water bill in 1988.
- Reliable technology
- Logistical constraints
- Availability
- Environmental effects

3.3.2 ALTERNATIVES THAT SATISFIED PART I CRITERIA

Fourteen alternatives were identified as satisfying or conditionally satisfying the Part I criteria. They include two mainstem dams, three tributary dams, dredging existing reservoirs, ground water development in Carmel Valley and Seaside, desalination, mandatory conservation and reclamation. The 28,000 AF Cañada Reservoir was not proposed until after the Part I evaluation had been completed, and thus was not analyzed.

3.3.3 ALTERNATIVES THAT DID NOT SATISFY PART I CRITERIA

The following alternatives did not satisfy the Part I evaluation criteria and are not considered as feasible alternatives. These alternatives will not be addressed in subsequent chapters of this EIR/EIS. The reasons for this determination are briefly summarized for each alternative below.

TABLE 3-1

RATINGS FOR ALTERNATIVES CONSIDERED IN PART I SCREENING

Alternative	Pass	Cond. Pass [1]	Fail
I. Carmel River Mainstem Dams			
A. New San Clemente – RCC	X		
B. New San Clemente – Rockfill			X
C. New San Clemente – Joint Use			X
D. U.S. Army Corps of Engineers Proposals			
1. San Clemente Site			X
2. Cachagua Site			X
3. Pine Creek Site			X
4. Klondike Site			X
5. Los Padres			X
E. Enlarged Los Padres	X		
II. Carmel River Tributary Dams			
A. San Clemente Creek Variations	X		
B. Cachagua Creek Variations		X	
C. Chupines Creek Variations		X	
D. Buckeye Creek Variations			X
III. Sediment Removal			
A. Los Padres Reservoir	X		
B. San Clemente Reservoir	X		
IV. Storage and Infiltration Basins/Recharge			
A. Fort Ord Depressions			X
B. Seaside Groundwater Recharge – Coastal Barrier			X
C. Seaside Coastal Groundwater Subbasin – Recharge with Wells			X
V. Groundwater Development			
A. Seaside Coastal Groundwater Subbasin Well Development	X		
B. Seaside Inland Groundwater Subbasin Well Development			X
C. Upper Carmel Valley Well Development	X		
D. Lower Carmel Valley Well Development	X		
VI. Importation of Water from Distant Sources			
A. Arroyo Seco River			X
B. Lower Salinas Basin			X
C. San Felipe Project			X
D. Big and Little Sur Rivers			X
VII. Desalination		X	

Alternative	Pass	Cond. Pass [1]	Fail
VIII. Reclamation			
A. Used for Groundwater Recharge			X
B. Use of Monterey Treatment Facility		X	
C. Irrigation of Del Monte Forest Golf Courses	X		
IX. Conservation			
A. Residential and Institutional Cisterns			X
b. Comprehensive Program including Mandatory Retrofit	X		

[1] Conditionally Passes – Additional information may result in subsequent determination that this alternative fails to satisfy Part I screening criteria.

New San Clemente Dam (Rockfill): This dam was considered as a "fall-back" alternative if geotechnical studies performed by Bechtel in 1989 showed that an RCC dam would not be appropriate at the District's New San Clemente site. The rockfill option will not be pursued because the Bechtel studies were positive for the RCC dam. In addition, the rockfill method would be more costly and time-consuming than the RCC method, with no additional water supply or environmental benefits.

New San Clemente Dam – Joint Use (45,000 AF): This concept was rejected by the City of Marina and Fort Ord due to expensive pipeline and transmission costs. Those two agencies are independently pursuing water supply sources in the Lower Salinas Basin. Without joint funding, this alternative is not feasible.

Army Corps Dam at San Clemente Site (154,000 AF): The Corps concluded that this alternative was the best means to solve flood control and water supply problems for the area. This multiple-purpose project was abandoned by the Corps due to lack of community support, which was necessary to fund 84% of the cost. The District concluded that this project was not feasible for several reasons: (1) it is highly unlikely that the community would fund a $238 million (1979 dollars) project, (2) the significant environmental effects of inundating 1,160 acres, including 100 acres of riparian vegetation, could not be mitigated, and (3) a dam this size is not needed because flood control is not a District project purpose.

Army Corps Dam at Cachagua (Upper Syndicate) Site: In 1981, the Corps concluded that this alternative did not warrant a more detailed evaluation and it was rejected in favor of the New San Clemente site. On August 10, 1988 federal and state resource agency biologists and District consultants performed a Habitat Assessment of the riparian corridor within the inundation area. Due to the extremely high quality of the riparian habitat and the abundance of prime fish spawning and nursery habitat, the District and agency staff agreed that the District should not pursue the Upper Syndicate alternative. It also should be noted that topographic and physical features of the site are also less favorable for construction than other mainstem sites. For the above reasons, the Upper Syndicate alternative will not be considered further.

Army Corps Dam at Pine Creek (Lower Syndicate) Site: In 1981, this alternative was rejected by the Corps in favor of the New San Clemente site due to inundation of homes and roads in the

Cachagua area, and substantially higher costs per acre-foot than for a project at the New San Clemente site. On August 10, 1988 federal and state resource agency biologists and District consultants performed a Habitat Assessment of the riparian corridor within the inundation area. Due to the extremely high quality of the riparian habitat and the abundance of prime fish spawning and nursery habitat, the District and agency staff agreed that the District should not pursue the Lower Syndicate alternative. Thus the Lower Syndicate alternative will not be considered further.

Army Corps Dam at Klondike Site: This site was initially considered one of the more favorable sites until two active geologic faults were discovered traversing the valley at this location. Dam height would be limited and designs necessary to construct and maintain a safe structure would result in high costs. In 1981, the Corps concluded that this alternative did not warrant a more detailed evaluation and it was rejected in favor of the New San Clemente site. The District agrees with the Corps conclusion for reasons noted above. In addition, inundation and the need to relocate about one mile of Carmel Valley Road, Tularcitos Guard Station, facilities at the Carmel Valley filter plant, and the Sleepy Hollow subdivision would be prohibitively expensive. Erosion concerns due to the blockage of Tularcitos Creek as well as more pronounced construction impacts to Carmel Valley Village are other reasons not to pursue a dam at this site.

Army Corps Dam at Los Padres Site: In order to avoid inundating any lands in the Ventana Wilderness, the Corps concluded that storage at Los Padres Reservoir could be increased by only 4,000 AF and was not reasonable to pursue. The District agrees with the Corp's conclusion because a 4,000 AF increase in storage is not sufficient to meet the future water supply needs of the Monterey Peninsula. It should be noted that the District's concept for a 24,000 AF New Los Padres Dam is considered as a feasible alternative, even though four acres of the Ventana Wilderness would be inundated.

Buckeye Creek Dam: This alternative was eliminated from consideration due to serious technical problems. The Berwick Canyon fault crosses Buckeye Creek near the toe of the Buckeye dam site. Field investigation indicates that the left abutment is formed entirely of landslide material, forming a lobe-shaped ridge about 80 to 120 feet in thickness. Geologic conditions of unsuitable foundation material and seismic hazard preclude construction of a dam at the Buckeye Creek site. There are water quality concerns as well due to high values of total dissolved solids, cadmium and other metals in the Monterey Shale.[31]

Fort Ord Depressions and Associated Reservoir Sites: This alternative was not considered feasible due to availability, water quality and quantity, and cost considerations. Use of the depressions would require the cooperation of Fort Ord for access easements and water rights agreements. This is unlikely because much of the potential basin storage areas are within firing range impact areas, and use of the depressions as water supply facilities could severely disrupt present military operations. Also, there is uncertainty regarding water quality impacts from spent ammunition that exists throughout the firing range impact areas.

The technical complications and cost would be considerable to line all the depressions with impermeable material; the total area to be lined would approach one square mile. The probability of recovering infiltrated water from unlined depressions with wells in the Seaside Coastal area is uncertain given that the directions of leakage have not been determined. The installation of new wells closer to the depressions would be limited by their locations with respect to the Fort Ord firing range impact areas.

Seaside Groundwater Recharge – Coastal Barrier: This alternative is not considered feasible due to several technical reasons. Recharge trials conducted for the District in late 1981 indicated that a barrier recharge scheme would not be successful in the coastal dunes of the Seaside area due to the high transmissivity of the local materials.[32] Even if the recharge trials had shown that a barrier could be maintained here, it remains uncertain whether such a near-surface coastal barrier would successfully protect the aquifer against sea-water intrusion due to the variability of local hydrogeologic conditions.

The necessary recharge water from Carmel Valley may not be available during times when it is needed most (dry periods) or may not be suitable to transmit through the existing Cañada de la Segunda pipeline during wet periods due to excessive turbidity. Regulatory constraints would preclude the possibility of using treated wastewater for recharge. Responsible agencies have not been willing to allow the injection of treated wastewater into a subsurface fresh water source in the Monterey Peninsula area.

Seaside Coastal Groundwater Subbasin – Well Recharge: Technical constraints preclude this alternative from being considered further. The technical feasibility of recharging the coastal subbasin was tested in 1982 at Cal-Am's Plumas well facility in Seaside.[33] The first set of trials concluded that gravity injection was not capable of achieving the required injection rates. The second set of trials utilized a specially constructed pressurized recharge well. These tests also failed to achieve the recharge rates desired for a successful operational recharge scheme.[34] The availability of water from Carmel Valley for recharging the coastal subbasins would be limited by the capacity of the existing Cañada de la Segunda pipeline (unless an additional pipeline was constructed), the turbidity of the water, and any environmental restrictions placed on the export of this water.

Seaside Inland Groundwater Subbasin – Well Development: The District determined that additional wells in the Seaside Inland Subbasin should not be retained for additional analysis due to questionable supply, lack of available well fields due to firing ranges and preemptive Federal water rights. An exploratory drilling and monitor well installation program at three sites in 1986 concluded that ground-water production potential is considered poor.[35] This finding raises questions regarding the ability of other areas within the inland subbasin to meet water supply needs on the Monterey Peninsula.

Light artillery firing ranges exist over much of the inland subbasin, thereby restricting locations for ground-water supply exploration and development. Several Fort Ord wells have been taken out of production due to salt water intrusion and the Army is actively pursuing new sources of supply. Two 1986 reports commissioned by the Army recommended that additional well development in the Seaside ground-water basin be retained for further consideration.[36,37]

Even if ground-water development looked more promising in the subbasin, the District would not be able to preempt the federal reserve water rights of the U.S. Army. If a substantial water supply was found in the inland subbasin, it would be in the interest of Fort Ord to develop this supply for its own use rather than to allow the MPWMD to withdraw it. The U.S. Army would always hold the superior right to extract this water and could force outside entities to stop pumping completely or to curtail their pumping if the Fort Ord reservation operations were threatened.[38]

Lower Carmel Valley Well Development: The District's Water Allocation Program Final EIR[39] determined that the density and capacity of existing wells in aquifer subunit 3 has significant environmental effects. Thus development of additional production capacity from this area should not be considered further.

Few wells occur in aquifer subunit 4. Thus the concept of new wells in aquifer subunit 4 conditionally passed the Part I alternatives evaluation, pending additional study. Further research assessed the capability of increasing the production capacity without inducing sea water intrusion, impacting the riparian corridor or degrading the Carmel River lagoon.[40] The study results indicated that limited pumping could occur without inducing seawater intrusion, but there was a high likelihood of degrading the lagoon and riparian corridor. Based on this information, the Board voted in 1989 not to pursue new wells in lower Carmel Valley. More information is provided in Appendix C3.

A series of injection wells using reclaimed water from a nearby treatment plant has been suggested as a means of precluding sea water intrusion while allowing for additional ground-water development. However, the use of reclaimed wastewater for injection does not appear likely to be permitted by the responsible health authorities at this time.

Importation From Distant Sources: The State of California Statutes of 1977 that created the MPWMD include restrictions on development of water resources outside the District. The Statutes mandate, "To the extent feasible, the District policy shall require development of water resources within the district boundaries before utilizing water originating outside its boundaries."[41] The MPWMD Board would have to make findings and determine that all other alternatives within the District are infeasible before pursing options outside the District. As described in other sections of this document, feasible options within the District do exist. Additional jurisdictional, logistical or cost constraints preclude the following importation alternatives from being considered as feasible.

Arroyo Seco River: In 1983, the Monterey County Board of Supervisors voted not to proceed with the Arroyo Seco project. Though it may have been economically feasible for the MPWMD to participate in this jointly funded project in the past, this option is not feasible as a sole venture due to project costs and inter-basin transfer concerns. In addition, 8-10 miles of fish habitat would be inundated and up to 23 miles of steelhead spawning and rearing habitat would be blocked.

Lower Salinas Basin: The Lower Salinas project was not designed to yield water to the Monterey Peninsula. Eligibility for water is contingent on having riparian rights along the Salinas River and on being located within the zone that funded Nacimiento and San Antonio Dams. Neither of these criteria are met by the MPWMD. Monterey County is considering this project as a solution to salt water intrusion problems experienced by Fort Ord, Marina and North County agriculture.[18]

San Felipe Project: The Corps considered this alternative in 1977 and 1981 and concluded that supply of water from the San Felipe project is uncertain, and that "importation cannot be considered as a practical, or viable, solution."[4] The District agrees with the Corps conclusion for the following reasons:

(1) The Pajaro Valley Water Management Agency has contractual rights to the remaining 19,700 AF of San Felipe Project water and has submitted a resolution of intent to the Bureau of Reclamation to contract for its AF share. San Benito County and Santa Clara Valley water agencies have indicated that they would exercise their first rights to any remaining entitlement.[42,43]

(2) The Bureau of Reclamation confirmed that no yield would be available during peak periods; MPWMD could build a reservoir to store off-peak supply with the construction of a 30- to 40-mile pipeline.[44]

(3) The annual costs associated with the $64 million pipeline alone exceed the $8.64 million maximum set as a screening criterion. This limit would be greatly exceeded when the costs of purchasing water, construction and O&M of a reservoir were added.

The lack of available water due to other agencies' prior water rights, excessive costs associated with a 30-mile pipeline and the need to build a storage reservoir indicate that the San Felipe alternative is not a feasible alternative.

Big And Little Sur Rivers: Both rivers have been designated under the California Protected Waterways Program and the Big Sur River is being considered for protection under the Wild and Scenic Rivers Act. There are no extenuating circumstances or reasons in evidence at this time which would justify seeking exception to the prohibition of constructing a dam on either of these streams. This fact, together with the adverse environmental impacts, the likely high cost of construction and transmission due to extremely rugged terrain, make a plan for importing water from the Big Sur or Little Sur rivers highly impractical.

Reclamation Used For Groundwater Recharge: Though several wastewater recharge projects exist in California, health concerns, jurisdictional and permit constraints are major barriers to implementing new projects. Health issues include the potential acute or chronic effects of trace metals, minerals, pathogens and a variety of organic compounds. The State Department of Health Services typically opposes projects that introduce wastewater, however well treated, into drinking water sources because the long-term effects of chemicals found in wastewater are unknown.[45] Locally, the Monterey County Environmental Health officer has not allowed turf irrigation with reclaimed water where reclaimed water percolates more than 4" into a potable water aquifer. This policy precludes any recharge into coastal aquifers.

In 1987, the State Scientific Advisory Panel on Ground Water Recharge with Reclaimed Wastewater concluded that, "Other factors notwithstanding, wastewater should not be used as a source unless it can be demonstrated that natural and engineered treatment can be expected to produce consistently a better quality of drinking water than other alternatives. Accordingly, before recharge projects are undertaken, other alternatives . . . should be thoroughly evaluated."[46] Based on this information, the MPWMD determined that wastewater reclamation for recharge is not practicable on the Monterey Peninsula. This finding does not preclude reclamation for turf irrigation in areas that do not impact potable water aquifers.

Reclamation Using the Old Monterey Treatment Site: This alternative is not considered practicable due to the tenuous nature of the site and facilities, and questionable cost effectiveness. The site is leased to the regional sewer agency (MRWPCA) by the U.S. Navy. MRWPCA is presently taking bids for demolition of the facility unless another entity will assume responsibility and liability for the site. The liability issue is problematic due to a suit brought against MRWPCA by a nearby homeowners group regarding recurrent odor problems. An agreement recorded with the court stated that MRWPCA would not operate the Monterey plant as a wastewater treatment facility once the regional plant became operational; in return, the neighbors would drop their suit. It is unknown whether the homeowners association would sue the new operator of a reclamation facility.

Dryden[24] concluded that the project would be worthwhile to pursue based on an annual production of 415 AF. However, if the Navy chooses not to participate, it is very questionable whether the project would be warranted due to the high costs of converting the Monterey plant to reclaim only

170 AF/yr. At a public workshop in October 1989, the Navy indicated it had drilled several subpotable wells with which to irrigate its golf course, lessening the need for reclaimed water.

The above concerns may be moot as there is serious interest by MPWMD to use the Old Monterey site for a small desalination facility rather than for reclamation. The District has initiated discussions with the Navy regarding a desalination facility at the site.

Residential and Institutional Cisterns: This alternative is not considered practicable as a District-wide water supply project due to the combination of high cost per acre-foot and marginal benefits. In 1981, researchers concluded that "the rational user will generally not install collection systems if an adequately reliable supply of public water is available."[26] Use of cisterns as an "insurance policy by those who wish to protect valuable garden areas" was suggested. It should be noted that State Health laws preclude using untreated rainwater or grey water for many domestic uses.

If every home in the District installed cisterns, a 3% to 11% reduction in water use would occur; the more likely scenario of 25% installation would result in a 1% to 2% overall reduction. Benefits from cisterns are limited because most rainfall occurs in winter on the Monterey Peninsula. Thus the effective supply for the remainder of the year is the volume of the storage tank.

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APPENDIX 5
CVSIM OVERVIEW

OVERVIEW OF THE CARMEL VALLEY SIMULATION MODEL

PREFACE

This overview of the Carmel Valley Simulation Model (CVSIM) is presented in two parts. The first part is the original overview of the CVSIM model which appeared as Appendix A in the September 1987 Draft EIR/EIS for the New San Clemente Project.

The second part is an addendum to the CVSIM overview prepared in August 1991 for the Supplemental Draft EIR/EIS on the Monterey Peninsula Water Supply Project. It discusses the major changes made in CVSIM between 1987 and 1990, and describes specific revisions to the data, assumptions and procedures used in CVSIM.

Both the original overview and the addendum were written by Mr. Darby Fuerst, who is the Water Resources Manager for the Monterey Peninsula Water Management District. Dr. Yoram Litwin of RAMLIT Associates, a consultant to the District, contributed to the model development, calibration and technical review.

OVERVIEW OF CARMEL VALLEY SIMULATION MODEL

INTRODUCTION

This appendix presents an overview of the Carmel Valley Simulation Model (CVSIM) and the data, assumptions, and procedures that were used in its development. The descriptions in this appendix are purposely brief. A more detailed description and discussion of CVSIM will be given in District Technical Memorandum 87-01 (in preparation).

The overview of CVSIM is presented in four parts:

I. A general definition of CVSIM, including its purpose, operation, structure, and development.

II. Description of the water resources system of the Monterey Peninsula area, including physical and production aspects.

III. Representation of the system in CVSIM, focusing on the hydrologic inputs and processes.

IV. Description of the water management algorithm, with emphasis on the daily operation of the system.

The overview concludes with a discussion of the accuracy of the model.

The purpse of the overview is to provide sufficient information so that readers can properly evaluate the model-related results presented in the New San Clemente Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS).

I. CVSIM DEFINITION

Simulation refers to the mathematical formulation of a physical system and is used to preview the response of the system to specific plans or actions. The Carmel Valley Simulation Model (CVSIM) is a computer-based simulation model of the water resources system for the Monterey Peninsula area.

Purpose

The model was developed as a planning tool to evaluate various water supply alternatives for the New San Clemente Project EIR/EIS. The model was designed to simulate the performance of the water resources system under varying physical, structural and management conditions. Specifically, CVSIM was tailored to simulate daily processes in the Carmel River basin and provide information relating to streamflow, municipal yield, reservoir operations, and fishery impacts.

In addition, the process of developing CVSIM served to focus the District's research and improve its understanding of the water resources system.

Operation

CVSIM operates on a daily time-step and incorporates both surface and ground-water responses and interactions. CVSIM is a dynamic, accounting model based on the continuity equation. This equation simply means that inflow minus outflow equals the change in storage. Mathematically,

$$I - O = \Delta S$$

Where I = inflow during a given period to a specific area,

O = outflow during a given period from a specific area, and

Δ S = change in volumetric storage during a given period for a specific area

In its current version, CVSIM accounts for inflow, outflow, and storage effects in five aquifer subunits and two to three surface reservoirs, depending on the water supply alternative under investigation.

In addition to simulating the basic hydrologic system, CVSIM also includes options for different structural and operational plans. Sample options include various reservoir sites and sizes, municipal demands, instream flow releases, and rationing parameters. The current and proposed water management algorithms in CVSIM were developed by the District based on extensive computer analyses. The District relied on information provided by the California-American Water Company (Cal-Am), the major water purveyor in the district. The management algorithms were designed to be compatible with Cal-Am's present and projected production and treatment capacities.

Structure

CVSIM was structured based on a modular concept with the MAIN program the central element. The modular concept was used to facilitate refinements to individual components of CVSIM. In addition to basic input and output specifications, the MAIN program contains the water management algorithm that determines the daily production sequence and calls the various subroutines. These subroutines and brief descriptions of their functions are listed in Table A-1.

The MAIN program consists of four, nested loops. The three outer loops--annual, monthly, and daily--are controlled by specific time-steps. The innermost loop is based on satisfying daily municipal demands and instream flow requirements and allows up to six iterations each day.

Development

CVSIM was developed by District staff with assistance by RAMLIT Associates in 1985-1987. Two daily versions--CVSIM1 and CVSIM2--were developed and installed on the IBM 3033 computer system at the U.S. Naval Postgraduate School in Monterey, California. CVSIM1 was designed to represent New San Clemente Project alternatives and CVSIM2 was developed to simulate existing, No-Project and non San Clemente Project alternatives. Both CVSIM programs were based on earlier monthly (CV3) and daily (SAVEDAY) models developed by the District. The District's original computer model was developed in 1980.

TABLE A-1

CARMEL VALLEY SIMULATION MODEL SUBROUTINE DESCRIPTION

NAME	FUNCTION
READ	Reads daily, reconstructed Carmel River mainstem and tributary inflows; option to create synthetic sequence of inflow.
RESRVR	Reads area-capacity-elevation values for specified reservoirs, 2) adjusts reservoir capacities for sedimentation and dredging, and 3) computes reservoir elevation and area from capacity
DAM	Operates mainstem dams and calculates resulting releases, diversions, and storage.
TRBDAM	Operates tributary dams and calculates resulting releases, diversions, and storage; option for pumped storage.
EVAPO	Calculates net reservoir evaporation.
FLASH	Operates flashboards at existing San Clemente Dam.
FISHRL	Determines fishery flows required for the Carmel River at the Narrows and the Lagoon.
AQUIFR	Operates Carmel Valley aquifer subunits and calculates riparian evapotranspiration, pumpage, recharge, storage, and outflow.
SEASID	Operates Seaside coastal ground-water basin and calculates pumpage, recharge and outflow.
RATION	Determines reductions in demand required to maintain specified levels of drought reserve.
FREQ	Calculates monthly and annual exceedance frequency values: 10, 20, 40, 50, 60, 80, and 90 percentiles.
STAT	Calculates daily, monthly, and annual statistics; minimum, maximum, mean and sum.
OUTPUT	Prints daily, monthly, and annual values in tabular form.

II. SYSTEM DESCRIPTION

The water resources system for the Monterey Peninsula area is shown in Figure 1 and consists of the Carmel River drainage basin, Carmel Valley alluvial aquifer, and Seaside aquifer system. The Carmel River basin drains 255 square miles and includes nine major tributaries. Streamflow on the Carmel River is measured by the U.S. Geological Survey at two locations--at Robles del Rio and near Carmel. Records have been maintained at these sites since 1957 and 1962, respectively. Monthly, unimpaired flows at San Clemente Dam were reconstructed by the U.S. Corps of Engineers for the period 1902-1978. This record has been extended through 1985 by the District and is shown in Figure 2.

The long-term, reconstructed record shows significant annual and seasonal variation. Annual flows at San Clemente ranged from 2,600 to 229,000 acre-feet, with an average flow of 67,660 acre-feet. On a seasonal basis, runoff occurs in almost direct response to rainfall, with nearly 90% of the average annual flow occurring between December and April. The highest flow months are January, February, and March, with this period accounting for two-thirds of the annual flow.

Streamflow in the basin is regulated by two dams--Los Padres and San Clemente. A New San Clemente Dam has been proposed and would be located 0.7 miles below the existing San Clemente Dam.

The Carmel Valley alluvial aquifer extends 16 miles with a maximum thickness of about 190 feet near the Highway 1 bridge. The aquifer is composed of unconsolidated gravel, sand, silt, and clay. It is unconfined and has a surface area of six square miles. For purposes of analysis, the aquifer was divided into four subunits. Specific yield values range from 0.25 in the upper subunit to about 0.20 in the lower subunits.

The Seaside aquifer system is located north of the Carmel River basin and encompasses 24 square miles. The Seaside system consists of four vertical water-bearing units. In addition, the system has been divided into four areal sub-basins.

Each of the reservoir and aquifer units used in CVSIM are listed in Table A-2 and described by location.

Cal-Am is the major producer of water in the Monterey Peninsula area and supplies over 80% of the water used in the district. The remaining users obtain their water from small water systems and private wells. The Cal-Am system includes Los Padres and San Clemente Dams, 18 wells in Carmel Valley, 11 wells in the Seaside coastal area, and two water treatment plants. Cal-Am's operations are regulated by a number of agencies including the District, the California Department of Fish and Game, the California Department of Safety of Dams, and the California Public Utilities Commission.

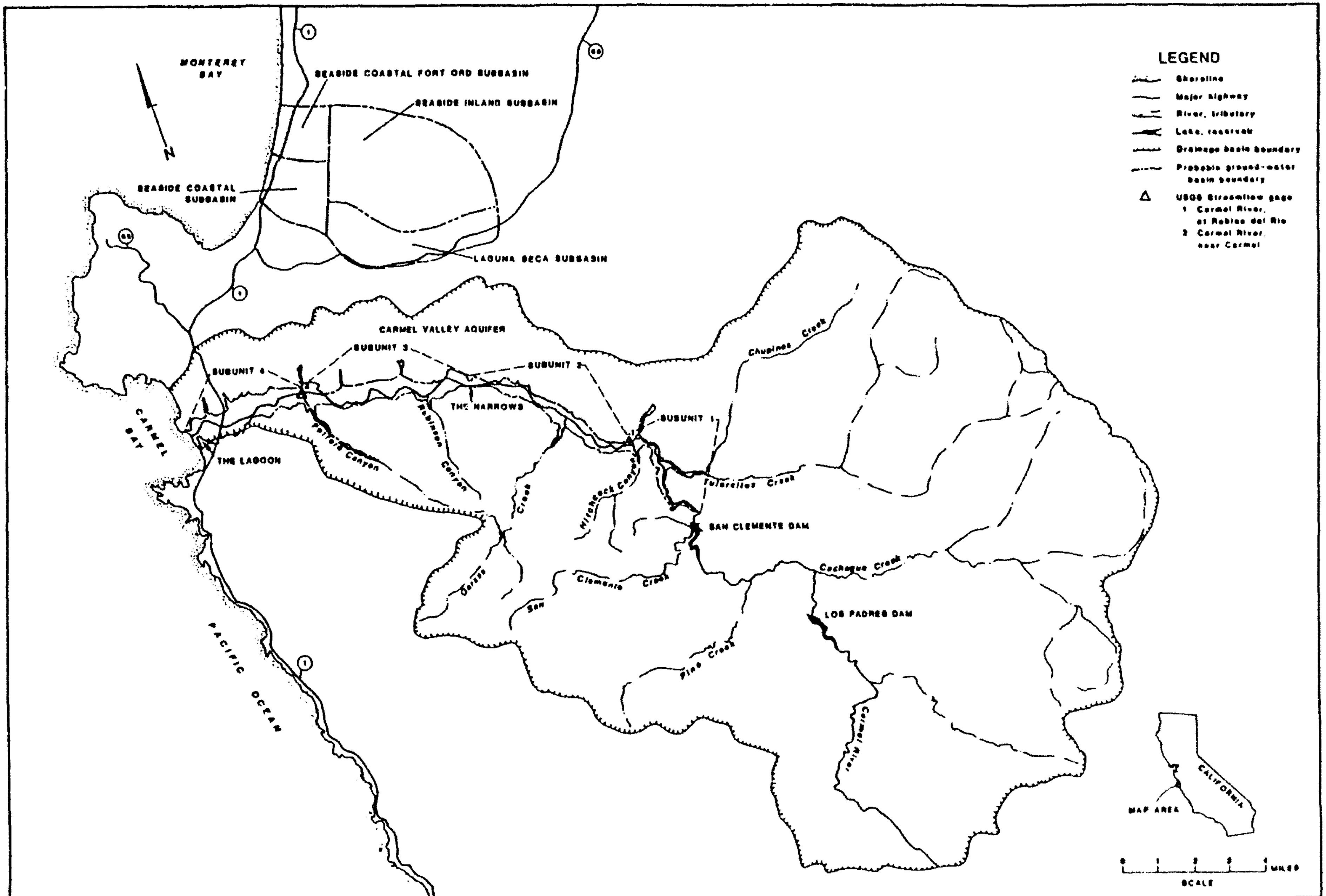


Figure 1. Water Resources System for the Monterey Peninsula Area

Figure 2

CARMEL RIVER AT SAN CLEMENTE DAM

Reconstructed Annual Flows: 1902 – 1985

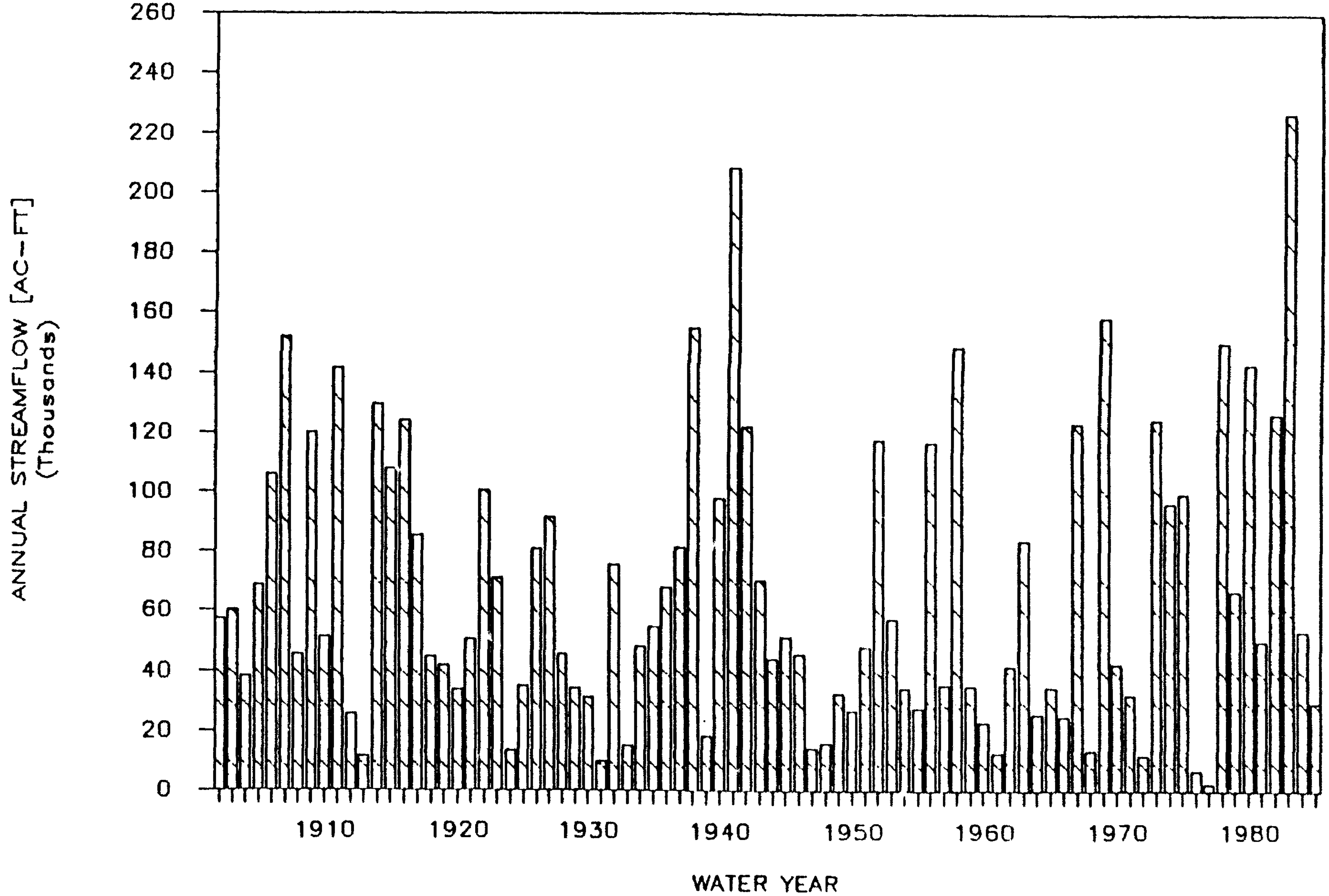


TABLE A-2

CARMEL VALLEY SIMULATION MODEL

RESERVOIR AND AQUIFER UNITS

UNIT	LOCATION	RIVER MILE
CARMEL RIVER RESERVOIRS		
Los Padres	- - - - - - - -	24.8
San Clemente	- - - - - - - -	18.5
New San Clemente	- - - - - - - -	17.8
CARMEL VALLEY AQUIFER		
Subunit 1	San Clemente Dam to the Robles del Rio gage	18.5 14.8
Subunit 2	Robles del Rio gage to the Narrows	14.8 9.7
Subunit 3	The Narrows to the near Carmel gage	9.7 3.6
Subunit 4	Near Carmel gage to the Lagoon	3.6 0.0
SEASIDE AQUIFER		
Coastal Subunit	Seaside	

Note: River miles are referenced from mouth.

III. SYSTEM REPRESENTATION

The water resources system for the Monterey Peninsula area is a complex system involving both hydrologic and operational constraints. In order to simulate this system, some simplification was necessary. Figure 3 shows a schematic of the simplified water resources system that was used in CVSIM. The schematic shows the general configuration of the flow system and the relative storage volumes for each reservoir and aquifer subunit. The volumes shown represent usable storage and do not include dead storage or water reserved for minimum pool requirements or as a safeguard against sea-water intrusion. The schematic also shows the location of the major tributaries in the system.

In CVSIM, the Carmel River drainage and Carmel Valley aquifer subunits were represented by a series of six, interconnected reservoirs. Flow and storage values were determined in a downstream order beginning at Los Padres Reservoir and ending at the Carmel River Lagoon. All values were expressed in acre-feet. For each reservoir or aquifer subunit, a water-balance calculation was made. Outflows calculated from upstream units were used as inflows to downstream units. Components for the reservoir and aquifer water balances are illustrated in Figure 4.

In the upper watershed (i.e., above San Clemente Dam), streamflow was simulated at four sites:

1) Inflow to Los Padres Reservoir;

2) Outflow from Los Padres Reservoir;

3) Inflow to San Clemente Reservoir; and

4) Outflow from San Clemente Reservoir.

These flows were based on reconstructed mainstem and tributary inflows, reservoir effects, and diversions. Reservoir effects included controlled releases to the river, spills, evaporation, and leakage. Ground-water flow in the upper watershed is considered negligible and was not included in CVSIM.

In the lower watershed, streamflow was simulated at four additional mainstem sites:

1) Robles del Rio,

2) Scarlett Narrows,

3) Near Carmel, and

4) Carmel River Lagoon.

Figure 3. Schematic of the Water Resources System for the Monterey Peninsula Area

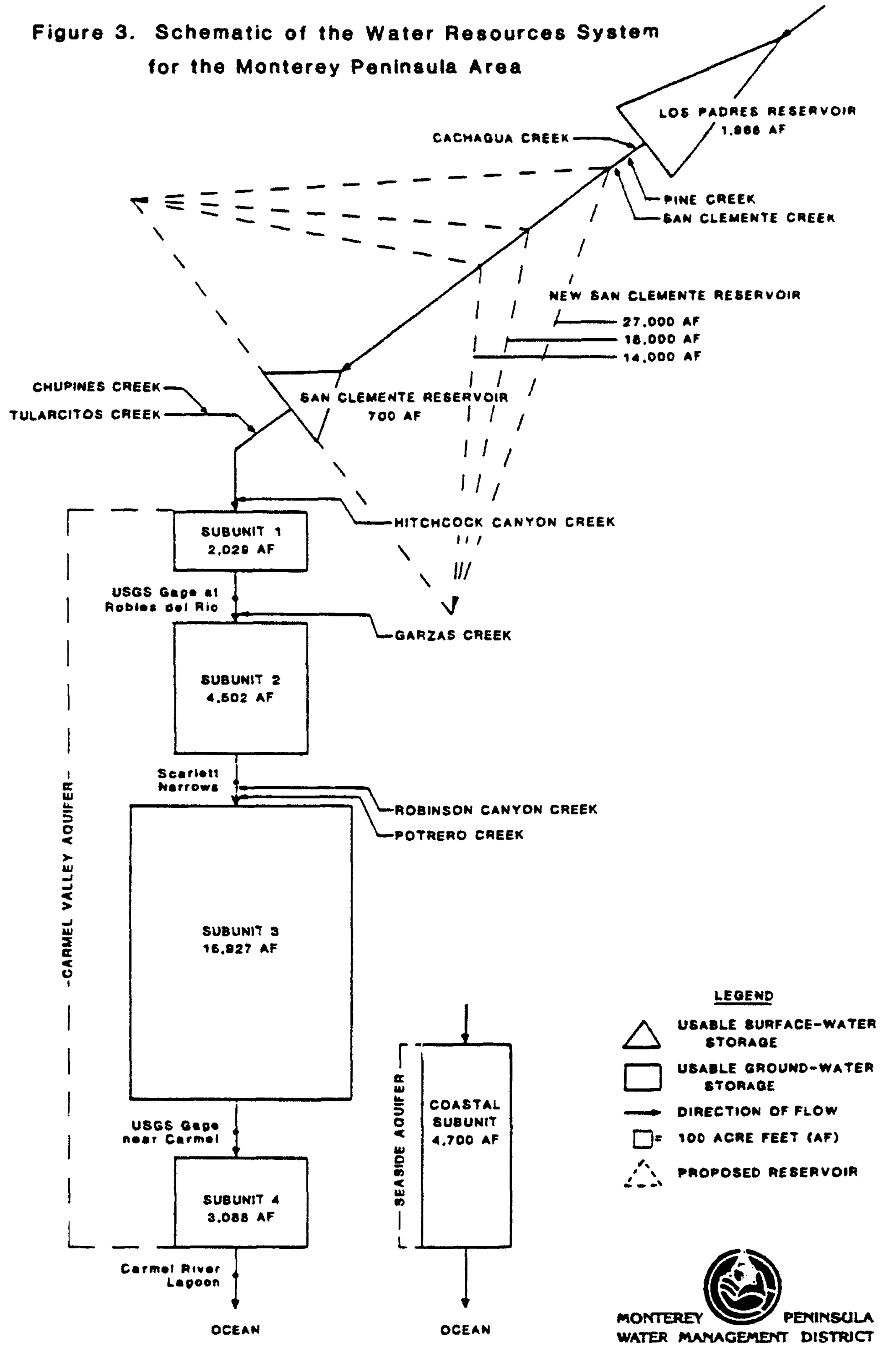
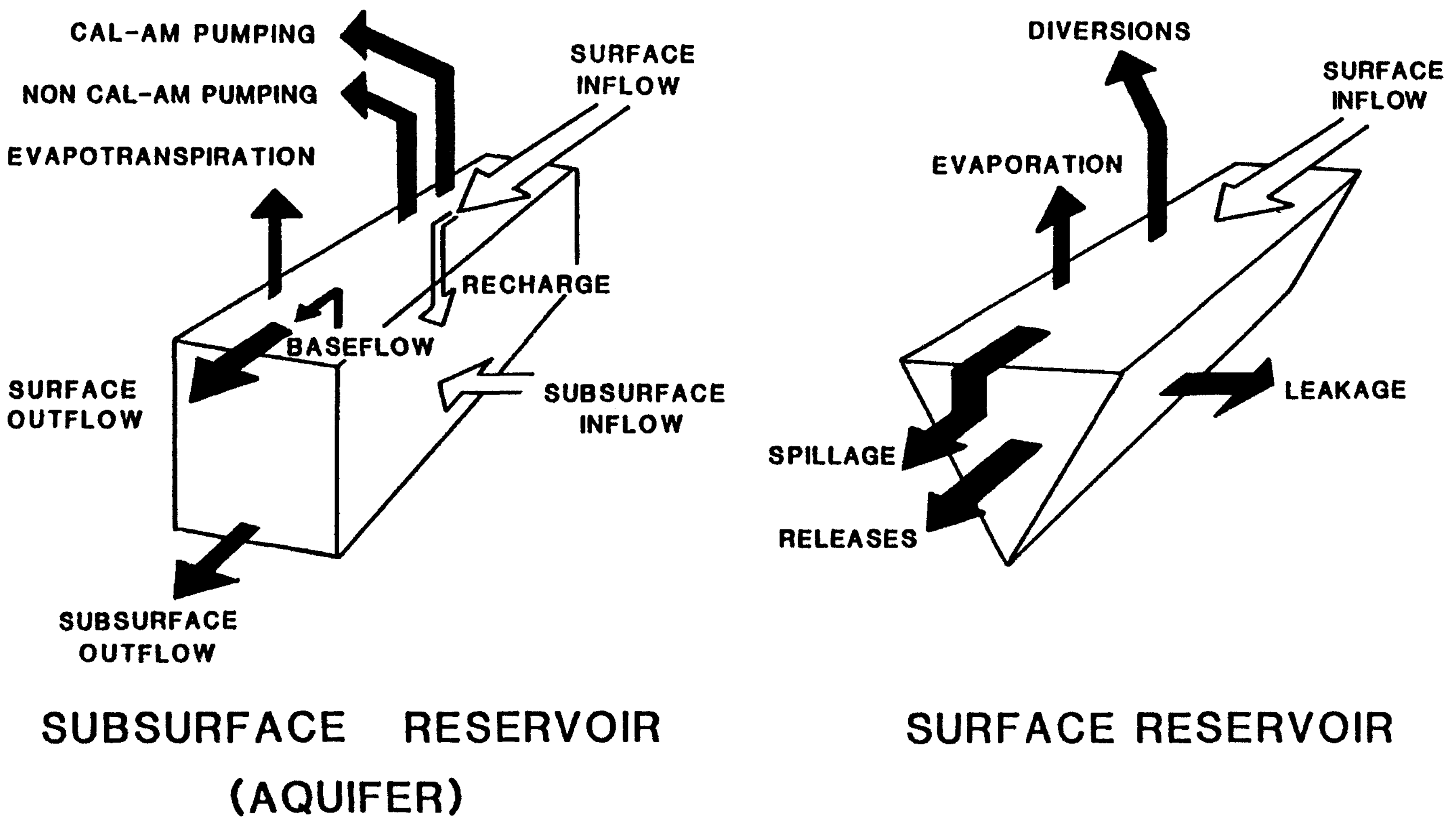


Figure 4. Carmel Valley Simulation Model Accounting Units



These flows were based on upstream mainstem inflow, reconstructed tributary inflows, aquifer effects, and pumpage. Aquifer effects included recharge, subsurface flow, evapotranspiration, and baseflow. Ground-water flow in the lower watershed was estimated from each subunit based on hydraulic conductivity, gradient, and cross-sectional area.

Storage volumes for the reservoir and aquifer units in the Carmel River watershed were calculated based on current storage and simulated inflows and outflows.

Storage and flow values for the Seaside coastal subunit were estimated in a similar, but simplified manner. For this unit, a single value was used to represent net inflow. This value was based primarily on subsurface inflow from the inland subbasins but also included adjustments for recharge from surface sources and losses due to evapotranspiration. No hydrologic connection exists or was assumed between the Seaside subbasin and Carmel River watershed. The units are connected only through the Cal-Am distribution system.

System Parameters

Various parameters were specified in simulating the water resources system for the Monterey Peninsula area. These parameters include estimates of storage, inflows, demand, operational capacities, and hydrologic processes. These parameters, as well as associated distributions, are presented below.

Storage

Refined storage estimates, particularly for the aquifer subunits, were critical in the development and calibration of CVSIM. Earlier estimates of aquifer storage were revised to correspond with specific subunit areas and to reflect operational and water quality constraints. Reservoir storage estimates were updated to reflect recent sedimentation. Table A-3 shows the total, usable, and initial storage values specified in CVSIM. The initial storage estimates were based on mean end-of-year storage values from preliminary simulation runs.

The large difference between total and usable storage in Carmel Valley Subunit 4 and the Seaside Coastal Subbasin is due to concerns regarding sea water intrusion. In the Seaside subbasin, the unusable storage (64,100 acre-feet) is below sea level. In Carmel Valley Subunit 4, 10,763 acre-feet are defined as unusable. Maintenance of this storage provides a positive fresh-water gradient to the ocean and minimizes the potential for sea water intrusion. In addition, most of this storage is not available to the existing Cal-Am production wells.

TABLE A-3

CARMEL VALLEY SIMULATION MODEL

RESERVOIR AND AQUIFER STORAGE ESTIMATES

STORAGE UNIT	TOTAL STORAGE (Acre-Feet)	USABLE STORAGE (Acre-Feet)	INITIAL STORAGE (1)	
			PROJECT (%)	NO PROJECT (%)
Carmel River Reservoirs				
Los Padres	2,180	1,968	50	80
San Clemente	316-796 (2)	220-700 (2)	—	80
New San Clemente	16,000-29,000 (3)	14,000-27,000 (3)	65	—
Carmel Valley Aquifer				
Subunit 1	2,029	2,029	100	100
Subunit 2	6,099	4,502	100	95
Subunit 3	19,615	16,927	90	80
Subunit 4	13,851	3,088	95	95
Seaside Aquifer				
Coastal Subbasin	68,800	4,700	98	98

(1) Percentage of total storage; based on simulated mean end-of-year values.

(2) With flashboards lowered and raised.

(3) Range of feasible reservoir sizes.

Inflows

Daily flows for the Carmel River at Los Padres Reservoir and nine, selected tributaries were estimated for use as inputs to CVSIM. The estimates were based on the daily flows recorded by the U.S. Geological Survey on the Carmel River at Robles del Rio.

The entire flow record through water year 1985 -- October 1, 1957 to September 30, 1985 -- was used in the estimation procedure. The procedure was developed to estimate daily inflow for the SAVEDAY model. The procedure and associated data were updated and extended for use in CVSIM.

The estimates of daily flow for each tributary were made by correlation with the flow at Robles del Rio. Regression equations for each tributary were developed based on periodic tributary flow measurements made by the District in 1981-1986 and corresponding flows recorded at Robles del Rio. Table A-4 shows the nine tributaries that were selected and includes associated drainage areas and mean annual flows. These tributaries were selected based on their flow and sediment contributions.

The daily flow on the Carmel River at Los Padres Reservoir was estimated by routing the flow at Robles del Rio back through the system. In this routing, the flow at Robles del Rio was reduced to offset tributary inflow, increased to account for diversions at San Clemente Dam, and adjusted for changes in storage (plus or minus) at San Clemente and Los Padres Reservoirs. The final result represents natural, unregulated flow at Los Padres Reservoir and averaged 54,977 acre-feet annually.

Demand

In CVSIM, water demand consisted of municipal supply and instream flow requirements. Municipal use included Cal-Am demand and non Cal-Am demand and was estimated for "Project" and "No-Project" conditions through the year 2020. Non Cal-Am demand included pumpage by small distribution systems and private pumpers and was aggregated by aquifer subunit. Table A-5 shows a breakdown of the demands used in CVSIM for existing "Project" and "No-Project" conditions. The No-Project demand is based on the existing, maximum allocation adopted by the District. The Project demands are based on development planned through the year 2020.

In the simulation, it was assumed that 33% of the non Cal-Am pumpage in Carmel Valley would percolate into the aquifer as return flow. No return flow was assumed for 1) Cal-Am pumpage in Carmel Valley, and 2) All pumpage in Seaside.

The demands shown in Table A-5 represented normal-year use and were increased for dry conditions. The increases in demand were made each month based on river flow conditions with a 7.5% annual maximum. Table A-6 shows the monthly distribution used to increase municipal demand and also lists the percentages used to distribute the annual Cal-Am and non Cal-Am demands. Mean daily

TABLE A-4

CARMEL VALLEY SIMULATION MODEL

SELECTED CARMEL RIVER TRIBUTARIES

TRIBUTARY	DRAINAGE AREA (Square Miles)	SIMULATED MEAN ANNUAL FLOW (Acre-Feet) (1)
Cachagua Creek	46.3	4,338
Pine Creek	7.8	4,039 (2)
San Clemente Creek	15.6	8,078
Tularcitos Creek	40.5	3,721 (3)
Chupines Creek	15.8	1,463 (4)
Hitchcock Canyon Creek	4.6	1,043
Garzas Creek	13.2	6,301
Robinson Canyon Creek	5.4	1,552
Potrero Creek	5.2	903

(1) Based on 1958-1985 period.

(2) Estimate based on area-yield relationship with San Clemente Creek.

(3) Adjusted for flow from Chupines Creek.

(4) Estimate based on area-yield relationship with Tularcitos Creek.

TABLE A-5

CARMEL VALLEY SIMULATION MODEL

ESTIMATED MUNICIPAL WATER DEMAND

USER/SOURCE	NORMAL-YEAR DEMAND: ACRE-FEET		
	EXISTING CONDITIONS (1987)	NO-PROJECT CONDITIONS (2020)	PROJECT CONDITIONS (2020)
CAL-AM			
System-wide	18,000	20,000	22,895
NON CAL-AM			
Carmel Valley Aquifer Subunit 1	130	139	139
Carmel Valley Aquifer Subunit 2	331	340	340
Carmel Valley Aquifer Subunit 3	676	697	697
Carmel Valley Aquifer Subunit 4	793	796	796
Seaside Coastal Aquifer Subbasin	825	850	850
TOTAL	20,755	22,822	25,717

TABLE A-6

CARMEL VALLEY SIMULATION MODEL

DEMAND-RELATED MONTHLY DISTRIBUTIONS

MONTH	PERCENTAGE OF ANNUAL CAL-AM DEMAND (1) (%)	PERCENTAGE OF ANNUAL NON CAL-AM (2) DEMAND (%)	PERCENTAGE INCREASE OF NORMAL-YEAR (3) DEMAND (%)
OCTOBER	8	7	6
NOVEMBER	6	2	7
DECEMBER	6	2	7
JANUARY	7	2	7
FEBRUARY	6	2	8
MARCH	7	4	15
APRIL	7	9	20
MAY	10	13	8
JUNE	11	16	7
JULY	11	15	7
AUGUST	11	15	2
SEPTEMBER	10	13	2

(1) Based on median monthly values for 1967-1983.

(2) Based on District well reporting program data for 1984-1985.

(3) Applied during dry and critically dry months, i.e., lower quartile flow at San Clemente Dam.

demands were estimated by dividing the monthly demands by the number of days in each respective month.

Instream flow releases for the steelhead fishery on the Carmel River were included in both "Project" and "No-Project" simulations. For No-Project conditions, the fishery flow releases were based on procedures specified in a Memorandum of Understanding between Cal-Am, the California Department of Fish and Game, and the District. In CVSIM2, a minimum, year-round release of three cubic feet per second (cfs) was specified at San Clemente Dam. This release was equivalent to an annual requirement of 2,171 acre-feet.

For New San Clemente Project conditions, the fishery flow releases were based on a flow schedule recommended by D.W. Kelley and Associates (DWK). The schedule was developed to satisfy the needs of the steelhead during each phase of their life cycle and varied according to water supply conditions. Requirements were specified at two sites below the dam: the Narrows and the Carmel River Lagoon. A constant flow of 20 cfs was specified at the Narrows and was equivalent to an annual requirement of 14,476 acre-feet. This water was available for recharge to the lower subunits in the Carmel Valley aquifer.

The flows that were specified at the Lagoon varied daily depending on runoff and storage conditions. Table A-7 shows the proposed flow schedule and includes a breakdown by water year type, month, and purpose. The annual requirement at the Lagoon can range from 3,014 acre-feet, under critically-dry conditions, to 24,308 acre-feet under normal or wet conditions. This water would not be available for recharge.

To simulate the proposed fishery flow releases, operating rules were developed jointly by the District and DWK. These rules are complicated and involve a number of factors including:

1) Water year classification,

2) New San Clemente Reservoir storage,

3) Daily inflows at Los Padres Reservoir, and

4) Daily flow at the Lagoon

Water Year Classification. In the process of developing the proposed flow schedule, DWK defined four water year types based on selected, non-exceedance flow frequencies. Table A-8 shows each type and selected non-exceedance frequency and value for the reconstructed annual flows at San Clemente.

In order to classify inflow conditions during the water year, the selected frequencies values were determined for the cumulative monthly flows. These cumulative values are shown in Table A-9

TABLE A-7

PROPOSED STEELHEAD FISHERY FLOW SCHEDULE FOR NEW SAN CLEMENTE PROJECT

JAN	FEB	MAR	APR	MAY	JUN - DEC
NORMAL OR BETTER WATER YEARS					
Adult migration and spawning:			Smolt emigration:		Juvenile rearing:
A. Maintain 5 cfs to Lagoon until attraction event (storm)			40 cfs to Lagoon for	40 cfs to Lagoon for	20 cfs to Narrows for
B. Attraction event triggers release of 200 cfs to Lagoon for			30 days	31 days	214 days
					and
2 days	4-7 days	4-7 days			5 cfs to Lagoon for
C. After attraction release, maintain 75 cfs to Lagoon until next attraction event or through March 31, if no more attraction events occur					214 days
BELOW NORMAL YEARS (1)					
Adult migration and spawning:			Smolt emigration:		Juvenile rearing:
A. Maintain 5 cfs to Lagoon until attraction event; if no attraction event by March 1, release 40 cfs to Lagoon all days in March			40 cfs to Lagoon for	30 cfs to Lagoon for	20 cfs to Narrows for
			30 days	31 days	214 days,
					and
B. Attraction event triggers release of 200 cfs to Lagoon for					5 cfs to Lagoon for
0 days	5 days	5 days			214 days
C. After attraction release, maintain 75 cfs to Lagoon until next attraction event or through March 31, if no more attraction events occur					

TABLE A-7 (CONT.)

PROPOSED STEELHEAD FISHERY FLOW SCHEDULE
FOR NEW SAN CLEMENTE PROJECT

JAN	FEB	MAR	APR	MAY	JUN - DEC
DRY YEARS (1)					
Adult migration and spawning:			Smolt emigration:		Juvenile rearing:
A. Maintain 5 cfs to Lagoon until attraction event; if no attraction event by March 1, release 40 cfs to Lagoon all days in March			40 cfs to Lagoon for 30 days	30 cfs to Lagoon for 31 days	20 cfs to Narrows for 214 days, and 0 cfs to Lagoon
B. Attraction event triggers release of 200 cfs to Lagoon for					
0 days	0 days	5 days			
C. After attraction release, maintain 75 cfs to Lagoon until next attraction event or through March 31, if no more attraction events occur					
CRITICAL YEARS (1)					
Adult migration and spawning:			Smolt emigration:		Juvenile rearing:
A. No attraction requirement			30 cfs to Lagoon for 30 days	20 cfs to Lagoon for 31 days	20 cfs to Narrows for 214 days, and 0 cfs to Lagoon

(1) If total reservoir storage exceeds 15,000 acre-feet, the "normal or better year" release schedule is in effect regardless of the actual water year type.

and were used to indicate natural inflow conditions **to date.** The cumulative values were, in turn, used as the basis for estimating the inflow expected through the remainder of the water year. Given the cumulative flow to date, estimates of the minimum flow expected for the remainder of the water year were made for each water year type. The estimates of expected inflow were specified at the 25% risk level. The expected inflows are shown in Table A-10 and were used in conjunction with the cumulative inflows to predict water year type for the entire year. The various levels of fishery flow releases were made based on this prediction of water year type. In the simulations, this prediction was updated at the beginning of each month.

Daily Inflows at Los Padres Reservoir. The timing of steelhead attraction releases during the January - March season was based on daily flow increases at Los Padres Reservoir. Specific sequences of 4-day and 3-day flow events were used to determine the appropriate release. The sequences were developed by DWK based on observed fishery response and were designed to mimic natural attraction events as closely as possible. In the simulations, the sequences were characterized by specific levels of increasing flow for each attraction month and were assessed daily. The duration of the releases depended on when the releases occurred within each month.

New San Clemente Reservoir Storage. The operating rules were designed to utilize storage in New San Clemente Reservoir for two purposes. The first purpose was to regulate flow so that the releases proposed for various water year types were maintained. The second purpose was to augment flow so that proposed releases could be increased whenever sufficient storage was available at New San Clemente Reservoir. Specifically, whenever total reservoir storage exceeded 15,000 acre-feet, "normal or better" year releases were made regardless of actual water year classification.

Daily Flow at the Lagoon. The operating rules also accounted for inadvertent attraction flows at the Lagoon. If attraction releases occurred at the Lagoon due to reservoir spill or downstream tributary inflows, releases were continued to maintain the attraction and migration event. In CVSIM1, if the flow at the Lagoon on the previous day exceeded 190 cfs, releases were made to maintain the attraction and migration requirements.

Operational Capacities

Operational capacities for the Cal-Am system and non Cal-Am users were specified in CVSIM. For the Cal-Am system, the capacities included surface-water diversion, ground-water pumpage, and water treatment facilities. Maximum, daily pumping capacities for Cal-Am wells were aggregated by aquifer subunit and decreased by 13% for system-wide depreciation.

TABLE A-8

CARMEL VALLEY SIMULATION MODEL

WATER YEAR CLASSIFICATION

	CARMEL RIVER AT SAN CLEMENTE DAM (1)	
WATER YEAR TYPE	NON-EXCEEDANCE FLOW FREQUENCY (2) (%)	NON-EXCEEDANCE FLOW VALUE (Acre Feet)
NORMAL OR BETTER	> 50	> 48,100
BELOW NORMAL	50 - 25	48,100 - 31,750
DRY	25 - 12.5	31,750 - 14,925
CRITICALLY DRY	< 12.5	< 14,925

(1) Based on reconstructed, unimpaired flow at San Clemente Dam: 1902-1978.

(2) Frequencies derived by D.W. Kelley and Associates. Originally applied to Carmel River flow at Robles del Rio (D.H. Dettman, personal communication).

TABLE A-9

CARMEL VALLEY SIMULATION MODEL

CUMULATIVE INFLOWS AT NEW SAN CLEMENTE SITE (ACRE-FEET)

Period	WATER SUPPLY CLASS			
	"Normal or Better" (1)	"Below Normal" (2)	"Dry" (3)	"Critically Dry" (4)
End of October	> 200	200 - 100	100 - 1	0
Oct - November	> 1,000	1,000 - 500	500 - 200	< 200
Oct - December	> 4,100	4,100 - 1,700	1,700 - 1,175	< 1,175
Oct - January	> 11,800	11,800 - 5,450	5,450 - 4,100	< 4,100
Oct - February	> 26,300	26,300 - 14,400	14,400 - 7,550	< 7,550
Oct - March	> 39,100	39,100 - 21,950	21,950 - 10,925	< 10,925
Oct - April	> 46,400	46,400 - 28,300	28,300 - 12,975	< 12,975
Oct - May	> 47,400	47,400 - 30,650	30,650 - 14,425	< 14,425
Oct - June	> 48,000	48,000 - 31,550	31,550 - 14,900	< 14,900
Oct - July	> 48,100	48,100 - 31,700	31,700 - 14,925	< 14,925
Oct - August	> 48,100	48,100 - 31,750	31,750 - 14,925	< 14,925

NOTE: Classes derived from monthly unimpaired flows to San Clemente Dam for the period 1902-1978. The unimpaired flows were estimated by the U.S. Army Corps of Engineers (1981).

TABLE A-10

CARMEL VALLEY SIMULATION MODEL

EXPECTED INFLOWS AT NEW SAN CLEMENTE SITE WITH 25% RISK (ACRE-FEET)

Period	WATER SUPPLY CLASS			
	"Normal or Better" (1)	"Below Normal" (2)	"Dry" (3)	"Critically Dry" (4)
November - September	48,100 1)	45,975	30,450	23,200
December - September	32,700	30,400	26,400	14,250
January - September	27,400	20,975	15,600	9,700
February - September	25,000	17,300	9,100	7,225
March - September	22,850	10,500	5,300	3,050
April - September	12,700	5,700	3,050	1,350
May - September	5,200	2,525	1,600	500
June - September	2,000	825	750	100
July - September	675	150	75	0
August - September	200	0	0	0
September	0	0	0	0

1) Annual median value.

For non Cal-Am users, the operational capacities were limited to ground-water production. Maximum daily pumping capacity for each aquifer subunit was estimated based on reported peak monthly pumpage.

Table A-11 shows the existing operational capacities for the Cal-Am system and non Cal-Am users. For New San Clemente Project conditions, the treatment capacity at the Begonia Iron Removal Plant was increased to 54.0 acre-feet/day and pumping capacities in Carmel Valley aquifer subunit 2 and Seaside coastal aquifer were increased to 14.76 and 19.01 acre-feet/day, respectively. Similar increases were assumed for the No-Project conditions, with the exception of the 5.38 acre-feet/day increase in Carmel Valley aquifer Subunit 2.

Reduced Pumping Capacity. In CVSIM, it was also assumed that ground-water pumping capacity would decrease as ground-water levels declined. Specific functions relating pumping capacity to ground-water storage in each aquifer subunit were developed. The functions were used to determine the percentage of maximum pumping capacity for the Cal-Am wells that would be available at various storage levels. Table A-12 shows the equations developed for each aquifer subunit. Pumping capacity goes to zero when water levels drop below the perforations of the Cal-Am wells.

Hydrologic Processes

In developing the water balance equations for the surface and subsurface reservoirs in CVSIM, a number of hydrologic processes were specified. These processes included:

1) Aquifer recharge,

2) Baseflow,

3) Subsurface flow,

4) Riparian evapotranspiration, and

5) Reservoir evaporation and leakage.

Each of these processes is described below.

Aquifer recharge. In CVSIM, it was assumed that all aquifer recharge in the Carmel Valley occurred via infiltration through the bed of the Carmel River. Tributary flows were added to the mainstem flow before estimating recharge. The recharge functions used in CVSIM were based on a set of monthly percolation-runoff-drawdown curves developed by the U.S. Corps of Engineers for the Carmel River. These curves were modified to provide daily recharge estimates in CVSIM. Based on three drawdown ranges--0-1,000, 1,000-3,000, and greater than 3,000 acre-feet--different equations were used to estimate the percentage of specified

TABLE A-11

CARMEL VALLEY SIMULATION MODEL

EXISTING OPERATIONAL CONSTRAINTS

FACILITY	OPERATIONAL CAPACITY: ACRE-FEET/DAY	
	CAL-AM SYSTEM	NON CAL-AM USERS
Carmel Valley Filter Plant (1)	32.00	----
Begonia Iron Removal Plant (2)	48.00	----
<u>Carmel Valley Aquifer</u>		
Subunit 1 Wells	2.61	0.80
Subunit 2 Wells	9.38	2.03
Subunit 3 Wells	57.20	4.14
Subunit 4 Wells	7.69	4.86
<u>Seaside Aquifer</u>		
Coastal Wells	16.70	2.63

(1) Also represents surface-water diversion capacity from San Clemente Dam.

(2) Treatment is required for all production wells in Carmel Valley aquifer subunits 3 and 4 except for Scarlett Wells #4 and #7 (7.61 acre-feet/day).

TABLE A-12

CARMEL VALLEY SIMULATION MODEL

REDUCED GROUND-WATER PUMPING CAPACITIES

AQUIFER SUBUNIT	EQUATION RELATING CAL-AM PUMPING CAPACITY TO GROUND-WATER STORAGE (1)
<u>Carmel Valley Aquifer</u>	
Subunit 1	$y = 0.97\,(x)^{0.34}$
Subunit 2	$y = 1.03\,(x)^{0.32}$; if $x > 0.46$
	$y = 2.68\,(x) - 0.58$; if $x < 0.46$
	$y = 0$; if $x < 0.26$
Subunit 3	$y = 1.02 + 0.45\,(x)$
	$y = 0$; if $x < 0.14$
Subunit 4	$y = 1.01 + 0.44\,(\ln x)$
	$y = 0$; if $x < 0.78$
<u>Seaside Aquifer</u>	
Coastal Subbasin	$y = 0.80 + 0.20\,(x)$

(1) Where:

x = percentage of total ground-water storage available.
y = percentage of Cal-Am pumping capacity available.

streamflow that would percolate into the aquifer. Recharge increased with increased streamflow and decreased with increased water levels. The recharge functions were applied to each aquifer subunit and uniform drawdown within each subunit was assumed.

Recharge from surface sources in the Seaside coastal subbasin is minor and was included in the estimate for net subsurface inflow.

Baseflow. In the simulation, baseflow occurred whenever aquifer subunit storage capacity was exceeded. At these times, the excess water was added to the surface outflow. Baseflow was not calculated for the Seaside coastal subbasin.

Subsurface flow. Estimates of the subsurface flow rates between the Carmel Valley aquifer subunits were initially developed as equations based on Darcy's law. During calibration of CVSIM, these rates were adjusted and expressed as constants. A flow rate of 7.62 acre-feet/day was specified into and out of Subunits 1 and 2. In the lower valley, 7.62 acre-feet/day were specified as inflow to Subunit 3 and 2.43 acre-feet/day as outflow. In Subunit 4, 2.43 acre-feet/day was specified as inflow and 0.95 acre-feet/day as outflow to the ocean.

Subsurface inflow to the Seaside coastal subbasin was specified as 3,950 acre-feet annually. This inflow was distributed uniformly during the year. The estimate was based on a comparison of basin water level response to varying ground-water extraction and recharge conditions. Subsurface outflow was specified as 500 acre-feet/year.

Riparian evapotranspiration. Evapotranspiration losses for the riparian vegetation along the Carmel River were specified as 600 acre-feet/year. This estimate was based on a riparian area of 160 acres extending 18.5 miles from San Clemente Dam to the Carmel River Lagoon. Evapotranspiration losses were calculated for each aquifer subunit and were not adjusted for dry conditions. Table A-13 shows the monthly distribution that was specified for riparian evapotranspiration in CVSIM.

Reservoir evaporation and leakage. Reservoir evaporation was calculated as the product of reservoir surface area and monthly net evaporation rate. The monthly net evaporation rates are shown in Table A-13 and were derived by the U.S. Army Corps of Engineers for Los Padres Reservoir. Negative, net evaporation occurs when precipitation exceeds evaporation. In CVSIM, gross evaporation rates were used during dry and critically dry periods. Annual net evaporation was 2.56 feet/acre for Los Padres and San Clemente Reservoirs.

Reservoir leakage for the existing and proposed San Clemente Dams was estimated as 2.0 acre-feet/day. No leakage was estimated for Los Padres Reservoir.

TABLE A-13

CARMEL VALLEY SIMULATION MODEL

MONTHLY EVAPORATION RATES

MONTH	NET RESERVOIR EVAPORATION RATE (Feet/Acre)	RIPARIAN VEGETATION EVAPOTRANSPIRATION (Acre-Feet)
October	0.247	42
November	-0.001	24
December	-0.230	18
January	-0.286	24
February	-0.185	30
March	0.030	42
April	0.238	60
May	0.612	84
June	0.612	72
July	0.645	78
August	0.563	66
September	0.419	60
Total	2.560	600

IV. CVSIM MANAGEMENT AND OPERATIONS

Water management algorithms were developed for the Project and No-Project conditions. The algorithms focused on operation of the Cal-Am system and were designed to meet the water supply goals of the District. The Project and No-Project algorithms were similar but differed mainly in the volume of municipal water and fishery flow requirements that were supplied. Each algorithm utilized conjunctive-use management to maximize the benefits from the surface and ground-water resources.

The algorithms were designed to reflect District policy and to be consistent with present and projected Cal-Am production facilities. All water management decisions were structured in a real-time context and were based on a comparison between system supply and demand. Both short-term (daily) and long-term (seasonal and annual) comparisons were considered in the water management algorithms.

In general, water management decisions were made within the water year--October through September--at the beginning of each month. Specific water production sequences and fishery flow releases were determined daily.

The decisions were made in a downstream, sequential order. The management sequence began with the Seaside coastal subbasin and then moved through the Carmel River system (Figure 3). The decision process was complicated by two factors: 1) the extreme seasonal and annual flow variability, and 2) the dynamic nature of the system. The uncertainty regarding future inflow made it difficult to reliably plan reservoir releases. The complex stream-aquifer-pumping interaction in the Carmel Valley also made it difficult to maintain flow requirements and meet municipal demands. These difficulties were overcome by including a recursive routine in the daily operations and running numerous trial simulations.

The water management algorithms can be divided into two elements:

1) Monthly management decisions, and

2) Daily operations.

Each of these elements are described below, with special emphasis on the daily operations.

Monthly Water Management

Current and expected water supply conditions were assessed monthly in CVSIM. Current conditions were represented by:

1) All usable surface and subsurface reservoir storage, and

2) All unimpaired inflow to San Clemente Dam to date.

The cumulative inflow at San Clemente was compared with selected non-exceedance flow values (Table A-9) to classify flow conditions. This index was termed CUMFLO and consisted of four classes, with "1" representing "normal or better".

CUMFLO was used to determine:

1) the dry-year adjustment to municipal demand,

2) the diversion to the filter plant under Project conditions,

3) the effective reservoir evaporation rate, and

4) the expected inflow for the remainder of the water year.

Expected water supply conditions were represented by:

1) the inflow expected at San Clemente for the remainder of the water year, and

2) the sum of the inflow to date (CUMFLO) and the expected inflow for the remainder of the water year.

The estimates for expected inflow were based on the flow to date and were provided at the 25% risk level (Table A-10). This means that, given the current inflow, the expected inflow will equal or exceed the indicated value three out of four times. The expected inflow was termed EXPINF.

CUMFLO and EXPINF were summed and compared to the selected, annual frequency values to predict the eventual water year class. This predicted water year type was termed STATUS and was used to determine fishery flow releases. STATUS was ordered like CUMFLO, with "1" equivalent to "normal or better".

Filter Plant Diversions

Diversions to the Carmel Valley filter plant from the New San Clemente Project were determined monthly based on reservoir storage and cumulative inflow conditions. Storage, in excess of fishery flow requirement for the current and following month, was calculated and allocated for diversion. The maximum diversion (32 acre-feet/day) was reduced by 65% in below normal years and set at the minimum (6 acre-feet/day) under dry and critically dry conditions. For existing and No-Project conditions, annual diversion to the filter plant was specified as 35% of Cal-Am annual demand and was distributed monthly based on a schedule developed by Cal-Am.

Rationing

Rationing requirements were determined monthly based on a comparison of expected system demand and supply. If needed, reductions in demand were specified to forestall and lessen the impacts from severe or sustained drought. The reductions used in CVSIM are shown in Table A-14 and were applied to Cal-Am and non Cal-Am users.

The rationing procedure was designed to maintain selected levels of drought reserve. If the expected system supply fell below the expected demand, rationing was initiated. Three levels of drought reserve were specified and included in the expected system demand. The reserves were expressed as percentages--90%, 40%, 0%--of Cal-Am dry-year demand.

Daily Operations

The daily operations plan was developed principally for the Cal-Am system and consisted of a series of decisions related to the timing and magnitude of reservoir releases and diversions and ground-water pumpage. The plan was designed to:

1) Satisfy and, when possible, augment the proposed steelhead flow requirements, and

2) Satisfy Cal-Am and non Cal-Am demands as frequently as possible, and

3) Maintain system equipment and efficiency.

The daily operations involved an 11-step procedure. The last step in the process was a test to see if the municipal supply and fishery flow requirements had been met. If not satisfied, the procedure was repeated up to six times to correct for the shortages. Each of the steps in the operations procedure for the New San Clemente Project is described below.

1. Pump Seaside coastal subbasin. Cal-Am's initial pumpage is based on an annual production target of 2,500 acre-feet. This value is divided among the months using Cal-Am demand distribution (Table A-6). If a shortage occurs in the Cal-Am system, Seaside production is increased to offset or reduce the deficit.

2. Determine the fishery flow releases at the Narrows and Lagoon.

TABLE A-14

CARMEL VALLEY SIMULATION MODEL

MUNICIPAL DEMAND REDUCTION DUE TO RATIONING

POLICY	DEMAND REDUCTION (%)
No Rationing	0
Voluntary Rationing	10
Mandatory Outdoor Restrictions	25
Mandatory Outdoor and Indoor Restrictions	40

3. Select the controlling fishery flow release. The controlling release is the greater of the two requirements and includes associated conveyance losses. For example, a 5 cfs requirement at the Lagoon that requires a 40 cfs release at the dam is greater than a 20 cfs requirement at the Narrows that requires a 25 cfs release at the dam. Therefore, the 5 cfs requirement is the control and a release of 40 cfs is specified at the dam. The conveyance loss is treated as a fishery flow shortage and is determined by trial and error through the iterations.

4. Increase filter plant diversion to maximum capacity if New San Clemente Reservoir storage exceeds 15,000 acre-feet. This increase overrides the monthly determination and is included to account for large stormflows within a month.

5. Operate Los Padres Reservoir. No diversions are made at Los Padres Reservoir and a constant 5 cfs instream flow release is initially specified. If shortages occur, releases are increased to offset diversions from New San Clemente Reservoir.

6. Operate New San Clemente Reservoir. Make filter plant diversions and river releases based on earlier determinations.

7. Pump Carmel Valley Aquifer Subunit 1. If total storage in Subunit 2 is less than 4,380 acre-feet (approximately 15 feet drawdown), maximize pumping. If storage is greater, limit pumping to maintenance level. The maintenance level was defined as pumping at half capacity for one day each week.

8. Pump Carmel Valley Aquifer Subunit 2. If total storage in Subunit 3 is less than 10,730 acre-feet (approximately 40 feet drawdown) or total storage in New San Clemente Reservoir is less than 10,000 acre-feet, maximize pumping. If both storages are greater, limit pumping to maintenance level.

9. Pump Carmel Valley Aquifer Subunit 3. Calculate remaining Cal-Am demand and distribute demand between Subunits 3 and 4. Subunit 3 is assigned 85% of the remaining demand based on relative pumping capacities. Total pumping from Subunit 3 and 4 is compared with the maximum capacity at the Begonia treatment plant and reduced, if necessary.

10. Pump Carmel Valley Aquifer Subunit 4. Pump specified demand.

11. Determine shortages for Cal-Am system or fishery flow requirements. If shortages occur, add shortage increment to respective requirement and repeat procedure. Maximum number of iterations is currently six.

It should be noted that after each production source was operated, the remaining Cal-Am demand was calculated and a test for over-production was made. If yield exceeded demand, then the last source was reduced accordingly and production from the remaining sources was bypassed.

V. CVSIM ACCURACY

CVSIM was calibrated using two flow periods: 1976-1978 and 1984-1985. The 1976-1978 period was chosen because it represents the critical dry period and includes an above-normal year. The 1984-1985 period was used because it represents a below-normal period and includes pumpage from Cal-Am's four new wells in the lower Carmel Valley subunits. In the calibration, emphasis was placed on the 1976-1978 period. This is the Project design period and, from a water management perspective, accuracy during this period was considered foremost. Observed data were available at two mainstem flow sites--Robles del Rio and near Carmel--and four reservoirs--Los Padres, San Clemente, Carmel Valley Subunit 3, and Carmel Valley Subunit 4. Graphs comparing the observed and simulated values for streamflow near Carmel and storage in Carmel Valley Aquifer Subunit 3 are presented in Figure 5 and 6, respectively.

In general, the results indicated good agreement between the recorded and simulated values, especially for ground-water storage.

Other checks on model accuracy included:

1) Detailed review of the computer codes by District staff and RAMLIT Associates,

2) Automatic daily water balance calculations for each reservoir and aquifer unit, and

3) Optional monthly and annual water balance calculations for the total system.

Figure 5

CARMEL RIVER NEAR CARMEL

Water Years 1976 – 1978

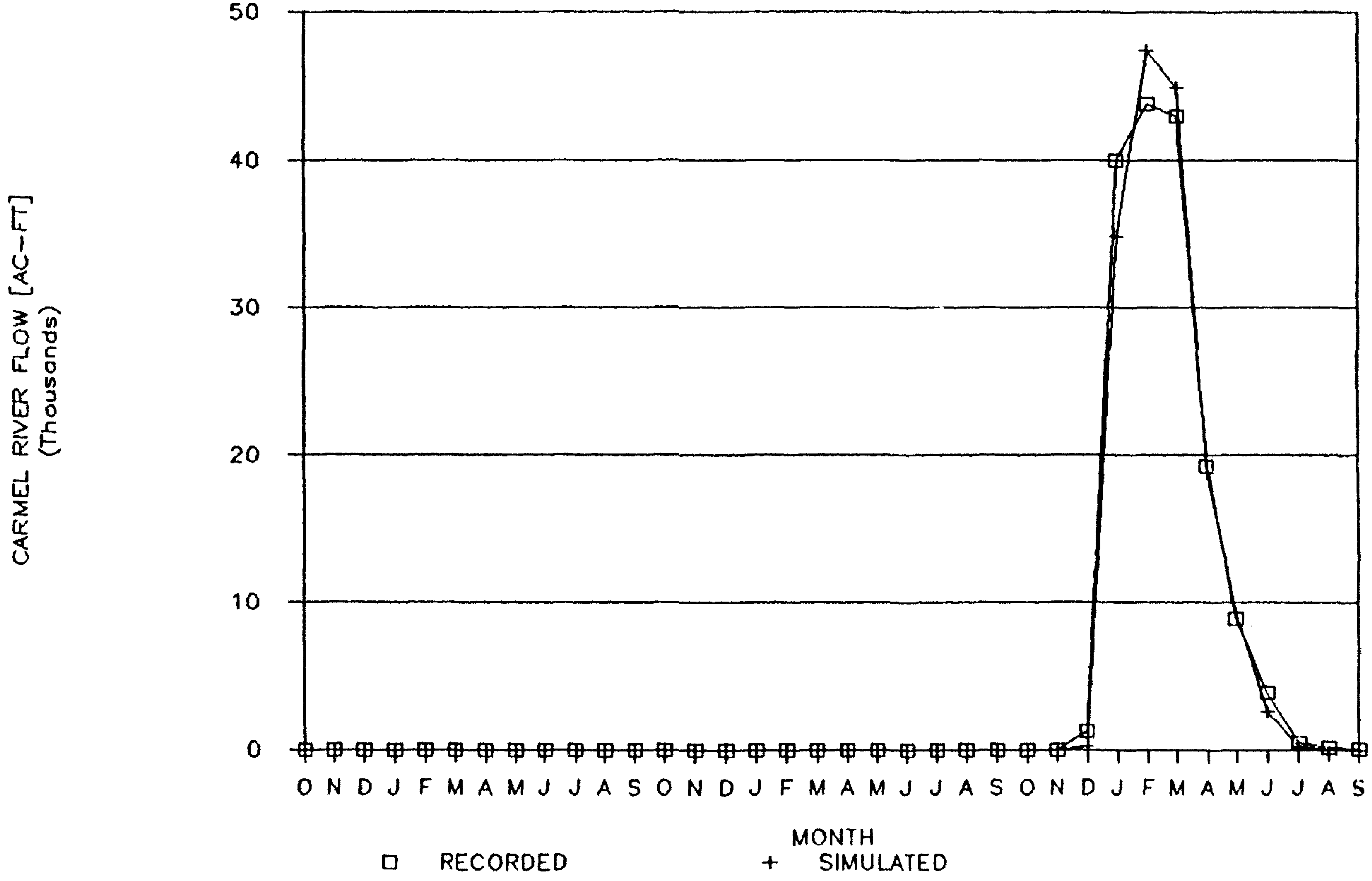
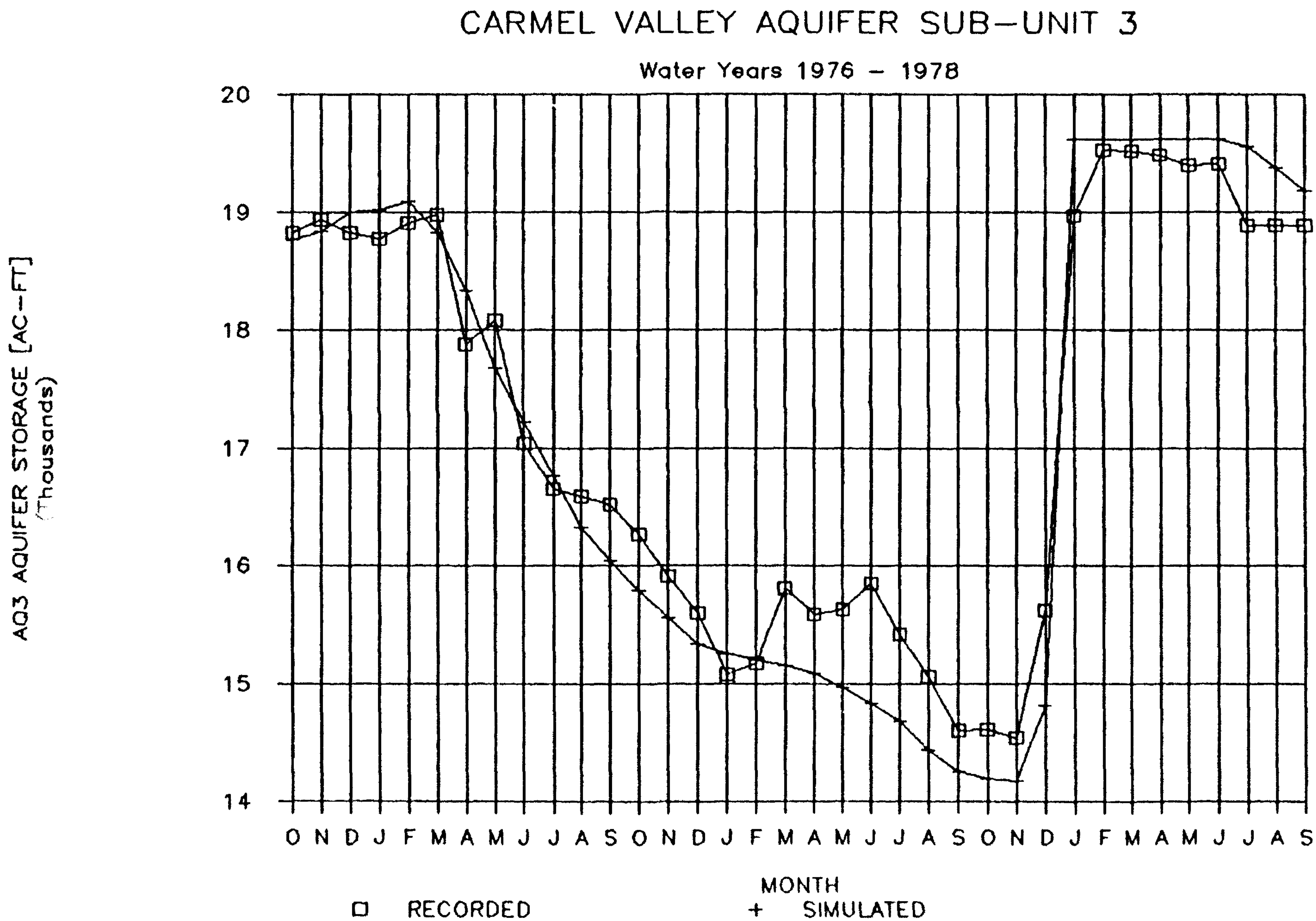


Figure 6



CARMEL VALLEY AQUIFER SUB-UNIT 3
Water Years 1976 - 1978
20
19
18
17
16
15
14
AQ3 AQUIFER STORAGE [AC-FT]
(Thousands)
O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S
MONTH
□ RECORDED
+ SIMULATED

OVERVIEW OF THE CARMEL VALLEY SIMULATION MODEL

ADDENDUM

This addendum updates the information regarding the Carmel Valley Simulation Model (CVSIM) that was presented in Appendix A of the New San Clemente Project Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) that was published in September 1987. The addendum is divided into two sections. In Section I, the major changes made to CVSIM between 1987 and 1990 are discussed. In Section II, specific revisions to the data, assumptions, and procedures used in CVSIM are described.

I. MAJOR CHANGES

Two major changes were made to CVSIM for the Supplemental Draft Environmental Impact Report/Environmental Impact Statement (SDEIR/EIS) for the Monterey Peninsula Water Supply Project. The first change reflected the decision by the District to analyze the performance and impacts of a wider range of water supply alternatives, and involved the development of several new options and alternatives in CVSIM. Several of these alternatives (e.g. San Clemente Creek, Cachagua Creek and Chupines Creek Reservoirs; Carmel Valley and Seaside ground water development; and reservoir dredging) were simulated with CVSIM for the original EIR/EIS analyses. Other alternatives such as New Los Padres Reservoir, Cañada Reservoir, desalination, or new combinations of facilities were developed specifically for the SDEIR/EIS analyses. Each of the water supply alternatives that was simulated by CVSIM for the SDEIR/EIS is listed in Table 1.

The second change centered on the decision by the District to operate all of the water supply alternatives that would either impound or pump excess flow from the Carmel River mainstem according to the bypass logic proposed by the California Department of Fish and Game (CDFG) for evaluating the Cañada Reservoir Project in 1989. CDFG proposed the bypass logic in an effort to minimize active reservoir management and dependence upon humans for upstream and downstream migration flows. Conceptually, the bypass logic is designed to reflect and mimic natural flow conditions to the greatest degree possible. The District incorporated the bypass logic in its project operation to comply with CDFG recommendations and to provide a common basis for comparing project performance and environmental impacts.

Table 1

MONTEREY PENINSULA WATER SUPPLY PROJECT
WATER SUPPLY ALTERNATIVES SIMULATED WITH CVSIM

ALTERNATIVE	REFERENCE
24,000 AF New Los Padres Reservoir	24 NLP
16,000 AF New Los Padres Reservoir with 3 MGD desalination plant	16 NLP/D
9,000 AF New Los Padres Reservoir with 3 MGD desalination plant	9 NLP/D
23,000 AF New San Clemente Reservoir	23 NLP
11,000 AF San Clemente Creek Reservoir with pumped storage	11 SCC
10,500 AF Chupines Creek Reservoir with pumped storage	10 CHU
6,000 AF Cachagua Creek Reservoir with 3 MGD desalination plant	6 CAC/D
25,000 AF Cañada Reservoir	25 CAN
7 MGD desalination plant	7 DSL
No Project	NO PRJ

Note: CVSIM refers to Carmel Valley Simulation Model

II. SPECIFIC REVISIONS

1. <u>CVSIM4 Development</u> -- A separate program code, CVSIM4, was developed to simulate the performance of the Cañada Reservoir Project. CVSIM4 was created to test CDFG's bypass logic at the Cañada diversion site and provide a means to respond to several special modeling requests made by the Cañada Reservoir Project proponent, California-American Water Company (Cal-Am) and its consultants.

2. <u>Ground Water Storage Estimates</u> -- The volume of total and usable ground water storage in the subunit 4 of the Carmel Valley Aquifer and the Seaside Coastal Subbasin were revised based on additional hydrogeologic investigations. Specifically, the usable storage in Carmel Valley Aquifer subunit 4 was increased from 3,088 to 5,000 acre-feet and the usable storage in the Seaside Coastal Subbasin was increased from 4,700 to 7,500 acre-feet.

3. <u>Inflow Record Extension</u> -- The daily streamflow records used as inputs to CVSIM were extended to include Water Years 1988, 1989, and 1990. These records included flows for the Carmel River at Los Padres Reservoir and nine, selected tributaries. The records were extended to include all available data, especially information from the current drought event (i.e. 1987 - 1990).

4. <u>Cal-Am Demand</u> -- "Project" demand for the Cal-Am system was estimated for buildout conditions. Buildout refers to the growth that could legally occur within the District under the General Plans, zoning, and other applicable land use policies of the jurisdictions within the District as of January 1988. Project demand for the Cal-Am system in normal years was estimated to be 23,080 acre-feet of production.

   "No Project" demand for the Cal-Am system in normal years was estimated to be 20,000 acre-feet of production. The No Project demand was based on the District's current allocation for the Cal-Am system (16,744 acre-feet) plus an increase in demand for intensification.

5. <u>Non Cal-Am Demands</u> -- The non Cal-Am demands were revised to take into account recent changes in water well ownership and use and expected conservation savings. Specifically, demand in Carmel Valley Aquifer subunits 1 through 4 in normal years was specified as 89.1, 363.0, 784.7, 948.8 acre-feet, respectively. Non Cal-Am demand in the Seaside Coastal Subbasin in normal years was specified as 1,110 acre-feet and included production from the Fort Ord Coastal Subbasin. The non Cal-Am demands were assumed to be the same under both Project and No Project conditions.

Variable rates of return flow for non Cal-Am pumping in Carmel Valley were assumed, depending on the type of land use in place.

6. Demand Adjustments -- Normal year water use was adjusted for wet, dry, and critically-dry weather conditions based on streamflow conditions. The adjustments were made monthly and in wet years resulted in an eight percent decrease in annual demand, assuming all months were wet during the year. Similarly, a two and one-half percent increase in annual demand was applied for 12 months of dry conditions and a five percent increase was applied for 12 months of critically-dry conditions.

7. Instream Flow Releases -- For the mainstem storage alternatives, releases for instream flows were based on the flow schedule recommended by CDFG for fishery flows near the Highway 1 Bridge over the Carmel River. These flows are shown in Table 2 and include a flow duration, rate, and volume for each portion of the steelhead lifecyle.

   For the tributary storage alternatives, releases for instream flows were based on a flow schedule developed specifically for smaller, off-channel projects. These flows are shown in Table 3 and have similar purposes as those shown for the same periods in Table 2. The flow schedule for the tributary storage projects reflect two key features of these projects. That is, these projects (1) would have relatively limited storage capacity and (2) would not substantially affect high-flow events in the Carmel River mainstem. Accordingly, storage from these projects would be conserved during the high-flow period (January-March) and would be released during the low-flow period (April-December) to satisfy downstream fishery flow requirements.

   For all of the upstream storage projects, except the 9,000 AF New Los Padres/Desalination alternative, releases for instream flows would be augmented with stored water, whenever available. These additional releases would be made to balance surface and ground water storage and to minimize the conveyance losses associated with the bypass flows.

TABLE 2

MINIMUM FISHERY FLOW REQUIREMENTS AT THE HIGHWAY 1 BRIDGE FOR UPPER CARMEL RIVER BASIN MAINSTEM STORAGE PROJECTS

Period	Purpose	Flow		
		Duration (Days)	Rate (Cfs)	Volume (AF)
January-March	Attraction	18	200	7,200
	Spawning, incubation, and migration	72	75	5,800
April-May	Incubation, migration, and rearing	61	20	2,240
June-December	Rearing	214	5	2,200
Total		365		17,440

Source: California Department of Fish and Game, 1986.

Note: These requirements also apply to the 25,000 AF Cañada Reservoir Project

TABLE 3

MINIMUM FISHERY FLOW REQUIREMENTS AT NARROWS AND LAGOON FOR UPPER CARMEL RIVER BASIN TRIBUTARY STORAGE PROJECTS

Period	Flow at Narrows			Flow at Lagoon		
	Duration (Days)	Rate (Cfs)	Volume (Af)	Duration (Days)	Rate (Cfs)	Volume (Af)
January-March	0	0	0	90	5	890
April[1]	0	0	0	30	5	300
				30	**20**	**1,190**
May[1]	0	0	0	31	0	0
				31	**20**	**1,230**
June-December[2]	214	5	2,120	0	0	0
	214	**20**	**8,490**			

Dry-Year Total: 3,310 acre-feet
Wet-Year Total: **11,800** acre-feet

Source: Krebs, 1982

Notes:

1. If usable reservoir storage is greater than 7,000 acre-feet, the fishery flow requirements at the Lagoon are increased as shown in bold type. In CVSIM, the increases are made daily based on current reservoir storage. The volumes shown in bold were calculated assuming that the storage exceeds 7,000 acre-feet every day of the year.

2. If inflow conditions for the water year are projected to be normal or better, the flow requirements at the Narrows are increased as shown in bold type. In CVSIM, inflow conditions are assessed monthly. The volume shown in bold was calculated assuming that inflow conditions were expected to be normal or better every month of the year.

8. Pumping Capacities -- The pumping capacities for Cal-Am's production wells in each aquifer subunit and subbasin were revised to reflect updated conditions and information. Specifically, the 13 percent depreciation factor previously used for the entire Cal-Am system was eliminated and replaced with updated capacity values for each well in the Cal-Am system. These values included an implicit inefficiency value. The revised capacities for Carmel Valley Aquifer subunits 1 through 4 were 2.61, 12.30, 57.53, and 8.84 acre-feet per day, respectively. The revised pumping capacity for Cal-Am's existing production wells in the Seaside Coastal Subbasin was 13.26 acre-feet per day. An additional 13.26 acre-feet per day of capacity was included to represent capacity that will be added to the Cal-Am system in Seaside as new wells are developed (e.g. Paralta). Total pumping capacity for the Cal-Am system from the Seaside Coastal Subbasin is projected to be 26.52 acre-feet per day.

9. Water Treatment Capacity -- The treatment capacity at the Begonia Iron Removal and Water Treatment Plant was revised to 54.0 acre-feet per day. This increase reflects the addition of a new filter at the plant. It should be noted that Cal-Am has corrected its initial estimate of maximum capacity at the Begonia Plant from 54.0 to 55.3 acre-feet per day. This correction was not included in the simulations for the SDEIR/EIS, but has been incorporated into CVSIM for future simulations.

10. Riparian Evapotranspiration -- Evapotranspiration losses due to riparian vegetation along the Carmel River were increased from 600 to 1,310 acre-feet per year based on updated mapping studies.

11. Water Rationing -- This option was not used in the simulations for the SDEIR/EIS.

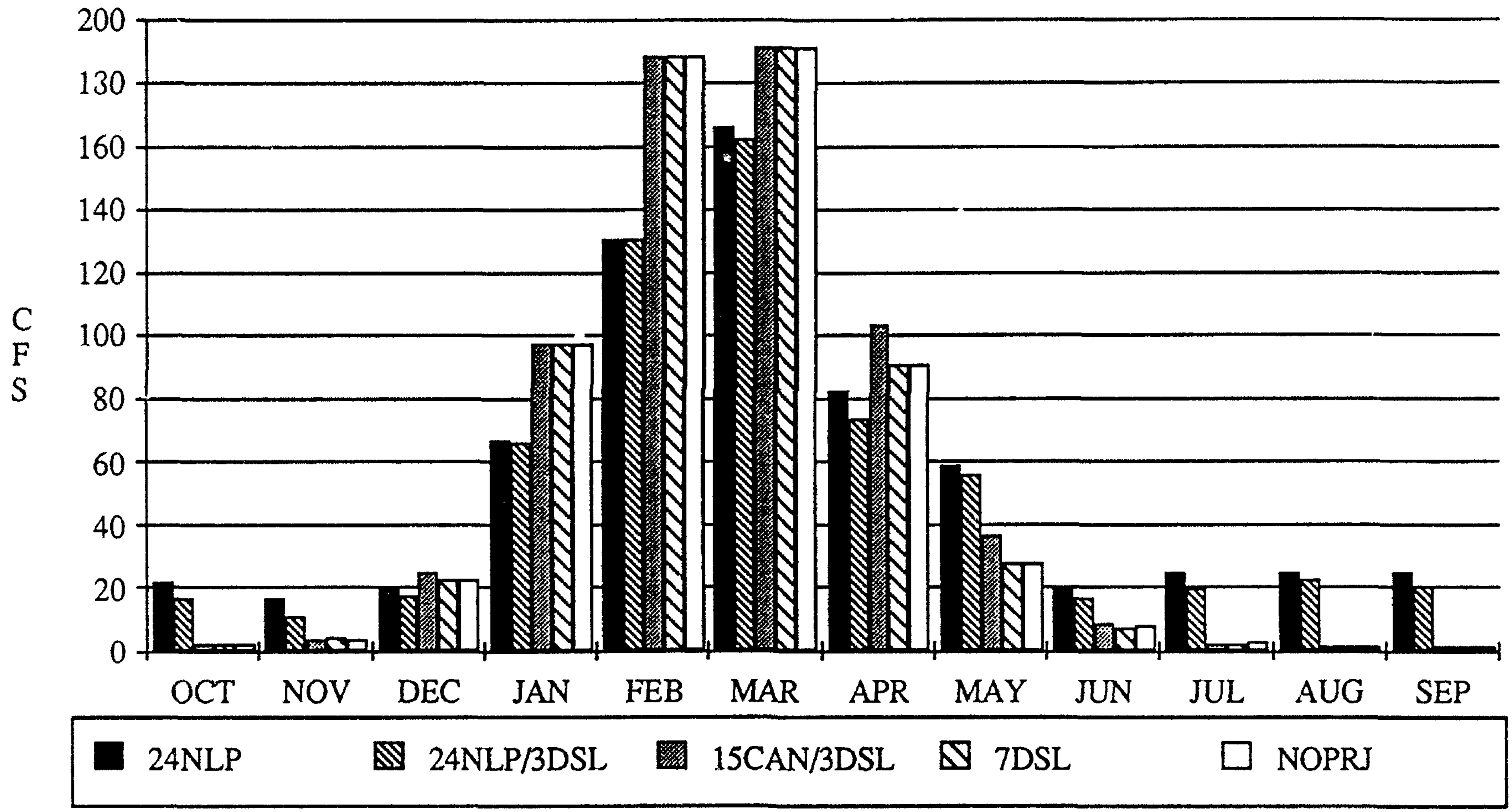
12. Project Operations -- The revised project operations, based on CDFG's bypass proposal, and No Project operations are described in Chapter 4, Description of Projects Analyzed in the EIR/EIS, of the main text.

13. CVSIM Accuracy -- No additional calibration or verification of CVSIM has been made. A rigorous verification and sensitivity study is planned for 1992, based on information gathered during the current drought period (1987 - 1991).

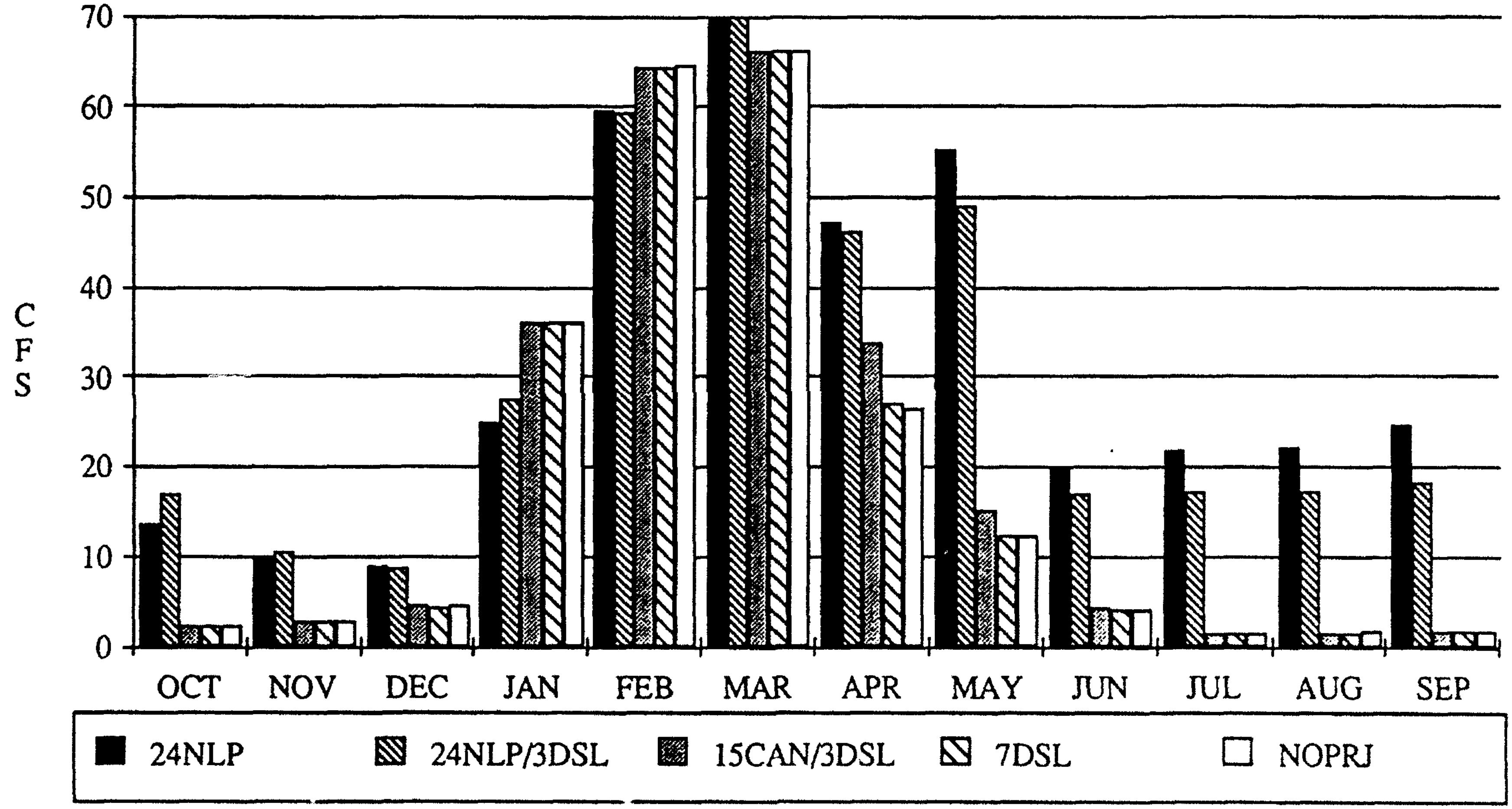
    It should be noted that CVSIM has been used for several studies -- MPWMD's Water Allocation Program EIR, Monterey County's Capital Facilities Study, and Cal-Am's Cañada Reservoir Study. In the course of these studies, CVSIM and its results have been thoroughly reviewed by a number of independent consultants. Several minor revisions and improvements have been suggested and have been or will be incorporated into CVSIM.

