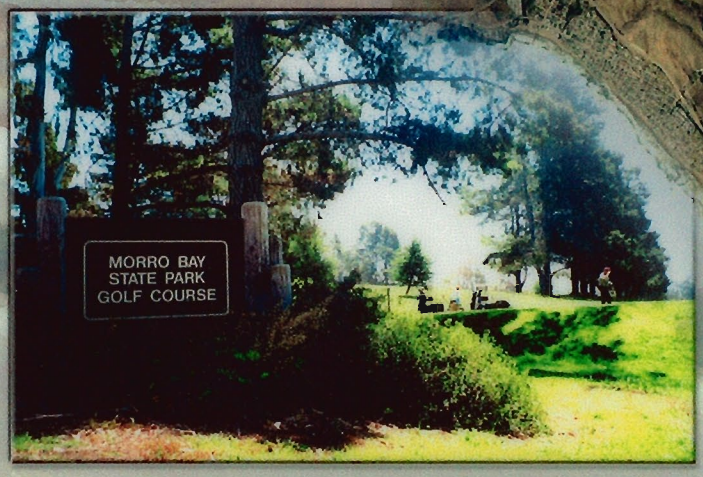
BK

Cayucos/Morro Bay

Comprehensive Recycled Water Study

City of Morro Bay
Cayucos Sanitary District

ACCEPTED AS FINAL
by Central Coast RWQCB
based on Letter Addendum
attached to inside cover



October 1999

carollo engineers

City of Morro Bay
Morro Bay, CA 93442 • 805-772-6200

March 24, 2000
4857A00

Mr. Roger Briggs
California Regional Water Quality Control Board
Central Coast Region
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5427

Subject: Morro Bay-Cayucos Sanitary District
Comprehensive Recycled Water Study
Addendum Letter to Finalize October 1999 Draft Report

Dear Mr. Briggs:

Thank you for your review and response on the above referenced report. You stated in your review letter dated February 16, 2000:

> *"We noted only minor issues regarding the content of the report, which should be addressed prior to final adoption by your respective agencies. These are as follows:*
>
> 1. *Page 3-9 refers to median and maximum coliform limitations. We suggest you clarify that these limits apply to total (rather than fecal) coliform bacteria.*
>
> 2. *Also on page 3-9, Table 3.2 lists type 2 recycled water with turbidity limits, however we are unfamiliar with this application of the turbidity limits. Also, the same table lists type 3 recycled water with unclear turbidity limits and disinfected to 23 MPN coliform bacteria. However the following page describes type 3 water as "undisinfected". These limits should be clarified in the table and/or text.*
>
> *With the exception of these very minor issues, we found the report informative and excellent reference for future water reuse planning within your communities."*

We would like to address these minor issues by replacement of Table 3.2, titled Existing Recycled Water Treatment Regulations with the attached table of the same title. You will note that the revised table includes the call-out of total coliform as requested and references to turbidity limits is removed.

FINANCE
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ADMINISTRATION
595 Harbor Street

FIRE DEPARTMENT
715 Harbor Street

PUBLIC SERVICES
590 Morro Bay Boulevard

HARBOR DEPARTMENT

POLICE DEPARTMENT

RECREATION AND PARKS

We discussed finalizing the report with Ms. Sorrel Marks of your staff and it was agreed that since the comments were very minor that the October 1999 report would not be reprinted but would be considered as final based on the following:

1. This revised addendum letter will be distributed to be stapled to the inside cover page.

2. A new inside cover page with the engineers stamp indicating the report is final will be distributed (see attached).

3. A sticker will be made for the outside cover which states:

   ACCEPTED AS FINAL
   by Central Coast RWQCB
   based on Letter Addendum
   attached to inside cover

   and will be distributed.

A CD of the final report will also be provided to both the City of Morro Bay and Cayucos Sanitary District..

The above three items will be distributed by the City of Morro Bay and Cayucos Sanitary District to those who received the October 1999 draft report. The distribution will occur within this month, March 2000. If you have further issues please feel free to contact either of us.

Sincerely,

Mr. Bruce Keogh
City of Morro Bay

Mr. David Phillips
Cayucos Sanitary District

cc: Tracy Clinton, Carollo Engineers, P.C.
David Stringfield, Carollo Engineers, P.C.

Brigg01.doc

Table 3.2 Existing Recycled Water Treatment Regulations
California Code of Regulations, Title 22, Division 4, Chapter 3
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Type[1]	Approved Uses	Treatment Level	Total Coliform Standard (Median)
1	• Spray Irrigation of Food Crops • Landscape Irrigation[2] • Nonrestricted Recreational Impoundment	Disinfected, Oxidized, Coagulated, Clarified, Filtered Wastewater	2.2 / 100 ml
2	• Surface Irrigation of Food Crops • Restricted Recreational Impoundment	Disinfected, Oxidized Wastewater	2.2 / 100 ml
3	• Pasture for Milking Animals • Landscape Irrigation[3] • Landscape Impoundment	Disinfected, Oxidized Wastewater	23 / 100 ml
4	• Surface Irrigation of Orchards and Vineyards[4] • Fodder, Fiber and Seed Crops	Primary Effluent	N/A

(1) Recycled water type designation not part of Title 22. Established for clarity.
(2) Includes parks, playgrounds, school yards, and other landscaped areas with similar access.
(3) Includes golf courses, cemeteries, freeway landscapes, and landscapes with similar public access.
(4) No fruit is harvested that has come in contact with irrigating water or the ground.

Cayucos - Morro Bay
Comprehensive Recycled Water Study

Copies distributed to:

Ms. Sorrel Marks	(1)	Draft October 1999
Mr. Mr. Bob Hendricks/Bruce Keogh/ Mr. Larry McPherson	(4)	Draft October 1999
Mr. David Phillips	(2)	Draft October 1999
Mr. Dean Uota	(1)	Admin Draft - September 1999
Mr. David Phillips	(7)	Admin Draft - September 1999
Mr. Bob Hendricks/Mr. Bruce Keogh/ Mr. Jim Chapman	(8)	Admin Draft - September 1999
Mr. Larry McPherson	(1)	Admin Draft - September 1999
Mr. Bob Hendricks - Public Works Advisory Board	(8)	Admin Draft - September 1999

Cayucos/Morro Bay

COMPREHENSIVE RECYCLED WATER STUDY

FINAL

March 2000

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WWTP

Cayucos/Morro Bay

COMPREHENSIVE RECYCLED WATER STUDY

DRAFT

October 1999

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CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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COMPREHENSIVE RECYCLED WATER STUDY

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EXECUTIVE SUMMARY

The City of Morro Bay and the Cayucos Sanitary District discharge wastewater to the wastewater treatment plant (WWTP), which is jointly owned and located in Morro Bay. The WWTP has a 301(h) modified National Pollutant Discharge Elimination System (NPDES) permit for discharge of primary and secondary blended effluent to the ocean. The 301(h) waiver waives only two secondary requirements namely, BOD_5 and TSS. All other NPDES secondary discharge limitations, including toxicity, apply to the WWTP discharge without exception. The WWTP's current operation maximizes secondary treatment to ensure the highest quality effluent is achieved. Based on scientific ocean monitoring, the discharge consistently meets or is far below the permitted discharge limits. A decade of ocean monitoring has found no impact to the ocean environment as confirmed by the U.S. Environmental Protection Agency (EPA). The WWTP effluent limits and historical discharge values are shown in Table ES.1.

Table ES.1 Effluent Quality Comparison Comprehensive Recycled Water Study Cayucos/Morro Bay

Constituent	Units	Permit Limit	5-Year Average[1]
BOD_5	mg/L	120	35.6
TSS	mg/L	70	34.1
Oil & Grease	mg/L	25	5.6
Turbidity	NTU	75	33.6
pH	–	6-9	7.6
Acute Toxicity	TUa	1.5	0.6
Chronic Toxicity	TUc	134.0	5.8

(1) 1994-1998

The current NPDES permit, renewed in December 1998, requires the dischargers to submit a report "summarizing comprehensive evaluation of reclamation options and feasibility". This report summarizes the findings of the recycled water study that was conducted for the City of Morro Bay and the Cayucos Sanitary District. The scope of this study also included a review of water supply and demand for the study area, which is summarized in Table ES.2.

Table ES.2 Communities Water Supply and Demand
Comprehensive Recycled Water Study
Cayucos/Morro Bay

	Existing		Future	
Community	**Supply, AFY**	**Demand, AFY**	**Supply, AFY**	**Demand, AFY**
Cayucos	600[1]	485[1]	724[1,3]	661[2] 573[1]
Morro Bay	3,551[4]	1,250[5]	3,551[4]	1,930[6]

(1) Values from the 1998 CAWO Water Management Plan.
(2) *Analysis of Holding Capacity and Projection of Future Water Demand,* 1997.
(3) CAWO currently pursuing 124 acre-feet per year (AFY) additional water supply (600 AFY existing + 124 AFY future = 724 AFY).
(4) Based on 1313 AFY from State Water Project, 1723 AFY from groundwater and 515 AFY from desalination.
(5) 1997 demand.
(6) Based on population cap of 12,200.

Implementation of a reuse project would increase the regulatory requirements on the WWTP, depending on type of reuse and final discharge location. The existing and potential future regulations for implementing a reuse project are summarized in Table ES.3.

Table ES.3 Regulatory Requirements
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Existing Requirements	NPDES Permit Ocean Plan
Reuse Requirements	California Water Code Title 22 Department of Health Services - Groundwater Recharge Guidelines
Additional Requirements Beyond Title 22	Central Coast Basin Plan Inland Surface Waters Plan Enclosed Bays and Estuaries Plan

Potential reuse sites were evaluated throughout the study area. Types of reuse considered include: irrigation of agricultural crops, irrigation of landscape, parks and public facilities, industrial reuse, stream-flow enhancement, estuary/wetlands enhancement, groundwater recharge, and seawater intrusion barrier. A total of 38 potential reuse sites were combined into projects and screened based on volume of water to be used, proximity to the WWTP, level of treatment required, seasonal or year-round use, and benefits/issues of each. The final viable reuse projects include nine reuse sites divided into two implementable phases as shown in Figure ES.1. Planning level project costs were developed for the two viable reuse projects as shown in Table ES.4.

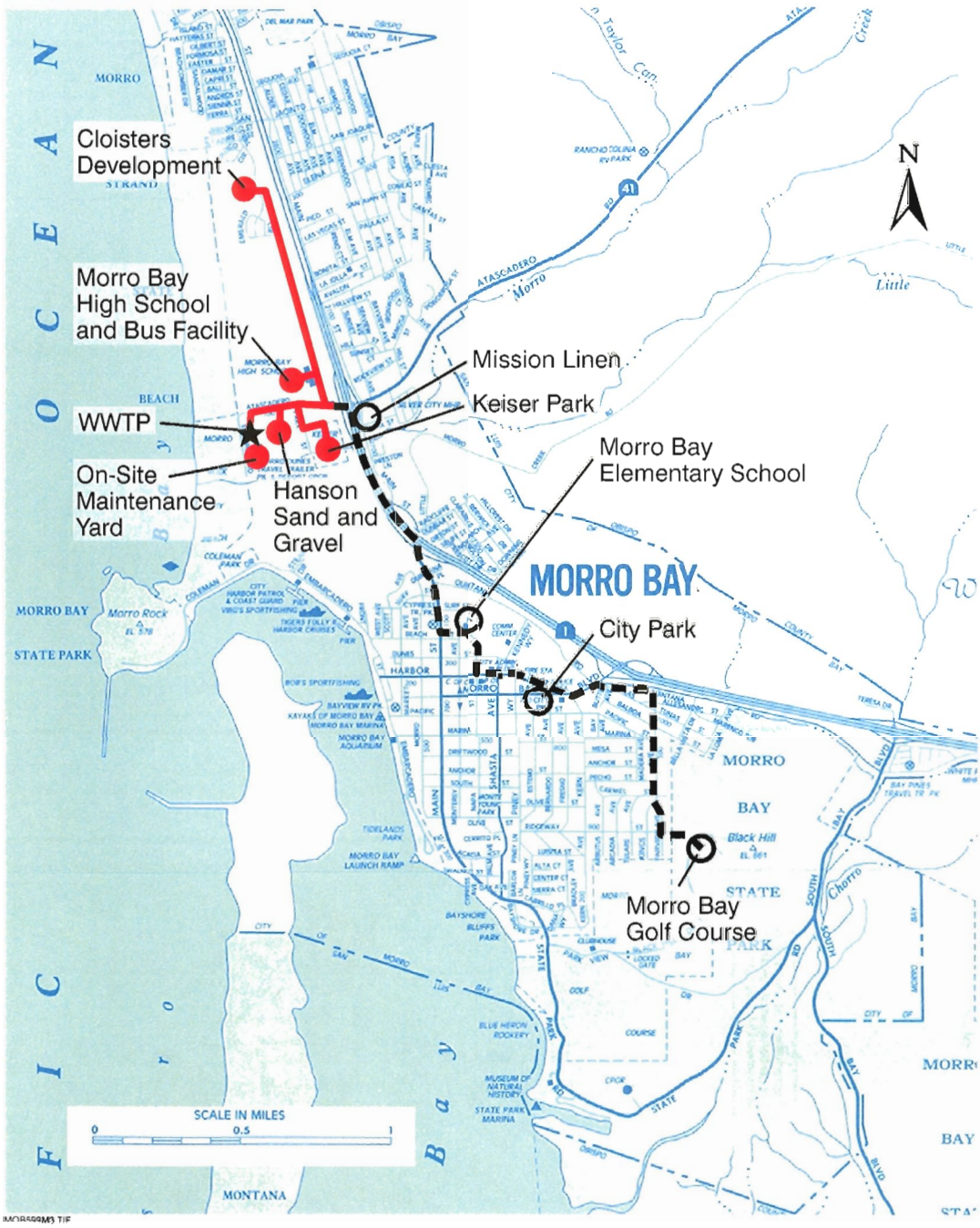


Figure ES.1
VIABLE REUSE PROJECTS
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

Table ES.4 Summary of Viable Reuse Project Costs Comprehensive Recycled Water Study Cayucos/Morro Bay

	Phase 1 Costs	Phase 2[3] Costs	Total Costs Phases 1 and 2
Project Costs - Present Worth	8,660,000[1]	6,820,000	15,480,000
Project Costs - Annual Basis[2]	576,000	453,000	1,029,000
O&M Costs - Annual	190,000	234,000	424,000
Total Annual Costs	766,000	687,000	1,453,000
AFY[4]	148 AFY	287 AFY	435 AFY
Dollars per Ac-Ft (Annual Basis)	$5,200/AFY	$2,400/AFY	$3,300/AFY

(1) Includes project costs at $4.8 million for providing full secondary treatment.
(2) Based on 6% interest over 40 years.
(3) Incremental costs in addition to Phase 1 estimates.
(4) Acre-foot per year.

Water costs of other sources were also investigated and are listed as: pumped groundwater – $45/ac-ft, State water project – $685/ac-ft, and desalination plant water – $1,500/ac-ft. A major factor in the high recycled water cost is the need for the entire effluent flow to be upgraded to full secondary treatment.

In conclusion, the viable reuse projects developed in this report are implementable and do not have any identifiable fatal flaws. However, the cost to implement these projects would be an extreme burden to the dischargers, who are already producing a high quality effluent and disposing of it in an environmentally safe, friendly fashion. Conclusions of this report are as follows:

- The WWTP's effluent quality consistently meets existing permit limits.
- Ocean monitoring over the last decade has shown no negative environmental impact associated with the discharge.
- Current operation of the WWTP maximizes overall treatment performance and ensures highest quality effluent possible is being discharged.
- Existing water supply is adequate to meet existing water demand.
- Existing water supply may not be adequate for future water demands, particularly in drought years, although additional sources are being pursued.
- WWTP capacity is adequate for future planned growth at existing level of treatment.

- Implementation of reuse project will require upgrading entire wastewater flow to secondary treatment.
- Implementation of reuse project will require portion of wastewater flow going to reuse be upgraded to tertiary treatment.
- Addition of full secondary treatment and tertiary treatment will increase the amount of biosolids to be disposed.

While the Phase 1 and 2 viable reuse projects have no fatal flaws, the costs to implement these projects are high. Therefore, no reuse project is recommended at this time. Both Cayucos and Morro Bay have been and continue to be proactive in the use of alternative sources to potable water. In Cayucos, nonpotable well water is used to irrigate Hardi Park and the school grounds as well as the agricultural area below Whale Rock Reservoir dam. Well water is also used in the community pool and at the cemetery for landscape irrigation. Two large water users in Morro Bay namely, Hanson Sand and Gravel and the Morro Bay Golf Course, use nonpotable well water for cement mixing and irrigation, respectively. Although these uses are not recycled water from treated effluent, the communities support the use of alternative water sources to potable water to meet their needs for water supply.

Chapter 1

INTRODUCTION

1.1 PURPOSE AND SCOPE OF STUDY

The communities of Morro Bay and Cayucos discharge wastewater to the wastewater treatment plant (WWTP) located in Morro Bay. The WWTP is jointly owned by the City of Morro Bay and the Cayucos Sanitary District. It has a National Pollutant Discharge Elimination System (NPDES) permit (WDR Order No. 98-15, NPDES Permit No. CA0047881) from the California Regional Water Quality Control Board (RWQCB), Central Coast Region and a 301(h) waiver from the Environmental Protection Agency (EPA).

The purpose of the 301(h) waiver is to allow the dischargers to discharge a primary treated effluent blended with a secondary treated effluent provided the effluent is within the permit requirements and does not adversely affect the receiving waters or impact the marine environment. The waiver waives only two secondary requirements, namely BOD_5 and TSS. All other NPDES secondary discharge limitations, including toxicity, apply to the WWTP discharge without exception. Offshore monitoring and reporting is conducted by a "second-party," Marine Research Specialists, who has found that over the last decade, the wastewater effluent and discharge to the ocean is consistently within the permit limits. Therefore, the current WWTP operation is more than adequate and provides a least-cost system that is also environmentally friendly.

The current NPDES permit, renewed in December 1998, states on page 11, F. Provisions, item 10, "...Dischargers shall submit a draft report summarizing comprehensive evaluation of reclamation options and feasibility...The report shall include (but not be limited to) evaluation of technical, financial and potential water quality issues, identification of the most cost effective alternative, and a recommendation."

This report presents the findings of the comprehensive recycled water study that was conducted regarding the Morro Bay - Cayucos Sanitary District's wastewater treatment plant.

The scope of this study included reviewing existing reports and background information, confirming recycled water quality regulations and guidelines, evaluating water supply needs through the year 2020, and evaluating a wide range of potential recycled water alternatives. The alternatives evaluated were then screened to the most viable options based on a qualitative evaluation. The viable alternatives were investigated further and again screened to identify the apparent best alternative for the use of recycled water. The scope also included identifying and detailing the "no project" alternative which included development of the probable facility requirements and costs associated with continued ocean discharge.

This report describes the apparent best alternative's general design criteria, recycled water demand and quality, treatment/conveyance/storage requirements, and planning level costs for capital and operations and maintenance.

1.2 PREVIOUS REPORTS AND STUDIES

Several existing reports and studies were reviewed to provide general background information for development of this report. The reports are listed in Table 1.1 in chronological order by title, author, and date. Additional studies were also reviewed to provide specific background information and are referenced as needed.

A detailed water reuse study was conducted in 1998 and finalized in March 1999 by Boyle Engineering Corporation (Boyle) called City of Morro Bay CDBG Wastewater Reclamation Feasibility Study. This study reviewed the possible construction of a new wastewater treatment plant at the southeast end of Morro Bay. The new plant would treat flows from Highway 1 west to the Morro Bay golf course and along Main Street north of Radcliffe Street. Therefore, the WWTP flows would be reduced to and from the existing plant and be used for reuse purposes. The treated effluent would be used to augment the flow in Chorro Creek which would enhance wildlife habitat along the creek and ultimately in the estuary, and enhance the underlying creek aquifer. The aquifer enhancement would allow Morro Bay to extend the months of pumping potable water from their wells in this location.

However, the findings of the report show that, at this time, the separate WWTP would not be able to meet the total flow requirements of Chorro Creek. In addition, the high project costs and unsuitable wastewater quality could render the new WWTP infeasible. Also, it was noted that a separate WWTP could have adverse effects on the existing effluent quality. Due to these results, a separate treatment plant for Morro Bay was not studied as an option for this report as it was previously studied in depth. However, the benefits and costs of the CDBG reclamation study should ultimately be compared with the options in this study should water recycling become a necessity. The CDBG reclamation study was used to provide background information for this report.

Table 1.1 Summary of Existing Reports and Studies Comprehensive Recycled Water Study Cayucos/Morro Bay

Description	Date	Author
Ground Water Level Data, August 9, 1999	August 9, 1999	City of Morro Bay
City of Morro Bay Staff Report	May 3, 1999	City of Morro Bay
California Coastal Commission Action on Local Coastal Program Amendment 1-97, Water Allocation	March 5, 1999	California Coastal Commission
CDBG Reclamation Feasibility Study Phase II - Final Report Draft Report	 March 1999 August 1998	Boyle Engineering Corporation
1998 CAWO Water Management Plan Update - Final Report	January 1999	Boyle Engineering Corporation
State of CA RWQCB Central Coast Region Waste Discharge Requirements Order No. 98-15 (NPDES Permit No. CA0047881)	December 1998	RWQCB/EPA
Wastewater Treatment Plant and Trunk Sewer Facility Plan - California Mens Colony, San Luis Obispo	December 1998	Carollo Engineers, P.C.
City of Morro Bay and Cayucos Sanitary District Offshore Monitoring and Reporting	1998, 1997, 1996	Marine Research Specialists
California Ocean Plan	1997	State Water Resources Control Board
City of Morro Bay CDBG Wastewater Reclamation Feasibility Study Phase I	October 1996	Boyle Engineering Corporation
Water Quality Control Plan - Central Coast Region	December 1995	State Water Quality Control Board
RWQCB Central Coast Basin Plan	September 1994	Regional Water Resources Control Board
Analysis of Issues Associated with State Imported Water	July 1994	Carollo Engineers, P.C.
City of Morro Bay Analysis and Recommendations for a Water Management Plan	March 1994	Boyle Engineering Corporation
City of Morro Bay Water Management Plan, Appendix B, Groundwater Analysis	1993	Cleath & Associates
Impact Assessment, Sea Water Well Field Operations for the City of Morro Bay	1993	Cleath & Associates
Final Environmental Impact Report for Appropriative Water Rights for Toro Creek Underflow, prepared for the City of Morro Bay	1988	McClelland Engineers, Inc.
Groundwater Study, Cayucos Area, prepared for the Cayucos Area Water Organizations	1988	Cleath, Timothy S.

Table 1.1 Summary of Existing Reports and Studies Comprehensive Recycled Water Study Cayucos/Morro Bay

Description	Date	Author
Observations on Ground Water Recharge and Water Supply Sources: Old Creek Valley Below Whale Rock Dam under subcontract to Lawrence, Fisk & McFarland, Inc. for the Cayucos Area Water Organizations and the Whale Rock Commission	1987	Cleath, Timothy S.
City of Morro Bay Sewer System Master Plan	June 1986	CH_2M Hill
Joint Powers Agreement for the Ownership, Operation, and Maintenance of Wastewater Treatment Facilities	October 1982	—
Groundwater Evaluation of the Cabrillo Property in Morro Creek Basin, prepared for the City of Morro Bay	1981	Brown & Caldwell
Morro Bay - Cayucos Wastewater Facilities Project Report	February 1979	Carollo Engineers, P.C.
Morro Bay Wastewater Discharge Facilities - Environmental Assessment	1973	Carollo Engineers, P.C.

2.1 STUDY AREA CHARACTERISTICS

Study Area Description

The communities of Morro Bay and Cayucos are located in San Luis Obispo County in the area of California known as the Central Coast. They are situated on the coast along Highway 1, approximately 14 miles northwest of San Luis Obispo and about halfway between San Francisco and Los Angeles. The area is characterized as having a coastal climate of mild to moderate temperatures year-round with little diurnal variation. Average annual rainfall in the region is 15 inches/year and usually occurs between October and April. However, when droughts occur in this area they are usually very severe.

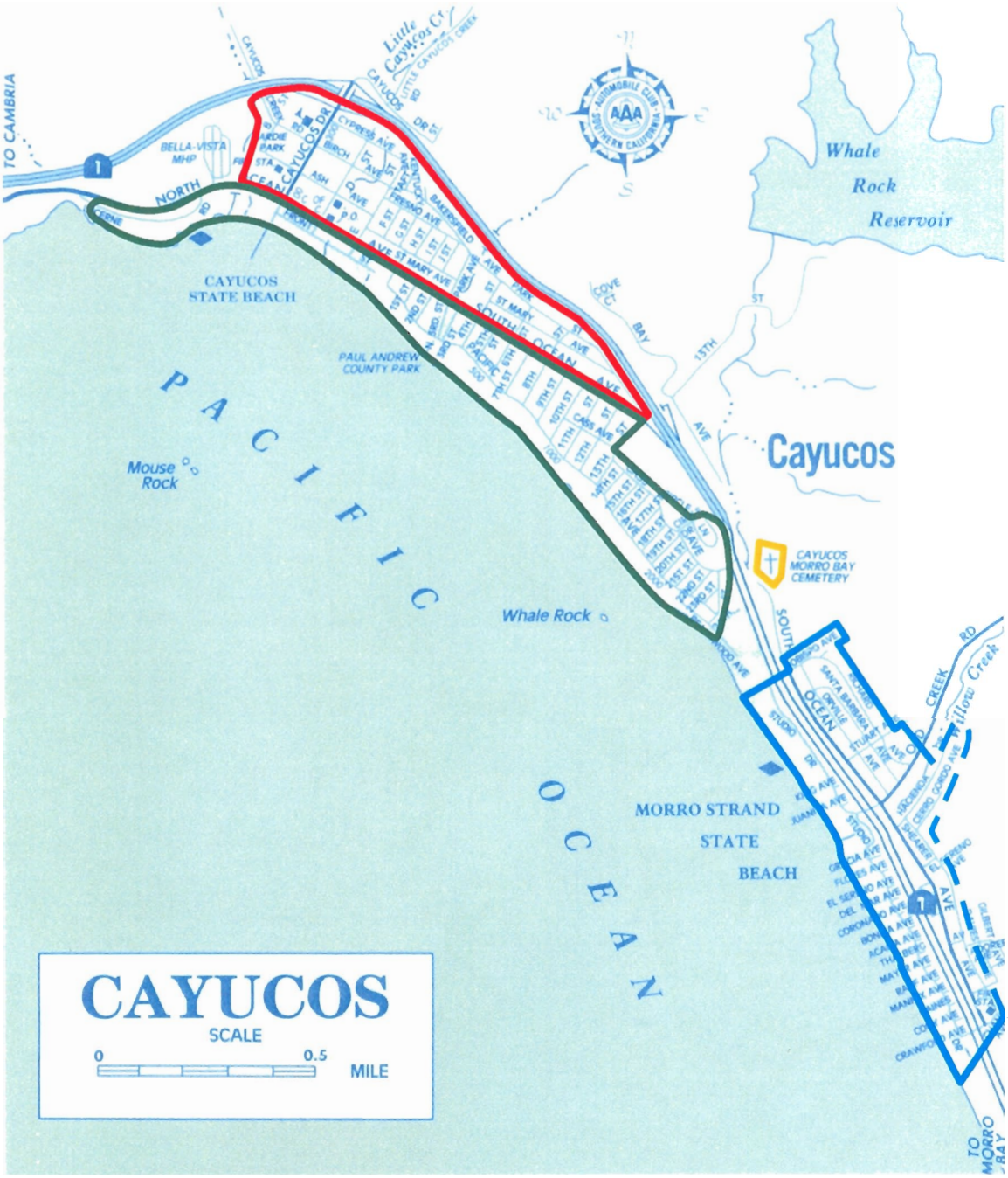
The study area consists of the City of Morro Bay, the community of Cayucos, and a few of the bordering parts of San Luis Obispo County. This report also includes the portion along Highway 1 between the two cities. The study area is outlined in Figure 2.1.

Heading north, the area along the coast consists of mildly sloping beach lands with a gradual slope towards the south end of Cayucos. Downtown Cayucos is set in a lower flat area that quickly rises to hillside terrace-type views from homes. The study area has many small creeks draining to the ocean or estuary. As one travels inland along some of the creeks or highways, rolling or gradual hills are seen tapering to the ocean. Hills are also prevalent in Morro Bay State Park located on the south side of Morro Bay.

The main industries in the Morro Bay-Cayucos area are tourism and fishing-related activities. Morro Bay also contains a power generation plant located adjacent to Morro Rock. The area abounds with hotels and restaurants ready to serve the tourists and seasonal part-time residents.

Population and Population Projections

The population for the City of Morro Bay has remained fairly constant over the past 10 years as shown in Table 2.1. Tourism and retirement living provide the city with a dynamic population which usually increases during the summer months. The average annual occupancy rate for residential dwellings in Morro Bay is approximately 80 percent. In 1984, the voters of Morro Bay adopted Measure F in perpetuity which placed a population cap in the City of 12,200. At that time, it was estimated that the cap would be reached by the year 2000. Once the population in the City reaches this capacity, no more residential buildings will be permitted unless approved by the residents of the City. The California Department of Finance estimated in 1998 that Morro Bay had a population of 9,850. Morro



LEGEND

- Morro Rock Mutual Water Company
- Paso Robles Beach Water Association
- Cayucos Cemetery District
- County Water Works District No. 8

Figure 2.2
CAYUCOS WATER PURVEYORS
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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Table 2.1 Populations for the Communities of Morro Bay and Cayucos Comprehensive Recycled Water Study Cayucos/Morro Bay		
Year	Morro Bay[1]	Cayucos[2]
1990	9,600	2,960
1991	9,675	2,975
1992	9,825	2,973
1993	9,975	2,975
1994	10,050	2,981
1995	9,525	3,016
1996	9,550	3,055
1997	9,625	3,150
1998	9,850	3,200

(1) Based on estimates from the California Department of Finance.
(2) Based on estimates from the San Luis Obispo County Planning Office.

Bay also has a building permit limit of 77 per year, but is currently issuing approximately 50 permits per year. This limit will end by December 31, 2000. The current growth for Morro Bay was estimated based on the building permits issued times the average occupancy rate of 1.8 persons/dwelling (according to estimates from the Morro Bay Planning and Building Department). Based on the actual building permits issued of 50 per year, the growth rate would be 90 persons per year. However, based on a building permit issuance of 77 per year, the growth rate is 139 persons per year. Therefore, the population in Morro Bay can be expected to reach its capacity of 12,200 people between the years of 2016 and 2025.

The community of Cayucos exhibits similar population trends to that of Morro Bay as shown in Table 2.1. The population remains relatively constant with a slight increase occurring in the summer months due to tourism and seasonal housing. The average annual occupancy rate for residential housing in Cayucos is 65 to 70 percent.

2.2 EXISTING WATER SYSTEMS AND WASTEWATER FACILITIES

Water Sources/Purveyors

The community of Cayucos obtains its drinking water from two main sources – Whale Rock Reservoir and a groundwater well located on the east side of Highway 1 (adjacent to Cayucos). Water from the reservoir is piped to the Cayucos Water Treatment Plant (WTP) and then distributed to the Cayucos Area Water Organization (CAWO). The CAWO consists of three water purveyors: Paso Robles Beach Water Association (PRBWA), Morro Rock Mutual Water Company (MRMWC), and the County of San Luis Obispo (CSA-10A)

(See Figure 2.2). In effect, the Cayucos Sanitary District has no control over the water treatment plant, water use or water management for the community.

Traditionally, the City of Morro Bay depended upon groundwater as its main municipal and industrial water supply. Twelve wells draw water from two small alluvial aquifers, the Morro and Chorro Basins. However, saltwater intrusion into the aquifer reduced the water quality. In addition, outside groundwater users have decreased the amount of water available in the aquifers. These factors have limited the reliability of obtaining potable water from the groundwater wells. Due to the limited potable water supply, a desalination plant was constructed. In 1997, the City of Morro Bay began supplementing its water source with water supplied from the State Water Project (SWP). The desalination plant has not been in use since that time.

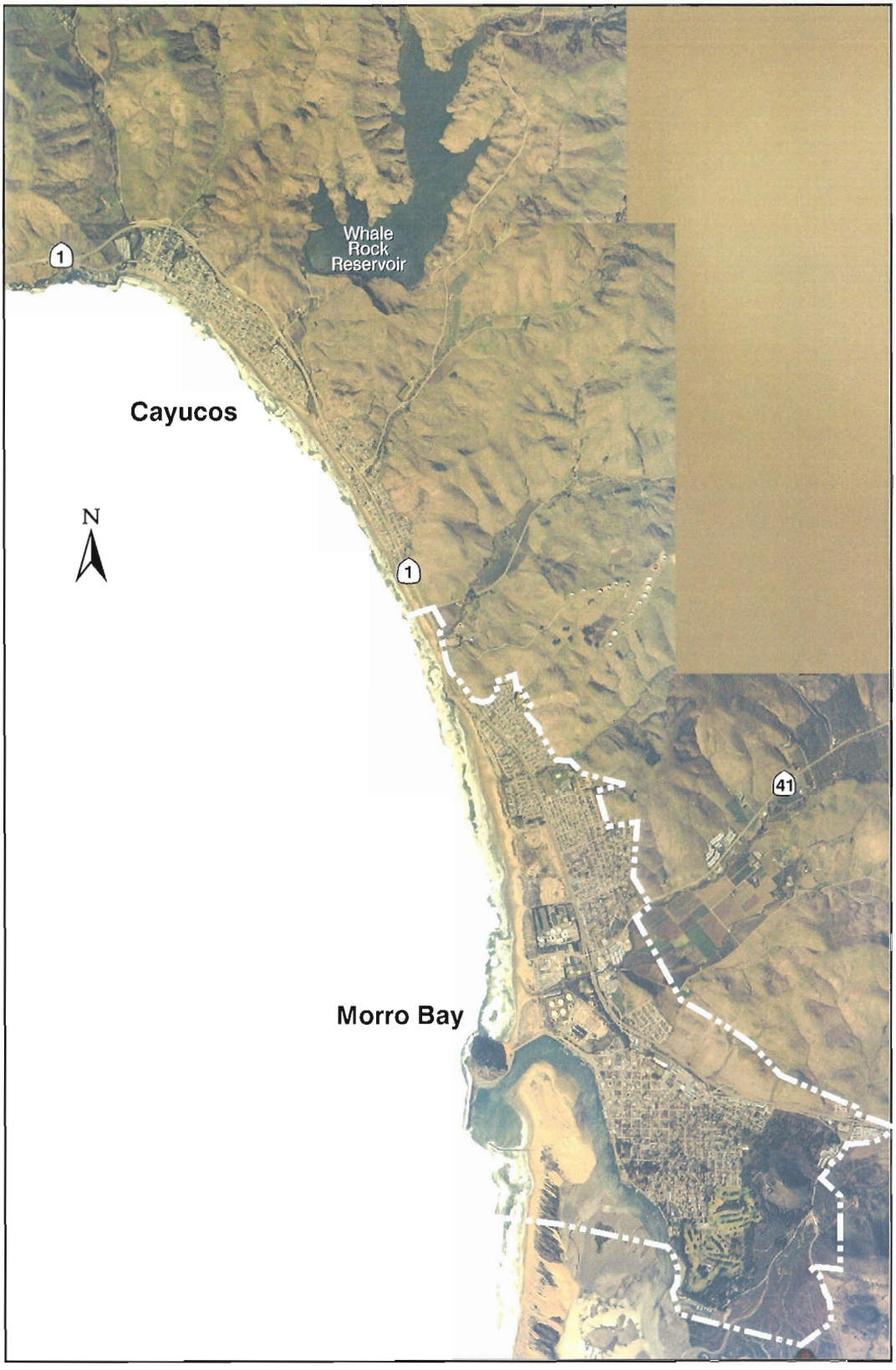
Wastewater Facilities

The City of Morro Bay and the Cayucos Sanitary District (MBCSD) jointly own the wastewater treatment facility (WWTP) located at the west end of Atascadero Road, also known as Highway 41 in Morro Bay. A joint powers agreement defines ownership of the WWTP facility, capacity and outfall between Morro Bay and Cayucos at 65 and 35 percent, respectively. The WWTP is designed to accommodate average dry-weather flows of 2.06 million gallons per day (mgd), peak seasonal dry-weather flows of 2.36 mgd and maximum wet-weather flows of 6.64 mgd. The WWTP'S average annual discharge from 1994 to 1998 was 1.6 mgd; however, the average influent flow is heavily influenced by seasonal activity such as tourism, which causes increases during the summer months (May through August).

The WWTP uses a split-stream treatment process where all influent flow is subjected to primary (physical) treatment including screening, grit removal and primary sedimentation. A portion of the flow (approximately 1 mgd) is routed to secondary (biological) treatment consisting of trickling filters, solids-contact and secondary clarification. After secondary treatment, the treated wastewater is blended with the primary-treated wastewater and both are disinfected using chlorination/dechlorination. The blend of the primary and secondary effluent is then discharged to the Pacific Ocean. Further discussion of the wastewater facilities is included in Chapter 4.

Effluent Water Quality Comparison

The WWTP effluent was compared with other sources of irrigation water in the area such as the Morro Bay well water, State Water Project (SWP) water, the Cayucos WTP product (or drinking water) and the CAWO groundwater, as shown in Table 2.2. Parameters common to all waters were compared. The largest deviations found in the wastewater effluent quality were the level of sodium and chloride ions in the water and the electrical



LEGEND

Morro Bay City Limit

Figure 2.1
STUDY AREA
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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Table 2.2 Comparison of Morro Bay Water Comprehensive Recycled Water Study Cayucos/Morro Bay

	Units	SWP[1]	Average Morro Bay Well Data	Cayucos WTP[2]	CAWO Well[2]	Morro Bay Effluent Average[3]
pH		8.5	7.5	7.5	7.6	7.6
Salinity						
EC	dS/m		1.2	0.6	0.8	1.7
TDS	mg/L	241.0	700.0	420.0	500.0	866.7
Permeability						
SAR			–	–	–	5.7
Elemental						
Na^+	mg/L	44.0	58.2	30.0	44.0	210.0
Cl^-	mg/L	51.0	76.0	27.0	45.0	300.0
Ca_2^+	mg/L	19.0	62.0	53.0	61.0	46.7
Mg_2^+	mg/L	11.0	87.0	34.0	47.0	36.7
B	mg/L					0.5
Compounds						
HCO_3	mg/L as $CaCO_3$		488.9	210.0	320.0	293.3
NH_4	mg/L		–	–	–	29.0
NO_3	mg/L	15.5	18.9	160.0	770.0	–
Combined Nitrogen	mg/L		–	–	–	36.7
Total Alkalinity	mg/L as $CaCo_3$	77.0	409.8	210.0	320.0	293.3
Total Hardness	mg/L as $CaCo_3$	95.0	503.1	260.0	350.0	263.3

(1) City of Morro Bay 1998 Annual Water Quality Report.
(2) Cayucos Annual Water Quality Report.
(3) Morro Bay Effluent Averages are based on data collected from MBCSD July 8 through 15, 1999.

conductance of the effluent, which was higher than the amounts found in the other four water sources. The amount of total dissolved solids (TDS) in the WWTP effluent was significantly higher than the Cayucos well water, WTP and SWP, but only slightly higher than that of the Morro Bay well water.

2.3 HISTORICAL AND PROJECTED WATER SUPPLY/DEMAND

Water Supply

Historically, the City of Morro Bay has obtained its water supply largely from groundwater drawn from two small alluvial aquifers located in the Morro and Chorro Valleys. These

basins contain groundwater that is flowing by gravity to the ocean and they have a limited storage capacity. Also, the basins rely on annual rainwater infiltration as their main source of recharge. When drought conditions occur, as they did for the 6-year period from 1987 through 1992, the aquifers can be drained and saltwater intrusion into the aquifer can decrease the quality of water that is drawn from them.

During years of normal rainfall, the Morro and Chorro basins can provide the area with a large portion of their needed water supply.

In 1992, the City of Morro Bay constructed a desalination plant to help remedy the water supply shortage caused by the recent drought. The desalination plant uses four reverse osmosis membrane elements that will produce a maximum plant output of 645 acre-feet/year (AFY) running on a continual basis. Allowing for maintenance downtime with the plant, the actual water production from the desalination plant would be closer to 515 AFY. The permit obtained for the plant is for operation in declared emergency drought situations only. The plant has not been in operation since 1992. If the desalination plant were to be used, it would most likely require recommissioning prior to use.

The State Water Project (SWP) constructed a coastal branch to provide water from the Feather River at Oroville to San Luis Obispo and Santa Barbara Counties. In 1997, the coastal branch to Morro Bay was completed and the City has been using SWP water as it primary water source since then. The City of Morro Bay is entitled to 1,313 AFY of water from the SWP, however the actual delivery amount varies depending upon weather conditions, hydrologic conditions and political decisions. By paying additional fees above the regular charge for the SWP water, Morro Bay has been able to ensure that they will receive their total allotment even when the overall SWP delivery level is cut by 50 percent. Table 2.3 depicts the water sources and their respective supply outputs for the City of Morro Bay.

Table 2.3 Current Estimated Water Supply for the City of Morro Bay Comprehensive Recycled Water Study Cayucos/Morro Bay

Water Sources	AFY(1)
Groundwater Wells	1,723
Desalination	515
State Water Project	1,313

(1) California Coastal Commission, Commission Action on Local Coastal Program Amendment 1-97, Water Allocation.

The community of Cayucos and the CAWO receive their water from the Whale Rock Reservoir. They are entitled to 600 AFY based on the terms of the 1958 agreement with the Whale Rock Commission. In addition to the current allotment, the CAWO is currently

pursuing supplemental water sources that would amount to an added 124 AFY. In the reports consulted, there were no indications of a shortage of supply occurring with Whale Rock Reservoir in the past drought years for the then existing population.

Water Demand

Before the drought that occurred from 1987-1992, the water demand in Morro Bay ranged from 140 to 193 gallons per capita per day (gpcpd). During the 6-year drought period, a conservation program was implemented aimed at reducing water usage during critical and non-critical periods. Certain conservation measures were instituted to decrease the amount of water losses and unaccounted use by replacing and repairing many of Morro Bays damaged pipelines. The City also implemented best management practices for water conservation that would, in theory, lower the demand for water which would be critical in drought situations. In 1989, before the water conservation program was implemented, the average per capita demand was 154 gpcpd. During the 1987-1992 drought, the per capita daily demand was only 92 gpcpd after stringent conservation measures were imposed. Then, in 1997, several years after the drought and with the conservation program still in place, the estimated daily demand was 115 gpcpd, which was equivalent to 1,250 AFY. Therefore, the implemented water conservation program is working to reduce the City's current water demand.

An average annual gross per capita demand of 141 gpcpd was used from the Morro Bay Water Plan to represent water usage during normal conditions without water conservation. The projected water demand for the population cap of 12,200 people is estimated at 1,927 AFY. However, if water conservation is included in the estimation, the annual water demand for Morro Bay is 1,780 AF using an average annual gross per capita daily demand of 130 gpcpd. The historical and projected water demands for Morro Bay are shown in Table 2.4.

Table 2.4 Morro Bay Current and Predicted Water Demand
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Year	AFY[2]
1992	1,319
1997	1,250
(Population Cap = 12,200)	1,930[1]

(1) Under normal operating conditions. Demand would drop to an estimated 1,780 AFY with the water conservation program in place.
(2) California Coastal Commission, Commission on Local Coastal Program Amendment 1-97, Water Allocation.

Water demand for the Cayucos area is currently estimated at 485 AFY for residential and commercial use. At a projected buildout population, the water demand is approximated to

be 661 AFY as determined in 1997 in the *Analysis of Holding Capacity and Projection of Future Water Demand*. At this demand, the possibility of a water shortage would arise if the CAWO is unable to secure the additional 124 AFY supply. In the 1998 CAWO Water Management Plan Update, the total demand was projected at 573 AFY which is lower than the 1997 prediction. Given the 1998 demand projection, the current supply of 600 AFY would be sufficient to meet the future demand. The current and future supply and demand of the Cayucos area is outlined in Table 2.5.

Table 2.5 Current and Predicted Estimation for Water Supply and Demand in the Cayucos Area
Comprehensive Recycled Water Study
Cayucos/Morro Bay

	Current, AFY[1]	Future, AFY[1]
Supply	600	724[2]
Demand	485	661[3] 573[1]

(1) 1998 CAWO Water Management Plan Update.
(2) Includes an additional 124 AFY that CAWO is currently working on securing but it has not been finalized as of yet.
(3) *Analysis of Holding Capacity and Projections of Future Water Demand,* 1997.

Water Supply Problems and Deficiencies

The CAWO is currently able to meet the water demands of their customers and from the estimated projections, it appears that they will be able to continue that service in the future. A potential water shortage may arise in Cayucos if the CAWO is unable to secure the additional water allotment and the future demand rises to the level of the 1997 projection. The City of Morro Bay using their entitled SWP water, currently meets the water demands of their customers. However, based on the water use projections for the future population cap, the SWP water allotment will no longer meet the needs of Morro Bay. Also, in drought conditions, if the SWP water entitlement to the City is reduced, Morro Bay will rely upon groundwater wells and the desalination plant.

Alternative Water Sources to Potable Water

Both Cayucos and Morro Bay have been and continue to be proactive in the use of alternative sources to potable water. In Cayucos, nonpotable well water is used to irrigate Hardi Park and the school grounds as well as the agricultural area below Whale Rock Reservoir dam. Well water is also used in the community pool and at the cemetery for landscape irrigation. Two large water users in Morro Bay namely, Hanson Sand and Gravel and the Morro Bay Golf Course, use nonpotable well water for cement mixing and irrigation, respectively. Although these uses are not recycled water from treated effluent, the communities support the use of alternative water sources to potable water to meet their needs for water supply.

REGULATORY REQUIREMENTS

3.1 INTRODUCTION

The purpose of this chapter is to identify the major existing and proposed federal, state and regional regulatory requirements governing the existing and future discharge or reuse of the WWTP effluent. Wastewater discharges are governed by both federal and state requirements. The primary laws regulating water quality are the Clean Water Act (CWA) and the California Water Code.

Under the CWA, the Environmental Protection Agency (EPA) or a delegated State agency regulates discharge of pollutants into waterways through the issuance of National Pollutant Discharge Elimination System (NPDES) permits. NPDES permits set limits on the amount of pollutants that can be discharged into the waters of the United States. The California Water Code and the Porter-Cologne Act, a provision of the Code, require the State to adopt water quality policies, plans and objectives for the protection of the State's waters. The State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) meet this requirement by establishing water quality criteria in regional Basin Plans, the Inland Surface Waters Plan, the Enclosed Bays and Estuaries Plan, the Thermal Plan, and the Ocean Plan. The SWRCB and RWQCBs also have regulatory authority along with the Department of Health Services (DHS) over projects using recycled water.

Because Cayucos/Morro Bay is located in a coastal region, the California Coastal Commission has jurisdiction on any proposed new development. They maintain the aesthetic and environmental quality of the area by requiring permits for all new developments. Recently, the Coastal Commission gave the City of Morro Bay permitting power but the Commission retains ultimate authority through the review of all permit applications.

3.2 EXISTING REGULATORY REQUIREMENTS

The WWTP currently discharges all effluent to the ocean. Therefore, the discharge is primarily regulated by the NPDES permit and the Ocean Plan.

NPDES Permit

The WWTP presently operates under Waste Discharge Requirement Order No. 98-15 and NPDES No. CA 0047881 issued in December 1998. The permit is a modified NPDES permit with a 301(h) waiver which waives only the TSS and BOD requirements. All other NPDES secondary discharge limitations, including toxicity, apply to the WWTP discharge

without exception. Thus, the effluent limitations are based on a combined primary and secondary effluent blend. The permit limits are summarized in Table 3.1.

Table 3.1 NPDES Effluent Limitations
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Constituents	Units	Monthly (30-day) Average	Weekly (7-day) Average	Maximum
Peak Seasonal Dry Weather Flow	mgd	2.36	-	-
BOD_5	mg/L lbs/day(1)	120 2,062	-	180 3,092
Suspended Solids	mg/L lbs/day(1)	70 1203	-	105 1,804
Total Coliform	MPN/100 ml	23	-	2,400
Grease and Oil	mg/L lbs/day(1)	25 430	40 687	75 1,288
Settleable Solids	ml/L	1.0	1.5	3.0
Turbidity	NTU	75	100	225
pH	Within limits of 6.0 to 9.0 at all times			
Acute Toxicity	TUa	1.5	2.0	2.5

(1) Mass emission based on average design flow rate of 2.06 mgd.

In addition to the effluent limits specified in Table 3.1, the NPDES permit requires that as a 30-day average the WWTP shall remove at least 75 percent suspended solids and 30 percent of BOD_5 from the wastewater prior to discharging to the ocean. The NPDES permit also establishes receiving water requirements based on Ocean Plan requirements and an effluent dilution of 133:1. The NPDES permit is included in Appendix B.

Ocean Plan

The Water Quality Control Plan for Ocean Waters of California (Ocean Plan) was adopted by the State Water Resources Control Board in 1972 and most recently amended in 1997. The Ocean Plan specifies the beneficial uses of the ocean to be protected include industrial water supply, water contact and non-contact recreation, navigation, commercial and sport fishing, mariculture, preservation and enhancement of Areas of Special Biological Significance, rare and endangered species, marine habitat, fish migration, fish spawning and shellfish harvesting. Water quality objectives and effluent limits specified in the Ocean Plan are included in the WWTP's NPDES permit.

3.3 RECYCLED WATER REGULATIONS

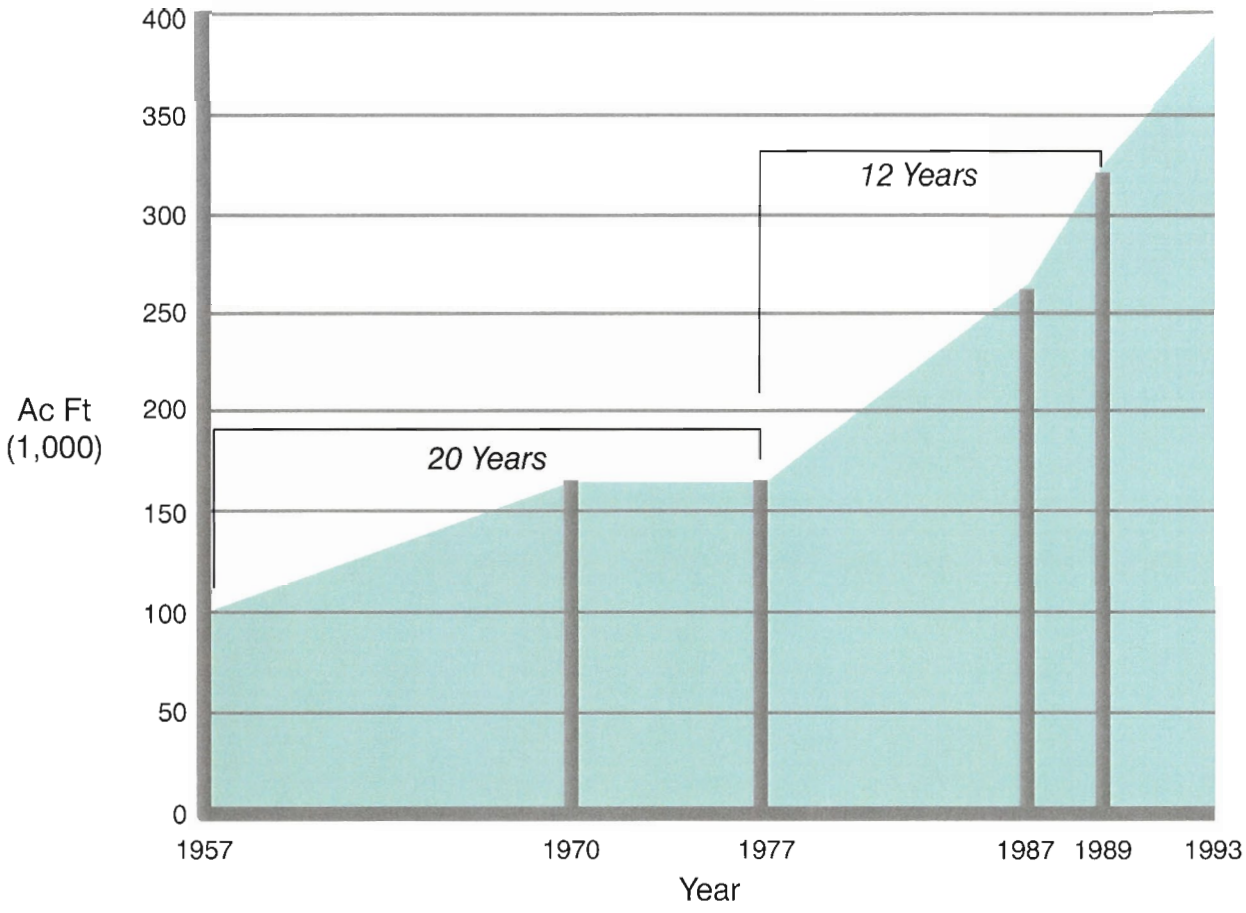
Water Recycling Overview

California has been practicing water recycling since the last century. In fact, the fastest growing water supply in California is recycled water. Water, including recycled water, is a very precious resource in both northern and southern California. At any time, one can pick up a local newspaper and usually find at least one article pertaining to water or water recycling. A recent article in the Fresno Bee (August 11, 1999) titled, "Gov. Davis' Push to Reuse Water is Good Public Policy" written by Jim Costa, 16th District representative in the California Senate states:

> "Water reuse is essential if we are to succeed in blending the needs of a stable agricultural and urban economy, with a thriving environment, in our arid state.
>
> In the first days of his administration, Gov. Davis filed a friend of the court brief in a federal court action concerning how some of the state's water will be allocated under the Central Valley Project Improvement Act (CVPIA).
>
> The state's position was that after water is used to benefit fish migration through the Delta, it should then be reused to irrigate crops or as drinking water supplies for cities in Northern and Southern California.
>
> Gov. Davis wisely understood that in a state that is chronically water short, it is common sense to reuse water after it has accomplished its environmental purpose. Not surprisingly, the federal court agreed with Gov. Davis' point and reaffirmed that water used to benefit the environment could later be used for California's farms and cities."

Since the mid-1980s, over 250,000 acre-feet (ac-ft) of water has been reused annually. California's use of recycled water steadily increased to almost 400,000 acre-feet in 1993 (WateReuse, March 1993) (see Figure 3.1). The state-wide water recycling goals are to meet 700,000 acre-feet/year (AFY) by the year 2000 and 1,000,000 AFY by the year 2010. By the year 2010, enough water will be recycled to meet the needs of 5 million people. Some of the appropriate uses for recycled water include:

- Irrigation
  - Farms
  - Parks
  - Golf Courses
  - Roadway Landscaping
  - Residential and Commercial Landscaping
- Industrial Cooling
- Construction



SOURCE: WateReuse *"Enhancing California's Future through Recyling Wastewater"* March 1993

Figure 3.1
CALIFORNIA'S USE OF RECYCLED WATER
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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- Firefighting
- Seawater Intrusion Barriers
- Groundwater Recharge
- Fisheries Enhancement
- Wildlife Habitat Maintenance and Development
- Recreational Lakes
- Toilet Flushing

All of these potential uses are practiced in California. Figure 3.2 shows the breakdown of existing water reuse in California by Category (WateReuse, July 1993). Southern California is a leader in water reclamation, especially in groundwater recharge, salt water intrusion barriers and irrigation. Northern California has greater experience in wetlands management projects.

Key Water Recycling Concerns

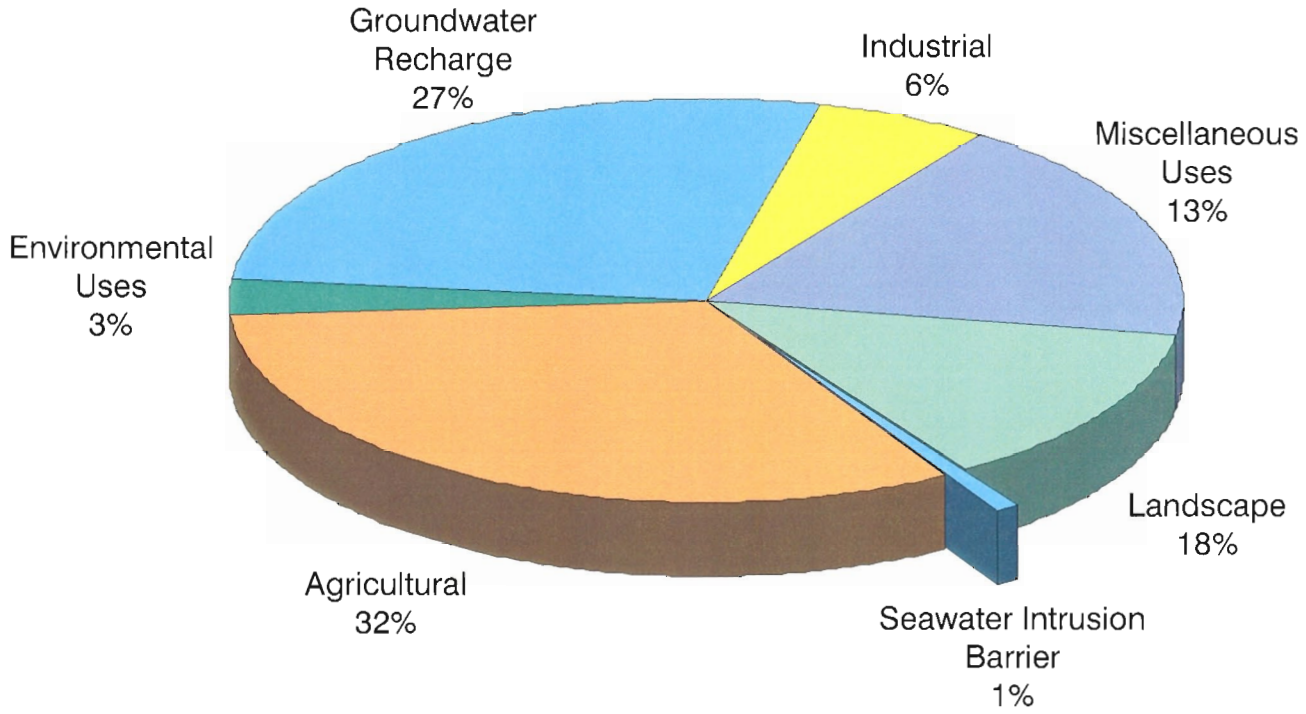
Although its use is widespread, numerous issues and concerns surround the use of recycled wastewater, including customer, public, legal, and institutional. These issues are often interdependent.

Customer Concerns

Customer concerns include water quality, quantity, delivery, reliability and price. Water quality concerns relate to the ability to apply recycled water for the intended use and the potential for long term impacts. Many irrigation uses require low salt and other mineral concentrations to allow best growth of crops. Refer to Chapter 5 for a more detailed discussion of irrigation water quality. Industrial uses may require water relatively free of organics, nutrients, and minerals in order to avoid biogrowth, scaling, or contamination of the industrial systems. Customers are concerned about receiving the amount of water they require, without interruption and at a competitive price to alternative water sources. They are also apprehensive about possible land degradation from the recycled water. In addition, customers are concerned about how the public may feel about the use of recycled water being used at their location or for their products. This point is particularly true when dealing with agricultural irrigation and the marketability of the crop and the potential misconception of the water quality.

Public Concerns

Public concerns over the use of recycled water are predominantly health related. To be accepting of a project, the public must perceive that no short term or long term adverse health impacts will result from the use of recycled water. These potential health impacts



SOURCE: WateReuse 1995 Survey Summary, based on 450,000 ac-ft.

Figure 3.2
EXISTING CALIFORNIA
WATER REUSE BY CATEGORY
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

MOB899G2.CDR

relate to the people that may directly or indirectly come in contact with recycled water at its point of use, as well as the environment into which the water may be eventually released. Public acceptance of a water recycling project may be dependent on the level of treatment that is provided. Public acceptance can also be influenced by the success of a public awareness program emphasizing the benefits of using recycled water.

Legal Concerns

Legal concerns stem from the issue of water rights. Water rights issues are mainly dealt with in the California Water Code, and/or by the State Water Regional Control Board (SWRCB). One legal concern is the ownership of the treated wastewater produced by the wastewater treatment plant. If the recycled water is used for stream flow enhancement, there are currently unresolved issues between wastewater producers and downstream users as to the respective water right when treated wastewater is discharged to a surface water. Another aspect of this same concern is that approval must be obtained prior to a change in the place or purpose of use or point of discharge of the treated effluent. Water rights are also a concern when a municipality desires to appropriate an equal amount of water downstream from a surface discharge. Another water right issue is the adoption of a groundwater management plan by a local agency. These issues are all outlined and authorized by the Water Code.

Institutional Concerns

Institutional concerns include regulatory and contractual requirements. A recycling project must be permitted by the Regional Water Quality Board (RWQCB) and conform with California Department of Health Services (DHS) regulations. Also, contracts may be required with local water purveyors and irrigation districts to be allowed to provide recycled water within their service areas.

An institutional consideration is the duplication of a utility as is discussed in the Service Duplication Act of the Public Utilities Code (PUC), Chapter 8.5. Existing law prohibits a sanitary district from providing recycled water service to any part of the sanitary districts' service area that is part of a City, water district or other local agency that provides water service without that agency's prior consent. The PUC also allows for compensation for damages that the utility may suffer by reason of the City extending their facilities into the service area of the privately-owned public utility.

Another institutional issue is the potential loss of revenue by converting a user form potable water to recycled water. Recycled water is often delivered free of charge or at a reduced rate, while potable water is charged at a fee that covers the full cost of delivery.

Customer agreements will also need to be obtained from the irrigation districts or end users. The customer agreements can initially consist of letters of intent from end users stating their intention to use recycled water under stated conditions once it becomes

available followed by formal customer contracts which clearly identify the divisions of responsibility between the recycled water wholesaler (producer), retailer and end-use customer.

Obtaining easements or access agreements for recycled water pipelines is also considered an institutional concern. Easements, or some form of access, may need to be obtained for the entire length of the pipelines. Land acquisition may also be required for pump stations, storage reservoirs, or other facilities, unless the facility is constructed on property already owned by the agency.

Water Recycling Regulations

All of the potential uses of recycled water listed herein are highly regulated. Several agencies have regulatory authority or jurisdiction over potential projects using recycled water. The major state agencies include the DHS, the SWRCB, and the RWQCB. In addition to State regulatory agencies, there may also be involvement by county and local authorities. There are currently no federal regulations pertaining to water recycling.

The DHS is the primary State agency responsible for public health, whereas the SWRCB and the RWQCB are the primary State agencies charged with protection, coordination, and control of water quality. These agencies work together to develop discharge permits for recycling projects. Generally, the DHS interprets the laws dictated by the California Code of Regulations applicable to reclamation and makes recommendations on individual projects to the RWQCB which is overseen by the SWRCB. The RWQCB issues the final permit for the reclamation project.

The existing water recycling regulations, which dictate wastewater treatment processes and effluent quality criteria, are contained in the California Code of Regulations, Title 22, Division 4, Chapter 3, Sections 60301 through 60355. These regulations are intended "...to establish acceptable levels of constituents of recycled water and to prescribe means for assurance of reliability in the production of recycled water in order to ensure that the use of recycled water for the specified purposes does not impose undue risks to health..." The most recent revision to these regulations came into effect in 1978. The DHS regularly issues draft updates to Title 22 regulations for water recycling with the latest version dated September 1998.

Until the updated Title 22 regulations are adopted, the 1978 version currently remains in effect. However, most if not all of the regulating agencies refer to the criteria in the latest draft updates. The existing water recycling regulations cover allowable uses of recycled water; methods of treatment; sampling and analysis; preparation of an engineering report; general requirements of design; and operational and reliability requirements. Information is presented below on both the existing 1978 regulations and the September 1998 draft updates.

Existing (1978) Recycled Water Regulations

The existing DHS regulations basically define four types of recycled water determined by the required treatment process, turbidity and coliform bacteria levels. Although the DHS has not assigned type designations to the grades of recycled water defined by the current regulations, designations are provided here for clarity. The four treatment types of recycled water that are currently permitted by the DHS are summarized in Table 3.2.

Table 3.2 Existing Recycled Water Treatment Regulations
California Code of Regulations, Title 22, Division 4, Chapter 3
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Recycled Water Type[1]	Treatment Process	Average Turbidity (NTU)[2]	Maximum Turbidity (NTU)	Median Coliforms (MPN/ 100 ml)[3]	Maximum Coliforms (MPN/ 100 ml)
1A	Oxidized, Coagulated, Clarified, Filtered, Disinfected	2	5[4]	2.2[5]	23[6]
1B	Oxidized, Coagulated, Filtered, Oxidized, Disinfected[7]	2	5[4]	2.2[5]	23[6]
2	Oxidized, Disinfected	2	5[4]	2.2[5]	23[6]
3	Oxidized, Disinfected	[4]	[4]	23[3]	240[9]
4	Primary (Oxidized)	[8]	[8]	[8]	[8]

(1) Reclaimed water type designation not part of Title 22. Established for clarity.
(2) NTU-Nephelometric Turbidity Unit.
(3) MPN/100 ml-Most Probable Number per 100 milliliters.
(4) No more than five percent of the time in any 24 hour period.
(5) For the last seven days analyses have been conducted.
(6) In any sample or more than one sample in any 30 day period, depending on application.
(7) Direct filtration has additional, specific guidelines.
(8) No standard.
(9) In any two consecutive samples.

Type 1 (1A and 1B) treatment recycled water (frequently referred to as unrestricted use or disinfected tertiary reclaimed water) is at all times an adequately oxidized, coagulated, clarified, filtered and disinfected wastewater. The wastewater is considered adequately filtered if the effluent turbidity does not exceed an average of two Nephelometric Turbidity Units (NTU) nor exceed 5 NTU more than five percent of the time during any 24-hour period. The wastewater is considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 2.2 per 100 milliliters (ml), as determined from the bacteriological results of the last seven days for which analyses have

been completed, and the number of coliform organisms does not exceed 23 per 100 ml in any sample.

The DHS has developed separate guidelines for direct filtration of oxidized wastewater. The requirements for direct filtration are covered by DHS document entitled Policy Statement for Wastewater Reclamation Plants with Direct Filtration. This policy statement allows a maximum filtration rate of five gallons per minute per square foot (gpm/sf) for all types of filters except the traveling bridge automatic backwash filter, which is allowed a maximum filtration rate of 2 gpm/sf. Previously, the DHS preapproved certain proprietary filters that were demonstrated to be effective at directly filtering oxidized wastewater to the Type 1 treatment standards. The preapproval program is no longer in effect and all filters must meet the performance standards. Chlorine contact time for disinfection following direct filtration is two hours with chlorination capacity capable of maintaining a 10 milligram per liter (mg/L) chlorine residual.

Type 2 treatment recycled water has the same quality standards as Type 1 treatment water except the clarification and filtration steps are eliminated in the treatment chain.

Type 3 treatment recycled water (also known as restricted use or undisinfected secondary reclaimed water) is at all times adequately oxidized and disinfected wastewater. The wastewater is considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 ml, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 ml in any two consecutive samples.

Type 4 treatment recycled water is primary effluent. Specific requirements for primary treatment shall be determined by the governing RWQCB who issues the permit for the reclamation project. Undisinfected oxidized effluent would generally be acceptable for Type 4 treatment uses.

Recycled wastewater of these four types may be used for crop irrigation, landscape irrigation, impoundments, groundwater recharge, industrial processes or other uses.

Irrigation. Recycled water that is used for spray irrigation of food crops must meet Type 1 treatment requirements. Recycled water that is used for surface irrigation of food crops must be Type 2 treatment or better. Recycled water that is used for surface irrigation of orchards and vineyards must be Type 4 treatment or better provided that the harvested fruit does not come in contact with irrigating water or the ground.

Exceptions to the water quality requirements for recycled water irrigation of food crops may be granted by the DHS on an individual basis. An exception may be granted if the irrigated food crop undergoes extensive commercial physical or chemical processing

sufficient to destroy pathogenic agents before the crop is available for human consumption.

Recycled water that is used to irrigate fodder, fiber or seed crops must be Type 4 treatment or better. If pasture for milking animals is irrigated with recycled water, it must be Type 3 treatment or better unless an exception is granted.

Recycled water that is used to irrigate golf courses, cemeteries, freeway medians, landscapes and other areas where the public has similar access or exposure must be Type 3 treatment or better. Recycled water that is used to irrigate parks, playgrounds, schoolyards, and other areas with similar access or exposure must be Type 1 treatment.

Impoundments. Recycled water may be impounded to serve recreational purposes or as a reservoir for landscape irrigation. Recreational impounds are either nonrestricted or restricted. Warning signs shall be placed around any impoundment and discharge from impoundments shall not take place except as allowed by a National Pollutant Discharge Elimination System (NPDES) permit.

Recycled water that is used as a source of supply for a nonrestricted recreational impoundment must have undergone Type 1 treatment. Recycled water that is used as a source of supply for a restricted recreational impoundment shall be Type 2 treatment or better. Recycled water that is stored in an impoundment for landscape irrigation purposes shall be Type 3 treatment or better.

Groundwater Recharge. There are currently no detailed regulations relating to groundwater recharge with recycled water in effect. Requirements for groundwater recharge projects will be evaluated on a case by case basis. The DHS will make its recommendations to the RWQCB based on effluent quality and quantity, spreading area operations, soil characteristics, hydrogeology, residence time, and distance to withdrawal. The DHS requires that a public hearing be held prior to issuing final recommendations. In December 1994, the DHS prepared the draft document, Proposed Regulations for Groundwater Recharge with Reclaimed Water. The regulations are proposed pursuant to Section 13521 of the Water Code. Table 3.3 lists the proposed regulations for groundwater recharge with recycled water. This document proposes specific guidelines relating to maximum percentage of reclaimed water, depth to groundwater, retention time, horizontal distance to extraction treatment processes, and other parameters. This document is the guiding force regarding groundwater recharge projects. This draft is included in Appendix B.

Industrial Use. The use of recycled water for industrial purposes is not specifically addressed by the existing regulations and is handled on a case by case basis. The treatment process and effluent quality is often dictated by the industrial process requirements.

