SOUTHERN MARIN SEWER AGENCIES
SERVICE REVIEW AND
SPHERE OF INFLUENCE UPDATE

Appendices to Correspondence from Bonner Beuhler, Almonte Sanitary District

October 2011

Appendix A

RICHARDSON BAY SANITARY DISTRICT

MARIN COUNTY, CALIFORNIA

REPORT ON

INTERIM IMPROVEMENTS

JUNE, 1971

J. WARREN NUTE, INC.
CIVIL AND SANITARY ENGINEERS

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June 18, 1971

To the Honorable Board of Directors
RICHARDSON BAY SANITARY DISTRICT
618 Town & Country Village
Mill Valley, CA 94941

Letter of Transmittal

Gentlemen and Madam:

In accordance with your request, we have analyzed the requirements of the Regional Water Quality Control Board Order No. 71-14 and have investigated possible interim improvements to allow growth of the District over the next few years while still holding waste loadings to the bay within present levels.

As summarized herein, the interim improvements at the Trestle Glen Plant consist of (1) a chlorine contact chamber already under contract for construction and (2) land disposal of a portion of the effluent at the plant site. Within the Salt Works and Ricardo Road Watersheds, the interim improvements consist of corrections and repairs to the sewer system as a means of preventing significant amounts of storm water from entering the sewer system and thereby reducing the level of bypassing.

It is hoped that this report will provide a basis on which the District can meet the interim improvements required by the Regional Water Quality Control Board until such time as the studies being conducted by Improvement District A are completed.

Very truly yours,

J. WARREN NUTE, INC.

By J. Warren Nute
J. Warren Nute

By Warren E. Nute
Warren E. Nute

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CHAPTER 1

INTRODUCTION

General

The Richardson Bay Sanitary District has a commendable history of productive effort toward providing efficient and effective water pollution control and water quality enhancement, with the added objective of a minimum financial burden upon the citizens served by the District.

Consistent with the District's past history of meeting its obligations, the present interim efforts described herein have been undertaken for the purposes of allowing growth of the District to continue while still holding waste loadings to the bay within present levels. These interim efforts must continue until such time as a permanent sewage disposal solution can be implemented to serve the District as well as other communities in the Richardson Bay area.

Accordingly, the purpose of this report is to review the District's past efforts of pollution control, project needs for the immediate future, describe the interim improvements which have already been undertaken and present a program of continuing improvements to the system so that the District can continue to accommodate the expected growth over the next few years until a permanent sewage disposal solution is implemented.

Water Quality Control Board Orders

On April 22, 1971, the Regional Water Quality Control Board, San Francisco Bay Region, adopted Order No. 71-14 which set new waste discharge requirements for the Richardson Bay Sanitary District. Order No. 71-14 rescinded Resolution No. 228 which previously regulated waste discharge from the Richardson Bay Sanitary District and is reproduced in Appendix A.

In essence, to comply with Order No. 71-14, the District must install an extreme level of tertiary treatment at its Trestle Glen Treatment Plant (waste "A") and eliminate all wet weather bypassing throughout its system (waste "B"). Inasmuch as the District cannot immediately comply with either of the new discharge requirements, a cease and desist hearing has been set by the Regional Water Quality Control Board to consider issuance of such an order and also to consider restricting additional connections to the District system.

INTRODUCTION

To avoid a restriction on additional connections, the District must demonstrate that interim improvements which have been instituted will hold waste loadings to the bay within present levels when additional connections are made. Such interim improvements will be necessary until a permanent solution is implemented which will comply with all present and future waste discharge orders.

Scope of Report on Interim Improvements

In compliance with Water Quality Control Board Policy, this report provides background information about the District and describes the interim improvements which have been instituted by the District. Further, this report demonstrates that the interim improvements already accomplished, along with a continuing program of such improvements, will serve to enhance water quality of the bay and thereby make the issuance of a restriction of future connections to the District system unnecessary.

Specifically, this report covers the following basic subject areas:

(a) DISTRICT BACKGROUND -- Review of the history of the District and review of efforts now being made by the District itself and on a regional basis in cooperation with other agencies around Richardson Bay to enhance water quality of the bay by providing adequate sewage collection and disposal.

(b) FUTURE NEEDS -- A description of the District service areas, development of present and anticipated future growth of the District and projection of service needs for the immediate future.

(c) INTERIM IMPROVEMENTS -- Description of interim improvements already instituted and development of a program of interim improvements which will allow additional connections to the system while still enhancing water quality by holding waste loadings to the bay within present levels.

(d) CONCLUSIONS AND RECOMMENDATIONS -- Presentation of conclusions and recommendations as to a program of interim improvements.

CHAPTER 2

DISTRICT BACKGROUND

General

To establish a general understanding of past District activities, this chapter presents a brief historical description of the District's past activities. Further, in recognition of the necessity to plan future sewage disposal improvements, a review of the present District activities toward achieving permanent solutions for enhancement of water quality in the bay is presented.

Historical Background

Since its formation in 1949, the Richardson Bay Sanitary District has a commendable history in meeting its obligations of providing sewerage service and meeting the demands of continued growth within the District. The first sewer system in the Strawberry area was installed about 1945 to serve the Bayview Terrace subdivision after septic tanks throughout the tract had failed. A collecting system was constructed in the rear of the houses to intercept septic tank effluent and an outfall line was run to the Salt Works Canal which discharged without further treatment into the bay. In 1947 sewers from Bayview Heights were connected to this outfall line.

In 1946 development of the Strawberry Point properties was started with the construction of homes along Belvedere Drive. Two community septic tanks were installed by the developer to serve this tract with approval of the County Health Department. One septic tank and leaching field was installed on the west side between Reed Boulevard and the State Highway and the second on the east slope between Ricardo Road and Strawberry Drive.

Subsequently, in 1948, a third community septic tank was installed on the west slope to serve the Strawberry Manor tract. This tank was located south of Ricardo Road with an outfall to the bay on the east side of DeSilva Island. Approval of these facilities by the County Health authorities was with the understanding that they were temporary in nature and that they would have to be replaced with better treatment and disposal facilities in the near future. It became evident to the new residents of these tracts that the facilities provided by the developer would soon become entirely inadequate and, since the proposed Southern Marin Sanitation District had

been rejected by the voters, the residents of the Strawberry area formed the Richardson Bay Sanitary District in February, 1949. Upon its formation, the District became the owner of the three community sewage disposal systems.

To solve the problem of the east side of Strawberry, a Biofilter, Jr. package-type sewage treatment plant was constructed in 1950 on the Tiburon Highway adjacent to Salt Works Canal. At the same time, the Belveron Gardens area was under development and was subsequently annexed to the District. A second Biofilter, Jr. treatment plant was constructed by the developer of Belveron Gardens at the location of the present Trestle Glen plant. Each plant was designed to provide complete treatment for a population of 800.

Rapid growth of the Strawberry Point area had, by 1953, made the Salt Works Canal plant and the two community septic tanks on the west side entirely inadequate. After studies to seek the most economical solution, the District contracted with the Sausalito-Marin City Sanitary District for treatment of sewage at their new plant near Fort Baker rather than attempt to enlarge the Salt Works Canal plant or to construct another package-type plant to serve the west side of Strawberry Point.

To connect the system to the Sausalito-Marin City Sanitary District plant, a new force main and trunk sewer was laid from the Salt Works Canal plant along Belvedere Drive and Highway 101 to the west end of Ricardo Road together with a force main across the Richardson Bay bridge and connecting with the Sausalito system at Manzanita. The treatment plant at Salt Works Canal was converted to a pumping station and a new pumping plant was built at the western end of Ricardo Road. As part of the widening project for the Tiburon Highway, a new pumping station was constructed for the District in 1962 by the State Highway Department on the north side of the highway and the old Salt Works plant was dismantled.

The original force main across Richardson Bay Bridge was installed on the old redwood highway bridge which had a lift span. Every time the span was raised, it was necessary to disconnect the pipe. When the present high level concrete bridge was built in 1956, a new force main was installed as part of the construction.

Connection to the Sausalito system was made into an 8-inch force main with limited capacity which connected with a larger

main at Marin City. This line was replaced by the Sausalito-Marin City District in 1959 with a 16-inch pipe line to serve both the Richardson Bay and Tamalpais Valley systems.

It had been expected that the connection to the Sausalito system would provide adequate service for the future needs of the areas served by the Ricardo Road and Salt Works pumping stations. However, the Sausalito system is of limited capacity to handle peak flows, and operating experience has indicated that the present system will be inadequate to serve the ultimate needs of the District.

That portion of the District served by the original Biofilter, Jr. plant at Trestle Glen was growing rapidly, and by 1956 it became evident that the plant should be enlarged. About 1,200 persons were being served by the plant which amounted to about 50 per cent overload, and the degree of treatment was rapidly deteriorating.

In view of the high degree of treatment necessary at the Trestle Glen location, the design for the enlarged plant incorporated a modified activated sludge process known as Spiro-Vortex system. The plant was designed to serve a population of 4,000 to be constructed in two stages. The first stage was constructed in 1958. By making use of the existing settling tanks of the Biofilter, Jr. plant, the construction of the secondary clarifier was delayed until 1963.

Over the years, the Richardson Bay Sanitary District has brought about the consolidation of a number of separate and community disposal systems and the elimination of several sewage discharges to the bay as itemized in Table 2-1. The consolidation of facilities represents the results of considerable planning and progress on the part of the District toward enhancing water quality in the bay and providing for protection of the health of the community through adequate sewage collection and treatment.

At the present time, the District operates the Trestle Glen Sewage Treatment facility which discharges disinfected secondary effluent to Richardson Bay. Sewage from the Salt Works and Ricardo Road Watersheds is pumped to the Sausalito-Marin City Sanitary District for treatment and disposal.

TABLE 2-1

CONSOLIDATION OF SEPARATE AND COMMUNITY SEWAGE DISPOSAL SYSTEMS BY THE RICHARDSON BAY SANITARY DISTRICT

Community System	Watershed	Type of Treatment	Effluent Disposal	Connected to Dist. System
East Strawberry	Salt Works	Community Septic Tank	Leaching Field	1950
West Strawberry	Ricardo Rd.	Community Septic Tank	Leaching Field	1954
Strawberry Manor	Ricardo Rd.	Community Septic Tank	Outfall to bay	1958
Bayview Terrace Sewer Maint. District	Salt Works	Indiv. Septic Tanks	Outfall to bay	1955
West of Highway	Ricardo Rd.	Indiv. Septic Tanks	Leaching Field	1957
South Knoll Road	Ricardo Rd.	Indiv. Septic Tanks	Leaching Field	1957
Richardson Bay Sanitary Dist.	Salt Works	Biofilter Jr. Sec. Treat.	Outfall to bay	1962
Del Mar	Trestle Gl.	Community Septic Tank	Leaching Field	1961
Hawthorne Terrace Sewer Maint. District	Trestle Gl.	Community Septic Tank	Outfall to bay	1963
Bay Vista Dr. - Sky Rd.	Salt Works	Indiv. Septic Tanks	Leaching Field	1967

Present District Activities

In a 1963 report to the District, it was recommended that the sewage originating in the Salt Works Watershed which is pumped to Sausalito be diverted to the Trestle Glen plant for treatment and thus relieve the load on the Sausalito-Marin City system. This plan was never implemented, basically because the growth of the District slowed down and there was a renewed interest in finding a regional solution to the sewage disposal problems of the Richardson Bay area.

Recognizing the need to further enhance water quality on a regional basis, the Richardson Bay Sanitary District is co-operating with the other sewerage agencies in the Southern Marin area and participating in a subregional study to develop a wastewater management program.

The subregional study is now being conducted by the Marin Municipal Water District under Improvement District A, and the results of the study should be known by mid-1972.

Since the feasibility of a regional sewerage plan depends on reduction of peak flows in so far as possible, the District, on an individual basis, has undertaken an intensive program of infiltration detection and leak correction. This program is intended both as a permanent solution toward reduction of wet weather flows and as an interim solution toward enhancing water quality by holding waste loadings to the bay within present levels until a permanent sewerage plan can be implemented.

Summary

The Richardson Bay Sanitary District has a commendable history of providing adequate sewage disposal as well as meeting the demands of growth. Since its foundation in 1949, the District eliminated four separate outfalls to the bay and various individual and community septic tank systems.

Recognizing the need to further enhance water quality, the District is now participating in a subregional wastewater management study for Southern Marin now being conducted by the Marin Municipal Water District. Further, in anticipation of the need to reduce peak flows, the District itself has undertaken a program of infiltration detection and leak correction in its sewer system.

CHAPTER 3

INTERIM NEEDS

General

In development of the interim needs of the District, it is necessary to have a general understanding of the physical area served by the District and the existing service characteristics as determined by the measured flows and population estimates.

Estimates of growth rates are then determined on the basis of past service and growth characteristics. Once estimates of the interim needs are made, the nature and magnitude of interim improvements can be determined so that the waste loading to the bay can be held within present levels while still allowing for growth over the next few years.

Area Served by the District

The Richardson Bay Sanitary District generally serves the southwest slope of the Tiburon peninsula and is physically divided into three distinct watersheds as shown in Figure 3-1. Each watershed, along with its general physical sewage disposal facilities, is described below.

TRESTLE GLEN WATERSHED - Encompasses the Reedlands, Belveron Gardens, Little Reed Heights, Del Mar and Hawthorne Terrace areas of the Tiburon peninsula. Development in the service area is entirely residential, and there is almost no prospect for future commercial or multiple dwelling development.

Sewage disposal in the Trestle Glen Watershed is provided by the Trestle Glen sewage treatment plant, with disposal of the disinfected effluent to the shallow water of Richardson Bay. The existing treatment plant provides complete activated sludge secondary treatment with separate sludge incineration. The treatment plant is now operating at approximately two-thirds of its design capacity.

SALT WORKS WATERSHED - Encompasses the Bel Air Estates, Reedland Woods, East Strawberry and Harbor Point areas of the Tiburon peninsula. With the exception of one small shopping center, development in this area is residential in nature, with both single family and multiple residences. Future development potential will probably consist of both single family and multiple development.

INTERIM NEEDS

Sewage originating in the Salt Works Watershed is pumped by the Salt Works Pumping Station west to the Ricardo Road Watershed, where it is pumped again by the Ricardo Road Pumping Station to the Sausalito-Marin City Sanitary District for treatment and disposal. Since sewerage service to the Salt Works Watershed and Ricardo Road Watersheds are physically combined, the two watersheds will be hereinafter discussed together.

RICARDO ROAD WATERSHED - Encompasses the Eagle Rock, West Strawberry, Seminary, and Highway 101 frontage road developments. The service area contains commercial, multiple and single family developments and has a large future potential for commercial and multiple dwelling developments.

As described above, the sewage from both the Salt Works and Ricardo Road Watersheds is pumped by means of the Ricardo Road Pumping Station to the Sausalito-Marin City Sanitary District for treatment and disposal.

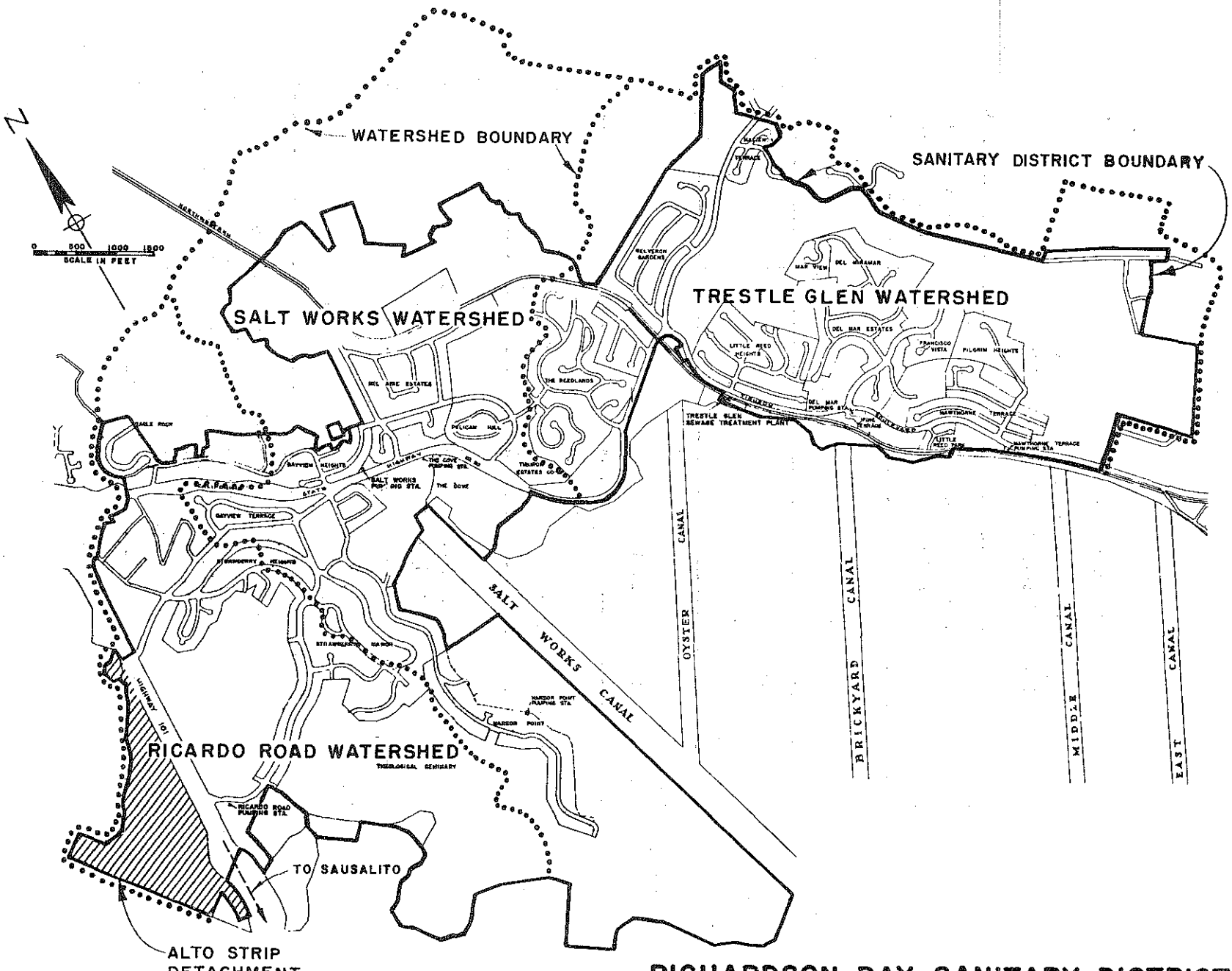
Service Characteristics

The service characteristics of each watershed are tabulated in Table 3-1. Since the Salt Works and Ricardo Road Watersheds are physically served together, their flow and population estimates have been combined.