APPENDIX 7-A
CARMEL RIVER STREAMFLOW DATA FOR WATER SUPPLY ALTERNATIVES

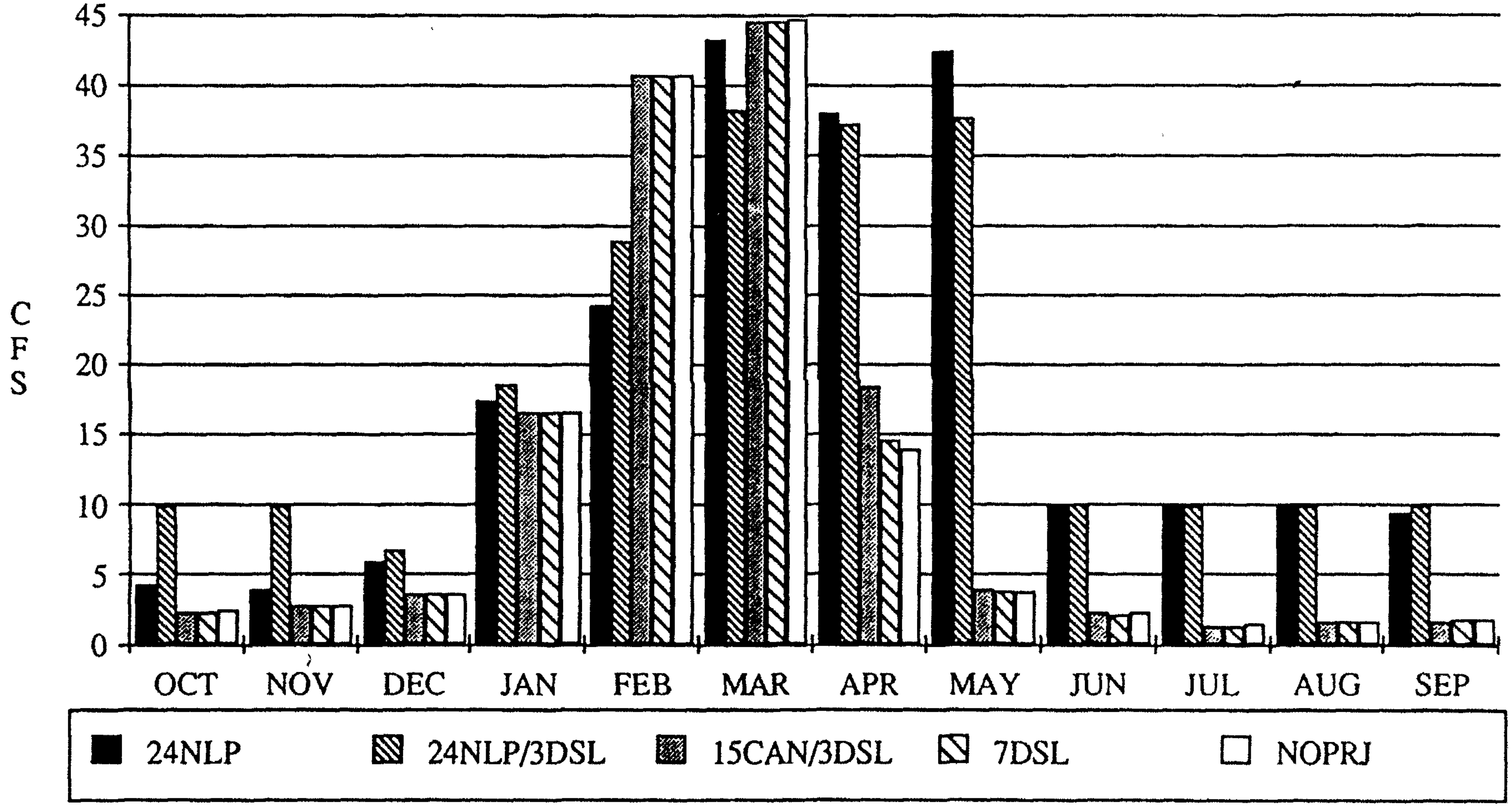
MONTHLY FLOW AT THE NARROWS
50% EXCEEDENCE



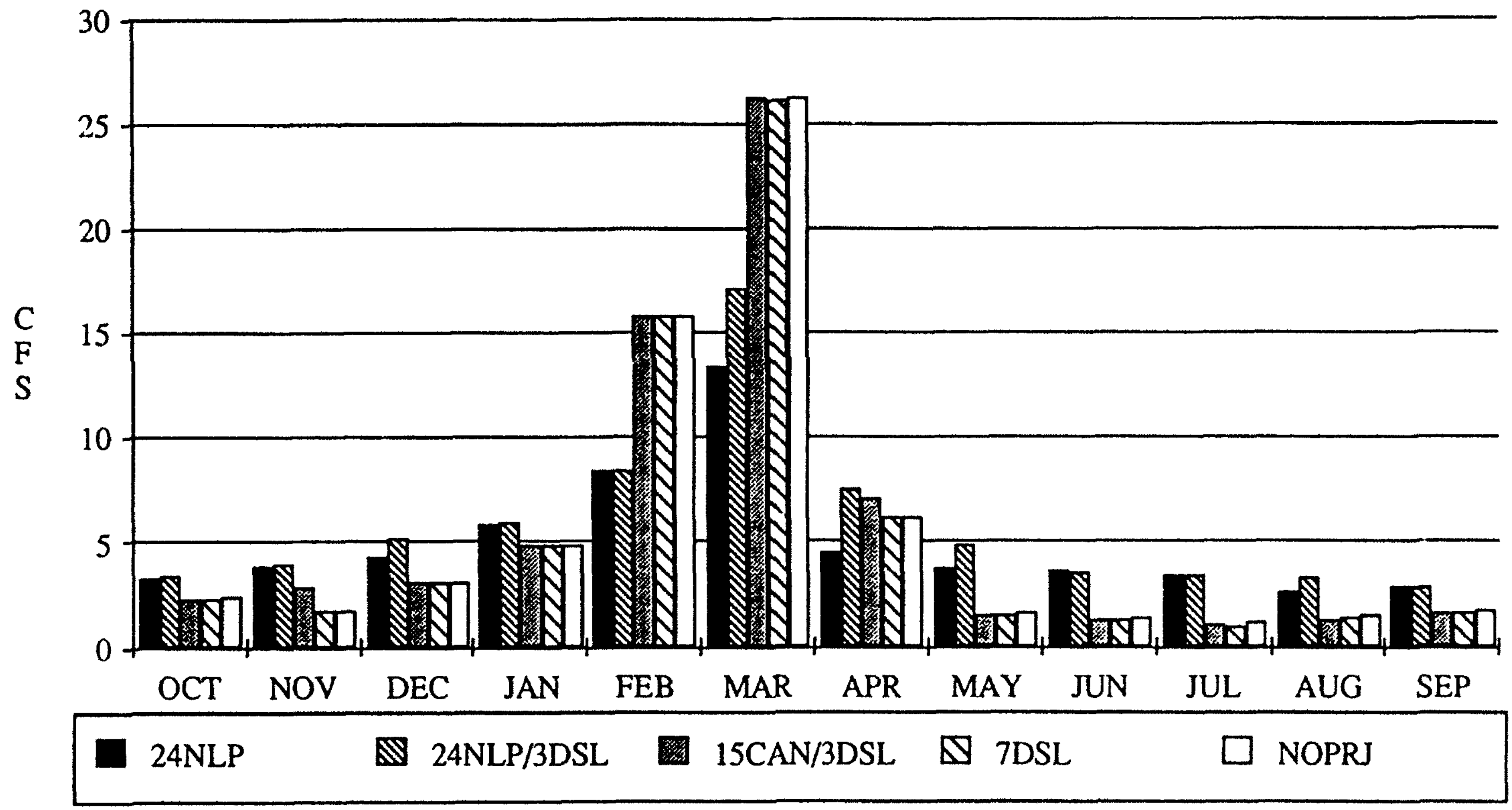
MONTHLY FLOW AT THE NARROWS
75% EXCEEDENCE



MONTHLY FLOW AT THE NARROWS
87.5% EXCEEDENCE



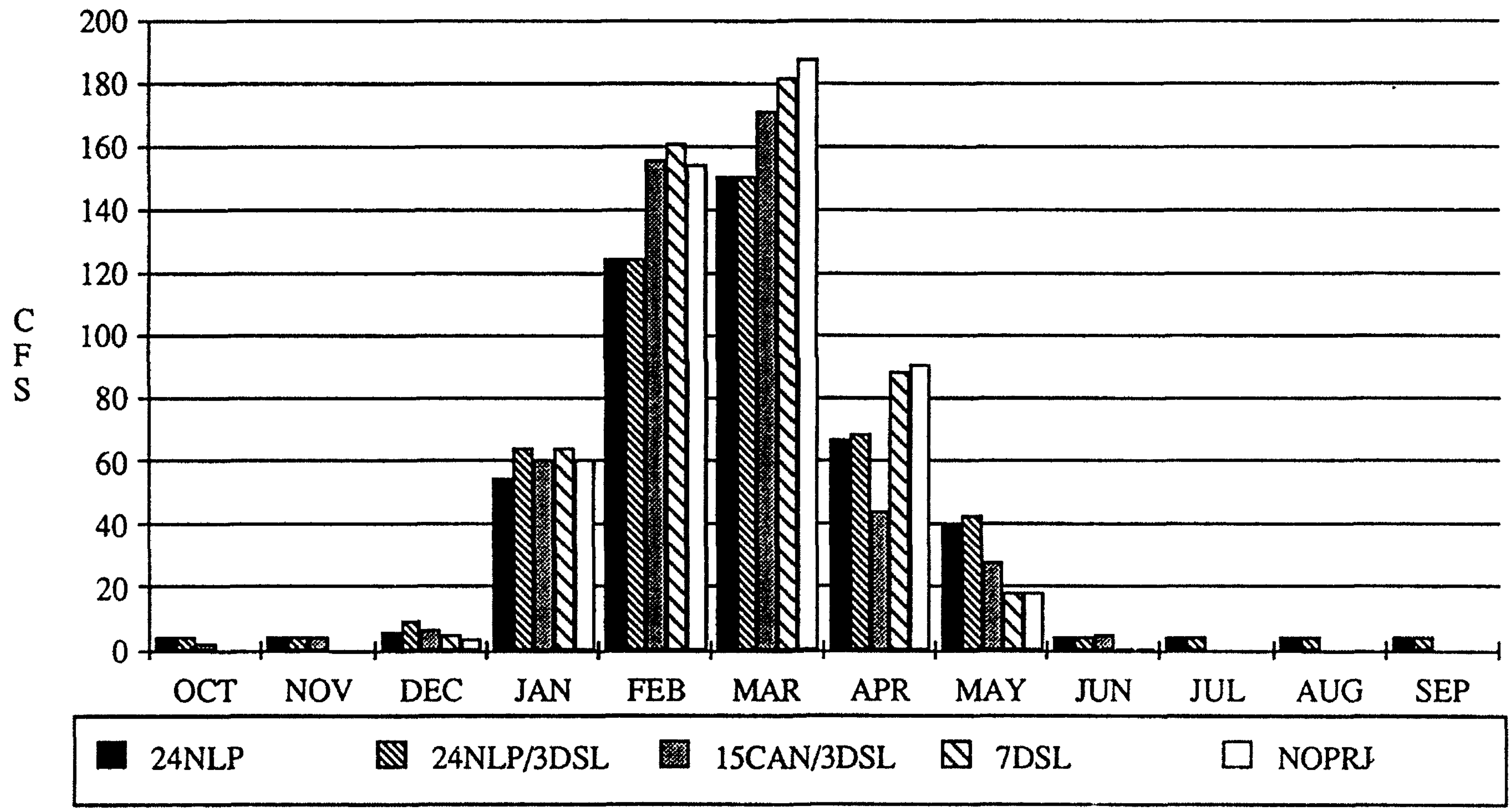
MONTHLY FLOW AT THE NARROWS
95% EXCEEDENCE



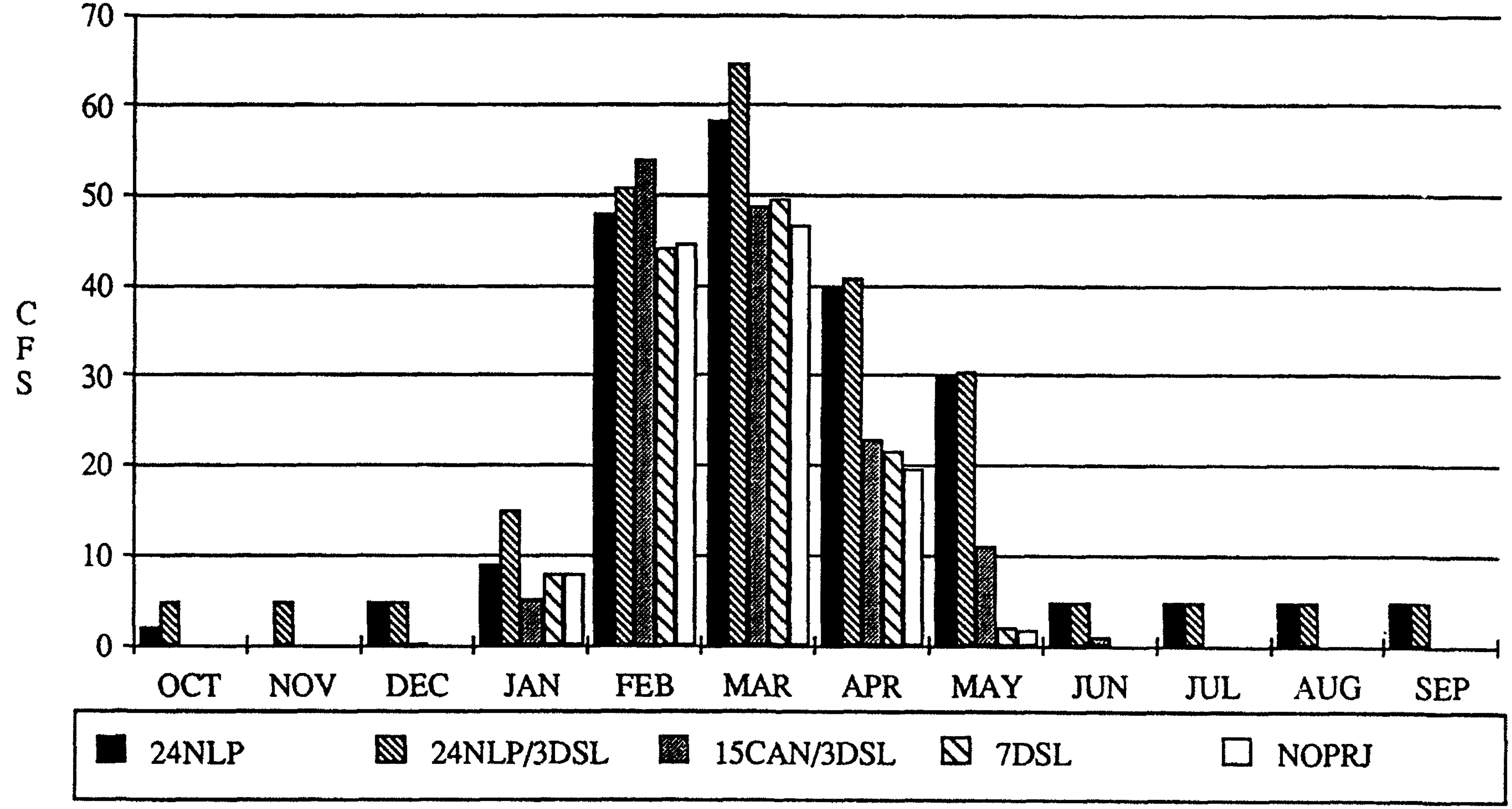
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	*Monthly flow values at Narrows in AF/mo at 50%*							*Monthly flow values at Narrows in AF/mo at 75%*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	1381	1064	159	159	163		OCT	839	1055	147	147	151
6	NOV	1028	682	248	254	250		NOV	595	628	177	177	179
7	DEC	1304	1095	1572	1436	1428		DEC	555	550	283	281	283
8	JAN	4156	4115	6027	6027	6028		JAN	1545	1711	2232	2232	2233
9	FEB	7283	7261	10453	10460	10454		FEB	3322	3306	3580	3580	3586
10	MAR	10208	10012	11752	11752	11754		MAR	4303	4303	4075	4075	4077
11	APR	4950	4422	6164	5419	5422		APR	2814	2749	2026	1615	1582
12	MAY	3633	3449	2295	1727	1730		MAY	3398	3023	938	764	769
13	JUN	1209	1028	547	470	475		JUN	1208	1018	262	252	257
14	JUL	1535	1219	171	170	176		JUL	1355	1062	97	97	102
15	AUG	1545	1405	116	116	121		AUG	1377	1067	104	104	109
16	SEP	1495	1265	115	115	119		SEP	1480	1093	110	110	114
17													
18	AVERAGE	3311	3085	3302	3175	3177		AVERAGE	1899	1797	1169	1120	1120
19													
20	*Monthly flow values expressed as CFS*							*Monthly flow values expressed as CFS*					
21													
22		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ			24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
23	OCT	22	17	3	3	3		OCT	14	17	2	2	2
24	NOV	17	11	4	4	4		NOV	10	11	3	3	3
25	DEC	21	18	26	23	23		DEC	9	9	5	5	5
26	JAN	68	67	98	98	98		JAN	25	28	36	36	36
27	FEB	131	131	188	188	188		FEB	60	60	65	65	65
28	MAR	166	163	191	191	191		MAR	70	70	66	66	66
29	APR	83	74	104	91	91		APR	47	46	34	27	27
30	MAY	59	56	37	28	28		MAY	55	49	15	12	13
31	JUN	20	17	9	8	8		JUN	20	17	4	4	4
32	JUL	25	20	3	3	3		JUL	22	17	2	2	2
33	AUG	25	23	2	2	2		AUG	22	17	2	2	2
34	SEP	25	21	2	2	2		SEP	25	16	2	2	2
35													
36	AVERAGE	55	52	56	53	53		AVERAGE	32	30	20	19	19

	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	*Monthly flow values at Narrows in AF/mo at 87.5%*							*Monthly flow values at Narrows in AF/mo at 95%*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	273	614	147	147	151		OCT	209	214	146	146	150
6	NOV	237	594	173	173	175		NOV	234	237	173	107	108
7	DEC	375	423	226	226	227		DEC	266	324	191	191	193
8	JAN	1080	1150	1027	1027	1028		JAN	363	372	301	301	303
9	FEB	1345	1608	2264	2264	2266		FEB	469	467	881	881	883
10	MAR	2661	2354	2744	2744	2746		MAR	824	1059	1613	1612	1614
11	APR	2266	2214	1100	872	832		APR	273	448	424	373	372
12	MAY	2604	2323	249	236	242		MAY	236	304	99	99	104
13	JUN	594	603	136	127	142		JUN	218	214	84	84	90
14	JUL	614	614	87	87	93		JUL	213	212	69	66	75
15	AUG	614	614	102	103	108		AUG	166	206	85	89	95
16	SEP	567	594	105	108	112		SEP	172	172	102	102	107
17													
18	AVERAGE	1103	1142	697	676	677		AVERAGE	304	352	347	338	341
19													
20	*Monthly flow values expressed as CFS*							*Monthly flow values expressed as CFS*					
21													
22		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ			24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
23	OCT	4	10	2	2	2		OCT	3	3	2	2	2
24	NOV	4	10	3	3	3		NOV	4	4	3	2	2
25	DEC	6	7	4	4	4		DEC	4	5	3	3	3
26	JAN	18	19	17	17	17		JAN	6	6	5	5	5
27	FEB	24	29	41	41	41		FEB	8	8	16	16	16
28	MAR	43	38	45	45	45		MAR	13	17	26	26	26
29	APR	38	37	18	15	14		APR	5	8	7	6	6
30	MAY	42	38	4	4	4		MAY	4	5	2	2	2
31	JUN	10	10	2	2	2		JUN	4	4	1	1	2
32	JUL	10	10	1	1	2		JUL	3	3	1	1	1
33	AUG	10	10	2	2	2		AUG	3	3	1	1	2
34	SEP	10	10	2	2	2		SEP	3	3	2	2	2
35													
36	AVERAGE	18	19	12	11	11		AVERAGE	5	6	6	6	6

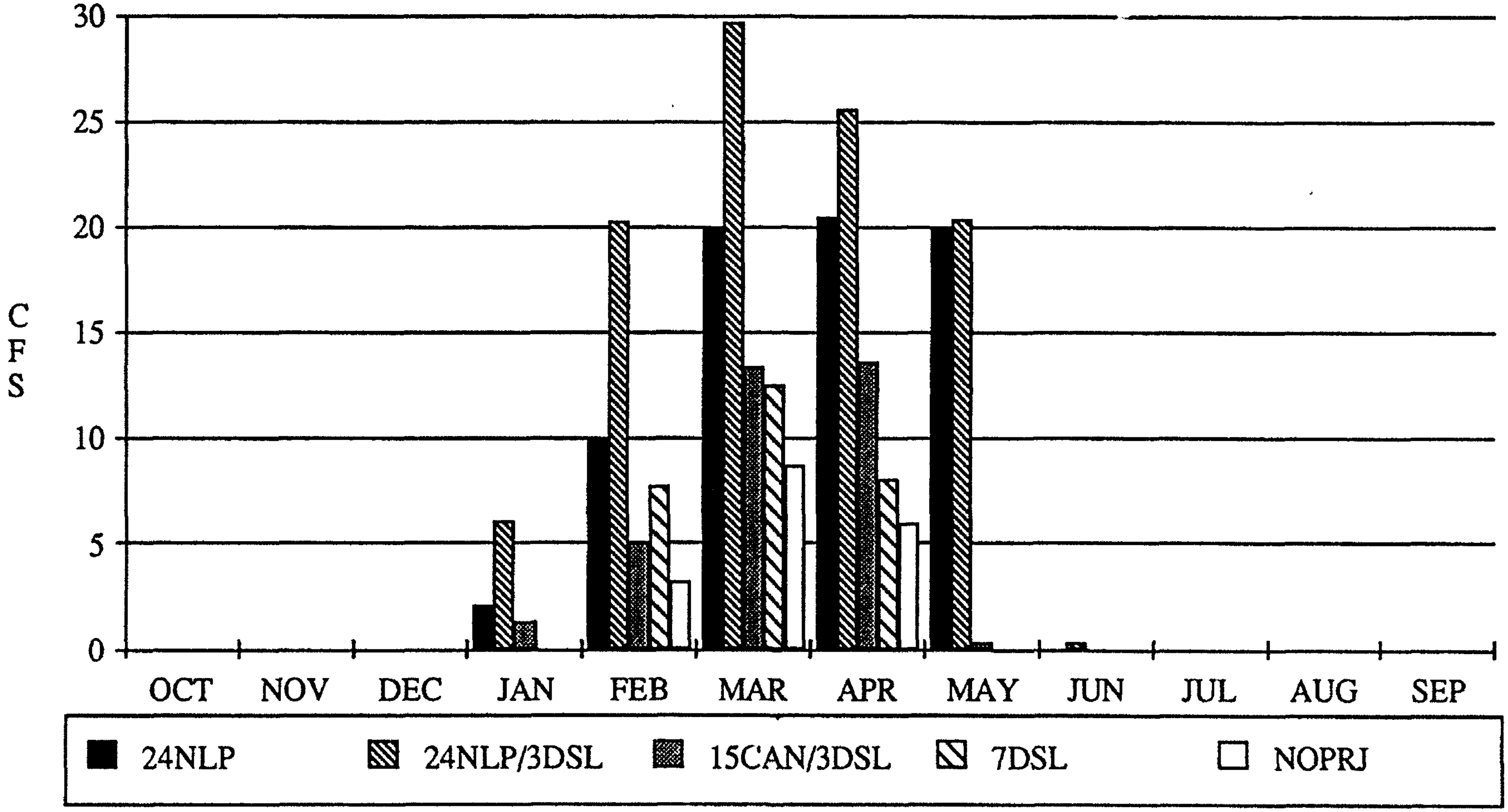
MONTHLY FLOW AT THE LAGOON
50% EXCEEDENCE

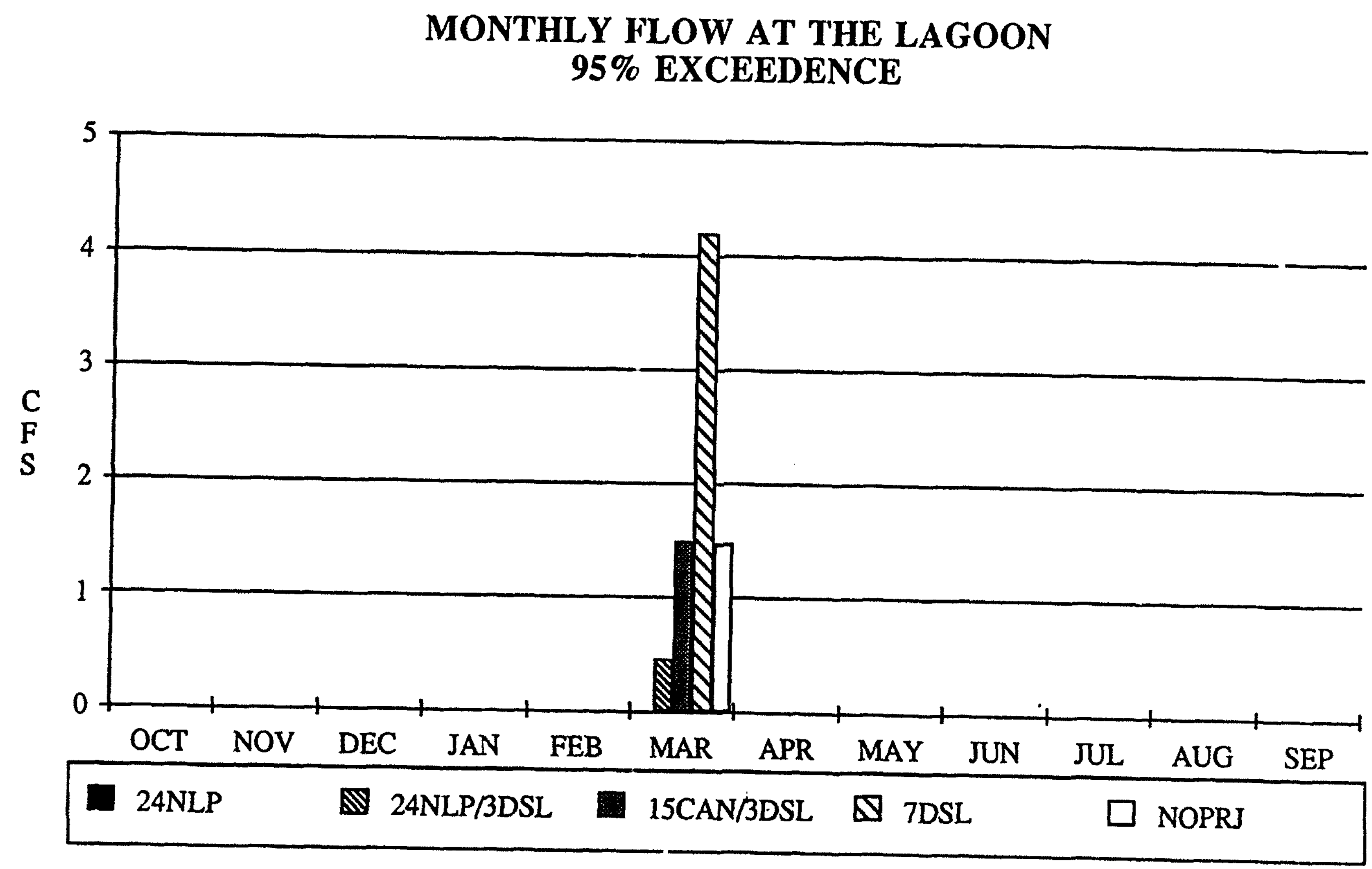


MONTHLY FLOW AT THE LAGOON
75% EXCEEDENCE



MONTHLY FLOW AT THE LAGOON
87.5% EXCEEDENCE

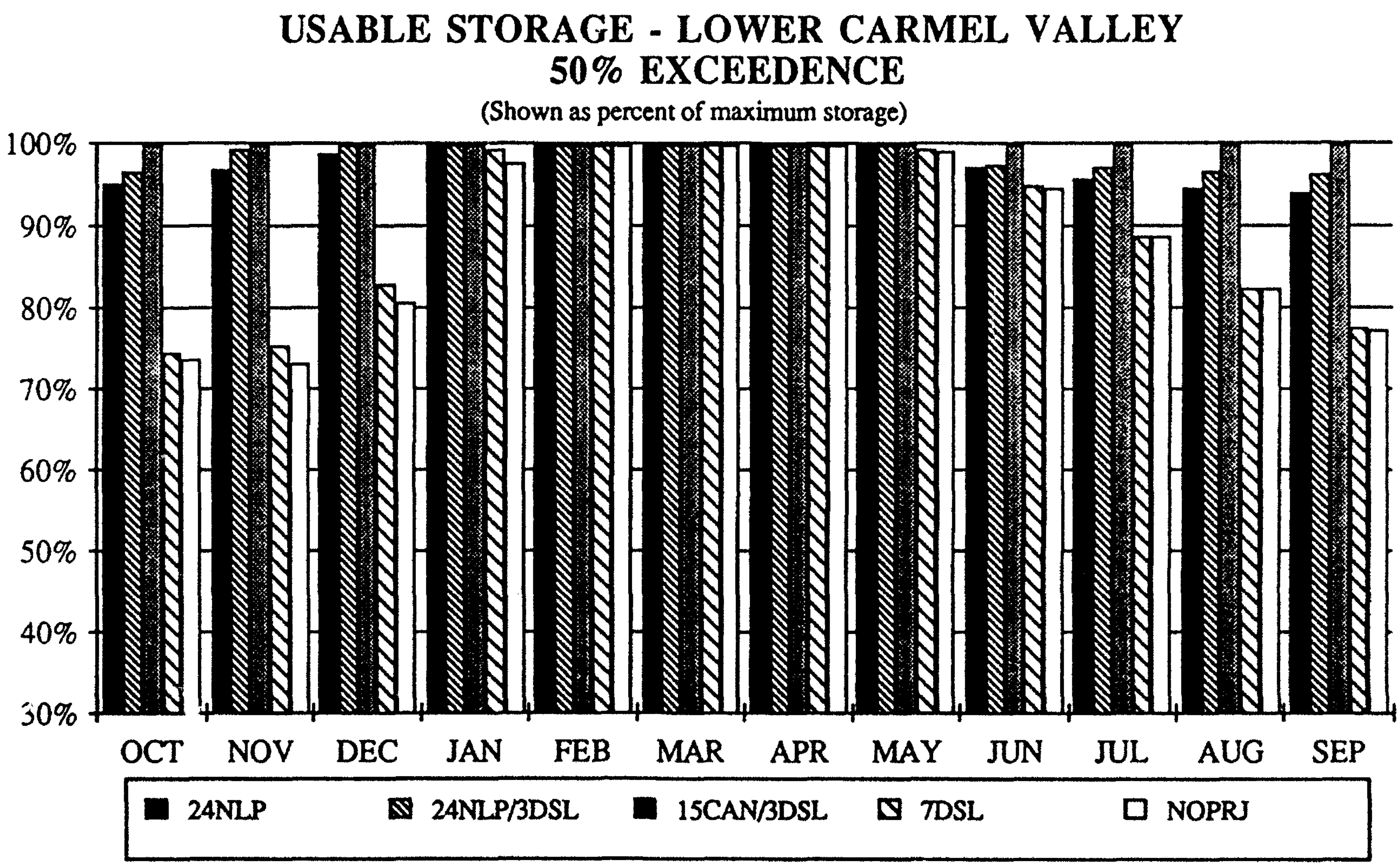


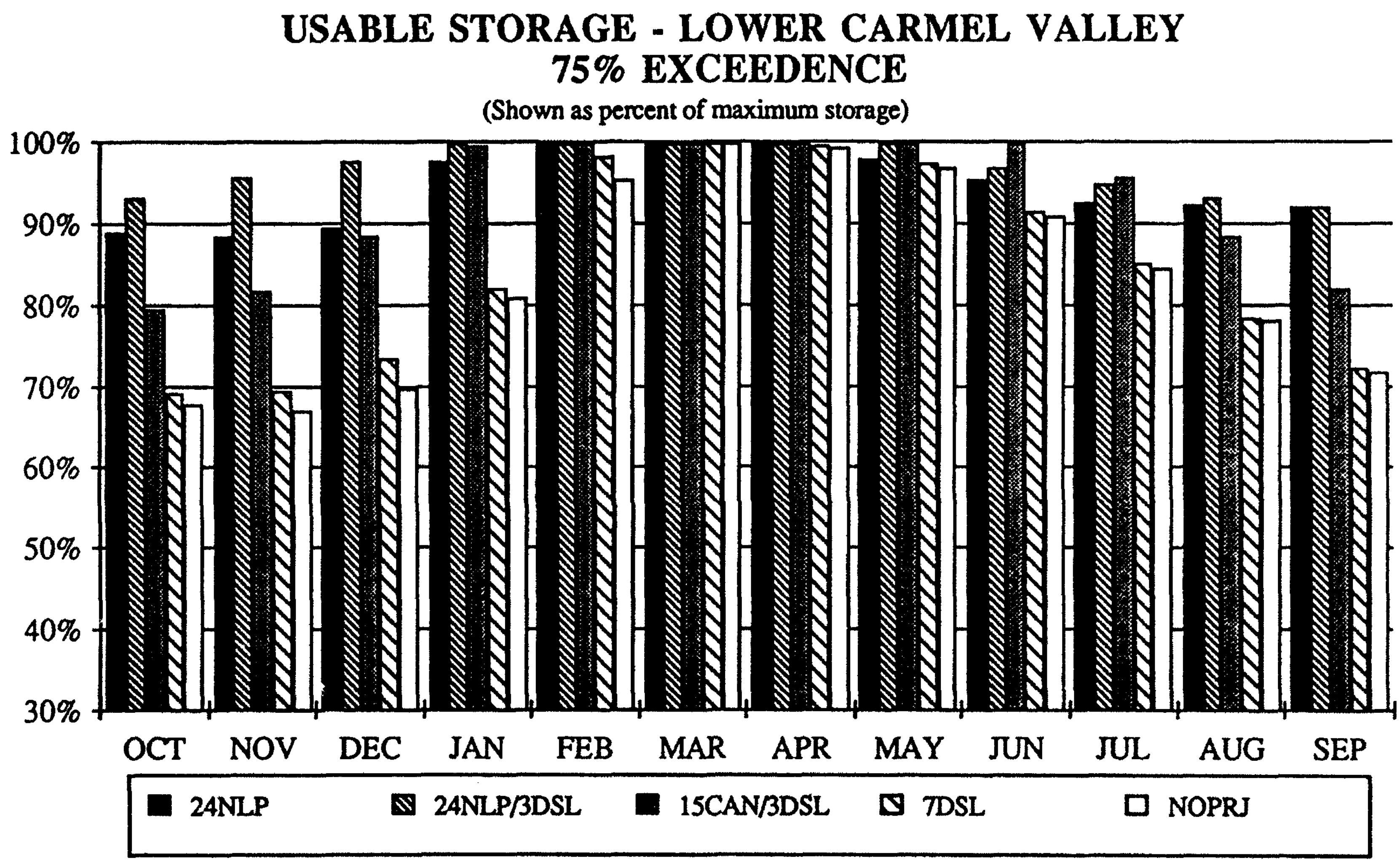

MONTHLY FLOW AT THE LAGOON
95% EXCEEDENCE
C
F
S
0
1
2
3
4
5
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
24NLP
24NLP/3DSL
15CAN/3DSL
7DSL
NOPRJ

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	*Monthly flow values at Lagoon in AF/mo at 50%*							*Monthly flow values at Lagoon in AF/mo at 75%*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	304	304	146	0	0		OCT	138	305	0	0	0
6	NOV	295	295	261	0	0		NOV	0	295	0	0	0
7	DEC	386	602	414	317	228		DEC	305	306	15	0	0
8	JAN	3371	3960	3714	3945	3715		JAN	560	932	315	500	501
9	FEB	6935	6935	8650	8954	8563		FEB	2676	2830	3002	2455	2484
10	MAR	9294	9296	10524	11184	11534		MAR	3602	3978	3014	3058	2885
11	APR	3999	4079	2661	5265	5398		APR	2377	2437	1368	1290	1171
12	MAY	2458	2634	1757	1139	1163		MAY	1847	1876	686	128	116
13	JUN	295	295	304	51	48		JUN	295	295	66	0	0
14	JUL	305	305	35	0	0		JUL	304	304	0	0	0
15	AUG	305	305	0	0	0		AUG	304	304	0	0	0
16	SEP	295	295	0	0	0		SEP	294	294	0	0	0
17													
18	AVERAGE	2354	2442	2372	2573	2554		AVERAGE	1059	1180	706	619	596
19													
20	*Monthly flow values expressed as CFS*							*Monthly flow values expressed as CFS*					
21													
22		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ			24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
23	OCT	5	5	2	0	0		OCT	2	5	0	0	0
24	NOV	5	5	4	0	0		NOV	0	5	0	0	0
25	DEC	6	10	7	5	4		DEC	5	5	0	0	0
26	JAN	55	64	60	64	60		JAN	9	15	5	8	8
27	FEB	125	125	156	161	154		FEB	48	51	54	44	45
28	MAR	151	151	171	182	188		MAR	59	65	49	50	47
29	APR	67	69	45	88	91		APR	40	41	23	22	20
30	MAY	40	43	29	19	19		MAY	30	31	11	2	2
31	JUN	5	5	5	1	1		JUN	5	5	1	0	0
32	JUL	5	5	1	0	0		JUL	5	5	0	0	0
33	AUG	5	5	0	0	0		AUG	5	5	0	0	0
34	SEP	5	5	0	0	0		SEP	5	5	0	0	0
35													
36	AVERAGE	40	41	40	43	43		AVERAGE	18	20	12	10	10
37													

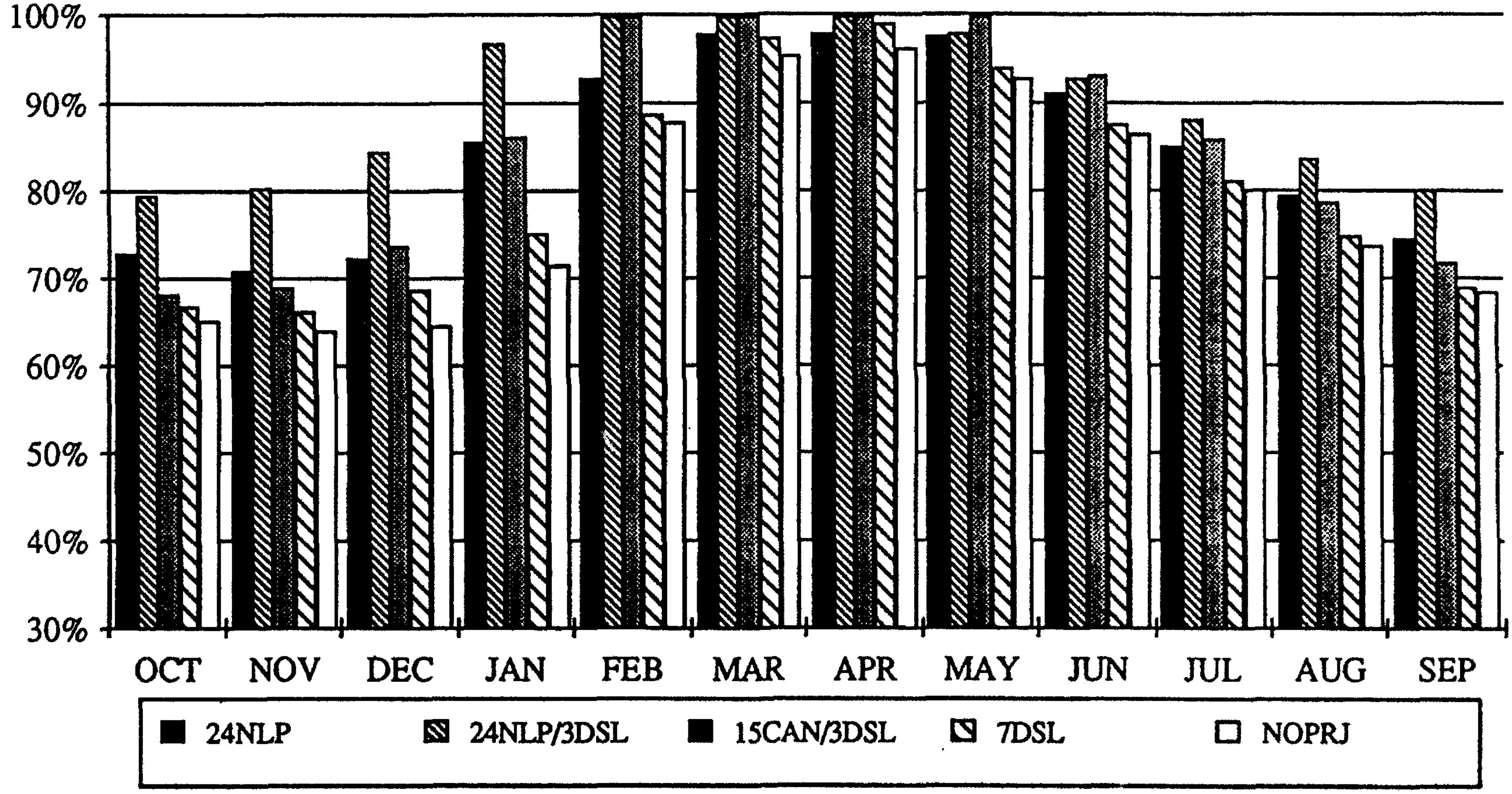
	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	*Monthly flow values at Lagoon in AF/mo at 87.5%*							*Monthly flow values at Lagoon in AF/mo at 95%*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	0	0	0	0	0		OCT	0	0	0	0	0
6	NOV	0	0	0	0	0		NOV	0	0	0	0	0
7	DEC	0	0	0	0	0		DEC	0	0	0	0	0
8	JAN	129	375	86	0	0		JAN	0	0	0	0	0
9	FEB	559	1126	287	429	182		FEB	0	0	0	0	0
10	MAR	1229	1824	829	769	538		MAR	0	29	92	258	91
11	APR	1219	1526	813	484	355		APR	0	0	0	0	0
12	MAY	1230	1255	24	1	0		MAY	0	0	0	0	0
13	JUN	0	21	0	0	0		JUN	0	0	0	0	0
14	JUL	0	0	0	0	0		JUL	0	0	0	0	0
15	AUG	0	0	0	0	0		AUG	0	0	0	0	0
16	SEP	0	0	0	0	0		SEP	0	0	0	0	0
17													
18	AVERAGE	364	511	170	140	90		AVERAGE	0	2	8	22	8
19													
20	*Monthly flow values expressed as CFS*							*Monthly flow values expressed as CFS*					
21													
22		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ			24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
23	OCT	0	0	0	0	0		OCT	0	0	0	0	0
24	NOV	0	0	0	0	0		NOV	0	0	0	0	0
25	DEC	0	0	0	0	0		DEC	0	0	0	0	0
26	JAN	2	6	1	0	0		JAN	0	0	0	0	0
27	FEB	10	20	5	8	3		FEB	0	0	0	0	0
28	MAR	20	30	13	13	9		MAR	0	0	1	4	1
29	APR	20	26	14	8	6		APR	0	0	0	0	0
30	MAY	20	20	0	0	0		MAY	0	0	0	0	0
31	JUN	0	0	0	0	0		JUN	0	0	0	0	0
32	JUL	0	0	0	0	0		JUL	0	0	0	0	0
33	AUG	0	0	0	0	0		AUG	0	0	0	0	0
34	SEP	0	0	0	0	0		SEP	0	0	0	0	0
35													
36	AVERAGE	6	9	3	2	1		AVERAGE	0	0	0	0	0
37													

APPENDIX 7-B
AQUIFER STORAGE DATA
IN LOWER CARMEL VALLEY
FOR WATER SUPPLY ALTERNATIVES

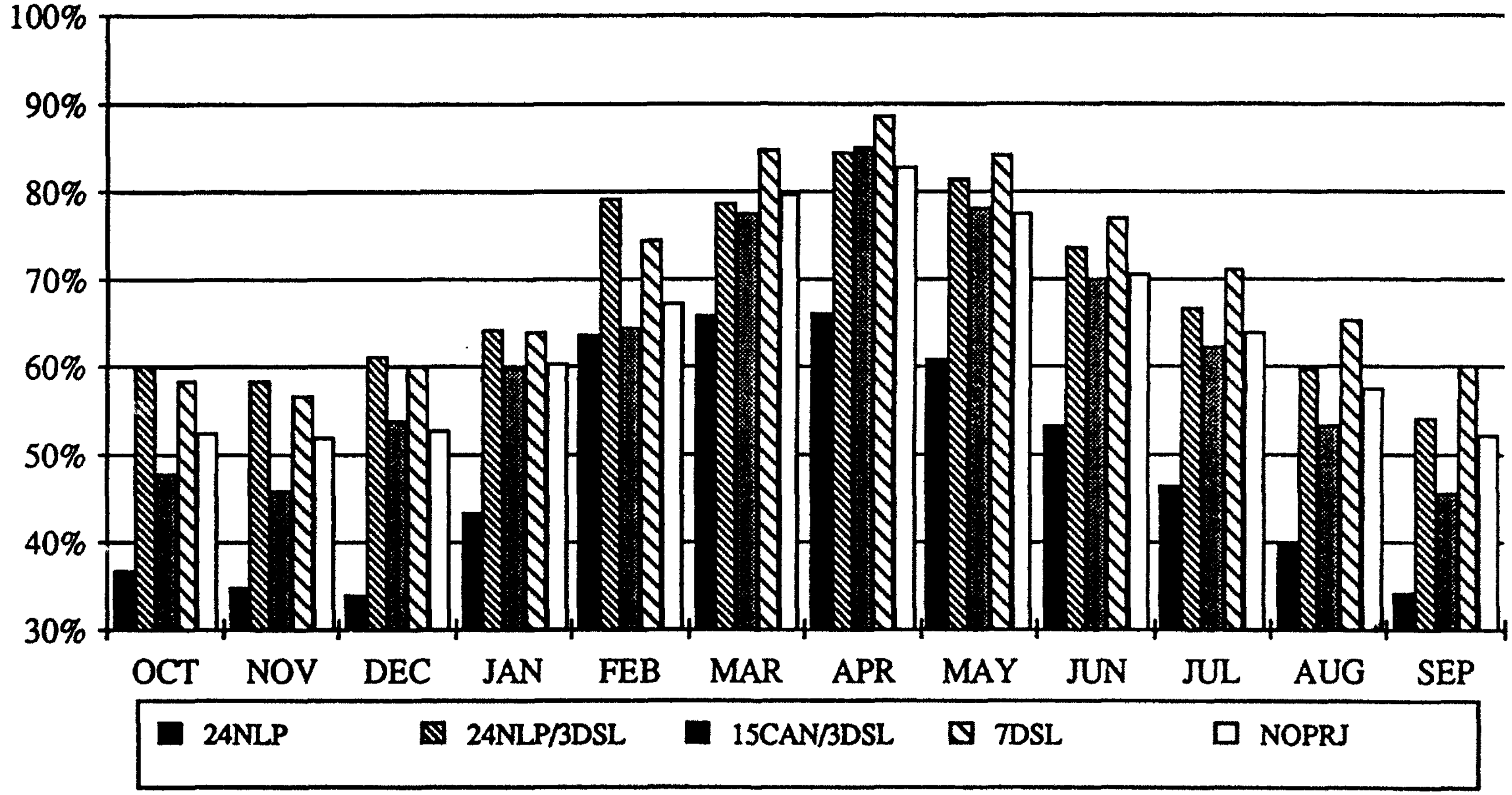

USABLE STORAGE - LOWER CARMEL VALLEY
50% EXCEEDENCE
(Shown as percent of maximum storage)
100%
90%
80%
70%
60%
50%
40%
30%
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
24NLP
24NLP/3DSL
15CAN/3DSL
7DSL
NOPRJ


USABLE STORAGE - LOWER CARMEL VALLEY
75% EXCEEDENCE
(Shown as percent of maximum storage)
100%
90%
80%
70%
60%
50%
40%
30%
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
24NLP
24NLP/3DSL
15CAN/3DSL
7DSL
NOPRJ

USABLE STORAGE - LOWER CARMEL VALLEY
87.5% EXCEEDENCE
(Shown as percent of maximum storage)



USABLE STORAGE - LOWER CARMEL VALLEY
95% EXCEEDENCE
(Shown as percent of maximum storage)



	A	B	C	D	E	F	G	H	I	J	K	L	M
40		50% Exceedance							75% Exceedance				
41													
42	*AQ3 + AQ4 Storage Total*							*AQ3 + AQ4 Storage Total*					
43													
44	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
45													
46	OCT	20849	21176	21927	16384	16151		OCT	19548	20411	17430	15183	14892
47	NOV	21247	21800	21927	16544	16070		NOV	19425	20993	17945	15242	14735
48	DEC	21682	21927	21927	18195	17719		DEC	19664	21393	19387	16091	15333
49	JAN	21917	21927	21927	21753	21396		JAN	21414	21916	21840	17981	17752
50	FEB	21927	21927	21927	21927	21927		FEB	21905	21927	21927	21502	20946
51	MAR	21927	21927	21927	21927	21927		MAR	21927	21927	21927	21927	21927
52	APR	21927	21927	21927	21927	21927		APR	21927	21927	21927	21866	21782
53	MAY	21894	21927	21927	21785	21735		MAY	21485	21927	21927	21364	21222
54	JUN	21262	21374	21927	20782	20754		JUN	20903	21219	21902	20059	19945
55	JUL	20997	21273	21908	19481	19471		JUL	20335	20791	20977	18687	18524
56	AUG	20713	21193	21898	18070	18069		AUG	20229	20417	19427	17231	17125
57	SEP	20618	21136	21908	16999	16938		SEP	20168	20203	17999	15877	15734
58													
59	AVERAGE	21413	21626	21921	19648	19507		AVERAGE	20744	21254	20385	18584	18326
60													
61	*Combined AQ3 + AQ4 Storage as % Max Storage*							*Combined AQ3 + AQ4 Storage as % Max Storage*					
62													
63		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ			24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
64	OCT	95%	97%	100%	75%	74%		OCT	89%	93%	79%	69%	68%
65	NOV	97%	99%	100%	75%	73%		NOV	89%	96%	82%	70%	67%
66	DEC	99%	100%	100%	83%	81%		DEC	90%	98%	88%	73%	70%
67	JAN	100%	100%	100%	99%	98%		JAN	98%	100%	100%	82%	81%
68	FEB	100%	100%	100%	100%	100%		FEB	100%	100%	100%	98%	96%
69	MAR	100%	100%	100%	100%	100%		MAR	100%	100%	100%	100%	100%
70	APR	100%	100%	100%	100%	100%		APR	100%	100%	100%	100%	99%
71	MAY	100%	100%	100%	99%	99%		MAY	98%	100%	100%	97%	97%
72	JUN	97%	97%	100%	95%	95%		JUN	95%	97%	100%	91%	91%
73	JUL	96%	97%	100%	89%	89%		JUL	93%	95%	96%	85%	84%
74	AUG	94%	97%	100%	82%	82%		AUG	92%	93%	89%	79%	78%
75	SEP	94%	96%	100%	78%	77%		SEP	92%	92%	82%	72%	72%
76													
77	AVERAGE	98%	99%	100%	90%	89%		AVERAGE	95%	97%	93%	85%	84%

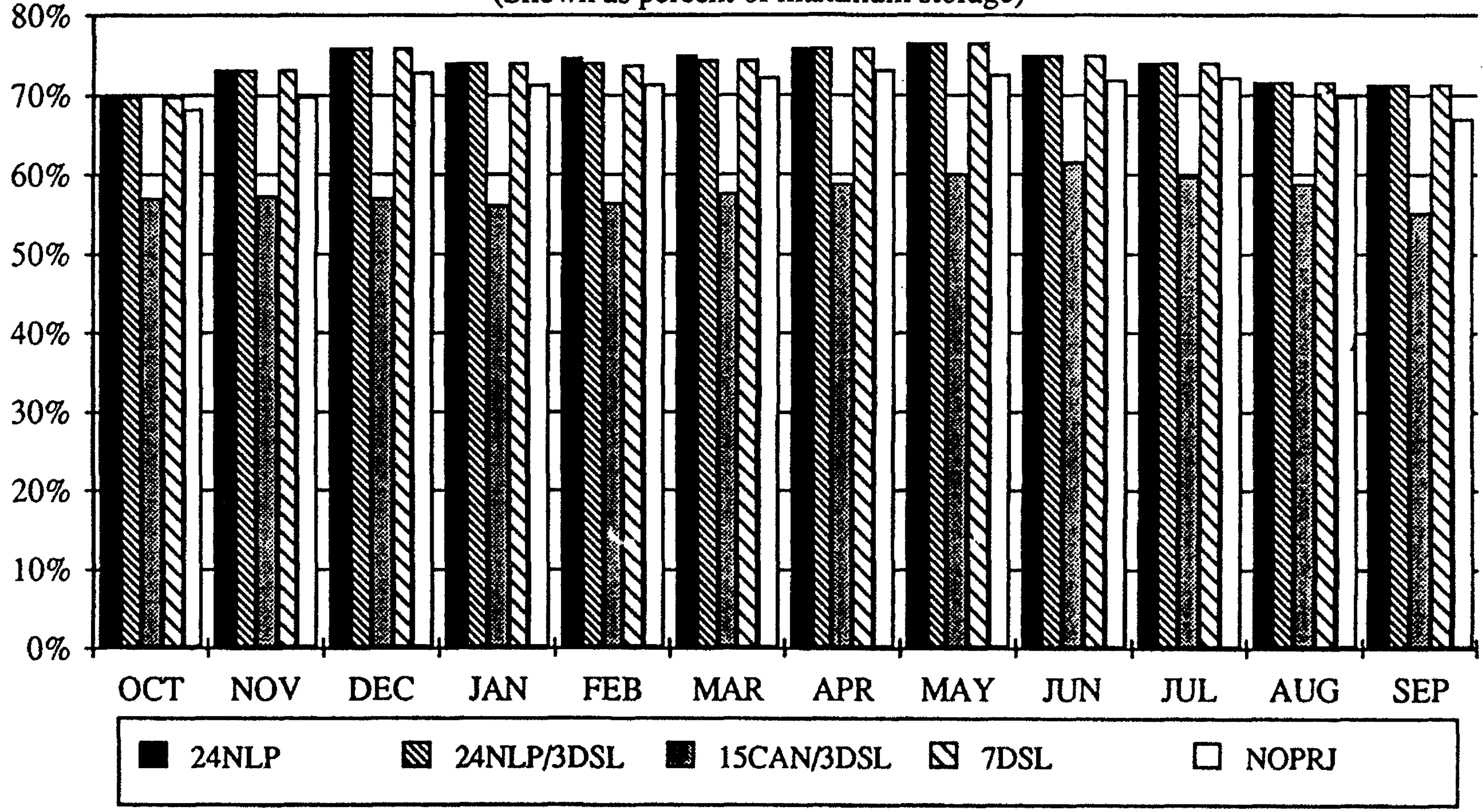
	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
40		87.5% Exceedance							95% Exceedance				
41													
42	*AQ3 + AQ4 Storage Total*							*AQ3 + AQ4 Storage Total*					
43													
44	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
45													
46	OCT	15988	17450	14976	14660	14258		OCT	8077	13168	10497	12795	11556
47	NOV	15571	17626	15165	14539	14023		NOV	7668	12832	10110	12470	11452
48	DEC	15886	18522	16188	15085	14155		DEC	7487	13458	11831	13187	11634
49	JAN	18766	21258	18925	16490	15705		JAN	9539	14116	13129	14062	13260
50	FEB	20405	21927	21889	19491	19294		FEB	13970	17400	14141	16376	14775
51	MAR	21453	21927	21927	21373	20951		MAR	14459	17244	17002	18602	17509
52	APR	21458	21927	21927	21688	21096		APR	14552	18553	18641	19494	18170
53	MAY	21429	21477	21898	20645	20393		MAY	13354	17896	17154	18458	17049
54	JUN	20017	20394	20455	19238	18951		JUN	11721	16197	15374	16909	15513
55	JUL	18681	19360	18853	17792	17556		JUL	10212	14639	13675	15626	14049
56	AUG	17439	18343	17263	16421	16161		AUG	8764	13148	11708	14325	12661
57	SEP	16357	17567	15768	15130	14988		SEP	7507	11891	10018	13201	11494
58													
59	AVERAGE	18621	19815	18770	17713	17294		AVERAGE	10609	15045	13607	15459	14094
60													
61	*Combined AQ3 + AQ4 Storage as % Max Storage*							*Combined AQ3 + AQ4 Storage as % Max Storage*					
62													
63		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ			24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
64	OCT	73%	80%	68%	67%	65%		OCT	37%	60%	48%	58%	53%
65	NOV	71%	80%	69%	66%	64%		NOV	35%	59%	46%	57%	52%
66	DEC	72%	84%	74%	69%	65%		DEC	34%	61%	54%	60%	53%
67	JAN	86%	97%	86%	75%	72%		JAN	44%	64%	60%	64%	60%
68	FEB	93%	100%	100%	89%	88%		FEB	64%	79%	64%	75%	67%
69	MAR	98%	100%	100%	97%	96%		MAR	66%	79%	78%	85%	80%
70	APR	98%	100%	100%	99%	96%		APR	66%	85%	85%	89%	83%
71	MAY	98%	98%	100%	94%	93%		MAY	61%	82%	78%	84%	78%
72	JUN	91%	93%	93%	88%	86%		JUN	53%	74%	70%	77%	71%
73	JUL	85%	88%	86%	81%	80%		JUL	47%	67%	62%	71%	64%
74	AUG	80%	84%	79%	75%	74%		AUG	40%	60%	53%	65%	58%
75	SEP	75%	80%	72%	69%	68%		SEP	34%	54%	46%	60%	52%
76													
77	AVERAGE	85%	90%	86%	81%	79%		AVERAGE	48%	69%	62%	71%	64%

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	*Monthly storage in AQ3 at 50% exceedance*							*Monthly storage in AQ3 at 75% exceedance*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	16164	16487	16927	13081	12894		OCT	15110	15749	13830	12111	11890
6	NOV	16519	16927	16927	13231	12845		NOV	15092	16300	14478	12249	11843
7	DEC	16819	16927	16927	14427	14076		DEC	15255	16611	15608	12983	12459
8	JAN	16917	16927	16927	16753	16506		JAN	16507	16916	16927	14220	13983
9	FEB	16927	16927	16927	16927	16927		FEB	16905	16927	16927	16502	16151
10	MAR	16927	16927	16927	16927	16927		MAR	16927	16927	16927	16927	16927
11	APR	16927	16927	16927	16927	16927		APR	16927	16927	16927	16878	16811
12	MAY	16894	16927	16927	16814	16768		MAY	16485	16927	16927	16529	16424
13	JUN	16348	16460	16927	16081	16051		JUN	15995	16311	16927	15610	15561
14	JUL	16170	16446	16927	15190	15180		JUL	15522	15978	16267	14635	14562
15	AUG	15965	16445	16927	14183	14182		AUG	15501	15684	15126	13568	13568
16	SEP	15932	16450	16927	13478	13422		SEP	15502	15536	14077	12588	12551
17													
18	*Monthly storage in AQ4 at 50% exceedance*							*Monthly storage in AQ4 at 75% exceedance*					
19													
20	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
21													
22	OCT	4685	4689	5000	3303	3257		OCT	4438	4662	3600	3072	3002
23	NOV	4728	4873	5000	3313	3225		NOV	4333	4693	3467	2993	2892
24	DEC	4863	5000	5000	3768	3643		DEC	4409	4782	3779	3108	2874
25	JAN	5000	5000	5000	5000	4890		JAN	4907	5000	4913	3761	3769
26	FEB	5000	5000	5000	5000	5000		FEB	5000	5000	5000	5000	4795
27	MAR	5000	5000	5000	5000	5000		MAR	5000	5000	5000	5000	5000
28	APR	5000	5000	5000	5000	5000		APR	5000	5000	5000	4988	4971
29	MAY	5000	5000	5000	4971	4967		MAY	5000	5000	5000	4835	4798
30	JUN	4914	4914	5000	4701	4703		JUN	4908	4908	4975	4449	4384
31	JUL	4827	4827	4981	4291	4291		JUL	4813	4813	4710	4052	3962
32	AUG	4748	4748	4971	3887	3887		AUG	4728	4733	4301	3663	3557
33	SEP	4686	4686	4981	3521	3516		SEP	4666	4667	3922	3289	3183
34													
35													
36													
37													
38													
39													

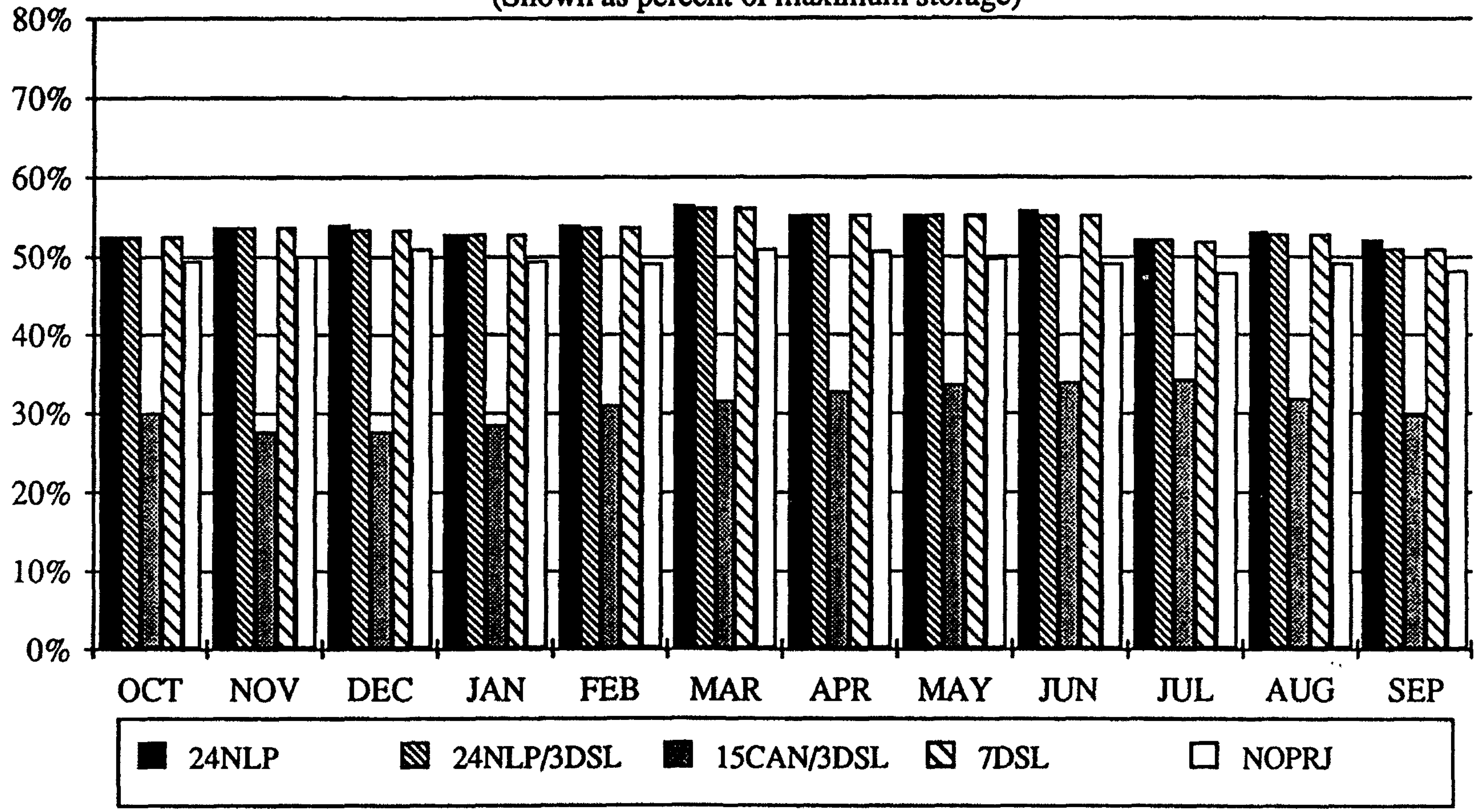
	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	*Monthly storage in AQ3 at 87.5% exceedance*							*Monthly storage in AQ3 at 95% exceedance*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	12873	14282	11836	11825	11509		OCT	7502	10908	9512	10909	10012
6	NOV	12713	14729	12248	11795	11396		NOV	7344	10846	9389	10652	10007
7	DEC	13009	15461	13387	12274	11457		DEC	7233	11713	10803	10993	10025
8	JAN	14922	16689	15174	13164	12545		JAN	8271	11739	11038	11744	11543
9	FEB	15832	16927	16927	15390	15247		FEB	11855	14851	12058	13521	12394
10	MAR	16453	16927	16927	16565	16215		MAR	12323	14964	14213	14936	14260
11	APR	16458	16927	16927	16778	16406		APR	12004	14705	15371	15602	14626
12	MAY	16429	16477	16925	16091	15971		MAY	11011	13709	14284	14911	13850
13	JUN	15371	15724	15801	15099	14914		JUN	9759	12425	12911	13771	12720
14	JUL	14459	15097	14624	14065	13909		JUL	8634	11286	11623	12892	11651
15	AUG	13624	14487	13441	13095	12877		AUG	7554	10196	10048	11964	10627
16	SEP	12918	14088	12322	12143	12065		SEP	6638	9310	8721	11151	9767
17													
18	*Monthly storage in AQ4 at 87.5% exceedance*							*Monthly storage in AQ4 at 95% exceedance*					
19													
20	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
21													
22	OCT	3115	3168	3140	2835	2749		OCT	575	2260	985	1886	1544
23	NOV	2858	2897	2917	2744	2627		NOV	324	1986	721	1818	1445
24	DEC	2877	3061	2801	2811	2698		DEC	254	1745	1028	2194	1609
25	JAN	3844	4569	3751	3326	3160		JAN	1268	2377	2091	2318	1717
26	FEB	4573	5000	4962	4101	4047		FEB	2115	2549	2083	2855	2381
27	MAR	5000	5000	5000	4808	4736		MAR	2136	2280	2789	3666	3249
28	APR	5000	5000	5000	4910	4690		APR	2548	3848	3270	3892	3544
29	MAY	5000	5000	4973	4554	4422		MAY	2343	4187	2870	3547	3199
30	JUN	4646	4670	4654	4139	4037		JUN	1962	3772	2463	3138	2793
31	JUL	4222	4263	4229	3727	3647		JUL	1578	3353	2052	2734	2398
32	AUG	3815	3856	3822	3326	3284		AUG	1210	2952	1660	2361	2034
33	SEP	3439	3479	3446	2987	2923		SEP	869	2581	1297	2050	1727
34													
35													
36													
37													
38													
39													

APPENDIX 7-C
AQUIFER STORAGE DATA IN SEASIDE COASTAL SUBBASIN FOR WATER SUPPLY ALTERNATIVES

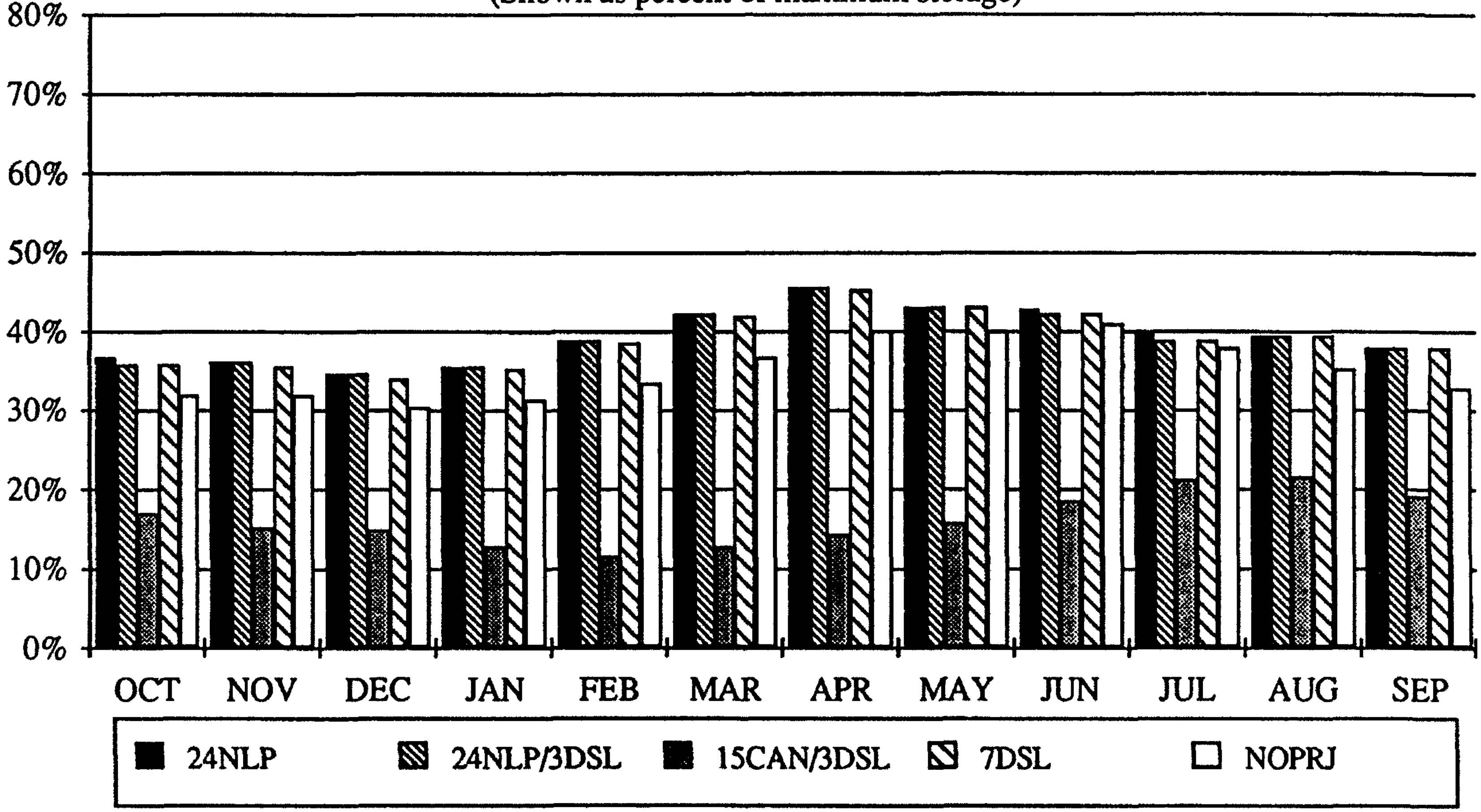
USABLE STORAGE - SEASIDE
50% EXCEEDENCE
(Shown as percent of maximum storage)



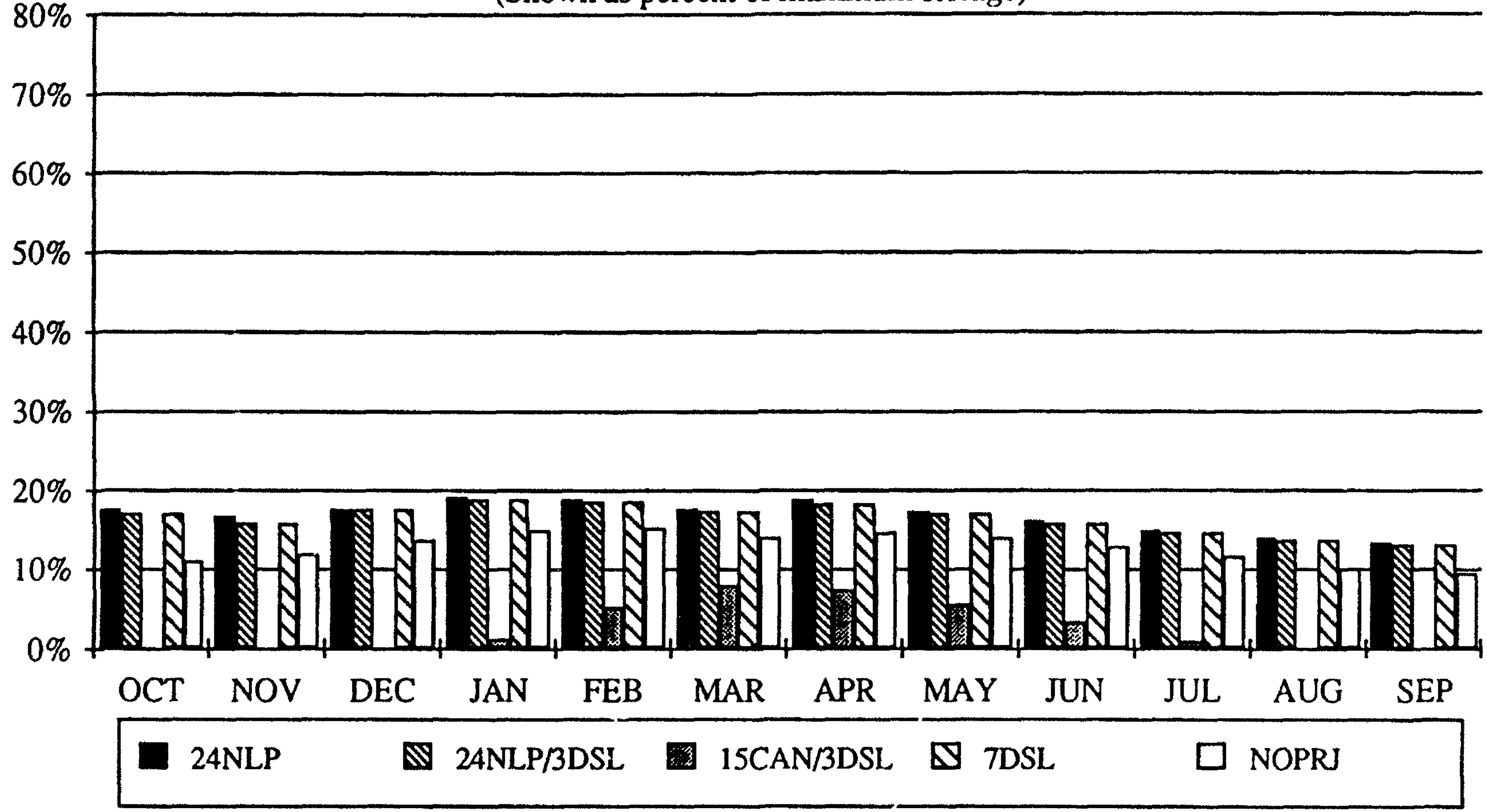
USABLE STORAGE - SEASIDE
75% EXCEEDENCE
(Shown as percent of maximum storage)



USABLE STORAGE - SEASIDE
87.5% EXCEEDENCE
(Shown as percent of maximum storage)



USABLE STORAGE - SEASIDE
95% EXCEEDENCE
(Shown as percent of maximum storage)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	*Monthly storage in Seaside at 50% exceedance*							*Monthly storage in Seaside at 75% exceedance*						
2														
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ	
4														
5	OCT	5239	5240	4285	5240	5140		OCT	3943	3943	2253	3943	3730	
6	NOV	5485	5485	4316	5485	5245		NOV	4031	4031	2078	4031	3755	
7	DEC	5695	5695	4290	5695	5474		DEC	4065	4012	2083	4011	3834	
8	JAN	5554	5554	4229	5554	5361		JAN	3967	3965	2149	3965	3711	
9	FEB	5608	5554	4236	5550	5359		FEB	4058	4041	2339	4041	3704	
10	MAR	5629	5594	4337	5594	5426		MAR	4241	4228	2385	4226	3834	
11	APR	5700	5700	4414	5700	5485		APR	4145	4145	2479	4145	3810	
12	MAY	5751	5750	4509	5748	5439		MAY	4156	4155	2542	4154	3741	
13	JUN	5637	5637	4620	5637	5406		JUN	4208	4163	2558	4163	3708	
14	JUL	5566	5566	4484	5566	5424		JUL	3929	3929	2578	3909	3613	
15	AUG	5387	5382	4417	5382	5235		AUG	3983	3966	2406	3966	3704	
16	SEP	5356	5351	4152	5350	5041		SEP	3917	3823	2233	3823	3633	
17														
18	AVERAGE	5551	5542	4357	5542	5336		AVERAGE	4054	4033	2340	4031	3731	
19														
20	*Seaside Storage as % of Maximum (7500) - 50%*							*Seaside Storage as % of Maximum (7500) - 75%*						
21														
22		24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ	
23	OCT	70%	70%	57%	70%	69%		OCT	53%	53%	30%	53%	50%	
24	NOV	73%	73%	58%	73%	70%		NOV	54%	54%	28%	54%	50%	
25	DEC	76%	76%	57%	76%	73%		DEC	54%	53%	28%	53%	51%	
26	JAN	74%	74%	56%	74%	71%		JAN	53%	53%	29%	53%	49%	
27	FEB	75%	74%	56%	74%	71%		FEB	54%	54%	31%	54%	49%	
28	MAR	75%	75%	58%	75%	72%		MAR	57%	56%	32%	56%	51%	
29	APR	76%	76%	59%	76%	73%		APR	55%	55%	33%	55%	51%	
30	MAY	77%	77%	60%	77%	73%		MAY	55%	55%	34%	55%	50%	
31	JUN	75%	75%	62%	75%	72%		JUN	56%	56%	34%	56%	49%	
32	JUL	74%	74%	60%	74%	72%		JUL	52%	52%	34%	52%	48%	
33	AUG	72%	72%	59%	72%	70%		AUG	53%	53%	32%	53%	49%	
34	SEP	71%	71%	55%	71%	67%		SEP	52%	51%	30%	51%	48%	
35														
36	AVERAGE	74%	74%	58%	74%	71%		AVERAGE	54%	54%	31%	54%	50%	

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	*Monthly storage in Seaside at 87.5% exceedance*							*Monthly storage in Seaside at 95% exceedance*					
2													
3	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
4													
5	OCT	2756	2696	1290	2691	2391		OCT	1327	1288	0	1288	839
6	NOV	2724	2724	1156	2669	2404		NOV	1268	1204	0	1204	898
7	DEC	2611	2611	1127	2557	2283		DEC	1341	1320	0	1320	1033
8	JAN	2677	2677	978	2655	2345		JAN	1438	1417	95	1417	1125
9	FEB	2929	2929	880	2894	2525		FEB	1427	1404	390	1404	1148
10	MAR	3179	3179	972	3144	2769		MAR	1336	1313	611	1313	1049
11	APR	3426	3422	1079	3392	3011		APR	1415	1379	558	1373	1109
12	MAY	3233	3233	1196	3233	3024		MAY	1304	1284	414	1284	1058
13	JUN	3218	3167	1406	3167	3090		JUN	1220	1199	253	1199	963
14	JUL	2983	2919	1614	2919	2848		JUL	1135	1114	82	1114	868
15	AUG	2980	2961	1622	2961	2642		AUG	1050	1029	0	1029	771
16	SEP	2850	2850	1453	2850	2470		SEP	1008	987	0	987	720
17													
18	AVERAGE	2964	2947	1231	2928	2650		AVERAGE	1272	1245	200	1244	965
19													
20	*Seaside Storage as % of Maximum (7500) - 87.5%*							*Seaside Storage as % of Maximum (7500) - 95%*					
21													
22	MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ		MONTH	24NLP	24NLP/3DSL	15CAN/3DSL	7DSL	NOPRJ
23	OCT	37%	36%	17%	36%	32%		OCT	18%	17%	0%	17%	11%
24	NOV	36%	36%	15%	36%	32%		NOV	17%	16%	0%	16%	12%
25	DEC	35%	35%	15%	34%	30%		DEC	18%	18%	0%	18%	14%
26	JAN	36%	36%	13%	35%	31%		JAN	19%	19%	1%	19%	15%
27	FEB	39%	39%	12%	39%	34%		FEB	19%	19%	5%	19%	15%
28	MAR	42%	42%	13%	42%	37%		MAR	18%	18%	8%	18%	14%
29	APR	46%	46%	14%	45%	40%		APR	19%	18%	7%	18%	15%
30	MAY	43%	43%	16%	43%	40%		MAY	17%	17%	6%	17%	14%
31	JUN	43%	42%	19%	42%	41%		JUN	16%	16%	3%	16%	13%
32	JUL	40%	39%	22%	39%	38%		JUL	15%	15%	1%	15%	12%
33	AUG	40%	39%	22%	39%	35%		AUG	14%	14%	0%	14%	10%
34	SEP	38%	38%	19%	38%	33%		SEP	13%	13%	0%	13%	10%
35													
36	AVERAGE	40%	39%	16%	39%	35%		AVERAGE	17%	17%	3%	17%	13%

APPENDIX 8
SPAWNING HABITAT MITIGATION PLAN

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

TECHNICAL MEMORANDUM 90-01

SPAWNING HABITAT MITIGATION PLANS FOR

ALTERNATIVE WATER SUPPLY PROJECTS IN THE CARMEL RIVER BASIN

Prepared By
David H. Dettman
AUGUST 1990

INTRODUCTION

The Monterey Peninsula Water Management District is analyzing the impact of several alternative water supply projects on the steelhead resource in the Carmel River Basin, and preparing preliminary mitigation plans for each alternative. Several alternative projects will inundate or block steelhead spawning habitat. The amount of spawning habitat impacted by construction of projects ranges from zero with Canada Reservoir to about 14,800 square feet with San Clemente Creek Reservoir.

OBJECTIVE

The objectives of this memorandum are: (1) to describe the quantity, quality and location of existing and potential spawning habitat in the Carmel River between the confluence with Tularcitos Creek at rivermile 15.9 (RM 15.9) and Los Padres Dam (RM 23.5); (2) to describe the effects of each water supply alternative on spawning habitat, and (3) to develop mitigation measures for alternatives that inundate or block spawning habitat. The mitigation measures include: an initial placement of spawning sized gravel at specific locations; subsequent injection of gravel at several locations during storm flows; and periodic monitoring of spawning habitat to insure enough is maintained to compensate for losses.

BACKGROUND

The California Department of Fish and Game (CDF&G), the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) will require at least full mitigation for any steelhead spawning habitat inundated or blocked by a water supply project.

In the Carmel River Basin three practicable approaches exist for mitigating the loss of steelhead spawning habitat. First,spawning habitat can be increased by adding gravel to spawning glides where the habitat is limited by insufficient amounts of appropriately sized gravel. Second, in some years, projects with storage above spawning habitat can provide optimum flows which produce the maximum amount of spawning. Third, natural or manmade barriers, which block adults from reaching potential spawning habitat, can be modified to open additional areas for spawning and rearing steelhead.

HYDRAULIC AND SUBSTRATE CONDITIONS INFLUENCING SPAWNING HABITAT

In central coastal California streams adult steelhead usually spawn in "glide habitat", which is the transition between pools and riffles. This portion of the stream is relatively stable during the winter because fine sediment tends to be scoured away and suitable gravel tends to be deposited on ascending and descending flows. Water depth is sufficient to provide space for spawning adults and highly oxygenated water exists for incubating eggs. Yet, velocities are not so high as to sweep adults and eggs downstream. In small tributaries of the Carmel Basin and within some riffles in the mainstem Carmel River, steelhead probably spawn in small pockets of gravel, particularly where large boulders create local conditions that match hydraulic conditions at the transition of pools and riffles.

DISTRIBUTION AND EXTENT OF SPAWNING GLIDES

Kelley and Dettman (1982) mapped the distribution of spawning glides in the mainstem of the Carmel River, downstream of San Clemente Dam, upstream of Los Padres Dam and in portions of Cachagua and Danish Creeks. During spring 1989 the location of spawning glides in the mainstem between San Clemente and Los Padres Dams and several other tributaries were mapped to assess the impacts of the proposed New Los Padres and San Clemente Creek Dams.

Table 1 lists spawning habitat area in the mainstem and in smaller tributaries affected by alternative water supply projects. Figures 1, 2 and 3 illustrate the existing distribution of the principal spawning glides in the mainstem between Los Padres Dam and San Clemente Reservoir and immediately below San Clemente Dam.

LIMITS TO SPAWNING HABITAT

Although adult steelhead can potentially use all glides, the actual spawning habitat is often limited by hydraulic factors (water depth and velocity) and by the extent and size distribution of gravel.

The Relationship Between Spawning Habitat and Streamflow

The streamflow over potential spawning glides influences the quality and quantity of spawning habitat by creating a mosaic of

Table 1. Summary of steelhead spawning habitat measured in 26 reaches of the Carmel River Basin upstream of Tularcitos Creek and estimates of spawning habitat in the Carmel River and selected tributaries upstream of Tularcitos Creek.

STREAM	REACH		Length of Reach (ft) [1]	Portion of Reach Surveyed (ft)	Spawning Habitat Measured in Portion of Stream Surveyed (sqft)	Estimate of Total Spawning Habitat in Reach (sqft)	Potential Number of Steelhead Nests (nos.)	Spawner Index (nos./mi)
Carmel River	The Narrows to Sleepy Hollow		57,750	57,750	45,445	45,445	909	166
	Sleepy Hollow to San Clemente Dam		7,000	5,350	1,864	2,439	49	74
		subtotal	64,750			47,884	958	156
	San Clemente Res. to Pine Creek		10,600	8,122	3,369	4,397	88	88
	Pine Creek to Syndicate Camp		5,350	5,478	2,482	2,482	50	98
	Syndicate Camp to Cachagua Creek		6,300	3,594	1,797	3,150	63	106
	Cachagua Creek to Los Padres Dam		6,300	6,503	722	722	14	24
		subtotal	28,550			10,751	215	80
	Danish Creek to Bluff Camp		7,200	5,171	7,460	10,415	208	306
	Bluff Camp to Bruce Fork		5,900	1,785	1,573	5,199	104	186
	Bruce Fk to trib. above Sulphur Sprgs.		3,850	1,828	2,987	6,291	126	345
	Trib. above Sulphur Spr to trib below Buckskin Camp		5,650	2,733	2,254	4,660	93	174
	Trib. below Buckskin Camp to rightbank trib. above Buckskin		4,350	1,811	6,826	16,396	328	796
	Rightbank trib above Buckskin Camp to trib below Benchmark 1743		4,750	3,234	10,557	15,506	310	689
	Tributary below Benchmark 1743 to Barrier above Ventana Mesa Creek		4,200	489	119	1,022	20	51
		subtotal	35,900			59,489	1,190	350
	Total Mainstem Carmel River		129,200	103,848	87,475	118,124	2,362	193
		(miles)	24.47	19.67				

1 From Dettman and Kelley (1986)

(Table 1. continued)

MILLER FORK	Confluence with Carmel River to meadow ˜ 1 mile upstream	5,150	1,117	137	632	13	26
	Meadow to Clover Basin Camp	5,750	1,908	1,659	5,000	100	184
	Clover Basin Camp to Miller Canyon	2,850	1,503	698	1,324	26	98
	Miller Canyon Camp to probable migration barrier	17,300	1,201	50	720	14	9
	Subtotals Miller Fork Basin	31,050	5,729	2,544	7,675	154	52
	(miles)	5.88	1.09				
DANISH CREEK	Confluence with Carmel River to migration barrier (miles)	9,000 1.70	2,442 0.46	1,386	5,108	102	120
CACHAGUA CREEK	Frc ~ Carmel River to Conejo Creek	24,500	14,011	841	1,471	29	13
	Conejo Creek to Finch Creek	750	680	56	62	1	17
-Finch Creek	From James Creek to Big Creek	10,900	2,405	543	2,461	49	48
-James Creek	From Finch Creek to Lambert Ranch	5,600	451	34	422	8	16
	Subtotals Cachagua Creek Basin	41,750	17,547	1,474	4,416	88	22
	(miles)	7.91	3.32				
SAN CLEMENTE CREEK	San Clemente Reservoir to Trout Pond Dam	9,000	?	?	3,906	78	92
	Trout Pond Reservoir to Black Rock Creek	3,450	2,315	1,005	1,498	30	92
	Confluence with Blk Rk Crk to end of permanent flow	9,750	669	161	2,346	47	51
-Black Rock Creek	Confluence with San Clemente Creek to confluence of North and South Forks	3,450	1,460	410	969	19	59
--No.Fork Black Rock Cr	Confluence with South Fork to permanent barrier at White Rock Dam	12,350	1,494	184	1,522	30	26
	Subtotals San Clemente Creek Basin	38,000			10,241	205	57
	(miles)	7.20					

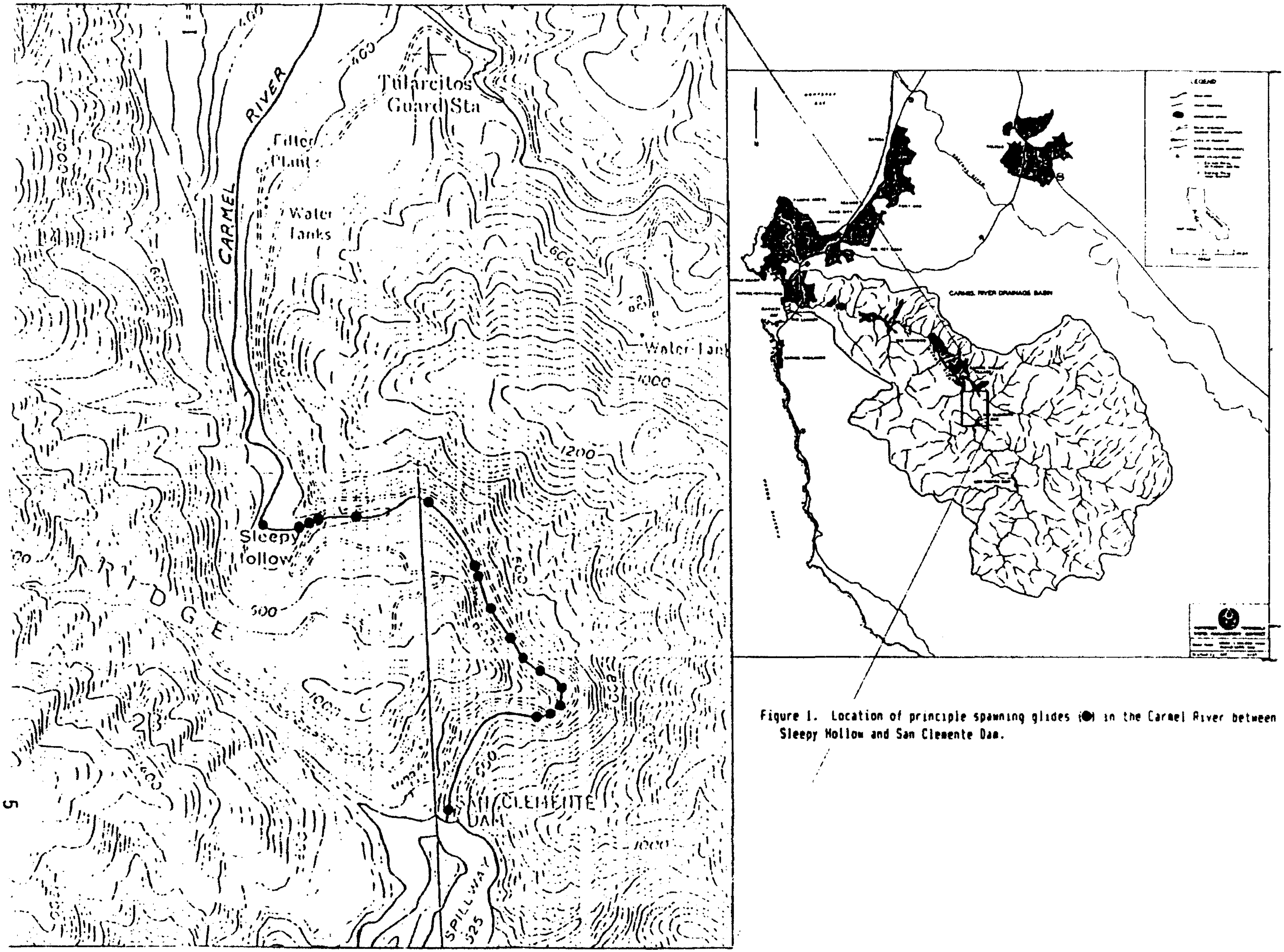


Figure 1. Location of principle spawning glides (●) in the Carmel River between Sleepy Hollow and San Clemente Dam.

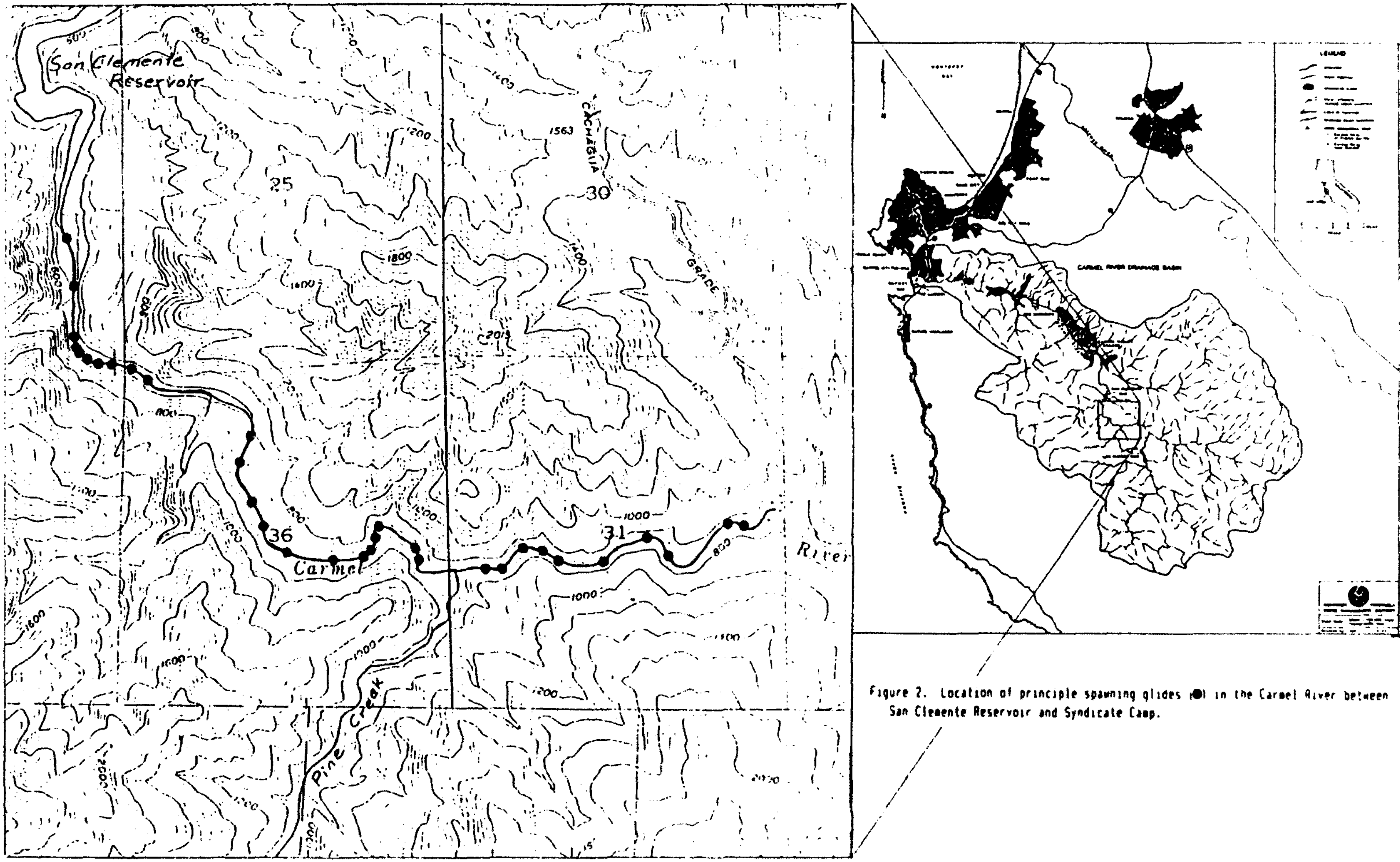


Figure 2. Location of principle spawning glides (●) in the Carmel River between San Clemente Reservoir and Syndicate Camp.

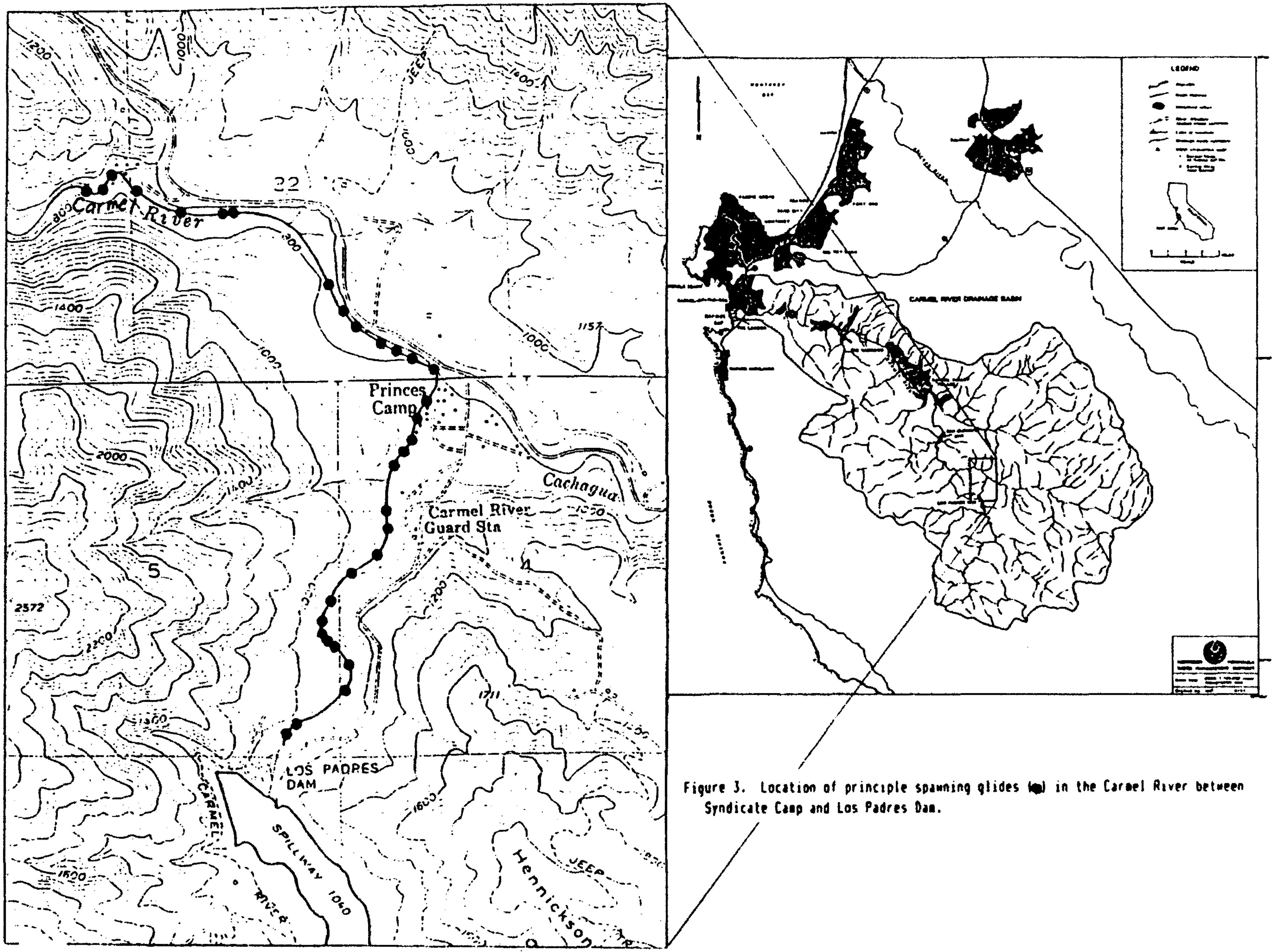


Figure 3. Location of principle spawning glides (●) in the Carmel River between Syndicate Camp and Los Padres Dam.

depths and velocities across the stream channel. Spawning females select an appropriate combination of depth, velocity, and substrate conditions which allow them to construct and nest. As flows change, a greater or less portion of the channel is covered with the appropriate combination of depth, velocity, and suitably sized gravel.