Table 3.3 Proposed DHS Criteria for Groundwater Recharge with Recycled Water[1,2] Comprehensive Recycled Water Study Cayucos/Morro Bay

Project Category[3]	Treatment Process	Maximum Percent Reclaimed Water[4]	Depth to Groundwater[5] (feet) at Initial Percolation Rate[6] of: ≤0.2 in/min	≤0.3 in/min	Retention Time Underground (Months)	Horizontal Distance (Feet)[7]
Surface Spreading						
I	Organics Removal,[8] Oxidized, Filtered & Disinfected[9]	50	10	20	6	500
II	Oxidized, Filtered and Disinfected[9]	20	10	20	6	500
III	Oxidized & Disinfected[10]	20	20	50	12	1,000
Direct Injection						
IV	Organics Removal,[8] Oxidized, Filtered, & Disinfected[9]	50	N/A[11]	N/A[11]	12	2,000

(1) Source: Proposed Regulations for Groundwater Recharge with Reclaimed Water, State of California, December 1, 1994.
(2) Alternatives to the requirements specified in this table may be accepted if the applicant demonstrates an equivalent degree of health protection.
(3) This is a designation to identify a set of conditions for an acceptable project.
(4) Not more than the given percent of the water withdrawn at any domestic well shall be reclaimed water. The above table is based on a 20 percent contribution of reclaimed water in recharged water. The percentage of reclaimed water in the recharged water may be increased to as much as 50 percent provided additional trace organics removal is accomplished. The maximum allowable TOC (mg/L) should comply with the performance standards listed in the proposed regulations. The percent contribution of reclaimed water may be determined by averaging over a maximum three year period of time.
(5) Depth to groundwater is the minimum depth to groundwater during the life of the project.
(6) Maximum initial percolation rate shall not exceed the listed values. Borings shall show the soil characteristics at least to the depths listed in this table.
(7) Horizontal distance measured from the injection well or closest edge of the recharge basin to the nearest point of extraction.
(8) The maximum allowable TOC (mg/L) should comply with the performance standard listed in the proposed regulations. The percent contribution of reclaimed water may be determined by averaging over a maximum three year period of time.
(9) The median number of total coliform organisms does not exceed 2.2 MPN/100 ml, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of total coliform organisms does not exceed 23 MPN/100 ml in any sample.
(10) The median number of total coliform organisms does not exceed 23 MPN/100 ml, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of total coliform organisms does not exceed 240 MPN/100 ml in any sample.
(11) Not applicable.

Other Methods of Treatment. Methods of treatment other than those specified by Title 22 may be employed for water recycling if it is demonstrated to the DHS that the proposed method of treatment is equal to those specified.

Proposed Title 22 Draft Updates

As mentioned earlier, the existing 1978 water recycling regulations are continuously updated with proposed revisions with the intent of revising the criteria established. The most recent proposed draft regulations were distributed in September 1999. This proposed draft included revisions to Title 22 and a few revisions to Title 17. The Title 22 revisions were to Articles 1 through 6, namely, (1) Definitions, (2) Sources of Recycled Water, (3) Uses of Recycled Water, (4) Use Area Requirements, (5) Dual Plumbed Recycled Water Systems, and (6) Sampling and Analysis.

Recycled water definitions are included for disinfected tertiary (commonly referred to as "unrestricted use"), disinfected secondary 2.2 and 23, and undisinfected secondary. Table 3.4 summarizes the proposed recycled water treatment regulations. As can be seen from the table, primary effluent is no longer an option in these revisions. The uses of recycled water are also outlined in the proposed revisions. A table was developed by the Water Reuse Association of California which summarizes the recycled water uses allowed in California . The summary table and the proposed draft regulations are contained in Appendix B.

Table 3.4 Proposed Recycled Water Treatment Regulations (per September 1998 Updates) Comprehensive Recycled Water Study Cayucos/Morro Bay

Recycled Water Type	Treatment Process	Median Total Coliform (MPN/100ml)[1]	Maximum Total Coliform (MPN/100 ml)[2]
Disinfected Tertiary	Filtered, Disinfected[4]	2.2	23[3]
Disinfected Secondary - 2.2	Oxidized, Disinfected	2.2	23
Disinfected Secondary - 23	Oxidized, Disinfected	23	240
Undisinfected Secondary	Oxidized	—	—

(1) Utilizing bacteriological results of the last 7 days for which analyses were completed.
(2) Does not exceed in more than one (1) sample in any 30 day period.
(3) No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.
(4) See proposed regulations for acceptable disinfection methods.

3.4 OTHER REGULATORY REQUIREMENTS

If the WWTP changes its discharge location to groundwater, to an inland surface water (i.e., creek or river), or to an estuary as part of a reuse project, the discharge would be subject to additional requirements based on the Central Coast RWQCB Basin Plan, the

Inland Surface Waters Plan and/or the Enclosed Bays and Estuaries Plan, as discussed below.

Central Coast Basin Plan

Regional water quality control plans (Basin Plans) are required by the Porter-Cologne Act for each of the nine regions of California. The Basins Plans are used to establish beneficial uses, water quality objectives, and implementation plans for the water bodies within each region.

The Central Coast Regional Board adopted the latest version of the Central Coast Water Quality Control Plan (Basin Plan) in 1994. The Basin Plan identifies beneficial uses for the major creeks in the study area as well as the Morro Bay Estuary, as shown in Table 3.5. The Basin Plan contains general water quality objectives, water quality objectives specific to each beneficial use, and water quality objectives for specific water bodies. The general objectives and the objectives specific to each beneficial use are too numerous for discussion herein. The objectives for specific water bodies within the study area, namely Chorro Creek and Chorro groundwater basin, are shown in Table 3.6.

The Basin Plan implementation section specifies that for stream discharge secondary treatment is a minimum requirement. Discharges to streams with water contact recreation designations are required to follow California Department of Health Services recommendations of coagulation, filtration and disinfection to provide a median coliform of 2.2 MPN/100 ml. Where fisheries protection in a stream is a concern, detoxification is required.

The Basin Plan implementation section also states that requirements for disposal into an estuary are the most stringent, and that discharge to estuaries are prohibited unless the discharge will enhance water quality. Eutrophication of estuaries are of specific concern, and the Basin Plan suggests secondary treatment with denitrification or phosphorus removal and disinfection may be required.

Inland Surface Waters Plan/Enclosed Bays and Estuaries Plan

On September 11, 1997, the SWRCB issued the Draft Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California and the Functional Equivalent Document for public review and comment. The Draft State Implementation Policy contains provisions for implementing the pollutant criteria promulgated by EPA in the proposed California Toxics Rule (CTR), the National Toxics Rule (NTR), and the water quality objectives adopted by the RWQCBs in their respective Basin Plans. The CTR, released in draft form in August of 1997, and the NTR establish water quality standards for toxic pollutants (trace metals, pesticides, PCBs, other trace organics) and provisions for implementation of the standards. The SWRCB will receive

Table 3.5 Beneficial Uses of Creeks in Study Area[1] Comprehensive Recycled Water Study Cayucos/Morro Bay

Beneficial Use	Cayucos Creek	Old Creek		Toro Creek	Morro Creek	Little Morro Creek	Chorro Creek	Morro Bay Estuary
		Above WRR[2]	Below WRR[2]					
Municipal Supply	X	X	X	X	X	X	X	
Agricultural Supply	X	X	X	X	X	X	X	
Industrial Process/ Service Supply		X	X					X
Ground Water Recharge	X	X	X	X	X	X	X	
Water Contact Recreation	X	X	X	X	X	X	X	X
Non-contact Recreation	X	X	X	X	X	X	X	X
Wildlife Habitat	X	X	X	X	X	X	X	X
Cold Water Habitat	X		X	X	X	X	X	X
Warm Water Habitat	X	X	X	X	X		X	
Migration	X			X	X	X	X	X
Spawning	X	X	X	X	X	X	X	X
Biological Significance							X	X
Rare, Threatened or Endangered Species	X	X	X	X	X	X	X	X
Estuarine Habitat				X	X			X
Freshwater Replenishment				X	X		X	
Commercial/ Sport Fishing	X	X	X	X	X	X	X	X
Shellfish harvesting								X

(1) From the Water Quality Control Plan - Central Coast Region.
(2) WRR - Whale Rock Reservoir.

Table 3.6 Water Quality Objectives for Chorro Creek and Chorro Groundwater Basin[1],[2]
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Constituent, mg/L	TDS	Cl	SO_4	B	Na	N
Chorro Creek	500	50	50	0.2	50	-
Chorro Groundwater Basin	1000	250	100	0.2	50	5

(1) From the Water Quality Control Plan - Central Coast Region.
(2) Annual median values.

final approval of the State Implementation Policy and the new plans after final promulgation of the CTR. The ability of the WWTP to attain compliance with these criteria would need to be assessed if a change in discharge location to a stream or estuary is proposed. Compliance with the criteria may require additional source control or advanced treatment.

EXISTING AND FUTURE WASTEWATER TREATMENT FACILITIES

4.1 EXISTING WASTEWATER FACILITIES

The City of Morro Bay and Cayucos Sanitary District jointly own the wastewater treatment plant (WWTP) located in Morro Bay on Atascadero Road. The WWTP has a 301(h) modified NPDES permit for discharge of primary and secondary blended effluent to the ocean. The WWTP processes include screening, grit removal, and primary clarification. The flow is then split after primary clarification with a portion of the flow proceeding through secondary treatment of tricking filters, solids contact and secondary clarification. The secondary effluent is then blended with the reserved primary effluent and chlorinated and dechlorinated prior to discharge approximately one mile out into the Pacific Ocean, north of Morro Rock. Solids removed in the primary and secondary treatment processes are digested and dried in solar drying beds prior to being hauled offsite for land application. The treatment process schematic is shown in Figure 4.1.

The WWTP is designed for 2.06 mgd average dry weather flow, 2.36 mgd peak seasonal dry weather flow and 6.6 mgd peak wet weather flow. The preliminary, primary and disinfection treatment facilities are sized for the design flows. The secondary treatment facilities are designed for a 0.97 mgd flow to meet effluent criteria of 30 milligrams per liter (mg/L) BOD_5 and 30 mg/L TSS, although the secondary system can and does treat higher flows. The WWTP's number of facilities, sizes and design criteria is shown in Appendix C.

Flow to the secondary facilities is controlled by one of two methods: a gate which fixes the secondary flow to 0.97 mgd; or a valve which can be manually adjusted to control flow. The valve does not have a flow meter, and therefore is adjusted based on visual inspection of secondary effluent quality. The gate has not been used to control flow to the secondary facilities since the late 1980s. The 301(h) waiver for discharge of primary/secondary blend waives secondary requirements for BOD_5 and TSS, although all other NPDES limits apply. The secondary treatment system is, therefore, operated to maximize flow through the secondary facilities without overloading the secondary clarifier rather than operated to meet secondary requirements for BOD_5 and TSS. This operation maximizes overall wastewater treatment performance and ensures the highest quality effluent possible is being discharged, with a majority of the final effluent blend being secondary effluent rather than primary effluent. The secondary facilities are estimated to operate at flows between 1.2 to 1.6 mgd.

4.2 EXISTING AND PROJECTED WASTEWATER FLOW

Wastewater flow to the WWTP has remained fairly constant from 1986 to 1998, as shown in Figure 4.2, deviating only slightly from the average flow of 1.6 mgd. The influent flow

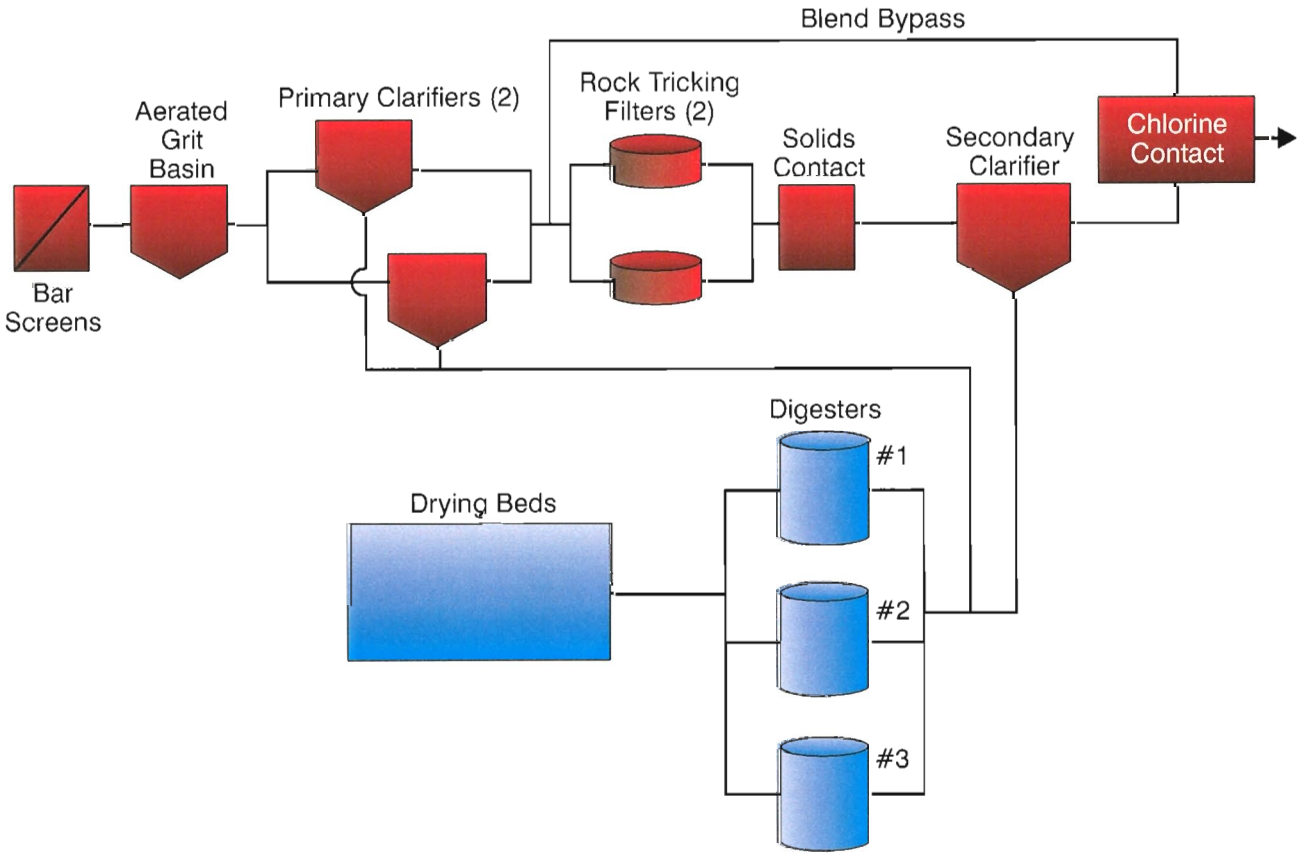
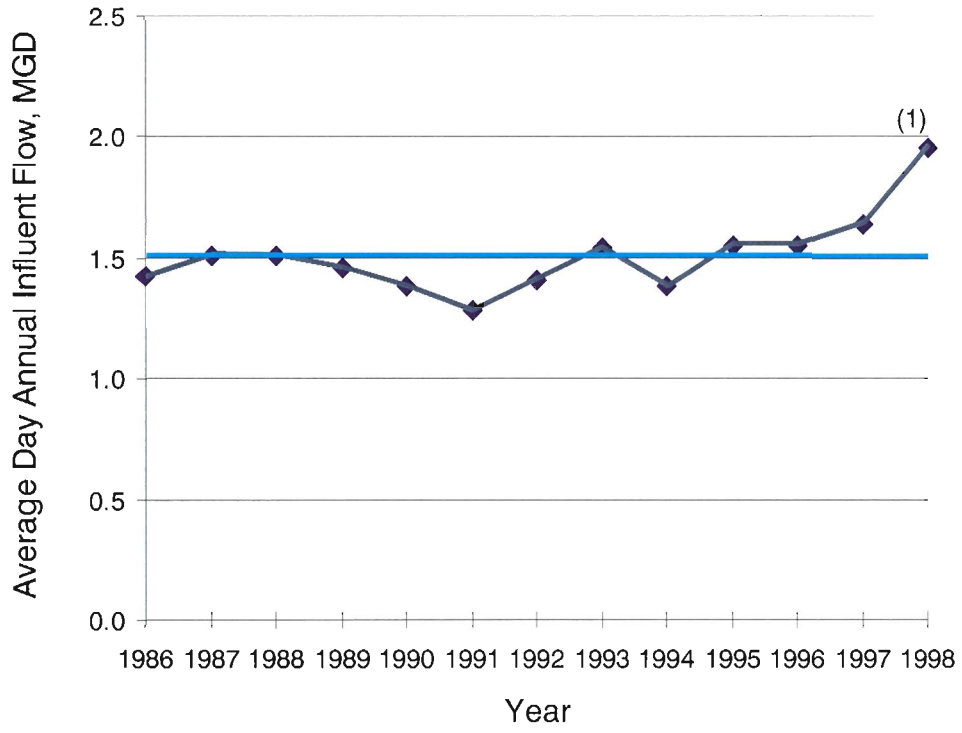


Figure 4.1
WWTP EXISTING PROCESS SCHEMATIC
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY



LEGEND

Flow

Mean Flow

(1) 1998 flow was high due to increased infiltration caused by a damaged influent trunk line.

Figure 4.2
WWTP AVERAGE DAY ANNUAL FLOWS
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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variation over the course of a year is influenced by peak wet weather flows in the winter, typically January through March, and peak dry weather flows during the summer tourist season, typically July and August, as shown in Figure 4.3. The WWTP experiences a large diurnal variation of flow over the course of a day, as shown in Figure 4.4.

Future wastewater flow correlates to water use and is largely dependent on the rate of population growth and the degree of water conservation measures in effect. Water use projections, discussed in Chapter 2, estimate future demands of 661 AFY for Cayucos and 1930 AFY for Morro Bay. The total projected annual average water demand is 2,591 AFY or 2.366 mgd. Assuming wastewater is 85 percent of the water use, a typical textbook value for domestic and commercial uses, the annual average wastewater flow will be 2.01 mgd. As discussed earlier, the WWTP has a design capacity flow of 2.06 mgd average dry weather flow and 2.36 mgd peak dry weather flow. This design capacity will be sufficient through the planning period (2016 to 2025). For the purposes of this report, the projected wastewater flow will be assumed to be equal to these design flows.

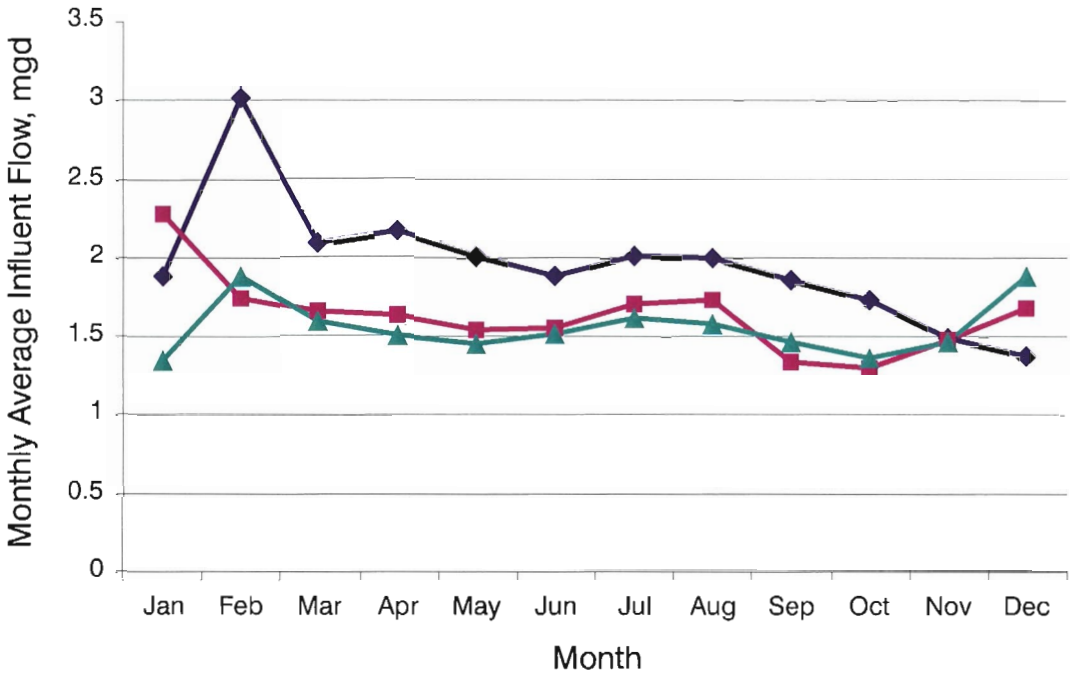
4.3 WASTEWATER QUALITY

The WWTP consistently meets or exceeds all its discharge requirements and produces a high quality effluent for a primary/secondary blend plant. The average WWTP final effluent quality more closely resembles a full secondary treatment effluent than a primary/secondary blend. The historical influent and effluent BOD_5 and TSS concentrations are shown in Figure 4.5., and shown in Table 4.1.

Table 4.1 Historical Annual Average Effluent Quality Comprehensive Recycled Water Study Cayucos/Morro Bay

Year	TSS (mg/L)	BOD_5 (mg/L)	Oil and Grease (mg/L)	Turbidity (NTU)	pH	Acute Toxicity (TUa)	Chronic Toxicity (TUc)
1994	32.0	33.0	4.1	36	7.5	1.3	4.37
1995	30.6	31.4	5.1	32	7.5	0.7	4.35
1996	33.1	35.7	7.9	34	7.7	0.5	4.83
1997	36.0	38.6	5.3	32	7.7	0.4	7.80
1998	38.8	39.1	5.4	34	7.6	0.1	7.80
NPDES Permit Limit	70	120	25	75	6-9	1.5	134.0

The effect of the wastewater discharge on receiving water quality is evaluated quarterly by offshore monitoring. The quarterly surveys have consistently found no indications that the wastewater plume extends beyond the zone of initial dilution. Semiannual monitoring for



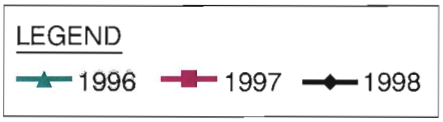
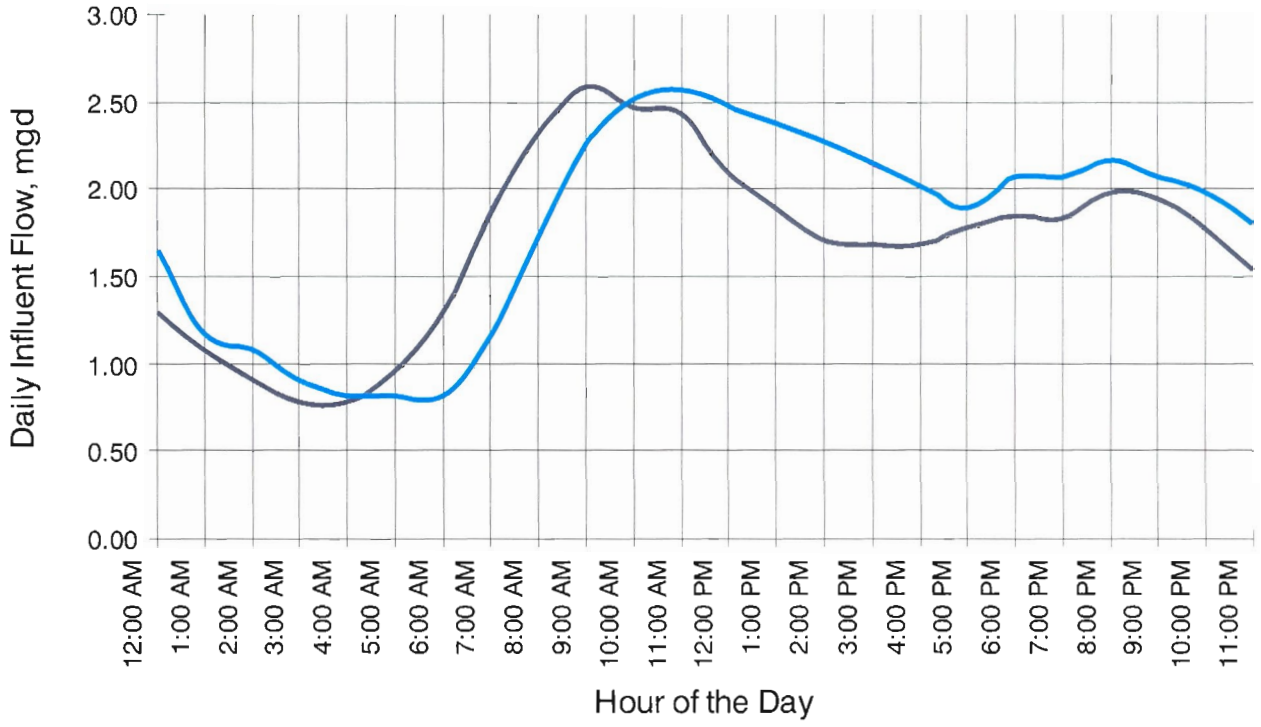


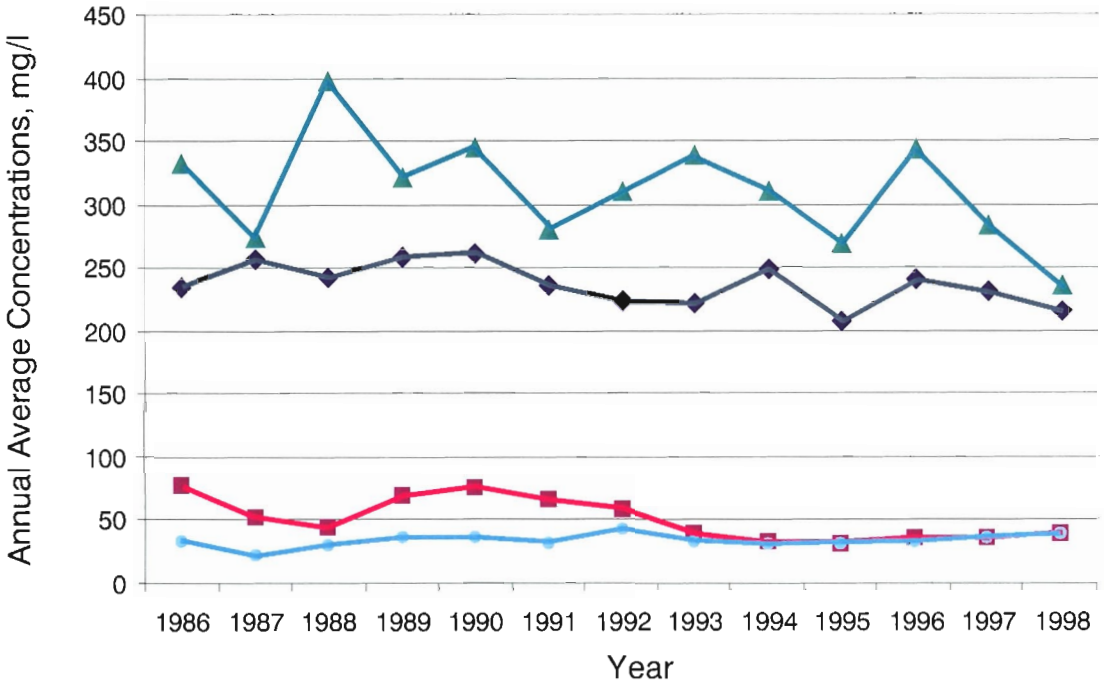
Figure 4.3
MONTHLY FLOW VARIATION
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY



LEGEND

- Average Weekday Flow
- Average Weekend-Day Flow

Figure 4.4
DIURNAL FLOW
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY



LEGEND

- Influent BOD
- Influent TSS
- Effluent BOD
- Effluent TSS

Figure 4.5
INFLUENT AND EFFLUENT
BOD_5 AND TSS CONCENTRATIONS
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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benthic organisms in the sediments surrounding the outfall has also found no evidence of increased concentrations of any toxic substances. Data collected since 1986 shows that the high quality, low toxicity WWTP discharge dissipates quickly and has no negative impact on the ocean environment. These conclusions have been supported by an independent review of monitoring data conducted in 1998 by the United States Environmental Protection Agency (EPA). In September 1998, the EPA confirmed these conclusions by granting the WWTP a continuation of its 301(h) modified NPDES permit, allowing continued discharge of a primary/secondary blended effluent. While the 301(h) modified NPDES permit waives the more stringent secondary requirements for BOD_5 and TSS, all other NPDES limits apply to the WWTP discharge without exception. Table 4.1 shows the WWTP's historical effluent quality (from 1994 to 1998) compared to the NPDES permit limits.

For evaluation of the suitability of the effluent for reuse, the WWTP effluent was tested for irrigation water quality parameters in July 1999. These results were compared to existing water supplies for irrigation (see Chapter 2) and to water quality guidelines for irrigation (see Chapter 5).

4.4 FUTURE FACILITIES NEEDS AND COMPATIBILITY OF REUSE PROJECTS WITH EXISTING FACILITIES

There are several issues that must be addressed regarding the WWTP for future facilities needs and operation of existing facilities if a reuse project is implemented. First, if treated wastewater is diverted for reuse, the quantity of flow in the outfall will decrease and the outfall may not maintain a minimum flow needed to prevent sanding over or silting in of the ports. Secondly, if a reuse project diverts a portion of the secondary flow, the primary effluent portion of the primary/secondary effluent blend to be disposed will increase, potentially causing problems meeting the final effluent discharge requirements. Finally, if the WWTP should ever lose its 301(h) waiver for discharge of a primary/secondary blended effluent, the facilities would have to be upgraded for full secondary treatment. These issues are discussed in the following sections.

Compatibility of Reuse Projects with Existing Facilities

Operation of Effluent Discharge Outfall

Implementation of a reuse project would divert effluent flow for reuse and thereby decrease effluent flow to the outfall either on a seasonal basis or year-round. During the course of this study, concern was raised that the outfall and diffuser ports may silt over or backfill with sediments if a minimum flow in the outfall is not met. Available design information on the outfall system was reviewed and no calculations were found of the minimum flow required to keep the ports open.

Flow Science, Inc. reviewed the available information and determined that under certain conditions, backflow of seawater into the ports may occur. The full report from Flow Science is contained in Appendix C. Backflow can possibly be prevented by installing one-way check valves on each diffuser at an equipment cost of $530 each. Visual inspection of the outfall is conducted annually to determine if silting over of the ports is a concern. If sediment accumulation is a problem, extensions (or risers) can be installed on each diffuser to raise the elevation of the diffuser. The equipment cost for the one-way check valve with a 1 to 2 foot extension is $580/port. In addition, some of the outfall ports could be capped so the remaining outfall diffusers maintain a higher discharge velocity. Capping a portion of the parts may also be required to ensure the initial dilution ratio is maintained (133:1) at the lower flows. Further investigation into these options is recommended if a reuse project is implemented. The costs for these options shown herein do not include cost of installation.

Meeting Discharge Requirements

Implementation of a reuse project would divert a portion of the secondary flow to reuse (see Chapter 7). Either full secondary treatment would be required, or the remaining secondary effluent could be blended with the primary effluent for continued discharge to the ocean. However, as the percentage of primary effluent in the primary/secondary effluent blend is increased, the final effluent quality will degrade and may potentially have problems meeting the final effluent discharge requirements. Compliance with discharge requirements with a reduced discharge flow was evaluated through examination of existing data and jar testing.

Jar testing was performed to determine the additional chlorine needed to maintain the same chlorine residual and to meet the total coliform effluent limits, as the percentage of primary effluent increases in the final effluent blend. The jar testing was a limited study, performed using samples collected on one day, Monday, August 2, 1999. Mondays during the summer months are typically high flow and load days at the WWTP. This condition was chosen as representative for peak tourist season operation. The results of the jar testing indicate that as the percentage of primary effluent in the final blend increases from 20 to 80 percent, the amount of chlorine required would increase by approximately 7 mg/L. The most important findings of the jar testing are that the effluent coliform limits can still be achieved with a high percentage of primary effluent (80 percent) in the final effluent blend. The results of the jar tests are included in Appendix C.

If a reuse project is implemented, a portion of the secondary effluent flow would be diverted for reuse with the possible addition of tertiary treatment. In order to optimize the tertiary facilities and/or meet reuse requirements (see Chapter 3), the secondary effluent should not exceed typical secondary effluent standards (30 mg/L BOD_5 and 30 mg/L TSS). This would require the existing secondary facilities to be limited to the design flow of approximately 1 mgd. It is possible that the existing secondary facilities could produce a

high quality effluent at higher flows, but a detailed plant stress test and pilot of tertiary facilities would be required to determine at what flow the effluent degrades below standards suitable for reuse or tertiary treatment.

The WWTP was designed to just meet the final effluent permit limits of 70 mg/L TSS and 120 mg/L BOD_5 at the design flow of 2.36 mgd peak seasonal dry weather flow. Therefore, no secondary flow could be diverted for reuse at the design flow and have the ocean discharge still meet BOD_5 and TSS requirements. At plant influent flows less than the design flow, some diversion may be possible while still achieving final discharge requirements, depending on the influent BOD_5 and TSS concentrations. Based on a review of historical data, diversion of a portion of the secondary flow for reuse could occur during average annual conditions, but during the peak summer months of July and August any diversion of secondary effluent would cause noncompliance for the ocean discharge. Therefore, if production of reuse water is required in the summer, the peak season for irrigation, the WWTP would have to be upgraded for full secondary treatment in order to meet both the reuse requirements and the ocean discharge requirements.

"No Project" Alternative - Future Facilities Required

The "No Project" Alternative is the alternative for which no reuse project is implemented. In this scenario, the WWTP will need to continue to discharge to the ocean. As long as the WWTP is granted a 301(h) waiver, the existing facilities (with regular maintenance and repairs) will adequately serve the communities of Morro Bay and Cayucos in the future. However, if the 301(h) waiver was denied by the EPA, the WWTP would need to provide full secondary treatment for continued discharge to the ocean. There is currently no scientific basis for denial of the 301(h) waiver, as the WWTP discharge meets all requirements and the effluent quickly dissipates in the ocean to nondetectable levels. However, for the purposes of being complete, an evaluation of the required facilities to meet full secondary requirements is included in this report. The "No Project" Alternative, therefore, has two sub-alternatives: continue existing high quality ocean discharge with primary/secondary blend at no additional costs; and upgrade facilities to full secondary treatment if 301(h) waiver is no longer granted.

The preliminary and primary treatment facilities were designed for the full 2.06 mgd ADWF/2.36 mgd PSDWF and, therefore, are sufficient to handle future wastewater flows. The secondary facilities (trickling filters, solids contact and secondary sedimentation) were designed for 0.97 mgd to meet a final discharge of 30 mg/L BOD_5 and 30 mg/L TSS. Because the WWTP currently operates the secondary facilities at higher flows than the designed 0.97 mgd, the secondary effluent quality degrades as a result. For the purposes of this report, it is assumed the existing secondary facilities must be limited to 0.97 mgd to meet design secondary discharge requirements. Therefore, the secondary facilities would require an expansion of 1.39 mgd to meet the design PSDW flow of 2.36 mgd.

It is beyond the scope of this report to prepare a facilities master plan with evaluation of future treatment options and optimization of existing facilities. Therefore, for the purposes of this report, additional secondary facilities will be sized and costs are estimated based on mirroring the existing secondary system, with small exceptions. Future secondary facilities for the additional 1.39 mgd would include: one biotower, one solids contact channel, and one secondary clarifier. The existing shallow rock trickling filters are from an older era of attached growth wastewater treatment design. A tall biotower with plastic media is more representative of current technology. Alternative options for secondary treatment, such as converting to a full suspended growth system (activated sludge), was not considered. A detailed plant evaluation for optimization of existing facilities through upgrades (i.e., changing existing trickling filter media from rock to plastic) could result in considerable cost savings for upgrading to full secondary treatment.

The solids facilities were originally designed to handle the solids produced by a 2.06/2.36 mgd primary facility and a 0.97 mgd secondary facility. Operation of expanded secondary facilities would produce approximately 50 percent more solids. These additional solids must be disposed of in an environmentally friendly fashion which also increases the annual operational costs of the WWTP. Currently, operation of only two of the three existing digesters yields a 30 day solids detention time in the digesters. Increased solids production caused by operation of full secondary treatment would require use of all three digesters to maintain a 15 day detention time as required by regulations for biosolids reuse. The decrease in detention time from 30 days to 15 days may change the aesthetic characteristics of the solids, likely producing more odors, although the solids will still meet regulations. While the digestion volume is adequate for increased solids, the structural integrity of the digesters was not reviewed, and the digester heating and mixing systems may need to be upgraded. The existing sludge drying beds do not have sufficient area and volume to handle additional solids from full secondary treatment. Therefore, additional drying beds have been included in the cost estimate.

Planning level costs for upgrading to a full secondary treatment system are shown in Table 4.2. Costs for a biotower pump station have been included, although significant cost saving may be possible if the existing trickling filter pump station could be modified to include new pumps. Layouts of future facilities have not been evaluated, however, based on conversations with the plant staff, the WWTP owns sufficient property for siting new facilities. The current operation of the WWTP produces a high quality effluent, and the additional secondary facilities shown in Table 4.2 are not required for ocean discharge under the existing permit conditions. Additional secondary facilities are shown for planning purposes only, to show the costs that would be incurred if the EPA ever denies the WWTP its 301(h) waiver.

Table 4.2 Estimated Costs for Expanding to Full Secondary Treatment
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Facility	Costs
Biotower	$800,000
Biotower Pump Station	$500,000
Solids Contact Basin and solids pumping	$400,000
Secondary Sedimentation Basin	$600,000
New Sludge Drying Beds	$450,000
Subtotal	$2,750,000
'+ Estimating Contingency (20%)	$550,000
'+ Construction Contingency (15%)	$413,000
Total Construction Costs	$3,713,000
'+ Administration, Legal, Planning, Design & Construction Management (30%)	$1,114,000
Total Project Costs	**$4,827,000**

GENERAL DESCRIPTION OF ALTERNATIVES

5.1 GENERAL DESCRIPTION OF CONCEPTUAL ALTERNATIVES

The uses of recycled water vary greatly throughout the state from irrigation to process cooling to artificial snow making. Obviously the uses are very site- and region-specific. The conceptual relationship between the entire market for water for all uses, the potential market for recycled water, the segment of the market identified in this study, and the developable portion of the potential market are presented in Figure 5.1. Figure 5.1 indicates that only a portion of the overall market for all uses of water can be served by recycled water. That is because recycled water is assumed to be inappropriate for drinking and some other uses. Figure 5.1 also indicates that this study identifies only a portion of the potential market for recycled water. This study intentionally focuses on relatively large potential recycled water customers which, therefore, eliminates a portion of the total recycled water market. The developable market for recycled water is a subset of the potential market for recycled water. The level of effort dedicated to marketing recycled water and securing commitments for its use will determine if more or less than the market identified in this study is actually developed.

A wide range of water recycling uses were reviewed for the Morro Bay - Cayucos area including irrigation, stream flow/estuary enhancement, industrial reuse, groundwater recharge, and use as a seawater intrusion barrier. All of these uses and their viability are discussed in the following sections. Contact was made with several of the potential users to confirm acreage and water uses. Telephone memoranda and miscellaneous information about the conceptual alternatives is contained in Appendix C.

5.2 IRRIGATION

Recycled Water Irrigation Uses

Three types of irrigation uses were identified for this report, namely, landscape/ community-based irrigation, golf course irrigation, and agricultural irrigation. Landscape/ community-based irrigation sites identified included parks, playing fields, cemeteries, highway medians, and general irrigation for aesthetic purposes. The Morro Bay State Park Golf Course was included as a large potential golf course irrigation user. Agricultural irrigation sites included row crops, orchards, and general pasture irrigation. According to the County Agricultural Commissioner the row crops grown are broccoli, cabbage, celery, cauliflower, and sugar peas. The orchards are mainly avocados, and citrus further east along Highway 41.

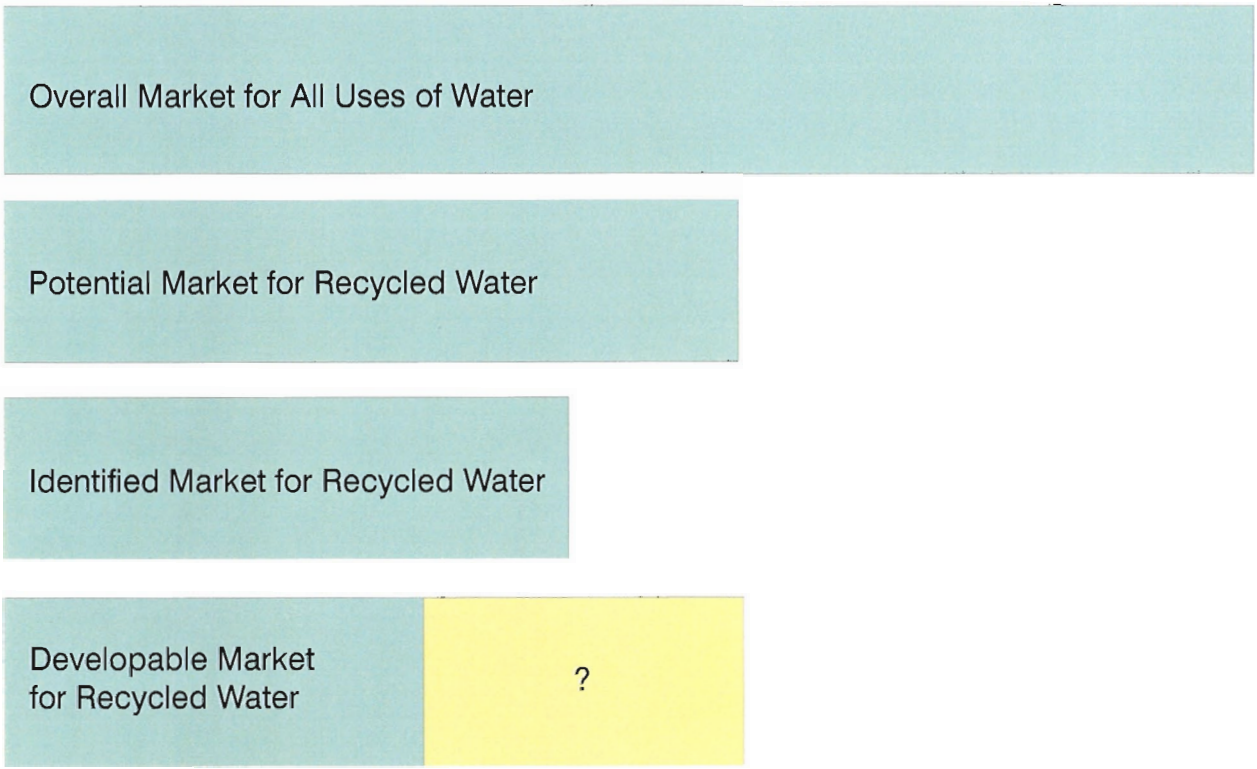

Figure 5.1
WATER MARKET RELATIONSHIPS
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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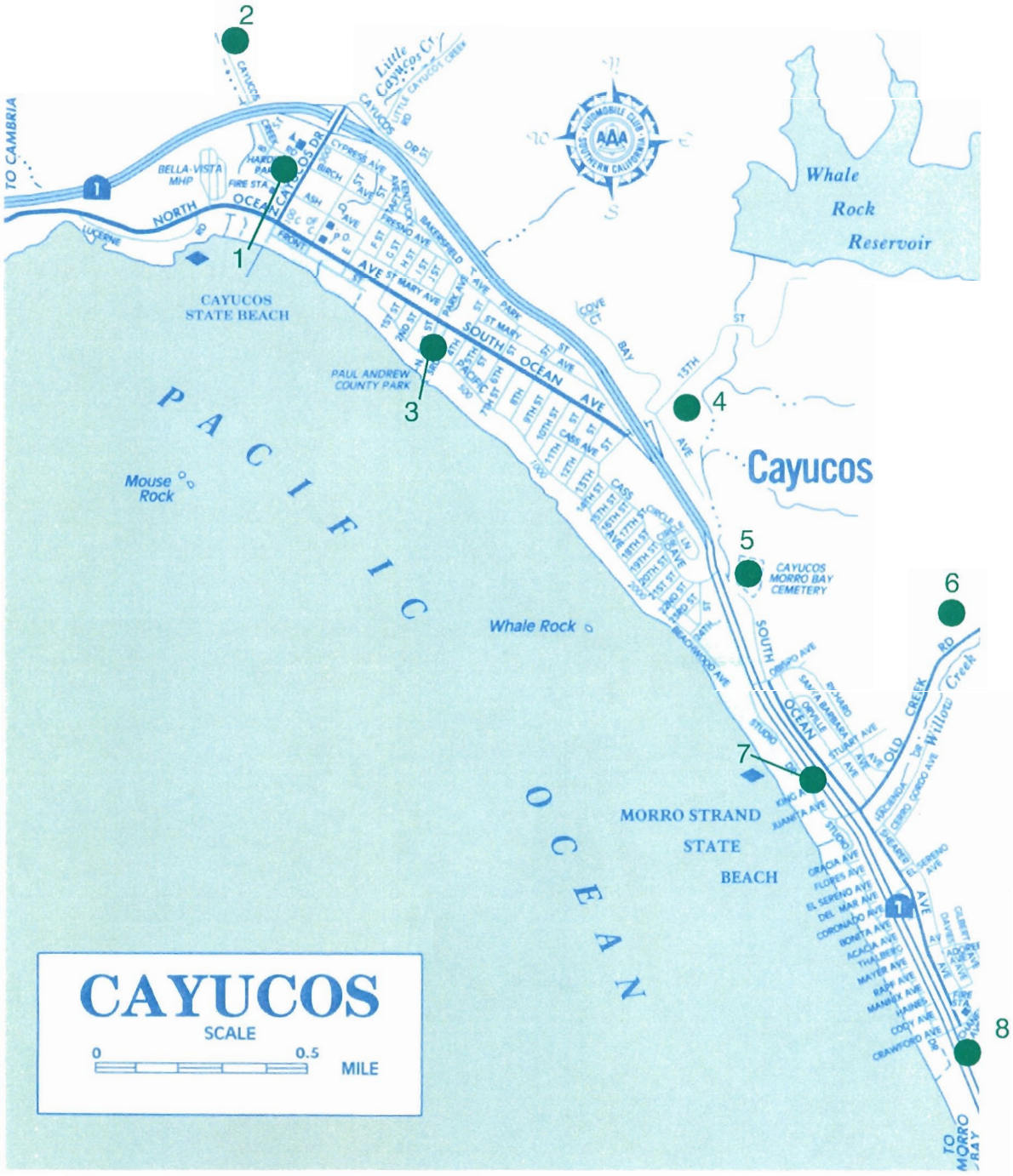
All of the potential irrigation uses identified, along with their corresponding location, current water source, and approximate size are shown in Tables 5.1 and 5.2. The tables also list a few sites that were initially identified, such as Coleman Park, but not given a site number due to their lack of irrigable land. Potential future water users, such as Tri-W Development, have not been investigated because of the uncertainties associated with their actual development and implementation. A total of 22 irrigation sites are listed. The Cayucos irrigation reuse sites are shown in Figure 5.2. The Morro Bay irrigation reuse sites are shown in Figure 5.3 along with the industrial reuse sites.

Table 5.1 Potential Reuse Irrigation Sites in Cayucos Comprehensive Recycled Water Study Cayucos/Morro Bay

Site No.	Brief Description	Location	Reuse Potential	Currently Irrigated	Current Water Source	Size (Acres)	Reuse Type	Irrig. Type
–	N of Cayucos	Along Hwy 1 - Cayucos Point	No	No	None	–	–	Native
0	Onsite/ Main. Yard	WWTP	Yes	No	None	–	–	–
1	Hardie Park & School	Cayucos Creek Rd. & Cayucos Dr.	Yes	Yes	Untreated Well	1	Irrig.	Grass
2	Cayucos Creek Rd.	N side Whale Rock Res. – 1-2 miles East of Hwy 1	Yes	Yes	Wells		Agr	Oranges, Snow Peas, Avocados, Pastures
3	Paul Andrew Park	Between 3rd & 4th, S of South Ocean Ave.	Yes	Yes	Domestic Water Supply	0.25	Irrig.	Grass
4	S/W of Whale Rock Reservoir	Below Whale Rock Reservoir dam	Yes	Yes	Private Well	5	Agr. Irrig.	Grass/Hill
5	Cayucos-Morro Bay Cemetery	N end of South Ocean Ave.	Yes	Yes	Whale Rock Direct	4	Irrig.	Grass
6	Old Creek Rd.	S side of Whale Rock Reservoir Past Whale Rock Rec. Area	Yes	Yes	Creek Before Res	100-300	Agr.	Oranges, Avocados
7	Highway 1 Median	S of Cemetery to Chaney Ave.	Yes	No	N/A	2	Irrig.	Grass/LS
8	Toro Creek Rd.	S of Old Creek Rd at Hwy 1	No	Yes/No	None	200-400	Agr. (Dry Land Farming)	Winter Wheat, Grass

Table 5.2 Potential Reuse Irrigation Sites in Morro Bay Comprehensive Recycled Water Study Cayucos/Morro Bay

Site No.	Brief Description	Location	Reuse Potential	Currently Irrigated	Current Water Source	Size (Acres)	Reuse Type	Irrig. Type
9	Del Mar Park	N of Sequoia & Hemlock	Yes	Yes	State Water	9	Irrig.	Grass
10	The Cloisters Develop.	Coral Ave/San Jacinto St.	Yes	Part	State Water	34	Irrig.	Grass, LS Medians
11	Morro Bay High School	W of Hwy 1 at Atascadero Rd.	Yes	Yes	State Water	14	Irrig. Agr.	Grass Horticulture Farm Animals
12	Keiser Park	W of Hwy 1 at Park St/ Atascadero Rd	Yes	Yes	State Water	9	Irrig.	Grass
13	Atascadero Rd.- E of Hwy 1	Hwy 41 to Approx Don Taylor Canyon	Yes	Yes	Morro Creek	200	Agr.	Fields Orchards Crops
14	Misc. Pasture Area	Main St./Little Morro Creek Rd/Hwy 1	Yes	No	None	10	Irrig.	Pasture
–	Coleman Park	Coleman Dr/ Embarcadero St.	No	No	None	–	–	Native
15	Del Mar Elementary	Sequoia St/ Hemlock Ave.	Yes	Yes	State Water	6	Irrig	Grass/LS
16	S Side of Hwy 1	Morro Bay Blvd/Quintana/ Main/Hwy 1	Yes	No	–	4	Irrig.	Grass/LS
17	Morro Bay Elementary Sch.	Napa St/ Monterey Ave.	Yes	Yes	State Water	4	Irrig.	Grass/LS
18	City Park	Morro Bay Blvd/Harbor St.	Yes	Yes	State Water	0.8	Irrig.	Grass/LS
19	Monte Young Park	Shasta Ave/ Olive St.	Yes	Yes	State Water	0.25	Irrig.	Grass
–	Tri W Development Area	N Hwy 1/W of South Bay Blvd.	Maybe	No	None	–	Irrig.	Grass/LS
20	Bayshore Bluffs Park	Main St/State Park Rd/ Bayshore Dr.	Yes	Part	State Water	3	Irrig.	Grass, LS
21	Morro Bay Golf Course	State Park Rd.	Yes	Yes	Chorro Creek Water Right	110	Irrig.	Grass/ Greens
22	Chorro Flats Enhancemen t Project	S to Hwy 1/E of South Bay Blvd.	Yes	No		45	Agr.	
–	Morro Bay State Park	S of Hwy 1/W of South bay Blvd.	No	No	–	–	–	Native



LEGEND

● Potential Irrigation Reuse Sites
(refer to text for site number names)

Figure 5.2
CAYUCOS POTENTIAL IRRIGATION REUSE SITES
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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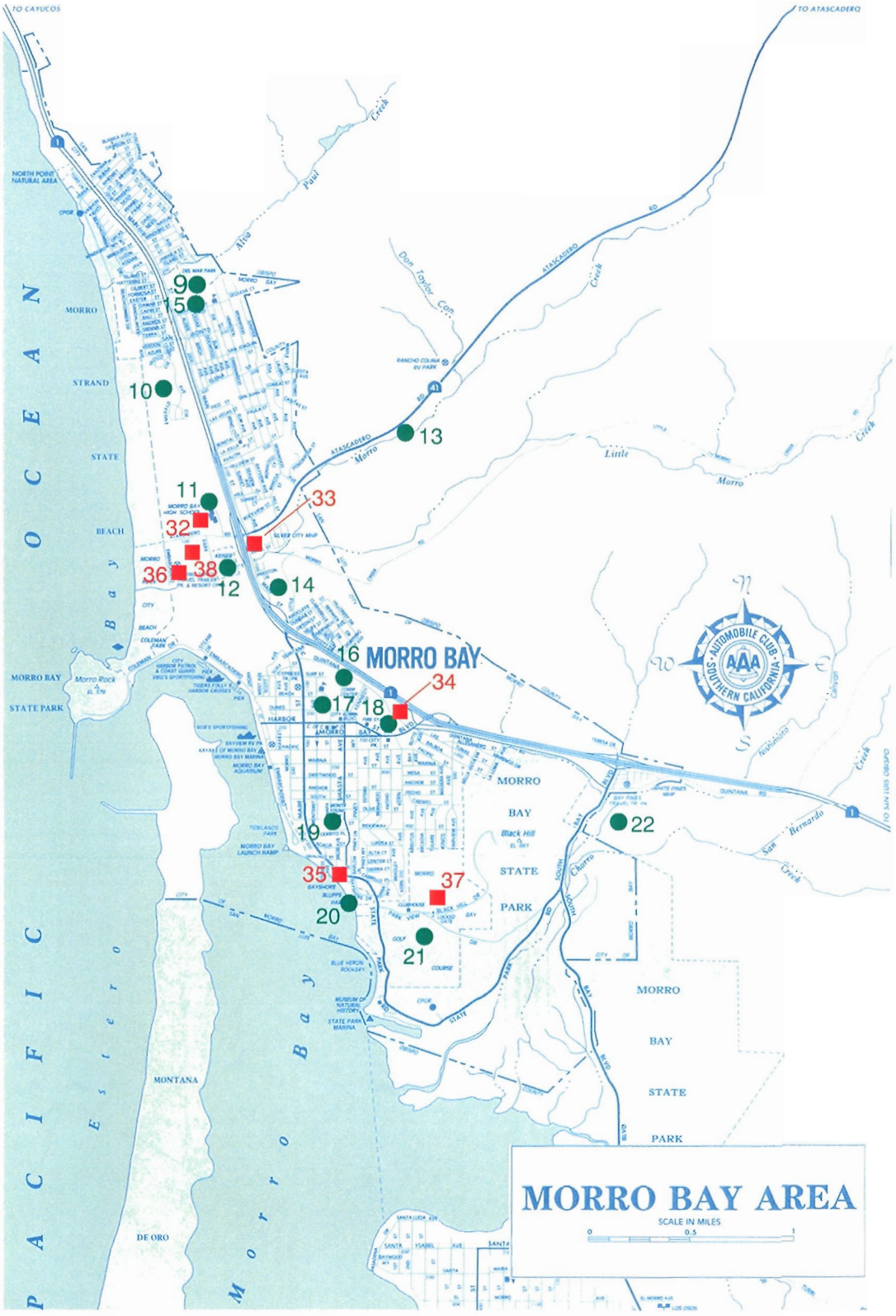

LEGEND

- Potential Irrigation Reuse Sites
- Potential Industrial Reuse Sites (refer to text for site number names)

Figure 5.3
MORRO BAY POTENTIAL IRRIGATION AND INDUSTRIAL REUSE SITES
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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Site number 2, Cayucos Creek Road, and site number 6, Old Creek Road, were determined to be impractical due to the great distance from the WWTP, the instability of the road to access the sites with a pipeline, and the large difference in elevation from the irrigation source. Site number 8, Toro Creek Road was also not considered further at this time due to the winter wheat crop grown not requiring irrigation. Three smaller parks which are less than 1 acre (site numbers 3, 18, and 19) were left in as potential sites should a pipeline pass by them, but should not be considered on their own merits due to their small size. The pastures, site numbers 14 and 16, were only considered for the possible reuse of disinfected secondary recycled water as they would be for disposal and aesthetic purposes only.

Duke Energy is planning a facility modernization project that will include extensive landscaping using drought-tolerant plants along berms and around the site facility. This irrigation project was also not considered at this time due to its speculative nature in timing, however it should be considered in the future after it is constructed.

Irrigation Water Demand and Water Quality

Based on conversations with the golf course staff, City of Morro Bay Recreation and Parks Department, and the Morro Bay Schools Director of Facilities, irrigation water use ranges from about 2 to 2.5 feet per year (ft/yr). This is based on the mild coastal climate and the type of "hardy" grass that is grown in this area. The higher value of 2.5 ft/yr was assumed for water reuse purposes since the water would be available and the higher volume is better for flushing of the soil to keep salts migrating downward. The irrigation season was assumed to be April through October, a total of 214 days.

Available effluent data collected by the WWTP for key irrigation water quality parameters was compiled and a comparison of the effluent to water quality guidelines for irrigation was developed and is presented in Table 5.3. These irrigation water quality parameters are not regularly collected so special sampling was conducted for comparison purposes. Table 5.4 summarizes the probable reuse restrictions of the MBCSD wastewater effluent for irrigation. In Table 5.3 and 5.4, it can be seen that sodium, chloride and bicarbonate ion levels fall within the moderate degree of restricted use category, indicating that an increased level of management should accompany any irrigation. Also, the combined nitrogen levels are considered severe with respect to the degree of use restrictions, while all other parameters tested should pose minimal to no problems to water reuse.

General Irrigation Use Guidelines

All water used for irrigation, whether derived from reservoirs, or rivers, or pumped from wells, contains various quantities of dissolved salts. Even the beneficial application of commercial fertilizers and organic materials such as composts and manures add salts to the soil. Quality of water means different things to different people. Industrial engineers

Table 5.3 Comparison of MBCSD Effluent to Water Quality Guidelines for Irrigation[1]
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Irrigation Water Key Quality Parameter	Units	Established Criteria Degree of Use Restriction[2, 3, 4] None	Slight to Moderate	Severe	MBCSD Effluent Typical Value[5]
Salinity EC	dS/m	<0.7	0.7-3.0	>3.0	1.7
TDS	mg/L	<450	450-2000	>2000	867
Permeability[6]			EC		
SAR = 0-3		>0.7	0.7-0.2	<0.2	SAR 5.7
= 3-6		>1.2	1.2-0.3	<0.3	EC_w 1.7
= 6-12		>1.9	1.9-0.5	<0.5	
= 12-20		>2.9	2.9-1.3	<1.3	
= 20-40		>5.0	5.0-2.9	<2.9	
Sodium (Na)					
Surface	SAR	< 3	3-9	> 9	5.7
Sprinkler	mg/L	<70	>70		210
Chloride (Cl)					
Surface	mg/L	<140	140-350	>350	300
Sprinkler	mg/L	<100	>100		300
Boron (B)	mg/L	<0.7	0.7-3.0	>3.0	0.5
Bicarbonate	mg/L	<90	90-500	>500	293
pH	---	6.5-8.4 (normal range)			7.6
Ammonia (NH_4)	mg/L	(see combined N values below)			29
Nitrate (NO_3)	mg/L	(see combined N values below)			---
Combined Nitrogen (N)	mg/L	< 5	5-30	>30	37

(1) Adapted from University of California Committee of Consultants (1974), and Ayers and Westcot (1984).

(2) Method and Timing of Irrigation: Assumes normal surface and sprinkler irrigation methods are used. Water is applied as needed, and the plants utilize a considerable portion of the available stored soil water (50^ or more) before the next irrigation. At least 15 percent of the applied water percolates below the root zone (leaching fraction [LF] > 15%).

(3) Site Conditions: Assumes soil texture ranges from sandy loam to clay with good internal drainage with no uncontrolled shallow water table present.

(4) Definitions of "The Degree of Use Restriction" terms:
None = Reclaimed water can be used similar to the best available irrigation water.
Slight = Some additional management will be required above that with the best available irrigation water in terms of leaching salts from the root zone and/or choice of plants.
Moderate = Increased level of management required and choice of plants limited to those which are tolerant of the specific parameters.
Severe = Typically cannot be used due to limitations imposed by the specific parameters

(5) "MBCSD Effluent Typical Values" are average values based on data collected from July 8 through 15, 1999.

(6) Permeability is evaluated based on the combination of sodium adsorption ratio (SAR) and electrical conductivity (EC_w) values.

Table 5.4 Reuse Restrictions for MBCSD Effluent Comprehensive Recycled Water Study Cayucos/Morro Bay	
Water Quality Parameter	**Degree of Restriction**
Salinity	Slight
Permeability	None
Sodium	Slight to moderate (surface) Slight to moderate (sprinkler)
Chloride	Moderate
Boron	None
Bicarbonate	Moderate
Combined Nitrogen	Severe

are generally concerned about scale deposition and pipe corrosion. Homemakers are primarily concerned with safety to family health. Farmers and landscapers are interested in the effects of irrigation waters on plant-soil-water relations, and on the chemical and physical properties of soils, particularly as they influence plant growth.

It is important to understand that the successful long-term use of irrigation water depends more on rainfall, leaching, soil drainage, irrigation water management, salt tolerance of plants, and soil management practices than upon water quality itself.

Since salinity problems may eventually develop from the use of any water, the following guidelines are given, should they be needed, to assist water users to better manage salinity in either agricultural or community-based irrigation:

- Irrigate more frequently to maintain an adequate soil water supply.
- Select plants that are tolerant of an existing or potential salinity level.
- Routinely use extra water to satisfy the leaching requirements.
- If possible, direct the spray pattern of sprinklers away from foliage. To reduce foliar absorption, try not to water during periods of high temperature and low humidity or during windy periods. Change time of irrigation to early morning, late afternoon, or night.
- Maintain good downward water percolation. Prevent the development of a perched water table using deep tillage or artificial drainage, if necessary.
- Salinity may be easier to control under sprinkler and drip irrigation than under surface irrigation. However, sprinkler and drip irrigation may not be adapted to all qualities of water and all conditions of soil, climate, or plants.

General management/use guidelines were developed for landscape and crop irrigation based on the average constituent quantity. These constituents and management/use guidelines are presented in Table 5.5.

Table 5.5 Irrigation Management/Use Guidelines For Agricultural Crops, Landscapes, Turfgrasses, and Golf Courses Comprehensive Recycled Water Study Cayucos/Morro Bay

Analyte	Suggested Management/Use Guidelines Refer to Table 5.3 for Specific Water Quality Values
pH	Suitable for a wide range of plants and soils.
Bicarbonate (HCO_3)	To reduce the potential for "whitewash" deposit to develop on foliage wetted by sprinkler irrigation, direct spray patterns away from foliage. If possible, irrigate during periods of cool temperatures such as early morning, late afternoon, or during the night. Avoid windy conditions and periods of low humidity when evaporative losses may be high.
Electrical Conductivity (EC_w) and Total Dissolved Solids (TDS)	On all but sensitive plants, salinity should not be a limiting factor. Crops should attain levels of productivity comparable to the use of water with lower salinity. Ornamental species should not exhibit foliar injury or excessive stunting. Normal irrigation inefficiencies and rainfall should provide adequate leaching to maintain a favorable salt balance in the root zone. Moderately sensitive and sensitive plants may require some modification of cultural practices (see General Use Guidelines for discussion) to maintain a favorable salt balance in the root zone.
SAR	When the electrical conductivity of the water (EC_w), or its salinity, is considered in association with the sodium level as measured by the Sodium Absorption Ratio (SAR), the water will experience a slight to moderate restriction on the water intake rate or permeability of the soil. Sodium should not affect the physical condition of the soil and its ability to adequately take water (infiltration rate). Infiltration may be reduced by soil compaction and surface crusting resulting from certain cultural practices. Use appropriate tillage practices and control both the time and amount of equipment traffic on the soil. Best management practices would include maintaining an adequate level of organic matter in the surface soil and the periodic use of gypsum or other soil amendments that improve the rate of water infiltration.
Chloride (Cl)	Woody plant species, such as citrus, stone fruits and avocados, can be damaged by high levels of chloride applied through surface irrigation. The tolerances for Cl^- ion vary within the woody plant species. Vegetable, grain, forage and fiber crops are tolerant of the presence of chloride. However, high enough concentrations of chloride can be detrimental to any crop. In the case of sprinkler irrigation, the tolerance of the woody plant species decreases at similarly high chloride levels.

Table 5.5 Irrigation Management/Use Guidelines For Agricultural Crops, Landscapes, Turfgrasses, and Golf Courses (Continued) Comprehensive Recycled Water Study Cayucos/Morro Bay	
Analyte	**Suggested Management/Use Guidelines Refer to Table 5.3 for Specific Water Quality Values**
Ammonia as (NH_4) and Nitrate (NO_3)	Essential for optimum plant growth. The combination of ammonia-N and nitrate-N will add 112 lbs. of N per ac-ft of applied water. This is equivalent to 45 to 140% of the average N required by most plants. Ornamentals and turfgrasses may respond with excessive growth. The rate of application and timing of N fertilizer should be adjusted as needed to prevent the addition of excessive levels of combined nitrogen. Grasses tend to absorb high levels of nitrogen, making them tolerant of excess amounts in the soil.
Calcium (Ca) and Magnesium (Mg)	An ac-ft of water will add 106 lbs. of Ca and 41 lbs. of Mg. Both elements are essential for optimum plant growth. Both elements serve to counteract the effects of sodium on reducing soil permeability.
Sodium (Na)	For surface irrigation, the level of sodium ion will result in a slight restriction from most tree crops and woody plants. Most annual crops are not sensitive to sodium. With overhead sprinkler irrigation and low humidity (<30 percent), there is slight to no restriction associated with sodium. It may be absorbed through the leaves of sensitive crops such as almond, apricot, citrus and plum. Most grasses and landscape plants are tolerant to the levels of sodium ion present.
Boron (B)	An essential plant element. Plants, particularly citrus and stone fruits, vary in their tolerance to B. Concentrations in the MBCSD water are suitable for a wide range of crops and ornamentals.

5.3 STREAM FLOW/ ESTUARY ENHANCEMENT

As was mentioned earlier, the Morro Bay-Cayucos area abounds with small creeks. The flow in some creeks varies with the seasons, while other creeks are able to maintain some level of flow year round. The use of recycled water to supplement creek/stream flow is a common practice throughout California. The recycled water usually enhances the creek or stream by augmenting the flow and aiding with wildlife populations and providing additional growth to occur along the banks promoting habitat and shade.

Morro Bay Estuary

The study area also includes the Morro Bay National Estuary (MBNE). The Morro Bay watershed and estuary have recently received State and National Estuary status which calls for a management plan which will guide the estuary and bay's future. The MBNE Program is a federally funded program whose mission is to work with the community to develop and implement a plan that will protect the resources and quality of the bay, while also preserving the economic and recreational uses of the bay. The estuary staff has

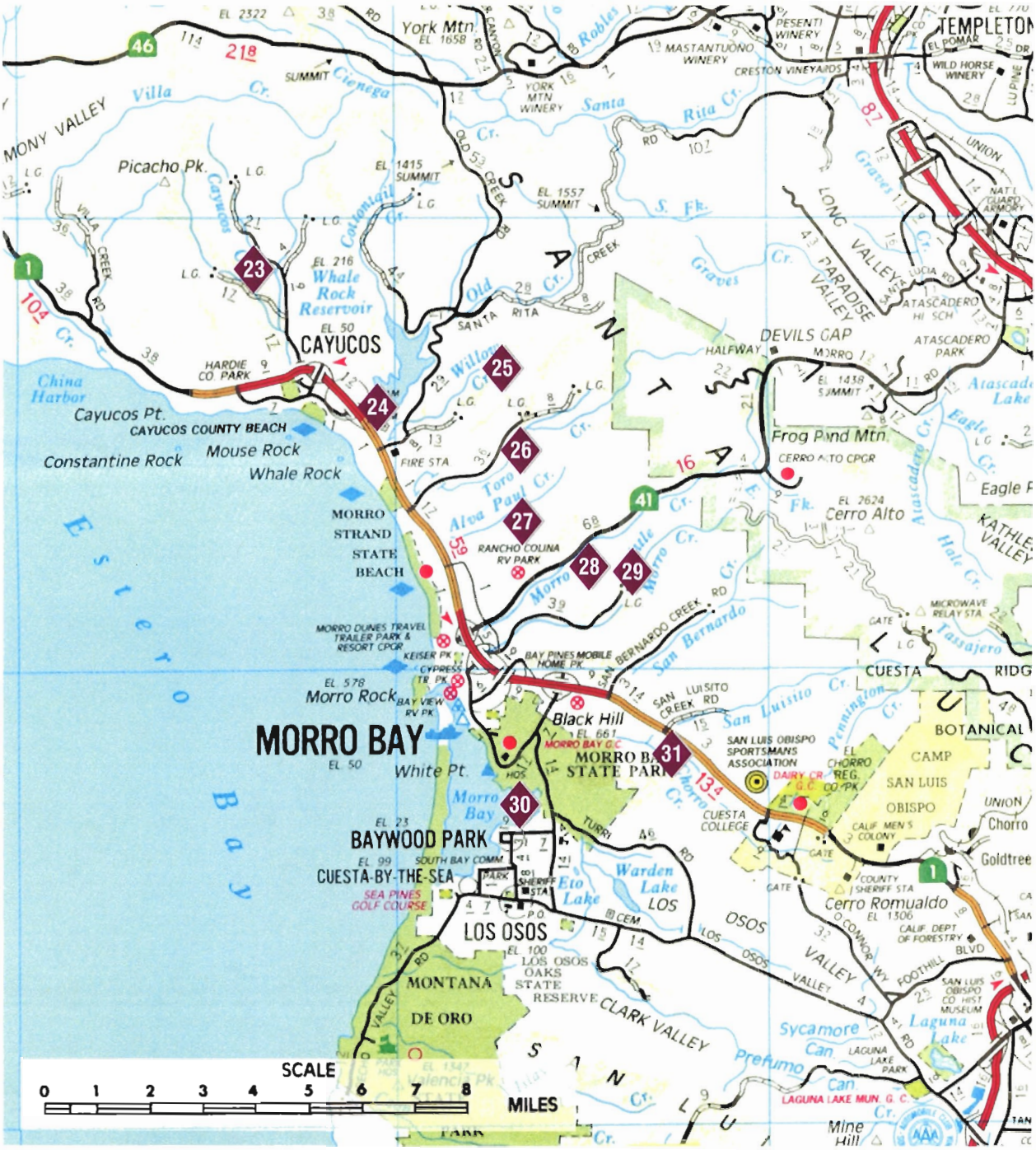
indicated a need for additional water supplies for the estuary. The plan, "Turning the Tide for Morro Bay" - Draft Comprehensive Conservation and Management Plan for Morro Bay, was released August 1999 and should be coordinated with for possible water reuse efforts.

Recycled Water Stream Flow Enhancement Uses

A total of nine creeks and the Morro Bay Estuary, listed in Table 5.6 and shown on Figure 5.4, were initially reviewed for the potential reuse of water by stream flow enhancement. Cottontail Creek was eliminated immediately since it is one of the water supplies to Whale Rock Reservoir. This use would be allowed by the regulations, however, recent history has shown that the use of recycled water for indirect potable use is one of the most controversial. Cayucos and Willow Creeks (site numbers 23 and 25) were also eliminated from further consideration due to the considerable distance from the WWTP, the unstable road to run a supply pipeline, and the difference in elevation from the source. Site number 27, Alva Paul Creek was also deleted as having no flow for the majority of the year so it was seen as nonbeneficial. Toro Creek and Little Morro Creek (site numbers 26 and 28) were also deleted as they were not seen as having a primary benefit for flow enhancement or potable supply replacement at this time. A possible benefit may be for offsetting stream flow requirements for water rights, but this would require further investigation.