The average dry weather flow and the peak wet weather flows shown are actual measured flows. The population served has been estimated on the basis that the average sewage contribution is 75 gallons per capita per day.

In so far as interim facilities are concerned, the problem in the Trestle Glen Watershed is completely different from the problem in the Salt Works and Ricardo Road Watersheds. Sewage generated within the Trestle Glen Watershed receives complete secondary treatment, and no bypassing has been experienced in recent years.

Sewage disposal from the Salt Works and Ricardo Road Watersheds is by contract with the Sausalito-Marin City Sanitary District. The Ricardo Road Pumping Station pumps the sewage across the Richardson Bay Bridge to the Sausalito-Marin City Sanitary District system. During storms, considerable bypassing of untreated sewage occurs since neither the Richardson Bay Sanitary District system nor the Sausalito-Marin City Sanitary District system can handle extreme wet weather flows.



RICHARDSON BAY SANITARY DISTRICT

MARIN COUNTY, CALIFORNIA

FIGURE 3-1

TABLE 3-1

RICHARDSON BAY SANITARY DISTRICT
WATERSHED SERVICE CHARACTERISTICS

Service Area	Trestle Glen Watershed	Salt Works Watershed	Ricardo Rd. Watershed*
Total watershed area, acres	704	714	700
Total developed area, acres	368	383	227
1970 Average Dry Weather Flow, mgd	0.188	0.486	
1970 Estimated Population @ 75 gpcd	2510	6480	
1970 Peak Wet Weather Flow, mgd	1.129 (12/3/70)	1.130 (12/4/70)	
1970 Wet Weather Bypassing, mgd	0	Unknown	
Existing Sewerage Facilities	Complete Secondary Treatment Disposal to Richardson Bay	Pumped to Sausalito-Marin City Sanitary District for treatment and disposal	

*Includes Alto Strip Detachment.

Projected Interim Growth Rates

The growth rates in each watershed for the past three years and a projected 1971 growth rate is tabulated in Table 3-2. The rates of growth for succeeding years will probably be similar to the 1971 projected growth rates.

Projections of population and waste flows have been made on the basis of the following design criteria:

People per single family living unit = 3.5
People per apartment unit = 2.5
Per capita waste flow, gallons per day = 75

TABLE 3-2

RICHARDSON BAY SANITARY DISTRICT
PAST GROWTH RATES AND PROJECTED INTERIM GROWTH RATES
BY WATERSHED

Service Area	Trestle Glen Watershed	Salt Works Watershed	Ricardo Rd. Watershed
Living Units Connected			
1968	27	20	10
1969	28	42	1
1970	16	27	2
Projected Annual Single Family Living Units	30	30	0
Projected Annual Apartment Living Units	0	12	170
Projected Annual Population Increase	105	135	425
Projected Annual Flow Increase, gal/day	7,875	10,125	31,875

INTERIM NEEDS

Alto Strip Detachment

On May 12, 1971, the Local Agency Formation Commission approved detachment of approximately 60 acres from the Richardson Bay Sanitary District. Once detached, this area will be served through the City of Mill Valley sewer system. The Alto Strip detachment lies within the Ricardo Road Watershed and, although now within the city limits of Mill Valley, at the present time the Richardson Bay Sanitary District provides the sewerage service. To avoid double taxation and to serve the Alto Strip area through its system, it will be necessary for the City of Mill Valley to construct new collection facilities and cut off connections to the Richardson Bay Sanitary District.

The number of existing connected living units and services in the Alto Strip detachment is given in Table 3-3. Once this area is physically disconnected from the Richardson Bay Sanitary District system and served through the City of Mill Valley system, it is proposed that the Richardson Bay Sanitary District receive credit for the equivalent number of new connections elsewhere in the Salt Works and Ricardo Road Watersheds.

TABLE 3-3

ALTO STRIP DETACHMENT

Area, ac.	60
Single Family Living Units	0
Apartment Units	107
Motel Units	65
Commercial Establishments	5
Water Consumption (per Marin Municipal Water District records) av. gal/day	51,665
Equivalent Population Credit @ 75 gpcd	689

Summary

The purpose of this chapter is to develop the interim needs of the District in terms of population and waste flow for each watershed service area.

Based on the foregoing, the interim needs in terms of the projected annual population increase for each watershed are given below:

Projected Annual Population Increase	
Trestle Glen Watershed	105
Salt Works Watershed	135
Ricardo Road Watershed	425
Alto Strip Detachment - Equivalent Population Credit	732

CHAPTER 4

INTERIM IMPROVEMENTS

General

In previous chapters of this report, the District's past and present efforts to meet its obligations toward pollution control have been summarized, and the present and anticipated future service characteristics of the District have been developed.

The purpose of this chapter is to evaluate the capability of the existing facilities to meet the new requirements and describe the program of interim improvements already undertaken by the District. The interim improvements are intended to enhance water quality by holding waste loadings to the bay within present levels while still accommodating the anticipated interim growth of the District. Further, this chapter will present recommendations for a continuing program of interim improvements to continue to allow future connections to the District system until a permanent sewage disposal solution is implemented.

Waste "A"

Waste "A" as defined by Order No. 71-14 is the discharge of the District's Trestle Glen Sewage Treatment Plant. The Trestle Glen Sewage Treatment Plant handles only sewage generated within the Trestle Glen Watershed and discharges the chlorinated effluent to the shallow water of Richardson Bay.

The requirements for discharge of Waste "A" as set forth in Order No. 71-14 are extremely restrictive, requiring installation of highly advanced, possibly experimental tertiary processes, which in essence is tantamount to a prohibition of discharge of Waste "A". The existing treatment plant already provides complete secondary treatment with separate sludge incineration, which is equivalent to the degree of treatment provided by the best and most modern sewage treatment plants now existing in the Bay Area.

Inasmuch as the District cannot comply with the requirements of Order 71-14 for Waste "A", the interim improvements described below will enhance the water quality in the bay while holding waste loading within existing levels.

INTERIM IMPROVEMENTS

Chlorine Contact Chamber Enlargements

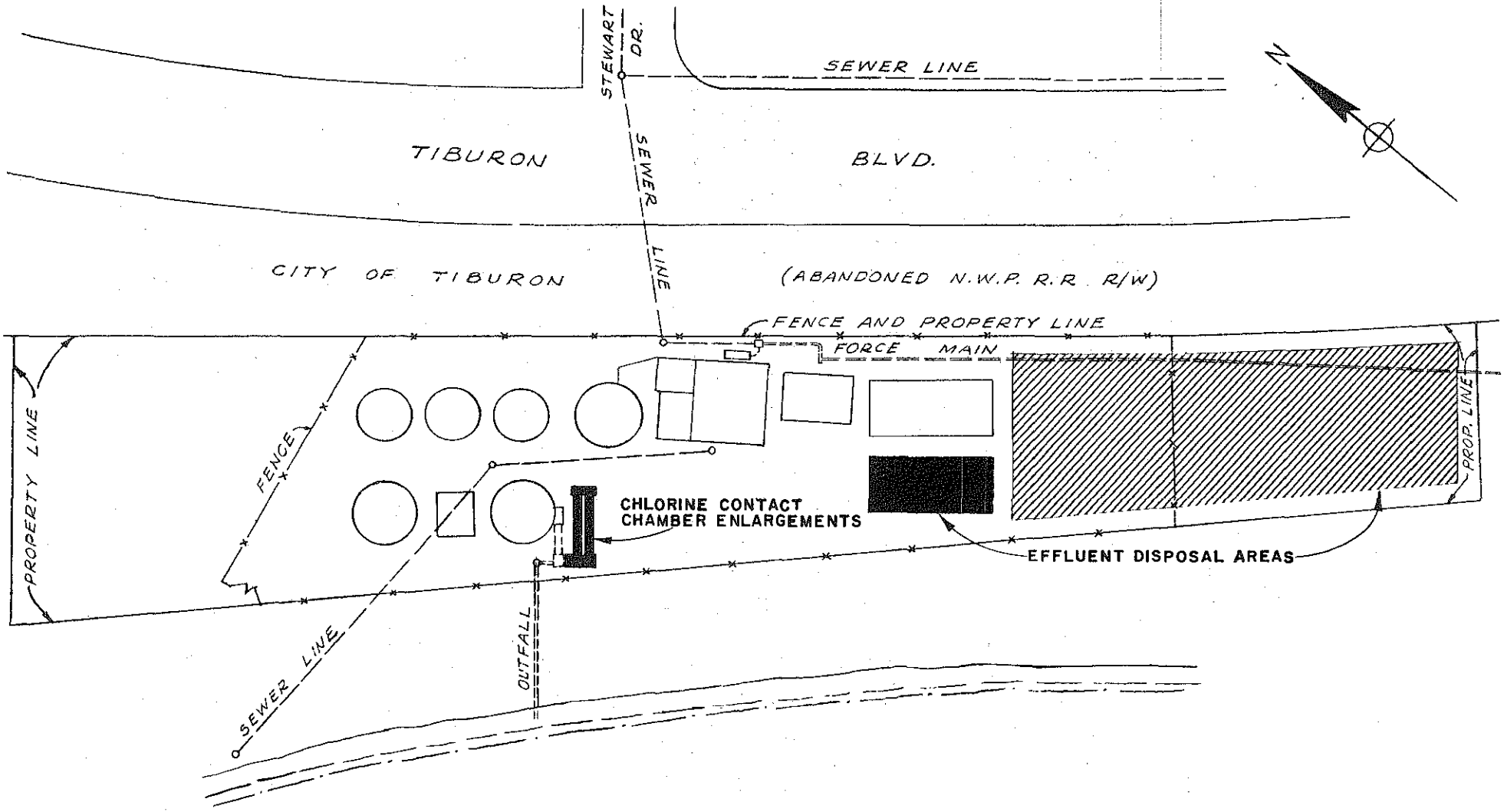
Under the previous Regional Water Quality Control Board orders, Resolution 228, disinfection was considered adequate if the chlorine residual was 0.5 ppm in the effluent for at least 20 minutes prior to discharge or if the coliform organisms in Richardson Bay within 500 feet, but not more than 150 feet distant from the discharge point, did not exceed 10 per milliliter in at least 80 per cent of the samples analyzed, nor in more than three (3) consecutive daily samples. The District elected to test the bay waters rather than the effluent to demonstrate compliance with this requirement with good success except during months with generally high rainfall and storm water runoff to the bay. Furthermore, the existence of numerous septic tanks in the vicinity of Greenwood Beach, adjacent to the plant, undoubtedly contributed to some water quality degredation in the vicinity of the plant outfall.

The Regional Water Quality Control Board Order No. 71-14 now requires that the effluent be filtered and have a moving median of seven daily samples of coliform organisms of 2.2 MPN/100 ml. Although this requirement cannot be met without tertiary treatment facilities, the District on June 15, 1971, awarded a construction contract for enlargement of the chlorine contact chamber (see Figure 4-1) as an interim improvement so that better effluent disinfection can be achieved. At 300,000 gallons per day, the contact time will be increased from 17 minutes to 61 minutes, thereby affording an improvement in disinfection capability and significantly reducing the number of coliform organisms entering the bay.

Interim Effluent Disposal

Regarding the amount of waste loading in terms of BOD and suspended solids now going to the bay from this plant, at the present time it is extremely small. The average daily BOD loading to the bay is 52 pounds and suspended solids 43 pounds.

Under Regional Water Quality Control Board Policy, however, interim improvements must further reduce this already small waste loading. Accordingly, to enhance the water quality of the bay on an interim basis by reducing the existing waste loading below present levels, it is proposed that a portion of the effluent be held out of the bay by means of land disposal on the treatment plant property. Further, it is proposed that new connections within the Trestle Glen Watershed be allowed



LEGEND

IMMEDIATE INTERIM IMPROVEMENTS

FUTURE INTERIM IMPROVEMENTS

RICHARDSON BAY SANITARY DISTRICT
MARIN COUNTY, CALIFORNIA

TRESTLE GLEN SEWAGE TREATMENT PLANT INTERIM IMPROVEMENTS

0 50 100 150
SCALE IN FEET

FIGURE 4-1

equivalent to the flow withheld from the bay by means of land disposal at the treatment plant site.

In April, 1971, realizing that interim improvements might be necessary under the new Order 71-14, the Richardson Bay Sanitary District installed a land disposal facility for a portion of the plant effluent. This facility consists of a pump equipped with a water meter which pumps disinfected effluent through water sprinklers over an existing sludge bed which has been cleaned and sealed (see Figure 4-1). The sprinklers are turned on at 8 p.m. every evening and turned off at 8 a.m. in the morning. No discharge to the bay is possible from the sludge bed, and in the event excess water accumulates, it can be measured as it is returned to the plant influent.

In 49 consecutive days since interim effluent disposal began on April 12, 1971, approximately 308,520 gallons of effluent have been disposed of on land and thus have not reached the bay. This rate of disposal amounts to 6,300 gallons per day on a 1,800 square foot area. The rate of disposal is thus 5.6 inches per day. On this basis, 153,000 gallons per day could be disposed of on one acre. Table 4-1 shows the present disposal area and and loading and future disposal area immediately available. All disposal areas would be fenced and inaccessible to the public.

TABLE 4-1

TRESTLE GLEN SEWAGE TREATMENT PLANT
INTERIM EFFLUENT DISPOSAL

	Disposal Area sq.ft.	Application Rate gal/day	Annual Application Rate * gal/day	Population Equivalent @ 75 gpcd
Present spray field	1,800	6,300	5,440	72
Projected Future spray fields	19,000	66,500	57,400	765
Total Potential spray fields	20,800	72,800	62,840	837

*Based on 315 days of application per year.

To date, the weather has been relatively dry, and it is expected that the effluent disposal will have to be somewhat curtailed on very wet and rainy days. Thus, assuming there are 50 wet days out of the year and that effluent can be disposed of at the rate of 6,300 gallons per day, for the remaining 315 days of the year, approximately 1,984,500 gallons of effluent can be disposed of over the entire year at the Trestle Glen Plant. Assuming 75 gallons per capita per day, the 1,984,500 gallons of effluent disposed of per year is equivalent to about 72 people or 21 new single family connections to the plant.

Based on the foregoing, it is proposed that on an interim basis to enhance the water quality in the bay by holding the waste loading to the bay within present levels, new connections to the system be justified against the amount of effluent withheld from the bay on an annual basis. With the present interim effluent disposal program, it is proposed that 21 new connections be allowed in the Trestle Glen Watershed if a cease and desist order is adopted. It is recommended that as the demand for new connections increases, the District will have to expand its effluent disposal facilities on additional land around the plant site to allow the increased flow to be withheld from the bay.

Waste "B"

Waste "B" as defined by Order 71-14 is the wet weather untreated sewage bypasses to Richardson Bay or its tributaries from Hawthorne Terrace and Salt Works Pumping Stations and a manhole in Frontage Road at Belvedere Drive. Under Order 71-14, the bypassing of untreated sewage, Waste "B", is prohibited.

Although not specifically prohibited under previous Water Quality Control Board Orders (Resolution 228), the bypassing of untreated sewage during wet weather is an intolerable situation. Basically, it is caused by excess storm water entering the sanitary sewers through broken and defective pipe joints as well as through patio drains, open cleanouts, or roof leaders illegally connected to the sewers.

Within the Richardson Bay Sanitary District, considerable bypassing of untreated sewage occurs during wet weather. A general description of the bypassing locations in each watershed and frequency of bypassing for Waste "B" are given in Table 4-2 and generally described below.