The influence of streamflow on spawning habitat in the Carmel River was studied by Nakaji (1980), Kelley and Dettman (1986), and Alley, Hoefler and Mori (1990). Nakaji (1980) applied the USFWS Instream Flow Incremental Method (IFIM) in two reaches of the river below San Clemente Dam and estimated Weighted Usable Spawning Area (WUA) at flows ranging from 30 to 400 (Figure 4). Based on this study the USFWS recommended a flow of 200 cfs during the January through March period to provide near maximum spawning habitat.

Dettman and Kelley (1986) developed criteria for evaluating spawning habitat, based on observations of spawning steelhead, and applied an alternative method for evaluating the influence of streamflow. They estimated the square footage of spawning habitat in the mainstem between the Narrows and San Clemente Dam at flows ranging from 40 to 150 cfs (Figure 5). Based on this study Dettman and Kelley concluded that a flow of 75 cfs during the January through March period would provide spawning habitat for 200 female steelhead, habitat for incubating eggs, and enough swim-up fry to fully seed the river below San Clemente Dam with young-of-the-year.

Alley, Hoefler, and Mori (1990) applied the USFWS IFIM to the Carmel River between San Clemente and Los Padres Reservoirs and estimated WUA in three reaches at flows ranging from 5 to 200 cfs (Figure 6). This study indicates at least 90 percent of maximum amount of spawning habitat in the Carmel River between the dams is produced at flows ranging from 90 to 135 cfs. The results indicate the optimum spawning flow is about 120 cfs, but that only one-third of the potential spawning habitat is produced at the optimum flow because the streambed is too coarse.

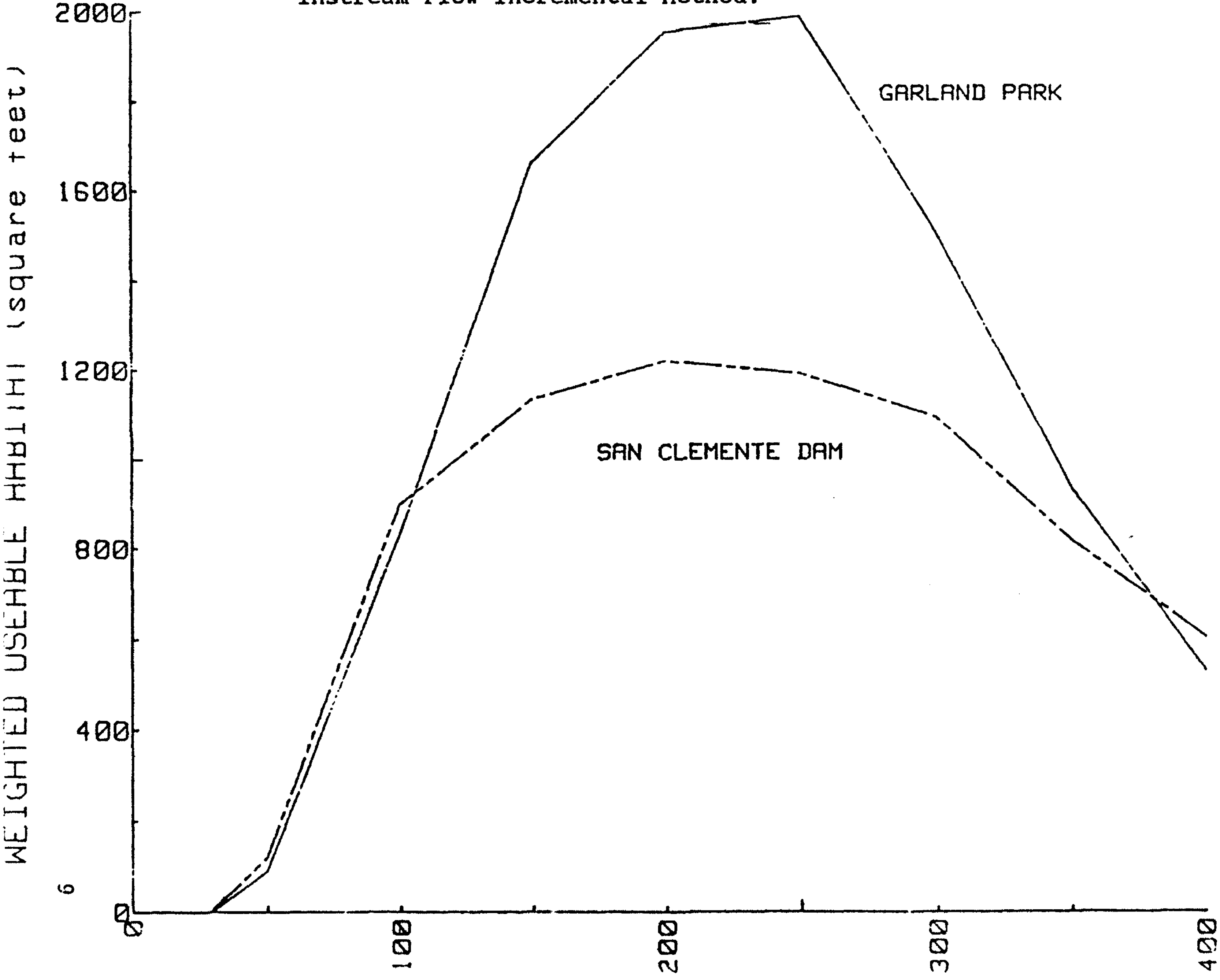
The Influence of Substrate Conditions On Spawning Habitat

The depth and velocity of water over glides can be within suitable ranges, yet steelhead do not use the glide for spawning, or only use a portion of the glide. Common reasons for this are that the size of gravel is outside suitable limits and that insufficient gravel is available to fully cover the bottom of the stream. Both of these problems occur in the Carmel River, particularly below Los Padres and San Clemente Dams where the recruitment of spawning gravel has been blocked by the existing dams.

Size of Suitable Gravel

Dettman and Kelley (1986) investigated the size of gravel utilized by steelhead by sampling undisturbed gravel immediately

Figure 4. Relationship between Weighted Useable Spawning Habitat Area and streamflow in the Carmel River at Garland Park and below San Clemente Dam. From Nakaji (1982) and based on application of the United States Fish and Wildlife Service Instream Flow Incremental Method.



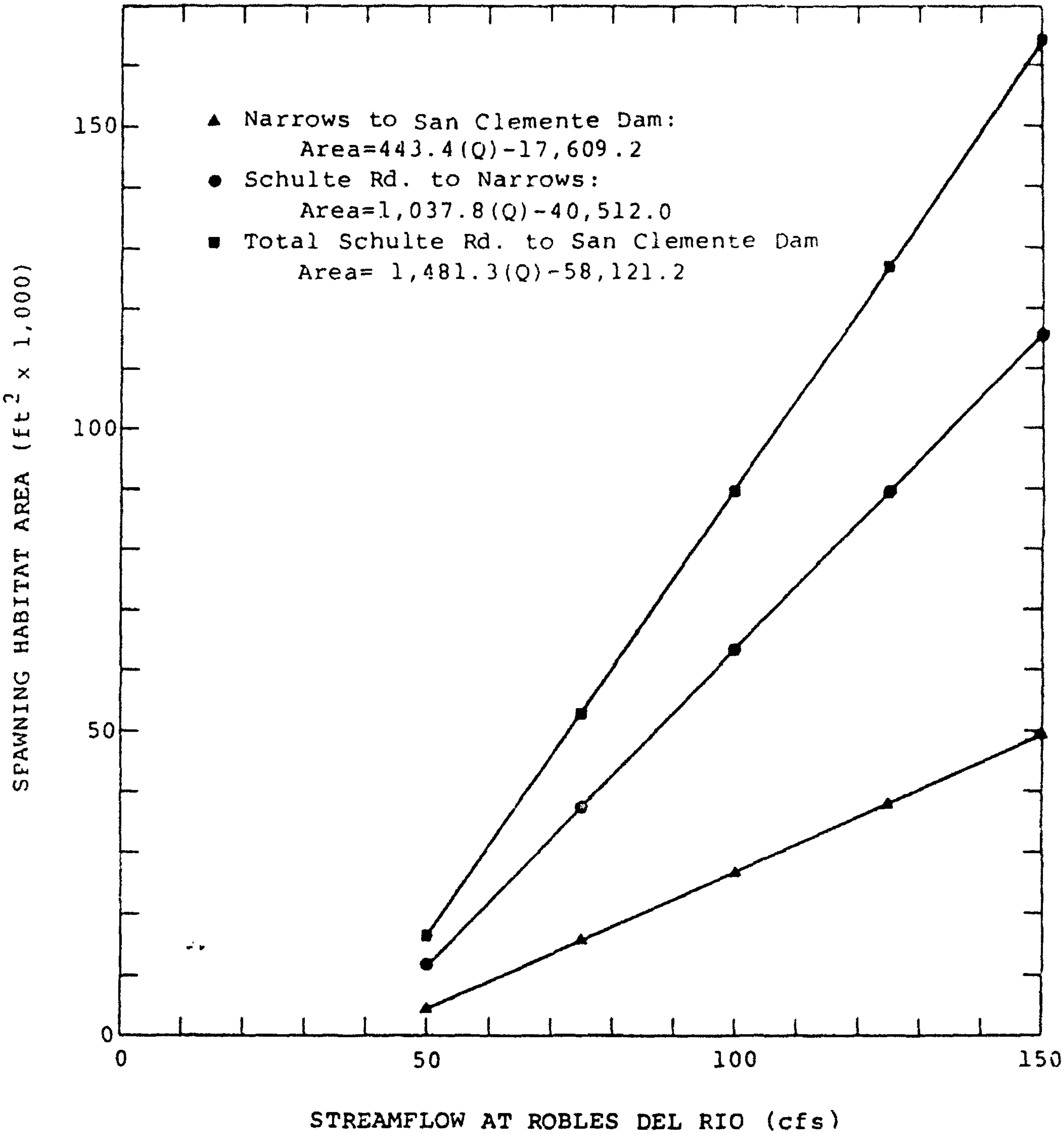


Figure 5. Relationship between steelhead spawning habitat area and streamflow in the Carmel River during 1982. Streamflow measured at Robles del Rio USGS gaging station. From Dettman and Kelley (1986).

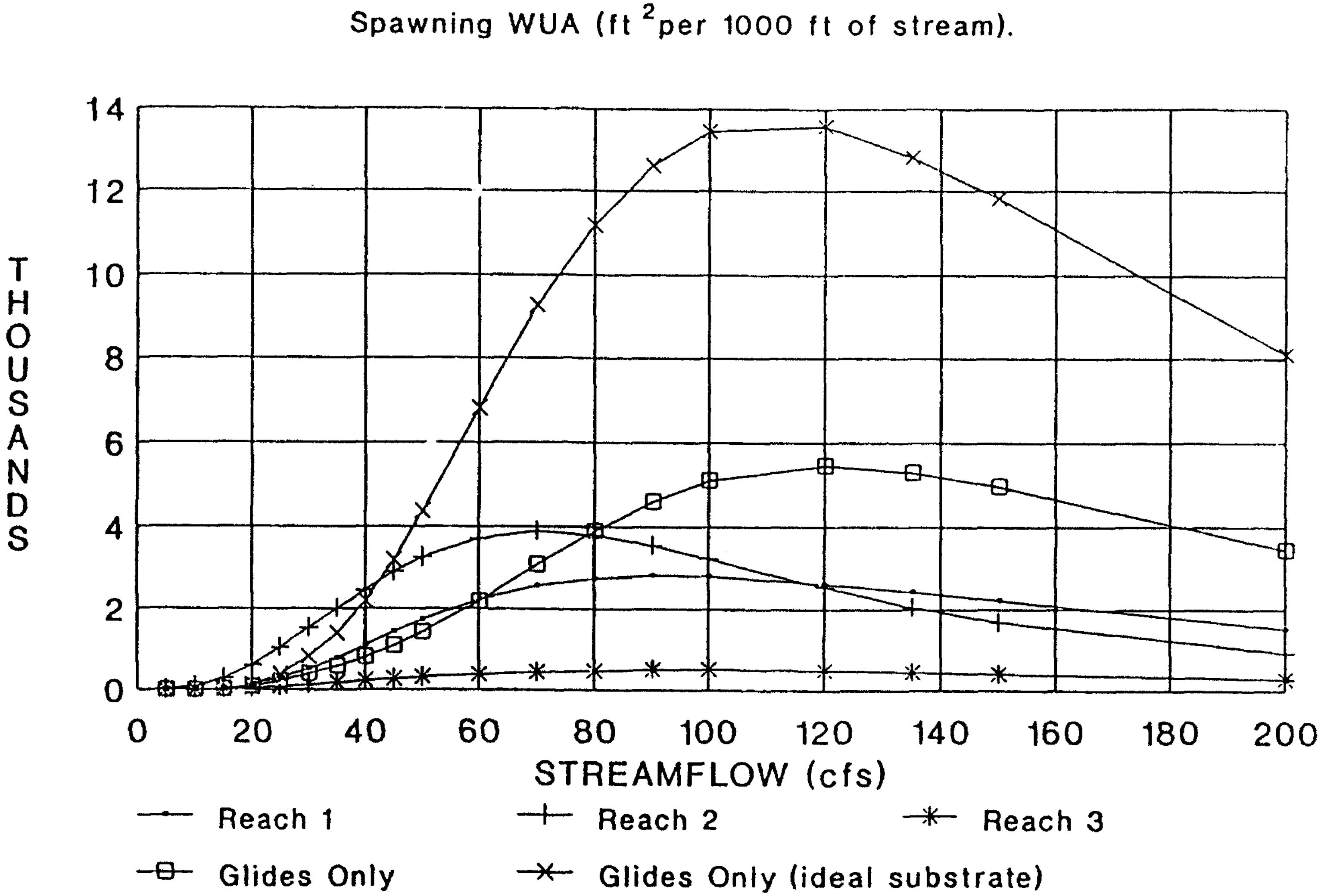


Figure 6. Steelhead Habitat, Carmel River, Composite Weighted Useable Area (WUA) from hydraulic simulations with appropriate weighting factors. From Alley, Hoefler, and Mori (1990).

adjacent to freshly built nests in the Carmel River between Robinson Canyon and San Clemente Dam. Figure 7 illustrates the size range of gravel utilized by steelhead in the Carmel River. This size range is similar to ranges found in other steelhead streams throughout California and the Pacific Northwest.

Size of Substrate Material in Spawning Glides Below Los Padres and San Clemente Dams

During spring 1989 D. W. Kelley and Associates sampled gravel in the Carmel River between San Clemente and Los Padres Dams and between Tularcitos Creek and San Clemente Dam to assess whether spawning habitat is limited by the size of gravel. After mapping the location of spawning glides, seven were selected in the reach between the dams, including glides used to develop estimates of WUA with the IFIM applied by Alley, Hoefler, and Mori (1990). Between Sleepy Hollow and San Clemente Dam five glides were randomly selected to represent conditions between Tularcitos Creek and San Clemente Dam. At each glide four transects were placed across the stream in a X-shaped pattern. To approximate the location where adult steelhead spawn, transects were placed within 25 feet of the hydraulic break between the glide and riffle. This guideline was developed by biologist Paul Bratovich, who found that 90 percent of the steelhead and salmon in Lagunitas Creek (Marin County) spawned just upstream of the glide-riffle break (Bratovich and Kelley, 1988). To characterize the size of substrate in potential spawning glides, the median diameter of substrate particles was measured and classified into following metric size classes:

2-4 mm
4-5.6 mm
5.6-8 mm
8-11 mm
11-16 mm
16-22 mm
22-32 mm
32-45 mm
45-64 mm
64-90 mm
90-128 mm
128-180 mm
180-256 mm
256-360 mm
360-512 mm
512-720 mm
\> 720 mm

Figures 8 and 9 illustrate and Tables 2 - 5 list the size distribution of gravel in potential spawning glides between the dams and immediately below San Clemente Dam. Most of the substrate in spawning glides is comprised of cobble and larger sized material. A comparison of these distributions with the distribution of gravel used by steelhead (Figure 7) indicates

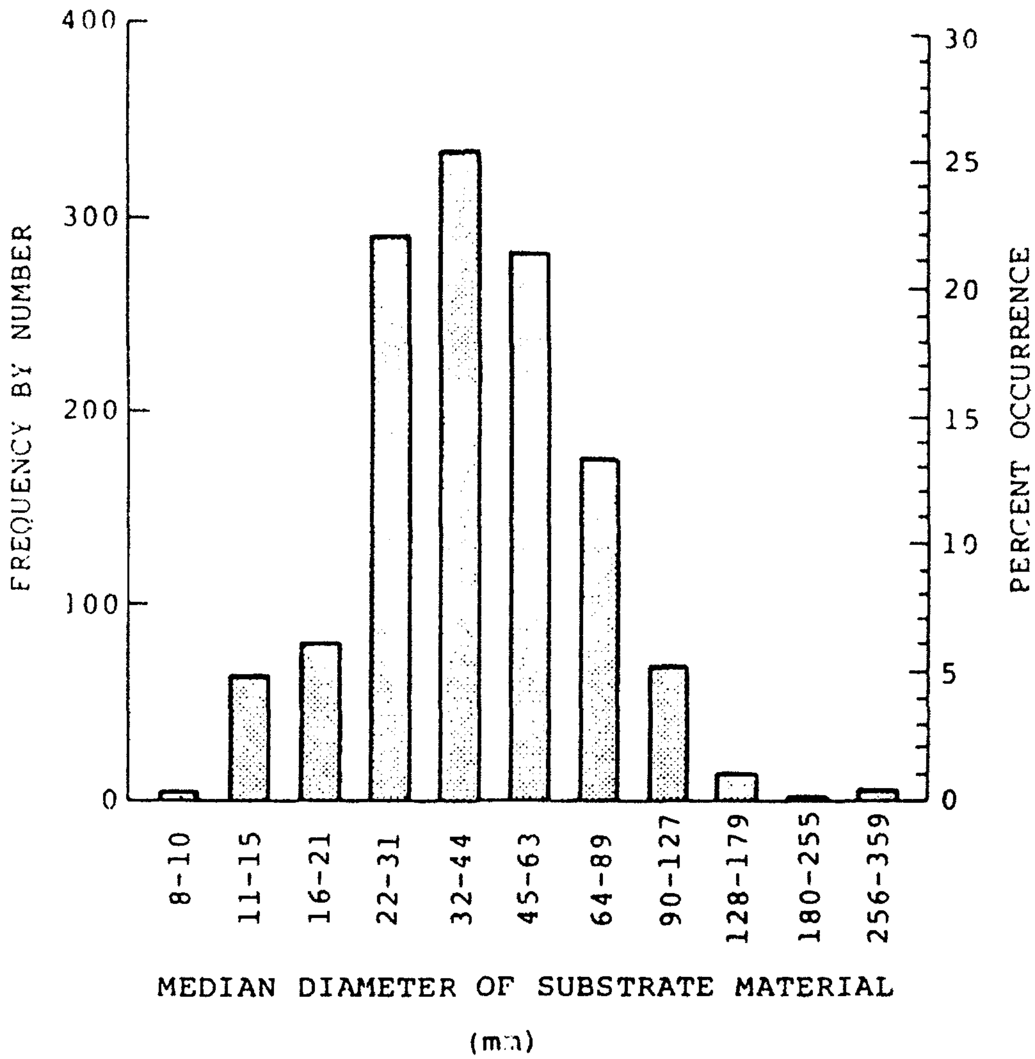
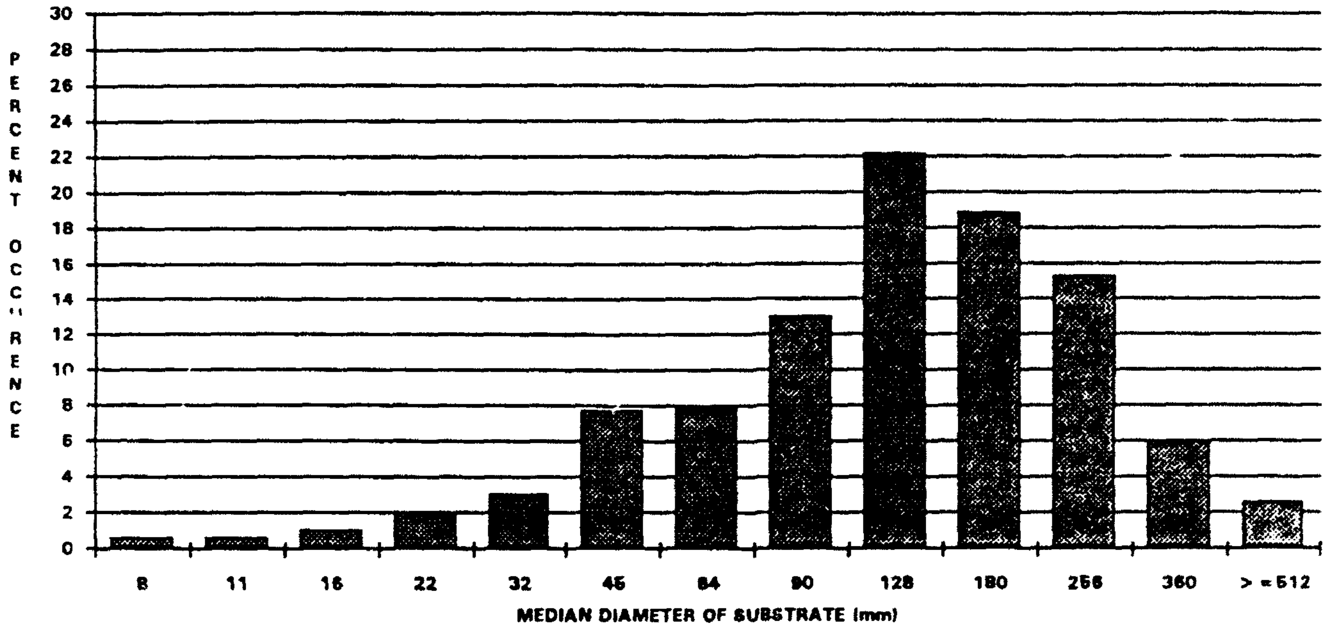


Figure 7. Size class composition of substrate mixture directly adjacent to 15 steelhead nests in the Carmel River between Robinson Canyon and San Clemente Dam. Based on median diameter measurements in a 3 square foot sample of surface gravel and cobble with diameters greater than 8 mm.

CARMEL RIVER
SLEEPY HOLLOW TO SAN CLEMENTE DAM



CARMEL RIVER
BELOW PINE CREEK

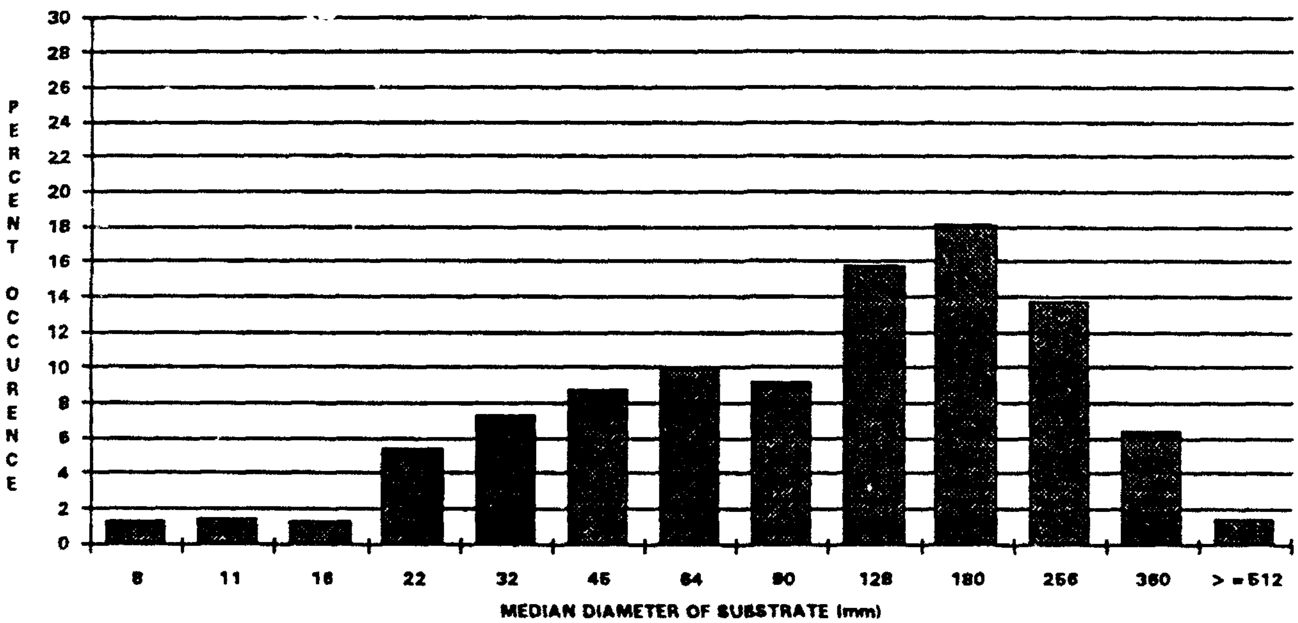
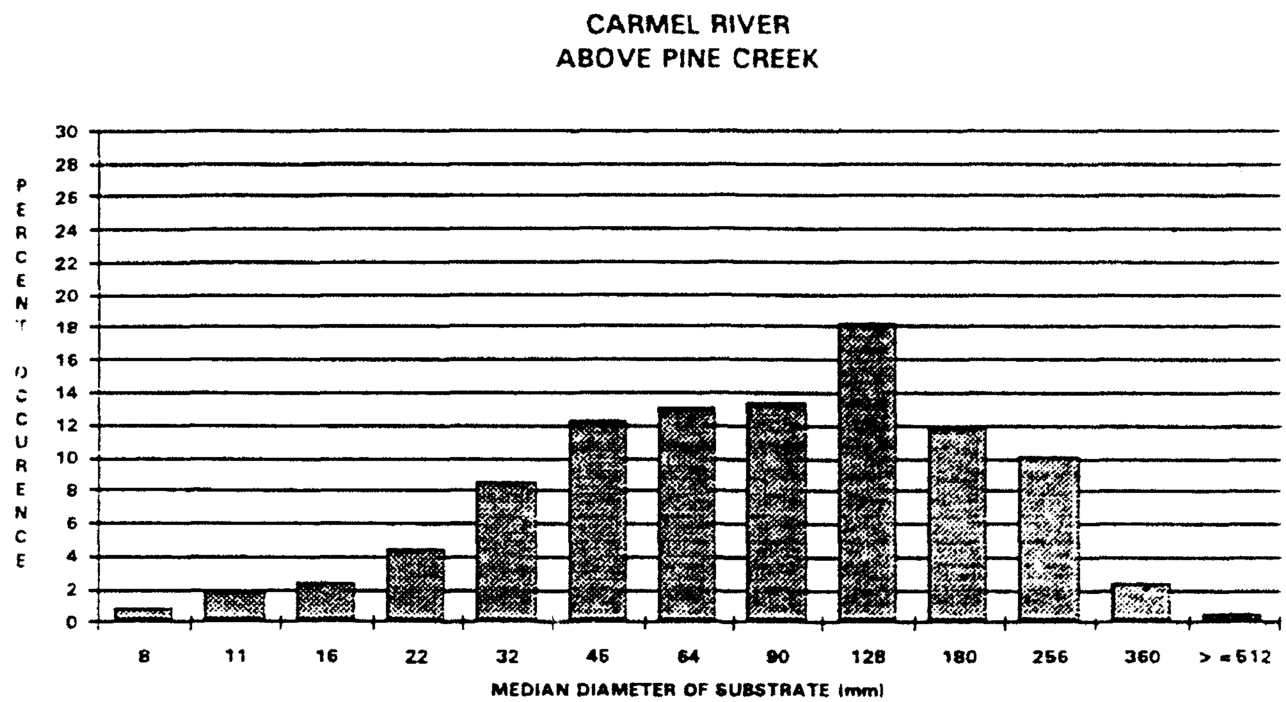


Figure 8. Size class composition of substrate mixture in spawning glides in the Carmel River between Sleepy Hollow and San Clemente Dam (top graph) and betwe-n San Clemente Reservoir and Pine Creek (bottom graph). Sleepy Hollow distribution based on measurements of median diameter of 658 rocks in five spawning glides. San Clemente to Pine Creek distribution based on measurements of 543 rocks in three spawning glides used for IFIM Study (TBP 1B,



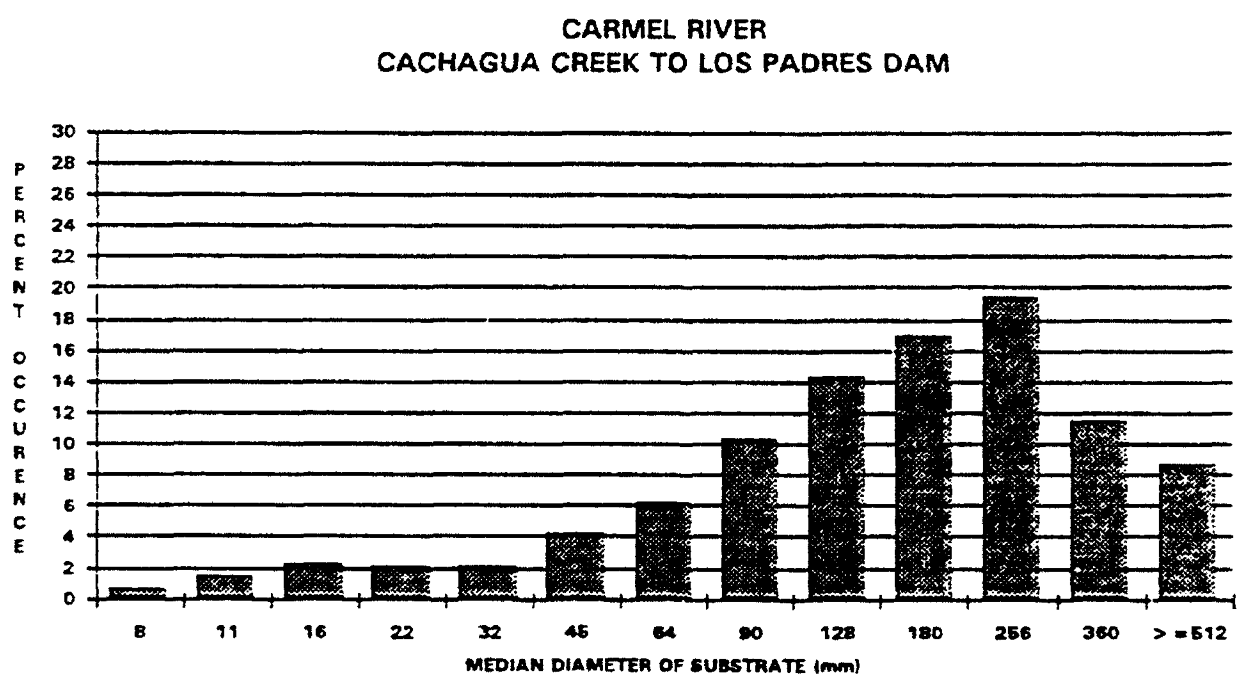


Figure 9. Size class composition of substrate mixture in spawning glides in the Carmel River between Pine Creek and Syndicate Camp (top graph) and between Cachagua Creek and Los Padres Dam (bottom graph). Pine Creek to Syndicate Camp distribution based on measurements of median diamteter of 417 rocks in two spawning glides used for IFIM Study (TAP 4 and TAP 14) and glide downstream of critical riffle (TAP CR1). Cachagua Creek to Los Padres distribution based on measurements of 639 rocks in five spawning glides (TAC 6, below TAC 1, below TAC 2, TAC 0, and below TAC 9).

Table 2. Size class distribution of substrate material in spawning glides in the Carmel River between Sleepy Hollow and San Clemente Dam, spring 1989.

SIZE CLASS	Sleepy Hollow Number 1 num	cnum	c %	Sleepy Hollow Number 2 num	cnum	c %	Sleepy Hollow Number 3 num	cnum	c %	Sleepy Hollow Number 4 num	cnum	c %	Sleepy Hollow Number 5 num	cnum	c %	Overall num	cnum	c %
<4	4	4	2.1	0	0	0.0	14	14	10.9	0	0	0.0	0	0	0.0	18	18	2.7
4	0	4	2.1	5	5	4.9	12	26	20.3	2	2	2.1	3	3	2.2	22	40	6.1
5.6	0	4	2.1	0	5	4.9	0	26	20.3	0	2	2.1	1	4	2.9	1	41	6.2
8	0	4	2.1	1	6	5.9	2	28	21.9	0	2	2.1	0	4	2.9	3	44	6.7
11	1	5	2.6	0	6	5.9	0	28	21.9	0	2	2.1	2	6	4.3	3	47	7.1
16	0	5	2.6	2	8	7.8	2	30	23.4	1	3	3.2	1	7	5.1	6	53	8.1
22	1	6	3.1	2	10	9.8	3	33	25.8	5	8	8.4	1	8	5.8	12	65	9.9
32	2	8	4.1	5	15	14.7	4	37	28.9	3	11	11.6	4	12	8.7	18	83	12.6
45	14	22	11.3	9	24	23.5	8	45	35.2	7	18	18.9	9	21	15.2	47	130	19.8
64	17	39	20.0	2	26	25.5	15	60	46.9	3	21	22.1	12	33	23.9	49	179	27.2
90	37	76	39.0	5	31	30.4	13	73	57.0	8	29	30.5	17	50	36.2	80	259	39.4
128	48	124	63.6	14	45	44.1	22	95	74.2	15	44	46.3	37	87	63.0	136	395	60.0
180	41	165	84.6	18	63	61.8	12	107	83.6	13	57	60.0	32	119	86.2	116	511	77.7
256	24	189	96.9	22	85	83.3	14	121	94.5	20	77	81.1	14	133	96.4	94	605	91.9
360	6	195	100.0	15	100	98.0	2	123	96.1	11	88	92.6	3	136	98.6	37	642	97.6
>=512	0	195	100.0	2	102	100.0	5	128	100.0	7	95	100.0	2	138	100.0	16	658	100.0
SIZE CLASSES > 8 mm																		
8	0	0	0.0	1	1	1.0	2	2	2.0	0	0	0.0	0	0	0.0	3	3	0.5
11	1	1	0.5	0	1	1.0	0	2	2.0	0	0	0.0	2	2	1.5	3	6	1.0
16	0	1	0.5	2	3	3.1	2	4	3.9	1	1	1.1	1	3	2.2	6	12	1.9
22	1	2	1.0	2	5	5.2	3	7	6.9	5	6	6.5	1	4	3.0	12	24	3.9
32	2	4	2.1	5	10	10.3	4	11	10.8	3	9	9.7	4	8	6.0	18	42	6.8
45	14	18	9.4	9	19	19.6	8	19	18.6	7	16	17.2	9	17	12.7	47	89	14.4
64	17	35	18.3	2	21	21.6	15	34	33.3	3	19	20.4	12	29	21.6	49	138	22.4
90	37	72	37.7	5	26	26.8	13	47	46.1	8	27	29.0	17	46	34.3	80	218	35.3
128	48	120	62.8	14	40	41.2	22	69	67.6	15	42	45.2	37	83	61.9	136	354	57.4
180	41	161	84.3	18	58	59.8	12	81	79.4	13	55	59.1	32	115	85.8	116	470	76.2
256	24	185	96.9	22	80	82.5	14	95	93.1	20	75	80.6	14	129	96.3	94	564	91.4
360	6	191	100.0	15	95	97.9	2	97	95.1	11	86	92.5	3	132	98.5	37	601	97.4
>=512	0	191	100.0	2	97	100.0	5	102	100.0	7	93	100.0	2	134	100.0	16	617	100.0

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Table 3. Size class distribution of substrate material in spawning glides in the Carmel River between San Clemente Reservoir and Pine Creek, spring 1989.

SIZE CLASS	IFIM Transect # TBP 1B			Upstream IFIM Transect # TBP 2			IFIM Transect # TBP 10			OVERALL			
	num	cnum	c %	num	cnum	c %	num	cnum	c %	num	%	cnum	c %
<4	30	30	14.0	21	21	10.7	7	7	5.3	58	11	58	11
4	2	32	15.0	2	23	11.7	2	9	6.8	6	1	64	12
5.6	0	32	15.0	0	23	11.7	0	9	6.8	0	0	64	12
8	2	34	15.9	2	25	12.8	0	9	6.8	4	1	68	13
11	6	40	18.7	1	26	13.3	0	9	6.8	7	1	75	14
16	6	46	21.5	0	26	13.3	0	9	6.8	6	1	81	15
22	12	58	27.1	8	34	17.3	6	15	11.3	26	5	107	20
32	21	79	36.9	7	41	20.9	7	22	16.5	35	6	142	26
45	19	98	45.8	7	48	24.5	16	38	28.6	42	8	184	34
64	19	117	54.7	15	63	32.1	14	52	39.1	48	9	232	43
90	15	132	61.7	17	80	40.8	12	64	48.1	44	8	276	51
128	18	150	70.1	38	118	60.2	20	84	63.2	76	14	352	65
180	28	178	83.2	39	157	80.1	20	104	78.2	87	16	439	81
256	19	197	92.1	34	191	97.4	13	117	88.0	66	12	505	93
360	15	212	99.1	5	196	100.0	11	128	96.2	31	6	536	99
>=512	2	214	100.0	0	196	100.0	5	133	100.0	7	1	543	100

SIZE CLASSES > 8 mm

8	2	2	1.1	4	4	2.3	0	0	0.0	6	1	6	1
11	6	8	4.4	1	5	2.9	0	0	0.0	7	1	13	3
16	6	14	7.7	0	5	2.9	0	0	0.0	6	1	19	4
22	12	26	14.3	8	13	7.4	6	6	4.8	26	5	45	9
32	21	47	25.8	7	20	11.4	7	13	10.5	35	7	80	17
45	19	66	36.3	7	27	15.4	16	29	23.4	42	9	122	25
64	19	85	46.7	15	42	24.0	14	43	34.7	48	10	170	35
90	15	100	54.9	17	59	33.7	12	55	44.4	44	9	214	44
128	18	118	64.8	38	97	55.4	20	75	60.5	76	16	290	60
180	28	146	80.2	39	136	77.7	20	95	76.6	87	18	377	78
256	19	165	90.7	34	170	97.1	13	108	87.1	66	14	443	92
360	15	180	98.9	5	175	100.0	11	119	96.0	31	6	474	99
>=512	2	182	100.0	0	175	100.0	5	124	100.0	7	1	481	100

Table 4 . Size class distribution of substrate material in spawning glides in the Carmel River between Pine Creek and Cachagua Creek, spring 1989.

SIZE CLASS	2 nd Glide d.s. IFIM # TAPCR 1			IFIM Transect # TAP 14			IFIM Transect # TAP 4			OVERALL			
	num	cnum	c %	num	cnum	c %	num	cnum	c %	num	%	cnum	c %
<4	26	26	26.0	9	9	5.7	15	15	9.4	50	12	50	12
4	0	26	26.0	0	9	5.7	0	15	9.4	0	0	50	12
5.6	0	26	26.0	0	9	5.7	0	15	9.4	0	0	50	12
8	1	27	27.0	0	9	5.7	2	17	10.7	3	1	53	13
11	1	28	28.0	4	13	8.2	2	19	11.9	7	2	60	14
16	4	32	32.0	3	16	10.1	2	21	13.2	9	2	69	17
22	6	38	38.0	6	22	13.9	4	25	15.7	16	4	85	20
32	7	45	45.0	11	33	20.9	13	38	23.9	31	7	116	28
45	6	51	51.0	17	50	31.6	22	60	37.7	45	11	161	39
64	5	56	56.0	20	70	44.3	23	83	52.2	48	12	209	50
90	8	64	64.0	22	92	58.2	19	102	64.2	49	12	258	62
128	14	78	78.0	27	119	75.3	26	128	80.5	67	16	325	78
180	9	87	87.0	18	137	86.7	17	145	91.2	44	11	369	88
256	10	97	97.0	15	152	96.2	12	157	98.7	37	9	406	97
360	3	100	100.0	4	156	98.7	2	159	100.0	9	2	415	100
>=512	0	100	100.0	2	158	100.0	0	159	100.0	2	0	417	100

SIZE CLASSES > 8 mm

SIZE CLASS	num	cnum	c %	num	cnum	c %	num	cnum	c %	num	%	cnum	c %
8	1	1	1.4	0	0	0.0	2	2	1.4	3	1	3	1
11	1	2	2.7	4	4	2.7	2	4	2.8	7	2	10	3
16	4	6	8.1	3	7	4.7	2	6	4.2	9	2	19	5
22	6	12	16.2	6	13	8.7	4	10	6.9	16	4	35	10
32	7	19	25.7	11	24	16.1	13	23	16.0	31	8	66	18
45	6	25	33.8	17	41	27.5	22	45	31.3	45	12	111	30
64	5	30	40.5	20	61	40.9	23	68	47.2	48	13	159	43
90	8	38	51.4	22	83	55.7	19	87	60.4	49	13	208	57
128	14	52	70.3	27	110	73.8	26	113	78.5	67	18	275	75
180	9	61	82.4	18	128	85.9	17	130	90.3	44	12	319	87
256	10	71	95.9	15	143	96.0	12	142	98.6	37	10	356	97
360	3	74	100.0	4	147	98.7	2	144	100.0	9	2	365	99
>=512	0	74	100.0	2	149	100.0	0	144	100.0	2	1	367	100

Table 5. Size class distribution of substrate material in spawning glides in the Carmel River between Cachagua Creek and Los Padres Dam, spring 1989.

SIZE CLASS	IFIM Transect # TAC 6 num	cnum	c %	IFIM Transect BTAC#1 num	cnum	c %	IFIM Transect BTAC#2 num	cnum	c %	IFIM Transect ATAC#0 num	cnum	c %	IFIM Transect BTAC#9 num	cnum	c %	OVERALL num	%	cnum	c %
<4	0	0	0.0	2	2	1.4	0	0	0.0	3	3	1.8	0	0	0.0	5	1	5	1
4	2	2	1.9	0	2	1.4	1	1	1.1	1	4	2.5	0	0	0.0	4	1	9	1
5.6	0	2	1.9	0	2	1.4	0	1	1.1	0	4	2.5	0	0	0.0	0	0	9	1
8	1	3	2.8	0	2	1.4	1	2	2.1	2	6	3.7	0	0	0.0	4	1	13	2
11	3	6	5.6	2	4	2.9	4	6	6.3	0	6	3.7	0	0	0.0	9	1	22	3
16	7	13	12.0	0	4	2.9	5	11	11.6	2	8	4.9	0	0	0.0	14	2	36	6
22	0	13	12.0	2	6	4.3	3	14	14.7	5	13	8.0	3	3	2.2	13	2	49	8
32	4	17	15.7	5	11	7.9	2	16	16.8	2	15	9.2	0	3	2.2	13	2	62	10
45	3	20	18.5	6	17	12.2	4	20	21.1	12	27	16.6	2	5	3.7	27	4	89	14
64	11	31	28.7	10	27	19.4	5	25	26.3	8	35	21.5	5	10	7.5	39	6	128	20
90	14	45	41.7	22	49	35.3	7	32	33.7	9	44	27.0	13	23	17.2	65	10	193	30
128	24	69	63.9	24	73	52.5	15	47	49.5	14	58	35.6	13	36	26.9	90	14	283	44
180	19	88	81.5	25	98	70.5	16	63	66.3	22	80	49.1	25	61	45.5	107	17	390	61
256	17	105	97.2	21	119	85.6	17	80	84.2	37	117	71.8	30	91	67.9	122	19	512	80
360	3	108	100.0	13	132	95.0	11	91	95.8	30	147	90.2	15	106	79.1	72	11	584	91
>=512	0	108	100.0	7	139	100.0	4	95	100.0	16	163	100.0	28	134	100.0	55	9	639	100

SIZE CLASSES > 8 mm

SIZE CLASS	IFIM Transect # TAC 6 num	cnum	c %	IFIM Transect BTAC#1 num	cnum	c %	IFIM Transect BTAC#2 num	cnum	c %	IFIM Transect ATAC#0 num	cnum	c %	IFIM Transect BTAC#9 num	cnum	c %	OVERALL num	%	cnum	c %
8	1	1	0.9	0	0	0.0	1	1	1.1	2	2	1.3	0	0	0.0	4	1	4	1
11	3	4	3.8	2	2	1.5	4	5	5.3	0	2	1.3	0	0	0.0	9	1	13	2
16	7	11	10.4	0	2	1.5	5	10	10.6	2	4	2.5	0	0	0.0	14	2	27	4
22	0	11	10.4	2	4	2.9	3	13	13.8	5	9	5.7	3	3	2.2	13	2	40	6
32	4	15	14.2	5	9	6.6	2	15	16.0	2	11	6.9	0	3	2.2	13	2	53	8
45	3	18	17.0	6	15	10.9	4	19	20.2	12	23	14.5	2	5	3.7	27	4	80	13
64	11	29	27.4	10	25	18.2	5	24	25.5	8	31	19.5	5	10	7.5	39	6	119	19
90	14	43	40.6	22	47	34.3	7	31	33.0	9	40	25.2	13	23	17.2	65	10	184	29
128	24	67	63.2	24	71	51.8	15	46	48.9	14	54	34.0	13	36	26.9	90	14	274	43
180	19	86	81.1	25	96	70.1	16	62	66.0	22	76	47.8	25	61	45.5	107	17	381	60
256	17	103	97.2	21	117	85.4	17	79	84.0	37	113	71.1	30	91	67.9	122	19	503	80
360	3	106	100.0	13	130	94.9	11	90	95.7	30	143	89.9	15	106	79.1	72	11	575	91
>=512	0	106	100.0	7	137	100.0	4	94	100.0	16	159	100.0	28	134	100.0	55	9	630	100

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spawning habitat in the reaches between the dams and below San Clemente Dam is limited by gravel size. The differences are most noticeable immediately downstream of Los Padres and San Clemente Dams where the supply of gravel has been cut off since construction of the dams. For example, while steelhead selected a mixture composed of 80 percent of material within the range of 22 to 90 mm, only 25 percent of the substrate material in glides below Los Padres Dam fell into this size range. The majority of the substrate was larger than 128 mm. Based on these comparisons, it appears there are ample opportunities for improving the quality of spawning gravel between the dams and below San Clemente Dam.

Extent of Suitable Gravel in Potential Spawning Glides

While the measurements of gravel size in spawning glides provides data to determine whether the quality of gravel limits spawning habitat, it does not provide enough information to assess how much additional habitat could be created by adding gravel to the river. To assess this, a survey was conducted to map the distribution of suitable substrate within potential spawning glides.

In selected potential glides between San Clemente and Los Padres dams, a series of steel pins were driven into the stream bottom around patches where substrate conditions were judged to be suitable for spawning (Plate 1). The following criteria were applied in the field to judge whether substrate was suitable:

1) 75 percent of material larger than 8 mm, and

2) at least 50 percent of substrate in medium gravel to small cobble size range (22 - 64 mm), and

3) at least 75 percent of substrate in medium gravel to medium cobble size range (22 - 90 mm)

These criteria are based on the size class distribution of gravel used by spawning steelhead (Figure 7). Following the placement of pins, the distance between pins was measured to the nearest 0.1 foot. After measuring the distances between pins, the total potential spawning area was mapped by measuring distances between pins set along the base of each bank at approximately 5-foot intervals starting at the glide/riffle break. Later, the location of all pins was mapped at a scale of 1" = 5 feet and the potential and actual spawning habitat areas were measured with a planimeter. Figure 10 is a sample of the maps used for this procedure.

Table 6 lists estimates of actual and potential spawning habitat area based on the procedure outlined in the previous paragraph and estimates in other spawning glides based on field measurements of actual and potential area. Potential area was

Plate 1. Photo illustrating the placement of pins outlining area with suitable spawning gravel within a glide. Area outlined in overlay corresponds to suitable habitat area in Figure 10.

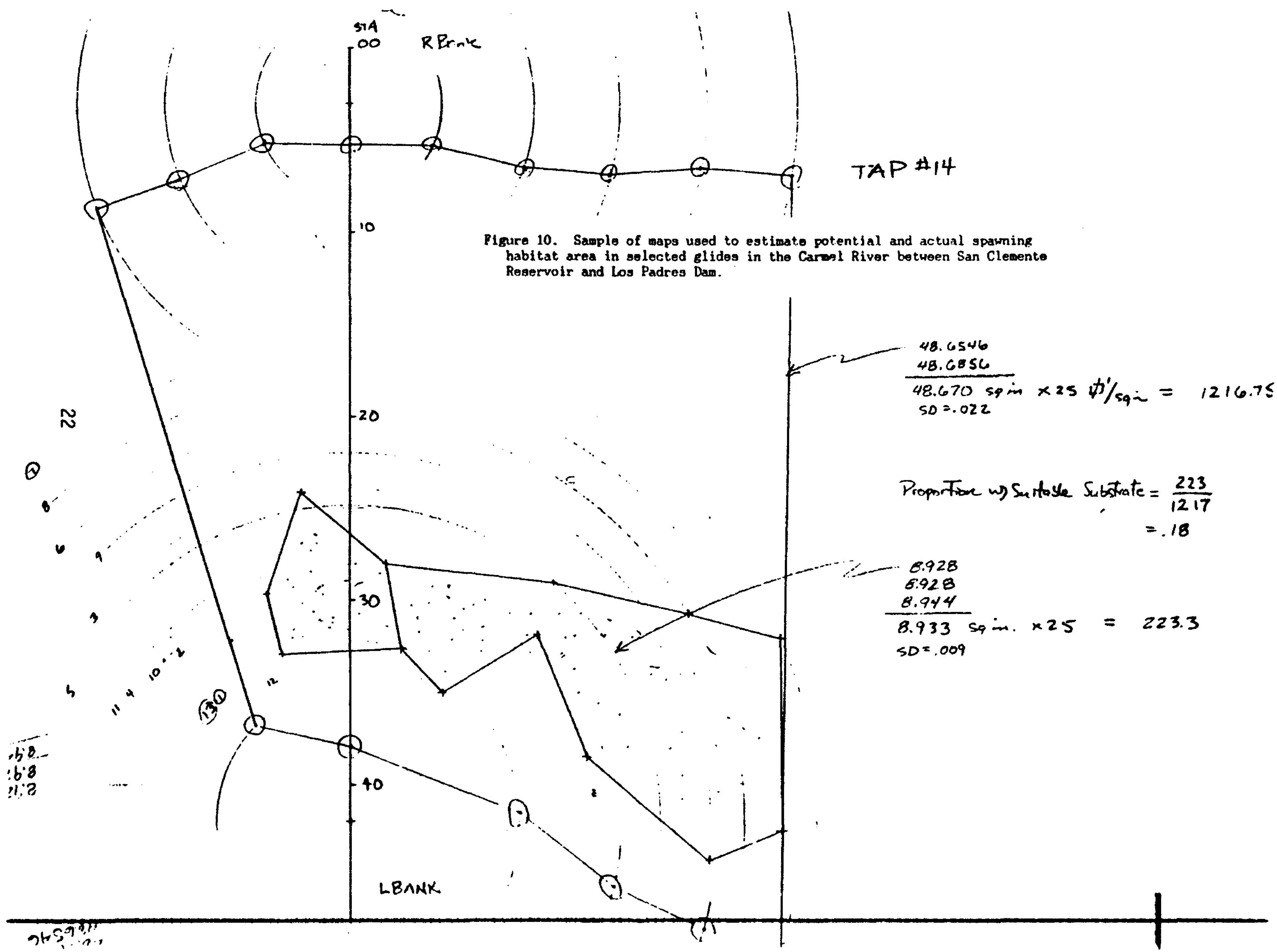

Figure 10. Sample of maps used to estimate potential and actual spawning habitat area in selected glides in the Carmel River between San Clemente Reservoir and Los Padres Dam.

Table 6. Estimated suitable and potential spawning habitat area in glides in the Carmel River between Sleepy Hollow and Los Pa
Dam. Measurements of suitable habitat include areas where depth, velocity and substrate conditions are within range used
spawning steelhead. Measurements of potential habitat include areas where depth and velocity are within range, but where s
mixture is too coarse for construction of steelhead nests.

REACH	LENGTH (ft)	LENGTH SURVEYED (ft)	EXISTING HABITAT Measured (sqft)	EXISTING HABITAT Estimated (sqft)	POTENTIAL HABITAT Measured (sqft)	POTENTIAL HABITAT Estimated (sqft)	PERCENT OF POTENTIAL HABITAT WITH SUITABLE GRAVEL (%)
SLEEPY HOLLOW TO SAN CLEMENTE DAM							
--Above Damsite[1]	3,953	1,397	351	926	3,247	6,007	15
--Below Damsite	3,047	3,047	1,513	1,513	5,830	5,830	26
Total	7,000	5,350	1,864	2,439	9,047	11,837	21
SAN CLEMENTE RES. TO PINE CREEK	10,600	8,122	3,369	4,397	12,579	16,417	27
PINE CREEK TO SYNDICATE CAMP	5,350	5,478	2,092	2,092	7,237	7,237	29
SYNDICATE CAMP TO CACHAGUA CREEK	6,300	3,594	1,797	3,150	7,699	13,496	23
CACHAGUA CREEK TO LOS PADRES DAM							
--Above Damsite[1]	2,725	2,725	132	132	6,648	6,648	2
--Below Damsite	3,575	3,575	590	590	6,363	6,363	9
Total	6,300	6,300	722	722	13,011	13,011	6
SLEEPY HOLLOW TO LOS PADRES DAM	35,550	28,844	9,844	12,800	49,573	61,998	21

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estimated in the field by multiplying the gross width of the glide times 25 feet upstream from the glide/riffle break. Actual spawning areas were estimated by multiplying the length times the width of patches with suitable substrate conditions.

Overall, only 21 percent of the potential habitat area in glides is covered with appropriately-sized gravel (Table 6). Based on these estimates and a comparison of potential habitat to actual habitat, it is reasonable to conclude spawning habitat between the dams and below San Clemente Dam is limited by the lack of appropriately sized gravel. Application of these estimates to other portions of the river indicates the 5.4 mile-long reach from San Clemente Reservoir to Los Padres Dam and the 1.3 mile-long reach from Sleepy Hollow to San Clemente Dam can support a total of 264 nests, or about 80 spawners per mile of river (Table 1). This habitat represents one-third as much spawning habitat per unit of stream, as compared to the remainder of the mainstem, where the river accommodates a total 2,100 nests, or about 240 spawners per mile (Table 1). The lack of spawning gravel probably limits the population of spawning adults that can be accommodated without interference and overlap between nests. Ultimately, the lack of suitable gravel will reduce the population of returning adults in the reach between the dams and below San Clemente Dam.

Based on comparisons of gravel size and on estimates of potential and actual spawning habitat area, it appears the losses of spawning habitat with alternative water supplies could be mitigated by adding appropriately sized gravel to the reach between the dams and below San Clemente Dam.

LOSS OF SPAWNING HABITAT WITH WATER SUPPLY ALTERNATIVES

Table 7 from Dettman (1989) lists the amount of spawning habitat inundated or blocked by water supply alternatives. The losses range from zero with the no project and Canada Reservoir to about 14,800 square feet with New Los Padres Reservoir.

MITIGATION PLAN

The District's plan for mitigating losses of spawning habitat includes a program to increase and maintain spawning habitat by placing gravel in key spawning glides where existing spawning habitat is limited by the size and quantity of gravel. The goal of the program would be to permanently offset losses which occur due to inundation and blockage of spawning habitat.

Key features of the program are collection of spawning gravel, initial placement of gravel in potential glides, long-term, periodic monitoring of key spawning glides, and injection of appropriately sized gravel during periods of high flow to maintain spawning habitat.

Table 7. Estimates of steelhead spawning habitat inundated or blocked by alternative water supply projects. Based on measurements of spawning habitat in the Carmel River and selected tributaries during 1982 and 1989.

			Length of Stream					Amount of Spawning Habitat			Potential Loss of Steelhead	
			Inundated		Blocked		Total	Inundated	Blocked	Total	Nests	Spawners
ALTERNATIVE	STREAM	REACH	(ft)	(mi)	(ft)	(mi)	(mi)	(sqft)	(sqft)	(sqft)	(nos.)	(nos.)
New Los Padres Dam	Carmel River	below LPD	2,725	0.52	0	0.00	0.52	302	0	302	6	12
24,000 acft		above LPD	6,124	1.16	0	0.00	1.16	8,868	0	8,868	177	354
	Danish Creek		2,388	0.45	6,612	1.25	1.70	1,355	3,753	5,108	102	204
New Los Padres Dam	Carmel River	below LPD	2,725	0.52	0	0.00	0.52	302	0	302	6	12
16,000 acft		above LPD	3,737	0.71	0	0.00	0.71	5,406	0	5,406	108	216
	Danish Creek		1,494	0.28	7,506	1.42	1.70	848	4,260	5,108	102	204
New Los Padres Dam	Carmel River	below LPD	2,725	0.52	0	0.00	0.52	302	0	302	6	12
9,000 acft		above LPD	1,360	0.26	0	0.00	0.26	1,953	0	1,953	39	78
	Danish Creek		600	0.11	8,400	1.59	1.70	341	4,768	5,108	102	204
Cachagua Creek Dam 6,000 acft	Cachagua Cr.		2,831	0.54	0	0.00	0.54	187	0	187	4	7
	James Creek		2,672	0.51	2,912	0.55	1.06	201	220	421	8	17
	Finch Creek		6,621	1.25	4,283	0.81	2.07	1,495	969	2,464	49	99
San Clemente Creek Dam 11,000 acft	San Clemente Creek		9,795	1.86	10,569	2.00	3.86	4,252	4,588	8,840	177	354
	Black Rock Creek		0	0.00	15,817	3.00	3.00	0	2,491	2,491	50	100
New San Clemente Dam	Carmel River	below SCD	3,953	0.75	0	0.00	0.75	1,377	0	1,377	28	55
23,000 acft		above SCD	7,590	1.44	0	0.00	1.44	3,148	0	3,148	63	126
	San Clemente Creek Basin		3,216	0.61	34,784	6.59	7.20	1,396	8,847	10,243	205	410
Chupines Creek Dam 10,500 acft	Chupines Creek		4,890	0.93	18,314	3.47	4.39	411	1,538	1,949	39	78
Canada Dam	seasonal arroyo		0	0.00	0	0.00	0.00	0	0	0	0	0

(Table 7 con't)

			Length of Stream					Amount of Spawning Habitat			Loss of Steelhead	
			Inundated		Blocked		Total	Inundated	Blocked	Total	Nests	Spawners
ALTERNATIVE	STREAM	REACH	(ft)	(miles)	(ft)	(miles)	(mi)	(sqft)	(sqft)	(sqft)	(nos.)	(nos.)
Summary: Totals For Each Alternative												
NEW LOS PADRES DAM (24,000 acft)			11,237	2.13	6,612	1.25	3.38	10,516	3,753	14,269	285	571
NEW LOS PADRES DAM (16,000 acft)			7,966	1.51	7,506	1.42	2.93	6,556	4,260	10,816	216	433
NEW LOS PADRES DAM (9,000 acft)			4,676	0.89	8400	1.59	2.48	2,596	4,768	7,364	147	295
CACHAGUA CREEK DAM (6,000 acft)			12,124	2.30	7,205	1.36	3.66	1,883	1,189	3,072	61	123
SAN CLEMENTE CREEK DAM (11,000 acft)			9,795	1.86	26,386	5.00	6.86	4,252	7,079	11,331	227	453
NEW SAN CLEMENTE DAM (23,000 acft)			14,759	2.80	34,784	6.59	9.38	5,922	8,847	14,769	295	591
CHUPINES CREEK DAM (10,500 acft)			4,890	0.93	18,314	3.47	4.39	411	1,538	1,949	39	78
CANADA DAM (any size)			0	0.00	0	0.00	0.00	0	0	0	0	0
NON-DAM ALTERNATIVE			0	0.00	0	0.00	0.00	0	0	0	0	0
NO PROJECT ALTERNATIVE			0	0.00	0	0.00	0.00	0	0	0	0	0
EXISTING CONDITION			0	0.00	75,800	14.36	14.36	0	72,300	72,300	1,446	2,892

Collection of Spawning Gravel

Initial Collection--The existing San Clemente and Los Padres Reservoirs have extensive deltas of gravel deposited at the upstream end of the inundation zones. The District proposes to extract and stockpile 360 to 2,700 cubic yds of appropriately sized gravel from the inundation zones of the existing reservoirs (Table 8). This is equivalent to about five times the amount of gravel needed to fully mitigate losses. The stockpiles would be used to replenish gravel after a new reservoir is constructed.

Maintenance--The stockpile of gravel from the initial collection will last for an unknown period, after construction of the new reservoir. Before it is exhausted, the District will institute a program to maintain the supply of gravel for injecting at appropriate locations.

Initial Placement of Spawning Gravel

The District has received a grant from CDF&G to restore spawning habitat between the dams. Following the outline of methods in the grant, the District will place gravel in spawning glides by using a sluiceway in locations that are accessible to truck and tractor, and a helicopter in locations that are inaccessible with trucks.

Periodic Monitoring of Key Spawning Glides

The goal of the spawning mitigation program would be to perpetually maintain enough spawning habitat to mitigate for the losses caused by construction and operation of a new reservoir. This requires monitoring to measure the amount of spawning habitat over time. The District proposes to fund and conduct a monitoring program to measure spawning habitat in several "key" glides. At a minimum, spawning habitat will be measured annually. However, during most wet years, it will be necessary to measure habitat several times during the winter to insure that enough gravel is added during storm events.

Injection of Appropriately Sized Gravel

The District will hire a consulting hydrogeologist to develop a program for injecting gravel into the river. Initially, the river is expected to rapidly scour and move the gravel added to the river. During the first few years of operation the movement of gravel bedload will be measured to develop a bedload transport curve at locations near spawning glides. This curve will be used a guideline to recommend the amount of gravel that must be added to maintain spawning habitat.

Gravel from the stockpile will be added at several locations including, below existing Los Padres Dam (RM 23.5) or New Los Padres Dam (RM 23.0), Flavin's Crossing (RM 22.0), Syndicate Camp (RM 21.5), below San Clemente Dam (RM 18.1), and San Clemente Ford

Table 8. Estimated volume of gravel added to four reaches in the Carmel River for mitigating the spawning habitat inundated or blocked by water supply alternatives.

ALTERNATIVE	REACH	# GLIDES	SPAWNING HABITAT AREA (sqft) UNIMPROVED POST PROJECT	TOTAL POTENTIAL	MITIGATED POST PROJECT	INCREASE (sqft)	INCREASE (%)	Volume of Gravel added (cubic yds)
New Los Padres (24,000 acft)	Sleepy Hollow to San Clemente Dam	16	2,439	11,837	6,150	3,711	152	137
	San Clemente Res. to Syndicate Camp	30	6,489	23,654	7,987	1,498	23	55
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	6,500	3,350	106	124
	Cachagua Creek to Los Padres Dam	8	590	6,363	6,300	5,710	968	211
	Total	66	12,668	55,350	26,937	14,269	113	528
New Los Padres (16,000 acft)	Sleepy Hollow to San Clemente Dam	16	2,439	11,837	5,000	2,561	105	95
	San Clemente Res. to Syndicate Camp	30	6,489	23,654	6,489	0	0	0
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	5,779	2,629	83	97
	Cachagua Creek to Los Padres Dam	8	590	6,363	6,300	5,710	968	211
	Total	66	12,668	55,350	23,568	10,900	86	404
New Los Padres (9,000 acft)	Sleepy Hollow to San Clemente Dam	16	2,439	11,837	4,500	2,061	85	76
	San Clemente Res. to Syndicate Camp	30	6,489	23,654	6,489	0	0	0
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	5,043	1,893	60	70
	Cachagua Creek to Los Padres Dam	8	590	6,363	4,000	3,410	578	126
	Total	66	12,668	55,350	20,032	7,364	58	273

(Table 8 continued)

ALTERNATIVE	REACH	# GLIDES	SPAWNING HABITAT AREA (sqft) UNIMPROVED POST PROJECT	TOTAL POTENTIAL	MITIGATED POST PROJECT	INCREASE (sqft)	INCREASE (%)	Volume of Gravel added (cubic yds)
Cachagua Creek (6,000 acft)	Sleepy Hollow to San Clemente Dam	16	2,439	11,837	3,733	1,294	53	48
	San Clemente Res. to Syndicate Camp	30	6,489	23,654	6,489	0	0	0
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	3,150	0	0	0
	Cachagua Creek to Los Padres Dam	18	722	13,011	2,500	1,778	246	66
	Total	76	12,800	61,998	15,872	3,072	24	114
San Clemente Creek (11,500 acft)	Sleepy Hollow to San Clemente Dam	16	2,439	11,837	5,000	2,561	105	95
	San Clemente Res. to Syndicate Camp	30	6,489	23,654	6,489	0	0	0
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	5,000	1,850	59	69
	Cachagua Creek to Los Padres Dam	18	722	13,011	7,642	6,920	958	256
	Total	76	12,800	61,998	24,131	11,331	89	420
New San Clemente (23,000 acft)	Sleepy Hollow to San Clemente Dam	10	1,513	5,830	5,000	3,487	230	129
	San Clemente Res. to Syndicate Camp	10	2,092	7,237	4,246	2,154	103	80
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	5,000	1,850	59	69
	Cachagua Creek to Los Padres Dam	18	722	13,011	8,000	7,278	1008	270

	Total	50	7,477	39,574	22,246	14,769	198	547

(Table 8 continued)

ALTERNATIVE	REACH	# GLIDES	SPAWNING HABITAT AREA (sqft) UNIMPROVED POST PROJECT	TOTAL POTENTIAL	MITIGATED POST PROJECT	INCREASE (sqft)	INCREASE (%)	Volume of Gravel added (cubic yds)
Chupines Creek (10,000 acft)	Sleepy Hollow to San Clemente Dam	16	2,439	11,837	3,610	1,171	48	43
	San Clemente Res. to Syndicate Camp	30	6,489	23,654	6,489	0	0	0
	Syndicate Camp to Cachagua Creek	12	3,150	13,496	3,150	0	0	0
	Cachagua Creek to Los Padres Dam	18	722	13,011	1,500	778	108	29
	Total	76	12,800	61,998	14,749	1,949	15	72

(RM 17.3).

CONCEPTUAL COSTS FOR SPAWNING HABITAT MITIGATION PROGRAM

Table 9 summarizes a comparison of capital and O&M costs for the alternatives. With projects that require mitigation, the estimated capital cost for mitigating losses of spawning habitat ranges from $26,000 to $122,200 and estimated O&M costs range from $10,800 to $24,900, depending on which alternative is constructed. Three alternatives, Canada, Desalination and the No Project do not inundate or block any spawning habitat, so no mitigation is required.

Tables 10 - 16 outline tasks and list conceptual cost estimates for constructing and operating the spawning habitat mitigation program with each alternative.

Table 9. Summary of preliminary conceptual costs for mitigating the loss of spawning habitat inundated or blocked in the Carmel River Basin with alternative water supply projects.

ALTERNATIVE	INITIAL COST	ANNUAL OPERATION COST
New Los Padres Reservoir (24,000 acre-feet)	$176,000	$22,300
New Los Padres Reservoir (16,000 acre-feet)	$122,800	$18,000
New Los Padres Reservoir (9,000 acre-feet)	$104,800	$15,100
Cachagua Creek Reservoir (6,000 acre-feet)	$86,600	$10,500
San Clemente Creek Reservoir (11,000 acre-feet)	$144,100	$19,900
New San Clemente Reservoir (23,000 acre-feet)	$176,100	$24,200
Chupines Creek Reservoir (10,000 acre-feet)	$83,100	$10,200
Canada Reservoir (any size)	$0	$0
Desalination	$0	$0
No Project	$0	$0

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Table 10. Preliminary conceptual cost estimate for program to mitigate the the loss of spawning habitat inundated or blocked with the 24,000 acre-foot New Los Padres Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Number of Hours	Hourly Rate	Total
Biologist	11	88	$20.19	$1,777
Hydrologist	19	152	$19.23	$2,923
Field Tech	37	296	$12.40	$3,670
Equipment Operator	57	456	$35.00	$15,960
Laborer	57	456	$9.00	$4,104
			Subtotal:	$28,434
Staff Benefits at 40%				$11,374
			Total Labor Costs:	$39,808

--MATERIALS AND SUPPLIES	
Read Screenall Mod RD258	$48,100
500 feet 10" PVC @ $7.00/ft	$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft	$2,500
500 feet 3" PVC @ $.87/ft	$435
250 gal/min pump, 3 inch discharge	$850
3-inch suction hose	$300
Misc Valves	$250
Misc PVC and ABS connectors	$1,000
Safety Items	$250
Hoppers for gravel (3 @ $500)	$1,500
Misc tools and supplies	$500
Total Materials and Supplies:	$59,185

--OPERATING EXPENSES	
4-wheel drive tractor with backhoe and load bucket (60 days @ $100.00 per day)	$6,000
5-yd dump truck (60 days at $160.00 per day)	$9,600
Subcontractor, Heliocopter (56 hours @ $500.00/hr)	$28,000
Diesel Fuel (600 gal at $1.50/gal)	$900
Gasoline (600 gal at $1.50/gal)	$900
Maintenance supplies, oil, grease, etc.	$200
Mobilization/Demobilization (10% operating costs)	$4,560
Total Operating Expenses:	$50,160

--CONTINGENCY AND OVERHEAD	
Administrative overhead at 5 % (labor+operation)	$4,498
Contingency (15 % of personnel, material and operating costs)	$22,373
TOTAL INITIAL COST	$176,024

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Number of Hours	Hourly Rate	Total
Biologist	7	56	$20.19	$1,131
Hydrologist	7	56	$19.23	$1,077
Field Tech	10	80	$12.40	$992
Equipment Operator	14	112	$35.00	$3,920
Laborer	14	112	$9.00	$1,008
			Subtotal:	$8,128
Staff Benefits at 40%				$3,251
			Total Labor Costs:	$11,379

--MATERIALS AND SUPPLIES	
Materials on hand, but assume 25% replacement of expendable material cost per year	$2,771
Total Materials and Supplies:	$2,771

--OPERATING EXPENSES	
4-wheel drive tractor with backhoe and load bucket (14 days @ $100.00 per da)	$1,400
5-yd dump truck (14 days at $160.00 per da)	$2,240
Diesel Fuel (100 gal at $1.50/gal)	$150
Gasoline (100 gal at $1.50/gal)	$150
Maintenance supplies, oil, grease, etc.	$200
Mobilization/Demobilization (10% operating costs)	$414
Total Operating Expenses:	$4,554

--CONTINGENCY AND OVERHEAD	
Administrative overhead at 5 % (labor+operation)	$797
Contingency (15 % of personnel, material and operating costs)	$2,806
TOTAL ANNUAL OPERATING COST	$22,306

/N/EXCEL/OTHER/DD/TECHMEMO/COS24NLP.XLS

Table 11. Preliminary conceptual cost estimate for program to mitigate the the loss of spawning habitat inundated or blocked with the 16,000 acre-foot New Los Padres Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Number of Hours	Hourly Rate	Total
Biologist	10	80	$20.19	$1,615
Hydrologist	18	144	$19.23	$2,769
Field Tech	30	240	$12.40	$2,976
Equipment Operator	45	360	$35.00	$12,600
Laborer	45	360	$9.00	$3,240
			Subtotal:	$23,200
Staff Benefits at 40%				$9,280
			Total Labor Costs:	$32,480
--MATERIALS AND SUPPLIES				
Read Screenall Mod RD25B				$48,100
500 feet 10" PVC @ $7.00/ft				$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft				$2,500
500 feet 3" PVC @ $.87/ft				$435
250 gal/min pump, 3 inch discharge				$850
3-inch suction hose				$300
Misc Valves				$250
Misc PVC and ABS connectors				$1,000
Safety Items				$250
Misc tools and supplies				$500
			Total Materials and Supplies:	$57,685
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (45 days @ $100.00 per day)				$4,500
5-yd dump truck (45 days at $160.00 per day)				$7,200
Diesel Fuel (450 gal at $1.50/gal)				$675
Gasoline (450 gal at $1.50/gal)				$675
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$1,325
			Total Operating Expenses:	$14,575
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$2,353
Contingency (15 % of personnel, material and operating costs)				$15,711
TOTAL INITIAL COST				$122,804

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Number of Hours	Hourly Rate	Total
Biologist	7	56	$20.19	$1,131
Hydrologist	7	56	$19.23	$1,077
Field Tech	9	72	$12.40	$893
Equipment Operator	10	80	$35.00	$2,800
Laborer	10	80	$9.00	$720
			Subtotal:	$6,620
Staff Benefits at 40%				$2,648
			Total Labor Costs:	$9,268
--MATERIALS AND SUPPLIES				
Materials on hand, but assume 25% replacement of expendable material cost per year				$2,396
			Total Materials and Supplies:	$2,396
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (10days @ $100.00 per da)				$1,000
5-yd dump truck (10 days at $160.00 per da)				$1.600
Diesel Fuel (100 gal at $1.50/gal)				$150
Gasoline (100 gal at $1.50/gal)				$150
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$310
			Total Operating Expenses:	$3,410
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$634
Contingency (15 % of personnel, material and operating costs)				$2,261
TOTAL ANNUAL OPERATING COST				$17,970

Table 12. Preliminary conceptual cost estimate for program to mitigate the loss of spawning habitat inundated or blocked with the 9,000 acre-foot New Los Padres Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Number of Hours	Hourly Rate	Total
Biologist	5	40	$20.19	$808
Hydrologist	14	112	$19.23	$2,154
Field Tech	18	144	$12.40	$1,786
Equipment Operator	31	248	$35.00	$8,680
Laborer	31	248	$9.00	$2,232
			Subtotal:	$15,659
Staff Benefits at 40%				$6,264
			Total Labor Costs:	$21,923
--MATERIALS AND SUPPLIES				
Read Screenall Mod RD25B				$48,100
500 feet 10" PVC @ $7.00/ft				$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft				$2,500
500 feet 3" PVC @ $.87/ft				$435
250 gal/min pump, 3 inch discnarge				$850
3-inch suction hose				$300
Misc Valves				$250
Misc PVC and ABS connectors				$1,000
Safety Items				$250
Misc tools and supplies				$500
			Total Materials and Supplies:	$57,685
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (31 days @ $100.00 per day)				$3,100
5-yd dump truck (31 days at $160.00 per day)				$4,960
Diesel Fuel (310 gal at $1.50/gal)				$465
Gasoline (310 gal at $1.50/gal)				$465
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$919
			Total Operating Expenses:	$10,109
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$1,602
Contingency (15 % of personnel, material and (operating costs)				$13,457
TOTAL INITIAL COST				$104,776

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Number of Hours	Hourly Rate	Total
Biologist	7	56	$20.19	$1,131
Hydrologist	6	48	$19.23	$923
Field Tech	10	80	$12.40	$992
Equipment Operator	7	56	$35.00	$1,960
Laborer	7	56	$9.00	$504
			Subtotal:	$5,510
Staff Benefits at 40%				$2,204
			Total Labor Costs:	$7,714
--MATERIALS AND SUPPLIES				
Materials on hand, but assume 25% replacement of expendable material cost per year				$2,396
			Total Materials and Supplies:	$2,396
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (7 days @ $100.00 per da)				$700
5-yd dump truck (7 days at $160.00 per da)				$1,120
Diesel Fuel (100 gal at $1.50/gal)				$150
Gasoline (100 gal at $1.50/gal)				$150
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$232
			Total Operating Expenses:	$2,552
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$513
Contingency (15 % of personnel, material and (operating costs)				$1,899
TOTAL ANNUAL OPERATING COST				$15,074

Table 13. Preliminary conceptual cost estimate for program to mitigate the loss of spawning habitat inundated or blocked with the 6,000 acre-foot Cachagua Creek Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	3	24	$20.19	$485
Hydrologist	13	100	$19.23	$1,923
Field Tech	14	112	$12.40	$1,389
Equipment Operator	14	112	$35.00	$3,920
Laborer	14	112	$9.00	$1,008
			Subtotal:	$8,724
Staff Benefits at 40%				$3,490
			Total Labor Costs:	$12,214
--MATERIALS AND SUPPLIES				
Read Screenall Mod RD25B				$48,100
500 feet 10" PVC @ $7.00/ft				$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft				$2,500
500 feet 3" PVC @ $.87/ft				$435
250 gal/min pump, 3 inch discharge				$850
3-inch suction hose				$300
Misc Valves				$250
Misc PVC and ABS connectors				$1,000
Hoppers for gravel (0 @ $500 each)				$0
Safety Items				$250
Misc tools and supplies				$500
			Total Materials and Supplies:	$57,685
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (14 days @ $100.00 per day)				$1,400
5-yd dump truck (14 days at $160.00 per day)				$2,240
Subcontractor, Heliocopter (0 hours @ $500.00/hr.)				$0
Diesel Fuel (140 gal at $1.50/gal)				$210
Gasoline (140 gal at $1.50/gal)				$210
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$426
			Total Operating Expenses:	$4,686
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$845
Contingency (15 % of personnel, material and operating costs)				$11,188
TOTAL INITIAL COST				$86,618

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	5.5	44	$20.19	$888
Hydrologist	5.5	44	$19.23	$846
Field Tech	7	56	$12.40	$694
Equipment Operator	3.5	28	$35.00	$980
Laborer	3.5	28	$9.00	$252
			Subtotal:	$3,661
Staff Benefits at 40%				$1,464
			Total Labor Costs:	$5,125
--MATERIALS AND SUPPLIES				
Materials on hand, but assume 25% replacement of expendable material cost per year				$2,396
			Total Materials and Supplies:	$2,396
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (3.5 days @ $100.00 per da)				$350
5-yd dump truck (3.5 days at $160.00 per da)				$560
Diesel Fuel (35 gal at $1.50/gal)				$53
Gasoline (35 gal at $1.50/gal)				$53
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$122
			Total Operating Expenses:	$1,337
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$323
Contingency (15 % of personnel, material and operating costs)				$1,329
TOTAL ANNUAL OPERATING COST				$10,510

Table 14. Preliminary conceptual cost estimate for program to mitigate the loss of spawning habitat inundated or blocked with the 11,000 acre-foot San Clemente Creek Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	9	72	$20.19	$1,454
Hydrologist	15	120	$19.23	$2,308
Field Tech	47	376	$12.40	$4,662
Equipment Operator	47	376	$35.00	$13,160
Laborer	47	376	$9.00	$3,384
			Subtotal:	$24,968
Staff Benefits at 40%				$9,987
			Total Labor Costs:	$34,955

--MATERIALS AND SUPPLIES	
Read Screenall Mod RD258	$48,100
500 feet 10" PVC @ $7.00/ft	$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft	$2,500
500 feet 3" PVC @ $.87/ft	$435
250 gal/min pump, 3 inch discharge	$850
3-inch suction hose	$300
Misc Valves	$250
Misc PVC and ABS connectors	$1,000
Safety Items	$250
Hoppers for gravel (3 @ $500 each)	$1,500
Misc tools and supplies	$500
Total Materials and Supplies:	$59,185

--OPERATING EXPENSES	
4-wheel drive tractor with backhoe and load bucket (47 days @ $100.00 per day)	$4,700
5-yd dump truck (47 days at $160.00 per day)	$7,520
Subcontractor, Heliocopter (24 hours @ $500.00/hr.)	$12,000
Diesel Fuel (470 gal at $1.50/gal)	$705
Gasoline (470 gal at $1.50/gal)	$705
Maintenance supplies, oil, grease, etc.	$200
Mobilization/Demobilization (10% operating costs)	$2,583
Total Operating Expenses:	$28,413

--CONTINGENCY AND OVERHEAD	
Administrative overhead at 5 % (labor + operation)	$3,168
Contingency (15 % of personnel, material and (operating costs)	$18,383
TOTAL INITIAL COST	$144,104

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	8	64	$20.19	$1,292
Hydrologist	8	64	$19.23	$1,231
Field Tech	15	120	$12.40	$1,488
Equipment Operator	10	80	$35.00	$2,800
Laborer	10	80	$9.00	$720
			Subtotal:	$7,531
Staff Benefits at 40%				$3,012
			Total Labor Costs:	$10,543

--MATERIALS AND SUPPLIES	
Materials on hand, but assume 25% replacement of expendable material cost per year	$2,771
Total Materials and Supplies:	$2,771

--OPERATING EXPENSES	
4-wheel drive tractor with backhoe and load bucket (10 days @ $100.00 per da)	$1,000
5-yd dump truck (10 days at $160.00 per da)	$1,600
Diesel Fuel (100 gal at $1.50/gal)	$150
Gasoline (100 gal at $1.50/gal)	$150
Maintenance supplies, oil, grease, etc.	$200
Mobilization/Demobilization (10% operating costs)	$310
Total Operating Expenses:	$3,410

--CONTINGENCY AND OVERHEAD	
Administrative overhead at 5 % (labor + operation)	$698
Contingency (15 % of personnel, material and (operating costs)	$2,509
TOTAL ANNUAL OPERATING COST	$19,931

Table 15. Preliminary conceptual cost estimate for program to mitigate the loss of spawning habitat inundated or blocked with the 23,000 acre-foot New San Clemente Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	12	96	$20.19	$1,938
Hydrologist	17	136	$19.23	$2,615
Field Tech	60	480	$12.40	$5,952
Equipment Operator	60	480	$35.00	$16,800
Laborer	60	480	$9.00	$4,320
			Subtotal:	$31,626
Staff Benefits at 40%				$12,650
			Total Labor Costs:	$44,276
--MATERIALS AND SUPPLIES				
Read Screenall Mod RD25B				$48,100
500 feet 10" PVC @ $7.00/ft				$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft				$2,500
500 feet 3" PVC @ $.87/ft				$435
250 gal/min pump, 3 inch discharge				$850
3-inch suction hose				$300
Misc Valves				$250
Misc PVC and ABS connectors				$1,000
Safety Items				$250
Hoppers for gravel (3 @ $500 each)				$1,500
Misc tools and supplies				$500
			Total Materials and Supplies:	$59,185
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (60 days @ $100.00 per day)				$6,000
5-yd dump truck (60 days at $160.00 per day)				$9,600
Subcontractor, Heliocopter (48 hours @ $500.00/hr.)				$24,000
Diesel Fuel (600 gal at $1.50/gal)				$900
Gasoline (600 gal at $1.50/gal)				$900
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$4,160
			Total Operating Expenses:	$45,760
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$4,502
Contingency (15 % of personnel, material and operating costs)				$22,383
TOTAL INITIAL COST				$176,106

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	8	64	$20.19	$1,292
Hydrologist	7	56	$19.23	$1,077
Field Tech	19	152	$12.40	$1,885
Equipment Operator	14	112	$35.00	$3,920
Laborer	14	112	$9.00	$1,008
			Subtotal:	$9,182
Staff Benefits at 40%				$3,673
			Total Labor Costs:	$12,855
--MATERIALS AND SUPPLIES				
Materials on hand, but assume 25% replacement of expendable material cost per year				$2,771
			Total Materials and Supplies:	$2,771
--OPERATING EXPENSES				
4-wheel drive tractor with backhoe and load bucket (14 days @ $100.00 per da)				$1,400
5-yd dump truck (14 days at $160.00 per da)				$2,240
Diesel Fuel (140 gal at $1.50/gal)				$210
Gasoline (140 gal at $1.50/gal)				$210
Maintenance supplies, oil, grease, etc.				$200
Mobilization/Demobilization (10% operating costs)				$426
			Total Operating Expenses:	$4,686
--CONTINGENCY AND OVERHEAD				
Administrative overhead at 5 % (labor + operation)				$877
Contingency (15 % of personnel, material and operating costs)				$3,047
TOTAL ANNUAL OPERATING COST				$24,236

/N/EXCEL/OTHER/DD/TECHMEMO/COS24NLP.XLS

Table 16. Preliminary conceptual cost estimate for program to mitigate the loss of spawning habitat inundated or blocked with the 10,000 acre-foot Chupines Creek Reservoir.

INITIAL COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	2	16	$20.19	$323
Hydrologist	11	88	$19.23	$1,692
Field Tech	9	72	$12.40	$893
Equipment Operator	9	72	$35.00	$2,520
Laborer	9	72	$9.00	$648
			Subtotal:	$6,076
Staff Benefits at 40%				$2,430
			Total Labor Costs:	$8,507

--MATERIALS AND SUPPLIES	
Read Screenall Mod RD25B	$48,100
500 feet 10" PVC @ $7.00/ft	$3,500
500 feet 12" ABS Flex Pipe @ $5.00/ft	$2,500
500 feet 3" PVC @ $.87/ft	$435
250 gal/min pump, 3 inch discharge	$850
3-inch suction hose	$300
Misc Valves	$250
Misc PVC and ABS connectors	$1,000
Safety Items	$250
Misc tools and supplies	$500
Total Materials and Supplies:	$57,685

--OPERATING EXPENSES	
4-wheel drive tractor with backhoe and load bucket (9 days @ $100.00 per day)	$900
5-yd dump truck (9 days at $160.00 per day)	$1,440
Subcontractor, Heliocopter (0 hours @ $500.00/hr.)	$0
Diesel Fuel (90 gal at $1.50/gal)	$135
Gasoline (90 gal at $1.50/gal)	$135
Maintenance supplies, oil, grease, etc.	$200
Mobilization/Demobilization (10% operating costs)	$281
Total Operating Expenses:	$3,091

--CONTINGENCY AND OVERHEAD	
Administrative overhead at 5 % (labor+operation)	$580
Contingency (15 % of personnel, material and operating costs)	$10,392
TOTAL INITIAL COST	$80,255

ANNUAL OPERATING COSTS

--LABOR	Number of Days	Hours	Hourly Rate	Total
Biologist	5.5	44	$20.19	$888
Hydrologist	5.5	44	$19.23	$846
Field Tech	8	64	$12.40	$794
Equipment Operator	3	24	$35.00	$840
Laborer	3	24	$9.00	$216
			Subtotal:	$3,584
Staff Benefits at 40%				$1,434
			Total Labor Costs:	$5,018

--MATERIALS AND SUPPLIES	
Materials on hand, but assume 25% replacement of expendable material cost per year	$2,396
Total Materials and Supplies:	$2,396

--OPERATING EXPENSES	
4-wheel drive tractor with backhoe and load bucket (3 days @ $100.00 per da)	$300
5-yd dump truck (3 days at $160.00 per da)	$480
Diesel Fuel (30 gal at $1.50/gal)	$45
Gasoline (30 gal at $1.50/gal)	$45
Maintenance supplies, oil, grease, etc.	$200
Mobilization/Demobilization (10% operating costs)	$107
Total Operating Expenses:	$1,177

--CONTINGENCY AND OVERHEAD	
Administrative overhead at 5 % (labor+operation)	$310
Contingency (15 % of personnel, material and operating costs)	$1,289
TOTAL ANNUAL OPERATING COST	$10,189

APPENDIX 9-A
NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN THE WATER SUPPLY PROJECT AREAS

NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN NEW LOS PADRES INUNDATION AREA, 6, 8, 9 JUNE, AND 8 SEPT., 1989, BY JEFF NORMAN

TREES:

Acer macrophyllum	big-leaf maple
Aesculus californicus	buckeye
Alnus rhombifolia	white alder
Alnus rubra	red alder
Arbutus menziesii	madrone
Eucalyptus globulus	blue gum
Lithocarpus densiflorus	tan oak
Pinus coulteri	Coulter pine
Pinus ponderosa	ponderosa pine
Pinus radiata	Monterey pine
Platanus racemosa	western sycamore
Populus trichocarpa	black cottonwood
Quercus agrifolia	coast live oak
Quercus chrysolepis	canyon live oak
Quercus kelloggii	black oak
Quercus lobata	valley oak
Robinia pseudo-acacia	black locust
Salix coulteri	coulter willow
Salix hindsiana	sandbar willow
Salix laevigata var. araquipa	red willow
Salix laevigata var. laevigata	red willow
Salix lasiolepis var. lasiolepis	arroyo willow
Sambucus mexicana	blue elderberry
Umbellularia californica	California bay

SHRUBS:

Adenostoma fasciculatum	chamise
Antirrhinum multiflorum	sticky snapdragon
Arctostaphylos glandulosa ssp. zacaensis f. zacaensis	Eastwood manzanita
Arctostaphylos tomentosa ssp. crustacea	brittle-leaf manzanita
Arctostaphylos sp.	manzanita
Artemisia californica	California sagebrush
Baccharis pilularis var. consanguinea	coyote brush
Baccharis viminea	mule fat
Brickellia californica	California brickelbush
Ceanothus cuneatus	buck brush
Ceanothus sorediatus	jimbrush
Clematis lasiantha	pipe-stem
Cornus sericea ssp. occidentalis	western red dogwood
Epilobium canum	California fuchsia
Ericameria arborescens	golden fleece
Eriodictyon californicum	yerba santa
Eriogonum fasciculatum var. foliolosum	buckwheat brush
Eriophyllum confertiflorum var. confertiflorum	golden yarrow
Galium angustifolium var. angustifolium	narrow-leaved bedstraw
Galium porrigens var. porrigens	climbing bedstraw
Heteromeles arbutifolia	toyon
Holodiscus discolor	cream bush
Keckiella breviflora	bush beard-tongue
Lonicera hispidula var. vacillans	hairy honeysuckle
Lonicera interrupta	chaparral honeysuckle

NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN NEW LOS PADRES INUNDATION AREA, 6, 8, 9 JUNE, AND 8 SEPT., 1989, BY JEFF NORMAN

SHRUBS (cont.):

Lotus scoparius var. scoparius f. scoparius	deerweed
Lupinus albifrons var. albifrons	silver lupine
Mahonia pinnata	California barberry
Mimulus aurantiacus	sticky monkey-flower
Mimulus bifidus ssp. fasciculatus	Santa Lucia sticky monkey-flower
Prunus ilicifolia	holly-leaved cherry
Penstemon heterophyllus ssp. australis	chaparral penstemon
Rhamnus californica ssp. californica	coffeeberry
Rhamnus californica ssp. tomentella	coffeeberry
Rhamnus crocea ssp. crocea	redberry
Rhamnus crocea ssp. ilicifolia	hollyleaf redberry
Ribes amarum	bitter gooseberry
Ribes divaricatum	straggly gooseberry
Ribes menziesii var. menziesii ?	canyon gooseberry
Ribes sericeum ?	Santa Lucia gooseberry
Ribes speciosum	garnet gooseberry
Rosa californica	California wild rose
Rosa gymnocarpa	wood rose
Rubus parviflorus	thimbleberry
Rubus procerus	Himalaya-berry
Rubus ursinus	Pacific blackberry
Salvia mellifera	black sage
Symphoricarpos mollis	creeping snowberry
Toxicodendron diversilobum	poison oak

HERBACEOUS SPECIES:

Achillea borealis ssp. californica	common yarrow
Agoseris californica	annual agoseris
Agoseris grandiflora	large-flowered agoseris
Aira caryophyllea	hair grass
Allophyllum divaricatum	divaricate gilia
Allophyllum glutinosum	glutinous allophyllum
Anagallis arvensis	scarlet pimpernel
Anthriscus caucalis	bur-chervil
Aquilegia formosa var. hypolasia	columbine
Arabis glabra var. glabra	tower mustard
Aralia californica	elk clover
Arenaria douglasii	Douglas' sandwort
Artemisia douglasiana	mugwort
Artemisia dranunculus	dragon sagewort
Asclepias eriocarpa	Indian milkweed
Avena barbata	slender oat
Baccharis douglasii	Douglas' baccharis
Barbarea verna	winter-cress
Boykinia elata	brook foam
Brassica geniculata	summer mustard
Briza maxima	rattlesnake grass
Briza minor	little quaking grass
Brodiaea lutea	golden brodiaea

NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN NEW LOS PADRES INUNDATION AREA, 6, 8, 9 JUNE, AND 8 SEPT., 1989, BY JEFF NORMAN

HERBACEOUS SPECIES (cont.):

Brodiaea pulchella	blue dicks
Bromus carinatus	California brome
Bromus mollis	soft chess
Bromus rigidus	ripgut grass
Bromus rubens	red brome
Calochortus albus var. albus	white globe lily
Calystegia purpurata ssp. solanensis	western morning-glory
Camissonia fruticetorum	primrose
Cardamine oligosperma	hill cress
Carex spp.	sedges
Castilleja affinis	Indian paint brush
Castilleja foliolosa	wooly painted cup
Centaurea melitensis	tocalote
Cerastium glomeratum	mouse-ear chickweed
Chenopodium ambrosioides	Mexican tea
Chlorogalum pomeridianum	amole
Chorizanthe staticoides	Turkish rugging
Chrysopsis villosa var. camphorata	hairy golden aster
Cirsium occidentale	cobweb thistle
Cirsium proteanum	red thistle
Cirsium vulgare	bull thistle
Clarkia cylindrica	band clarkia
Clarkia lewisii	Lewis' clarkia
Clarkia purpurea ssp. purpurea	purple clarkia
Clarkia purpurea ssp. quadrivulnera	four spot
Clarkia unguiculata	canyon clarkia
Claytonia perfoliata	miner's lettuce
Collinsia heterophylla	Chinese houses
Collomia grandiflora	large-flowered collomia
Conyza canadensis	horseweed
Corethrogyne filaginifolia var. rigida	corethrogyne
Cryptantha microstachys	tejon cryptantha
Cryptantha muricata var. muricata	spiny cryptantha
Cyperus eragrostis	umbrella sedge
Datisca glomerata	durango root
Daucus pusillus	yerba vibra
Delphinium parryi	Parry's larkspur
Dodecatheon sp.	shooting star
Dudleya cymosa ssp. minor	Goldman's dudleya
Elymus condensatus	giant wild rye
Elymus glaucus	blue wild rye
Epilobium adenocaulon var. parishii	California willow-herb
Epilobium paniculatum	summer cottonweed
Epipactis gigantea	stream orchis
Erechtites prenanthoides	toothed coast fireweed
Eremocarpus setigerus	dove weed
Erigeron foliilosus var. foliolosus	leafy daisy
Eriogonum elongatum	long-stemmed eriogonum
Eriogonum nudum var. auriculatum	naked buckwheat
Eriogonum roseum	virgate eriogonum
Erodium botrys	long-beaked filaree
Erodium cicutarium	red-stemmed filaree
Eschscholzia caespitosa	tufted poppy

NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN NEW LOS PADRES INUNDATION AREA, 6, 8, 9 JUNE, AND 8 SEPT., 1989, BY JEFF NORMAN

HERBACEOUS SPECIES (cont.):

Eschscholzia californica var. californica	California poppy
Filago californica	California cotton rose
Filago gallica	narrow-leaved filago
Foeniculum vulgare	sweet fennel
Galium aparine	goosegrass
Galium californicum ssp. flaccidum	California bedstraw
Galium parisiense	wall bedstraw
Geranium molle	dove's foot geranium
Gilia capitata ssp. abrotanifolia	blue field gilia
Gnaphalium beneolens	fragrant everlasting
Gnaphalium californicum	California everlasting
Gnaphalium chilense	cotton-batting plant
Gnaphalium luteo-album	weedy cudweed
Gnaphalium purpureum	purple cudweed
Helenium puberulum	sneezeweed
Heracleum lanatum	cow parsnip
Heterotheca grandiflora	telegraph weed
Heuchera micrantha var. hartwegii	alum root
Hieracium argutum var. parishii	yellow-flowered hawkweed
Horkelia frondosa	leafy horkelia
Hypochoeris glabra	smooth cat's ear
Juncus spp.	wire rushes
Lactuca serriola	prickly lettuce
Lathyrus vestitus ssp. puberulus	Pacific pea
Lathyrus vestitus ssp. vestitus	Pacific pea
Layia paniculata	slender layia
Lilium pardalinum	tiger lil
Linanthus liniflorus ssp. pharnacoides	flax-flowered linanthus
Lolium multiflorum	Italian rye
Lomatium utriculatum	bladder parsnip
Lotus crassifolius	broad-leaved lotus
Lotus micranthus	hill lotus
Lotus purshianus	Spanish clover
Lotus strigosus	bishop lotus
Lupinus bicolor ssp. microphyllus	Lindley's annual lupine
Lupinus formosus var. bridgesi	lunara lupine
Lupinus hirsutissimus	stinging lupine
Lupinus latifolius	broad-leaved lupine
Lupinus nanus ssp. nanus	sky lupine
Lupinus succulentus	succulent annual lupine
Madia elegans ssp. elegans	common madia
Madia gracilis	gumweed
Malacothrix clevelandii	Cleveland's malacothrix
Marah fabaceus	manroot
Medicago lupulina	black medic
Medicago polymorpha var. polymorpha	bur clover
Melilotus albus	white sweet-clover
Melilotus indicus	Indian melilot
Micropus californicus	slender cottonweed
Microseris lindleyi	blow-wives
Mimulus cardinalis	scarlet monkey-flower
Mimulus floribundus	floriferous monkey-flower
Mimulus guttatus ssp. guttatus	seep-spring monkey-flower

NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN NEW LOS PADRES INUNDATION AREA, 6, 8, 9 JUNE, AND 8 SEPT., 1989, BY JEFF NORMAN

HERBACEOUS SPECIES (cont.):

Monardella villosa var. obispoensis	coyote mint
Navarretia atractyloides	holly-leaved navarretia
Orthocarpus purpurascens var. purpurascens	purple owl's clover
Osmorhiza brachypoda	California cicely
Petasites palmatus	western coltsfoot
Phacelia egena	phacelia
Phacelia imbricata	imbricate phacelia
Pholistoma auritum	fiesta flower
Phoradendron tomentosum ssp. villosum	oak mistletoe
Plantago lanceolata	ribgrass
Plectritis sp.	plectritis
Polygala californica	California milkwort
Polygonum aviculare	common knotweed
Polygonum lapathifolium	willow weed
Polypogon monspeliensis	rabbit's foot grass
Psoralea macrostachya	leather root
Psoralea physodes	California tea
Pterostegia drymarioides	pterostegia
Rafinesquia californica	California chicory
Ranunculus californicus var. californicus	California buttercup
Rorippa curvisiliqua	western yellow-cress
Rumex acetosella	sheep sorrel
Rumex conglomeratus	clustered dock
Rumex crispus	curly dock
Rumex salicifolius	willow dock
Salvia columbariae	chia
Salvia spathacea	crimson sage
Sanicula crassicaulis	gamble weed
Satureja chamissonis	yerba buena
Scrophularia californica	coast figwort
Silene antirrhina	sticky catchfly
Silene gallica	windmill pink
Solanum nigrum	black nightshade
Solidago californica	California goldenrod
Sonchus oleraceus	common sow thistle
Spergula arvensis	corn spurrey
Stachys bullata	hedge nettle
Stellaria media	common chickweed
Stephanomeria virgata ssp. pleurocarpa	tall wire lettuce
Tauschia hartwegii	Hartweg's tauschia
Thalictrum fendleri	Fendler's meadow rue
Thysanocarpus elegans	lace pod
Tillaea erecta	sand pygmy
Torilis nodosa	hedge parsley
Trichostema lanceolatum	vinegar weed
Trifolium ciliolatum	tree clover
Trifolium microcephalum	maiden clover
Trifolium obtusiflorum	creek clover
Trifolium tridentatum	tomcat clover
Trifolium variegatum var. variegatum	white-tipped clover
Typha sp.	cattail
Urtica holosericea	hoary nettle
Verbena lasiostachys var. abramsii	western vervain

NATIVE AND NATURALIZED VASCULAR PLANTS SEEN IN NEW LOS PADRES INUNDATION AREA, 6, 8, AND 9 JUNE, AND 8 SEPT., 1989, BY JEFF NORMAN

HERBACEOUS SPECIES (cont.):

Verbena lasiostachys var. lasiostachys	western vervain
Veronica angallis-aquatica	water speedwell
Viola pedunculata	Johnny-jump-up
Wyethia helenoides	woolly mule-ears
Yucca whipplei ssp. percursa	Spanish bayonet
Zigadenus fremontii var. fremontii	star-lily

FERNS AND FERN ALLIES:

Adiantum jordanii	California maidenhair fer
Adiantum pedatum var. aleuticum	five-finger fern
Dryopteris arguta	wood fern
Equisetum arvense	horsetail
Equisetum x ferrissii	scouring rush
Equisetum laevigatum	Braun's scouring rush
Equisetum telmateia var. braunii	giant horsetail
Pellaea andromedaefolia	coffee fern
Pellaea mucronata	bird's foot fern
Pityrogramma triangularis	printback fern
Polypodium californicum var. californicum	California polypody
Polystichum munitum ssp. munitum	sword fern
Pteridium aquilinum var. pubescens	western bracken
Selaginella bigelovii	bushy selaginella
Woodwardia fimbriata	chain fern

ADDITIONS AND CORRECTIONS TO THE LIST OF NATIVE AND NATURALIZED VASCULAR PLANTS OF THE NEW LOS PADRES INUNDATION AREA, AS OF SPRING, 1990.