Table 5.6 Potential Reuse Streamflow Augmentation Sites Comprehensive Recycled Water Study Cayucos/Morro Bay

Site No.	Brief Description	Location	Purpose/Benefit
23	Cayucos Creek	Along Cayucos Creek Rd.	Agricultural Crops, Riparian Habitat
24	Old Creek	S of Whale Rock Res/-24th St.	Possible Potable offset
–	Cottontail Creek	N of Whale Rock Res	Water Supply to Whale Rock Reservoir
25	Willow Creek	Along Old Creek Rd.	Agricultural Crops, Riparian Habitat
26	Toro Creek	Along Toro Creek Rd.	Riparian Habitat
27	Alva Paul Creek	Near Del Mark Park/Island St.	
28	Morro Creek	Along Atascadero Rd (Hwy 41)	Agricultural Crops, Riparian Habitat
29	Little Morro Creek	Along Little Morro Creek Rd.	Agricultural Crops, Riparian Habitat
30	Morro Bay Estuary	S of State Park Rd/W of south Bay Blvd.	Wetlands
31	Chorro Creek	S of Hwy 1/E of South Bay Blvd.	Estuary, Irrigation, Red Legged Frogs, Fish



LEGEND

◆ Potential Stream Flow Augmentation Reuse Sites (refer to text for site number names)

Figure 5.4
POTENTIAL STREAM FLOW AUGMENTATION REUSE SITES
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

MOB599M1.CDR

Old Creek, site number 24, was left in the study in case there is a requirement to maintain a flow in the creek to preserve wildlife habitats. Currently flow in the creek is supplied by Whale Rock Reservoir during winter spills. In 1998, the National Marine Fisheries Service (NMFS) found steelhead in Old Creek below the dam west of Highway 1 and consequently, requested the Whale Rock Commission to maintain flows in Old Creek. The Whale Rock Commission is currently preparing a Habitat Conservation Plan, which will determine the suitability of Old Creek for steelhead habitat. The results of the Habitat Plan will determine whether streamflow must be maintained in Old Creek below the dam. If a flow is required for this creek it may be more beneficial to supply it with recycled water than the potable water from the reservoir. If a flow in Old Creek is determined to be required, a separate study should be conducted to review if a small package plant should be located there or if a pipeline should be run from the existing WWTP. Morro Creek was left in at this time and was seen as a benefit for the agricultural sites and the riparian habitat. The estuary and Chorro Creek were also left in at this time as these sites would benefit wetlands and preserve habitats.

Stream Flow Demand

The demand assumed for all creeks and the estuary was 1.4 cfs (900,000 gpd). This was based on the CDBG Study that was completed in 1998. This demand was the requirement from CA Fish & Game for Chorro Creek.

5.4 INDUSTRIAL REUSE

In many areas, industrial reuse makes up the largest majority of reuse, therefore making it well worthwhile to include. Recycled water can be used at industrial type facilities for purposes such as processing, cooling, construction dust control, commercial laundries and car washes, concrete mixing, and sanitary sewer flushing.

Industrial Reuse Sites and Demand

Cayucos has no industrial uses to be considered for water reuse since there are no industries in the community. In Morro Bay however, there are several industrial uses to be considered for reuse. A list of Industrial Users Discharging Nondomestic Waste, dated 1994, was provided by the WWTP for review. This list contains almost 100 sites and addresses, the industrial category, the pollutants known or suspected discharged, and average pollutant concentration. The list also answers for each site if the discharge is direct into the sewer system and if there is pretreatment provided to the nondomestic waste stream. Pretreatment programs or in-plant existing recycling opportunities were not investigated at this time. The list is provided in Appendix C.

Out of the 97 sites on the list, 23 were found to be potential industrial users of recycled water. The sites considered consisted of car/bus washing facilities, laundromats, a plant nursery, a mortuary, metal/electronic shops, a boat dock, a power company, and a

concrete mixing company. These 23 sites were further investigated and screened down to a potential list of seven sites that are shown in Table 5.7. The demands for each site are also listed in the table. The sites are shown on Figure 5.4 with the Morro Bay irrigation sites.

Table 5.7 Potential Industrial Reuse Sites Comprehensive Recycled Water Study Cayucos/Morro Bay

Site No.	Name	Address	Code/ Industrial Category	General Type of Use	Average Flow[1] (gpd)
32	Morro Bay Sr. H.S.	235 Atascadero Rd.	44	bus facility	3,171
33	Mission Linen Supply	399 Errol St.	47	comm. laundry	14,286[2]
34	Tropicana Nursery	861 Quintana Rd.	56	nursery	524[3]
35	Morro Bay Fuel Dock	201 Main	76	boat dock	1,390
36	City of Morro Bay Maintenance Yard	170 Atascadero Rd.	94	wash down	383
37	Morro Bay State Park/GC	Golf Course	97	cart washing	250[3]
38	Hanson Sand & Gravel	Atascadero Rd/ Park St.	–	concrete mixing	2,663[4]

(1) Unless otherwise noted, demand estimate based on Industrial Users Discharging Domestic Waste - dated 1994.
(2) Demand estimate based on water use quantity provided by General Manager on June 11, 1999.
(3) Demand estimate based on 80 percent of flow from the 1994 Industrial Users Discharging Domestic Waste List.
(4) Conservative estimate based on 3,000 yds of concrete per month for 9 months, and 36 gallons water per yard of concrete.
(5) Demand estimate based on quantity provided by County Golf Course.

All of the car washes were screened out since they were not commercial sites. The bus washing facility at the Morro Bay High School (site number 32), however, remained on the list since it does not have access from the general public for the washing process. Of the five laundry facilities, only site number 33, Mission Linen Supply, is a commercial facility.

Tropicana Nursery, site number 34, should be considered as irrigation, but was on this list due to the nondomestic wastes discharged. The Morro Bay Fuel Dock, site number 35, was later deleted when compared against the most recent water use records for that site.

The water use at the dock was shown to be minimal to none. Site Number 36, the City maintenance yard, was also shown to have a minimal water use so it was combined with the on-site washdown at the WWTP.

5.5 GROUNDWATER RECHARGE/SEA WATER INTRUSION BARRIER

Overview

Groundwater recharge of the discharged effluent could have the potential of increasing available water in the adjacent groundwater basins for potable water use and reducing sea water intrusion, where it occurs. Groundwater recharge methods include the percolation of treated effluent in surface ponds, discharge of treated effluent to stream channels (where percolation into the groundwater occurs), and the injection of treated effluent directly into an aquifer through recharge wells. There are specific treatment criteria and point of discharge requirements for each recharge option which have been discussed in Chapter 3.

The discharge of treated effluent to stream channels as a means of recharging the groundwater basin must be considered as a separate alternative not directly related to groundwater recharge, since it primarily is a stream discharge with different treatment requirements.

Groundwater Basin Conditions

Groundwater recharge locations in the vicinity of Cayucos and Morro Bay are limited to the alluvial valleys, because very little groundwater storage is available in the underlying geologic formations (predominantly metasedimentary, metavolcanic, and intrusive volcanic rock types). The alluvial groundwater basins within the study area include, from north to south, Cayucos, Old Creek, Willow, Toro, Morro/Little Morro, and Chorro basins.

The water bearing alluvial deposits underlie the flood plains of the main streams which flow through the study area out to the ocean. The alluvial deposits are deepest near the ocean (less than 90 feet deep) and generally become increasingly shallow further upstream. Within the alluvial deposits, there are aquifer layers of sand and gravel and aquitard layers of silt and clay. Typically the aquifer layers occur above the base of the alluvium and within the upper portion of the alluvial deposits. In order for groundwater recharge to be effective, the treated effluent must be discharged either directly into the aquifer layers or into areas where the effluent can migrate into the aquifer layers.

Currently, groundwater basins are naturally recharged by percolation of runoff and precipitation but this has been significantly modified in the Old Creek Basin and the Chorro Basin. Recharge to Old Creek Basin downstream of Whale Rock dam occurs from percolation of dam releases and from dam seepage, since runoff from the main watershed

for Old Creek valley is intercepted by the reservoir. Natural recharge to Chorro Creek is altered by the small reservoir on upper Chorro Creek and by the wastewater discharge occurring from the California Men's Colony (CMC) wastewater treatment plant. The wastewater discharged by the CMC plant is currently largely imported water, which augments the natural stream flow. This discharge varies dramatically from day to night as water use varies.

During normal and high precipitation years, there is adequate runoff to fully recharge the groundwater basins in the winter. During the dry portion of the year, groundwater levels decline as base stream flow declines and groundwater production from wells increases for agricultural and domestic use. The depth to water in the City of Morro Bay wells in Morro and Chorro Basins as measured on August 9, 1999 are all between 9 feet and 11 feet with the exception of Well 10A in Chorro Basin which is 23 feet below ground surface. This illustrates that the groundwater basins currently are nearly full and would benefit in a very limited way from groundwater recharge of treated effluent during the dry season of this low rainfall year.

Some of these groundwater basins have experienced sea water intrusion during drought years. Sea water intrusion is characterized by the existence of groundwater levels remaining below sea level for a sufficient time to allow sea water to flow into the basin and impact the quality of water produced from wells. This has been documented in the Cayucos, Old Creek, Morro/Little Morro, and Chorro Basins. The occurrence in Old Creek was an unusual event, since recharge is largely controlled. The sea water intrusion in Cayucos and Morro/Little Morro Basins has occurred in the portion of the basins downstream of Highway 1 and can be expected to continue to occur due to increases primarily in agricultural use from groundwater wells and surface water diversions. Chorro Basin sea water intrusion events are likely to decrease over the short term due to the importation of water replacing well water production in the basin. The use of treated effluent for groundwater recharge to halt sea water intrusion would be limited to those years when groundwater levels are low along the coast, which occurs on an irregular basis from one year to the next. It should also be noted that the greatest need for water coincides with the lowest dry weather flows at the WWTP (i.e., summer).

Of the basins mentioned, Willow Creek groundwater basin can be excluded from consideration as a candidate for treated effluent recharge due to its very limited storage capacity and high clay content in the alluvial deposits.

Potential Areas for Groundwater Recharge

The potential for groundwater recharge using treated effluent in the remaining basins, Cayucos, Old, Toro, Morro/Little Morro and Chorro are considered in the following paragraphs.

In general, since these alluvial basins are a product of stream deposition of sediments, the sediments deposited on the flood plain areas are finer grained than those sediments in the stream channel. Due to the low permeability of the finer grained sediments, these flood plain areas are not favorable locations for groundwater recharge through percolation ponds. This has been verified by studies performed in Old Creek, Chorro and Morro Basins. The stream channels which may have higher permeability sediments are constrained from being used to percolate treated effluent by some of the other regulatory guidelines and can not receive treated effluent without more treatment than is proposed in Projects I-III outlined in the Groundwater Recharge Guidelines.

Project IV in the Guidelines involves the injection of the treated effluent directly into the saturated aquifers and is not limited by the low permeability of flood plain soils.

The Project IV effluent disposal option has limitations which restrict areas where direct injection can be used. The groundwater storage availability, the required set back distances from potable wells and the retention time within the groundwater are the factors which reduce the area within the basins where the treated effluent can be recharged and the time when recharge can occur. These criteria are presented in Chapter 3. Since groundwater recharge will be limited to times when groundwater storage is available, it could occur only during the summer time (see Table 5.8).

Cayucos Basin

The guidelines established for each of the project types make it difficult to find a location where groundwater recharge could occur. Domestic water wells are located on most of the properties going up the valley from downstream of Highway 1 and generally there is less than 2000 feet between them. The regulatory guideline limits injection to areas more than 2000 feet from a domestic well. This eliminates Cayucos Basin as a site for potential groundwater recharge using injection wells.

Old Creek Basin

Old Creek Basin has several domestic wells within its less than 4000 foot length. The only place where a recharge point would be more than 500 feet from a domestic well would be at the mouth of the basin. In this area, groundwater levels are shallower than 20 feet. Therefore, no site would be available where guidelines for wastewater recharge to the groundwater could be met with the four project options.

Toro Creek Basin

In the downstream-most ½ mile of Toro Creek Basin where the most favorable conditions exist for recharge, wells appear to be spaced less than 2000 feet apart, precluding the Project IV type effluent groundwater recharge.

Table 5.8 Groundwater Recharge Limitations by Basin Comprehensive Recycled Water Study Cayucos/Morro Bay				
Basin	**Project I[(1)]**	**Project II[(1)]**	**Project III[(1)]**	**Project IV[(1)]**
Cayucos	Low Permeability Soils	Low Permeability Soils	Low Permeability Soils	Horizontal Separation from Domestic Wells
Old	Low Permeability Soils	Low Permeability Soils	Low Permeability Soils	Horizontal Separation from Domestic Wells
Willow	Low Permeability Soils	Low Permeability Soils	Low Permeability Soils	Limited ground water storage capacity
Toro	Low Permeability Soils	Low Permeability Soil	Low Permeability Soils	Horizontal Separation from Domestic Wells
Morro	Low Permeability Soils	Low Permeability Soils	Low Permeability Soils	Horizontal Separation from Domestic Wells
Chorro	Low Permeability Soils	Low Permeability Soils	Low Permeability Soils	Horizontal Separation from Domestic Wells/Limited groundwater storage capacity
(1) Based on Groundwater Recharge Guidelines outlined in Chapter 3 and contained in full in Appendix B.				

Morro Creek Basin

There are many wells within this basin and the setback guideline from potable wells for Project IV treated effluent can not be met. Because the City of Morro Bay has wells along the coast line to produce sea water for desalination and then potable water use, treated wastewater injected into coastal wells to create a sea water intrusion barrier would not be able to maintain the set-back distance from wells used for potable purposes. Therefore, no treated effluent groundwater recharge options are available in the Morro Creek Basin.

Chorro Creek Basin

Groundwater recharge by injection of Project IV quality water into Chorro Creek Basin, similarly to the Morro Basin, is limited by well set-backs and residency time to the mouth of the basin where the closest wells are used for irrigation of the golf course. There is also an inactive domestic well at this location. If these wells can be shown to be non-potable water

sources, injection of treated effluent could be considered near the mouth of Chorro Creek Basin to prevent sea water intrusion, which has occurred in the past.

With the recent importation of water from the Coastal Aqueduct, the immediate result has been decreased pumpage in Chorro Valley. Therefore, the threat of sea water intrusion has diminished and there is a reduced amount of available storage which could be used to receive treated effluent within Chorro Creek Basin compared to the past years. For this reason, over the near future, groundwater recharge is not appropriate.

Groundwater Recharge Summary

The alluvial groundwater basins are not suitable for groundwater recharge using treated effluent under Projects I-IV defined in the Guidelines. The flood plain areas overlying the groundwater basins are underlain by soils which are known to have low permeabilities and would not readily percolate the treated effluent via percolation ponds. The alluvial deposits have very limited capacities to store recharged treated effluent even should there be a site where recharge could occur. Available groundwater storage would occur only during dry portions of drought years. Generally, wells are present at intervals along these valleys which are too short to maintain the guideline set-backs from treated effluent recharge to potable wells. Sea water intrusion barrier wells would not be appropriate because of the well set-back guidelines. Some areas which have experienced sea water intrusion in the past are not expected to see intrusion in the near future due to reduced pumpage of wells resulting from the availability of Coastal Aqueduct water.

5.6 SUMMARY OF CONCEPTUAL ALTERNATIVES

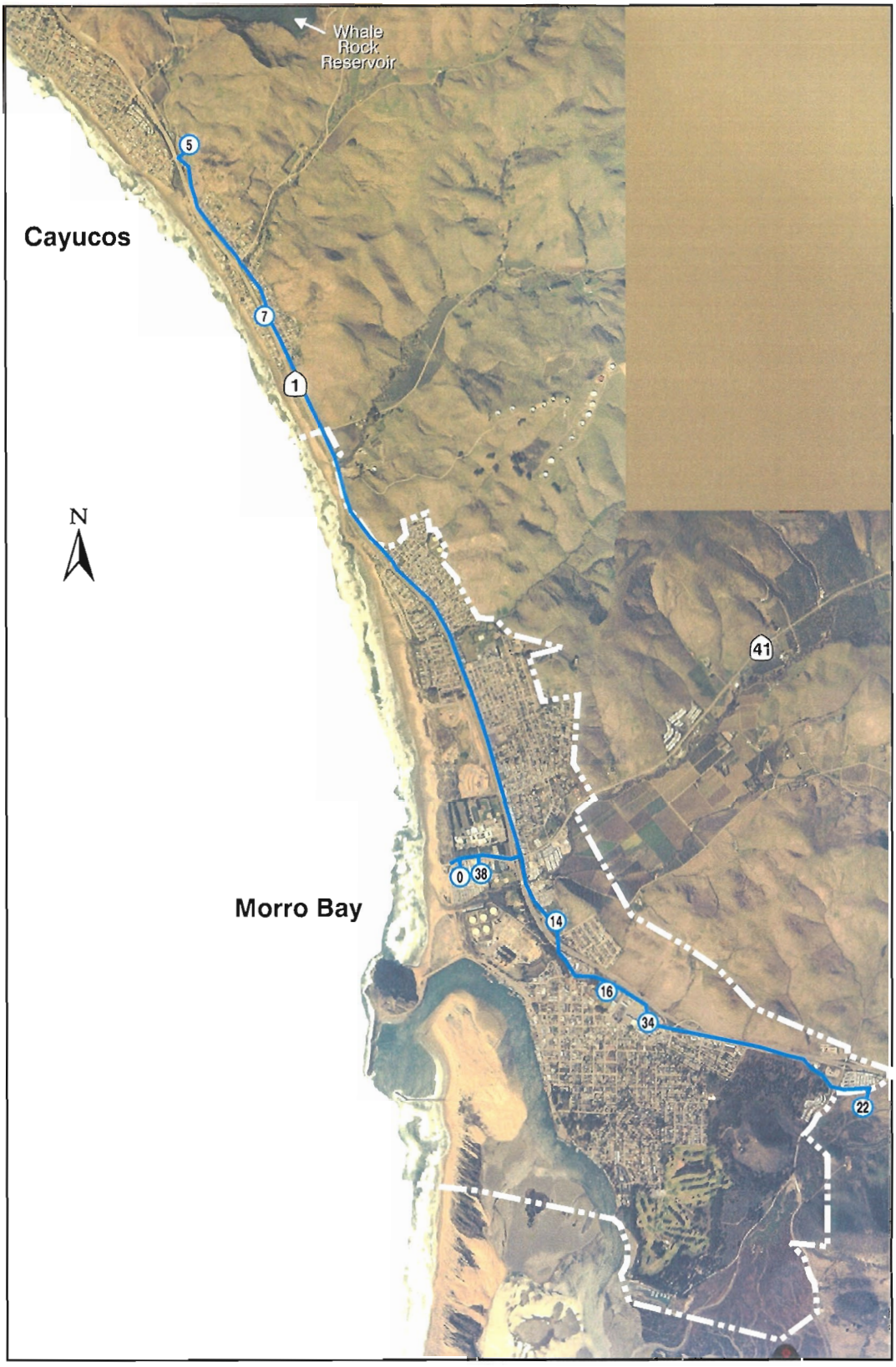
After identification of the recycled water uses, conceptual alternatives were developed. The individual uses were combined into seven conceptual alternatives. The conceptual alternatives are listed in Table 5.9.

Table 5.9 Conceptual Reuse Alternatives Comprehensive Recycled Water Study Cayucos/Morro Bay

Alternative No.	Description
1	Secondary Reuse
2	Cayucos Package Plant
3	Cayucos
4	WWTP Vicinity
5	Morro Bay - N
6	Agricultural Reuse - E
7	Morro Bay - S

Secondary Reuse, Alternative No. 1, included sites that could use disinfected secondary-23. Eight sites were included for the use of disinfected secondary effluent. A preliminary pipeline route and the sites are shown on Figure 5.5. All other alternatives were developed based on a minimum use of disinfected tertiary recycled water. The Cayucos Package Plant, Alternative No. 2, shown in Figure 5.6, was developed based on the premiss of a requirement for flow in Old Creek. Alternative No. 3 was developed to supply Cayucos only with recycled water. WWTP Vicinity, Alternative No. 4, included all of the uses located near the WWTP. Alternatives No. 5, 6, and 7 included uses in Morro Bay to the north, east, and south, respectively. The agricultural uses are included in the alternative to the east. Figure 5.7 shows the pipeline route and uses for conceptual Alternatives No. 3 through 7.

A summary of the conceptual water reuse alternatives is presented in Table 5.10. As can be seen from the summary table, the demands for Alternatives No. 2, 3, 6, and 7 appear very high compared to the other alternatives. This is due to those alternatives including a possible creek enhancement project. However, if the creeks or estuary are removed, the demands seem more comparable with the other projects. Please refer to the notes in the table for the assumptions for the demand estimates.



LEGEND

- Site Number
- Secondary Pipeline
- Morro Bay City Limit

Figure 5.5
SECONDARY REUSE CONCEPTUAL ALTERNATIVES
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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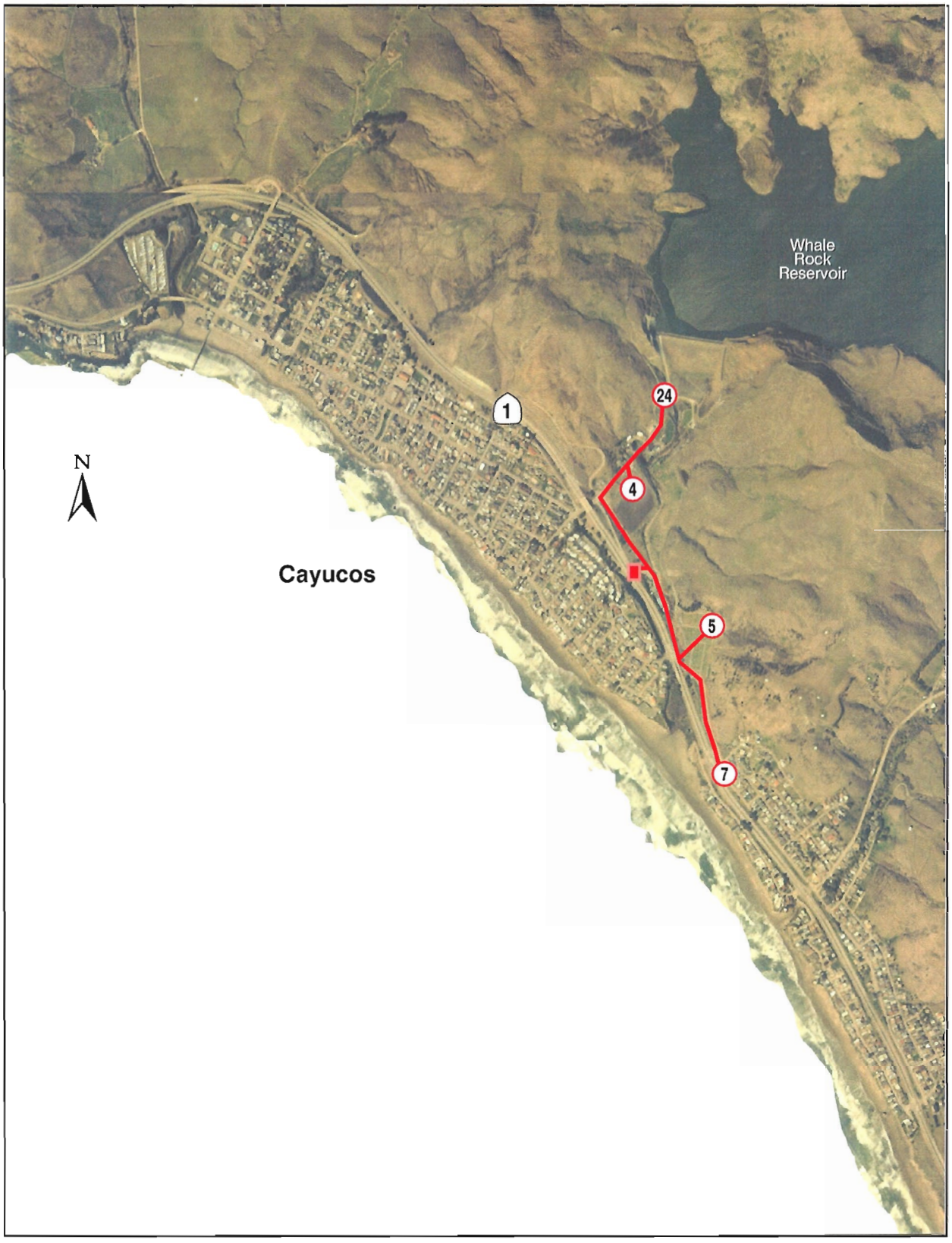

LEGEND

7 Site Number

Cayucos

Package Plant

Figure 5.6
CAYUCOS PACKAGE PLANT
AND PIPELINE FOR REUSE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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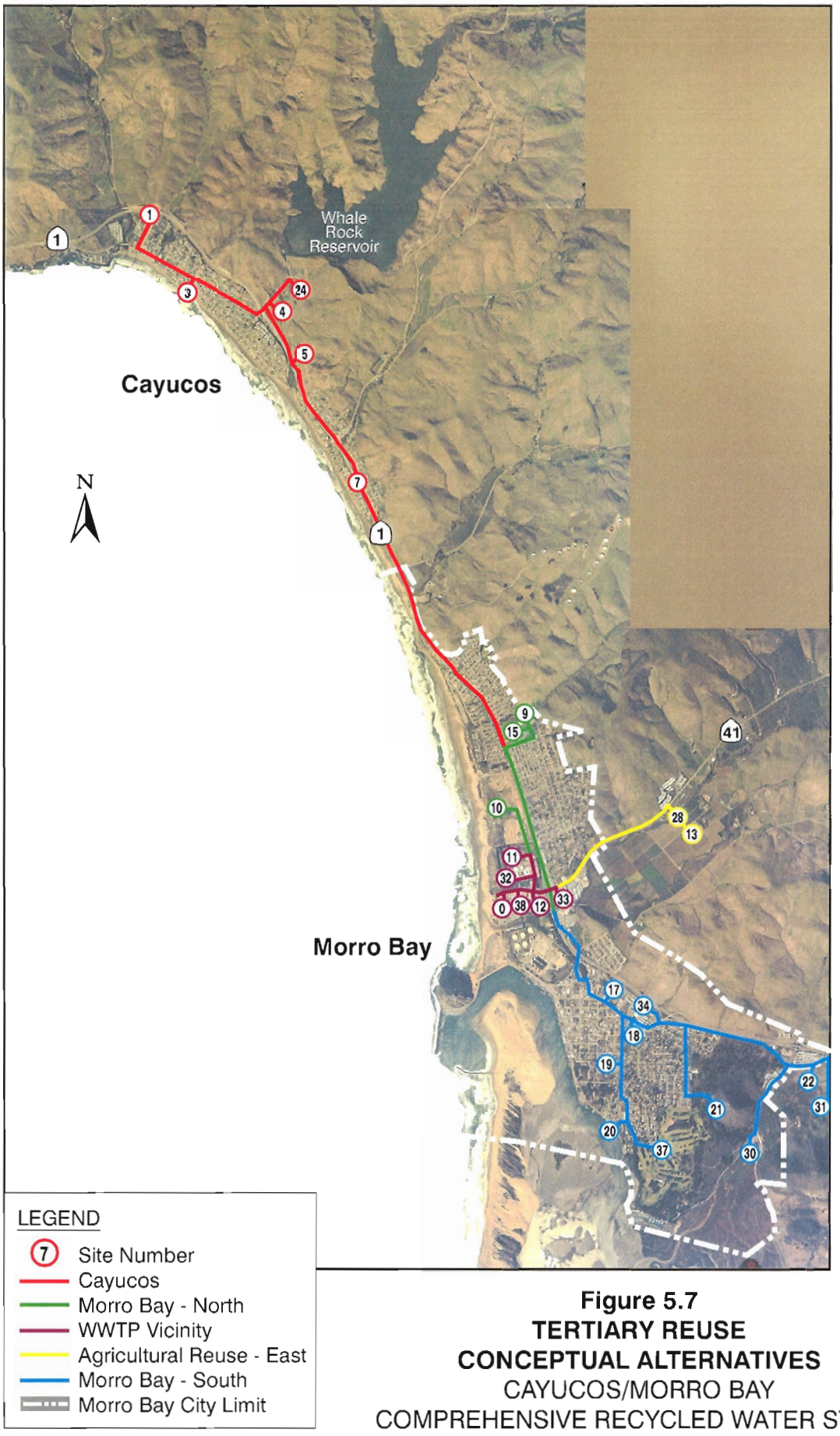

Figure 5.7
TERTIARY REUSE
CONCEPTUAL ALTERNATIVES
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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MorrobayTINTED2.tif (70%)

Table 5.10 Conceptual Alternatives Reuse Summary
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Alt No	Project Alternative	Reuse Type	Sites Included: Use[1]	Site No.	Site Description	Potential Use[2] (AFY)
1	Secondary	Secondary	I	0	WWTP - Onsite/ Maint. Yard[3]	0.9
	Reuse		I	38	Hanson Sand and Gravel[4]	3.0
			Ag	14	Misc Pasture Area	50.0
			Ag	16	S side of Highway 1	10.0
			LS	34	Tropicana Nursery[5]	0.6
			Ag	22	Chorro Flats Enhancement Project	112.5
			LS	7	Highway 1 median	5.0
			LS	5	Cayucos-Morro Bay Cemetery	10.0
	TOTAL					**192.0**
2	Cayucos	Tertiary +	Ag	4	S/W of Whale Rock Res.	12.5
	Package		Str	24	Old Creek[6]	1013.0
	Plant		LS	5	Cayucos-Morro Bay Cemetery	10.0
			LS	7	Highway 1 median	5.0
	TOTAL					**1040.5**
3	Cayucos	Tertiary	LS	1	Hardie Park & School	2.5
			LS	3	Paul Andrew Park	0.6
			Ag	4	S/W of Whale Rock Res.	12.5
			LS	5	Cayucos-Morro Bay Cemetery	10.0
			LS	7	Highway 1 median	5.0
		Tertiary +	Str	24	Old Creek[6]	1013.0
	Total					**1043.6**
4	WWTP	Tertiary		0	WWTP - Onsite/ Maint. yard	0.9
	Vicinity		I	38	Hanson Sand and Gravel	3.0
			LS	11	Morro Bay High School	35.0
			I	32	Morro Bay H.S. Bus Facility[7]	3.6
			LS	12	Keiser Park	22.5
			I	33	Mission Linen Supply[8]	16.0
	Total					**81.0**
5	Morro Bay-N	Tertiary	WWTP Vicinity		(see Alt. No. 4)	81.0
			LS	10	The Cloisters Development	85.0
			LS	15	Del Mar Elementary	15.0
			LS	9	Del Mar Park	22.5
	Total					**203.5**

Table 5.10 Conceptual Alternatives Reuse Summary (Continued)
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Alt No	Project Alternative	Reuse Type	Sites Included: Use[1]	Site No.	Site Description	Potential Use[2] (AFY)
6	Agr. Reuse-E	Tertiary	WWTP Vicinity		(see Alt. No. 4)	81.0
			Ag	13	Atascadero Road (E of Hwy. 1)	750.0
		Tertiary +	Str	28	Morro Creek[6]	1013.0
	Total					**1844.0**
7	Morro Bay-S	Tertiary	WWTP Vicinity		(see Alt. No. 4)	81.0
			LS	17	Morro Bay Elementary School	10.0
			LS	19	Monte Young Park	0.6
			LS	20	Bayshore Bluffs Park	7.5
			I	37	Morro Bay GC - Cart Wash[9]	0.3
			LS	18	City Park	0.8
			LS	34	Tropicana Nursery[5]	0.6
			LS	21	Morro Bay Golf Course	275.0
			Ag	22	Chorro Flats Enhancement Project	112.5
		Tertiary +	Str	30	Morro Bay Estuary[6]	1013.0
		Tertiary +	Str	31	Chorro Creek[6]	1013.0
	Total[10]					**1501.3**

(1) I = Industrial reuse
Ag = Agricultural irrigation
LS = Landscape irrigation
Str = Stream flow enhancement
(2) Unless otherwise noted, use estimates based on (acreage) x (2.5 feet/yr).
(3) Use estimate based on 80 percent of water use records for 1997.
(4) Conservative estimate based on 3,000 yards of concrete per month for 9 months, and 36 gallons water per yard of concrete.
(5) Use estimate based on 80 percent of flow from the 1994 Industrial Users Discharging Domestic Waste List.
(6) Use estimate based on maintaining flow in creek of 1.4 cfs.
(7) Use estimate based on the 1994 Industrial Users Discharging Domestic Waste List.
(8) Use estimate based on water use quantity provided by General Manager on June 11, 1999.
(9) Use estimate based on quantity provided by County GC.
(10) Total includes supplying recycled water to either Chorro Creek *or* the Estuary, but not both.

SCREENING OF CONCEPTUAL ALTERNATIVES

6.1 ALTERNATIVES SCREENING

Description of Evaluation Process

In order to effectively evaluate the alternatives, a screening process was used. First, Carollo Engineers, P.C. (Carollo) presented all the water reuse sites and draft screening criteria at the June 1999 Progress Meeting. The screening criteria was reviewed by the attendees and their top five criteria were selected for the process.

The Carollo team then developed the seven conceptual alternatives on a feasibility level, based on the criteria, and conducted a qualitative evaluation. Based on the qualitative evaluation, the Carollo team then made a first draft selection of the five most viable projects. The seven alternatives and five draft viable projects were presented at a monthly Progress Meeting in July 1999. The purpose of the presentation was to review the conceptual alternatives and draft viable projects, discuss key issues with each, and to screen and rank the top two alternatives. The top two alternatives were then developed in more detail.

It should be noted that although some of the alternatives were not carried through for further development, they were not eliminated. These alternatives may, at some future date, be recognized as more viable based upon cost and/or ease of implementation.

Screening Criteria

The seven conceptual alternatives were preliminarily screened and ranked by the Carollo team as to their viability based on the following screening criteria developed by the agencies:

- Potential Volume of Recycled Water to be Used.
- Proximity to Treatment and Conveyance Facilities.
- Level of Treatment Required.
- Seasonal or Year Round Use.
- Benefits Realized/Potential Issues.

Weighting factors were not used for the screening criteria. It was felt that they were not needed at this time by the team members. Rough pipeline sizing was also preliminarily conducted for the proximity criteria. Most of the information in the tables should be "cross-

compared" to avoid decisions being made on a single screening criteria. In other words, one criteria may show an alternative as the best option, while another criteria may show it as a less favorable option.

Table 6.1 presents the potential volume of recycled water to be used. Alternatives No. 1, 4, and 5 have the potential to use about 6 to 17 percent of the daily effluent flow from the WWTP. Alternatives No. 2, 3, 6, and 7 have the potential to use about 55 percent to over 100 percent of the daily effluent flow. Most uses are, however, seasonal. The percentage of use values are based on an effluent flow of 1.7 mgd. Also it can be seen that the higher volume alternatives are those involving creek or estuary enhancement. If the creek or estuary enhancement is removed then Alternative No. 6, Agricultural Reuse-East, would have the highest volume of use and the Cayucos options the lowest.

Table 6.1 Volume of Recycled Water to be Used Comprehensive Recycled Water Study Cayucos/Morro Bay

Alternative No.	Alternative Description	Volume of Use (AFY)	Months of Use
1	Secondary Reuse	192.0	April - October[2] January-December[3]
2	Cayucos Package Plant	1040.5[1]	April - October[2]
3	Cayucos	1043.6[1]	April - October[2]
4	WWTP Vicinity	81.0	April - October[2] January-December[3]
5	Morro Bay - North	203.5	April - October[2]
6	Agricultural Reuse-East	1844.0[1]	April - October[2]
7	Morro Bay - south	1501.3[1]	April - October[2]

(1) Includes an assumed flow to either a creek or the estuary of 1.4 cfs, which equals 1,013 AFY.
(2) Assumed irrigation season and creek/estuary use.
(3) Industrial sites have year-round use.

One of the main considerations with the higher volumes of use is maintaining the use of the outfall. A minimum flow is needed through the ocean outfall to maintain its operation otherwise it could be jeopardized with backflows or sand-overs due to waves. However, the operation of the outfall and regulated dispersal rates could be maintained by instituting various options. The outfall operation is discussed further in Chapter 4.

Table 6.2 presents the proximity, in miles, from the WWTP to each of the alternatives. This table also shows the pipe diameters. An actual route was selected for each alternative to

Table 6.2	Proximity to Treatment and Conveyance Facilities Comprehensive Recycled Water Study Cayucos/Morro Bay		
Alternative No.	**Alternative Description**	**Pipe Size, Diameter[2]**	**Proximity total Length, (miles)**
1	Secondary Reuse	2" - 10"	7.8
2	Cayucos Package Plant	2" - 10"	1.6
3	Cayucos	2" - 10"	8.6[1]
4	WWTP Vicinity	2" - 8"	1.1
5	Morro Bay - North	2" - 12"	3.1[1]
6	Agricultural Reuse-East	2" - 20"	3.9[1]
7	Morro Bay - south	2" - 18"	7.8[1]

(1) Including WWTP vicinity.
(2) Pipe size based on average daily flow during irrigation season, and average annual use of 2.5 feet per year.

provide a more approximate mileage than a "straight line" distance. Mileage estimates ranged from a close distance of about 1 mile to the WWTP vicinity sites to over 8 miles to the Cayucos sites. The pipelines were sized based on average daily flow during the irrigation season. See Appendix D for detailed sizing information.

Table 6.3 presents the Department of Health Services minimum level of treatment that would be required to discharge the WWTP effluent to the various alternatives. A separate alternative was developed for the disinfected secondary uses, Alternative No. 1, so it could stand on its own for comparison. Some of the secondary uses were combined into the alternatives requiring tertiary treatment if they were close to the plant and would provide a benefit. The tertiary + level of treatment refers to the additional treatment requirements that would most likely be needed if a creek discharge is pursued. The additional requirements would also be needed if the estuary is selected. The level of treatment is discussed in detail in Chapter 3 and Appendix B.

Table 6.4 presents the extent of reuse regarding seasonal or year round. The most common use in the Morro Bay-Cayucos area is irrigation, which in dryer years constitutes year round use but is usually considered seasonal. Alternative Nos. 1 and 4 have year round use due to industries such as Mission Linen. The industrial year-round use is considered as being a constant flow on a monthly basis.

The cyclical nature of the irrigation season must also be considered when reviewing demands. Typically, an irrigation season is from about April through October, with a peak

Table 6.3 Level of Treatment Required Comprehensive Recycled Water Study Cayucos/Morro Bay		
Alternative No.	**Alternative Description**	**Level of Treatment**
1	Secondary Reuse	Disinfected Secondary 23
2	Cayucos Package Plant	Tertiary + (1)
3	Cayucos	Tertiary + (1)
4	WWTP Vicinity	Tertiary
5	Morro Bay - North	Tertiary
6	Agricultural Reuse- East	Tertiary + (1)
7	Morro Bay - South	Tertiary + (1)
(1) Based on additional treatment needed for creeks or estuary.		

Table 6.4 Seasonal or Year Round Use Comprehensive Recycled Water Study Cayucos/Morro Bay			
Alternative No.	**Alternative Description**	**Seasonal**	**Year Round(1)**
1	Secondary Reuse	X	X
2	Cayucos Package Plant	X	---
3	Cayucos	X	---
4	WWTP Vicinity	X	X
5	Morro Bay - North	X	---
6	Agricultural Reuse- East	X	---
7	Morro Bay - South	X	---
(1) Year round use assumed for Hanson Sand & Gravel and Mission Linen.			

month in July or August. There are usually wet months when the demand may drop to zero such as in winter and dry months when demand could theoretically outstrip the plant capacity. Therefore, demand should be considered on an acre-feet per year (AFY) basis, rather than a daily demand.

Table 6.5 presents the main benefits realized and the potential issues and disadvantages for each alternative. As can be seen from the list of issues, some concerns can be overcome more readily than others. Some common issues to all reuse alternatives were

Table 6.5 Benefits Realized/Potential Issues Comprehensive Recycled Water Study Cayucos/Morro Bay

Alt. No	Alternative Description	Benefits Realized	Potential Issues/Disadvantages[1]
1	Secondary Reuse (192 AFY)	• Closest reuse options with on-site and Hanson • Lowest level of treatment • Offset water use at nursery and cemetery	• Perception of quality (i.e., health, safety, marketability) • Some sites considered disposal only • Possible regrowth in pipes/emitter clogging
2	Cayucos Package Plant (1041 AFY with creek)	• Offset potable use if creek discharge is required • Package plant more efficient than pipeline from existing WWTP	• Potential additional treatment beyond tertiary required (i.e., ammonia, temp, TDS, etc.) • New, separate plant to operate • Possible water right conflict w/ agriculture use • Additional control by others for creek (i.e., F&G, Caltrans, Whale Rock Comm., etc.)
3	Cayucos (1044 AFY with creek)	• Offset water use at parks/cemetery	• Small uses furthest from WWTP site • Highway medians disposal only • Possible water rights conflict w/ agriculture use • Additional control by others for creek (i.e., F&G, Caltrans, Whale Rock Comm.)
4	WWTP Vicinity (81 AFY)	• Possibly aid in sea water intrusion with Hanson • Closest proximity to WWTP • Offset potable water use • Easily expandable system to other tertiary uses • Desire to use by schools	• Possible quality issue with Mission Linen
5	Morro Bay-North (204 AFY)	• All sites controlled by City • Close proximity to WWTP • Desire to use by schools	
6	Agricultural Reuse-East (1844 AFY with creek)	• Largest reuse option	• Existing minimal pumping costs for agriculture • Possible water right conflict • Additional control by others for creek • Possible perception issue (crop marketability) • Potential additional treatment for creek beyond tertiary
7	Morro Bay-South (1501 AFY with creek or estuary)	• Possible funding from National Estuary Program • Possibly free up prescriptive water rights owned by GC for other use • Desire to use by schools • Potential for incidental groundwater recharge from creek • Offset potable water use • Possibility to use existing desalination for blending	• Largest uses great distance from WWTP • Additional control by others for creek/estuary • Potential additional treatment for creek/estuary beyond tertiary

(1) Common to all alternative potential issues:
- Any reuse project without treatment plant upgrade may degrade quality of water going to ocean
- Production of additional solids with upgraded treatment process
- Loss of water revenue
- Storage size and location

also identified and are footnoted in the table. It can easily be seen from the table those alternatives that provide more benefits than issues.

6.2 DRAFT VIABLE REUSE PROJECTS TO BE SCREENED

Based on a qualitative evaluation of the seven conceptual alternatives and the screening criteria, the Carollo team made a draft selection of the five most viable projects. The five viable projects selected, for the most part, were subsets of the seven conceptual alternatives rather than full alternatives. It was felt that since the seven conceptual alternatives contained all of the reuse sites, it was not practical to keep them as complete projects. Table 6.6 presents the first screening of the draft viable reuse projects.

Table 6.6 Draft Viable Reuse Projects Comprehensive Recycled Water Study Cayucos/Morro Bay

Viable Project Number and Name	Annual Demand (AFY)	Seasonal Demand[(1)] (gpd)	Pipeline Cost ($1,000)	Pipeline Costs ($/gpd)
1. Disinfected Secondary 23	4	3,510	11	3.2
• Onsite Washdown/ Maintenance Yard				
• Hanson Sand & Gravel				
2. Tertiary/WWTP Vicinity	81	108,520	165	1.5
• Onsite				
• Hanson				
• Keiser Park				
• Morro Bay HS/Bus Facility				
• Mission Linen				
3. Tertiary	204	295,050	608	2.1
• WWTP Vicinity Sites				
• Cloisters				
• Del Mar Park				
• Del Mar Elementary				
4. Tertiary	368	545,530	886	1.6
• WWTP Vicinity Sites				
• Morro Bay Elementary				
• City Park				
• Golf Course				
5. Tertiary	831	1,250,520	1,000	0.8
• WWTP Vicinity Sites				
• Agricultural Use Along Hwy 41				

(1) GPD demand based on industrial flow 365 days/year and irrigation flow for 214 days/year.

The sites selected for the viable projects in Table 6.6 tended to be either close to the recycled water source and/or larger potential uses. All of the creeks and estuaries were screened out at this time due to the additional treatment required beyond tertiary level. Again, these uses could be included during a later pipeline extension.

The recycled water demand was then compared with the pipeline cost in order to obtain a preliminary cost-per-gallon-per-day ranking. As can be seen from the table, the project serving the agricultural use along Highway 41 was the least cost, while the disinfected secondary project was the highest cost. Only the pipeline cost was used here for screening purposes. Additional costs should be added when considering implementation of any reuse project.

6.3 MOST VIABLE REUSE PROJECTS

The five draft viable reuse projects were presented and discussed in detail at the July 1999 Progress Meeting. The disinfected secondary alternative was screened out due to its high cost per gpd and due to the fact that secondary quality is less acceptable to the public than tertiary treated recycled water. Therefore, all alternatives being considered further would require tertiary level treatment.

When discussing the remaining draft viable alternatives, a common benefit was looked for, namely, control by the agencies. If the agencies were in control of the end use such as with a city park, then the implementation and operation of a reuse system was considered to be much easier. Another important benefit that was looked for with the remaining alternatives was the ability of the agencies to recoup some or all of the costs for the reuse system from the end users.

The potential agricultural use of recycled water for irrigation was discussed next. Although this use had proven to be the least cost per gallon based on the draft viable reuse projects, it also had several issues and disadvantages. It was felt that minimum to no reuse system costs could be recouped from the agricultural users since they currently draw water from on-site private wells. If the recycled water system costs were to be passed through to the farmers, it would most likely cause a bankruptcy situation or undue hardship. This use would also relinquish most of the control to an "outside party", namely the farmer. The agencies felt the optimum situation would be for the agricultural land to be owned by either Cayucos or Morro Bay. Another disadvantage raised with the potential agricultural use was that it would not offset groundwater use such as with a park. When considering the other remaining draft viable alternatives, it was determined that agricultural use was the most unreliable seasonal use and presented the highest level of risk to the agencies. Therefore, the draft viable project containing agricultural irrigation was screened out.

Table 6.7 presents the viable reuse projects selected for further development. These viable projects were selected by combining the remaining draft viable projects and screening out some of the higher cost/lower demand sites.

Table 6.7 Viable Reuse Projects
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Viable Project Number	Viable Project Description
1	• On-site Washdown/Maintenance Yard
	• Hanson Sand & Gravel
	• Keiser Park
	• Morro Bay High School and Bus Facility
	• Cloisters Development
2	• Mission Linen
	• Morro Bay Elementary School
	• City Park
	• Morro Bay Golf Course

Project 1 includes the potential reuse sites located adjacent to the WWTP. Project 2 is an extension of Project 1 which heads to the south to include an industry, park, school, and the large golf course user.

DEVELOPMENT OF VIABLE ALTERNATIVES

7.1 VIABLE ALTERNATIVE DESCRIPTIONS

Viable Reuse Sites Development

General

Additional data and information was gathered on each of the viable reuse sites as needed. Some of the information obtained included irrigation times and schedules, water quality issues, monthly water use, and/or system operations. The additional information is listed below by site with the Phase 1 projects listed first followed by the Phase 2 projects. Supporting data for the viable reuse projects is contained in Appendix E.

The viable reuse sites and preliminary pipeline routing is shown on Figure 7.1.

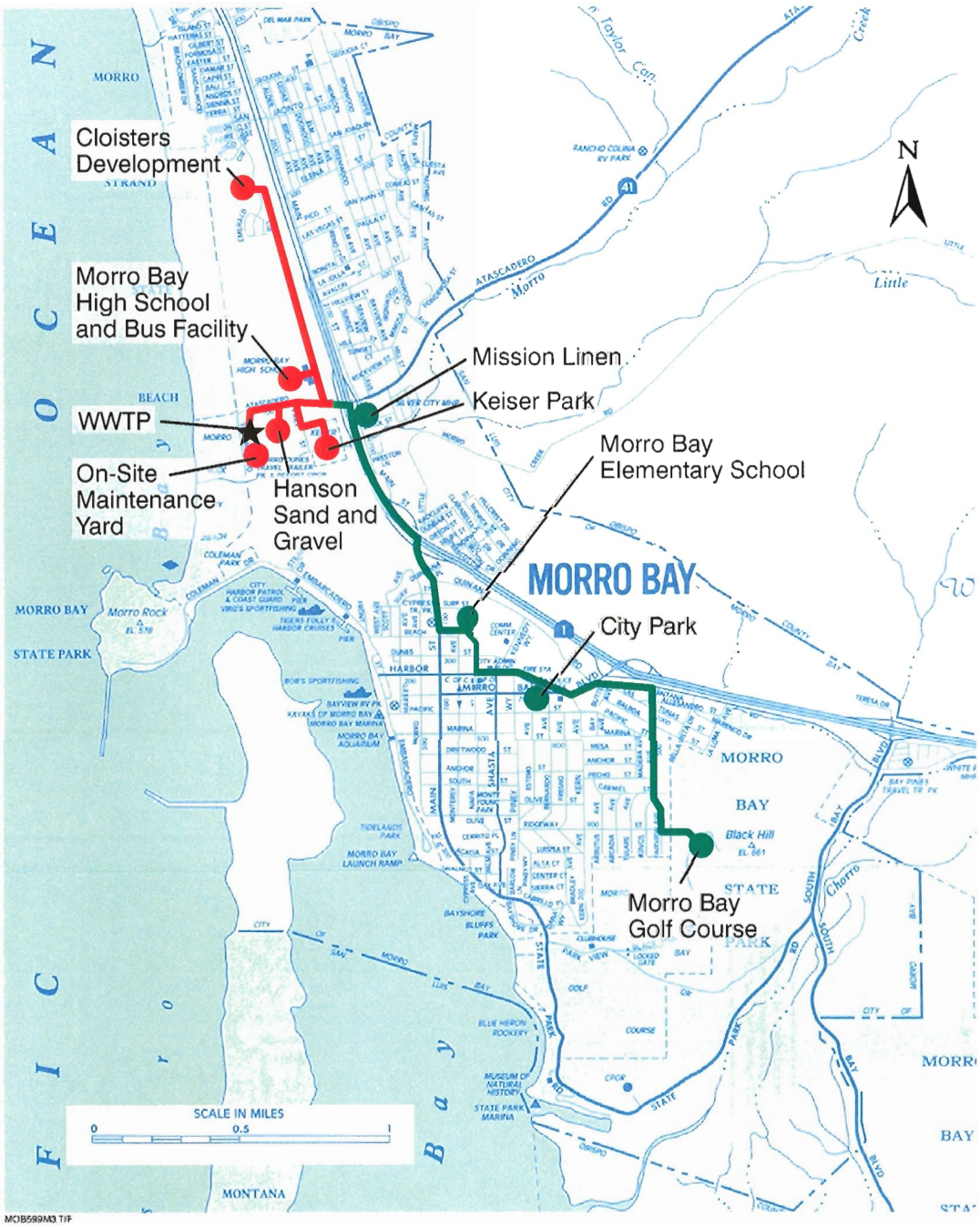
Phase 1: On-Site/Maintenance Yard

The easiest water reuse for any treatment plant is on-site process and wash-down water. At most plants, this is referred to as "Number 3 water," chlorinated effluent. The various uses range from foam suppression and scum sprays, utility stations and line flushing, coolant water, sprinkler systems, chemical dilution, and general washdown water. Also on-site landscaping is usually irrigated with recycled water. The Morro Bay-Cayucos WWTP has two 3-water pumps at the chlorine contact basin. However, the effluent is not currently used since it is a blend of primary and secondary effluent. If the WWTP were to upgrade to full secondary treatment then most likely, the 3-water system could be supplied by the treated effluent.

Water use data was obtained from the City of Morro Bay for both the WWTP and the maintenance yard. The maintenance yard had minimal use so intermittent washdown of equipment was assumed. The use of recycled water first for these purposes would be considered a "good faith effort" by the agencies from the public's point of view should the effluent be upgraded to an acceptable level.

Phase 1: Hanson Sand and Gravel

Hanson Sand & Gravel (Hanson) is a main supplier of concrete for the area. Their operation is generally year-round but somewhat weather-dependent due to rain. Hanson noted that concrete production this past year was continuous for them. They usually produce about 3,000 yards of concrete per month and use 36 gallons of water per yard of concrete. Currently, they use water from an on-site non-potable well owned by Morro Bay and CSD. Water is supplied to the mixing/pumper trucks either directly from the well pump or from a small storage tank. They generally mix concrete from about 6:00 a.m. to 3:30 p.m., however, this can vary to as early as 2:00 a.m. and as late as 5:00 p.m. They are



LEGEND

Phase 1 Viable Projects

Phase 2 Viable Projects

Figure 7.1
VIABLE REUSE PROJECTS
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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located directly east and adjacent to the WWTP on leased land owned by the City of Morro Bay and the Cayucos Sanitary District. Water quality is not monitored regularly so background information was not available. However, the WWTP staff collected a water sample from the well in July 1999 and analyzed it for TDS. The sample indicated a TDS of 660 mg/L which is slightly lower than that of the WWTP.

Hanson staff was supportive of using recycled water for their cement mixing provided the quality of the concrete can still be achieved. As discussed earlier, mixing concrete can be accomplished using disinfected secondary-23 recycled water. However, it does not make economic sense at this time to upgrade the treatment to this level for use only at Hanson.

Phase 1: Keiser Park

Keiser Park is a 9-acre park that consists of a baseball diamond and other playing fields. It is located adjacent to Hanson Sand and Gravel to the east and is shown in Figure 7.2. The park is on land owned by Duke Power Company which the City of Morro Bay leases for $1 per year. The park also provides restroom facilities and a barbecue pit with a faucet. These facilities are on the same mainline as the irrigation system, however, they do have separate water meters.

The Morro Bay Recreation and Parks Department noted that most city parks have more than one station for irrigation purposes so they can irrigate various areas simultaneously or alter their irrigation patterns. Usually, at any one time during the evening irrigation, at least one station is running (i.e., irrigating). The city parks are typically irrigated Monday through Friday in the summer and not on the weekends due to activities and tourists.

Phase 1: Morro Bay High School and Bus Facility

Morro Bay High School, shown in Figure 7.3, has 13.3 acres of turf, 0.7 acres of lawn, miscellaneous planters, a horticulture unit, a FFA school farm, and a bus facility which all currently use water from the State Water Project (SWP) for irrigation and washwater. The water source for these purposes can easily be replaced with recycled water. In fact, the school district indicated that they would be very comfortable using recycled water. Currently, they estimate their irrigation use is about 44 acre-feet per year (AFY). They do have backflow devices and believe the irrigation system is separate, for the most part, from the potable water system. A complete separation of the systems (i.e., recycled from potable) would need to be confirmed. Two irrigation system connection points were noted by the district for the high school.

Phase 1: Cloisters Development

The Cloisters Development is a planned and partially constructed residential neighborhood located on the west side of Highway 1 directly north of the Morro Bay High School playing fields, and is shown in Figure 7.4. The development is planned to contain

Figure 7.2
KEISER PARK SITE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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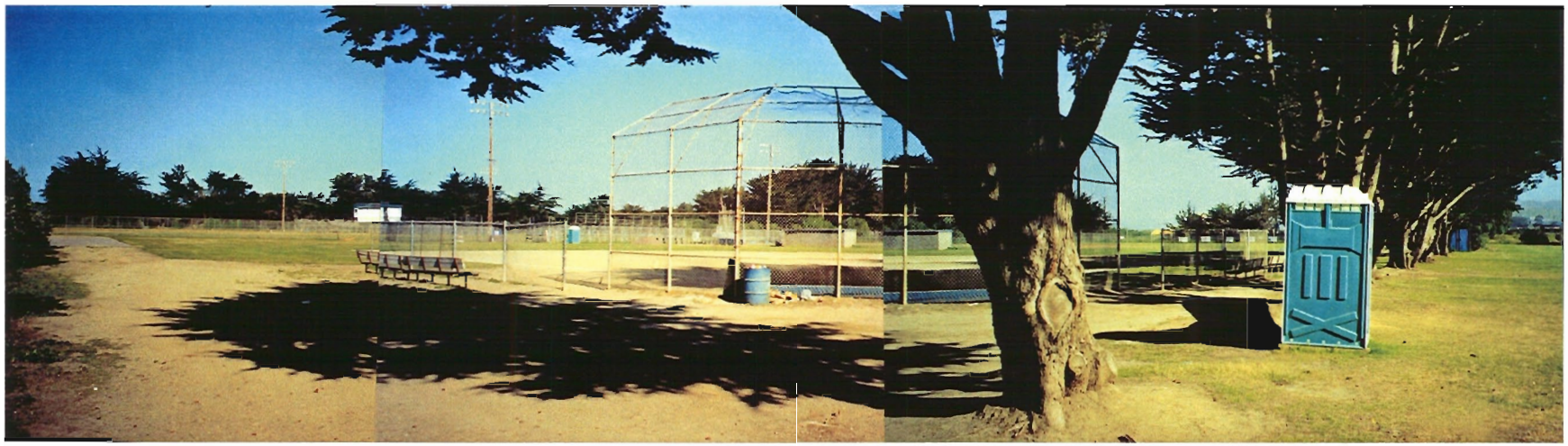

Figure 7.3
MORRO BAY HIGH SCHOOL SITE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

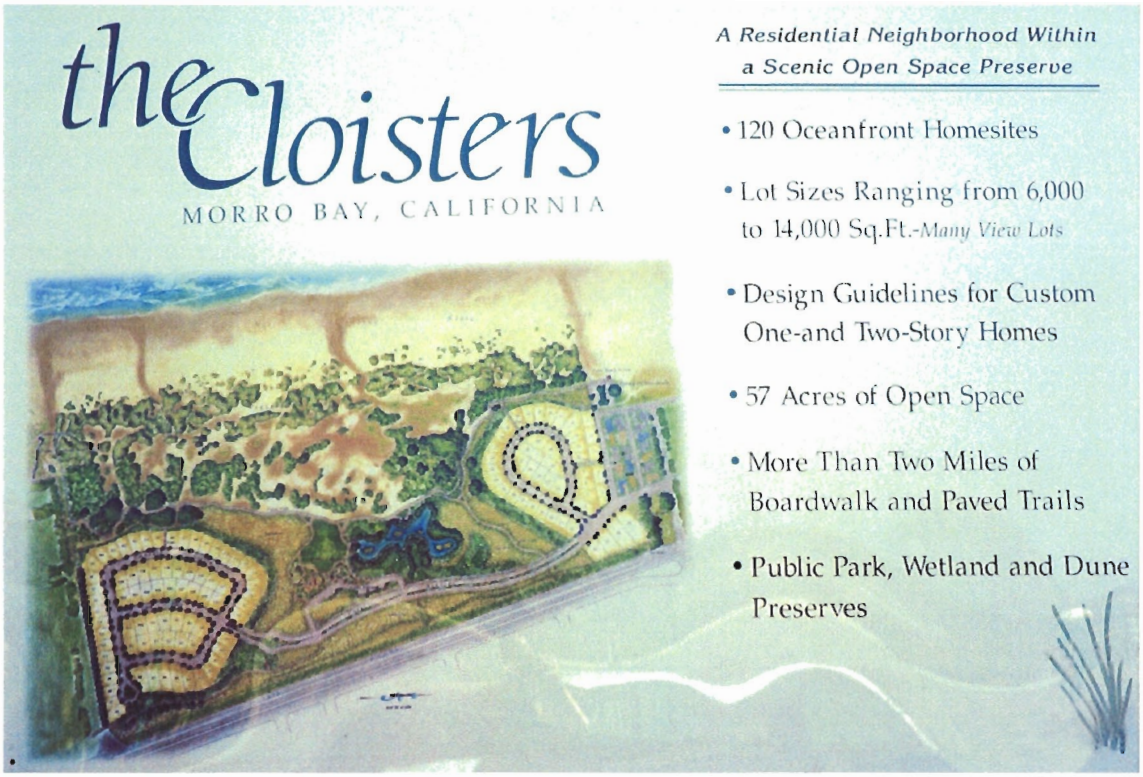

Figure 7.4
CLOISTERS DEVELOPMENT SITE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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120 ocean-front home sites, 57 acres of open space, over two miles of boardwalk and paved trails, and a public park, wetland, and dune preserve. The Recreation and Parks Department estimated that 34 acres of the development will be in right-of-way landscaping, demonstration gardens, medians, and grass meadow. The irrigation of the development landscaping is the responsibility of the City of Morro Bay and is currently using SWP water.

Phase 2: Mission Linen

Mission Linen is the only commercial laundry in the study area. Use of recycled water for commercial laundries is allowed by Title 22. Mission Linen is located on Errol Street to the east of Highway 1 and directly south of Atascadero Road. Their non-potable use is about 100,000 gallons/week which is a little over 14,000 gpd. Their hours of operation are Monday through Friday, 5:00 a.m. until 2:00 p.m. Their water use is fairly consistent throughout the year as they try to maximize their water efficiency with full 450-pound loads in the machines. Mission Linen's current water is supplied by the SWP.

The Mission Linen General Manager felt that their main concern with the use of recycled water would be an acceptable pH level for the detergents to work. He also noted that their water supply for the linens/uniforms is combined with the supply to two restrooms and two eye wash stations. However, bottled water is provided for drinking purposes.

Phase 2: Morro Bay Elementary School

The Morro Bay Elementary School is located near City Hall and the Community Center. The school has a four-acre lawn with one irrigation connection point. Again, the school district believes the irrigation system is piped separate from the potable water system. This would therefore, minimize any retrofit efforts.

Phase 2: City Park

City Park is a small community park located near City Hall with approximately one acre of irrigable lawn. The park contains restroom facilities which are common-piped with the irrigation system. Again, the two systems are metered separately for water supply/demand purposes.

Phase 2: Morro Bay Golf Course

The Morro Bay Golf Course is situated in Morro Bay State Park. San Luis Obispo County (the County) is responsible for the operations and maintenance of the 110-acre, 18-hole golf course. As can be seen from Figure 7.5, the golf course has unrestricted access and is set amongst rolling hills and Monterey pines. The course is planted with Kikuyu grass which is a hearty turf grass and, therefore, requires less irrigation and maintenance.

Figure 7.5
MORRO BAY GOLF COURSE SITE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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Currently, the course is irrigated with water supplied by a non-potable well in South Bay Boulevard which draws from Chorro Creek subsurface flows. The County is party to an agreement with the California Men's Colony (CMC) to buy imported water which is then used and processed through the CMC WWTP. The processed water is then discharged to Chorro Creek. The County has a prescriptive water right for up to 180 AFY which can be extracted by the South Bay Boulevard well. The water right has only been in effect since 1998. The CMC flow to Chorro Creek is a regulated flow that must be put in the creek on a daily and monthly basis.

The golf course has a 300,000 gallon (275,000 gallon working volume) storage tank on Black Hill which is used for storage of irrigation water from the well. The steel storage tank was built in the 1940s when the golf course was only 9 holes. Irrigation occurs at night from approximately 8:30 p.m. until 4:00 a.m. Both the storage tank and the well are used to meet the full irrigation demand. For example, the irrigation system turns on and as the tank draws down, a level switch is triggered which turns on the well pumps too. Both systems are used simultaneously to irrigate the course efficiently. The recycled water system could be run to the storage tank and main line irrigation system supply.

Level of Treatment Required

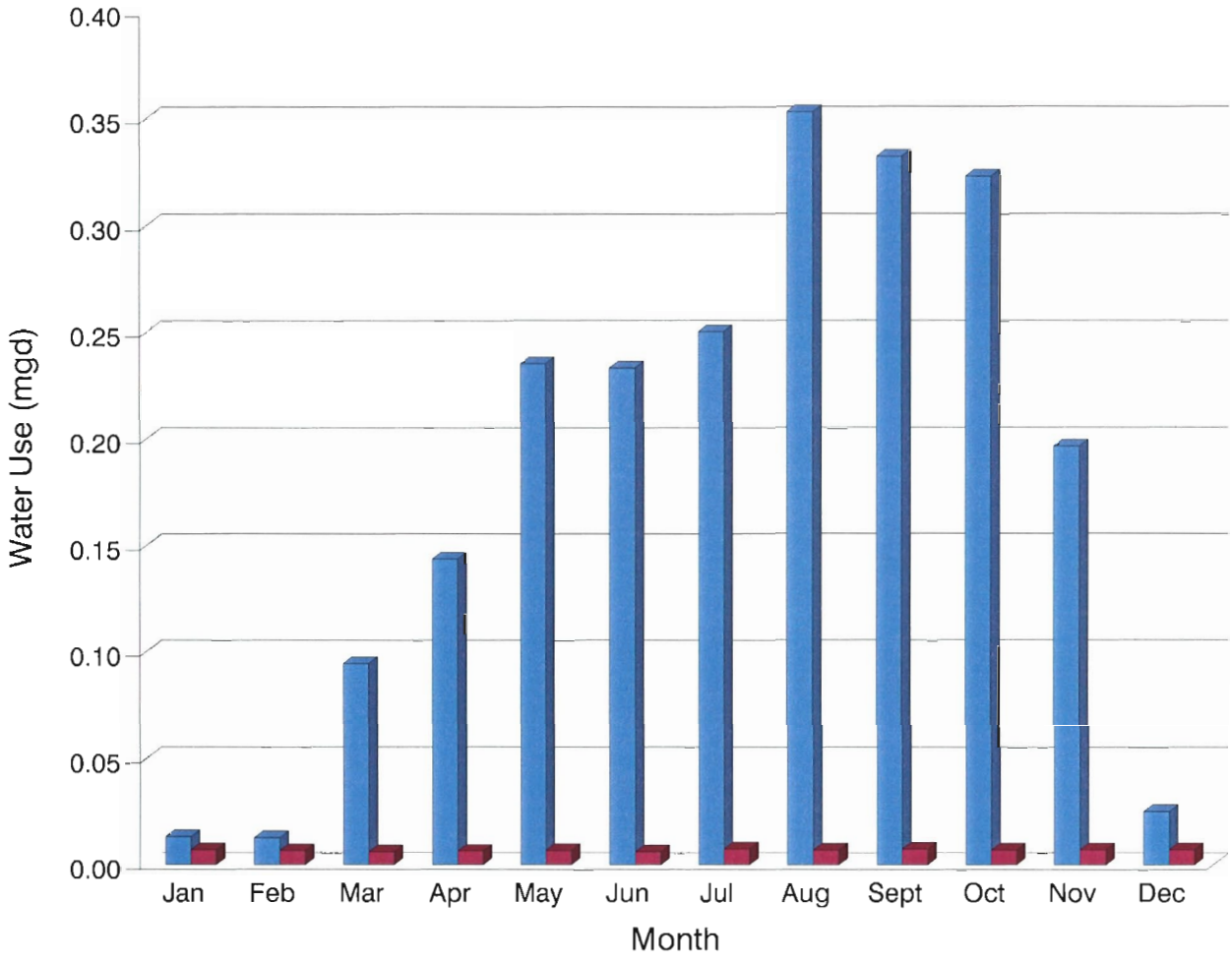
The system and retrofits to existing irrigation and industrial systems would need to comply with California Department of Health Services, Title 22 unrestricted use requirements.

7.2 VIABLE ALTERNATIVE FACILITIES/INFRASTRUCTURE

Flow Peaking Factors

A peak month demand for irrigation and industrial use was estimated based on information on historical demand and is presented in Table 7.1. Figures 7.6 and 7.7 graphically depict the monthly demand variation for Phases 1 and 2. In the figures, a much higher demand is shown for irrigation during the summer months than the winter months while the industrial usage tends to be constant throughout the year. Using the peak month demand (the month of August), a maximum daily use was approximated using a peaking factor of 1.3 and assuming that the number of days of use would be 21 days/month. For Phase 1, the total peak monthly demand was estimated to be 0.36 mgd with the demand increasing to 1.09 mgd for Phases 1 and 2. The overall maximum daily demand on the reuse system was approximated to be 0.47 and 1.4 mgd for Phases 1 and 2, respectively.