TABLE 4-2

RICHARDSON BAY SANITARY DISTRICT
INVENTORY OF EXISTING BYPASSES

No.	Description	Bypass Pipe Size	Frequency of Use
TRESTLE GLEN WATERSHED			
1.	Hawthorne Terrace Pumping Station	10" flap gate	During power failure only
2.	Trestle Glen Sewage Treatment Plant		
	A. Raw Sewage Bypass	8" flap gate	During power failure only
	B. Primary Effluent Bypass	12" slide gate (manual)	During extreme wet weather
SALT WORKS WATERSHED			
3.	Salt Works Pumping Station		
	A. High water bypass	10" flap gate	During extreme high water
	B. Force Main bypass	6" (automatic control)	During extreme wet weather
4.	Strawberry Circle high water protective bypass	6" flap gate	During extreme high water
5.	Harbor Point high water protective	6" flap gate	During power failure
RICARDO ROAD WATERSHED			
6.	Frontage Road at Belvedere Drive	12" flap gate	During extreme wet weather

TRESTLE GLEN WATERSHED - Although there are three physical bypass locations within the Trestle Glen Watershed, they operate only during a power failure or during an extreme wet weather situation. Sincy bypassing is so infrequent, it is generally not considered to be a problem in this watershed.

To improve the system and enhance the water quality in the bay, bypasses #1 and #2A have been closed off. Consequently, during extreme wet weather or a power failure, the sewer system will be required to provide more storage of the sewage rather than discharging through the bypass before all the possible storage is utilized. Further, some connections to this sewer system have been made to reduce infiltration as described hereinafter.

SALT WORKS AND RICARDO ROAD WATERSHEDS - Bypassing within the Salt Works and Ricardo Road Watersheds is generally regarded as a problem. There are five separate bypasses, two of which (#3B and #6) operate relatively often during wet weather.

Bypass #3B operated for approximately 43 hours during 1970. In 1969, the District installed an automatic gate on the bypass which was controlled by water level. Prior to installation of the automatically controlled bypass, the District personnel would simply open the bypass during every heavy rain just in case the level became high. With the automatically controlled bypass, the number of hours of bypassing has been significantly reduced.

Bypass #6 relieves the Ricardo Road system when the pumps at the Ricardo Road Pumping Station cannot handle all the water. There is no estimate on how often this bypass is open.

Bypasses #3A, #4 and #5 are relatively minor bypasses and only operated during extreme high water. Bypass #4 is needed as a protection to low-level houses which are subject to inundation if there is a major malfunction of the Salt Works Pumping Station. Bypasses #3A and #5 have been closed off in an effort to enhance the water quality in the bay by utilizing additional storage in the sewer system.

Sausalito-Marin City Sanitary District Contract

The Richardson Bay Sanitary District contracts with the Sausalito-Marin City Sanitary District for treatment and disposal of all the wastes generated in the Salt Works and Ricardo

Road Watersheds. The sewage flow pumped to Sausalito is metered at the Ricardo Road Pumping Station.

The annual flows pumped to the Sausalito-Marin City Sanitary District for the last five years are given below.

ANNUAL FLOWS PUMPED TO
SAUSALITO-MARIN CITY SANITARY DISTRICT
FROM THE SALT WORKS & RICARDO ROAD WATERSHEDS

Year	Gallons
1965-66	146,576,000
1966-67	177,761,200
1967-68	180,698,000
1968-69	205,836,000
1969-70	204,733,000

On September 8, 1970, the Sausalito-Marin City Sanitary District informed the Richardson Bay Sanitary District that their system was almost up to capacity and requested that the District take measures as necessary to maintain a gallonage not to exceed the 1968-69 flow of 205,836,000 gallons. The Sausalito-Marin City Sanitary District further stated that they cannot make firm plans for future expansion of their facilities until a Master Plan for sewage disposal has been developed and approved by all Districts and Agencies in the Richardson Bay Watershed area.

In response to this request, the Richardson Bay Sanitary District undertook a program of collection system improvements to restrict storm water inflow and ground water infiltration. Further, the District is reviewing all requests for commercial and multiple apartment unit connections as it pertains to available system capacity. Appropriately, this program of collection system improvements which commenced September, 1970, coincides with the need under Order 71-14 to eliminate infiltration to the system and, further, to justify new connections to the District against enhancement of bay water quality by reducing bypasses below present levels.

Bypassing Correction Program

Bypassing of the untreated sewage can be prevented by one or more of the following methods: (1) provide storage for the excess storm flows so they can be treated after the storm ends, (2) provide additional sewer line and pumping capacity, (3) correction of leaks and defective or illegal connections to the sanitary sewer system.

Storage of excess flows for treatment later would be a good interim method of leveling out peak flows if suitable land and storage ponds are available. Unfortunately, in the case of the Richardson Bay Sanitary District, no such land is available.

Additional sewer line and pumping capacity is also an adequate way of handling peak flows, provided the problem is not just transferred elsewhere. In consideration of the request by the Sausalito-Marin City Sanitary District to limit the sewage flows to 1968-69 levels, installation of additional pumping capacity at this time is not considered to be an appropriate solution to eliminating bypassing in the District system as it would only transfer the problem to the Sausalito-Marin City system.

Accordingly, the District has elected to undertake an aggressive program of leak correction and elimination of illegal storm water connections. Leak correction is a permanent solution to eliminating excess infiltration to the sewers and thereby eliminate bypassing of raw sewage. Furthermore, a leak correction program will be an essential part of any long-range sewage disposal solution in the Richardson Bay area. Ultimately, however, in the long-range solution a bypass elimination program must include both increased system capacity and correction of leaks and illegal storm drainage connections.

Table 4-3 summarizes the sewer correction program undertaken by the District since September, 1970. Estimates have been made of the amount of infiltration eliminated by each repair or improvement. Since it is usually impossible to make measurements of the amount of water leaking into a sewer pipe, the estimates given in Table 4-3 have been made from typical measurements of infiltration.

Specifically, estimates for leakage into a manhole have been based on an average of actual measurements of some typical leaks. In a typical leaky manhole, one half a gallon a minute of infiltration is considered a reasonable volume.

TABLE 4-3

RICHARDSON BAY SANITARY DISTRICT
SEWER LINE CORRECTION PROGRAM

Report Date	Location & Description	Watershed	Basis of Infiltration Estimate	Est. Amount of Infiltration Eliminated - gpd
SEWER MAIN CORRECTIONS				
9-9-70	Belvedere Drive Replaced 12" Sewer Main	Ricardo Rd.	430 LF 12" sewer @ 50,000 gal/day/in/mile	49,000
1-19-71	108 Richardson Drive Plugged leaking 4" sewer stub	Ricardo Rd.	20 LF 4" sewer @ 50,000 gal/day/in/mile	760
2-16-71 & 5-20-71	Sutter Court - Repaired break and relaid main	Trestle Gl.	40 LF 6" sewer @ 50,000 gal/day/in/mile	2,280
2-16-71	240 E. Strawberry Drive Repaired large hole in main	Salt Works	20 LF 6" sewer @ 50,000 gal/day/in/mile	1,140
3-16-71	82 S. Knoll Road Repaired 2 breaks	Ricardo Rd.	40 LF 6" sewer @ 50,000 gal/day/in/mile	2,280
3-16-71	Tiburon Blvd. at Reedlands Repaired break	Trestle Gl.	20 LF 6" sewer @ 50,000 gal/day/in/mile	1,140
4-20-71	Bayview Terrace Repaired 9 breaks	Ricardo Rd.	180 LF 6" sewer @ 50,000 gal/day/in/mile	10,250
4-20-71	Tiburon Blvd. @ Palmer Ave. Repaired 2 breaks	Trestle Gl.	40 LF 6" sewer @ 50,000 gal/day/in/mile	2,280
5-1-71	Belvedere Drive Replaced 12" sewer main	Ricardo Rd.	190 LF 12" sewer @ 50,000 gal/day/in/mile	21,600
5-20-71	Reed Blvd. Repaired 4 breaks	Ricardo Rd.	80 LF 6" sewer @ 50,000 gal/day/in/mile	4,560
5-20-71	South Knoll Road Repaired 2 breaks	Ricardo Rd.	40 LF 6" sewer @ 50,000 gal/day/in/mile	2,280
6-15-71	Richardson Drive Abandoned 52' of leaky sewer	Ricardo Rd.	52 LF 6" sewer @ 50,000 gal/day/in/mile	2,960

MANHOLE REPAIRS				
1-19-71	112 Richardson Drive	Ricardo Rd.	1/2 gpm	720
2-16-71	Clotilda Ct. & Carlotta Cir.	Ricardo Rd.	1/2 gpm	720
2-16-71	Cecilia Way	Salt Works	1/2 gpm	720
2-16-71	301 E. Strawberry Drive	Salt Works	1/2 gpm	720
5-20-71	Carlotta Circle	Ricardo Rd.	1/2 gpm	720
SMOKE TESTING REPAIRS				
2-4-71	18 Claire Way, Bel Air	Salt Works	50 LF 4" sewer @ 50,000 gal/day/in/mile	1,900
3-4-71	26 Claire Way, Bel Air	Salt Works	50 LF 4" sewer @ 50,000 gal/day/in/mile	1,900
2-5-71	146 Blackfield Dr., Bel Air	Salt Works	50 LF 4" sewer @ 50,000 gal/day/in/mile	1,900
	TOTALS			109,830

TABLE 4-4

RICHARDSON BAY SANITARY DISTRICT

SEWER LINE CORRECTION PROGRAM
SUMMARY OF ESTIMATED AMOUNT OF INFILTRATION ELIMINATED

September 1970 to May 1971

	Trestle Gl. Watershed*	Salt Works Watershed	Ricardo Rd. Watershed
Sewer Main Corrections Wet Weather flow eliminated, gpd	5,700	1,140	93,690
Manhole Repairs Wet Weather flow eliminated, gpd	0	1,440	2,160
Smoke Testing Repairs Wet Weather flow eliminated, gpd	0	5,700	0
TOTAL WET WEATHER FLOW ELIMINATED, gpd	5,700	8,280	95,850
Equivalent Raw Sewage Flow, gpd	2,850	4,140	47,925
Equivalent Additional Population @ 75 gpcd	38	55	639

*Bypassing within the Trestle Glen Watershed is not a problem. However, the basic data is included in this table for completeness.

Estimates for infiltration into typical leaky sewer lines have been based on data presented in the following report:

> County of Sonoma, Sanitation Department
> "Evaluation of External Sealing Method to Reduce Storm Flow Effects in Sewerage Systems"
> Final Progress Report, F.W.P.C.A. Demonstration Grant WPD 111-01-66.

Accordingly, in a typical leaky sewer line, 50,000 gallons per day per inch of diameter per mile of pipe is considered a reasonable volume and is used in Table 4-3. Under District testing requirements, a new sewer must have an infiltration rate of less than 630 gallons per day per inch of diameter per mile of pipe.

Inasmuch as the Salt Works and Ricardo Road system adequately handles the dry weather flows, new connections will only be a problem during the wet weather when bypassing is a problem. Thus, during a severe storm, each new connection will add to the amount of untreated sewage bypassed unless the storm water entering the system is decreased accordingly.

Consequently, to enhance water quality by holding waste loadings to the bay within present levels, additional connections must be justified against estimates of the waste loadings withheld from the bay during wet weather. Since the mixture of sewage and storm water which bypasses from the sewer system is approximately half the strength of raw sewage in terms of BOD and suspended solids, it is suggested that infiltration eliminated from the system in gallons per day be equated to the daily flow contribution from new connections on a 2 to 1 basis.

Accordingly, Table 4-4 summarizes the results of the District's sewer line correction program to date for each watershed and estimates the equivalent additional population which can be allowed to connect to the District's system while still holding waste loading to the bay from wet weather bypasses within present levels.

It is recommended that this program of sewer system improvements be continued so that excess infiltration flows can be reduced as much as possible. Infiltration reduction has both the short-term benefit of allowing additional connections to the system and the long-term benefit in terms of reduced pumping and treatment costs during wet weather.

INTERIM IMPROVEMENTS

Future Permanent Improvements

Although the present chapter discusses primarily interim improvements, it is appropriate at this time to look ahead at possible directions which will lead to more permanent improvements. Permanent improvements to the District system must have the direction of the subregional study for Southern Marin now being conducted by the Marin Municipal Water District, the results of which should be known by mid-1972.

In so far as the Trestle Glen Treatment Plant is concerned, the nature of future permanent improvements will depend very heavily upon the conclusions of the subregional study. Basically, two alternatives exist: (1) the plant can be phased out in favor of a regional treatment plant in which case the plant would be converted to a major pumping station or (2) the plant can be converted to a water reclamation plant.

Water reclamation is appropriate at this location since the reclaimed water would be used to irrigate the considerable amount of landscaping for parks and parkways now being planned along the shore of Richardson Bay north and south of the treatment plant site. The District has long proposed to make use of the effluent for landscape irrigation and recreational lakes and ponds at such time as the City of Tiburon is ready to proceed with park improvements.

In this regard, the District has initiated a pilot program to test the reclaimability of the effluent for possible reuse and for compliance with discharge requirements under Order 71-14. The pilot program consists of the testing of a small sand filter which treats a portion of plant effluent. Test results are being analyzed, and it is hoped they will become basic information for analysis of alternatives in the subregional plan.

Regarding corrections and repairs to the District sewer system which eliminate water infiltration, almost any work that is done can be considered a permanent improvement. Basically, any alternative project which may be recommended in the subregional plan must handle all sewage flows, including the peak wet weather flows. Reduction in wet weather flows will be essential to the functional adequacy of a regional system and, furthermore, will put the District in a favorable position if it is necessary to negotiate contracts for sewage treatment and disposal.

Summary

This chapter outlines the program of interim improvements which the Richardson Bay Sanitary District has undertaken intended to enhance water quality in the bay. Furthermore, the interim improvements described herein should accommodate the anticipated interim growth of the District while holding waste loadings to the bay within present levels.

At the Trestle Glen Plant, the District has awarded a contract to enlarge the existing chlorine contact chamber to better comply with disinfection requirements. In addition, the District has started a program of land disposal of a portion of the plant effluent and thus decrease the volume discharged to the bay. Disposing of effluent on land will make it possible to permit additional connections to the system without increasing waste loadings to the bay.

Within the Salt Works and Ricardo Road Watersheds, the District has undertaken an aggressive program of sewer system corrections which will significantly reduce the bypassing of sewage during wet weather. The sewer system corrections are intended to serve both as interim and as permanent improvements toward enhancement of water quality in the bay. Estimates of the amount of infiltration eliminated by each system repair have been equated to the additional population which can be accommodated on an interim basis while still holding waste loadings to the bay within present levels.

Future permanent improvements to the District system depend heavily on the recommendations of the Southern Marin subregional plan now being conducted by the Marin Municipal Water District. The possibility of making use of a major portion of the effluent from the Trestle Glen Plant for landscape irrigation and recreational lakes and ponds has long been proposed by the District in its planning and is only dependent upon definitive plans being considered by the City of Tiburon for parkway and recreational improvements in the vicinity of the plant. Improvements which will be permanent and most essential to the functional adequacy of any regional or local plan is the elimination of excess storm water infiltration to the sanitary sewer system.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

General

The general objective of the present study has been to develop a program of interim improvements to the District system which will enhance water quality in the bay by holding waste loadings within present levels and thus allow the District to continue to accommodate the expected growth over the next few years until a permanent sewage disposal solution is implemented.

Conclusions

Based on the general objective outlined above and considerations previously summarized, the following conclusions are made:

1. It is concluded that the District has a commendable history of meeting its obligations of providing sewerage service and meeting the demands of continued growth.

2. It is concluded that the District has recognized the need to further enhance water quality in the bay and is participating in the Southern Marin subregional study now being conducted by the Marin Municipal Water District.

3. It is concluded that over the next few years there will be need to accommodate additional growth in the District.

4. It is concluded that the District cannot immediately comply with the requirements of Water Quality Control Board Order 71-14.

5. It is concluded that at the Trestle Glen Plant enlargement of the chlorine contact chamber and land disposal of a portion of the plant effluent will enhance water quality in the bay and allow additional connections to the system while holding waste loadings to the bay within present levels.

6. It is concluded that sewer system corrections and repairs within the Salt Works and Ricardo Road Watersheds

will enhance water quality in the bay and allow additional connections to the system while holding waste loadings to the bay within present levels.

Recommendations

Based on the foregoing conclusions and considerations previously summarized, the following recommendations are presented:

1. It is recommended that the District expand its land disposal facilities at the Trestle Glen Plant as necessary to accommodate the interim growth by holding waste loadings to the bay within present levels.

2. It is recommended that the District continue its aggressive program of sewer system corrections and repairs, both to accommodate interim growth by holding waste loadings to the bay within present levels and also as permanent improvements for enhancement of water quality.

3. It is recommended that the District continue to evaluate the water reclamation potential at the Trestle Glen Plant as necessary input to the subregional study.