The following taxa should be eliminated from the list of plants seen in June and September, 1989: Ribes menziesii var. menziesii
Ribes sericeum

The shooting stars, which were not seen early enough last year to determine, were found to be Dodecatheon clevelandii ssp. sanctarum. The plectritis seen last year, likewise too early to identify, was found to be Plectritis congesta ssp. congesta.

In addition to the two taxa listed above, the following should be added to the list, based on field work of 15, 16, 24 and 25 May, 1990:

SHRUBS, SUBSHRUBS, AND WOODY VINES:

Clematis ligusticifolia	yerba de chivato
Dendromecon rigida	bush poppy
Oemleria cerasiformis	oso berry

HERBACEOUS SPECIES:

Amsinckia intermedia	common fiddleneck
Bowlesia incana	bowlesia
Calochortus albus var. rubellus	globe lily
Camissonia hardhamiae	Hardham's camissonia
Cardamine californica	milk maids
Chorizanthe membranacea	pink chorizanthe
Collomia heterophylla	varied-leaved collomia
Cordylanthus rigidus	bird's beak
Cryptantha muricata var. jonesii	cryptantha
Cuscuta californica var. californica	chaparral dodder
Cynoglossum grande	hound's tongue
Delphinium patens ssp. patens	coast larkspur
Disporum hookeri	fairy bells
Erigeron foliosus var. stenophyllus	leafy daisy
Erysimum capitatum	Douglas' wallflower
Euphorbia crenulata	Chinese caps
Euphorbia peplus	petty spurge
Fritillaria lanceolata	checker lily
Galium californicum ssp. californicum	California bedstraw
Galium sp.	anomalous bedstraw
Gilia achilleaefolia ssp. achilleaefolia	California gilia
Gilia achilleaefolia ssp. multicaulis	gilia
Gnaphalium bicolor	Bioletti's cudweed
Habenaria unalascensis	Alaska habenaria
Heuchera micrantha var. pacifica	alum-root
Lasthenia chrysostoma ssp. chrysostoma	goldfields
Linanthus androsaceus ssp. luteolus	shower gilia
Linanthus ciliatus	whisker brush
Lithophragma heterophylla	hill star

ADDITIONS AND CORRECTIONS TO THE LIST OF NATIVE AND NATURALIZED VASCULAR PLANTS OF THE NEW LOS PADRES INUNDATION AREA, AS OF SPRING, 1990.

HERBACEOUS SPECIES (cont.):

Lobelia dunnii var. serrata	Rothrock's lobelia
Lomatium sp.	anomalous lomatium
Lotus oblongifolius	narrow-leaved lotus
Madia elegans ssp. vernalis	madia
(Material seen in the inundation area this season fits the description of the low-elevation ecotype in Munz, 1959. Hoover (1970) finds little other than blooming period to distinguish it from ssp. elegans. Not previously reported from Monterey County.)	
Madia exigua	little tarweed
Madia sativa	Chile tarweed
Matricaria matricarioides	pineapple weed
Mimulus nasutus	snouted monkey-flower
Nemophila heterophylla	variable-leaved nemophila
Nemophila menziesii	baby-blue-eyes
Osmorhiza chilensis	wood cicely
Phacelia distans	common phacelia
Phacelia malvaefolia	stinging phacelia
Plagiobothrys nothofulvus	popcorn flower
Potentilla glandulosa	sticky cinquefoil
Saxifraga californica	California saxifrage
Silene lemmonii	Lemmon's campion
Sisymbrium officinale	hedge mustard
Smilacina racemosa var. amplexicaulis	western Solomon's seal
Thysanocarpus curvipes	hairy fringe pod
Thysanocarpus laciniatus var. crenatus	narrow-leaved fringe pod
Trifolium albopurpureum	rancheria clover
Trifolium gracilentum	pin-point clover
Trifolium variegatum var. pauciflorum	white-tipped clover
Tunica prolifera	wild carnation
(Introduced. Not previously reported from Monterey County.)	
Veronica arvensis	corn speedwell
Veronica persica	Persian speedwell
Vicia benghalensis	vetch
Vicia exigua	slender vetch
Vicia sativa	spring vetch
Viola quercetorum	oak violet
Whipplea modesta	yerba de selva

FERNS AND FERN ALLIES:

Cheilanthes intertexta	coastal lip-fern

COMMON, POTENTIAL AND OBSERVED PLANT SPECIES FOR THE DESALINATION PROJECT REGION MONTEREY COUNTY, CALIFORNIA

Common Name	Scientific Name
Abronia umbellata	Pink Sand Verbena
Achhillea millifolium	Yarrow
Alopecurus sp.	Foxtail
Ambrosia chamissonis var. *bipinnatisecta*	Beach Bur
Anagalis arvensis	Scarlet Pimpernel
Artemisia californica	California Sagebrush
Artemisia pycnocephala	Beach Sagewort
Astragalus nuttallii	Rattleweed
Atriplex lentiformis var. *breweri*	Saltbush
Atriplex patula ssp. *hastata*	Fat Hen
Atriplex semibaccata	Australian Saltbush
Atriplex sp.	Saltbush
Avena fatua	Wild Oats
Baccharis pilularis var. *consanguinea*	Coyote Brush
Brassica geniculata	Short-podded Mustard
Brassica sp.	Mustard
Bromus diandrus	Rip-gut Brome
Bromus mollis	Soft Chess
Bromus sp.	Brome Grass
Cakile maritima	Sea Rocket
Camissonia cheiranthifolia	Beach Evening-primrose
Cardionema ramosissimum	Sand Mat
Carpobrotus edule	Hottentot-fig
Carpobrotus sp.	Iceplant
Castilleja sp.	Paintbrush
Centaurea solstitialis	Yellow Star-thistle
Chorizanthe sp.	Spineflower
Cirsium vulgare	Bull Thistle

Common Name	Scientific Name
Conium maculatum	Poison-hemlock
Cortaderia selloana	Pampas Grass
Cotula coronipifolia	Brass Buttons
Croton californicus var. *californicus*	Croton
Cupressus macrocarpa	Monterey Cypress
Cyperus eragrostis	Umbrella Sedge
Cytisus monspessulanus	French Broom
Distichlis spicata var. *stolonifera*	Salt Grass
Dudleya farinosa	Live Forever
Elymus mollis	American Dunegrass
Elymus pacificus	Pacific Dunegrass
Elymus triticoides	Ryegrass
Epilobium watsonii var. *franciscanum*	San Francisco Willow-herb
Ericameria ericoides	Mock-heather
Eriogonum latifolium	Broadleaved Buckwheat
Eriogonum parvifolium	Seacliff Buckwheat
Eriophyllum staechadifolium	Lizardtail
Erodium cicutarium	Red-stem Filaree
Erodium moschatum	Whit-stem Filaree
Eschscholzia californica	California Poppy
Foeniculum vulgare	Sweet Fennel
Frankenia salina	Alkali Heath
Gernaium sp.	Wild Geranium
Gnaphalium sp.	Cudweed
Grindelia sp.	Gumplant
Heliotropium curassavicum	Heliotrope
Hemizonia sp.	Tarweed
Heterotheca grandiflora	Telegraph Weed
Hordeum sp.	Foxtail
Jaumea carnosa	Jaumea
Lepidium latifolium	Broadleaved Peppergrass
Lobularia maritima	Sweet Alyssum
Lolium multiflorum	Italian Ryegrass
Lotus scoparius	Deer Weed
Lupinus albifrons	Silver Lupine
Lupinus arboreus	Tree Lupine
Lupinus chamissonis	Coastal Silver Lupine
Lupinus nanus	Annual Lupine
Lupinus sp.	Perennial Lupine
Malacothrix sp.	Snakeweed
Malva parvifolia	Cheeseweed
Marah fabaceus	Manroot
Melilotus indica	Yellow Sweet-clover
Nicotiana glauca	Tree Tobacco

Common Name	Scientific Name
Oxalis pes-caprae	Bermuda-buttercup
Parapholis incurva	Sicklegrass
Phacelia distans	Common Phacelia
Poa douglasii	Dune Bluegrass
Polygonum paronychia	Knotweed
Polypogon monspeliensis	Rabbit's-foot Grass
Populus trichocarpa	Black Poplar
Potentilla egedii	Cinquifoil
Raphanus sativus	Wild Radish
Raphanus californica	California Coffeeberry
Rubus sp.	Wild Blackberry
Rumex acetosella	Sorrel
Rumex crispus	Curly Dock
Salicornia sp.	Pickleweed
Salix lasiolepis	Arroyo Willow
Scirpus americanus	Three Square
Scirpus californicus	California Bulrush
Scirpus robustus	Alkali Bulrush
Senecio vulgaris	Groundsel
Senecio mikanioides	German-ivy
Solanum sp.	Nightshade
Sonchus asper	Prickly Sow-thistle
Spergularia sp.	Sand-spurry
Taraxacum officinale	Dandelion
Tetragonia expansa	New Zealand-spinich
Toxicodendron diversilobum	Poison-oak
Typha sp.	Cat-tail
Vulpia sp.	Annual Fescue

Plant species recorded during field surveys on July 11, October 30, 1991 and February 26, 1992.

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Source: Denise Duffy and Associates, Environmental Assessment of the Canada Reservoir Project, April 1991.

Vascular Plant Species Observed by Habitat During 1989 and 1990 Field Surveys in the Cañada Reservoir Project Study Area

PTERIDOPHYTA

ADIANTACEAE
Adiantum jordanii: LO, M-L
Pityrogramma triangularis: MP, LO, CS, R, M-L, C-L

ASPLENIACEAE
Dryopteris arguta: MP, LO, CS, M-L, C-L
Polystichum munitum: MP

DENNSTAEDTIACEAE
Pteridium aquilinum var. *pubescens*: MP, C-S

EQUISETACEAE
Equisetum arvense: R

POLYPODIACEAE
Polypodium californicum: MP, LO, CS

GYMNOSPERMAE

PINACEAE
Pinus radiata: MP, LO, CH, C-S, M-L

TAXODIACEAE
Sequoia sempervirens: DW

ANGIOSPERMAE

DICOTS

ACERACEAE
Acer negundo var. *californicum*: B, R

AMARANTHACEAE
Amaranthus retroflexus: F

ANACARDIACEAE

* *Schinus molle*: F
Toxicodendron diversilobum; MP, LO, B, CS, C-S, CP, DG, R, M-L, C-L

APIACEAE

* *Anthriscus caucalis*: LO, B, DG
Bowlesia incana: LO, M-L,
* *Conium maculatum*: MP, LO, B, DG, R, F, DW, M-L
Daucus pusillus: LO
* *Foeniculum vulgare*: R, F
Heracleum lanatum: MP, LO, M-L
Osmorhiza chilensis: MP, LO, M-L
Sanicula arctopoides: CP
Sanicula bipinnata: MP, LO, C-S
Sanicula bipinnatifida: CP
Sanicula crassicaulis: MP, LO, C-S, M-L
Sanicula sp. nov.: LO, M-L
* *Torilis nodosa*: LO, DG, C-L
Yabea microcarpa: LO

APOCYNACEAE

* *Vinca major*: R, DW

ASTERACEAE

Achillea millefolium var. *californica*: MP, LO, C-S, CP, M-L, C-L
Agoseris grandiflora: LO
Agoseris heterophylla: MP, C-S, CP
Anaphalis margaritacea: LO
Artemisia californica: LO, B, CS, C-S, CP, R, C-L
Artemisia douglasiana: LO, CS, R, M-L, C-L
Aster hesperius: LO, CS
Baccharis pilularis var. *consanguinea*: MP, LO, B, CS, C-S, CP, DG, R, M-L, C-L
Baccharis viminea: R
* *Carduus pycnocephalus*: LO, B, DG, F, DW
* *Centaurea solstitialis*: DG, DW
Cirsium proteanum: CP, M-L
* *Cirsium vulgare*: MP, LO, B, DG, C-L
Conyza canadensis: R, F
Corethrogyne filaginifolia: C-S, CP
* *Cotula coronopifolia*: P
* *Erechtites arguta*: MP
Eriophyllum confertiflorum: CS
Euthamia occidentalis: R
Gnaphalium beneolens: MP, C-S

Gnaphalium californicum: MP, LO, B, CS, C-S, M-L, C-L
Gnaphalium chilense: MP, LO, B, DG, R, P
Gnaphalium microcephalum: R
Gnaphalium palustre: R, P
Gnaphalium purpureum: MP, LO, B, DG
Gnaphallium ramosissimum: MP, LO, CS, R, M-L, C-L
Grindelia hirsutula: CP
Hazardia squarrosus: CS, C-S, M-L, C-L
Helenium puberulum: R
Helianthus annuus: F
Hemizonia corymbosa ssp. *macrocephala*: C-S, CP, DG
Hemizonia fitchii: DG
Heterotheca grandiflora: R, F
* *Hypochoeris glabra*: LO, CP, DG
* *Hypochoeris radicata*: MP, C-S, CP
* *Lactuca serriola*: MP, LO, B, CS, DG, R. F, DW
Lasthenia californica: CP
* *Logfia gallica*: LO, CS, C-S, CP, C-L
Madia gracilis: MP, LO, C-S, M-L,
Matricaria matricarioides: B, DG, R, F, DW
Micropus californicus: C-S, CP
Microseris lindleyi: MP, LO, CP, R, M-L
Microseris paludosa: CP
* *Picris echioides*: B, DG, F
Psilocarphus tenellus: LO, M-L
Rafinesquia californica: CS
* *Senecio vulgaris*: LO, B, DG, DW
* *Silybum marianum*: B, DG, R, F, DW
Soliva sessilis: LO, CP
* *Sonchus asper*: B, DG, F
* *Sonchus oleraceus* : LO, R
Stephanomeria virgata ssp. *pleurocarpa*: CS, C-L
Stylocline sp. nov.: CS
* *Taraxacum officinale*: CP
* *Xanthium spinosum*: P, F
Xanthium strumarium var. *canadense*: R, F

BORAGINACEAE

Allocarya chorisianus var. *hickmanii*: LO
Allocarya stipitatus var. *micranthus*: LO, P
Amsinckia douglasii: DG
Amsinckia intermedia: MP, LO, DG
Cynoglossum grande: MP, LO, M-L
Heliotropium curassavicum var. *oculatum*: DG, F

Plagiobothrys canescens: C-S, CP
Plagiobothrys nothofulvus: CP
Plagiobothrys tenellus : CP

BRASSICACEAE
Arabis glabra: LO, M-L
* *Brassica geniculata*: LO, B, DG, R, F, DW
* *Capsella bursa-pastoris*: LO, B, DG, R, F
Cardamine californica: LO
Lepidium nitidum var. *insigne*: C-S, CP
Lepidium strictum: B
* *Raphanus sativus*: B, DG, R, F
* *Sinapis arvensis* = *Brassica kaber*: B, DG, R, F
* *Sisymbrium officinale*: B, DG
Tropidocarpum gracile: CP

CALLITRICHACEAE
Callitriche verna: P

CAMPANULACEAE
Triodanis perfoliata var. *biflora*: LO

CAPRIFOLIACEAE
Lonicera hispidula var. *vacillans* : MP, LO, C-S, M-L
Sambucus mexicana: LO, B, R
Symphoricarpos albus var. *laevigatus*: LO, R, M-L
Symphoricarpos mollis: LO, R

CARYOPHYLLACEAE
Cardionema ramosissima: C-S, CP
Cerastium fontanum ssp. *triviale*: MP, LO
* *Cerastium glomeratum*: LO, B, DG, M-L
* *Sagina decumbens* var. *occidentalis*: DG
* *Silene gallica*: MP, LO, CS, C-S, CP, DG, R, M-L, C-L
* *Spergula arvensis*: DG
* *Spergularia rubra*: B, P, DG
* *Stellaria media*: LO, B, M-L

CHENOPODIACEAE
* *Chenopodium album*: LO, B, DG, F
* *Chenopodium ambrosioides*: R, F
Chenopodium californicum: LO, M-L
* *Chenopodium rubrum*: B, F
* *Salsola kali*: B, F

CONVOLVULACEAE

Calystegia occidentalis: CS, C-S, C-L
Calystegia subacaulis: CP
* *Convolvulus arvensis*: CP, DG, F
Cuscuta occidentalis: MP
Dichondra donnelliana: CP

CRASSULACEAE

Crassula erecta: LO, CP
Dudleya sp.: CS

CUCURBITACEAE

Marah fabaceus : MP, LO, B, CS, C-S, R, M-L, C-L

ERICACEAE

Arctostaphylos tomentosa: MP, CH
Vaccinium ovatum: MP

EUPHORBIACEAE

Eremocarpus setigerus: C-S, CP, DG, R, F, DW
* *Euphorbia peplus*: CP

FABACEAE

* *Acacia decurrens*: DW
* *Cytisus monspessulanus*: LO, B, DG, R, DW, M-L
Lathyrus vestitus: MP, LO, M-L
Lotus benthamii: CS
Lotus corniculatus: MP
Lotus heermanii var. *eriophorus*: MP
Lotus micranthus: MP, C-S, CP, M-L
Lotus scoparius: CH, CS, C-S, R, C-L
Lotus subpinnatus: CP
Lupinus arboreus: F
Lupinus bicolor: MP, CP
Lupinus densiflorus: CP
Lupinus latifolius: LO
Lupinus nanus ssp. *latifolius*: CP
Lupinus succulentus: CP
* *Medicago polymorpha*: B, DG, F
* *Melilotus alba*: R, F
* *Melilotus indica*: R, F
Trifolium bifidum: MP, CP, M-L
* *Trifolium dubium*: DG
Trifolium gracilentum: MP, LO, CP, M-L

* *Trifolium hirtum*: DG
  Trifolium macraei: CP
  Trifolium microcephalum: MP, SO, C-S, CP, M-L
* *Trifolium repens*: MP, CP
  Trifolium tridentatum: MP, LO, CP, M-L
  Vicia ludoviciana: MP
* *Vicia villosa*: CP, DG

FAGACEAE

Quercus agrifolia: MP, LO, CS, C-S, DG, R, M-L, C-L

GERANIACEAE

* *Erodium brachycarpum*: MP, CP, DG
* *Erodium cicutarium* ssp. *jacquinianum*: MP, LO, B, C-S, CP, DG, F
* *Erodium moschatum*: CP, DG
* *Geranium dissectum*: LO
* *Geranium molle*: MP, LO, M-L

GROSSULARIACEAE

Ribes divaricatum var. *pubiflorum*: LO, R
Ribes speciosum: MP, LO, C-S, M-L, C-L

HIPPOCASTANACEAE

Aesculus californica: LO, B, CS, DG, R

HYDROPHYLLACEAE

Eucrypta chrysanthemifolia: MP, LO, B, M-L
Phacelia malvifolia: LO
Phacelia nemoralis: MP, CS, C-L
Pholistoma auritum: MP, LO, M-L

LAMIACEAE

* *Lamium amplexicaule*: B, DG, F, DW
* *Marrubium vulgare*: LO, B, CS, DG, R, F, DW
* *Mentha pulegium*: B, DG
  Monardella villosa ssp. *subserrata*: LO, M-L
  Salvia mellifera: LO, CS
  Satureja douglasii: MP, LO, C-S, R, M-L, C-L
  Stachys bullata: MP, LO, CS, R, M-L, C-L
  Stachys pycnantha: R

LAURACEAE

Umbellularia californica: LO

LYTHRACEAE

Lythrum hyssopifolia: P

MALVACEAE

Malacothamnus palmeri var. *involucratus*: CS
* *Malva neglecta*: B, DG, F
* *Malva parviflora*: B, F
Sidalcea malviflora ssp. *malviflora*: MP

MYRTACEAE

* *Eucalyptus globulus*: R, DW

ONAGRACEAE

Camissonia ovata: C-S, CP
Clarkia purpurea ssp. *quadrivulnera*: MP, C-S, M-L
Epilobium ciliatum ssp. *ciliatum*: LO, R
Epilobium paniculatum: LO, R
Oenothera hookeri: R

OXALIDACEAE

* *Oxalis laxa*: LO, DW

PAPAVERACEAE

Eschscholtzia californica: C-S, CP, R

PLANTAGINACEAE

* *Plantago coronopus*: MP, B
Plantago erecta: C-S, CP
* *Plantago lanceolata*: MP, LO, B, C-S, CP, DG, R, F, M-L
* *Plantago major*: CP, R

PLATANACEAE

Platanus racemosa: R

POLEMONIACEAE

Linanthus androsaceus ssp. *luteus*: CP
Navarretia atractyloides: LO, B, DG, M-L
Navarretia squarrosa: MP, CP

POLYGONACEAE

Eriogonum elongatum: CS
Eriogonum nudum var. *nudum*: MP, LO, CS, C-S, CP
Eriogonum parvifolium: CS, C-S
* *Polygonum arenastrum*: LO, B, DG, P, F

* *Rumex acetosella*: C-S, CP
* *Rumex conglomeratus*: MP
* *Rumex crispus*: MP, LO, DG, R, M-L
* *Rumex pulcher*: B, DG, F

PORTULACACEAE

Calandrinia ciliata: LO, B, CP DG, F
Claytonia parviflora: MP, LO, M-L
Claytonia perfoliata: MP, LO, B, M-L

PRIMULACEAE

* *Anagallis arvensis*: MP, LO, B, C-S, DG, R, F, DW

Dodecatheon hendersonii: MP, C-S

RANUNCULACEAE

Clematis lasiantha: CS,
Clematis ligusticifolia var. *californica*: R
Delphinium californicum: CS
Delphinium hesperium: CP
Ranunculus californicus: MP, LO, CS, CP, M-L
Ranunculus hebecarpus: MP, LO, M-L
Thalictrum polycarpum: LO

RHAMNACEAE

Ceanothus thyrsiflorus: MP
Rhamnus californica: MP, LO, B, CS, DG, M-L, C-L
Rhamnus crocea ssp. *crocea*: MP, CH, LO, CS, M-L, C-L

ROSACEAE

Acaena californica: C-S, CP
Adenostoma fasciculatum: CH, CS, C-L
Alchemilla arvensis: CP
Fragaria vesca ssp. *californica*: MP, LO, M-L
Heteromeles arbutifolia: MP, CS, M-L
Holodiscus discolor: MP, CS, R, M-L
Horkelia californica: CP
Oemleria cerasiformis: LO
Potentilla glandulosa ssp. *glandulosa*: MP, LO, B, CS, CP, M-L, C-L
Rosa californica: LO, R
Rosa gymnocarpa: MP, LO, M-L

* *Rubus discolor*: R, F

Rubus ursinus: MP, R, LO, B, C-S, M-L, C-L

RUBIACEAE

Galium aparine: MP, LO, CP
Galium californicum: MP, LO, M-L
* *Galium murale*: DG
Galium porrigens var. *tenue*: MP, LO, C-S, M-L

SALICACEAE

Populus balsamifera ssp. *trichocarpa*: R
Salix laevigata: R
Salix lasiolepis: R
Salix melanopsis: R

SAXIFRAGACEAE

Lithophragma heterophylla: LO

SCROPHULARIACEAE

Castilleja affinis: MP, LO, CS, M-L
Mimulus aurantiacus: MP, LO, CS, C-S, R, M-L, C-L
Orthocarpus densiflora: CP
Orthocarpus pusillus: CP
Scrophularia californica: MP, CS, R
* *Veronica arvensis*: LO

SOLANACEAE

* *Solanum douglasii*: R
Solanum nodiflorum: MP
Solanum umbelliferum var. *incanum*: CS, C-L

URTICACEAE

Hesperocnide tenella: LO
Urtica dioica var. *holosericea*: LO, B, R
* *Urtica urens*: B

VALERIANACEAE

Plectritis macrocera var. *macrocera*: C-S, CP

VERBENACEAE

Verbena lasiostachys: MP, LO, B, C-S, CP, DG, F, M-L

VIOLACEAE

Viola pedunculata: CP

VITACEAE

Vitis californica: R

MONOCOTS

ALLIACEAE

Brodiaea terrestris: C-S, CP
Dichelostemma pulchellum: MP, C-S, CP, M-L
Triteleia lutea: CP

CYPERACEAE

Carex montereyensis: MP, LO, B, C-S, CP, M-L
Carex nudata: LO, R
Carex obnupta: R
Carex tumulicola: LO, CP
Cyperus eragrostis: R, P
Eleocharis palustris: P
Scirpus acutus: P

IRIDACEAE

Sisyrinchium bellum: C-S, CP, DG

JUNCACEAE

Juncus balticus: P
Juncus bufonius var. *bufonius*: P
Juncus patens: MP, LO, B, CP, M-L
Juncus tenuis var. *congestus*: CP
Luzula subsessilis: LO, C-S, CP, M-L

LEMNACEAE

Lemna minuta: P

LILIACEAE

Asparagus officinale: R
Calochortus albus: MP
Calochortus luteus : CP
Chlorogalum pomeridianum: CH, CS, C-S, CP, C-L
Smilacina stellata: MP
Trillium chloropetalum: MP, LO
Zigadenus fremontii: C-S, CP, M-L

ORCHIDACEAE

Piperia sp.: MP

POACEAE

- *Agrostis hallii*: MP, LO, CS, M-L, C-L
- * *Aira caryophyllea*: MP, LO, CS, C-S, CP, DG, M-L, C-L
- * *Avena barbata*: MP, LO, B, CS, C-S, CP, R, F, M-L, C-L
- * *Briza minor*: CP, F
- *Bromus carinatus*: MP, LO, R, M-L
- * *Bromus diandrus*: MP, LO, B, CS, M-L, CP, DG, R, F, DW, C-L
- * *Bromus hordeaceus*: MP, LO, B, CS, C-S, CP, DG, F, DW, M-L, C-L
- * *Bromus rubens*: MP, LO, B, CS, C-S, CP, DG, R, F, DW, M-L, C-L
- * *Catapodium rigidum*: LO, B, M-L
- * *Cortaderia dioica*: R
- * *Cynodon dactylon*: R, F
- * *Dactylis glomerata*: MP, LO
- *Danthonia californica*: C-S, CP
- *Elymus condensatus*: CS
- *Elymus glaucus* var. *glaucus*: LO, M-L
- *Elymus glaucus* var. *virescens*: MP, LO, R
- *Elymus triticoides*: CP
- *Festuca californica*: MP, CS, C-S, C-L
- *Festuca elatior*: DG, F
- * *Gastridium ventricosum*: MP, LO, C-S, CP, M-L
- *Hordeum brachyantherum*: CP
- * *Hordeum geniculatum*: DG, P
- * *Hordeum glaucum*: DG
- * *Hordeum leporinum*: LO, B, CP, DG, F, DW
- *Koeleria cristata*: MP, CS, C-S, CP, M-L
- * *Lolium multiflorum*: DG, R, F
- * *Lolium persicum*: DG
- *Melica imperfecta*: LO, M-L
- *Melica torreyana*: MP, LO, M-L
- * *Phalaris aquatica*: B, DG
- * *Phalaris paradoxa*: B, DG
- * *Poa annua*: LO, DG, P, F
- *Poa howellii*: MP, LO, M-L
- *Poa unilateralis*: MP
- * *Polypogon interruptus*: R
- * *Polypogon monspeliensis*: B, R, P, F
- *Stipa lepida*: CP
- *Stipa pulchra*: MP, LO, C-S, CP
- *Trisetum canescens*: LO, CP
- * *Vulpia bromoides*: B, DG
- * *Vulpia myuros*: MP, LO, B, CS, C-S, CP, DG, F, M-L

* = plants introduced or naturalized in the study area.

Key to Habitat Types

Symbol	Habitat Type
MP	Montery pine forest
LO	Coast live oak forest
M-L	Monterey pine-coast live oak forest
B	Buckeye woodland
CS	Coastal scrub (including poison oak)
C-L	Coastal scrub-coast live oak
CH	Chaparral
CP	Coastal prairie
C-S	Coastal prairie-coastal scrub
R	Riparian forest (including arroyo willow)
P	Pond
DG	Disturbed grassland
F	Farmland
DW	Old dwelling sites

APPENDIX 9-B
COMMON POTENTIAL AND OBSERVED WILDLIFE SPECIES IN THE PROPOSED WATER SUPPLY ALTERNATIVE SITES, MONTEREY COUNTY, CALIFORNIA

APPENDIX 9-B

COMMON, POTENTIAL AND OBSERVED WILDLIFE SPECIES IN THE PROPOSED WATER SUPPLY ALTERNATIVE SITES MONTEREY COUNTY, CALIFORNIA

Common Name	Scientific Name	Site[1] NLP	CAN	3DSL	7DSL
MAMMALS					
Opossum	*Didelphis marsupialis*		*		
Ornate Shrew	*Sorex ornatus*				
Vagrant Shrew	*S. vagrans*				
Trowbridge's Shrew	*S. trowbridgii*	+			
Shrew-mole	*Neurotrichus gibbsii*				
Broad-footed Mole	*Scapanus latamanus*	+			+
California Myotis	*Myotis californicus*	+			
Yuma Myotis	*M. yumanensis saturatus*				
Long-eared Myotis	*M. evotis*				
Fringed Myotis	*M. thysanodes*				
Long-legged Myotis	*M. volans longicura*				
Small-footed Myotis	*M. leibii*				
Western Pipistrelle	*Pipistrellus hesperus*				
Big Brown Bat	*Eptesicus fuscus*	+			
Red Bat	*Lasiurus borealis*				
Hoary Bat	*L. cinereus*				
Townsend's Big-eared Bat	*Plecotus townsendii*				
Pallid Bat	*Antrozoas pallidus*				
Brazilian Free-tailed Bat	*Tadarida braziliensis*				
Western Mastiff Bat	*Eumops perotis*				
Raccoon	*Procyon lotor*	+	*		
Ringtail	*Bassariscus astutus*				
Bobcat	*Lynx rufus*		*		
Mountain Lion	*Felis concolor*		*		
Feral House Cat	*F. domesticus*	+	*	+	+
Gray Fox	*Urocyon cinereoargenteus*	+	*	+	+
Coyote	*Canis latrans*	+	*	+	#
Long-tailed Weasel	*Mustela frenata*				
Badger	*Taxidea taxus*				
Striped Skunk	*Mephitis mephitis*	+	*		+
Spotted Skunk	*Spilogale putorius*				

Appendix 9-B (Continued)

Common Name	Scientific Name	Site[1]			
		NLP	CAN	3DSL	7DSL
California Ground Squirrel	*Spermophilus beecheyi*	+	*	+	+
Western Gray Squirrel	*Sciurus griseus*	+	*		
Merriam's Chipmunk	*Tamias merriami*				
Botta's Pocket Gopher	*Thomomys bottae*	+	*	+	+
California Pocket Mouse	*Perognathus californicus*	+			
Heerman's Kangaroo Rat	*Dipodomys heermanni*				
Western Harvest Mouse	*Reithrodontomys megalotis*	+	*		
Deer Mouse	*Peromyscus maniculatus*	+	*		
California Mouse	*P. californicus*	+			
Brush Mouse	*P. boylii*	+			
Pinon Mouse	*P. truei*	+			
Dusky-footed Wood Rat	*Neotoma fuscipes*	+	*		+
California Vole	*Microtus californicus*	+	*		
Norway Rat	*Rattus norvegicus*		*	+	#
House Mouse	*Mus musculus*	+	*	+	#
Black-tailed Jackrabbit	*Lepus californicus*			+	#
Brush Rabbit	*Sylvillagus bachmani*		*		
Desert Cottontail	*S. audubonii vallicola*	+			+
Mule Deer	*Odocoileus hemionus*	+	*		
TOTAL		24	19	8	12

REPTILES AND AMPHIBIANS

Common Name	Scientific Name	NLP	CAN	3DSL	7DSL
California Tiger Salamander	*Ambystoma tigrinum californiense*				
California Newt	*Taricha torosa*	+			
Ensatina	*Ensatina eschscholtz*	*			
California Slender Salamander	*Batrachoseps attenuatus*	*			
Arboreal Salamander	*Aneides lugubris*	*			
Western Toad	*Bufo boreas*	+			
Pacific Treefrog	*Hyla regilla*	+	*	+	#
Reg-legged Frog	*Rana aurora draytoni*	+			
Foothill Yellow-legged Frog	*R. boylei*	+			
Bullfrog	*R. catesbeiana*	+			
Southwestern Pond Turtle	*Clemmys marmorata pallida*	+			
Coast Horned Lizard	*Phrynosoma coronatum frontale**				
Western Fence Lizard	*Sceloporus occidentalis*	+	*	+	+
Side-blotched Lizard	*Uta stansburiana*	*	*		
Western Skink	*Eumeces skiltonianus*	*			
California Whiptail	*Cnemidophorus tigris mundus*	+			
Northern Alligator Lizard	*Gerrhonotus coeruleus*			+	#
Southern Alligator Lizard	*G. multicarinatus*	*	*		
Calif. Black Legless Lizard	*Anniella pulchra niger*				

Appendix 9-B (Continued)

		Site[1]			
Common Name	Scientific Name	NLP	CAN	3DSL	7DSL
Rubber Boa	*Charina bottae*				
Ringneck Snake	*Diadophis punctatus*	*			
Night Snake	*Hypsiglena torquata*				
Sharp-tailed Snake	*Contia tenuis*				
Racer	*Coluber constrictor*				
Striped Racer	*Masticophis lateralis*				
Coachwip	*M. flagellum*				
Pacific Gopher Snake	*Pituophis melanoleucus*	*	*		
Long-nosed Snake	*Rhinocheilus leucontei*				
Common Kingsnake	*Lampropeltis getulus*	+	*		
California Mountain Kingsnake	*L. zonata*				
West. Terrestrial Garter Snake	*Thamnophis elegans*	*			
Western Aquatic Garter Snake	*T. couchi*	*			
Common Garter Snake	*T. sirtalis*		*		
Western Rattlesnake	*Crotalus viridis*	+	*		
TOTAL		22	8	3	3
BIRDS					
Arctic Loon	*Gavia arctica*				+
Pied-billed Grebe	*Podilymbus podiceps*				
California Brown Pelican	*Pelicanus occidentalis*			+	#
Double-crested Cormorant	*Phalacrocorax auritus*			+	#
Great Blue Heron	*Ardea herodias*		*		
Green-backed Heron	*Butorides striatus*				
Great Egret	*Casmerodius albus*		*		
Snowy Egret (w)	*Egretta thula*				
Black-crowned Night Heron	*Nycticorax nycticorax*				
American Bittern	*Botaurus lentiginosus*	+			
Canada Goose (w)	*Branta canadensis*				
Mallard	*Anas platyrhynchos*	+	*	+	#
Gadwall	*A. strepera*				
Cinnamon Teal	*A. cyanoptera*				
Green-winged Teal (w)	*A. carolinensis*				
Northern Shoveler (w)	*A. clypeat*				
American Widgeon (w)	*Mareca americana*				
Wood Duck	*Aix sponsa*				
Surf Scoter	*Melinitta perspicillata*			+	#
Ruddy Duck	*Oxyura jamaicensis*				
Common Merganser	*Mergus merganser*	+			+
Turkey Vulture	*Cathartes aura*	+	*	+	+
Black Shouldered Kite	*Elanus leucurus*		*	+	#

Appendix 9-B (Continued)

Common Name	Scientific Name	Site[1]			
		NLP	CAN	3DSL	7DSL
Cooper's Hawk	*Accipiter cooperi*			*	#
Sharp-shinned Hawk (w)	*A. striatus*	+			
Northern Harrier	*Circus cyaneus*		*		
Osprey (w)	*Pandion haliaetus*				
Rough-legged Hawk (w)	*Buteo lagopus*				
Ferruginous Hawk (w)	*B. regalis*				
Red-tailed Hawk	*B. jamaicensis*	+	*	+	+
Red-shouldered Hawk	*B. lineatus*	+			
Swainson's Hawk	*B. swainsoni*				
Golden Eagle	*Aquila chrysaetos*		*		
Bald Eagle (w)	*Haliaeetus leucocephalus*				
American Kestrel	*Falco sparverius*	+	*	+	+
Merlin (w)	*F. columbarius richardsonii*			+	#
American Peregrine Falcon (w)	*F. peregrinus anatum*				
Prairie Falcon (w)	*F. mexicanus*				
Wild Turkey	*Meleagris gallopavo*	+			
California Quail	*Callipepla californica*	+	*		
Mountain Quail	*Oreortyx pictus*	+			
Common Moorhen (w)	*Gallinula chloropus*				
American Coot	*Fulica americana*			+	#
Western Gull	*Larus occidentalis*			+	+
California Gull	*L. californicus*			+	#
Herring Gull	*L. argentatus*			+	+
Heermann's Gull	*L. heermanni*			+	+
Caspian Tern	*Sterna caspia*			+	#
Mourning Dove	*Zenaidura macroura*	+	*	+	+
Band-tailed Pigeon	*Columba fasciata*	+	*		
Rock Dove	*C. livia*		*	+	#
Common Poorwill	*Phalaenoptilus nuttallii*				
Killdeer	*Charadrius vociferus*	+	*	+	+
Common Snipe (w)	*Gallinago gallinago*				
Long-billed Dowitcher (w)	*Limnodromus scolopaceus*			+	#
Marbled Godwit	*Limosa fedoa*			+	#
Long-billed Curlew (w)	*Numenius americanus*				
Sanderling	*Calidris alba*			+	#
Black-bellied Plover	*Pluvialis squatarola*			+	#
Snowy Plover	*Charadrius alexandrinus*			*	#
Spotted Sandpiper (w)	*Actitus macularia*				
Greater Yellowlegs (w)	*Totanus melanoleucus*				
Spotted Owl	*Strix occidentalis*				
Western Screech Owl	*Otus kennicottii*				
Flammulated Owl (s)	*O. flammeolus*				
Northern Pigmy Owl	*Glaucidium gnoma*		*		
Great Horned Owl	*Bubo virginianus*	+	*		

Appendix 9-B (Continued)

Common Name	Scientific Name	Site[1] NLP	CAN	3DSL	7DSL
Barn Owl	*Tyto alba*		*		
Burrowing Owl	*Athene cunicularia*				
Long-eared Owl	*Asio otus*				
Short-eared Owl	*A. flammeus*				
Northern Saw-whet Owl	*Aegolius acedicus*				
Black Swift (s)	*Cypseloides niger*				
White-throated Swift	*Aeronautes saxatali*	+		+	+
Anna's Hummingbird	*Calypte anna*	+	*		
Allen's Hummingbird (s)	*Selasphorus sasin*	+	*		
Belted Kingfisher	*Ceryle alcyon*	+	*		
Northern Flicker	*Colaptes auratus*	+	*		
Acorn Woodpecker	*Melanerpes formicivorus*	+	*		
Lewis' Woodpecker (w)	*M. lewis*				
Red-breasted Sapsucker (w)	*Sphyrapicus varius daggetti*				
Nuttall's Woodpecker	*Piciodes nuttalli*	+	*		
Hairy Woodpecker	*P. villosus*		*		
Downy Woodpecker	*P. pubescens*	+	*		
Western Kingbird (s)	*Tyrannus verticalis*	+	*		
Black Phoebe	*Sayornis nigricans*	+	*	+	#
Say's Phoebe (w)	*S. saya*			+	#
Ash-throated Flycatcher	*Myiarachus cinerascens*	+			
Western Wood Peewee (s)	*Contopus sordidulus*		*		
Olive-sided Flycatcher (s)	*C. borealis*		*		
Pacific-slope Flycatcher	*Embidonax difficilis*	+	*		
Horned Lark	*Eremphila alpestris*		*	+	+
Barn Swallow (s)	*Hirundo rustica*		*		+
Cliff Swallow (s)	*Petrochelidon pyrrhonota*		*		
Violet-green Swallow	*Tachycineta thalassina*	+	*		
Tree Swallow	*Iridoprocne bicolor*	+			
N. Rough-winged Swallow (s)	*Stelgidopteryx serripennis*	+			
Purple Martin (s)	*Progne subis*	+			
Scrub Jay	*Aphelocoma coerulescens*	+	*		
Steller's Jay	*Cyanocitta stelleri*	+	*		
Yellow-billed Magpie	*Pica nuttalli*				
American Crow	*Corvus brachyrhynchos*	+		+	+
Common Raven	*C. corax*		*		
Chestnut-backed Chickadee	*Parus rufescens*	+	*		
Common Bushtit	*Psaltriparus minimus*	+	*		+
Plain titmouse	*P. inornatus*	+	*		
White-breasted Nuthatch	*Sitta carolinensis*	+			
Red-breasted Nuthatch (w)	*S. canadensis*				
Pigmy Nuthatch	*S. pygmaea*		*		
Wrentit	*Chamaea fasciata*	+	*		
Brown Creeper (w)	*Certhia americana*	+	*		

Appendix 9-B (Continued)

Common Name	Scientific Name	Site[1] NLP	CAN	3DSL	7DSL
Water Ouzel (Dipper)	*Cinclus mexicanus*	+			
Bewick's Wren	*Thryomanes bewickii*	+	*		
Winter Wren	*Troglodytes troglodytes*		*		
House Wren	*T. aedon*	+	*		
Marsh Wren	*Cistothorus palustris*				
Canyon Wren	*Catherpes mexicanus*				
Rock Wren (w)	*Salpinctes obsoletus*				
California Thrasher	*Toxostoma redivivum*	+	*		
Northern Mockingbird	*Mimus polyglottos*		*	+	#
Robin	*Turdus migratorius*	+	*		
Hermit Thrush (w)	*Catharus guttata*				
Swainson's Thrush (s)	*C. ustulatus*				
Western Bluebird	*Sialia mexicana*	+			
Mountain Bluebird (w)	*S. currucoides*				
Blue-gray Gnatcatcher (s)	*Polioptila caerulea*		*		
Ruby-crowned Kinglet (w)	*Regulus calendula*	+	*		
Golden-crowned Kinglet (w)	*R. satrapa*				
American Pipit (w)	*Anthus spinoletta*			+	#
Cedar Waxwing (w)	*Bombycilla cedrorum*				
Loggerhead Shrike	*Lanius ludovicianus*		*	+	#
European Starling	*Sturnus vulgaris*	+	*	+	+
Hutton's Vireo	*Vireo huttoni*	+	*		
Warbling Vireo (s)	*V. gilvus*	+	*		
Solitary Vireo (s)	*V. solitarius*				
Orange-crowned Warbler	*Vermivora celata*	+			
Yellow-rumped Warbler	*Dendroica coronata*			+	#
Yellow Warbler (s)	*D. petechia*	+	*		
Black-throated Gray Warbler (s)	*D. nigrescens*		*		
Townsend's Warbler (w)	*D. townsendi*				
Hermit Warbler (w)	*D. occidentalis*				
Wilson's Warbler (s)	*Wilsonia pusilla*	+	*		
Common Yellowthroat	*Geothlypis trichas*				
Yellow-breasted Chat (s)	*Icteria virens*				
House Sparrow	*Passer Domesticus*		*		+
Red-winged Blackbird	*Agelaius phoeniceus*	+	*	+	+
Tricolored Blackbird	*A. tricolor*				
Brewer's Blackbird	*Euphagus cyanocephalus*		*	+	+
Brown-headed Cowbird	*Molothrus ater*				
Western Meadowlark	*Sturnella neglecta*		*	+	+
Northern Oriole (s)	*Icterus galbula*				
Western Tanager (w)	*Piranga ludoviciana*		*		
Black-headed Grossbeak (s)	*Pheucticus melanocephalus*	+			
Lazuli Bunting (s)	*Passerina amoena*	+	*		
Purple Finch	*Carpodacus purpureus*	+	*		

Appendix 9-B (Continued)

Common Name	Scientific Name	Site[1] NLP	CAN	3DSL	7DSL
House Finch	*C. mexicanus*		*	+	+
Pine Siskin	*Spinus pinus*				
American Goldfinch	*S. tristis*		*		
Lesser Goldfinch	*S. psaltria*	+	*		
Red Crossbill	*Loxia curvirostra*				
Rufous-sided Towhee	*Pipilo erythrophthalmus*	+	*		
Brown Towhee	*P. fuscus*	+	*	+	+
Savannah Sparrow	*Passerculus sandwichensis*			+	#
Lark Sparrow	*Chondestes garmmacus*		*		
Rufous-crowned Sparrow	*Aimophila ruficeps*				
Grasshopper Sparrow (s)	*Ammodramus savannarum*				+
Sage Sparrow	*Amphispiza belli*				
Dark-eyed Junco (w)	*Junco hyemalis*	+	*		
Chipping Sparrow (s)	*Spizella passerina*		*		
White-crowned Sparrow	*Zonotrichia leucophrys*			+	+
Golden-crowned Sparrow (w)	*Z. atricapilla*			+	#
Fox Sparrow (w)	*Passerella iliaca*		*		
Lincoln's Sparrow (w)	*Melospiza lincolnii*				
Song Sparrow	*M. melodia*	+	*	+	#
TOTAL		62	75	42	49
TOTAL ALL WILDLIFE SPECIES		108	102	53	64

(w) = Winter range only
(s) = Summer range only

[1] Sites:

NLP = New Los Padres - Field Surveys, May 28-29, 1989; May 28 - June 3 and August 31 - September 1, 1992. [Total Survey Days = 10]

CAÑ = Cañada Reservoir - Field Surveys, May 14, 17, 18 and 29, August 13, 19-20, 26-27, and August 31 - September 1, 1990. [Total Survey Days = 11]

3DSL = 3-million-gallon-per-day Desalination Alternative Sites in and west from Sand City - Field Surveys, October 30 and July 6-7, 1991. [Total Survey Days = 3]

7DSL = 7-million-gallon-per-day Desalination Alternative Site(s) at and west of the MRWPCA Site to the Pacific Shore and south along the proposed service pipeline. Field Surveys, July 22, 1992. [Total Survey Days = 1] The 7DSL Alternative Site also includes all elements of the 3DSL Alternative, therefore, surveys for wildlife species for these two Alternative Sites are totaled together. [Total Survey Days = 4]

+ = Wildlife species recorded during field surveys for this report.
* = Wildlife species reliably reported to occur on project site.
# = Wildlife species recorded on 3DSL Alternative Site

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APPENDIX 9-C
SENSITIVE SPECIES SURVEYS
(LEAST BELL'S VIREO, SMITH'S
BLUE BUTTERFLY AND SPOTTED OWL)

CARMEL RIVER BIRD SURVEY

May 1987

Prepared for

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

and

ENVIRONMENTAL IMPACT PLANNING CORPORATION
319 Eleventh Street
San Francisco, CA. 94103

By

Don & Robin Roberson

June 1987

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CARMEL RIVER BIRD SURVEY

I. INTRODUCTION AND SUMMARY

Between 2-31 May 1987, we surveyed the Carmel River from the San Clemente Dam to the mouth and the two major tributaries of San Clemente Reservoir for birds. The primary purpose of the survey was a search for the endangered Least Bell's Vireo Vireo bellii pusillus. We found none. Secondary purposes were to confirm and map specified habitats along the river and to survey the bird populations in those habitats. The results are enumerated below, showing quite extensive riparian habitat and correspondingly healthy bird populations.

II. METHODS

We walked the 18.5 mile stretch of the Carmel River from San Clemente Dam to the river mouth three times, thus surveying in early (2-12 May), mid (15-19 May) and late (28-31 May) May. In addition, nearly a mile of San Clemente Creek upstream from the reservoir and over two miles of the Carmel River upstream from the reservoir were surveyed twice, the latter area's survey including a survey of night birds as well. In all, we walked approximately 62 miles of riparian habitats over a 16 day period, for a total of 74½ hours in the field.

Below the Dam the River was divided into 7 separate stretches (more fully described below). Each stretch was between 2.5 to 3.5 miles in length, except for the one-mile stretch from Hwy 1 to the river mouth lagoon. These stretches, plus the upstream reaches of the Carmel and San Clemente, were surveyed by walking either in or adjacent to the riverbed slowly, keeping a running tally of all birds heard or seen. All surveys were conducted between 6 a.m. and noon (prime time for most bird song) and took between 2 and 4 hours on the average, thus surveyed at a pace just under a mile an hour. This slow pace was often necessitated by the rough terrain; often walking in water, occasionally even chest high or moving slowly through thick riparian habitat sometimes dominated by poison oak or nettles. The terrain was most difficult from the Dam to below Carmel Valley Village; below that point water levels decreased and the river stopped running entirely at either about Schulte Bridge (12 May) or just below Robinson Canyon Bridge (31 May), with only puddles and flow due to groundwater thereafter.

Riparian habitat fringes the entire river thinly and only near the Cal-Am filter plant was the habitat judged wide enough to require some zig-zagging to survey the entire area. At all other points, we believe we surveyed the entire riparian community thoroughly and our surveys often included birds on the edge of the adjacent habitats (especially where cliffs reach the river's edge with oak woodlands or chapparel) or flying over.

About 80% of the birds recorded were heard singing or calling only. The ability to survey by bird song/call is crucial in obtaining acceptable bird surveys in breeding season (Robbins et al 1986).

III. BELL'S VIREO SURVEY

The California race (pusillus) of the Bell's Vireo (Vireo bellii), known as the "Least Bell's Vireo" is one of California's most endangered passerine birds. Once considered common to abundant in riparian ecosystems throughout much of California, it is now reduced to perhaps just 300 breeding pairs (U.S. Fish & Wildlife Service 1986). Destruction of riparian habitat coupled with high rates of parasitism by Brown-headed Cowbird Molothrus ater have contributed to this unparalled decline; a full historical summary and statewide survey is in Goldwasser et al.(1980). The precipitous decline is unparalled in California ornithology for a songbird, though less serious declines have been documented in other primarily riparian species, such as Yellow-billed Cuckoo Coccyzus americanus (Gaines & Laymon

1984), Willow Flycatcher _Empidonax traillii_, Yellow Warbler _Dendroica petechia_ and Yellow-breasted Chat _Icteria virens_ (e.g., Roberson 1985).

We found no published information showing presence of Bell's Vireo on the Carmel River even in historic times. The Carmel Valley was not indicated as within the range of the species by the classic California survey (Grinnell & Miller 1944) nor by the comprehensive historical summary on Bell's Vireo (Goldwasser _et al_ 1980). No records for the Carmel River are indicated in the most recent in-depth summary of bird distribution in Monterey County (Roberson 1985). It is quite possible the species never nested on the Carmel River.

Nonetheless much apparent habitat exists. Bell's Vireos were known to be common on the Salinas River in southern Monterey County in the first part of this century (Grinnell & Miller 1944) but surveys of the Salinas River sites in the 1970s found them entirely absent (Goldwasser _et al_ 1980). Yet informal surveys by local birders re-discovered the bird around Bradley, on the Salinas River, in 1983, when nesting was documented (Roberson 1985) and their presence was again noted in 1984. However no birds were detected in brief attempts in 1985 and 1986 (pers. obs.). Thus the re-discovery on the Salinas suggested the possibility birds might be present on the Carmel. Williams'(1974)local checklist also listed Bell's Vireo as "accidental" in the Monterey Peninsula area, giving at least the implication that there were some unpublished historic records in the Carmel area.

Bell's Vireo is a summer resident of riparian habitats dominated by a mixture of canopy trees (for feeding) and low riparian growth (for nesting). They still occur in appropriate habitat in warmer interior valleys of coastal counties from Santa Barbara County south, and at some desert oases and canyons. Typical plants required include willows (_Salix_ sp.), mulefat or guamote (_Baccharis glutinosa_)and wild blackberry (_Rubus ursinus_). A recent survey at Camp Pendleton, San Diego County, found 100 territorial males and 323 nests, of which nearly 60% were in willows (Salata 1987). The Bradley nest in 1983 was in _Baccharis_ adjacent to willows (pers. obs.). Much willow/_Baccharis_ habitat exists along the Carmel River.

Despite the presence of much apparently suitable habitat observed during this survey, no Bell's Vireos were found. Given the very tenuous status of the Salinas River birds, in an area where they were once common, this finding was not surprising in an area from which there is no historical published records. Furthermore, the southern coastal populations are heavily impacted by cowbird parasitism (Jones 1985, Hays 1986) and one would expect northern coastal populations, if any, to be equally impacted. We found high populations of cowbird on the Carmel River near its mouth; these densities might eliminate any embroyonic Bell's Vireo population in at least the lower 15 miles of the Carmel River.

As Salata noted in his recent experience, "Bell's Vireos are extremely vociferous throughout most of the breeding season" (Salata 1987, p. 3). The persistent loud singing of the male is the best clue to the bird's presence, as they are often difficult to observe in their preferred dense riparian habitat (Goldwasser _et al_ 1980, Salata 1987, pers. obs.). Our surveys took place during what should have been the height of the singing period, as populations just to the south are composed of birds arriving by the end of April (Lehman 1982); May should be the best month to locate the species in Monterey County, if present. Given the persistancy of singing, the loudness and distinctiveness of the song, the narrowness of the riparian habitat and the triple surveys of each appropriate area, we can say with a high degree of confidence that no Bell's Vireos were present in 1987. However, given the disappearance, re-discovery and re-disappearance of the bird on the Salinas River, it may be that birds might be found in another year. We believe the area near and just downstream from the filter plant appears (to human eyes) the best potential vireo habitat, particularly since cowbird numbers were lowest there and become much more abundant farther downstream.

In the final analysis, though, the absence of Bell's Vireo in the Carmel Valley may not be due to lack of habitat (which appears to be present in abundance) or due the density of cowbirds, but could be a result of geography. The range of Bell's Vireo in California is entirely outside the summer fog belt and Bell's Vireo breeds in warm to hot climates (Goldwasser et al 1980). Although we had clear warm weather during early and late May, the middle of the month was dominated by low clouds and fogs extending up the Valley to the Carmel Valley Village. Although we have not undertaken a climatic survey of the area, it is a working hypothesis that the presence of summer fog limits the range of Bell's Vireo in an area with otherwise suitable-appearing habitat.

IV. HABITAT SURVEY

During our bird surveys, we were asked to observe and help map the various riparian habitats along the Carmel River. We were provided with a Riparian Habitat Classification prepared by Rick Villasenor of Environmental Impact Planning Corporation (Table 1) and asked to "ground-truth" the designation of habitats on large, detailed aerial photos of the river from the filter plant to Hwy 1. We placed polygons arounds sections of habitats on the photos, giving each such section a specific designation. To some extent, these designations merge into the next and lines drawn between designations are approximations at best. The marked up aerials have been returned to Graham Matthews of the Monterey Peninsula Water Management District, who had prepared the original block designations which we observed and compared to the Classifications. We found only minor changes from the original scheme of block designations.

A rough approximation of habitats is shown on Map 1. A very general overview shows mostly Mixed Evergreen Forest/Riparian above the dam with only small patches of purer Riparian Woodland/Thicket, a predominance of the Riparian Woodland/Thicket habitat below the dam to nearly Valley Greens Drive, and mostly Riparian Forest (with taller canopy of cottonwoods) thereafter until the Emergent Vegetation appears around the river mouth lagoon. Various stretches interspersed were best termed Riparian Scrub (many more small patches than shown on Map 1) and Mixed Evergreen Forest/Riparian (mostly oak woodland, but occasionally chaparral) abutted on the river where steep cliffs brought this habitat to the river's edge. Ruderal or non-native habitat included rip-rap banks, planted eucalyptus, and disturbed golf course habitats along the river. We have not designated the surface water or Dry Wash habitats, but these include the entire riverbed proper.

The Riparian Habitat Classifications do not have much use in defining bird habitats, because most species habitats are more clearly defined "micro-habitats" for each major activity; e.g., Acorn Woodpecker is present where there are large dead trees to use for nesting. They are present in the riparian zone where large dead trees, particularly sycamores, are standing, without reference to "scrub", "thickets","woodland" or "forest" designations. They are equally at home and widespread in the adjacent oak woodland component of Mixed Evergreen Forest. In the main bird list, we do attempt to generally place the species within its preferred habitat. Miller (1951) has a standard discussion of California bird habitats.

Despite the "micro-habitat" preference of most species, the generalized "Riparian" designation does have use in defining bird populations. Within the general rubric of Riparian we would include the Riparian Scrub, Northern Riparian Woodland/Thicket and Riparian Forest designations and the riparian edge only of the Mixed Evergreen Forest/ Riparian designation. This generalized Riparian habitat has many species either exclusively or predominately associated or restricted to it. It is a rapidly declining habitat in California, yet crucial for healthy populations of numerous species (Miller 1951, Small [illegible], Remsen 1977). This Riparian habitat does occur along the Carmel River for most of its length and, as will be noted in the following bird list, does support good populations of riparian specialist species. We found good numbers of Warbling Vireo Vireo gilvus and Yellow Warbler, which have been declining elsewhere in Monterey County and statewide (Roberson 1985) and probably three pairs of Yellow-breasted Chat, whose local populations have declined to near the critical state. These pecies suffer from the same circumstances that have endangered the Bell's ireo, namely riparian habitat destruction and cowbird parasitism, so that he presence of these species on the Carmel indicates a comparatively healthy iparian ecosystem. Preservation of this riparian ecosystem should be an nportant component in any management plan for the Carmel River.

Below we give brief descriptions of the stretches of the Carmel and San Clemente ırveyed, indicating an approximation of the mileage covered in each stretch and he habitats encountered. Each such stretch has been labelled with letter from -I, and these symbols reappear in the bird lists themselves to designate the articular area discussed. In the bird lists, we also indicate which time frame ne particular stretch was surveyed by indicating either the 1st, 2nd or 3rd time ırveyed. Thus a designation of "C2" indicates this refers to the 2nd time the trech labelled "C" (Dam to Filter Plant) was surveyed. The exact date of this ırvey appears in the descriptions below.

: CARMEL RIVER UPSTREAM FROM RESERVOIR (2+ mi.)

strikingly scenic area ith the river flowing in moderately steep canyon, ominated by Mixed Evergreen orests with a riparian ringe and few denser atches of willows adjacent o the river. The avifauna s much more reminescent of igher elevations in the anta Lucia Mnts., e.g. the oundance of Steller's Jay nd Mountain Quail (with alifornia Quail restricted o the dense riparian only nd to chaparral away from ne river). Figure 1 shows ne such stretch, including liffs (left-center) where hite-throated Swifts are esting.
URVEYS: A1=4 May (Don & obin); A2=16 May (Don & obin). (Both times we lept overnight adjacent o the survey area and ecorded nightbirds also).


Figure 1: Carmel River about 1½ mi. above reservoir

igure 2 shows the San lemente Reservoir and am, surrounded on all ides by oak woodlands ithout any riparian ringe. This habitat s inappropriate for ell's Vireo (Miller 951, Grinnell & Miller 944) so was not surveyed, hough we did casually ote species present hen we crossed this abitat and sometimes omment thereon.


Figure 2: San Clemente Reservoir encircled by oak woodlands

B: SAN CLEMENTE CREEK UPSTREAM FROM THE RESERVOIR (@1 mile)

A very steep-walled canyon composed entirely of Mixed Evergreen Forest without a true riparian component. There was a small stand of redwoods in the upper reaches of the survey area, and thoughout the undergrowth includes a profusion of ferns. As a potential inundation area, this area was surveyed twice, but it is entirely unsuitable for Bell's Vireo. SURVEYS: B1=2 May (Don); B2=7 May (Don).

(Irrelevent to this project, but interesting nonetheless, was the finding of a Coast Horned Lizard Phrynosoma coronatum at the upper end of the trail leading to San Clemente Creek on 7 May; figure 3).

Figure 3: Coast Horned Lizard

C: DAM to FILTER PLANT (2½ miles)

This stretch has two distinct elements, demarcated at the point where the steep closed-in canyon opens up to a broader wide canyon, at a point just about where the San Clemente loop road crosses the Carmel River via a ford. Above this point, the habitat is best termed Mixed Evergreen Forest/Riparian, with many oaks and sycamores lining the canyon, interspersed with steeper slopes of chaparral, and willow patches only here and there along the river, with many alders forming a canopy forest. This "closed-in" canyon habitat is shown in figure 4 and is quite different from the remaining habitats downstream. We found a pair of nesting Dippers in this gorge; Steller's Jay were common and the entire "feel" is of an upper elevation avifauna (though entirely below 500' elevation). Below the ford, the canyon widens (figure 5)

Figure 4: Carmel River below San Clemente Dam

Figure 5: Carmel River above Filter Plant

and becomes dominated by true Northern Riparian Woodland/Thicket. The widening of the canyon seems to demarcate the ranges of several species; European Starling, Brown-headed Cowbird and Scrub Jay, for example, were not found above this line; Steller's Jay and Dark-eyed Junco (essentially montane and closed-cone pine forest birds) were quite scarce below this line.

In the area of the filter plant and just downstream, the riparian growth extends out widely as Riparian Scrub and we criss-crossed this habitat several times. The area just below the filter plant, composed of the Scrub, several Thickets, and some pools surrounded by reeds (and nesting Red-winged Blackbirds), seems the most appropriate habitat on the entire river for Bell's Vireo. Factors other than habitat, though, as discussed above, may be responsible for the absence of the bird here.

SURVEYS: C1=5 May (Don); C2=17 May (Robin); C3=29 May (Don).

D: FILTER PLANT to ROSIE'S BRIDGE (2½ miles)

Actually, this stretch begins (and the previous stretch ends) at a point ¼ mile below the filter plant itself, on the edge of the widest section of Riparian Scrub and described under C, above. The entire stretch has much healthy Riparian Thicket/ Woodland and was surveyed mostly from the stream by wading.

SURVEYS: D1=5 May (Robin); F2=17 May (Don); F3=29 May (Robin).

E: ROSIE'S BRIDGE to GARLAND RANCH (3½ miles)

Another stretch with mostly Riparian Woodland/Thicket, interspersed with some Riparian Scrub and with several splaces where steep cliffs bring Evergreen Forest to nearly river's edge. There are some deep pools skirting around Carmel Valley Village (colonies of Red-winged Blackbirds) near which is some particularly thick Riparian Thicket habitat which supports a pair of Yellow-breasted Chat which were documented as breeding during the survey. This area also apppears quite suitable for Bell's Vireo if they were present in the Carmel Valley. There are several areas where willows are being reintroduced, but as yet there is little bird colonization of this reforestation.

SURVEYS: E1=11 May (Don); E2=18 May (Robin); E3=30 May (Don).

F: GARLAND RANCH to ROBINSON CANYON BRIDGE (2½ miles)

A mixture of Riparian Woodland/Thicket, Riparian Scrub, some reforestation, and extensive Ruderal (non-native) habitats, the latter taking the form of planted stands of eucalyptus and rip-rap and disturbed scrub adjacent to a golf course. Opposite the golf course, just upstream from the Bridge, is a steep cliff with a large colony of Cliff Swallow. When appropriate, the wider Riparian Scrub habitats were criss-crossed on the survey, but in general the area appears too disturbed and too filled with cowbirds to be appropriate Bell's Vireo habitat.

SURVEYS: F1=11 May (Robin); F2=18 May (Don & Rick Villasenor); F3=30 May (Robin).

G: ROBINSON CANYON BRIDGE to VALLEY GREENS DRIVE (3 miles)

At the upper end are some nice stands of Riparian Thicket/Woodland, but sometimes shortly thereafter (by the Schulte Bridge during this May) the streamflow disappeared to be replaced from place to place by pools. Riparian Scrub is found in much of the central stretch, but is slowly replaced by a denser and taller canopy, eventually designated as Riparian Forest, by the time Quail Lodge golf course area is reached.

SURVEYS: G1=12 May (Don); G2=19 May (Robin); G3=31 May (Robin).

H: VALLEY GREENS DRIVE to HIGHWAY 1 BRIDGE (3½ miles)

The upper end of the stretch, from the Quail Lodge golf course to Via Mallorca Drive, is a very attractive strech of Riparian Forest with a tall canopy of cottonwoods, pools of water, and dense undergrowth, supporting a healthy riparian avifauna despite the presence of numbers of cowbirds. The wildness of this area is illustrated by the

presence of a Bobcat Lynx rufus watched hunting amongst the pools and undergrowth on 31 May. Downstream a mixture of Forest and Scrub is interspersed along the Carmel Valley golf course, sometimes with extensive Dry Wash. From the golf course downstream to the Hwy 1 Bridge, the Forest canopy again becomes predominate and comparatively undisturbed.
SURVEYS: H1=12 May (Robin); H2=19 May (Don); H3=31 May (Don).

I: HIGHWAY 1 BRIDGE to RIVER MOUTH LAGOON (1 mile)

Until the emergent vegetation at the lagoon appears, the entire stretch is healthy Riparian Forest with some undergrowth supporting species (e.g. House Wren, Wrentit) not present in the upstream stretches of Riparian Forest. At the river mouth itself is a lagoon used for bathing by gulls and feeding by shorebirds; these species are not considered a part of this riparian survey but were briefly noted. In addition, the coastal scrub on "Cross Hill" just at the mouth was surveyed; it supports the only population of White-crowned Sparrow on the entire river (their range being restricted to coastal scrub in Monterey County; Roberson 1985). There is also a reedy pond with a colony of Red-winged Blackbirds below the Hill which hosted single Virginia's Rail and Common Yellowthroat, riparian species restricted to this coastal pond-type habitat and which may, or may not, be nesting here.

This entire stretch is the one well-known and well-birded stretch of the Carmel River. Over 270 species have been recorded here, including some of the rarest vagrants which have ever occurred in California; e.g. Black-billed Cuckoo, Broad-billed Hummingbird (2nd Northern California record at the time), White-rumped Sandpiper (3rd state record), Buff-breasted and Sharp-tailed Sandpipers, Cerulean, Yellow-throated, Prothonotary and Mourning Warblers (Roberson 1985). The area is surveyed almost daily by birders from mid-August to mid-November, the height of fall migration. Our notes show over 30 hours expended by us in the 60 day stretch 4 Sep-4 Nov in 1986. Assuming that only 20 other birders expend similar efforts (15 hrs/fall migration), an assumption which is likely well-underestimated since the area is birded on weekends heavily by birders from the Bay Area, often in groups up to 20-30 birders, this one-mile stretch of the Carmel receives 330 person-hours of use by recreational birders, whose efforts are adding to the knowledge compiled for use in ornithology as the results are published in American Birds and elsewhere. This 330 person-hours in a mile stretch over a two-month period compares with an estimated 558 person-hours spent fishing per mile for steelhead during the Jan-Feb 1984 season (based on Dettman 1986). As the prime fall migration period is Sep-Oct, a period when no steelhead migration of import is taking place (see Dettman & Kelley 1986), any management plan for the Carmel should take into consideration the access needs of the recreational birdwatcher and field ornithologist. Access to this important stretch of the Carmel has heretofore been available by walking the dry river bed in autumn from the Hwy 1 bridge to the lagoon.

Even during our surveys, other birders were surveying this stretch and did discover two migrants, a Rose-breasted Grosbeak Pheucticus ludovicianus and a Yellow-breasted Chat, which were missed on our surveys of this stretch. Migration is very volatile here, though the healthy breeding populations were reconfirmed each time.
SURVEYS: I1=9 May (Robin); I2=15 May (Don); I3=28 May (Don).

V. BIRD SURVEY RESULTS

We recorded 99 species of birds in, over or immediately adjacent to the riparian habitat on the Carmel River. An additional 5 species (Brown Pelican, Whimbrel, and Heermann's, California and Western Gulls) were recorded at the river mouth lagoon. We obtained positive nesting evidence in the riparian zone or immediately adjacent for 41 species and probable nesting evidence for another 31 species; we believe these 72 species regularly nest on the Carmel (another, Blue-gray Gnatcatcher, nests just above the riparian zone around San Clemente Reservoir, and Rufous-crowned Sparrow probably does as well). Possible nesting evidence was obtained for 5 species. The remaining species were migrants, or, in a few cases, species which nest elsewhere in Monterey County (even the adjacent hills to Carmel Valley) and use the River only for feeding (e.g., Black-crowned Night-Heron) or were simply overflying the Valley (e.g., Turkey Vulture, which also roosts in numbers on the river).

Under each species we present general comments, a complete table of our survey results, and a "birds per mile" figure for each stretch of the river as previously discussed. This "birds per mile" figure is an attempt to give some comparative statistics regarding the population density on the river, rather than an actual population estimate. Observer bias, detection ability, and weather all impact counts in linear surveys; our study was not designed to obtain actual population estimates (see Robbins et al 1986). To obtain the "birds per mile" total we averaged the two highest counts (throwing out low counts which reflect poor weather or detectability during one survey, yet averaging to downplay the effects of migrant individuals or the effects of possible overcounting), then multiply by a "detection factor". This "factor" is a number between 1 and 2 and is a subjectively (but carefully) determined estimate of the detectibility of the species. Swallows, hawks and ducks, for example, we believe are entirely detected, so their factor is simply "1". In contrast, we detect only the singing male Wrentits (quiet females being very difficult to detect in the dense preferred chaparral or thick scrub) so, to make a comparison of the number of Wrentits to, say, Violet-green Swallow, we must multiply the Wrentit count by two to have an objectively comparable population estimate. For many passerine birds, the factors are 1.5 or 1.75, indicating our estimate that most birds recorded are singing males, but some (between ¼ and ½) of the presumed present females are detected as well. Dependent young are not counted in our figures (except to be mentioned under breeding). The averaged count, adjusted by the "factor", is ten divided by the miles (approximate) in that particular stretch to obtain the "birds per mile" figure (rounded to the nearest whole numbler).

We also indicate any nesting evidence obtained, whether Confirmed, Probable or Possible, using standard Breeding Bird Atlas criteria (Table 2). Each such evidence is cross-reference to the stretch of river and the date surveyed. Thus a"FL(C2)" for Common Merganser will be read as "downy young" (FL on Table 2) observed on stretch C (Dam to Filter Plant) on the 2nd survey (17 May).

VI. SPECIES ACCOUNTS

DOUBLE-CRESTED CORMORANT
Phalacrocorax auritus

Factor: 1

Date	A	B	C	D	E	F	G	H	I

Not in riparian; single immature on San Clemente Resevoir 2 May - a migrant. There is one small nesting colony on the Big Sur coast (Roberson 1985)

GREAT BLUE HERON *Ardea herodias*

These are simply migrants or non-breeding summerers feeding along the river. Nearest nesting colonies are in southern Monterey Co.
Factor: 1

Date	A	B	C	D	E	F	G	H	I
1					2	2	1	1	1
2					2	1	1		
3	_	_	_	_	_	3	_	1	1
Birds/mi.					1	2	1	1	1

GREAT EGRET *Casmerodius albus*

Factor: 1

Simply one migrant; nearest nesting colonies are in the Bay Area or the Central Valley.

Date	A	B	C	D	E	F	G	H	I
1									
2					1				
3									

GREEN-BACKED HERON *Butorides striatus*

Not known to nest on the Carmel (Roberson 1985) but we suspect they could nest here. Factor: 1
BREEDING: Possible (birds as shown, in correct season, appropriate habitat)

Date	A	B	C	D	E	F	G	H	I
1				2	1			2	2
2					3			1	1
3	_	_	_	_	1	1	_	1	_
Birds/mi.				1	1	1		1	1

BLACK-CROWNED NIGHT-HERON *Nycticorax nycticorax*

Date	A	B	C	D	E	F	G	H	I
1					2	3	8	2	
2					12		10	1	2
3	—	—	—	—	7	1	2	1	—
Birds/mi.					3	1	3	1	1

These are simply birds feeding up the river, presumably from their only known nesting colony at Carmel Point. We recorded about equal numbers of adults and immatures. Factor: 1

MALLARD *Anas platyrhynchos*

Date	A	B	C	D	E	F	G	H	I
1	2		5	7	14	32	11	7	6
2	5		7	5	23	18	10	2	10
3	—	—	6	18	6	19	5	—	20
Birds/mi.	2		3	5	5	10	4	1	15

We found evidence of nesting along the entire Carmel, though flocks of birds were non-nesters, including the average of 15 birds on the river mouth lagoon. Factor: 1

BREEDING: Confirmed FL(E1-broods of 3,10,4,5&4 young each; C2; I2- 4 yng; G2- 3 yng; E3-broods of 6 & 9 yng; F3-broods of 12 & 2 yng; H3). Also brood of 8 yng w/female on San Clemente Reservoir 2 May.

CANADA GOOSE *Branta canadensis*

Date	A	B	C	D	E	F	G	H	I
1									2
2					4				
3									

The sightings were of pairs flying up-river, showing characteristics of the large race *moffitti*. These birds have been introduced and are breeding in the upper Carmel Valley; they use the lagoon for feeding. Factor: 1

CINNAMON TEAL *Anas clypeata*

Date	A	B	C	D	E	F	G	H	I
1									5
2									
3									

The group of 5 at the lagoon included BREEDING:Probable D(I1), however they were not found thereafter and they may simply have been displaying on migration. However, the species could nest here given favorable water conditions and do nest at the Salinas River mouth and elsewhere in Monterey County. Factor: 1

COMMON MERGANSER *Mergus merganser*

Date	A	B	C	D	E	F	G	H	I
1	3	1	3	2					
2	3		4	1	1	1			
3	—	—	1	2	—	—	—	—	—
Birds/mi.	2	1	1	1	1	1			

One of our major findings was the confirmation of nesting on the Carmel by this species, previously unknown. All birds found were females, except for a single male on the Reservoir 2 May. Males do not help in rearing the young. Factor: 1

BREEDING: Confirmed FL(C1-brood of 8 yng; F2-brood of 8 yng; C2-brood of 8 yng; D2-brood of 8 yng), FE=female carrying broken egg (D1); ON(B1-female leaving nesthole in oak above San Clemente Creek).

TURKEY VULTURE *Cathartes aura*

Date	A	B	C	D	E	F	G	H	I
1	4		2	20	1	13	9	1	
2	2		3	5	18	1	20		
3				10	1	3			1

All birds are simply foraging well over the Valley opportunistically; birds/mi. has no relevence for such strategy. They nest in the mountains and foothills surrounding the Carmel Valley.

OSPREY *Pandion haliaetus*

One migrant over the river mouth lagoon 9 May.

BLACK-SHOULDERED KITE *Elanus caeruleus*

Two birds (pair?) seen near Garland Ranch 18 May might represent a pair breeding somewhere in the Carmel Valley, but they were not refound on subsequent surveys and could have been migrants.

SHARP-SHINNED HAWK *Accipiter striatus*

Single migrant near Robinson Canyon on 12 May.

RED-SHOULDERED HAWK *Buteo lineatus*

A riparian hawk evenly distributed along the Carmel.
BREEDING: Confirmed NB(I1), FY(D1).
Factor: 1.5

Date	A	B	C	D	E	F	G	H	I
1				4	1	5	2		3
2	1		3	2	4	1	2	1	2
3	—	—	1	1	5	3	2	1	1
Birds/mi.	1		1	2	2	2	2	1	4

RED-TAILED HAWK *Buteo jamaicensis*

A widespread hawk in many habitats rather evenly distributed along the Carmel. Surprisingly, we did find
BREEDING: Confirmed NE(E2).
Factor: 1

Date	A	B	C	D	E	F	G	H	I
1			1		2	2		3	
2	2		3	1	2	1	3	3	1
3	—	—	2	—	3	3	1	—	—
Birds/mi.	1		1	1	1	1	1	1	1

GOLDEN EAGLE *Aquila chrysaetos*

Single adult over Quail Lodge golf course 19 May. Does not nest in the riparian, but hunts overhead Carmel Valley from nesting sites in the Los Padres Nat'l Forest.

AMERICAN KESTREL *Falco sparverius*

Locally distributed in open areas such as Garland Ranch.
BREEDING: Confirmed NB(E2).
Factor: 1.75

Date	A	B	C	D	E	F	G	H	I
1					1	1			
2				1	2	1			
3	—	—	—	1	1	1	—	—	—
Birds/mi.				1	1	1			

CALIFORNIA QUAIL *Callipepla californica*

Widespread along the lower Carmel, but closely restricted to dense riparian above reservoir, where coexists with Mountain Quail.

Date	A	B	C	D	E	F	G	H	I
1			7	7	14	3	36	19	2
2	2		5	11	13	10	23	22	
3	—	—	3	18	28	6	15	7	—
Birds/mi.	1		3	7	8	4	12	7	1

BREEDING: Confirmed FL(E1-brood of 6 yng; H2-brood of 2 yng; E3-brood of 2 yng).
Factor 1.25

MOUNTAIN QUAIL *Oreortyx pictus*

Common on the Carmel above the Dam, in the dense woods & chaparral (but not in the riparian). A very low elevation (650') for this species.
BREEDING: Probable S(A2)
Factor: 2

Date	A	B	C	D	E	F	G	H	I
1	4								
2	8								
3	—	—	—	—	—	—	—	—	—
Bird/mi.	6								

VIRGINIA RAIL *Rallus limicola*

Single bird in pond below "Cross Hill" at river mouth on 9 May, probably a migrant, but nesting might be looked for here in the future.

KILLDEER *Charadrius vociferus*

Present in most dry washes and pool edges in lower Carmel River, but proof of positive nesting not obtained.
BREEDING: Probable T(all dates)
Factor: 1

Date	A	B	C	D	E	F	G	H	I
1	1				5	14	18	4	1
2	2				6	8	20	3	2
3	—	—	—	—	8	9	12	6	2
Birds/mi.	1				2	5	6	1	1

GREATER YELLOWLEGS *Tringa melanleuca*

Group of 3 migrants at Robinson Canyon Bridge on 11 May.

SPOTTED SANDPIPER *Actitis hypoleucos*

Despite widespread birds, no nesting evidence positive and numbers declined.
BREEDING: Probable T(A2). Factor: 1

Date	A	B	C	D	E	F	G	H	I
1	1				1	2	1		1
2	2					4	1		1
3	—	—	—	—	—	1	—	—	—
	1				1	1	1		1

LEAST SANDPIPER *Calidris minutilla*

A group of 3 breeding-plumaged migrants on the riverbed at the mouth on 15 May.

BAND-TAILED PIGEON *Columba fasciata*

Virtually all pigeons were in large flocks (including the flock of up to 220 at the river mouth) and are best considered post-breeding dispersal birds. These flocks move widely after food post-nesting (the species nests very early) and a "bird/mi." figure would have no meaning, so is deleted.

Date	A	B	C	D	E	F	G	H	I
1				11	18	2		6	141
2				20	37		1	40	220
3				17	24			21	8

MOURNING DOVE *Zenaida macroura*

A common species of the lower Carmel with numbers distributed upstream throughout. Factor: 1
BREEDING: Probable D(A1,2 etc)

Date	A	B	C	D	E	F	G	H	I
1	6		8	10	11	23	31	41	10
2	8		13	7	4	5	31	59	9
3	—	—	13	10	3	16	17	41	12
Birds/mi.	4		5	2	2	8	10	14	11

GREAT HORNED OWL *Bubo virginianus*

Only recorded on the upper Carmel because that was the only night surveying done, though known to occur throughout the Valley.
BREEDING: Probable S(A1,2). Factor: 1

Date	A	B	C	D	E	F	G	H	I
1	2								
2	3								
3	—	—	—	—	—	—	—	—	—
Birds/mi.	1								

NORTHERN PYGMY-OWL *Glaucidium gnoma*

Two calling in the evening of 4 May and another in oak woodlands above this area 16 May seen, indicate they are local residents and BREEDING: Probable S(A1). Another heard below the dam in the early morning 5 May.

LONG-EARED OWL *Asio otus*

One giving an unearthly scream-call repeatedly in the pre-dawn of 4 May along the upper Carmel upstream 1 mile from the Reservoir, suggests possible nesting in this riparian (which looks appropriate) though no nesting in this area is known (Roberson 1985)

WHITE-THROATED SWIFT *Aeronautes saxatalis*

Present and nesting around appropriate cliffs, but forages more widely. Factor: 1
BREEDING: Confirmed ON(A2;F2,3;E3).

	A	B	C	D	E	F	G	H	I
1	4		6		4	5	2	2	3
2	4		2	4	2	2	1		
3	—	—	4	1	10	17	—	2	—
Birds/mi.	1		2	1	2	4	1	1	1

ANNA'S HUMMINGBIRD *Calypte anna*

Commonest on the lower Carmel but widely present throughout. Decrease in numbers late May probably reflects dispersal after end of breeding season. Factor: 1.5
BREEDING: Probable D(E1; G1,2,3).

Date	A	B	C	D	E	F	G	H	I
1	3		3	7	14	9	18	20	9
2	7		10	5	16	11	22	9	11
3	—	—	4	4	2	4	5	4	8
Birds/mi.	4		4	4	6	6	10	6	14

ALLEN'S HUMMINGBIRD *Selasphorus sasin*

Commonest in the lower Carmel, esp. around flowering eucalyptus or willow. One female both times at 650' on upper Carmel is approaching a local elevational record. Factor: 1.5
BREEDING: Probable D(E1,F1,G1,H1).

Date	A	B	C	D	E	F	G	H	I
1	1			1	10	3	18	9	6
2	1			1	5	2	10	14	1
3	—	—	—	3	5	6	5	4	4
Birds/mi.	1			1	3	3	7	5	4

BELTED KINGFISHER <u>Ceryle alcyon</u>

Apparent pairs rather evenly distributed along the entire Carmel.
Factor: 1
BREEDING: Confirmed ON,FY(G2); FY(E3).

Date	A	B	C	D	E	F	G	H	I
1	2		3	4	2	4	1		2
2	3		3	3	3	2	2		
3	—	—	3	1	2	4	1	—	—
Birds/mi.	1		1	1	1	2	1		1

ACORN WOODPECKER <u>Melanerpes formicivorus</u>

Restricted along the Carmel to the vicinity of dead trees, particularly sycamores, where colonies exist.
Factor: 1.5
BREEDING: Confirmed NY(H3),ON(G2).

	A	B	C	D	E	F	G	H	I
1	2		6	10	16	19	4	4	1
2	2		5	6	16	7	13	6	
3	—	—	6	11	15	11	6	2	—
Birds/mi.	1		4	6	7	9	5	2	1

NUTTALL'S WOODPECKER <u>Picoides nuttallii</u>

Pairs are very evenly distributed throughout the riparian habitat; also common in adjacent oak woodlands.
Factor: 1.5
BREEDING: Probable T(most dates).

	A	B	C	D	E	F	G	H	I
1	2		3	1	8		2		1
2	3		1	3	1	2	3	8	1
3	—	—	5	5	2	5	2	3	3
Birds/mi.	2		2	2	2	2	1	2	3

DOWNY WOODPECKER <u>Picoides pubescens</u>

Small numbers evenly distributed, irregularly detected (drumming season having past), with a decided center of population around the Riparian Forest downstream from Valley Greens Drive. Factor: 1.25
BREEDING: Confirmed NY(I2; H2-two different active nest holes with young).

Date	A	B	C	D	E	F	G	H	I
1	1						4	3	1
2			1	1	2	1		12	
3	—	—	2	1	1	—	—	10	2
Birds/mi.	1		1	1	1	1	1	4	1

HAIRY WOODPECKER <u>Picoides villosus</u>

A characteristic species of heavy forest at all elevations, we were surprised to find even this many in the riparian habitat. Factor: 1
BREEDING: Confirmed NY(A2), FY(A1, D2).

Date	A	B	C	D	E	F	G	H	I
1	1			2					
2	2		3				1	1	
3	—	—	5	1	—	—	—	—	—
Birds/mi.	1		2	1			1	1	

NORTHERN FLICKER <u>Colaptes auratus</u>

Rather thinly & evenly distributed, commonest just below dam. Partial to tall trees, dead trees. Factor: 1.25
BREEDING: Confirmed DD(D1-copulation).

Date	A	B	C	D	E	F	G	H	I
1	2	1	6	4	2	1	1	3	
2	3	1	6		2	2	4	2	
3	—	—	2	—	—	2	1	—	—
Birds/mi.	2	1	3	1	1	1	1	1	

OLIVE-SIDED FLYCATCHER <u>Contopus borealias</u>

Only a few calling birds in lower Carmel, which may, or may not, suggest nesting. Factor: 2(assumes nesting)
BREEDING: Probable? S(as shown).

	A	B	C	D	E	F	G	H	I
1							2		
2						3	1	1	
3	—	—	—	—	—	1	—	—	—
Birds/mi.						2	1	1	

WESTERN WOOD-PEWEE <u>Contopus sordidulus</u>

Rather common in the Riparian Forest, esp. between the golf courses in the lower Valley; a few upstream also.
Factor: 1.25
BREEDING: Confirmed NB(H1).

	A	B	C	D	E	F	G	H	I
1		1		1		1	8	7	
2				3		4	12	21	
3	—	—	1	2	—	1	2	21	2
Birds/mi.		1	1	1		1	4	8	1

WESTERN FLYCATCHER *Empidonax difficilis*

Very common species in thicker shady and riparian habitats, particularly in the Riparian Forest.
Factor: 1.75
BREEDING: Confirmed FL(H3-2 being fed).

	A	B	C	D	E	F	G	H	I
1	10	2	12	28	8	20	11	50	9
2	12	6	26	18	7	11	23	31	6
3	—	—	28	13	5	15	11	36	9
Birds/mi.	10	7	19	16	4	12	7	22	16

BLACK PHOEBE *Sayornis nigricans*

Rather evenly distributed along the Carmel, esp. in the vicinity of appropriate nesting structures such as bridges. Factor: 1.25
BREEDING: Confirmed NY(I2-w/3 yng); NE(D3); FL(E3-being fed).

Date	A	B	C	D	E	F	G	H	I
1	1	1	2	3	13	2	9	4	7
2	3		4	3	6	5	7	7	6
3	—	—	6	5	7	9	3	8	1
Birds/mi.	1	1	3	3	4	4	3	3	7

ASH-THROATED FLYCATCHER *Myiarchus cinerascens*

A species of open woodlands and chaparral with only a few scattered, esp. near brushy sections, on the Carmel. Only calling males heard, so Factor: 2
BREEDING: Probable S(most dates, esp A2).

	A	B	C	D	E	F	G	H	I
1			1		3		2		1
2	3			3		2			
3	—	—	1	—	—	1	—	—	—
Birds/mi.	3		1	2	1	1	1		1

WESTERN KINGBIRD *Tyrannus verticalis*

A single bird seen near filter plant on 5 May was probably a migrant; they are not known to nest in Carmel Valley.

TREE SWALLOW *Tachycineta bicolor*

Scarce amonst the much more common Violet-green Swallow, and cruising range probably accounted for irregular detection. Factor: 1
BREEDING: Probable N(G1,3; F3 - investigating holes in dead trees).

Date	A	B	C	D	E	F	G	H	I
1					4	5	8	7	1
2			1		2	1	4		6
3	—	—	—	—	—	2	—	3	1
Birds/mi.			1		1	1	2	3	3

VIOLET-GREEN SWALLOW *Tachycineta thalassina*

A common widespread woodland swallow, though the wandering nature of flocks, sometimes large, skews distributional data. Factor: 1
BREEDING: Confirmed ON(G2,H3).

Date	A	B	C	D	E	F	G	H	I
1	4		8	31	24	27	15	23	10
2	12		5	10	97	45	16	39	4
3	—	—	8	18	19	24	7	38	5
Birds/mi.	4		3	10	17	14	5	11	7

NORTHERN ROUGH-WINGED SWALLOW
Stelgidopteryx serripennis

Nesting of this species was previously unpublished for the Carmel River (Roberson 1985) but we found them locally distributed throughout, and confirmed nesting in both sandbanks and in manmade pipes on bridges. Factor: 1
BREEDING: Confirmed ON(A1; I1,3; F1,3; G1; H3).

Date	A	B	C	D	E	F	G	H	I
1	4			8	4	9	9	7	4
2	2		2	5	25	7	14	8	4
3	—	—	1	1	2	1	5	5	2
Birds/mi.	3		1	2	4	3	3	2	4

CLIFF SWALLOW *Hirundo pyrrhonota*

Locally common in the lower Valley, esp. at the large cliff nesting area just up from Robinson Canyon Bridge (@100-200 active nests). Wandering flocks elsewhere. Factor: 1, possibly underestimated.
BREEDING: Confirmed ON(F2,3); also nests on houses (F2).

Date	A	B	C	D	E	F	G	H	I
1				18	2	3	39		6
2					31	81	38	28	
3	—	—	1	1	11	103	1	4	1
Birds/mi.			1	4	6	33	13	5	4

BARN SWALLOW *Hirundo rustica*

Locally present, esp. near habitation in the lower Carmel. Factor: 1
BREEDING: Confirmed FL(C3).

Date	A	B	C	D	E	F	G	H	I
1			2	8	5	1	8	2	6
2				1	8	8	9		2
3	—	—	2	6	8	1	6	—	2
Birds/mi.			1	3	2	2	3	1	4

STELLER'S JAY *Cyanocitta stelleri*

A common and conspicuous species above and just below the reservoir, in the "montane" cool habitat (but only 500-650' elevation), rapidly becoming scarce downstream. Factor: 1
BREEDING: Confirmed FL(A2), FY(C2,3).

Date	A	B	C	D	E	F	G	H	I
1	5	2	7	4	6	6			
2	13	5	19	2	9	8	2	4	
3	—	—	15	7	3	7	1	1	—
Birds/mi.	5	4	7	2	2	3	1	1	

SCRUB JAY *Aphelocoma coerulescens*

The common jay of the warmer lower Carmel in more typical "upper Sonoran" zone habitat (Miller 1951). None were found above the dam. Factor: 1
BREEDING: Confirmed FL(H1,F3), FS(G3)

Date	A	B	C	D	E	F	G	H	I
1			3	20	14	6	16	19	1
2			2	9	22	8	17	18	2
3	—	—	2	10	29	16	15	23	3
Birds/mi.			1	6	7	5	3	6	2

AMERICAN CROW *Corvus brachyrhynchos*

Apparently feeds or moves along the river in numbers, but no nesting evidence obtained beyond Possible. The numbers at the river mouth are simply feeding flocks moving from beach to fields. Factor 1. BREEDING: Possible

Date	A	B	C	D	E	F	G	H	I
1			2	13	24	9	5		7
2			3	14	46	4	6	1	5
3	—	—	4	18	18	4	—	—	21
Birds/mi.			1	6	10	2	2	1	14

CHESTNUT-BACKED CHICKADEE *Parus rufescens*

A common species throughout the riparian, becoming more abundant in the Riparian Forest near the coast.
Factor: 1
BREEDING: Confirmed FL(K1, I2, C2, H2, D3, G3, H3- numerous family groups w/fledglin being fed; up to 9 sets of 2-4 young/each on the stretch H2).

	A	B	C	D	E	F	G	H	I
1	10	2	10	22	37	8	43	97	13
2	11	1	17	31	12	32	33	81	15
3	—	—	16	36	25	17	19	97	18
Birds/mi.	5	2	7	13	9	10	13	28	17

PLAIN TITMOUSE *Parus inornatus*

Occurs locally in residential areas and stands of large sycamores, though very common in adjacent oak woodland.
Factor: 1
BREEDING: Confirmed FL(D2, G2, F3)

Date	A	B	C	D	E	F	G	H	I
1					12		1		
2				8	10		1		
3	—	—	—	3	21	4	—	—	—
Birds/mi.				2	5	1	1		

BUSHTIT *Psaltriparus minimus*

Common in all riparian habitats, esp. so in the Riparian Forest area.
Factor: 1
BREEDING: Confirmed FL(I1, E2), FY(C2, F2).

Date	A	B	C	D	E	F	G	H	I
1	8	5	15	15	47	50	130	110	16
2	35		40	38	45	67	90	70	26
3	—	—	60	55	60	30	65	80	20
Birds/mi.	11	3	20	19	16	23	37	27	23

WHITE-BREASTED NUTHATCH *Sitta carolinensis*

Local and poorly detected in the vicinity of large oaks or sycamores only. Factor: 2
BREEDING: Probable S(all dates)

	A	B	C	D	E	F	G	H	I
1			1		2				
2				5					
3	—	—	—	—	—	—	—	—	—
Birds/mi.			1	2	1				

PYGMY NUTHATCH *Sitta pygmaea*

A resident of closed-cone forests, this species is restricted to the pines near the Hwy 1 bridge and near Carmel Valley golf course. Factor: 1.5
BREEDING: Probable T(all dates).

Date	A	B	C	D	E	F	G	H	I
1								1	1
2								2	6
3	—	—	—	—	—	—	—	2	2
Brids/mi.								1	6

BROWN CREEPER *Certhia americana*

A species of the "montane" forest, shaded woods above the dam on both the Carmel & San Clemente. Factor: 2
BREEDING: Probable S(all dates).

Date	A	B	C	D	E	F	G	H	I
1	2	1							
2	2	2							
3	—	—	—	—	—	—	—	—	—
Birds/mi.	2	3							

CANYON WREN *Catherpes mexicanus*

Singing bird in the canyon at the dam on 4 May and also two non-survey visits. Very likely nests here.

BEWICK'S WREN *Thyromanes bewickii*

A typical species of chaparral, but also in brushy spots along the river, particularly around Quail Lodge area. Factor: 1.75
BREEDING: Probable S(most dates).

Date	A	B	C	D	E	F	G	H	I
1					8	1	7	5	
2	3			5	2	3	4	16	
3	—	—	1	5	4	—	4	10	1
Birds/mi.	1		1	3	3	1	3	7	1

HOUSE WREN *Troglodytes aedon*

Most common in lush alder & brush in moist forest below the dam, but a few elsewhere in favored places. Factor: 1.5
BREEDING: Probable S(most dates).

Date	A	B	C	D	E	F	G	H	I
1	2		13	3	2		1		
2	15	1	19	8		3		1	1
3	—	—	14	1	6	1	3	—	3
Birds/mi.	6	1	10	3	2	1	1	1	3

AMERICAN DIPPER *Cinclus mexicanus*

A pair found feeding four fledged young along the Carmel just below San Clemente Dam is the first known nesting published for the Carmel (Roberson 1985). Single birds were recorded on each visit thereafter. Photographed.

BLUE-GRAY GNATCATCHER Polioptila caerulea

Recorded in chaparral above proposed inundation zone at the dam and above San Clemente Creek, where probable breeding documented.

WESTERN BLUEBIRD *Sialia mexicana*

A pair seen investigating holes in dead tree below the filter plant 5 May might have attempted to breed, but were not recorded thereafter. The species is not known to breed in the lower Carmel Valley, though does so commonly in oak woodlands just inland.

SWAINSON'S THRUSH *Catharus ustulatus*

A common species in the lower Carmel in thicker Riparian Forest habitat. Factor: 1.5
BREEDING: Probable S(most dates).

Date	A	B	C	D	E	F	G	H	I
1				1		1	7	20	4
2			1	5		7	2	35	7
3	—	—	—	1	1	4	9	37	8
Birds/mi.			1	1	1	3	4	15	11

AMERICAN ROBIN *Turdus migratorius*

Scattered widely, but seemingly prefers residential gardens and golf course edges. Factor: 1.25
BREEDING: Confirmed NY(I3- 3yng); FY(A2- also broken egg found).

Date	A	B	C	D	E	F	G	H	I
1			2	1	3		4	19	2
2	2			1		3	7	9	1
3	—	—	2	—	—	2	1	14	4
Birds/mi.	1		1	1	1	1	2	6	4

WRENTIT Chamaea fasciata

A characteristic species of chaparral, but also occurring in thickets in the riparian zone. Factor: 2
BREEDING: Probable S(all dates).

Date	A	B	C	D	E	F	G	H	I
1	2		3	3	9	3	14	4	2
2	7		10	5	6	9	10	4	2
3	—	—	7	6	10	5	7	1	1
Birds/mi.	5		9	4	5	6	8	2	4

CEDAR WAXWING Bombycilla cedrum

A nesting species of much farther north, these were simply opportunistic feeding flocks remaining from the winter. The data shows the pattern of departure in mid to late May.

Date	A	B	C	D	E	F	G	H	I
1					30	5	210	67	2
2							48	12	47
3									18

EUROPEAN STARLING Sturnus vulgaris

A despised introduced pest which usurps nesting holes of native species in dead trees, rather uniformly distributed in the lower Carmel but fortunately scarce above the dam. Factor: 1.
BREEDING: Confirmed FL & NY(F1, H1, I1, C2, E2- 40 fledglings, H2, D3), NB(G2).

Date	A	B	C	D	E	F	G	H	I
1			6	31	67	27	37	39	12
2	1		7	9	78	23	22	23	8
3	—	—	—	11	34	7	4	4	12
Birds/mi.	1		3	8	21	10	10	9	12

HUTTON'S VIREO Vireo huttoni

A characteristic species of mixed live oak/pine woods, and recorded in such habitat where it abuts the river, but also a few in the mixed lower riparian zones. Factor: 1.75
BREEDING: Probable S(most dates).

Date	A	B	C	D	E	F	G	H	I
1			5		2	1	3	2	1
2	3			3	1	4	2	3	1
3	—	—	7	4	4	1	—	2	—
Birds/mi.	3		4	2	2	2	1	1	2

WARBLING VIREO Vireo gilvus

A species rather restricted to the Riparian Forest/Woodland/Thicket, becoming a bit more common in the lower Carmel. Factor: 1.5
BREEDING: Confirmed FL(G2).

Date	A	B	C	D	E	F	G	H	I
1	2		9	5	16	15	16	24	
2	9		14	7	10	15	19	34	4
3	—	—	16	15	12	19	16	28	7
	4		9	6	6	10	9	13	8

ORANGE-CROWNED WARBLER Vermivora celata

Rather uniformly distributed in the riparian and oak woodland edge, where there is a brushy understory.
Factor: 1.5
BREEDING: Confirmed FL(G2- being fed).

	A	B	C	D	E	F	G	H	I
1	6	1	12	18	28	12	21	16	
2	16	1	33	22	25	15	14	31	
3	—	—	23	23	27	21	9	13	—
Birds/mi.	8	2	17	17	12	10	9	10	

YELLOW WARBLER Dendroica petechia

A riparian specialist that has been impacted statewide by habitat destruction and parasitism by cowbirds, the populations on the lower Carmel are quite healthy, and suggest a comparatively healthy ecosystem in the riparian zone. Factor: 1.5
BREEDING: Probable S(all dates).

Date	A	B	C	D	E	F	G	H	I
1			5	32	14	30	15	25	6
2			12	21	33	22	22	21	5
3	—	—	8	23	16	16	12	17	15
Birds/mi.			6	17	11	16	9	10	16

TOWNSEND'S WARBLER Dendroica townsendi

Two late migrants, female-plumaged, were encountered: Quail Lodge area on 12 May and (very late) near Robinson Canyon 19 May.

BLACK-THROATED GRAY WARBLER *Dendroica nigrescens*

Date	A	B	C	D	E	F	G	H	I
1	3		3						
2	4		1			1			
3			1	1					
Birds/mi.	4		2	1		1			

A nesting species more usual at higher elevations, it was recorded in the Mixed Evergreen Forest above and below the dam, with a couple individuals singing down as far as Garland Ranch. Factor: 2
BREEDING: Probable S(all dates).

MacGILLIVRAY'S WARBLER *Oporornis tolmiei*

A persistently singing male about 2 miles above the reservoir on the Carmel on 4 May suggested nesting in the appropriate appearing alder/thicket woodland, but not recorded thereafter. There are few Monterey County nesting areas (Roberson 1985) but the site resembled typical breeding habitat.