A summary of the maximum monthly and daily flows is shown in Table 7.2. Using the maximum daily demand and approximating the hourly time of use for irrigation and industrial purposes, an hourly distribution was developed for both Phases 1 and 2, as shown in Figures 7.8 and 7.9, respectively. The hourly distribution was developed based on discussions with each potential viable reuse site to determine their hours of irrigation or



LEGEND
Irrigation
Industrial

Figure 7.6
VIABLE RECYCLED WATER USE BY MONTH
FOR THE PHASE 1 ALTERNATIVE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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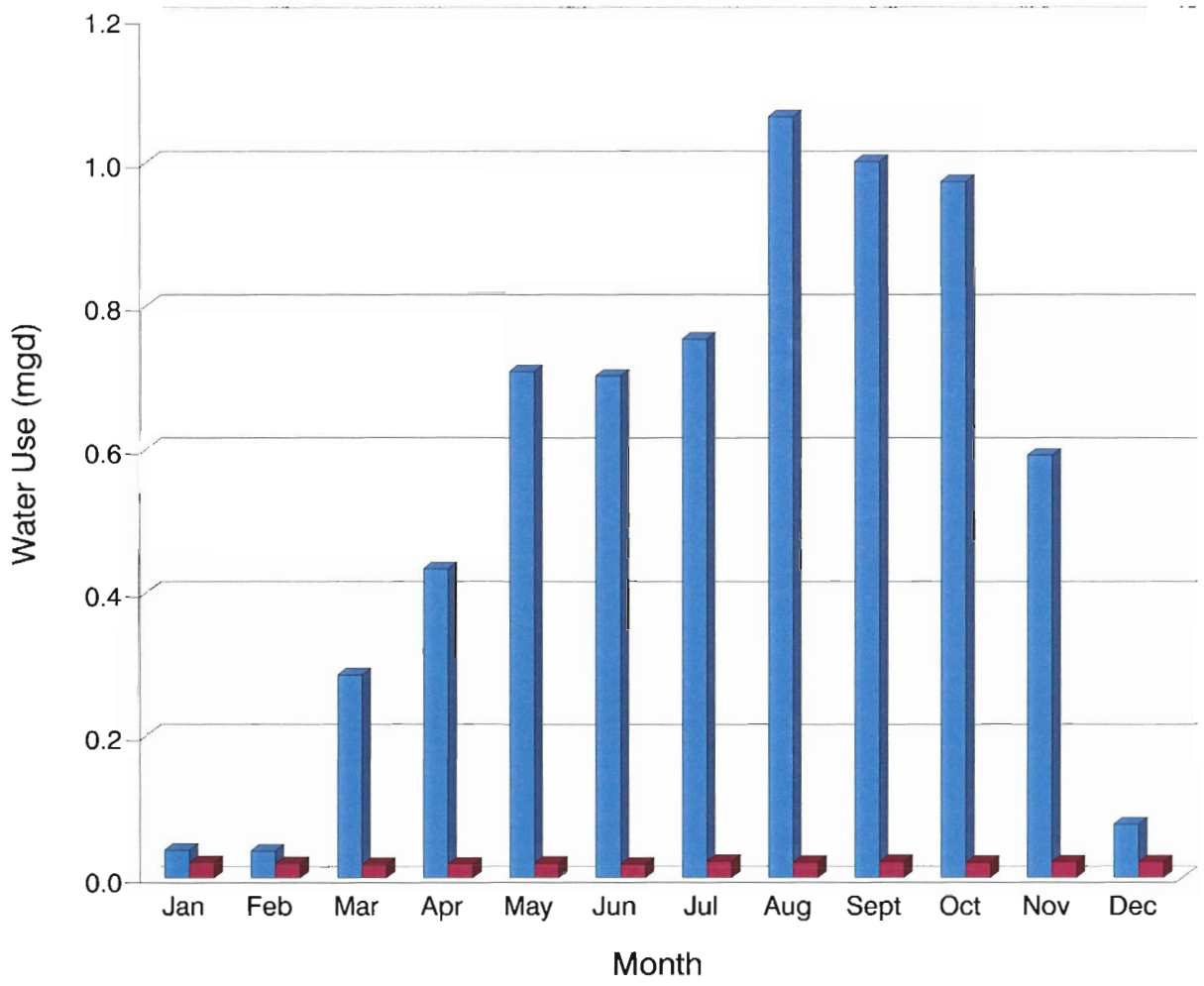

LEGEND
Irrigation
Industrial

Figure 7.7
VIABLE RECYCLED WATER USE BY MONTH FOR THE PHASE 2 ALTERNATIVE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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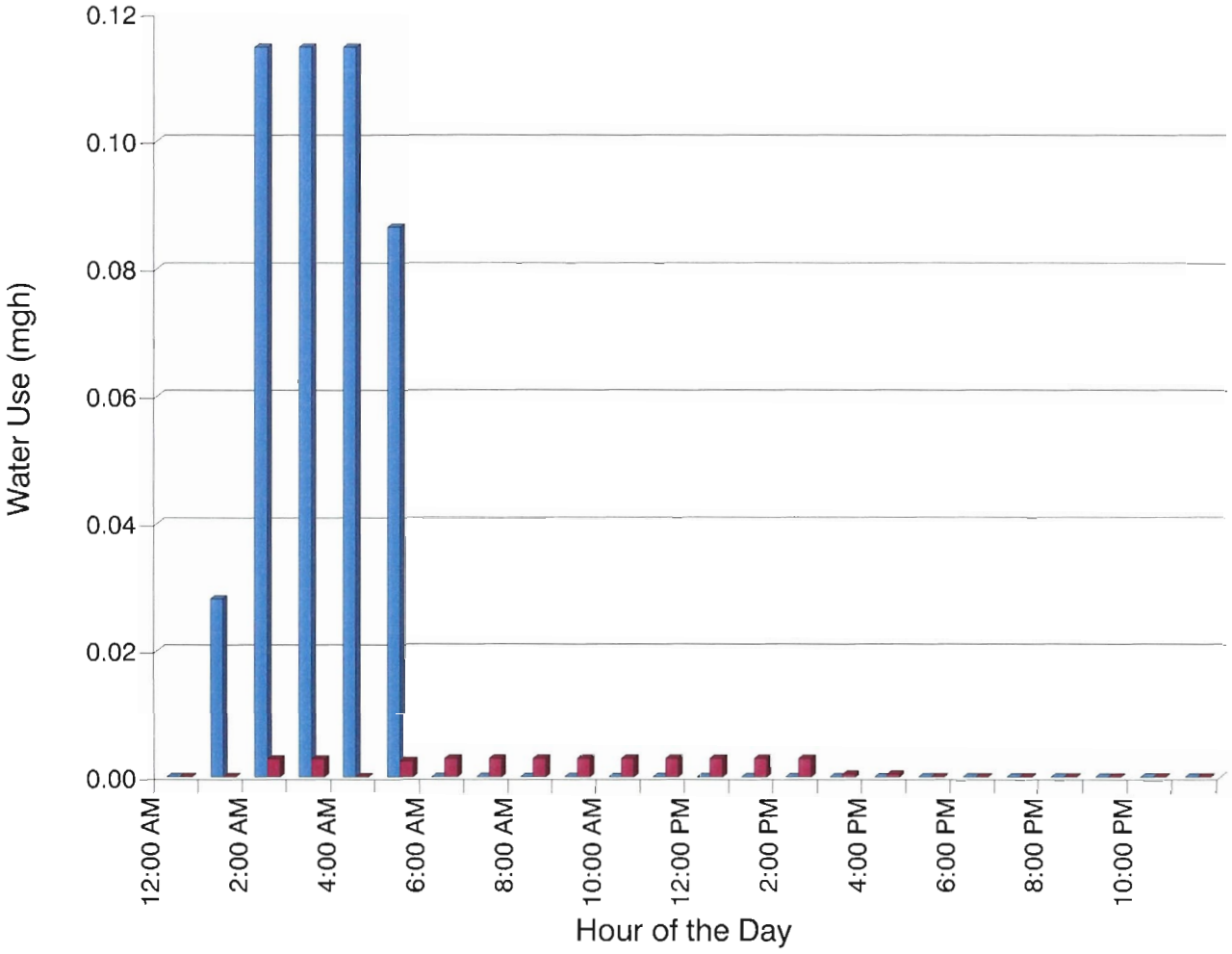

LEGEND
Irrigation
Industrial

Figure 7.8
ANTICIPATED PEAK DAY
RECYCLED WATER USE SCHEDULE
FOR THE PHASE 1 ALTERNATIVE
CAYUCOS/MORRO BAY
COMPREHENSIVE RECYCLED WATER STUDY

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Table 7.1 Monthly Demand Distribution for Irrigation and Industrial Users
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Month	Monthly Demand Distribution, Phase 1			Monthly Demand Distribution, Phase 2		
	Irrigation (mgd)	Industrial (mgd)	Total (mgd)	Irrigation (mgd)	Industrial (mgd)	Total (mgd)
Jan	0.01	0.007	0.02	0.04	0.02	0.06
Feb	0.01	0.007	0.02	0.04	0.02	0.06
Mar	0.09	0.006	0.10	0.28	0.02	0.30
Apr	0.14	0.006	0.15	0.43	0.02	0.45
May	0.24	0.007	0.24	0.71	0.02	0.73
Jun	0.23	0.006	0.24	0.70	0.02	0.72
Jul	0.25	0.007	0.26	0.75	0.02	0.77
Aug	0.35	0.007	0.36	1.06	0.02	1.08
Sept	0.33	0.007	0.34	1.00	0.02	1.02
Oct	0.32	0.007	0.33	0.97	0.02	0.99
Nov	0.20	0.007	0.21	0.59	0.02	0.61
Dec	0.02	0.007	0.03	0.08	0.02	0.10

Table 7.2 Peak Demands for Irrigation and Industrial Uses in Morro Bay
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Constituents	Use	Total Use (hr/day)	Peak Month (ac-ft/mo)	Max Day (ac-ft/d)
Phase 1				
Cloisters	IRR	4	13.6	0.840
Hanson	IND	8	0.2	0.012
Keiser Park	IRR	4	3.6	0.222
Morro Bay H.S. Bus Facility	IND	2	0.2	0.014
Morro Bay H.S.	IRR	4	5.6	0.346
WWTP	IND	2	0.1	0.004
Total			**23.3**	**1.437**
Phase 1 Total in mgd			**0.36**	**0.47**

Table 7.2 Peak Demands for Irrigation and Industrial Uses in Morro Bay (Continued) Comprehensive Recycled Water Study Cayucos/Morro Bay				
Constituents	Use	Total Use (hr/day)	Peak Month (ac-ft/mo)	Max Day (ac-ft/d)
Phase 2				
City Park	IRR	4	0.3	0.020
Cloisters	IRR	4	13.6	0.840
Hanson	IND	9	0.2	0.012
Keiser Park	IRR	4	3.6	0.222
Mission Linen	IND	8	1.0	0.062
Morro Bay H.S. Bus Facility	IND	2	0.2	0.014
Morro Bay Elementary	IRR	4	1.6	0.099
Morro Bay Golf Course	IRR	8	43.9	2.718
Morro Bay H.S.	IRR	4	5.6	0.346
WWTP	IND	2	0.1	0.004
Total			**70.1**	**4.337**
Phase 2 Total in mgd			**1.09**	**1.4**

industrial use. A worst case scenario assuming that all irrigation took place in the same time period was used to estimate an hourly distribution for the demand, both for irrigation and industrial reuse. The peak monthly, daily and hourly demands were used to determine the sizes of the pipelines, treatment and storage facilities.

Treatment Facility Upgrades

Recycled water used for irrigation of parks and educational facilities must meet Title 22 regulations for unrestricted water use. These requirements specify secondary treatment followed by tertiary treatment. Since the joint WWTP currently does not use tertiary processes in their treatment train, the facilities would need to be upgraded. As discussed in Chapter 4, the WWTP would need to upgrade to full secondary treatment in order to proceed with recycled water use. Tertiary treatment would include coagulation, sand filtration, disinfection and storage. Sand filtration units would be enlisted to decrease the total solids and turbidity prior to disinfection. For the Phase 1 viable reuse alternative, two sand filtration units would be required with an additional two filters installed to upgrade to Phase 2. Chlorine disinfection will be used to reduce pathogens to meet the Title 22 total coliform limit of 2.2 MPN/100 ml. A total contact time of 120 minutes based on the maximum monthly demand flow will be used to meet the regulation criteria. Since the WWTP currently uses chlorine disinfection in their existing process, it was assumed that the on-site supply of sodium hypochlorite will also be used for the tertiary disinfection process.

Storage

Storage of the tertiary-treated effluent will be required to compensate for the fluctuations in diurnal influent WWTP flow and the diurnal variations in demand (discussed in Chapter 4). The hourly supply of treated wastewater was compared with the hourly demand for recycled water from the potential irrigation and industrial users. The hours of peak demand (~12:00 to 4:00 a.m.) coincide with the hours of the low influent flow into the plant. Therefore, storage would be necessary to meet the demand of the users during the hours of low flow into the plant. A storage volume of 2 days demand was assumed to calculate the volume of storage needed based on the maximum daily demand exhibited by the potential users. Based on this, 1 million gallons of storage will be provided for Phase 1 and an additional 2 million gallons will be provided for Phase 2. The storage tank for Phase 2 could be located next to the existing golf course tank. This is a high point in the reuse system. Other locations must be investigated for Phase 1 facilities.

Pipeline Sizing

After the preliminary route was determined, preliminary sizing was conducted and is presented in Table 7.3. The pipelines were sized for maximum day flows at a velocity of 5 feet per second (fps). A "C" value of 130 was selected for all pipeline sizing. The transmission mains were sized in Phase 1 assuming the eventual addition of the Phase 2 project. Therefore, the Phase 2 project will not require upsizing the pipelines from Phase 1. One booster pump station is required for Phase 2 for delivery to the golf course.

Table 7.3 Pipeline Diameter Sizing Comprehensive Recycled Water Study Cayucos/Morro Bay

	Pipeline[1]	Pipe Diameter (inches)
Phase 1	East-West Main Transmission Line	20
	WWTP Onsite	2
	Hanson Sand and Gravel	2
	Morro Bay H.S.	8
	Morro Bay H.S. Bus Facility	2
	Keiser Park	6
	The Cloisters Development	10
Phase 2	North-South Main Transmission Line	12
	Mission Linen	2
	Morro Bay Elementary School	4
	City Park	2
	Morro Bay Golf Course	12

(1) The pipeline is a distribution line unless otherwise noted.

Pipeline Routing

In addition to gathering data on the viable reuse sites and sizing the tertiary treatment facilities, a preliminary distribution routing was also selected. The routing was selected based on field reconnaissance, discussions with the agencies and selecting the most direct route to each potential viable customer. A main east-west and north-south transmission line was routed along with smaller distribution lines to each customer. The routing was shown previously in Figure 7.1. The preliminary routing is discussed in general in the following paragraphs.

Phase 1 Routing

The transmission line leaves the WWTP and heads east along Atascadero Road to Coral Avenue. One distribution line runs south from the Atascadero main to Hanson Sand & Gravel and a second distribution line suns south along Atascadero Park Road to Keiser Park. At the intersection of Atascadero Road and Coral Avenue, the transmission line for Phase 1 turns north along Coral Avenue and ends at the Cloisters Development. A distribution line for the Morro Bay High School and Bus Facility runs west off of this transmission main.

Phase 2 Routing

The transmission line for Phase 2 connects at the Atascadero Road-Coral Avenue intersection, passes under Highway 1 and turns south along Main Street. A distribution line runs southward along Errol Street to Mission Linen. The main transmission line follows Main Street southward passing under the interstate once again. It then, turns east onto Beach Street heading to Napa Street, where a short distribution line is run further east to the Morro Bay Elementary School. At Napa Street, the main line jogs southward to Harbor Boulevard and then turns back east towards City Park. A distribution line is run southwest to City Park while the transmission main continues eastward. Turning south onto Kern Avenue from Harbor Boulevard, the transmission line runs to Ridgeway Street. The main line then heads east along Ridgeway and up Black Hill to the end of the line at the golf course's irrigation storage tank.

7.3 COST ESTIMATES

General

Planning level cost estimates were prepared for the two viable alternatives. The cost elements include project costs, operation and maintenance expenses, and dollars per acre-foot (ac-ft) annually. Revenue from the sale of the recycled water was not considered in these estimates however, it is generally charged at approximately 75 to 80 percent of the cost of potable water.

Project Costs

"Project Costs" include estimated costs of construction, engineering design, construction management and inspection, and contingencies for estimating and construction, where applicable. Construction costs are based on an average of the Engineering News-Record 20 cities area and San Francisco area Construction Cost Index (ENR-6350 at present) and then escalated to the basis of study to January 2000 = ENR 6615. Estimating and construction contingencies are assumed to be 20 percent and 15 percent of the estimated construction cost, respectively. Administration, legal, planning, design, and construction management costs are estimated to be 30 percent of the total construction cost at the basis of the study.

Project costs of the facilities are divided into the following elements:

- Customer connections.
- Customer retrofits.
- Treatment plant facilities.
- Distribution system and storage.

Each element is discussed below. These costs were based on previous project experience.

Customer Connections

Connections are required for serving the recycled water from the distribution pipelines to the customer properties. Items included in the connection cost are: tapping the distribution mains, installing service laterals, meters, pressure reducing valves (PRVs), and a backflow prevention device on the potable water system. It is assumed the average size for laterals, meters and PRV's are one and one half inch. Customer connection costs are estimated to be $1,600 each plus $2,000 each for the installation of a backflow prevention device.

Customer Retrofits

Retrofit costs include costs associated with separating a customer's existing water system from a new recycled water system. An example would be a park where restroom and drinking fountain water supply pipes would need to be isolated from an existing irrigation system that is to carry the recycled water. Additional costs include posting signs identifying that recycled water is being used. Water system retrofits are one time costs and are estimated for each different site. If the site has a separate system already and is not combined with a potable service, then the retrofit cost assumed is zero. Only the combined sites are listed here.

Phase 1

- Keiser Park = 1 restroom and barbeque faucet combined = $5,000.
- Cloisters Development = 1 restroom combined = $5,000.
- Mission Linen = 2 restrooms and 2 eye washes combined = $20,000.

Phase 2

- City Park = 1 restroom combined = $5,000.
- Morro Bay Golf course = 1 restroom combined = $5,000.

Treatment Plant Facilities

Costs have been developed for providing full secondary treatment (see Chapter 4) and for providing tertiary treatment and storage facilities for Phases 1 and 2. Facilities include influent pumping, sand filters, chlorine contact basins, steel storage tanks and recycled water pumps. Tertiary and storage facilities costs shown for Phase 2 are the incremental costs to add additional capacity required to serve the Phase 2 users and do not represent the total cost to install Phase 1 and Phase 2 facilities.

Distribution System

Construction costs for the distribution system include pipe material, excavation, installation, bedding material, backfill material, transport, and paving where applicable. Pipe material costs are based on PVC for pipe 16 inches and smaller and ductile iron for larger sizes. Valves and appurtenances are included in the costs.

Project Costs

The project costs for Phase 1 are shown in Table 7.4. The incremental project costs for adding Phase 2 onto the Phase 1 project are shown in Table 7.5. In other words, the Phase 2 project can not be implemented without first constructing the Phase 1 project since some costs, such as the upgrade to full secondary, are only shown in Table 7.4 (i.e., the Phase 1 project). Costs for the Environmental Impact Report (EIR) have not been considered here but could range from several hundred thousand to several million dollars.

Operation and Maintenance Costs

Operation and Maintenance costs (O&M) are comprised of the following items:

- Purchased power (pumping costs).
- Chemicals (sodium hypochlorite, lime, and polymer).
- Maintenance of distribution system.

Table 7.4	Cayucos/Morro Bay Reuse Phase 1, Capital and Project Costs Comprehensive Recycled Water Study Cayucos/Morro Bay	
	ENR at Estimate for January 2000	**6615**
	Description	**Total**
Customer Connections		$18,000
Customer Retrofits		10,000
Upgrade Plant to Full Secondary Facilities		2,750,000
Title 22 Treatment Facility and Storage		1,190,000
Effluent Pump Station		450,000
Distribution System		409,560
	Subtotal	$4,827,560
	Estimating Contingency (20%)	965,512
	Construction Contingency (15%)	868,961
	Total Construction Cost at Basis of Study	6,662,033
	Administration, Legal, Planning, Design, and Construction Management (30%)	1,998,610
	Total Phase 1 Project Cost	**$8,660,000**

Table 7.5	Cayucos/Morro Bay Reuse Phase 2, Capital and Project Costs (Incremental Costs to Increase to Phase 2) Comprehensive Recycled Water Study Cayucos/Morro Bay	
	ENR at Estimate for January 2000	**6615**
	Description	**Total**
Customer Connections		$14,400
Customer Retrofits		30,000
Title 22 Treatment Facility (0.73 mgd maximum month)		2,330,000
Effluent Pump Station		150,000
Booster Pump Station		400,000
Distribution System		875,700
	Subtotal	$3,800,100
	Estimating Contingency (20%)	760,020
	Construction Contingency (15%)	684,018
	Total Construction Cost at Basis of Study	5,244,138
	Administration, Legal, Planning, Design, and Construction Management (30%)	1,573,241
	Total Phase 2 Project Cost	**$6,820,000**

- General administration.
- Labor.
- Biosolids disposal.

Purchased Power

The majority of purchased power will be used to pump the recycled water. Average flow pumping is used to determine the power consumption. The costs are based on an average of $0.08 per kilowatt hour.

Chemicals

Several chemicals for coagulation/flocculation and disinfection will be used for the reuse projects. The following chemicals and concentrations are used to determine the quantities of chemicals used.

- Lime = 35 mg/L.
- Polymer = 2 mg/L.
- Sodium Hypochlorite = 10 mg/L.

Maintenance

The average annual maintenance expense used for the distribution system is $2,800 per mile per year, based on the WWTP's current costs for maintaining the sewer collection system.

General Administration

General administration includes costs associated with customer accounting, meter reading, employee salaries not included elsewhere, benefits, insurance, office and other miscellaneous costs associated with operating a water system. The general administration costs is estimated at $1,500 per mile of distribution pipe per year.

Labor

Additional labor costs are estimated assuming an annual salary of $65,000 for an operator.

Operation and Maintenance Costs

The additional O&M costs at the WWTP estimated for the implementation of the Phase 1 reuse project are shown in Table 7.6. The additional O&M costs for adding the Phase 2 reuse project are shown in Table 7.7.

Cost Summary and Dollars per Acre-Foot Cost

An annual cost per ac-ft was estimated based on the above project costs and O&M expenses. A 6 percent interest rate at 40 years was used to convert the project cost to an

Table 7.6 Cayucos/Morro Bay Reuse - Phase 1, O&M Costs
Comprehensive Recycled Water Study
Cayucos/Morro Bay

	Description	Total
1.	Additional Chlorine Requirements	$5,978
2.	Purchased Power (Pumping Costs)	70,023
3.	Maintenance of Distribution System	3,920
4.	General Administration	2,100
5.	Labor	65,000
6.	Additional Biosolids Disposal for Full Secondary Treatment	11,139
7.	Additional Biosolids Disposal for Tertiary Treatment	142
	Subtotal	$158,302
	Estimating Contingency (20%)	31,660
	Total	**$189,962**

(1) No charges for the water source (WWTP) are anticipated. Charges are for additional chlorination.
(2) All power costs estimated to be purchased at $0.08 per kilowatt hour.
(3) Distribution system maintenance costs based on 1.4 miles at $1,500 per mile.
(4) Administration costs based on costs provided by WWTP.
(5) Labor costs based on 1 new operator at $65,000 per year.
(6) Biosolids disposal estimated for 470 tons at $23.70 per ton for full secondary treatment.
(7) Biosolids disposal estimated for 6 tons at $23.70 per ton for tertiary treatment..

Table 7.7 Cayucos/Morro Bay Reuse - Phase 2, O&M Costs
(Incremental Costs to Increase to Phase 2)
Comprehensive Recycled Water Study
Cayucos/Morro Bay

	Description	Total[7]
1.	Additional Chlorine Requirements	$12,271
2.	Purchased Power (Pumping Costs)	105,660
3.	Maintenance of Distribution System	7,840
4.	General Administration	4,200
5.	Labor	65,000
6.	Additional Biosolids Disposal for Tertiary Treatment	332
	Subtotal	$195,303
	Estimating Contingency (20%)	39,061
	Total	**$234,364**

(1) No charges for the water source (WWTP) are anticipated. Charges are for additional chlorination.
(2) All power costs estimated to be purchased at $0.08 per kilowatt hour.
(3) Distribution system maintenance costs based on 2.9 miles at $1,500 per mile.
(4) Administration costs based on costs provided by WWTP.
(5) Labor costs based on 1 new operator at $65,000 per year.
(6) Biosolid disposal estimated for 14 tons at $23.70 per ton for tertiary treatment.
(7) Incremental costs to Phase 1 estimate. Phase 1 must be implemented prior to Phase 2.

annual basis. The annual costs and the costs per ac-ft are shown in Table 7.8 for Phase 1 and Table 7.9 for Phase 2.

Table 7.8 Cayucos/Morro Bay Reuse - Phase 1, Dollars per Ac-Ft
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Description	Total
Project Costs (Present Worth)	$8,660,000
Convert to Annual Basis (6% at 40 Years)	0.06646
Project Costs Annual Basis	$575,544
O&M Costs	$189,962
Total Annual Costs	$765,506
Ac-ft Per Year	148
Dollars per Ac-ft - Annual Basis	**$5,170**

Table 7.9 Cayucos/Morro Bay Reuse - Phase 2, Dollars per Ac-Ft
(Incremental Costs to Increase to Phase 2)
Comprehensive Recycled Water Study
Cayucos/Morro Bay

Description	Total
Project Costs (Present Worth)	$6,820,000
Convert to Annual basis (6% at 40 Years)	0.06646
Project Costs Annual Basis	$453,257
O&M Costs	$234,364
Total Annual Costs	$687,621
Ac-ft Per Year	287
Dollars per Ac-Ft - Annual Basis	**$2,400**

7.4 NON-ECONOMIC CONSIDERATIONS

When considering the implementation of any water reuse project, non-economic as well as economic factors must be reviewed. The non-economic factors most likely represent key issues that are seen as either advantages (benefits) or disadvantages. They may also represent implementation concerns that could extend a project beyond its desired start-up date. These issues and concerns also have very different impacts on the various "publics" such as internal agencies, rate payers, home owners, or environmental groups.

Recycled water projects should not be reviewed simply based on costs, as they do, in most, if not all cases, provide additional benefits. In some instances, the benefit may be seen as providing an additional water supply for drought situations or to provide for planned growth. The benefit could also be seen as alleviating a political pressure at the state or local level. One example is in the Monterey area where the farmers were experiencing extensive sea water intrusion so the use of recycled water was called on. Another example can been seen in the San Jose area that was experiencing planned growth due to Silicon Valley, yet was discharging to a salt water marsh in the south bay and converting it to fresh water. The use of recycled water for irrigation is helping to save the salt water marsh and its endangered species.

One of the most influential non-economic considerations is public perception. The public has the ability to delay or even halt an entire project if they do not agree with its need or purpose. The viable alternatives selected aid in the public perception by the willingness of the agencies to use the recycled water on their own city parks and schools.

Any site converted to the use of recycled water would also need to have signed agreements from both parties receiving and distributing the water. The agreements set the acceptable conditions for the recycled water for both the user and the WWTP. Internal agreements would also be needed since the WWTP is jointly owned by Morro Bay and CSD. The original Joint Powers Agreement could be amended to account for this. Since the use of recycled water would off set potable use, consideration must also be given to the displaced revenue from the potable supplier. In this case, the potable source is the City of Morro Bay while the recycled water source is the jointly owned WWTP. Operating agreements for this situation would also need to be made.

In general, most of the sites selected for both the Phase 1 and Phase 2 projects were included due to the fact that they are sites that the agencies feel they would be able to maintain the most control over the use of the water. Most are sites that currently have water supplied by the City of Morro Bay, as opposed to private wells. They were previously supplied by the City's potable groundwater wells and then converted to SWP water. The exception to this control factor is the Morro Bay Golf Course which currently uses well water supplied from Chorro Creek. Since the golf course is managed by the County, the agencies would need to meet with the County and agree on an acceptable method of operation for the recycled water system. Hanson Sand and Gravel uses a water supply well on property jointly owned by the agencies located near the WWTP and ocean. The conversion of this property to recycled water rather than well water, could aid in providing a sea water intrusion barrier if a problem were to develop with intrusion.

Another non-economic consideration is the quality of the water. In addition to meeting the Department of Health Services criteria, the irrigation sites and industries all have water quality constituents that must be met for their operation to occur successfully. For

example, Mission Linen's water must have a specific pH range for the detergents to work to successfully clean the uniforms. The pH range can be achieved by several different means, however, it must be achieved. The irrigation sites are usually concerned mainly with high salt levels in the water and soil. This also can be controlled to a degree through proper irrigation management and selecting salt-tolerant plants. Hanson Sand and Gravel's main concern is the ability of the concrete to meet the testing strength for pouring and setting.

Another non-economic consideration is the issue of water rights. Currently the only viable reuse site that has water rights is the golf course. The use of recycled water on the course would possibly allow the water rights to be used for other purposes.

Meeting the existing and possible future permit conditions is also a main consideration. Even if recycled water is the "politically correct" use of this valuable resource in California, if its use will degrade the quality of the effluent, and therefore the ability of the plant to meet discharge requirements, then this must also be closely reviewed for solutions.

CONCLUSIONS

8.1 STUDY PURPOSE

Based on a requirement in the NPDES Permit issued by the Regional Water Quality Control Board (RWQCB), the City of Morro Bay and the Cayucos Sanitary District commissioned a report summarizing recycling options and feasibility. This Comprehensive Recycled Water Study is the result of that requirement. All engineering aspects of a water recycling plan were reviewed including potential recycled water uses and markets, water quality, water supply/demand, existing and future wastewater facilities, and regulatory requirements. Associated planning level costs and non-economic factors were then developed for the most cost effective alternative.

8.2 CONCLUSIONS

The WWTP has shown to continuously meet the discharge requirements for the current NPDES permit. Over a decade of ocean monitoring has found there is no impact on the ocean environment from the discharge. The permitted capacity of the WWTP appears to be adequate for the projected future population caps for Morro Bay and Cayucos. The current water supply meets the current demand for the Cayucos area and additional water sources are being pursued for future demands. The demand in Morro Bay has fluctuated quite a bit depending on drought conditions and with and without water conservation measures. Currently, the supply for Morro Bay appears adequate based on the State Water Project (SWP) water allocation supplemented with the existing potable groundwater wells and water conservation.

Numerous uses were identified for potential water reuse for irrigation, stream flow enhancement, industrial reuse, and groundwater recharge. Nine sites were selected and developed into the most viable reuse projects at this time as Phase 1 and 2. Unrestricted use tertiary treated recycled water was selected as the required level of treatment based on the viable uses. Before the projects can be instituted the WWTP processes would need to be upgraded to full secondary treatment with a portion of the flow treated to tertiary level for reuse. The full secondary treatment planning level cost estimate is $4,830,000. This cost would increase the secondary treatment capacity by 1.39 mgd.

The Phase 1 project includes: on-site and maintenance yard wash down and process use, Hanson Sand and Gravel concrete mixing use, Morro Bay High School irrigation and bus facility wash down use, and Keiser Park and the Cloisters Development irrigation use. The total annual demand for Phase 1 is 148 acre feet per year (AFY) at a project cost of $8,660,000. The Phase 2 reuse project is an extension of the Phase 1 project with the addition of Mission Linen, Morro Bay Elementary School, City Park, and Morro Bay Golf

Course. The total annual demand for Phase 2 is 287 AFY at an incremental project cost of $6,820,000. The annualized project costs, O&M and cost per acre-foot (ac-ft) of water are shown in Table 8.1.

Table 8.1 Summary of Viable Reuse Project Costs Comprehensive Recycled Water Study Cayucos/Morro Bay

	Phase 1 Costs	Phase 2[3] Costs	Total Costs Phases 1 and 2
Project Costs - Present Worth	$8,660,000[1]	$6,820,000	$15,480,000
Project Costs - Annual Basis[2]	576,000	453,000	1,029,000
O&M Costs	190,000	234,000	424,000
Total Annual Costs	766,000	687,000	1,453,000
Ac-Ft Per Year	148 AFY	287 AFY	435 AFY
Dollars per Ac-Ft (Annual Basis)	$5,200/AFY	$2,400/AFY	$3,300/AFY

(1) Includes project costs at $4.8 million for providing full secondary treatment.
(2) Based on 6 percent interest over 40 years.
(3) Incremental costs to Phase 1 estimates.

This cost should be compared against the cost of water. The Public Works Director noted that currently, Morro Bay relies on the State Water Project (SWP) water to supply 100 percent of the demand. As stated in the Morro Bay Water Management Plan, SWP water currently has a nominal unit cost of $685 per ac-ft. The potable groundwater wells supplement the imported SWP supply. Therefore, if additional water was needed by the City it would either come from the SWP supply or the existing groundwater wells. The additional cost would be that of the cost to pump from the wells which is on the order of $45 per ac-ft. The cost to operate the desalination plant would be the next in line for additional costs and that was previously estimated in an earlier study at $1500 per ac-ft.

At the present time, there are no classical circumstances to cause the JPA to move forward with a reuse project. There is no eminent shortage of potable water. The local geology prohibits reuse to hold back seawater intrusion. There are no requirements to supplement stream flow. All irrigation demands are currently being met with imported water or groundwater and the cost for reuse water exceeds the cost of other water supply options.

APPENDIX A - BACKGROUND INFORMATION BACKUP

CITY OF MORRO BAY

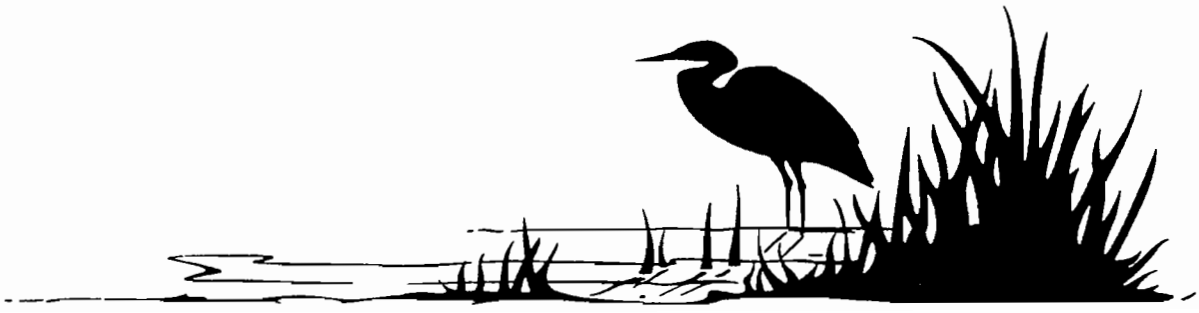
1998 ANNUAL WATER QUALITY REPORT

The State of California Department of Health Services (DOHS) requires all water purveyors to annually report their water quality characteristics. Copies of this report are being sent to customers at their billing address. Those of you with tenants are encouraged to furnish them with copies of this report; or to notify them that copies are available at City Hall, 595 Harbor St. If you have any questions, you many call (805) 772-6261.

During the calendar year 1998, 97% of the City's water was provided by the State water system. Well water from the Chorro and Morro Basins was used to supplement State water on a few occasions. Water in the municipal system is tested independently by a certified laboratory. State water is also tested at the Polonio Pass Water Treatment Plant.

The following items are defined to hopefully make the report more understandable:

Primary Standards: intended to protect public health against substances in water that may be harmful to humans if consumed for long periods.
Secondary Standards: ensure aesthetic quality of water, such as taste, odor, or clarity. These standards govern substances that may influence customer acceptance of water, rather than its healthfulness.
mg/l: milligrams per liter; a unit of concentration equivalent to parts per million. One part per million is equivalent to 1 cent in $10,000; I minute in 2 years; 1 inch in 16 miles.



PRIMARY STANDARDS

PARAMETER	UNITS	MCL	MCLG	PHG	MORRO & CHORRO PRODUCT WATER		STATE WATER PRODUCT WATER	
					RANGE	AVERAGE	RANGE	AVERAGE
Microbiological								
Coliform Bacteria (% of tests positive)	%	5		0			0 - 1	0.16
Organic Chemicals								
Total Trihalomethanes	mg/l	0.1			.005 - .074	.041	.018 -.038	.027
Volatile Organics					26 chemicals tested for - none detected			
Synthetic Organics					12 chemicals tested for -none detected			
Pesticides					24 chemicals tested for - none detected			
Additional Unregulated					36 chemicals tested for - none detected			
Inorganic Chemicals								
Aluminum	mg/l	1.0	ns	ns	0 - .33	.05	< .05 - .061	.051
Arsenic	mg/l	0.05	0	ns	nd		nd	
Barium	mg/l	1.0	2.0	ns	0 - .14	.07	nd	
Cadmium	mg/l	0.01	ns	.005	nd		nd	
Chromium	mg/l	0.05	0.1	ns	0 - .02	.005	nd	
Fluoride	mg/l	2.0	ns	1.0	nd		.06 - .18	.085
Lead	mg/l	0.005	ns	.002	0 - .001	< .001	nd	
Mercury	mg/l	0.002	.002	.002	nd		nd	
Nitrate	mg/l	45.0	ns	45	19 - 39	28	8.1 - 29.2	15.5
Selenium	mg/l	0.05	ns	ns	nd		nd	
Radioactivity								
Gross Alpha Activity	pCi/l	15.0	ns	ns	.99 - 1.52	1.17	.88 - 2.98	2.79

SECONDARY STANDARDS

Clarity								
Turbidity	NTU	5.0	ns	ns	.8 - 7.0	3.1	.04 - .08	.08
Color	Units	15.0	ns	ns	0 - 5.0	5.0	2 - 8	3
Odor - Threshold	Units	3	ns	ns	nd		1	1
Chloride	mg/l	**	ns	ns	10 - 227	111	23 - 98	51
Foaming Agents (MBAS)	mg/l	0.5	ns	ns	nd		nd	
Iron	mg/l	0.3	ns	ns	.02 - .26	< .02	nd	
Copper	mg/l	1.0	ns	ns	< .05	< .05	nd	
Manganese	mg/l	0.05	ns	ns	.01 - .04	< .02	nd	
Silver	mg/l	0.05	ns	ns	nd		nd	
Sulfate	mg/l	**	ns	ns	67 - 180	75	28 -112	50
Zinc	mg/l	5.0	ns	ns	< .05	< .05	nd	
Total Dissolved Solids	mg/l	***	ns	ns	550 - 690	598	157 - 326	241
Methyl Tert-Butyl Ether (MTBE)	mg/l	.005	ns	ns	0 - .005	< .005	n/a	
Unregulated General Mineral								
pH	Units	no standard	ns	ns	7.5 - 8.0	7.7	7.9 - 8.7	8.4
Hardness	mg/l	*	ns	ns	128 - 632	509	60 - 127	95
Sodium	mg/l	*	ns	ns	39 - 102	65	25 - 77	44
Calcium	mg/l	*	ns	ns	28 - 98	69	14 - 27	19
Potassium	mg/l	*	ns	ns	.7 - 2.3	1.2	n/a	
Magnesium	mg/l	*	ns	ns	14 - 114	77	6 - 16	11
Total Alkalinity	mg/l	*	ns	ns	230 - 472	394	51 - 95	77
Corrosivity	L. I.	*	ns	ns	non-corrosive		non-corrosive	

LEAD & COPPER RULE (2nd round of monitoring October 1998)

Copper	mg/l	1.3	ns	0.17	n/a	n/a	0 - .16	.05
Lead	mg/l	0.015	ns	0.002	n/a	n/a	0 - .027	<.002

< = less than nd = not detected ns = no standard MCL = Maximum Contaminant Level

MCLG = Maximum Contaminant Level Goal. The level of a contaminant in drinking water below which there is no known or expected risk to health. Established by the Federal Environmental Protection Agency.

PHG = Public Health Goal. The level of a contaminant in drinking water below which there is no known or expected risk to health. Established by the California Environmental Protection Agency

** = 250, 500, 600 (lower, recommended, upper limit)
*** = 500, 1000, 1500 (recommended, upper, short-term limit)

Cayucos

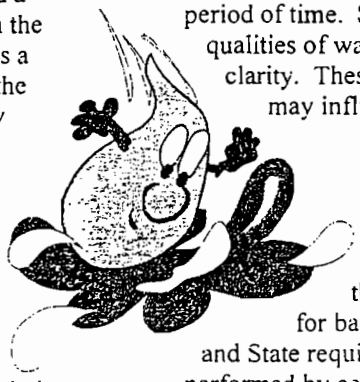
Annual Water Quality Report

To Our Customers

The Paso Robles Beach Water Association and Morro Rock Mutual Water Company are pleased to present this annual report describing the quality of your drinking water. We sincerely hope this report gives you the information you seek and have a right to know.

What is the source of my drinking water?

Your water comes from Whale Rock Reservoir and a groundwater well located adjacent to Cayucos on the east side of Highway One. Whale Rock Reservoir has a total capacity of 40,660 acre-feet and is managed by the City of San Luis Obispo. No swimming or other body contact sports are allowed on the reservoir in order to minimize viral contamination from human contact. Water from the reservoir is piped downstream to the Cayucos Water Treatment Plant (WTP) where it is filtered and chlorinated prior to distribution.



Treated water is distributed to the Cayucos Area Water Organization (CAWO) which consists of three water agencies, Paso Robles Beach Water Association (PRBWA), Morro Rock Mutual Water Company (MRMWC), and the County of San Luis Obispo (CSA-10A). These three agencies have a combined total entitlement of 582 acre-feet per year of Whale Rock Reservoir water and groundwater.

The Whale Rock Reservoir watershed is approximately 203 square miles in size and is susceptible to the following potential sources of contamination: wastewater, animal grazing, recreational activities, unauthorized activities, use of pesticides/herbicides, geologic formations, and hazardous materials spills. The watershed is well managed and these potential sources of contamination are minimized.

How is the water system operated?

The Cayucos Water Treatment Plant is assigned one full-time water treatment operator. This operator is certified by the California Department of Health Services (DHS). He is a knowledgeable professional dedicated to maintaining an excellent water system and providing you with the best quality water possible.

Who sets water quality standards?

As directed by law, the United States Environmental Protection Agency (EPA) and the DHS have established standards for drinking water quality. These standards, known as maximum contaminant levels (MCLs), are divided into two categories: primary and secondary standards. Primary standards are health related standards. They are set to protect the public from substances in water that may be immediately harmful to humans or affect their health if consumed for a long period of time. Secondary standards govern the aesthetic qualities of water such as taste, odor, mineral content, and clarity. These standards specify limits for substances that may influence consumer acceptance of the water.

Where is the water tested?

Water sampling and analysis is performed by the San Luis Obispo County Water Quality Laboratory. The lab is certified by the DHS as an environmental testing laboratory for bacteriological and chemical analyses. Federal and State requirements dictate that all regulatory analyses be performed by certified labs following approved procedures.

The lab is well equipped and capable of detecting some contaminants at parts per trillion levels. The staff performs approximately 4,500 analyses each month for all systems operated by the County to help insure our operators deliver drinking water that meets all Federal and State requirements.

One acre-foot = 325,850 gallons

General Water Statistics 1998

Whale Rock Reservoir Water	289 acre-feet
Groundwater Production	110 acre-feet
Total Water Production	399 acre-feet
CSA-10A Delivery	128 acre-feet
PRBWA Delivery	155 acre-feet
MRMWC Delivery	116 acre-feet
Average Daily Demand	1.09 acre-feet
Month of Maximum Usage	July
Amount of Water Used in Month	48 acre-feet
MRMWC Storage Tank	200,000 gallons
PRBWA Storage Tank	250,000 gallons
MRMWC Service Meters	531
PRBWA Service Meters	742

Este Informe contiene informacíon muy importante. Traduscalo o hable con un amigo quien lo entienda bien.

Where can I get more information?

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDs or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791). This hotline operates from 9:00 a.m. to 5:00 p.m. EST, Monday through Friday. Brochures and other materials can also be requested through the hotline.

Additionally, the Office of Ground Water and Drinking Water at EPA maintains a website with useful information on drinking water. The address is http://www.epa.gov/OGWDW/.

TABLE OF CONTAMINANTS (Continued)		Cayucos WTP		CAWO Well	
SECONDARY STANDARDS – AESTHETIC STANDARDS					
Contaminant	**MCL**	**Range**	**Average**	**Range**	**Average**
Aluminum	200 ppb	170 - 470	320	5	5
Chloride	250-500-600** ppm	25 - 31	27	38 - 48	45
Color	15 CU	1 - 3	2	1 - 2	1
Corrosivity	Noncorrosive (LI)	0.2 – 0.6	0.4	0.3	0.3
Iron	300 ppb	<5 - 20	9	<5 - 10	6
Manganese	50 ppb	<5 - 100	24	<5 - 13	9
Odor – Threshold	3 TON	1 - 4	2	1 – 1.4	1
pH	6.5 – 8.5	7.44 – 8.29	7.7	7.18 – 8.33	7.5
Specific Conductance	900-1600-2200 **µmhos/cm	548 - 640	580	740 - 814	780
Sulfate	250-500-600** ppm	63 - 68	65	46 - 54	50
Total Dissolved Solids	500–1000-1500** ppm	360 - 460	420	452 - 540	500
ADDITIONAL UNREGULATED CONSTITUENTS					
Bicarbonate Alkalinity	NS (ppm)	190 - 240	210	310 - 340	320
Bromodichloromethane	NS (ppb)	9.8	9.8	ND	ND
Calcium	NS (ppm)	40 - 79	53	59 – 62	61
Chloroform	NS (ppb)	21	21	ND	ND
Dibromochloromethane	NS (ppb)	3.1	3.1	ND	ND
Magnesium	NS (ppm)	30 - 41	34	44 - 50	47
Sodium	NS (ppm)	27 - 35	30	42.2 - 47	44
Total Hardness	NS (ppm)	240 - 290	260	329 - 360	350

Additional information can be obtained by accessing the American Water Works Association's website at http://www.awwa.org or by calling Percy Garcia at 781-5111 or John Beaton at 781-5109 at the County Water Quality Laboratory.

My water smells and tastes funny sometimes; what's the problem?

Taste and odor problems in the water this year were associated with Actinomycetes and Cyanobacteria (blue-green algae), which produce geosmin, an earthy smelling compound, and 2-methylisoborneol (MIB), a musty smelling compound. Though these compounds may create an unpleasant taste and odor in your water, they pose no health risk. During the summer months, you might notice an increase in taste and odor levels. These tastes and odors can be difficult to treat even using the best available technology. Treatment Plant staff is currently evaluating modification of the treatment facility to handle this problem.

What is *Cryptosporidium*?

Cryptosporidium is a protozoan parasite, a one-celled animal too small to be seen without a microscope. It is common in surface waters (e.g., lakes and rivers), especially when these waters contain a high amount of sewage contamination or animal waste. *Cryptosporidium* is very hard to kill with disinfection, and even a well-run water treatment system cannot ensure that drinking water will contain no live parasites.

Cryptosporidium can cause symptoms that include diarrhea, nausea, and/or stomach cramps. Because many other organisms and conditions can produce these same symptoms, a special laboratory test is needed to find out whether *Cryptosporidium* is the cause. The parasite is found in the feces of infected humans or animals and must first be swallowed to cause illness.

Cryptosporidium can be spread by the ingestion of a very small amount of infected feces. Contamination can be spread by or to unwashed hands, surfaces inside and outside the home, food, drinking water, recreational water, and certain sexual practices.

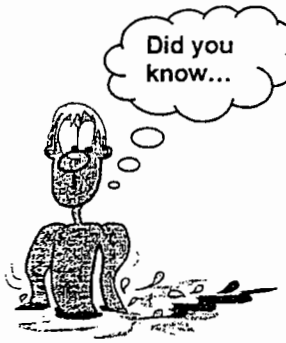
When infected, people with severely weakened immune systems are likely to develop more severe and longer lasting symptoms than healthy individuals. Immuno-compromised individuals may wish to speak with their health care providers about how best to protect themselves against *Cryptosporidium* infection from all sources. **The DHS has indicated the general public currently needs no precautions against *Cryptosporidium* when drinking Cavucos water.**

What is *not* in your Drinking Water

The following is a list of chemicals tested for but not found in your drinking water.

Antimony • Arsenic • Asbestos • Beryllium • Cadmium • Cyanide • Mercury • Nitrite • Silver • Thallium • Coliform Bacteria • MBAS(foaming agents) • Zinc • Alachlor • Aldicarb • Atrazine • Bentazon • Benzene • Bromocil • Carbaryl • Carbofuran • Carbon tetrachloride • Chlordane • *cis*-1,2-dichloroethylene • Dalapon • Diazinon • Dibromochloropropane (DBCP) • Dicamba • Dichloromethane • Dimethoate • Dinoseb • Diquat • Diuron • Endrin • Ethylbenzene • Ethylene dibromide • Heptachlor • Heptachlor epoxide • Lindane • Methomyl • Methoxychlor • Molinate • Monochlorobenzene • MTBE • Oxamyl (Vydate) • Picloram • Polychlorinated biphenyls (PCB) (as $C_{12}Cl_{10}$) • Prometryn • Simazine • Styrene • Tetrachloroethylene • Thiobencarb • Toluene • Toxaphene • *trans*-1,2-dichloroethylene • Trichloroethylene • Trichlorofluoromethane • Trichlorotrifluoroethane • Vinyl chloride • Xylenes • 1,1,1-trichloroethane • 1,1,2,2-tetrachloroethane • 1,1,2-trichloroethane • 1,1-dichloroethene • 1,1-dichloroethylene • 1,2,4-trichlorobenzene • 1,2-dichlorobenzene • 1,2-dichloroethane • 1,2-dichloropropane • 1,3-dichloropropene • 1,4-dichlorobenzene • 2,4,5-TP (Silvex) • 2,4-D • 3-hydroxycarbofuran •

In addition to the above constituents, we have conducted monitoring for 35 additional chemicals. These chemicals were also not detected in your water.



The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

In order to ensure that tap water is safe to drink, the EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. Federal Food and Drug Administration (FDA) regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants, such as salts and metals, can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive contaminants can be naturally occurring or be the result of oil and gas production and mining activities.

The following report summarizes contaminants found in your water. All analytical results are from January through December 1998, unless otherwise noted.

TABLE OF CONTAMINANTS

Contaminant	MCL	MCLG or PHG	Cayucos WTP Range	Cayucos WTP Average	CAWO Well Range	CAWO Well Average	Potential Source of Contamination
PRIMARY DRINKING WATER STANDARDS – MANDATORY HEALTH RELATED STANDARDS							
Aluminum	1000 ppb	---	170 - 470	320	5	5	Addition of chemical coagulant
Barium	1000 ppb	2000	110 - 160	140	120	120	Erosion of natural deposits
Chromium	50 ppb	100	<0.5 – 0.9	0.6	0.5	0.5	Erosion of natural deposits
Copper	AL = 1300 ppb	170	7 – 1170 (1996)	930 (90th percentile)	ND	ND	Corrosion of household plumbing; erosion of natural deposits
Fluoride	1.4 – 2.4 ppm	1	0.30 – 0.34	0.32	0.39	0.39	Erosion of natural deposits
Gross Alpha Particle Activity	15 pCi/L	---	0.9±2 – 1.0±1 (1997)	1 ± 1 (1997)	0.1±1 - 0.9 ±1	0.5 ± 1	Erosion of natural deposits
Lead	AL = 15 ppb	2	<1 – 4.1 (1996)	2.4 (90th percentile)	ND	ND	Corrosion of household plumbing; erosion of natural deposits
Nickel	100 ppb	100	<2 – 2.7	2.2	<2	<2	Erosion of natural deposits
Nitrate (as N)	10000 ppb	10000	110 - 220	160	680 - 940	770	Runoff from fertilizer use; leaching from septic tanks, sewage, erosion of natural deposits
Selenium	50 ppb	50	<2 – 2.4	2.2	2.6	2.6	Erosion of natural deposits
Total Trihalomethanes	100 ppb	---	33.7	33.7	ND	ND	By-product of drinking water chlorination
Turbidity	TT (NTU)*	---	0.03 – 0.20	0.05	0.08 – 0.25	0.13	Soil runoff

DEFINITIONS

Maximum Contaminant Level Goal (MCLG) and Public Health Goal (PHG) – The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the Federal Environmental Protection Agency and PHGs are set by the California Environmental Protection Agency.

Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible.

Primary Drinking Water Standard – Includes MCLs for contaminants that affect health, surface water treatment requirements, and the monitoring and reporting requirements for required constituents.

Treatment Technique (TT) – A required process intended to reduce the level of a contaminant in drinking water.

Action Level (AL) – The concentration of a contaminant which, if exceeded, triggers a treatment or other requirement which a water system must follow.

NS = No Standard
ND = Not Detected
pCi/L = picoCuries per liter
ppm = parts per million, or milligrams per liter (mg/L)
ppb = parts per billion, or micrograms per liter (µg/L)
NTU = Nephelometric Turbidity Unit
TON = Threshold Odor Number
LI = Langelier Index; Noncorrosive = Any positive value, Corrosive = Any negative value

* A treatment technique has been established for turbidity at Cayucos WTP. The turbidity of 95% of samples collected every four hours must fall below the MCL of 0.5 NTU. The MCL was not exceeded for this plant. This water system is committed to consistently keeping the turbidity at 0.3 NTU or lower in order to help insure that the water is free of any disease causing organisms.

** Recommended - Upper - Short Term MCL

What other regulations are on the horizon?

The EPA finalized several new regulations which will affect some water systems. Systems having a surface water source will see tightened turbidity performance criteria and a requirement for individual filter monitoring. Other new regulations call for the establishment of benchmarks to assure adequate disinfection when systems attempt to lower disinfection by-products. Maximum disinfectant levels and goals for chlorine, chloramine, and chlorine dioxides have also been proposed.

Systems having a groundwater source will be required to conduct periodic sanitary surveys based on source water assessments and other relevant information. The rule will include source water monitoring requirements for systems that detect coliform bacteria.

Hundreds of water systems in the U.S. are taking part in a major drinking water testing program known as the Information Collection Rule. This program will gather information on drinking water contaminants and will be used to revise drinking water safety standards.

Where can the community participate in decisions regarding water quality?

The Morro Rock Mutual Water Co. and Paso Robles Beach Water Assoc. meet the first Tuesday of each month at 9:30 a.m. The meeting is held at the Cayucos Fire Station, 201 Cayucos Drive, Cayucos California. The Cayucos Area Water Organization (CAWO) meets the first Monday of each month at the same location as above at 1:30 p.m.

Our goal is to always provide a high level of service to our customers. If you have questions about this report or concerning your water utility, please contact Ron Boyte or Ethel Girard at your water company office, (805) 995-3766. Office hours are 9:00 a.m. to 5:00 p.m. Monday through Friday. In addition, the office phone is our 24-hour emergency number.

Morro Rock Mutual Water
Paso Robles Beach Water Association
201 Cayucos Drive
Cayucos, CA 93430

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Permit No. 315

Comparision of Morro Bay Water											
		Morro Bay Well Number									Average
	Units	3	4	9	10a	10	11	12	15	16	Well Data
pH		7.7	7.6	7.3	7.2	8		7.2	7.6	7.7	7.5
Salinity											
EC	dS/m	0.62	1.33	1	1.5	1.17		1.6	1.01	1.06	1.2
TDS	mg/L	450	810	590	850	710		930	615	645	700.0
Permeability											
SAR											--
Elemental											
Na^+	mg/L	85	58	38	52	48	77	82	45	39	58.2
Cl^-	mg/L	28	118	49	110	81.2	10	150	79.3	58.7	76.0
Ca^{2+}	mg/L	28	90	57	79	56	55	69	70	54	62.0
Mg^{2+}	mg/L	14.2	92	86	120	100	100	110	69	92	87.0
B	mg/L										
Compounds											
HCO_3	mg/L as $CaCO_3$	281	519	420	610	533	470	620	440	507	488.9
NH_4	mg/L										--
NO_3	mg/L			39	62		20	49			18.9
Combined Nitrogen	mg/L										--
Total Alkalinity	mg/L as $CaCO_3$	230	425	420	500	437	390	510	361	415	409.8
Total Hardness	mg/L as $CaCO_3$	128	603	490	660	551		620	459	514	503.1

Comparision of Morro Bay Water							
		Cayucos	CAWO	Morro Bay	Morro Bay	Morro Bay	Morro Bay
	Units	WTP	Well	Effluent #1	Effluent #2	Effluent #3	Effluent Ave.
pH		7.5	7.6	7.6	7.6	7.6	7.6
Salinity							
EC	dS/m	0.6	0.8	1.7	1.8	1.7	1.7
TDS	mg/L	420.0	500.0	830.0	930.0	840.0	866.7
Permeability							
SAR		--	--	5.4	6.1	5.5	5.7
Elemental							
Na^+	mg/L	30.0	44.0	200.0	230.0	200.0	210.0
Cl^-	mg/L	27.0	45.0	290.0	340.0	270.0	300.0
Ca^{2+}	mg/L	53.0	61.0	47.0	48.0	45.0	46.7
Mg^{2+}	mg/L	34.0	47.0	37.0	38.0	35.0	36.7
B	mg/L			0.5	0.5	0.4	0.5
Compounds							
HCO_3	mg/L as $CaCO_3$	210.0	320.0	340.0	210.0	330.0	293.3
NH_4	mg/L	--	--	33.0	22.0	32.0	29.0
NO_3	mg/L	160.0	770.0				--
Combined Nitrogen	mg/L	--	--	36.0	35.0	39.0	36.7
Total Alkalinity	mg/L as $CaCO_3$	210.0	320.0	340.0	210.0	330.0	293.3
Total Hardness	mg/L as $CaCO_3$	260.0	350.0	270.0	270.0	250.0	263.3

APPENDIX B - REGULATIONS/PERMITS

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
WASTE DISCHARGE REQUIREMENTS
ORDER NO. 98-15

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IX, SAN FRANCISCO, CA
NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM PERMIT NO. CA0047881

FOR

CITY OF MORRO BAY AND CAYUCOS SANITARY DISTRICT
SAN LUIS OBISPO COUNTY

The California Regional Water Quality Control Board, Central Coast Region (Regional Board), and the Regional Administrator, Environmental Protection Agency, Region IX (EPA), find that:

1. The City of Morro Bay and Cayucos Sanitary District (Dischargers), jointly own wastewater treatment and disposal facilities operated by the City of Morro Bay. Each entity operates the collection system within its respective service area.

2. The wastewater treatment plant is located on property jointly owned by the City of Morro Bay and Cayucos Sanitary District (T29S, R10E, Section 25, MDB&M), as shown in Attachment A, included as part of this permit.

3. A modified National Pollutant Discharge Elimination System (NPDES) permit waiving secondary treatment requirements was originally issued to the Dischargers by the EPA and Regional Board on March 29, 1985 and reissued on March 8, 1993 (NPDES Permit No. CA0047881). The Dischargers applied for reissuance of its permit and 301(h) waiver on May 30, 1997. This permit expired March 8, 1998 and was administratively extended to December 11, 1998. The Dischargers' application requests renewal of the following effluent limitations:

	Monthly (30-day average)	Maximum (at any time)
Biochemical Oxygen Demand (mg/l)	120	180
Suspended Solids (mg/l)	70	105

These effluent limitations are based on the Morro Bay/Cayucos Wastewater Facility design specifications for combined primary and secondary effluent quality under peak seasonal dry weather flow of 2.36 million gallons per day (MGD).

4. EPA summarized its evaluation of the City of Morro Bay's 301(h) application and drafted a tentative decision which was issued on September 3, 1998, granting the Dischargers' request for reissuance of its 301(h) modified NPDES permit. The Tentative Review Report evaluated discharge of effluent through the year 2007, as follows:

	Current		Limits
Parameter	Average	2007	Proposed
Flow (MGD)	1.6	1.82	2.06

5. The treatment facilities provide treatment by a split-stream process of physical and biological treatment. All wastewater flows through primary sedimentation basins. A portion is then diverted through secondary treatment facilities including trickling filter, solids-contact, and secondary clarification. Secondary-treated wastewater is then blended with primary-treated wastewater and disinfected by chlorination/dechlorination prior to discharge to the Pacific Ocean. Biosolids are anaerobically digested and dried, and then used as a soil conditioner. The treatment plant has the following design capacities:

Average Dry Weather Flow	2.06 MGD
Peak Seasonal Dry Weather Flow	2.36 MGD
Maximum Wet Weather Flow	6.64 MGD

Diagram of the treatment processes is depicted on Attachment B, included as part of this permit.

6. Treated municipal wastewater is discharged to the Pacific Ocean through a 4400 foot (1340 m) outfall/diffuser system. The outfall terminates in the Pacific Ocean (35°23'11"N Latitude, 120°52'29"W Longitude) in approximately 50 feet (15 m) of water. The outfall location is shown in Attachment A. Alternative locations and methods of disposal or recycling, including land based alternatives, were considered during planning under the Clean Water Grants Program.

7. The State Water Resources Control Board adopted a revised Water Quality Plan for Ocean Waters of California (Ocean Plan) effective July 23, 1997. The Ocean Plan contains water quality objectives and other requirements governing discharges to the Pacific Ocean.

8. The Water Quality Control Plan, Central Coastal Basin (Basin Plan), was adopted by the Board and approved on September 8, 1994. The Basin Plan incorporates statewide plans and policies by reference and contains a strategy for protecting beneficial uses of the Pacific Ocean.

9. The Regional Board and EPA classify the discharge as a major discharge (>1.0 MGD) and the Dischargers are defined as a small applicant for 301(h) modified permit (<5 MGD) according to 40 CFR 125.58(c).

10. Existing and anticipated beneficial uses in the vicinity of the discharge include:

    a. Water contact recreation;
    b. Non-contact water recreation;
    c. Industrial water supply;
    d. Navigation;
    e. Marine habitat;
    f. Shellfish harvesting;
    g. Commercial and sport fishing;
    h. Rare, threatened or endangered species;
    i. Wildlife habitat

11. By letter dated July 27, 1998, staff of the Regional Board indicated its tentative determination that the proposed altered discharge, as described in the City of Morro Bay's 301(h) application, would comply with applicable state laws, including water quality standards, and would not result in additional treatment, pollution control, or other requirements on any other point or nonpoint source. This tentative determination complies with requirements specified in 40 CFR 125.61(b)(2) and 125.64(b) of the 301(h) regulations dated July 1, 1991.

12. The Dischargers have provided certification in a letter, dated July 30, 1998, from the National Marine Fisheries Service (NMFS) that the proposed 301(h) discharge is not expected to impact local critical habitats and/or endangered species. Additional certification is provided in a letter, dated September 18, 1998, from the U. S. Fish and Wildlife Service that continuation of the proposed 301 (h) discharge is not expected to impact endangered species.

13. The Dischargers are exempt from applicable pretreatment requirements specified under 40 CFR 125.66(d). In accordance with requirements specified in Section D ('Pretreatment Specifications/Pollution Prevention Program') of this Order and Permit, the Dischargers shall implement public education and waste minimization/source

reduction programs to limit the introduction of toxic pollutants and pesticides into the treatment plant. Implementation of 'Pollution Prevention Program' will substitute for those requirements specified under 40 CFR 125.66 (d) (Nonindustrial Source Control Program).

14. Receiving Water Limitations of this Order and Permit (Section C, No. 15) establish bacteriological objectives for areas where shellfish may be harvested for human consumption, as determined by the Regional Board. Shellfish are known to be harvested along Morro Strand (Atascadero State Beach) as well as inside Morro Bay.

15. The requirements contained in this Order and Permit are based on the Basin Plan, Ocean Plan, other federal and state plans and policies, current plant performance, and best professional judgment. Effluent limitations in this Order and Permit based on California Ocean Plan numerical objectives and U.S. EPA Water Quality Criteria (Acute and Chronic toxicity and Consumption of Marine Fish) were calculated using a minimum dilution ratio of 133:1 (i.e., 133 parts sea water to one part effluent).

16. The issuance of waste discharge requirements for this discharge is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Division 13, Chapter 3, Section 2100, et seq.) in accordance with Section 13389 of the California Water Code.

17. A permit and the privilege to discharge waste into waters of the State is conditional upon the discharge complying with provisions of Division 7 of the California Water Code and of the Clean Water Act (as amended or as supplemented by implementing guidelines and regulations), and with any more stringent effluent limitations necessary to implement water quality control plans, to protect beneficial uses, and to prevent nuisance. This order and permit shall serve as a National Pollutant Discharge Elimination System (NPDES) permit pursuant to section 402 of the Clean Water Act or amendments there to, and as waste discharge requirements pursuant to the California Water Code. Compliance with this order and permit should assure conditions are met and mitigate any potential changes in water quality due to the project.

18. On September 2, 1998, EPA Region IX and the Regional Board notified the Dischargers, and other interested agencies and persons of their intent to renew waste discharge requirements for this discharge, and incorporate modifications to the secondary treatment limitations, and has provided these interested parties with an opportunity to submit their written views and recommendations.

19. In a public hearing on December 11, 1998, EPA Region IX and the Regional Board heard and considered all comments pertaining to the discharge and found this Order and Permit consistent with the above findings.

IT IS HEREBY ORDERED, pursuant to authority in section 13377 of the California Water Code, that the City of Morro Bay and Cayucos Sanitary District, their agents, successors and assignees, may discharge wastes from the jointly owned wastewater treatment plant providing they comply with the following:

(Note: General permit conditions, definitions and the method of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for National Pollutant Discharge Elimination System Permits", dated January, 1985, and included as part of this Order and Permit.)

Throughout these requirements footnotes are listed to indicate the source of requirements specified. Requirement footnotes are as follows:

A = California Ocean Plan
B = Basin Plan
C = Thermal Plan
D = 40 CFR 122, 133 and 203

Requirements not referenced are based on Regional Board and U.S. EPA staff's professional judgment.

A. DISCHARGE PROHIBITIONS

1. The discharge of treated wastewater at a location other than 35°23'11"N Latitude, 120°52'29"W Longitude, is prohibited.

2. Bypass of the treatment facility and discharge of any wastes not meeting the discharge specifications of this Order and Permit is prohibited.

3. Discharge of any wastes including overflow, bypass and seepage from transport, treatment or disposal systems is prohibited.

B. EFFLUENT LIMITATIONS[1,2]

1. The Dischargers shall, as a 30-day average, remove at least 75% of suspended solids and 30% of BOD from the influent stream before discharging wastewater to the ocean, except that the limit shall not be less than 60 mg/l. In addition, effluent shall not exceed the following limits:

Constituent	Unit of Measurement	Monthly (30-Day) Average	Maximum At Any Time
BOD, 5-day	mg/l	120	180
	lbs/day	2062	3092
	kg/day	936	1404
Suspended Solids	mg/l	70	105
	lbs/day	1203	1804
	kg/day	546	819

2. Effluent shall not exceed the following limits:[A]

a.

Constituent	Unit of Measurement	Monthly (30-Day) Average	Weekly (7-Day) Average	Maximum At Any Time
Grease and Oil	mg/l	25	40	75
	lbs/day	430	687	1288
	kg/day	195	312	585
Settleable Solids	ml/L	1.0	1.5	3.0
Turbidity	NTU	75	100	225
pH	Within limits of 6.0 to 9.0 at all times.			
Acute Toxicity	TUa	1.5	2.0	2.5

b. FOR PROTECTION OF MARINE AQUATIC LIFE

Constituent	Units	Six-Month Median	Daily Maximum	Instantaneous Maximum
Arsenic	mg/l	0.67	3.89	10.3
Cadmium	mg/l	0.13	0.54	1.34
Chromium (Hexavalent)[3]	mg/l	0.27	1.07	2.68
Copper	mg/l	0.14	1.34	3.75
Lead	mg/l	0.27	1.07	2.68
Mercury	mg/l	0.005	0.021	0.054
Nickel	mg/l	0.67	2.68	6.70
Selenium	mg/l	2.01	8.04	20.1
Silver	mg/l	0.07	0.35	0.92
Zinc	mg/l	1.62	9.66	25.7
Cyanide	mg/l	0.13	0.54	1.34
Total Chlorine Residual	mg/l	0.27	1.07	8.04
Ammonia (as N)	mg/l	80.4	322	804
Phenolic Compounds (non-chlorinated)	mg/l	4.02	16.1	40.2
Chlorinated Phenolics	mg/l	0.13	0.54	1.34
Endosulfan[4]	ug/L	1.21	2.41	3.62
Endrin	ug/L	0.27	0.54	0.80
HCH[5]	ug/L	0.54	1.07	1.61
Chronic Toxicity[6]	TUc	---	134.0	----
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269, of the California Code of Regulations.			

c. FOR PROTECTION OF HUMAN HEALTH-NON-CARCINOGENS

Constituents	Units	30-day Average
acrolein	mg/l	29.5
antimony	mg/l	160.8
bis (2-chloroethoxy) methane	mg/l	0.59
bis (2-chloroisopropyl) ether	mg/l	160.8
chlorobenzene	mg/l	76.4
chromium (III)[3]	mg/l	25500
di-n-butyl phthalate	mg/l	469
dichlorobenzenes[7]	mg/l	683
1,1-dichloroethylene	mg/l	951
diethyl phthalate	mg/l	4420
dimethyl Phthalate	mg/l	109900
4,6-dinitro-2-methylphenol	mg/l	29.5
2,4-dinitrophenol	mg/l	0.54
ethylbenzene	mg/l	549
fluoranthene	mg/l	2.0
hexachlorocyclopentadiene	mg/l	7.8
isophorone	mg/l	20100
nitrobenzene	mg/l	0.66
thallium	mg/l	1.88
toluene	mg/l	11400

Constituents	Units	30-day Average
1,1,2,2-tetrachloroethane	mg/l	160.8
tributyltin	mg/l	0.00019
1,1,1-trichloroethane	mg/l	72400
1,1,2-trichloroethane	mg/l	5760

d. FOR PROTECTION OF HUMAN HEALTH-CARCINOGENS

acrylonitrile	ug/L	13.4
aldrin	ng/L	2.95
benzene	mg/l	0.79
benzidine	ng/L	9.25
beryllium	ug/L	4.42
bis (2-chloroethyl) ether	ug/L	6.03
bis (2-ethylhexyl) phthalate	mg/l	0.47
carbon tetrachloride	mg/l	0.12
chlordane[8]	ng/L	3.08
chloroform	mg/l	17.4
DDT[9]	ng/L	22.8
1,4-dichlorobenzene	mg/l	2.41
3,3-dichlorobenzidine	ug/L	1.09
1,2-dichloroethane	mg/l	17.4
dichloromethane	mg/l	60.3
1,3-dichloropropene	mg/l	1.19
dieldrin	ng/L	5.36
2,4-dinitrotoluene	mg/l	0.35
1,2-diphenylhydrazine	mg/l	0.021
halomethanes[10]	mg/l	17.4
heptachlor[11]	ng/L	96.5
hexachlorobenzene	ng/L	28.1
hexachlorobutadiene	mg/l	1.88
hexachloroethane	mg/l	0.34
N-nitrosodimethylamine	mg/l	0.98
N-nitrosodiphenylamine	mg/l	0.34
PAHs[12]	ug/L	1.18
PCBs[13]	ng/L	2.55
TCDD equivalents[14]	pg/L	0.52
tetrachloroethylene	mg/l	13.3
toxaphene	ng/L	28.1
trichloroethylene	mg/l	3.62
2,4,6-trichlorophenol	mg/l	0.04
vinyl chloride	mg/l	4.82

e. The effluent mass emission rate shall not exceed the Maximum Allowable Mass Emission Rate as described in the Standard Provisions and Reporting Requirements.

f. Violations of the Instantaneous Maximum or Maximum Allowable Daily Mass Emission Rate must be reported to the Regional Board within 24-hours.

4. The effluent peak seasonal dry weather flow shall not exceed a monthly average of 2.36 MGD (0.103 m^3/day).

5. Total coliform bacteria in effluent shall not exceed a 30-day median of 23 MPN/100 ml and a maximum of 2400 MPN/100 ml.

6. Effluent must be essentially free of:[A]

   a. Material that is floatable or will become floatable upon discharge.
   b. Settleable material or substances that may form sediments which will degrade benthic communities or other aquatic life.
   c. Substances that will accumulate to toxic levels in marine waters, sediments or biota.
   d. Substances that significantly decrease the natural light to benthic communities.
   e. Materials that result in aesthetically undesirable discoloration of the ocean surface.

Footnotes (Effluent Limitations)

1. The daily mass emission calculations are based on the average design flow rate of 2.06 million gallons per day (MGD).

2. Based on Ocean Plan criteria using a calculated minimum initial dilution of 133:1. If actual dilution is found to be less than 133:1, these values will be recalculated.

3. The Dischargers may at its option meet this limitation as a Total Chromium limitation.

4. ENDOSULFAN shall mean the sum of endosulfan-alpha and -beta and endosulfan sulfate.

5. HCH means the sum of the alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.

6. Chronic Toxicity Units (TUc): TUc = 100/NOEL No Observed Effect Level (NOEL) is expressed as the maximum percent effluent or receiving water that causes no observable effect on a test organism, as determined by the result of a critical life stage toxicity test listed in Appendix II of the California Ocean Plan adopted and effective July 23, 1997.

7. Sum of 1,2- and 1,3-dichlorobenzene.

8. Sum of chlorodane-alpha, chlorodane-gamma, chlorodene-alpha, chlorodene-gamma, nonachlor-alpha and oxychlorodane.

9. Sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, and 2,4'-DDD.

10. Sum of bromoform, bromoethane (methylbromide), chloro-methane (methyl chloride), chlorodibromomethane and dichlorobromo-methane.

11. Sum of heptachlor and heptachlor epoxide.

12. Sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,1,2- benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]- anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenan-threne and pyrene.

13. Sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260.

14. Sum of the concentration of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below:

Isomer Group	Toxicity Equivalent Factor
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
octa CDD	0.001

Isomer Group	Toxicity Equivalent Factor
2,3,7,8-tetra CDF	0.1
1,2,3,7,8-penta CDF	0.05
2,3,4,7,8-penta CDF	0.5
2,3,7,8-hexa CDFs	0.1
2,3,7,8-hepta CDFs	0.01
octa CDF	0.001

C. RECEIVING WATER LIMITATIONS

(Receiving water quality is a result of many factors, some unrelated to the discharge. This permit considers these factors and is designed to minimize the influence of the discharge to the receiving water.)