APPENDIX A

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 71-14

WASTE DISCHARGE REQUIREMENTS
FOR
RICHARDSON BAY SANITARY DISTRICT
TIBURON, MARIN COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region, finds that:

1. This Board prescribed requirements for the Richardson Bay Sanitary District, called the discharger below, in Resolution No. 228 on November 15, 1956.

2. The discharges include:

   Waste "A" is 0.2 mgd of sewage only, in dry weather, from 2800 people, and discharges through rocks at the shoreline of Richardson Bay. Design capacity of the plant is 0.3 mgd to serve a population of 4200 people.

   Wastes "B" are wet weather untreated sewage bypasses to Richardson Bay or its tributaries from Hawthorne Terrace and Salt Works pumping stations and a manhole in Frontage Road at Belvedere Drive.

3. The Board adopted a water quality control plan for tidal waters inland from the Golden Gate and within the San Francisco Bay Region on March 26, 1970.

4. The beneficial uses of Richardson Bay are:

   Swimming, water-skiing, wading, pleasure boating, marinas, fishing and shellfishing

   Fish, shellfish, and wildlife propagation and sustenance, and waterfowl and migratory birds habitat and resting

   Navigation channels

   Esthetic appeal.

5. Land within 1000 feet of the point of discharge for Waste "A" is used for transportation, business, residence and recreation. Mt. Tamalpais Game Refuge encompasses this area and along the shore of Strawberry peninsula, just opposite the discharge, is an area designated by Fish and Game as suitable for protecting as a shellfish bed.

6. The Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge.

7. The Board in a public meeting February 25, 1971 heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, the discharger shall comply with the following:

A. Waste Discharge Requirements

1. The treatment or disposal of waste shall not create a nuisance as defined in Section 13050(m) of the California Water Code.

2. Waste "A" shall not cause:

a. Floating, suspended, or deposited macroscopic particulate matter or foam, in waters of the State at any place;

b. Bottom deposits or aquatic growths at any place;

c. Alteration of temperature, or apparent color beyond present natural background levels in waters of the State at any place;

d. Visible, floating, suspended or deposited oil or other products of petroleum origin in waters of the State at any place;

e. Waters of the State to exceed the following limits of quality at any point:

Dissolved oxygen	5.0 mg/l minimum When natural factors cause lesser concentrations then this discharge shall not cause further reduction in the concentration of dissolved oxygen.
Dissolved sulfide	0.1 mg/l maximum
Nutrients	50 ug chlorophyll χ /l When background levels exceed this requirement then this discharge shall not add further nutrients.
Other substances	Any one or more substances in concentrations that impair any of the protected beneficial water uses or make aquatic life or wildlife unfit or unpalatable for consumption.

3. Waste "A" as discharged or at some point in the treatment process shall meet the following quality limits at all times:

   a. The waste shall meet quality requirements equivalent to those which would result from conformance with Section 8047 of Title 17, California Administrative Code.

   b. Coliform organisms — 2.2 MPN/100 ml, moving median of seven consecutive daily samples, maximum.

4. Waste "A" as discharged to waters of the State shall meet these quality limits at all times:

   a. In any grab sample:

      pH — 7.0 minimum
      8.5 maximum

   b. In any representative 24-hour composite sample:

      (1) Turbidity — 10 units, maximum

      (2) 5-day BOD — 5 mg/l, median for any 30-day period
      10 mg/l, maximum

   c. In any representative set of samples:

      Toxicity: survival of test fishes in 96-hour bioassays of the waste as discharged

      Any determination — 70% minimum

      Average of any three or more consecutive determinations made during any 21 or more days — 90% minimum

5. The mean daily flow of Waste "A" for any month shall not exceed 0.3 mgd.

6. The bypassing of untreated sewage, Wastes "B", is prohibited.

B. <u>Provisions</u>

1. This Order includes items numbered 1, 2, 3, 4, 6 and 7 of the attached "Reporting Requirements" dated August 28, 1970.

2. This Order rescinds Resolutions Nos. 228, 42, 41 and 26.

3. This Order includes items numbered 1, 2, 3, 4, 5, 6 and 7 of the attached "Notifications" dated January 6, 1970.

4. This Order notifies the discharger that more restrictive requirements than the above may be imposed for the protection of shellfishing when information on the dispersion characteristics of the District's waste discharge has been analyzed.

I, Fred H. Dierker, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on February 25, 1971.

_____

Executive Officer

Subj: **More History for you**
Date: 4/5/2011 11:43:54 A.M. Pacific Daylight Time
From: PRibKing@aol.com
To: PBann@aol.com

Peter,

Here are three more historical reports that provide some background on a number of issues and collaborative efforts of the sewer agencies of Marin and Sonoma to come to terms with how best to address collection, treatment and disposal in light of the clean water act of 1972 as well as changes proposed by the RWQCB planning to eliminate shallow water discharge in Richardson Bay. (RBSD 1971, HVSD 1970)

Of note are early efforts of Homestead and Richardson Bay to get a handle and improve wet weather I&I issues. I imagine Almonte also looked at the same issues but I did not find any reports in the archive.

A lot has been made trying to paint or agencies as non-collaborative, self-interested districts only concerned with low rates for our rate payers. These documents show the historical predisposition of the agencies to look at regional solutions to common problems, long standing appreciation of the problems associated with I&I, and the need for quality information to inform their judgement on how best to proceed.

An interesting fact is that the sewers in RBSD were not more than 20 years old at the time of the 1971 report and efforts to deal with I&I. It just shows how construction methods have impacted treatment costs in Marin.

Also, in the 1973 alternatives study, at page 36, is that fixing I&I has always been identified as a significantly more expensive alternative than building larger transport and treatment works.

Bonner

Subj: **Some more interesting historical information**
Date: 4/1/2011 10:30:21 A.M. Pacific Daylight Time
From: PRibKing@aol.com
To: PBann@aol.com
CC: kevin@Reilly4RealEstate.com, ldkious@sbcglobal.net, millvalleyfig@yahoo.com

Peter,

Here are some excerpts from the 1973 Southern Marin Subregional Wastewater Management Plant that shed additional light on the development of sanitary service in our area. The full report is in the SASM archives.

Bonner

HOMESTEAD VALLEY SANITARY DISTRICT

MARIN COUNTY, CALIFORNIA

SANITARY SEWER SYSTEM
ANALYSIS AND EVALUATION

NOVEMBER 1970

J. WARREN NUTE, INC.
CIVIL AND SANITARY ENGINEERS

2

J. WARREN NUTE, INC.
CIVIL AND SANITARY ENGINEERS

411 FOURTH STREET
SAN RAFAEL, CALIFORNIA 94901
TELEPHONE (415) 453-4480

J. WARREN NUTE, P. E.
WARREN E. NUTE, P. E.

November 23, 1970

To the Honorable Board of Directors
HOMESTEAD VALLEY SANITARY DISTRICT
P. O. Box 149
Mill Valley, California 94941

Letter of Transmittal

Gentlemen:

In accordance with your request, we have investigated the condition of the District's sewer system, particularly with respect to wet weather flow conditions, and herewith submit our findings.

Basically, we have measured the peak wet weather flows in the District system and find that they are unnecessarily high. Not only do these excessive flows overtax the District's sewer system, but they also contribute to Mill Valley's wet weather flow problem. Furthermore, unless such peak flows are attenuated in all sewerage agencies around Richardson Bay, the ability of any area-wide sewage disposal project to intercept and treat all flows is questionable.

As a first step to mitigate the storm water infiltration problem we have recommended that the District undertake a program of smoke testing the sewers. To be effective, however, the smoke testing program or any leak detection program must be followed by corrective measures.

It is hoped that this report will provide a basis on which the Board can proceed with a program to upgrade the District sewer system.

Very truly yours,

J. WARREN NUTE, INC.

By Warren E. Nute
Warren E. Nute

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

General

Homestead Valley Sanitary District is one of four separate sewerage agencies which contract with the City of Mill Valley for sewage treatment and disposal. The City of Mill Valley provides secondary treatment for the sewage received and discharges the effluent to the upper end of Richardson Bay.

The Mill Valley sewer system, like many sewer systems in Marin County, contains many miles of older sewers which contribute large volumes of storm water into the system during wet weather. In realization of this problem, the City of Mill Valley, in 1968, undertook preparation of a study of the sanitary sewer system to determine the sources of storm water infiltration and to recommend a program of general upgrading to meet present and future needs.

Recognizing that the contracting sewerage agencies including the Homestead Valley Sanitary District also experience high wet weather flows which ultimately must be handled by the Mill Valley treatment plant, the 1968 Master Plan recommended as follows:

> "That the various Sanitary Districts which use the Mill Valley treatment plant eliminate excessive storm water intake and upgrade their sewage collection systems to at least the same degree as Mill Valley."

More recently, in March and April of 1970, the Regional Water Quality Control Board held hearings regarding the advisability of prohibiting all discharge of sewage bearing waste to Richardson Bay under the assumption that certain areas of the Bay should be protected for the taking of shellfish for human consumption. To date the discharge prohibition has not been adopted. However, the sewerage agencies around Richardson Bay have requested the Marin Municipal Water District to undertake studies to develop an area-wide sewerage program that will adequately protect Richardson Bay for all beneficial uses.

Whatever solution is developed for the Richardson Bay area, it will be necessary to eliminate or minimize all wet

weather sewage overflows. In addition, the ability of any regional project to intercept and carry off all of these flows will be very questionable unless all sewerage agencies upgrade their sewer system so as to mitigate, in so far as possible, storm water infiltration to the sewers.

Accordingly, in anticipation of the need to upgrade the sewer system, the Homestead Valley Sanitary District authorized the present study to document the amount of storm water infiltration experienced and provide a basis of comparison with conditions within the Mill Valley system.

Historical Background

The Homestead Sanitary District was established by the Board of Supervisors on July 7, 1931 under the Sanitary District Act of 1919 after an election which favored its formation. This election was precipitated by a controversy between residents in the area and the Board of Supervisors in which the Supervisors attempted to construct sewers in the Homestead Valley area. The Board of Supervisors finally abandoned the proceedings on assurance that the Sanitary District would diligently proceed with construction of sewers.

In 1932 the District was reorganized under the Sanitary District Act of 1923 as the Homestead Valley Sanitary District. Some sewers were constructed in the lower part of the District which connected to Mill Valley's outfall line on Miller Avenue. However, this arrangement was unsatisfactory since the tide would occasionally back the sewage into houses. Plans for the sewers in the rest of the District were prepared by 1933. The Sanitary Board, however, did not proceed because it was determined that the people would be better off with septic tanks in view of the problem of tidal backups in the Mill Valley outfall.

Between 1933 and the end of World War II, the District concerned itself with inspection of septic tank installations. With increasing development following the war, the Sanitary Board undertook the installation of sewers in the District. In 1948 the District sold bonds and, with the assistance of a State grant, a contract was awarded to construct sewers which now form the major part of the present sewer system. Similarly, the City of Mill Valley constructed a new trunk line and outfall system in 1946, a pumping station in 1948 and the initial stage of the present sewage treatment plant in 1952.

In order to dispose of the sewage from Homestead Valley, the Sanitary District negotiated a contract with Mill Valley which granted the District a license to use the City's system. The capital and operating costs of the Mill Valley treatment plant are allocated on the basis of the respective assessed valuations of the two agencies. In 1958 the Mill Valley treatment plant was expanded to its present capacity which now provides secondary treatment for 1.6 million gallons per day discharging the effluent to the upper end of Richardson Bay.

Scope of the Present Studies

The basic purpose of the present study is to document the existing condition of the Homestead Valley sewer system, particularly under wet weather conditions. This documentation is to provide a basis on which to evaluate the Homestead Valley sewer system in relation to the Mill Valley sewer system and to provide a reference on which to plan system improvements.

Specifically, the present study has been directed to the following basic subject areas:

1. Collection and analysis of available basic data with respect to the sewer system layout, topography and present development within the District.

2. Development of expected waste volumes under both dry weather and wet weather conditions for various sewerage service areas within the District.

3. Measurement and observation of actual flow experienced during maximum wet weather flow conditions.

4. Comparison of flow measurements within the District system with rainfall and flows actually recorded at the Mill Valley treatment plant.

5. Presentation of a report summarizing our findings and conclusions.

It was originally contemplated that smoke testing of the sewers in a few selected areas would be included as part of this report. However, considering the small size of the total District, a complete smoke testing program can be

performed at rather low cost and will be recommended as a first stage of the system upgrading. In anticipation of this program, the District has already adopted ordinances which permit the District to require property owners to correct deficiencies in individual laterals which may be found during a smoke testing program.

CHAPTER 2

SEWERAGE SYSTEM STUDIES AND ANALYSIS

General

To analyze and evaluate the District's sewer system, a comparison must be made between the calculated flow based on accepted design criteria and the flow actually measured during wet weather. The relation of measured wet weather flows to similar data developed for other systems provides a good indication of the relative condition of the District's sewers.

A basic consideration of this study has been the establishment of design criteria on which to evaluate the District's sewer system. Design criteria have been developed taking into consideration the size and topography of the area served, present and future land use, estimates of population and waste volumes to be expected.

Actual measurements were made of flows experienced during several storms in early 1970. These flows represent the peak wet weather flows experienced within the District and contain storm waters which have infiltrated to the sewers through defective pipelines or through direct storm drainage connections.

The following two studies have been used in developing and evaluating the data for the District's sewer system and are referred to in the text:

1. Bala and Strandgaard, "Mill Valley Master Plan for Sanitary Sewers," 1968.

2. Brown and Caldwell, "Sewerage Study, County of Marin," 1967.

Area Served

The Homestead Valley Sanitary District serves the watershed generally known as Homestead Valley located south and west of the City of Mill Valley. The entire watershed comprises about 620 acres, of which 450 acres are included within the Sanitary District boundaries (See Figure 1).

Undeveloped lands suitable for future service by the District generally lie on the ridges to the south and west of the valley mostly within the area known as the Dias Ranch.

TABLE 1

HOMESTEAD VALLEY SANITARY DISTRICT
ASSESSED VALUATION AND CONNECTED LIVING UNITS

FISCAL YEAR	ASSESSED VALUATION	CONNECTED LIVING UNITS (approx.)
1956-57	1,441,680	535
1957-58	1,525,968	558
1958-59	1,876,590	580
1959-60	1,953,500	595
1960-61	2,340,900	627
1961-62	2,423,440	651
1962-63	2,576,790	673
1963-64	2,729,410	718
1964-65	3,832,160	756
1965-66	4,052,740	779
1966-67	4,182,190	795
1967-68	5,046,048	805
1968-69	5,111,130	849
1969-70	5,176,073	856

The assessed valuation of the District and estimated connected living units for the last fourteen years are tabulated in Table 1.

Land Use

Prior to preparation of population estimates, available data regarding zoning and land use was compiled in order to make a projection of anticipated population density at the time of ultimate development of the service areas.

Generally, the Homestead Valley area is zoned for single family residential development and it is not expected to develop in any other manner except perhaps on the Dias Ranch. The Dias Ranch, on the other hand, is zoned for Planned Community which does not specify allowable density. For the purposes of this report, it is assumed that the population density would not exceed twelve persons per acre.

Curiously, the portion of the Dias Ranch lying within the Homestead Valley drainage area has now been annexed to the Tamalpais Valley Community Services District which only provides sewer service within the adjacent watershed to the south. Such a situation indicates a failure on the part of the Local Agencies Formation Commission to recognize the principles of sound sewer system planning and will very likely lead to serious complications when the area is finally developed.

In attempting to project populations from land use criteria it should be noted that Planning Commissions often rezone areas for multiple or higher densities without consulting the agencies involved with providing basic services. The possibility of higher densities makes it necessary to periodically re-evaluate the adequacy of District facilities to handle additional flows.

In developing population projections, it should be emphasized that, whereas population and/or density projections contained in this report may vary somewhat from planning projections, it is not the intention to promote or encourage higher population densities but rather to try to anticipate such forseeable occurrences in order that the District is more fully prepared to meet the demands of the future.

TABLE 2

PROJECTED POPULATION AND
WASTE FLOWS FROM SEWERAGE
SERVICE AREAS

Service Area Desig.	Area in Acres	Projected Population	ADWF mgd	Peak Factor	Excess Infil.	PWWF mgd
HV-1	55	550	0.044		0.24	
HV-2	20	200	0.016		0.09	
HV-3	26	310	0.025		0.11	
HV-4	49	390	0.031		0.21	
HV-5	161	1610	0.129		0.46	
HV-6	84	840	0.067		0.25	
HV-7	134	1340	0.107		0.34	
HV-8	20	200	0.013		0.09	
HV-9	37	300	0.024		0.16	
HV-10	33	260	0.021		0.14	
TOTALS	619	6000	0.477	1.9	2.09	3.00

Design Criteria:

Daily Per Capita Flow 80 gpcd
People per Single Family Unit = 3.5

Infiltration Rate
Existing System = 4300 gad
Future Systems = 1000 gad

ADWF = Average Dry Weather Flow
PWWF = Peak Wet Weather Flow
mgd = million gallons per day
gpcd = gallons per capita per day
gad = gallons per acre per day

Population Projections

Based on the estimated number of connections in the District as given in Table 1, the present population is estimated to be about 3,000 assuming 3.5 persons per living unit connection.