COMMON YELLOWTHROAT *Geothypis trichas*

A young singing male at the pond below "Cross Hill" at the river mouth was on apparently appropriate breeding habitat 15 May, but not found thereafter, so might have been a migrant. The species does occasionally nest at the Carmel River mouth.

WILSON'S WARBLER *Wilsonia pusilla*

Date	A	B	C	D	E	F	G	H	I
1	1		4		3		3	21	2
2	1		1	2		5		42	6
3			2	2	5	3	7	10	9
Birds/mi.	1		2	1	2	2	3	14	8

Thinly distributed in all riparian zones, but with a population center in the Riparian Forest of the lower Carmel. Factor: 1.75
BREEDING: Probable S(all dates).

YELLOW-BREASTED CHAT *Icteria virens*

Date	A	B	C	D	E	F	G	H	I
1				1	1				
2					1		1		
3					1				
Birds/mi.				1	1		1		

A riparian specialist declining statewide (Remsen 1977), this species thought to be absent from the Carmel since 1960 (when 8 males found; Roberson 1985). We found an apparent three pairs remaining. Factor: 2
BREEDING: Confirmed FY(E2).

WESTERN TANAGER *Piranga ludoviciana*

Date	A	B	C	D	E	F	G	H	I
1	4			5					
2	3								
3									1

A breeding species of the yellow pine forest zone in the Santa Lucia Mnts., all our birds were thought to be migrants (so no "birds/mi. calculated). It is possible, though, that nesting could occur on the upper Carmel down to the reservoir.

BLACK-HEADED GROSBEAK *Pheucticus melanocephalus*

Date	A	B	C	D	E	F	G	H	I
1	12	1	14	1	9	5	16	14	3
2	10		8	9	3	9	16	21	2
3			11	7	8	4	6	17	2
Birds/mi.	8	1	8	5	4	4	8	8	4

Evenly distributed along the entire Carmel, preferring areas with taller trees. Factor: 1.5
BREEDING: Confirmed NE(H1), FY(A2).

LAZULI BUNTING *Passerina amoena*

Date	A	B	C	D	E	F	G	H	I
1	2		2		1		2		
2	2								1
3									
Birds/mi.	2		1		1		1		1

A bird of scrubby patches, often adjacent to chaparral, and not in the riparian zone; Birds were recorded only in adjacent hillsides; it is probable the lower Carmel individuals were simply migrants. Factor: 2
BREEDING: Probable S(A1,2; C1- suggested nesting only).

RUFOUS-SIDED TOWHEE *Pipilo erythrophthalmus*

A species of chaparral adjacent to the riparian and thick brush in the riparian zone, commonest the first few stretches below the dam.
Factor: 1.75
BREEDING: Confirmed FY(A2).

	A	B	C	D	E	F	G	H	I
1	1		1		12	2	7		
2	6		10	5	10	2	3	2	
3	—	—	9	13	11	3	1	5	—
Birds/mi.	3		7	6	6	2	3	2	

BROWN TOWHEE *Pipilo fuscus*

A brush-loving species becoming gradually more common towards the coast. Factor: 1.25
BREEDING: Probable T(H1), S(most date)

Date	A	B	C	D	E	F	G	H	I
1			2	1		6	3	12	2
2				2	3	3	6	14	
3	—	—	6	9	8	1	8	21	4
Birds/mi.			2	3	2	2	3	6	4

RUFOUS-CROWNED SPARROW *Aimophila ruficeps*

Singing male in brushy, rocky chaparral on slope above dam 5 May stronly suggests breeding here in this appropriate-appearing habitat.

SONG SPARROW *Melospiza melodia*

The commonest species on the Carmel in the riparian brush, population becoming denser closer to the coast.
Factor: 1.5
BREEDING: Confirmed FL(D1, D2, E2, F2, D3, F3).

Date	A	B	C	D	E	F	G	H	I
1	2		11	30	81	45	60	80	16
2	9		22	46	57	47	48	77	23
3	—	—	26	26	66	43	24	53	34
Birds/mi.	4		14	23	32	28	27	34	38

WHITE-CROWNED SPARROW *Zonotrichia leucophyrs*

Virtually restricted to the coastal scrub on "Cross Hill" at the river mouth, but one was singing upstream one mile at the Hwy 1 bridge.
Factor: 1.25 BREEDING: Probable S(all dates).

	A	B	C	D	E	F	G	H	I
1									5
2									5
3	—	—	—	—	—	—	—	—	6
Birds/mi.									6

DARK-EYED JUNCO *Junco hyemalis*

A species of montane and cool forests, found in numbers only in the shady forest below the dam and rapidly declining downstream as habitat disappears. Factor: 1.5
BREEDING: Confirmed FL(C2, D2, E2, F3- 4 young).

Date	A	B	C	D	E	F	G	H	I
1	3		4	3					
2	4		16	8	2	2			
3	—	—	20	1	2	2	—	—	—
Birds/mi.	3		10	3	1	1			

RED-WINGED BLACKBIRD *Agelaius phoeniceus*

Locally common at the scattered breeding ponds in tules, feeding birds elsewhere. Factor: 1
BREEDING: Confirmed NE(E1), FL(E2), FY(I3).

	A	B	C	D	E	F	G	H	I
1			2	1	53	15	20	6	16
2	3			3	38	17	10	6	20
3	—	—	—	—	40	43	5	5	10
Birds/mi.	2		1	1	13	12	5	2	18

BREWER'S BLACKBIRD *Euphagus cyanocephalus*

Common in the lower Carmel, nesting in the riparian and feeding in open fields. A large roost at Robinson Canyon accounts for the totals in stretch G. Factor: 1
BREEDING: Confirmed FL(I1-being fed, E2, I2, D3).

	A	B	C	D	E	F	G	H	I
1				20	37	9	75	25	16
2				7	34	25	166	28	29
3	—	—	—	4	63	36	195	18	10
Birds/mi.				5	20	12	60	8	22

BROWN-HEADED COWBIRD *Molothrus ater*

High densities in the riparian zone near the mouth, but fewer upstream may be balanced in the ecosystem.
Factor: 1.75 BREEDING: Confirmed DD(I1-copulation)

Date	A	B	C	D	E	F	G	H	I
1			1		5		12	26	5
2			1	5	7	10	13	32	9
3	—	—	—	1	3	4	5	15	8
Birds/mi.			1	1	3	5	3	15	15

NORTHERN ORIOLE *Icterus galbula*

Restricted to large oaks/sycamores and mixed stands with eucalyptus. Factor: 1.5
BREEDING: Probable S(most dates).

Date	A	B	C	D	E	F	G	H	I
1					3	2	5		
2						1	3	1	
3	—	—	—	1	—	2	—	—	—
Birds/mi.				1	1	1	2	1	

PURPLE FINCH *Carpodacus purpureus*

Throughout the riparian of the lower Carmel, but commonest in the Riparian Forest nearer the mouth.
Factor: 1.75
BREEDING: Confirmed NB(H3), FS(H3).

Date	A	B	C	D	E	F	G	H	I
1			1	3	14	3	26	13	
2	3			8	11	9	17	26	7
3	—	—	4	4	13	7	6	24	5
Birds/mi.	1		2	4	7	6	13	13	11

HOUSE FINCH *Carpodacus mexicanus*

Common in open areas in the lower Carmel, using the riparian only to feed (probably). Numbers at the mouth are feeding flocks, not high nesting densities. Factor: 1.25
BREEDING: Probable S(most dates).

Date	A	B	C	D	E	F	G	H	I
1				1	3	4	13	10	28
2				3	6	8	23	42	27
3	—	—	—	—	13	4	10	8	7
Birds/mi.				1	4	3	7	9	34

PINE SISKIN *Carduelis pinus*

Restricted to mixed pine/riparian habitats, or eucalyptus, near the river mouth. Factor: 1
BREEDING: Possible

Date	A	B	C	D	E	F	G	H	I
1							2		
2							2	8	1
3	—	—	—	—	—	—	—	2	4
Birds/mi.							1	1	3

LESSER GOLDFINCH *Carduelis psaltria*

Rather evenly distributed throughout in the riparian zone. Factor: 1
BREEDING: Confirmed NE(F1-4 eggs, later NY-4 yng F3), NE(F3-another), NB(I1).

Date	A	B	C	D	E	F	G	H	I
1	4		2	11	14	24	12	15	8
2	6		5	14	6	7	19	18	
3	—	—	24	10	20	16	11	22	10
Birds/mi.	3		5	5	5	8	5	6	9

LAWRENCE'S GOLDFINCH *Carduelis lawrencei*

Only previously suspected as nesting at the river mouth once before (in 1981-Roberson 1985), we found pairs and proved nesting this year, which may be anomolous. Factor: 1
BREEDING: Confirmed NB(I3), probable FL(J3-with another pair).

	A	B	C	D	E	F	G	H	I
1							4	5	
2				1			7	2	2
3	—	—	—	—	—	—	—	7	3
Birds/mi.				1			2	2	2

AMERICAN GOLDFINCH *Carduelis tristis*

Restricted to the immediate vicinity of the coast, using riparian of river mouth for feeding, but may not nest in that habitat. Factor: 1
BREEDING: Possible

Date	A	B	C	D	E	F	G	H	I
1									1
2								3	1
3	—	—	—	—	—	—	—	—	1
Birds/mi.								1	1

HOUSE SPARROW *Passer domesticus*

A denizen of human habitation, esp. around shopping centers; BREEDING: Confirmed NB(H3) at Rio Road shopping center adjacent (but not in) riparian.

Date	A	B	C	D	E	F	G	H	I
1						1		1	1
2								1	
3								1	

Acknowledgements: Henrietta Stern was very helpful in many ways, including obtaining permission for access to private property above and below the dam. Graham Matthews drove us to all the access points prior to the survey and did the bulk of the aerial mapping, which we confirmed in our walks. Rick Villasenor helped with the mapping, prepared the habitat descriptions (Table 1) and supervised the entire project.

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Table 1

RIPARIAN HABITAT CLASSIFICATIONS

1. Surface Water (Aquatic): Pools and River bed.

2. Emergent Vegetation: Annual and perennial herbs occupying permanently wet habitats in the River as well as pools, springs or seeps. Typical species are: Carex spp. (Sedge), Juncus spp. (Rush) Typha latifola (Cat-Tail), Scirpus spp. (Bulrush or Tule) and Equisetum spp (horsetail).

3. Dry Wash: Low annual herbs and grasses that occur in scoured or rocky substrate areas. Often the habitat is covered with mats of dried algae. Common and characteristic plant species include: Brassica spp. (Mustards), Heliotropidum currassivicum (Chinese Pusley), Lactuca scariola (Willow Lettuce), Melilotus albus (White Sweet Clover), Paspalum districhum (Knotgrass), Polypogon monspeliensis (Rabbitfoot Grass), Rumex crispus (Curly Dock), Xanthium spp. (Cocklebur).

4. Riparian Scrub: Dominated by various shrubs and herbs that occupy gravel and point bars and lacks a well-established tree canopy. Scrub consists of low (2-10 feet) shrubs in rocky open areas. Common and characteristic plant species of riparian scrub include: Artemisia douglasiana (Mugwort), Baccharis piluraris (Coyote Bush), Rubus vitifolius (Blackberry), Foeniculum vulgare (Sweet Fennel), Toxicodendron diversilobum (Poison Oak) and Rhamnus californica (Coffeeberry).

5. Northern Riparian Woodland/Thicket: A woodland is dominated by large (30-60 feet high), deciduous trees that occur in a range of densities. Open, scattered trees represent a woodland. The understory also varies from bare ground (due to scouring or poor light penetration) to a dense herb and/or scrub thicket. This habitat type may be divided into associations based upon the dominant tree species. Common and typical tree species include: Cottonwoods (Populus trichocarpa), Willows (Salix spp.), Sycamores (Platanus racemosa) and Alders (Alnus rhombifolia).

A thicket is a dense stand of woody riparian vegetation less than 20 feet in height and is usually dominated by a single species. There is a continuum of size and structural complexity between these two extremes. Common and characteristic plant species of riparian thickets include: Salix lasiandra (Yellow Willow), S. hindsiana (Sandbar Willow), S. laevigata (Red Willow) and Cornus stoloniferous (Dogwood).

6. Riparian Forest: Dominated by large (30-60 feet high), deciduous trees with overlapping canopies. The understory also varies from bare ground (due to scouring or poor light penetration) to a dense herb and/or scrub thicket. This habitat type may be divided into associations based upon the dominant tree species. Common and typical tree species include: Cottonwoods (Populus trichocarpa), Willows (Salix spp.), Sycamores (Platanus racemosa) and Alders (Alnus rhombifolia).

7. Mixed Evergreen Forest/Riparian: In the steep canyon and gorge areas where the river bottom is right next to the adjacent canyon slopes, the riverside vegetation is dominated by oaks (Quercus agrifolia), bay (Umbellularia californica), and California Buckeye (Aesculus californicus). The understory is often characterized by a dense stand of poison oak, wild current (Ribes sp.), coffeeberry and blackberry.

8. Ruderal or Non-Native Communities: Areas along the river that have been disturbed or planted with non-native plant species. Examples would be Eucalyptus groves, grass covered banks, or rock rip-rap areas.

Map 1: Generalized habitats on the Carmel River (width of habitats exaggerated
Definitions of habitats in table 1

Emergent vegetation

Riparian forest

Riparian scrub

Mixed evergreen forest/ riparia

Northern riparian woodland/thicket

Ruderal (non-native)

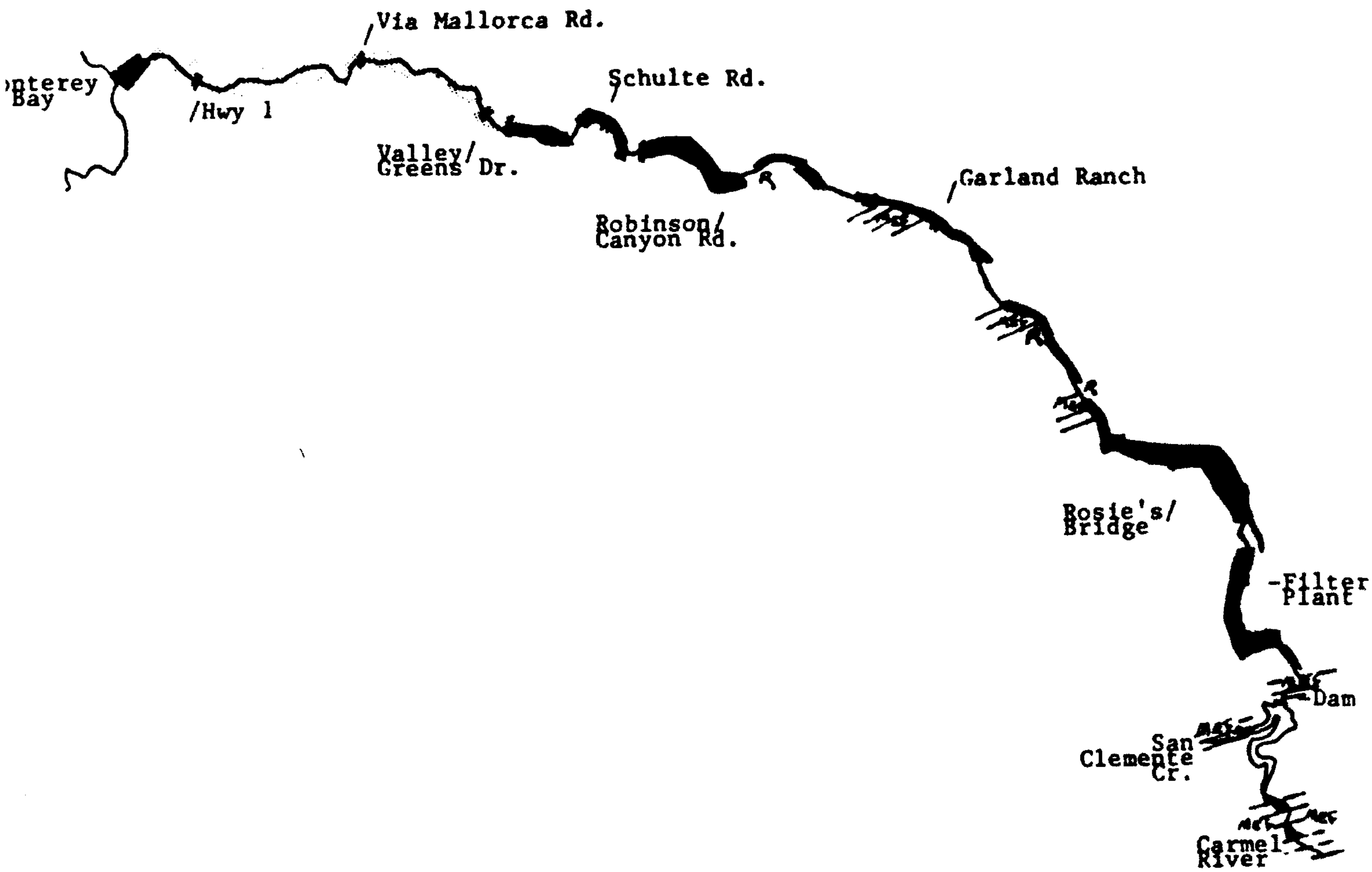

Table 2

CRITERIA FOR POSSIBLE, PROBABLE AND CONFIRMED BREEDING

SSIBLE BREEDING - this code should be entered in the first column of the Atlas Card (PO).

Bird recorded in the breeding season in possible nesting habitat but no other indication of breeding noted. Take 1 May through 31 July as the breeding season for most species. Summering, non-breeding adults such as gulls in a dump when you know there is no gullery in your block, migrant shorebirds and warblers, should NOT be included.

OBABLE BREEDING - codes entered in second column (PR).

Singing male present (or breeding calls heard) on more than one date in the same place. It is a good indication that a bird has taken up residence if the dates are a week or more apart.
Bird (or pair) apparently holding territory. In addition to singing, chasing of others of the same species often marks territory.
Courtship and display; or agitated behavior or anxiety calls from adults, suggesting probable presence of nest or young nearby; brood-patch on trapped female or cloacal protuberance on trapped male.
Visiting probable nest-site.
Nest building by wrens and woodpeckers. Wrens may build many nests and woodpeckers, although they usually drill only one nesting cavity, may also drill roosting holes.

NFIRMED BREEDING - codes entered in third column (CO).

Distraction display or injury feigning, coition. Agitated behavior and/or anxiety calls are "D" only.
Nest building by any species except wrens and woodpeckers.
Used nest found. These must be carefully identified if they are to be used. Some nests (like Northern Oriole) are persistent and very characteristic. Others are more difficult to identify correctly.
Female with egg in the oviduct.
Recently fledged young (including downy young of waterfowl etc.). This code should be used with caution for species such as Starlings and swallows which may move some distance soon after fledging. Recently fledged passerines are still dependent on parents and being fed by them.
Adult carrying fecal sac.
Adult(s) with food for young. Some birds (gulls, terns and birds of prey) continue to feed their young long after they've fledged and may move considerable distances. Also some birds (like terns) may carry food long distances to young in a neighboring block. Be careful especially on the edge of a block. Care should be taken to avoid confusion with courtship feeding (D).
Adult(s) entering or leaving nest-site in circumstances indicating occupied nest. Not generally used for open nesting birds. The correct code would be "N" if you simply see a bird fly into or out of a bush or tree and do not find the nest. It should be used for hole nesters as when a bird enters a hole and remains inside, changes over at a hole or bird leaves hole after having been inside for some time.
Nest and eggs or bird setting and not disturbed or egg shells found below the nest. If you find a cowbird egg in a nest, it's NE for cowbird and NE for the host nest.
Nest with young or downy young or downy young of waterfowl, quail, waders, etc. If you find a young cowbird with the other young, it's NY for the cowbird and NY for the host species. Since parents often lead down young for considerable distances, care should be taken if such records are close to the edge of the block.

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21 July 1991

Mr. Dave Mullen
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RE: San Clemente Dam project

Dear Dave:

At your request, I have conducted a status survey for the endangered Smith's Blue butterfly (*Euphilotes enoptes smithi*), at two of the alternative project sites for the proposed New San Clemente Dam in Monterey County. My status survey was conducted as a follow-up to the habitat assessment surveys that I conducted for EIP Associates on this project in 1989. Because of the presence of occasionally used buckwheat (*Eriogonum* spp.) foodplants at some of the alternative dam sites, one of the recommendations in my 1989 report was that status surveys for the Smith's Blue should be conducted during the butterfly's adult flight season in June and July. I refer you to my 1989 report for general background information on the butterfly and the specific findings of my habitat assessment. The remainder of this letter reports the findings of my status surveys at two of the alternative dam sites, and provides an update on the geographic range of the Smith's Blue butterfly.

My status surveys were conducted during the week of July 14th, 1991. Based on my field studies at other sites in the Carmel Valley, the timing of my surveys coincided with the peak of the butterfly's flight season and flowering period of the buckwheat foodplants.

My surveys were conducted at the New Los Padres Dam and San Clemente Dam sites. Potential foodplants for the Smith's Blue at both sites included *Eriogonum nudum* and *E. fasiculatum*. Although two other buckwheats, *Eriogonum parvifolium* and *E. latifolium*, are the preferred foodplants for the Smith's Blue butterfly, it will occasionally utilize *E. nudum* or *E. fasiculatum*, especially in interior portions of Monterey County. A non-sensitive relative of the Smith's Blue, known as Tilden's Blue (*Euphilotes enoptes tildeni*), is more commonly associated with *E. nudum* and *E. fasiculatum*, especially in interior portions of Monterey County.

Below the inundation line at the New Los Padres Dam site, about 30 specimens of the Tilden's Blue were observed in association with the *E. nudum* and *E. fasiculatum* growing there. No specimens of the Smith's Blue were observed during my surveys. Based on these findings, and because of the more interior location of the New Los Padres Dam site, I doubt that the Smith's

Blue butterfly occurs there. Tilden's Blue replaces Smith's Blue in the interior portions of Monterey County.

Below the inundation line at the New San Clemente Dam site, about 60 specimens of the Tilden's Blue were observed in association with *E. nudum* and *E. fasiculatum*. An additional 22 adults of Tilden's Blue were observed at scattered locations above the inundation line. I also observed one specimen of the Smith's Blue on *E. nudum* above the inundation line on a hilltop immediately west of the canyon created by San Clemente Creek. Because of this observation, I spent extra time at this location searching for the Smith's Blue, but I did not see any other individuals. At other locations in the Carmel Valley, west of the project site, I have occasionally observed adults of Smith's Blue nectaring on *E. nudum* flowers. However this behavior has usually been observed in areas where *E. parvifolium*, a preferred foodplant, is also present. My earlier surveys of the New San Clemente Dam site did not find any stands of *E. parvifolium* and I could not find any at or near the hilltop location where I observed the single Smith's Blue adult. Thus, it is possible that this individual may have been a stray.

Since completing my 1989 surveys of the alternative dam sites, I have been able to conduct additional field studies on the Smith's Blue butterfly in the hills of the Carmel Valley. The results of these studies provide an improved understanding of the geographic range of the Smith's Blue and its non-sensitive relative, the Tilden's Blue (*Euphilotes enoptes tildeni*) in this portion of Monterey County.

As I discussed in my 1989 report, Smith's Blue was previously thought to occur in coastal areas and a few interior areas where coastal sage scrub vegetation grows. Tilden's Blue was previously thought to occur in the interior, rain-shadow areas of the Coast Range. However, new information from my more recent studies in the Carmel Valley suggest that the geographic ranges of these two butterflies overlap extensively in the Carmel Valley and surrounding hills, with *smithi* generally predominating in locations closer to the coast and *tildeni* predominating farther inland. During its 1991 flight season, I have discovered nearly 50 new colonies of the Smith's Blue in the Carmel Valley and surrounding hills between Garland Park and the coast. East of Garland Park, the colonies of blue butterflies on buckwheats tend to be entirely *tildeni*.

If you have any questions about my survey findings, just give me a call to obtain clarification.

Sincerely,

Richard A. Arnold

Richard A. Arnold, Ph.D.
President

SMITH'S BLUE BUTTERFLY

SURVEY OF THE PROPOSED CANADA RESERVOIR SITE

CARMEL VALLEY, CALIFORNIA

MARCH 19, 1990

Prepared by Thomas Reid Associates
Palo Alto, California

SMITH'S BLUE BUTTERFLY
SURVEY OF THE PROPOSED CANADA RESERVOIR SITE
CARMEL VALLEY, CALIFORNIA

A. INTRODUCTION

The proposed Canada Reservoir project site is located on the Eastwood, Morgens, and Monterra properties in Carmel Valley, Monterey County (Figure 1).

Smith's blue butterfly is listed as an endangered species by the United States Fish and Wildlife Service. Because Smith's blue is known from the vicinity of Carmel Valley, a study of the butterfly was undertaken to determine if the proposed Canada Reservoir project would have an impact on the butterfly or its habitat.

The information presented here is based on field work by Robert Langston, and Michael Baumgartner for Thomas Reid Associates in 1989 and on the work of others as reported in the published literature.

B. BACKGROUND ON THE SMITH'S BLUE BUTTERFLY

Smith's blue butterfly is found along the coastal dunes of Monterey County, where the larvae (caterpillar form) feed on two species of buckwheat: the seacliff buckwheat, Eriogonum parvifolium, used to the south, and the coast buckwheat, Eriogonum latifolium, used to the north. While the overall distribution of Smith's blue is smaller than the geographic range of its larval food plants, Carmel Valley is clearly within the present range of the butterfly and thus there is a possibility of finding the Smith's blue wherever the buckwheats occur.

Smith's blue adults are found close to its larval host plants, which also serve as adult nectar sources as well as egg-laying sites for females. The close relationship between the butterfly and its food plant allows Smith's blue to colonize and maintain populations on habitat areas as small as a few acres. Such small populations may frequently go extinct, however, and can only be re-established by migrants from more persistent colonies.

1. Taxonomy

Smith's blue is a small lycaenid butterfly. The adults have a 1 inch wingspan. The wing has a pale grey underside speckled with black dots and a reddish-orange band on the hind-wing border. The topside of the male is a lustrous blue, the female has a brown topside with a band of orange bordering the hind wing (1984 Smith's Blue Butterfly Recovery Plan). Larvae are slug-shaped and vary in color from cream to pale yellow or rose, depending on the color of the flowerhead on which they are feeding.

The species Euphilotes enoptes comprises nine described subspecies, including Smith's blue (Euphilotes enoptes smithi). The following paragraph is a general introduction to the species biology adapted from Langston (1975).

The species group distribution is restricted to western North America, Western Canada and Baja California. Adults are closely associated with their host plants, several species of wild buckwheat, Eriogonum (Polygonaceae). Eggs are deposited on late buds or early flower heads of the buckwheat plants. Young larvae feed solely on the flowerheads of the plant. Each subspecies is generally restricted to one or a few closely related host species of buckwheat. There is only one generation per year. Depending upon subspecies, the adults may fly in early-late spring, early summer, mid-summer or early fall.

Smith's blue (Euphilotes enoptes smithi) was originally described in 1954 by R.H.T. Mattoni from specimens collected at Burns Creek, State Highway 1, Monterey County, California. In 1975, Langston described the butterfly as inhabiting the sand dunes of north Monterey County southward through Big Sur.

The most recent distribution of Smith's Blue is described in the U.S. Fish and Wildlife Service (USFWS) Smith's blue Butterfly Recovery Plan (1984). Figure 2 (taken from the Recovery Plan) shows the known collection locations of Smith's blue through 1983. Note that the Santa Cruz and San Mateo County locations are not considered to be assignable to Euphilotes enoptes smithi.

Robert Langston and Dennis Murphy, Ph.D. (Thomas Reid Associates) conducted a survey of Euphilotes enoptes in 1986 in inland Santa Cruz County for the USFWS to determine the taxonomic status of the insect and its distribution. That study concluded that Euphilotes enoptes found in inland Santa Cruz Co. and San Mateo County are phenotypically intermediate between E. e. smithi and E. e. tildeni.

Two other subspecies of Euphilotes enoptes are found in the greater San Francisco Bay Area. E. e. bayensis is found in the northern San Francisco Bay area: including Marin, Contra Costa, and Solano Counties, ranging northward in Sonoma, Mendocino and Humboldt Counties. E. e. tildeni is also more widespread than smithi: it occurs in the inner coast range foothills and mountains in Santa Clara, Stanislaus, San Benito, Monterey, San Luis Obispo, Kern and Ventura Counties.

2. Ecology

a. Life Cycle

The following is summarized from the Smith's Blue Recovery Plan (USFWS 1984). Smith's blue butterflies are univoltine -- there is only a single generation per year. The butterflies overwinter as pupae, emerging as adults in the late spring or early summer. The males emerge a few days to a week ahead of the females. Once the females emerge, they are quickly mated. All courtship and mating behavior takes place around the buckwheat plants.

The females lay their eggs singly on flower heads of the plants. The larvae hatch in about a week. After hatching the larvae begin eating the flowering heads of the buckwheat. As larvae grow they molt, passing through 5 growing stages (or instars). Following the fifth instar stage the larvae pupate (August - November), and then overwinter in the leaf litter at the base of the plants. Some pupae have been found to overwinter in the dried flower heads of the plant.

b. Larval Food Plants

The Smith's blue is known to use two buckwheat species as larval food plants: seacliff or dune buckwheat, Eriogonum parvifolium, and coast buckwheat, Eriogonum latifolium. In California, Eriogonum parvifolium is found in dunes and hillsides along the California coast from Monterey County south to San Diego

County (Abrams, 1944). The dune buckwheat, Eriogonum parvifolium, is a low spreading shrub with slender leafy branches (Figure 3). It has a single inflorescence; the flower is a pale rose color. Eriogonum latifolium is found in bluffs and dunes along the coast from Oregon south to San Luis Obispo (Munz 1968). It has mostly basal oval leaves (Figure 3), and also has a single white or pale rose inflorescence.

c. Oviposition Suitability

Female butterflies lay their eggs singly on the buds and newly opened flowering heads of buckwheat. Because the plants bloom earlier in the more sheltered aft-dunes, the earliest emerging adults are found flying in these locations. The adults subsequently emerge in the mid-dunes, and ultimately in the more exposed areas of the fore-dunes.

d. Nectaring

Adult Smith's blue butterflies nectar (feed) almost exclusively on buckwheat flowers. Under inclement weather conditions when butterflies do not get sufficient warmth from sunlight to allow flight, adult feeding is also curtailed.

C. SMITH'S BLUE SURVEY AT THE CANADA RESERVOIR SITE

E. latifolium blooms in June and July; E. parvifolium blooms from July through September. Because E. latifolium blooms earlier than E. parvifolium and because the larvae feed on the flowerheads, Smith's blue began to exhibit an earlier adult flight period. Where Smith's blue is associated with E. latifolium, the butterfly flies in June and early July, and where associated with E. parvifolium, the butterfly flies from July to September. Morphologically, the adults fall within the same range of variation from either host.

On July 17, 1989 Victoria Harris and Michael Baumgartner met with Rex Palmer of Biosystems on the proposed Canada Reservoir site. Mr. Palmer had observed some Eriogonum parvifolium plants during vegetation surveys he had conducted for the Environmental Impact Report. Mr. Palmer had only found a few Eriogonum plants in the proposed reservoir inundation area. The plants were all Eriogonum parvifolium. Most of the site is heavily vegetated with thick shrubs, trees, and poison oak. In addition many areas are steep and inaccessible. Eriogonum parvifolium and Smith's blue butterflies are not typically found in this type of habitat.

During the initial site visit on July 17, 1989 the two small patches of Eriogonum parvifolium found along the valley floor road were thoroughly searched for signs of the butterfly (see Figure 4). At the first patch (labeled A on the map) there were about 15 plants scattered along a thickly vegetated road cut. The second patch (B) comprised only three plants. No Smith's blue were observed in either location. On the morning of July 17, prior to our visit to the Canada Reservoir site, three adult Smith's blue were observed in Sand City.

TRA made two more visits to the site, one on August 11th and one on August 17th, both under favorable weather conditions. Additional host plant searches were conducted during both visits. No additional Eriogonum plants were observed. During both visits the same two patches of Eriogonum found along the valley floor road were searched. Robert Langston, our Smith's blue expert, participated in the survey work. It is his belief that there are too few Eriogonum plants on the site to support a colony of Smith's blue butterfly.

D. BIBLIOGRAPHY

U.S. Fish and Wildlife Service, Smith's Blue Butterfly Recovery Plan, 1984

Persons Contacted

Denise Duffy, Duffy and Associates

Chris Nagano, U.S. Fish and Wildlife Service, Office of Endangered Species, Sacramento, CA

Rex Palmer, Biosystems, Inc.

Report Participants

Michael Baumgartner
Victoria Harris
Robert Langston

FIGURE 1
SITE LOCATION

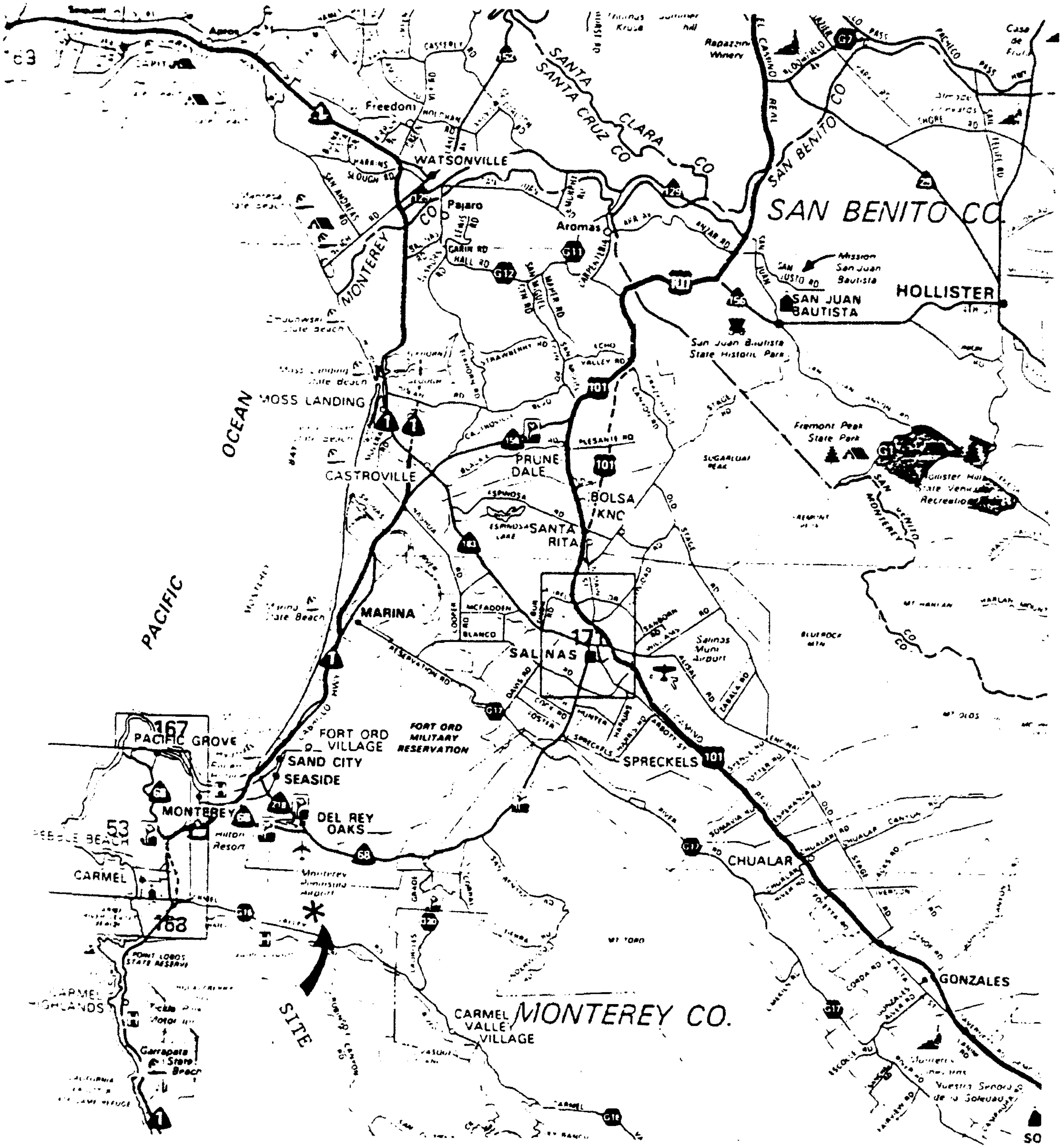


FIGURE 2
KNOWN LOCATIONS OF SMITH'S BLUE BUTTERFLY THROUGH 1983

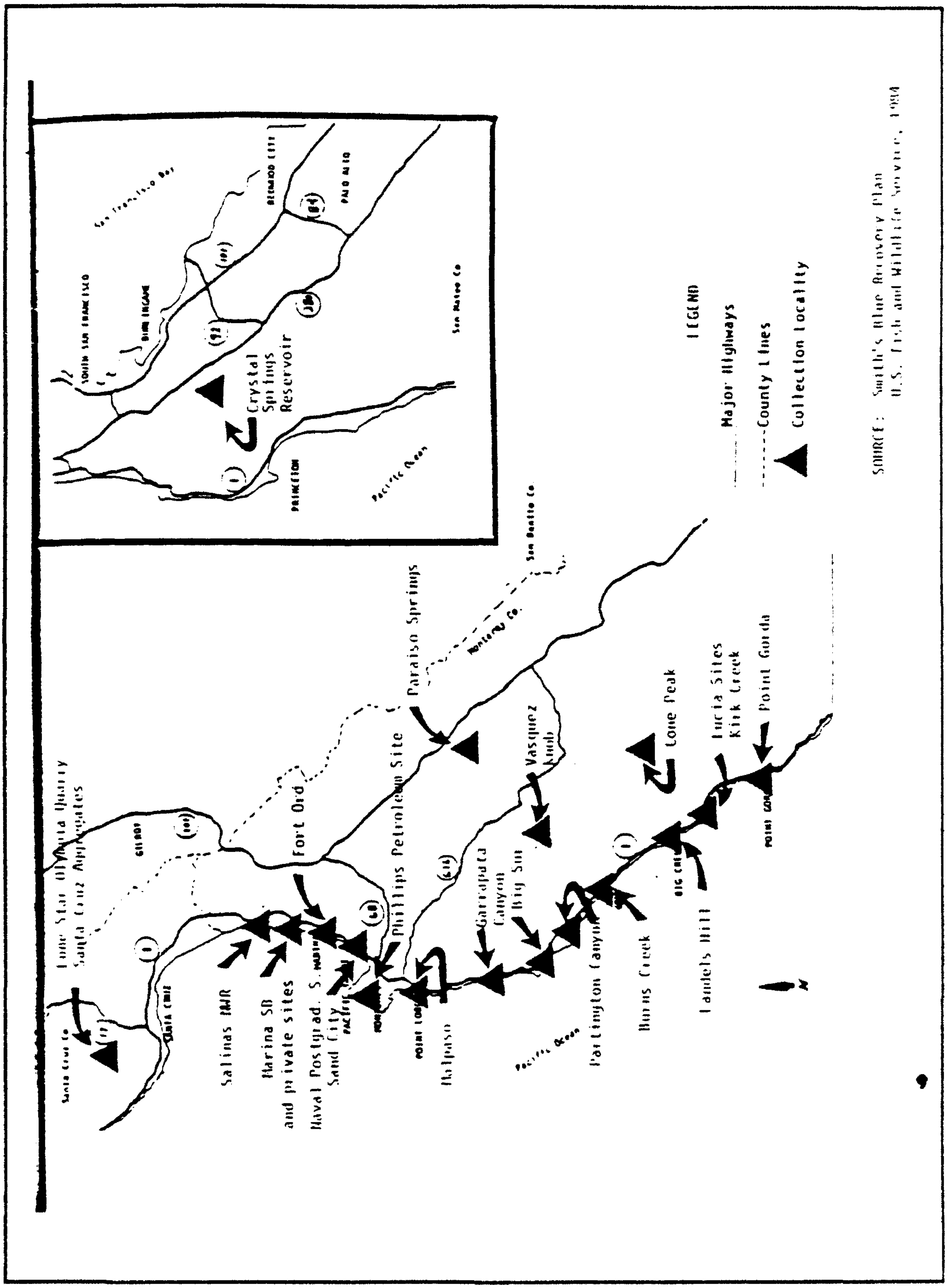
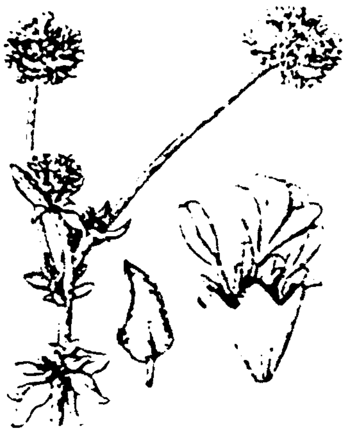


FIGURE 3
ILLUSTRATIONS OF ERIOGONUM HOST PLANTS

PLANTS OF CONCERN



Eriogonum parvifolium

75. Eriogonum parvifòlium Smith. Dune Eriogonum. Fig. 1-2?

Eriogonum parvifolium Smith in Rees, Cycl. 13: No. 2. 1809.
Eriogonum parvifolium subsp. *rufidum* Howell ex Stokes Gen. Eriog. 67. 1936.

Low spreading shrub, 3-10 dm. high, with slender densely leafy branches, thinly floccose. Leaves fasciculate at the nodes, round-ovate to oblong-lanceolate, 6-12 mm. long, short-petioled, thick, revolute on the margins, densely white-tomentose beneath, dark green and shining above; heads solitary or racemosely disposed on a simple or umbellately branched peduncle; involucres 4 mm. long, glabrate outside, woolly on the throat within; calyx white or tinged with rose, glabrous, 3-4 mm. long, the lobes obovate; filaments sparsely hairy.

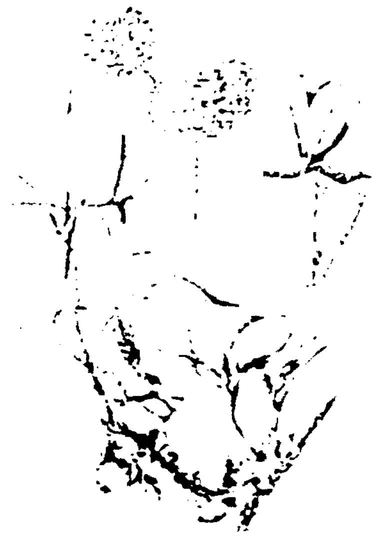
Dunes and hillsides along the coast, mainly Upper Sonoran Zone; Monterey Bay to San Diego County, California. Type locality: California (Menzies), probably Monterey. June-Dec.

70. Eriogonum latifòlium Smith. Coast Eriogonum. Tibinagua. Fig. 1418.

Eriogonum latifolium Smith in Rees, Cycl. 13: No. 3. 1809.

Leaves persistent, densely clothing the branches of the low woody caudex, ovate or ovate-oblong, rounded or cordate at base, densely white-woolly beneath, lanate or glabrate above, 2.5-4 cm. long, the margins plane or somewhat crisped; flowering stems leafless, floccose-tomentose, stout, 2-6 dm. high, simple or 2-4-forked, the forks simple or again forked; involucres congested forming a large terminal head or in the forms with forked stems the heads more reduced and occurring in the forks as well as the ends of the branches, shallowly 5-toothed, tomentose, 4 mm. long; calyx white or pale rose, glabrous, 3 mm. long, the lobes obovate, rounded at apex; filaments densely villous at base.

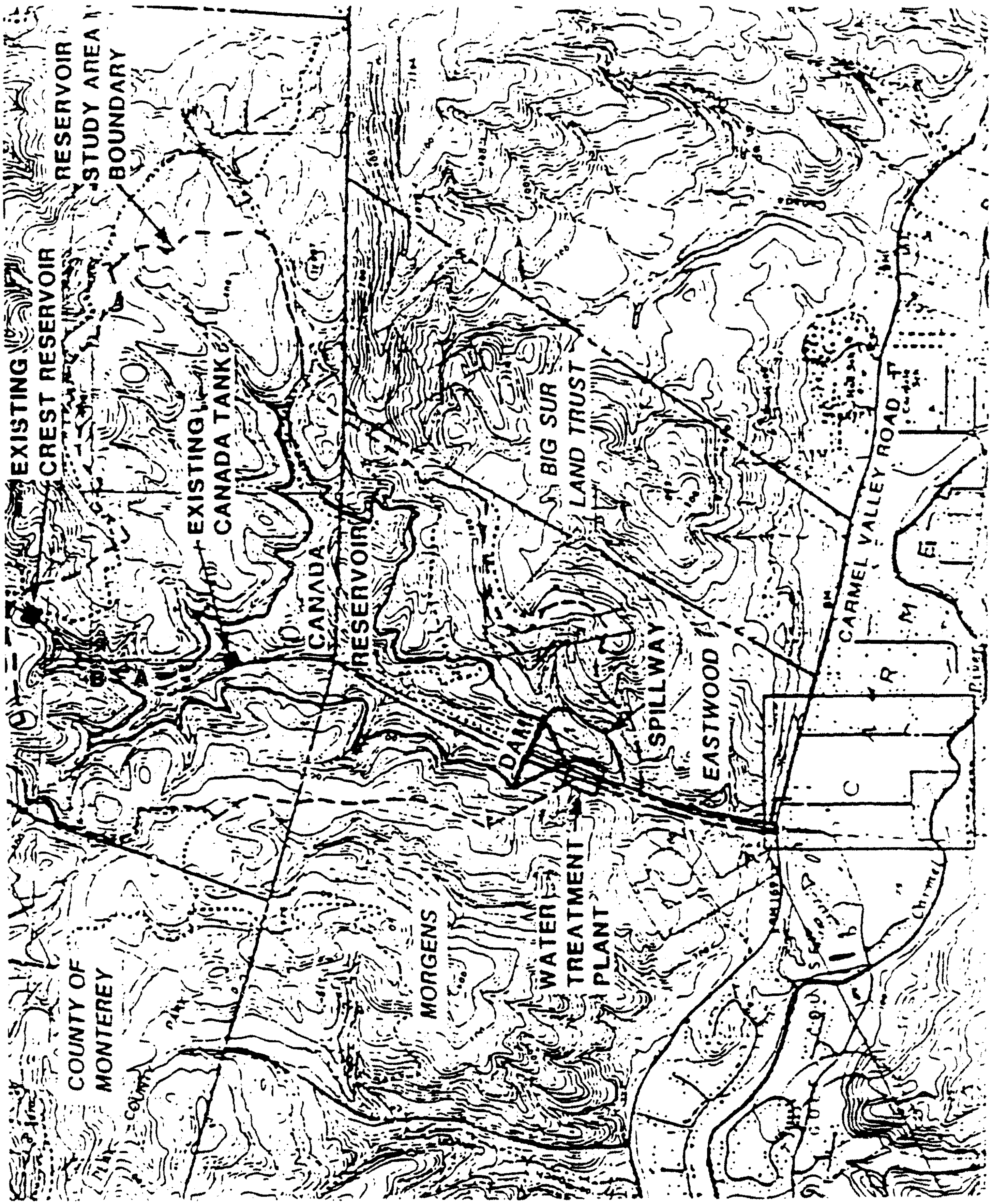
Bluffs and dunes along the coast, Humid Transition Zone; Cape Blanco, Oregon, to Monterey County, California. Type locality: California (Menzies). June-Dec.



Eriogonum latifolium

Source: Illustrated Flora of the Pacific States, Leroy Abrams, 197-

FIGURE 4
SURVEY RESULTS



SMITH'S BLUE BUTTERFLY

HABITAT ASSESSMENT REPORT

FOR THE NEW SAN CLEMENTE

DAM PROJECT IN

MONTEREY COUNTY, CALIFORNIA

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1 February 1990

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INTRODUCTION

The availability and quality of water for residents of the Monterey Peninsula has been a concern for several years as population numbers have continued to increase in this portion of California. In the not too distant future, current water supplies will not be able to meet projected demands as anticipated population growth continues. For this reason, the Monterey Peninsula Water Management District (MPWMD) is presently considering five locations in the Carmel Valley area as alternative project sites for the new San Clemente dam and reservoir. The five sites are:

a) New San Clemente Dam;
b) San Clemente Creek;
c) Chupines Creek;
d) Cachagua Creek; and
e) New Los Padres Dam.

All five sites occur within the known geographic ranges of the endangered Smith's Blue butterfly *(Euphilotes enoptes smithi)* or the non-endangered Tilden's Blue butterfly *(Euphilotes enoptes tildeni)*. Smith's Blue was recognized as endangered in 1976 by the U.S. Fish & Wildlife Service, pursuant to provisions of the Endangered Species Act of 1973. Tilden's Blue is a close relative.

Aerial photography and botanical surveys by EIP Associates indicate that coastal sage scrub and grassland, habitats known to support the endangered butterfly, occur at or in the vicinity of the five alternative sites. Preliminary findings of the botanical surveys reveal that one or more species of the buckwheat (*Eriogonum*) foodplants of the endangered butterfly grow at these alternative sites currently under consideration. Thus a field survey was conducted to determine the status of the endangered Smith's Blue and assess the suitability of habitat conditions present at all five sites to support the endangered butterfly. If the endangered Smith's Blue butterfly occurs at a site selected for future dam and reservoir development, then the MPWMD would need to comply with provisions of the Endangered Species Act to protect the endangered butterfly and its habitat. This report describes my survey methods, findings, and recommendations.

BACKGROUND INFORMATION

Smith's Blue butterfly *(Euphilotes enoptes smithi)* was described in 1954 from material collected at Burns Creek, near California Highway 1 in Monterey County, California (Mattoni 1954). This subspecies can be distinguished morphologically from other named races of *Euphilotes enoptes* by its wing markings and coloration. When it was originally described as a new subspecies, the butterfly was known from only a handful of sites near Monterey and south of Big Sur.

Since its description, numerous other colonies of Smith's Blue have been discovered, primarily in association with coastal sand dunes around Monterey Bay (Langston 1963, 1965, 1969, and 1975). Due to extensive development and alteration of the sand dune habitat in the Monterey Bay area, the butterfly was recognized by the U.S. Fish & Wildlife Service as endangered in 1976. However, subsequent field work has determined that the butterfly occurs in a variety of habitats, including coastal dunes, inland sandy deposits, coastal sage scrub, and grassland communities, and that its geographic range includes coastal and inland portions of Monterey County and southern Santa Cruz County (Arnold 1983a, 1983b and 1986; Kellner 1989; U.S. Fish & Wildlife Service 1984). A few populations in Santa Cruz and San Mateo County are found in association with serpentine grassland habitats (U.S. Fish & Wildlife Service 1984). Although these serpentine populations have previously been called *smithi* (U.S. Fish & Wildlife Service 1984), they may actually be intermediate between *smithi* and *tildeni* (J. Lane, pers. comm.). Another intermediate population is known from Santa Paula in Ventura County (O. Shields, pers. comm.). Future scientific investigation will be required to determine the real taxonomic identity of these apparently intermediate populations.

The best known populations of the butterfly are from the sand dunes of coastal Monterey County, particularly in the vicinity of Ft. Ord and Marina State Beach. At these sites I have conducted extensive studies on the ecology, natural history, and population dynamics of the butterfly annually since 1977 (see Arnold 1983a, 1983b, and 1986 for summaries of these studies). Additional populations are known from a number of sites south of Big Sur that are characterized by grassland, coastal bluff, or coastal sage scrub communities (Arnold 1986; Kellner 1989). Similarly, other entomologists (Langston 1963 and 1965; B. Walsh, pers. comm.) and I have discovered several populations from inland areas of Monterey County in association with grassland and coastal sage scrub communities. These inland localities include: Laurelles Grade, Paraiso Springs, Vasquez Knob, Cone Peak, and the Hastings Reservation operated by the University of California.

Regardless of the habitat type or geographic location, the Smith's Blue butterfly feeds on one of several perennial species of buckwheat (Polygonaceae: *Eriogonum*), usually *Eriogonum latifolium* or *E. parvifolium* (Arnold 1983a and U.S. Fish & Wildlife Service 1984), but occasionally also on *E. fasiculatum* (O. Shields, pers. comm. and Arnold, pers. observ.), and maybe *E. nudum*. Usage of *E. nudum* is uncertain, due to unverified reports that are not substantiated by voucher specimens of the foodplant and butterfly. Also, the populations from Santa Cruz and San Mateo counties that are apparently intermediate between *smithi* and *tildeni*, were formerly thought to feed on *E. latifolium* (U.S. Fish & Wildlife Service 1984). More recently, these foodplants have been identified as *E. nudum* (J. Lane, pers. comm.).

Both the larval (i.e., caterpillar) and adult life stages of the butterfly feed on the flowers of the buckwheat foodplant. The species of buckwheat foodplant utilized at a particular location seems to be dependent on vegetation and soil conditions. The adult flight season varies depending upon the species of buckwheat utilized, but typically ranges from mid-June until early September. The adult flight season and larval developmental period coincide with flowering of the buckwheat foodplant.

A closely-related butterfly, *Euphilotes enoptes tildeni*, is found in the inner coast ranges of central California, including portions of Monterey County. This subspecies is a denizen of the hot, dry "rain shadow" foothills bordering the San Joaquin Valley. Vegetation growing in these areas is generally dominated by chamise chaparral. The geographic ranges of *tildeni* and *smithi* overlap in inland portions of Monterey County, however the degree of overlap is not well-known at this time. *E. e. tildeni* can be distinguished from the endangered Smith's Blue butterfly by its wing markings and color patterns, although the differences are often subtle due to morphological variation in both subspecies. Like *smithi*, *tildeni* feeds only on buckwheats. It is found primarily in association with *E. nudum*, but has occasionally been reported using *Eriogonum latifolium* and *E. parvifolium*, both perennials, plus the annual, *E. covilleanum* (Howe 1975; Scott 1989).

SURVEY METHODS

Prior to conducting the field reconnaissance, the scientific literature was consulted to identify inland locations in Monterey County known to support either the endangered Smith's Blue or its relative, Tilden's Blue. Several references, cited elsewhere in this report were reviewed. In addition, entomological collections at California Academy of Sciences, California Department of Food & Agriculture, Los Angeles County Museum of Natural History, and University of California's collections at Berkeley, Davis, and Riverside were either visited to review label data or curators provided such data for these butterflies. Also, herbaria at the above-noted institutions were consulted to obtain collection records from Monterey County for the primary and secondary buckwheat foodplants used by the Smith's and Tilden's Blues.

Each alternative reservoir site was visited during August or early September 1989, a period that coincided with the adult flight season and larval activity period of Smith's Blue. Aerial photography, provided by EIP Associates, was used to identify vegetation types and portions of each site that might support the endangered Smith's Blue and its buckwheat foodplants. Surveys concentrated on the inundation portions of each alternative reservior site, as identified on maps provided by EIP Associates. However, if suitable habitat or buckwheat foodplants were found at or near the inundation line, these areas were also surveyed. In addition, Jeff Norman, who conducted botanical surveys of the reservior sites for EIP Associates, identified several buckwheat species during his surveys and mapped their locations.

Habitat suitability for Smith's Blue at each reservior site was evaluated based on:

a) the vegetation types present (coastal sage scrub and grassland preferred by Smith's Blue);

b) the species of *Eriogonum* present; and

c) sightings of larvae or adults of Smith's or Tilden's Blues.

Each of the five alternative sites was surveyed on foot and via four-wheel drive vehicle. As noted earlier, surveys concentrated within the inundation areas, but were not limited to these sectors. Binoculars and a spotting scope were used to scan the vegetation growing on canyon walls that were too steep to traverse by foot.

RESULTS AND DISCUSSION

No specimens (i.e., larvae or adults) of the endangered Smith's Blue butterfly were observed at any of the five alternative reservoir sites. The dominant plant community present at all five alternative sites was chamise chaparral rather than coastal sage scrub, which is favored by the Smith's Blue. Furthermore, preferred foodplants of the endangered butterfly, *Eriogonum parvifolium* and *E. latifolium*, were not observed at the reservoir sites currently under consideration. Also, no secondary buckwheat foodplants were observed at San Clemente Creek, Chupines Creek, and Cachagua Creek, thus it is unlikely that the Smith's Blue would be found at any of these three locations.

However, another occassionally used foodplant of the Smith's Blue, *E. fasiculatum* was observed at both the New Los Padres Dam and New San Clemente Dam sites. At the time of my field visits to both these sites in early September, all flowerheads of *E. fasiculatum* had already dried up as the blooming period was somewhat advanced in 1989 due to the drought. For this reason, I could not find any sign of larvae, larval feeding damage, or adults in association with this buckwheat. Approximately 1,000 *E. fasiculatum* plants were observed at New Los Padres Dam, while about 2,500 plants were observed at the New San Clemente Dam site. As I have previously observed adults of Smith's Blue on *E. fasiculatum* at the nearby Hastings Reservation, it is possible that *E. fasiculatum* at one or both of these reservoir sites may support the butterfly, however this could not be confirmed due to the timing of 1989 field surveys. Nonetheless, the probability of the Smith's Blue inhabiting either of these sites is relatively low due to the presence of Tilden's Blue (see next paragraph) and the presence of chamise chaparral rather than coastal sage scrub or grassland habitats.

Larvae or adults of Tilden's Blue butterfly were observed at all of the alternative reservoir sites except Chupines Creek. At each site the butterfly was associated with *Eriogonum nudum* growing in the chamise chaparral plant community. Other buckwheats observed growing at one or more of the sites included the following annuals: *E. roseum*, *E. elongatum*, *E. gracile*, and *E. angulosum*. None of these buckwheats are known or suspected to be foodplants of the endangered Smith's Blue or the non-endangered Tilden's Blue.

EVALUATION OF IMPACTS AND RECOMMENDATIONS

Chupines Creek does not support any of the buckwheat foodplants of the endangered Smith's Blue butterfly. Thus the butterfly would not be expected to occur there and construction and operation of the proposed water project would not impact the butterfly or its habitat.

Two alternative reservior sites, San Clemente Creek and Cachagua Creek do not support any of the buckwheat foodplants typically utilized by the endangered Smith's Blue butterfly. Although *E. nudum* does grow at these sites, the non-endangered Tilden's Blue butterfly was observed using this foodplant at these localities. For these reasons, the endangered butterfly would not be expected to occur at either of these sites. Thus construction and operation of the reservior should not impact the endangered butterfly or its habitat at either of these sites.

Primary buckwheat foodplants of the Smith's Blue butterfly are also lacking at the New San Clemente Dam and New Los Padres Dam sites. However, *E. fasiculatum*, a secondary foodplant that is occassionally used by the butterfly at other nearby localities, grows at these sites in sufficient numbers to support the butterfly in areas below the inundation line. Status of Smith's Blue associated with *E. fasiculatum*, which had completed its flowering by the time of my 1989 surveys, could not be determined. If the MPWMD selects either the New San Clemente Dam or New Los Padres Dam sites for further consideration, I recommend that a follow-up survey to determine the status of Smith's Blue at these sites should be conducted in July or early August. Based on the findings of the follow-up survey, potential impacts to the butterfly and its habitat can then be assessed more completely.

If subsequent surveys reveal that the endangered Smith's Blue butterfly is present at either of the New San Clemente Dam or New Los Padres Dam sites, then the U.S. Fish & Wildlife Service will need to review the project. Any loss of *E. fasiculatum* foodplants due to project-related activities (ex. inundation) could be interpreted as "take" (i.e., loss of individuals or habitat of an endangered species), a violation of section 9 of the federal Endangered Species Act. On both private and public lands, the Endangered Species Act (Sections 4, 9, & 11) prohibits "taking" of an endangered species, such as the Smith's Blue butterfly. Because the Smith's Blue is closely associated with its buckwheat foodplants, any loss of its primary or secondary foodplants within its geographic range due to grading, inundation, or maintenance of the new dam and reservior is potentially subject to Section 9 enforcement. The federal Endangered Species Act provides two ways to legally resolve a "take" situation: a) the Section 7 consultation process for federal actions; and b) the Section 10(a) permit to allow "incidental take" of an endangered species by private parties.

If any other federal agency is involved in the permitting, funding, construction, or operation of the anticipated water project by the MPWMD, then that agency may request a Section 7 consultation with the U.S. Fish & Wildlife Service. In this situation, a 404 permit, pursuant to the Clean Water Act, will need to be obtained from the U.S. Army Corps. of Engineers, hence the Corps. could request a Section 7 consultation with the U.S. Fish & Wildlife Service regarding the endangered Smith's Blue butterfly issue. As part of the Section 7 consultation process, the U.S. Fish & Wildlife Service prepares a document known as a "biological opinion", which evaluates the impacts of the project on the endangered species and recommends mitigation appropriate to alleviate any impacts. If the Service finds that the project will not jeapordize the survival of the endangered species, then the Service may approve the federal action, which in this case would be the 404 permit.

If no other federal agency is involved in this project, then the MPWMD would need to obtain a Section 10(a) permit from the U.S. Fish & Wildlife Service. However, because of the likely involvement of the U.S. Army Corps. of Engineers, the Section 7 consultation process would take precedence.

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PERSONS CONTACTED

Mr. John Lane, Santa Cruz City Museum, 1305 E. Cliff Dr., Santa Cruz, CA 95062.

Dr. Oakley Shields, 6506 Jerseydale Road, Mariposa, CA 95338.

Mr. Bruce Walsh, Dept. of Zoology, University of Washington, Seattle, WA 98195.

BIOSYSTEMS ANALYSIS INC.

To: Denise A. Duffy
Denise Duffy & Associates
546-A Hartnell Street
Monterey CA 93940

October 22, 1990

From: Gary Ahlborn
BioSystems Analysis, Inc.

Re: Cañada Reservoir Spotted Owl Surveys Results

Introduction

To satisfy an informal request by the California Department of Fish and Game, BioSystems Analysis conducted surveys for the California spotted owl (*Strix o. occidentalis*) in the proposed Cañada Reservoir site. Although the project area would probably be considered marginal habitat for the species, there are records documenting the species occurrence within several miles of the proposed reservoir. After discussing the matter with several other CDFG personnel and authorities on the species BioSystems agreed that field surveys to determine the presence of the owl would be prudent.

Background and Natural History

Status: On 23 July, 1990 a subspecies of the spotted owl, the Northern spotted owl (*S. o. caurina*) was listed as a federally threatened species under the Endangered Species Act, as amended. The California spotted owl (*S. o. occidentalis*) which potentially occurs in the project area has no special legal status, although there is concern for their populations and the species is being monitored. At least one petition has been filed to "list" the California subspecies (Armond Gonzales, CDFG wildlife biologist).

Reasons for Listing: Populations may be declining due to habitat destruction, especially logging of old growth forest and human occupation of habitat. Extensively clear cut areas will not support spotted owls, although some habitat disturbance can be tolerated, provided nearby high quality habitat is available.

303 Potrero Street, Suite 29-203, Santa Cruz, CA 95060 • (408) 425-8755

Distribution: Spotted owls range throughout many forested habitats in several areas of California. Population concentrations of the northern subspecies occur in north coast forests, along the South Fork of the Trinity River and into the Yolla Bolly Wilderness, Trinity and Tehama counties, and at Point Reyes National Seashore. The southern subspecies, the California spotted owl, is concentrated along the Western Divide and Greenhorn Mountains in Tulare and Kern counties, in Sequoia National Park, northwest of Yosemite Valley, and in Deep Creek and the Green Valley area in San Bernadino County.

The Northern spotted owl does not occur in coastal habitats south of about San Francisco. The "California spotted owl (*S. o. occidentalis*) is found along the length of the Sierra Nevada from southeastern Shasta County to northeastern Kern County; a second population occurs along California's south coast from Monterey County to San Diego County" (Gould 1985, p.22). The California spotted owl potentially occurs within the proposed Cañada Reservoir site. There are at least nine known occupied territories in Monterey County; one of these are within a few miles to the southeast of the project location.

Habitat Requirements: Spotted owls are generally found in densely forested, shady canyons and dense conifer and/or oak forest; usually multilayered with a high degree of canopy closure. Fairly extensive areas of habitat (40-240 ha; 100-600 ac) are believed to be necessary to support breeding owls (Forsman 1976). Nest sites are usually located on lower slopes of canyons and area usually near a source of water. Nest are usually located in snags and snag-top trees. Roost sites are selected in dense multilayered woodland and forests. Hunting is done from elevated perches, from which spotted owls pounce on prey species. Prey includes small mammals, birds and insects. In the project area the primary prey for the owl is expected to be dusky-footed woodrats (*Neotoma fuscipes*) and western gray squirrel (*Sciurus griseus*).

Objective

BioSystems objective was to conduct surveys to determine the presence of California spotted owls in the proposed project site.

Methods

Habitat occupancy for spotted owls will be determined by following standard sampling protocol being developed by the California Department of Fish and Game. The State will not finalize their suggested sampling guidelines for several more months which would be too late to use for surveys this season. The procedures that we followed were derived from consultation with CDFG personnel. Generally, our survey methods followed Forsman (1975).

Presence of owls was determined by eliciting vocal responses from owls by broadcasting tape recordings of spotted owl calls. A tape recording of "typical" calls was obtained from CDFG. The nocturnal surveys were conducted throughout the project areas judged as appropriate habitat. Although most calling stations were located in the inundation area several adjacent sites were also surveyed. Nighttime surveys were conducted along roads and trails, stopping at 0.8 km (0.5 mi) intervals to call. Recordings were played for 10 to 20 minutes at a given location. Gould (1977) found that owls usually responded within 10 minutes. Calling inventories were completed during the period when owls are responsive.

Results

A total of four nocturnal surveys of the study area were conducted (Table 1). Calling inventories were conducted during on August 13, 19-20, 26-27, and 31-September 1. Individual surveys were separated by at least four days. Approximately, 22.5 hours were spent calling for spotted owls.

No California spotted owls were located. Although great horned owl call were not broadcasted, they were located during every survey period and were found in almost all forested sections of the project area. Four individual owls were seen roosting in a stand of snag-top Monterey pines about 0.5 miles below the American Water Company pumping facility. These owls responded to the spotted calls with typical vocalizations and begging calls. Great horned owls were heard from the oak woodlands in the northeastern and northwestern drainages, and the Monterey pines on the upper east facing slopes of the main drainage. Owls also were located in three drainages east and north of the project area. Barn owls were located on three occasions during two of the surveys. In each case the owls were seen flying over grassland habitat north of the project area.

Based on vegetation structure and topographic features, several portions of the project area appear to provide at least marginal habitat for the California spotted owl. The limited extent and fragmented pattern of appropriate forest stands may be the primary habitat components reducing the value of the project site.

Great horned owls are known to be one of the few predators of spotted owls. While the two species do coexist, the abundance and ubiquitous distribution of great horned owls in the proposed reservoir area, lowers the sites suitability for spotted owls.

Conclusions

BioSystems conducted field surveys to determine the presence of California spotted owls in the proposed Cañada Reservoir project site. No spotted owls were located. Along with negative survey results, observations of habitat conditions, and the configuration of habitats in the landscape indicates that no spotted owls are present in the project area and that habitat is only marginally suitable for the species. BioSystems concludes that no additional surveys for the California spotted owl are necessary.

Table 1. Spotted owl survey timing, effort and results.

	13 Aug	19-20 Aug	26-27 Aug	31 Aug-1 Sept	Total
Hours	4.5	6	7	5	22.5
Approx. no. of stations	12	15	17	11	
Owl Species Observed					
California spotted owl	No	No	No	No	
Great horned owl	Yes	Yes	Yes	Yes	
Barn owl	Yes	Yes	No	No	

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Ted Wooster. Pers. Comm. Region 3 Spotted Owl Coordinator.

APPENDIX 9-D
LETTERS FROM AGENCIES ON SPECIES OF SPECIAL CONCERN

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
SACRAMENTO, CALIFORNIA 95814
Planning Branch
(916) 322-2493

RECEIVED
AUG 29 1983
M. P. W. M. D.

August 25, 1983

Monterey Peninsula Water Management District
Fred Adjarian
187 El Dorado Street
Monterey, CA 93940

Dear Mr. Adjarian:

In response to your request of August 16, 1983 we have searched our files for records of occurrences of elements of concern within Carmel Valley, Mount Carmel and Ventura Cones 7½' quads (Monterey County) and have found the following:

Animals:

1. Smith's Blue-Federally Listed Endangered; State Listed Rare

Plants:

✓1. *Malacothrix saxatilis* var. *arachnoidea* (CNPS List 2)
✓2. *Fritillaria falcata* (CNPS List 2)
✓3. *Lupinus cervinus* (CNPS List 3)
✓4. *Galium clementis* (CNPS List 3)
5. ✓*Raillardella muirii* (CNPS List 2) SC 18
✓6. *Galium californicum* ssp. *luciense* (CNPS List 2)

In addtional to the above elements, a sensitive element is present. Please contact Ted Wooster, Environmental Services Supervisor, at (707)944-4489 for further information.

Additional comments: Also included is a program description of the Data Base, Element Lists, Field Survey Forms and Instructions.

SPECIAL NOTICE TO DEVELOPERS AND CONSULTANTS

1. A Natural Diversity Data Base Report does not constitute official Department of Fish and Game environmental review of a project under CEQA, NEPA, or other statutory or regulatory authority.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

SACRAMENTO ENDANGERED SPECIES OFFICE
2800 Cottage Way, Room E-1823
Sacramento, California 95825-1846

November 4, 1986

Mr. William C. Angeloni
Chief, Planning/Engineering Division
U.S. Army Corps of Engineers
211 Main Street
San Francisco, California 94105

Subject: Request for List of Endangered and Threatened Species for the Proposed Construction of a Concrete Dam on the Carmel River, Monterey County (Case No. 1-1-87-SP-29)

Dear Mr. Angeloni:

As requested by letter from your agency dated October 6, 1986, you will find attached a list of listed endangered and threatened species (Attachment A) that may be present in the area of the subject project. To the best of our knowledge no proposed species occur within the area. The list is intended to fulfill the requirement of the Fish and Wildlife Service to provide a list of species under Section 7(c) of the Endangered Species Act, as amended. Please see Attachment B for your requirements.

Also for your assistance, we have included a list of candidate species. These species are presently being reviewed by our Service for consideration to propose and list as endangered or threatened. Candidate species have no protection under the Endangered Species Act and are included for your consideration as it is possible the candidates could become formal proposals and be listed during the construction period.

Upon completion of the Biological Assessment (see Attachment B), should you determine that a listed species is likely to be affected (adversely or beneficially), then your agency should request formal Section 7 consultation through our office at the letterhead address. If there are both listed and candidate species (if included in the assessment) that may be affected and if requested, we will informally consult on the candidate species during the formal consultation. However, should the assessment reveal that only candidate species may be affected, then you should consider informal consultation with our office at the letterhead address.

One of the benefits of informal consultation to the consulting agency is to provide the necessary planning alternatives should a candidate species become listed before completion of a project. Informal consultation may also be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to listed species.

If the Biological Assessment is not initiated within 90 days of receipt of this letter, you should informally verify the accuracy of the list with our office.

Should you have any additional questions regarding this list or your responsibilities under the Act, please contact Dr. Jack Williams at (916) 978-4866 or (FTS) 460-4866. Thank you for your interest in endangered species, and we await your assessment.

Sincerely,

Gail C. Kobetich

Gail C. Kobetich
Project Leader

Attachments

cc: Chief, Endangered Species, Portland, OR (FWE-SE; Attn: Ralph Swanson)
Field Supervisor, Ecological Services, Sacramento, CA (ES-S)

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED CONSTRUCTION OF A CONCRETE DAM ON THE CARMEL RIVER AT RIVER MILE 18, MONTEREY COUNTY, CALIFORNIA
(Case No. 1-1-87-SP-29)

Listed Species

Birds

✓Least Bell's vireo, Vireo bellii pusillus (E)

Habitat value
To see if suitable habitat exists.

Proposed Species

None

Candidate Species

Reptiles

Black legless lizard, Anniella pulchra nigra (2)

Plants

Eastwood's goldenweed, Ericameria fasciculata (1)
Carmel Valley bush-mallow, Malacothamnus palmeri var. involucratus (2)
Carmel Valley malacothrix, Malacothrix saxatilis var. arachnoidea (2)

(E)--Endangered (T)--Threatened (CH)--Critical Habitat
(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

SACRAMENTO ENDANGERED SPECIES OFFICE
2800 Cottage Way, Room E-1823
Sacramento, California 95825-1846

OCT 14 1987

In Reply Refer To:
1-1-87-I-632

RECEIVED
OCT 28 1987
M.P.W.M.D.

Mr. William C. Angeloni
Chief, Planning/Engineering Division
U.S. Army Corps of Engineers
211 Main Street
San Francisco, California 94105-1905

Subject: Biological Assessment for the New San Clemente Dam Project, Monterey, California

Dear Mr. Angeloni:

In response to your letter dated September 16, 1987, we have reviewed the Biological Assessment for the proposed project. We concur with your findings that no listed or candidate species would be affected by the project.

Please contact Peter Sorensen of my staff at FTS 460-4866 if you have any questions.

Sincerely,

David L. Harlow
for Gail C. Kobetich
Field Supervisor

cc: Field Supervisor, Ecological Services, Sacramento, CA (ES-S)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Endangered Species Office
2800 Cottage Way, Room E-1823
Sacramento, California 95825-1846

In Reply Refer To:
1-1-89-TA-708

June 15, 1989

Ms. Henrietta Stern
Project Coordinator
Monterey Peninsula Water Management District
187 Eldorado, Suite E
P.O. Box 85
Monterey, California 93940

RECEIVED
JUN 19 1989
M.P.W.M.D.

Subject: Species List for the Proposed Alternatives to the New San Clemente Dam Project, Monterey County, California

Dear Ms. Stern:

The attached list replies to your letter of May 1, 1989, requesting information on listed and proposed endangered and threatened species that may occur within the subject project area. Some pertinent information concerning the distribution, life history, habitat requirements, and published references for the listed species is also attached. This information may be helpful in preparing a biological assessment for this project, if one is required.

Information and maps concerning candidate species in California are available from the California Natural Diversity Data Base, a program of the California Department of Fish and Game. Address your request to: Ms. Elaine Hamby, California Department of Fish and Game, Natural Diversity Data Base, 1416 Ninth Street, Sacramento, California 95814 [(916) 324-0562)]. You should also request additional information from the Chief, California Department of Fish and Game, Non-Game Heritage Program (916) 324-8348.

We appreciate your concern for endangered species. If you have further questions, please call Peggie Kohl of our Sacramento Endangered Species Office at (916) 978-4866.

Sincerely,

Gail C. Kobetich
Field Supervisor

Attachments

ATTACHMENT A

LISTED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED ALTERNATIVES TO THE NEW SAN CLEMENTE DAM PROJECT MONTEREY COUNTY, CALIFORNIA (1-1-89-TA-708)

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)
bald eagle, *Haliaeetus leucocephalus* (E)

Invertebrates

Smith's blue butterfly, *Euphilotes enoptes smithi* (E)

Candidate Species

Birds

spotted owl, *Strix occidentalis* (2)

Amphibians

California tiger salamander, *Ambystoma tigrinum californiense* (2)
California red-legged frog, *Rana aurora draytoni* (2)

Reptiles

black California legless lizard, *Anniella pulchra nigra* (2)

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)
greater western mastiff-bat, *Eumops perotis californicus* (2)

Plants

talus fritillary, *Fritillaria falcata* (2)
Santa Lucia bedstraw, *Galium californicum* subsp. *luciense* (2)
Carmel Valley malocothrix, *Malocothrix saxatilis* var. *arachnoidea* (2)

(E)--Endangered (T)--Threatened (CH)--Critical Habitat

(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
SOUTHERN CALIFORNIA FIELD STATION
Ventura Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003-7786

June 12, 1991

RECEIVED
JUN 17 1991
M.P.W.M.D.

Henrietta Stern
Senior Project Coordinator
Monterey Peninsula Water
Management District
Post Office Box 85
Monterey, California 93942-0085

Re: Species List for the Proposed Various Water Supply Alternatives in the Carmel River Basin, Monterey County, California (1-6-91-TA-V227)

Dear Ms. Stern:

This concerns your May 17, 1991, letter that requested the Fish and Wildlife Service (Service) provide an updated list of endangered, threatened, and candidate species of flora and fauna that may be affected by potential reservoir construction sites in the Carmel River Basin, Monterey County, California. The Monterey Peninsula Water Management District requested the updated species list as supplemental information for the preparation of a Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS) on a long-term water supply project for Carmel Valley.

Per your request, we have attached a list of endangered and threatened species and candidate species that may occur within the vicinity of the proposed water supply project alternatives. That list, in part, fulfills the requirements of the Service under Section 7(c) of the Endangered Species Act of 1973, as amended (Act). Should this project have a Federal nexus, the Federal lead agency should request a species list update if the project is not initiated within 180 days from this date.

If the project may affect a listed species, the Federal lead agency has the responsibility to prepare a biological assessment if the project is a construction project which may require an EIS. If a biological assessment is not required, the Federal lead agency still has the responsibility to review its proposed activities and determine whether the listed species may be affected.

Project proponents without a Federal nexus should be aware of the prohibitions against the take of a listed species. Section 9 of the Act prohibits the "take" of any listed species. The definition of "take" includes to harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.

"'Harm', in the definition of 'take' in the Act, means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3)." Anyone who engages in a take would be subject to prosecution under Section 9 of the Act. Such taking may occur only under the authority of the Service pursuant to Section 7 (through Federal interagency consultation) of the Act, or through a Section 10(a) permit (for non-federal actions), as mandated by the Act.

The Service recommends that any DEIR/EIS conducted for this project also include an analysis of potential effects to any of the candidate species included on the attached list that may be present in the project vicinity. Candidate species have no protection under the Act, but are included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is completed. Should the DEIR/EIS reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

We also recommend that a copy of the DEIR/EIS be forwarded to this office for review and/or comment prior to the initiation of any construction activities.

Should you require additional information regarding this matter, please contact Mr. Dennis Carlson of my staff at (805) 644-1766 or at the letterhead address.

Sincerely,

Judy Hohman

Acting Office Supervisor

LISTED ENDANGERED AND THREARENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED ALTERNATIVES TO THE NEW SAN CLEMENTE DAM PROJECT IN MONTEREY COUNTY, CALIFORNIA

LISTED SPECIES

Birds

American peregrine falcon	*Falco peregrinus anatum*	(E)
bald eagle	*Haliaeetus leucocephalus*	(E)

Invertebrates

Smith's blue butterfly	*Euphilotes enoptes smithi*	(E)

CANDIDATE SPECIES

Birds

southern spotted owl	*Strix occidentalis*	(C2)

Amphibians

California tiger salamander	*Ambystoma tigrinum californiense*	(C2)
California red-legged frog	*Rana aurora draytoni*	(C2)

Reptiles

black legless lizard	*Anniella pulchra nigra*	(C2)

Mammals

Pacific western big-eared bat	*Plecotus townsendii townsendii*	(C2)
greater western mastiff-bat	*Eumops percotis californicus*	(C2)

PLANTS

talus fritillary	*Fritillaria falcata*	(C2)
Cone Peak bedstraw	*Galium californicum spp. luciense*	(C2)
Carmel Valley malocothrix	*Malocothrix saxatilis var. arachnoidea*	(C2)

PLANTS (cont.)

Toro manzanita	*Arctostaphylos montereyensis*	(C2)
Pinnacles buckwheat	*Eriogonum nortonii*	(C3(c))
fragrant fritillary	*Fritillaria liliacea*	(C2)
Santa Cruz microseris	*Microseris decipiens*	(C2)

(E) - Endangered (T) - Threatened (CH) - Critical Habitat
(1) - Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2) - Category 2: Taxa for which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
(3) - Category 3(c): Taxa more common than previously thought, no longer being considered for a listing proposal at this time.

APPENDIX 9-E
DRAFT VALLEY OAK WOODLAND MITIGATION PLAN

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
NEW LOS PADRES DAM PROJECT

VALLEY OAK WOODLAND MITIGATION PLAN

DRAFT

July 15, 1992

Prepared for:

Monterey Peninsula Water Management District
P. O. Box 85
Monterey, California 93942

Prepared by:

EIP Associates
601 Montgomery Street, Suite 500
San Francisco, California 94111

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I. SUMMARY

The Monterey Peninsula Water Management District proposes to enhance 22 acres of valley oak woodland on a site above the Carmel River downstream of the proposed New Los Padres Dam. Approximately 40 valley oaks will be established on the site during the first 5 years of the mitigation plan. Data will be gathered on both plant and animal species and presented in reports prepared annually for the first 5 years and at 5 year intervals thereafter. The site will be monitored for 30 years.

II. INTRODUCTION

A. HISTORICAL BACKGROUND

The Monterey Peninsula Water Management District (MPWMD or the "District") has proposed constructing a 24,000 acre-foot (AF) dam and reservoir for the Monterey Peninsula. The primary purposes of the proposed project are to (a) provide a water supply for increased drought protection for existing and future water users, and (b) meet projected municipal demand associated with planned growth within the MPWMD service area. An additional goal is to help restore the degraded environmental resources of the lower Carmel River.

In August 1991, a Supplemental Draft EIR/EIS (SDEIR/EIS) was prepared for the 24,000 AF New Los Padres Project and nine alternatives.[1] While responding to comments on the 1991 SDEIR/EIS, significant new information was developed for certain project components. Thus, the District is currently preparing a revised Supplemental Draft EIR/EIS that analyzes five water supply alternatives: The 24,000 AF New Los Padres Reservoir; a 24,000 AF reservoir combined with a 3 million gallon per day (MGD) desalination plant; a 15,000 AF Cañada Reservoir combined with a 3 MGD desalination plant; a stand-alone 7 MGD desalination project; and a No Project Alternative.

In January 1992, MPWMD invited staff biologists from several State and federal resource agencies to review the District's work plan for responding to agency comments on the 1991 SDEIR/EIS. At the meeting, an Interagency Vegetation Working Group was formed to guide MPWMD as the District develops revised riparian and upland mitigation plans. The group's first field trip and discussion of mitigation requirements was held on March 5 and 6, 1992. At that time, agency representatives indicated that the District should focus its mitigation efforts on riparian vegetation and valley oak woodland. The second field trip and review of MPWMD's preliminary riparian and upland mitigation plans was held on June 11, 1992.

This report presents the mitigation plan for valley oak woodland that would be inundated or otherwise affected by the 24,000 AF New Los Padres Project.

B. NAME AND LOCATION OF THE PROJECT

New Los Padres Reservoir will be located on the Carmel River approximately 19 miles southeast of the city of Monterey and 7 miles southeast of Carmel Village. The new dam will be about 2,400 feet downstream of the existing Los Padres Dam and 24 river-miles upstream from the mouth of the Carmel River at Carmel Bay (Figure 1). The new reservoir would completely inundate the existing Los Padres Dam and Reservoir. The dam crest will be approximately 1,600 feet wide and spillway crest will be at an elevation of 1,130 feet. In addition to the dam, other features include access roads, fish passage facilities, and staging areas. These features are discussed in the 1993 SD EIR/EIS-II.

C. NAME OF THE RESPONSIBLE PARTY

Monterey Peninsula Water Management District
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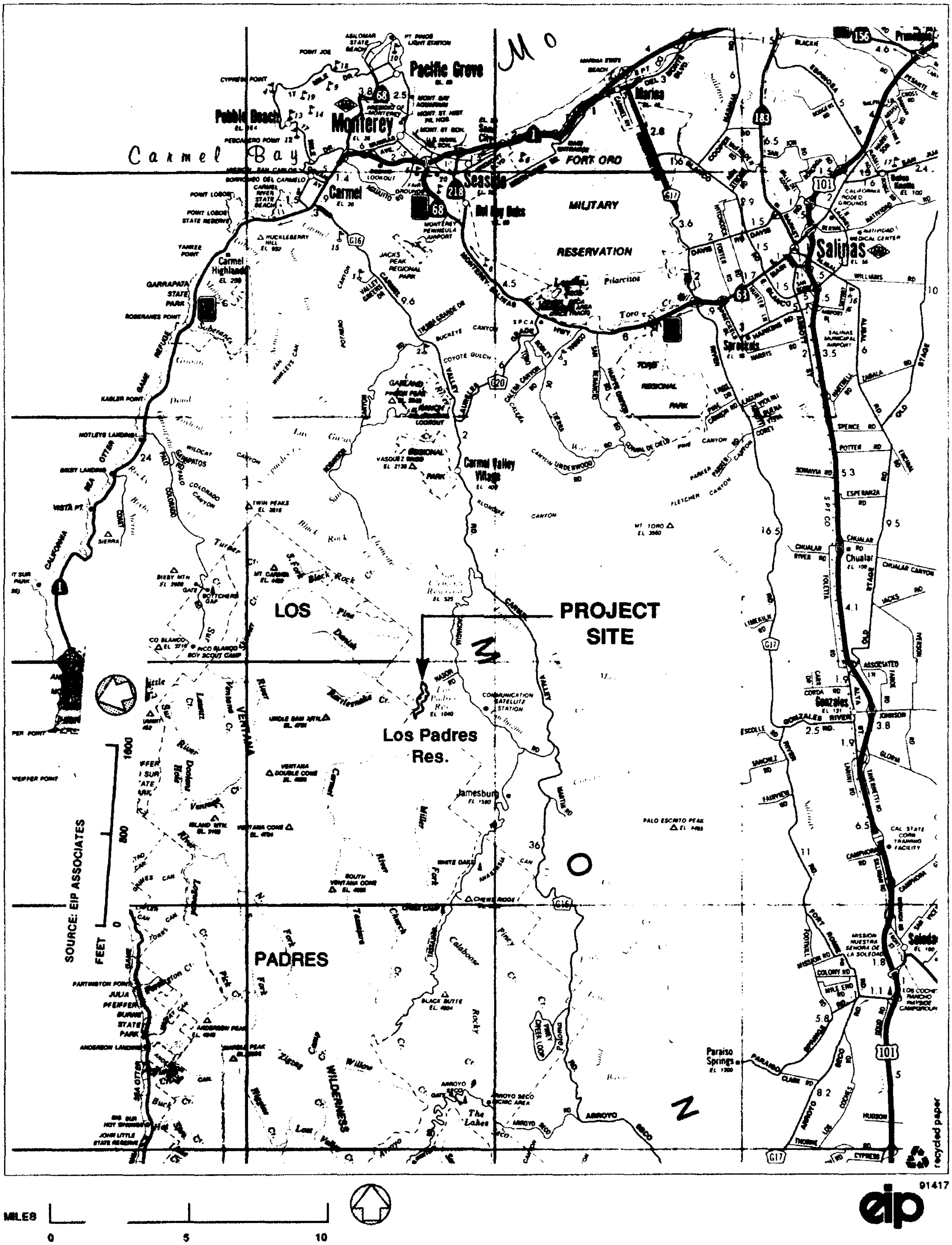
PROJECT LOCATION MAP

FIGURE 1



III. SENSITIVE SPECIES AND HABITATS

Three sensitive plant species are known to occur within the project area; Lewis' clarkia, valley oak, and straggly gooseberry. All are California Native Plant Society (CNPS) List 4 species.[2] In addition, Douglas' spineflower, also a CNPS List 4 species, occurs in the proposed construction staging area downstream of the New Los Padres Reservoir.[3]

Lewis' clarkia (*Clarkia lewisii*): Originally, members of this species were identified as *C. bottae*. In 1977, Raven and Parnell determined that some plants with this name were in fact a new species, which they named *C. lewisii*.[4] While they noted that it was different from *C. cylindrica*, they did not provide a key to the species in this complex. Populations of *C. lewisii* seem to be more coastal, whereas *C. cylindrica* is more common inland. It is possible that both species can be found within the vicinity of New Los Padres Dam. A report prepared for the 1993 SD EIR/EIS-II indicates that *C. lewisii* occurs within both the inundation area and the staging area.[5] This species is local but common in the Carmel Valley and it occurs elsewhere in Monterey County.[6] It has also been reported from San Benito County.[7]

Valley oak (*Quercus lobata*): The valley oak is a common tree in many of the valleys of California. Agriculture and urban expansion have greatly reduced much of its former area, and resulted in the CNPS placing it on their List 4. List 4 species are those that may be fairly common but whose habitat is in jeopardy and therefore deserve to be monitored. State resource agencies are asking that projects that result in the destruction of valley oak woodland mitigate that loss through compensation, restoration, or both. The District will comply with that request, and their plan for mitigation is contained in this report. In doing so, the District also realizes that not all CNPS List 4 species require mitigation.

Straggly gooseberry (*Ribes divaricatum* var. *pubiflorum*): This variety of the straggly gooseberry is found in many counties in California, and is probably fairly common. Additional work is needed to circumscribe the taxon and map its range. The New Los Padres Dam will not have a significant effect on this species.

Douglas' spineflower (*Chorizanthe douglasii*): Douglas' spineflower has wide distribution in Monterey County, primarily in the Santa Lucia Range, but it is also found in Salinas Valley and the Gabilan Range.[8] Although at least one population would be affected, the current project will not have a significant effect on this species.

Besides the impacts that result from inundation, there would be additional impacts from construction activities. The area of greatest impact would be the 19-acre construction staging area below the New Los Padres Dam. This site would contain maintenance buildings and would be used to store construction material for the new dam. The District is working with biologists to determine areas where impacts could be minimized, such as placing structures in open areas to avoid tree removal. The disturbed areas would be mapped and restored following dam construction.

The following acreage estimates are provided and these impacts would occur primarily in coastal oak woodland: aggregate storage (8.3 acres); heavy equipment storage (0.9 acres); batch plants/silos (0.3 acres); contractor storage (1.5 acres); and roads (3.4 acres).

To protect sensitive riparian habitat, the District will impose a 200 foot setback from the Carmel River, where construction related activities will be prohibited.

The 1991 SD EIR/EIS for the project stated that 28.1 acres of valley oak woodland would be lost by inundation. Early surveys were done primarily from aerial photography and supplemental ground truthing has shown that the original figure of 28.1 acres is incorrect. Inundation and staging areas, roads, and other project facilities will result in the loss of 6.8 acres of valley oak woodland. Most of this acreage is in the immediate vicinity of the new dam. One small area (approximately 1.1 acres) of valley oak woodland on the west side of the river consists of dead and dying valley oaks. No seedlings or saplings were seen there during field surveys. This location is probably marginal for valley oaks and the existing trees may have been severely stressed by six years of below normal rainfall. The valley oak woodland forms a savannah-like association with non-native grassland dominated by introduced annual grasses and forbs.

The California Department of Fish and Game (CDFG) has requested that mitigation for oak woodland habitat include preservation of similar habitat at a 3:1 (acre:acre) ratio and revegetation of degraded valley oak habitat at a 1:1 (acre:acre) ratio. This mitigation plan is concerned only with the requirements for valley oak woodland revegetation. Replacing lost riparian habitat is part of another mitigation plan that is being prepared by MPWMD.

IV. GOAL OF MITIGATION

A. PRIMARY GOAL

The history of oak woodlands has been well documented.[9,10] Native Americans used acorns as a main source of food and periodically burned woodlands for several reasons. The Spanish introduced cattle during the Mission period, and large herds once grazed the many land grants of the state. In upland oak woodlands, grazing is still the major agricultural activity. Oaks have been cut for firewood and charcoal since the days of the gold rush. Valley oaks, in particular, once grew on fertile valley soils that have since been cleared for agriculture. Currently, the growth of cities and towns threaten valley oaks in many parts of California. Today, the acreage of valley oak woodland in California is far less than what it was 200 years ago. For this reason, the California Native Plant Society has placed the valley oak on its List 4, which is a "watch list".

Therefore, the primary goal of this revegetation plan is to replace the nearly 7 acres of valley oak woodland lost to project activities with 22 restored or enhanced acres elsewhere in the Carmel River watershed. The terms "restored or enhanced" mean to increase the habitat value per acre of the mitigation site to a similar level of the habitat value of the inundated acreage. The habitat value will be determined through methods developed by the interagency Vegetation Working Group.

B. SECONDARY GOALS

Oak woodlands provide habitat for a number of animal species. It is estimated that at least 30 bird species include acorns in their diet and at least 45 obtain insects from various parts of the oak.[11] One species particularly associated with valley and blue oaks is the acorn woodpecker, which uses acorns, insects, and sap in its diet. Oaks are used by mammals as well, and valley oak has especially strong ties to some species.[12]

The District assumes that the value of the mitigation site to wildlife will increase because there will be additional valley oak woodland available for foraging and nesting by species that may already be present in the area. It is expected that there will be an increase in the number of individual animals using the site rather than an increase in species diversity. However, because it may be 10 or more years before changes may be measured, attaining this goal will not be one of the success criteria for the project.

An additional goal of the project is to establish native grassland in at least a portion of the site. Grassland restoration is not required by the SDEIR/EIS because native grassland will not be inundated by the project. Despite the significant restoration problems present at the mitigation site, the District proposes to extend an effort toward this goal. District biologists will monitor the site, collect data, and provide this information for the annual report, but the District will not be held to success criteria for grassland since determining these criteria can be difficult or impossible.

V. FINAL SUCCESS CRITERIA

The District will enhance and restore approximately 22 acres of valley oak woodland on the site known as Big Oak Flat.

Valley oak woodland at Big Oak Flat already supports about 20 valley oaks and 5 coast live oaks on 22 acres. Young trees, estimated to be 5 to 15 years old, of both species are becoming established there as well, although their growth is slowed by constant browsing by horses and deer. It is estimated that this site could support an additional 40 to 80 trees in a savannah-like setting. Most existing trees are in the center and western portion of the site, whereas the eastern portion is almost devoid of trees, perhaps due to past agricultural activities. MPWMD proposes to enhance and restore this woodland by planting enough acorns and seedlings to guarantee that 40 new trees survive the first 5 years of the mitigation plan. Naturally established trees will be temporarily caged to prevent grazing and will be counted toward this goal. At least 15 of the successful trees will be located in the barren eastern portion of the site.

Additional goals of this plan (i.e., increasing habitat values to wildlife and establishing native grassland) will not be held to any established success criteria. However, the techniques used and the results found will be part of the annual reports.

VI. PROPOSED MITIGATION SITE

A. PRESENT OWNERSHIP

The mitigation site is located within a 300-acre parcel that is privately owned by a local family. The land is presently undeveloped, with some grazing by horses. A vacation home also exists on the property, but is located on the opposite side of the Carmel River from the mitigation site.

In preliminary discussions, the property owner indicated that he would ask the District to purchase the entire parcel because of construction impacts and long-term public access through a portion of his property. Future negotiations will confirm whether this course of action will be taken. If so, the District would become the owner of the mitigation site. An alternative is a conservation easement to implement the mitigation project and protect the site in perpetuity. It should be noted that the District also has the power of eminent domain.

B. SITE DESCRIPTION

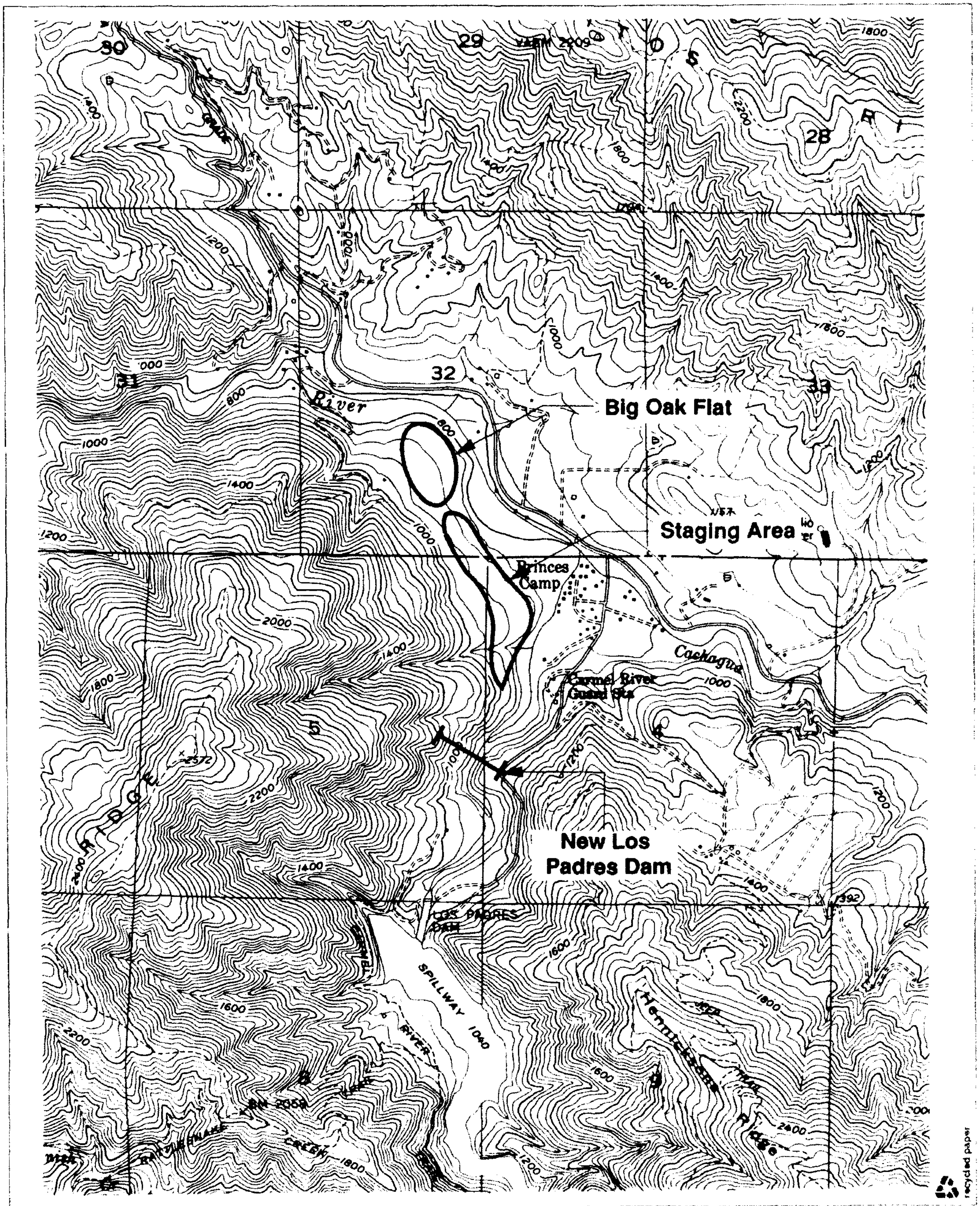
Two sites were originally proposed as potential mitigation sites; one known as Mesa Grande in Garland Ranch Regional Park, and the second known as Big Oak Flat north of the existing Los Padres Dam. The Interagency Vegetation Working Group preferred the Big Oak Flat site to Mesa Grande, and as a result the following discussion will focus on Big Oak Flat. A brief discussion of Mesa Grande is found in Attachment A.

The proposed mitigation site is located along the Carmel River approximately 6.7 miles south of Carmel Valley Village (see Figures 1 and 2). The River supports cottonwood/alder/sycamore riparian forest surrounded by coast live oak woodland composed of oaks and other hardwood species.