The discharge shall not cause:

1. The following bacterial objectives to be exceeded throughout the water column within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas outside this zone used for water contact sports, as determined by the Board, but including all kelp beds:[A]

Parameter Applicable	Total Coliform Organisms (MPN/100 ml)	Fecal Coliform Organisms (MPN/100 ml)
Log Mean (30-day period)	---	200
90% of samples (60-day period)	---	400
80% of samples (60-day period)	1,000	---
Maximum*	10,000	---

* Verified by a repeat sample taken within 48 hours.

2. The following bacterial limits to be exceeded in the water column at all areas where shellfish may be harvested for human consumption, as determined by the Regional Board.[A]

Parameter Applicable to any 30-day period	Total Coliform Organisms (MPN/100 ml)
Median	70
90% of samples	230

3. Floating particles and oil and grease shall not be visible on the ocean surface.[A]

4. Aesthetically undesirable discoloration of the ocean surface.[A]

5. Significant reduction in the transmittance of natural light at any point outside the initial dilution zone.[A]

6. Change in the rate of deposition and the characteristics of inert solids in ocean sediments such that benthic communities are degraded.[A]

7. The dissolved oxygen concentration outside the zone of initial dilution to fall below 5.0 mg/l[B] or to be depressed more than 10 percent from that which occurs naturally.[A]

8. The pH outside the zone of initial dilution to be depressed below 7.0, raised above 8.3,[B] or changed more than 0.2 units from that which occurs naturally.[A]

9. The dissolved sulfide concentration of waters in and near sediments to be significantly increased above that present under natural conditions.[A]

10. The concentration in marine sediments of substances listed in the California Ocean Plan, Chapter IV, Table B to be

increased above levels which would degrade indigenous biota.[A]

11. The concentration of organic materials in marine sediments to increase above levels which would degrade marine life.[A]

12. Objectionable aquatic growths or degradation of indigenous biota resulting from the discharge of nutrients.[A]

13. Degradation of marine communities, including vertebrate, invertebrate, and plant species.[A]

14. Alteration of the natural tastes, odor, and color of fish, shellfish, or other marine resources used for human consumption.[A]

15. The concentrations of organic materials in fish, shellfish or other marine resources used for human consumption to bioaccumulate to levels that are harmful to human health.[A]

16. Degradation of marine life due to radioactive waste.[A,B]

17. Temperature of the receiving water to adversely affect beneficial uses.[C]

D. PRETREATMENT SPECIFICATIONS/POLLUTION PREVENTION PROGRAM

A Pretreatment Program or Pollution Prevention Program is a regulatory program administered by the Dischargers to prevent the introduction of pollutants into the POTW (publicly owned treatment works) which will interfere with the operation of the treatment works, pass through the treatment facility, reduce opportunities to recycle and reuse municipal wastewater and sludge, or expose POTW employees to hazardous chemicals. This permit implements pollution prevention requirements specified in 40 CFR Part 125.66(d) in lieu of the General Pretreatment Regulations specified in 40 CFR Part 403.

1. The Dischargers shall implement an ongoing pollution prevention program (approved by the Regional Board) to prevent the introduction of incompatible pollutants into the treatment works. At a minimum, the program shall include:

   a) Inventory all chemicals used for the operation and maintenance of the treatment plant that may enter the discharge and classify each according to its potential to cause toxicity to be present in the effluent. If toxicity data is not available for the chemicals used at the plant, and toxicity is found to be present in the effluent, the Dischargers should conduct toxicity tests on the individual chemicals that potentially contribute to effluent toxicity.

   b) Develop and implement a public educational program targeted at residential and commercial sources of toxic pollutants emphasizing the need to properly manage and minimize the disposal (i.e., source reduction) of potentially harmful pollutants (oil, antifreeze, pesticides, herbicides, paints, solvents, etc.).

   c) Develop and implement program(s) which provide convenient means for people to properly dispose of (and/or recycle) oil, antifreeze, pesticides, herbicides, paints, solvents, and other potentially harmful chemicals.

   d) Develop and implement waste minimization measures to reduce or eliminate incompatible pollutants discharged to the treatment plant. Waste minimization measures must address all significant controllable sources of pollutants including residential, industrial, and commercial sources.

   e) On an annual basis, to be submitted with the annual report specified in Standard Provisions and Reporting

Requirements, Section E.16, the Dischargers shall submit a status report to the EPA and Regional Board detailing efforts of compliance with regard to the 'Pollution Prevention Program' requirements specified herein.

f) In order to provide adequate legal authority for the Dischargers to protect its POTW, and to evaluate sources of industrial discharges, the Dischargers must perform the following activities:

1. Develop and implement a sewer use ordinance to provide the legal authorities described in 40 CFR 403.8(f)(1).

2. Update annually (and summarized in the annual report) industrial waste survey as described in 40 CFR 403.8 (f)(2)(i)-(ii).

3. Update annually (and summarized in the annual report) potential impacts of industrial discharges, identified in D.1.f)2. above, upon the POTW. The report must address the need for regulation of industrial discharges to implement the objectives of the pollution prevention program.

4. If, in the evaluation of D.1.f)2. and D.1.f)3. above, the Executive Officer determines that a formal pretreatment program is necessary to adequately meet program objectives, then the Dischargers shall develop such a program in accordance with 40 CFR 403.9.

5. The Dischargers shall comply, and ensure affected indirect Dischargers comply, with Paragraph No. D.1. of Standard Provisions and Reporting Requirements.

E. BIOSOLIDS REQUIREMENTS

1. The Discharger shall be responsible for meeting all applicable biosolids requirements contained in 40 CFR 257, 258, 501 and 503 as appropriate to the Discharger's biosolids disposal/reuse method(s), including monitoring, recordkeeping and reporting requirements. The Discharger shall be subject to enforcement actions, penalties, fines and other remedies by the EPA, or other appropriate parties, as provided in the CWA.

F. PROVISIONS

1. This Order and Permit shall serve as a National Pollutant Discharge Elimination System (NPDES) permit pursuant to Section 402 of the Clean Water Act or amendments thereto, and as waste discharge requirements pursuant to the California Water Code. This Order and Permit shall first be adopted by the Regional Board and then signed by the Regional Administrator. This Order and Permit shall become effective 30 days after the date of the signature by the Regional Administrator.

2. The requirements of this Order supersede requirements prescribed by Order No. 92-67, adopted by the Board on November 13, 1992. Order No. 92-67 is hereby rescinded.

3. The Dischargers shall comply with the attached "Monitoring and Reporting Program No. 98-15," as ordered by the Executive Officer and the Regional Administrator and included in this Order and Permit.^

4. The Dischargers shall comply with the attached "Standard Provisions and Reporting Requirements for the National Pollutant Discharge Elimination System," dated January 1985. Oral and written reports required by item C.4 that pertain to disinfection shall also be made available to active local mariculture growers, as identified by the California Department of Health Services.

Paragraph (a) of Standard Provision E.1 shall apply only if the bypass is for essential maintenance to assure efficient operation.

5. The Dischargers shall develop and implement a Spill Prevention Program, which shall be reviewed and updated as necessary by September 1, of every year. The Spill Prevention Program shall be developed in accordance with good engineering practices and shall identify and implement spill prevention measures and collection system management practices to ensure overflows and spills are minimized.

6. Dischargers shall implement toxicity identification and reduction evaluations and take appropriate remedial action to reduce toxicity to its required level, if the effluent toxicity limit is consistently exceeded.[A]

7. Dischargers shall conduct a bacterial assessment to identify the source(s), if Receiving Water Limitations, C.1 or C.2 are consistently exceeded or the following enterococcus densities are exceeded:[A]

Parameter Applicable	Enterococcus Organisms (MPN/100 ml)
Log Mean (30-day)*	24
Log Mean (6 month)*	12

*Log Mean shall be a moving average based on no less than five samples per month, spaced evenly over the time interval.

8. The discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Clean Water Act and regulations adopted thereunder. If more stringent water quality standards are promulgated or approved pursuant to Section 303 of the Clean Water Act or amendments thereto, the Regional Board and EPA will revise and modify this order and permit in accordance with such more stringent standards.

9. This Order and Permit expires five years after issuance of the final permit, and the Dischargers must file a Report of Waste Discharge with EPA Region IX and the Regional Board, in accordance with Title 23 of the California Administrative Code, no later than 6 months in advance of such date as application for issuance of new waste discharge requirements and NPDES permit.

10. By October 8, 1999, Dischargers shall submit a draft report summarizing comprehensive evaluation of reclamation options and feasibility. A final report shall be submitted by December 10, 1999. The report shall include (but not be limited to) evaluation of technical, financial and potential water quality issues, identification of the most cost effective alternative, and a recommendation.

11. A copy of these waste specifications shall be maintained at the discharge facility and be available at all times to operating personnel.

12. In the event of any change in name, ownership or control of these waste disposal facilities, the Dischargers shall notify the succeeding owner or operator of the existence of this Order by letter, copy of which shall be forwarded to the Regional Board and the Regional Administrator.

13. These requirements do not exempt the operator of this facility from compliance with any other laws, regulations and ordinances which may be applicable; they do not legalize this waste disposal facility, and they leave unaffected any further restraint on the disposal of wastes at this site which may be contained in other statutes or required by other agencies.

14. This Order and Permit may be modified, revoked and reissued, or terminated in accordance with the provision of 40 CFR 122.44, 122.62 - 122.64, 124.62 and 124.64. Cause for taking such action includes, but is not limited to failure to comply with any condition of this order, endangerment to human health or the environment resulting from the permitted activity or acquisition of newly obtained information which would have justified the application of different conditions if known at the time of order adoption and permit issuance. The filing of a request by the Dischargers for an order and permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated non compliance does not stay any condition of this order and permit.

This certifies that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Coast Region, on December 11, 1998, and of an NPDES permit issued by the U.S. Environmental Protection Agency, Region IX, on_____.

ROGER W. BRIGGS
Executive Officer, Central Coast Region
California Regional Water Quality Control Board

FELICIA MARCUS
Regional Administrator, Region IX
U.S. Environmental Protection Agency

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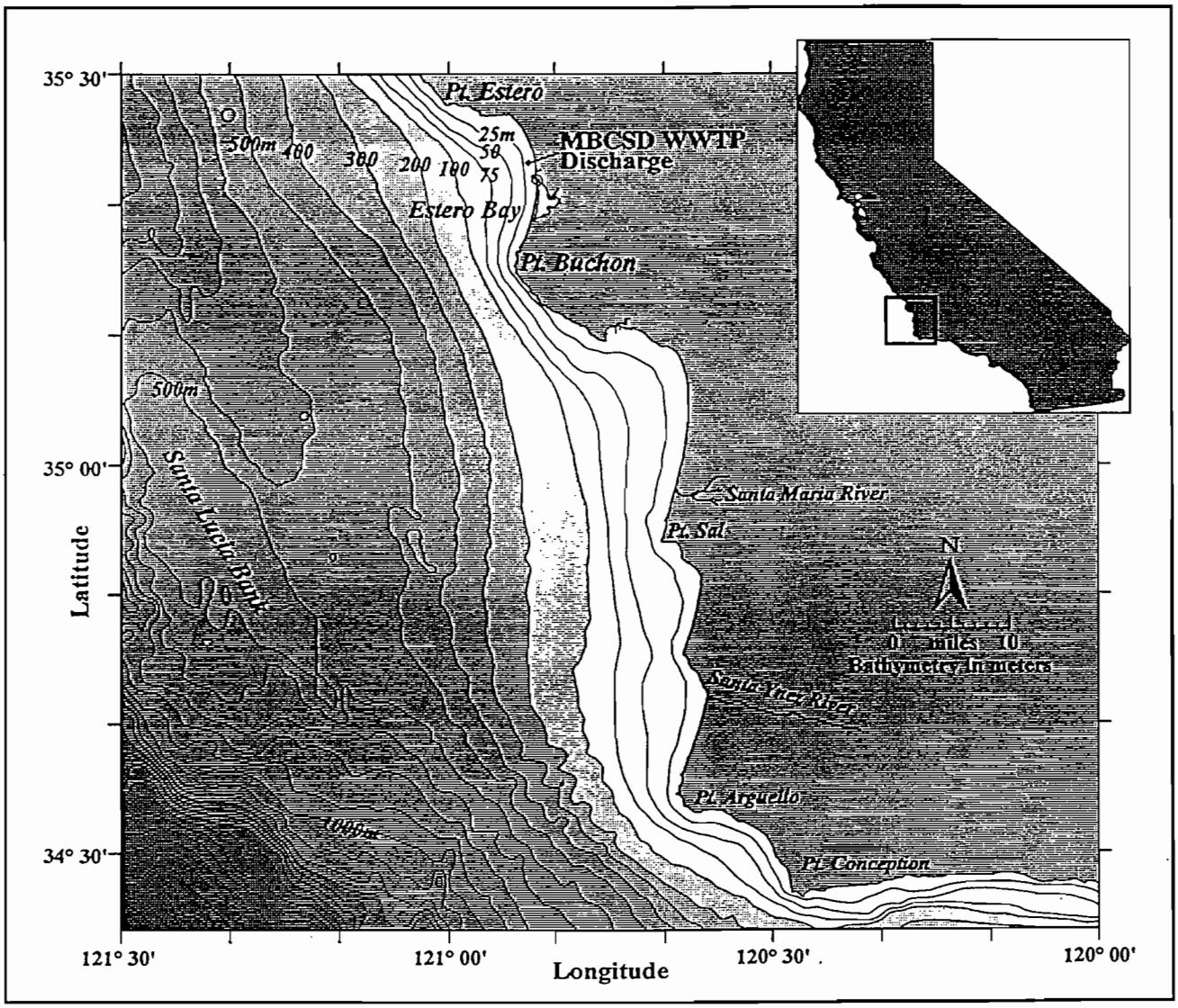
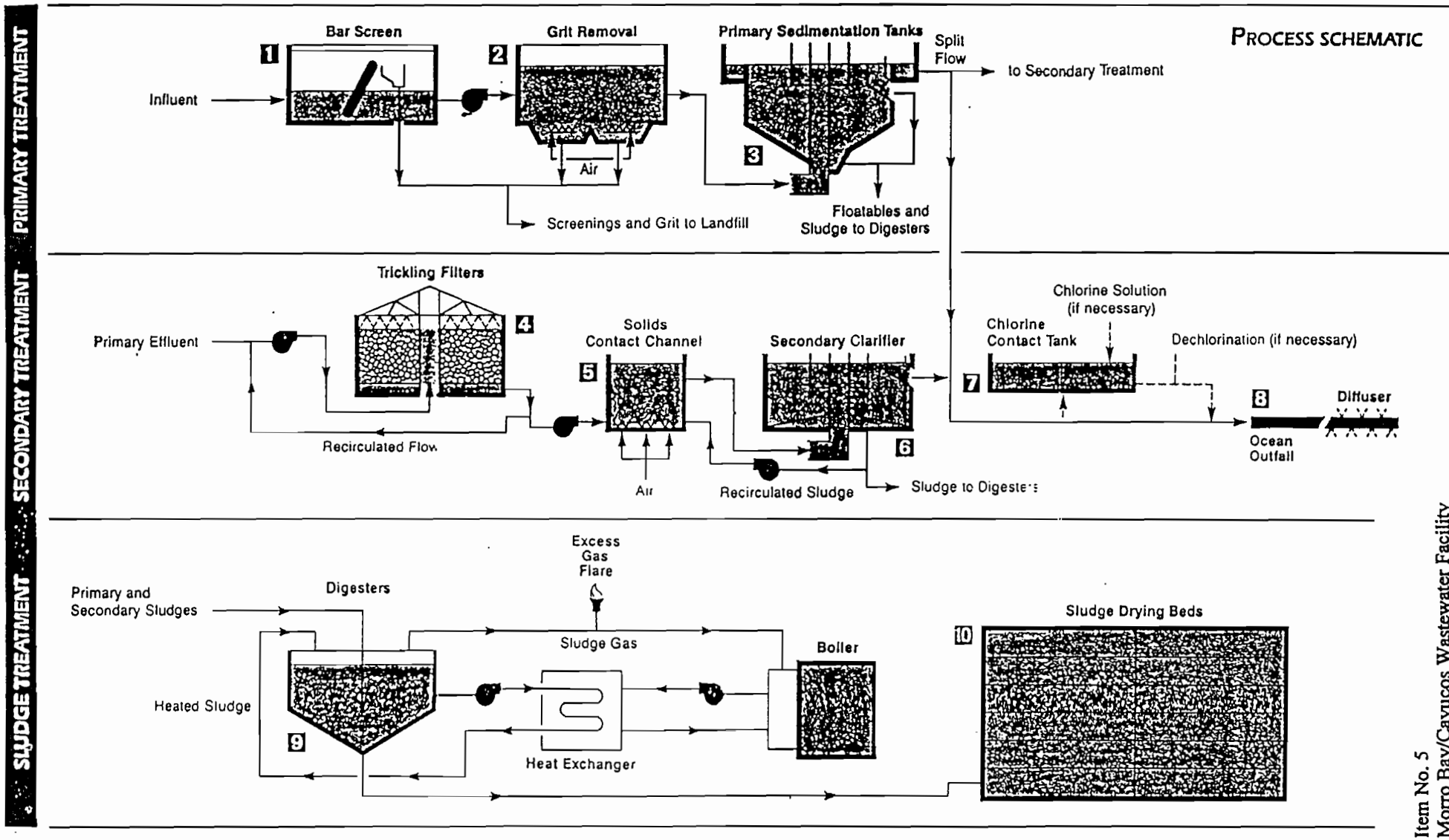
Attachment A

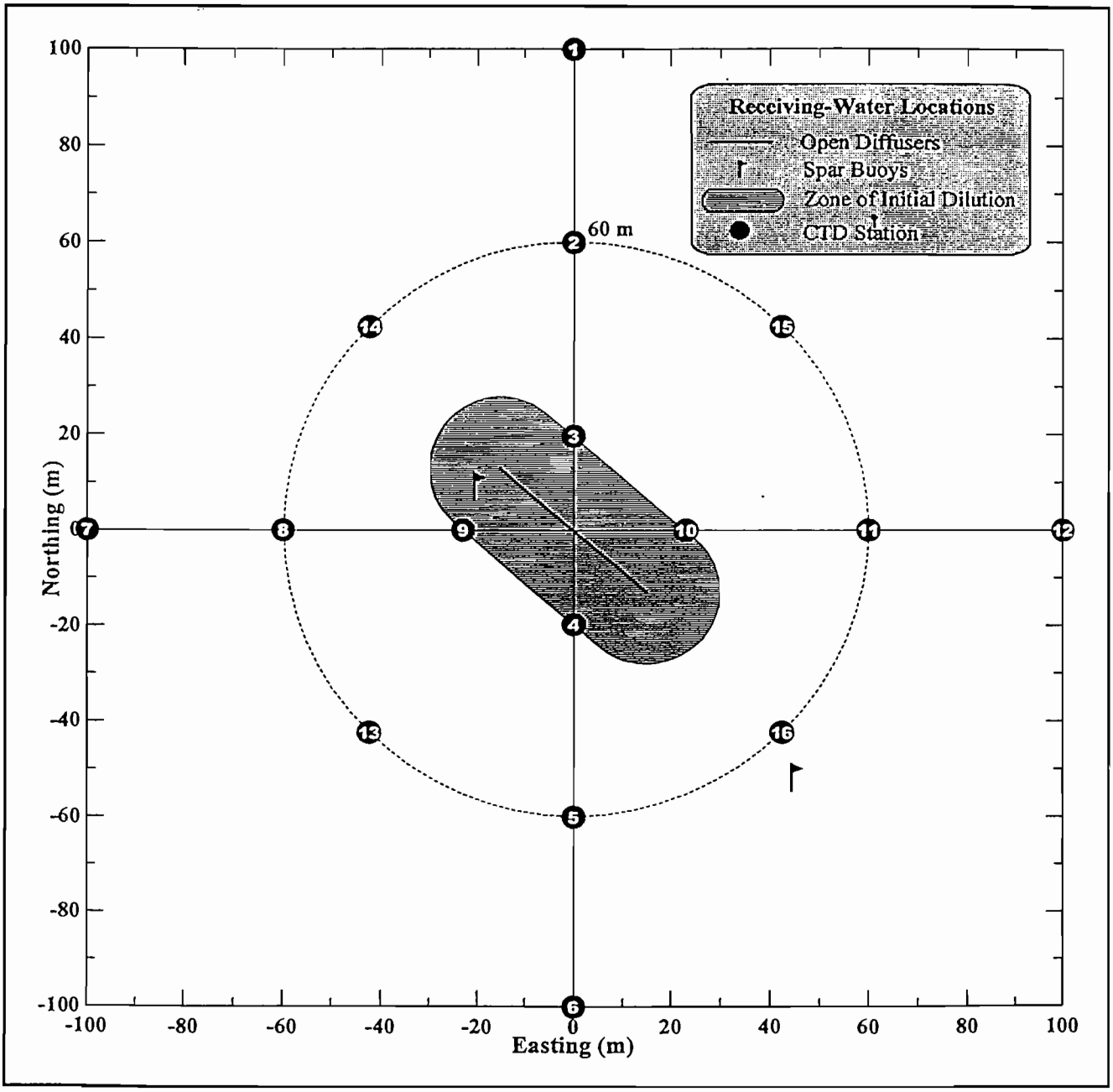


Item No. 5
Morro Bay/Cayucos Wastewater Facility
Attachment A



Item No. 5
Morro Bay/Cayucos Wastewater Facility
Attachment B

Attachment C



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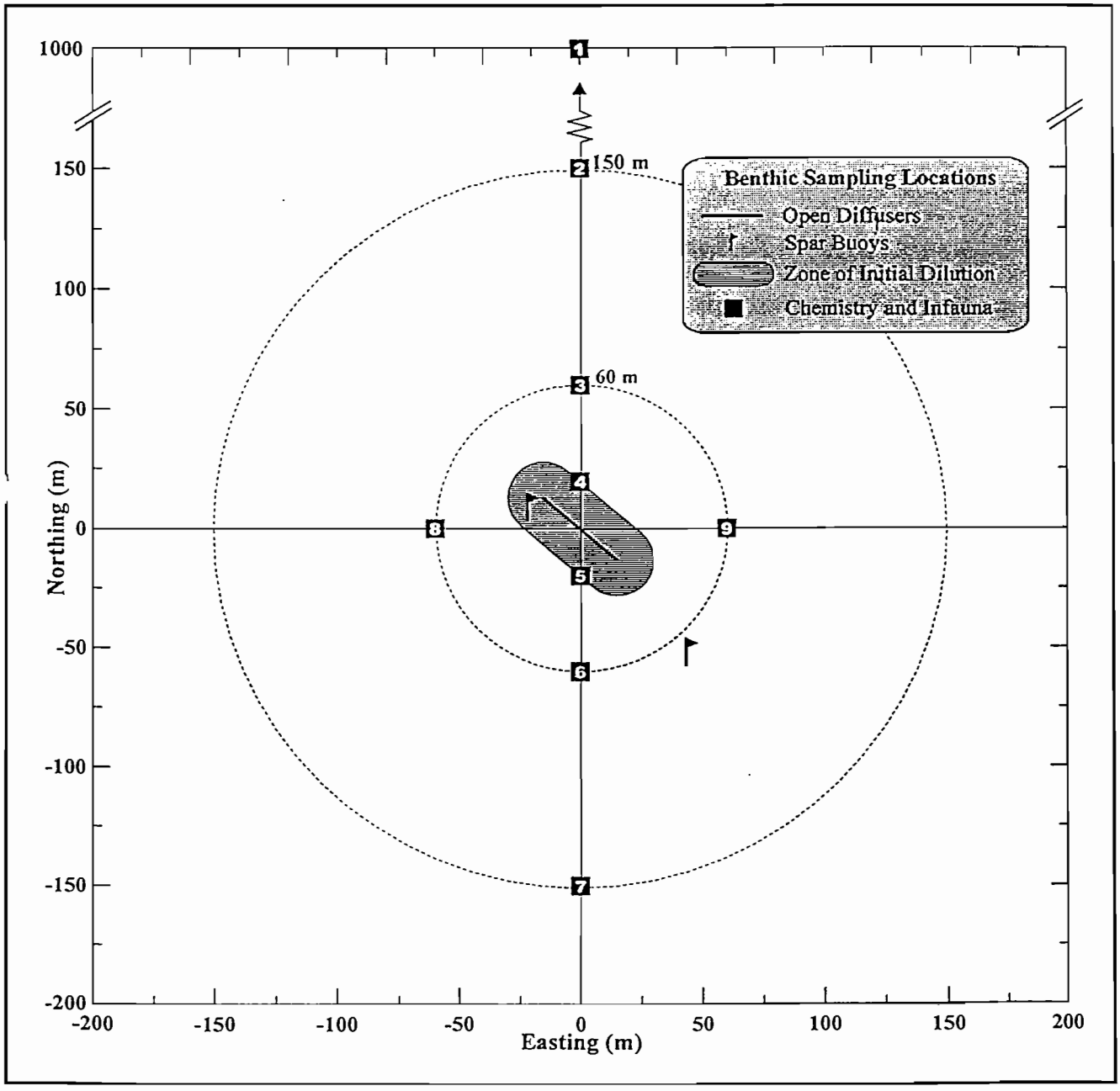

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IX, SAN FRANCISCO, CA

MONITORING AND REPORTING PROGRAM NO. 98-15
FOR
CITY OF MORRO BAY AND CAYUCOS SANITARY DISTRICT
WASTEWATER TREATMENT PLANT
SAN LUIS OBISPO COUNTY

The monitoring program for a discharger receiving a 301(h) modified National Pollutant Discharge Elimination System (NPDES) permit is intended to: a) document short and long-term effects of the discharge on receiving waters, sediments, biota, and on beneficial uses of the receiving water; b) determine compliance with NPDES permit items and conditions; and c) assess the effectiveness of industrial pretreatment and toxics control programs.

The Regional Water Quality Control Board (Regional Board) and U.S. Environmental Protection Agency, Region IX (EPA) may revise revise the monitoring program presented herein, within the specified order and permit period. The program will be reviewed at annual intervals to assess its effectiveness at meeting the objectives stated above. If predictable relationships among effluent, water quality and biological monitoring variables can be clearly demonstrated, it may be appropriate to decrease certain elements of the monitoring program. Conversely, the monitoring program may be intensified if it appears that the above objectives cannot be achieved through the existing monitoring program.

INFLUENT MONITORING

Representative samples of influent to the treatment plant shall be collected (upstream of any in-plant return flows) and analyzed as follows:

Constituent	Units	Sample Type	Minimum Frequency Sampling/Analysis
BOD_5 (20°C)	mg/l	24-hr Composite	Weekly
Suspended Solids	mg/l	24-hr Composite	Weekly

Influent flow metering shall be required if the Executive Officer determines such monitoring is necessary to identify sources of noncompliance with this Order.

EFFLUENT MONITORING

Representative effluent samples shall be collected (downstream of any inplant return flows or disinfection units) and analyzed as follows:

Constituent	Units	Sample Type	Minimum Frequency Sampling/Analysis
Daily Flow	MG	Metered	Daily
Maximum Daily Flow	MGD	Metered	Daily
Mean Daily Flow	MGD	Calculated	Monthly
Total Chlorine Residual	mg/l	Grab	Daily
Chlorine Used	lbs/day	Recorded	Daily
Total Coliform	MPN	Grab	5 days/week)[1]
Temperature	°C	Grab	5 days/week)
Turbidity	NTU	Grab	5 days/week)
BOD_5 (20°C)	mg/l	24-hr Composite	Weekly[1]
Suspended Solids	mg/l	24-hr Composite	Weekly[1]
pH	pH units	Grab	Weekly[1]
Settleable Solids	ml/l	Grab	Weekly
Grease and Oil	mg/l	Grab	Weekly
Acute Toxicity	TUa	Grab	Quarterly (Jan/Apr/July/Oct)
Chronic toxicity	TUc	24-hr Composite	Semi-annually (Jan/July)
Ammonia (as N)	mg/l	Grab	Monthly
Phenolic Compounds (non-chlorinated)	mg/l	Grab	Semi-annually
Chlorinated Phenolics	mg/l	Grab	Semi-annually

TABLE B - OBJECTIVES FOR PROTECTION OF MARINE AQUATIC LIFE

Constituent	Units	Sample Type	Minimum Frequency Sampling/Analysis
Arsenic	mg/l	24-hr Composite	Semi-annually (Jan/July)
Cadmium	mg/l	24-hr Composite	Semi-annually
Chromium (Hexavalent)[2]	mg/l	24-hr Composite	Semi-annually
Copper	mg/l	24-hr Composite	Semi-annually
Lead	mg/l	24-hr Composite	Semi-annually
Mercury	mg/l	24-hr Composite	Semi-annually
Nickel	mg/l	24-hr Composite	Semi-annually
Selenium	mg/l	24-hr Composite	Semi-annually
Silver	mg/l	24-hr Composite	Semi-annually
Zinc	mg/l	24-hr Composite	Semi-annually
Cyanide	mg/l	24-hr Composite	Semi-annually
Endosulfan[3]	mg/l	24-hr Composite	Semi-annually
Endrin	mg/l	24-hr Composite	Semi-annually
HCH[4]	mg/l	24-hr Composite	Semi-annually

TABLE B - OBJECTIVES FOR THE PROTECTION OF HUMAN HEALTH – NONCARCINOGENS

acrolein	ug/l	24-hr Composite	Semi-annually
antimony	ug/l	24-hr Composite	Semi-annually
bis(2-chloroethoxy)methane	ug/l	24-hr Composite	Semi-annually
bis(2-chloroisopropyl)ether	ug/l	24-hr Composite	Semi-annually
chlorobenzene	ug/l	24-hr Composite	Semi-annually
chromium (III)[2]	ug/l	24-hr Composite	Semi-annually
di-n-butyl phthalate	ug/l	24-hr Composite	Semi-annually
dichlorobenzenes[5]	ug/l	24-hr Composite	Semi-annually
1,1-dichloroethylene	ug/l	24-hr Composite	Semi-annually
diethyl phthalate	ug/l	24-hr Composite	Semi-annually
dimethyl phthalate	ug/l	24-hr Composite	Semi-annually
4,6-dinitro-2-methylphenol	ug/l	24-hr Composite	Semi-annually
2,4-dinitrophenol	ug/l	24-hr Composite	Semi-annually
ethylbenzene	ug/l	24-hr Composite	Semi-annually
fluoranthene	ug/l	24-hr Composite	Semi-annually
hexachlorocyclopentadiene	ug/l	24-hr Composite	Semi-annually
isophorone	ug/l	24-hr Composite	Semi-annually
nitrobenzene	ug/l	24-hr Composite	Semi-annually
thallium	ug/l	24-hr Composite	Semi-annually
toluene	ug/l	24-hr Composite	Semi-annually
1,1,2,2-tetrachloroethane	ug/l	24-hr Composite	Semi-annually
1,1,1-trichloroethane	ug/l	24-hr Composite	Semi-annually
1,1,2-trichloroethane	ug/l	24-hr Composite	Semi-annually

TABLE B - OBJECTIVES FOR THE PROTECTION OF HUMAN HEALTH – CARCINOGENS

acrylonitrile	ug/l	24-hr Composite	Semi-annually
aldrin	ug/l	24-hr Composite	Semi-annually
benzene	ug/l	24-hr Composite	Semi-annually
benzidine	ug/l	24-hr Composite	Semi-annually
beryllium	ug/l	24-hr Composite	Semi-annually
bis(2-chloroethyl)ether	ug/l	24-hr Composite	Semi-annually

Constituent	Units	Sample Type	Minimum Frequency Sampling/Analysis
bis(2-ethylhexyl)phthalate	ug/l	24-hr Composite	Semi-annually
carbon tetrachloride	ug/l	24-hr Composite	Semi-annually
chlordane[6]	ug/l	24-hr Composite	Semi-annually
chloroform	ug/l	24-hr Composite	Semi-annually
DDT[7]	ug/l	24-hr Composite	Semi-annually
1,4-dichlorobenzene	ug/l	24-hr Composite	Semi-annually
3,3-dichlorobenzidine	ug/l	24-hr Composite	Semi-annually
1,2-dichloroethane	ug/l	24-hr Composite	Semi-annually
dichloromethane	ug/l	24-hr Composite	Semi-annually
1,3-dichloropropene	ug/l	24-hr Composite	Semi-annually
dieldrin	ug/l	24-hr Composite	Semi-annually
2,4-dinitrotoluene	ug/l	24-hr Composite	Semi-annually
1,2-diphenylhydrazine	ug/l	24-hr Composite	Semi-annually
halomethanes[8]	ug/l	24-hr Composite	Semi-annually
heptachlor[9]	ug/l	24-hr Composite	Semi-annually
hexachlorobenzene	ug/l	24-hr Composite	Semi-annually
hexachlorobutadiene	ug/l	24-hr Composite	Semi-annually
hexachloroethane	ug/l	24-hr Composite	Semi-annually
N-nitrosodimethylamine	ug/l	24-hr Composite	Semi-annually
N-nitrosodiphenylamine	ug/l	24-hr Composite	Semi-annually
PAHs[10]	ug/l	24-hr Composite	Semi-annually
PCBs[11]	ug/l	24-hr Composite	Semi-annually
TCDD equivalents[12]	ug/l	24-hr Composite	Annually
tetrachloroethylene	ug/l	24-hr Composite	Semi-annually
toxaphene	ug/l	24-hr Composite	Semi-annually
trichloroethylene	ug/l	24-hr Composite	Semi-annually
2,4,6-trichlorophenol	ug/l	24-hr Composite	Semi-annually
vinyl chloride	ug/l	24-hr Composite	Semi-annually
Remaining "Priority Pollutants	ug/l	24-hr Composite	Annually
"Other Pesticides"	ug/l	24-hr Composite	Annually
Radioactivity		24-hr Composite	Annually

The discharger shall report the mass emission rates for all constituents that have mass emission effluent goals listed below, and the flow used to calculate the mass emission rates for each constituent. Annual mass emissions will be compared to performance based mass emission goals. The mass based goals are based on 99th percentile of effluent data from 1994 to 1998 and a flow of 2.06 MGD. For compounds with detectable concentrations, exceedances of mass based goals are indicative of statistically significant increases in loading and will trigger the need for antidegradation analysis in the following permit cycle.

TABLE B – OBJECTIVES FOR THE PROTECTION OF MARINE LIFE

Arsenic[13]	17	kg/yr
Cadmium	88	kg/yr
Chromium	93	kg/yr
Copper[13]	690	kg/yr
Lead	465	kg/yr
Mercury	1.4	kg/yr
Nickel	142	kg/yr
Selenium	65	kg/yr
Silver	28	kg/yr
Zinc[13]	244	kg/yr
Cyanide, Total	57	kg/yr
Endosulfan	3	kg/yr
Endrin	1	kg/yr
HCH	228	kg/yr

ABLE B – OBJECTIVES FOR THE PROTECTION OF HUMAN HEATH –NONCARCINOGENS

Acrolein		
Antimony	285	kg/yr
Bis(2-chloroethoxy) methane	142	kg/yr
Bis(2-chloroisopropyl)ether		
chlorobenzene		
Chromium III		
Di-n-butyl phthalate	142	kg/yr
Dichlorobenzene	5.7	kg/yr
1,1-Dichloroethene	3	kg/yr
Diethyl phthalate	191	kg/yr
Dimethyl phthalate	142	kg/yr
2-Methyl-4,6-dinitrophenol	142	kg/yr
2,4-Dinitrophenol	342	kg/yr
Ethylbenzene	3	kg/yr
Fluoranthene	142	kg/yr
hexachlorocyclopentadiene		
Isophorone	142	kg/yr
Nitrobenzene	142	kg/yr
Thallium	285	kg/yr
Toluene	4	kg/yr
1,1,2,2-Tetrachloroethane	3	kg/yr
1,1,1-Trichloroethane (TCA)	3	kg/yr
1,2-Trichloroethane	3	kg/yr

TABLE B – OBJECTIVES FOR THE PROTECTION OF HUMAN HEALTH – CARCINOGENS

acrylonitrile		
Aldrin[14]	0.01	kg/yr
Benzene	3	kg/yr
Benzidine[14]	0.03	kg/yr
Beryllium[14]	28	kg/yr
Bis (2-chloroethyl) Ether[14]	17	kg/yr
Bis(2-ethylhexyl) Phthalate	320	kg/yr
Carbon Tetrachloride	3	kg/yr
Chlordane[14]	8.8	g/yr
Chloroform[13]	5	kg/yr
DDT	60	g/yr
1,4-Dichlorobenzene	57	kg/yr
3,3-Dichlorobenzidine[14]	3.1	kg/yr
1,2-Dichloroethane	3	kg/yr
dichloromethane		
1,3-dichloropropene		
Dieldrin[14]	0.02	kg/yr
2,4-Dinitrotoluene	142	kg/yr
1,2-Diphenylhydrizine[14]	60	kg/yr
Halomethanes[13]	25	kg/yr
Heptachlor[14]	0.27	kg/yr
Hexachlorobenzene[14]	0.08	kg/yr
Hexachlorobutadiene	142	kg/yr
Hexachloroethane	142	kg/yr
N-Nitrosodimethylamine	342	kg/yr
N-Nitrosodiphenylamine	142	kg/yr
PAHs[14]	3.4	kg/yr
PCBs[14]	7.3	g/yr
Dibenzofuran	57	kg/yr

oxin (Total TCDD equivalents)[14]	1.42	mg/yr
Tetrachloroethene[13]	4	kg/yr
Toxaphene[14]	0.08	kg/yr
Trichloroethene (TCE)	3	kg/yr
2,4,6-Trichlorophenol[14]	114	kg/yr
Vinyl Chloride	3	kg/yr

TOXICITY TESTING

Compliance with the acute toxicity limitation (TUa) in Table A shall be determined using an established protocol, e.g., American Society for Testing Materials (ASTM), EPA, American Public Health Association, or State Board.

Compliance with chronic toxicity limitation shall be expressed and reported as toxic units chronic (TUc), where: TUc = 100/NOEC. The No Observed Effect Concentration (NOEC) is the maximum percent effluent that causes no observable effect on a test organism, as determined by the results of a critical life stage toxicity test.

A minimum of three test species with approved test protocols were used to measure compliance with the chronic toxicity objective. The test species included a fish, an invertebrate, and an aquatic plant. Based on this screening study, giant kelp (Macrocystis pyrifera) was identified as the most sensitive species and should be used for monitoring. Dilution and control water should be obtained from an unaffected area of the receiving waters. The sensitivity of the test organisms to a reference toxicant shall be determined concurrently with each bioassay test and reported with the test results.

The following tests may be used to measure TUc. Other tests may be added to the list when approved by the State Board.

Species	Effect	Tier	Reference
giant kelp, *Macrocystis pyrifera*	percent germination; germ tube length	1	1,3
red abalone, *Haliotis rufescens*	abnormal shell development	1	1,3
oyster, *Crassostrea gigas;* mussels, *Mytilus spp.*	abnormal shell development; percent survival	1	1,3
urchin, *Strongylocentrotus purpuratus*; sand dollar, *Dendraster excentricus*	percent normal development	1	1,3
urchin, *Strongylocentrotus purpuratus;* sand dollar, *Dendraster excentricus*	percent fertilization	1	1,3
shrimp, *Holmesimysis costata*	percent survival; growth	1	1,3
shrimp, *Mysidopsis bahia*	percent survival; growth; fecundity	2	2,4
topsmelt, *Atherinops affinis*	larval growth rate; percent survival	1	1,3
silversides, *Menidia beryllina*	larval growth rate; percent survival	2	2,4

.e first tier test methods are the preferred toxicity tests for compliance monitoring. A Regional Board can approve the use of a second tier test method for waste discharges if first tier organisms are not available. It is also suggested that the Discharger submit all data in electronic format on floppy diskettes, as specified in Suggested Standardized Reporting Requirements For Monitoring Chronic Toxicity (State Water Resources Control Board, California Environmental Protection Agency, August 1993).

Protocol References

1. Chapman, G.A., D.L. Denton, and J.M. Lazorchak. 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to west coast marine and estuarine organisms. U.S. EPA Report No. EPA/600/R-95/136.

2. Klemm, D.J., G.E. Morrison, T.J. Norberg-King, W.J. Peltier, and M.A. Heber. 1994. Short-term methods for stimating the chronic toxicity of effluents and receiving water to marine and estuarine organisms. U.S. EPA Report No. EPA-600-4-91-003.

3. SWRCB 1996. Procedures Manual for Conducting Toxicity Tests Developed by the Marine Bioassay Project. 96-1WQ.

4. Weber, C.I., W.B. Horning, I.I., D.J. Klemm, T.W. Nieheisel, P.A. Lewis, E.L. Robinson, J. Menkedick and F. Kessler (eds). 1988. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. EPA/600/4-87/028. National Information Service, Springfield, VA.

RECEIVING WATER MONITORING

SURF ZONE MONITORING

.ie following surf zone monitoring may be modified during the life of this permit in order to coordinate bacterial monitoring efforts with other public health agencies.

Surf zone monitoring is conducted to assess bacteriological conditions in areas used for body-contact sports (e.g., swimming) and where shellfish may be harvested for human consumption and to assess aesthetic conditions for general recreational uses (e.g., picnicking, boating, etc.). Grab samples shall be taken at all surf zone monitoring stations weekly during summer months (May-October) and at least monthly during winter months (November-April). Sampling shall be conducted during daylight hours and will be coordinated with local tide charts so that samples are collected between 1-3 hours prior to peak high tide (i.e., incoming tide). Samples shall be analyzed for fecal and total coliform organisms.

Monitoring shall include observations of wind (direction and speed), weather (e.g., cloudy, sunny, rainy), waves, longshore currents (e.g., direction), and tidal conditions (e.g., high, slack, or low tide). Observations of water discoloration, floating oil and grease, turbidity, odor and materials of sewage origin in the water or on the beach shall be recorded. The water temperature (Celsius) shall also be recorded. The sample shall be collected as far seaward within the surf zone as possible.

Surf Zone Monitoring Stations

Station	Description
A1	Surf, 1700 meters (5600 ft) upcoast of Station C
A	Surf, 610 meters (2000 ft) upcoast of Station C
B	Surf, 305 meters (1000 ft) upcoast of Station C
C	Surf, at point closest to outfall diffuser
D	Surf, 305 meters (1000 ft) downcoast of Station C
E	Surf, 610 meters (2000 ft) downcoast of Station C
F	Surf, 1520 meters (5000 ft) downcoast of Sation C
G	Morro Creek water immediately before flowing to the ocean

:CEIVING WATER (OCEAN) MONITORING

Monitoring stations have been located to assess the short and long-term environmental impacts of the discharge on the receiving water, benthic sediment, and biota in the vicinity of the outfall. Receiving water monitoring stations are depicted on Attachment C of the Order and Permit.

Receiving Water Monitoring Stations

Station	Description	Latitude	Longitude	Distance from Diffuser Center (m)
1	Upcoast Midfield	35° 23.253' N	120° 52.504' W	100
2	Upcoast Nearfield	35° 23.231' N	120° 52.504' W	60
3	Upcoast ZID	35° 23.210' N	120° 52.504' W	20
4	Downcoast ZID	35° 23.188' N	120° 52.504' W	20
5	Downcoast Nearfield	35° 23.167' N	120° 52.504' W	60
6	Downcoast Midfield	35° 23.145' N	120° 52.504' W	100
7	Offshore Midfield	35° 23.199' N	120° 52.570' W	100
8	Offshore Nearfield	35° 23.199' N	120° 52.544' W	60
9	Offshore ZID	35° 23.199' N	120° 52.519' W	23
10	Onshore ZID	35° 23.199' N	120° 52.489' W	23
11	Onshore Nearfield	35° 23.199' N	120° 52.464' W	60
12	Onshore Midfield	35° 23.199' N	120° 52.438' W	100
13	Southwest Midfield	35° 23.176' N	120° 52.532' W	60
14	Northwest Midfield	35° 23.222' N	120° 52.532' W	60
15	Northeast Midfield	35° 23.222' N	120° 52.476' W	60
16	Southeast Midfield	35° 23.176' N	120° 52.476' W	60

Data may be obtained using multiple electronic probes (as appropriate) to measure parameters (i.e., dissolved oxygen, pH, salinity, temperature, and natural light) through the entire water column, or by measurement of discrete samples collected at 0.3 meters below the surface, 3 meter intervals within the water column, and 2 meter above the seabed.

Water samples shall be collected between the hours of 6 AM and 6 PM at all receiving water monitoring stations and analyzed as follows:

Constituent	Units	Sample Type	Minimum Frequency Sampling/Analysis
Floating Particulates	Visual	Surface	Quarterly
Grease and Oil	Visual	Surface	Quarterly
Discoloration	Visual	Surface	Quarterly
Natural light	light transmissivity and/or total irradiance	Entire water column	Quarterly
Dissolved Oxygen	mg/L	Entire water column	Quarterly
pH	units	Entire water column	Quarterly
Salinity	ppt	Entire water column	Quarterly
Temperature	°C	Entire water column	Quarterly

BENTHIC MONITORING

BENTHIC SEDIMENT MONITORING

Sediment monitoring shall be conducted annually (October) at the benthic monitoring stations depicted on Attachment D of the Order and Permit. Benthic monitoring shall assess the temporal and spatial occurrence of pollutants in local marine ediments and to evaluate the physical and chemical quality of the sediments in relation to the outfall. At all benthic onitoring stations, one (1) grab sample shall be collected using a 0.1 m^2 Van Veen grab sampler and analyzed as follows:

Parameter	Units
Sediment particle size	phi size (% volume)
Organic Matter	volatile solids or TOC (mg/kg)

Parameter	Units
Biochemical Oxygen Demand	mg/l
Total Kjeldahl Nitrogen	mg/l
Sulfides (at pH 7)	mg/l
Grease and oil	mg/l
Aluminum	µg/kg
Iron	µg/kg
Arsenic	µg/kg
Cadmium	µg/kg
Total Chromium	µg/kg
Copper	µg/kg
Lead	µg/kg
Mercury	µg/kg
Nickel	µg/kg
Silver	µg/kg
Zinc	µg/kg
Nonchlorinated Phenolics	µg/kg
Chlorinated Phenolics	µg/kg
Aldrin	µg/kg
Dieldrin	µg/kg
Chlordane	µg/kg
DDT, DDE, DDD	µg/kg
Endrin	µg/kg
PAHs	µg/kg
PCBs	µg/kg
Toxaphene	µg/kg

When processing samples for analysis, macrofauna and large remnants greater than 0.25 inches (0.64 cm) should be removed, taking care to avoid contamination.

Sediment samples shall be analyzed according to Quality Assurance and Quality Control (QA/QC) for 301(h) Monitoring Programs: Guidance on Field and Laboratory Methods (EPA 430/9-86-004, 1987) and Analytical Methods for EPA Priority Pollutants and 301(h) Pesticides in Estuarine and Marine Sediments (EPA 503-6-90-004), 1986).

All sediment results shall be reported in the raw form and expressed on a dry weight basis. For all non-detect results, parameter detection limits shall be reported. Dry weight concentration target detection levels are indicated for National Oceanic and Atmospheric Administration (NOAA) National Status and Trends Program analyses.

Benthic monitoring results shall be included in the annual report with a complete discussion of benthic sediment survey results and (possible) influence of the discharge on sediment conditions in the study area. The discussion should be based on graphical, tabular, and/or appropriate statistical analyses of spatial and temporal patterns observed for raw sediment parameters. The annual report should also present an analysis of natural variation in sediment conditions, etc., which could influence the validity of study results. The Discharger's sediment results may also be compared with the results of other applicable studies, numeric protective levels, etc., as appropriate. Survey results shall be compared to pre-discharge and/or historical data using appropriate statistical methods.

BENTHIC COMMUNITY MONITORING

Benthic infaunal organisms shall be monitored annually (Octorber) at the benthic monitoring stations listed below and shown in Attachment D of the Order and Permit. Benthic infaunal monitoring shall assess the temporal and spatial status of local benthic communities in relation to the outfall. Sampling shall be conducted as follows:

Benthic Monitoring Stations

Station	Description	Latitude	Longitude	Distance from Diffuser Center (m)
1	Upcoast Reference	35° 23.730' N	120° 52.677' W	1016
2	Upcoast Midfield	35° 23.280' N	120° 52.504' W	150
3	Upcoast Nearfield	35° 23.231' N	120° 52.504' W	60
4	Upcoast ZID	35° 23.210' N	120° 52.504' W	20
5	Downcoast ZID	35° 23.188' N	120° 52.504' W	20
6	Downcoast Nearfield	35° 23.167' N	120° 52.504' W	60
7	Downcoast Midfield	35° 23.118' N	120° 52.504' W	150
8	Offshore Nearfield	35° 23.199' N	120° 52.544' W	60
9	Onshore Nearfield	35° 23.199' N	120° 52.464' W	60

1. Collection: Five (5) replicate samples shall be collected at each ocean monitoring station using a 0.1 m^2 Van Veen grab sampler.

2. For benthic infauna analyses, each replicate sample shall be passed through a 1 mm screen, and the organisms retained and preserved as appropriate for subsequent identification. It is recommended that sample preservation, sample processing, and data analyses be conducted according to Quality Assurance and Quality Control (QA/QC) for 301(h) Monitoring Programs: Guidance on Field and Laboratory Methods (EPA 430/9-86-004, 1987).

3. Benthic infauna from each replicate sample shall be counted and identified to the lowest possible taxon. For each replicate sample, number of individuals, number of species, and number of individuals per species, and within each major taxonomic group (polychaetes, molluscs, crustaceans, echinoderms, and all other macroinvertebrates) shall be recorded.

4. The annual report shall include a complete discussion of benthic infaunal survey results and (possible) influence of the outfall on benthic infauna communities in the study area. The discussion should be based on graphical, tabular, and/or appropriate statistical analyses of spatial and temporal patterns. Temporal trends in the number of individuals, number of species, number of individuals per species, and community structure indices, species richness (S), Margalef index (d), Shannon-Wiener index (H'), Brillouin index (h), Simpson's Index (SI), Swartz's dominance, and Infaunal Trophic Index (ITI) shall be reported. Statistical analyses shall include multivariate techniques consisting of classification and ordination analysis. The annual report should also present an analysis of natural community variation including the effects of different sediment conditions, oceanic seasons, and water temperatures, etc., that could influence the validity of study results. Survey results shall be compared to pre-discharge and/or historical data using appropriate statistical methods.

BIOSOLIDS MONITORING

The following information shall be submitted with the Annual Report required by Standard Provision C.16. Adequate detail should be included to verify characterize biosolids in accordance with 40 CFR 503.

1. Annual biosolids production in dry tons and percent solids.

2. A schematic diagram showing biosolids handling facilities (e.g., digesters, lagoons, drying beds, incinerators) and a solids flow diagram.

3. A narrative description of biosolids dewatering and other treatment processes, including process parameters. For example, if biosolids are digested, report average temperature and retention time of the digesters. If drying beds are used, report depth of application and drying time. If composting is used, report the temperature achieved and duration.

4. A description of disposal methods, including the following information related to the disposal methods used at the facility. If more than one method is used, include the percentage of annual biosolids production disposed by each method.

   a) For landfill disposal include: 1) the Regional Board's WDR numbers that regulate the landfills used, 2) the present classifications of the landfills used, and 3) the names and locations of the facilities receiving biosolids.

b) For land application include: 1) the location of the site(s), 2) the Regional Board's WDR numbers that regulate the site(s), 3) the application rate in lbs/acre/year (specify wet or dry), and 4) subsequent uses of the land.

2. A representative sample of residual solids (biosolids) shall be obtained from the last point in the handling process (i.e., in the drying beds just prior to removal. All constituents shall be analyzed for total concentrations for comparison with TTLC criteria. The Waste Extraction Test shall be performed on any constituent when the total concentration of the waste exceeds ten times the STLC limit for that substance. Twelve (12) discrete representative samples shall be collected at separate locations in the biosolids ready for disposal. These 12 samples shall be composited to form one (1) sample for constituent analysis as follows:

Constituent	Units	Sample Type	Minimum Frequency Sampling/Analysis
Quantity Removed	Tons or yd^3	Measured	During Removal
Location of Disposal	Narrative	---	During Removal
Pathogen Density	---	---	per 40 CFR 503
Moisture Content	%	Grab	Annually
Total Kjeldahl Nitrogen	mg/kg	Grab	Annually
Ammonia (as N)	mg/kg	Grab	Annually
Nitrate (as N)	mg/kg	Grab	Annually
Total Phosphorus	mg/kg	Grab	Annually
Grease & Oil	mg/kg	Grab	Annually
pH	mg/kg	Grab	Annually
Arsenic	mg/kg	Grab	Annually
Boron	mg/kg	Grab	Annually
Cadmium	mg/kg	Grab	Annually
Copper	mg/kg	Grab	Annually
Chromium (Hexavalent)[2]	mg/kg	Grab	Annually
Lead	mg/kg	Grab	Annually
Mercury	mg/kg	Grab	Annually
Molybdenum	mg/kg	Grab	Annually
Nickel	mg/kg	Grab	Annually
Selenium	mg/kg	Grab	Annually
Zinc	mg/kg	Grab	Annually
Priority Pollutants (excluding asbestos)	mg/kg	Grab	Annually

OUTFALL AND DIFFUSER INSPECTION

Annually, the Discharger shall conduct an inspection of the outfall pipe/diffuser system to ensure the proper operation and structural integrity of the system. This inspection shall include general observations and photographic records of the outfall pipe/diffuser system and the surrounding ocean bottom in the vicinity of the outfall/diffuser. The inspection shall be conducted along the outfall pipe/diffuser system from landfall to its ocean terminus. A report detailing inspection results shall be submitted to the Regional Board and EPA with the annual report required in Standard Provision C.16.

REPORTING

Monthly monitoring reports shall be submitted for all monitoring and sampling herein by the last day of the month following the sampling or monitoring event. An annual report shall be submitted by March 1st of each year in accordance with Standard Provision C.16. In addition, monitoring data (effluent and ambient) shall be submitted in an electronic format to EPA on an annual basis in a form that is compatible with EPA database (i.e., ODES/STORET). The annual report shall also include a summary of any spills or overflows from the collection system.

ote on detection limits: When the effluent limit is below the detection limit, compliance determinations based on analysis of a single sample shall only be undertaken if the concentration of the constituent of concern in the sample is greater than or equal to the detection limit.

f results of monitoring a constituent appear to violate effluent limitations based on a weekly, monthly, 30-day, or six-month period, but compliance or non-compliance cannot be validated because sampling is too infrequent, the frequency of sampling shall be increased to validate the test within the next monitoring period. The increased frequency shall be maintained until the Executive Officer agrees the original monitoring frequency may be resumed, as stated in B.2 of the Standard Provisions and Reporting Requirements.

FOOTNOTES:

1. Sampling shall be arranged so that each day of the 7-day week is represented, at least once, each month, or every two (2) months for weekly sampling. For samples collected 5 times per month, at least one (1) sample shall be taken weekly, and sampling should be arranged so that each day of the 7-day week is represented, at least once, every two (2) months.
2. Dischargers may at their option meet this limitation as total chromium limitation.
3. ENDOSULFAN shall mean the sum of endosulfan-alpha and -beta and endosulfan sulfate.
4. HCH shall mean the sum of the alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
5. DICHLOROBENZENES shall mean the sum of 1,2- and 1,3-dichlorobenzene.
6. CHLORDANE shall mean the sum of chlordane-alpha, chlordane-gamma, chlordene-alpha, chlordene-gamma, nonachlor-alpha, nonachlor-gamma, and oxychlordane.
7. DDT shall mean the sum of 4,4-DDT, 2,4-DDT, 2,4-DDE, 4,4-DDD, and 2,4-DDD.
8. HALOMETHANES shall mean the sum of bromoform, bromomethane (methyl bromide), chloromethane (methyl chloride), chlorodibromomethane, and dichlorobromomethane.
9. HEPTACHLOR shall mean the sum of heptachlor and heptachlor epoxide.
10. PAHs (polynuclear aromatic hydrocarbons) shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene.
11. PCBs (polychlorinated biphenyls) shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254 and Aroclor-1260.
12. TCDD EQUIVALENTS shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown below:

Isomer Group	Toxicity Equivalent Factor	Isomer Group	Toxicity Equivalent Factor
2,3,7,8-tetra CDD	1.0	1,2,3,7,8-penta CDF	0.05
2,3,7,8-penta CDD	0.5	2,3,4,7,8-penta CDF	0.5
2,3,7,8-hexa CDDs	0.1	2,3,7,8-hexa CDFs	0.1
2,3,7,8-hepta CDD	0.01	2,3,7,8-hepta CDFs	0.01
octa CDD	0.001	octa CDF	0.001
2,3,7,8-tetra CDF	0.1		

13. Mass emission based on detectable concentrations.
14. Mass emission based on Table B effluent limit concentrations listed in the Order No. 98-15.

This certifies that the foregoing is a full, true and correct copy of an order adopted by the California Regional Water Quality Control Board, Central Coast Region, on December 11, 1998, and of a NPDES permit issued by the U.S. Environmental Protection Agency, Region IX, on_____.

ROGER W. BRIGGS, Executive Officer
California Regional Water Quality Control Board
Central Coast Region

FELICIA MARCUS, Regional Administrator
U.S. Environmental Protection Agency
Region IX

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Recycled Water Uses* Allowed In California

This summary is prepared by WateReuse Association of California, from the March 1997 draft of proposed Title-22 revisions and supersedes previous versions.

Use of Recycled Water	Treatment Level: Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
rrigation of:				
·ood crops where recycled water contacts the edible portion of the crop, including all root crops	Allowed	Not allowed	Not allowed	Not allowed
Parks and playgrounds	Allowed	Not allowed	Not allowed	Not allowed
ıool yards	Allowed	Not allowed	Not allowed	Not allowed
·idential landscaping	Allowed	Not allowed	Not allowed	Not allowed
Unrestricted access golf courses	Allowed	Not allowed	Not allowed	Not allowed
·y other irrigation uses not prohibited by other provisions of the California Code of Regulations	Allowed	Not allowed	Not allowed	Not allowed
ıd crops where edible portion is produced above ground and not contacted by recycled water	Allowed	Allowed	Not allowed	Not allowed
Cemeteries	Allowed	Allowed	Allowed	Not allowed
Freeway landscaping	Allowed	Allowed	Allowed	Not allowed
tricted access golf courses	Allowed	Allowed	Allowed	Not allowed
amental nursery stock and sod farms	Allowed	Allowed	Allowed	Not allowed
Pasture for milk animals	Allowed	Allowed	Allowed	Not allowed
·nedible vegetation with access control to prevent use as a park, playground or school yard	Allowed	Allowed	Allowed	Not allowed
hards with no contact between edible portion and recycled water	Allowed	Allowed	Allowed	Allowed
·ineyards with no contact between edible portion and recycled water	Allowed	Allowed	Allowed	Allowed
Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest	Allowed	Allowed	Allowed	Allowed
der crops (e.g. alfalfa) and fiber crops (e.g. cotton)	Allowed	Allowed	Allowed	Allowed
d crops not eaten by humans	Allowed	Allowed	Allowed	Allowed
Food crops that undergo commercial pathogen-destroying processing before consumption by humans	Allowed	Allowed	Allowed	Allowed
Ornamental nursery stock, sod farms not irrigated less than 14 day before harvest	Allowed	Allowed	Allowed	Allowed
'upply for impoundment:				
Nonrestricted recreational impoundments, with supplemental monitoring for pathogenic organisms	Allowed**	Not allowed	Not allowed	Not allowed
tricted recreational impoundments and publicly accessible fish hatcheries	Allowed	Allowed	Not allowed	Not allowed
dscape impoundments without decorative fountains	Allowed	Allowed	Allowed	Not allowed
Supply for cooling or air conditioning:				
ıstrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that ·tes a mist	Allowed***	Not allowed	Not allowed	Not allowed
Industrial or commercial cooling or air conditioning not involving cooling tower, evaporative condenser, or spraying that creates a mist	Allowed	Allowed	Allowed	Not allowed
)ther uses:				
undwater Recharge	Allowed under special case-by-case permits by RWQCBs****			
Flushing toilets and urinals	Allowed	Not allowed	Not allowed	Not allowed
·aing drain traps	Allowed	Not allowed	Not allowed	Not allowed
ıstrial process water that may contact workers	Allowed	Not allowed	Not allowed	Not allowed
Structural fire fighting	Allowed	Not allowed	Not allowed	Not allowed
Decorative fountains	Allowed	Not allowed	Not allowed	Not allowed
nmercial laundries	Allowed	Not allowed	Not allowed	Not allowed
ısolidation of backfill material around potable water pipelines	Allowed	Not allowed	Not allowed	Not allowed
Artificial snow making for commercial outdoor uses	Allowed	Not allowed	Not allowed	Not allowed
nmercial car washes excluding the general public from washing process	Allowed	Not allowed	Not allowed	Not allowed
ustrial boiler feed	Allowed	Allowed	Allowed	Not allowed
Nonstructural fire fighting	Allowed	Allowed	Allowed	Not allowed
Backfill consolidation around nonpotable piping	Allowed	Allowed	Allowed	Not allowed
l compaction	Allowed	Allowed	Allowed	Not allowed
·ing concrete	Allowed	Allowed	Allowed	Not allowed
Dust control on roads and streets	Allowed	Allowed	Allowed	Not allowed
aning roads, sidewalks and outdoor work areas	Allowed	Allowed	Allowed	Not allowed
shing sanitary sewers	Allowed	Allowed	Allowed	Allowed

* Refer to the full text of the latest version of Title-22: California Water Recycling Criteria. This chart is only a guide to the March 1997 version.

** With "conventional tertiary treatment". Additional monitoring for two years or more is necessary with direct filtration.

*** Drift eliminators and/or biocides are required if public or employees can be exposed to mist.

**** Refer to Groundwater Recharge Guidelines, California Department of Health Services.

STATEMENT OF SUPPORT FOR WATER RECLAMATION

The United States Environmental Protection Agency (EPA), Region 9; the California Water Resources Control Board; the California Department of Water Resources; the California Department of Health Services; the California Conference of Directors of Environmental Health; the United States Bureau of Reclamation; and the WateReuse Association of California adopt the following joint statement of support for water reclamation:

Whereas, water reclamation is defined as the beneficial use of treated wastewater for such planned uses as irrigation, industrial cooling, recreation, groundwater recharge, environmental enhancement, and other uses permitted under California law; and

Whereas, the Governor of California has made water reclamation an important element of California's water supply policy; and

Whereas, the California State Legislature has adopted statewide goals for water reclamation providing 700,000 acre-feet by the year 2000; 1,000,000 acre-feet by the year 2010 so as to help the state meet its future water needs; and

Whereas, the Department of Water Resources estimates that California will need to increase its water supply by 3,000,000 to 5,000,000 acre-feet by 2020, which includes an assumption that 1,300,000 acre-feet of conservation will be achieved by then; and

Whereas, the Bureau of Reclamation is currently engaged in several water conservation and reuse projects and plans to help promote water saving throughout California and the West.

Whereas, the amount of water reclaimed in California has increased from 165,000 acre-feet per year in 1977 to over 380,000 acre-feet in 1993; and

Whereas, the WateReuse Association of California's 1993 survey reported that water reuse will continue to increase from 380,000 acre-feet per year in 1993 to a projected 1,000,000 acre-feet in 2000 and to a projected 1,300,000 acre-feet by 2010, and that the major constraints to achieving these levels of reuse appear to be funding, institutional and regulatory disincentives, the permitting process, and public acceptance; and

Whereas, California's extensive experience with water reclamation provides reasonable assurance that the potential public health risks associated with water reclamation in California are minimal, provided all regulations pertaining to water quality, monitoring, reporting, and reliability are adhered to; and

Whereas, California law and regulations are fully protective of human health and require a specific level of water quality and treatment corresponding to each beneficial use of reclaimed water; and

Whereas, this set of laws and regulations also provides general requirements and provisions which reclaimed water purveyors and users must comply, including monitoring and reliability requirements to further assure that use of reclaimed water is safe; and

Whereas, Congress established pollution prevention as a "national objective" in the Pollution Prevention Act of 1990 and EPA has adopted pollution prevention as the new environmental ethic, and EPA's definition of pollution prevention, pursuant to the Act, includes increased efficiency in the use of water.

Now, therefore, be it resolved on this first day of June 1994, the undersigned agencies support the pursuit and development of federal, state, and local water reclamation policies and regulations that will reduce constraints and promote water reclamation. Specifically, the agencies will work to overcome and reduce institutional and regulatory disincentives and funding constraints, and to promote public acceptance of water reclamation. The agencies will cooperate to develop specific policies and resource commitments that will enable the State of California to meet the Legislature's water reclamation goals and to help satisfy the State's overall water needs.

Felicia Marcus, Regional Administrator
United States Environmental Protection Agency

Marc Del Piero, Board Member/Task Force Chair
California Water Resources Control Board

Justin Malan, Executive Director
California Conference of Directors of Environmental Health

David N. Kennedy, Director
California Department of Water Resources

Daniel P. Beard, Commissioner
United States Bureau of Reclamation

S. Kimberly Belshé, Director
California Department of Health Services

James M. Kelly, President
WateReuse Association of California

TITLES 17 and 22 CALIFORNIA DEPARTMENT OF HEALTH SERVICES

ACTION: Notice of Proposed Rulemaking

SUBJECT: **Water Recycling Criteria (R-13-95)**

PUBLIC PROCEEDINGS: Notice is hereby given that the California Department of Health Services will conduct written public proceedings during which time any interested person or such person's duly authorized representative may present statements, arguments or contentions relevant to the action described in this notice. Any written statements, arguments or contentions must be received by the Office of Regulations, Department of Health Services, 714 P Street, Room 1000, P.O. Box 942732, Sacramento, CA 94234-7320, by 5:00 p.m. on November 8, 1999, which is hereby designated as the close of the written comment period. It is requested but not required that written statements, arguments or contentions sent by mail or hand-delivered be submitted in triplicate.

Comments by FAX (916-657-1459) or email (regulation@dhs.ca.gov) must be received before 5:00 p.m. on the last day of the public comment period. All comments, including email or fax transmissions, should include the author's name and U.S. Postal Service mailing address in order for the Department to provide copies of any notices for proposed changes in the regulation text on which additional comments may be solicited.

CONTACT: Inquiries concerning the action described in this notice may be directed to Charles E. Smith of the Office of Regulations at (916) 657-0730. In any such inquiries, please identify the action by using the Department regulation control number **R-13-95**.

Persons wishing to use the California Relay Service may do so at no cost. The telephone numbers for accessing this service are: 1-800-735-2929, if you have a TDD; or 1-800-735-2922, if you do not have a TDD.

INFORMATIVE DIGEST: The production and use of recycled water is currently regulated by state law and administrative regulations and requirements. Pursuant to Section 13521 of the California Water Code, the Department of Health Services (Department) is mandated to establish statewide recycling criteria for each varying use of recycled water where such use involves the protection of public health. In addition, the use of the term "recycling" in this section provides the authority for the replacement of the terms "Reclamation" and "reclaimed" by the terms "recycling" and "recycled" in the proposed regulations. The State Regional Water Quality Control Boards prescribe recycling requirements for individual water recycling projects. The requirements issued by the boards must include, or be in conformance with, the recycling criteria adopted by the Department.

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The existing recycling criteria were adopted by the Department on October 15, 1977. Since that time, the use of recycled water has expanded significantly. Furthermore, technical and health effects studies have been conducted and advances in treatment technology have been demonstrated. Also during this period, the increasing need for water conservation and the increase in potable water demand have created a greater need for more recycling and reuse of wastewater.

Pursuant to the authority granted by Section 13521 of the Water Code, the Department has developed proposed revisions to the existing recycling regulations. These revisions are intended to expand the range of allowable uses of recycled water, establish criteria for those new uses, and clarify some of the ambiguity contained in the existing regulations.

Specifically, the Department proposes the following changes to Title 22, Division 4 of the California Code of Regulations:

1. Repeal existing Section 60301 and replace with proposed new Sections 60301.100 through 60301.920. The purpose of this change is to reorganize the content of the existing section with new section numbers, repeal obsolete definitions, add new definitions for terms used in the proposed regulations, and reorder the definitions alphabetically.

2. Repeal Sections 60303 through 60319 and replace with proposed Sections 60302 through 60306. These sections reorganize existing uses and requirements, add new allowable uses, and add language relating to the use of recycled water for industrial cooling and establishing specific requirements.

3. Adopt a new Section 60310 establishing requirements for specific areas of use of recycled water.

4. Adopt new Sections 60313, 60314, 60315, and 60316 establishing requirements for use of recycled water in dual plumbing systems.

5. Repeal existing Section 60321 relating to sampling and analysis and replace with proposed Section 60321, which has better clarity.

In addition, the Department proposes to amend Section 7604 of Title 17, California Code of Regulations to modify the type of backflow prevention devices needed in order to be consistent with the dual plumbing requirements proposed in Article 4, Division 4 of Title 22, California Code of Regulations.

Plain English Policy Statement Overview: California does not have as much water as it needs. When sewage is cleaned up enough, it can be used in ways that can save drinking water. By law, the Department has to make rules that say how to figure out if the sewage is clean enough to use and tell people the ways the cleaned sewage can be used. The Department has to make sure that there is no risk to people when cleaned sewage is used in these ways. The Department made rules

on this for people in 1977. Those rules are out of date. These new rules will fix the old rules so they are up to date.

These rules will not cost small businesses in California any money. They will protect the public's health and safety. They will make it possible for California to save some of its drinking water for people to drink. No alternative would be better to carry out the law.

AUTHORITY: Section 116375, Health and Safety Code; and Sections 13521 and 13522.5, Water Code.

REFERENCE: Sections 13520, 13521, 13522.5, 13523.1, 13553 and 13554, Water Code.

FISCAL IMPACT ESTIMATE:

A. Fiscal Effect on Local Government: There would be indeterminate savings due to reduced use of potable water. There would be an estimated one-time cost of $200 per reclaimed water site to post appropriate warning signs, for a total of $35,000 to be absorbed by local agencies.

B. Fiscal Effect on State Government: There would be an estimated one-time cost of $200 per reclaimed water site to post appropriate warning signs, for a total of $21,000 to be absorbed by the Department.

C. Fiscal Effect on Federal Funding of State Programs: No fiscal impact exists.

D. Fiscal Effect on Private Persons or Businesses Directly Affected: There would be an estimated one-time cost of $200 per reclaimed water site to post appropriate warning signs, for a total of $84,000.

DETERMINATIONS: The Department has determined that the regulations would not impose a mandate on local agencies or school districts, nor are there any costs for which reimbursement is required by Part 7 (commencing with Section 17500) of Division 4 of the Government Code.

The Department has determined that the regulations would not have a significant adverse economic impact on businesses, including the ability of California businesses to compete with businesses in other states.