From an analysis of the planned and anticipated land development, the projected ultimate population of the overall service area of the District is estimated to be about 6,000 people.

In arriving at this projection, the Homestead Valley watershed was divided into sub-areas. The sub-areas are delineated on the map of the "Sewer System and Sewerage Service Areas" (Figure 1) and a detailed tabulation of the service areas, population projections and associated waste volumes is given in Table 2.

It is difficult to estimate when the District will approach its ultimate population. However, the single most significant contribution to a population increase will be the development of the Dias Ranch.

Waste Volumes

To establish a basis on which to compare the average dry weather flows to peak wet weather flows, an estimate must be made of the per capita waste contribution.

In developing the average dry weather per capita waste flow to be used as basic design criteria for the Homestead Valley system, a flow contribution of 80 gallons per capita per day (gpcd) was arrived at by comparing Mill Valley's present average dry weather flow of 1.42 million gallons per day (mgd) to the estimated population served of 18,000. This flow rate is consistent with flow projections for other areas of Marin County which averages 70 to 80 per cent of the estimated 103 gpcd water consumption rate.

It should be noted that in the 1968 "Mill Valley Master Plan for Sanitary Sewers" the present flow rate was estimated to be 60 gpcd and proposed a rate of 80 gpcd with ultimate development. The 1967 Marin County Study tabulated all the flows for the County and found the present usage averages 79 gpcd but used the value of 100 gpcd for system design.

SEWERAGE SYSTEM STUDIES AND ANALYSIS

Since the Homestead Valley is very similar in nature to other residential areas of Marin County, the per capita flow contribution of 80 gpcd was considered a reasonable estimate of average dry weather flows to be expected within the system.

Peak Dry Weather Flows

Peak flows are experienced daily during dry weather and are caused by varying hourly rates of flow in the sewers as a result of water usage and by changes in pipe storage with changes in flow. In this regard a sewer system should be considered an underground watershed. Accordingly, a smaller watershed will have quick response to peak demands on the system and a larger system will have a slower response. Thus, the ratio of maximum to average flows is greater for small populations served and decreases as the tributary areas and number of persons increase.

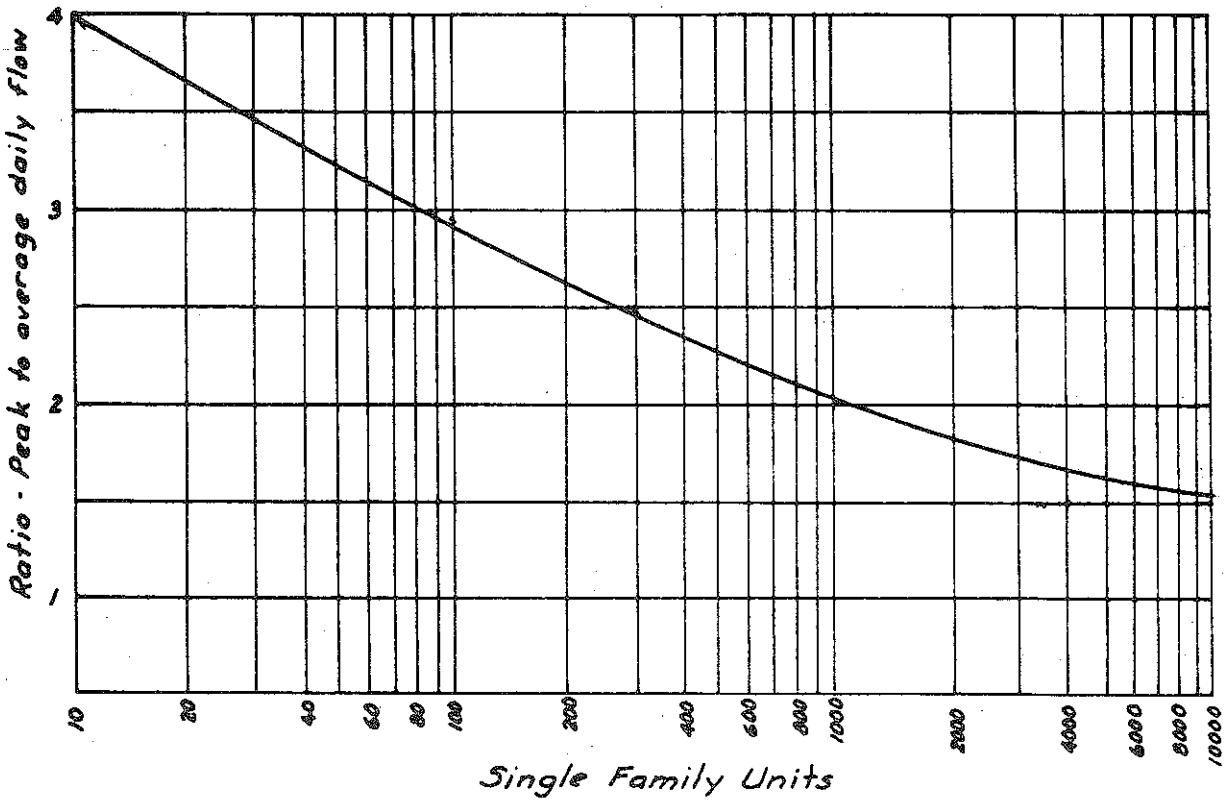
The ratio of peak dry weather flow to average flow has been projected in the 1968 "Mill Valley Master Plan for Sanitary Sewers" and is shown in Figure 2. Although other slightly different curves have been developed elsewhere, it is recommended that Figure 2 be accepted in order to analyze the Homestead Valley District system on the same basis as the Mill Valley system. Using this curve, with about 856 single family residences in the District, the dry weather peak factor is 2.1. Thus, with about 3,000 people in the District at 80 gpcd and a peak factor of 2.1, the peak dry weather flow is projected to be 0.50 mgd. This peak flow will usually be experienced between 8 and 10 in the morning.

Storm Water Infiltration

Storm water infiltration is of major importance in the hydraulic design of sewers, pumping stations and treatment facilities since this must provide for the maximum or extreme peak flows to be expected in the system. Storm water infiltration to the sewers usually comes from two sources, ground water infiltration and direct inflow. Ground water infiltrates to the sewers through broken or defective pipe joints in the older sewers and broken and defective house laterals. The direct inflow is storm water which enters the sewers through patio drains, open cleanouts, roof leaders illegally connected to the sewers and through manholes or rod holes in poorly drained and unimproved street areas that become

FIGURE 2

RATIO OF PEAK FLOW TO AVERAGE DAILY FLOW



People per Single Family Unit = 3.5

inundated. During heavy storms, water also enters directly through defective sewer pipe and particularly house laterals which are relatively shallow.

For the purposes of analysis and design, the storm water infiltration component of flow is measured in gallons per acre per day (gad). Accordingly, the peak wet weather flow (PWWF) is the combination of the peak dry weather flow and the storm water infiltration factor applied to the tributary area.

As a general rule, the storm water infiltration component of flow usually averages about 1000 gad for new systems and up to 5000 gad for older systems. The infiltration rates of

some very deteriorated sewer systems mostly in bay mud areas such as Kay Park and Gallinas Village are reported to be as high as 9500 gad.

The 1968 "Mill Valley Master Plan for Sanitary Sewers" reports the storm inflow for Mill Valley as 700 gallons per capita per day (gpcd) which with 12,000 people amounts to about 2800 gallons per acre per day over the entire 3044 acres of the Mill Valley watershed. This is low, however, since about 1800 acres in the watershed are developed. Using 700 gpcd for the Mill Valley area, this storm water inflow amounts to about 4700 gad. Obviously, certain areas of the City will have higher inflow rates and the 4700 gad should be considered an average value. The 1967 "Sewerage Study, County of Marin" gives the storm water infiltration rate in Mill Valley as about 5000 gad, which is typical of high infiltration rates of older sewer systems.

Peak Flow Measurements

The main purpose of the present study was to make a determination as to the magnitude of the peak flows experienced in the District sewer system. Measurements were made of the sewage flow in the 10" sewer line in Evergreen Avenue. This sewer line serves about 83 per cent of the District, and flows should be fairly representative of conditions in the entire District sewer system.

In January of 1970 a flow meter was installed in the manhole at Evergreen and Lillian Lane. However, the flow meter had to be removed to avoid damage prior to the severe storms of January 15 and January 21, 1970 which surcharged the sewer line almost to the top of the manholes.

Even though the flow meter could not be used during these particular storms, the surcharged sewers provided an excellent method of measuring peak flows. By measuring elevations of the surcharge level in the manholes along Evergreen Avenue, the flow was calculated from tables of flow rates in a 10" pipe under pressure.

Accordingly, the highest surcharge levels occurred about 8 A.M. on January 21, 1970, during the most severe storm of the season, which caused extensive flooding along Miller Avenue. Although the water level in the surcharged sewers nearly reached the top of the manholes, the only two manholes

in the District which overflowed were on Ethel Avenue one block from Miller Avenue. The main reason for these two overflows and the extreme height of the water in the District's line was the fact that the City of Mill Valley's sewer was full and most of the manholes on Miller Avenue were overflowing.

Measurements of the surcharge levels taken on January 21, 1970 along Evergreen Avenue showed that the highest level, as indicated by the grease on the side of the manhole, showed the District's sewer was carrying a peak flow of 1400 gallons per minute (gpm) or 2.00 million gallons per day (mgd). Later measurements showed that the maximum flow rate was of relatively short duration dropping less than 1200 gpm one hour after the rain stopped. The short duration of the peak flow in the District's relatively small watershed indicates that most of the water comes from direct storm water connections and from broken pipes or open joints which are relatively shallow. Both of these types of deficiencies are easily detected with a smoke testing program.

Assuming that the peak flow rate of 2.00 mgd coincided with the morning peak usage of the sewers, the per acre infiltration contribution was calculated from the criteria outlined previously. Accordingly, with approximately 2,500 people in the tributary area of 370 acres, 80 gpcd flow and a 2.1 peak factor, the theoretical peak dry weather flow should be 0.42 mgd. The difference between this flow and the peak wet weather flow of 2.00 mgd of 1.58 mgd represents an infiltration rate of 4300 gad.

The rainfall during the January 21 storm was 3.85 inches during the preceding 24-hour period. There was no way to measure the amount of flow the Mill Valley sewer system had received during this storm because control gates at the plant had been throttled to pass a maximum of 3.8 mgd through the plant, and most of the manholes in the lower part of the City's sewer system were overflowing. The infiltration rate of 4700 gad previously calculated for the City's system from data given in the 1968 "Mill Valley Master Plan for Sanitary Sewers" is the only guide available.

Although the District infiltration rate is not quite as high as that estimated for Mill Valley, it is unnecessarily high and should be mitigated through a systematic program of leak detection and correction.

SEWERAGE SYSTEM STUDIES AND ANALYSIS

Sewer System Evaluation

Besides computing the storm water inflow rates for the Homestead Valley sewer system, it is important to consider the system itself in order to appraise its condition as it relates to storm water infiltration.

The District's sewer system connects to the Mill Valley sewer system in three places: at Miller Avenue and Evergreen Avenue; at Miller Avenue and Reed Street; and at Miller Avenue east of Reed Street (See Figure 1). The sewer connecting at Evergreen and Miller is a 10" line which serves about 83 per cent of the present District. The other two connections are 6" lines serving the remainder of the District designated as HV-1 and HV-2 on Figure 1.

In so far as infiltration is concerned, it should be expected that the District's sewers will be in better condition than Mill Valley's sewers simply because they are not as old. Some sewers in Mill Valley, reportedly still in use, were constructed before 1900. In Homestead Valley almost all sewers were constructed as a part of the initial sewerage project in 1948.

The type of sewer pipe used in this initial project was vitrified clay with cement joints. Although the vitrified clay is a long lasting material, it is generally brittle and subject to damage from backfill loads and earth movement. Furthermore, cement pipe joints are subject to deterioration from corrosive action of the sewage. As the joints deteriorate, ground water and roots are allowed to enter the pipe. Roots not only plug the pipe and cause sewer stoppages but will also break the pipe as they grow. In this regard, an annual preventative maintenance program to clean sewers and cut the roots will help keep the sewers in good condition. It was not until the mid-1950's that better joint materials were developed for vitrified clay pipe and made possible the construction of relatively watertight sewers.

Since the District is hilly and many sewer lines are constructed in easements, roots entering the sewers have undoubtedly broken many pipes. House laterals are probably in similar condition and provide a major source of infiltration to the sewer system.

Direct connections of roof leaders and patio drains is not anticipated to be a major problem. The District staff has

in the past surveyed roof leaders and reported very few connected to the sewers. Since topography of the area served by the District provides good drainage, there should be little temptation for people to connect patio drains to the sanitary sewers. No information is available on possible street storm drains which may be connected to the sewers. A smoke testing program is well advised as it would reveal almost all direct storm drain connections as well as broken and defective sewers and house laterals.

Based on an infiltration rate of 4300 gad derived from the above analysis, the total peak flow expected from the fully developed District, providing nothing is done to mitigate the infiltration, is estimated to be 3.00 mgd (See Table 2). Infiltration from Service Zones HV-5, HV-6 and HV-7 was calculated using a factor of 4300 gad for the sewered areas and 1000 gad for undeveloped areas.

In general, if no infiltration mitigation measures are undertaken, the existing District sewer system will not be capable of handling the peak wet weather flows from the fully developed District. Peak flows from the existing development would probably be totally contained, even though the sewers are surcharged, providing the City's sewer on Miller Avenue does not surcharge.

Infiltration Mitigation

Since the District's sewer system evidences a high infiltration rate it is advisable that the storm water inflow be reduced. Not only would this decrease the District's peak wet weather flow contribution to Mill Valley's already overtaxed sewers, but it would also reduce the likelihood of stoppages, overflowing manholes, and bypassing within the District's own system. Furthermore, the functional adequacy of any area-wide scheme for intercepting, pumping and treating sewage from the Richardson Bay watershed depends on a substantial reduction in excess storm water infiltration in all the contributing sewer systems.

One of the simplest methods of locating direct storm drain connections, leaks and broken sewer pipe is through a thorough smoke testing program. An innocuous white smoke is blown into a sewer manhole and will appear from illegal drainage connections and broken sewer pipe. Breaks in shallow sewers such as house laterals are readily found. Once

obvious leaks are found, efforts should be made to correct the deficiencies, otherwise the leak detection is only of academic interest.

When severe leaks are located in the District mains, the lines should be televised and sealed or replaced where necessary. Leaks in manholes are easily repaired and can be readily located when ground water levels are high. Leaks in sewer mains are, of course, the District's responsibility to repair. However, leaks in private laterals must be corrected by the property owner.

Line sealing programs for sewer mains are difficult and expensive. Furthermore, the results with present sealing methods are questionable. If the backfill around the sewer pipes is granular, it is possible to seal the joints with a bituminous compound injected from the surface. In most cases, however, pipes must be sealed from the inside with a cement grout or a two component plastic compound applied under pressure. A line sealing program is recommended only as a last resort if the infiltration rate remains high after a thorough smoke testing and repair program has been completed.

Although replacement of large portions of the sewer system would be exorbitantly costly, it is recommended that sewer lines in very poor condition be replaced with better pipe material. The District should insist that all new sewer mains and house laterals be constructed with the best pipe and joint materials available and be watertight. In addition, preventative measures such as inspection and hydrostatic or air tests for leakage should become routine for new sewer lines and new house lateral construction so that future infiltration rates can be kept to a minimum.

With a knowledge of the present infiltration rate, the overall effectiveness of an infiltration mitigation program can be measured during severe storms by the same method as used in these studies. It should be pointed out, however, that even after smoke testing and possibly line sealing, the infiltration rate may still be well above the 1000 gallons per acre per day (gad) rate which can be expected for new systems.

Of perplexing interest, it should be noted that the 1968 "Mill Valley Master Plan for Sanitary Sewers" concluded that it would be realistic to expect to reduce storm water intake

to the sewers to 100 per cent of the projected domestic flow. With a density of 10 people per acre this amounts to less than the 1000 gad rate found in new systems. We do not expect that such a low infiltration rate is obtainable with the present methods of infiltration mitigation and without rebuilding the entire sewer and house lateral system.

Summary

Essentially, the purpose of the studies summarized herein has been to investigate and analyze the Homestead Valley sewer system, to document the magnitude of the peak wet weather flows experienced and to provide a basis for comparing the conditions existing in the system with that of the Mill Valley sewer system.

Accordingly, the analysis of the District's sewer system has yielded the following flow criteria:

Per capita sewage contribution	80 gpcd
Per acre storm water infiltration rate	4300 gad
Peak Factor	Per Figure 2

The following are estimates of population and flow conditions for the existing District system and the fully developed District service area using the above flow criteria:

	Present	Ultimate
Population	3000	6000
Average Dry Weather Flow mgd	0.24	0.48
Peak Dry Weather Flow mgd	0.50	0.90
Peak Wet Weather Flow mgd	2.43	3.00

If an infiltration mitigation program is undertaken, it is possible to obtain a substantial reduction in the storm water infiltration rate and the peak wet weather flows which presently cause surcharging of the system.