Big Oak Flat is a 22 acre valley oak woodland supporting both valley and coast live oaks in a savannah-like setting (see Figure 3). Very few shrubs are present and they occur in large mixed clumps rather than individually. Those present include California coffeeberry, poison-oak, and elder-

PROJECT VICINITY

FIGURE 2



SOURCE: USGS MAP

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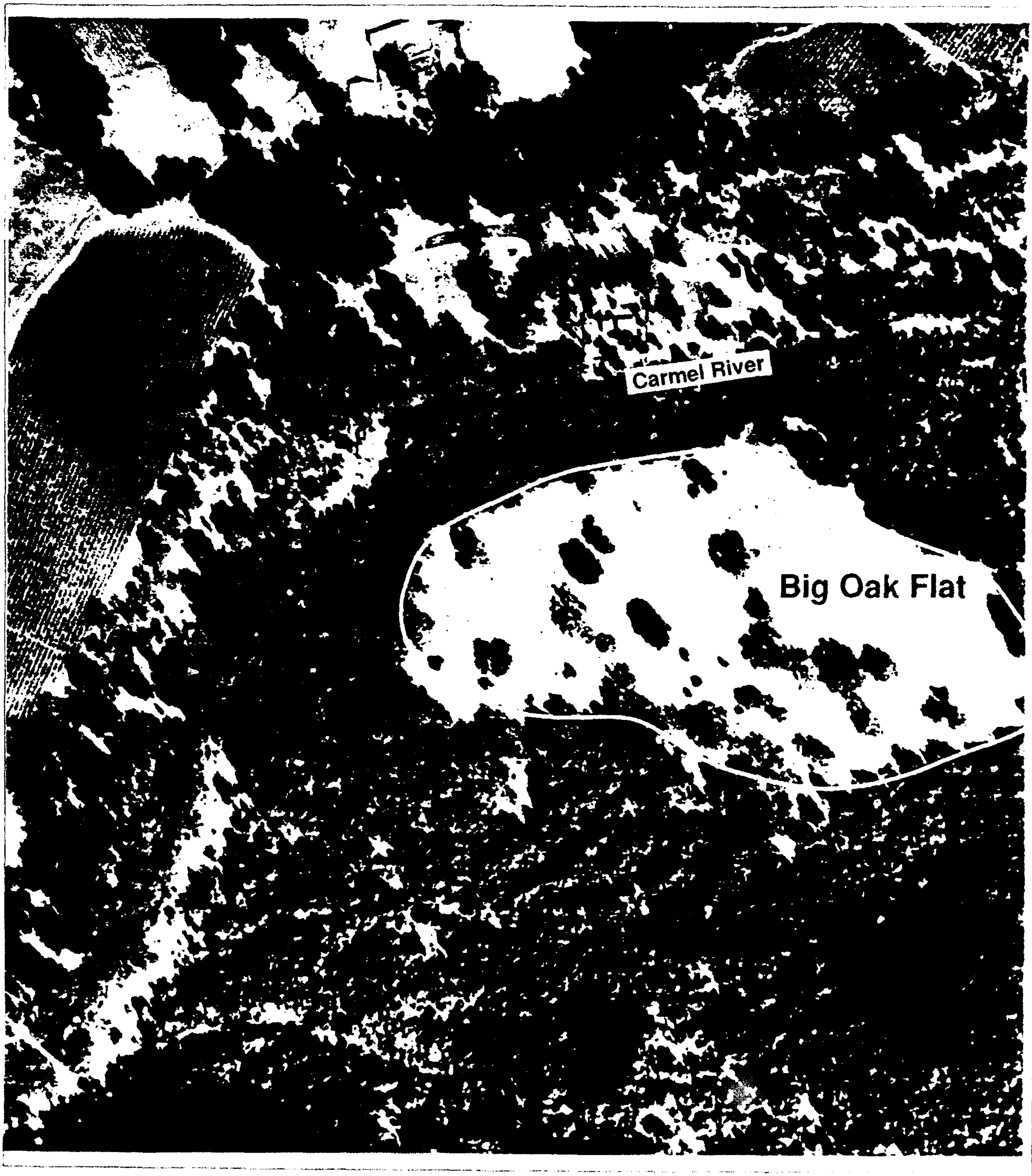
AERIAL PHOTOGRAPH OF THE MITIGATION SITE



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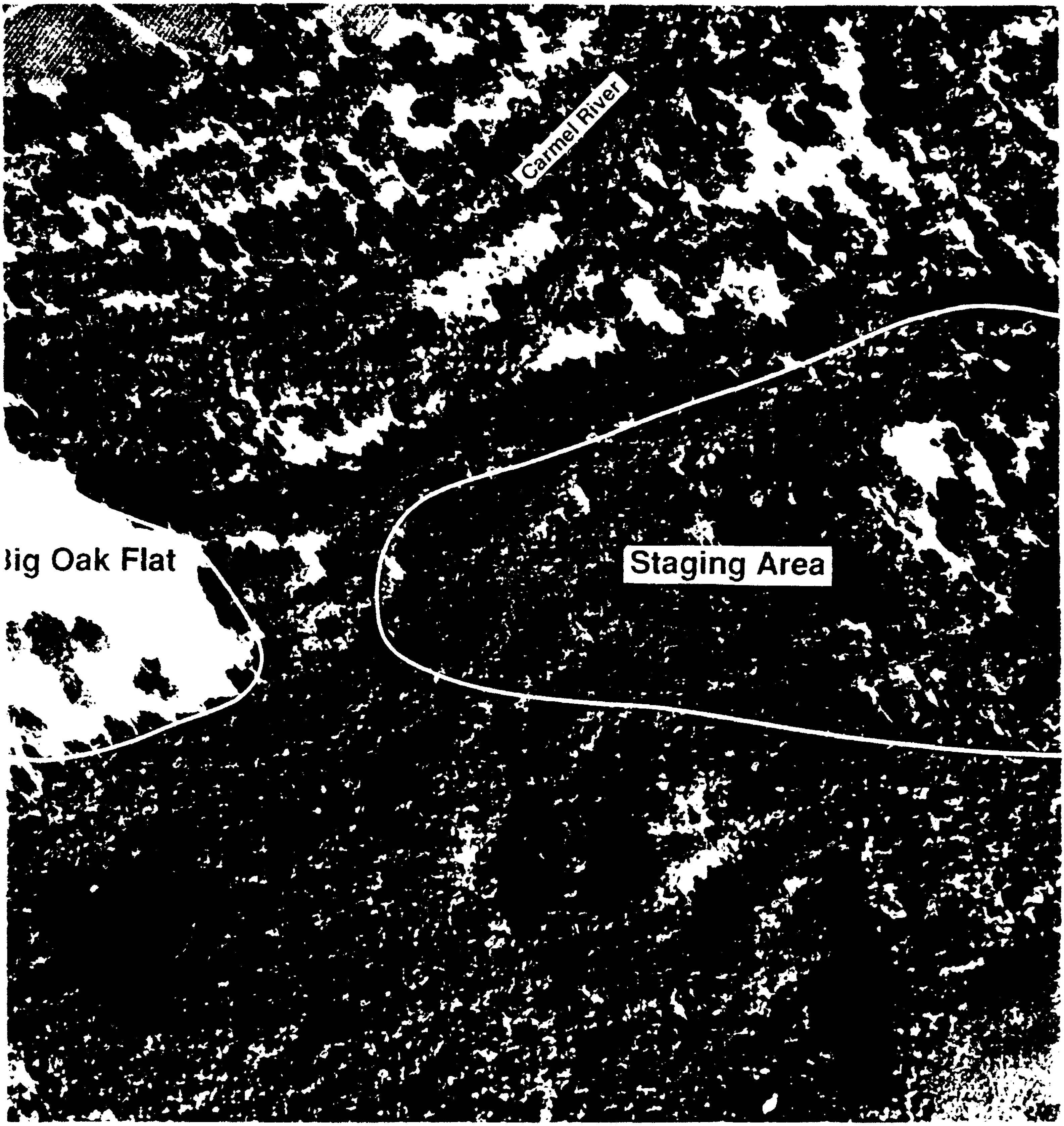
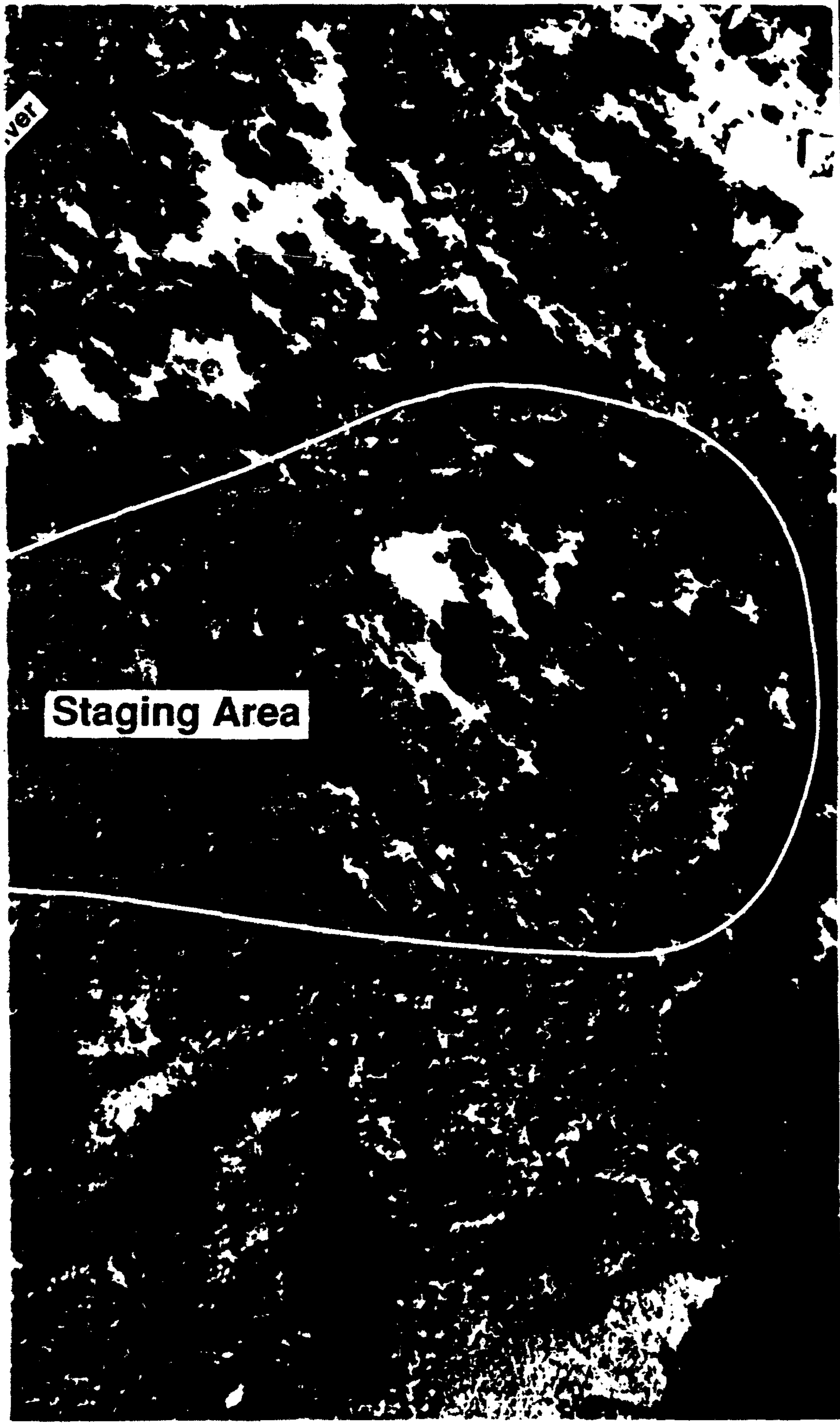


Carmel River
Big Oak Flat
Staging Area

FIGURE 3



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3 of 3

berry. The remainder of the understory is herbaceous and is dominated by introduced annual grasses such as annual fescue, ripgut brome, soft chess, and foxtail barley. Red brome is common and is often considered an indicator of overgrazing. Sorrel and red-stem and broad-leaved filarees are non-native forbs that are also present. No native grasses were seen during site surveys, but a number of herbaceous native species were present, including annual lotus, linanthus, winecups, annual lupine, biscuit-root, golden stars, morning-glory, milkweed, and California goosefoot. Horehound and verbena form dense stands beneath the existing valley oaks.

Soils on the site are Chualar loam which are classified as well drained alluvial soils formed from granitic and schistose rocks.[13] This same soil supports a dense coast live oak woodland on another alluvial terrace adjacent to Big Oak Flat. The reasons for the difference in density and species composition on the same soil are unknown.

VII. IMPLEMENTATION PLAN

A. RESPONSIBLE PARTIES

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B. SITE PREPARATION

Although Big Oak Flat has been grazed in the past, and is still grazed by horses, vegetation typical of heavy grazing such as various species of thistle are generally absent. Nor are there seriously invasive species such as Harding grass. As a result little site preparation is required. The horehound and verbena under the oaks will be treated with Roundup or similar systemic herbicide. The dead material will be left in place. Chemical treatment will prevent soil disturbance that could lead to increased weed problems.

C. PLANTING PLAN

Woodlands

All acorns will come from existing trees on or near Big Oak Flat. Acorns will be collected in September or October as they ripen. They will be placed in bucket of water and those that float will be discarded. Seed of valley oak requires no pretreatment for germination.[14,15] Acorns will be stored for short periods (one to two months) in a moist mixture of perlite and vermiculite and kept in a refrigerator. Planting dates will be dependent on the beginning of the winter rainy season, but will probably take place in November or December. By late December all acorns will be planted directly into the ground or into 1 gallon, 4 inch by 14 inch Treepots. Half the desired number of trees will be planted as acorns and the other half will be planted as 1 to 4 year old seedlings.

Seedlings grown in tubes may be left in them for two years, after which they will be replanted into 4 gallon, 7 3/4 inch by 18 inch Treepots, where they may be left for an additional two years.

Each planting area will be 15 feet by 15 feet and will be chosen by the revegetation manager (with assistance from a botanist, ecologist, or forester) based on soil, slope, existing vegetation, and other factors. At each planting spot, a 3 foot by 3 foot area will be cleared of all vegetation prior to planting.

Depending on whether acorns or seedlings are planted, planting holes will be two to four feet deep and eight to ten inches wide. One seedling and 2 to 3 acorns will be planted at each location. All holes will be backfilled with a mixture of native soil and organic matter. The top 2 to 3 inches will be backfilled with sterile potting soil to reduce weeds. Slow release fertilizer tablets will be placed in each hole; each tablet will have a fertilizer formulation of approximately 20-10-5. Direct seeded acorns and young seedlings will be planted in plant protection kits designed to reduce weeds, gopher damage, and browsing. Attachment B provides an example of a typical plant protection kit, which can be modified for particular sites.

In addition to planting seeds and seedlings, all young valley oak and coast live oak seedlings that result from natural regeneration will be caged with welded wire to prevent excessive browsing by deer (see Attachment B). These trees will be counted in assessing the success of the revegetation plan and will be monitored as part of the monitoring plan.

Grassland

No native grasses were noted on Big Oak Flat during preliminary site surveys. Surveys of sites with similar soils will be conducted to determine which grass species may have been native to Big Oak Flat. Blue wild rye (*Elymus glaucus*) and one or more species of needlegrass (*Stipa* sp.) are likely possibilities. Once potential species are determined, seed will be collected from nearby sources. The time of seed collection will depend on which species are selected, but most species ripen in the late spring to early summer. Prior to planting, seed will be stored in closed containers where predation can be eliminated.

Grass seed will be planted in short versions of the Super Cell known as Super Stubbies. Two to three seeds will be planted in each cell in July or August; cells will be held in a nursery until fall. The contents of each cell will be planted at the mitigation site in November or December. They will be planted at a spacing of 3 feet by 3 feet within the area chosen. No special planting techniques are required.

D. IRRIGATION PLAN

Woodland

Irrigation details are being developed, and two methods are under consideration; hand watering, and drip irrigation. Attachment B includes schematic diagrams of a typical drip system.

A drip system would include a tank for water storage and a system of lines to convey water to the planting sites. The system would be turned on and off manually and the entire system would be inspected during each irrigation period. Rainfall will be monitored and time of irrigation will depend and the distribution of the winter rains. Irrigation may not be required if rainfall is evenly distributed throughout the winter season. By spring, as rainfall decreases and becomes sporadic, irrigation will be done on a weekly basis at the rate of 1 to 2 gallons per seedling. Established seedlings will not be irrigated. By August, the soil will be allowed to dry within the to 1.5 inches between waterings and soil moisture will determine the irrigation schedule. Irrigation will be done for the first 2 years of the project.

For logistic and economic reasons, hand watering is usually done less often and in lower quantities. Details of this method will be determined if it is the selected irrigation method.

Grassland

No irrigation is planned for the grassland because it is assumed that some of the planted plugs will survive in normal rainfall years. It is probably cheaper to keep a stock of desired species for replanting than to maintain an irrigation system for grassland.

E. ESTIMATED COST

It is estimated that the implementation cost for the valley oak woodland revegetation will be approximately $6,215. The total cost, including maintenance, is estimated at $33,290. Table 1 indicates provides a breakdown of these costs.

TABLE 1

VALLEY OAK REVEGETATION COST ESTIMATE

Item	Number of Units	Cost/Unit	Total	Subtotals
Materials				
Treepot valley oaks	100	$ 4.50	$ 450	
Collars and screens	100	1.50	150	
Weed fabric and nails	100	1.43	143	
Fertilizer	100	.10	10	
Auger rental	1	1.10	1	
Irrigation materials	100	3.25	325	
Irrigation tank, 1,000-gallon installation	1	546	546	$1,625
Installation				
Planting layout and supervision (hours)	20	60	1,200	
Auger operator	4	35	140	
Planting labor	32	35	1,120	
Weed fabric installation	8	35	280	
Supervise irrigation installation	10	60	600	
Irrigation system installation labor	30	35	1,050	
Mileage			200	4,590
Maintenance				
Water and weeding 1st year (28 visits)	224	35	7,840	
Water and weeding 2nd year (20 visits)	160	35	5,600	
Water and weeding 3rd year (15 visits)	120	35	4,200	
Three semi-annual survival surveys and reports	96	60	5,760	
Water truck rental	12.6	100	1,260	
Mileage			2,415	27,075
		GRAND TOTAL		**$33,290**

VIII. MAINTENANCE

A. RESPONSIBLE PARTIES

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B. MAINTENANCE ACTIVITIES

Maintenance activities will include, but are not limited to, repairing plant protection kits and cages where necessary and removing introduced weedy species from the vicinity of young seedlings and trees. As trees mature, maintenance can include pruning to remove dead or diseased branches.

Annual grasses common on the mitigation site remove a great deal of moisture that could ordinarily be used by oak seedlings. Thus, weeding removes this source of competition and allows the young trees to use a greater share of available water. Fabric netting used around the planting collars is an effective method of weed control, especially when combined with periodic hand weeding. Weeding will take place during the winter and spring and timing will be determined through site visits by the revegetation manager.

C. SCHEDULE

Weather conditions for each year will be monitored and maintenance will be performed as needed. Recommendations will be included in the upland mitigation annual report for implementation during the next monitoring year.

D. ESTIMATED COST

It is estimated that the cost of maintenance for the first five years of the plan will be approximately $27,075 (see Table 1).

IX. MONITORING PLAN

A. RESPONSIBLE PARTIES

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B. PERFORMANCE CRITERIA

Vegetation

When the success rate at the end of each year drops below 75 percent, new seedlings will be planted to bring the number up to 100 percent. Naturally established seedlings will be caged and included in the yearly counts.

Wildlife

The success of the mitigation plan is not dependent on performance criteria for wildlife.

C. METHODS

Vegetation

Monitors will count surviving trees, including caged established trees, and determine the dbh, height, and canopy size for selected trees. Percent cover and species composition in the grassland will be measured in permanent quadrats.

Wildlife

Permanent wildlife transects will be established. Small mammals will be trapped in Sherman live traps and individuals counted. Bird species will be determined and individuals counted during each survey period.

D. SCHEDULE

Vegetation

Formal monitoring will be done annually for 5 years in September or October, prior to the start of the winter rainy season. At the end of 5 years the area will be monitored every 5 years. The District also proposes to plant additional trees at the end of 15 and 30 years. The number and placement will depend on what the site looks like at that time. Planting at these intervals will help create a mixed age stand.

Wildlife

Winter and spring surveys for birds and mammals will be conducted during years 0, 2, 4, 7, 10, 15, 20, 25, and 30.

E. ANNUAL REPORTS

Annual reports will be produced at the end of the fall (late November to December) for the first 5 years and will include all information gathered by the end of the summer survey and just before the start of the winter rainy season. Subsequent reports will be provided every 5 years.

X. CONTINGENCY MEASURES

If the success rate drops below 50 percent at any time during the first 5 years, the mitigation team composed of USFWS, CDFG, MPWMD personnel, and other interested parties, will be convened to determine the reasons for failure and what measures might be taken. Total failure is unlikely, but there are remedial measures that can be used in the event of partial failures. Some measures include reassessing soil factors and planting in new locations on the site, adjusting the irrigation method or schedule, and altering the planting kits to provide more protection from herbivores.

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ATTACHMENT A

GARLAND RANCH REGIONAL PARK SITE

INTRODUCTION

The Garland Ranch Regional Park site, known as Mesa Grande, occurs on a hillside above the Carmel River approximately 10 miles from the ocean and consists of about 60 acres of grassland surrounded by dense coast live oak woodland dominated by a mixture of hardwood species including coast live oak, madrone, and California-bay. Valley oaks occur on the site but are mostly found in the protected lee sides of hills or within the coast live oak canopy.

The grassland on the site is dominated by Harding grass (*Phalaris tuberosa*), but there are patches of native species such as California oatgrass (*Danthonia californica*), needlegrass (*Stipa* sp.), and California brome (*Bromus carinatus*). The presence of these and other species indicate that this site may have supported coastal prairie, a perennial grassland, rather than valley oak woodland. The abundance of Harding grass would make revegetation efforts difficult, and eliminating this species from the site would have to be one of the first goals of any plan.

Whether the site previously supported valley oak woodland is unknown, but studies have shown that salt spray affects tree symmetry up to 30 miles inland and leaves up to 37 miles inland; valley oaks are more susceptible to salt spray than coast live oaks.[1] The proximity of the Mesa Grande site to the ocean may impose severe restrictions on the ability to establish valley oaks there. Logical places for planting include the lee side of the hill and the margins of the existing coast live oak woodland. Because of the combination of salt wind and Harding grass, it is unlikely that the entire site could support valley oaks, but there is probably enough acreage available for the required 7 acres of mitigation.

POTENTIAL PLANTING PLAN

Acorns for mitigation would be collected from trees existing on or near Mesa Grande. It would be stored as described in the text for the Big Oak Flat site. Seed for native grass species, primarily *Stipa* sp., *Bromus carinatus*, *Elymus glaucus*, and *Danthonia californica*, would be collected within Garland Ranch Regional Park in the late spring as the seed ripens. It would be stored in paper bags in a cool location away from herbivores until it can be planted.

Pilot project for the control of Harding grass would be established. This could include periodic mowing, burning, or chemical weeding, and information gathered from the pilot projects could then be applied to a larger scale project. To ensure adequate freedom from competition, all Harding grass and other species would be removed from a 3 foot by 3 foot area around each oak planting site. Weed control would be the prime maintenance task for Mesa Grande.

Planting of acorns or seedlings would be done using the same methods outlined in the main text. Plant protection kits would be used and details of these can be found in Appendix B. Irrigation could be accomplished by using water from an existing well and a drip system. If the proposed site is changed to Mesa Grande, a more detailed irrigation plant will be prepared.

Enhancement of native grassland would depend on the findings of the pilot project. Permanent plots could be used to determine the effectiveness of various treatments on the health and vigor of the native grassland on the site.

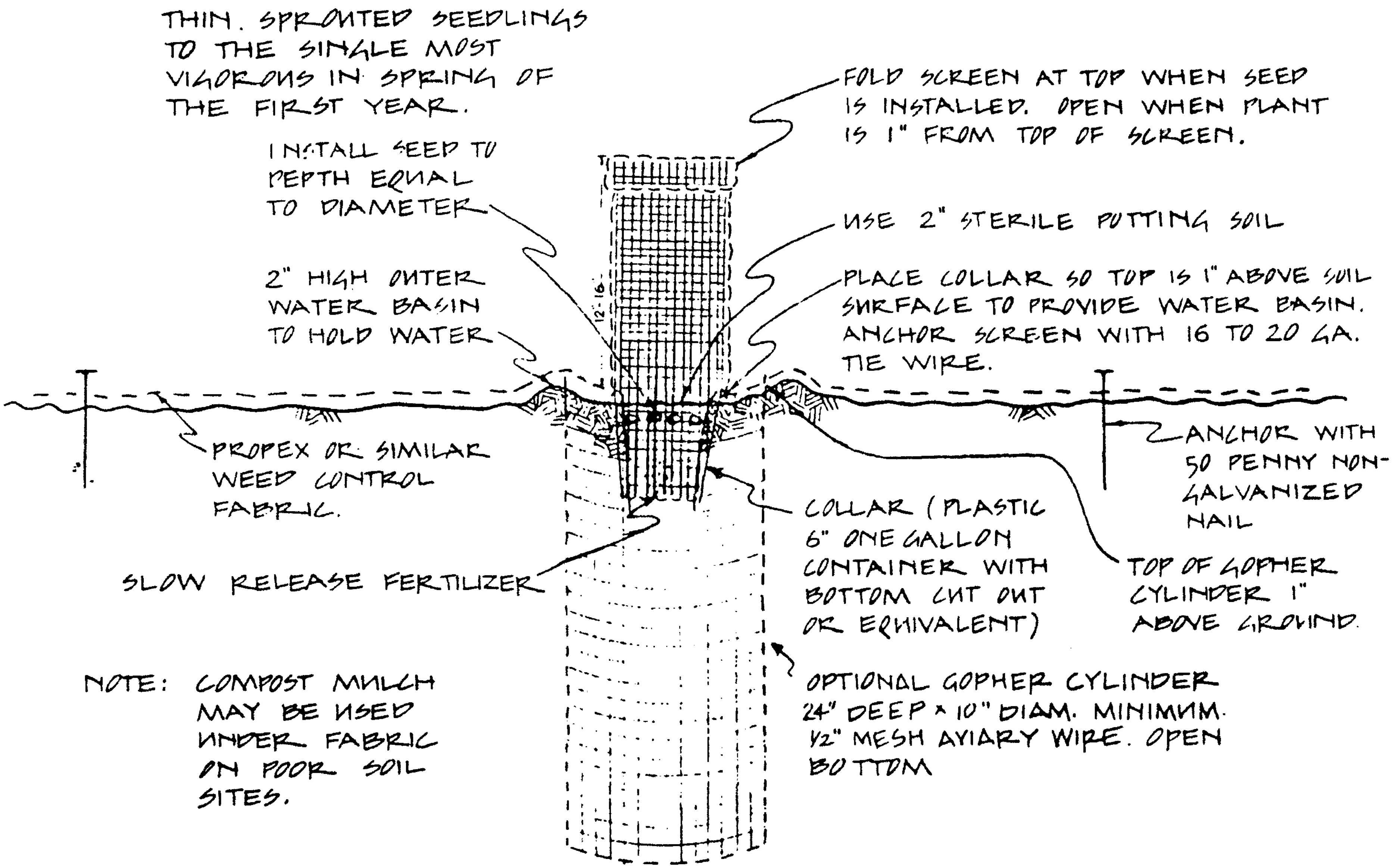
MONITORING

The monitoring plan and schedule would be similar to that for the Big Oak Flat site.

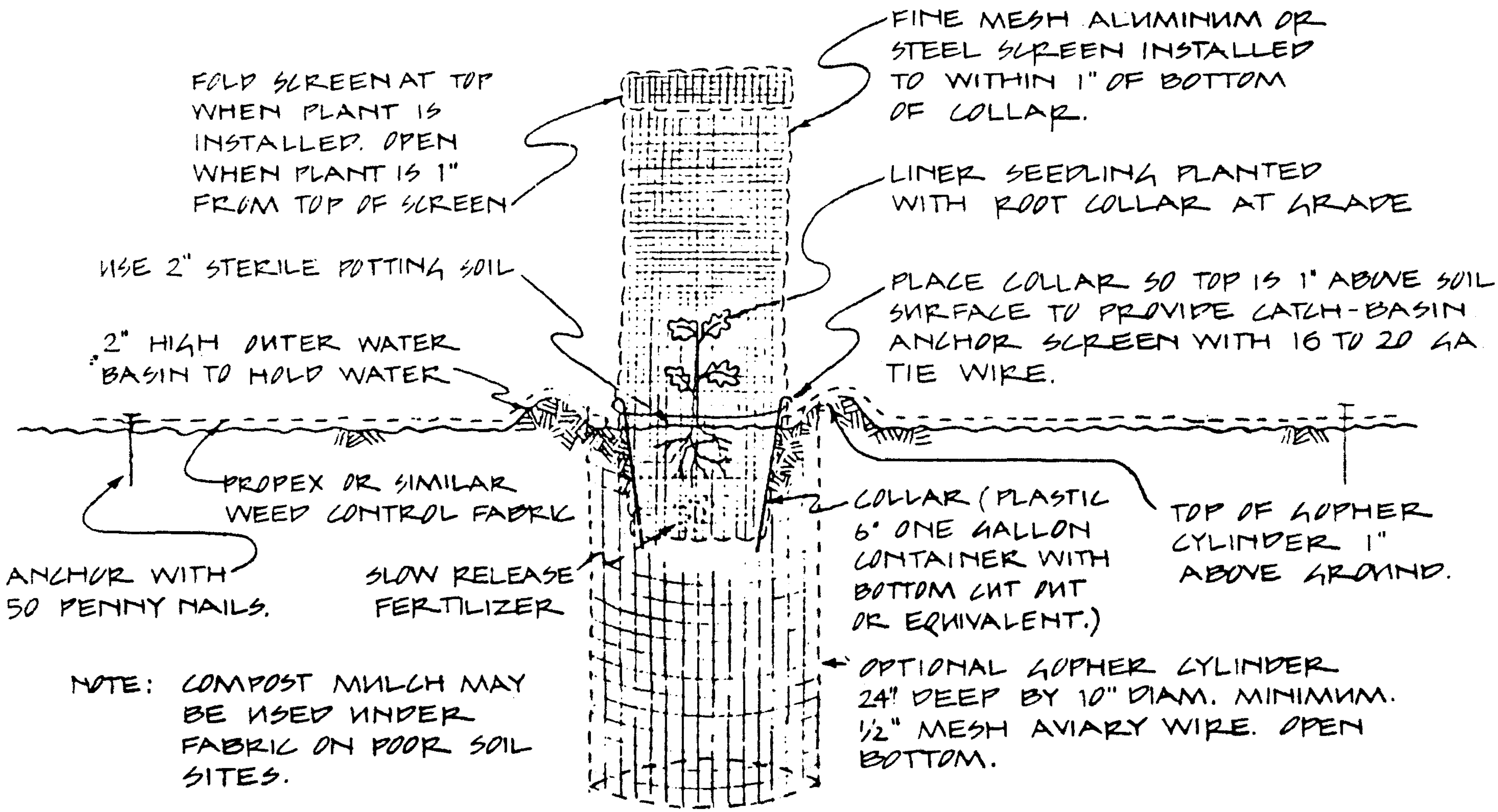
---

1. Ogden, G. L. 1980. "Sea-salt Aerosol Damage to *Quercus agrifolia* and *Quercus lobata* in the Santa Ynez Valley, California". In T. R. Plumb (ed.) *Ecology, Management, and Utilization of California Oaks*. General Technical Report PSW-44. Pacific Southwest Forest and Range Experiment Station, U. S. Forest Service.

ATTACHMENT B
PLANTING DETAILS



PRUNUSKE CHATHAM, INC. P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: 6-7-90	REVISIONS					TYPICAL PLANTING DETAIL DIRECT SEED WITH FABRIC, COLLAR, SCREEN AND OPTIONAL GOPHER CYLINDER
	SCALE: NTS	DATE	DESCRIPTION	REV BY	DRF BY	CHK BY	
	PLAN BY: HA	7/17/90	REVISE CONTAINER SIZE	KA	RL	HA	
	DRFTD BY: JSB	12/5/90	REVISE TIE WIRE	HA	JB	HA	
	CHKD BY: HA	1/16/91		SC	JB	HA	
	PAGE ___ OF ___						



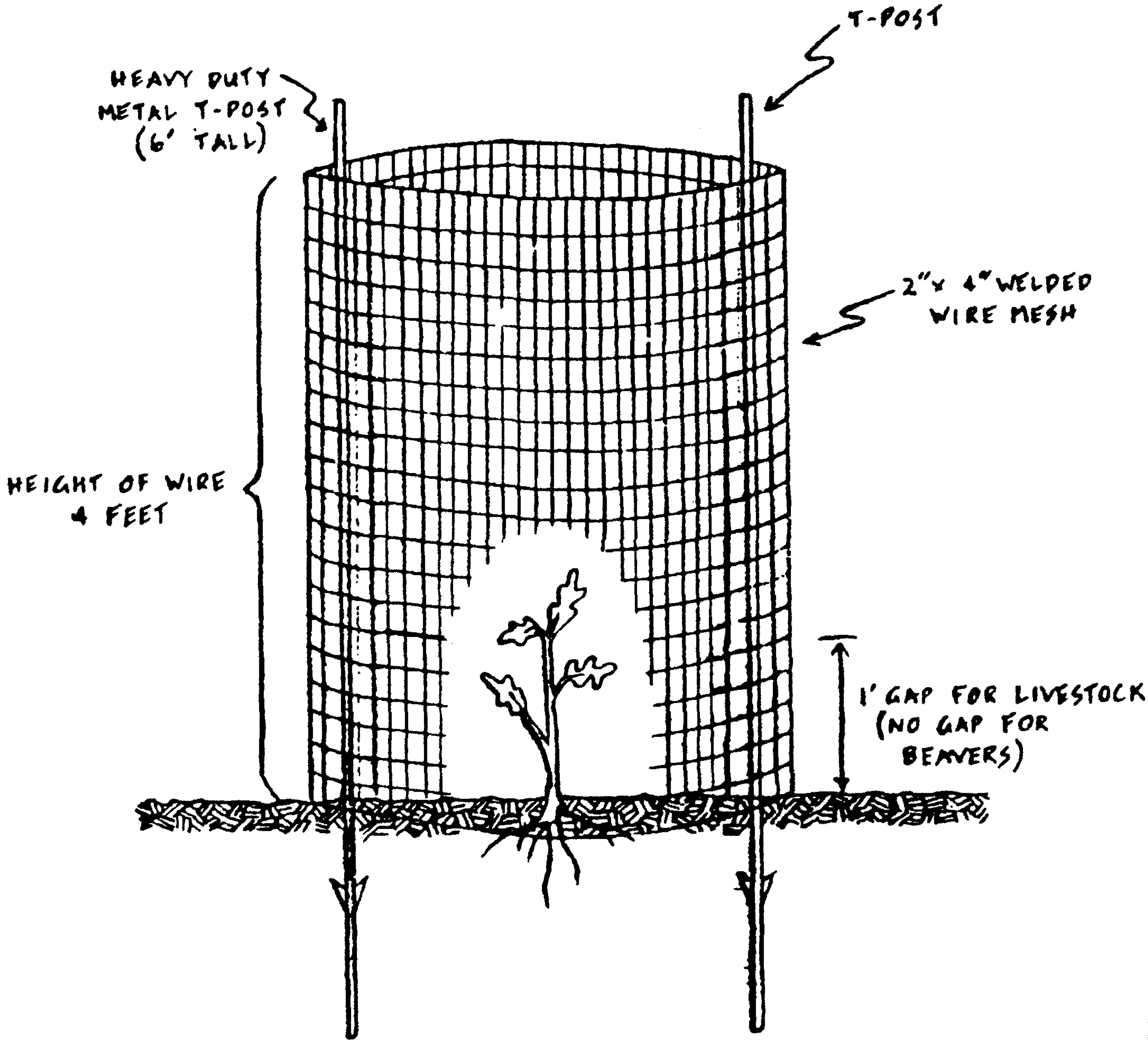
PRUNUSKE CHATHAM, INC.
P.O. BOX 828
OCCIDENTAL, CA 95465
(707) 874-0100

DATE: 6-7-90
SCALE: NTS
PLAN BY: HA
DRFTD BY: JSB
CHKD BY: SC/HA
PAGE ___ OF ___

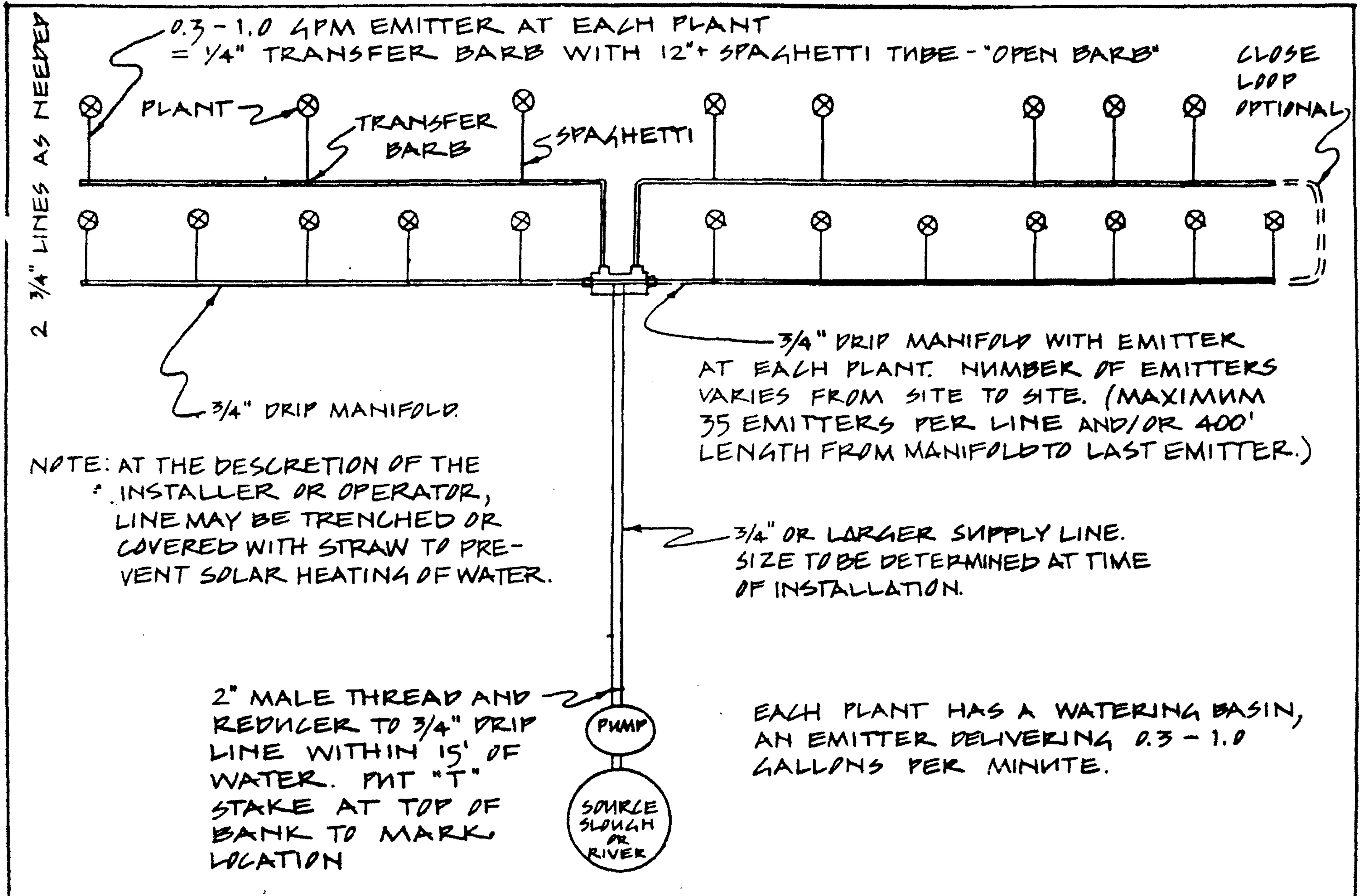
REVISIONS

DATE	DESCRIPTION	REV BY	DFT BY	CHK BY
7/17/90	REVISE CONTAINER SIZE	HA	KA	HA
12/5/90	ELIM STAPLES: REV TIE WIRE	HA	JF	HA
1/16/91		SC	JB	HA
11/91	EXTEND SCREEN TO PUT	HA	JB	HA

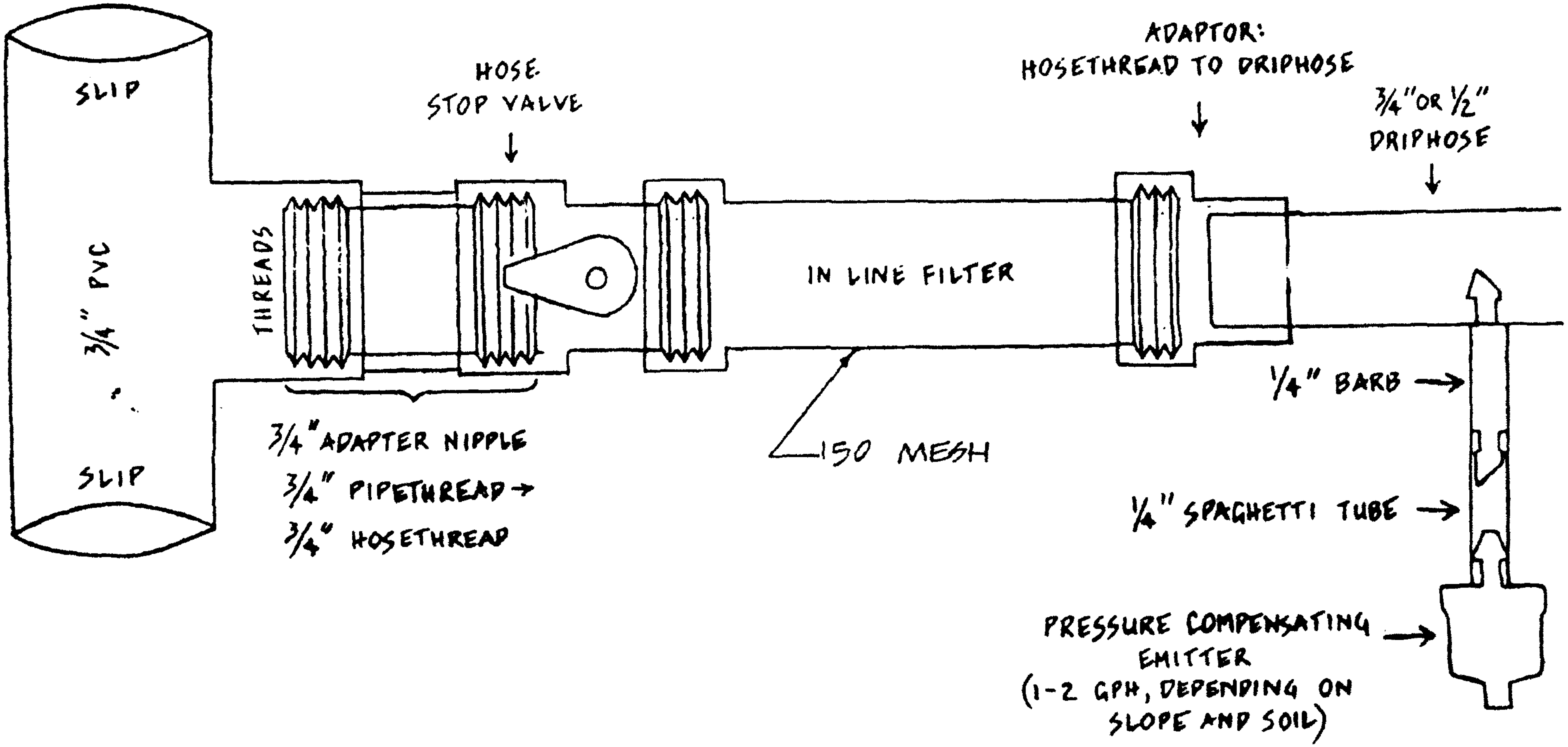
TYPICAL PLANTING DETAIL
SEEDLING
WITH FABRIC, COLLAR, SCREEN
AND OPTIONAL
GOPHER CYLINDER



PRUNUSKE CHATHAM P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE: 12-6-90 SCALE: 1" = 1' PLAN BY: HCA DRFTD BY: MAS CHKD BY: ___ PAGE __ OF __	REVISIONS	STANDARD SPECIFICATIONS FOR TREE CAGES PROTECTION FROM BEAVERS AND LIVESTOCK



PRUNUSKE CHATHAM P.O. BOX 828 OCCIDENTAL, CA 95465 (707) 874-0100	DATE 5-30-89 SCALE NTS PLAN BY JWD/SC DRFTD BY JSB	CHKD BY SC REV BY SC/HA 11-27-89 ~~SC 8-20-90~~/HA 12-6-90 PAGE ___ OF ___	TYPICAL SITE IRRIGATION SYSTEM SCHEMATIC OPEN BARBS/NO FILTER



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DATE: 12-12-90
SCALE: NTS
PLAN BY: HCA
DRFTD BY: MAS
CHKD BY: HCA
PAGE ___ OF ___

REVISIONS

DATE	DESCRIPTION	REV BY	APP BY	CHK BY
4-91	ADD 150 MESH	HA	JB	HA

STANDARD SPECIFICATION FOR 3 YEAR TEMPORARY IRRIGATION SYSTEM WITH DRIP EMITTERS, VALVE, FILTER & LATERAL

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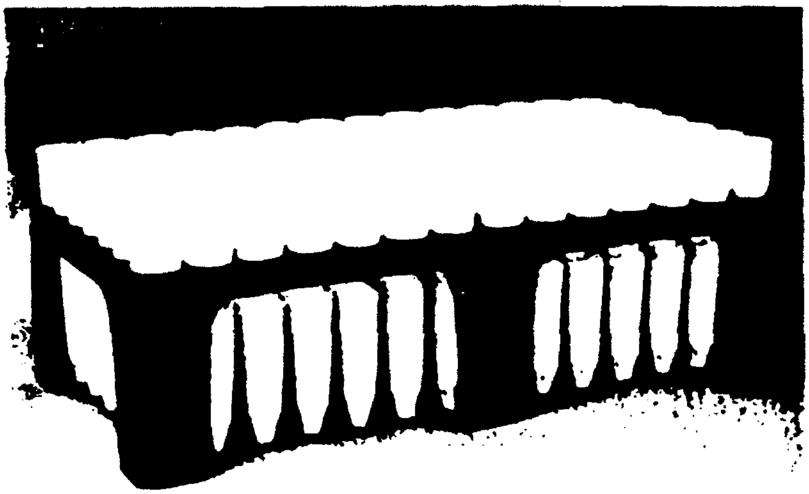

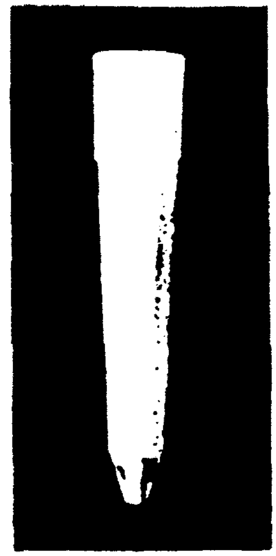

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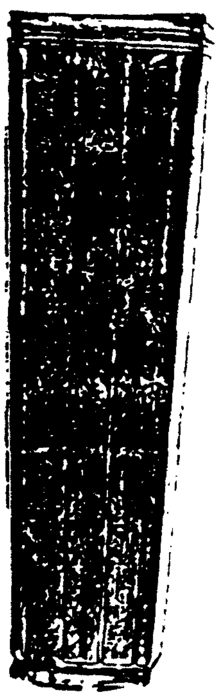

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Will fit all existing Ray Leach 98 cavity trays.
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APPENDIX 9-F
CONCEPTUAL RESTORATION PLAN FOR NEW LOS PADRES PROJECT CONSTRUCTION AREA

APPENDIX 9-F

CONCEPTUAL RESTORATION PLAN FOR NEW LOS PADRES PROJECT CONSTRUCTION AREA

INTRODUCTION

During construction of the New Los Padres Dam and Reservoir, approximately 19 acres of vegetation and wildlife habitat in the construction staging area would be eliminated temporarily. Much of the vegetation consists of coastal oak woodland, but chaparral and coastal scrub are also present. The coastal oak woodland is diverse in both species composition structure.

The dominant species on the site is the coast live oak, but madrone, California bay, and valley oak are also common. In much of the woodland there is a well developed understory of poison oak, snowberry, toyon, and various herbs and ferns. Patches of grassland occur scattered throughout the woodland. Although these areas are dominated by non-native annual grasses, several native grass species, such as wild rye, and a number of native herbaceous perennial species are also present.

Although cattle grazing has occurred in the area in the past, the woodland is relatively undisturbed, and the structure of the woodland is complex. Canopy cover over much of the woodland is 100 percent, except that open grassland with scattered valley oaks occurs in patches. The understory in much of the woodland is well developed, consisting of both shrub and herb layers, and containing seedlings of several of the dominant tree species.

GOALS

The aim of the restoration program is to reestablish the vegetation and wildlife habitat values that existed on the site prior to disturbance. The process of achieving those goals entails several steps:

- First, the existing vegetation and its habitat value will be characterized prior to disturbance;

- Second, a planting plan will be prepared that will be designed to replace the previously existing values; and
- Third, monitoring program will be prepared that will be used to determine whether the stated goals are being met.

CHARACTERIZATION OF EXISTING VEGETATION

The basis for restoring the disturbed areas is an inventory of those areas prior to disturbance. Several methods are available for characterizing the vegetation of a site, including line transects and plots. The line transect method is a relatively fast and cost effective method of making these determinations, but the actual method used can be chosen when the more detailed plan is developed.

Regardless of the method used, the data gathered from the site should include the percent cover and the species composition and density of the dominant species. Species composition and density of the understory shrub species should also be determined. Actual acreage of different habitat types, such as woodland and grassland, can be determined from aerial photographs.

PLANTING PLAN

A detailed planting plan will be prepared once the existing vegetation has been characterized. Planting densities can be determined based on an expected survival rate of 50 percent for non-irrigated plantings and about 80 percent if irrigation is used.

One crucial aspect of the planting plan is that all species used in the final plan come from either seed or cuttings taken from trees and shrubs on the site. Ideally, planting material will come from those trees and shrubs destroyed by the project activities. A site should be chosen as a nursery site for growing the planting stock.

In addition, the top four to six inches of top soil should be collected from each site and stored. This soil represents the annual and herbaceous perennial seedbank from each site, and will help reestablish the genetic lines that existed prior to disturbance.

On many restoration projects, plant protection kits are used around seedlings and young trees. These kits consist of wire mesh and other devices designed to reduce above and below ground herbivory and to lessen weed competition. Whether these kits are used in the final plan depends on a number of factors, and can be decided later. Using kits increases the immediate cost but can reduce the long term cost by increasing the success rate, thereby lowering the replanting rate.

Livestock grazing should be prohibited in the restoration areas, and can easily be accomplished by fencing if necessary.

MONITORING

Monitoring will be used to determine if the stated goals are being met. Monitoring will consist of installing permanent transects or quadrats, similar to those in the pre-disturbance characterization, and periodically taking vegetation measurements. Aerial photography would be another useful tool in making these determinations. It is recommended that the site be monitored for 30 years since the successional pattern may vary from the restoration plan, and may not be evident during the early years of the monitoring program.

Wildlife use of the site should also be monitored to provide information on wildlife habitat values. Bird counts and small mammal trapping can be used to gather this information.

Project activities will result in high levels of disturbance, including soil removal, soil compaction, potential introduction of weedy species, loss of typical wildlife and others. It is possible that the exact species composition and density that was present on the site may not be attainable. Therefore, a restoration group should be established to determine whether the goals are being met, and if not, to determine if the direction of site restoration is proceeding in an ecologically sound direction.

APPENDIX 9-G
HABITAT ASSESSMENT OF RIPARIAN VEGETATION

Riparian Habitat Assessment

ALTERNATIVES OF THE NEW SAN CLEMENTE DAM PROJECT

Prepared for:

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

Prepared by:

EIP Associates
150 Spear Street, Suite 1500
San Francisco, CA 94105
(415) 546-0600

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INTRODUCTION

This report describes the rationale, approach and results of a "desktop" HEP or Habitat Assessment (HA) that evaluated impacts of the various alternatives for the New San Clemente Dam project on riparian habitat and estimated the acreage of mitigation areas needed. Specifically, the HA was designed to: 1) estimate the project-related losses in habitat value of riparian habitats, and 2) estimate the acreage necessary to replace these habitat values on an in-kind basis.

The location and major features of the project alternatives are indicated in Figures 1 to 7. Much of the information on existing biological resources in the alternative sites was obtained during site visits on August 10 and 11, 1988. The Monterey Peninsula Water Management District (henceforth referred to as "the District") recognizes that further details in project design and mitigation necessitate revised calculations for a project specific mitigation plan.

This study assigns Habitat Suitability Index (HSI) ratings to the riparian cover type to be affected by a project. An HSI of 1.0 means that a particular site has optimal habitat value compared with other patches of that cover type in the general vicinity; usually a good-sized patch of undisturbed natural habitat will have an HSI of 1.0. Riparian habitats of less than optimal value were assigned values ranging from 0.1 to 0.9.

This HA will estimate HSI ratings before the project and at various points in time (Target Years) during the project. From these data, the HA estimates impacts on habitat value per acre. Similarly, a range of HSI ratings were assigned to mitigation sites, before and after implementation of a mitigation plan. The per-acre increase in habitat value and the acreage of mitigation lands needed to offset the project impacts were then calculated.

Because this is a desktop or simplified HEP, it does not include wildlife-habitat models. The HSI ratings were assigned based upon the professional judgment of the HA team members. This HA also simplifies the normal HEP method by assigning only one HSI value to each patch of riparian habitat, rather than separate HSI values to each of several wildlife species using given cover types. The single HSI value takes into account the overall value of a particular habitat patch to the wildlife that typically use that cover type. The HSI values assigned to each assessment site are presented in Table 1.

As is customary for these types of studies, a HA team was selected to make decisions about the approach, assumptions and HSI values to be used. The HA team consisted of the following members:

- Ric Villasenor, EIP Associates.
- Cay Goude, Ecological Services, U.S. Fish and Wildlife Service (FWS).
- Carl Wilcox, Environmental Services, Region 3, California Department of Fish and Game (DFG).
- Harriet Hill, Environmental Protection Specialist, Office of Federal Activities, Environmental Protection Agency (August 10th only).

TABLE 1

RIPARIAN HABITAT VALUES (HSI)
AT ALTERNATIVE PROJECT SITES[1]

Alternative Site	HSI Values TYØ[2]	TY100[3]
LOS PODRES ALTERNATIVE		
Danish Creek	0.6	
	0.6	
	0.7	(0.625)[4]
	0.6	
Carmel River	0.7	
	0.8	(0.80)
	0.9	
	0.8	
CACHAGUA CREEK ALTERNATIVE		
Cachagua Creek	0.4	
	0.4	(0.40)
	0.3	
	0.5	
James Creek	0.7	
	0.7	(0.7)
	0.7	
	0.7	
Canejo Creek	0.8	
	0.8	(0.825)
	0.9	
	0.8	
Finch Creek	0.7	
	0.6	(0.65)
	0.6	
	0.7	
CHUPINOS ALTERNATIVE		
Site #1	0.7	
	0.6	(0.67)
	0.7	

TABLE 1 continued

Alternative Site	HSI Values TYØ	HSI Values TY100
CHUPINOS ALTERNATIVE (continued)		
Site #2	0.3	
	0.4	(0.37)
	0.4	
Site #3	0.4	
	0.4	(0.4)
	0.4	
Site #4	0.7	
	0.7	(0.7)
	0.7	
NEW SAN CLEMENTE ALTERNATIVE		
Downstream of Existing Dam	1.0	
	1.0	(1.0)
	1.0	
Upstream of Existing Dam	0.8	
	0.9	(0.87)
	0.9	
Site #3 (Sedimentation Area)	0.1	
	0.1	(0.2)
	0.4	
San Clemente Creek	1.0	
	0.9	(0.97)
	1.0	
SAN CLEMENTE CREEK		
Lower Dam Site	1.0	
	0.9	(0.97)
	1.0	
Upper Dam Site	1.0	
	0.9	(0.97)
	1.0	

[1]HSI values were determined by the analysis team composed of 3 to 4 individuals.

[2]Target year 0.

[3]Target year 100.

[4]Average HSI value at each assessment site.

SCOPE OF THE STUDY

STUDY AREA

The study area is composed of six alternative dam sites in the Upper Carmel River region of Monterey County (see Figures 1 to 7). The impact areas addressed and evaluated included those portions of riparian habitat within the proposed dam and reservoir sites. Survey and sample sites within each riparian habitat were selected based upon access and representation of the cover type area.

No specific mitigation sites have been selected at this time. It was assumed that the eventual mitigation sites would most likely be degraded riparian habitats with a range of HSI values of 0.2 (very degraded) to 0.5 (somewhat degraded but for which habitat enhancement is promising).

COVER TYPES

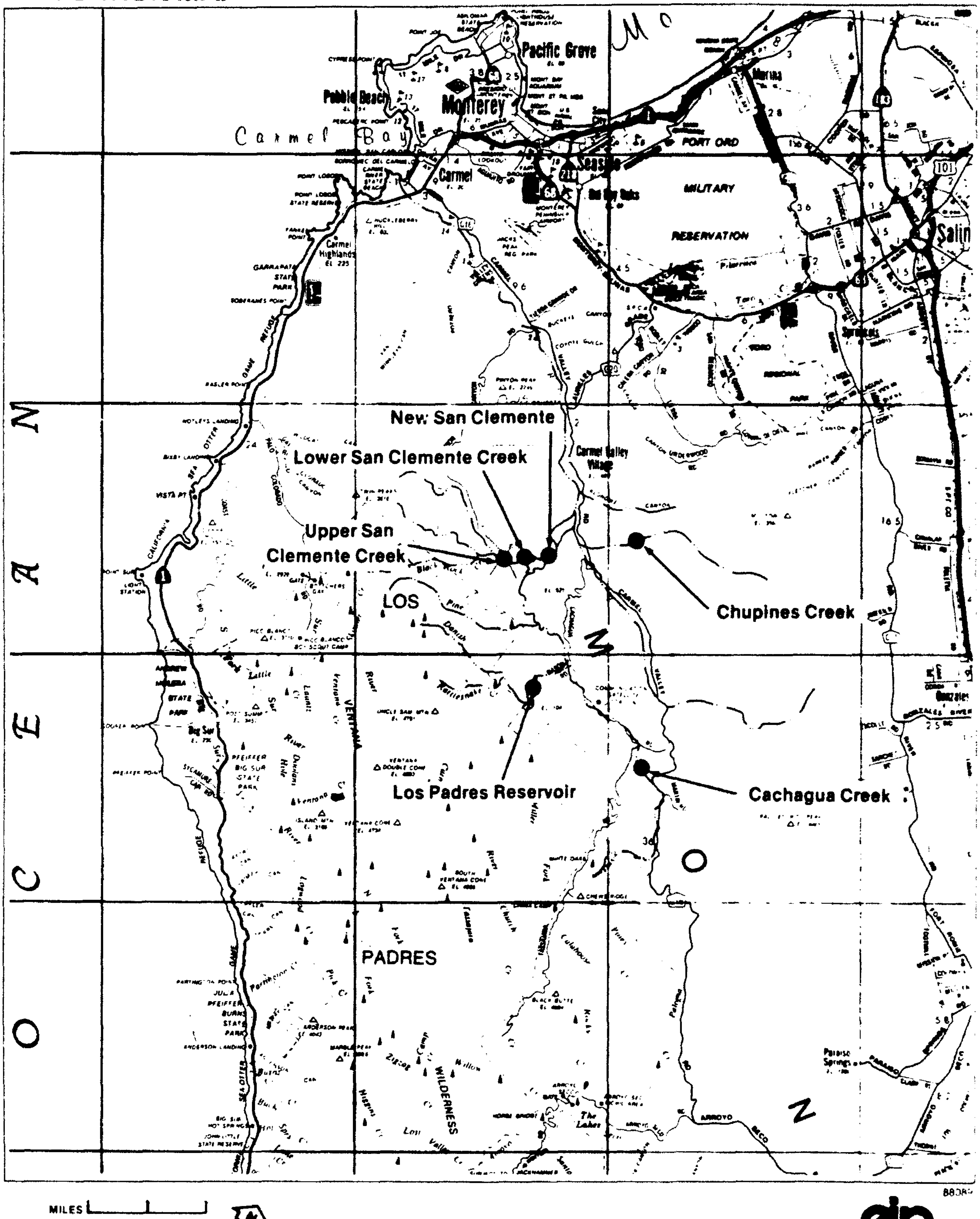
This HA addresses the impacts and mitigation of riparian habitats only. Other cover types to be affected by the project are not addressed. These may be included, however, in subsequent assessments if necessary. The reason this assessment focuses upon the riparian cover type is because the interested resource agencies have a policy of no-net-loss of this habitat type and thus require mitigation plans for any loss.

Time Period and Target Years

This assessment addresses a time period of 100 years, or the life of the project, from Target Year 0 (TYØ) when project construction begins, until Target Year 100 (TY100). A third Target Year (TY35) was used to signify when the mitigation sites are expected to reach a given level of maturity (HSI = 0.7). Straight line projections were used in estimating the development of the habitats over time (see Figure 8).

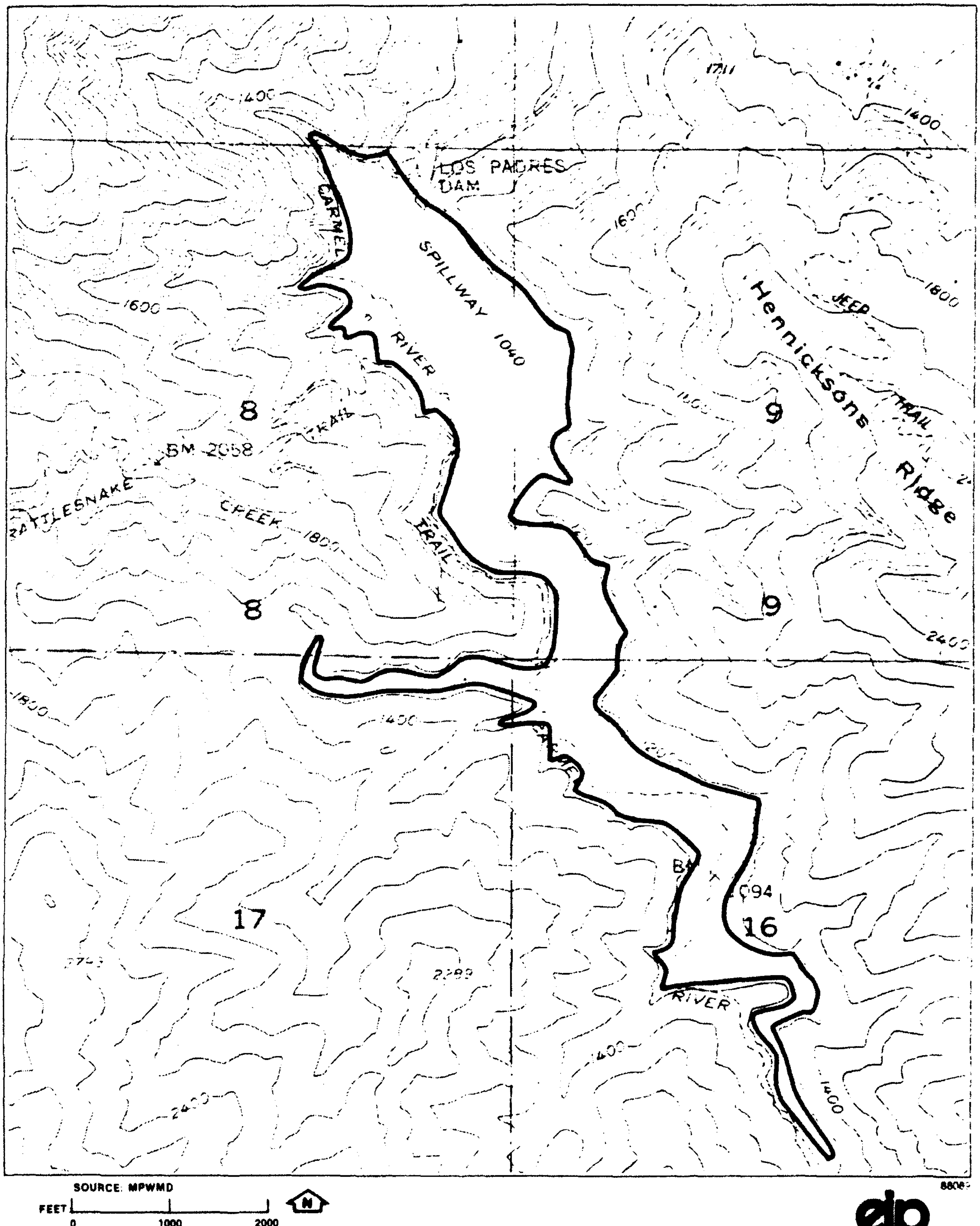
LOCATION MAP

FIGURE 1



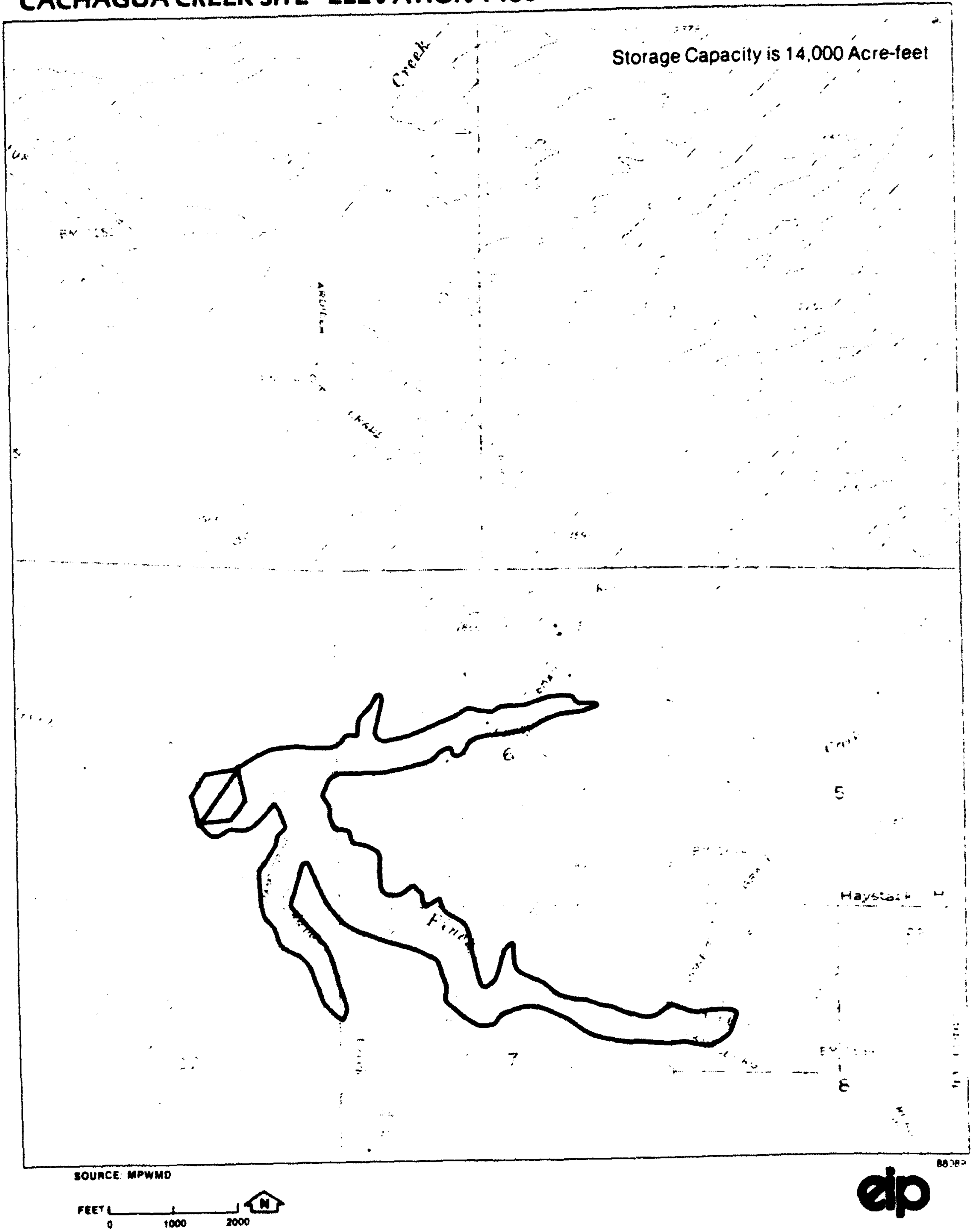
eip

INUNDATION AREA FOR SPILLWAY - ELEVATION 1160 FT. FIGURE 2



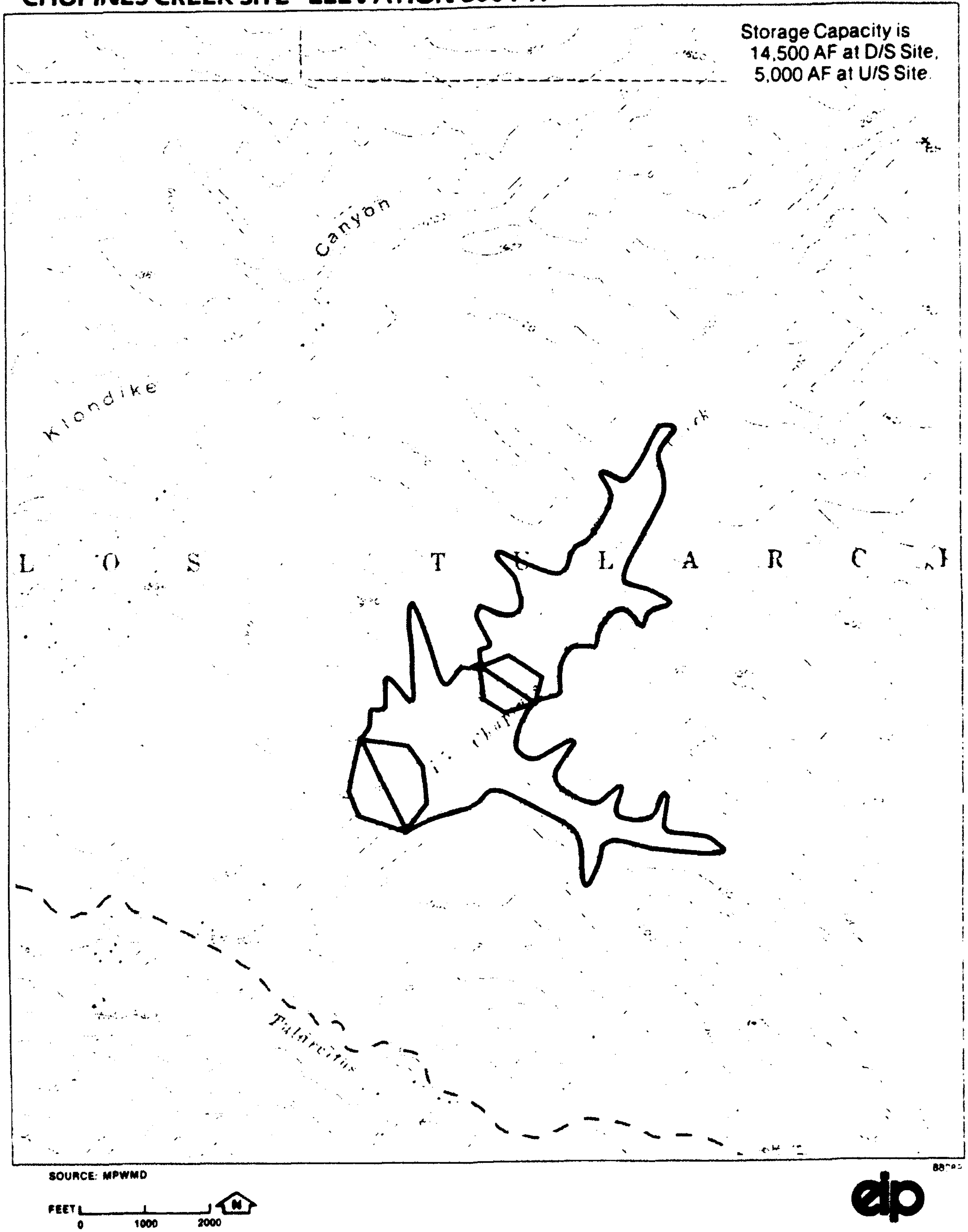
CACHAGUA CREEK SITE - ELEVATION 1480

FIGURE 3



CHUPINES CREEK SITE - ELEVATION 800 FT.

FIGURE 4

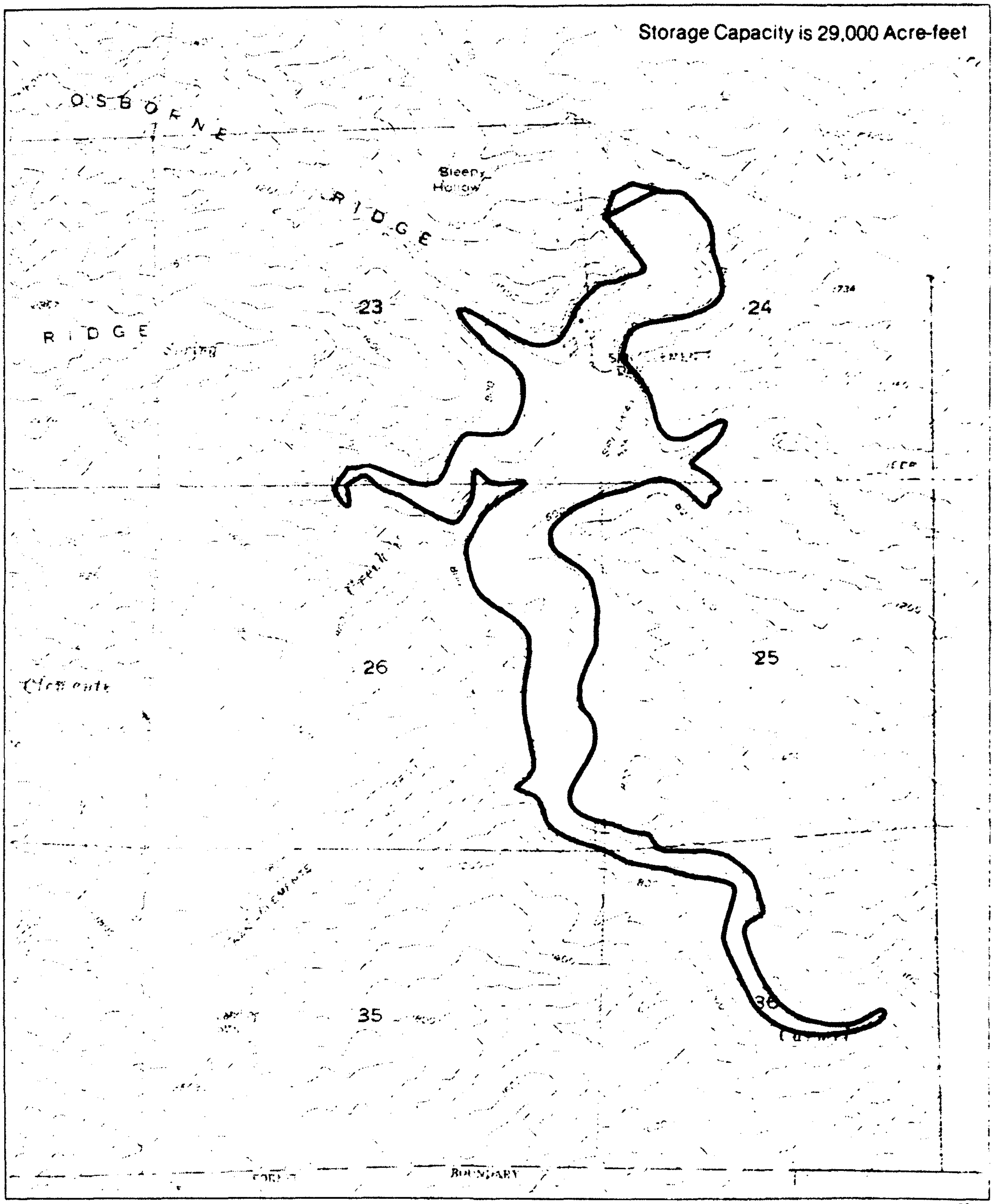


SOURCE: MPWMD

FEET 0 1000 2000

NEW SAN CLEMENTE SITE - ELEVATION 662 FT.

FIGURE 5



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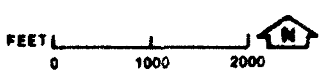
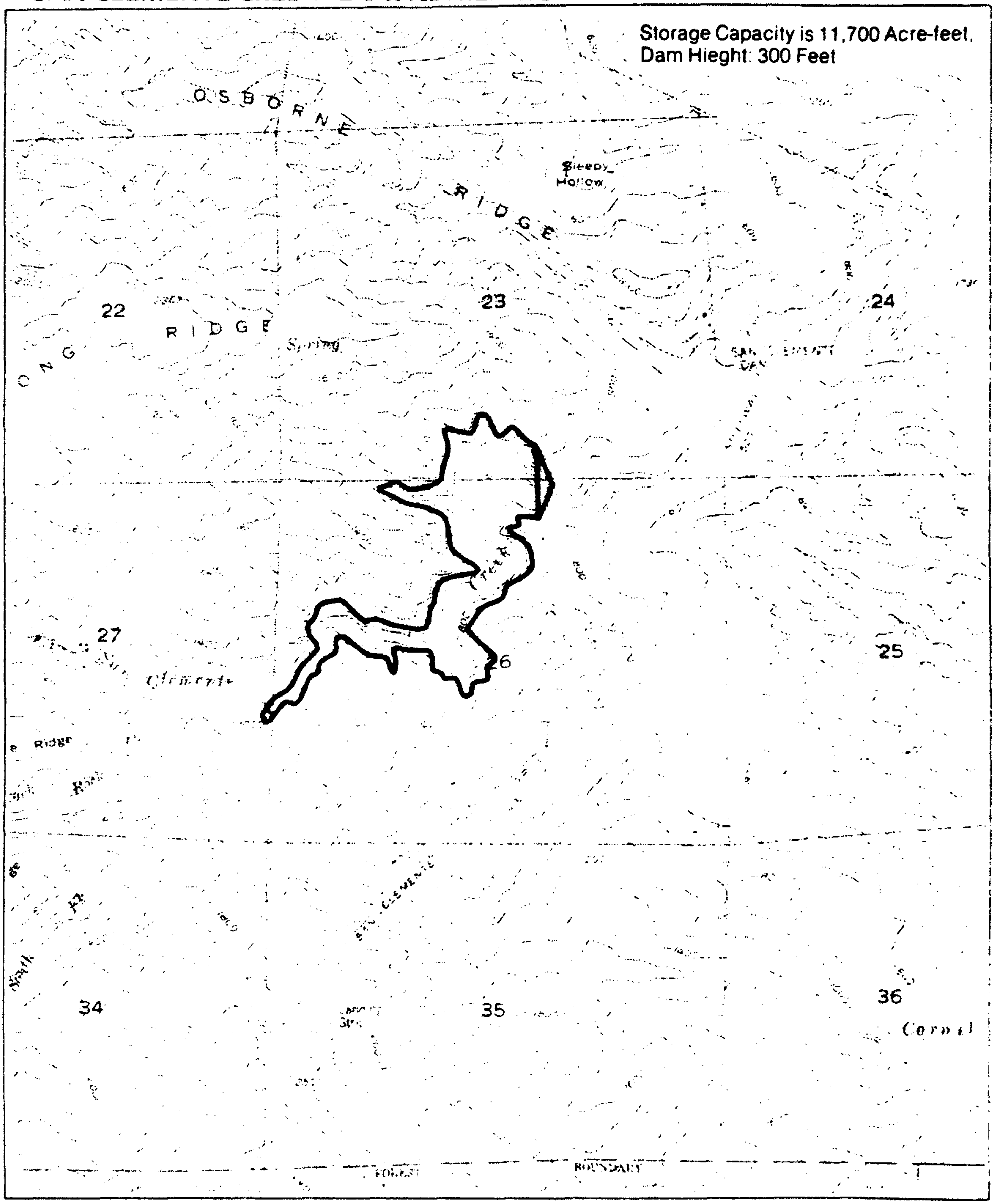


SAN CLEMENTE CREEK - DOWNSTREAM SITE

FIGURE 6



SOURCE: MPWMD

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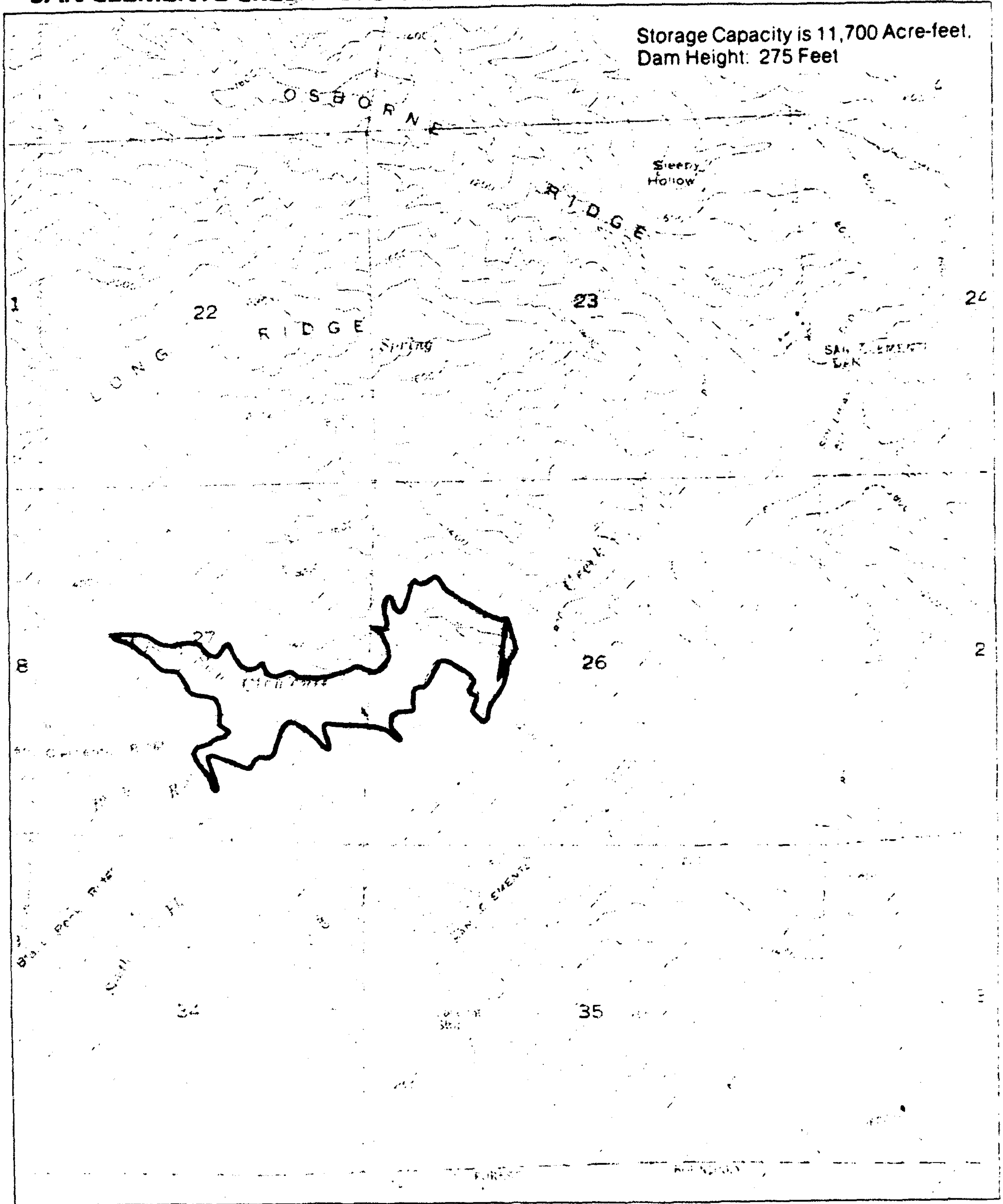
SAN CLEMENTE CREEK - UPSTREAM SITE

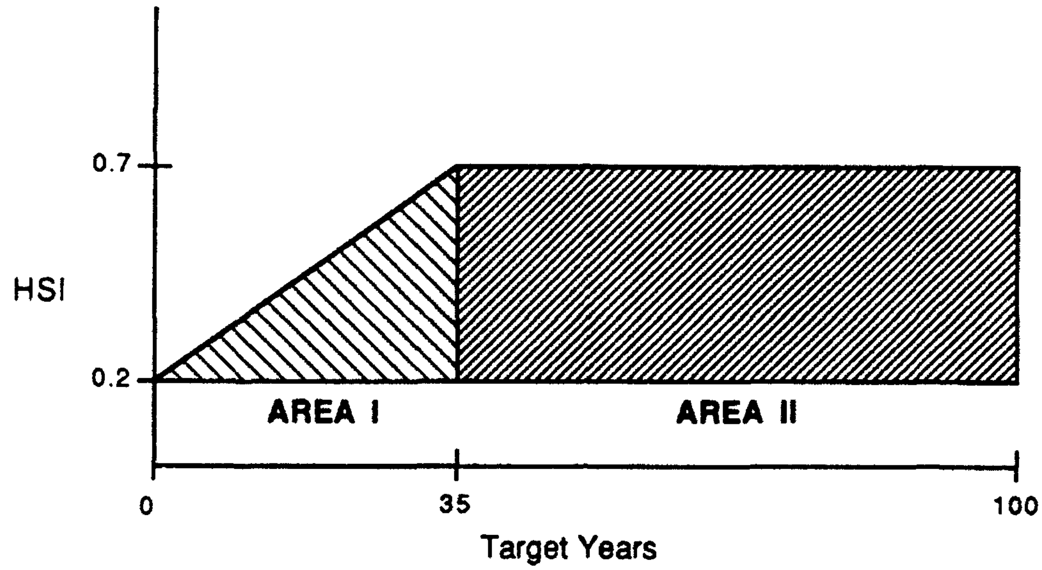
FIGURE 7



SOURCE: MPWMD

FEET 0 1000 2000

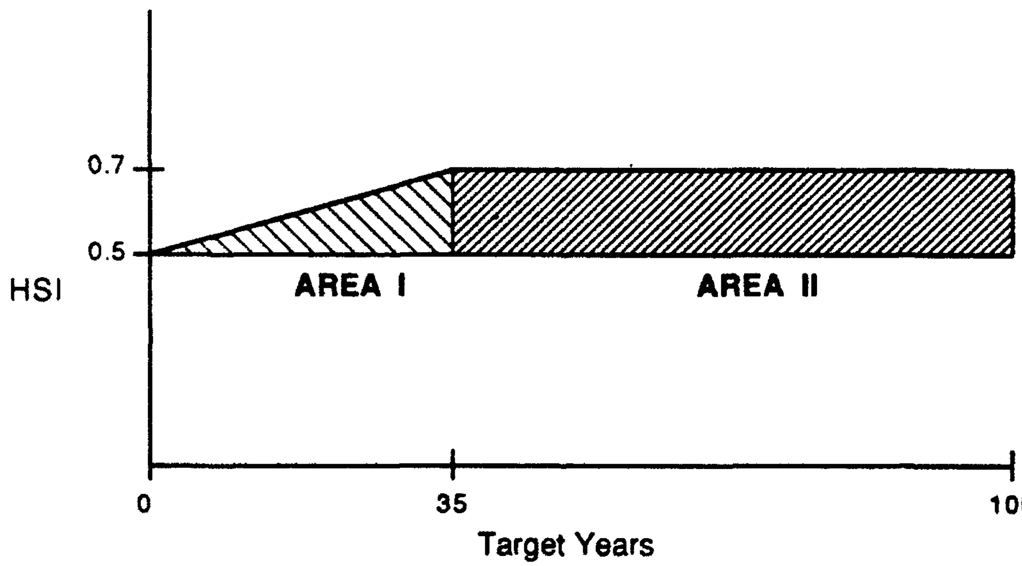
RIPARIAN MITIGATION SITES (CONCEPTUAL) — FIGURE 8



AREA I: $\frac{0.5 \times 35}{2} = 8.75$

AREA II: $0.5 \times 65 = 32.50$

AVERAGE ANNUAL HU / ACRE: $\frac{32.50 + 8.75}{100} = .41$



AREA I: $\frac{0.2 \times 35}{2} = 3.5$

AREA II: $0.2 \times 65 = 13$

AVERAGE ANNUAL HU / ACRE: $\frac{3.5 + 13}{100} = .165$

LEGEND

Projected Changes in Habitat Value (HSI)

Over the Life of the Project (TY 100)

SOURCE: EIP ASSOCIATES

8808-

EXISTING CONDITIONS

Riparian habitats in the Central Coast region of California are generally characterized by vegetation that can withstand periods of inundation and are closely associated with areas where the groundwater table is relatively shallow. The vegetation composition may range from forests with dense tree canopies to scrub type communities with little or no tree overstory.

Riparian forest is dominated by large deciduous trees (30 to 60 feet tall) with overlapping canopies. The dominant tree species are cottonwood (Populus trichocarpa) with sycamores (Plantanus racemosa) and willows (Salix sp.) scattered throughout. The understory varies from bare ground or low herbaceous cover (due to recent scouring), to a dense scrub thicket of either alder (Alnus rhombifolia), immediately along the banks, or common brush species such as poison oak (Toxicodendron diversilobum) and blackberry (Rubus vitifolius).

Riparian woodland or thickets are the most common and extensive riparian habitat type in the study areas. A woodland is also dominated by large trees; however, unlike the forest type, the canopies do not overlap, and there is a wide range of tree densities. The most common tree species are identical to the forest type. A thicket is very similar to the woodland type except that these are typically dense stands of one or two tree species less than 20 feet in height. Common and dominant species of the thicket type are red willow (Salix laevigata), sandbar willow (Salix hindsiana), cottonwood, and alder. There is a continuum of size and structural complexity between the woodland and thicket types.

Riparian scrub is also a common habitat type in the study areas. It is most often, however, very limited in extent in any given site. This habitat type is most common on gravel bars. It lacks a well-established tree canopy and is dominated by low shrubs two-ten feet in height. Common and characteristic plant species in this habitat type include mugwort (Artemisia douglasiana), coyote bush (Baccharis pilularis), blackberry, mule fat (Baccharis viminea), and sweet fennel (Foeniculum vulgare).

Additional riparian habitat types are scattered throughout the river valleys to a much smaller degree. Dry washes and barren gravel bars represent areas that have recently been scoured by the river and all that has developed is low herbaceous growth. There are numerous examples of this habitat type in the river bed areas. Emergent vegetation occurs in and along the shallow borders of deep pools with permanent surface water. Typical plant species include sedges (Carex spp.), rushes (Juncus spp.), bulrush, and cattail (Typha spp.). At those points where the river bed is closest to the valley walls, the mixed evergreen forest-riparian type, similar to the upper river area, occurs. Remnants of this type also occur on the upper alluvial terraces.

For purposes of this analysis, all of these various riparian plant communities were combined into one generic cover type, i.e. riparian habitat.

The wildlife habitat value of riparian corridors is relatively high. The high density of mature trees and the abundance of dense undergrowth enhance habitat value for many songbirds (especially insectivores), small mammals, reptiles, and amphibians. The numerous large, old trees, especially valley oaks, provide dead limbs for cavity-nesting birds.

The following is a brief description of the riparian habitats within each Project Alternative.

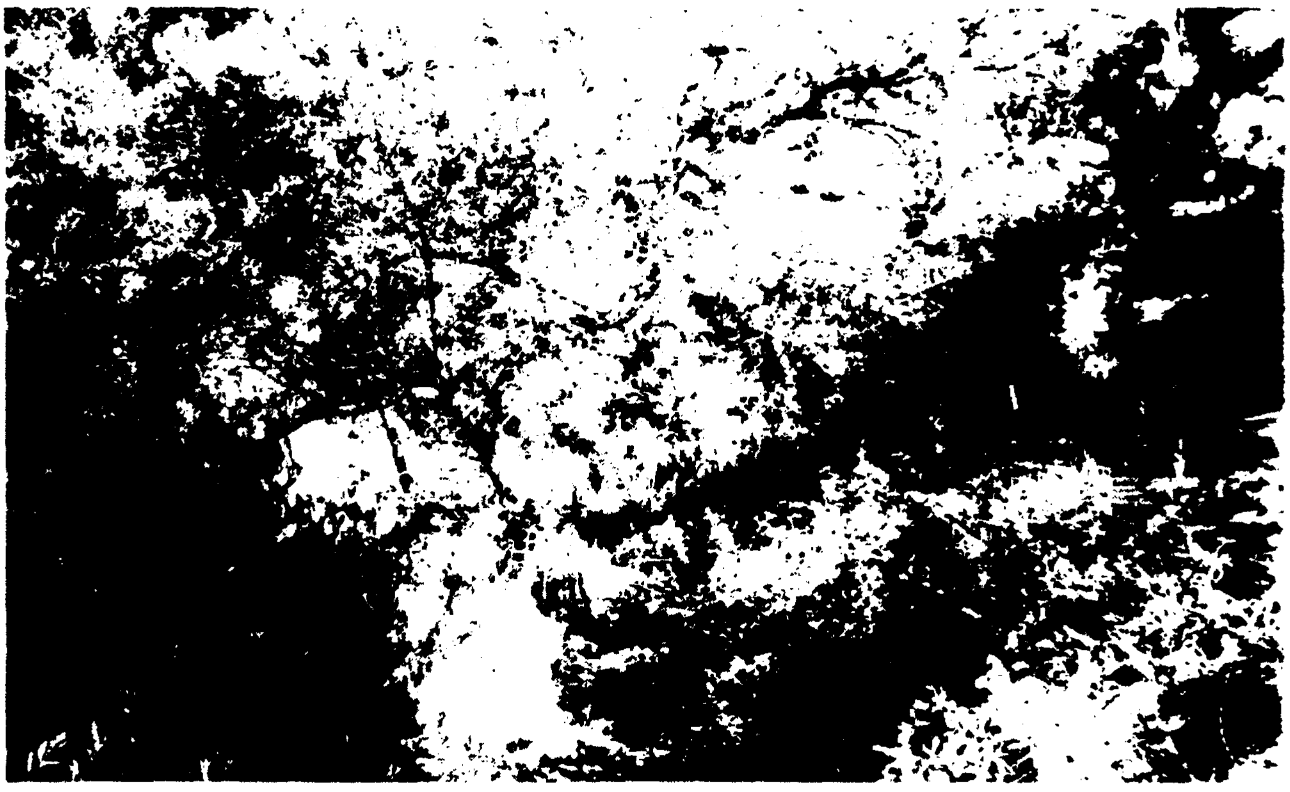
Los Podres Site

Two evaluation sites were taken for this project alternative, Danish Creek and the Carmel River upstream of the existing reservoir. Danish Creek is dominated by alder with little vegetative understory and was completely dry at the time of the survey. The Carmel River is typical of a Riparian Woodland with alder thickets, barren gravel bars and scattered sycamore and oaks (see Figure 9). Water pooling areas as well as flowing water habitats occur along its length.

SITE PHOTOS

FIGURE 9

A. Carmel River above Los Padres Dam.



B. Cachagua Creek at the proposed dam site.

SOURCE EIP ASSOCIATES

eip

Cachagua Creek Site

Four evaluation sites were used for this project alternative; Cachagua Creek, James Creek, Canejo Creek and Finch Creek. Cachagua Creek is narrow (estimated 30 feet) with Cachagua Road running along its southern bank. The riparian vegetation is dominated by brushy species with scattered oaks, sycamores and willows (see Figure 9). James Creek and Canejo Creek have similar habitats with dense willow and oak canopies. These creeks range in width from 40 to 75 feet. Finch Creek is wider than James and Canejo Creeks (approximately 90 to 120 feet), with a similar tree canopy. Grazing activities, however, have reduced the understory cover (see Figure 10).

Chupinos Creek Site

Four evaluation sites were used for this project alternative. The habitat values range from good productive sites with dense understories and open to closed tree canopies (see Figure 10), to degraded sites where heavy grazing bars have all but eliminated the understory vegetation, leaving scattered large oak and sycamore trees. The creeks range in width from 75 to 200 feet wide.

New San Clemente Site

Four evaluation sites were used for this project alternative; downstream of the existing San Clemente Dam, upstream of the existing Dam, an area where the habitat has been significantly degraded due to sediment deposition, and San Clemente Creek.

The riparian habitats downstream of the existing dam to the proposed new dam site are composed of a dense tree canopy and underbrush layer. This habitat is as close to a mature riparian forest as that on any of the alternative sites.

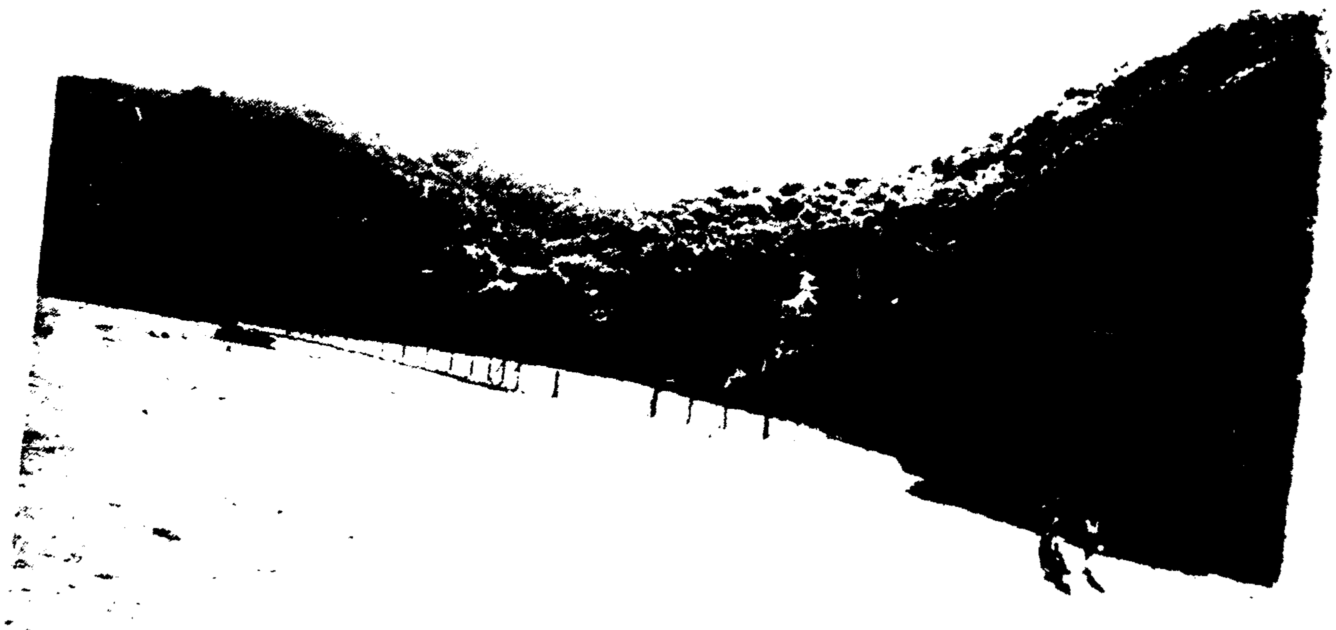
The riparian habitat upstream of the existing dam is very similar to that described upstream of the Los Podres site.

A small area (approximately 3 acres) on the Carmel River above the existing San Clemente Dam is a sedimentation site that has been significantly degraded due to the

SITE PHOTOS

FIGURE 10

A. F[illegible] Creek at the Jamesburg Bridge



B. [illegible] dam site

eip

deposition of sediments from a tributary drainage. Many of the mature sycamore trees have been damaged and the original understory has been replaced with weedy, invasive species.

The lower portion of San Clemente Creek supports a narrow band of dense riparian growth. Although this area is small in comparison to habitats on the Carmel River, it is of good to excellent quality.

Lower & Upper San Clemente Dam Site

Evaluation of these alternatives was done from the access road along the entire length of the creek. The riparian habitats are similar to those described for the New San Clemente Dam site above.

IMPACTS AND MITIGATION

EXPECTED IMPACTS

Estimates of the acreage of impact on riparian habitats was done with the use of a planimeter and 1:600 color aerial photographs, or by estimating habitat areas. These acreage figures represent the best information currently available. If there are significant changes in the dam size and area of inundation, the acreages may need to be recalculated. The calculated riparian habitat acreage for each alternative site is provided in Table 2.

MITIGATION

Specific mitigation sites have not been identified at this time. It is assumed that these sites would be degraded riparian habitats on the Carmel River and other water courses in the region. These degraded mitigation sites are assumed to have habitat values ranging from 0.2 to 0.5.

These sites will be planted with riparian trees native to the locality and appropriate for the local site conditions. In the project area, we assume that planted riparian trees would reach a habitat value of 0.7 in 35 years, with broad canopies, full seed production, substantial amounts of dead wood (for cavity-nesters), and many trees exceeding 50 feet in height and 12 inches in diameter (at breast height).

TABLE 2

EXISTING RIPARIAN HABITAT UNITS (HU)

Alternative Site	Riparian Habitat Acreage	Existing HU Per Acre (HSI)[1]	HU to Be Lost[2]
Los Podres Alternative			
Danish Creek	2.5	0.625	1.56
Carmel River	14.2	0.80	11.36
	16.7		12.92
Cachagua Creek Alternative			
Cachagua Creek	1.4	0.40	0.56
James Creek	4.6	0.70	3.22
Canejo Creek	7.5	0.825	6.16
Finch Creek	19.3	0.65	12.55
	32.8		22.49
Chupinos Alternative			
Site #1	2.4	0.67	1.62
Site #2	8.2	0.37	3.05
Site #3	8.2	0.40	3.30
Site #4	4.9	0.70	3.39
	23.8		11.36
New San Clemente Alternative			
Downstream of Existing Dam	17.6	1.00	17.60
Upstream of Existing Dam	35.1	0.87	30.54
Site #3 (Sedimentation Area)	3.0	0.20	0.60
San Clemente Creek	5.8	0.97	5.59
	61.5[3]		54.33
(San Clemente Creek Alternatives)			
Lower Dam Site Alternative	14.7	0.97	14.26
Upper Dam Site Alternative	11.0	0.97	10.67

[1] Average HSI values from Table 1.