For communities where development has been constrained by limited water resources, recycled water can provide a new source of water and, as such, may enable businesses or residential areas to develop beyond what might have otherwise been possible. Since the proposed regulations would expand the approved uses for recycled water, recycled water would have a broader range of applications, thus making recycled water a more viable option for a community. In addition, the use of recycled water can potentially free some quantity of potable water for drinking and other

appropriate uses where potable water is the only option. Based on this, the Department has determined that the regulations might affect the following:

1. The creation or elimination of jobs within the State of California. The requirements summarized above may create and/or enable the creation of jobs wherever recycled water is produced and/or used. Utilities choosing to produce recycled water may need additional staff in order to manage and monitor the treatment processes involved. Likewise, users of recycled water may need additional staff to ensure that the water is properly handled. Communities with currently limited water resources that avail themselves of the opportunity to use recycled water, may experience business expansion and development and, thus, an increase in jobs.

2. The expansion of businesses currently doing business within the State of California. Since the proposed regulations would expand the uses for recycled water, the demand for this resource is likely to increase and, therefore, more utilities would probably go into the production of recycled water. Also, utilities already producing recycled water might, if they are able, increase their production. Thus, these utilities would be expanding their services and clientele. For this reason, if no other, there would be some expansion.

   Since water is an expensive commodity for businesses that use a significant amount, the use of recycled water, where approvable, would result in a cost savings, enabling possible expansion for such businesses. For communities where water resources have limited development, the availability of recycled water could result in expansion of businesses previously constrained.

3. The creation of new businesses or the elimination of existing businesses within the State of California. Since the proposed regulations would expand the uses for recycled water, the demand for this resource is likely to increase and, therefore, more utilities would probably go into the production of recycled water.

   In addition, there may be would-be businesses unable to start up due to lack of available water resources or the cost of potable water, which might be able to establish themselves if they were able to utilize recycled water because of the broader range of uses under the proposed regulations.

The Department has determined that the regulations would affect small business. The Department has also determined that it is not feasible to draft the regulations in plain English due to the technical nature of the regulations; however, a noncontrolling plain English summary of the regulations is available from the Office of Regulations at the address noted above.

AVAILABILITY OF STATEMENT OF REASONS AND TEXT OF REGULATIONS: The Department has prepared and has available for public review an initial statement of reasons for the proposed regulations, all the information upon which the proposed regulations are based, and the text of the proposed regulations. A copy of the initial statement of reasons and a copy of the text

of the proposed regulations are available upon request by writing to the Office of Regulations at the address noted above, which address will also be the location of public records, including reports, documentation, and other material related to the proposed regulations.

AVAILABILITY OF CHANGED OR MODIFIED TEXT: The full text of any regulation which is changed or modified from the express terms of the proposed action will be made available by the Department's Office of Regulations at least 15 days prior to the date on which the Department adopts, amends, or repeals the resulting regulation.

ADDITIONAL STATEMENTS AND COMMENTS: In accordance with Government Code Section 11346.5(a)(12) the Department must determine that no alternative considered by the Department would be more effective in carrying out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

Any interested person or his or her duly authorized representative may request, no later than 15 days prior to the close of the written comment period, a public hearing pursuant to Government Code Section 11346.8.

Reasonable accommodation or sign language interpreting services at a public hearing will be provided upon request. Such request should be made no later than 15 days prior to the close of the written comment period.

DEPARTMENT OF HEALTH SERVICES

R-13-95

Dated: August 30, 1999

Diana M. Bontá, R.N., Dr.P.H.
Director

INITIAL STATEMENT OF REASONS

Water Recycling

Chapter 3. Water Recycling Criteria

Pursuant to section 13521 of the California Water Code, The Department of Health Services (Department) is mandated to establish statewide recycling criteria for each varying use of recycled water where such use involves the protection of public health. In addition, the use of the term "recycling" in this section provides the authority for the proposed substitution of terms in the attached regulations: "Reclamation" and "reclaimed" would be replaced with "recycling" and "recycled".

The existing recycling criteria were adopted by the Department on October 15, 1977. Since that time, the use of recycled water has expanded significantly. Furthermore, technical and health effects studies, have been conducted and advances in treatment technology have been demonstrated. Also during this period, the increasing need for water conservation and the increase in potable water demand have created a greater need for more recycling and reuse of wastewater.

Pursuant to the authority granted by section 13521 of the Water Code, the Department has developed proposed revisions to the existing recycling regulations. These revisions are intended to expand the range of allowable uses of recycled water, establish criteria for these new uses, and clarify some of the ambiguity contained in the existing regulations.

Article 1. DEFINITIONS

Section 60301. Definitions.

Existing section 60301 would be repealed and new sections 60301.100 through 60301.920 would be adopted. The existing section 60301 would be reorganized with new section numbers and the definitions placed into alphabetical order.

The terms in existing subsections (a), (g), (k), (l), (m), (o), (p), (s), (t), (v), (w), (x), (y), (z), (aa), and (bb) are no longer used or necessary or are already defined in law.

Subsection (f) would be amended and redesignated as new section 60301.800. The language would be reworded to clarify that the term "spray irrigation" is limited to crops or vegetation and does not include drip irrigation.

Subsections (h), (I), (j), and (u) would be amended for greater clarity and redesignated as new sections 60301.760, 60301.620, 60301.550 and 60301.830, respectively.

Subsection (q) would be amended and redesignated as new section 60301.160. The wording would be changed to clarify that the coagulation process must take place prior to the filter to assure that particle agglomeration takes place prior to filtration.

Subsection (r) would be redesignated as new section 60301.320. The wording would be changed to remove the clarification unit process requirement from this definition. The existing requirement would be adequately covered by other definitions and is unnecessary. A maximum turbidity limit of 10 NTU would be adopted into the previous definition. The existing definition allows the 2 NTU daily average to be exceeded up to 5 percent of the time. Not specifying an absolute maximum, however, would allow a treatment facility to produce an effluent with unlimited turbidity 5 percent of the time. This could cause the disinfection process to be ineffective for short periods. Imposing a 10 NTU maximum would preclude this possibility while not imposing unreasonable operational restrictions on existing plants. Existing plants that are well operated have demonstrated the capability to meet this requirement consistently. Other minor changes would be made in this section for greater clarity, such as specifying that "of the time" refers to a 24-hour period.

Subsection 60301.320(b) requires the use of filtration technologies with membranes to physically screen particulate matter, including certain pathogens (microfiltration, ultrafiltration,

nanofiltration, and reverse osmosis). Membrane filtration has been demonstrated to achieve virus removal when the turbidity performance objectives in this subsection have been met

Proposed sections 60301.170, 60301.220, 60301.225, 60301.240, 60301.245, 60301.250, 60301.300, 60301.310, 60301.400, 60301.600, 60301.620, 60301.700, 60301.750, 60301.900, and 60301.920 would be adopted to define new general terms used in the proposed regulations.

Proposed section 60301.100 would be adopted to define the term "approved Laboratory" as one which has been certified by the Department. This definition is necessary to assure the validity of the bacteriological results.

Proposed section 60301.230 would be adopted to define a wastewater that has been "adequately disinfected, oxidized, coagulated, clarified, and filtered"; these terms are used in the existing sections 60303 through 60305. This definition contains specific proposed criteria relating to the disinfection process. Existing regulations (sections 60303 through 60317) specify a median concentration of coliform bacteria of 2.2 per 100 milliliters and a maximum of 23 coliform per 100 milliliters which may be exceeded in only one sample within a 30 day period. These bacterial requirements are unchanged in the proposed regulations but are made a part of the definition for greater clarity. The existing regulation does not specify a maximum for the one sample exceedance. The Department believes that this should not be unlimited because it could create a short period of substantial contamination to users. A maximum of 240 MPN has been inserted for the one sample exceedance. This would allow ample operational flexibility without creating an unreasonable risk to the public.

Currently, the term "adequate disinfection" is defined strictly in terms of coliform concentrations. The Department does not believe this provides sufficient reliability for inactivation of viruses. A report on a major study of the effectiveness of wastewater treatment processes in controlling viruses (the Pomona Virus Study) was released in February 1977. That report made specific technical recommendations on minimum disinfection concentration and contact time necessary to control viruses. Since the release of that study the Department has used those recommendations

as the basis for comments to the regional water quality control boards on proposed recycling project requirements, to ensure adequate public health protection when recycled water is used. Proposed section 60301.230, therefore, also adds a requirement for a minimum chlorine concentration versus time (generally referred to as CT values) of 450 based on a minimum 90 minute contact time. These requirements are based on the Department's experience with several demonstration projects (including the 1977 report on the Pomona Virus Study) where these concentrations and detention times were shown to be effective in inactivating viruses and on operational testing data submitted by the Los Angeles County Sanitation Districts. An alternative disinfection method can be used provided that it is demonstrated to be capable of removing or inactivating viruses to a level of 1/100,000 (5 logs) of the initial concentration. The demonstration of a 5 log reduction or use of the specified CT values were determined by the Department to be necessary to assure effective and reliable removal and inactivation of enteric viruses for those uses where the public exposure to the recycled water is exceptionally high.

Sections 60303 through section 60319. These sections would be repealed from title 22, division 4 and new sections 60302 through 60310 would be adopted.

ARTICLE 2. Sources of Recycled Water

Section 60302. Source Specifications

This new section would be adopted to establish that only municipal sewage can be used as a source for recycled water. If this limitation did not exist, any kind of wastewater could be used, including various types of industrial wastewaters; this could result in water quality issues beyond the scope of these regulations.

ARTICLE 3. Use of Recycled Water

Section 60303. Exceptions

This section would be adopted to make it clear that the requirements of this chapter do not apply to onsite use of recycled water at a treatment plant. Many water recycling or wastewater treatment plants utilize treated effluent from the plant for a variety of operational purposes. These operational uses are under the direction of wastewater treatment plant operators who are

knowledgeable and trained in the safe handling of wastewater. Since the primary purpose of these regulations would be to protect the general public who may be unaware of potential hazards, applying them to onsite uses would serve no useful purpose and would unreasonably restrict treatment plant operations.

Section 60304. Use of Recycled Water for Irrigation

(a) This new section would not substantively change the existing requirements set forth in sections 60303 through 60317 for irrigation of food crops, parks, playgrounds, or schoolgrounds which currently require the use of disinfected tertiary effluent. Residential landscaping and unrestricted access golf course uses would be added to the list of acceptable uses of tertiary recycled water because the risk of public exposure for these uses is comparable to the currently allowed uses. This subsection would permit a recycled water to be produced without the use of chemical coagulation for the uses set forth in this section provided certain turbidity levels were not exceeded. The Department has determined from the Castroville demonstration project and other plant experiences that the disinfection process can be effective for irrigation uses without the need for coagulation as long as the turbidities remain below 5 NTU and the filter effluent turbidity does not exceed 2 NTU. This provision would allow some recycling projects to save treatment costs and still provide a recycled water which is safe for the uses stated in this subsection.

(b) Subsection (b) is the same as section 60305 of the current requirements except that the wording would be modified for greater clarity.

(c) This subsection would be essentially the same as existing requirements (sections 60311 through 60313) except that the requirements would be reorganized and the wording modified for greater clarity.

(d) This subsection would be essentially the same as sections 60307 through 60309 of the existing regulations. Several terms would be changed, wording modified, and the section reorganized for greater clarity. Existing section 60309 requires the use of at least primary

treatment effluent for seed, fodder and fiber crops. While public contact with these types of uses are minimal, contact is still possible by workers and others. Therefore, the Department has determined that this type of effluent should receive oxidation in addition to primary treatment to assure an acceptable minimal quality of recycled water and thereby protect public health ("Review of Health Risks Relating to Ingestion and Inhalation of Constituents of Recycled Water," Department of Health Services 1992, section 2). Primary treatment by itself is rarely practiced in California and the Department is not aware of any recycled water facility that uses only primary treatment without at least also having oxidation ponds. Therefore, this change should not affect any existing operations.

In addition, the use of recycled water for Christmas tree farms would be adopted with the provision that no irrigation with recycled water take place for a period of 14 days prior to harvesting or allowing public access. Based on observations of irrigated sites, the Department has determined that the 14 days allows for sufficient absorption and evaporation of irrigation water to ensure that the public would not be at any risk of exposure to the recycled water used for irrigation.

(e) This subsection is proposed to be added to assure that the public is not exposed to an unreasonable risk of infection due to the eating of food that has come into direct contact with inadequately treated recycled water. The Department has determined ("Review of Health Risks Relating to Ingestion and Inhalation of Constituents of Recycled Water," Department of Health Services 1992) that the highest conceivable probability of contracting a viral intestinal infection from one episode (one day) of eating one meal that includes food that was sprayed with disinfected tertiary recycled water during irrigation is 1 in 100,000. As pointed out in the above referenced document, the Department considers this to be an acceptable level of infectious risk. Since a less treated recycled water (i.e., disinfected secondary-2.2) would create a higher and unacceptable risk of infection, the requirement for use of disinfected tertiary recycled water is proposed.

Section 64305. Use of Recycled Water for Impoundments

(a) The purpose of this subsection would be to set forth the requirement for disinfected tertiary treatment, as defined in section 60301.22 and which has been subjected to conventional treatment, for nonrestricted recreational impoundments in order to provide adequate public health protection from enteric viruses and bacteria. Nonrestricted recreational use of recycled water presents one of the most significant public exposures to the possibility of infection from recycled water due to potential ingestion of the recycled water while swimming. Existing section 60315 requires complete conventional treatment for nonrestricted recreational use but does not define this treatment in the same manner as the proposed regulations.

(b) The purpose of this subsection would be to allow the use of disinfected tertiary recycled water for nonrestricted recreational impoundments in certain circumstances. The Department recognizes that disinfected tertiary treated recycled water (which does not include the sedimentation unit process as part of the treatment chain) has been demonstrated to be equivalent to conventional treatment with respect to removal and inactivation of viruses. However, there is some uncertainty that this type of treatment can reliably produce a pathogen free effluent in all cases. The Blue Ribbon Panel on Assessment of Risk recommended that this type of treatment should be required to demonstrate its treatment effectiveness by means of additional monitoring if the recycled water is intended to be used for nonrestricted recreation. The Department concurred in this recommendation. This subsection sets forth the monitoring that would need to be performed during the first two years of operation if disinfected tertiary recycled water is proposed to be used in lieu of conventionally treated recycled water.

The Department determined that 12 samples of pathogenic organisms taken at monthly intervals followed by quarterly monitoring for at least an additional year would provide sufficient data to establish the effectiveness of the treatment process and also provide valuable data needed to evaluate the health risk associated with the project. Although the purpose of the demonstration would be to establish that the recycled water is essentially free of enteric virus, the advisory panel recommended that monitoring for giardia and cryptosporidium also be performed during this demonstration period as this information would be useful in evaluating the effectiveness of

the treatment process and would be valuable in establishing a possible basis for future standards for these organisms.

(c) The requirement that the coliform densities specified for disinfection shall be met at a point between the disinfection process and the point of entry to the use area is necessary to assure that coliform bacteria are monitored prior to the recycled water being introduced into the actual use impoundment.

(d) This subsection is the same as existing section 60317 for restricted recreational impoundments except that it has been reworded for better clarity. Use of this type of recycled water for fish hatchery impoundments would be adopted since this type of use was not included in existing regulations. The Department has determined that the degree of public exposure to impoundments at a fish hatchery (where such public access is allowed) is similar to a restricted recreational impoundment and a similar treatment requirement is, therefore, warranted.

(e) The requirement of this subsection is the same as existing requirements (section 60303) except for the exclusion of decorative fountains. The Department has determined ("Review of Health Risks Relating to the Ingestion and Inhalation of Constituents of Recycled Water," Department of Health Services 1992) that decorative fountains are capable of producing a mist that can increase the exposure hazard to the public through inhalation and, therefore, requires a higher level of treatment. The treatment requirement for recycled water for use in decorative fountains is specified in section 60306 (a).

Section 60306. Use of Recycled Water for Cooling

This section is proposed to be added to existing regulations to cover the use of recycled water for cooling purposes. This is a relatively new use of recycled water that was not recognized when the existing regulations were adopted. Cooling towers are generally equipped with drift eliminators to minimize the loss of cooling system water, thereby reducing the necessity to add water to the cooling system; drift eliminators would also provide specific health protective benefits when recycled water is used in cooling towers by minimizing the potential

exposure to microorganisms contained in the droplets of cooling water. The use of drift eliminators is a prevailing practice not primarily necessitated by the use of recycled water for this purpose. The use of recycled water for cooling falls into two categories based on whether or not a mist is produced that could contact members of the public.

(a) The purpose of this subsection would be to set forth the requirement for disinfected tertiary treatment of the recycled water in cooling systems that generally produce a mist (also known as drift) as part of the cooling process. This level of treatment is necessary to ensure that the mist does not pose a potential risk of infection to workers and the public via inhalation or contact with particles that remain in the air after the mist evaporates.

(b) This subsection allows the use of a lesser treated (disinfected secondary-23) recycled water in those situations where the cooling system does not produce a mist. Since there is a lesser likelihood of public contact or inhalation under these circumstances, the Department has determined ("Review of Health Risks Relating to the Ingestion and Inhalation of Constituents of Recycled Water," Department of Health Services 1992, section 3) that use of disinfected secondary-23 recycled water in lieu of disinfected tertiary recycled water provides adequate public health protection.

(c) This subsection adds additional requirements for cooling systems that produce a mist during the cooling process. The subsection requires the use of a drift eliminator whenever the cooling systems is used in conjunction with an air conditioning system. The Department has determined that the requirement to minimize drift is warranted due to the higher risk of inhalation associated with use of recycled water in air conditioning systems ("Review of Health Risks Relating to Ingestion and Inhalation of Constituents of Recycled Water," Department of Health Services 1992, pages 20-26).

The requirement for use of a biocide, such as chlorine, in the operation of the cooling system using recycled water is necessary to assure that pathogenic organisms of wastewater origin do not grow or regrow in the recirculated water. Biocides and other conditioning chemicals are

generally used in recirculating cooling towers regardless of the water source. Since cooling systems operate on a continuous recirculating basis, the lack of disinfectant treatment (such as periodic shock treatment) of the recirculated water could lead to the eventual growth of pathogenic organisms in the recycled water.

Section 60307. Use of Recycled Water for Other Purposes.

The purpose of this section would be to identify additional uses of recycled water that should be allowed and are not covered by the existing title 22, Division 4 regulations. The uses are broken into two categories, those that have a fairly high potential for public exposure thus requiring a high level of treatment and those with little public exposure thus allowing a lesser degree of treatment.

(a) Each of the uses specified in this subsection are new uses for recycled water that are not covered in the existing title 22, Division 4 regulations. These uses pose as much risk for public contact with the recycled water through direct contact, inhalation, or ingestion, as do those listed in section 60304(a) which require disinfected tertiary treatment to reduce the risk of infection. Therefore, the Department has determined that the recycled water used for these purposes must meet the definition for a disinfected tertiary recycled water in order to avoid unreasonable health risks.

This subsection also permits a recycled water to be produced without the use of chemical coagulation for the uses set forth in this section provided certain turbidity levels are not exceeded. As described under section 60303 (a), the disinfection process can be effective for moderate exposure uses without the need for coagulation as long as the turbidities remain below 5 NTU and the filter effluent turbidity does not exceed 2 NTU. This provision would allow some recycling projects to save treatment costs and still provide a recycled water which is safe for the uses stated in this section.

(b) The uses listed in this subsection are also new uses for recycled water, however, these uses have considerably less potential for public contact than the uses specified in subsection (a)

and thus do not require that same high level of treatment. The use of disinfected secondary-23 recycled water is allowed because the Department has determined that the probable risk of infection from the use of this type of recycled water for the listed uses are comparable to existing allowed uses for disinfected secondary-23 recycled water. Therefore, use of disinfected secondary-23 recycled water for these uses would not result in an unreasonable risk of infection to the public.

(c) Subsection (c) allows the use of undisinfected secondary recycled water to be used for the flushing of sanitary sewers. While this use has some potential for exposure or contact by the employees engaging in this activity, these employees are trained in the handling of untreated wastewater.

ARTICLE 3. USE AREA REQUIREMENTS

Section 60310. Use Area Requirements

(a), (b), (c) These subsections would establish setbacks or buffer zones around domestic water supply wells to provide assurance that recycled water would not enter and potentially contaminate a domestic water supply well. These types of setbacks are currently common practice and are reflected in several state and local regulations with respect to septic tanks, leach fields, and wastewater disposal areas. Providing an appropriate distance from a well allows sufficient movement through the soil to eliminate the entry of pathogenic organism since the ability to travel through soil for such organisms is limited. The distances set forth in the proposed regulation varies dependent upon the degree of prior treatment of the recycled water. The distances established in this subsection were determined by the Department to represent an adequate degree of protection and are consistent with current guidelines and practices already in use.

With respect to use of disinfected tertiary recycled water, the Department has included language that allows the elimination of the 50 foot setback if specific mitigation measures are present and taken. The Department has determined that the combination of these factors provides an

equivalent degree of protection for disinfected tertiary recycled water and has already approved several such installations in recent years.

(d) This requirement would assure that recycled water used for the various purposes set forth in sections 60302 through 60306 would be confined to the designated area of use and not allowed to affect persons outside of the designated area. The Regional Water Quality Control Boards have developed "best management practices" to control certain runoff situations and occasionally allows runoff to occur subject to these practices. This would be allowable where this runoff is approved by the Boards in the establishment of water recycling requirements. Provisions are also added to assure that areas that have a high risk potential for possible contamination are not affected by drifting spray or runoff from use of a recycled water.

(e) This subsection would provide assurance that mist or spray from an irrigation project that uses recycled water, other than disinfected tertiary recycled water, does not come into contact with sensitive areas where children or other vulnerable members of the public may be exposed. A 100 foot setback was determined by the Department to be an adequate buffer against inadvertent spray drift based on the document "Review of Health Risks Related to Ingestion and Inhalation of Constituents of Recycled Water," Department of Health Services 1992.

(f) The purpose of this subsection would be to alert workers and members of the public that recycled water is being used in a particular area and that this water is considered unsafe for drinking. The purpose of requiring an international symbol in addition to the English wording of the signs would be to assure that persons who do not read or understand English would be properly alerted to avoid drinking the recycled water. This symbol is consistent with the symbol being used on a voluntary basis by several recycled water agencies. Use of wording in another language in lieu of the symbol would not be practical because of the multitude of languages that would have to be included. This approach has been included in guidance which the Department has used for several years in evaluating recycling facilities. Thus many existing facilities already conform. The Department does not believe that it is necessary to specify the size of the letters and symbol since recycling facilities operating under the guidance have created signs that

adequately display both the wording and the symbol without such specifications. However, the overall size of the sign is specified to establish the minimum dimensions necessary to catch the eye of anyone in the vicinity.

(g) Whenever recycled water is used in a piping system in a facility or area that also receives potable water by means of a separate piping system, a possibility for cross connections exists. Cross connections can allow unsafe water to be drawn back into and contaminate the potable drinking water supply. The purpose of these subsections would be to make it clear that no physical connections between the two systems is allowed (except as allowed under section 7604, title 17). Hose bibs provide an easy and quick means for intentionally or inadvertently creating such a physical connection by simple means of a double connected garden hose. The prohibition of hose bibs on the recycled water system would minimize this possibility. Provision has been allowed for use of detachable "quick couplers" which would not be available to the public or unknowledgeable workers.

ARTICLE 4. DUAL PLUMBED RECYCLED WATER SYSTEMS

Section 60313. General Requirements

Subsection (a). The proper oversight and daily management of a recycled water system that is utilized for dual plumbing is extremely important for public health protection.. For example, failure to adequately monitor the quality of the recycled water, inspect the facilities for cross connections or properly test the systems could lead to serious contamination of the potable water supplies. Public water systems are already required to conduct and maintain comprehensive cross connection control programs and have the expertise needed to assure that potential contamination problems do not occur. In order to assure responsible oversight and operation of such a system, the Department has determined that it is necessary that the system be under the direct control of a public agency or a public water system. This subsection makes it clear that only such an agency may deliver recycled water to dual plumbed facilities.

Subsection (b) The purpose of subsection (b) would be to assure that certain types of facilities that have unusually high risk potential do not receive recycled water for indoor use. These

facilities include residential type facilities which are well defined in the Uniform Building Code and facilities that produce food or beverages such as food processing plants, restaurants, bottling plants, and similar establishments. The potential risk for food or beverage contamination with subsequent human ingestion is sufficiently great in the Department's opinion that these facilities should be excluded from the allowable internal use of recycled water via dual plumbed facilities. See also the discussion of section 60302 which is also applicable to this subsection.

Subsection (c) Section 13522.5 of the Water Code requires the submission of an engineering report to the State Regional Water Quality Control Board. Existing section 60323 (California Code of Regulations) already requires certain information to be included in the engineering report. Section 60323, however, focuses on the treatment of the recycled water and does not include the information necessary to evaluate a proposed dual plumbed facility. The purpose of this subsection would be to make it clear that additional information, as specified in section 60314, must be submitted as part of the required engineering report.

Since plumbing systems are extremely difficult and expensive to remove or modify after they have been installed, the requirement to submit the proposal prior to installation or construction is necessary.

Section 60314. Report Submittal.

The purpose of this section would be to make it clear what information must be submitted as part of the engineering report.

Subsection (a) sets forth the information that the Department has determined is necessary to evaluate the degree of health risk. The number, type, and location of each facility and type of use to be made of the recycled water is necessary to assure that the proposed method of distribution and plumbing layout is appropriate for the type of public or employee exposure that would be encountered at each facility. The number of persons served is necessary to determine the degree of overall risk since the more persons potentially exposed the greater the hazard and need for possible additional protective measures. The requirement for identification of the person

responsible for operation of the dual plumbed system at each facility is necessary to assure the agency and the Department that someone has been designated that responsibility and allows the agency to know whom to contact should any problems with the recycled water occur.

Subsection (a) (2) is necessary to provide the Department with the details of how the piping system would be constructed and installed. This information is necessary to assure that the potable water supply would not be subjected to unreasonable risk of cross connection or possible backflow.

The purpose of subsection (a) (3) would be to require the agency to describe how the provisions of sections 60315 and 30616 are proposed to be complied with. The description of these methods prior to construction of the project are necessary in order for the Department to make a reasonable judgment that the proposed system as planned to be operated by the agency would not pose unreasonable risks to public health. Since there are various methods available to test the integrity of the recycled water system, it is necessary for the agency to describe which method they propose to use so that the Department can properly evaluate the proposal and include any appropriate conditions in its approval.

Subsection (b) allows a project proponent to submit one report covering multiple facilities where this would be practical. Since not all facilities would necessarily be hooked up at the outset, the submission of plans and specifications for individual facilities covered by the report could be submitted at a later date prior to the actual hookup of the facility. The purpose of this subsection would be to simplify the report process and eliminate unnecessary paperwork.

Section 60315. Design Requirements.

Using the potable water system as a source of makeup water (to be used when the supply of recycled water may not be sufficient to maintain pressure and supply users) requires a direct connection between the two systems thus creating a potential serious hazard to the potable water system. The purpose of this subsection would be to allow for such a situation provided the potable water system is protected by an air gap assembly. This type of backflow protection is

similar and consistent with backflow requirements for similar hazardous conditions that are specified in sections 7602 and 7603 of the California Code of Regulations.

Section 60316. Operation Requirements.

Subsection (a) The purpose of this subsection would be to require that the dual plumbed system be inspected and tested initially for cross connections prior to use of the recycled water system. As discussed under several previous sections, a high potential for the creation of cross connections exists whenever a dual plumbed system is used. These cross connections can be inadvertently created after the system has been installed by unknowing workers or plumbers. A cross connection can go undetected for a period of time as long as there is not a drop in pressure in the potable water system. It is necessary, therefore, to periodically inspect the system to detect any visible cross connections that may have been created. The Department has determined that annual inspection of the system provides reasonable assurance of detection of cross connections and does not pose significant costs to the recycled water system. This is the same inspection frequency required of public water systems for backflow prevention devices. Some cross connections, however, may be buried or hidden behind walls and may not be visibly detectable. The Department has determined therefore, that the recycled water system should be tested by one of several means to detect leaks or cross connections. Some existing facilities have utilized the injection of dye into the recycled water system combined with a pressure drop in the potable system to detect cross connections. Other methods are also available. The proposed regulation allows the user to propose the method of testing to be used. The Department has determined that a physical test conducted at least every four years is a reasonable frequency to conduct such tests. More frequent would provide better assurance but would present unreasonable costs to the user. Less frequent could expose consumers to an unreasonable risk. This testing frequency has also been recommended by the California Ad-Hoc Dual Plumbing Committee (an independent informal panel established in 1993 by the Department of Water Resources and The Department of Health Services. See Appendix number 2 for membership listing.) for inclusion into section R-10 of the California Uniform Plumbing Code.

The type of inspection and testing required by this subsection is complex and requires someone who has been trained to evaluate cross connection hazards and conduct appropriate testing. The American Water Works Association tests and certifies cross connection control specialists on a voluntary basis. The Department has determined that a specialist thus certified would constitute a acceptable trained individual. The requirement for submission of a report to the Department would be to assure that the inspection and testing has been performed and completed.

Subsection (b) This subsection requires the agency to notify the Department whenever an actual backflow of recycled water to the potable water system has occurred. It is important for the Department to be notified of such an occurrence so that the degree of immediate risk of contamination may be evaluated and to allow the Department to determine if mitigation measures such as the issuance of a boil water notice to the public needs to be taken. Allowing 24 hours to notify the Department does not impose an unreasonable burden on the agency and allows the Department to react quickly to take additional steps to protect the public if necessary.

Subsection (c). This subsection would ensure that all cross connection control devices are installed and inspected according to the procedures established in regulation that cover specifics related to inspection and maintenance.

ARTICLE 6. SAMPLING AND ANALYSIS

Section 60321. Sampling and Analysis.

This section has been deleted and replaced with a new section 60321 that has been rewritten for better clarity. With the exception of the language regarding determination of compliance with the turbidity standard, the requirements of the proposed section 60321 are essentially the same as the existing section. The means of determining compliance with the turbidity requirement in the existing section 60321 is not clearly stated. As required in the existing section, turbidity analysis must be performed by a continuous recording turbidimeter. This results in a very large amount of turbidity data that cannot be conveniently incorporated into a compliance calculation, and is not necessary to assure adequate process performance. The proposed section 60321 would allow

the selection of a value each four hours from the continuous record to be used in the determination of compliance. This is consistent with the approach used in the drinking water filtration regulation (title 22, CCR, Division 4, chapter 17, section 64655). The monthly reporting of turbidity data is consistent with other water quality data reporting (CCR section 64451) and enables the regulatory agency to properly track the process performance.

New language would be adopted requiring the results of the daily turbidity compliance determinations to be submitted monthly to the regulatory agency. The current section 60321 is silent on the reporting frequency thus creating confusion. The Department has determined that monthly submittal of this data is sufficient for compliance determinations and oversight by the regulatory agency and that it would be unreasonable to require daily submittal. In addition, this reporting period is consistent with other reporting requirements administered by the Department's Drinking Water Program.

Subsection (c) simply clarifies who is responsible for conducting the sampling since the present section 60321 is silent on this point.

TITLE 17, DIVISION 1, CHAPTER 5

ARTICLE 1

Section 7604. Type of Protection Required.

This section has been reorganized to remove recycled water from the previous subsection (a) and create a new subsection for recycled water uses. Existing paragraph (a)(2) has been redesignated as (a)(1), and the word "may", which was omitted in printing, has been restored.

Existing subsection (a) (3) has been redesignated as (c) (2) and has been modified in order to be consistent with the changes made in title 22, Article 4, sections 60312 through 60316. The existing section 7604 requires an air gap for premises where recycled water is used except that under certain circumstances, an RP could be used instead of an air gap. Since these circumstances are covered under the changes to Article 4, there is no reason to continue to

require an air gap, therefore, the minimum requirement is now proposed as an RP and the special circumstance language stricken.

Subsection (c) (3) is added to make it clear that the requirement of subsection (c) (2) does not apply to individual residences that use recycled water for landscape irrigation. This would be an unreasonable requirement on individual homeowners and is not necessary as a result of the Article 4 changes. Instead subsection (c) (3) reduces the requirement from RP devices to double check valves for approved dual plumbed use areas. This change is appropriate because of the additional safety factors built in as a result of proposed sections 60312 through 60316. Since a project proponent has the option to include additional backflow prevention measures in the project proposal, allowance has been made to use an alternative backflow prevention plan where the local water utility is satisfied that the alternative plan provides equivalent protection for their potable water system. The Department would review and approve the alternative plan in those instances where the public water supply utility is also the recycled water supplier to avoid a utility from approving its own plan.

Similarly, subsection (d) (4) modifies existing subsection (c) to make it clear that dual plumbed facilities that use potable water for fire protection within buildings and recycled water in a separate piping system for external use are allowed to install double check valves in lieu of an RP device

ALTERNATIVES CONSIDERED

These proposed regulations were developed with input from a Water Reclamation Advisory Panel. This panel was made up of representatives from wastewater treatment agencies, water recycling and distribution agencies, local health departments and affected state agencies. During the panel discussions, alternatives to specific details were evaluated. The proposed regulations represent a general consensus (although not necessarily unanimous) agreement of the group that these regulations would be the least burdensome to the regulated community while still maintaining appropriate public health protection.

The Department has determined that no alternative considered would be more effective in protecting public health, or as effective and less burdensome to affected private persons, than the proposed regulations.

LOCAL MANDATE DETERMINATION

The proposed regulations do not impose a mandate on local agencies which requires state reimbursement pursuant to Part 7, (commencing with Section 17500) of Division 4 of the Government Code. The regulations do not mandate the use of recycled water. This is a discretionary action on the part of the user. While in certain circumstances, a local agency can mandate the use of recycled water, that mandate is a result of such local action and is not a result of or related to these regulations.

The Department of Health Services has identified potential costs which may be incurred by existing users to modify the signs currently used to warn the public of the use of recycled water. To the extent public agencies use recycled water, some additional cost, therefore, may be incurred by a few local agencies depending upon their particular circumstances. However, these costs are not the result of a "new program or higher level of service" within the meaning of Article XIIIB, Section 6 of the California Constitution because they apply generally to all public and private individuals and entities that utilize recycled water and do not impose unique requirements on local government. Therefore, no state reimbursement of these costs is required.

destroying processing before being consumed by humans, and

(7) Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

(e) No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with the edible portion of food crops eaten raw by humans unless the recycled water complies with subsection (a).

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60305. Use of Recycled Water For Impoundments.

(a) Except as provided in subsection (b), recycled water used as a source of water supply for nonrestricted recreational impoundments shall be disinfected tertiary recycled water that has been subjected to conventional treatment.

(b) Disinfected tertiary recycled water that has not received conventional treatment may be used for nonrestricted recreational impoundments provided the recycled water is monitored for the presence of pathogenic organisms in accordance with the following:

(1) During the first 12 months of operation and use the recycled water shall be sampled and analyzed monthly for *Giardia*, enteric viruses, and *Cryptosporidium*. Following the first 12 months of use, the recycled water shall be sampled and analyzed quarterly for *Giardia*, enteric viruses, and *Cryptosporidium*. The ongoing monitoring may

be discontinued after the first two years of operation with the approval of the department. This monitoring shall be in addition to the monitoring set forth in section 60321.

(2) The samples shall be taken at a point following disinfection and prior to the point where the recycled water enters the use impoundment. The samples shall be analyzed by an approved laboratory and the results submitted quarterly to the regulatory agency.

(c) The total coliform bacteria concentrations in recycled water used for nonrestricted recreational impoundments, measured at a point between the disinfection process and the point of entry to the use impoundment, shall comply with the criteria specified in section 60301.230 (b) for disinfected tertiary recycled water.

(d) Recycled water used as a source of supply for restricted recreational impoundments and for any publicly accessible impoundments at fish hatcheries shall be at least disinfected secondary-2.2 recycled water.

(e) Recycled water used as a source of supply for landscape impoundments that do not utilize decorative fountains shall be at least disinfected secondary-23 recycled water.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60306. Use of Recycled Water for Cooling.

(a) Recycled water used for industrial or commercial cooling or air conditioning that involves the use of a cooling

tower, evaporative condenser, spraying or any mechanism that creates a mist shall be a disinfected tertiary recycled water.

(b) Use of recycled water for industrial or commercial cooling or air conditioning that does not involve the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates a mist shall be at least disinfected secondary-23 recycled water.

(c) Whenever a cooling system, using recycled water in conjunction with an air conditioning facility, utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system shall comply with the following:

(1) A drift eliminator shall be used whenever the cooling system is in operation.

(2) A chlorine, or other, biocide shall be used to treat the cooling system recirculating water to minimize the growth of *Legionella* and other micro-organisms.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60307. Use of Recycled Water for Other Purposes.

(a) Recycled water used for the following shall be disinfected tertiary recycled water except that coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU, and that there is the capability to automatically activate chemical addition or divert

the wastewater should the filter influent turbidity exceed 5 NTU at any time:

(1) Flushing toilets and urinals,

(2) Priming drain traps,

(3) Industrial process water that may come into contact with workers,

(4) Structural fire fighting,

(5) Decorative fountains,

(6) Commercial laundries,

(7) Consolidation of backfill around potable water pipelines,

(8) Artificial snow making for commercial outdoor use,

(9) Commercial car washes where the washing is not done by hand and where the general public is excluded from the washing process, and

(b) Recycled water used for the following uses shall be at least disinfected secondary-23 recycled water:

(1) Industrial boiler feed,

(2) Nonstructural fire fighting,

(3) Backfill consolidation around nonpotable piping,

(4) Soil compaction,

(5) Mixing concrete,

(6) Dust control on roads and streets,

(7) Cleaning roads, sidewalks and outdoor work areas, and

(c) Recycled water used for flushing sanitary sewers shall be at least undisinfected secondary recycled water.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

ARTICLE 4. USE AREA REQUIREMENTS.

Section 60310. Use Area Requirements.

(a) No irrigation with disinfected tertiary recycled water shall take place within 50 feet of any domestic water supply well unless all of the following conditions have been met:

(1) A geological investigation demonstrates that an aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.

(2) The well contains an annular seal that extends from the surface into the aquitard.

(3) The well is housed to prevent any recycled water spray from coming into contact with the wellhead facilities.

(4) The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.

(5) The owner of the well approves of the elimination of the buffer zone requirement.

(b) No impoundment of disinfected tertiary recycled water shall occur within 100 feet of any domestic water supply well.

(c) No irrigation with, or impoundment of, disinfected secondary-2.2 or disinfected secondary-23 recycled water shall take place within 100 feet of any domestic water supply well.

(d) No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

(e) Any use of recycled water shall comply with the following:

(1) Any irrigation runoff shall be confined to the recycled water use area unless otherwise authorized by the regulatory agency.

(2) Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.

(3) Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.

(f) No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.

(g) All use areas where recycled water is used that are accessible to the public shall be posted with conspicuous signs,

in a size no less than 4 inches high by 8 inches wide, that include the following wording : "RECYCLED WATER - DO NOT DRINK". Each sign shall display an international symbol similar to that shown in Figure 1.

(h) Except as allowed under section 7604 of title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

(i) The recycled water piping system shall not include any hose bibbs. Only quick couplers that differ from those used on the potable water system shall be used on the recycled water piping system.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

ARTICLE 5. DUAL PLUMBED RECYCLED WATER SYSTEMS.

Section 60313. General Requirements.

(a) No person other than a recycled water agency shall deliver recycled water to a dual-plumbed facility.

(b)No recycled water agency shall deliver recycled water for any internal use to any individually-owned residential units including free-standing structures, multiplexes, or condominiums.

(c)No recycled water agency shall deliver recycled water for internal use except for fire suppression systems, to any facility that produces or processes food products or beverages. This exclusion does not apply to a cafeteria or snack bar in a facility whose primary function does not involve the production or processing of foods or beverages.

(d) No recycled water agency shall deliver recycled water to a facility using a dual plumbed system unless the report required pursuant to section 13522.5 of the Water Code, and which meets the requirements set forth in section 60314, has been submitted to the regulatory agency.

Authority cited: Section 13521 Water Code
Reference: Sections 13521, 13522.5, 13523.1, 13553 and 13554 Water Code

Section 60314. Report Submittal.

(a) For dual-plumbed recycled water systems, the report submitted pursuant to section 13522.5 of the Water Code shall contain the following information in addition to the information required by section 60323:

(1) A detailed description of the intended use area identifying the following:

(A) The number, location, and type of facilities within the use area proposing to use dual plumbed systems,

(B) The average number of persons estimated to be served by each facility on a daily basis,

(C) The specific boundaries of the proposed use area including a map showing the location of each facility to be served,

(D) The person or persons responsible for operation of the dual plumbed system at each facility, and

(E) The specific use to be made of the recycled water at each facility.

(2) Plans and specifications describing the following:

(A) Proposed piping system to be used,

(B) Pipe locations of both the recycled and potable systems,

(C) Type and location of the outlets and plumbing fixtures that will be accessible to the public, and

(D) The methods and devices to be used to prevent backflow of recycled water into the public water system.

(3) The methods to be used by the recycled water agency to assure that the installation and operation of the dual plumbed system will not result in cross connections between the recycled water piping system and the potable water piping system. This shall include a description of pressure, dye or other test methods to be used to test the system every four years.

(b) A master plan report that covers more than one facility or use site may be submitted provided the report includes the information required by this section. Plans and specifications for individual facilities covered by the report may be submitted at any time prior to the delivery of recycled water to the facility.

Authority cited: Sections 13521 and 13522.5 Water Code and 4023.3 Health and Safety Code

Reference: Sections 13521, 13522.5, 13523.1, 13553 and 13554 Water Code

Section 60315. Design Requirements.

The public water supply shall not be used as a backup or supplemental source of water for a dual-plumbed recycled water system unless the connection between the two systems is protected by an air gap separation which complies with the requirements of sections 7602 (a) and 7603 (a) of title 17, California Code of Regulations, and the approval of the public water system has been obtained.

Authority cited: Sections 13521 Water Code and 4023.3 Health and Safety Code
Reference: Sections 13521, 13523.1, 13553 and 13554 Water Code

Section 60316. Operation Requirements.

(a) Prior to the initial operation of the dual-plumbed recycled water system and annually thereafter, the dual plumbed system within each facility and use area shall be inspected for possible cross connections with the potable water system. The recycled water system shall also be tested for possible cross connections at least once every four years. The testing shall be conducted in accordance with the method described in the report submitted pursuant to section 60314. The inspections and the testing shall be performed by a cross connection control specialist certified by the California-Nevada section of the American Water Works Association. A written report documenting the result of the inspection and testing for the prior year shall be submitted to the department within 30 days following completion of the testing.

(b) The recycled water agency shall notify the department of any incidence of backflow from the dual-plumbed recycled water system into the potable water system within 24 hours of the discovery of the incident.

(c) Any backflow prevention device installed on the dual-plumbed recycled water system to protect the public water system

shall be inspected and maintained in accordance with section 7605 of Title 17, California Code of Regulations.

Authority cited: Sections 13521 Water Code and 4023.3 Health and Safety Code
Reference: Sections 13521, 13553 and 13554 Water Code

ARTICLE 6. Sampling and Analysis.

~~**Section 60321. Sampling and Analysis.**~~

~~(a) Samples for settleable solids and coliform bacteria, where required, shall be collected at least daily and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures. Turbidity analysis, where required, shall be performed by a continuous recording turbidimeter.~~

~~(b) For uses requiring a level of quality no greater than that of primary effluent, samples shall be analyzed by an approved laboratory method of settleable solids.~~

~~(c) For uses requiring an adequately disinfected, oxidized wastewater, samples shall be analyzed by an approved laboratory method for coliform bacteria content.~~

~~(d) For uses requiring an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater, samples shall be analyzed by approved laboratory methods for turbidity and coliform bacteria content.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60321. Sampling and Analysis.

(a) Disinfected secondary-23, disinfected secondary-2.2, and disinfected tertiary recycled water shall be sampled at least once daily for total coliform bacteria. The samples shall be taken from the disinfected effluent and shall be analyzed by an approved laboratory.

(b) Disinfected tertiary recycled water shall be continuously sampled for turbidity using a continuous turbidity meter and recorder following filtration. Compliance with the daily average operating filter effluent turbidity shall be determined by averaging the levels of recorded turbidity taken at four-hour intervals over a 24-hour period. Compliance with turbidity pursuant to section 60301.320(b) shall be determined by averaging the levels of recorded turbidity taken at 1.2-hour intervals over a 24-hour period. The results of the daily average turbidity determinations shall be reported monthly to the regulatory agency.

(c) The producer or supplier of the recycled water shall conduct the sampling required in subsections (a) and (b).

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

TITLE 17

DIVISION 1

CHAPTER 5

Group 4

ARTICLE 1.

Section 7604. Type of Protection Required.

The type of protection that shall be provided to prevent backflow into the public water supply shall be commensurate with the

degree of hazard that exists on the consumer's premises. The type of protective device that may be required (listed in an increasing level of protection) includes: Double check Valve Assembly--(DC), Reduced Pressure Principle Backflow Prevention Device--(RP) and an Air gap Separation--(AG). The water user may choose a higher level of protection than required by the water supplier. The minimum types of backflow protection required to protect the public water supply, at the water user's connection to premises with various degrees of hazard, are given in Table 1. Situations not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the water supplier or health agency.

TABLE 1

TYPE OF BACKFLOW PROTECTION REQUIRED

Degree of Hazard	*Minimum Type of Backflow Prevention*
(a) Sewage and Hazardous Substances	
~~(1) Premises where the public water supply is used to supplement the reclaimed water supply.~~	~~AG~~
~~(2)~~ (1) Premises where there are waste water pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
~~(3) Premises where reclaimed water is used and there~~	~~AG~~

~~is no interconnection with the potable water system. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.~~

~~(4)~~(2) Premises where hazardous substances are handled in any manner in which the substances may enter the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier. AG

~~(5)~~(3) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected. RP

(b) Auxiliary Water Supplies

(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and water supplier. AG

(2) Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and water supplier. RP

(c) Recycled Water

(1) Premises where the public water system is used to supplement the recycled water supply. AG

(2) Premises where recycled water is used, other than as allowed in paragraph (3), and there is no

interconnection with the potable water system. RP

(3) Residences using recycled water for landscape irrigation as part of an approved dual plumbed use area established pursuant to sections 60313 through 60316 unless the recycled water supplier obtains approval of the local public water supplier, or the Department if the water supplier is also the supplier of the recycled water, to utilize an alternative backflow protection plan that includes an annual inspection and annual shutdown test of the recycled water and potable water systems pursuant to subsection 60316(a). DC

~~(c)~~ (d) Fire Protection Systems

(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected). DC

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier. AG

(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from private reservoirs or tanks are used. DC

(4) Buildings where the fire system is supplied from the public water system and where recycled water is used in a separate piping system within the same building. DC

~~(d)~~ (e) Dockside Watering Points and Marine Facilities

(1) Pier hydrants for supplying water to vessels for any purpose. RP

(2) Premises where there are marine facilities. RP

~~(f)~~ (f) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that they do not exist. RP

~~(g)~~ (g) Premises where there is a repeated history of cross-connections being established or re-established. RP

Authority cited: Section ~~208 and 4026~~ 116375, Health and Safety Code and Section 13521 Water Code

Reference: Section ~~4026~~ 116375, Health and Safety Code and Section 13520, 13521 and 13554 (a) (3) Water Code

BUSINESS IMPACT

The treatment and use of recycled water has been covered by existing regulations for many years. The proposed regulations would amend the existing regulations governing recycled water by expanding the range of allowable uses of recycled water, establishing criteria for those new uses, and eliminating the areas of ambiguity in the existing regulations.

The production and/or use of recycled water is, for the most part, a discretionary activity. These regulations do not mandate that anyone produce or use recycled water, but there are potential effects on those businesses that choose to produce or use recycled water.. Producers can be drinking water or waste water utilities. Users can be various types of businesses and developments within a community that chose to use recycled water as a source of water for the purposes spelled out in the proposed regulations.

For communities where development has been constrained by limited water resources, recycled water can provide a new source of water and, as such, may enable businesses or residential areas to develop beyond what might have otherwise been possible. Since the proposed regulations would expand the approved uses for recycled water, recycled water would have a broader range of applications, thus making recycled water a more viable option for a community. In addition, the use of recycled water can potentially free some quantity of potable water for drinking and other appropriate uses where potable water is the only option. Based on this, the Department has determined that the regulations might affect the following:

1. The creation or elimination of jobs within the State of California. The requirements summarized above may create and/or enable the creation of jobs wherever recycled water is produced and/or used. Utilities choosing to produce recycled water may need

additional staff in order to manage and monitor the treatment processes involved. Likewise, users of recycled water may need additional staff to ensure that the water is properly handled. Communities with currently limited water resources that avail themselves of the opportunity to use recycled water, may experience business expansion and development and, thus, an increase in jobs.

2. The expansion of businesses currently doing business within the State of California. Since the proposed regulations would expand the uses for recycled water, the demand for this resource is likely to increase and, therefore, more utilities would probably go into the production of recycled water Also, utilities already producing recycled water might, if they are able, increase their production. Thus, these utilities would be expanding their services and clientele. For this reason, if no other, there would be some expansion.

Since water is an expensive commodity for businesses which use a significant amount, the use of recycled water, where approvable, would result in a cost savings, enabling possible expansion for such businesses. For communities where water resources has limited development, the availability of recycled water could result in expansion of businesses previously constrained.

3. The creation of new businesses or the elimination of existing businesses within the State of California. Since the proposed regulations would expand the uses for recycled water, the demand for this resource is likely to increase and, therefore, more utilities would probably go into the production of recycled water.

In addition, there may be would-be businesses unable to start up due to lack of available water resources or the cost of potable water, which might be able to establish themselves if they were able to utilize recycled water because of the broader range of uses under the proposed regulations.

DRAFT

CHAPTER 3 WATER RECYCLING ~~RECLAMATION~~ CRITERIA

ARTICLE 1 DEFINITIONS

~~60301. Definitions.~~

~~(a) Reclaimed Water. Reclaimed water means water which, as a result of treatment of domestic wastewater, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.~~

~~(b) Reclamation Plant. Reclamation plant means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.~~

~~(c) Regulatory Agency. Regulatory agency means the California Regional Water Quality Control Board in whose jurisdiction the reclamation plant is located.~~

~~(d) Direct Beneficial Use. Direct beneficial use means the use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to waters of the state.~~

~~(e) Food Crops. Food crops mean any crops intended for human consumption.~~

~~(f) Spray Irrigation. Spray irrigation means application of reclaimed water to crops by spraying it from orifices in piping.~~

~~(g) Surface Irrigation. Surface irrigation means application of reclaimed water by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.~~

~~(h) Restricted Recreational Impoundment. Restricted recreational impoundment is a body of reclaimed water in which recreation is limited to fishing, boating, and other non body contact water recreation activities.~~

~~(i) Nonrestricted Recreational Impoundment. A nonrestricted recreational impoundment is an impoundment of reclaimed water in which no limitations are imposed on body contact water sport activities.~~

~~(j) Landscape Impoundment. A landscape impoundment is a body of relaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.~~

~~(k) Approved Laboratory Methods. Approved laboratory methods are those specified in the latest edition of "Standard Methods for the Examination of Water and Wastewater" prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and which are conducted in laboratories approved by the State Department of Health.~~

~~(l) Unit Process. Unit process means an individual stage in the wastewater treatment sequence which performs a major single treatment operation.~~

~~(m) Primary Effluent. Primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliters per liter per hour of settleable solids as determined by an approved laboratory method.~~

~~(n) Oxidized Wastewater. Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.~~

~~(o) Biological Treatment. Biological treatment means methods of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.~~

~~(p) Secondary Sedimentation. Secondary sedimentation means the removal by gravity of settleable solids remaining in the effluent after the biological treatment process.~~

~~(q) Coagulated Wastewater. Coagulated wastewater means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc forming chemicals or by an equally effective method.~~

~~(r) Filtered Wastewater. Filtered wastewater means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24 hour period.~~

~~(s) Disinfected Wastewater. Disinfected wastewater means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.~~

~~(t) Multiple Units. Multiple units means two or more units of a treatment process which operate in parallel and serve the same function.~~

~~(u) Standby Unit Process. A standby unit process is an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of~~

~~providing comparable treatment for the entire design flow of the unit for which it is a substitute.~~

~~(v) Power Source. Power source means a source of supplying energy to operate unit processes.~~

~~(w) Standby Power Source. Standby power source means an automatically actuated self starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.~~

~~(x) Standby Replacement Equipment. Standby replacement equipment means reserve parts and equipment to replace broken-down or worn out units which can be placed in operation within a 24 hour period.~~

~~(y) Standby Chlorinator. A standby chlorinator means a duplicate chlorinator for reclamation plants having one chlorinator and a duplicate of the largest unit for plants having multiple chlorinator units.~~

~~(z) Multiple Point Chlorination. Multiple point chlorination means that chlorine will be applied simultaneously at the reclamation plant and at subsequent chlorination stations located at the use area and/or some intermediate point. It does not include chlorine application for odor control purposes.~~

~~(aa) Alarm. Alarm means an instrument or device which continuously monitors a specific function or a treatment process and automatically gives warning of an unsafe or undesirable condition by means of visual and audible signals.~~

~~(bb) Person. Person also includes any private entity, city, county, district, the State or any department or agency thereof.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.100. Approved Laboratory.

"Approved laboratory" means a laboratory that has been certified by the Department to perform microbiological analyses pursuant to section 116390, Health and Safety Code.

Authority cited : Section 13521, Water Code
Reference : Sections 13520 and 13521, Water Code

Section 60301.160. Coagulated Wastewater.

"Coagulated wastewater" means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated upstream from a filter by the addition of suitable floc-forming chemicals.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.170. Conventional Treatment.

"Conventional treatment" means a treatment chain that utilizes a sedimentation unit process between the coagulation and filtration processes and produces an effluent that meets the definition for disinfected tertiary recycled water.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.200. Direct Beneficial Use.

"Direct beneficial use" means the use of recycled water that has been transported from the point of treatment or production to the point of use without an intervening discharge to waters of the State.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.220. Disinfected Secondary-2.2 Recycled Water.

"Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.225. Disinfected Secondary-23 Recycled Water.

"Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.230. Disinfected Tertiary Recycled Water.

"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following conventional treatment or its equivalent that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.240. Drift.

"Drift" means the amount of water that escapes to the atmosphere as water droplets from a cooling system.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.245. Drift Eliminator.

"Drift eliminator" means a feature of a cooling system that reduces to a minimum the generation of drift from the system.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.250. Dual Plumbed System.

"Dual plumbed system" or "dual plumbed" means a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:

(a) To serve plumbing outlets used by the public within a building or

(b) Landscape irrigation at individual residences.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.300. F-Specific Bacteriophage MS-2.

"F-specific bacteriophage MS-2" means a strain of a specific type of virus that infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC 15597B1) and is grown on lawns of E. coli (ATCC 15597).

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.310. Facility.

"Facility" means any type of building or structure, or a defined area of specific public use that receives water for domestic use from a public water system as defined in section 116275 of the Health and Safety Code.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.320. Filtered Wastewater.

"Filtered wastewater" means an oxidized wastewater that meets the criteria in subsection (a) or (b):

(a) Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:

(1) At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and

(2) So that the turbidity of the filtered wastewater does not exceed any of the following:

(A) A daily average of 2 NTU;

(B) 5 NTU more than 5 percent of the time within a 24-hour period; and

(C) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:

(1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and

(2) 0.5 NTU at any time.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.330. Food Crops.

"Food crops" means any crops intended for human consumption.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.400. Hose Bibb.

"Hose bibb" means an outdoor faucet or similar device to which a common garden hose can be readily attached.

Authority cited: Section 1351, Water Code
Reference: Sections 1350 and 1351, Water Code

Section 60301.550. Landscape Impoundment.

"Landscape impoundment" means an impoundment of recycled water which is stored or used for aesthetic enjoyment or landscape irrigation, or which otherwise serves a similar function and is not intended to include public contact.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.600. Modal Contact Time.

"Modal contact time" means the amount of time elapsed between the time that a tracer, such as salt or dye, is injected into the influent at the entrance to a chamber and the time that the highest concentration of the tracer is observed in the effluent from the chamber.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.620. Nonrestricted Recreational Impoundment.

"Nonrestricted recreational impoundment" means an impoundment of recycled water, in which no limitations are imposed on body-contact water recreational activities.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.630. NTU.

"NTU" (Nephelometric turbidity unit) means a measurement of turbidity as determined by the ratio of the intensity of light scattered by the sample to the intensity of incident light as measured by method 2130 B. in Standard Methods for the Examination of Water and Wastewater, 19th ed.; Eaton, A. D., Clesceri, L. S., and Greenberg, A. E., Eds; American Public Health Association: Washington, DC, 1995; p. 2-8.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.650. Oxidized Wastewater.

"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.700. Recycled Water Agency.

"Recycled water agency" means the public water system, or a publicly owned or operated recycled water system, proposing to deliver recycled water to a facility.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.710. Recycling Plant.

"Recycling plant" means an arrangement of devices, structures, equipment, processes and controls which produce recycled water.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.740. Regulatory Agency.

"Regulatory agency" means the California Regional Water Quality Control Board in whose jurisdiction the recycling plant is located.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.750. Restricted Access Golf Course.

"Restricted access golf course" means a golf course where public access is controlled so that areas irrigated with recycled water cannot be used as if they were part of a park, playground, or school yard and where irrigation is conducted only in areas and during periods when the golf course is not being used by golfers.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.760. Restricted Recreational Impoundment.

"Restricted recreational impoundment" means an impoundment of recycled water in which recreation is limited to fishing,

boating, and other non-body-contact water recreational activities.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.800. Spray Irrigation.

"Spray irrigation" means the application of recycled water to crops to maintain vegetation or support growth of vegetation by applying it from sprinklers or orifices in piping. Spray irrigation does not include drip irrigation.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.830. Standby Unit Process.

"Standby unit process" means an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment of the actual flow through the unit for which it is a substitute.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.900. Undisinfected Secondary Recycled Water.

"Undisinfected secondary recycled water" means oxidized wastewater.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60301.920. Use Area.

"Use area" means an area of recycled water use with defined boundaries. A use area may contain one or more facilities.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~ARTICLE 2. IRRIGATION OF FOOD CROPS.~~

~~Section 60303. Spray Irrigation.~~

~~Reclaimed water used for the spray irrigation of food crops shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within a 30 day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~Section 60305 Surface Irrigation.~~

~~(a) Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.~~

~~(b) Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~**Section 60307. Exceptions.**~~

~~Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual case basis where the reclaimed water is to be used to irrigate a food crop which must undergo extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~**Article 3. Irrigation of Fodder, Fiber, and Seed Crops.**~~

~~**Section 60309. Fodder, Fiber, and Seed Crops.**~~

~~Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~**Section 60311. Pasture for Milking Animals.**~~

~~Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters as determined from the bacteriological results of the last 7 days for which analyses have been completed.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~ARTICLE 4. Landscape Irrigation.~~

~~Section 60313. Landscape Irrigation.~~

~~(a) Reclaimed water used for the irrigation of golf courses, cemeteries, freeway landscapes, and landscapes in other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 milliliters in any two consecutive samples.~~

~~(b) Reclaimed water used for the irrigation of parks, playgrounds, schoolyards, and other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater or a wastewater treated by a sequence of unit processes that will assure an equivalent degree of treatment and reliability. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 23 per 100 milliliters in any sample.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~ARTICLE 5. Recreational Impoundments.~~

~~Section 60315. Nonrestricted Recreational Impoundment.~~

~~Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30 day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~Section 60317. Restricted Recreational Impoundment.~~

~~Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

~~Section 60319. Landscape Impoundment.~~

~~Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment~~

~~process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.~~

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Article 2. SOURCES OF RECYCLED WATER.

Section 60302. Source Specifications.

The requirements in this chapter shall only apply to recycled water from sources that contain domestic waste, in whole or in part.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

ARTICLE 3. USES OF RECYCLED WATER.

Section 60303. Exceptions.

The requirements set forth in this chapter shall not apply to the use of recycled water onsite at a water recycling plant, or wastewater treatment plant, provided access by the public to the area of onsite recycled water use is restricted.

Authority cited: Section 13521, Water Code
Reference: Sections 13520 and 13521, Water Code

Section 60304. Use of Recycled Water for Irrigation.

(a) Recycled water used for the irrigation of the following shall be a disinfected tertiary recycled water except that coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2

NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU at any time:

(1) Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop,

(2) Parks and playgrounds,

(3) School yards,

(4) Residential landscaping,

(5) Unrestricted access golf courses, and

(6) Any other irrigation use not specified in this section and not prohibited by other sections of the California Code of Regulations.

(b) Recycled water used for the irrigation of food crops where the edible portion is produced above ground and not contacted by the recycled water shall be at least disinfected secondary-2.2 recycled water.

(c) Recycled water used for the irrigation of the following shall be at least disinfected secondary-23 recycled water:

(1) Cemeteries,

(2) Freeway landscaping,

(3) Restricted access golf courses,

(4) Ornamental nursery stock and sod farms where access by the general public is not restricted,

(5) Pasture for animals producing milk for human consumption, and

(6) Any nonedible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground or school yard

(d) Recycled wastewater used for the irrigation of the following shall be at least undisinfected secondary recycled water:

(1) Orchards where the recycled water does not come into contact with the edible portion of the crop,

(2) Vineyards where the recycled water does not come into contact with the edible portion of the crop,

(3) Non food-bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public),

(4) Fodder and fiber crops and pasture for animals not producing milk for human consumption,

(5) Seed crops not eaten by humans,

(6) Food crops that must undergo commercial pathogen-

State of California — Department of Health Services

Memorandum

Date : December 1, 1994

To : Ron Wetherall, Chief
Office of Regulations
714 P Street, Room 1000

1/DE

RECEIVED
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STATE OF CALIFORNIA
DRINKING WATER
FIELD OPERATIONS BRANCH

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RECEIVED
JAN 3 1995
CA DEPT. OF HEALTH SVCS.
OFFICE OF DRINKING WATER

From : Division of Drinking Water and Environmental Management
601 North 7th Street, MS 216
322-2308

Subject: Proposed Regulations for Groundwater Recharge with Reclaimed Water

Attached are five copies of the first draft of the proposed regulations for Groundwater Recharge with Reclaimed Water. These regulations are being proposed pursuant to Section 13521 of the Water Code. The proposed regulations establish reclaimed water quality and monitoring requirements and minimum treatment technologies for acceptable planned groundwater recharge projects.

The proposed regulations will affect a limited group of public agencies that plan to use reclaimed water to augment existing groundwater sources. There is an expected fiscal impact to certain public agencies presently practicing groundwater recharge. The cost that could be incurred relate to monitoring and treatment as well as the possible construction of new water supply wells. A presentation of potential estimated costs is contained in the Fiscal Impact Estimate.

We would appreciate your review of this regulation and scheduling it for public hearing. Should your have any questions concerning this regulation, please contact Bob Hultquist of my staff at 8-571-2149.

Harvey F. Collins, Ph.D., P.E., Chief
Division of Drinking Water and
Environmental Management

Attachments

cc: See next page

cc: Bob Hultquist
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Drinking Water Technical Programs Branch

PROPOSED REGULATION:

Title 22, CALIFORNIA CODE OF REGULATIONS

DIVISION 4. ENVIRONMENTAL HEALTH

CHAPTER 3. RECLAMATION CRITERIA

ARTICLE 1. DEFINITIONS

60301.210. Direct Injection.

"Direct injection" means the controlled subsurface addition of water directly into the groundwater basin that results in the replenishment of groundwater used or suitable for use as a source of domestic water supply.

60301.350. General Mineral.

"General mineral" means water analyses for bicarbonate, carbonate, and hydroxide alkalinity, calcium, chloride, copper, foaming agents, iron, magnesium, manganese, pH, sodium, sulfate, specific conductance, total dissolved solids, total hardness, and zinc.

60301.355. General Physical.

"General physical" means water analyses for color and odor.

60301.450. Initial Percolative Capacity.

"Initial percolative capacity" means the rate (unit volume per unit area per unit time or unit length per unit time) at which water moves through the soil prior to recharge conditions.

60301.640. Organics Removal.

"Organics removal" means granular activated carbon adsorption or reverse osmosis treatment designed to remove organic compounds from the reclaimed water.

60301.660. Planned Groundwater Recharge Project.

"Planned groundwater recharge project" means any water reclamation project designed for the purpose of recharging groundwater suitable for use as a source of domestic water supply.

60301.670. Project Category I.

"Project category I" means surface spreading recharge project which uses reclaimed water that has been oxidized, filtered, disinfected, and subjected to organics removal.

60301.672. Project Category II.

"Project category II" means surface spreading recharge project which uses reclaimed water that has been oxidized, filtered, and disinfected.

60301.674. Project Category III.

"Project category III" means a surface spreading recharge project which uses reclaimed water that has been oxidized and disinfected.

60301.676. Project Category IV.

"Project Category IV" means a direct injection recharge project which uses reclaimed water that has been oxidized, filtered, disinfected, and subjected to organics removal.

60301.690. Project Sponsor.

"Project sponsor" means an agency or agencies that receives from a Regional Water Quality Control Board water reclamation requirements for a planned groundwater recharge project.

60301.850. Surface Spreading.

"Surface spreading" means the controlled application of water to the ground surface for the purpose of replenishing

groundwater used or suitable for use as a source of domestic water supply.

60301.870. Total Organic Carbon (TOC).

"Total organic carbon (TOC) means the oxidizable organic carbon present in the reclaimed water measured by the methods prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation in Section 5310 of the 17th edition of Standard Methods for the Examination of Water and Wastewater and which are conducted in laboratories approved by the State Department of Health Services.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

ARTICLE 5.1. GROUNDWATER RECHARGE

~~Section 60320. Groundwater Recharge.~~

~~(a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.~~

~~(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.~~

~~(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.~~

Section 60320.01. Planned Groundwater Recharge Projects.

(a) This article shall apply only to planned groundwater recharge projects using reclaimed water. The creation or operation of recharge facilities to cause the infiltration or injection of reclaimed water into a groundwater basin is evidence of a planned groundwater recharge project.

(b) A wastewater disposal project which is not designed for groundwater recharge, but which incidentally results in portions of the treated wastewater reaching groundwater or discharging to an ephemeral stream, is not covered by this article.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.02. Source Control.

All reclaimed water used for planned groundwater recharge projects shall be from a wastewater collection system operating under a comprehensive program for the control of discharge of toxic wastes from point sources, which is approved by the Regional Water Quality Control Board.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.03. Treatment Requirements and Performance Standards.

Reclaimed water used for planned groundwater recharge projects shall comply with the following treatment requirements and treatment performance standards. Monitoring requirements and the basis for determining compliance with treatment performance standards are specified in Section 60320.06.

(a) Oxidized Wastewater.

Oxidized wastewater is required for all project categories. The oxidized wastewater prior to recharge shall not exceed 20 milligrams per liter (mg/L) total organic carbon (TOC), 30 mg/L suspended solids (SS), and 30 mg/L biochemical oxygen demand (BOD).

(b) Filtered Wastewater.

Filtered wastewater is required for project categories I, II, and IV.

(c) Disinfected Wastewater.

Reclaimed water used for any category shall be disinfected to meet the following criteria:

(1) For project categories I, II, and IV, the median number of total coliform organisms in the disinfected wastewater shall not exceed 2.2 per 100 milliliters (mL). The number of total coliform organisms shall not exceed 23 per 100 mL in more than one sample within any 30-day period.

(2) For project category III, the median number of total coliform organisms in the disinfected wastewater shall not exceed 23 per 100 mL. The number of total coliform organisms shall not exceed 240 per 100 mL in more than one sample within any 30-day period.

(d) Organics Removal.

Reclaimed water used for project categories I and IV shall be subjected to organics removal. The TOC in the wastewater prior to recharge shall be reduced to the concentration specified in Table 1 as identified by the reclaimed water contribution to any affected domestic water supply well and by project category. The entire reclaimed water stream used

for project category IV shall be subjected to organics removal.

Table 1. Maximum Allowable TOC after Organics Removal

Reclaimed Water Contribution (%)	Maximum TOC (mg/L)	
	Surface Spreading (Category I)	Direct Injection (Category IV)
0-20	20	5
21-25	16	4
26-30	12	3
31-35	10	3
36-45	8	2
46-50	6	2

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.04. Reclaimed Water Quality Requirements.

(a) The level of general physical characteristics, radioactivity, and the concentration of general mineral, inorganic chemicals (except nitrogen compounds), and organic chemicals in the reclaimed water prior to recharge shall not exceed the maximum contaminant levels specified in Chapter 15, Sections 64435, 64443, 64444.5, and 64473.

(b) The total nitrogen concentration of the reclaimed water shall not exceed a standard of 10 mg/L as nitrogen unless the project sponsor demonstrates that the standard can be consistently met prior to reaching the groundwater level.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.05. Recharge Site Requirements.

(a) Maximum Reclaimed Water Contribution.

(1) For project categories II and III, all the water of reclaimed water origin extracted from any domestic water supply well shall not exceed 20 percent of the total flow.

(2) For project categories I and IV, all the water of reclaimed water origin extracted from any domestic water supply well shall not exceed 50 percent of the total flow.

(3) Calculation of the percent in section 60320.05(a)(1 and 2) shall be based upon the reclaimed water contribution of all planned groundwater recharge projects affecting the basin.

(b) Minimum Depth-To-Groundwater Requirement.

(1) Planned groundwater recharge projects using surface spreading shall meet the minimum depth-to-groundwater

requirements specified in Table 2 by project category and initial percolative capacity.

(2) Planned groundwater recharge projects shall not be allowed where the initial percolative capacity exceeds 0.3 in/min.

(3) The initial percolative capacity shall be determined once by representative testing of the spreading area prior to the start of groundwater recharge and shall reflect conditions throughout the required depth to groundwater. The testing procedure and results shall be described in the engineering report submitted pursuant to Section 60320.07.

(A) For existing surface spreading basins using reclaimed water or other waters, the initial percolative capacity shall be determined at least 14 days after the basins which make up a spreading area have been drained and at least 24 hours after pre-recharge conditions have been restored in the bottom of the basin.

(B) For proposed surface spreading basins, the initial percolative capacity shall be determined in a prototype basin or basins.

Table 2. Minimum Required Depth-to-Groundwater for Surface Spreading Groundwater Recharge Projects

Initial Percolative Capacity (in/min)	Minimum Depth-to-Groundwater (ft) Project Category		
	I	II	III
≤0.2	10	10	20
≤0.3	20	20	50

(c) Minimum Retention Time Underground and Horizontal Separation Requirements.

(1) Reclaimed water shall be retained underground a minimum of 6 months prior to being withdrawn at a domestic water supply well for project categories I and II.

(2) Reclaimed water shall be retained underground a minimum of 12 months prior to being withdrawn at a domestic water supply well for project categories III and IV.

(3) The minimum horizontal separation between an area where reclaimed water is applied by surface spreading and a domestic water supply well shall be 500 feet for project categories I and II.

(4) The minimum horizontal separation between an area where reclaimed water is applied by surface spreading and a domestic water supply well shall be 1000 feet for project category III.

(5) The minimum horizontal separation between the point where reclaimed water is applied by direct injection and a

domestic water supply well shall be 2000 feet for project category IV.

(6) The project sponsor shall prevent the use of groundwater for drinking water within the area required to achieve the minimum retention time and minimum horizontal separation pursuant to Section 60320.05 (c)(1-5).

(d) Monitoring Wells.