CHAPTER 3

CONCLUSIONS AND RECOMMENDATIONS

General

The general objective of the present study has been to analyze and evaluate the District's sewer system, particularly with respect to the amount of storm water infiltration entering the system. Documentation of the wet weather flows experienced provides a basis on which to evaluate the condition of the District's sewer system and provide a reference on which to plan system improvements.

Conclusions

Based on the general objectives outlined above and considerations previously summarized, the following conclusions are made:

1. It is concluded that the per capita flow contribution is approximately 80 gallons per day.

2. It is concluded that the storm water infiltration rate to the existing sewer system is approximately 4300 gallons per acre per day.

3. It is concluded that a preventative maintenance program and a smoke testing program would substantially reduce this infiltration rate.

4. It is concluded that the functional adequacy of any sewage treatment and disposal system depends on the reduction of storm water inflow to the sewer systems.

Recommendations

Based on the foregoing conclusions and considerations previously summarized, the following recommendations are presented:

1. It is recommended that the District establish an annual preventative maintenance program of line cleaning and root removal.

2. It is recommended that as a first stage of sewer system improvements the District undertake a program

of smoke testing, the repairing of faulty sewers and the elimination of sources of direct storm water inflow to the system.

3. It is recommended that after the smoke testing and sewer correction program is completed, the peak wet weather flows be again measured to determine the effectiveness of the corrective work performed and the necessity for further system improvements.

Acknowledgments

For their interest and helpful cooperation, we wish to express our appreciation to the District Board, including Gus Wolfe and Jim MacNichols; and to Mr. Philip B. Lygren, now deceased.

SCHULTE

(PRELIMINARY DRAFT)

NORTH MARIN - SOUTH SONOMA
CENTRAL MARIN
SOUTH MARIN

WASTEWATER MANAGEMENT PROGRAMS

OVERVIEW REPORT
INCLUDING
ENVIRONMENTAL IMPACT EVALUATION
OF
REGIONAL, AREA-WIDE ALTERNATIVES

NOVEMBER 1973

J. WARREN NUTE, INC. / JENKS & ADAMSON
YODER-TROTTER-ORLOB & ASSOCIATES

P R E F A C E

This document has been prepared for the purpose of assisting the responsible local sewering agencies and affected public within North Marin/South Sonoma, Central Marin and South Marin County areas, in reaching final decisions as to the Alternative Water Quality Management Program best suited to meeting of combined, regional needs.

OVERVIEW REPORT
Including
ENVIRONMENTAL IMPACT EVALUATION
of
REGIONAL, AREA-WIDE ALTERNATIVES

S U M M A R Y

PREPARED FOR — Wastewater Planning Coordinating Committee

PARTICIPATING AGENCIES

North Marin/South Sonoma Subregion

- Novato Sanitary District
- County of Sonoma
- Sonoma Valley County Sanitation District
- City of Petaluma
- Hamilton Air Force Base
- Las Gallinas Valley Sanitary District
- San Rafael Sanitation District

Central Marin Subregion

- San Rafael Sanitation District
- Sanitary District No. 1 of Marin County
- California State Prison at San Quentin

South Marin Subregion

- City of Mill Valley
- Richardson Bay Sanitary District
- Sanitary District No. 5 of Marin County
- City of Belvedere
- Sausalito-Marin City Sanitary District
- Homestead Valley Sanitary District
- Almonte Sanitary District
- Alto Sanitary District
- Tampalpais County Sanitary District

PREPARED BY — Jenks & Adamson; J. Warren Nute, Inc.; and Yoder-Trotter-Orlob & Associates

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Introduction

- Three subregional Water Quality Management Program studies and reports have been completed on behalf of 25 local sewering agencies within, (1) North Marin/South Sonoma Counties, (2) Central Marin County, and (3) South Marin County.

- The separate subregional studies were performed pursuant to and in accordance with requirements of the State Regional Water Quality Control Board, San Francisco Bay Region.

- The separate subregional studies were performed by two consortiums of the same engineering firms who provided the important coordination between the studies.

- The separate subregional studies all considered essentially the same alternatives for regional consolidations and are in common agreement as to the best apparent regional program.

- The best apparent regional program, covering the entire three subregional areas, Alternative Program A, involves reducing the number of treatment plants from 15 to 4 and the number of points for discharges from 15 to 2.

- In order to provide a summary of the separate subregional study results in respect to alternatives and to establish a fuller evaluation of regional alternatives, an Overview Report has been prepared.

- Further, the Overview Report was mandated by the San Francisco Bay Regional Water Quality Control Board as a condition of State and Federal grant application approval.

Background

- The three separate subregional studies were performed and reported upon by the engineering firms of J. Warren Nute, Inc., Jenks & Adamson and Yoder-Trotter-Orlob & Associates.

- The three separate subregions cover essentially the entire Marin and South Sonoma County lands which normally drain to the waters of San Francisco and San Pablo Bays. The subregions are separated by natural topographic boundaries.

- Within the separate subregions there are a combined total of 25 sewering agencies serving a total population of about 157,000, contributing 20 million gallons per day combined sewage flow to 15 treatment plants with 15 separate points of near-shore disposal.

- With the possible exception of the San Rafael Sanitation District Marin Bay facility, none of the wastewater dischargers within the subregional areas are meeting all requirements and objectives of the State.

Projections

- Projections have been established based on a "Low," "Median" and High level of development with the median projections utilized for present planning purposes.

- Median projections for the combined three subregional service areas suggest a future year 2000 population of 589,410, with associated wastewater volume of 56.8 million gallons per day. The low projections indicate a year 2000 population of 426,000, which figure is consistent with the controlled groth projections by the various responsible planning agencies.

- It is noted that the Alternative Programs were later tested in respect to fundamental changes in assumed population and wastewater volume projections and were found to be insensitive to those changes.

Objectives

- Program objectives were established and utilized based upon State and Federal water quality objectives.

- Program objectives are essentially the same for each of the three subregional studies.

- In respect to treatment and disposal, Program objectives call for at least full secondary treatment, together with central Bay discharge.

- Mathematical modelling established that objectives could be met through discharge of treated wastewater offshore from either or both Point San Quentin and Point San Pedro.

- In respect to reclamation, it was established that this common objective will be realized to best advantage through developing a program of large-scale reclamation in the South Sonoma County area, phased to include elements for a recreation lake, agriculture irrigation, landscape irrigation and ultimately, direct potable water supply supplement.

- Uncertainties in respect to the economics of large-scale reclamation at present result in questions relating to the time this objective can be fully achieved.

Regional Alternatives

- Of the some 54 regional and subregional alternatives considered as part of the combined subregional studies, 4 regional final candidate alternatives have been identified as Alternative Programs "A", "B", "C" and "D" for evaluation.

  Alternative A would involve consolidations resulting in four treatment plants and two points of disposal.

  Alternative B would involve consolidations resulting in three treatment plants and one point of disposal.

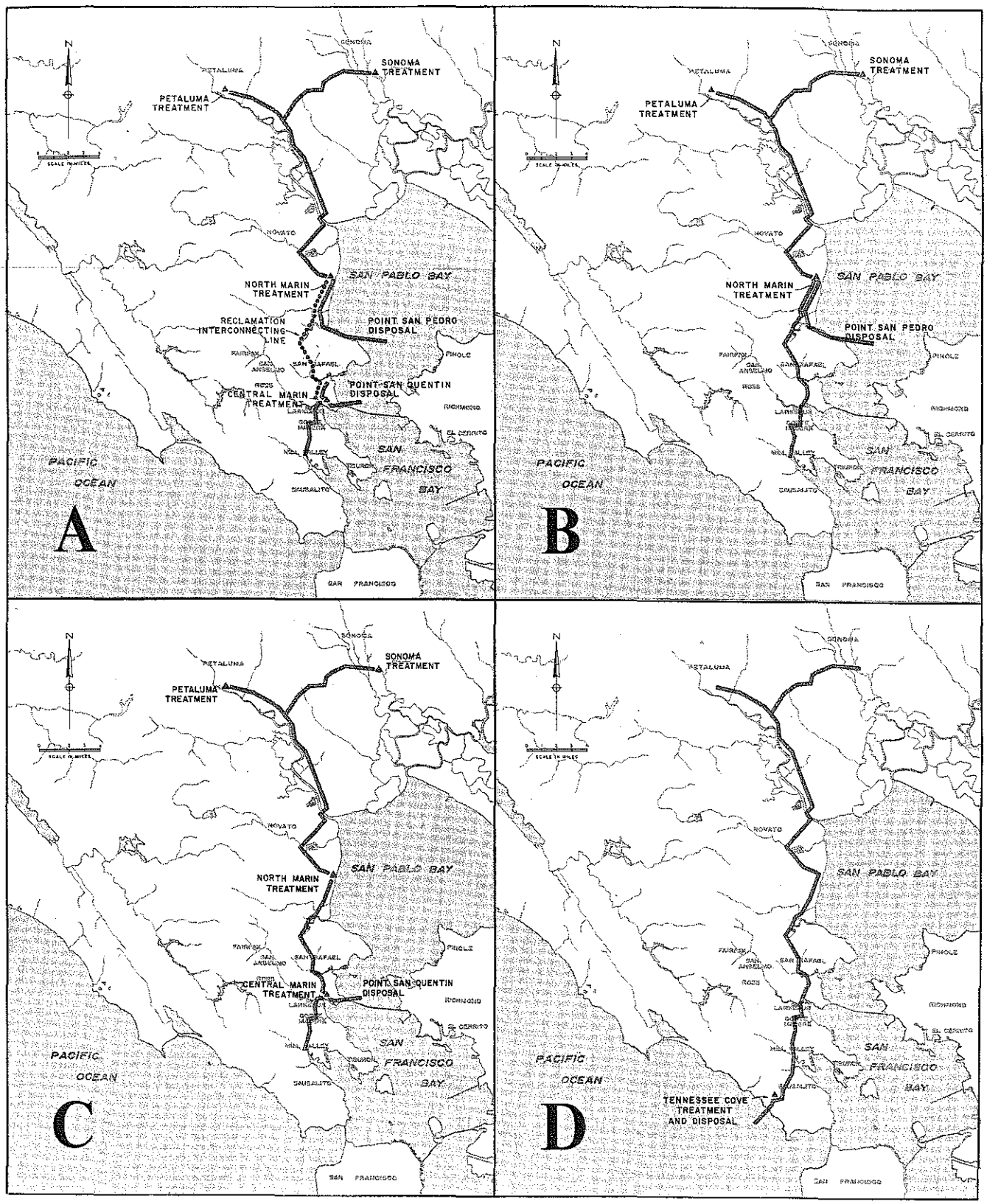
  Alternative C would involve consolidations resulting in four treatment plants and one point of disposal.

  Alternative D would involve consolidations resulting in one treatment plant and one point of disposal (Pacific Ocean).

- Alternative Programs A, B and C would accommodate the same long-range program for large-scale reclamation.

- Alternative Program B would limit possibilities of local reclamation in the Central and South Marin areas and Alternative D would essentially eliminate possibilities for reclamation.

- The evaluation of Alternatives provided as part of the three separate subregional studies indicated that on the combined basis of economic and non-economic factors utilized for comparison, Alternative Program A is the best apparent means of meeting objectives.



REGIONAL ALTERNATIVE PROGRAMS

Additional Evaluation

- Alternative D, the total consolidation for ocean disposal Alternative, was eliminated as a candidate Alternative because of, (1) excessive costs, (2) lack of reclamation potential, and (3) negative environmental impact.

- Alternative Programs were subjected to further evaluation on the basis of economics and effectiveness within the framework of different potential Program sequencing, or staging.

  It was found that sequencing changes did not basically alter the economic ranking of Alternative Programs.

  It was found that in consideration of numerous factors related to, (1) environmental, (2) resource utilization, (3) flexibility, (4) reliability, (5) planning objectives, and (6) implementation, Alternative Programs A and C are preferred over Alternative B.

- Alternative Programs were subjected to sensitivity analysis in respect to costs, including cost impact of, (1) reducing "excessive" infiltration/inflow, (2) O and M versus Capital cost refinement, and (3) plant site relocation.

  It was found that potential cost sensitivity factors do not basically alter the ranking of Alternative Programs.

- The Alternative Programs were subjected to sensitivity analysis in respect to effectiveness factors, including relative impacts on, (1) overall environmental impact, (2) resource utilization, (3) flexibility in respect to reclamation and changed requirements, and (4) reliability.

  It was found that sensitivity factors in respect to effectiveness do not basically alter the ranking of Alternative Programs.

- Alternative Programs were subjected to sensitivity analysis in respect to meeting of the reclamation objectives, including, (1) timing of large-scale reuse market, (2) recreation lake possibilities, and (3) "zero" discharge.

  It was found that Alternative Programs A and C offer the greatest amount of flexibility in respect to providing means of meeting combined, limited local reuse market, while Alternative Programs B and C could enhance the early possibilities of large-scale wastewater reuse.

- Alternative Programs were subjected to sensitivity evaluation in respect to other factors, specifically public acceptance.

  It was found that additional evaluation of the factor of public acceptance does not basically alter the ranking of Alternative Programs.

- A re-evaluation of the economics related to Alternative Programs was undertaken on the basis of utilizing most recently prescribed Federal cost/effectiveness analysis criteria.

  The re-evaluation of economics indicated a somewhat wider spread between Alternatives with Alternative Program A being the least costly, followed by Alternatives C and B in that order, with Alternative B being 20% more costly and Alternative C being 10% more costly than A on a Present Worth basis.

Environmental Impact

- A detailed environmental impact report has been prepared as part of a separate study.
- That portion of the environmental impact report dealing with the impacts of Alternative Programs has been excerpted and included verbatim in the Overview Report.
- The environmental impact report identifies both construction and long-term impacts related to each Alternative Program.
- Secondary impact of Alternative Programs, including growth inducing potential are also considered.
- The environmental and economic impacts associated with different Alternative Program sequencing has also been evaluated.
- It was found that changing the implementation sequencing did not basically alter the ranking of Alternative Programs.
- It was found that the most significant differences in negative impacts related to construction of a Point San Pedro outfall line and the larger interconnecting line of Alternatives B and C.
- It was suggested by State Fish & Game and State Department of Public Health Staff that as a matter of principle, concentrating the larger volume of wastewater discharge closer to the Golden Gate, offshore from Point San Quentin, as under Alternative Program C, was more desirable.
- It was suggested that meeting of most stringent water quality objectives related to shellfish beds could be met to greater advanatage by a single Point San Quentin discharge.
- It was agreed that from the overall standpoint of achieving water quality objectives, no Alternative Program is clearly more advantageous.
- While the differences on a combined, overall basis do not appear to be major, the evaluation of combined environmental impacts indicate a preference for Alternative Programs C and A over B.

Combined Evaluation

- Combining the results of the separate economic, effectiveness and environmental impact evaluations of Alternative Programs set forth in the Overview Report results in the summary found in Table 13.
- Assuming that the economic advantage of Alternative Program A outweighs in importance the less tangible, somewhat more advantageous environmental and "effectiveness" advantages of Alternative Program C, then Alternative Program A remains the best apparent Alternative.

Table of Contents

I N T R O D U C T I O N

Because of the evident needs to do so, coupled with specific requirements of the San Francisco Bay Regional Water Quality Control Board, three separate subregional Water Quality Management Programs have been developed during the past three years, covering the entire South Marin, Central Marin and North Marin/South Sonoma County areas, which naturally drain to the waters of San Francisco Bay.

The three separate subregional Study efforts were undertaken through cooperation of 25 separate sewering agencies served by 15 separate existing wastewater treatment plants. The three separate Studies were performed by two different consortiums of the same engineering firms, thus affording excellent opportunity of coordinated study efforts between the contiguous subregional areas and, in particular, in respect to consideration of Alternative Programs on an entire, area-wide, regional basis. A total of 54 Alternatives within the combined study areas were evaluated, including 4 Alternatives involving consolidations covering all three subregional areas.

The three separate engineering Studies are consistent with each other in respect to final Water Quality Management Program recommendations, recommendations which call for major physical facility consolidations, both within each subregional area and, in the case of the South Marin subregion, consolidation for joint treatment and disposal with the Central Marin subregion. The recommended combined Program would result in reducing the total number of existing treatment plants, 15 to 4 and points of discharge from 15 to 2.

Coordinating Committee

While each of the three separate Studies did include an independent evaluation of the consolidation Alternatives involving combined facilities serving the three subregional areas, it has been agreed that a need exists to summarize this area of evaluation in a single, "overview" document. To work towards fulfilling this objective,

the Wastewater Planning Coordinating Committee - Marin/South Sonoma Counties was established during December of 1972, with representatives from each of the subregional areas, plus representatives from the two major water districts serving the combined area, and County representatives.

The Coordinating Committee has met since January 1973 and during this time has undertaken a systematic review of the basic factors relating to Water Quality Management Program needs of the combined subregional areas. In particular, the Coordinating Committee has studied the four basic Alternative Programs, including the recommended Program, all involving various degrees of consolidation and coordination within and between the three subregions.