[2] HSI X Acreage.

[3] This is a higher value than was previously reported in the Draft EIR/EIS because it includes all habitats inclusive of gravel beds, ponds, etc., whereas the DEIR/EIS reported only riparian vegetation.

ASSUMPTIONS

1. For purposes of this analysis, the project life is 100 years.

2. Existing habitat values (HSI) at the degraded riparian mitigation sites are expected to range from 0.2 to 0.5.

3. There will be no significant changes in habitat values or acreages of the riparian habitats at the alternative project sites that would be displaced if the project were built.

4. Habitat values and acreages at the mitigation sites will remain the same over time.

5. Impacts on the riparian habitats will occur at Target Year 0 (TY0), i.e. when project construction is initiated and result in the loss of all riparian habitat values.

6. Mitigation plans will be designed to replace riparian habitats on an in-kind basis and will begin with project construction (TY0).

7. The planted riparian habitat at the mitigation site(s) will reach maturity or full habitat value in 35 years, in a straight-line projection.

8. Because of the uncertainty of mitigation success, it is assumed habitats at the mitigation site will not achieve a maximum value of 1.0.

9. Endangered species and fish habitat is not included in this analysis.

RESULTS AND DISCUSSION

The results of the HA study are summarized in Tables 2 and 3. Impacts on habitat value were expressed in Habitat Units (HU); an HU of 1.0 for a particular cover type is equivalent to a one-acre site with optimal habitat value (HSI = 1.0). Thus, the value of a particular site in HUs is simply the acreage of the site multiplied by its HSI. In this study, all impacts were assumed to take place at the beginning of the project (TY0), simplifying the impact calculations. The results indicate that the greatest number of HU loss would occur with the New San Clemente Alternative (54.33 HU). A good portion of this impact is due to the large area of riparian habitat to be removed (61.5 acres) and the relatively high habitat values of these riparian areas. The next highest impact would occur at the Cachagua site primarily because this shallow reservoir would inundate a relatively large amount of riparian habitat. The Los Podres site had a relatively low impact because much of the inundation area includes the existing reservoir and thus the riparian habitat acreage to be lost would be relatively low.

The mitigation analysis first determined the average habitat value expected for mitigation sites with HSI values of 0.2 and 0.5 through the 100-year study period, based on the graphs in Figure 8. The average habitat value is expressed in average annual habitat units per acre and is equivalent to the average HSI over the 100-year period. The next step calculated the mitigation acreage needed to fully replace the HUs of each cover type to be lost, presented in Table 3. For example, in the Los Podres Alternative the total HUs that would be lost (12.92) was divided by the average annual HU per acre that would be gained over the 100-year life of the project at a highly degraded site (0.41) to determine that the mitigation site would have to be 31.5 acres. This is approximately a 2:1 ratio of mitigation area to impact area.

The results presented can be useful in assessing the implications of changes in the project design or final mitigation plan. For example, it is likely that some combination of riparian mitigation sites would be used, rather than just one of a given habitat value. In this case, it would be easy to calculate the necessary acreages using the data in Table 3.

TABLE 3

RIPARIAN MITIGATION REQUIREMENT CALCULATIONS

<u>Los Podres Alternative</u>

A.[1] 12.92 HU to be lost/0.41 average annual HU per acre = 31.5 acres

B.[1] 12.92 HU to be lost/0.165 average annual HU per acre = 78.3 acres

<u>Cachagua Creek Alternative</u>

A. 22.49 HU to be lost/0.41 average annual HU per acre = 54.9 acres

B. 22.49 HU to be lost/0.165 average annual HU per acre = 136.3 acres

<u>Chupinos Creek Alternative</u>

A. 11.36 HU to be lost/0.41 average annual HU per acre = 27.7 acres

B. 11.36 HU to be lost/0.165 average annual HU per acre = 68.9 acres

<u>New San Clemente Alternatives</u>

A. 54.33 HU to be lost/0.41 average annual HU per acre = 132.5 acres

B. 54.33 HU to be lost/0.165 average annual HU per acre = 329.3 acres

<u>Lower San Clemente Creek Alternative</u>

A. 14.26 HU to be lost/0.41 average annual HU per acre = 34.8 acres

B. 14.26 HU to be lost/0.165 average annual HU per acre = 86.4

<u>Upper San Clemente Creek Alternative</u>

A. 10.67 HU to be lost/0.41 average annual HU per acre = 26.0 acres

B. 10.67 HU to be lost/0.165 average annual HU per acre = 64.7 acres

[1] A = Assumes mitigation or replacement sites have an HSI value of 0.2.

[2] B = Assumes mitigation or replacement sites have an HSI value of 0.5.

Similarly, if the HA team determines that adjustments must be made in the HSI values or the acreages of impact, the results could be recalculated without difficulty. This HA report can provide the basic framework for future calculations.

APPENDIX 9-H
DRAFT RIPARIAN HABITAT MITIGATION PLAN

DRAFT

RIPARIAN HABITAT MITIGATION PLAN
FOR THE
MONTEREY PENINSULA WATER SUPPLY PROJECT

Prepared by

Ambessaw Assegued
MPWMD Riparian Projects Coordinator

Monterey Peninsula Water Management District

June 1992

I. INTRODUCTION

The Monterey Peninsula Water Management District (MPWMD) is evaluating the water supply performance and impacts of constructing a 24,000 acre-foot (AF) New Los Padres Dam and Reservoir for the Monterey Peninsula. The purpose of this water supply project is to (a) provide increased drought protection for existing and future water users, and (b) to meet projected municipal demand associated with planed growth within the jurisdictions of the MPWMD. An additional goal is to help restore the degraded environmental resources of the lower Carmel River.

In August 1991, a Supplemental Draft EIR/EIS (SDEIR/EIS) was prepared for the 24,000 AF New Los Padres Project as well as nine alternatives to it. During the course of responding to comments on the 1991 EIR/EIS, additional information has been developed for certain project components. Thus, the District is presently preparing a revised Supplemental Draft EIR/EIS-II that analyzes five water supply alternatives -- the 24,000 AF New Los Padres Reservoir, a 20,000 AF New Los Padres Reservoir combined with a 3 million gallon per day (MGD) desalination plant, a 16,000 AF Canada Reservoir combined with a 3 MGD desalination plant, a stand-alone 7 MGD desalination plant, and the No Project alternative.

In January 1992, MPWMD invited staff biologists from several state and federal resources agencies to review MPWMD's work plan to respond to agency comments on the 1991 SDEIR/EIS. At a meeting on January 24, 1992, an interagency Vegetation Working Group was formed to guide MPWMD as it develops revised Draft Riparian and Upland Mitigation Plans. A revised conceptual riparian mitigation plan that focused on revegetation at Garland Ranch Park was forwarded to group members for review on February 27, 1992.

The Vegetation Working Group's first field trip and discussion of mitigation concepts was held on March 5 and 6, 1992. At that time, agency representatives indicated that they agreed with the District's revised conceptual mitigation plan for Garland Ranch Park, owned by the Monterey Peninsula Regional Park District (MPRPD). Group members also agreed that they believed there would be a high likelihood of successful revegetation at the site.

Carl Wilcox of the California Department of Fish and Game asked that excavation of relict channels or other means to bring winter storm flows onto the Garland Ranch flood plain be explored as a project goal. After extensive efforts by MPWMD and MPRPD staff, five alternative scenarios were developed. After two public MPRPD Board meetings in April and May 1992, as well as a detailed walking tour for each alternative, the MPRPD Board unanimously voted to oppose the concept of bringing water into the Park due to the extensive disruption such action would create. However, the MPRPD Board unanimously voted to support the MPWMD riparian revegetation concept at Garland Ranch, which includes trail relocation, minor recontouring, irrigation and restriction of public access in certain areas.

This document focuses solely on mitigation for riparian habitat that would be inundated or otherwise affected by the 24,000 AF New Los Padres Project. A preliminary draft of the Riparian Mitigation Plan was transmitted to the Vegetation Working Group on June 3, 1992. This document was revised following review and comments provided at the group's second field trip on June 11, 1992.

II. RESPONSIBLE PARTIES

The MPWMD is the agency that is responsible for the development, financing and implementation of this Riparian Mitigation Plan. The principal author of this document is Ambessaw Assegued, MPWMD Riparian Projects Planner. Henrietta Stern, MPWMD Senior Project Coordinator, is responsible for coordinating the preparation of the SD EIR/EIS - II. Stern has provided review a and comments on this mitigation plan. Randall Morgan, a consulting botanist to MPWMD, assisted Assegued in compiling the plant list and evaluating the general habitat conditions of the mitigation sites.

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III. PROJECT DESCRIPTION

A. Project Location

New Los Padres Reservoir will be located on the Carmel River approximately 19 miles southeast of the City of Monterey, and 7 miles southeast of Carmel Valley Village. The new dam will be about 2,400 feet downstream of the existing Los Padres Dam and 24 river-miles upstream from the mouth of the Carmel River at Carmel Bay. The new reservoir would completely inundate the existing Los Padres Dam and Reservoir **(Figure 1)**.

B. Summary of Overall Project

The 24,000 acre-foot dam will be 270-feet high constructed of roller-compacted concrete (RCC), and measure approximately 1,600 feet along its crest. The spillway crest would be at an elevation of 1,130 feet.

A multi-level intake structure will be built at the upstream face of the dam for water release to the river below. Permanent access roads will be constructed for the project. During construction, a cofferdam will be built upstream of the dam, and the river will be diverted through the damsite via a conduit.

Clearing and grubbing of the reservoir inundation area will also occur. Other project features associated with the construction and operation of the dam and reservoir include quarry sites, fish passage facilities for upstream and downstream migrants, staging areas, and storage facilities.

C. Existing Conditions in the Project Area

The New Los Padres Reservoir alternatives are proposed to be built within the upper section of the Carmel River Drainage Basin. This section is defined here as the upper 21 miles of the Carmel River, and located upstream of the Camp Steffani area (River Mile 15.4).

The principal vegetation types found in the vicinity of the New Los Padres Reservoir include: (1) Riparian, (2) Mixed Hardwood Forest [Broadleafed Upland Forest], (3) Foothill Woodland [Oak Woodland], (4) Grassland, and (5) Brushland. A detailed description of the various vegetation types is presented in Chapter 9 of the Supplemental Draft EIR/EIS (1991).

In the reservoir inundation area, the riparian vegetation community type is limited to the canyon bottoms that are filled with recently deposited gravel and sand between 6 and 15 feet deep, and are found immediately adjacent to the canyon slopes. Along the river, the riparian vegetation averages 100 to 150 feet wide. The vegetation structure is highly variable, ranging from typical forest communities with tree overstory and a brush and herbaceous understory, to woodland or scrub communities of open stands of scattered trees with little understory, to dry washes with little or no vegetation cover.

A dominant riparian forest community is a mixture of the riparian vegetation type and the adjacent mixed hardwood forest, known as the "Central Coast Cottonwood-Sycamore Riparian Forest". The riparian components of this community type are sycamores (Platanus recemosa), cottonwoods (Populus trichocharpa), white alders (Alnus rhombifolia), and red willows (Salix laevigata). The mixed hardwood forest types consist of live oak (Quercus agrifolia, California bay (Umbellularia californica), and California buckeye (Aesculus californicus). The brush understory is typically composed of poison oak (Toxicodendron diversilobum), coffeeberry Rhamnus californica), wild current (Ribes spp.), and stinging nettle (Urtica holosericea).

In some areas the riparian forest community is dominated by white alders, located along those areas of the river where the water flow is rapid and the channel bed is composed of very coarse material. In the drier outer flood plains along the waterways, the coast live oak dominates. In sandy and gravely deposits, the arroyo willow

(Salix lasiolepis) dominates as a low, dense, closed canopy forest.

In an attempt to describe the ecological attributes (wildlife functions and values) of the project area, the site was evaluated using Species Diversity Index (SDI) of avian species. In addition, a small mammal live-trapping survey and direct observations of large mammals were conducted. The results of these studies are described in further detail in Chapter 9 of the Supplemental Draft EIR/EIS-II (1992).

D. Impacts of Project on Existing Riparian Habitats

The construction of a 24,000 AF New Los Padres Dam and Reservoir will eliminate approximately 39 acres of riparian habitat, a habitat type the USFWS has identified as a resource Category 2. This is considered to be a significant adverse impact. Project construction would result in the loss of riparian habitat by inundation, by activities such as quarrying, road building and by the construction of new operations facilities.

Federal and state law prescribes that when a development action (project) causes adverse change to a habitat, such as inundation by a reservoir, the applicant must consider ways to avoid, minimize, or compensate for the loss of unavoidable environmental resources. The purpose of this Riparian Mitigation Plan is to compensate for the loss of riparian habitat values and functions that would result from the new reservoir.

IV. GOALS OF THE MITIGATION PLAN

A. Goals of the Mitigation Plan

The goals of this Riparian Habitat Mitigation Plan are to:

1. Mitigate the loss of 39 acres of riparian habitat by revegetation of degraded riparian habitats at the Garland Ranch Park and the adjacent East Pasture mitigation sites, such that no net loss of habitat values and functions would occur.

2. Establish riparian habitat values and functions to compensate for those that are presently found in the project area.

3. Return the mitigation sites to a stable ecosystem which would require minimum or no human input once vegetation has been established.

B. Methods for Achieving Goals of the Mitigation Plan

The methods for achieving the goals of this Riparian Habitat Mitigation Plan are as follows:

1. Revegetation of the mitigation sites by using the dominant canopy cover and the associated understory species of the riparian vegetation community type presently found in the project area.

2. Although the understory vegetation and the less dominant plant species in this riparian community type are expected to gradually invade the mitigation area through natural colonization, revegetation of the understory will be undertaken to hasten its recovery and establishment.

3. Widen the riparian corridor by relocating existing trails away from the active channel in order to minimize impacts associated with Park use.

4. Preservation of the established riparian plants found at the mitigation sites in their present condition, and the removal of invasive, non-native vegetation.

5. Restriction of public access to the restoration areas and the installation of interpretive signs to educate park users about riparian ecosystem.

V. Habitat Evaluation Procedure

The Habitat Evaluation Procedure (HEP) is a method to quantify the impacts of proposed projects on existing habitats and to determine the amount of mitigation acreage necessary. The HEP may be completed at various levels of complexity ranging from simple, using an index of habitat suitability for all wildlife, to moderately complex, using wildlife "word models" and evaluation species, to highly complex, using mathematical models. For the purposes of the 1991 Supplemental Draft EIR/EIS, given the large number of alternatives, the MPWMD and resource agencies agreed to follow the simplest form of HEP, otherwise known as a Habitat Assessment (HA), as described in Appendix 9-E of the Supplemental Draft EIR/EIS.

The HA requires the selection of a team to make decisions regarding approach, assumptions, and Habitat Suitability Index (HSI) values used. The team was composed of professional biologists representing the USFWS, CDFG, EPA, and EIP Associates (EIP, the MPWMD consultant). The study group assigned HSI values to each section of riparian habitat within alternative project areas and to existing conditions at proposed mitigation sites. Future habitat values after revegetation at the mitigation sites were also estimated. The single HSI value estimates the habitat value of a given area of vegetation for all wildlife that typically uses that cover type (EIP, 1988). For the purposes of the HA, all of the various riparian plant communities previously described were combined into a generic cover type, i.e. "riparian vegetation." Field work for the HA at proposed project sites was completed in August 1988, except for the Canada alternative which was evaluated in June 1990. The proposed mitigation sites were evaluated by the team in July 1989. The Habitat Units (HU) are obtained by multiplying the HSI value by the number of acres.

Following the selection of a preferred alternative, the MPWMD intends to complete a more detailed HEP or other comparable habitat evaluation method on that specific project. It is possible that some of the details or acreage that follow would change due to that work. In addition, the inundated acreage of riparian vegetation shown in Table 2 for each project only considers habitat within the inundation area of the reservoir, while other project activities such as quarrying and road construction may also cause the loss of additional riparian habitat. The detailed HEP prepared on the selected alternative will address this issue and modify the acreage as necessary.

Initially, the MPWMD chose 16 locations covering 156 acres as potential mitigation sites. These sites primarily consisted of degraded or unvegetated locations adjacent to the Carmel River on recent (1911) flood terraces generally no more than 10-15 feet above the low water level. Since similar undisturbed areas support healthy riparian forests, it appeared reasonable that these types of sites could serve as successful mitigation sites. All of these sites were visited and existing habitat values estimated by the HA team. Following the site visit, calculations were made to determine the Average Annual Habitat Units (AAHU) that can be expected at each site. Target Years (TY) of 5, 10, 25, and 100 were used in the analysis. The maximum HSI value that a mitigation site could achieve over the project life was assumed to be 0.7. Furthermore, it was assumed that one-half of the 0.7 HSI value would be obtained in the first five years, that by TY10 the value of the sites would increase by an additional one quarter of the difference between the existing value and the maximum of 0.7, and that by TY25 the maximum HSI value would be achieved and would continue through TY100 (EIP, 1989).

After comparing the total AAHU (AAHU times acreage) at each site with the habitat units lost for each alternative, it became clear that New Los Padres alternative could be completely mitigated using only land that was within the Garland Ranch Regional Park.

VI. PROPOSED MITIGATION SITES

A. Location of the Mitigation Sites

The Garland Ranch Park and the East Pasture mitigation sites are located on the south bank of the Carmel River in Carmel Valley. They are situated approximately 8 miles southeast of the City of Monterey, and 2 miles northwest of Carmel Valley Village. The site is 14 miles downstream of the existing Los Padres Dam and 10 river-miles upstream from the mouth of the Carmel River at Carmel Bay. Garland Ranch Park consists of 64 acres and the East Pasture site is about 16 acres in size. These two mitigation sites and other surrounding parklands form one of the major areas of open space within the Carmel River floodplain (**Figure 2**).

B. Ownership Status

The Garland Ranch Park and East Pasture mitigation sites are publicly owned land administrated by the Monterey Peninsula Regional Park District (MPRPD). In 1989 the MPWMD began negotiating with the MPRPD to obtain an easement for sufficient land to mitigate for the impacts of the proposed project on riparian habitat. The Board of Directors of both the MPRPD and the MPWMD conceptually approved such an agreement in 1989. In May 1992 the MPRPD Board approved the major elements of this Riparian Habitat Mitigation Plan. Following a final approval, an easement agreement will be formally recorded between the two agencies which will allow the MPWMD to implement the mitigation plan.

C. Existing Conditions at the Mitigation Sites

The Garland Ranch Park and the East Pasture sites are part of the Carmel River floodplain that was formed by overbank flow and resultant deposition, and the lateral migration of the Carmel River channel. The latter is perhaps the most significant process that built the floodplain. The evidence for this can be found in the "meander scars" (or relict channels) on the floodplain, and the presence of an oxbow just north of the mitigation sites.

Examination of the floodplain reveals a few large relict stands of riparian forest. Black Cottonwoods (<u>Populus trichcarpa</u>) and willow plants (<u>Salix spp</u>.) are predominant on the immediate stream banks, whereas sycamores (<u>Platanus recemosa</u>) and a few coastal live oaks (<u>Quercus agrifolia</u>) are spread irregularly over the floodplain farther away from the river. a list of the plant species observed at the mitigation sites is provided in (**Table 1**)

The historical evidence suggests that the riparian forest in Carmel Valley had varied characteristics including trees of all sizes, from brush to large sycamores (Matthews, 1990). Most likely, the trees were scattered irregularly in groves. Presently, the mitigation sites can be described as a remnant of a once expansive riparian woodland. The numerous traces that remain, along with historical photographs and oral accounts by local residents, corroborate this observation.

In this reach of the Carmel River, the channel is characterized by a relatively wide braided channel, and a perennial flowing stream. The north bank of the river is bordered by Carmel Valley Road and some low density residential developments. The riverbanks have been subject to realignment, rip-rapping and other disturbances. Monitoring data on the depth-to-groundwater collected by MPWMD Water indicate that the water level remains between 10 and 15 feet below the surface.

Land clearing, grazing, and recent droughts have contributed to a substantial decline of the riparian vegetation, particularly in the last 25 years. These disturbances have caused the exposed ground to be occupied by opportunistic (introduced) annual grasses and forbs. The dominant groundcover is ripgut grass (Bromos diandrus) which extends in a thick mat throughout the mitigation sites.

In areas where the weedy annuals are not densely established, native groundcover species have colonized. Common native understory herbs found at the sites include clarika (Clarikia spp.) and lupine (Lupinus), which themselves are opportunistic, adopted to natural floodplain disturbances (flooding, erosion) and are able to move in and recolonize the habitats that become available. During a recent site visit in preparation of this plan, four herbaceous plants -- elegant buckwheat (Eriogonum elegans), slender woolly buckwheat (Eriogonum gracile), gilia (Gilia tensiflora) and (Lessingia germanorum) -- were found concentrated in one low laying, nearly exposed sand deposit area at the western end of Garland Ranch Park. Although these plants are not rare, they are uncommon. These plants are considered early successional species which become established following natural disturbance and rely on a certain amount of stability to maintain themselves. Gradually they would give way to the more aggressive, permanent species of the riparian community. Monterey pines (Pinus radiata) and eucalyptus (Eucalyptus spp.) are found bordering the river banks and the property boundary between Garland Ranch Park and the East Pasture sites. Most probably, they were planted by the former property owners for a wind break or to mark boundaries (**Figure 3**).

D. Present and Proposed Uses of the Mitigation Sites

The proposed Garland Ranch Park and East Pasture mitigation sites are publicly owned land administrated by the MPRPD. Several trails, maintenance roads, the administrative offices of the MPRPD, and two municipal water supply wells (Los Laurels # 5 & #

6) are located in the general vicinity of the Garland Ranch Park site. This area is heavily used by Park visitors for various recreational activities including hiking, fishing, horseback riding and picnicking. It should be noted that it is MPRPD's policy to limit foottraffic to established trails. While public access and park use patterns will remain unaltered as a result of this plan, access to the restoration area will be restricted and/or limited to low impact uses such as educational and guided tours.

The East Pasture site includes an old barn which is on a higher terrace, an old riding ring and a well. Public access to this site will be permanently restricted, as it is intended to provide a "buffer zone" between the Garland Ranch Park to the east and the Cooper Ranch to the west.

VII. REVEGETATION PLAN

A. Planting Design

Final design considerations will be made based upon a "Reference Riparian Forest"[1] (RRF) from which exotic and weedy species will be ignored in the floristic inventory. Since virtually all candidate RRF areas have suffered at least some relatively recent disturbance, only those plant species that represent the habitat type that is targeted for creating at the mitigation sites will be used.

The design will incorporate the naturally occurring conditions of the riparian forest floor where plant communities are concentrated in patches, with few individuals occurring as dominant plant species. To recreate the riparian community type that is found at the RRF, the planting design will be to install the plant species identified in association with each other in distinct planting basins. This clumped distribution is expected to facilitate the establishment of a mosaic of habitat types.

Portions of the existing trails at the mitigation sites would be relocated 75 to 100 feet from their present location to widen high value habitat areas, and to minimize impact associated with Park use (**Figure 4**).

Planting basins will be established by creating a microrelief of depressions and rises, with characteristic berms constructed around the edges. The dimensions of these planting basins will be based upon existing edaphic and topographic conditions. The

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[1]= A locally representative high quality riparian forest that would be selected to serve as a "model". The RRF would be used to recreate the kind of species composition, structure and distribution at the mitigation site.

shape of each planting will be irregular and sinuous, wherever possible.

Dominant overstory trees will be planted as individuals or in single species groves. Understory shrubs and groundcover species will be planted within and between open areas connecting the groves. Planting density will be no greater than 100 tree and shrubs per acre, and for herbaceous plant species it shall be no greater than 200 plants per acre.

The riparian habitat will be created in a longitudinal vegetation distribution across the floodplain. On the slopes and tops of the river banks immediately adjacent to the low flow channel, red and arroyo (Salix lasiolepsis) willows will be installed. On the floodplain terraces, where the available soil moisture is reduced away from the river banks as the distance to the ground water increases, sycamores will be installed. Black cottonwood will occupy the transition areas between willows and sycamores. This arrangement will result in vegetation distribution in the order of the ability of the root systems to reach the ground water levels (**Figure 5**).

Although the topography and slope characteristics of the water supply project area will not be recreated at the mitigation sites, this riparian mitigation plan takes into account the ecological consideration that the size (width) of a plant community has a direct relation to its habitat value and function. While narrow strips of riparian vegetation that maximize the "edge effect" are very important for certain wildlife species, narrow riparian woodlands are unsuitable for species requiring larger area of forest to establish territories. In addition, it should be noted that the supply of large stands of riparian woodland in Carmel Valley is rapidly diminishing.

The following list provides the primary plant species that would be used for planting at the mitigation sites:

Plant Species Name

Trees

Acer negundo ssp. californicum
Alnus rhombifolia
Platanus recemosa
Populus trichcarp
Salix laevigata
S. lasiandra

Shrubs

Ribes spp.
Rhamnus californica

Rosa californica
Rubus vitigolius
S. lasiolepis
S. hindsiana
Sambucus mexicana (orbiculata)

Herbaceous

Artemisia sp.
Epilobium sp.
Urtica holosericea
Eriogonum spp.
Carex spp.

B. Description of the Riparian Reference Forest (The Oxbow Site)

The Oxbow site (**Figure 6**) is selected as an RRF because of its high riparian habitat quality, its proximity to the mitigation sites and because it represents how riparian areas adapt to altered soil and water conditions. The site is a relict meander bend that has been cut off from the mainstem of the river by Carmel Valley Road, and now its floristic composition constitutes one of the most unique features of the Carmel River floodplain.

The riverine forest growing at this site has achieved a measure of stability, and is regenerating as fast as it is declining. This is more evident with the cottonwoods; where they lack in

imposing heights, their regeneration and persistence is evident and impressive.

The understory vegetation is more complex and diverse than what is typically found in younger riparian forests. Eight to ten co-dominant species, consisting of four species of buckwheat (Eriogonum gracile, E. viineum, E. parvifolium and Eriogonum sp.), snow berry (Symphoricarpos rivularis), western bracken fern (Peteridium aquilinum), and (Ribes spp.) goose berry plants flourish under the tall cottonwood and sycamore trees. Large meadows of perennial sedges and grasses occupy the open areas. The edges of the riparian forest are occupied by chaparral species, such as sedges (Carex spp.) coffeeberry (Rhamnus califronica), and sagebrush (Artemisia dracunculus).

The diversity and complexity of the riparian forest trees are also very high. Sycamore, buckeye (Aesculus californica), bay Umbellularia californica, coastal live oak, black cottonwood, red willow (Salix laevigata), and blue elder berry (Sambucus mexicana) trees make up the canopy. As a whole, the various vegetation communities found here are not distributed in discrete chunks, but in a mosaic of habitats dispersed in a random fashion throughout the site.

C. Plant Protection

During implementation of the mitigation project, and wherever possible, existing riparian vegetation within the mitigation area will be protected from potential injury by equipment and vehicle incursion. Native vegetation to be protected will include mature willows, cottonwoods, sycamores, oaks and bay trees that are found scattered across the Garland Park flood plain. No disturbance shall occur to within 25 feet of the canopy dripline of any tree designated for protection. Plant protection will include construction of temporary fencing and flagging. A qualified biologist or a revegetation specialist will mark native vegetation designated for protection.

D. Site Preparation

Prior to the installation of plant materials, soil samples will be collected from the mitigation area to evaluate the soil characteristics and soil conditions. Laboratory analysis of chemical and physical characteristics including pH values, electrical conductivity (EC) measurements, organic matter content and sediment texture will be conducted. Result of soil tests will be used to determine appropriate soil amendments or treatments necessary prior to planting.

To construct the planting basins and the irrigation system, and to install plants, a combination of manual labor and a backhoe will be used. In areas where the soil is highly compacted, such as under relocated roads, the soil will be scarified to reduce compaction and promote water infiltration, seed germination and root penetration.

Non-native trees, primarily eucalyptus and Monterey pines will be removed consistent with the MPRPD Garland Park Management Plan. The duff layer beneath the eucalyptus tress will also be removed by scraping to within the top six inches of the soil surface.

E. Propagule Material Handling

Seeds, pole cuttings and nursery grown container-stock propagules will be used to establish riparian vegetation overstory, understory and groundcover. Propagule material will be collected from the general vicinity of the Carmel River Valley, to the extent possible, and will be augmented by other sources located within Monterey County.

Seed collection and propagation will be performed either by MPWMD or can be contracted to a local native plant nursery. It is expected that sufficient quantities of propagules will be collected from the Carmel Valley to satisfy the demand for this mitigation project. The biologist or revegetation specialist will determine the appropriate seeds designated for collection and the time of year to be collected.

Seed propagation and other container-stock plant materials shall be started at least 140 days prior to the start of the revegetation project, to allow for plant rooting and growth.

Nursery stock plant container can be any of the following kinds and sizes: dee pots (2.5" x 10" plastic tubes), tree bands (2" x 7" plastic container), tree pots (4" x 4" x 13" plastic containers) or 1-gallon pots.

F. Installation of Propagule Materials

Pole cuttings will be installed in augered holes, having at least 8 inches in diameter, typically with tillage no less than 65 percent of the distance to the average summer groundwater level, when known, or 6 feet deep, minimum. Augering can be replaced with trenching if site conditions warrant it. A tractor with a backhoe mount will be used to dig planting holes to the required depth and to backfill the holes once pole cuttings are installed.

Pole cuttings shall be no larger than 1.5 inches and no less than 0.5 inches in diameter. Cutting length can vary depending upon the depth of the augured holes. However, cutting sizes will be such that no less than 15 and no more than 24 inches shall protrude above the ground surface.

Nursery stock will be installed by: (1) clearing a 1 square yard area of weeds, rocks, and rubble, (2) excavating a planting hole large enough to receive the rootball of the plant, (3) placing the rootballs in the hole without bending or damaging the root system, with the rootcrown standing flush with the ground surface, (4) backfilling each planting hole with moist soil and pressing down to make good contact with the rootball, and (5) constructing a circular, 3-foot diameter, 4-inch high berm around each plant to create a basin for watering. All plants shall be watered immediately after installation and irrigation shall continue throughout the establishment period, generally considered to be three years. Irrigation after this period will be continued if monitoring results indicate that plant establishment at the mitigation sites is not progressing in satisfactory manner.

G. Installation of the Irrigation System

Prior to the installation of the plants, the major components of an automatic irrigation system will be installed, including a water source (a well, if necessary), an electric source, filter systems, PVC mainline and lateral pipes, and depth-to-groundwater monitoring wells.

The irrigation system will consist of buried PVC mainlines starting at about 3" diameter at the water source and decreasing with distance. The mainlines and the lateral lines will be underground. The aboveground components will be polyethylene (PE) tubes feeding the drip emitters to individual plantings. The flow rate of the emitters will be adjustable to take advantage of the individual irrigation needs of each species. Efforts will be made to minimize the visual impacts of the aboveground tubes, and the irrigation system shall be dismantled and removed from the mitigation site when monitoring results indicate that the plant establishment is progressing in a satisfactory manner.

Newly installed plants shall be irrigated throughout the summer months. Once the first rain of the year arrives in the winter, the plants need not be irrigated.

VIII. PERFORMANCE STANDARDS

Performance standards describe the minimum threshold of acceptable vegetation recovery at the mitigation sites. A well-defined performance standard provides a success criterion that will establish the degree to which the goals of the mitigation plan will be satisfactorily met. Performance standards will be based on initial measurements to be taken from the RRF site, thereby establishing "target" habitat conditions. These target habitat conditions, with examples of the community types, different types of ranges, the varying conditions under which they may exist, the specific stands of vegetation and the wildlife habitats they support will be adequately documented. Based on this information, the performance standard for the mitigation project will be established for the final mitigation plan.

In general, the performance standards will be attained when the mitigation project site contains:

1. An approved composition of canopy and understory species typical of the RRF, and is represented by self-sustaining populations.

2. An approved tree abundance in terms of density and spatial distribution throughout the project site.

3. Well established trees, that is, trees that have been rooted at the mitigation sites long enough to survive the normal gamut of extremes in the environment.

This mitigation plan would attain the following standards:

1. A mean density of 50 trees per acre will be growing at the project site primarily consisting of sycamores, cottonwoods and willows. These trees will at least be 12 feet tall and which have been established on the site at least 36 months.

2. At least 50 trees per acre, regardless of height and duration of establishment, grow on every acre within the project site.

3. Each of the three key species mentioned (# 1) above shall be present at a minimum density of 25 trees per acre.

4. All of the selected shrubs and herbaceous plant species will be growing at the project site for at least 36 months, and shall include at least 25 percent of the preferred undercover species of the RRF.

5. Invasive, non-native species will cover less than 10 percent of the project area.

IX. MONITORING PROGRAM

The monitoring program objectives are as follows: (1) address the mitigation requirements as set forth by the Monterey Peninsula Water Supply Project EIR/EIS and ensure compliance with its requirements, (2) ensure the establishment of suitable wildlife habitat at the mitigation area, (3) evaluate the degree of success attained in reaching the performance standards outlined below, and identify required remedial actions to be taken, if necessary, and (4) use the information gained from the monitoring program to develop design criteria that could be used in planning future mitigation and restoration plans. All monitoring activities shall be performed by a qualified biologist or a riparian specialist.

This monitoring program calls for the coordinated quantitative and qualitative assessment of soil attributes, vegetation establishment and recovery, wildlife (avifauna), groundwater characteristics and recreation use on the newly restored riparian habitat of the mitigation sites. The results of monitoring these resources shall be used to prepare a detailed description of the types of habitats and wildlife values that will be created. The monitoring program shall be in place for five years after the completion of the revegetation project. The project monitoring period assumes normal progress towards meeting the performance standards described above. This period will be extended if warranted, based on the periodic progress evaluations.

The overall approach of the monitoring program will be to quantify vegetation establishment and wildlife populations on sampling grids to be located on selected areas at the mitigation site. These grids will serve as the permanent stations for collecting all data throughout the life of the monitoring program.

A. Vegetation Monitoring

Vegetation monitoring shall be conducted using a permanent quadrat method. Data will be collected on species composition and structure, height, basal areas (indicative of dominance and relative importance of species), areal spread of crowns (foliage volume), percent cover, rates of self-colonization (regeneration) and mortality rates.

Each vegetation type will be stratified and each stratum will be sampled separately with an appropriate size plot (quadrat). The smaller plots, used to sample groundcover, shall be "nested" within the larger size plots used to sample trees and shrubs. Trees can be satisfactorily sampled in 10 x 10 meter size plots, shrubs 4 x 4 meter size plots, and groundcover herbs in 1 x 1 meter plots. By separating the data into distinct size classes, various strata levels can be distinguished. Species:Area curves will be constructed to determine the number of quadrats in each grid. Distribution of quadrats in each grid shall be spaced evenly and as widely as possible along a transect line. Transect lines will be placed in regular intervals across the greatest extent of the monitoring grids.

Standard surveying equipment shall be used to establish the permanent sampling grids, quadrats and transects. Permanent markings of the sampling areas will be made by driving metal pipes into the ground, leaving a few inches protruding and by spray-painting the extended piece with colored paint.

Vegetation maps will be prepared for each sample grid and species composition and structure, height, basal areas, areal spread of crowns (foliage volume), percent cover, rates of self-colonization (regeneration) and mortality rates will be recorded.

The data obtained will be compared to reference monitoring grids established in the RRF, and will serve as standards of comparison and to asses whether the mitigation sites have been successfully restored. The reference monitoring grids will be located in naturally revegetated areas of the RRF with similar vegetation. It is assumed that the RRF will be representative of the geology, soil, slope, elevation, precipitation and community types as those that will be established at the mitigation area. It should be noted that the RRF is located within 1000 feet of the mitigation site.

Quantitative characteristics, obtained by the permanent quadrat method, indicating number of individuals, their sizes and the space they occupy will be analyzed. Plant species lists and descriptive statistics for each vegetation type will be presented in annual reports. A schedule of monitoring activities is provided below under Part XI.

B. Wildlife Monitoring

Wildlife use of the mitigation site will be monitored to determine and document the value of the restored area to wildlife populations. The primary objective of the wildlife monitoring program will be to relate bird use to habitat availability on and adjacent to the mitigation site. Data will be collected only on bird populations because they represent the most numerous and most visible wildlife found in the Carmel River Valley. Observations of amphibians, reptiles, insects and mammals will be recorded if encountered during monitoring visits. Samples will be collected in December to characterize winter populations; spring sampling will be conducted in April, May and June to document use by breeding species, late winter residents and spring migrants. Direct count of birds on each monitoring grid (see vegetation monitoring) will be recorded using the method described below.

Bird counts will be conducted within 2-3 hours of sunrise. To minimize the effect of disturbance by the observer, the observer shall move quietly and remain out of view of the birds, whenever possible. The observer shall move systematically through the entire grid such that every part shall receive equal coverage. When a bird or flock of birds are encountered, the species, number of individuals, location, habitat use and activity are recorded. Maps illustrating the location of vegetation types and grid cells will be used to identify the location and vegetation type being used. A schedule of monitoring activities is provided below under Part XI.

C. Soil Attributes Monitoring

Soil characteristics, including salinity levels, pH values, organic matter content and soil structure will be analyzed by laboratory method. Soil samples will be gathered from permanent monitoring stations that will be established in each monitoring grid.

To obtain information on environmental conditions that can be correlated to the newly installed vegetation, data on several parameters, including elevation, aspect, slope, topography, soil moisture status, depth to water table and distance to the surface water (Carmel River channel) will be recorded.

The results of this soil monitoring data will be used to assess the management of the mitigation area and to document the changes in the physical and chemical character of the soil throughout the life of the monitoring period. A schedule of monitoring activities is provided below under Part XI.

D. Groundwater Monitoring

The success of the establishment of riparian habitat at the mitigation site is dependent upon the physical and chemical characteristic of the groundwater. Groundwater monitoring wells (piezometers) will be installed within the monitoring grids and periodic data will be collected and analyzed.

Data will be collected on depth to groundwater underlaying the mitigation area and seasonal groundwater fluctuations. The information gained from this groundwater monitoring shall be used to assess the management needs of the mitigation area. A schedule of monitoring activities is provided below under Part XI.

E. Recreation Use Monitoring

Recreational use on and around the mitigation area will be monitored to determine types of use, number of users, duration of use and effects of use on the mitigation area and its resources. Special attention shall be given to evidence that human use had affected the newly created habitats. Qualitative data will be collected during any project related site visits. The following recreation activities will be recorded systematically: (1) hiking, (2) picnicking, (3) wildlife observation and (4) other activity. A schedule of monitoring activities is provided below under Part X.

F. Photo Monitoring

The objective of this monitoring task is to use photographs (1) for permanent record keeping and to aid in the selection of sample sites, (2) to monitor change in the shape of the mitigation area and (3) to document changes in the habitat development, types and distribution. Existing areal photographs taken before and after the implementation of the restoration project will be assessed. Periodically, ground level photography and slides will be taken from permanent photo points and fixed compass orientation at approximately 5.5 feet above ground level. A schedule of monitoring activities is provided below under Part X.

G. Monitoring Reports

Annual monitoring reports will be prepared by MPWMD for subsequent submittal to resource agencies. These reports will contain the monitoring results, present summary of data analysis findings, make recommendations for remedial actions to be taken and will evaluate the results with respect to meeting the performance standards.

A final monitoring report will be prepared at the end of the five-year monitoring period. It will include a summary of all the previous years' monitoring results, a detailed analytical treatment of the available data, an assessment of the monitoring program, and will make conclusions and recommendations.

X. MAINTENANCE PLAN

Maintenance is essential to ensure the establishment of newly installed plants and the continued stability and integrity of the mitigation sites. Maintenance tasks described here are related to the Performance Standards and the Monitoring Program discussed elsewhere in this plan.

The purpose of the Maintenance Plan will be to identify problems needing remedial actions (e.g. replanting, erosion protection, and invasive plants removal). It is possible that some maintenance tasks will be conducted simultaneously with monitoring activities, to the degree possible.

The following activities will be performed during each maintenance visits:

1. Conduct routine maintenance and repair of the irrigation system to insure its proper operations.

2. Remove trash and debris that may hinder vegetation establishment and growth.

3. Remove non-native weedy vegetation that will reduce the quality of the mitigation site.

4. Replant trees, shrubs and herbaceous plants to replace those that do not survive. Determine the reason for the loss, if possible, and remedy the problem.

5. Prepare reports to document results and findings of the maintenance program and to evaluate the progress towards the mitigation goals.

6. A schedule of photo monitoring activities is provided below under Part XI.

XI. PRELIMINARY IMPLEMENTATION SCHEDULE

A detailed implementation plan will be developed for the final mitigation plan. Implementation of the revegetation project shall begin at least 12 months following issuance of project permit and/or approval of the bond election to fund construction of the project. A general guideline for developing an implementation final schedule is provided below:

* Final plans and specifications	Spring
* Site preparations	September to October
* Revegetation	November to January
* Vegetation monitoring	
(first 5 years)	Summer, Spring & Fall
(every 5 years for 25 years)	Spring & Fall
* Wildlife monitoring	

(first 5 years)	Spring & Winter
(every 5 years for 25 years)	Spring & Winter

* Soil Attributes Monitoring

(first 5 years)	Summer
(every 5 years for 25 years)	Summer

* Ground Water Monitoring

(depth-to-groundwater)	
(first 5 years)	Monthly
(every 5 years for 25 years)	Summer
(chemical characteristics)	
(first 5 years)	Summer
(every 5 years for 25 years)	Summer

* Recreational Use Monitoring

(first 5 years)	Winter, Spring, and Summer
(every 5 years for 25 years)	Winter, Spring and Summer

* Photo Monitoring

(first 5 years)	Winter, Spring, and Summer
(every 5 years for 25 years)	Winter, Spring and Summer

* Monitoring Reports

(first 5 years)	January
(every 5 years for 25 years)	January

* Maintenance

(first 5 years)	Spring, Summer & Winter
(every 2 years for 25 years)	Spring & Winter

* Monitoring Reports (every year for 5 years)	January

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TABLE 1

MPWMD RIPAIRAN MITIGATION PLAN
THE GARLAND RANCH PARK AND EAST PASTURE SITE
VEGETATION LIST

SCIENTIFIC NAME	COMMON NAME
Acer negundo	box elder
Aesculus californica	buckeye
Agoseris grandiflora	
+ Aira cahyophyllea	hair grass
Alnus rhombifolia	white alder
Amsinckia menziesii	
Amsinckia intermedia	fiddleneck
+ Anthriscus cancalis	
Artemisia californica	california sagebrush
Artemisia douglasiana	mugwort
Artemisia dracunculus	sagebrush
Ascflepias eriocarpa	
+ Avena barbata	
Baccharis pilularis	coyote bush
Baccharis viminea	mule fat
Bacchaxis douglasii	
Brickellia californica	
Bromus carinatus	california brome
+ Bromus diandrus	brome
+ Bromus mollis	brome
Calystegia pourpurata	
Camissonia micrantha	
+ Cammissonia contorta	contorted primrose
Cardiunema namosissima	sandmat
Carex nudata	sedge
Carex barbrae	sedge
+ Centaurea melitensis	star thistle
Cerastium visonsum	mouse-ear chickweed
+ Cerastium viseosum	
Chenopodium californicum	
+ Chenopodium ambrosioides	
Clarikia purpurea	clarika
Clematis sp.	clematis
+ Conium maculatum	poison-hemlock
Conyza cannadensis	
Cryptantha intermedia	common cryptantha
+ Cynodon dactylon	bermuda grass
Cyperus eragrostis	umbrella-sedge
+ Cytisus monspessulanus	french broom
+ Cytisus scoparius	broom
Dichelostemma capitata	
Diplacus aurantiacus	
Elymus condensatus	wild rye

SCIENTIFIC NAME	COMMON NAME
Elymus glaucus	rye grass
Elymus triticoides	wild rye
Encameria arborescens	golden fleece
Epilobium paniculatum	willow herb
Equisetum arvenae	horsetail
Equisteum laevigatum	
Ericameria ericoides	
Eriogonum elegans	elegant buckwheat
Eriogonum gracile	buckwheat
Eriophyllum confertiflorum	
+ Erodium cicutarium	redstem filaree
+ Erodium botrys	
Eschoscholzia californica	california poppy
+ Eucalyptus sp.	
+ Euphorbia peplus	spurge
+ Festuca megaluva	fescue
+ Festuca densonesis	six-weeks fescue
+ Festuca arundinacea	tall fescue
Festuca pacifica	pacific fescue
+ Filago gallica	narrow-leaved filago
+ Foeniculum vulgare	sweet fennel
Galium nuttallii	bedstraw
+ Geranium sp.	
Gilia tenuiflora	
Gnaphaluim beneolens	fragrant everlasting
Graphalium ramosissimum	cudweed
Graphalium chilense	cotton-batting plant
H. glabra	smooth cat's ear
Heteromeles arbutifolia	toyon
Holodiscus discolor	
+ Hordeum leporium	barley
Hypochaens radicata	hairy cat's ear
Juncus capitatus	
L. Bicolor	
+ Lactuca serriola	prickly lettuce
+ Laminum amplexicaule	henbit
Lathyrus vestitus	pacific pea
Layia hieracioides	
Lemna sp.	duckweed
Lessingia germanorum	
+ Limonium sp.	statice
+ Lolium multiflorum	italian rye
Lotus pushianus	spanish trefoil
Lotus scoparius	trifolium
Lupines arboreus	lupine
Lupinus bicolor	lupine

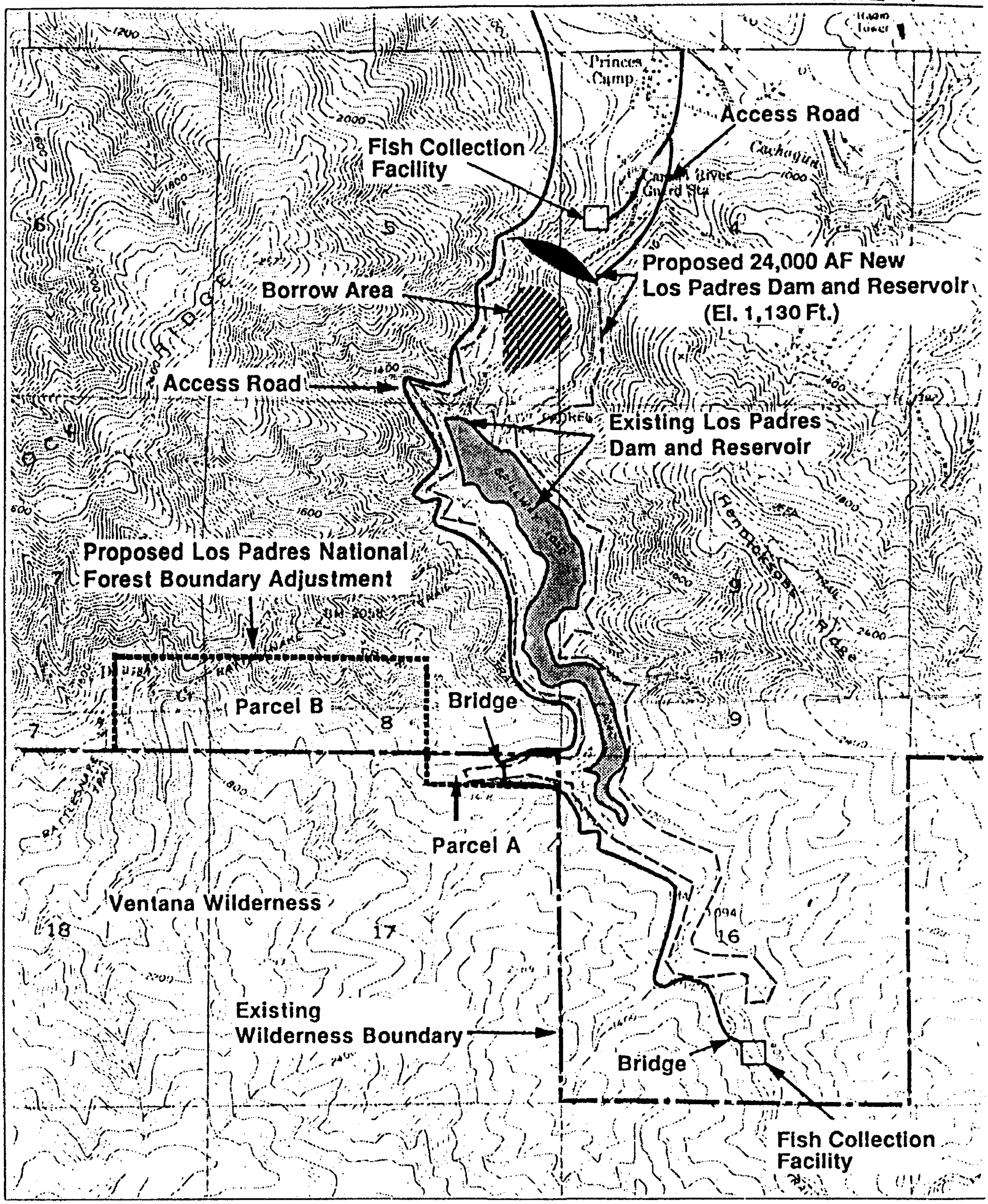
SCIENTIFIC NAME	COMMON NAME
Lupinus nanus	lupine
+ Madia sativa	tarweed
madia gracilis	
+ Marrubium vulagare	horehound
Matricaria matricarioides	pineapple weed
Matricaria matricariodes	pineapple weed
+ Medicago polymorpha	bur-clover
+ Melilotus indicus	yellow sweetclover
Melilotus albus	white sweet-clover
Mentha sp.	mint
Microsens lindleyi	
Montia perfoliata	miner's lettuce
+ Nasturtium plantago-aquatica	water-cress
Nasturtium officinale	watercress
Osmaronia cerasiformis	oso berry
+ Paspalum distichum	knot grass
+ Pennisetum clandestinum	kikoyo grass
Peteridium aquilinum	
Pholistoma auritium	fiesta flower
+ Pinus radiata	monterey pine
+ Plantago coronopus	plantain
+ Plantago major	common plantain
Platanus racemose	sycamore
+ Poa annua	annual bluegrass
+ Polygonum arenastrum	syartweed
+ Polypogon monspeliensis	rabbit's foot grass
Populus trichocarpa	black cottonwood
Quercus agrifolia	coastal live oak
+ R. acetosella	sheep sorrel
Rafinesquia californica	
Rhamnus californica	buckthorn
Ribes divaricantum	currant
Rosa californica	california rose
Rubus ursinus	pacific blackberry
+ Rumex conglomeratus	sorrel
+ Rumex crispus	sorrel
Salix laevigata	red willow
Salix lasiandra	yellow willow
Salix hindsianna	sandbar willow
+ Sambucus mexicana	blue elderberry
Satureja douughlasii	yerba buena
Senecio douglasii	shrubby butterweed
Siline gallica	
Silone gallica	
+ Silybum manianum	milk thistle
+ Sisymbrium officinale	hedge mustard

SCIENTIFIC NAME	COMMON NAME
+ Sisymbrium altissimum	
Solanum umbelliferum	nightshade
Solidago occidentalis	goldenrod
+ Sonchus oleraceus	sow thistle
+ Sonibrus asper	prockly sow-thistle
+ Spergulaia rubra	
Stachys bullata	hedge-nettle
+ Stellaria media	chickweed
Stylocline gnaphalioides	
Tillaea erecta	pygmyweed
Toxicodendron diversilobium	poison oak
+ Trifolium hirt????	rose clover
Trifolium unicrocephalum	
Trifolium ciliolatum	
Trifolium tridentatum	tomcat clover
Tritelica lutea	golden brodiaea
Typha sp.	cattail
Umbrellularia californica	california bay
Urtica holosericea	nettle
V. comosa	
V. benghalensis	
Veronica americana	brookline
Vicia sativa	common vetch
+ Vicia sativa	common vetch
Vicia binghalenzis	

/u/rm/lotus/veglst.ss (6/1/92.wp)

PROPOSED 24,000 AF NEW LOS PADRES DAM AND RESERVOIR

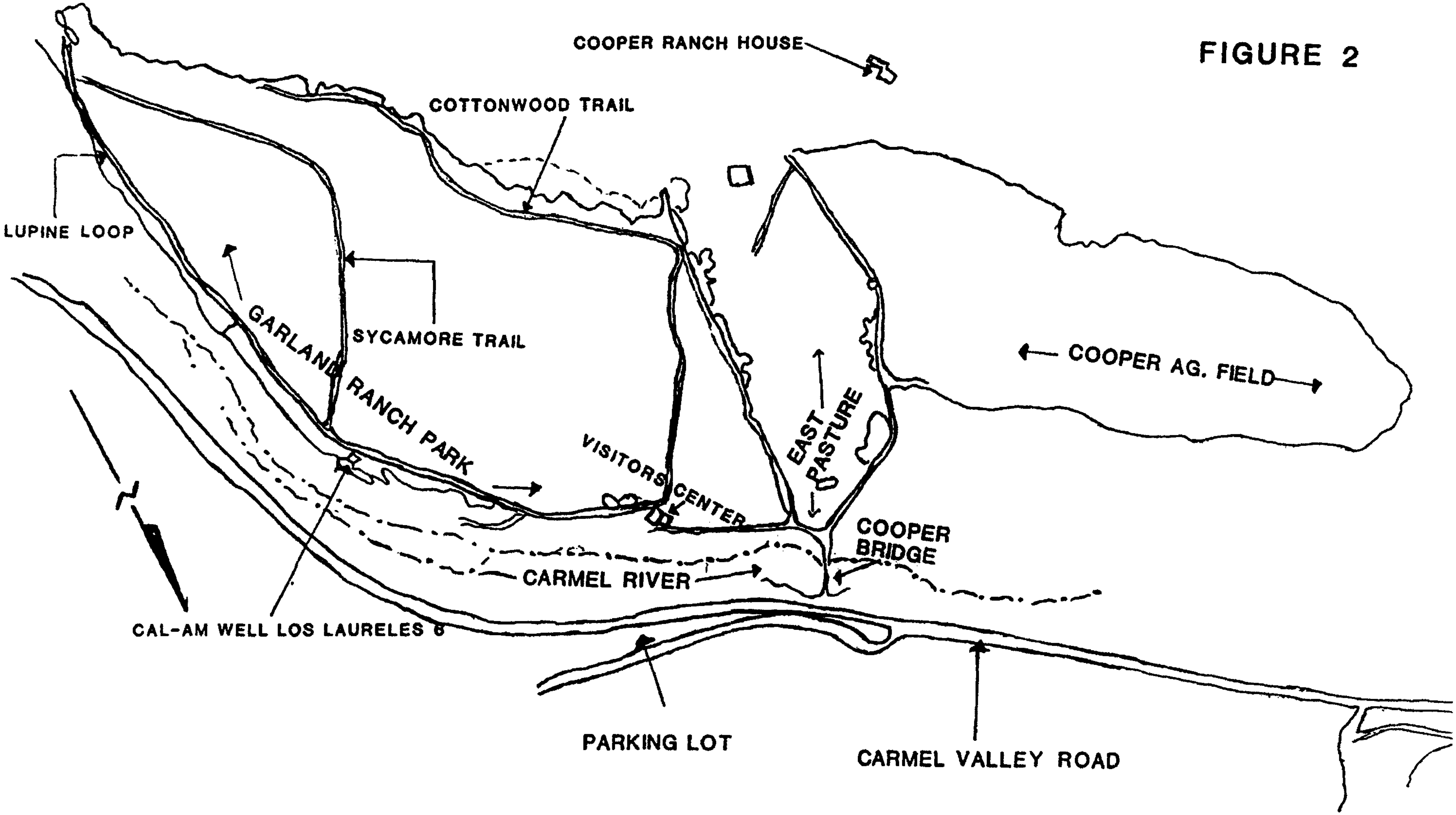
FIGURE 1



SOURCE: USGS QUAD MAP (CARMEL VALLEY, VENTANA CONES)

FEET 0 1000 2000 N

FIGURE 2



MPWMD RIPARIAN MITIGATION PLAN
LOCATION MAP

SCALE: 1"=500'

EXISTING CONDITIONS AT MITIGATION SITE - GARLAND RANCH REGIONAL PARK

SOURCE: MONTEREY PENINSULA REGIONAL PARK DISTRICT

MILES 0 4 8

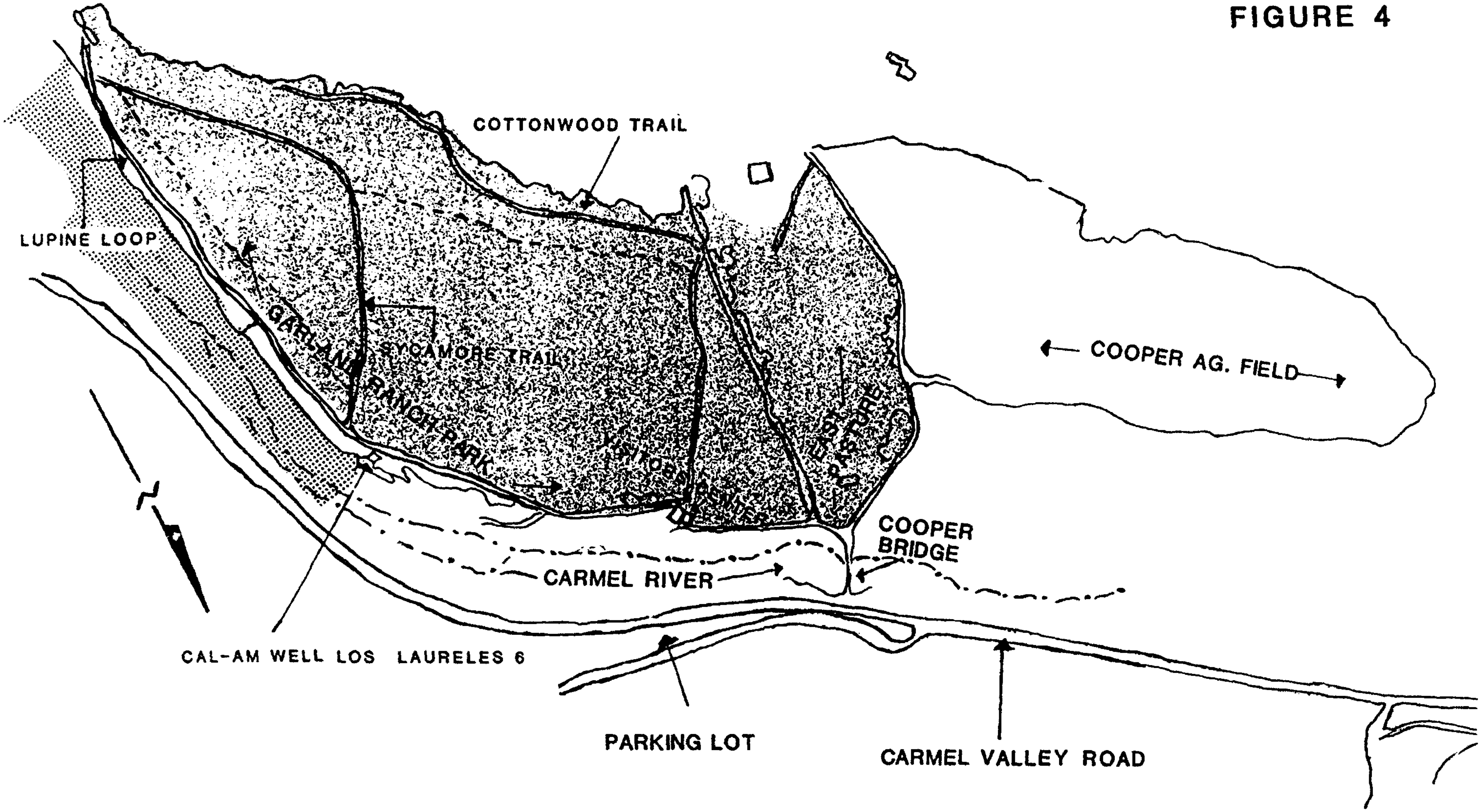
1 03

FIGURE 3

3Q3

eip 91417

FIGURE 4

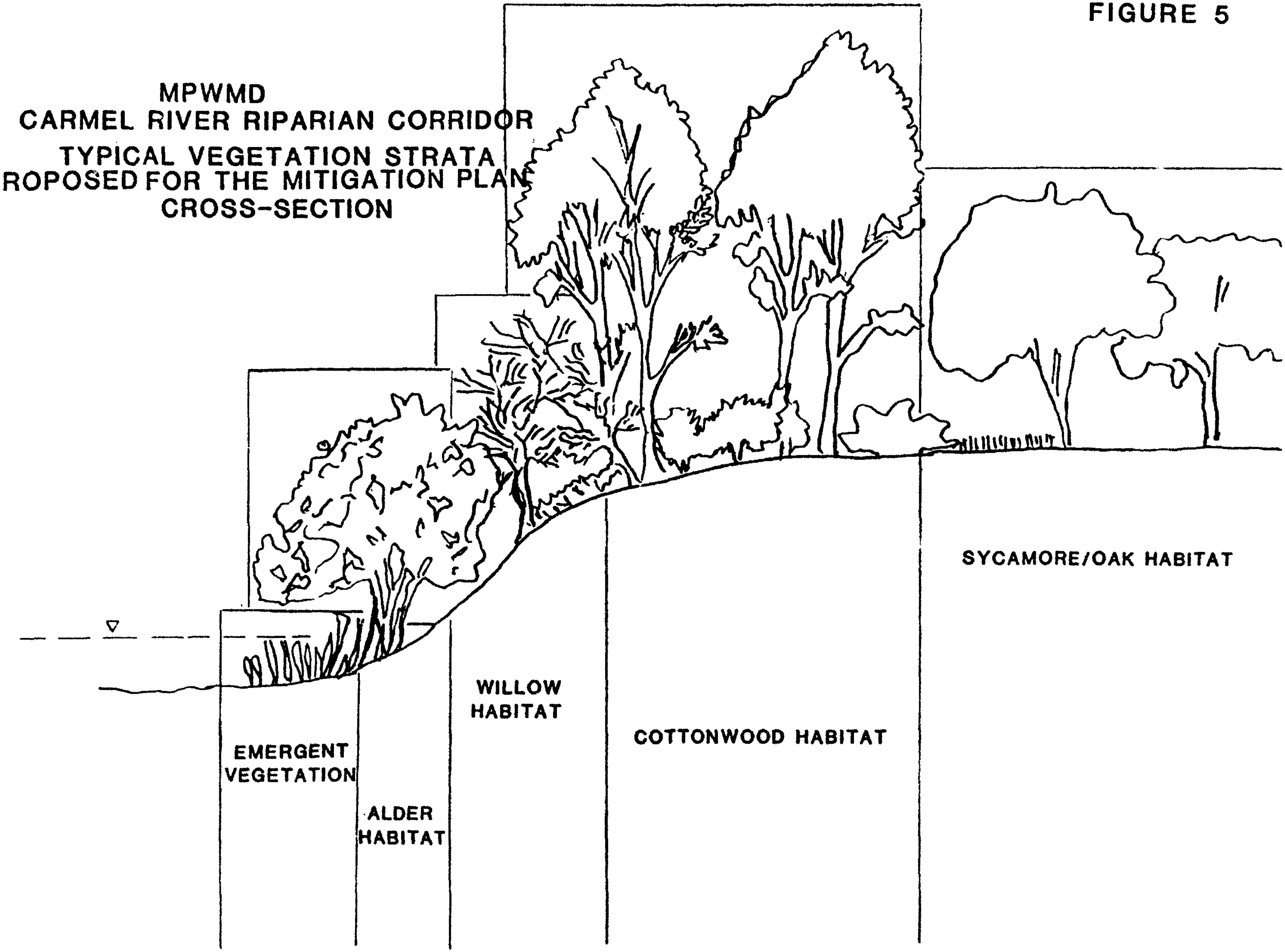


GENERAL MITIGATION CONCEPTS

SCALE: 1"=500'

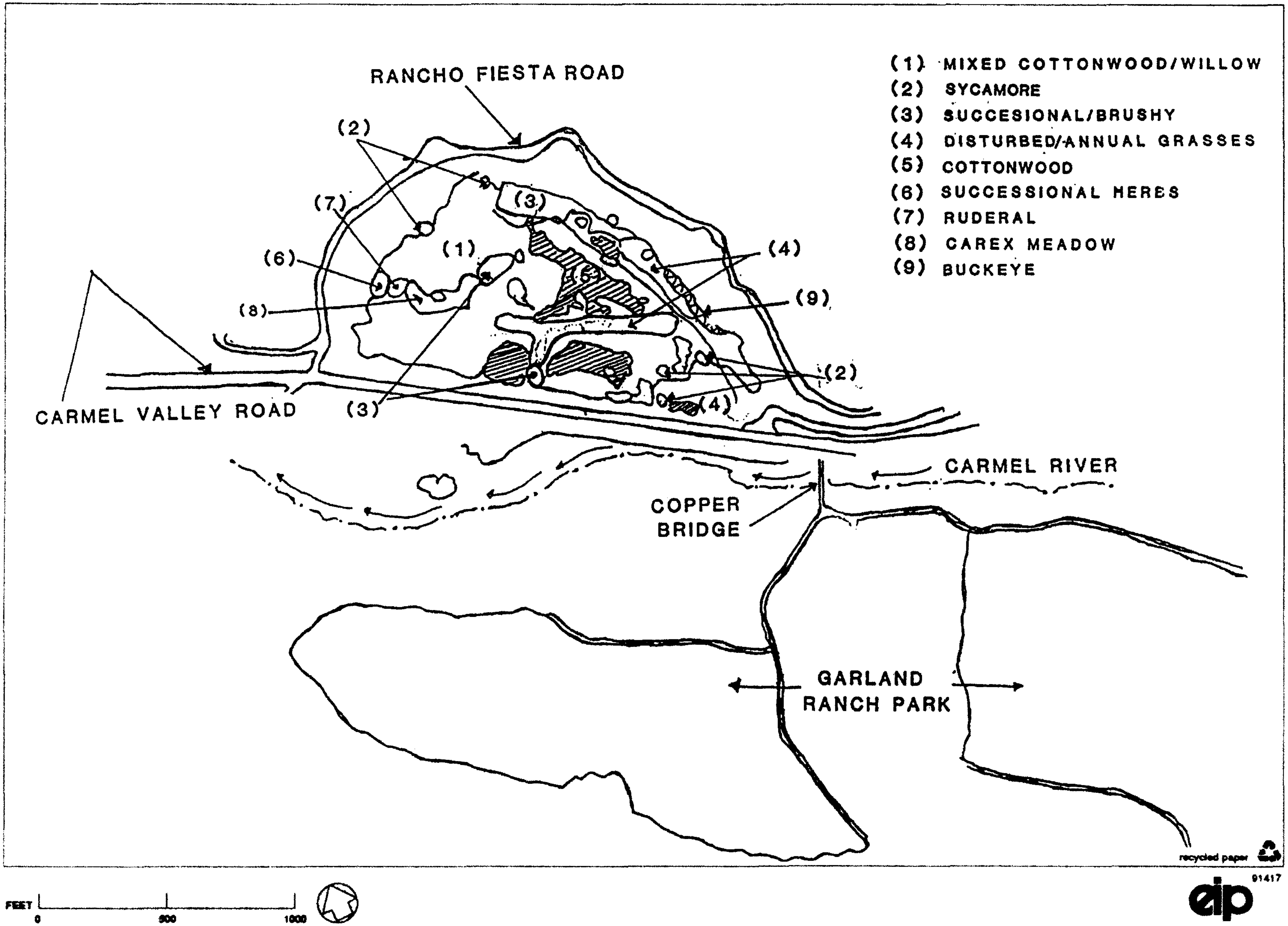
FIGURE 5

MPWMD
CARMEL RIVER RIPARIAN CORRIDOR
TYPICAL VEGETATION STRATA
PROPOSED FOR THE MITIGATION PLAN
CROSS-SECTION



VEGETATION MAP OF OXBOW SITE (RRF)

FIGURE 6



APPENDIX 9-I
PROJECTED RIPARIAN VEGETATION IMPACTS ALONG THE CARMEL RIVER UNDER FIVE WATER SUPPLY PROJECT ALTERNATIVES

PROJECTED RIPARIAN VEGETATION IMPACTS ALONG THE CAMEL RIVER UNDER FIVE WATER SUPPLY PROJECT ALTERNATIVES

I. INTRODUCTION

In this report a brief summary of the assumptions and methodology used to analyze the impacts of groundwater pumping on the riparian vegetation along the lower valley of the Carmel River is given. Results are described according to two "water-year-types" and five project alternatives.

A critical assumption of this evaluation was that the seasonal drawdown in the Carmel Valley aquifer due to groundwater pumping directly impacts the riparian vegetation in the general vicinity of the pumps. The method of analysis used to identify riparian impacts for the five alternatives was based on a model developed by Monterey Peninsula Water Management District (MPWMD) staff and Charles McNiesh, consultant to MPWMD. No detailed discussion of the procedure (or methodology) is presented here, as the main features of this model are described in other MPWMD documents. An outline of the methodology is presented in **Attachment A**.

For this analysis five project alternatives are considered including: (1) 24,000 acre-foot (AF) New Los Padres Dam (24NLP); (2) 24NLP plus a 3 million gallon-per-day (MGD) desalination plant (24NLP/3DSL); (3) 15,000 AF Canada Reservoir plus a 3 MGD desalination plant (15CAN/3DSL); (4) a stand-alone 7 MGD desalination plant (7DSL); and (5) the "No Project" alternative (NOPRJ). The analysis was based on the most recent Carmel Valley Simulation Model (CVISM) results. Comparison of the alternatives are discussed for two water-year-types: normal year and critically dry year. All alternatives except the No Project assumes a buildout demand of 22,750 AF/year of Cal-Am production. The No Project demand would be 17,360 AF/year.

II. DISCUSSIONS AND RESULTS

No significant impact is expected to occur during normal and critically dry years in subunit 1 and 2 under these five alternatives. Thus, the results of this analysis are described with respect to impacts in subunits 3 and 4, only.

Under normal conditions (or water year types) significant and severe drawdowns would occur under the NOPRJ alternative, and would affect approximately 116 acres of Carmel River riparian habitat (see **Table 1** and **Table 2**). Similarly, approximately 109 acres of riparian habitat will be impacted under the 7DSL alternative. No significant drawdown would be associated would be the 24NLP, 24NLP/3DSL and the 15CAN/3DSL alternatives.

During critically dry conditions, none of the alternatives would be able to meet the municipal water demands without significant effect upon the riparian vegetation in subunits 3 and 4. The 24NLP would significantly and/or severely impact approximately 119 acres; the 24NLP/3DSL approximately 116 acres; the 15CAN/3DSL 97 acres; and both the 7DSL and the NOPRJ would affect approximately 118 acres of riparian vegetation in subunits 3 and 4.

The 24NLP will reduce the severity of the impact in the drawdown category of 16 feet or greater under these conditions. As a result, the 24NLP provides the lesser impact to the riparian vegetation when compared to the other four alternatives.

III. CONCLUSIONS

The 24NLP, the 24NLP/3DSL and the 15CAN/3DSL alternatives are expected to provide beneficial impacts to the riparian habitat downstream of the proposed dam at least in 50% of water-years (or normal conditions), thus requiring no mitigation measures. During critically dry conditions, the riparian vegetation impacted can be irrigated under the current Five-Year Mitigation Program of MPWMD's Water Allocation Program EIR.

RIPARIAN VEGETATION IMPACT ANALYSIS
OUTLINE OF METHODOLOGY

Step 1. Execute CVSIM to simulate response of the water resource system to the water supply alternatives under consideration.

Step 2. Select the type of water year or years (e.q. "normal", "dry", or "worst case") that best fits the purpose and conditions of the analysis.

Step 3. Using CVSIM output, identify which of the four aquifer subunits (see Figure 1) would be subject to extended dry channel conditions under each water supply alternative. Only these subunits need be considered in the subsequent GADSIM analysis.

Step 4. Using CVSIM output, estimate the well pumping rates within the identified subunits under each water supply alternative.

Step 5. Using CVSIM output, estimate the dry channel duration within the identified subunits under each water supply alternative.

Step 6. Specify image well locations, observation points, and physical input parameters prior to executing GADSIM.

Step 7. Execute GADSIM to simulate groundwater drawdown due to well pumping.

Step 8. Using GADSIM output, quantify and compare impacts of the water supply alternatives.

/u/ambessaw/cvisim/eireis

TABLE 1

ACREAGES OF RIPARIAN HABITAT IMPACTED

CRITICALLY DRY CONDITION

drawdown catgories	15CAN/3DSL	24NLP	24NLP/3DSL	7DSL	NO PROJECT
< 4′	133.7	111.7	114.4	113	113
4′ - 8′	38.4	19.3	18.4	9.2	8.6
8′ - 12′	37.4	16.5	11.8	9.3	8.3
12′ - 16′	21.4	27.8	31.2	37.4	27.4
16′ - 20′	0	33.4	30.9	38.5	39.9
> 20′	0	22.2	24.2	23.5	33.7
Total Acres	230.9	230.9	230.9	230.9	230.9

NORMAL CONDITION

drawdown catgories	15CAN/3DSL	24NLP	24NLP/3DSL	7DSL	NO PROJECT
< 4′	230.9	230.9	230.9	121.5	114.7
4′ - 8′	0	0	0	17.6	14.4
8′ - 12′	0	0	0	30	13.1
12′ - 16′	0	0	0	47.2	32.1
16′ - 20′	0	0	0	14.6	31.9
> 20′	0	0	0	0	24.7
Total Acres	230.9	230.9	230.9	230.9	230.9

TABLE 2

AREA OF RIPARIAN AREA IMPACTED
UNDER TWO DRAWDOWN CATAGORIES

15CAN/3DSL

drawdown cat	Severe (>20')	Significant (4'-20')	Non-Significant (<4')
Wet	0	0	0
Normal	0	0	230.9
Critical	0	97.2	133.7
Worst Case	0	0	0

24NLP

drawdown cat	Severe (>20')	Significant (4'-20')	Non-Significant (<4')
Wet	0	0	0
Normal	0	0	230.9
Critical	22.2	97	111.7
Worst Case	0	0	0

24 NLP/3DSL

drawdown cat	Severe (>20')	Significant (4'-20')	Non-Significant (<4')
Wet	0	0	0
Normal	0	0	230.9
Critical	24.2	92.3	114.4
Worst Case	0	0	0

7DSL

drawdown cat	Severe (>20')	Significant (4'-20')	Non-Significant (<4')
Wet	0	0	0
Normal	0	109.4	121.5
Critical	23.5	94.4	113
Worst Case	0	0	0

NO PROJECT

drawdown cat	Severe (>20')	Significant (4'-20')	Non-Significant (<4')
Wet	0	0	0
Normal	24.7	91.5	114.7
Critical	33.7	84.2	113
Worst Case	0	0	0

APPENDIX 9-J
RESULTS OF RIPARIAN CORRIDOR WILDLIFE HABITAT MONITORING PROGRAM

TABLE 9J-1

SMALL MAMMAL LIVE TRAPPING RESULTS
IN SELECTED HABITATS WITHIN THE NEW LOS PADRES INUNDATION ZONE
AND CONSTRUCTION AREAS, MAY 29 - JUNE 6, 1992

Site/Habitat[1]	Total Trap-Nights[2]	Captures/100 Trap Nights	Total Captures by Species[3] (Percent Total Captures)					
			P.c.	*P.b.*	*P.m.*	*N.f.*	*R.m.*	*Per.c.*
A. Construction/Upland	120	13 (10.8)	4 (30.1)	6 (46.2)	1 (7.7)	1 (7.7)	1 (7.7)	(0)
B. Construction/Upland	120	21 (17.5	6 (28.6)	11 (52.4)	1 (4.8)	3 (14.3)	(0)	(0)
C. Inundation/Upland	120	13 (10.8)	(0)	2 (15.4)	6 (46.2)	2 (15.4)	1 (7.7)	2 (15.4)
D. Inundation/Upland	120	21 (17.5)	8 (38.1)	5 (23.8)	4 (19.1)	4 (19.1)	(0)	(0)
E. Inundation/Riparian	120	11 (9.2)	2 (18.2)	1 (9.1)	6 (54.5)	2 (18.2)	(0)	(0)

1 A. Oak Woodland/Savannah: Proposed Upland Mitigation Site.
B. Oak Woodland: Proposed Aggregate Storage Site.
C. Oak Woodland/Grassland/Coastal Scrub: Inundation Zone downstream of Los Padres Dam
D. Mixed Oak, Madrone, Eucalyptus Woodland/Grassland: Inundation Zone upstream of Los Padres Dam
E. Oak, Willow-Riparian Woodland/Wetland: Inundation Zone upstream of Los Padres Dam.

2 One trap set for one night = 1 trap night.

3 Key to Species Names:
P.c. = *Peromyscus californicus* - California Mouse
P.b. = *P. boylii* - Brush Mouse
P.m. = *P. maniculatus* - Deer Mouse
N.f. = *Neotoma fuscipes* - Dusky-footed Woodrat
R.m. = *Reithrodontomys megalotus* - Western Harvest Mouse
Per. c. = *Perognathus californicus* - California Pocket Mouse

TABLE 9J-2

SMALL MAMMAL LIVE TRAPPING RESULTS
IN SELECTED HABITATS ALONG THE LOWER CARMEL RIVER RIPARIAN CORRIDOR
SPRING SURVEY, APRIL 25 - MAY 1, 1992

Site/Habitat[1]	Total Trap-Nights[2]	Captures/100 Trap Nights	Total Captures by Species[3] (Percent Total Captures)						
			P.c.	*P.m.*	*N.f.*	*R.m.*	*M.c.*	*M.m.*	*S.t.*
2B. Garland Park/Upland	60	8 (13.3)	(0)	3 (37.5)	1 (12.5)	(0)	4 (50.0)	(0)	(0)
Garland Park/Riparian	60	7 (11.6)	3 (42.9)	4 (57.1)	(0)	(0)	(0)	(0)	(0)
3A. Robinson Canyon Rd/Upland	60	9 (15.0)	7 (77.8)	(0)	1 (11.1)	1 (11.1)	(0)	(0)	(0)
Robinson Canyon Rd/Riparian	60	9 (15.0)	(0)	5 (55.6)	(0)	(0)	2 (22.2)	2 (22.2)	(0)
4A. San Carlos Ranch Rd/Upland	60	6 (10.0)	(0)	(0)	6 (100.0)	(0)	(0)	(0)	(0)
San Carlos Ranch Rd/Riparian	60	9 (15.0)	8 (88.9)	(0)	(0)	(0)	(0)	(0)	1 (11.1)

1 2B. Upland: Mixed Cottonwood, Oak Woodland/Grassland above Flood Plain
Riparian: Dense Willow Riparian Thicket, Sandy River Bank
3A. Upland: Mixed Cottonwood, Oak Woodland/Grassland above Flood Plain
Riparian: Sparse Willow, Rocky River Bank
4A. Upland: Mixed Cottonwood, Oak Woodland above Flood Plain
Riparian: Dense Willow Riparian Thicket, Sandy River Bank

2 One trap set for one night = 1 trap night.

3 Key to Species Names:
P.c. = *Peromyscus californicus* - California Mouse
P.b. = *P. boylii* - Brush Mouse
N.f. = *Neotoma fuscipes* - Dusky-footed Woodrat
R.m. = *Reithrodontomys megalotus* - Western Harvest Mouse
M.c. = *Microtus californicus* - California Vole
M.m. = *Mus musculus* - House Mouse
S.t. = *Sorex trowbridgii* - Trowbridge's Shrew

TABLE 9J-3

SMALL MAMMAL LIVE TRAPPING RESULTS
IN SELECTED HABITATS ALONG THE LOWER CARMEL RIVER RIPARIAN CORRIDOR
SUMMER SURVEY, AUGUST 25 - 29, 1992

Site/Habitat[1]		Total Trap-Nights[2]	Captures/100 Trap Nights	Total Captures by Species[3] (Percent Total Captures) *P.c.*	*P.b.*	*P.m.*	*N.f.*	*M.c.*	*Per. c.*
2B.	Garland Park/Upland	60	11 (18.3)	4 (36.4)	(0)	4 (36.4)	2 (18.2)	(0) (0)	1 (9.1)
	Garland Park/Riparian	60	6 (10.0)	2 (33.3)	1 (16.7)	2 (33.3)	(0)	1 (16.7)	(0)
3A.	Robinson Canyon Rd/Upland	60	10 (16.7)	7 (70.0)	1 (10.0)	1 (0)	1 (10.0)	1 (10.0)	(0)
	Robinson Canyon Rd/Riparian	60	1 (1.6)	(0)	1 (100.0)	(0)	(0)	(0)	(0)
4A.	San Carlos Ranch Rd/Upland	60	7 (11.7)	4 (57.1)	1 (14.3)	(0)	1 (14.3)	1 (14.3)	(0)
	San Carlos Ranch Rd/Riparian	60	4 (6.7)	2 (50.0)	2 (50.0)	(0)	(0)	(0)	(0)

[1] 2B. Upland: Mixed Cottonwood, Oak Woodland/Grassland above Flood Plain
Riparian: Dense Willow Riparian Thicket, Sandy River Bank
3A. Upland: Mixed Cottonwood, Oak Woodland/Grassland above Flood Plain
Riparian: Sparse Willow, Rocky River Bank
4A. Upland: Mixed Cottonwood, Oak Woodland above Flood Plain
Riparian: Dense Willow Riparian Thicket, Sandy River Bank

[2] One trap set for one night = 1 trap night.

[3] Key to Species Names:
P.c. = *Peromyscus californicus* - California Mouse
P.b. = *P. boylii* - Brush Mouse
P.m. = *P. maniculatus* - Deer Mouse
2*N.f.* = *Neotoma fuscipes* - Dusky-footed Woodrat
M.c. = *Microtus californicus* - California Vole
Per. c. = *Perognathus californicus* - California Pocket Mouse

TABLE 9J-4

BIRD SPECIES ENCOUNTERED[1] DURING TIME CONSTRAINED SURVEYS[2] ON FIXED TRANSECTS AROUND THE PROPOSED NEW LOS PADRES RESERVOIR INUNDATION ZONE
May 28 through June 4, 1992

SPECIES	TRANSECTS[3] 1	2	3	4	5	6
American Bittern						2
Mallard			1			25
Turkey Vulture	7	1				
Sharp-Shinned Hawk	2					
Red-Tailed Hawk	5					
Red-Shouldered Hawk	3	7				
American Kestrel						3
Wild Turkey	16			4		
California Quail	3		1	5		
Mountain Quail						4
Mourning Dove	6	1		3	1	13
Band-tailed Pigeon	3			2	2	
Great Horned Owl		1				
Anna's Hummingbird	4	1		3	5	3
Allen's Hummingbird			2			
Belted Kingfisher			1		2	2
Northern Flicker	1		3	2	3	5
Acorn Woodpecker	14	1		2	14	5
Nuttall's Woodpecker	4			3		
Downy Woodpecker			3	4	1	2
Ash-throated Flycatcher	5			1	3	4
Black Phoebe	1		3			3
Western Flycatcher	6	7	6	2	12	2
White-throated Swift				2		
Violet-green Swallow	31	14		1	2	10
Tree Swallow	2	1				
Rough-winged Swallow						5
American Crow	9	6	8	11	2	
Scrub Jay	6	2	1	7	1	7
Steller's Jay	3	1	1	4	6	16

Table 9J-4 (Continued)

SPECIES	TRANSECTS[3] 1	2	3	4	5	6
Chestnut-backed Chickadee	4		2		5	1
Common Bushtit	11	7	2	2		1
Plain Titmouse	10	5		5	2	
White-breasted Nuthatch	8	2				
Wrentit		1		5	1	6
Starling	2					
Hutton's Vireo		3				
Warbling Vireo	1	19	6	5	13	7
Bewick's Wren		2			1	2
House Wren		4	8	2	4	8
California Thrasher						1
Western Bluebird	2	3				
Ruby-Crowned Kinglet		1			3	
Orange-crowned Warbler	9	12		7	3	8
Black-throated Gray Warbler		4	1	5	2	
Wilson's Warbler	7	1	1			
Red-Winged Blackbird						19
Black-Headed Grossbeak			1	2		5
Lesser Goldfinch	1	5		4	1	1
Rufous-Sided Towhee	4	9		3	4	7
Brown Towhee	1	4	2	1		1
Purple Finch	3	4		2	2	3
Dark-Eyed Junco	2		2	2		
Song Sparrow	2					7
Species Recorded	35	29	20	29	25	32
Total Number	198	129	55	101	95	188
Diversity Index[3]	3.01	2.97	2.54	2.69	2.86	3.11

[1] Total of all visual and auditory identifications.
[2] Four 15-minute transect stations per 2,000-foot census line X two repetitions of each transect = 120 minutes of census time per habitat type.
[3] 1 = Big Oak Flat: Upland Mitigation Area, Oak Savannah Habitat, 1725'.
2 = Aggregate Storage Site: Upland Construction Zone, Oak Woodland Habitat, 1200'.
3 = Carmel River: Lower Inundation Zone, Riparian Woodland Habitat, 1575'.
4 = Carmel River: Lower Inundation Zone, Mixed Oak Woodland, Grassland, Coastal Scrub Habitat, 975'.
5 = Los Padres Reservoir: Inundation Zone, Mixed Oak Woodland, Grassland Habitat, 975'.
6 = Carmel River: Upper Inundation Zone, Willow Riparian Habitat, 1200'.
[4] Species Diversity Index (SDI).

TABLE 9J-5

BIRD SPECIES ENCOUNTERED[1] DURING TIME CONSTRAINED SURVEYS[2] ON FIXED TRANSECTS ALONG SELECTED REACHES OF THE CARMEL RIVER
April 25-30, 1992

SPECIES	TRANSECTS[3]								
	2A	2B	2C	3A	3B	3C	4A	4B	4C
Great Blue Heron		1							1
Canada Goose	2		11				1		4
Mallard	15	10	27	12	14		7	5	8
Common Merganser	2								
Turkey Vulture	6	12	14	13	10	2	1	7	1
Sharp-Shinned Hawk									1
Red-Tailed Hawk	1	3		6	3	2	4	4	6
Red-Shouldered Hawk	5	1	2						2
American Kestrel	4		1	2					
California Quail	9	16	7	24	4	17	23	8	1
Gull sp.									6
Mourning Dove	7	8	28	30	19	19	24	32	36
Band-tailed Pigeon	19		1	3		2	2	5	24
Rock Dove				1	1			2	22
Killdeer			6	9	10	1		3	
Great Horned Owl		1							
Spotted Sandpiper				1					
Anna's Hummingbird	3	2	3	6	3	4	4	1	5
Allen's Hummingbird	2		1	2	2		5	1	4
Belted Kingfisher	3		1	4					
Northern Flicker	1	5	3	2	1	3	2	2	
Acorn Woodpecker	10	6	19	3	1	2	8	2	
Nuttall's Woodpecker	2	1	2	6				1	
Downy Woodpecker	1				1	1	7	2	
Western Kingbird				1					
Western Wood Peewee		3							
Ash-throated Flycatcher		1		6			1	1	
Empidonax Flycatcher							1		
Western Flycatcher	1	4	2	3	5	5	7	5	9
Olive-sided Flycatcher					1	4			

Table 9J-5 (Continued)

SPECIES	TRANSECTS[3] 2A	2B	2C	3A	3B	3C	4A	4B	4C
Black Phoebe			1			2			
White-throated Swift			13	3	6			2	
Barn Swallow		1	3	4			1	1	
Cliff Swallow			6	46	80	3	7	10	5
Violet-green Swallow	1		4		50	2		12	8
Tree Swallow			1		4	7	9	7	19
Rough-winged Swallow			3	4	8				
American Crow	13	23	1	2	3			5	38
Scrub Jay	25	13	17	20	9	20	11	10	12
Steller's Jay	9	13			2		3		
Chestnut-backed Chickadee	1	6			2	11	6	8	4
Common Bushtit	8	8	3	7	9	10	12	13	9
White-breasted Nuthatch							1		
Pigmy Nuthatch								1	
Wrentit		3	3	5	6	1	8	8	9
Starling	31	26	22	15	7	16	11	26	34
Warbling Vireo		1	1	1		7	4	3	1
Bewick's Wren		1			7	9	3	2	6
House Wren	1			2	1		1		1
Northern Mockingbird				1	1				
Cedar Waxwing		19	8		31	26	48	29	20
American Robin	4	4	15		8	10	3	1	3
Orange-crowned Warbler	3			3	4	4	10	5	
Yellow-Rumped Warbler								1	1
Black-throated Gray Warbler									1
Wilson's Warbler	3	4	3	1					8
House Sparrow								1	
Red-Winged Blackbird	7	20	19	2			2	4	6
Brewer's Blackbird		2	26	43	39	14	3	2	16
Brown-headed Cowbird			4		1		3	6	3
Northern Oriole		2	1	3	3				5
Hooded Oriole						1			1
Western Tanager						3		2	
Black-Headed Grossbeak	4	2			1	7	4		1
Lesser Goldfinch	1		5	1	3	2	4	5	1

Table 9J-5 (Continued)

SPECIES	TRANSECTS[3] 2A	2B	2C	3A	3B	3C	4A	4B	4C
Rufous-Sided Towhee	5	5	1	3	1	2	3	3	7
Brown Towhee	6	1	8	10	10	4	3	9	1
Purple Finch				1	3	1	3	5	1
House Finch	4	1	7	8	9	3	5	12	16
Dark-Eyed Junco						2			
Golden-Crowned Sparrow							1	2	
Song Sparrow	5	11	8	2	11	8	8	12	13
Species Recorded	36	36	41	42	42	37	42	46	44
Total Number	224	240	311	321	394	237	274	288	380
Diversity Index[4]	3.13	3.12	3.24	3.11	2.98	3.21	3.24	3.37	3.27

[1] Total of all visual and auditory identifications.

[2] Four 15-minute transect stations per 2,000-foot census line X two repetitions of each transect = 120 minutes of census time per habitat type.

[3] 2A = De Dampierre Park, west from eastern park boundary, 1750' along south bank.
2B = Garland Park, west from Carmel River bridge 1750' along south bank.
2C = Carmel Valley Ranch Golf Club, west from eastern property limits, 3300' along south bank.
3A = Robinson Canyon Road, east from barns area for 2000' along south bank.
3B = Schulte Road Bridge, west for 1375' along south bank.
3C = Valley Greens Drive Bridge, east for 2200' along south bank.
4A = San Carlos Ranch Road Bridge, west for 1250' along south bank.
4B = Riverwood, west for 2500' from eastern property boundary along north bank.
4C = U.S. Highway 101 Bridge, west for 2250' along south bank.

[4] Species Diversity Index (SDI).

TABLE 9J-6

BIRD SPECIES ENCOUNTERED[1] DURING TIME CONSTRAINED SURVEYS[2] ON FIXED TRANSECTS ALONG SELECTED REACHES OF THE CARMEL RIVER

August 25 - September 2, 1992

	TRANSECTS[3]								
SPECIES	2A	2B	2C	3A	3B	3C	4A	4B	4C
Great Blue Heron			1						
Green-backed Heron			6						
Canada Goose							11		
Mallard		15	2				4	1	
Turkey Vulture	8	7	4	6	5	2	2	1	4
Sharp-Shinned Hawk			1	2					
Red-Tailed Hawk	2	1		1				6	
Red-Shouldered Hawk	4	1	2	1					2
American Kestrel				1					
California Quail	4	7	1	36	7	54	30	14	
Western Gull							4		3
Mourning Dove	36	3	33	28	13	3	18	7	4
Band-tailed Pigeon	6			6	1				
Rock Dove		2		1	21	2		8	26
Killdeer			7	1	1	1		3	6
Anna's Hummingbird	5		3	3			3	2	5
Allen's Hummingbird							1		
Belted Kingfisher	2	1	1						
Northern Flicker		1	2	5	2	4	2	1	
Acorn Woodpecker	21	9	6	16		10	4	10	
Nuttall's Woodpecker	2			4		1			
Hairy Woodpecker			1	1	1				
Downy Woodpecker							2		1
Western Wood Peewee							3		1
Pacific Slope Flycatcher	1	1	1		1		1		

Table 9J-6 (Continued)

SPECIES	TRANSECTS[3]								
	2A	2B	2C	3A	3B	3C	4A	4B	4C
Black Phoebe	7	2	2	1	2	3	3	2	
Barn Swallow			6	4		4	5	1	
American Crow	16	17	2	17	16	32	2		16
Scrub Jay	32	8	23	12	21	30	19	17	11
Steller's Jay	27	16		6	3	4			
Chestnut-backed Chickadee	3	5	1	2	6	24	31	7	9
Common Bushtit	5	10	16		12	21	23	8	4
Wrentit	5	1	2	6	7	4	13	8	3
Starling	14	26	9	23	4	70	23	24	94
Warbling Vireo						1			
Bewick's Wren			2		2	8	1		3
Cedar Waxwing						35			
American Robin	1	4		1		17	2		
Orange-crowned Warbler			3	2	5	4	7	1	2
Yellow Warbler		1							1
Wilson's Warbler							1		1
Red-Winged Blackbird		6	4	14			5		
Brewer's Blackbird			12	30	48	17	59	12	54
Western Tanager	1					2			
Black-Headed Grossbeak						1			
Lesser Goldfinch	7		6	14	37		6		
Rufous-Sided Towhee	3								
Brown Towhee	3		5	12	7	13	3	12	1
House Finch	4	2			15	4	3	4	1
Dark-Eyed Junco	36	1		3		7	1		
Song Sparrow	1	3	6	1	7	4	5	1	3
Species Recorded	27	25	30	31	24	29	32	22	23
Total Number	256	150	170	260	244	382	297	150	255
Diversity Index[4]	2.76	2.75	2.87	2.89	2.67	2.74	2.83	2.72	2.13

[1] Total of all visual and auditory identifications.

[2] Four 15-minute transect stations per 2,000-foot census line X two repetitions of each transect = 120 minutes of census time per habitat type.

Table 9J-6 (Continued)

[3] 2A = De Dampierre Park, west from eastern park boundary, 1750' along south bank.
2B = Garland Park, west from Carmel River bridge 1750' along south bank.
2C = Carmel Valley Ranch Golf Club, west from eastern property limits, 3300' along south bank.
3A = Robinson Canyon Road, east from barns area for 2000' along south bank.
3B = Schulte Road Bridge, west for 1375' along south bank.
3C = Valley Greens Drive Bridge, east for 2200' along south bank.
4A = San Carlos Ranch Road Bridge, west for 1250' along south bank.
4B = Riverwood, west for 2500' from eastern property boundary along north bank.
4C = U.S. Highway 101 Bridge, west for 2250' along south bank.

[4] Species Diversity Index (SDI).

TABLE 9J-7

SEASONAL VARIATIONS IN THE NUMBERS AND DIVERSITY OF BIRD SPECIES UTILIZING LOWER CARMEL RIVER RIPARIAN CORRIDOR HABITATS.

	Species Recorded	Percent Change from Previous Season	Total Birds Recorded	Percent Change from Previous Season	Species Diversity Index (SDI)	Percent Change from Previous Season
Winter (Dec-Jan)						
Spring (Apr-May)	72		2,669		3.19	
Summer (Aug-Sept)	50	-30.6	2,164	-18.9	2.71	-15.0

TABLE 9J-8

COMPARISON OF THE NUMBERS AND DIVERSITY OF BIRD SPECIES RECORDED IN PERENNIALLY AND SEASONALLY WATERED REACHES OF THE LOWER CARMEL RIVER RIPARIAN CORRIDOR

	Perennially Watered Reach (Transects 2A-2C)						Seasonally Dewatered Reach (Transects 3A-4C)					
	Species Recorded	Percent Change from Previous Season	Total Birds Recorded	Percent Change from Previous Season	Species Diversity Index (SDI)	Percent Change from Previous Season	Species Recorded	Percent Change from Previous Season	Total Birds Recorded	Percent Change from Previous Season	Species Diversity Index (SDI)	Percent Change from Previous Season
Winter (Dec-Jan)												
Spring (Apr-May)	54		775		3.16		69		1,894		3.20	
Summer Aug-Sep	41	-24.1	576	-25.7	2.79	-11.7	47	-31.9	1,588	-16.2	2.66	-16.9

APPENDIX 11
AIR QUALITY TABLES

APPENDIX 11-A

OZONE HOURLY AVERAGES EXCEEDING STATE OR FEDERAL AMBIENT AIR QUALITY STANDARDS

Year Hours	Salinas Days	Salinas Hours	Monterey Days	Monterey Hours	Aptos Days	Aptos Hours	Hollister Days	Hollister Hours	Scotts Valley Days	Scotts Valley Hours	Carmel Valley Days	Carmel Valley Hours	Santa Cruz II Days	Santa Cruz II Hours	Gonzales Days	Gonzales Hours	Davenport Days	
Hourly Average of Greater Than 0.09 ppm (State Standard)																		
1978	7	10	0	0	1	1	4	13	0[1]	0	–	–	–	–	–	–	–	–
1979	0	0	0	0	0	0	3	3	–	–	0[2]	0	–	–	–	–	–	–
1980	1	3	1	1	4	9	12	32	5[1]	8	4	10	–	–	–	–	–	–
1981	0	0	0	0	0	0	7	24	3	3	0	0	–	–	–	–	–	–
1982	0	0	1	1	0	0	1	1	0	0	0	0	–	–	–	–	–	–
1983	0	0	0	0	1	1	4	9	–[1]	–	1	2	–	–	–	–	–	–
1984	0	0	0	0	0	0	6	8	–	–	1	1	–	–	–	–	–	–
1985	0	0	–	–	–	–	11	20	–	–	1	2	2	6	–	–	–	–
1986	0	0	–	–	–	–	1	1	–	–	0	0	0	0	0[3]	0	–	–
1987	0	0	–	–	–	–	7	15	–	–	0	0	0	0	0	0	0	0
1988	0	0	-	-	-	-	4	5	-	-	0	0	0	0	0	0	0	0
1989	0	0	-	-	-	-	1	1	-	-	3	7	0	0	-	-	1	2

Year Hours	Salinas Days	Salinas Hours	Monterey Days	Monterey Hours	Aptos Days	Aptos Hours	Hollister Days	Hollister Hours	Scotts Valley Days	Scotts Valley Hours	Carmel Valley Days	Carmel Valley Hours	Santa Cruz II Days	Santa Cruz II Hours	Gonzales Days	Gonzales Hours	Davenport Days	
Hourly Average Greater Than 0.12 ppm (Federal Standard																		
1978	0	0	0	0	0	0	0	0	0[1]	0	–	–	–	–	–	–	–	–
1979	0	0	0	0	0	0	0	0	–	–	0[2]	0	–	–	–	–	–	–
1980	0	0	0	0	0	0	1	3	0[1]	0	1	2	–	–	–	–	–	–
1981	0	0	0	0	0	0	2	4	0	0	0	0	–	–	–	–	–	–
1982	0	0	0	0	0	0	0	0	0	0	0[1]	0	–	–	–	–	–	–
1983	0	0	0	0	0	0	0	0	–	–	0	0	–	–	–	–	–	–
1984	0	0	0	0	0	0	0	0	–	–	0	0	–	–	–	–	–	–
1985	0	0	–	–	–	–	0	0	–	–	0	0	0	0	–	–	–	–
1986	0	0	–	–	–	–	0	0	–	–	0	0	0	0	0	0	–	–
1987	0	0	–	–	–	–	0	0	–	–	0	0	0	0	0	0	0	0
1988	0	0	-	-	-	-	0	0	-	-	0	0	0	0	0	0	0	0
1989	0	0	-	-	-	-	0	0	-	-	1	1	0	0	-	-	0	0

1 Closed 3/16/78, reopened 7/1/80, closed 9/30/82.
2 Closed 3/31/76, reopened 3/7/79.
3 Opened 9/86.

APPENDIX 11-B

RECORDED VIOLATIONS OF THE PM_{10} CALIFORNIA AAQS
IN THE NORTH CENTRAL COAST AIR BASIN
1986 THROUGH 1989

Station	Date	Concentration (ug/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	S .ptember 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
Hollister	January 28, 1989	58
Santa Cruz	June 21, 1989	51
Salinas	June 21, 1989	54
Salinas	December 12, 1989	51
Salinas	January 5, 1990	56

Source: MPUAPCD

APPENDIX 11-C

CONSTRUCTION ACTIVITIES

						Paved Rd.		Unpaved Rd.		Distance		Volume	Volume
Volume													
		Acres		Paved Rd.		Within		Within		From		Material	Foundation
Waste		RCC		Steel	Cement								
Alternative			Cleared		From CV		Project Area		Project Area		Quarry		Hauled
Excavation		Hauled			Placed (CY)		(Tons)	(Tons)					
24 NLP		260		17		1		5		1.5		1,200,000	535,000
450,000	665,000		490	37,100									
15 CAN/D			275		8		1		2		1	--	-------
--													

APPENDIX 11-D

MAJOR EQUIPMENT DELIVERIES TO THE PROJECT SITE

Cement:	Between 16,000 and 37,000 tons of cement must be hauled to the site from Salinas or San Jose which equates to between three and eight trucks per day during the 10-month construction period.
Structural Steel:	Between 170 and 1,000 tons of structural steel must be delivered to the site which is equivalent to between 0.7 and four truckloads per month during the construction period.
Lumber:	Some 50,000 board feet of lumber weighing about 112 tons would be needed for each alternative, which is about six truckloads.
Explosives Quarrying:	About 240 tons of dynamite would be needed during the excavation and quarrying. This would equal about one truck per month.
Mobilization Truck:	Mobilization for the construction phase of the project would involve many trips hauling in heavy equipment, the aggregate plant, the batch plant, the warehouses, trailers and other support facilities.
Fuel:	The operation of the diesel construction equipment will require about four fuel trucks per month for each project.
Wood:	Any merchantable wood including firewood would have to be hauled away from the project site. Assuming all of the clearing would be done in the first construction season, the amount of merchantable wood ranges from _______ to _______ tons. Assuming small private trucks were to haul the wood away this would equal about _____ trips per day over the six month clearing and grubbing period.