Monitoring wells shall be provided to detect the influence of the recharge operation. As a minimum, monitoring wells shall be located at points one-quarter and one-half of the distance (plus or minus 10%) from the recharge area to the nearest domestic water supply well. The number and location of the proposed monitoring wells shall be described in the engineering report submitted pursuant to Section 60320.07.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.06. Monitoring and Compliance.

(a) Treatment Performance Standards.

(1) Oxidized Wastewater. For all project categories, the BOD, SS, and TOC concentration of the oxidized wastewater shall be determined from 24-hour composite samples. Compliance with Section 60320.03(a)(1) shall be determined monthly for each constituent by averaging the results of all samples collected during the month and comparing the average to the standard in Section 60320.03(a)(1).

(A) The BOD samples for all project categories shall be collected at least weekly.

(B) The SS samples for all project categories shall be collected at least daily.

(C) The TOC samples for project categories II and III shall be collected at least daily.

(D) The TOC samples for project categories I and IV shall be collected at least weekly.

(2) Filtered Wastewater. For project categories I, II, and IV, the turbidity of the filtered wastewater shall be continuously measured and recorded.

(A) Turbidity measurements shall be read at least once every 4 hours. Compliance with the daily average operating turbidity level of 2 NTU shall be determined monthly by averaging the results of all turbidity samples read during the month and comparing the average to 2 NTU.

(B) The turbidity record shall be read daily. Compliance with the requirement that the turbidity not exceed 5 NTU more than 5 percent of the time shall be determined monthly by determining the highest percent of a day during the month that the filtered wastewater exceeded 5 turbidity units and comparing that percent to 5 percent.

(3) Disinfected Wastewater. For all project categories, bacteriological samples shall be collected and tested for coliform to monitor the performance of the disinfection process each day reclaimed water is produced for planned groundwater recharge projects. Compliance with the disinfected wastewater requirements pursuant to Section 60320.03(a)(3) shall be determined daily by determining the median coliform result of the last 7 days for which analyses have been completed and comparing that median to the appropriate coliform standard in Section 60320.03(a)(3). Samples shall be analyzed by an approved laboratory.

(4) Organics Removal. For project categories I and IV the TOC concentration in the wastewater after the organics removal process shall be determined daily from 24-hour composite samples. Compliance with the organics removal requirement pursuant to Section 60320.03(a)(4) shall be determined daily by averaging daily TOC concentrations for the last 90 days of operation and comparing that average to the appropriate maximum TOC concentration in Section 60320.03(a)(4).

(b) Reclaimed Water Quality.

(1) On a quarterly basis, grab or 24-hour composite samples of reclaimed water shall be collected and analyzed for the general mineral and general physical constituents listed in subsections 64433(1) and (2), for the inorganic chemicals (except nitrogen compounds) listed in Section 64435 (Table 2), and for gross alpha and gross beta. Compliance with Section 60320.04(a) shall be determined annually by averaging the results of all samples collected during the previous 12 months and comparing the average to the standards in Section 64473 (Table 6), Section 64435 (Table 2), and Section 64443 (Table 4).

(2) On a quarterly basis, grab samples of reclaimed water shall be collected and analyzed for the organic chemicals in Table 5, Section 64444.5. Compliance with Section 60320.04(a) shall be determined annually by averaging the results of all samples collected during the previous 12 months and comparing the average to the standards in Section 64444.5 (Table 5).

(3) On a weekly basis, grab or 24-hour composite samples shall be collected and analyzed for total nitrogen. Compliance with Section 60320.04(b) shall be determined annually by averaging the results of all samples collected during the previous 12 months and comparing the average to the total nitrogen standard in Section 60320.04(b).

(c) Recharge Site Requirements.

(1) Maximum Reclaimed Water Contribution.

(A) The reclaimed water contribution, pursuant to Sections 60320.03(a)(4) and 60320.05(a), shall be determined annually and at the domestic water supply well which receives the highest percentage of reclaimed water. The method used for the annual determination shall be described in the engineering report pursuant to Section 60320.07. Compliance with the maximum reclaimed water contribution shall be determined by averaging the last five annual determinations of reclaimed water contribution and comparing that average to the appropriate maximum percent contribution in Section 60320.05(a).

(B) The project sponsor shall demonstrate and document, once every five years, in a complete engineering report to the Regional Water Quality Control Board and the Department of Health Services that the maximum reclaimed water contribution pursuant to Section 60320.05(a) will not be exceeded.

(2) Minimum Depth-to-Groundwater Requirement.

(A) The depth-to-groundwater shall be measured every day reclaimed water is present in the spreading basin. Compliance with Section 60320.05(b) shall be determined daily by averaging the previous 30 daily depth-to-groundwater measurements taken when reclaimed water was present in the spreading basin and comparing the result to the appropriate standard in Table 2.

(B) When the average depth-to-groundwater is less than the depth-to-groundwater requirement pursuant to Section 60320.05(b), the discharge of reclaimed water onto the spreading basin shall be halted until the depth-to-

groundwater measurement exceeds the required depth-to-groundwater pursuant to Section 60320.05(b).

(C) The depth-to-groundwater shall be measured at at least one monitoring well located at each spreading basin. The location of this well shall be specified in the engineering report pursuant to Section 60320.07. The monitoring well shall be sited so that the groundwater level is measured at a point where it is closest to the bottom of the spreading basin.

(3) Minimum Retention Time Underground and Horizontal Separation Requirements.

(A) The retention time underground, pursuant to Section 60320.05(c), shall be determined annually and at the domestic water supply well in which the reclaimed water has the shortest retention time underground. The method used for the annual determination shall be described in the engineering report pursuant to Section 60320.07. Compliance with the minimum retention time underground shall be determined by averaging the last five annual determinations of retention time and comparing that average to the appropriate retention time in Section 60320.05(c).

(B) The project sponsor shall demonstrate and document, once every five years, in a complete engineering report to the Regional Water Quality Control Board and Department of Health Services that the minimum retention time underground pursuant to Section 60320.05(c) will not be exceeded.

(C) Compliance with the horizontal separation requirement pursuant to Section 60320.05(c) for surface spreading and direct injection projects shall be determined by taking field measurements of the shortest distance between a point of recharge and a domestic water supply well. In no case

shall the distance be less than the horizontal separation requirement pursuant to Section 60320.05(c).

(d) Monitoring Well Requirements.

Samples shall be collected from monitoring wells at least quarterly and analyzed for TOC and total nitrogen.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.07. Engineering Report.

(a) Any project sponsor proposing a groundwater recharge project using reclaimed water shall submit an engineering report on the proposed groundwater recharge project to the regulatory agency. The report shall be submitted in lieu of the report required pursuant to Section 60323 and shall be prepared by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply, in conjunction with a geologist, experienced in hydrogeology and registered in California.

(b) Groundwater recharge projects not in operation by January 1, 1995, shall not recharge reclaimed water until the project sponsor submits a complete engineering report to the Regional Water Quality Control Board and the Department of Health Services. For direct injection projects, the Department will not schedule a hearing pursuant to section 13540, Article 6, until a complete engineering report has been received by the Department.

(c) For existing groundwater recharge projects, project sponsors have five years from January 1, 1995 to submit a completed engineering report to the Regional Water Quality control Boards and Department of Health Services.

(d) For existing and proposed groundwater recharge projects, the engineering report shall consist of a thorough investigation and evaluation of the groundwater recharge project, impacts on the existing and potential uses of the impacted groundwater basin, and proposed means for achieving compliance with Sections 60320.01 to 60320.06. The engineering report shall include, but not be limited to the following:

(1) An engineering plan of the reclamation plant, transmission facilities, spreading basins/direct injections wells, and monitoring wells.

(2) A physical description of the proposed groundwater recharge project.

(3) A hydrogeologic study on the impacted groundwater basin. The study shall describe the impact of the recharge project on domestic groundwater sources. The study shall describe the source, area of recharge, quantity, quality, and groundwater flow patterns of all basin recharge waters. The study shall identify all quantities and sources of water used to determine the percent reclaimed water contribution. The study shall identify the aquifer zone in which the maximum allowed reclaimed water contribution is not met pursuant to Section 60320.05(a). The study shall identify the aquifer zone in which the provided organics removal is not sufficient for the reclaimed water contribution to the groundwater pursuant to Section 60320.03(a)(4). The study shall identify all wells that will be impacted by the proposed project and describe the groundwater quality in the impacted basin. The study shall identify the well(s) subject to the highest reclaimed water contribution and shortest reclaimed water retention time. The study shall also include quantitative descriptions of the soil, soil layers, infiltration rates, aquifer transmissivity, groundwater movement, historic depth-to-groundwater, safe yield of the basin, and usable storage capacity of the basin.

(4) A description of the operational and management personnel, their qualifications, experience, and responsibilities.

(5) A description of how the project will be operated to comply with the recharge site requirements of maximum reclaimed water contribution, minimum depth-to-groundwater, horizontal separation, and retention time underground pursuant to Section 60320.05 (b and c).

(6) Identification of the agency responsible for preventing the use of groundwater for drinking water within certain areas pursuant to Section 60320.05 (c)(6), and the mechanism that will be used.

(7) A contingency plan for redirection of reclaimed water when treatment performance standards or depth-to-groundwater requirements are not met.

(8) A description of the methods of determination and results for initial percolative capacity, maximum reclaimed water contribution, minimum retention time underground, and horizontal separation.

(9) The number and location of monitoring wells in the spreading basin and groundwater basin.

(10) A plan for the monitoring well network to monitor groundwater flow and water quality in the impacted groundwater basin.

(11) A water quality monitoring plan for the treated wastewater, reclaimed water, and monitoring wells.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.08. Alternatives.

(a) Alternatives to the recharge site requirements specified in Section 60320.05 (b) and (c) (2, 4, and 5), or the treatment performance standards specified in Section 60320.03 may be allowed if the project sponsor demonstrates to the regulatory agency and the Department of Health Services that the proposed alternative reliably achieves an equal degree of public health protection. Alternatives may not be used to reduce the retention time below 6 months in Section 60320.05 (c)(2) or the horizontal

separation below 500 feet in Section 60320.05 (c)(4 and 5). Alternatives to Sections 60320.01 to 60320.07, inclusive, shall not be allowed, unless the planned groundwater recharge projects meet the requirements of Section 60320.08 (b to e) or 60320.09

(b) Alternatives to achieve a disinfected and filtered wastewater pursuant to Section 60320.03(b) and (c) shall be accepted if the project sponsor demonstrates to the regulating agency that the alternatives reliably provide an equal degree of public health protection. Such a demonstration shall be based on the results from a prior equivalency demonstration, pilot-plant testing, or full-scale testing on an installation that is treating a wastewater with similar flow and wastewater quality characteristics as the wastewater proposed for treatment.

(c) Alternatives to the granular activated carbon or reverse osmosis treatment processes shall be accepted if the project sponsor demonstrates to the regulating agency that the organics removal treatment performance standards pursuant to Section 60320.03 (d) can be reliably met. Such a demonstration shall be based on the results from a prior equivalency demonstration, pilot-plant testing, or full-scale testing on an installation that is treating a wastewater with similar flow and wastewater quality characteristics as the wastewater proposed for treatment.

(d) The results of any alternative demonstration shall be presented in a complete report prepared and signed by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply. Such alternatives shall not be accepted until the Regional Water Quality Control Boards and the Department of Health Services have reviewed the reports.

(e) Within 60 days following the first full year of operation of any alternative approved by the regulating agency, the project sponsor shall submit an report, prepared by an engineer registered in California and experienced in the fields of

wastewater treatment and public water supply, describing the effectiveness of the plant operation. The report shall include results of all water quality tests performed and shall evaluate compliance with established performance standards under actual operating conditions. It shall also include an assessment of problems experienced, corrective actions needed, and a schedule for providing needed improvements.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.09. Research and Demonstration Projects.

The maximum percentage reclaimed water contribution in the total flow extracted from any domestic water supply well pursuant to Section 60320.05(a)(2) shall not apply to a project which the Department has designated as a research and demonstration project for the purpose of conducting special monitoring, treatment, health effects, or other research studies.

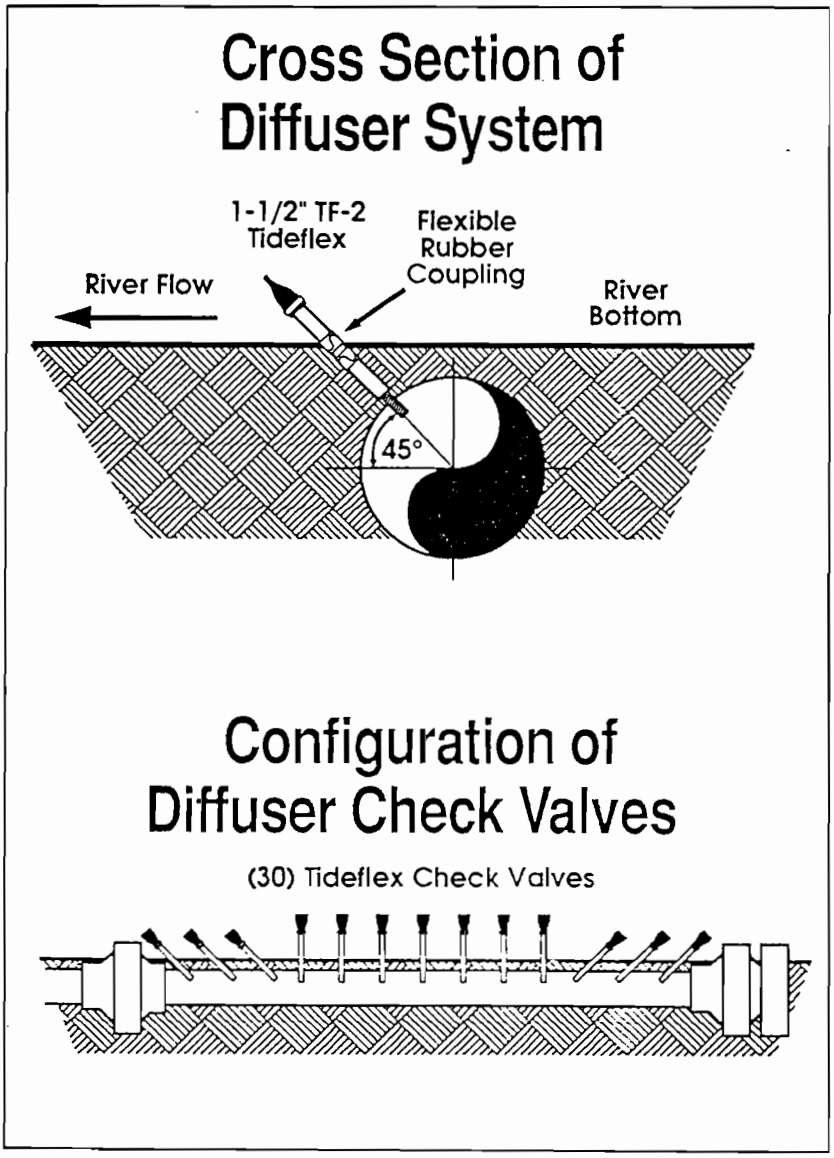
NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

APPENDIX C - TREATMENT FACILITIES INFORMATION

Application Data

Chemical ◆ Diffuser System ◆ Tideflex®

Red Valve Company, Inc.

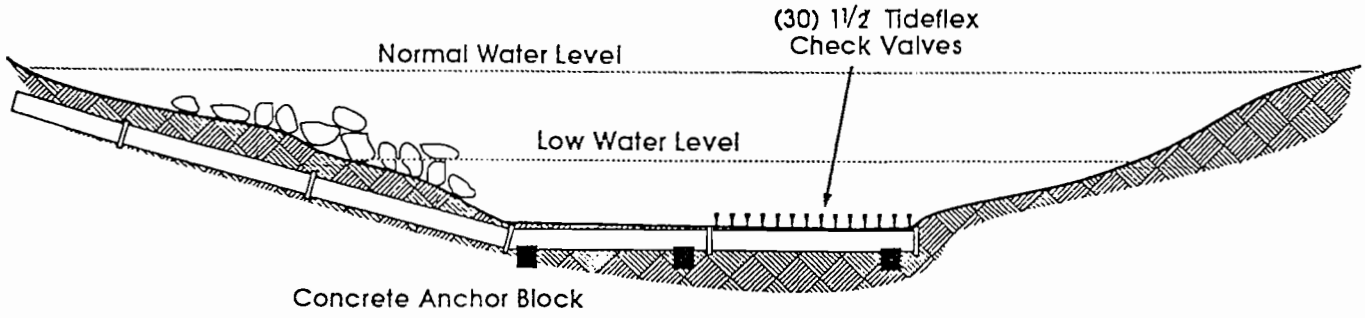


Red Valve Tideflex® Check Valves provide the ideal solution for a chemical plant in Orangeburg, South Carolina. Thirty 1-1/2" TF-2 Tideflex® Check valves are installed in their effluent diffuser system.

The diffuser system was developed to meet EPA requirements for the discharge of toxins into a nearby stream. Particular conditions of the stream, such as a changing water level, had to be considered in designing an appropriate diffuser system.

To meet the criteria recommended and achieve optimal mixing in the stream, the discharge velocities through each of the diffusers had to be at least 15 feet per second at all times. The plant discharge flow rate varied drastically from day to day, as did the river's water level. This therefore affected the variable flow rate and velocity through the diffusers. The Tideflex® Check Valves were installed with their bill opening perpendicular to the flow of the stream, at a 45° angle to the river bottom.

Red Valve's complete product line of Tideflex® Diffuser Check Valves are designed to meet customer's exact flow requirements on specific applications.

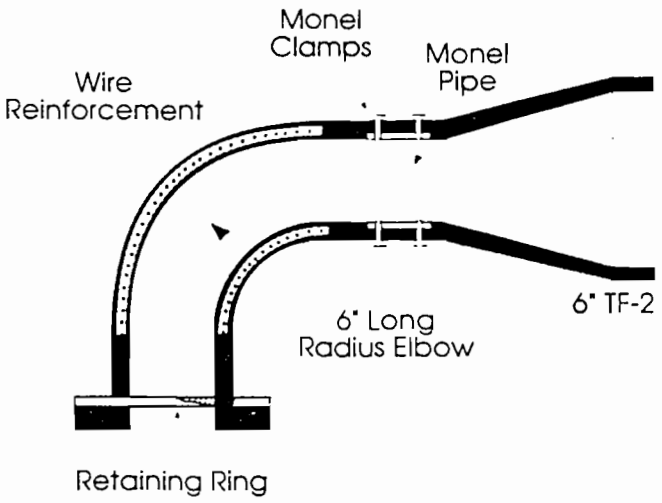


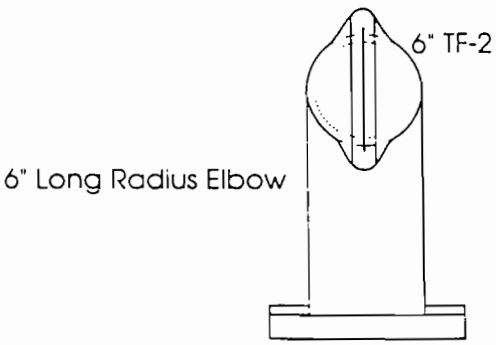
Application Data

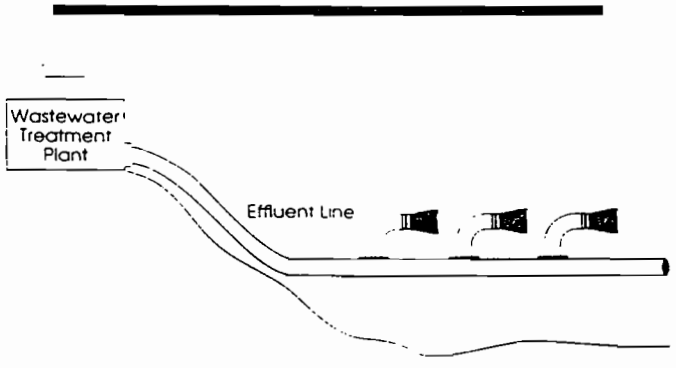
Red Valve Company, Inc.

Wastewater Treatment ♦ Diffuser System ♦ Tideflex™

DIAGRAM OF TIDEFLEX WITH COLLAPSIBLE ELBOW







Red Valve Tideflex Check Valves are currently installed on an outfall line from a Wastewater Treatment Plant in Brookings, Oregon. The plant is located near a Pulp and Paper Mill further downstream, and the river is used to transport logs to the Mill. As the logs travel with the current, they can build up a momentum of 700 lbs. of force; thus, the standard TF-2 valve could easily be damaged or knocked loose and carried away by the logs.

The Wastewater Treatment Plant required a valve capable of meeting the diffuser system specifications, and rugged enough to withstand the force of the logs on their course to the Mill.

The solution was the Red Valve Tideflex Check Valve.

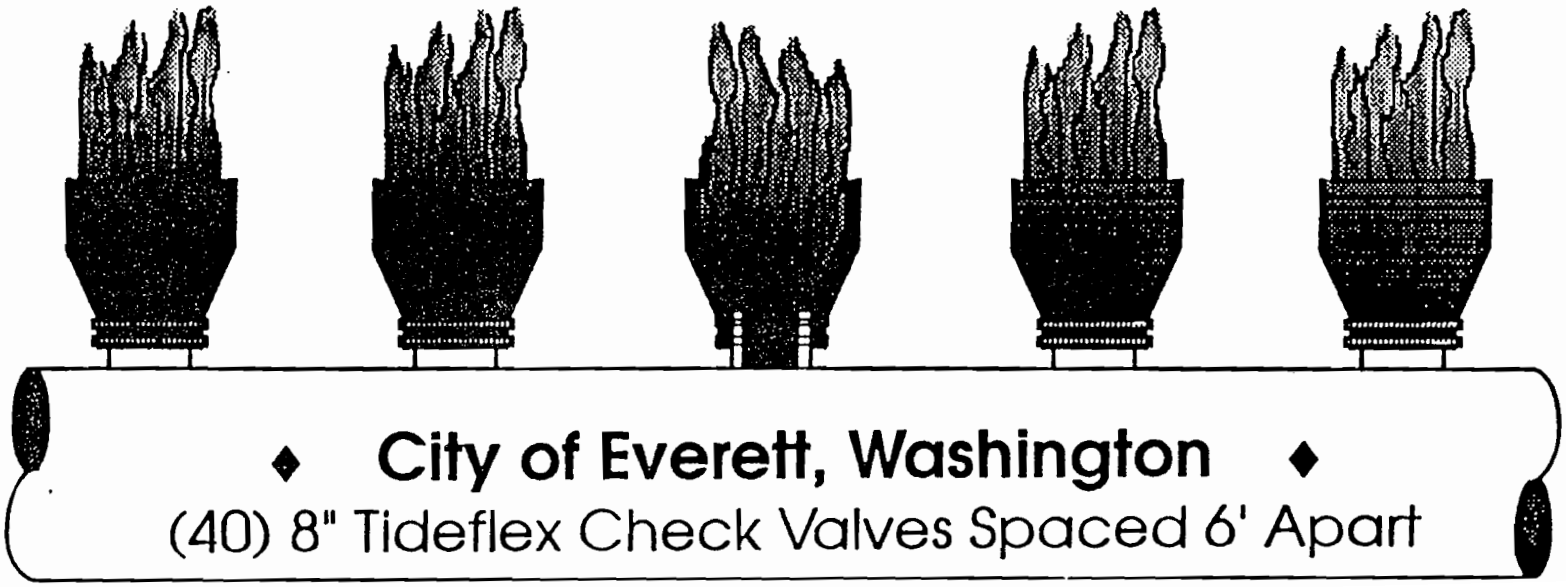
The Tideflex is mounted to a specially constructed, wire reinforced rubber elbow using Monel clamps and bolts. The seven 6" Check Valves and the curved elbow pipes to which they are attached are able to flex and collapse under the pressure of the semi-submerged logs, yet return to their original shapes when the logs pass by. The all rubber construction also prevents the valve from freezing in the cold Oregon Winters, permitting it to function all year.

Tideflex Check Valves are an ideal valve on effluent diffuser systems because their simple, yet technologically advanced elastomer and fabric reinforced design makes them maintenance free. Additionally, low head loss and the ability to disperse effluent even buried under sand and silt assure maintenance free performance.

Red Valve's complete product line of Check Valves are designed to meet our customer's exact flow requirements and specific applications.

Effluent Diffuser Outfall

- **Tideflex Check Valves meet EPA criteria - multi port discharge, low pressure drop, prevent backflow**



City of Everett, Washington

(40) 8" Tideflex Check Valves Spaced 6' Apart

Diffuser System Has Maintenance-Free Operation

THE Brookings, Oregon wastewater treatment plant operates under the difficult environmental conditions that beset coastal municipalities—salt water, heavy debris, ocean tides, and cold temperatures. Over four years ago, when the city decided to design a new outfall line, the Brookings plant wanted a system that would minimize its backflow, clogging, and corrosion problems.

Before installing the new system, the Brookings plant experienced all the typical failings of a standard outfall line. The fixed-orifice port that was simply drilled into the previous outfall line did nothing to increase the flow velocity or prevent marine life and debris from entering the line. Flow rate from the port was uncontrollable and covered a very narrow range from maximum to minimum. Headloss was also problematic.

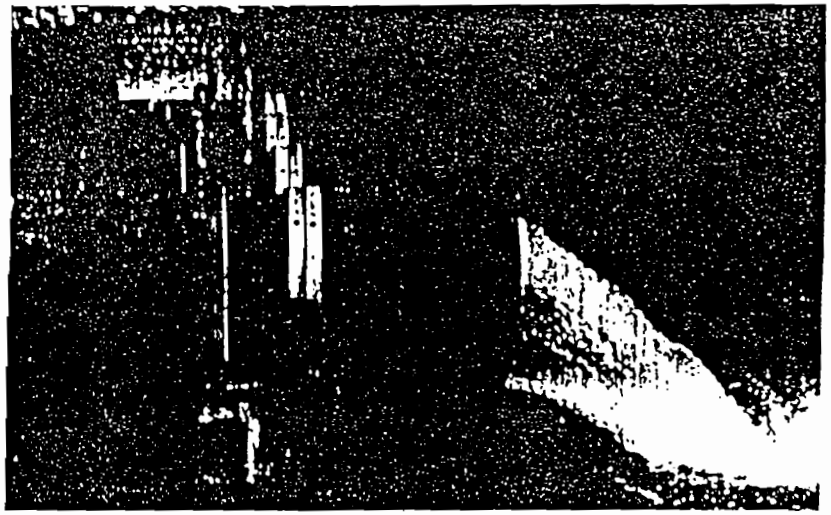
In fall 1990, a longer outfall line, extending 400 ft into the Pacific Ocean with a diffuser section at the end, was designed by Brown & Caldwell. "Our main concern was to implement a system that would keep the sand, logs, and other debris out of the line and, at the same time, equalize the flow through the diffusers," said Bill James, Brown & Caldwell's project engineer for the outfall project. To ensure those objectives would be met, the company specified Tideflex™ check valves (Red Valve® Company, Inc., Carnegie, Pennsylvania).

Tideflex is often referred to as a "duckbill" valve. Its design—a flexible tube fabricated from a reinforced, all-rubber matrix—is much like the material used in jet airplane tires. At its end, the tube is sealed by two or more sets of flat lobes, giving the valve the appearance of a duck's bill. Forward hydraulic head opens the seal, allowing flow to be released. Conversely, reverse hydraulic head automatically collapses the lobes, completely closing the valve against backflow. The durable nozzle does not corrode, jam, or bind even in salt water laden with heavy ocean debris.

"I suggested using the Tideflex valve on the Brookings application because of its ability to prevent silting up and clogging. If there is no or low flow, the valve automatically closes. A significant added benefit is that, under low flow, the small orifice in the Tideflex tends to increase the velocity and improve the mixing energy of the diffuser," explained James.

"We were concerned about the potential of damage from submerged logs and rolling rocks on the diffuser ports since the outfall line was located in fairly shallow water—it's only about 15 to 20 feet deep," James said. Red Valve constructed specialized elbow riser sections for the Brookings outfall line that are integral with the diffuser, made from the same reinforced rubber as the valves. When hit by debris, the risers bend, without breaking, then rebound to their original profile.

Six months after the valves were on line, a diving team went down to examine them and found no problems. In the four years since they were installed, there has been no trouble with backflow or clogging.



■ DUCKBILL shaped, all-rubber Tideflex check valves prevent backflow.

Public Works®

City, County and State

June, 1995

DISINFECTION EXPERIMENT

Purpose:

Measure the effective dose of sodium hypochlorite for disinfection with different ratios of primary and secondary effluents.

Supplies from Plant:

- 1 - 5 gallon sample of Primary Effluent
- 1 - 5 gallon sample of secondary effluent

Equipment from Laboratory:

- 2 - 5 gallon polyethylene sample containers delivered to plant.
- Digital scale, measures up to 1500 g. (Allowed laboratory to measure sample volumetrically).
- 6 - 100 ml wide mouth pipettes with bulbs for transferring liquid to sample containers.
- Micro-pipette with inserts to dose between 50 and 750 micro-liters of Sodium Hypochlorite.
- Grocery store Sodium Hypochlorite with known percent active concentration. Analyze for percent concentration, transmit concentration to Carollo Engineers. Adjust equation on data bench sheet per results.
- 6 - 1 liter beakers.
- Optional 6 - no-heat stir plate. Six coated magnets must be new or very well cleaned and disinfected. All six must be the same size and set at the same speed. DO NOT mix with a vortex. DO NOT contaminate test.
- 6 - metal or glass paddle shaped string rods.
- Alcohol for disinfection of equipment.
- "Quick" Total Chlorine Test Kit (i.e. Hach DPD photo meter method.)

Procedure:

1. Collect about 5 gallons each of secondary effluent and primary effluent the day of test and deliver it to the laboratory. Pre-rinse the sample containers with sample.
   a. Collect sample for BOD, suspended solids, and total coliform after mixing both sample containers.
2. Disinfect clean beakers and stirring rods by wiping down with alcohol pads. Let equipment dry. After disinfecting, do not contaminate.
3. Weigh the amount of water used in each test beaker.
   a. Tare the beaker weight.
   b. Add 200 ml, 400ml, 600 ml, or 800 ml of primary effluent to the beaker. Weigh the sample and record.
   c. Finish filling the beaker to the 1000 ml mark with secondary effluent.
   d. Weigh the sample and record the total weight.
4. Conduct jar test.
   a. Always perform procedures on the highest dose jar first then proceed to the lower doses.
   b. Apply sixth beaker Sodium Hypochlorite dose while stirring beaker without aerating.

Continue stirring for 3 minutes after chlorination. Start 30 minute disinfection timer.

c. Apply fifth beaker through second beaker Sodium Hypochlorite dose while stirring each beaker without aerating. Continue stirring after each chemical application for 3 minutes.

d. Stir first beaker (called "0") for 3 minutes without aerating and let sit for 30 minutes.

e. Time between setting up each beaker should be 4 to 5 minutes.

Chlorine Dose from Sodium Hypochlorite:

$$mg/l = \frac{??? \ \mu l \ x \ \frac{ml}{1000 \ \mu l} \ x \ \frac{1 \ g}{1 \ ml} \ x \ 1.1 \ spg \ x \ 0.0525 \ active \ x \ \frac{1000 \ mg}{1 \ g}}{??? \ g \ beaker \ x \ \frac{1 \ l}{1000 \ g}}$$

5. Collect Samples
   a. After 30 minutes use a pipette to collect samples for coliform test and total chlorine residual. Collect samples from the highest chlorine dose beaker to the lowest ensuring each one has had 30 minutes contact time. Time between collecting sample from each beaker should be 4 to 5 minutes.
   b. Use a new or cleaned and disinfected pipette for each beaker. Pipette from ½ inch below surface without disturbing settled material. Place total coliform sample in a sterile container with sodium thiosulphate solution to dechlorinate sample. Allow sample to set in bottle for a minimum of one hour for dechlorination before setting up total coliform tests.
   c. After collecting each total coliform sample, run total chlorine residual test on beaker. Record results.
   d. Beaker '0' should have a coliform count equal to raw wastewater. Two lower dose beakers coliform counts should be significant, on the order of 50 percent less to 80 percent less than raw wastewater. Three higher dose beakers should have coliform counts similar to disinfected plant effluent. The highest dose should be less than 2.2 MPN/100 ml. These are estimates, adjusted based on your own experience, do not underestimate dilution required.
6. Results
   a. Plot chlorine dose (mg/L) vs coliform count (MPN/100ml).
   b. Plot chlorine demand (mg/L) vs coliform count (MPN/100ml).
   c. Plot chlorine residual (mg/L) vs coliform count (MPN/100ml).
   d. Plot chlorine dose (mg/L) vs chlorine demand (mg/l).

CREEK ENVIRONMENTAL LABORATORIES, INC.
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August 12, 1999

Scott Joslyn
Carollo Engineers
Sacramento, CA

Dear Scott Joslyn:

Subject: Jar tests

In the 20% batch, the coliform results did not meet expectations. We could not rule out, or definitively rule in, switching samples for jars 3 and 4. Perhaps the coliform results, after dilution, really did vary that much. Overall, the coliforms conformed to the model's predictions.

Sincerely,

Orval Osborne
Laboratory Director
Creek Environmental Laboratories, Inc.

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CREEK ENVIRONMENTAL LABORATORIES, INC.
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Scott Joslyn
Carollo Engineers, Sacramento
2500 Venture Oaks Way, Suite 320
Sacramento, CA 95833

Lab Number: G1927-1

PROJECT: MBC-WWTP Jar tests

REPORT OF ANALYTICAL RESULTS

SAMPLE DESCRIPTION	MATRIX	SAMPLED BY	SAMPLED DATE/TIME	RECEIVED
Primary Eff.	Aqueous	SAA Steve	02 AUG 99/08:00	02 AUG 99

ANALYTE	RESULT	*D.L.	UNITS	METHOD	ANALYZED	BY	NOTES
Coliform, Total, 15-tube MPN	3E7	2.	MPN/100 mL	SM 9221B,C	08-02-99	ALF	1,2
Biochemical Oxygen Demand	210.	3.	mg/L	SM 5210 B	08-02-99	SAA	
Suspended Solids	19.	5.	mg/L	EPA 160.2	08-10-99	ERH	

'METHODS' are EPA SW-846 or 600/4 or as 'SM' indicating Standard Methods; 18th Ed. Lab Certification: ELAP#1958
*D.L. - Reported Detection Limit. 'RESULTS' reported as 'ND' means not detected above D.L.
[1] MPN = Most Probable Number
[2] Tube combination used: 5 each of 10 ml, 1.0 ml, 0.1 ml.

CREEK ENVIRONMENTAL LABORATORY

Orval Osborne
Laboratory Director

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Scott Joslyn
Carollo Engineers, Sacramento
2500 Venture Oaks Way, Suite 320
Sacramento, CA 95833

Lab Number: G1927-2

PROJECT: MBC-WWTP Jar tests

REPORT OF ANALYTICAL RESULTS

SAMPLE DESCRIPTION	MATRIX	SAMPLED BY	SAMPLED DATE/TIME	RECEIVED
Secondary Eff.	Aqueous	SAA Steve	02 AUG 99/08:00	02 AUG 99

ANALYTE	RESULT	*D.L.	UNITS	METHOD	ANALYZED	BY	NOTES
Coliform, Total, 15-tube MPN	1.6E8	2.	MPN/100 mL	SM 9221B,C	08-02-99	ALF	1,2
Biochemical Oxygen Demand	120.	3.	mg/L	SM 5210 B	08-02-99	SAA	
Suspended Solids	ND	5.	mg/L	EPA 160.2	08-10-99	ERH	

'METHODS' are EPA SW-846 or 600/4 or as 'SM' indicating Standard Methods; 18th Ed. Lab Certification: ELAP#1958
*D.L. - Reported Detection Limit. 'RESULTS' reported as 'ND' means not detected above D.L.
[1] MPN = Most Probable Number
[2] Tube combination used: 5 each of 10 ml, 1.0 ml, 0.1 ml.

CREEK ENVIRONMENTAL LABORATORY

Orval Osborne
Laboratory Director

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~~61851~~ 6940

DISINFECTION EXPERIMENT
July 28, 1999
Morrow Bay Water Reclamation Facility

	A	B	C	D	E	F	G	H	I	J
1	Sodium Hypochlorite to 80 percent blend of Primary Effluent and Secondary Effluent									
2	Sample			Test Condition				Results		
3		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
4	Sample	~~gal~~ ml	~~gal~~ ml	ul		mg/l	C	mg/l	count	mg/l
5	80%-0	800	1000	0	#DIV/0!	0		#DIV/0!	3.0×10^6	#DIV/0!
6	80%-150	800	1000	150	#DIV/0!	0.7		#DIV/0!	8.0×10^4	#DIV/0!
7	80%-240	800	1000	240	#DIV/0!	3		#DIV/0!	2.4×10^3	#DIV/0!
8	80%-330	800	1000	330	#DIV/0!	6		#DIV/0!	1.1×10^2	#DIV/0!
9	80%-420	800	1000	420	#DIV/0!	13		#DIV/0!	ND	#DIV/0!
10	80%-550	800	1000	550	#DIV/0!	13		#DIV/0!	7	#DIV/0!
11				Time				(C*1.1*0.0525)/(B/1000)		H-F
12	Comments									
13										
14										
15	Sodium Hypochlorite to 60 percent blend of Primary Effluent and Secondary Effluent									
16	Sample			Test Condition				Results		
17		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
18	Sample	~~gal~~ ml	~~gal~~ ml	ul		mg/l	C	mg/l	count	mg/l
19	60%-0	600	1000	0	#DIV/0!	0		#DIV/0!	1.3×10^8	#DIV/0!
20	60%-140	600	1000	140	#DIV/0!	0.3		#DIV/0!	1.1×10^5	#DIV/0!
21	60%-220	600	1000	220	#DIV/0!	4.5		#DIV/0!	1.4×10^2	#DIV/0!
22	60%-300	600	1000	300	#DIV/0!	7		#DIV/0!	1.3×10^2	#DIV/0!
23	60%-400	600	1000	400	#DIV/0!	10		#DIV/0!	ND	#DIV/0!
24	60%-500	600	1000	500	#DIV/0!	14		#DIV/0!	4	#DIV/0!
25				Time				(C*1.1*0.0525)/(B/1000)		H-F
26	Comments EPA 9971					0.79		95% RECOVERY		
27										
28										
29	Sodium Hypochlorite to 40 percent blend of Primary Effluent and Secondary Effluent									
30	Sample			Test Condition				Results		
31		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
32	Sample	~~g~~	~~g~~	ul		mg/l	C	mg/l	count	mg/l
33	40%-0	400		0	#DIV/0!	0		#DIV/0!	2.4×10^7	#DIV/0!
34	40%-130	400		130	#DIV/0!	0.4		#DIV/0!	5.0×10^4	#DIV/0!
35	40%-200	400		200	#DIV/0!	3.5		#DIV/0!	* 50×10^3	#DIV/0!
36	40%-270	400		270	#DIV/0!	5		#DIV/0!	2.4×10^2	#DIV/0!
37	40%-340	400		340	#DIV/0!	9		#DIV/0!	11	#DIV/0!
38	40%-450	400		450	#DIV/0!	14		#DIV/0!	4	#DIV/0!
39	40%-200	400	1000	200	Time	4.0		(C*1.1*0.0525)/(B/1000)		H-F
40	Comments * DUPLICATE OF 40%-200 : RESULT = 5.0×10^2									
41										
42										
43	Sodium Hypochlorite to 20 percent blend of Primary Effluent and Secondary Effluent									
44	Sample			Test Condition				Results		
45		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
46	Sample	g	g	ul		mg/l	C	mg/l	count	mg/l
47	20%-0	200		0	#DIV/0!	0		#DIV/0!	9.0×10^7	#DIV/0!
48	20%-120	200		120	#DIV/0!	1.8		#DIV/0!	5.0×10^3	#DIV/0!
49	20%-180	200		180	#DIV/0!	4.5		#DIV/0!	* 14	#DIV/0!
50	20%-240	200		240	#DIV/0!	5.5		#DIV/0!	80	#DIV/0!
51	20%-300	200		300	#DIV/0!	10.5		#DIV/0!	1.6×10^3	#DIV/0!
52	20%-400	200		400	#DIV/0!	14		#DIV/0!	ND	#DIV/0!
53	20%-180	200		180	Time	4.5		(C*1.1*0.0525)/(B/1000)		H-F
54	Comments * DUPLICATE OF 20%-180 : RESULT = 1.7×10^3									
55										
56										

TABLE 9221 IV MPN INDEX AND 95% CONFIDENCE LIMITS FOR VARIOUS COMBINATIONS OF POSITIVE RESULTS WHEN FIVE TUBES ARE USED PER DILUTION (10 mL, 1.0 mL, 0.1 mL)

Combination of Positives	MPN Index/ 100 mL	95% Confidence Limits		Combination of Positives	MPN Index/ 100 mL	95% Confidence Limits	
		Lower	Upper			Lower	Upper
				4-2-0	22	9.0	[illegible]
0-0-0	< 2	—	—	4-2-1	26	12	[illegible]
0-0-1	2	1.0	10	4-3-0	27	12	[illegible]
0-1-0	2	1.0	10	4-3-1	33	15	[illegible]
0-2-0	4	1.0	13	4-4-0	34	16	[illegible]
				5-0-0	23	9.0	[illegible]
1-0-0	2	1.0	11	5-0-1	30	10	[illegible]
1-0-1	4	1.0	15	5-0-2	40	20	[illegible]
1-1-0	4	1.0	15	5-1-0	30	10	[illegible]
1-1-1	6	2.0	18	5-1-1	50	20	[illegible]
1-2-0	6	2.0	18	5-1-2	60	30	[illegible]
2-0-0	4	1.0	17	5-2-0	50	20	[illegible]
2-0-1	7	2.0	20	5-2-1	70	30	[illegible]
2-1-0	7	2.0	21	5-2-2	90	40	[illegible]
2-1-1	9	3.0	24	5-3-0	80	30	[illegible]
2-2-0	9	3.0	25	5-3-1	110	40	[illegible]
2-3-0	12	5.0	29	5-3-2	140	60	[illegible]
3-0-0	8	3.0	24	5-3-3	170	80	[illegible]
3-0-1	11	4.0	29	5-4-0	130	50	[illegible]
3-1-0	11	4.0	29	5-4-1	170	70	[illegible]
3-1-1	14	6.0	35	5-4-2	220	100	[illegible]
3-2-0	14	6.0	35	5-4-3	280	120	[illegible]
3-2-1	17	7.0	40	5-4-4	350	160	[illegible]
4-0-0	13	5.0	38	5-5-0	240	100	[illegible]
4-0-1	17	7.0	45	5-5-1	300	100	[illegible]
4-1-0	17	7.0	46	5-5-2	500	200	[illegible]
4-1-1	21	9.0	55	5-5-3	900	300	[illegible]
4-1-2	26	12	63	5-5-4	1600	600	[illegible]
				5-5-5	≥1600	—	—

In *c*, select the first three dilutions so as to include the positive result in the middle dilution.

When a case such as that shown below in line *d* arises, where a positive occurs in a dilution higher than the three chosen according to the rule, incorporate it in the result for the highest chosen dilution, as in *e*:

Example	1 mL	0.1 mL	0.01 mL	0.001 mL	Combination of positives	MPN Index /100 mL
d	5/5	3/5	1/5	1/5	5-3-2	1400
e	5/5	3/5	2/5	0/5	5-3-2	1400

When it is desired to summarize with a single MPN value the results from a series of samples, use the geometric mean or the median.

Table 9221:IV shows the most likely positive tube combinations. If unlikely combinations occur with a frequency greater than 1% it is an indication that the technique is faulty or that the statistical assumptions underlying the MPN estimate are not being fulfilled. The MPN for combinations not appearing in the table, or for other combinations of tubes or dilutions, may be estimated by Thomas' simple formula:

$$\text{MPN/100 mL} = \frac{\text{no. of positive tubes} \times 100}{\sqrt{\left(\begin{matrix}\text{mL sample in}\\ \text{negative tubes}\end{matrix} \times \begin{matrix}\text{mL sample in}\\ \text{all tubes}\end{matrix}\right)}}$$

While the MPN tables and calculations are described for use in the coliform test, they are equally applicable to determining the MPN of any other organisms provided suitable test media are available.

3. Bibliography

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CAROLLO engineers

BY DSJ DATE _____ SUBJECT Morro Bay WWTP SHEET NO. 1 OF 1
CHKD. BY _____ DATE _____ Dilution Factors JOB NO. _____

Laboratory check

SE 1.6e8 MPN/100 ml

PE 3e7 MPN/100 ml

Beaker ϕ test results

80% PE

.8 * 3e7 = 2.4 e7
.2 * 1.6e8 = 3.2 e7
5.6 e7 * > 3e6

probably lower than actual

60% PE

.6 * 3e7 = 1.8 e7
.4 * 1.6e8 = 6.4 e7
8.2 e7 * < 1.3e3

40% PE

.4 * 3e7 = 1.2 e7
.6 * 1.6e8 = 9.6 e7
1.08e8 * > 2.4e7

20% PE

.2 * 3e7 = 6e6
.8 * 1.6e8 = 1.28e8
1.34e8 * > 9.0e7

* would expect beaker ϕ test results to be less than the native sample results because of settling during test.

Chlorine: Iodometric SM 4500-Cl B. SAA 7/30/99

To a small glass beaker with stir bar, added ~ 1 g KI (VWR lot 36137640) and with a vol. pipette, 5.0 ml glacial acetic acid (Fisher lot 61401) placed on stir plate & added 20.0 ml dH_2O (vol. pipette) added 0.5 ml of 1-1. starch indicator soln (Labchem lot 9137-11) titrated to disappearance of purple color with 0.01 N $Na_2S_2O_3$ (LC lot 9172-14)

	Volume of 0.01N $Na_2S_2O_3$ titrant	$\bar{x}$
dH_2O Blank (20 ml)	0.125 ml, 0.125 ml, 0.125 ml	0.125 ml

Now, with a vol. pipette, drew 2.0 ml of ~~S~~ Smart + Final Brand Germicidal Bleach into a 1 L vol flask containing dH_2O & brought to volume.

Titrated sample as blank above

	Volume of titrant
Bleach (20 ml)	8.0, 7.275, 7.275, 7.25, 7.25

So now as per SM4500-ClB. equation

Bleach Cl_2 in g/L = 69.79, 63.367, 63.367, 63.145, 63.145

* 69.79 outlier rejected

$\bar{x}$ for last 4* = 63.2561 g/L

= 6.32561 % = 6.3 %

%-RSD = 0.2 %

Took a HACH meter reading of above diluted bleach & diluted it 10/1000. Meter read ~ 6.75 %.

: DP[illegible] metr[illegible] colo[illegible]ric m[illegible]s (F[illegible]), respectively) are applicable to determining total chlorine in polluted waters. In addition, both DPD procedures and the amperometric titration method allow for estimating monochloramine and dichloramine fractions. Because all methods for total chlorine depend on the stoichiometric production of iodine, waters containing iodine-reducing substances may not be analyzed accurately by these methods, especially where iodine remains in the solution for a significant time. This problem occurs in Methods B and D. The back titration procedure (C) and Methods F and G cause immediate reaction of the iodine generated so that it has little chance to react with other iodine-reducing substances.

In all colorimetric procedures, compensate for color and turbidity by using color and turbidity blanks.

A method (I) for total residual chlorine using a potentiometric iodide electrode is proposed. This method is suitable for analysis of chlorine residuals in natural and treated waters and wastewater effluents. No differentiation of free and combined chlorine is pos-

5. R[illegible]nce

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Marks, H.C., D.B. Williams & G.U. Glasgow. 1951. Determination of residual chlorine compounds. *J. Amer. Water Works Assoc.* 43:201.

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Whittle, G.P. & A. Lapteff, Jr. 1973. New analytical techniques for the study of water disinfection. *In* Chemistry of Water Supply, Treatment, and Distribution, p. 63. Ann Arbor Science Publishers, Ann Arbor, Mich.

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4500-Cl B. Iodometric Method I

1. General Discussion

a. Principle: Chlorine will liberate free iodine from potassium iodide (KI) solutions at pH 8 or less. The liberated iodine is titrated with a standard solution of sodium thiosulfate ($Na_2S_2O_3$) with starch as the indicator. Titrate at pH 3 to 4 because the reaction is not stoichiometric at neutral pH due to partial oxidation of thiosulfate to sulfate.

b. Interference: Oxidized forms of manganese and other oxidizing agents interfere. Reducing agents such as organic sulfides also interfere. Although the neutral titration minimizes the interfering effect of ferric and nitrite ions, the acid titration is preferred because some forms of combined chlorine do not react at pH 7. Use only acetic acid for the acid titration; sulfuric acid (H_2SO_4) will increase interferences; *never use hydrochloric acid (HCl).* See Section A.3 for discussion of other interferences.

c. Minimum detectable concentration: The minimum detectable concentration approximates 40 µg Cl as Cl_2/L if 0.01*N* $Na_2S_2O_3$ is used with a 1000-mL sample. Concentrations below 1 mg/L cannot be determined accurately by the starch-iodide end point used in this method. Lower concentrations can be measured with the amperometric end point in Methods C and D.

2. Reagents

a. Acetic acid, conc (glacial).

b. Potassium iodide, KI, crystals.

c. Standard sodium thiosulfate, 0.1*N:* Dissolve 25 g $Na_2S_2O_3 \cdot 5H_2O$ in 1 L freshly boiled distilled water and standardize against potassium bi-iodate or potassium dichromate after at least 2 weeks storage. This initial storage is necessary to allow oxidation of any bisulfite ion present. Use boiled distilled water and add a few milliliters chloroform ($CHCl_3$) to minimize bacterial decomposition.

Standardize 0.1*N* $Na_2S_2O_3$ by one of the following:

1) Iodate method—Dissolve 3.249 g anhydrous potassium bi-iodate, $KH(IO_3)_2$, primary standard quality, or 3.567 g KIO_3 dried at 103 ± 2°C for 1 h, in distilled water and dilute to 1000 mL to yield a 0.1000*N* solution. Store in a glass-stoppered bottle.

To 80 mL distilled water, add, with constant stirring, 1 mL conc H_2SO_4, 10.00 mL 0.1000*N* $KH(IO_3)_2$, and 1 g KI. Titrate immediately with 0.1*N* $Na_2S_2O_3$ titrant until the yellow color of the liberated iodine almost is discharged. Add 1 mL starch indicator solution and continue titrating until the blue color disappears.

2) Dichromate method—Dissolve 4.904 g anhydrous potassium dichromate, $K_2Cr_2O_7$, of primary standard quality, in distilled water and dilute to 1000 mL to yield a 0.1000*N* solution. Store in a glass-stoppered bottle.

Proceed as in the iodate method, with the following exceptions: Substitute 10.00 mL 0.1000*N* $K_2Cr_2O_7$ for iodate and let reaction mixture stand 6 min in the dark before titrating with 0.1*N* $Na_2S_2O_3$ titrant.

$$\text{Normality } Na_2S_2O_3 = \frac{1}{\text{mL } Na_2S_2O_3 \text{ consumed}}$$

d. Standard sodium thiosulfate titrant, 0.01*N* or 0.025*N:* Improve the stability of 0.01*N* or 0.025*N* $Na_2S_2O_3$ by diluting an aged 0.1*N* solution, made as directed above, with freshly boiled distilled water. Add 4 g sodium borate and 10 mg mercuric iodide/L solution. For accurate work, standardize this solution daily in accordance with the directions given above, using 0.01*N* or 0.025*N* iodate or $K_2Cr_2O_7$. Use sufficient volumes of these standard solutions so that their final dilution is not greater than 1 + 4. To speed up operations where many samples must be titrated use an automatic buret of a type in which rubber does not come in contact with the solution. Standard titrants, 0.0100*N* and 0.0250*N*, are equivalent, respectively, to 354.5 µg and 886.3 µg Cl as Cl_2/1.00 mL.

e. Starch indicator solution: To 5 g starch (potato, arrowroot, or soluble), add a little cold water and grind in a mortar to a thin paste. Pour into 1 L of boiling distilled water, stir, and let settle overnight. Use clear supernate. Preserve with 1.25 g salicylic acid, 4 g zinc chloride, or a combination of 4 g sodium propionate and 2 g sodium azide/L starch solution. Some commercial starch substitutes are satisfactory.

f. Standard iodine, 0.1*N:* See C.3*g*.

g. Dilute standard iodine, 0.0282*N:* See C.3*h*.

3. Procedure

a. Volume of sample: Select a sample volume that will require no more than 20 mL 0.01*N* $Na_2S_2O_3$ and no less than 0.2 mL for the starch-iodide end point. For a chlorine range of 1 to 10 mg/L, use a 500-mL sample; above 10 mg/L, use proportionately less sample. Use smaller samples and volumes of titrant with the amperometric end point.

b. Preparation for titration: Place 5 mL acetic acid, or enough to reduce the pH to between 3.0 and 4.0, in a flask or white porcelain casserole. Add about 1 g KI estimated on a spatula. Pour sample in and mix with a stirring rod.

c. Titration: Titrate away from direct sunlight. Add 0.025*N* or 0.01*N* $Na_2S_2O_3$ from a buret until the yellow color of the liberated iodine almost is discharged. Add 1 mL starch solution and titrate until blue color is discharged.

If the titration is made with 0.025*N* $Na_2S_2O_3$ instead of 0.01*N*, then, with a 1-L sample, 1 drop is equivalent to about 50 µg/L. It is not possible to discern the end point with greater accuracy.

d. Blank titration: Correct result of sample titration by determining blank contributed by oxidizing or reducing reagent impurities. The blank also compensates for the concentration of iodine bound to starch at the end point.

Take a volume of distilled water corresponding to the sample used for titration in ¶s 3*a–c*, add 5 mL acetic acid, 1 g KI, and 1 mL starch solution. Perform blank titration as in 1) or 2) below, whichever applies.

1) If a blue color develops, titrate with 0.01*N* or 0.025*N* $Na_2S_2O_3$ to disappearance of blue color and record result, *B* (see ¶ 4, below) is negative.

2) If no blue color occurs, titrate with 0.0282*N* iodine solution until a blue color appears. Back-titrate with 0.01*N* or 0.025*N* $Na_2S_2O_3$ and record the difference. *B* is positive.

Before calculating the chlorine concentration, subtract the blank titration of ¶ 1) from the sample titration; or, if necessary, add the net equivalent value of the blank titration of ¶ 2).

4. Calculation

For standardizing chlorine solution for temporary standards:

$$\text{mg Cl as } Cl_2/\text{mL} = \frac{(A \pm B) \times N \times 35.45}{\text{mL sample}}$$

For determining total available residual chlorine in a water sample:

$$\text{mg Cl as } Cl_2/\text{L} = \frac{(A \pm B) \times N \times 35\,450}{\text{mL sample}}$$

where:

A = mL titration for sample.
B = mL titration for blank (positive or negative), and
N = normality of $Na_2S_2O_3$.

5. Precision and Bias

Published studies[1,2] give the results of nine methods used to analyze synthetic water samples without interferences; variations of some of the methods appear in this edition. More current data are not now available.

6. References

1. Water Chlorine (Residual) No. 1. 1969. Analytical Reference Service Rep. No. 35, U.S. Environmental Protection Agency, Cincinnati, Ohio.
2. Water Chlorine (Residual) No. 2. 1971. Analytical Reference Service Rep. No. 40, U.S. Environmental Protection Agency, Cincinnati, Ohio.

7. Bibliography

LEA, C. 1933. Chemical control of sewage chlorination. The use and value of orthotolidine test. *J. Soc. Chem. Ind.* (London) 52:245T.

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MARKS, H.C., R. JOINER & F.B. STRANDSKOV. 1948. Amperometric titration of residual chlorine in sewage. *Water Sewage Works* 95:175.

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NUSBAUM, I. & L.A. MEYERSON. 1951. Determination of chlorine demands and chlorine residuals in sewage. *Sewage Ind. Wastes* 23: 968.

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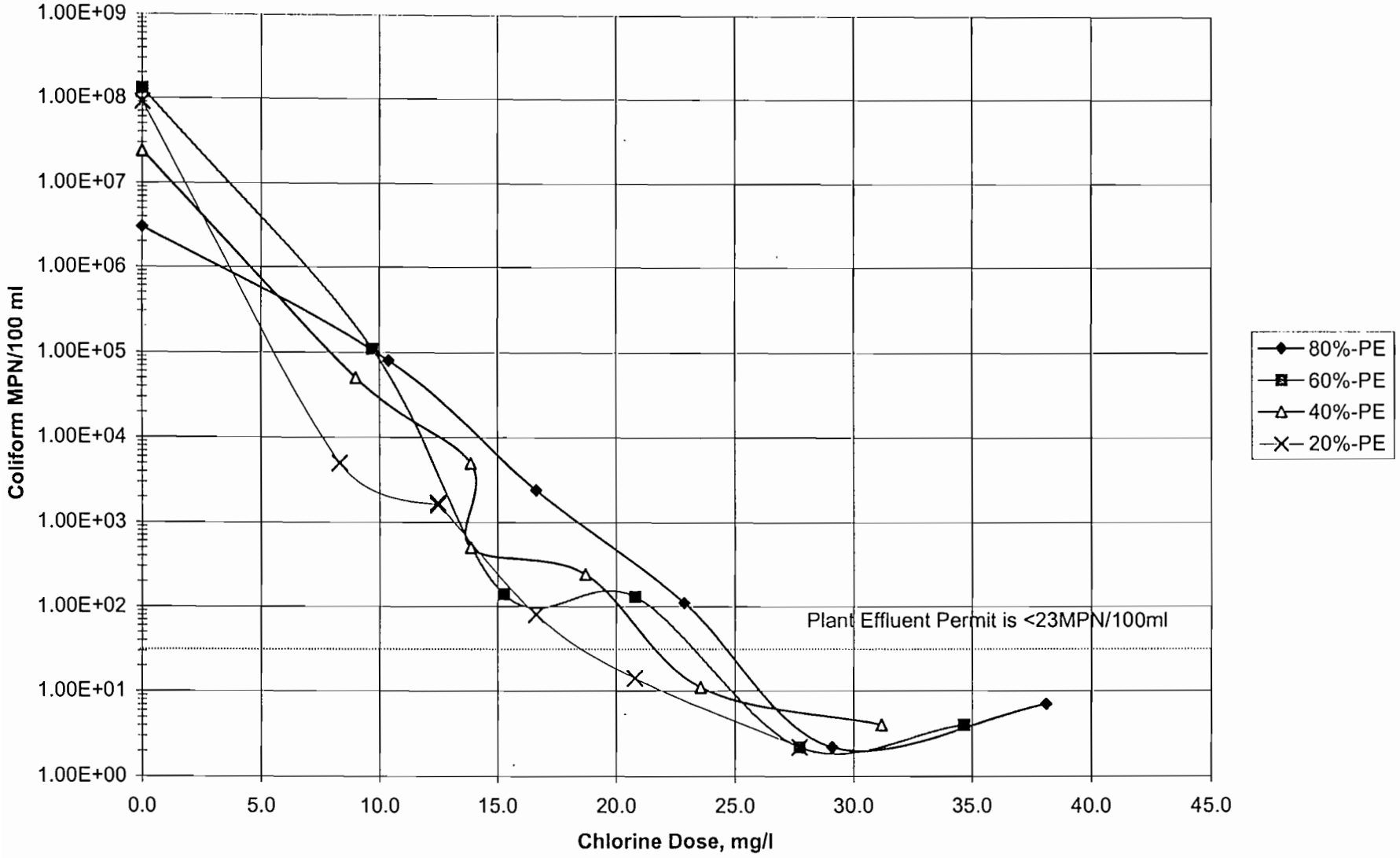
DISINFECTION EXPERIMENT
August 2, 1999
Morro Bay Wastewater Treatment Plant

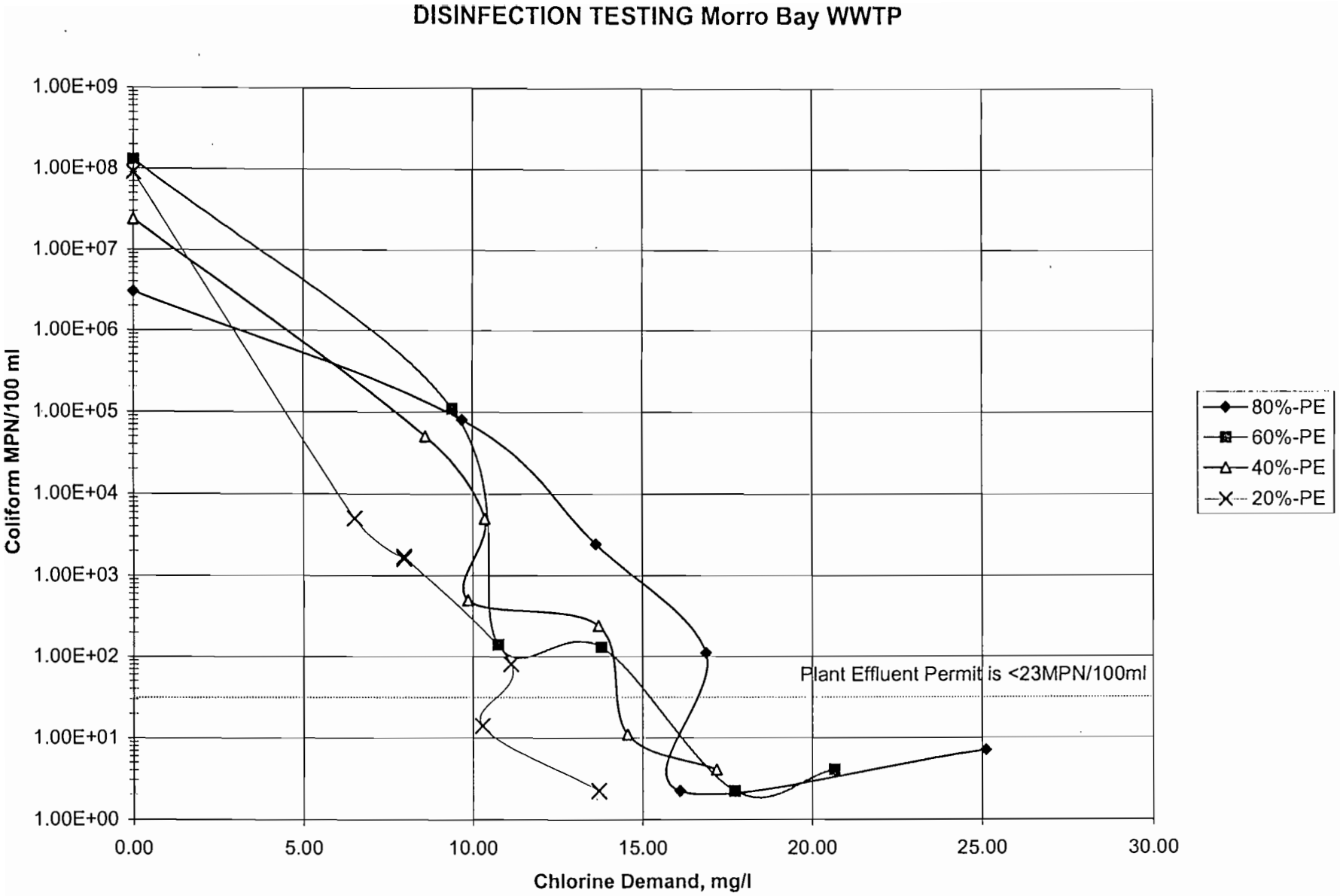
	A	B	C	D	E	F	G	H	I	J
1	**Sodium Hypochlorite to 80 percent blend of Primary Effluent and Secondary Effluent**									
2	Sample			Test Condition				Results		
3		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
4	Sample	g	g	ul		mg/l	C	mg/l	count	mg/l
5	80%-PE	800	1000	0	80%	0		0.0	3.00E+06	0.00
6	80%-150	800	1000	150	80%	0.7		10.4	8.00E+04	9.70
7	80%-240	800	1000	240	80%	3		16.6	2.40E+03	13.63
8	80%-330	800	1000	330	80%	6		22.9	1.10E+02	16.87
9	80%-420	800	1000	420	80%	13		29.1	2.2	16.11
10	80%-550	800	1000	550	80%	13		38.1	7	25.12
11				Time				(C*1.1*0.063)/(B/1000)		H-F
12	Comments:									
13										
14										
15	**Sodium Hypochlorite to 60 percent blend of Primary Effluent and Secondary Effluent**									
16	Sample			Test Condition				Results		
17		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
18	Sample	g	g	ul		mg/l	C	mg/l	count	mg/l
19	60%-PE	600	1000	0	60%	0		0.0	1.30E+08	0.00
20	60%-140	600	1000	140	60%	0.3		9.7	1.10E+05	9.40
21	60%-220	600	1000	220	60%	4.5		15.2	1.40E+02	10.75
22	60%-300	600	1000	300	60%	7		20.8	1.30E+02	13.79
23	60%-400	600	1000	400	60%	10		27.7	2.2	17.72
24	60%-500	600	1000	500	60%	14		34.7	4	20.65
25				Time				(C*1.1*0.063)/(B/1000)		H-F
26	Comments:									
27										
28										
29	**Sodium Hypochlorite to 40 percent blend of Primary Effluent and Secondary Effluent**									
30	Sample			Test Condition				Results		
31		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
32	Sample	g	g	ul		mg/l	C	mg/l	count	mg/l
33	40%-PE	400	1000	0	40%	0		0.0	2.40E+07	0.00
34	40%-130	400	1000	130	40%	0.4		9.0	5.00E+04	8.61
35	40%-200	400	1000	200	40%	3.5		13.9	5.00E+03	10.36
36	40%-200-Dup	400	1000	200	40%	4		13.9	5.00E+02	9.86
37	40%-270	400	1000	270	40%	5		18.7	2.40E+02	13.71
38	40%-340	400	1000	340	40%	9		23.6	11	14.56
39	40%-450	400	1000	450	40%	14		31.2	4	17.19
40				Time				(C*1.1*0.063)/(B/1000)		H-F
41	Comments:									
42										
43										
44	**Sodium Hypochlorite to 20 percent blend of Primary Effluent and Secondary Effluent**									
45	Sample			Test Condition				Results		
46		PE	Total	Dose	PE/Total	Residual	Temp	Dose	Coliform	Demand
47	Sample	g	g	ul		mg/l	C	mg/l	count	mg/l
48	20%-PE	200	1000	0	20%	0		0.0	9.00E+07	0.00
49	20%-120	200	1000	120	20%	1.8		8.3	5.00E+03	6.52
50	20%-180	200	1000	180	20%	4.5	14	12.5	1600	7.97
51	20%-180-Dup	200	1000	180	20%	4.5		12.5	1.70E+03	7.97
52	20%-240	200	1000	240	20%	5.5		16.6	80	11.13
53	20%-300	200	1000	300	20%	10.5	1600	20.8	1.40E+01	10.29
54	20%-400	200	1000	400	20%	14		27.7	2.2	13.72
55				Time				(C*1.1*0.063)/(B/1000)		H-F
56	Comments: Results for 20%-180 and 20%-300 were reversed.									