Regional Water Quality Control Board Resolution No. 73-12

On June 26, 1973, the San Francisco Bay Regional Water Quality Control Board passed their Resolution No. 73-12, "Regarding Marin/Sonoma Subregional Studies Coordination," a copy of which Resolution is appended hereto.

The action of the Regional Water Quality Control Board established the following points of special significance:

XIII. THEREFORE, BE IT RESOLVED, that this Regional Board commends the efforts of the Wastewater Planning Coordinating Committee.

XIV. BE IT FURTHER RESOLVED, that this Regional Board finds that full evaluation of alternatives involving consolidation of subregional facilities will be necessary prior to any grant certification by the Regional Board.

XV. BE IT FURTHER RESOLVED, that this Regional Board finds that, in order to assure this evaluation, any project report submitted by the three subregions for facilities for the subregional programs must be accompanied by an "overview" report and environmental impact statement which fully evaluates the consolidation alternatives.

Purpose of Present Study

Essentially, the purpose of the study summarized hereinafter has been to fulfill the need for an "overview" report as further required by the Regional Water Quality Control Board in addition to the established Project Reports as a condition for grant approvals.

To assist in achieving the present study purpose, as reported upon hereinafter, the following basic areas of previous specific study have been summarized.

- BACKGROUND information describing the combined, three subregional study areas geographically and summarizing existing conditions.
- PROJECTIONS of wastewater volume and other characteristics for the combined, three subregional study areas, on the basis of which anticipated future facility needs are assumed.
- OBJECTIVES in respect to meeting of receiving water quality objectives as well as consideration of reclamation for purposes of beneficial reuse.
- REGIONAL ALTERNATIVES for meeting of Objectives are defined and evaluated, centering on the basic Alternatives for consolidations covering the combined, three subregional study areas.

Following the foregoing summary of previous study results, subsequent studies provided to the Coordinating Committee have been summarized, also centering on:

- ENVIRONMENTAL IMPACT of the Alternative Programs from recently completed draft of final EIR.
- ADDITIONAL EVALUATION of regional Alternative Programs to provide more thorough basis upon which final decisions can be made in respect to best Program Alternative implementation.
- COMBINED EVALUATION of Alternative Programs summarizing the result of evaluations of the economics, effectiveness and environmental impacts of Alternatives.

It is important to note that the studies summarized hereinafter are not meant to take the place of the prior three separate subregional studies, nor to develop new information beyond that already provided. Nor is the present report meant to obviate the need for the required Project Report(s). Thus, with the exception of that section concerning the Additional Evaluation, the information provided herein is primarily a concise, limited synopsis of the information previously developed and set forth comprehensively in the three separated subregional studies, which are incorporated herein and herewith by reference.

BACKGROUND

B A C K G R O U N D

Subregional Studies

The pertinent three separate subregional Water Quality Management Program studes are referenced as follows:

Regional Water Quality Management Program
North Marin-South Sonoma
Dated: December 1, 1972
J. Warren Nute, Inc./Jenks & Adamson/Yoder-Trotter-Orlob & Associates

A Water Quality Management Program for
Central Marin County
Dated: July 1972
Jenks & Adamson/J. Warren Nute, Inc.

Southern Marin Subregional Wastewater Management Plan
Dated: October 8, 1973
J. Warren Nute, Inc./Jenks & Adamson/Yoder-Trotter-Orlob & Associates

The foregoing studies contain a detailed and comprehensive summary of all background information leading to study recommendations and should be referred to as basic foundational resources, along with the "overview" presented herein.

Subregional Planning Area Characteristics

The three subregional study areas are shown geographically in Fig. 1.

The specific wastewater dischargers within each subregion and related contracting sewering agencies are summarized in Table 1.

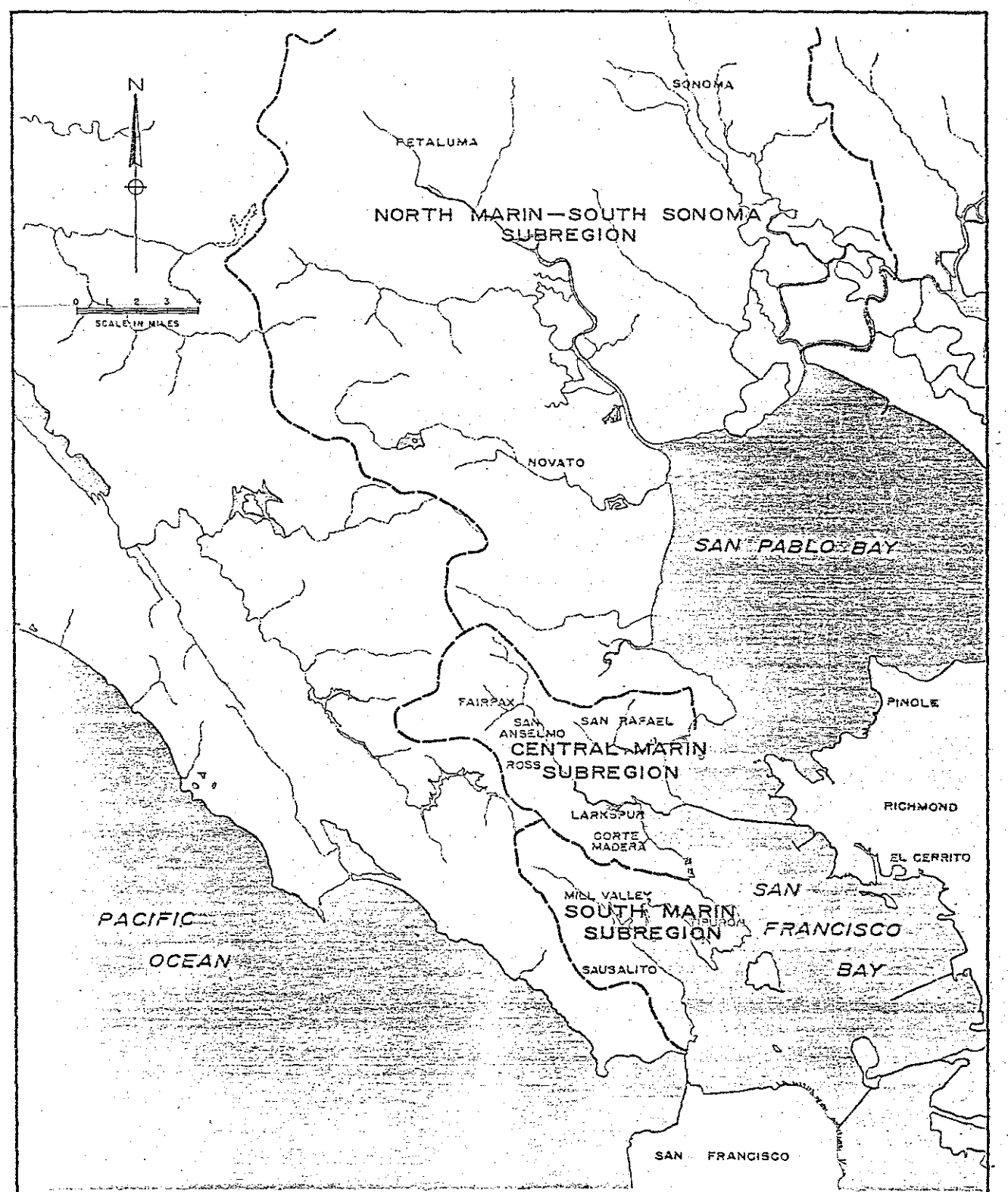


Fig. 1
~~FIGURE 7-1~~

MARIN - SONOMA SUBREGIONS

TABLE 1 Participants in Coordinated Marin/South Sonoma Counties - Subregional Water Quality Management Program Studies 1972/1973

Subregional Area	Dischargers	Contracting Agencies
SOUTHERN MARIN	Sausalito-Marin City Sanitary District	Tamalpais Valley Community Services District
	City of Mill Valley	Richardson Bay Sanitary District Homestead Valley Sanitary District Almonte Sanitary District Kay Park Sewer Maintenance District Alto Sanitary District
	Richardson Bay Sanitary District	
	Sanitary District No. 5	City of Belvedere
CENTRAL MARIN	Sanitary District No. 1	Corte Madera (S.D. No. 2) City of Larkspur Murray Park Sewer Maintenance District
	San Rafael Sanitation District (Main Plant)	
	San Quentin	San Quentin Village Sewer Maintenance District
NORTH MARIN/SOUTH SONOMA	Novato Sanitary District (Novato, Ignacio, Bahia Plants)	Hamilton AFB (portion)
	Las Gallinas Valley Sanitary District	
	San Rafael Sanitation District (Marin Bay Plant)	
	Hamilton AFB	
	City of Petaluma	
	Sonoma Valley Sanitation District	

An additional summary of existing conditions within the subregional areas is presented in Table 2.

TABLE 2 Existing Conditions

Sub-Region	Present Population	Present Wastewater Plain Avg. dry-weather, mgd	Number of Sewering Agencies	Number of Treatment Plants
SOUTHERN MARIN	47,000	3.5	10	4
CENTRAL MARIN	92,000	7.8	7	3
NORTH MARIN/ SOUTH SONOMA	118,000	8.6	8	8
Totals	157,000	19.9	25	15

Present Wastewater Treatment & Disposal Practices

Wastewater treatment and disposal practices related to each of the wastewater dischargers within the three subregional study areas are summarized in Table 3.

Compliance with Existing Requirements

It is noted that all of the fifteen dischargers except two in the combined study areas provide a degree of wastewater treatment which is beyond "primary," and the two "primary" plant dischargers, Sausalito-Marin City S. D. and S. D. No. 5 of Marin County, dispose of treated effluent to deep water. However, with the advent of most recent waste discharge requirements based upon higher water quality objectives of the Interim Basin Plan, particularly in respect to limitations upon and prohibitions against shallow water discharge, none of the fifteen dischargers in the combined subregional study areas, with the possible exception of San Rafael S. D. Marin Bay are currently meeting discharge requirements and objectives. This condition of non-compliance with existing waste discharge requirements and objectives is, of course, by no means unique to the San Francisco Bay area or elsewhere. The determination of how best to correct the conditions of non-compliance and to meet anticipated still more stringent requirements and objectives in the future has constituted the primary motivation for the three subregional studies referenced herein.

'ABLE 3 Existing Wastewater Treatment & Disposal Facilities
/ithin Marin/Sonoma Subregional Study Areas

Subregional Area	Discharger	Degree of Treatment	Location of Disposal
SOUTHERN MARIN	Sanitary District No. 5 (Tiburon and Belvedere)	Primary	Deep Water Racoon Straights
	Richardson Bay S.D.	Secondary	Shallow Water Richardson Bay
	Mill Valley	Intermediate	Shallow Water Richardson Bay
	Sausalito-Marin City S.D.	Primary	Deep Water S. F. Bay
CENTRAL MARIN	San Rafael S. D. Main Plant	Intermediate	Shallow Water San Rafael Bay
	Sanitary District No. 1 (Ross Valley, Corte Madera, Larkspur)	Secondary	Shallow Water Corte Madera Creek
	San Quentin	Intermediate	Shallow Water Corte Madera Creek
NORTH MARIN/ SOUTH SONOMA	San Rafael S.D. Marin Bay Plant	Secondary	Submerged Discharge San Pablo Bay
	Novato S. D.		
	Novato Plant	Secondary	Shallow Water San Pablo Bay
	Ignacio Plant	Secondary	Shallow Water San Pablo Bay
	Bahia Plant	Secondary	Submerged Discharge Petaluma River
	Los Gallinas Valley S. D.	Intermediate	Slough to San Pablo Bay
	Hamilton AFB	Intermediate	Shallow Water San Pablo Bay
	Petaluma	Secondary	Submerged Discharge Petaluma River
	Sonoma S. D.	Secondary	Schell Slough to San Pablo Bay

PROJECTIONS

PROJECTIONS

Population & Wastewater Characteristics

It should be noted that during the intervening period of time, now totaling more than two years, during which the three subregional studies were being performed, a considerable amount of change has taken place in respect to basic land use planning and population projections. Basic planning policy objectives have been undergoing re-evaluation within all three subregional areas and are, at the time of this writing, still in a general state of flux.

Nevertheless, for purposes of present study and evaluation, the population projections developed, utilizing all planning data available and as specifically referenced in each of the subregional Water Quality Management Program studies, are considered sufficiently valid for purposes of Alternate Program evaluation, the fundamental purpose of the "overview" reported upon herein. In any case, as further noted, as part of the evaluation of Alternatives, the Alternates were tested in respect to sensitivity to fundamental changes in assumed population and wastewater volume projections. It is considered that this process adequately accounts for possible major changes in projections in respect to potential impact from such changes upon the evaluation of Alternatives.

The projections derived, as discussed above, covering a range of possible future populations and wastewater volumes, are summarized in Table 4.

TABLE 4 Projections

Do not agree with general plan.

	Population Projections- Year 2000			Wastewater Flow Projections- Year 2000 Avg. dry-weather, mgd		
	Low	Median	High	Low	Median	High
SOUTHERN MARIN	63,000	87,000	125,000	5.4	7.5	10.7
CENTRAL MARIN	110,000	127,000	140,000	11.7	13.2	14.8
NORTH MARIN/ SOUTH SONOMA	253,200	375,410	425,000	23.6	36.1	42.5
Totals	426,200	589,410	690,000	40.7	56.8	68.0

A summary of the combined subregional median value projections, utilized for purposes of predicting long-range needs within each major service area subdivision, and as utilized in the evaluation of Alternatives, are summarized in Table 5.

Local Planning Objectives

In developing the above projections, considerable effort was made to take into account local planning objectives. Specifically, many of the responsible planning agencies in Marin and Southern Sonoma County are considering the adoption of positive growth controls, thus reducing the historic rate of growth. In this regard, it should be noted that the low projections as given in Table 4 are generally slightly lower than the projected year 2000 populations if it is assumed that growth controls are implemented.

Although the projected wastewater management facilities were planned around the median population, they were found to be insensitive to the low population projections, primarily because of the need to provide large enough facilities to handle the higher sewage flows experienced during wet weather.

TABLE 5 Projected Regional Long-Range Needs for the Year 2000

Service Area	Median Population	ADWF mgd	PWWF mgd
SOUTHERN MARIN			
Tiburon and Belvedere	13,000	1.12	7.44
Richardson Bay Sanitary District	15,000	1.29	6.68
Mill Valley and Tributary Agencies	30,000	2.58	17.64
Tamalpais Valley	11,000	0.95	7.00
Sausalito-Marin City	18,000	1.55	8.35
SUBTOTAL SOUTHERN MARIN	87,000	7.48	43.92
CENTRAL MARIN			
San Rafael	44,000	4.89	27.06
Ross Valley	81,000	8.09	51.54
San Quentin	2,000	0.45	0.75
SUBTOTAL CENTRAL MARIN	127,000	13.16	78.37
NORTH MARIN-SOUTH SONOMA			
Marin Bay	14,760	1.27	4.55
Las Gallinas	52,550	5.50	17.43
Novato and Hamilton AFB	168,600	15.97	58.45
Petaluma	79,500	7.80	36.07
Sonoma	60,000	5.58	26.49
SUBTOTAL NORTH MARIN-SOUTH SONOMA	375,410	36.12	142.99
REGIONAL TOTAL – COMBINED SERVICE AREAS	589,410	56.76	265.28

OBJECTIVES

OBJECTIVES

Each of the three separate subregional studies utilized Water Quality Management Program objectives which are essentially the same. These objectives were derived through careful consideration of, (1) State and Federal receiving water objectives and requirements, (2) mathematical model studies to ascertain impact on the receiving waters of alternative points of disposal, and (3) wastewater reclamation for potential reuse and/or meeting of the "zero discharge of pollutants" objective.

State and Federal Objectives and Requirements

The subregional studies uniformly assumed that minimum objectives and requirements would be those associated with the "Interim Water Quality Control Plan for San Francisco Bay" combined with specific requirements of the Regional Water Quality Control Board, particularly in respect to biostimulants. Of the receiving water objectives, it was uniformly judged that the most critical needs would be those associated with:

Toxicity (both acute and "relative")
Dissolved Oxygen
Bacterial Contamination
Biostimulants
Prohibitions

While specific significance was attached to the prohibitions of discharge contained in the Interim Basin Plan objectives and specifically that prohibition against discharge to, "any embayment, slough, creek, or other confined shallow water area," nevertheless, for study purposes it was assumed that such discharge to the Petaluma River or San Pablo Bay could be evaluated on the basis of substantially removing all "biostimulants" and "toxicants" as well as substantial removal of suspended solids and biochemical oxygen demand through use of higher forms of tertiary treatment.

A more detailed summary of the basis upon which Study objectives and requirements were assumed are to be found in each of the subregional reports.

Essentially, the common conclusion of each subregional study has been that to meet State and Federal objectives and requirements, both current and anticipated, at least the following would be necessary:

Treatment

For San Francisco Bay discharge, a minimum of full secondary affording 90% reduction of both 5-day biochemical oxygen demand and resulting in an effluent in which 90 percent of test fishes survive after 4 days (activated sludge treatment was assumed as necessary to meet this study objective with possible inclusion of a nitrification stage and/or filtration (or fine screening)). Similar treatment, but limited to a minimum of 85% reductions for ocean discharge.