Note:

Certain projects have unique components. It was assumed that the actual truck trips would exceed those listed here by 20 percent.

APPENDIX 11-E

ACREAGE TO BE CLEARED FOR EACH ALTERNATIVE

Alternative	Reservoir Site	Acreage to be Cleared
24 NLP 24 NLP/D	24,000	260
15 CAN/D	25,000	275

Source: Bechtel, 1989; Converse, 1986.

APPENDIX 11-F

SUMMARY OF PARTICULATE EMISSION YIELDS REPORTED FROM WILDLAND FUELS

		Particulates (lbs. per Ton of Fuel Burned)		
		Type of Fire		
Fuel Type	Lab/Field Experiment	Heading	Backing	Reference
Logging residues (Western)	Field	26-207		Sandberg (1974a)
	Laboratory		6-24	Sandberg (1974a)
	Field	=80		Radke et al (1978)
	Laboratory		4	Fritschen et al (1970)
Landscape refuse	Laboratory		24	Feldstein et al (1963)
Grass burning	Field		16	Bouebel et al (1969)
Live understory (Australia)	Field	14-40		Vines et al (1971)
	Laboratory	28-40		Vines et al (1971)
(Southern)	Field		15-30	Ward et al (1976)
	Laboratory		24-97	Ryan (1974)
Pine litter (Southern)	Field		45-55	Ward et al (1976)
	Laboratory		6-29	Ryan and McMahon (1976)
	Laboratory	22-125		Ryan and McMahon (1976)

APPENDIX 11-G

SUMMARY OF AVERAGE EMISSION FACTORS SUGGESTED FOR FOREST FUELS FOR CONSISTENCY

Geographic	Fuel Type	Particulates	Hydrocarbons	CO	SOx	NOx	Reference
Nationwide	Open burning						USEPA (1972)
	– Agric. field	17	20	100	Neg.	2	
	– Landscape	17	20	60	Neg.	2	
	– Wood	17	4	50	Neg.	2	
National	Prescribed burn	17	24	140	Neg.	4	Yamate (1973)
National	Prescribed burn	50					Ward et al (1976)
	Wildfires	150					
	Litter (backfires)	26-50					
	Logging debris	28-107					
Northwest	Prescribed burn	17-67	10-40	20-500	Neg.	2-6	Cook et al (1978)

Source: Sandberg, et. al., 1979.

APPENDIX 11-H

EMISSION FACTORS AND EMISSION ESTIMATES FOR OFF-SITE PAVED ROADS

Using Equation $e = k \left(\frac{sL}{0.7}\right)$

where e = emission factor, ib/VMT
k = base emission factor, ib/VMT
s = surface silt content
L = total road surface dust loading, g/ft
p = exponent, dimensionless

The roadway surfaces are divided into three categories:

Major streets/highways	sL = 0.516 g/ft
Collector streets	sL = 1.32
Local streets	sL = 2.02

The base emission factors and exponents are:

TSP	k = 0.0208	p = 0.9
PM_{10}	k = 0.0081	p = 0.8

Emission Factors:	TSP	PM10
Major streets/highways	0.016	0.0064
Collector streets	0.035	0.013
Local streets	0.053	0.018

APPENDIX 11-I

UNPAVED ROAD FUGITIVE DUST EMISSION FACTORS

Using the Equation $E = k(5.9) \quad \frac{s}{12} \times \frac{S}{30} \times \frac{W^{0.7}}{3} \times \frac{w^{0.5}}{4} \times \frac{365-p}{365}$

where k = Particle size multiplier for PM_{10}=0.36 for TSP=1.0
s = Silt content of road surface, 10%
S = Mean vehicle speed, 20 mph
W =Mean vehicle weight, 15 tons
w = Mean number of wheels, 8 wheels
p = Number of days with at least 0.01 precipitation for this area, 50

Emission Factors: PM_{10}: 10.17 lbs/VMT

TSP: 28.25 lbs/VMT

APPENDIX 11-J

ESTIMATED VEHICULAR FUGITIVE DUST EMISSIONS

Off-Site Paved Roads[1]

Alternative Location	MAJOR PM_{10} Car/Truck (VMT)	Car/Truck (VMT)	COLLECTOR Car/Truck (VMT)	LOCAL Tons/Day	
24 NLP, 24 NLP/D	20/70 (3050)	16/16 (1840)	36/36 (4140)	0.166	0.059
15 CAN/D	12/72	8/8	N/A	0.024	0.009

On-Site Unpaved Roads[2]

Alternative Location	Unpaved Roads (Miles)	Vehicle Miles (Miles/Day)	PM_{10} Tons/Day	TSP Tons/Day
24 NLP, 24 NLP/D	5/1.5	300	1.526	4.238
15 CAN/D	3/1	175	0.890	2.472

[1] Assume 100 cars, 15 trucks for RCC dams. Assume 100 cars, 1 truck for Earthfill dams.

[2] Miles of unpaved roads within project area and length of haul from quarry are speculative at this point, without detailed investigations of potential borrow/quarry sites. These would probably represent worst case scenarios.

APPENDIX 11-K

EMISSION FACTORS FOR AGGREGATE PROCESSING
(Lbs/Tons)

	TSP	PM_{10}	
Process Sources			
Primary Crushing (wet)	0.018	0.001	
Primary Crushing (dry)	0.28	0.017	
Open Dust Sources			
Screening (flat screens)	0.16	0.12	
Bulk Loading	0.056	0.0024	
Active Storage Piles			
– Active Day	13.2	6.3	lb/acre/day
– Inactive Day	3.5	1.7	lb/acre/day

APPENDIX 11-L

EMISSION ESTIMATES FOR STATIONARY SOURCES

Uncontrolled Aggregate Processing[1]

Alternative	Aggregate (CY)	Processed (Tons)	TSP (Tons)	PM_{10} (Tons)
24 NLP 24 NLP/D	1,200,000	2,400,000	616	178
15 CAN/D	N/A			

Concrete Batch Plant Operation[2]

Alternative	Amount RCC (CY)	Placed Particulate (Tons)	Emissions (Tons/Day)
24 NLP 24 NLP/D	668,000	66.8	(0.223)
15 CAN	–	–	–

[1] Emissions calculated assuming dry crushing. Storage pile sizes were estimated as follows: New San Clemente 5 acres, Chupines/Cachagua 1 acre, New Los Padres (24k) 6 acres, (9k) 4 acres, San Clemente Creek 5.5 acres. For RCC dams assume 500 active, 120 inactive storage days. For Earthfill assume 800 active, 220 inactive.

[2] These estimates using EMFAC7C Emission Factors (0.20 lb/CY) which were estimated for normal concrete batch plant mix of 500 lb of cement per CY concrete. Since the majority of the emissions are from cement dust, and RCC mix only contains 100 lb of cement per CY of mix, these figures are too high by up to a factor of 5. The earthfill type dams will only require small amounts of concrete. Construction period assumed to be 10 months for RCC placement.

APPENDIX 11-M

POSSIBLE FUGITIVE DUST EMISSION REDUCTIONS BY SOURCE CATEGORY

Source		Category
(1) Off-Site Paved Roads	–	Transporting workers from a central staging area will reduce the dust emissions from vehicle movement over paved roads by an estimated 75 percent.
	–	Trucks delivering materials cannot be controlled.
(2) On-Site Paved Roads	–	Daily or greater waterings and weekly cleaning with a vacuum sweeper will yield a greater than 50 percent reduction and when combined by the reduced vehicle traffic from (1) above, the reduction should be on the order of 90 percent.
(3) On-Site Unpaved Roads	–	Sufficient watering to eliminate visible dust clouds during dry periods, probably at least twice daily, would yield an estimated 80 percent.
(4) Aggregate Processing	–	Spray systems at transfer points have been shown to be 70-95 percent effective.
	–	Spray systems at storage pile areas have been shown to be 80 to 90 percent effective.
	–	Chemical stabilization agents on inactive storage piles have been shown to be 95 percent effective.
(5) Concrete Batch Plant Operation	–	Using wet suppression techniques at appropriate points could yield an estimated 50 percent reduction in emissions.

APPENDIX 17
POLICY CONSISTENCY ANALYSIS

APPENDIX 17
POLICY CONSISTENCY ANALYSIS

1. INTRODUCTION

The following policy consistency analysis was prepared in response to the County of Monterey Planning and Building Inspection Department's comments on the August 1991 Supplemental Draft EIR/EIS in a letter to Henrietta Stern (MPWMD) dated October 22, 1991. Such an analysis would be used by the County Department during the building permit process. Many of the relevant policies pertain to environmental topics analyzed in a number of sections of the EIR/EIS. As such, the policy consistency analysis summarizes and references the relevant material.

The analysis is divided into the following sections.

1. Introduction
2. Summary
3. Consistency of Desalination With County General Plan and Other Policies
4. Consistency of Reservoir With County General Plan and Other Policies
   - 4.1 Water Supply
   - 4.2 Water Quality
   - 4.3 Riparian Corridor Impacts
   - 4.4 Flood Hazards
   - 4.5 Rare, Threatened, and Endangered Species
   - 4.6 Vegetation and Wildlife Habitats
   - 4.7 Soils and Geologic Hazards
   - 4.8 Fire Hazards
   - 4.9 Noise Hazards
   - 4.10 Archaeologic Resources
   - 4.11 Park and Recreation Facilities
   - 4.12 Visual Quality
   - 4.13 Transportation

2. SUMMARY

The desalination plant(s) that would be part of the 24 NLP/D, the 15 CAN/D, and the 7 DSL alternatives would all be consistent with the County General Plan, the County Department of Environmental Health Desalination System Ordinance, and the California Coastal Act.

In general, the reservoir facility of the two NLP alternatives and the CAN alternative appear to comply with the general objectives and policies of the County General Plan and the Area Plans as follows:

- preservation and protection of prime groundwater recharge areas;
- provision of additional water supplies (such as water reclamation projects) for planned growth;
- elimination of long-term groundwater overdrafting;
- implementation of water conservation measures for all types of land uses;
- use of public water reservoirs for multiple purposes;
- the County's designation of adequate locations for future public services and facilities;
- compatibility between surrounding land uses and multiple uses of water bodies;
- achievement of a sustained level of adequate water services; and
- the development of suitable water supplies in keeping with broad conservation goals.

However, there are some policies for which one or more of the project alternatives would be inconsistent as follows. Consistency with such policies and appropriate mitigation would need to be determined by the Monterey County Planning and Building Department during the building permit process.

<u>Water Supply</u>

Cachagua Area Plan (24 NLP/D):

* 6.2.1.1 Groundwater shall not be exported to points outside of the Planning Area boundaries.

Riparian Corridor Impacts

Carmel Valley Master Plan (15 CAN/D):

* 7.1.3 "...development shall not occur in the riparian corridor..." in order to protect riparian vegetation, minimize erosion, and preserve the visual aspects of the river.

* 16.2.2.1 In order to protect the public health, welfare, and safety, no land located in the river channel shall be developed except for subsequently approved bridges or emergency access roads.

Flood Control

Monterey County General Plan (All Alternatives):

* 16.2.3 Development requiring a discretionary permit, shall be prohibited from within 200 feet of the riverbank or within the 100-year floodway except as permitted by ordinance. No new development, including structural flood control projects, shall be allowed within the riparian corridor.

Vegetation and Wildlife Habitats

Greater Monterey Peninsula Area Plan (15 CAN/D):

* 7.1.5 Coastal and interior wetlands should be retained as open space due to their importance as wildlife habitat and as scenic resources.

* 7.1.6 No new development or landscape alterations shall be permitted within a 100 foot setback from all wetlands.

* 11.1.6 Environmentally sensitive areas should be preserved as open space.

Carmel Valley Master Plan (15 CAN/D):

* 7.1.1.1 Areas of biological significance shall be identified and preserved as open space.

Soils and Geologic Hazards

Monterey County General Plan (All Alternatives):

* 26.1.10 The County shall prohibit development on slopes greater than 30%.

Noise Hazards

Cachagua Area Plan (24 NLP/D):

- * 22.4.7 Noise from major construction project sites shall not exceed 55 dBA l_{dn} as measured at affected residences.

Park and Recreation Facilities

Cachagua Area Plan (24 NLP/D):

- * 32.1.4 Land uses adjacent to the Ventana Wilderness shall not impact the purpose of the wilderness areas.

- * 51.1.5 The dedication of recreational trail easements shall be encouraged to implement planned trail systems or to replace a trail jeopardized by development.

1. CONSISTENCY OF DESALINATION WITH COUNTY GENERAL PLAN AND OTHER POLICIES

Three of the refined project alternatives would include a desalination plant to be constructed at either the Monterey Regional Water Pollution Control Agency Treatment Plant site or the Sand City site. The desalination project as a whole would appear to be consistent with County General Plan goals and policies. The project promotes the provision of adequate, sustainable water service for all County needs and protection of groundwater resources. No County policies directly address desirability of desalination, but reclamation, which is a similar concept, is supported. Also, the County Department of Environmental Health has adopted a Desalination System Ordinance, indicating that this means of water procurement is acceptable with respect to County health and welfare policies. Finally, the County General Plan addresses an affirmative obligation to reserve land specifically to assure provision of adequate utility sites and corridors. All pipelines associated with the desalination facility would be underground except as needed to cross sloughs and streams. Thus the treatment concept, the production facility and ancillary utility elements are all apparently consistent with and supported by specific provisions of County General Plan policy and ordinances.

Desalination would also appear to be consistent with policies of the California Coastal Act. Desalination is a coastal dependent industrial use. In particular, the proposed Ranney Collectors must, by definition, have immediate proximity to the mean high water line. Coastal dependent industrial uses are accorded highest priority of new development uses within the Coastal Zone. At the same time, the proposed project maximizes retention of public coastal access; under all alternatives presently being analyzed, only the Ranney Collectors would be located between the mean high water line and the nearest inland roadway. Moreover, the collectors and associated intake lines would be underground and set back sufficiently from the mean high water line to assure that they would not be uncovered by winter wave action, potentially causing obstruction of lateral shoreline access rights of the public.

Finally, under all these alternatives, the desalination facility would represent an expansion of existing industrial and commercial development located within the Coastal Zone; no new development centers would be established by any of the alternatives within the Coastal Zone. Expansion of existing coastal dependent industrial areas is consistent with policies of the State Coastal Act and The North County Local Coastal Plan.

Regulatory Setting

The project elements reviewed include: the seawater intake wells, or Ranney Collectors; pipelines, including those to convey intake water, finished water and brine discharge; the desalination facility; and terminal storage tanks (up to a 1.5 million gallon tank located in one of three locations).

Monterey County General Plan

The following policies of the Monterey County General Plan are relevant to the proposed project.

Water Service

Goal 53: To promote adequate water service for all County needs.

Objective 53.1: Achieve a sustained level of adequate water services.

Policy 53.1.1: The County shall encourage coordination between those public water service providers drawing from a common water table to assure that the water table is not overdrawn.

Policy 53.1.4: New development shall be required to connect to existing water service providers which are public utilities, where feasible.

Policy 53.1.5 Proliferation of wells, serving residential, commercial, and industrial uses, into common water tables shall be discouraged.

The proposed project helps to implement these goals, objectives and policies by providing a reliable, sustainable source of potable water intended for distribution by a public utility. Development of this new source of water would permit limited accommodation of planned levels of urban growth within the District's jurisdiction, while it could help to limit reliance on groundwater resources in Carmel Valley, the current production from which have been determined to cause significant environmental impacts on the Carmel River watershed.

Wastewater Treatment Plant Facilities

Objective 54.2: Improve groundwater recharge through the use of reclaimed wastewater in accordance with health and safety standards.

Policy 54.2.3: The County shall be attentive to the state of the art in reclamation technology and, where applicable and cost-effective, shall encourage implementation thereof.

The focus of this objective and of its supporting policies is to make use of reclamation technology to decrease exhaustion of County groundwater resources. It specifically encourages reclamation of septic wastewater but clearly acknowledges that advances in reclamation technology may increase the range of technical options that meet the objective of decreasing pressure on groundwater resources. The proposed desalination system is essentially a reclamation technology that has become increasingly feasible, both technically and economically, since adoption of this policy in 1982. Project implementation would be consistent with this objective and policy.

Public Utilities

Goal 56: To promote the efficient distribution of public utilities by reserving land uses for utility sites and access corridors which provide utilities for planned population centers.

Objective 56.1: Provide for adequate public utilities to planned growth areas.

Policy 56.1.1: The County shall, when planning for development, provide for utility corridor rights-of-way.

Objective 56.2: Ensure the aesthetic placement of utility lines.

Policy 56.2.1: The County shall, in accordance with the Monterey County Subdivision Ordinance, require that all new utility lines be placed underground.

The project proposes underground installation of all seawater intake, finished water transport and brine discharge pipelines. Where feasible, unpaved County right-of-way is proposed to be used, which is consistent with the direction of these policies that utility corridors be developed and maintained by the County. Finally, the purpose of the project is to provide a critical utility - water service - for use by planned urban development within the District's jurisdiction.

State Coastal Act Policies[1]

Section 30101 of the California State Coastal Act states that: "Coastal-dependent development or use means any development or use which requires a site on, or adjacent to, the sea to be able to function at all." The proposed desalination plant requires two sites within about 200 feet of the surf zone from which to draw seawater. The desalination plant must be located in relatively close proximity to the intake wells to minimize energy use and costs associated with pumping the raw seawater to the reverse osmosis filters for desalination. These technical requirements define the proposed project as a coastal-dependent use as defined by the Act.

Section 30255

Coastal-dependent developments shall have high priority over other developments on or near the shoreline. Except as provided elsewhere in this division, coastal-dependent developments shall not be sited in a wetland. When appropriate, coastal-related developments should be accommodated within reasonable proximity to the coastal-dependent uses they support.

Neither the treatment plant proposed for the Sand City site nor the Monterey Regional Water Pollution Control District (MRWPCD) site is located within a wetland. Both the Sand City site and the MRWPCD site would require installation of two Ranney Collectors within 200 feet of the surf zone in high-quality sandy beaches, both of which are areas either proposed for or are already used for public recreation. Both sites would avoid traversing wetlands, sloughs, and rivers.

Section 30250

New residential, commercial, or industrial development, except as otherwise provided in this division, shall be located within, contiguous with, or in close proximity to, existing developed areas able to accommodate it or, where such areas are not able to accommodate it, in other areas with adequate public services and where it will not have significant adverse effects, either individually or cumulatively, on coastal resources.

Section 30260

Coastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and Sections 30261 and 30262 if (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.

The two desalination plant sites would be located in essentially industrial coastal tracts. Of the two alternatives, the Sand City site would entail the least intensification of coastal industrial use because the building is already constructed, while the MRWPCD site would entail new construction.

The Sand City alternative would entail the greatest qualitative disruption of coastal resources: the proposed Ranney Collector intake wells would be located in high-quality sandy beaches which are closest to the Peninsula's urban centers. The MRWPCA alternative would entail disruption of comparable beach sites, but their more distant location relative to Peninsula population centers makes the disruption qualitatively less severe. Both intake locations would be disrupted only temporarily and long-term erosional effects would be minimal due to the absence of soil in the sand base (i.e., backfill is easily recompacted.)

Section 30211

Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.

Section 30240

(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.

(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.

The Sand City and MRWPCD sites would involve the installation of Ranney Collectors on beaches that are either at present, or may become in the future, publicly accessible parklands. The Ranney Collectors would also involve the temporary disruption of habitat suitable for nesting by the Snowy Plover, a Class 1 federally listed species of shorebird (see Section 4.2, Vegetation and Terrestrial Wildlife). However, the bird's nesting season occurs from late April through August; installation of the wells would be scheduled to avoid the nesting season and thus, would not affect the species. The wells would be below ground and would therefore only temporarily restrict public coastal access to a portion of the respective beaches.

Section 30251

The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character [of] surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas.

All facilities at both sites would be located within already industrialized portions of the coastal zone or underground. The MRWPCA site would not be visible from Highway 1. The Sand City site would be contained within an already existing commercial warehouse, east of Highway 1. The water storage tank proposed for the Sand City site would also be located just east of Highway 1 in the non-appealable portion of the Sand City coastal zone; it would be built into a hillside to minimize apparent bulk and would also be subject to review and approval by the Sand City Design Review Commission.

Monterey Bay National Marine Sanctuary (MBNMS)

The Final Environmental Impact Report and Management Plan for the MRBNMS describes the regulatory policies of the management plan.[2] They are summarized in Chapter III, Alternatives Including the Preferred Alternative, Volume I. They are described in further detail in Appendix B, Notice of National Marine Sanctuary Designation; Final Rule; and Summary of Final Management Plan, Volume II, particularly section IV., summary of Regulations, pp. B-43/59.

In summary, the regulatory policies of the MRBNMS Master Plan state that the National Oceanic and Atmospheric Administration (NOAA) will work within the current regulatory process with the current regulatory agencies to insure that permitted uses affecting the Sanctuary contain conditions of use that prevent adverse effects to the Sanctuary. A Memorandum of Understanding (MOA) has been signed by the relevant parties to formalize this approach. NOAA will be acting in an oversight capacity within the existing regulatory framework. Existing authorities set up standards, criteria and discharge requirements. NOAA will work with these existing authorities, within the existing regulatory process, to determine if the standards and criteria are sufficient to protect Sanctuary resources and qualities. NOAA will also work with desalination plant owners, operators and relevant management authorities through the Sanctuary's review and regulation procedures provided in 15 CFR 944.11.

The Management Plan's policies regulating actions in the Sanctuary are summarized below, particularly as they apply to the point source discharge of desalination facilities.

> "In formulating the proposed Sanctuary regulatory regime, NOAA ...proposed regulations ... deemed necessary to protect Sanctuary resources and qualities."[3]

> However, "NOAA will work within the existing regulatory process, rather than create an entirely new regulatory review and approval procedure, governing discharge activities in the Monterey Bay NMS [National Marine Sanctuary] area and coastal watersheds. NOAA intends to minimize any additional administrative burden on those dischargers that are required to obtain a National Pollution Discharge Elimination System (NPDES) permit or a Waste Discharge Requirement (WDR) permit for discharges that affect or may affect the Monterey Bay NMS, while at the same time , ensure that the existing process addresses the special concerns of the Sanctuary and its resources and qualities. In addition, a close working relationship between the Sanctuary and existing authorities and affected users will necessitate the identification and exchange of information relevant to the parties' mutual goals for the maintenance of the areas's high water quality and protection and conservation of resources and qualities of the Monterey Bay area."[4]

"NOAA and EPA and the State have developed a Memorandum of Agreement (MOA) between Federal, state and local water quality management agencies to provide specific procedures and develop a mechanism to achieve the goals of the Sanctuary by using the existing discharge permitting process.... The MOA specifies how the NOAA regulations on certification of existing discharge permits and review of new discharge permits will be administered within State waters within the Sanctuary in coordination with the State permit program."[5]

"The MOA also addresses integration and coordination of research and monitoring efforts and the development of a comprehensive water quality protection program for the Sanctuary.

In consultation with scientific institutions and local, State and regional organizations such as the Association of Monterey Bay Area Governments, NOAA would consult with the permittees and the relevant permitting authorities of these activities to determine means of achieving the Sanctuary purposes. If additional constraints are necessary, NOAA will work with the permittees and permitting authorities to determine the necessary level of terms and conditions to provide adequate protection of the Sanctuary's resources and qualities.

New proposals for permits, licenses, or other authorizations after the effective date of Sanctuary designation, e.g., allowing the discharge of municipal sewage, industrial, power, or desalination effluent would be subject to Sanctuary review to ensure that Sanctuary resources and qualities are protected from injury."[6]

The current regulatory framework for point source discharges is as follows. "NPDES permits are required by all dischargers, municipal and industrial, that discharge pollutants from a point source into navigable waters of the U.S., the waters of the contiguous zone, or ocean waters. The SWRCB [State Water Resources Control Board] and the RWQCBs [Regional Water Quality Control Board] are responsible for the protection of the quality of the State's waters through the development of water quality control plans and the issuance of waste discharge orders. Pursuant to Section 402 of the CEA and Section 13370 of the California Water Code, EPA has approved the State's program to issue and enforce NPDES permits to ensure, to the greatest extent possible, that discharges to surface waters do not adversely affect the quality and beneficial uses of the such waters. The state issues NPDES permits in accordance with a Memorandum of Agreement (MOA) between the EPA and the State Board. Regional Board staff prepare the permit and the State Board and EPA may comment upon, or object to the issuance of, a permit or the terms and conditions therein. Neither the State Board nor the regional Boards adopt or issue an NPDES permit until all objections have been resolved pursuant to 40 CFR 123.44 and the MOA.[7]

2. CONSISTENCY OF RESERVOIR WITH COUNTY GENERAL PLAN AND OTHER POLICIES

The relevant planning documents that regulate development in the proposed reservoir project areas are the Monterey County General Plan, the applicable Area Master Plans, and the Monterey County Zoning Ordinance (Title 21). The revised New Los Padres Reservoir alternative projects (24,000 AF reservoir or 24,000 AF reservoir + 3 MGD desalination plant) are located within the Cachagua Area Plan boundary, and the revised Cañada Reservoir alternative project (15,000 AF reservoir) is located within both the Carmel Valley Master Plan and the Greater Monterey Peninsula Area Plan boundaries.

The reservoir alternatives in general appear to be consistent with most of the relevant policies established in the County General Plan and the Area Plans. Many of the General Plan and Area Plan policies relevant to the proposed projects are too specific in their scope to determine project compliance at this stage of the EIR planning process. For instance, design-related policies such as use of fire-retardant construction materials, adequate stormwater runoff system structures, and implementation of an erosion control plan would all be developed at a subsequent stage of project design, guided by relevant General Plan and Area Plan policies, and evaluated for compliance under the building permit review process. Thus, many of the relevant planning policies set forth in the General and Area Plans would be complied with under the appropriate permit review process. It is the project sponsor's intent to comply with relevant planning policies to the maximum feasible extent and to consult with the Monterey County Planning Commission and other appropriate agencies to achieve this objective.

The reservoir alternatives comply with the following general objectives and policies of the County General Plan and Area Master Plans:

- preservation and protection of prime groundwater recharge areas;
- provision of additional water supplies (such as water reclamation projects) for planned growth;
- elimination of long-term groundwater overdrafting;
- implementation of water conservation measures for all types of land uses;
- use of public water reservoirs for multiple purposes;
- the County's designation of adequate locations for future public services and facilities;
- compatibility between surrounding land uses and multiple uses of water bodies;
- achievement of a sustained level of adequate water services; and
- the development of suitable water supplies in keeping with broad conservation goals.

However, there are several General or Area Plan policies that are either inconsistent, or have the potential to be inconsistent with the proposed reservoir project alternatives, unless mitigated properly. The following sections list the relevant Area Plan policies by topic area for the proposed Los Padres Reservoir and Cañada Reservoir project alternatives. In addition, the relevant County General Plan policies that are not duplicated in the Area Plans are listed for the project alternatives. Policy consistency of the proposed alternatives, as well as applicable permitting processes and regulatory agencies, are also identified and discussed. The planning policies that are potentially inconsistent with the proposed alternatives are discussed in the following sections and are identified with an asterisk. The listed Plan policies and compliance discussions are largely in response to comments received from the Monterey County Planning Department. It should be noted that the italicized policies in the following sections are those policies added to SDEIR Table 17-1: Relevant Area Plan Policies by request of the County Planning Department.

2.1 Water Supply

The responsible agencies and water-related permits necessary for project implementation are discussed briefly in this section. The U.S. Army Corps of Engineers (COE) is the federal lead agency for the preparation of the EIR/EIS documents. The COE regulates the placement of fill in the nation's waterways through Section 404 of the Clean Water Act. Therefore, construction of the proposed New Los Padres Dam, intake structures and any other placement of fill within the Carmel River would require a Section 404 permit, and would trigger the COE permit review process.

The State Water Resources Control Board (SWRCB) administers water rights within California. The Monterey Peninsula Water Management District must obtain a Permit to Appropriate Water in order to allow the diversion of water from the Carmel River. The SWRCB establishes the right of the applicant to use water, and the priority of that right. In addition, the SWRCB is concerned that permittees prevent waste, practice water conservation, and use the water to the fullest beneficial use.

The Division of Safety of Dams (DSOD) is responsible for the licensing and approval of dams within California to ensure that public safety is protected. The plans and specifications for any new dam would be subject to review and approval by the DSOD. In addition, the completed structure would be subject to periodic inspection by the DSOD.

The proposed alternatives are in general compliance with the following General and Area Plan policies, pending agency interaction and permit approval by the COE, SWRCB, and the DSOD. It should be noted that Cachagua Area Plan policy 6.2.1.1 regarding the export of groundwater outside of the planning area boundaries could be potentially inconsistent with the New Los Padres Reservoir alternatives.

2.1.1 New Los Padres Reservoir Project

Cachagua Area Plan:

6.2.1.1 *Groundwater shall not be exported to points outside of the Planning Area boundaries.*

6.2.1.2 *The Planning Area should not be deprived of water reasonably required for the beneficial needs of its inhabitants.*

Monterey County General Plan:

5.3 *Promote the use of public water reservoirs for multiple purposes, where appropriate, i.e., water conservation, flood control, recreation, and hydroelectric generation.*

6.1 *Eliminate long-term groundwater overdrafting in the County as soon as practicable possible.*

6.1.2 *Water conservation measures for all types of land uses shall be encouraged.*

6.2.1 *The County shall pursue development of suitable water supplies in keeping with broad conservation goals.*

9.2.2 *Projects that modify or otherwise impact inland waters and waterways shall be referred to appropriate agencies for review, recommendations, and appropriate conditional permits.*

31.1.2 *The County shall designate adequate locations for future development of needed public services and facilities.*

33.1.1 *The County, based on recommendations developed jointly by appropriate departments and agencies, shall recommend priorities for multiple use of the major water bodies.*

33.1.2 *Compatibility shall exist between surrounding land uses and multiple uses of major water bodies.*

53.1 *Achieve a sustained level of adequate water services.*

53.1.1 *The County shall encourage coordination between those public water service providers drawing from a common water table to assure that the water table is not overdrawn.*

56.2.2 *The County shall seek to place existing utility lines underground whenever feasible.*

2.1.2 Cañada Reservoir Project

Carmel Valley Master Plan:

6.1.3 *All beneficial uses of the total water resources of the Carmel River and its tributaries shall be considered and provided for in future planning decisions.*

6.1.5 *The Carmel Valley Master Plan contains policies which encourage development of water reclamation, conservation, and new source production. This development could create additional water for the area. While the additional water and its development are, in part, controlled by the Monterey Peninsula Water Management District and the Board of Supervisors water allocation priorities, it is also imperative that this future development be allowed only with strict adherence to the Carmel Valley Master Plan goals for maintaining ecological and economic environment and rural character.*

54.1.7 *The County of Monterey supports the new San Clemente dam project or some other water project as a means of assuring an adequate supply of water for future growth in the Carmel Valley. Without additional supplies, development will be limited to vacant lots of record and already approved projects. All development which requires a water supply shall be subject to County adopted water allocation and /or ordinances applicable to lands in the Carmel Valley Master Plan area. This is the Low Growth Alternative addressed in the Final SEIR 85-002.*

However, the MPWMD would provide only enough allocation for planned growth in Carmel Valley.

54.1.8 *The County shall encourage and support reclamation projects as a source of additional water supply. Such projects must show conclusively that they do not contribute to groundwater degradation. If additional water is generated by this method, it may be used to replace domestic water supply in landscape irrigation and other approved uses to free domestic water of planned growth provided that the water reclaimed creates no adverse environmental impacts.*

Monterey County General Plan:

See policies listed above for the New Los Padres Reservoir.

2.2 Water Quality

Protection of water quality within California is the responsibility of the State Water Resources Control Board. The State Board acts jointly with the nine Regional Water Quality Control Boards (RWQCBs) to provide State-level coordination and regional familiarity with local needs and conditions. The Central Coast RWQCB therefore has regulatory authority over the Carmel River. The project sponsor would consult with the Central Coast RWQCB, as well the COE, to maintain high water quality within the reservoirs. In addition, the Monterey Peninsula Water Management District established a groundwater quality monitoring program in 1981, and the project sponsor will track water quality trends in the proposed project areas.

The proposed Cañada Reservoir project alternative would have no effect on Carmel River water quality because this alternative would not release water to the river. Implementation of the mitigation measures set forth in SDEIR Section 7.14 would reduce the water quality impacts of the proposed New Los Padres Reservoir alternatives to a less than significant level. The proposed reservoir alternatives are in general compliance with the following water quality policies.

2.2.1 New Los Padres Reservoir Project

Cachagua Area Plan:

5.1.2.1 *Areas identified by the County as prime groundwater recharge areas shall be preserved and protected from sources of pollution and blockage. Development in prime groundwater recharge areas shall be restricted to land uses which will not cause groundwater contamination.*

5.1.2.2 *Groundwater recharge areas should be protected from all sources of pollution. Groundwater recharge systems shall be designed to protect groundwater from contamination and shall be approved by both the Director of Environmental Health and the Flood Control and Water Conservation District.*

5.1.2.3 *The County shall identify and protect areas in Cachagua which are valuable for the purposes of either natural groundwater recharge or the development of artificial groundwater recharge projects. Development shall not diminish the groundwater recharge capabilities of such areas, especially those which are highly susceptible to water quality degradation because of either high water tables or rapid percolation rates. Existing uses in such areas should be maintained in a manner that will preserve groundwater quality.*

21.1 *Protect and enhance surface and groundwater quality by implementing current adopted water quality programs and by continuing to evaluate new problems.*

21.1.2.2 The Monterey Peninsula Water Management District shall monitor water quality within its district boundaries in Cachagua.

2.2.2 Cañada Reservoir Project

Carmel Valley Master Plan:

21.3.8 A program of monitoring the quality of underground water throughout the Valley, similar to that recently undertaken by the County Health Department and the Monterey Peninsula Water Management District, shall be continued and expanded where appropriate.

54.1.10 The County shall increase monitoring efforts in the Carmel Valley Village and Mid-Valley Areas to:

- *identify existing groundwater quality or other impacts from septic systems;*
- *verify the data assumptions and predictions contained in the Carmel Valley Wastewater Study for these areas; and*
- *determine the need for community sewerage facilities or other improvement in waste disposal practices.*

2.3 Riparian Corridor Impacts

A Streambed Alteration Agreement from the California Department of Fish and Game (CDFG) would be required for the proposed reservoir alternatives. The so-called "1601" and "1603" permits are intended to protect the fish and wildlife resources of the state. In addition, the modification of riparian zones is subject to COE jurisdiction.

Implementation of the mitigation measures proposed in the SDEIR regarding project impacts to fish rearing and spawning habitat, fish migration, stream flow and riparian vegetation, as well as consultations with the CDFG and the COE would provide consistency with all of the following policies except two. Policies 7.1.3 and 16.2.21 of the Carmel Valley Master Plan respectively state that "..development shall not occur within the riparian corridor..", and that "no land located in the river channel shall be developed except for subsequently approved bridges or emergency access roads". These policies appear to preclude the proposed construction of the intake facility and pump station for the Cañada Reservoir alternative. Therefore, an amendment or exception to these policies from the County Board of Supervisors would be required for project approval. The process of obtaining an exception/amendment to the Carmel Valley Master Plan would occur in conjunction with the use permit review process.

2.3.1 New Los Padres Reservoir Project

Cachagua Area Plan:

9.1.3 *Development shall be sited to protect riparian vegetation and threatened fish species, minimize erosion, and preserve the visual aspects of the Carmel and Arroyo Seco Rivers. Private property owners are encouraged to preserve the Carmel River in its natural state, to prevent erosion and protect fishery habitat. This policy is intended to be consistent with the Fish and Game Code.*

9.2.2.1 *A proposed new San Clemente Dam may impact the Carmel River steelhead spawning areas that are located in the proposed reservoir inundation area. The County should work with the appropriate agencies to provide similar nursery habitat within the Planning Area. Such habitat would provide fry with the ability to migrate to lower portions of the Carmel River.*

9.2.3 *The County should work with the Department of Fish and Game to ensure that the fishery located above the Los Padres Dam is maintained in a productive state.*

9.2.4 *Fishery habitat located above the San Clemente Dam should be accessible to fish populations, especially steelhead.*

9.2.5 *The County should work with the appropriate agencies to develop a water supply system that will be sufficient to allow fish populations ingress and egress to all portions of the Carmel and Arroyo Seco Rivers throughout the year. This system would also consider provisions to allow fish populations to pass over river obstructions.*

9.2.6 *Major project proposals that impact areas of critical steelhead habitat in the riparian corridor should enhance the habitat.*

9.3.1 *The County should work with the California Department of Fish and Game to ensure that the fishery located above Los Padres Dam is maintained and is open to fishing during the appropriate season and in the appropriate locations.*

9.3.2 *The County should work with the Department of Fish and Game to ensure that established fishing locations above Los Padres Dam are available to the general public during the fishing season as long as such use does not threaten any endangered fish species.*

Monterey County General Plan:

5.1.1 *Vegetation and soil shall be managed to protect critical watershed areas.*

5.1.2 *Land use and development shall be accomplished in a manner to minimize runoff and maintain groundwater recharge in vital water resource areas.*

5.2.1 *Owners of property adjacent to waterways or responsible agencies shall be encouraged to maintain healthy vegetation along the drainage course, or provide other suitable means of preventing bank erosion or siltation.*

5.2.2 *The County shall establish special procedures for land use, building locations, grading operations, and vegetation removal adjacent to all waterways and significant water features.*

16.2.9 *The County should condition all modifications to living riparian vegetation to be in conformance with an overall approved river management plan. Where no such plan exists, modification may only take place when in accord with an approved landscape plan prepared by a licensed landscape architect or other qualified professional.*

2.3.2 Cañada Reservoir Project

Carmel Valley Master Plan:

*7.1.3 *Development shall be sited to protect riparian vegetation, minimize erosion, and preserve the visual aspects of the river. Therefore, development shall not occur within the riparian corridor. In places where the riparian vegetation no longer exists, it should be planted to a width of 150 feet from the river bank, or the face of adjacent bluffs, whichever is less. Density may be transferred from this area to other areas within a parcel.*

7.1.5 *A monitoring program shall be implemented to document changes in the vegetation of the Carmel River riparian corridor and to determine the most relevant factors involved. This shall be funded by the users of the riparian corridor, particularly those involved in water extraction, streambed alterations and developments which encroach upon the corridor. The monitoring program shall produce an annual report to the Board of Supervisors through a Joint Power Agreement with the agency or agencies conducting the monitoring. Upon two consecutive years of declining vigor in any reach of the river as defined by the Monterey Water Management District, the Board of Supervisors shall immediately hold public hearings to consider limitation of further development and /or a Carmel Valley Master Plan amendment to reverse the causes of declining riparian vegetation vigor determined by evidence in the record to be derived from implementation of the Carmel Valley Master Plan or development designated therein.*

7.1.6 *Motorized vehicles shall be prohibited on the banks or in the bed of the Carmel River, except by permit from the Water Management District or Monterey County.*

*16.2.2.1 *In order to protect the public health, welfare, and safety, no land located in the river channel shall be developed except for subsequently approved bridges or emergency access roads.*

16.2.6.1 *Private or public flood control measures should include restoration of the river banks to a natural vegetated appearance. Any bank restoration project shall use natural materials and be revegetated with native riparian vegetation or exotics, with similar characteristics* *selected from a list of plants approved for this purpose by the Monterey Peninsula Water Management District and Monterey County Planning Commission.*

Monterey County General Plan:

See policies listed above for the new Los Padres Reservoir project.

2.4 Flood Hazards

The proposed reservoir alternatives appear to be inconsistent with floodplain policy 16.2.3 in the County General Plan due to proposed development in the 100-year floodplain of the Carmel River. Thus, in order to achieve consistency between the proposed reservoir projects and the applicable General and Area Plan floodplain policies, an exception or amendment to these policies would be required from the County Board of Supervisors. The process of obtaining an exception/amendment to the Cachagua Area Plan and County General Plan would occur in conjunction with the use permit review process. The project sponsor will work with the Monterey County Flood Control and Water Conservation District, and participate in the National Flood Insurance Program.

2.4.1 New Los Padres Reservoir Project

Cachagua Area Plan:

**16.2.11 Development within the 100 year flood plain shall be subject to the provisions of the County Flood Plain Ordinance #3272; and development shall be set back at least 20 feet from the top of the bank of any tributary, except as permitted by the ordinance.*

16.2.12 Dam construction should be undertaken only in areas where the risk of loss of life or property damage due to dam failure is low.

Monterey County General Plan:

**16.2.3 All new development for which a discretionary permit is required, including filling, grading, and construction, shall be prohibited within 200 feet of the riverbank or within the 100-year floodway except as permitted by ordinance. No new development, including structural flood control projects, shall be allowed within the riparian corridor. However, improvements to existing dikes and levees shall be allowed if riparian vegetation damage can be minimized and at least an equivalent amount and quality of replacement is planted. In addition, exceptions may be made for carefully sited recreational trails.*

16.2.4 All new development, including filling, grading, and construction, within designated 100-year floodplain areas shall conform to the guidelines of the National Flood Insurance Program and *policies established by the County Board of Supervisors, with the advice of the Monterey County Flood Control and Water Conservation District.*

16.2.5 *All new development, including filling, grading, and construction, proposed within designated floodplains shall require submission of a written assessment prepared by a qualified hydrologist/engineer on whether the development will significantly contribute to the existing flood hazard. Development shall be conditioned on receiving approval of this assessment by the County Flood Control and Water Conservation District.*

2.4.2 Cañada Reservoir Project

Monterey County General Plan:

See policies listed above for the new Los Padres Reservoir project.

2.5 Rare, Threatened and Endangered Species

Rare, threatened and endangered species are those species so listed under the Federal Endangered Species Act (FESA) or the California Endangered Species Act (CESA). Sensitive species can be legally protected by FESA, CESA, CEQA, or through policies issued by State or federal agencies. If permits from a federal agency are necessary, and federally listed species are likely to be affected, a consultation, known as a Section 7 consultation, between that agency and the U.S. Fish and Wildlife Service (USFWS) is required by FESA.

Section 2090 of the California Fish and Game Code requires that State lead agencies consult with CDFG if the project is likely to jeopardize the continued existence of State listed endangered or threatened species. Section 2095 of the Fish and Game Code encourages cooperation between CDFG and USFWS in developing a coordinated biological opinion regarding sensitive species.

Pursuant to the aforementioned federal and state regulations, the environmental analysis for the proposed alternatives involved consultations with the USFWS and CDFG to identify the locations of rare species, develop appropriate survey methods, and formulate adequate mitigation measures to protect those species. The following Area Plan policies relating to rare species are in general compliance with the reservoir alternatives, upon the implementation of the mitigation measures proposed in the SDEIR/EIS.

2.5.1 New Los Padres Reservoir Project

Cachagua Area Plan:

7.1.3 The protection of rare and endangered plant species should be encouraged through an education process in conjunction with the California Native Plant Society, the University of California Extension Service and other appropriate agencies to ensure that all rules and regulations set forth in the Federal Endangered Species Act of 1973, as amended, are enforced.

2.5.2 Cañada Reservoir Project

Carmel Valley Master Plan:

7.1.1.2 Areas of critical habitat for rare and endangered species as identified by either federal or state law and areas of biological significance should be identified and preserved as open space.

11.1.1.1 Whenever a development proposal is received and is in or adjacent to a rare or endangered plant community, as identified in policy 11.1.1.2, the County shall require the applicant to provide a botanical report prepared by a botanist from the County list of approved consultants. The report shall include a description of the habitat to be affected by the project including area, species, rare and endangered status, if applicable, and suggestions for mitigation of project impacts. In any cases where a rare or endangered species as defined by either State or Federal legislation is found on-site, no development shall proceed until and Incidental Taking Permit or exclusion is obtained in accordance with Federal Endangered Species Act and the State Department of Fish and Game is notified of the existence of the rare and endangered species (whether on Federal list, State list or both) pursuant to Fish and Game Code Chapter 10 Section 1913c.

11.1.1.2 The County Planning Department shall maintain records of the known locations of all rare and endangered plant species. Reports shall be on file and locations shall be noted on the resources base maps. These maps shall be updated continuously as project applicant reports are received, and from time to time as other agencies such as Fish and Game or the California Native Plant Society may make additional location reports available.

2.6 Vegetation and Wildlife Habitats

Depending on the method of clearing and grubbing for the proposed reservoir alternatives, an approved Timber Harvest Plan may be required from the California Department of Forestry. The proposed Cañada Reservoir alternative would be inconsistent with Greater Monterey Peninsula Area Plan policies 7.1.5, 7.1.6 and 11.1.6, and Carmel Valley Master Plan policy 7.1.1.1, as construction of the intake facility and pump station would impact riparian forest (wetland) vegetation (see SDEIR Table 9-7). The filling of wetlands is regulated by the COE under Section 404 of the Clean Water

Act. Thus, in order to achieve consistency between the Cañada reservoir alternative and the applicable Area Plan floodplain policies, an exception or amendment to these policies would be required from the County Board of Supervisors. The process of obtaining an exception/amendment to the Area Plans would occur in conjunction with the use permit review process.

2.6.1 New Los Padres Reservoir Project

Cachagua Area Plan:

8.2.1 *The County shall cooperate with the United States Forest Service and private property owners to ensure that Santa Lucia fir are protected due to their significance to the natural history of the Planning area.*

8.2.2 *The removal of native trees shall be discouraged and shall be allowed only under the following conditions:*

1. *in conjunction with an approved timber harvest plan, or*
2. *in conjunction with an approved agricultural management plan, or*
3. *in conjunction with an approved discretionary permit application, or*
4. *with administration permit approval for removal of 4 or more trees with a trunk diameter in excess of 6 inches, measured two feet above ground level, on any given parcel in any twelve month period, or*
5. *in emergency situations caused by the hazardous or dangerous condition of a tree, provided that the County is notified of the removal within ten working days.*

A minimum fine, equivalent to the retail value of the wood removed, shall be imposed for each violation. Exemptions shall include tree removal by public utilities, as specified in the California Public Utility Commission's General Order 95.

2.6.2 Cañada Reservoir Project

Greater Monterey Peninsula Area Plan:

7.1.3 *In recognition of its status as a threatened resource, its function as riparian habitat and its important role in watershed protection, redwood forest habitat should be retained as open space through conservation easements or, where necessary, fee acquisition.*

7.1.4 *Redwood forest and chaparral habitat on land exceeding 30 percent slope should remain undisturbed due to potential erosion impacts and loss of visual amenities.*

**7.1.5* *In recognition of their function as important habitat for many wildlife species and their contribution to scenic resources within the Planning Area, coastal and interior wetlands should be retained as open space through conservation easements or, where necessary, fee acquisition.*

*7.1.6 *A setback of 100 feet from all wetlands shown on Environmentally Sensitive Areas Map shall be provided and maintained in open space use. No new development shall be allowed in this setback area. No landscape alterations will be allowed in this setback area unless accomplished in conjunction with a restoration and enhancement plan approved by the California Department of Fish and Game.*

9.1.1.1 *Open space areas should include a diversity of habitats with special protection given to ecologically important zones such as areas where one habitat grades into another and areas used by wildlife for access routes to water or feeding grounds.*

*11.1.6 *Environmentally sensitive areas as shown on the GMP Environmentally Sensitive Areas Map should be preserved as open space. When an entire parcel cannot be developed because of this policy a low intensity, clustered development may be approved. However, the development should be located on those portions of the land least biologically significant.*

Carmel Valley Master Plan:

*7.1.1.1 *Areas of biological significance shall be identified and preserved as open space. These include, but are not limited to, the redwood community of Robinson Canyon and the riparian community and redwood community of Garzas Creek. When a parcel cannot be developed because of this policy, a low-density, clustered development may be approved. However, the development shall occupy those portions of the land not biologically significant or on a portion of the land adjoining existing vertical forms, either on-site or off-site and either natural or man-made, so that the development will not diminish the visual quality of such parcels or upset the natural functioning of the ecosystem in which the parcel is located. If this policy precludes development of a parcel because of biological significance, a low level of development (but no subdivision) may be allowed provided impacts of the resource are minimized.*

Additional such areas include:

- *All wetlands, including marshes, seeps and springs (restricted occurrence, sensitivity, outstanding wildlife value).*
- *Native bunchgrass stands and natural meadows (restricted occurrence and sensitivity).*
- *Cliffs, rock outcrops and unusual geologic substrates (restricted occurrence).*
- *Ridgelines and wildlife migration routes (wildlife value).*

7.2.1.1 *In order to preserve soil stability and wildlife habitat, the chaparral community shall be maintained in its natural state to the maximum extent feasible consistent with fire safety standards.*

7.2.2.1 *Botanically appropriate species shall be used for required landscaping and erosion control.*

7.2.2.5 The County shall discourage the removal of healthy, native oak, madrone and redwood trees in the Carmel Valley Master Plan area. A permit shall be required for the removal of any of these trees with a trunk diameter in excess of six inches, measured two feet above ground level. Where feasible, trees removed will be replaced by the nursery-grown trees of the same species and not less than one gallon in size. A minimum fine, equivalent to the retail value of the wood removed, shall be imposed of reach violation. In the case of emergency caused by the hazardous or dangerous condition of a tree and requiring immediate action for the safety of life or property, a tree may be remove without the above permit, provided the County is notified of the action within ten working days. Exemptions to the above permit requirement shall include tree removal by public utilities, as specified in the California Public Utility Commission's General Order 95, and by governmental agencies.

2.7 Soils and Geologic Hazards

Both the proposed New Los Padres Reservoir and the Cañada Reservoir alternatives are located in areas containing slopes of 30 percent or greater. In addition, both reservoir alternatives are located in moderately high seismic hazard areas. In terms of landslide and erosion susceptibility, the Los Padres Reservoir alternatives are located in an area with low susceptibility, and the Cañada Reservoir alternative is located in a highly susceptible area. Therefore, a detailed erosion control plan, geologic investigation and soils report would be required for construction of all of the reservoir alternatives.

The reservoir alternatives would comply with the following listed Area Plan policies upon implementation of mitigation measures proposed in the SDEIR. However, the proposed reservoir alternatives may be inconsistent with Monterey County General Plan policy 26.1.10, which "prohibit[s] development of slopes greater than 30 percent", unless the "development can further the goals, and policies of this Plan." Thus, it would be the responsibility of the County to decide if the proposed reservoir alternatives would further the policies in the Carmel Valley Master Plan.

2.7.1 New Los Padres Reservoir Project

Cachagua Area Plan:

15.1.16 Areas identified as being subject to landsliding, faulting, or other geologic hazards shall receive competent review by professionals acceptable to the County Planning and Building Inspection Department. The findings of such review shall be used in determining possible development constraints and in defining appropriate mitigation measures.

26.1.27 Every attempt should be made to minimize hillside scarring by avoiding cuts and fills where possible. Where cuts and fills are unavoidable slopes shall be revegetated. Permanent *nonrevegetated scarring of hillsides is strongly discouraged and should occur only if no other reasonable alternative is available and if adverse impacts can be mitigated.*

Monterey County General Plan:

*26.1.10 *The County shall prohibit development of slopes greater than 30%. It is the general policy of the County to require dedication of scenic easement on slope greater than 30%. Exception may be made for development which can further the goals, and policies of this Plan.*

2.7.2 <u>Cañada Reservoir Project</u>

Greater Monterey Peninsula Area Plan:

3.1.1.1 *Erosion control procedures shall be established and enforced for all private and public land clearing projects.*

15.1.11.1 *For high hazard areas, the County shall require, as a condition of development approval, a detailed geological investigation and soils report and shall further require, as a condition of approval, that the recommendations of that report be followed.*

Carmel Valley Master Plan:

3.1.1.1 *A soils report in accordance with the Monterey County Grading and Erosion Control ordinances shall be required for all changes in land use which require a discretionary approval in high or extreme erosion hazard areas as designated by the Soil Conservation Service manual "Soil Surveys of Monterey County". This report shall include a discussion of existing or possible future deposition of upslope materials or downslope slippage for each site.*

3.1.1.2 *As part of the building permit process, the erosion control plan shall include these elements:*

- *Provision for keeping all sediment on-site.*
- *Provision for slow release of runoff water so that runoff rates after development do not exceed rates prevailing before development.*
- *Revegetation measures that provide both temporary and permanent cover.*
- *Map showing drainage for the site, including that coming onto and flowing off the property.*
- *Storm drainage facilities shall be designed to accommodate runoff from 10-year or 100-year storms as recommended by the Monterey County Flood Control and Water Conservation District.*

3.1.1.3 *All exposed areas within development projects subject to erosion and not involved in construction operations shall be protected by mulching or other means during the rainy season (October 15-April 15).*

3.1.5 *The amount of land cleared at any one time shall be limited to the area that can be developed during one construction season. This prevents unnecessary exposure of large areas of soil during the rainy season.*

3.1.7 *The combination of generally steep slopes and often thin and erosive soils will present a definite potential for erosion and siltation which may have adverse effects both on and off-site. Development shall therefore be carefully located and designed with this hazard in mind.*

3.1.8 *The native vegetative cover must be maintained on areas prone to rapid runoff as defined in the Soil Survey of Monterey County. These include the following soils:*

a. *Santa Lucia shaly clay loam, 30-50% slope (SfF)*
b. *Santa Lucia-Reliz Association, 30-75% slope (Sg)*
c. *Cieneba fine gravelly sandy loam, 30-70% slope (CcG)*
d. *San Andreas fine sandy loam, 30-75% slope (ScG)*
e. *Sheridan coarse sandy loam, 30-75% slope (SoG)*
f. *Junipero-Sur complex, 50-85% slope (Jc)*

3.1.9 *A condition of approval requiring on-going maintenance of erosion control measures identified in the erosion control plan shall be attached to all permits allowing development in areas prone to slope failure, including, but not limited to, the following:*

- *all development in areas classified as highly susceptible to slope failure;*
- *all development on sites with slopes of greater than 20%;*
- *where roadways are cut across slopes greater than 30%, or across slopes with thin and highly erosive soils.*

3.1.15 *An erosion control plan shall be required for all discretionary development permits and all submittals for areas identified as having a high or extreme erosion hazard prior to accepting such applications as complete.*

15.1.16 *Areas identified as being subject to landsliding, faulting, or other geologic hazards shall receive competent review by professionals acceptable to the County Planning Department at the time any changes in use are proposed. The findings of such review shall be used in determining possible development constraints and in defining appropriate mitigation measures.*

15.1.17 *Areas classified as highly susceptible to slope failure (including categories 5 and 6 of the soil stability classification) should be designated as open space in proposed development plans unless detailed geologic investigations made by professionals acceptable to the Planning Department determine that development may be designed and constructed in a manner to reduce the risk of slope failure or associated hazards and such risk reduction is to a level acceptable to the Board of Supervisors.*

*26.1.10.1 *The County shall prohibit development of slopes greater than 30%. It is the general policy of the County to require dedication of scenic easement on slope greater than 30%.*

Exception may be made for development which can further the goals, and policies of this Plan (same as General Policy 26.1.10).

Monterey County General Plan:

See policies listed above for the New Los Padres Reservoir alternative.

2.8 Fire Hazards

The proposed New Los Padres Reservoir alternatives would be located in a very high fire hazard area, and the proposed Cañada Reservoir alternative would be located in a moderate to high fire hazard area. The reservoir alternatives would comply with the following listed Area Plan policies relating to fire hazards upon approval of a building permit.

2.8.1 New Los Padres Reservoir Project

Cachagua Area Plan:

17.3.5.1 In all new developments water supply for fire protection shall be designed to meet the fire flow requirements of the development, but in no case less than that required by the standards in Table-2 of the Monterey County General Plan. Where the provisions of Table-2 do not apply, a minimum of 10,000 gallons is required subject only to changes authorized pursuant to Policy 17.4.2 of the Monterey County General Plan.

17.4.a Reduce fire hazards to an acceptable level of risk by regulating the type, density, location, design and construction of development, and by prescribing the use, location, type and design of roadways.

17.4.a.1 The fire hazard policies contained in the safety element of the Monterey County General Plan shall be regularly reviewed and consistently applied.

17.4.1.1 The potential for wildland fires in the Planning Area must be recognized in development proposals and adequate mitigation measures incorporated in the design.

All proposed development, Residential, Commercial and Industrial, including accessory uses and existing lots of record, shall incorporate recommendations by the fire agency before a building permit can be issued.

17.4.2.1 In high and very high fire hazard areas as defined by the California Department of Forestry and Fire Protection, roof construction (except for partial repairs) of fire retardant materials shall be required as per Section 3203 (E) of the Uniform Building Code, subject to the following restrictions:

1. Class "A" fire rated roofs required in very high fire hazard areas.

2. *Class "B" or better fire rated roofs required in high fire hazard areas.*

17.4.3 *The County shall adopt the Uniform Fire Code and appropriate amendments.*

17.4.3.1 *The provisions of California Public Resources Code, Section 4291: "Reduction of Fire Hazards Around Buildings" shall be consistently applied and enforced by the fire agency throughout the entire Planning Area.*

17.4.13 *The Cachagua Fire Hazards map shall be used in applying General Plan and Area Plan policies for projects proposed in high and very high fire hazard areas.*

17.4.14 *New development proposals or development-inducing projects which would not be served by adequate fire protection services, public or private roads, or water for fire suppression should be limited to a low-intensity use commensurate with such increased risk.*

Greater Monterey Peninsula Area Plan:

17.3.1.2 *Alternate routes of escape that will safely handle evacuations and emergency equipment should be established....*

17.3.1.3 *In high and extreme wildland fire hazard areas, roof construction of fire retardant materials shall be required as per Section 3203 (e) (excluding 11) of the Uniform Building Code, or as approved by the fire protection agency. For existing wood roof replacement and new exterior wall construction, use of fire resistant materials is recommended but not required.*

17.4.1.1 *In high and extreme fire hazard areas, where practical, development should be clustered and should be separated from the wildland by fuel modification zones in order to facilitate fire protection and prevention.*

17.4.13 *If a fuel modification zone is to be established, provision must be made for its permanent maintenance.*

2.8.2 Cañada Reservoir Project

Carmel Valley Master Plan:

17.3.1.1 *For the purposes of fire equipment access to structural fires, the road widths shall be adequate for two lanes of traffic for those driveways or roads serving more than two habitable structures.*

Where this would result in excessive grading or tree removal, all-weather roads with one lane of traffic and turnouts at regular intervals may be provided with approval of the fire district.

17.4.1.2 *All proposed developments, including existing lots of record shall be evaluated by the appropriate fire district prior to the issuance of building permits. The recommendations of the fire district shall be given great weight and should, except for good cause shown, ordinarily be followed.*

17.4.15 *In high and very high fire hazard areas, as defined by the California Department of Forestry and shown on California Department of Forestry Fire Hazard Maps, roof construction (except partial repairs) of fire retardant materials, such as tile, asphalt or asbestos combination, or equivalent, shall be required as per Section 3203 (e) (excluding 11) of the Uniform Building Code, or as approved by the fire district. Exterior walls constructed of fire resistant materials are recommended but not required. Vegetation removal will not be allowed as a means of removing high or very high fire hazard designation from an entire parcel.*

2.9 Noise Hazards

The New Los Padres Reservoir alternatives would not comply with Cachagua Area Plan policy 22.4.7. SDEIR/EIS Table 12-4 indicates that noise from the proposed rock crushing plant at the New Los Padres Reservoir alternatives' site would result in a noise level of 70 dBA L_{dn} at the nearest residence, which would be above the 55 DBA L_{dn} level recommended in Cachagua Area Plan policy 22.4.7.

The rock crushing plant at the Cañada Reservoir alternative site would result in a noise level of 66 DBA L_{dn}, which would be classified as within the normally conditional noise range for utilities (70-75 dBA L_{dn}) in the County General Plan.

2.9.1 New Los Padres Reservoir Project

Cachagua Area Plan:

22.2.3.1 *The County shall require environmental review of all proposed new development, with special attention to development that will not be serviced by a public electric utility, with regard to cumulative increased in noise levels in surrounding areas.*

*22.4.7 *Noise from major construction project sites shall not exceed 55 dBA L_{dn} as measured at the affected residences.*

2.9.2 Cañada Reservoir Project

Carmel Valley Master Plan:

22.2.4.1 *Noise generating construction activities should be restricted to the hours of 8:00 a.m. to 5:00 p.m. Monday through Friday, where such noise would impact existing development. All construction equipment utilizing internal combustion engines shall be required to have mufflers which are in good condition. An exception to the above stated hours and days of operation is to be allowed for heavy equipment and other noise generating equipment operating to protect life and property in emergency conditions such as fire, flood or seismic emergencies.*

2.10 Archaeological Resources

The New Los Padres and Cañada Reservoir alternatives are respectively located in high and moderate-high archaeologically sensitive areas. Due to possible unknown cultural resource sites that could be inundated by the reservoir alternatives, an intensive cultural resources reconnaissance would be conducted prior to project construction and/or an archaeological monitor would be present during construction to locate any previously unidentified cultural resources (see SDEIR sections 14.2.1 and 14.2.8). Therefore, the proposed reservoir alternatives would comply with the following Area Plan policies upon implementation of mitigative measures.

2.10.1 New Los Padres Reservoir Project

Cachagua Area Plan:

12.1.7.1 The discovery of archaeological, historic, ethnographic or ethnohistoric sites will be followed by procedures which employ project modification, relocation or on-site mitigation measures appropriate to the location, significance of the find and potential impacts of development.

2.10.2 Cañada Reservoir Project

Carmel Valley Master Plan:

12.1.6.1 Archaeological resources, historic resources, and ethnographic and ethnohistoric resources shall be identified, and if adverse impacts would result from a project their significance shall be evaluated, prior to project approval. Based on this evaluation, important representative or unique resources shall be protected and preserved.

12.1.7.1 On discovery of archaeological sites or historic sites, or upon identification of ethnographic or ethnohistoric sites, procedures will be followed which employ project modification, relocation or on-site mitigation measures appropriate to the location, significance of the find and potential impacts of development.

12.1.8.1 Archaeological surveys are required within the three sensitivity zones as follows:

High and Potentially High Sensitivity Zones: All permit applications which include earth disturbing or earth altering activities (including but not limited to grading permits, utility and other excavations, foundation trenching and land leveling, etc.) shall be preceded by a cultural resources reconnaissance.

Low Sensitivity Zones: All major projects or projects otherwise requiring preparation of an EIR shall be preceded by a cultural resources reconnaissance. Construction of or addition to single-family dwellings and other minor projects shall not be required to conduct a cultural resources reconnaissance.

2.11 Park and Recreation Facilities

There are two policies (#32.1.4 and #51.1.5) in the Cachagua Area Plan that may be interpreted as inconsistent with the proposed New Los Padres Reservoir alternatives. As stated in the SD EIR/EIS (page 17-20), filling of the reservoir would inundate four of the affected 23 acres at the northern edge of the Ventana Wilderness Area. The remaining 19 impacted Wilderness Area acres would be used for access roads and buffer area. These impacts could be inconsistent with policy 32.1.4. In addition, visual impacts from an increased inundation area and the proposed access road could affect an isolated portion of the Wilderness Area. The significance of these potential visual impacts are discussed in Response to Comment _____. To mitigate direct project impacts on Wilderness Area land, the MPWMD would donate 140 acres with high quality wilderness value in exchange for the impacted 23 acres, under Public Law 101-539, which allows the Ventana Wilderness land exchange. Thus, the proposed New Los Padres Reservoir alternatives would appear to be in compliance with policy 32.1.4 upon the implementation of proposed mitigation measures.

The proposed inundation area for the New Los Padres Reservoir alternatives would also flood approximately two miles of the Carmel River Trail, which begins near the southern terminus of Nason Road and travels south into the Ventana National Wilderness Area of the Los Padres National Forest. However, Mitigation Measure 17.2.1-2 in the SDEIR (page 17-20) states that the impacted hiking trail would be rebuilt to parallel the existing trail outside the inundation area, thus complying with policy 51.1.5.

New Los Padres Reservoir Project

Cachagua Area Plan:

**32.1.4* *Land uses adjacent to the Ventana Wilderness shall not impact the purpose of the wilderness areas.*

**51.1.5* *The dedication of recreational trail easements shall be encouraged where appropriate either for establishing a planned Cachagua trails system, or where an established trail is jeopardized by impending development.*

2.11.2 Cañada Reservoir Project

Greater Monterey Peninsula Area Plan:

51.1.4 *Riding and hiking trails should be acquired and developed with the intent of creating a coordinated, areawide trails system. All motorized vehicles shall be prohibited from using these trails.*

In supporting a coordinated areawide trails system, the County should give the highest priority to establishing the following trails systems:

a) establish a permanent riding and hiking trail from Roach Canyon to Jacks Peak Park;
b) establish an easterly ridgeline trail from Jacks Peak Park to Laureles Grade;
c) establish a major trail link which generally traverses in a south easterly direction from Carmel Valley and forms a trail connection with the Los Padres National Forest trail system; and
d) establish a connection trail from the Jacks Peak Park/Laureles Grade ridgeline trail to the entrance of Laguna Seca Recreation Area to be used as a point of departure to Toro Regional Park along Highway 68.

51.2.4.1 *Each development proposal shall be evaluated to determine the extent to which such development may help further the County's park and recreation facility goals, objectives and policies.*

2.12 Visual Quality

The New Los Padres Reservoir alternatives are located partially in a visually sensitive area and partially within the Ventana Wilderness Area. The entire Cañada Reservoir alternative project area is located in a visually sensitive area, and Carmel Valley Road is a proposed scenic route. The New Los Padres Reservoir alternatives would comply with the following Cachagua Area Plan policies. The Cañada Reservoir alternative would comply with applicable Area Plan policies upon implementation of the mitigative measures described in SDEIR section 13.2.8, and the design control and site plan review zoning district regulations.

2.12.1 New Los Padres Reservoir Project

Cachagua Area Plan:

26.1.6.2 *The local citizens advisory committee should review all project proposals to assess the visual impacts of projects on the viewshed of the Planning Area. This viewshed consideration should be a required recommendation to the Planning Commission.*

26.1.26 *The visible alteration of natural landforms caused by cutting, filling, grading or vegetation removal shall be minimized through sensitive siting and design of all improvements and maximum possible restoration.*

40.1.2 *To enhance and maintain sensitive visual resources, the County shall pursue measures to designate Carmel Valley Road as a scenic County route.*

2.12.2 Cañada Reservoir Project

Monterey County General Plan:

26.1.9 *In order to preserve the County's scenic and rural character, ridgeline development shall not be allowed unless a special permit is first obtained. Such permit shall only be granted upon findings being made that the development as conditioned by permit will not create a substantially adverse visual impact...*

Greater Monterey Peninsula Area Plan:

1.1.3 *The County shall take comprehensive measures to ensure protection of sensitive and highly sensitive scenic areas as shown on the Greater Monterey Peninsula Visual Sensitivity Map.*

7.2.3 *Plant materials shall be used to integrate the manmade and natural environments, to screen or soften the visual impact of new development, and to provide diversity in developed areas.*

Carmel Valley Area Plan:

26.1.21 *It is intended that the Carmel Valley remain rural residential in character.*

26.1.24 *Every attempt should be made to minimize hillside scarring by avoiding cuts and fills where possible and where cuts and fills are unavoidable, by creating slopes that shall be revegetated. Permanent non-revegetated scarring of hillsides is strongly discouraged and should occur only if no other reasonable alternative is available.*

26.1.25 *The visible alteration of natural landforms caused by cutting, filling, grading, or vegetation removal shall be minimized through sensitive siting and design of all improvements and maximum possible restoration including botanically appropriate landscaping.*

26.1.29 *Design and site control shall be required for all new development throughout the Valley, including proposals for existing lots of record, utilities, heavy commercial and visitor accommodations but excluding minor additions to existing development where those changes are not conspicuous from outside of the property. The design review process shall encourage and further the letter and spirit of the Master Plan.*

26.1.31 *Materials and colors used in construction shall be selected for compatibility with the structural system of the building and with the appearance of the buildings natural and man-made surroundings.*

31.1.4 *Facilities (such as sewage treatment facilities, solid waste disposal facilities, water storage tanks, pumping stations, power and communications substations) shall be subject to design control and shall be screened from public view by use of natural terrain and vegetation or buffer areas and artificial screening.*

56.2.4 *Except where inconsistent with sound environmental planning, new above-ground transmission facilities shall 1) follow the least visible route (e.g., canyons, tree rows, and ravines, 2) cross ridgelines at the most visually unobtrusive locations, 3) follow, not compete with , either natural features of the terrain or man-made features in developed areas, and 4) be well designed, simple and unobtrusive in appearance, have a minimum of bulk, use the minimum number of elements permitted by good engineering practice, and make use of colors and materials compatible with local surroundings.*

Monterey County General Plan:

See the policies listed above for the New Los Padres Reservoir project.

2.13 Transportation

The transport of oversized equipment to and from the reservoir construction sites would require a Transportation Permit from Caltrans. The proposed reservoir alternatives would comply with the applicable Area and General Plan policies upon implementation of the mitigative measures described in SDEIR sections 10.3.1 and 10.3.8.

2.13.1 New Los Padres Reservoir Project

Cachagua Area Plan:

39.3.3 *The County shall consider traffic impacts on local roads that will be generated by projects. Projects that provide services and that will have the effect of reducing trips to points outside of the Planning Area should be encouraged.*

39.3.4 *The County shall require that any major timber, mining, or public works projects incorporate features, such as flagpersons, signs, or warning lights, into the project to ensure the safety of persons using public roads.*

39.3.5 *The County shall require that any major timber, mining or public works projects that use heavy vehicles on public roads restore such roads to the pre-project level.*

Monterey County General Plan:

13.3 *Incorporate energy efficiency into the design and location of development projects.*

13.3.3 *Plans for major projects shall address opportunities for reducing energy used for transportation, including pedestrian and bicycle pathways, access to transit, and roadway design.*

2.13.2 Cañada Reservoir Project

Monterey County General Plan:

See polices listed above for the new Los Padres Reservoir project.

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1. Monterey Peninsula Water Management District, *Near-Term Desalination Project Draft EIR*, April 1992, Section 4.1.3, Land Use, Planning, and Zoning.

2. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sanctuaries and Reserves Division, Monterey Bay National Marine Sanctuary, Volume I, Final Environmental Impact Statement and Management Plan, Volume II, Appendices, June 1992.

3. Ibid, p. III-24, Volume I.

4. Ibid, p. III-50.

5. Ibid.

6. Ibid, p. III-53.

7. Ibid, III-45.

APPENDIX 19-A

GROWTH STUDY UPDATE – 1992

APPENDIX 19-A

GROWTH STUDY UPDATE -- 1992

INTRODUCTION

This housing, population and employment update has been prepared at the request of the Monterey Peninsula Water Management District (District) to address comments received on the Long-Term Water Supply Project Supplemental Draft EIR/EIS. Numerous commentors suggested that the 1988 estimate of housing and employment buildout potential within the District's service area was based on dated information. Commentors noted that changes in local general plans and zoning adopted since 1988 might significantly reduce buildout potential within the District.

In January of 1992, District personnel conducted brief telephone interviews with planning department staff within the local jurisdictions served by the District. No significant changes in local planning were noted at that time. The District then commissioned EIP Associates to conduct a more thorough follow-up investigation of these issues. It should be noted at the outset that the objective of revisiting the 1988 study was not to "second guess" the study's conclusions or its methodology, both of which received thorough review and approval by local agencies in 1988. The scope of the additional investigation is to ascertain whether significant changes in local land use planning have occurred such that use of a modified estimate would be reasonable for District planning purposes.

EXECUTIVE SUMMARY

Planning staff of Monterey County, Carmel-by-the-Sea, Pacific Grove, City of Monterey, Seaside, Sand City and Del Rey Oaks were interviewed by telephone and/or in person. Minor changes in local planning suggest that approximately 1,486 fewer net dwelling units (d.u.) may occur within the District's present boundaries at buildout (824 fewer multi-family and 662 fewer single-family d.u.). Additionally, some 487 fewer hotel rooms can be expected, with a consequent reduction of some 390 hotel employees. The most substantial reduction in housing and employment potential has occurred in Sand City, the Del Monte Forest planning area of Monterey County (Pebble Beach) and the City of Monterey. An increase of approximately 169 existing but previously undocumented multi-family units in Pacific Grove were accounted for in this investigation (and are reflected in the above net-loss calculation).

New single-family units would be 16% less than projected in 1988, or a 2.0% reduction of the total single-family housing stock anticipated to exist at buildout (i.e., units existing in 1988 plus those expected at buildout). The multi-family reductions amount to 6.9% of new units and 2.4% of the total multi-family housing stock anticipated at buildout. The reduction of 487 hotel rooms (all in Sand City) amounts to a 33% reduction of units allowed by the 1985 Sand City LCP. The associated loss of 390 hotel workers amounts to about 1% of anticipated total new employees within the District and far less than 1% of all employment within the District at buildout.

These reductions do not account for increased density of residential uses within existing and future neighborhoods associated with auxiliary and efficiency units (e.g. "in-law" units). Nor do these reductions account for potential "density bonuses" of up to 25% mandated by State law to developers who propose construction of housing affordable to low income residents.

SAND CITY

Sand City represents a fairly unique situation within the District's jurisdiction for two principle reasons. First, the City's zoning ordinance permits limited housing as a secondary use in most of the City's industrial and commercial zoning districts. Because there is no way of foreseeing which future developments may or may not request such secondary uses, the 1988 estimate assumed that Sand City's industrial and commercial zoned acreage would support some 1,125 to 1,944 "mixed-use" residential units.[1] This is consistent with the overall methodology of the report (i.e. projection of maximum uses permitted by existing zoning). However, given the relative unattractiveness of living above an industrial use, this "maximum buildout assumption" is perhaps far less valid for Sand City than for virtually any other local jurisdiction within the District's boundaries.

The second factor which complicates any estimation of Sand City buildout potential is the controversial coastal development permitted by the City's Local Coastal Program (LCP). It is beyond the scope of this study to determine which if any of these coastal projects is "feasible." This study seeks only to integrate reduced buildout potential associated with projects and planning acknowledged by Sand City planning staff at this time.[2] Coastal lots are referenced in this update according to their numeric designation in the Sand City 1985 LCP, Appendix "Land Use Analysis Area Locations" (lots 1-11 from south to north).

The 1988 estimate indicates that no additional single-family units (defined as R-1 units) would be permitted at buildout; 673 new multi-family units are permitted and between 1,125 to 1,944 new "mixed-use" units are permitted as secondary uses above primary commercial and industrial uses. At this time, none of these new residential units have been constructed.

Single-Family Units

Approximately 20 single-family units (R-1 district) would be permitted as part of the 200 Coastal Visitor-Serving units proposed for the Monterey Bay Club development (lot 9, the "Ritter Property," also known as the 15.64 acre "dump site" property); permanent residential use of 10% of the 200 units is allowed by the LCP. These units were not considered separately from the lot's overall visitor serving zoning designation in the 1988 report and are thus treated as new residential development potential in this update. No other increase or reduction of single-family units was determined in this update.

Multi-Family Units

The 673 new "multi-family~ units, described in Table 11 of the 1988 Report, would be reduced by about 35 units to a total of about 638 units as described below.

Lot 10 was the subject of an extensive development proposal by Fargo Industries (Sands of Monterey project) which Sand City is now using as a specific plan "template" to guide any future site development. The Sands' development intensity is less than originally allowed by the 1985 LCP and includes 105 permanent residential condominiums (down from 140 allowed by the LCP). Lot 5 is the subject of a preliminary development proposal for 370 multi-family units (R-3), the maximum allowed by the 1985 LCP. The mixed ownership parcels east of Highway one and south of the Regional Shopping Center, the so-called East Dunes parcels, are the subject of extensive residential development planning by the Sand City Redevelopment Agency. Although the parcels have a legal development potential of nearly 300 units (due partly to substandard lot sizes), the Sand City

Multi-Family Development Potential

Parcel Description	d.u.
Lot 10 (Sands of Monterey proposal)	105
Lot 5 (South of Tioga)	370
"East Dunes" parcels (mostly non-coastal zone)	163
TOTAL	**638**

Planning Department believes that realistic development potential cf these lots, in a affordable housing planned unit development, is between 150 to 175 units, or an average of 163 units. Thus the estimate in the 1988 Report, of 673 new multi-family units, would be reduced by about 35 units under current planning.

Mixed-Use Units

The 1988 Report indicates a potential for approximately 1,125 - 1,944 "mixed-use" units, i.e., those capable of development as secondary uses in the various Sand City zoning districts. This update finds a reduction of approximately 674 units.

The Regional Shopping Center (Costco) consumed approximately 40 gross acres of industrially zoned land and provided no secondary housing units. The "north of Playa" properties, which comprise about 32.5 additional acres of industrially zoned land, are presently expected to accommodate only about 100 mixed-mixed use residential units. Subtraction of these 72.5 acres of "non-coastal" industrially zoned properties from the total of 92.51 acres yields a potential for 199 units.[3] Addition of the 100 anticipated units means that instead of 922 potential mixed-use units in the non-coastal industrially zoned portions of Sand City, only 299 are now feasible, a reduction of 623 units.

The 1988 report provided a comparable estimation of mixed-use housing potential in coastally zoned parcels; potential for between 495 and 781 mixed-use units was identified using a zoning district "net square foot calculation" (see endnote 3). This approach to calculating secondary use housing potential is less appropriate in the "west of Highway 1" portion of the Sand City coastal zone because this area is subject to relatively detailed planning contained in the 1985 LCP. Consequently, this update provides an alternative analysis of housing potential in Sand City's western coastal zone which indicates a reduction of 51 units of coastal mixed-use, multi-family housing from the maximum of 781 indicated in the 1988 Report. This alternative housing potential calculation is instead founded on Sand City's policy level commitment to require coastal developments to provide housing for up to 15% of new employees associated with development permitted by the 1985 LCP.

Table 13 of the 1988 Report indicates potential for 3,086 to 5,257 new coastal zone employees. Some 1,196 of these derive from the 1,495 hotel/motel rooms permitted by the 1985 LCP. The Sands of Monterey project reduced its hotel count from 375 rooms to 350. Recent purchase of individual beach lots by the State Park Department and the Monterey County Regional Park District has effectively eliminated potential for development of an additional 370 hotel rooms at the south end of Sand City (lots 1, 2, 3, and 4). The Sterling Center has been approved as a 137 room hotel, down 92 rooms from 229 permitted in the 1985 LCP. This reduction of 487 rooms correlates to a reduction of 390 employees (assuming 0.8 employees per hotel room). This reduces the maximum coastal-related employment potential to 4,867 persons. Assuming Sand City's commitment to require on-site housing for up to 15% of these employees, a demand driven potential for 730 units results, down 51 units from the maximum of 781 units estimated in the 1988 Report.

It is possible, and perhaps even probable, that far less development will occur in Sand City than is projected even in this reduced estimate of buildout potential. However, the political and legal controversy surrounding Sand City's development planning makes a more thorough investigation somewhat futile. The housing and employment potential indicated in this update is legally permitted by Sand City's unique zoning system and by its State approved LCP and is therefore an appropriately conservative basis for the District's water supply planning.

MONTEREY COUNTY: DEL MONTE FOREST PLANNING AREA (CalAm)

Monterey County planning department staff were interviewed by telephone and in person.[4] Since 1988, there have been no amendments of the Del Monte Forest Land Use Plan, the Carmel Valley Master Plan, the Carmel Area Land Use Plan or the Greater Monterey Peninsula Area Plan which would alter the buildout projection indicated in the 1988 Report.

However, the County is in the preliminary phase of a major amendment of the Del Monte Forest Plan which will likely reduce the potential for construction of 682 units of single family housing and increase potential for multi-family housing by 59 units above current planning.

The County Plan amendment is expected to take as its primary basis the recent Pebble Beach Company proposal to construct 350 new single family units. Construction of another 52 County Club units is proposed, and a residual of 174 vacant lots of record, which it is assumed will develop as single family units, indicates a potential for 576 new single family units in the Del Monte Forest planning area. The County is presently planning to require onsite construction of 59 units of affordable housing as a planned unit development. It is expected that the Pebble Beach Company would accommodate this requirement by eliminating 28 of the 350 single family units. Thus, of the total of 1,230 single-family units presently allowed by the Del Monte Forest Land Use Plan, it appears that as few as 548 will be built, a reduction of 682 units. The 80 multi-family (condominium) units indicated in the 1988 Report (since built) would be augmented by an additional 59 units of affordable housing. No other planning changes are contemplated by the County at this time within the District's boundaries.

CITY OF MONTEREY

City of Monterey planning department staff were interviewed by telephone and in person.[5] The City adopted a reformatting of it zoning ordinance in May 1990. The amendment reduced the potential for construction of 174 multi-family units. No other revision affecting the 1988 buildout estimate has occurred in the City of Monterey.

PACIFIC GROVE

Pacific Grove planning department staff were interviewed by telephone.[6] Documentation supplied by Pacific Grove indicated that the 1988 Report undercounted existing multi-family units in Pacific Grove by 169 units. No amendment of the City's zoning ordinance or general plan has occurred since 1988 that would directly affect the 1998 Report's projection of new multi- or single-family housing potential.

It should be noted though that Pacific Grove has recently adopted an ordinance permitting the construction, within select R-1 districts, of new "auxiliary" dwellings, or remodelled interior "efficiency" living quarters. Assuming all affected existing single-family units were to construct such units, up to 3,328 additional single person dwellings could potentially result above those accounted for in the 1988 Report.

It is the District's position that water demand of such units is accounted for in the District's 820 Acre Foot per Year allotment for Use Intensification. This allotment (8% of the residential sector demand estimated in the 1988 Report) is reserved by the District to supply increased water use per meter associated with intensification of existing residential uses resulting from grown children returning to the parental home, parents residing with adult children and shared housing among unrelated adults due to high housing costs. Therefore, this change in the Pacific Grove zoning ordinance is not considered to alter the 1988 estimate of buildout potential in Pacific Grove.

SEASIDE

City of Seaside planning department staff were interviewed in person.[7] Three amendments to the City's zoning ordinance since 1988 have each dealt with minor modification of permitted uses within commercial zoning districts within the City. No substantial alteration of residential or commercial buildout potential has occurred in Seaside since 1988.

CARMEL-BY-THE-SEA

Carmel-by-the-Sea planning department staff were interviewed by telephone.[8] Five minor amendments to the City's commercial zoning have occurred since 1988 none of which represent a substantial alteration of the City's commercial buildout potential. Recent legalization of 265 existing "in-law" units does not alter new development potential within the City. As with Pacific Grove, new "in-law" units would be accommodated by the District's intensification allotment.

DEL REY OAKS

The District determined that no amendments have occurred to the Del Rey Oaks zoning ordinance, or general plan since 1988. No further contact with the City was conducted as part of this update.

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1. See Table 11, page 2-30, 1988 Estimate.

2. Estimates of Sand City development potential included in this report are based on personal communications with Kelly Morgan, Director, Sand City Planning Department, May 5, 1992, and reflect modification of the estimates derived from application of the 1988 study methodology based on projects constructed since 1988 which include less than permitted housing uses, or on plan level analysis of development potential for large parcels in Sand City but for which no specific project proposals have been submitted at this time.

3. Assumes methodology in the 1988 Report (Table 12, page 2-31) and Costco and North of Playa acreage figures supplied by Kelly Morgan, Director, Sand City Planning Department, personal communication, May 5, 1992.

92.51 ac (non-coastal industrial zoned) - 40 ac. (Costco) = 52.51 ac - 32.5 ac. (North of Playa industrial) = 20.01 ac x .85 net ac = 17 ac x 43,560 s.f./ac = 740,520 s.f. x .35 lot coverage = 259,182 s.f. x .5 second floor coverage dedicated to 650 s.f. mixed-use units = 199 d.u.

4. Personal communication, Juliana Rose, Monterey County Planning Department, May 6, 1992.

5. Personal communication with Bruce Kibby, City of Monterey Planning Department, May 5, 1992.

6. Telephone communication, Judy McClelland, Pacific Grove Planning Department, May 4 and 6, 1992.

7. Personal communication with Earnest Franco, Seaside Planning Department, May 5, 1992.

8. Telephone communication with Jana Weston, Carmel-by-the-Sea Planning Department, May 8, 1992.

APPENDIX 19-B

SUMMARY OF MITIGATION MEASURES FOR GROWTH IMPACTS

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
NEAR-TERM DESALINATION PROJECT

SUMMARY OF GROWTH IMPACTS AND MITIGATION MEASURES FROM THE MPWMD WATER ALLOCATION PROGRAM EIR

Prepared by Margo Nottenkamper, Associate Project Planner
Revised November 18, 1992

SUMMARY

The Water Allocation Program EIR, prepared for the District by Mintier & Associates in 1990, analyzed the environmental and growth inducement impacts of five different water supply options and six alternative distribution options for the District. The largest water supply option, Option III, equates to a Cal-Am System Capacity Limit of 20,500 AF per year. This corresponds to the "worst case" scenario of 3,000 AF of new connections allocated from the Desalination Project. As discussed in Section 1 of the Final EIR, this Near-Term Desalination Project EIR is tiered from the Water Allocation Program EIR, specifically for the growth inducement and cumulative impacts for the desalination project.

The growth inducement impacts and mitigation measures identified were similar for all water supply options. The Findings which were adopted by the District Board during the EIR certification process in November 1990 enumerated the growth inducement impacts and mitigation measures identified in the Water Allocation Program EIR. These impacts and mitigation measures also apply to the various supply options associated with the Desalination Project.

In October 1992, the District Board expressed its intent to allocate 1,500 acre-feet of water from the desalination project to new connections, at an initial rate of 160 acre-feet per year. This annual rate is consistent with the *1991 Interim Regional Population and Employment Forecast* adopted by the Association of Monterey Bay Area Governments (AMBAG) in April 1992. The allocation of 1,500 acre-feet to new connections would result in a Cal-Am System Capacity Limit of 18,859 AF per year (with the Paralta well), which is below the maximum Cal-Am capacity of 20,500 AF analyzed in the Water Allocation Program EIR.

The following discussion of growth inducement impacts and mitigation measures are excerpted from the Water Allocation Program EIR, with updates made where new information has become available. The Transportation Agency for Monterey County was consulted for the Traffic impacts analysis[1], and the 1991 Air Quality Management Plan provided updated information regarding Air Quality impacts[2].

TRAFFIC

Impacts

The additional average daily trips (ADT) that would be generated by a Cal-Am System Capacity Limit of 20,400 AF per year would generally worsen the level of service (LOS) on Monterey Peninsula freeways relative to the existing conditions. Even with planned improvements, five of the eight segments analyzed would continue to experience unacceptable LOS. It should be noted that there is a shortage of funds to complete even a small set of the planned improvements. The failure of Measure B (sales tax) means that the Transportation Agency for Monterey County will not be able to compete for limited state funds as well as the areas with a sales tax for transportation. Only Segment 1 (SR 1) could be expected to meet the Monterey County standard of LOS C. The adverse traffic-related impacts of this System Capacity Limit are therefore considered significant. However, it should be noted that the following mitigation measures would apply to any conditions, since all of the freeway segments analyzed are currently operating at an unacceptable level of service, as shown in Attachment A.

Mitigation Measures

The District should ask the transportation authorities to implement the following improvements:

1. Street and highway project have been identified by the Transportation Agency for Monterey County and the California Department of Transportation to improve freeway conditions in the Monterey Peninsula region. These are:

    A. Hatton Canyon Freeway construction would bypass the existing SR 1 from 0.3 mile south of the Carmel River to 0.1 mile south of the SR 1 and SR 68 (Holman Highway) junction with a four-lane freeway. (Note that Hatton Canyon will be reviewed by the Transportation Agency in late 1992/early 1993 regarding relative priority with respect to other roads and design options.)

    B. Carmel Valley Road would be widened from SR 1 to Carmel Rancho Boulevard and from Via Petra to Valley Greens Road.

    C. SR 68 (Holman Highway) would be widened with a climbing lane between the junction with SR 1 and Presidio Boulevard.

    D. SR 68 would be widened to four lanes from its junction with SR 1 to Los Laureles Grade, or a separated Highway 68 bypass would be constructed.

    E. SR 1 would be widened from Route 68 to Ord Village.

F. A new multi-modal corridor through Fort Ord could be constructed to relieve traffic on Highways 1, 68, 218, and Reservation and Blanco Roads.

2. The following unplanned improvements would also be required to improve the level of service:

A. SR 1 would be widened to six lanes between Carmel Hill and the Sloat undercrossing;

B. SR 1 would be widened to eight lanes from the Sloat undercrossing to the junction with SR 68;

C. SR 68 (Holman Highway) would be upgraded from a four-lane highway to a four-lane freeway;

D. SR 68 would be widened to six lanes from the east junction with SR 1 to SR 218.

3. A number of additional regional measures are available to reduce traffic volumes in the Monterey Peninsula area, including the following:

A. Implement the Monterey-Salinas Short-Term Transit Plan, including:

1. maintaining existing levels of service including evening bus service,

2. expanding service to new areas to serve new development and presently unserved areas,

3. adding new service for visitor transportation on the Monterey Peninsula and in the unincorporated areas of the county where major visitor events are held,

4. adding to the existing bus fleet,

5. constructing transit centers and park-and-ride lots, and

6. improving passenger information at bus stops.

B. Develop a Long-Range Transit Program that includes provisions for:

1. an intercity bus service connecting south county and Salinas;

2. initiation of subscription bus service for large employers, hotels and motels, special events and major trip attractors; and

3. initiation of service to newly developing areas in Monterey County.

C. Implement Region-Wide Improvements:

1. Implement an intracity and intercity bicycle program as described in the Monterey Regional Transportation Plan (MTCT 1988).

2. Implement transportation control measures as outlined in the 1989 Air Quality Management Plan for the Monterey region.

3. Develop rail service between the San Francisco Bay Area, Gilroy, Salinas and Monterey via Fort Ord.

4. Construct a multi-modal transportation terminal and park-and-ride at Fort Ord.

5. Implement an Express Bus Service.

Cost estimates and funding sources are not available for the improvements listed above. In addition, the District lacks the authority to implement the above-mentioned improvements, and consequently, would not be able to carry out the required monitoring and mitigation pursuant to AB 3180. As a result, the proposed mitigation measures are unlikely to be implemented without the cooperation of other public agencies.

While these mitigation measures would improve traffic conditions, it is unknown whether they would reduce the traffic impacts of the distribution alternatives to a less than significant level.

SCHOOLS

Impacts

The MPUSD elementary and middle school system and the entire PGUSD system have adequate capacity to serve the additional student population that would occur with a 20,400 AF Cal-Am System Capacity Limit. Enrollment at the MPUSD high schools and the entire CUSD system could exceed capacity if no new schools or portable classrooms were constructed before buildout of the development supported by the increased system capacity limit.

While increased enrollments at several schools would exceed existing remaining capacity with a 20,400 AF Cal-Am System Capacity Limit, these impacts are considered less than significant since school districts are authorized by State law to levy school impact fees on new development to fund the construction of classrooms or installation of portable classrooms.

Mitigation Measures
None required.

WASTEWATER

Impacts
Combined treatment facility capacity (remaining capacity) is adequate to handle future wastewater flows generated by the 20,400 AF Cal-Am System Capacity Limit. The impact of additional wastewater generation is considered less than significant.

Mitigation Measures
None required.

EMPLOYMENT

Impacts
The increase of the Cal-Am System Capacity Limit to 20,400 AF per year would result in additional employment-generating development. While this is generally considered a beneficial impact, for CEQA purposes, it would result in no environmental impact.

Mitigation Measures
None required.

CONSTRUCTION INDUSTRY

Impacts
The Cal-Am System Capacity Limit increase to 20,400 AF per year would support pre-1991

levels of residential construction-related employment and income for approximately 11 years. Construction activities would probably experience a gradual slowdown within the Cal-Am service area after this period, which would allow construction workers and businesses to gradually adjust to lower levels of construction activity. While the impacts to the construction industry are considered less than significant, and for CEQA purposes, this would result in no environmental impact.

Mitigation Measures
None required.

TOURISM

Impacts
While the system capacity limit increase would have a generally beneficial impact on tourism by providing water which could be used for additional hotel development, it would result in no environmental impact for CEQA purposes.

Mitigation Measures
None required.

MILITARY

Impacts
The Cal-Am System Capacity Limit of 20,400 AF per year would have no impact on military facilities within the Cal-Am service area.

Mitigation Measures
None required.

FISCAL

Impacts
The potential fiscal impacts of the supply options on the eight jurisdictions are a result of the types of land uses which would be developed under each jurisdiction's general plan. For the purposes of CEQA, this would result in no environmental impacts.

Mitigation Measures
None required.

AIR QUALITY

Impacts
Increases in regional pollutant emissions from growth that would occur with a Cal-Am System Capacity Limit of 20,400 AF per year are expected to worsen air quality on the Monterey Peninsula and contribute to the cumulative impacts of increased air pollutant emissions within the region. Since the North Central Coast Air Basin is currently classified as in nonattainment of federal and state air quality standards for ozone and PM10 (particulates), increased air pollution emissions are considered to be significant adverse impacts.

The 1991 Air Quality Management Plan for the Monterey Bay Region identifies 20 measures to control emissions of reactive organic gases from stationary sources, 5 measures for stationary sources of oxides of nitrogen (NOx) emissions, and 8 transportation control measures. Implementation of these controls, in addition to those identified in the 1989 Air Quality Management Plan and the Air Resources Board (ARB), will achieve the 30 percent decrease in emissions required by the ARB by 1997.

It should be noted that the 1991 Air Quality Management Plan forecasts future emissions assuming already approved control measures and the growth forecasts for the area. The emission forecasts relating to growth and development are based on the AMBAG population and employment forecasts. As noted on page 1, the District has indicated an initial annual allocation of 160 acre-feet per year for new connections, which is also consistent with the regional population and employment forecasts. In this manner, the phased increase in water supply is consistent with the 1991 Air Quality Management Plan.

Mitigation Measures
Planned emission control measures identified in the 1991 Air Quality Management Plan and traffic mitigation measures identified in the previous section on traffic would reduce air pollutant emissions. However, the District lacks the authority to implement the various control measures, and consequently, would not be able to carry out the required mitigation and monitoring activities pursuant to AB 3180. As a result, the identified mitigation measures are unlikely to be implemented without the cooperation of other public agencies.

It is unknown whether these measures will be successfully implemented to reduce the air quality impacts to a less than significant level.

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[1] Pat Goodchild, Transportation Agency for Monterey County. Personal communication, November 12, 1992.

[2] Draft 1991 Air Quality Management Plan for the Monterey Bay Region. Prepared by the Monterey Bay Unified Air Pollution Control District, September, 1991.

TRAFFIC IMPACTS: LEVELS OF SERVICE DESIGNATIONS
(Excerpted from MPWMD Water Allocation Program EIR)

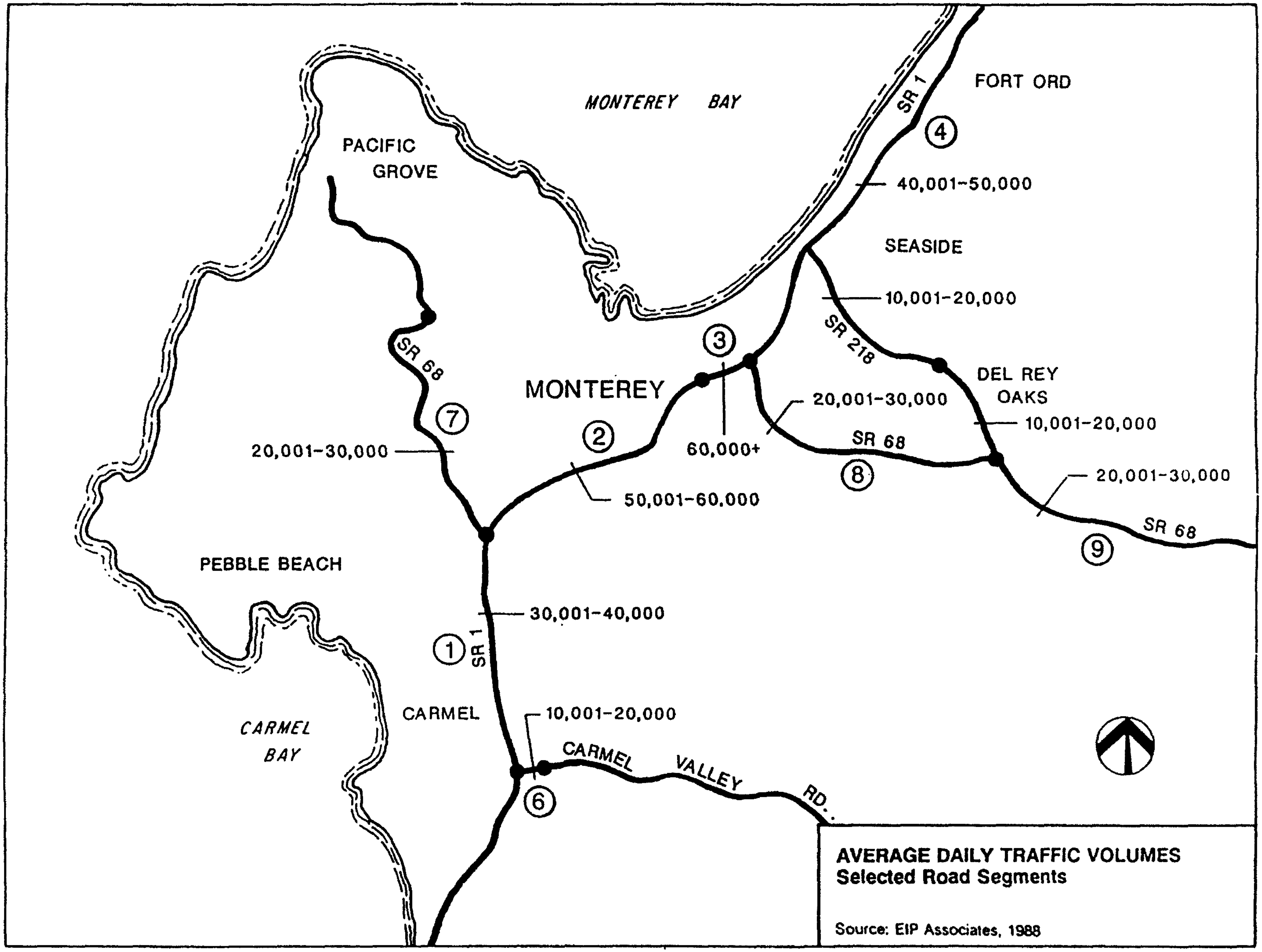
1986 LEVELS OF SERVICE FOR SELECTED FREEWAY/ROADWAY SEGMENTS
(Under Existing Conditions)

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	F[3]
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/E[3]

[1]Segments are illustrated in figure attached.
[2]See definitions below.
[3]1992 Congestion Management Program LOS Monitoring

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



AVERAGE DAILY TRAFFIC VOLUMES
Selected Road Segments

Source: EIP Associates, 1988