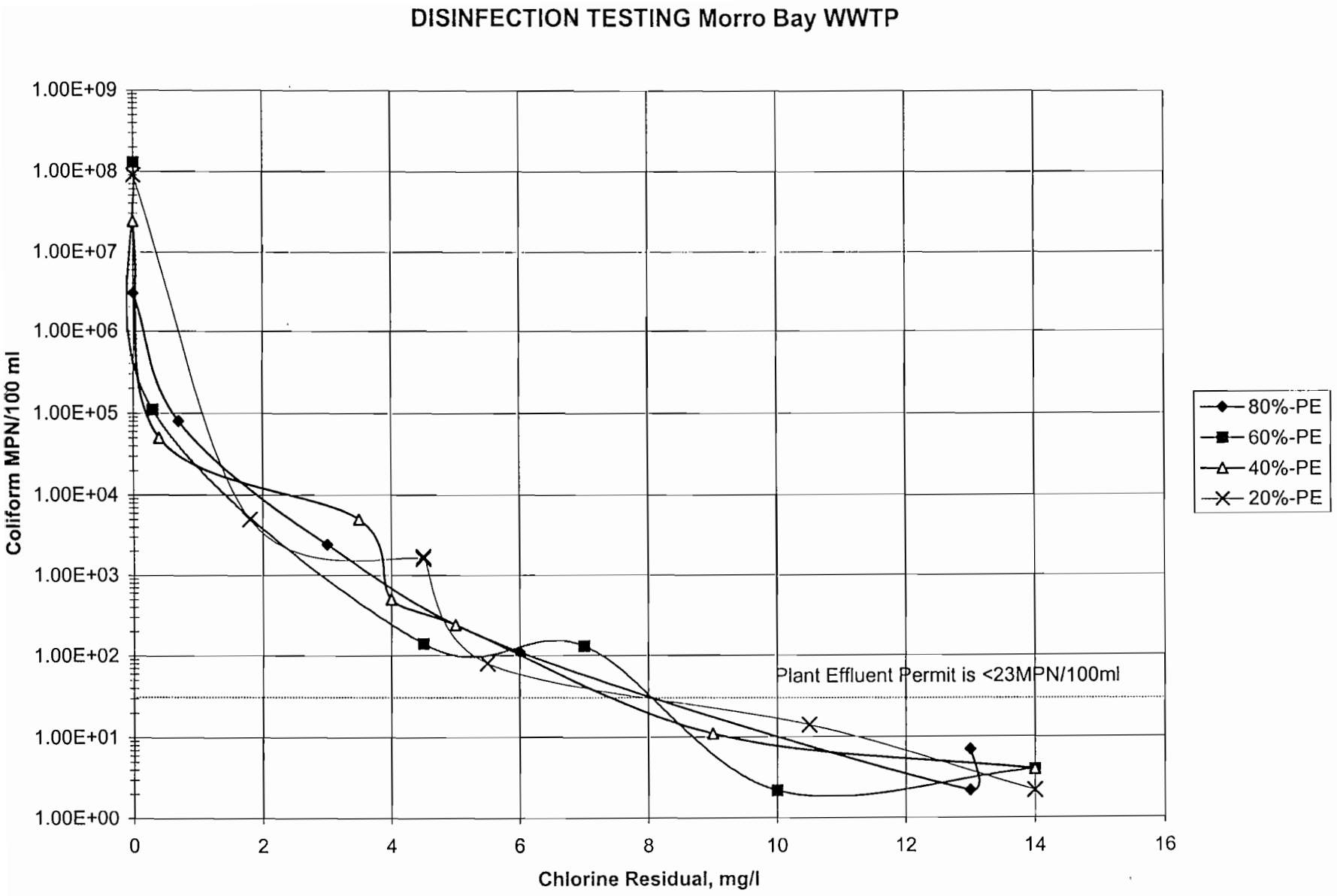
DISINFECTION EXPERIMENT
August 2, 1999
Morro Bay Wastewater Treatment Plant

	A	B	C	D	E	F	G	H	I	J
57										
58										

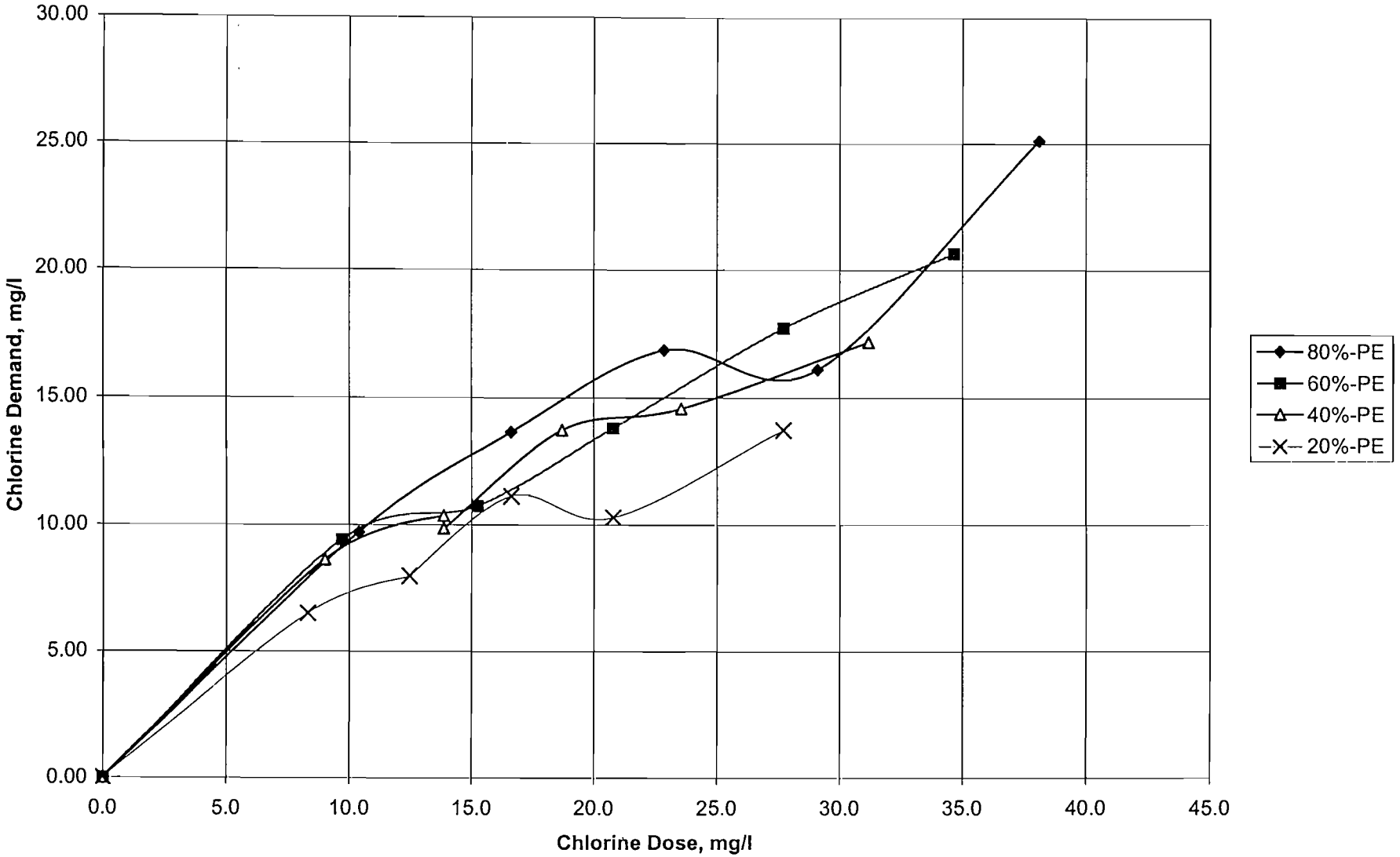
DISINFECTION TESTING Morro Bay WWTP




DISINFECTION TESTING Morro Bay WWTP
Coliform MPN/100 ml
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Chlorine Demand, mg/l
Plant Effluent Permit is <23MPN/100ml
80%-PE
60%-PE
40%-PE
20%-PE


DISINFECTION TESTING Morro Bay WWTP
Coliform MPN/100 ml
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0
2
4
6
8
10
12
14
16
Chlorine Residual, mg/l
Plant Effluent Permit is <23MPN/100ml
80%-PE
60%-PE
40%-PE
20%-PE

DISINFECTION TESTING Morro Bay WWTP



periods of low flow, the entrained sand could have become cohesive through bacterial or slime growth, in which case a cleaning operation may be required.

Q (mgd)	Velocity in pipe (fps)
3.0	1.168
4.0	1.557
5.0	1.946
6.64	2.584

Table 4: Previously calculated pipe flow.

Summary of Calculations: Wave Pressure acting on the Morro Bay/Cayucos outfall.

Backflow into the diffuser ports will result from the increase in pressure around the diffuser as waves propagate across the surface of the water, above the outfall. This increased pressure has two components calculated as follows for a wave of significant wave height H_S and period T.

Hydrostatic Pressure

$$P_s = \rho g \frac{H_s}{2}$$

where ρ = density of sea water; and
g = acceleration due to gravity.

Dynamic Wave Pressure

$$P_{dr} = \rho g \frac{H_s}{2} \frac{\cosh(k(h+z))}{\cosh(kh)}$$

where k = wavenumber of the wave[1]
h = total water depth
z = depth of the outfall (in this case = -h)

Note that pressure head is calculated as P/ρg. The additional hydrostatic, dynamic and total pressure head acting on the diffuser for various wave conditions are given in Table 1. The given values are calculated for the conditions under a wave crest when the increase in pressure on the outfall will be a maximum. The static wave head therefore corresponds to the wave amplitude.

Significant Wave H_S	Wave Period T (sec)	Frequency σ (rad s^{-1})	Wavenumber k (m^{-1})	Static Wave Head	Dynamic Wave Head	Total Wave head (H_{WT})
2.0m | 6.6'	5	1.25	.16	1.0m | 3.3'	0.13m | 0.4'	1.13m | 3.7'
2.0m | 6.6'	10	0.63	.06	1.0m | 3.3'	0.67m | 2.2'	1.67m | 5.5'
1.0m | 3.3'	5	1.25	.16	0.5m | 1.6'	0.13m | 0.2'	0.63m | 1.8'
1.0m | 3.3'	10	0.63	.06	0.5m | 1.6'	0.33m | 1.1'	0.83m | 2.7'

Table 1: Total wave induced pressure head.

[1] Wavenumber is calculated from the dispersion relation for gravity waves, $\sigma^2 = gk \tanh(kh)$, where $\sigma = 2\pi/T$, is the wave radial frequency.

The velocities corresponding to the total wave head values are given in Table 2. These are calculated according to

$$v_c = \sqrt{2gH_{WT}}$$

Significant Wave H_S	Wave Period T (sec)	Critical Velocity $V_c=(2g\ H_{WT})^{1/2}$ (ms^{-1})	Critical Velocity $V_c=(2g\ H_{WT})^{1/2}$ (fps)
2.0m | 6.6'	5	4.7	15.4
2.0m | 6.6'	10	5.7	18.7
1.0m | 3.3'	5	3.5	11.4
1.0m | 3.3'	10	4.0	13.1

Table 2: Total wave head velocities.

The calculated flow rates through the diffuser ports (taken from the design calculation, 28 ports open) are given in Table 3.

Q (mgd)	Q/port (cfs)	Velocity at port exit V_o (fps)	Velocity Head $V_o^2/2g$ (ft)
3.0	0.166	7.545	0.844
4.0	0.221	10.045	1.567
5.0	0.276	12.545	2.444
6.64	0.367	16.682	4.321

Table 3: Previously calculated diffuser port flow.

Comparing the head values given in Table 3 to those induced by the wave (Table 1) it can be seen that the total induced wave head will exceed the velocity head of the flow from the ports under many conditions. This will result in backflow of seawater into the outfall through the ports and with it transport of any sediment in suspension into the outfall. It is therefore recommended that one-way check valves such as the Tideflex valves manufactured by the Red Valve Company Inc be used to prevent backflow.

Sediment Resuspension Velocity

Assuming quartz sand with an approximate median diameter of 1mm, any sediment resident in the outfall will be resuspended by flows of 0.5-0.9fps (15-30cms^{-1}). These velocities are less than the calculated flow rates through the main outfall pipe given in Table 4 (taken from the design calculation, 28 ports open). Hence, if backflow is prevented by the presence of one-way valves, any resident sediment should be resuspended and removed by the outfall flow. However, if the outfall has had significant

TDS Data

Date/time	Cayucos Line	Morro Bay 18" Line	Morro Bay Lift Station #2	Headworks
6-Apr-99	1000	1990	800	1850
7-Apr-99	980	820	730	890
8-Apr-99	1080	840	810	920
9-Apr-99	960	900	690	870
10-Apr-99	1170	930	1040	1060
11-Apr-99	650	630	880	720
12-Apr-99	940	980	890	950
13-Apr-99	960	1810	1280	1470
14-Apr-99	1020	980	700	1050
15-Apr-99	1130	1070	920	1270
16-Apr-99	990	1090	720	1000
17-Apr-99	930	830	740	850
18-Apr-99	1050	770	870	950
19-Apr-99	1120	860	940	990
20-Apr-99	1080	940	830	1030
21-Apr-99	1180	1020	810	1030
Average	1015	1029	853	1056

All stations were sampled at approximately 1430

Flow Science Incorporated
599 N. Fair Oaks Ave., Pasadena, CA 91103 **(626) 304-1134 FAX (626) 304-9427**
135 E. Hancock St., Lansdale, PA 19446 **(215) 361-6065 FAX (215) 361-7626**

FLOW SCIENCE

Carollo Engineers
2700 Ygnacio Valley Road, Suite 300
Walnut Creek, CA 94598

15 July, 1999

Attention: Lydia Holmes

Subject : Morro Bay/Cayucos Outfall
FSI994044

Dear Ms. Holmes,

We have reviewed the Morro Bay/Cayucos Outfall design and have concluded that under certain wave conditions a backflow of seawater into the diffuser ports will occur. As described in the attached calculations, waves with a significant wave height of 2.0 m (and period of 5 or 10 s) will induce enough additional pressure at the outfall ports to induce backflow. Waves with a significant wave height of 1.0 m (and period of 5 or 10 s) will also induce backflow at the lesser outfall flow rates. This backflow can be avoided by using one-way check valves such as the Tideflex valves manufactured by Red Valve Company, Inc. These valves can be directly attached to the 2" diffuser ports.

Since the exposure of the diffuser ports is presently unknown we recommend a visual inspection of the outflow. If the ports are completely or partially covered with sediment, hence blocking flow, vertical extensions to the ports may be necessary to ensure proper exposure of the ports. Extensions are available with the Tideflex valves. It is possible that periods of low flow in the outfall may have lead to the formation of coherent sediment masses that could require active removal before the full capacity of the outfall is regained.

Literature describing the one-way Tideflex valves is enclosed. Pricing of these valves provided to us by Capital Westward Systems & Controls, 1290 Santa Fe, San Jacinto, CA 92583, telephone (909) 654 7484. For 32 valves, 2" diffuser Tideflex check valves appropriate for use in sea water are $530 each with up to 1ft of extension and $580 each with 1ft to 2ft of extension.

Sincerely,

Emily Pidgeon, Ph.D.
Staff Engineer

RECEIVED
JUL 19 1999
CAROLLO ENGINEERS

15

DESIGN DATA

PLANT CAPACITY

Flow, mgd	
Average dry weather flow (ADWF)	2.06
Peak seasonal dry weather flow (PSDWF)	2.36
Peak dry weather flow (PDWF)	6.64
Peak wet weather flow (PWWF)	6.60
Strength	
Biochemical oxygen demand (BOD_5), mg/l	280
Suspended solids (SS), mg/l	280

PRELIMINARY TREATMENT

Mechanically cleaned bar screen	
Number	1
Capacity, mgd	8.2
Manually cleaned bar screen	
Number	1
Capacity, mgd	8.2
Influent pumps (variable speed)	
Number	3
Capacity, each, mgd	3.3
Total head, feet	31.6
Aerated grit removal tank	
Length, feet	30
Width, feet	16
Depth, feet	8
Detention time at PWWF, minutes	6.3

PRIMARY TREATMENT

Sedimentation tanks (existing)	
Number	2
Diameter, feet	
Tank 1	50
Tank 2	40
Average side water depth, feet	9
Surface loading rate at PSDWF, gal/sq. ft./day	730

TRICKLING FILTERS (in partial secondary treatment mode of operation)

Flow Distribution at PSDWF, mgd	
Filter 1	0.39
Filter 2	0.58
Diameter, feet	
Filter 1	60
Filter 2	70
Net media surface area, sq. ft.	
Filter 1	2,820
Filter 2	3,770
Average media height, feet	
Filter 1	4.5
Filter 2	5.0
Specific organic loading rate, lb BOD_5/day/1,000 cu. ft. media	47
Hydraulic loading rate, gpm/sq. ft. media surface	
Filter 1	0.34
Filter 2	0.38

SOLIDS CONTACT CHANNEL

Channel length, feet	
Reaeration portion	25
Contact portion	25
Channel depth, feet	4
Recirculated sludge flow, gpm	
Minimum	100
Maximum	500
Interstage pumps	
Number	2
Capacity, each, gpm	2,300
Total head, feet	27.0

SECONDARY SEDIMENTATION TANK

Diameter, feet	55
Tank surface area, sq. ft.	2,376
Tank volume, cu. ft.	35,640
Average water depth, feet	15
Overflow rate at PSDWF gal/sq. ft./day	408

TOTAL TREATMENT

Overall treatment efficiencies, percent	
BOD_5 removal	57
SS removal	75
Expected effluent quality, mg/l	
BOD_5	120
SS	70

SOLIDS STABILIZATION

Anaerobic digesters	
Loading, 1,000 lb/day	
Primary solids	3.58
Secondary solids	0.88
Assumed sludge volatile content, percent	
Primary solids	70
Secondary solids	82
Sludge volume, 1,000 cu. ft./day	1.79
Digester 1 (fixed cover)	
Diameter, feet	40
Side water depth, feet	16
Volume, 1,000 cu. ft.	22.2
Digester 2 (fixed cover)	
Diameter, feet	40
Side water depth, feet	19
Volume, 1,000 cu. ft.	25.6
Digester 3 (floating cover)	
Diameter, feet	35
Side water depth, feet, average	22.5
Volume, 1,000 cu. ft.	22.8
Hydraulic detention time based on net volume of digesters 2 & 3, days	23
Expected sludge gas production 1,000 cu. ft./day	28.4
Sludge drying beds	
Number	12
Length, each, feet	162
Width, each, feet	32
Loadings, lb of solids/sq. ft./year	16

OCEAN OUTFALL

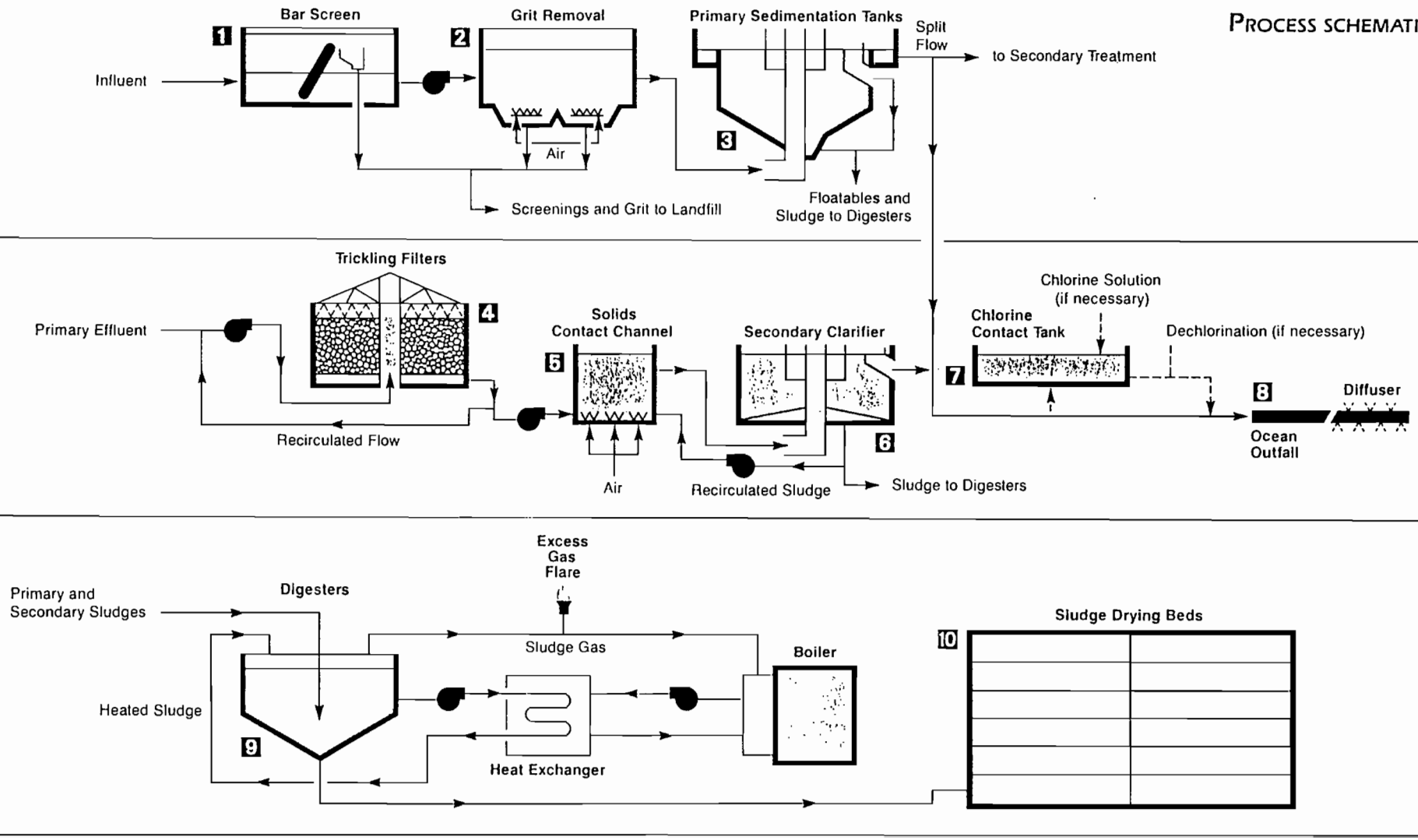
Length, feet	
Land portion	1,100
Ocean portion	4,060
Diameter, inches	27
Discharge depth, feet below MLLW	50
Multiport diffuser	
Ports open	29
Ports closed (future)	5
Port diameter, inches	2

PRIMARY TREATMENT

SECONDARY TREATMENT

SLUDGE TREATMENT

PROCESS SCHEMATIC



APPENDIX D - CONCEPTUAL ALTERNATIVES BACKUP, PHONE MEMOS AND GENERAL INFORMATION

CAROLLO engineers

Route

B. Hampson	FSN

TELEPHONE MEMORANDUM

DATE 5·26·99 TIME 11 am ± PROJECT NO. 4857A.00

FROM Ray Festa TO TAC

OF MB Golf Course - County TELEPHONE NO. 805-781-1318

SUBJECT Golf Course Irrigation

- Need tertiary (unrestricted GC access)
- possibility to use recycled water
- Irrig ~ 110 Acres (120-125 Acres typical course size)
- Use well in S Bay Blvd
- Agrmnt w/ cmc to buy imported water, CMC process it & put it in Creek-Chorro.
  up to 180 Ac·Ft/yr "Prescriptive right"
- County owns the right ↑. In affect only since last year('98).
- City restricted from extracting from Chorro Wells Due to Not riparian rights or use except in winter mos
- Regulated flow that cmc must put in the creek daily, monthly, etc
- Grass grown: "cacuyah grass"
- most gc around ~ ~~400-450~~ 200-400 Ac·Ft/Yr
- Coastal area 2.5 Ac·Ft/Ac/Yr
- Pay at about 1200 $/Ac·Ft (based on State water)
  24K/yr pumping cost only in past
- Not regulated withdraw from creek (ie: seasonal use OK)

Route

carollo engineers

TELEPHONE MEMORANDUM

DATE 5·28·99 TIME 1:45 pm PROJECT NO. 4857A.00

FROM TAC TO Brad Parker

OF Morro Bay High School TELEPHONE NO. 805-543-2010

SUBJECT Use Quantities for Schools

- Morro Bay HS 13.3 Ac turf
  0.7 Ac lawn
  + planters, misc
  - 2 connection pts

- Morro Elem School - near City Hall (Comm Ctr.)
  4 Ac lawn
  - 1 connection pt

- Del Mar Elem - 6 Ac lawn
  - 1 connection pt

- total 24 Acres = 55 Ac·Ft/Yr total w/ Domestic
  80% is irrigation
  ≈ 44 Ac·Ft/Yr
  ~ 2 Ac·Ft/Ac

- Backflow devices present - would need some retrofit, but systems are seperate for the most part.

Route

CAROLLO engineers

TELEPHONE MEMORANDUM

DATE 6·9·99 TIME 11:30 am± PROJECT NO. 4857A.00

FROM TAC TO Pat Paulson - QC

OF Hanson (~~Kaiser~~) Sand & Gravel TELEPHONE NO. 805·543·8100

SUBJECT Reuse @ sand & gravel site

- He thought it was city water but he will check.
- Bruce Carter (925) 846-8800 Pleasanton
  QC for company
- Well water supply
- 3,000 yds/mos of concrete 36 gal H_2O / yard
  (3,000 x 12 mos x 36) = High Usage = 1,300,000 gal/yr
  (3,000 x 8 mos x 36) = Conserv. Usage = 864,000 gal/yr
- Owns wells
- Uses fly ash & cement & water ⇒ concrete
  (makes catalyst
  product from coal plants
- He will fax a WQ sample (if he can find one!)
- He is interested in using recycled water provided the quality can be met w/ the concrete.

Route

carollo engineers

TELEPHONE MEMORANDUM

DATE 6.11.99 TIME 11 am PROJECT NO. 4857A.00

FROM TAC TO Ron - Gm

OF Mission Linen Uniforms TELEPHONE NO. 805-772-4451

SUBJECT Reuse in Comm Laundry

- Ron said they are the only commercial laundry in town - uniform laundry
- Use is about 100,000 gal/wk (non potable)
  = 14,286 gal/d
- They would need water to be an acceptable pH for detergents to work in machines
- Current water source is state water from city

7.7.99 - 8 hr day use only. Uniforms Only.
office 8-5

8-17-99 5Am - 2pm operation M-F
wait till full loads - 450 #/machine
2 restrooms
2 eyewash
Use bottled water
33 people per day employees (includes 11 mgrs)

CAROLLO engineers

Route

TELEPHONE MEMORANDUM

DATE 7-12-99 TIME 2:30 pm ± PROJECT NO. 485 7A.00

FROM TAC TO Robert Stockel

OF County Agr. Comm Office TELEPHONE NO. 805 · 781 · 5910

SUBJECT Crops grown along Hwy 41

- Robert told me the main grower of row crops in that area is Robert Hiyashi. He has ~ 100 Acres of row crops of brocolli, cabbage, celery, cauliflower.

- Some property owners in that area also lease land to smaller growers who mainly grow sugar peas

- Further East along 41 are avocado's, then east of the Avocados is a grower named Andy De La Cruise who grows lg variety of row crops ie: peppers, tomatoes squash, etc...

- Crops grown determines quality of recycled water (ie: Second vs Tertiary)

Morro Bay - Cayucos Reuse

Project Description	Seg-ment	User #	User Description	Flow cfs	Time of use	Flow in Seg., cfs	Vel. fps	Calculated Pipe Dia. inches	Dia.Used inches	Length of Seg., ft	Pipe cost $/DIF	Pipe cost Costs
Secondary												
1 MB-CSD	AB	0	WWTP - washdown	0.016	day	0.016	4	0.85	2	200	$6	$2,400
combined	BC					1.665	4	8.74	10	528	$5	$26,400
	CD	38	Hanson Sand & Gravel	0.012	day	0.012	4	0.75	2	200	$6	$2,400
	CE					1.653	4	8.70	10	1320	$5	$66,000
	EH					1.653	4	8.70	10	1584	$5	$79,200
	HG	14	Misc pasture area	0.707		0.707	4	5.69	6	250	$6	$9,000
	HI					0.946	4	6.59	8	3960	$6	$190,080
	IJ	16	S side of Hwy 1	0.141		0.141	4	2.55	4	200	$6	$4,800
	IK					0.805	4	6.07	6	1320	$6	$47,520
	KL	34	Tropicana Nursery	0.010		0.010	4	0.67	2	250	$6	$3,000
	KM	22	Chorro Flats	0.795		0.795	4	6.04	6	7260	$6	$261,360
	EN					0.212	4	3.12	4	20011	$6	$480,269
	NO	7	Highway 1 median	0.071		0.071	4	1.80	2	250	$6	$3,000
	NP	5	Cemetery	0.141		0.141	4	2.55	4	3630	$6	$87,120
											total	$1,262,549
Tertiary - Cayucos only - separate plant												
2	AB					1.577	4	8.50	10	250	$5	$12,500
	AC					1.577	4	8.50	10	1000	$5	$50,000
	CD					1.577	4	8.50	10	250	$5	$12,500
	DE	4	S/W of Whale Rk Res	0.177		0.177	4	2.85	4	400	$6	$9,600
	DF	24	Old Creek	1.400		1.400	4	8.01	8	1320	$6	$63,360
	AG					0.212	4	3.12	4	1640	$6	$39,360
	GH	5	Cemetery	0.141		0.141	4	2.55	4	330	$6	$7,920
	GI	7	Highway 1 median	0.071		0.071	4	1.80	2	3300	$6	$39,600
											total	$234,840
Tertiary - Common												
4 Common	AB	0	WWTP - washdown	0.016	day	0.016	4	0.85	2	200	$6	$2,400
Common	BC					0.950	4	6.60	8	528	$6	$25,344
Common	CD	38	Hanson Sand & Gravel	0.012	day	0.012	4	0.75	2	200	$6	$2,400
Common	CE					0.938	4	6.56	8	660	$6	$31,680
Common	EF					0.554	4	5.04	6	660	$6	$23,760
Common	FQ					0.495	4	4.76	6	660	$6	$23,760
Common	QG	11	Morro Bay High School	0.495	Night	0.495	4	4.76	6	500	$6	$18,000
Common	FH	32	MB High School - bus	0.059	day	0.059	4	1.64	2	660	$6	$7,920
Common	EI	12	Keiser Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
Common	EJ					0.066	4	1.74	2	660	$6	$7,920
Common	JK	33	Mission Linen	0.066	day	0.066	4	1.74	2	500	$6	$6,000
											total	$165,024
Tertiary - Morro Bay North & Cayucos												
3,5 Common	AB	0	WWTP - washdown	0.016	day	0.016	4	0.85	2	200	$6	$2,400
Common	BC					4.515	4	14.39	16	528	$5	$42,240
Common	CD	38	Hanson Sand & Gravel	0.012	day	0.012	4	0.75	2	200	$6	$2,400
Common	CE					4.503	4	14.37	16	660	$5	$52,800
Common	EF					1.755	4	8.97	10	660	$5	$33,000
Common	FQ					1.696	4	8.82	10	660	$5	$33,000
Common	QG	11	Morro Bay High School	0.495	Night	0.495	4	4.76	6	500	$6	$18,000
Common	FH	32	MB High School - bus	0.059	day	0.059	4	1.64	2	660	$6	$7,920
Common	EI	12	Keiser Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
Common	EJ					2.429	4	10.55	12	660	$5	$39,600
Common	JK	33	Mission Linen	0.066	day	0.066	4	1.74	2	500	$6	$6,000
MB North	QR	10	The Cloisters development	1.202	Night	1.202	4	7.42	8	2640	$6	$126,720
	JS					2.363	4	10.41	12	5808	$5	$348,480
	ST					0.530	4	4.93	6	1056	$6	$38,016
	TU	15	Del Mar Elementary	0.212	Night	0.212	4	3.12	4	200	$6	$4,800
	TV	9	Del Mar Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
Cayucos	SW					1.833	4	9.17	10	14203	$5	$710,160
	WX	7	Highway 1 median	0.071	Night	0.071	4	1.80	2	250	$6	$3,000
	WY					1.762	4	8.99	10	3300	$5	$165,000
	YZ	5	Cemetery	0.141	Night	0.141	4	2.55	4	330	$6	$7,920
	YA'					1.621	4	8.62	10	2640	$5	$132,000
	A'B'					1.577	4	8.50	10	250	$5	$12,500
	B'C'	4	S/W of Whale Rk Res	0.177	Night	0.177	4	2.85	4	400	$6	$9,600
	B'D'	24	Old Creek	1.400		1.400	4	8.01	8	1320	$6	$63,360
	A'E'					0.044	4	1.42	2	3136	$6	$37,636
	E'F'	3	Paul Andrew Park	0.009	Night	0.009	4	0.64	2	250	$6	$3,000
	E'G'	1	Hardie Park & School	0.035	Night	0.035	4	1.27	2	2970	$6	$35,640
											total	$1,966,872

Morro Bay - Cayucos Reuse

Project Description	Segment	User #	User Description	Flow cfs	Time of use	Flow in Seg., cfs	Vel. fps	Calculated Pipe Dia. inches	Dia.Used inches	Length of Seg., ft	Pipe cost $/DIF	Pipe cost Costs
Tertiary - Morro Bay North												
5 Common	AB	0	WWTP - washdown	0.016	day	0.016	4	0.85	2	200	$6	$2,400
Common	BC					2.682	4	11.09	12	528	$5	$31,680
Common	CD	38	Hanson Sand & Gravel	0.012	day	0.012	4	0.75	2	200	$6	$2,400
Common	CE					2.670	4	11.06	12	660	$5	$39,600
Common	EF					1.755	4	8.97	10	660	$5	$33,000
Common	FQ					1.696	4	8.82	10	660	$5	$33,000
Common	QG	11	Morro Bay High School	0.495	Night	0.495	4	4.76	6	500	$6	$18,000
Common	FH	32	MB High School - bus	0.059	day	0.059	4	1.64	2	660	$6	$7,920
Common	EI	12	Keiser Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
Common	EJ					0.596	4	5.23	6	660	$6	$23,760
Common	JK	33	Mission Linen	0.066	day	0.066	4	1.74	2	500	$6	$6,000
MB North	QR	10	The Cloisters development	1.202	Night	1.202	4	7.42	8	2640	$6	$126,720
	JS					0.530	4	4.93	6	5808	$6	$209,088
	ST					0.530	4	4.93	6	1056	$6	$38,016
	TU	15	Del Mar Elementary	0.212	Night	0.212	4	3.12	4	200	$6	$4,800
	TV	9	Del Mar Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
											total	$608,064
Tertiary - Morro Bay East												
6 Common	AB	0	WWTP - washdown	0.016	day	0.016	4	0.85	2	200	$6	$2,400
Common	BC					7.652	4	18.73	20	528	$5	$52,800
Common	CD	38	Hanson Sand & Gravel	0.012	day	0.012	4	0.75	2	200	$6	$2,400
Common	CE					7.639	4	18.71	20	660	$5	$66,000
Common	EF					0.554	4	5.04	6	660	$6	$23,760
Common	FQ					0.495	4	4.76	6	660	$6	$23,760
Common	QG	11	Morro Bay High School	0.495	Night	0.495	4	4.76	6	500	$6	$18,000
Common	FH	32	MB High School - bus	0.059	day	0.059	4	1.64	2	660	$6	$7,920
Common	EI	12	Keiser Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
Common	EJ					6.767	4	17.61	18	660	$5	$59,400
Common	JK	33	Mission Linen	0.066	day	0.066	4	1.74	2	500	$6	$6,000
MB East	JL					6.701	4	17.53	18	6600	$5	$594,000
	LM	13	Atascadero Rd - E of Hwy 1	5.301	Night	5.301	4	15.59	16	2640	$5	$211,200
	LN					1.400	4	8.01	8	5280	$6	$253,440
	NO	28	Morro Creek	1.400		1.400	4	8.01	8	250	$6	$12,000
											total	$1,348,920
Tertiary - Morro Bay South												
7 Common	AB	0	WWTP - washdown	0.016	day	0.016	4	0.85	2	200	$6	$2,400
Common	BC					6.788	4	17.64	18	528	$5	$47,520
Common	CD	38	Hanson Sand & Gravel	0.012	day	0.012	4	0.75	2	200	$6	$2,400
Common	CE					6.776	4	17.62	18	660	$5	$59,400
Common	EF					0.554	4	5.04	6	660	$6	$23,760
Common	FQ					0.495	4	4.76	6	660	$6	$23,760
Common	QG	11	Morro Bay High School	0.495	Night	0.495	4	4.76	6	500	$6	$18,000
Common	FH	32	MB High School - bus	0.059	day	0.059	4	1.64	2	660	$6	$7,920
Common	EI	12	Keiser Park	0.318	Night	0.318	4	3.82	4	660	$6	$15,840
Common	EJ					5.904	4	16.45	18	660	$5	$59,400
Common	JK	33	Mission Linen	0.066	day	0.066	4	1.74	2	500	$6	$6,000
MB South	JH'					5.838	4	16.36	18	5280	$5	$475,200
	H'I'	17	Morro Bay Elementary Sch	0.141	Night	0.141	4	2.55	4	150	$6	$3,600
	H'J'					5.696	4	16.16	16	990	$5	$79,200
	J'Z'					0.120	4	2.34	4	2218	$6	$53,222
	Z'Y'	19	Monte Young Park	0.009	Night	0.009	4	0.64	2	300	$6	$3,600
	Z'T'					0.111	4	2.25	4	1980	$6	$47,520
	T'U'	20	Bayshore Bluffs Park	0.106	Night	0.106	4	2.20	4	660	$6	$15,840
	T'V'					0.005	4.	0.46	2	1320	$6	$15,840
	V'W'	37	MB Golf Course - Cart Wash	0.005	day	0.005	4	0.46	2	1980	$6	$23,760
	J'K'					5.577	4	15.99	16	660	$5	$52,800
	K'L'	18	City Park	0.028	Night	0.028	4	1.14	2	150	$6	$1,800
	K'M'					5.549	4	15.95	16	1320	$5	$105,600
	M'N'	34	Tropicana Nursery	0.010	day	0.010	4	0.67	2	660	$6	$7,920
	M'X'					5.539	4	15.93	16	1320	$5	$105,600
	X'Y'	21	Morro Bay Golf Course	1.944	Night	1.944	4	9.44	10	3960	$5	$198,000
	X'O'					3.595	4	12.84	14	3960	$5	$277,200
	O'P'	30	Morro Bay Estuary	1.400		1.400	4	8.01	8	3300	$6	$158,400
	O'Q'					2.195	4	10.03	10	660	$5	$33,000
	Q'R'	22	Chorro Flats	0.795	Night	0.795	4	6.04	6	660	$6	$23,760
	Q'S'	31	Chorro Creek	1.400		1.400	4	8.01	8	3960	$6	$190,080
											total	$2,138,342

E - VIABLE ALTERNATIVES BACKUP

carollo engineers

Route

TELEPHONE MEMORANDUM

DATE 8.16.99 TIME 11:45 am ± PROJECT NO. 4857A.00

FROM TAC TO (below)

OF _____ TELEPHONE NO. _____

SUBJECT Retrofit Costs - seperate or combined systems

(1) Schools MBay H.S. & Elem Sch 805-543-2010 x124
irrig - 10pm - 5am Sequences Brad Parker
-

(2) P+Rec Keiser, Cloisters, City Park (BBQ pit w/ faucet) 805-772-6278
- 1 main, but metered seperately Antrea Lucker
- All 3 have rstrm facilities combined w/ irrig
- Most parks have >1 station. At any one time, btwn 2Am-6Am 1 station will be run.

(3) GC 805-781-1318
- Seperate irrig vs potable Ray Festa
- rstrm is however cross connected

(4) Industry Mission Linen, Hanson, On-Site (Mission Linen) 805-772-4451
* Hanson - Seperate GW well 805-772-2777 Ron - 6m
plant hours: 6Am - 5pm, M-F; use ~ 6am - 3:30pm
* Mission - Combined System w/ 2 rstrms & 2 eye wash stns
* On-Site - seperate connection

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carollo engineers

Route

TELEPHONE MEMORANDUM

DATE 7.7.99 TIME 11:30 AM ± PROJECT NO. 4857A.00

FROM Ray Festa TO TAC

OF Morro Bay GC - County TELEPHONE NO. 805-781-1318

SUBJECT Detail on GC setup for irrig

- Ray returned my call. One storage tank on hill is for irrigation use - its 300,000 gal total w/ a working volume of 275,000 gal. Tank was built in 40's when GC was only 9 holes.

- Irrigation is @ night from ~ 8:30pm - 4 AM during peak summer months (Peak is April - Oct).

- Use both tank and well for irrig system. As tank starts to draw down a level switch is triggered which kick on well pumps too. (Example, if tank starts around 8:30 pm, well pumps go on around 10 pm). Both irrigate course at same time. Reuse system could be hooked up to tank and mainline irrigation system.
- Use about 1,000 gpm @ night in summer.

- Cart washing is plumbed seperate to a cart wash pad located at club house. Club attendants wash carts and flow goes to a retention basin which is only percolation - No flow sent to WWTP. Operated this way for 8-10 years!

CAROLLO engineers

Route

TELEPHONE MEMORANDUM

DATE 7.7.99 TIME 11 Am PROJECT NO. 4857A.00

FROM TAC TO Lou

OF M Bay - P&R Dept (field Oper.) TELEPHONE NO. 805.772.6278

SUBJECT Parks Irrig Operation

- Lou said he is usually in field but all parks have meters to calc volume used, time on/off

- Most parks irrigation starts between 11pm - 2am and goes till around 6 Am.

- Starting time is dependent on park (ie: baseball fields, vandalism area) use

- In summer usually only irrigate 5 days/wk (M-F) not weekends due to tourists in park

- Larger sites are irrigated in 2 stages

Average Diurnal Flow for WWTP (Data taken in May 1999)													
Irrigation Time	Weekdays Flows, gpm				Average	Average	Average	Weekends, gpm			Average	Average	Average
	Day 1	Day 2	Day 3	Day 4	Flows	Flows, mgd	Flows, mgh	Day 5	Day 6	Day 7	Flows	Flows,mgh	Flows,mgh
12:00 AM			3.25	3.25	4.25	3.58	1.29	0.0538		5.25	4.00	4.63	1.67	0.069375
1:00 AM			2.75		3.25	3.00	1.08	0.0450		3.50	3.00	3.25	1.17	0.04875
2:00 AM			2.25	2.25	3.00	2.50	0.90	0.0375		3.00		3.00	1.08	0.045
3:00 AM			2.00	2.50	2.00	2.17	0.78	0.0325		2.50		2.50	0.90	0.0375
4:00 AM			2.00	2.50	2.00	2.17	0.78	0.0325		2.25	2.25	2.25	0.81	0.03375
5:00 AM	2.25		2.75	3.00	2.50	2.63	0.95	0.0394		2.00	2.50	2.25	0.81	0.03375
6:00 AM	3.75		4.00	4.00	2.50	3.56	1.28	0.0534	2.25	2.25	2.25	2.25	0.81	0.03375
7:00 AM	5.50		6.00	6.00	3.50	5.25	1.89	0.0788	3.00	2.75	3.75	3.17	1.14	0.0475
8:00 AM	6.75		7.00	6.00	6.00	6.44	2.32	0.0966	4.50	4.00	6.00	4.83	1.74	0.0725
9:00 AM	8.00		7.50	6.75	6.50	7.19	2.59	0.1078	5.75	6.00	7.00	6.25	2.25	0.09375
10:00 AM	7.25			7.00	6.25	6.83	2.46	0.1025	7.25	7.00	6.75	7.00	2.52	0.105
11:00 AM	8.00		6.25	6.50	6.25	6.75	2.43	0.1013	7.75		6.50	7.13	2.57	0.106875
12:00 PM	6.00		5.50	6.25	5.50	5.81	2.09	0.0872	7.75		6.00	6.88	2.48	0.103125
1:00 PM	5.25		5.00	5.25	5.50	5.25	1.89	0.0788	7.00	7.00	5.75	6.58	2.37	0.09875
2:00 PM	5.25		4.50	4.50	4.75	4.75	1.71	0.0713	6.75	6.75	5.50	6.33	2.28	0.095
3:00 PM	5.25		4.25	4.25	5.00	4.69	1.69	0.0703	6.00	6.25	5.50	5.92	2.13	0.08875
4:00 PM	5.25		4.50		4.25	4.67	1.68	0.0700	6.00	5.75	5.00	5.58	2.01	0.08375
5:00 PM	5.50		4.75	4.75	4.75	4.94	1.78	0.0741	5.75	5.50	4.50	5.25	1.89	0.07875
6:00 PM	5.50		5.25	4.75	5.00	5.13	1.85	0.0769	6.00	5.50		5.75	2.07	0.08625
7:00 PM			5.50	4.75	5.00	5.08	1.83	0.0763	5.75	5.75		5.75	2.07	0.08625
8:00 PM	6.00		5.50	5.00		5.50	1.98	0.0825		6.00		6.00	2.16	0.09
9:00 PM	5.75		5.00	5.50		5.42	1.95	0.0813	5.50	6.00		5.75	2.07	0.08625
10:00 PM	5.00		4.75	5.00		4.92	1.77	0.0738	5.50	5.50		5.50	1.98	0.0825
11:00 PM	4.00		3.75	5.00		4.25	1.53	0.0638	5.00	5.00		5.00	1.80	0.075
Daily Ave.	5.57		4.52	4.76	4.39	4.69	1.69		5.74	4.80	4.77	4.95	1.78	

Peak Month, Day and Hour Calculations for the Irrigation and Industrial Demand					
	Peak Month ac-ft/mo.	Max. Day ac-ft/d	Max. Day cfs	Use, hrs.	Hourly Demand, ac-ft/hr
Mbay HS	5.587	0.346	1.046	4	0.0865
Keiser	3.592	0.222	0.673	4	0.0556
Cloisters	13.569	0.840	2.541	4	0.2100
City Park	0.319	0.020	0.060	4	0.0049
Golf Course	43.901	2.718	4.110	8	0.3397
Mbay Elem.	1.596	0.099	0.299	4	0.0247
Mission Linen	1.002	0.062	0.094	8	0.0078
Hansen	0.187	0.012	0.016	9	0.0013
WWTP	0.059	0.004	0.022	2	0.0018
Mbay Bus	0.222	0.014	0.083	2	0.0069
Total, ac-ft	**70.035**	**4.335**			**0.7392**
Total, gal/d	**1086705.9**	**1412717.67**			

Monthly Industrial Demand										
Month	1998	1997	1996	Average Demand	Average Demand, gpd	Peaking Factor	Industrial Demand, AF/mo. Mission Linen	Hansen S&G	WWTP Washdown	Mbay Bus Facilities
Jan	647	480	389	563.50	20072.73	8.52%	0.941	0.175	0.056	0.209
Feb	631	435	532	532.67	18974.40	8.05%	0.890	0.166	0.053	0.197
Mar	530	469	467	488.67	17407.05	7.39%	0.816	0.152	0.048	0.181
Apr	565	529	451	515.00	18345.08	7.79%	0.860	0.160	0.051	0.191
May	529	574	511	538.00	19164.38	8.13%	0.899	0.168	0.053	0.199
Jun	535	538	410	494.33	17608.91	7.47%	0.826	0.154	0.049	0.183
Jul	564	722	513	599.67	21361.04	9.07%	1.002	0.187	0.059	0.222
Aug	662	619	423	568.00	20233.03	8.59%	0.949	0.177	0.056	0.211
Sept	584	729	468	593.67	21147.31	8.98%	0.992	0.185	0.059	0.220
Oct	577	539	556	557.33	19853.06	8.43%	0.931	0.174	0.055	0.207
Nov	621	626	494	580.33	20672.36	8.77%	0.969	0.181	0.057	0.215
Dec	629	661	460	583.33	20779.22	8.82%	0.974	0.182	0.058	0.216
Total				6614.50	235618.57		11.05	2.06	0.65	2.45

	Demand, gpd	Demand, AFY
Mission Linen	14286	11.0482
Hansen S&G	2663	2.0595
WWTP-Washdown	845	0.6535
Mbay Bus Facilities	3171	2.4523

Monthly Irrigation Demand													
Month	1998 (100 cf)	1997 (100 cf)	1996 (100 cf)	Average Demand	Ave. Demand gpd	% of Total Demand	Monthly Irrigation, AF/mo. Morro Bay HS	Keiser Park	The Cloisters Develop.	Mbay Elem School	City Park	Mbay Golf Course	Sum
Jan	18	73	513	45.50	1620.78	0.59%	0.205	0.132	0.499	0.059	0.012	1.614	2.521
Feb	16	46	70	44.00	1567.35	0.57%	0.199	0.128	0.483	0.057	0.011	1.561	2.438
Mar	11	909	73	331.00	11790.72	4.27%	1.495	0.961	3.630	0.427	0.085	11.744	18.342
Apr	9	771	731	503.67	17941.37	6.50%	2.274	1.462	5.523	0.650	0.130	17.870	27.910
May	460	924	1088	824.00	29352.14	10.63%	3.721	2.392	9.036	1.063	0.213	29.236	45.661
Jun	254	979	1217	816.67	29090.91 .	10.54%	3.688	2.371	8.956	1.054	0.211	28.975	45.254
Jul	801	857	972	876.67	31228.20	11.31%	3.959	2.545	9.614	1.131	0.226	31.104	48.579
Aug	1211	1524	977	1237.33	44075.70	15.96%	**5.587**	**3.592**	**13.569**	**1.596**	**0.319**	**43.901**	**68.565**
Sept	1006	1740	747	1164.33	41475.33	15.02%	5.258	3.380	12.769	1.502	0.300	41.311	64.520
Oct	870	1336	1190	1132.00	40323.56	14.60%	5.112	3.286	12.414	1.460	0.292	40.163	62.728
Nov	769	497	799	688.33	24519.48	8.88%	3.108	1.998	7.549	0.888	0.178	24.422	38.143
Dec	187	23	52	87.33	3110.95	1.13%	0.394	0.254	0.958	0.113	0.023	3.099	4.839
Total	5612	9679	8429	646	276096.49								
				Average	23008.04								

** assumed 21 days of irrigation.

Brief Description	Size (ac.)	Irrigation Used ac-ft annually
Morro Bay HS/Bus Facility	14	35.0
Keiser Park	9	22.5
The Cloisters development	34	85.0
Morro Bay Elementary	4	10.0
City Park	0.8	2.0
Morro Bay Golf Course	110	275.0

Calculations of the monthly totals for Phase 1 and Phase 2

Phase I Total

	Morro Bay HS	Keiser Park	The Cloisters Develop.	Irrigation Sum,ac-ft/mo.	Sum, mgd	Hansen S&G	WWTP Washdown	Mbay Bus Facilities	Industrial Sum, ac-ft/mo.	Sum, mgd	Overall Sum mgd
Jan	0.2055	0.1321	0.4990	0.8365	0.0130	0.1754	0.0557	0.2089	0.4400	0.0068	0.0198
Feb	0.1987	0.1277	0.4825	0.8089	0.0126	0.1658	0.0526	0.1975	0.4160	0.0065	0.0190
Mar	1.4947	0.9609	3.6299	6.0855	0.0944	0.1521	0.0483	0.1812	0.3816	0.0059	0.1003
Apr	2.2744	1.4621	5.5235	9.2600	0.1437	0.1603	0.0509	0.1909	0.4022	0.0062	0.1499
May	3.7209	2.3920	9.0364	15.1493	0.2351	0.1675	0.0532	0.1995	0.4201	0.0065	0.2416
Jun	3.6878	2.3707	8.9560	15.0145	0.2330	0.1539	0.0488	0.1833	0.3860	0.0060	0.2390
Jul	3.9587	2.5449	9.6140	16.1176	0.2501	0.1867	0.0592	0.2223	0.4683	0.0073	0.2574
Aug	5.5874	3.5919	13.5693	22.7485	0.3530	0.1769	0.0561	0.2106	0.4436	0.0069	0.3599
Sept	5.2577	3.3800	12.7687	21.4064	0.3322	0.1848	0.0587	0.2201	0.4636	0.0072	0.3393
Oct	5.1117	3.2861	12.4141	20.8120	0.3229	0.1735	0.0551	0.2066	0.4352	0.0068	0.3297
Nov	3.1083	1.9982	7.5487	12.6551	0.1964	0.1807	0.0573	0.2152	0.4532	0.0070	0.2034
Dec	0.3944	0.2535	0.9577	1.6056	0.0249	0.1816	0.0576	0.2163	0.4555	0.0071	0.0320

Phase II Total

	Mbay Elem School	City Park	Mbay Golf Course	Irrigation Sum,ac-ft/mo.	Sum, mgd	Phase I Sum, mgd	Phase II Sum, mgd	Mission Linen	Industrial Sum,ac-ft/mo.	Phase I Sum, mgd	Phase II Sum, mgd	Overall Sum, mgd
Jan	0.0587	0.0117	1.6143	1.6848	0.0261	0.0130	0.0391	0.9412	0.0146	0.0068	0.0214	0.0606
Feb	0.0568	0.0114	1.5611	1.6292	0.0253	0.0126	0.0378	0.8897	0.0138	0.0065	0.0203	0.0581
Mar	0.4271	0.0854	11.7439	12.2564	0.1902	0.0944	0.2846	0.8162	0.0127	0.0059	0.0186	0.3032
Apr	0.6498	0.1300	17.8701	18.6499	0.2894	0.1437	0.4331	0.8602	0.0133	0.0062	0.0196	0.4527
May	1.0631	0.2126	29.2356	30.5113	0.4734	0.2351	0.7085	0.8986	0.0139	0.0065	0.0205	0.7290
Jun	1.0537	0.2107	28.9754	30.2398	0.4692	0.2330	0.7022	0.8257	0.0128	0.0060	0.0188	0.7210
Jul	1.1311	0.2262	31.1042	32.4615	0.5037	0.2501	0.7538	1.0016	0.0155	0.0073	0.0228	0.7766
Aug	1.5964	0.3193	43.9007	45.8163	0.7109	0.3530	1.0639	0.9487	0.0147	0.0069	0.0216	1.0855
Sept	1.5022	0.3004	41.3106	43.1133	0.6690	0.3322	1.0011	0.9916	0.0154	0.0072	0.0226	1.0237
Oct	1.4605	0.2921	40.1634	41.9160	0.6504	0.3229	0.9733	0.9309	0.0144	0.0068	0.0212	0.9945
Nov	0.8881	0.1776	24.4221	25.4878	0.3955	0.1964	0.5919	0.9693	0.0150	0.0070	0.0221	0.6139
Dec	0.1127	0.0225	3.0986	3.2338	0.0502	0.0249	0.0751	0.9743	0.0151	0.0071	0.0222	0.0973

Diurnal Demands from the Irrigation and Industrial Sources using Max Day Average Hourly Flow Rates

Time	Mbay HS	Kelser	Cloisters	City Park	Golf Course	Mbay Elem.	Irrigation Total, ac-ft	Irrigation Total, mgh	Hansen	Mission Linen	WWTP	Mbay Bus	Industrial Total, ac-ft	Industrial Total, mgh	Overall Total ac-ft	Overall Total gpm	Overall Total cfs	Overall Total mgh
12:00 AM					0.34		0.3397	0.1107					0.00000	0.00000	0.340	1844.89	4.1105	0.11069
1:00 AM	0.08647				0.34		0.4262	0.1389					0.00000	0.00000	0.426	2314.50	5.1568	0.13887
2:00 AM	0.08647	0.0556	0.2100	0.0049	0.34	0.024705997	0.7214	0.2351			0.001833777	0.006881546	0.00872	0.00284	0.730	3965.22	8.8346	0.23791
3:00 AM	0.08647	0.0556	0.2100	0.0049	0.34	0.024705997	0.7214	0.2351			0.001833777	0.006881546	0.00872	0.00284	0.730	3965.22	8.8346	0.23791
4:00 AM	0.08647	0.0556	0.2100	0.0049		0.024705997	0.3817	0.1244					0.00000	0.00000	0.382	2072.99	4.6187	0.12438
5:00 AM		0.0556	0.2100	0.0049			0.2705	0.0882		0.007750691			0.00775	0.00253	0.278	1511.30	3.3672	0.09068
6:00 AM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
7:00 AM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
8:00 AM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
9:00 AM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
10:00 AM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
11:00 AM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
12:00 PM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
1:00 PM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
2:00 PM							0.0000	0.0000	0.00128	0.007750691			0.00903	0.00294	0.009	49.07	0.1093	0.00294
3:00 PM							0.0000	0.0000	0.00128				0.00128	0.00042	0.001	6.97	0.0155	0.00042
4:00 PM							0.0000	0.0000	0.00128				0.00128	0.00042	0.001	6.97	0.0155	0.00042
5:00 PM							0.0000	0.0000					0.00000	0.00000	0.000	0.00	0.0000	0.00000
6:00 PM							0.0000	0.0000					0.00000	0.00000	0.000	0.00	0.0000	0.00000
7:00 PM							0.0000	0.0000					0.00000	0.00000	0.000	0.00	0.0000	0.00000
8:00 PM					0.34		0.3397	0.1107					0.00000	0.00000	0.340	1844.89	4.1105	0.11069
9:00 PM					0.34		0.3397	0.1107					0.00000	0.00000	0.340	1844.89	4.1105	0.11069
10:00 PM					0.34		0.3397	0.1107					0.00000	0.00000	0.340	1844.89	4.1105	0.11069
11:00 PM					0.34		0.3397	0.1107					0.00000	0.00000	0.340	1844.89	4.1105	0.11069

Hour of Day	Phase I Total mgh	Phase II Total mgh	Phase 1 Filter 0.0195 mgh Max day	Phase 2 Filter 0.0585 mgh Max Day	WWTP Average mgd	Phase I Differences	Phase II Differences
12:00 AM	0	0.1106937	0.0195	0.0585	0.0369936		0.05219367
1:00 AM	0.0281766	0.1388702	0.0195	0.0585	0.0272681	0.00867657	0.08037025
2:00 AM	0.1175588	0.237913	0.0195	0.0585	0.0274565	0.09805879	0.179413
3:00 AM	0.1175588	0.237913	0.0195	0.0585	0.0237065	0.09805879	0.179413
4:00 AM	0.1147189	0.1243794	0.0195	0.0585	0.0194662	0.0952189	0.06587944
5:00 AM	0.0890679	0.090678	0.0195	0.0585	0.0187641	0.06956789	0.03217798
6:00 AM	0.002944	0.002944	0.0195	0.0585	0.0169363		
7:00 AM	0.002944	0.002944	0.0195	0.0585	0.0238113		
8:00 AM	0.002944	0.002944	0.0195	0.0585	0.0363113		
9:00 AM	0.002944	0.002944	0.0195	0.0585	0.0469363		
10:00 AM	0.002944	0.002944	0.0195	0.0585	0.0525613		
11:00 AM	0.002944	0.002944	0.0195	0.0585	0.0534988		
12:00 PM	0.002944	0.002944	0.0195	0.0585	0.0516238		
1:00 PM	0.002944	0.002944	0.0195	0.0585	0.0494363		
2:00 PM	0.002944	0.002944	0.0195	0.0585	0.0475613		
3:00 PM	0.0004185	0.0004185	0.0195	0.0585	0.0443837		
4:00 PM	0.0004185	0.0004185	0.0195	0.0585	0.0418837		
5:00 PM	0	0	0.0195	0.0585	0.039375		
6:00 PM	0	0	0.0195	0.0585	0.043125		
7:00 PM	0	0	0.0195	0.0585	0.043125		
8:00 PM	0	0.1106937	0.0195	0.0585	0.0473061		0.05219367
9:00 PM	0	0.1106937	0.0195	0.0585	0.0454311		0.05219367
10:00 PM	0	0.1106937	0.0195	0.0585	0.0435561		0.05219367
11:00 PM	0	0.1106937	0.0195	0.0585	0.0398061		0.05219367
					Total	0.36958093	0.79822204

Volume of Storage Basin					
	Deficiency	Ave.	Max	Ave. Vol.	Max. Vol.
	Time, hours	Difference	Difference	Needed, mg	Needed, mg
Phase 1					
	5	0.074	0.098	0.370	0.490
Phase 2					
	10	0.080	0.179	0.798	1.794
	Storage	Volume			
	Time, days	Needed, mg			
Phase 1					
	2	0.936			
Phase 2					
	2	2.808			
Phase 1: Can serve peak hour demand for up to:				9.545	hours
Phase 2: Can serve peak hour demand for up to:				15.651	hours

Morro Bay - Cayucos Pipeline Costs												
Project Description		Seg-ment	User Description	Max Day Flow cfs	Flow in Seg., cfs	Vel. fps	Calculated Pipe Dia. inches	Dia.Used inches	Length of Seg., ft		Pipe cost $/DIF	Costs
Phase 1	Common	AB	WWTP - washdown	0.022	0.022	5	0.90	2	200	assumed	$6	$2,400
	Common	BC			8.922	5	18.09	20	528		$5	$52,800
	Common	CD	Hanson Sand & Gravel	0.016	0.016	5	0.75	2	200	assumed	$6	$2,400
	Common	CE			8.906	5	18.07	20	660		$5	$66,000
	Common	EF			3.671	5	11.60	12	660		$5	$39,600
	Common	FQ			3.587	5	11.47	12	660		$5	$39,600
	Common	QG	Morro Bay High School	1.046	1.046	5	6.19	8	500		$6	$24,000
	Common	FH	MB High School - bus	0.083	0.083	5	1.75	2	660		$6	$7,920
	Common	EI	Keiser Park	0.673	0.673	5	4.97	6	660		$6	$23,760
	Common	QR	The Cloisters development	2.541	2.541	5	9.65	10	2640		$6	$158,400
											Subtotal	**$416,880**
Phase 2	MB South	EJ			4.563	5	12.94	12	660		$5	$39,600
Additions	MB South	JK	Mission Linen	0.094	0.094	5	1.85	2	500		$6	$6,000
	MB South	JH'			4.469	5	12.80	12	5280		$5	$316,800
	MB South	H'I'	Morro Bay Elementary Sch	0.299	0.299	5	3.31	4	150		$6	$3,600
	MB South	H'J'			4.170	5	12.37	12	990		$5	$59,400
	MB South	J'K'			4.170	5	12.37	12	660		$5	$39,600
	MB South	K'L'	City Park	0.060	0.060	5	1.48	2	150		$6	$1,800
	MB South	K'M'			4.110	5	12.28	12	1320		$5	$79,200
	MB South	M'X'			4.110	5	12.28	12	1320		$5	$79,200
	MB South	X'Y'	Morro Bay Golf Course	4.110	4.110	5	12.28	12	3960		$5	$237,600
											Subtotal	**$862,800**
											Total	**$1,279,680**

** Pipeline costs were based on the following:
$5/DIF - greater than 10" pipe
$6/DIF - less than 10" pipe

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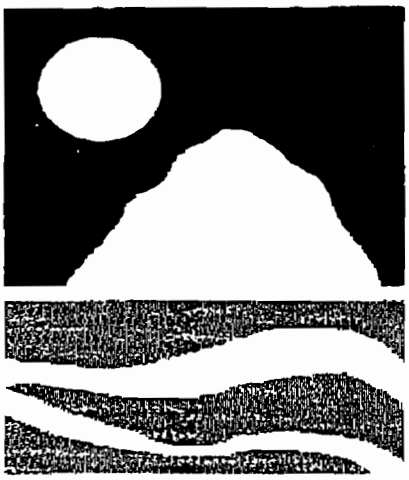

City of Morro Bay

Water Management Plan

Prepared by

Boyle Engineering Corporation

FINAL DRAFT

VT-M12-150-01

October 1993

TABLE 15-3

Estimated Fixed and Unit Costs of State Water to Morro Bay

Cost Component	Nominal Unit Cost ($/AF)	Fixed Annual Cost ($)	Unit Cost for Water Received ($/AF)
Existing SWP facilities	66	86658	
Coastal Branch aqueduct	292	383396	
Increase factor-fewer agencies	75	98475	
Local water treatment			
Capital costs	80	105040	
Operating costs	50		50
SUBTOTAL	130		
Pumping from the Delta	122		122
Total State Water Costs	685	673569	172

Notes
1) Based on entitlement of 1313 AF/Yr

2) Local State Water Facilities

The annual and unit costs in **Table 15-3** do not include the costs of the Chorro Valley Pipeline, and related local facilities to convey water from the Coastal Branch Aqueduct to the City of Morro Bay. The Chorro Valley Pipeline was originally sized by the County of San Luis Obispo to be a 10-inch pipeline. Based on a review of the hydraulic requirements, a 10-inch pipeline from the aqueduct appears to be adequate to supply all State Water participants along the Chorro Valley, including the City.

Recommendations were made by City staff to oversize the Chorro Valley Pipeline from 10 to 16 inches. In principle, such an oversizing could be beneficial for a variety of reasons, including participation in Nacimiento and wheeling/exchanges of water. The design life of the pipeline may exceed 75 years, well beyond present planning horizons. When a major new transmission line is constructed, it should be sized for reasonable contingencies so that a second pipeline will not be needed in 20-30 years.

However, the alternatives evaluated in this water management plan have been defined to meet projected demands in 2010. The State Water alternative, 2B, is capable of meeting demands in 2010 if received through a 10-inch Chorro Valley Pipeline. In order to provide an equitable comparison with the other alternatives, project costs for Alternative 2B are calculated on the basis of a 10-inch pipeline for the Chorro Valley Pipeline. To provide a comparison of the cost of oversizing the pipeline to 16 inches, Alternative 2C has been defined to be the same as Alternative 2B but with a 16-inch pipeline.

The Chorro Valley Pipeline will be constructed in two phases. The first phase will be from the Coastal Aqueduct to the California Men's Colony. The second phase will be to extend the line from CMC to Morro Bay. Based on cost information provided by the County of San Luis Obispo, Morro Bay's share of the costs of the Chorro Valley Pipeline would be approximately as summarized in **Table 15-4**. The Chorro Valley Pipeline costs include construction, engineering, administration, right-of-way, and legal costs, as well as a 30 percent contingency. The large contingency is probably necessary due to the extensive environmental mitigations that may be required.

3) Well Facilities

All of the screened alternatives include continued use of groundwater. Capital improvements to the City's well system would therefore be similar for each alternative, and are not included in the cost evaluation. All of the alternatives require a replacement for Well No. 8, and that cost is therefore not included in the comparison. Only costs directly associated with pumping and operation of the wells can differentiate between the alternatives. The cost of pumping from the wells into the City's distribution system is estimated to average about $45/AF for water actually pumped.

4) Nacimiento Water Supply Project

Preliminary information from the County's ongoing Nacimiento studies indicate that the costs associated with Morro Bay's share of the Nacimiento Water Supply Project would be as summarized in Table 15-

The costs have been adjusted to reflect an entitlement of 1200 AF/Yr and a peaking factor of 1.1. The [illegible] of the Nacimiento project depend on which other agencies participate in the project. Several alternative

29-Sep-99

CAROLLO ENGINEERS
Preliminary Cost Estimate

Project: Morro Bay/Cayucos Reuse - Phase 1

ENR AT ESTIMATE for Jan 2000 6615

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
	Customer Connections				
1	Service Connections	5	EA	$1,600	$8,000
2	Backflow Preventors	5	EA	$2,000	$10,000
	Customer Retrofits				
3	Keiser Park	1	EA	$5,000	$5,000
4	Cloisters	1	EA	$5,000	$5,000
5	**Upgrade Plant to Full Secondary Facilities**			Subtotal	$2,750,000
	Biotower Pump Station				$500,000
	Biotower				$800,000
	Solids Contact & Solids Pumping				$400,000
	Secondary Sedimentation Basin				$600,000
	Sludge Drying Beds				$450,000
6	**Title 22 Treatment Facility (0.36 mgd max month)**			Subtotal	$1,190,000
	Filter Pump Station				$200,000
	Filters				$310,000
	Chlorine Contact Basins				$300,000
	Storage Tanks				$380,000
7	**Effluent Pump Station**				$450,000
	Distribution System				
	Pipe Diameter (in)				
8	2 (urban)	1,060	LF	$30	$31,800
9	6 (urban)	660	LF	$36	$23,760
10	8 (urban)	500	LF	$48	$24,000
11	10 (urban)	2,640	LF	$50	$132,000
12	12 (urban)	1,320	LF	$60	$79,200
13	20 (urban)	1,188	LF	$100	$118,800
	Subtotal	7,368			
	Subtotal				$4,827,560
	Estimating Contingency			20%	$965,512
	Construction Contingency			15%	$868,961
	Total Construction Cost at Basis of Study				$6,662,033
	Administration, Legal, Planning, Design, and Construction Management			30%	$1,998,610
	Total Project Cost				**$8,660,000**

Morro Bay/Cayucos Reuse - Phase 1

30-Sep-99

Item No.	Description	1st Full Year QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Additional Chlorine Requirement				$5,978
2	Purchased Power (Pumping Costs)	875,291	KWH	$0.08	$70,023
3	Maintenance of Distribution System	1.4	MILE	$2,800	$3,920
4	General Administration	1.4	MILE	$1,500	$2,100
5	Labor (1 new operator)	1	EA	$65,000	$65,000
6	Additional Biosolids Disposal for Full Secondary Treatment	470	TON	$24	$11,139
7	Additional Biosolids Disposal for Tertiary Treatment	6	TON	$24	$142
	Subtotal				$158,303
	Estimating Contingency			20%	$31,661
	Total				**$189,963**

Notes:
1) No charges for the water source (RWCF) are anticipated. Charges are for additional Chlorination.
2) All power costs estimated to be purchased at $0.06 per kilowatt hour.
3a) Distribution system maintenance costs based on 29 miles at $1,500 per mile.
3b) Scalping plant maintenance costs based on $250 / MGD.
3c) Recharge facility maintenance costs based on $100 per acre.
4) Administration costs based on simiar costs as maintenance.

Dollars per Acre Foot

Project Costs (Present Worth)	$8,660,000
Convert to Annual Basis (6% at 40 years)	0.06646
Project Costs Annual Basis	$575,544
O&M Costs	$189,963
Total Annual Costs	$765,507
Acre Feet per year	148
Dollars per Acre Foot - Annual Basis	**$5,180**

Power Costs

	Effluent PS	Filter PS	Biotower PS	RAS/WAS PS
Flow (MGD)	0.19	0.19	3.00	0.10
Flow (GPM)		132	2,083	69
TDH (Feet)		20	40	20
Pump Efficiency		0.65	0.65	0.65
HorsePower	100	1	32	0.5
Kilowatts	75	1	24	0.4
Kilowatt hours	653,496	6,700	211,570	3,526

Sodium Hypochlorite Costs

Rate (ppm)	10
Pounds per Million Gallon	83.5
Annual Ave Flow (MGD)	0.19
Pounds of Hypochlorite per day	16
Hypochlorite Rate ($/ton)	$1,060
Annual Hypochlorite Costs	$3,067

Lime Costs

Rate (ppm)	35
Pounds per Million Gallon	292.1
Flow (MGD)	0.19
Pounds of Lime per day	55
Lime Rate ($/ton)	$116
Annual Chlorine Costs	$1,175

Polymer Costs

Rate (ppm)	2
Pounds per Million Gallon	16.7
Flow (MGD)	0.19
Pounds of Polymer per day	3
Polymer Rate ($/ton)	$3,000
Annual Polymer Costs	$1,736

29-Sep-99

CAROLLO ENGINEERS
Preliminary Cost Estimate

Project: Morro Bay/Cayucos Reuse - Phase 2 - Incremental Costs

ENR AT ESTIMATE for Jan 2000 6615

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
	Customer Connections				
1	Service Connections	4	EA	$1,600	$6,400
2	Backflow Preventors	4	EA	$2,000	$8,000
	Customer Retrofits				
3	Mission Linen	2	EA	$10,000	$20,000
4	City Park	1	EA	$5,000	$5,000
5	Golf Course	1	EA	$5,000	$5,000
6	**Title 22 Treatment Facility (1.09 - 0.36 mgd max month)**			Subtotal	$2,330,000
	Filter Pump Station				$50,000
	Filters				$310,000
	Chlorine Contact Basins				$450,000
	Storage Tanks				$1,520,000
7	**Effluent Pump Station**				$150,000
8	**Booster Pump Station**				$400,000
	Distribution System				
	Pipe Diameter (in) and location				
9	2 (urban)	650	LF	$30	$19,500
10	4 (urban)	150	LF	$32	$4,800
11	12 (urban)	14,190	LF	$60	$851,400
	Subtotal	14,990			
	Subtotal				$3,800,100
	Estimating Contingency			20%	$760,020
	Construction Contingency			15%	$684,018
	Total Construction Cost at Basis of Study				$5,244,138
	Administration, Legal, Planning, Design, and Construction Management			30%	$1,573,241
	Total Project Cost				**$6,820,000**

Morro Bay/Cayucos Reuse - Phase 2 - Incremental Costs

30-Sep-99

Item No.	Description	1st Full Year QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Additional Chlorine Requirement	6	TON	$1,060	$12,271
2	Purchased Power (Pumping Costs)	1,320,744	KWH	$0.08	$105,660
3	Maintenance of Distribution System	2.8	MILE	$2,800	$7,840
4	General Administration	2.8	MILE	$1,500	$4,200
5	Labor (1 new operator)	1	EA	$65,000	$65,000
7	Additional Biosolids Disposal for Tertiary Treatment	14	TON	$24	$332
	Subtotal				$195,302
	Estimating Contingency			20%	$39,060
	Total				**$234,363**

Notes:
1) No charges for the water source (RWCF) are anticipated. Charges are for additional Chlorination.
2) All power costs estimated to be purchased at $0.06 per kilowatt hour.
3a) Distribution system maintenance costs based on 29 miles at $1,500 per mile.
3b) Scalping plant maintenance costs based on $250 / MGD.
3c) Recharge facility maintenance costs based on $100 per acre.
4) Administration costs based on simiar costs as maintenance.

Dollars per Acre Foot

Project Costs (Present Worth)	$6,820,000
Convert to Annual Basis (6% at 40 years)	0.06646
Project Costs Annual Basis	$453,257
O&M Costs	$234,363
Total Annual Costs	$687,620
Acre Feet per year	287
Dollars per Acre Foot - Annual Basis	**$2,390**

Power Costs

	Effluent PS	Filter PS	Booster PS
Flow (MGD)	0.39	0.39	
Flow (GPM)		271	
TDH (Feet)		20	
Pump Efficiency		0.65	
HorsePower	200	2	100.0
Kilowatts	149	2	74.6
Kilowatt hours	1,306,992	13,752	653,496

Sodium Hypochlorite Costs

Rate (ppm)	10
Pounds per Million Gallon	83.5
Annual Ave Flow (MGD)	0.39
Pounds of Hypochlorite per day	33
Hypochlorite Rate ($/ton)	$1,060
Annual Hypochlorite Costs	$6,296

Lime Costs

Rate (ppm)	35
Pounds per Million Gallon	292.1
Flow (MGD)	0.39
Pounds of Lime per day	114
Lime Rate ($/ton)	$116
Annual Chlorine Costs	$2,411

Polymer Costs

Rate (ppm)	2
Pounds per Million Gallon	16.7
Flow (MGD)	0.39
Pounds of Polymer per day	7
Polymer Rate ($/ton)	$3,000
Annual Polymer Costs	$3,564