Disposal

Central Bay discharge to deep water at sufficient depth and at a location where a 100:1 initial dilution could be achieved (discharge to the deep

water channel of San Francisco Bay offshore from Point San Pedro or Point San Quentin was assumed as necessary to meet this study objective, as well as discharge to the offshore waters of the Pacific Ocean at Tennessee Cove), again with a minimum 100:1 initial dilution.

As further noted above, in spite of the current prohibitions against shallow water disposal, for study purposes it has also been assumed that such discharge could be evaluated on the basis of assuming prior treatment to a level such as afforded by secondary followed by nitrogen removal, filtration and carbon adsorption.

Mathematical Modelling

A detailed evaluation of the impacts resulting from disposal of treated wastewater at alternative locations was common to all three subregional studies through use of a single mathematical model developed by Water Resources Engineering Co. of Walnut Creek. This model was used to evaluate, (1) background conditions resulting from discharges to the system other than those in the combined study areas, (2) assumed disposal of combined, three subregional treated wastewaters offshore from Point San Pedro, (3) assumed disposal of combined, three subregional treated wastewaters offshore from Point San Quentin, and (4) assumed disposal of separate treated wastewaters at present local points of discharge, (except for South Marin dischargers).

The modelling was done on the basis of assumed "high" projections of populations and associated loadings from the combined study areas and corresponding peak loading conditions resulting from Contra Costa County and Vallejo discharges. High projections were used to establish the most conservative basis of comparison.
The mathematical model was run to determine the resultant impact on the receiving water for the alternative conditions of disposal in respect to:

Relative Toxicity
Nitrogen
Chlorophyl "a"

The modelling studies confirmed the fact that for combined discharge at either the offshore, deep water areas from Point San Quentin or Point San Pedro, all existing and anticipated water quality objectives and requirements can be met. A qualification to this conclusion would be in respect to possible need for nitrogen removal at some future date applicable to any discharge to the upper Bay system by reason of potential exceeding of Chlorophyl "a" limitations. On the other hand, the modelling showed that for local discharge, objectives in respect to "relative toxicity" as currently defined, cannot be met.

The details of the foregoing studies are summarized to best advantage in the North Marin-South Sonoma subregional report, Chapter 8, beginning at page 8-16. It is noted again, however, that the modelling studies and results therefrom were utilized uniformly and applied to the evaluations of each of the three subregional studies.

Reclamation and "Zero Discharge"

Throughout all three of the subregional studies, it was clearly established that ultimate Program objectives would include a maximum amount of wastewater reclamation for beneficial reuse. Also, each of the studies has recognized the possibilities of a "zero discharge" of pollutants requirement being imposed at some time in the future. As part of the evaluation of these ultimate Study objectives, an unusually thorough investigation of reclamation and beneficial reuse alternatives was iniated and made applicable uniformly to each of the three subregional studies.

A summary of the separate and combined studies relating to wastewater reclamation and beneficial reuse within the subregional areas is presented as follows:

Southern Marin -- The potential reuse market for landscape irrigation, industrial reuse, recreation lakes and direct municipal recycle was evaluated. This study and evaluation led to the conclusion that,

> "--the potential for reclamation of wastewater within Southern Marin is very small. Furthermore, the present highly mineralized quality of Southern Marin wastewater makes it practically unsuited for many uses without expensive demineralization.
>
> Aside from the development of an effluent impoundment in Southern Marin, which apparently is unacceptable to environmental groups, there is no potential for total reuse of reclaimed Southern Marin effluents. There may be a justification, however, to develop local small-scale landscape irrigation projects as demonstration projects to educate the public with regard to the feasibility of water reclamation and enhance the possibility for public acceptance of future direct reuse."

The foregoing conclusions led to a further study of potential for large-scale reclamation and reuse in the south Sonoma County area, combined with the Central and North Marin-South Sonoma subregional areas. These further studies led to the following conclusions:

> "--It appears that the most viable large-scale potential exists in the North Marin-South Sonoma area in the form of recreational lakes, and in the North Bay and Delta areas in the form of agricultural irrigation. Once a recreational lake is developed utilizing reclaimed wastewater, the chances of receiving Health Department approval for direct municipal recycle appear to be greatly enhanced. There is the possibility, of course, that it may be preferable to use the overflow from the recreational lakes for agricultural irrigation rather than for domestic reuse."

The studies from which the conclusions noted above were derived are to be found in Chapter 8 of the South Marin subregional report.

Central Marin -- As was the case with South Marin, the Central Marin subregional study included an evaluation of the potential wastewater reuse market for landscape irrigation, recreation lakes and direct municipal reuse with essentially the same conclusions. However, a wider, but still limited market for landscape irrigation within the lower Ross Valley does appear to be practical and is offered as a potential near-term, economically feasible possibility.

In respect to large-scale wastewater reclamation for beneficial reuse, the conclusions in respect to the Central Marin subregional study area were precisely the same as for Southern Marin, that is, the market is to the North in the form of recreational lakes, and in the North Bay and Delta areas in the form of agricultural irrigation.

The studies from which the conclusions noted above were derived are to be found in Chapter VI of the Central Marin subregional report.

North Marin-South Sonoma -- Having concluded concurrently that the potential wastewater reuse market on a large-scale basis exists uniquely within the North Marin-South Sonoma Counties study area, the most comprehensive studies in this regard are to be found summarized in the North Marin-South Sonoma subregional report.

In addition to the potentials for local and large-scale wastewater reuse, the North Marin-South Sonoma subregional study included a thorough review of basic municipal water requirements and alternatives for meeting these requirements within the context of a water resources development program.

Separate additional studies were made in respect to ground water recharge, wetlands development and stream flow augmentation, wetlands enhancement with runoff to the bay, wetlands development with disposal by evaporation with final emphasis upon the potential for recreation lake and water supply agriculture irrigation.

Recognizing that the possibilities for large-scale wastewater reclamation for beneficial reuse related primarily to recreation lake water supply and agriculture irrigation within the foresseable future, this conclusion being consistent with those arrived at as part of both the Southern Marin and Central Marin subregional studies, a more detailed evaluation was provided in this regard with specific alternatives identified for recreation lakes. Also, the agriculture irrigation potential was defined on the basis of actual survey of irrigation interests amongst farmers in the area.

The study conclusions were essentially:

> "Basically, the greatest potential for utilizing reclaimed wastewater appears to lie in developing an agricultural irrigation demand or (and) creating a recreational lake."

The studies from which the conclusion noted above was derived are to be found in Chapter 9 of the North Marin-South Sonoma subregional report.

Synthesis -- All three subregional studies were in common agreement that large-scale wastewater reclamation for beneficial reuse is limited to the South Sonoma County area where large volumes of reclaimed wastewater could be utilized for, (1) a recreation lake, and/or (2) agriculture irrigation. The foregoing conclusion was not meant to imply that wastewater reclamation for beneficial reuse for limited purposes in South and Central Marin should not be encouraged, but merely did serve to establish that ultimate Program objectives for maximum reuse most likely will be realized through transport of wastewater for reuse to the north.

Need Versus Supply -- An important factor which speaks to the question of potential for large-scale wastewater reuse of course is in respect to actual reuse potential in relationship to potential supply. In this regard, Tables No. 6 and 7 are of interest. Of particular significance, the foregoing referenced Tables reveal that the potential volume of wastewater from the combined three subregional areas exceeds the currently identified potential large-scale reuse market. In fact, most of the ultimate reuse potential could be supplied by North Marin-South Sonoma wastewater dischargers alone. Thus, it appears that if total reclamation and beneficial reuse, or a "zero" discharge objective is to be realized ultimately, then it may be necessary to develop additional markets and/or areas for ground disposal beyond those already identified.

Economics -- While the conclusion is that a recreation lake and/or large-scale agriculture irrigation in South Sonoma County through use of reclaimed wastewater represents the most viable reclamation alternative for the combined subregional areas, it is recognized that the time at which this potential might be realized will rest significantly upon the economics related thereto. In addition, of course, there may be a time, even in the near future, where the fundamental question of supply will overshadow the question of economics. In the meantime, however, it is recognized that the costs associated with a recreation lake, or agriculture irrigation, may be the determining factor as to the actual time at which large-scale reclamation for beneficial reuse will become a reality.

In this regard, then, it is important to note that as part of the survey to determine the agriculture reclaimed wastewater market, it was found that farmers today could afford a maximum cost for water, depending upon the type of crop, determined to be at two levels, $3.50 and $20.00 per acre foot. From these figures, a rough estimate of the amount of subsidy which would be required to supply reclaimed wastewater at these support levels appears to be at least $15.00 per acre foot. It seems unlikely that the sewering agencies would be justified in paying the foregoing subsidies. Similarly, a limited study was made of the potential offsetting costs for a recreation lake-park development and it appears that an even larger subsidy, from an as yet unknown source, would be required to make this potential reuse program viable. A limited landscape irrigation reclaimed wastewater irrigation program does appear to be more favorable economically.

To provide an indication as to the basic economics involved in respect to the possible reclamation programs, the estimates which have been made are summarized in Table 8.

As can be observed from Table 8, with the possible exception of a limited local landscape irrigation program, economics do not favor the use of reclaimed wastewater under the assumed conditions noted. It should also be pointed out, the adverse economics could be more severe if any additional costs for wastewater treatment beyond those necessary for disposal purposes are added.

TABLE 6 Year 2020 Potential Large-Scale Reclaimed Wastewater Reuse in Sonoma/Marin Counties[1]

Reuse	Estimated Reuse Potential 1000's acre-ft./year
Recreation Lake, Chileno (evaporation & infiltration losses)	7
Recreation Lake, Tolay[2] (evaporation & infiltration losses)	(5)
Supplemental Agriculture Irrigation[3]	
at $3.50/ac. ft. support level	28
at $20.00/ac. ft. support level	13
Total	48
	(46)

[1] Additional potential exists in Napa and Solano Counties, overlaps potential local available reclaimed wastewater

[2] Assume would construct one recreation lake.

[3] Market estimated on basis of price level farmers can pay, assume subsidy ranging from $13-$58/ac. ft.

TABLE 7 Year 2000 Potential Reclaimed Wastewater Supply from Sonoma/Marin Counties

Source	Estimated Potential Supply 1000's acre-ft./year
Southern Marin	8
Central Marin	15
North Marin/South Sonoma	40
Total	63

Significance to Present Studies -- In evaluating the significance of the foregoing in respect to the Present Studies, the following is concluded:

- Large-scale wastewater reclamation and beneficial reuse potential is essentially limited to the South Sonoma County area and is seen most clearly as water supply for a recreation lake and/or agriculture irrigation.

- The economics related to the large-scale wastewater reclamation suggest that realization of this potential may be some time into the future, at least until an acceptable method of financing is determined.

- Local wastewater reclamation for purposes of landscape irrigation appears to be limited in the South Marin area and, to a lesser extent, limited in the Central Marin area, but should be encouraged where found to be feasible.

- The economics of wastewater reclamation for beneficial reuse are adverse at the present time.

- The Water Quality Management Program(s) for the combined North Marin-South Sonoma, Central Marin and South Marin subregions should all provide the flexibility whereby the potential large-scale wastewater reclamation and beneficial reuse market to be found in the South Sonoma area could be realized in the future, presumably at such time as the economics or supply factors are more favorable than at present.

TABLE 8 Preliminary Estimated Annual Revenues and Benefits from Development of Potential Reclaimed Wastewater Use Projects

Characteristic	Recreational Lake Park Development	Agricultural Irrigation by the year 2020		Local Landscape Irrigation		
		Water Priced at Current Rates	Water Priced at $20/ac.ft.	Ross Valley	Las Gallinas	Total
ESTIMATED REVENUES						
Utilization Basis	500,000 user days/year (125,000 automobiles)	28,000 ac.ft.	13,000 ac.ft.	385 ac.ft.	567 ac.ft.	952 ac.ft.
Cost Basis	$1.00/car Admission Fee	$3.50/ac.ft.	$20/ac.ft.	$100/ac.ft.	$100/ac.ft.	$100/ac.ft.
Estimated Revenues	$125,000	$ 98,000	$260,000	$38,500	$56,700	$95,200
ESTIMATED EXPENSES						
Estimated Capitalization	$2,000,000 (Park only)	$7,656,250 (1)	$3,555,000 (1)	$445,000	$560,000	$1,005,000
Annual Debt Amortization @ 5.5% for 50 years	118,000	452,000	210,000	26,280	33,070	59,350
Estimated Annual O&M Costs	100,000	75,000	50,000	3,450	7,200	10,650
Total Estimated Annual Cost	$218,000	$527,000	$260,000	$29,730	$40,270	$70,000
Estimated Net Annual Offsetting Costs	($93,000)	($429,000)	$ 0			$25,200
Secondary Benefits	1. Stimulate recreational oriented businesses in adjacent communities. 2. Reduce fuel consumption by providing recreational lake close to population centers.	1. Stimulate Agricultural industry. 2. Economize on use of water resources.		1. Economize on use of water resources. 2. Economize on use of fertilizer.		
Remarks	There appears to be a need for fresh water oriented recreation in North Marin County and Southern Sonoma County.	A case could possibly be made for a State subsidy to agriculture to offset the additional costs of delivery.		Up to 5,000 ac.ft. of water could be used on local landscaping areas in Eastern Marin and Southern Sonoma; however, their locations are generally so dispensed that the cost of the secondary distribution system is far more than the revenues generated.		

(1) Assumes installation of 10,000 feet of distribution main per square mile of irrigated farmland at $35.00/ft. with water application rate of 2 ac.ft. per acre of land per year.

REGIONAL ALTERNATIVES

REGIONAL ALTERNATIVES

Each of the three subregional studies approached the needs to define and evaluate alternatives, both regional and subregional, following basically the same format and utilizing the same study objectives.

Essentially, the format involved consideration of, (1) the area-wide, regional alternatives involving consolidations embracing all three subregional study areas, and (2) alternatives involving consolidations within each of the subregional areas as well as the independent, "go-it-alone" base alternative.

As previously noted, fortuitously the three subregional study efforts were all conducted by consortiums involving the same engineers, so that the study of alternatives, particularly those involving area-wide, regional consolidations, were defined and evaluated on essentially a uniform, common basis.

The detailed description and evaluation of the combined total of 54 candidate alternatives considered are summarized in the subregional studies as follows:

North Marin/South Sonoma	Chapter 10
Central Marin	Chapters 7 and 8
South Marin	Chapter 9

The procedure followed in each subregional study was to screen out all but the most promising alternatives, both regional and subregional, on the basis of both economic and non-economic factors.

The evaluation process resulted in the recommended Program(s) defined in each of the subregional reports, the individual Programs being consistent with each other.

Regional Alternatives Identified

The screening and evaluation process, both as part of the three studies and subsequent thereto, resulted in the narrowing of the area-wide regional alternatives to be given final consideration to four. These final candidate alternative programs are shown graphically in Fig. 2 and are further identified as follows:

Alternative A -- This Alternative Program would provide facilities for consolidation of wastewater transport, treatment and disposal of combined South Marin and Central Marin wastewater. For central and south Marin, a single consolidated treatment facility would be constructed at the existing Sanitary District No. 1 plant site near San Quentin Prison, with disposal of combined wastewater to deep water offshore from Point San Quentin.

All north Marin and south Sonoma treated wastewater would be consolidated for combined disposal to the deep water offshore from Point San Pedro. A consolidated, subregional treatment plant, located in the Hamilton Field AFB area, would be constructed to serve all of north Marin County, while the Petaluma and Sonoma Valley County S.D. plants would be enlarged.

Subsequent reclamation and reuse would be provided by Phase 2 of this

Alternative, which phase would include an intertie between the Central Marin and North Marin treatment and conveyance facilities, thus permitting transport of treated south and central Marin wastewater to the north Marin/south Sonoma systems, then reversed for conveyance to a storage and possible recreation lake located in south Sonoma County. From this point, it would be assumed that treated, stored wastewater would be utilized for agriculture irrigation purposes. A Phase 3 of this Alternative would result in use of the treated and stored, combined wastewater from the entire regional area for direct reuse purposes, assuming technology and Health Department needs will combine to make this Phase feasible in time.

This Alternative would involve abandonment of 12 existing treatment plants and 15 points of existing disposal. At the same time, there would be constructed two new subregional treatment plants and two new central Bay outfalls.

Alternative B -- This Alternative Program would provide for the same basic consolidations as for Alternative A, except that the subregional plant at Point San Quentin would not be constructed, the intertie between the regions would be constructed as part of Phase 1 and the north Marin subregional plant would provide for combined treatment of south-central and north Marin wastewater, prior to discharge through use of a single outfall offshore of Point San Pedro.

Phase 2 and Phase 3 of this Alternative Program would involve essentially the same facilities, meeting the same objectives as for Alternative Plan A.

This Alternative would involve the same consolidations as for Alternative Program A, except that there would be one less treatment plant and one central Bay outfall off from Point San Pedro instead of the two outfalls of Program A.

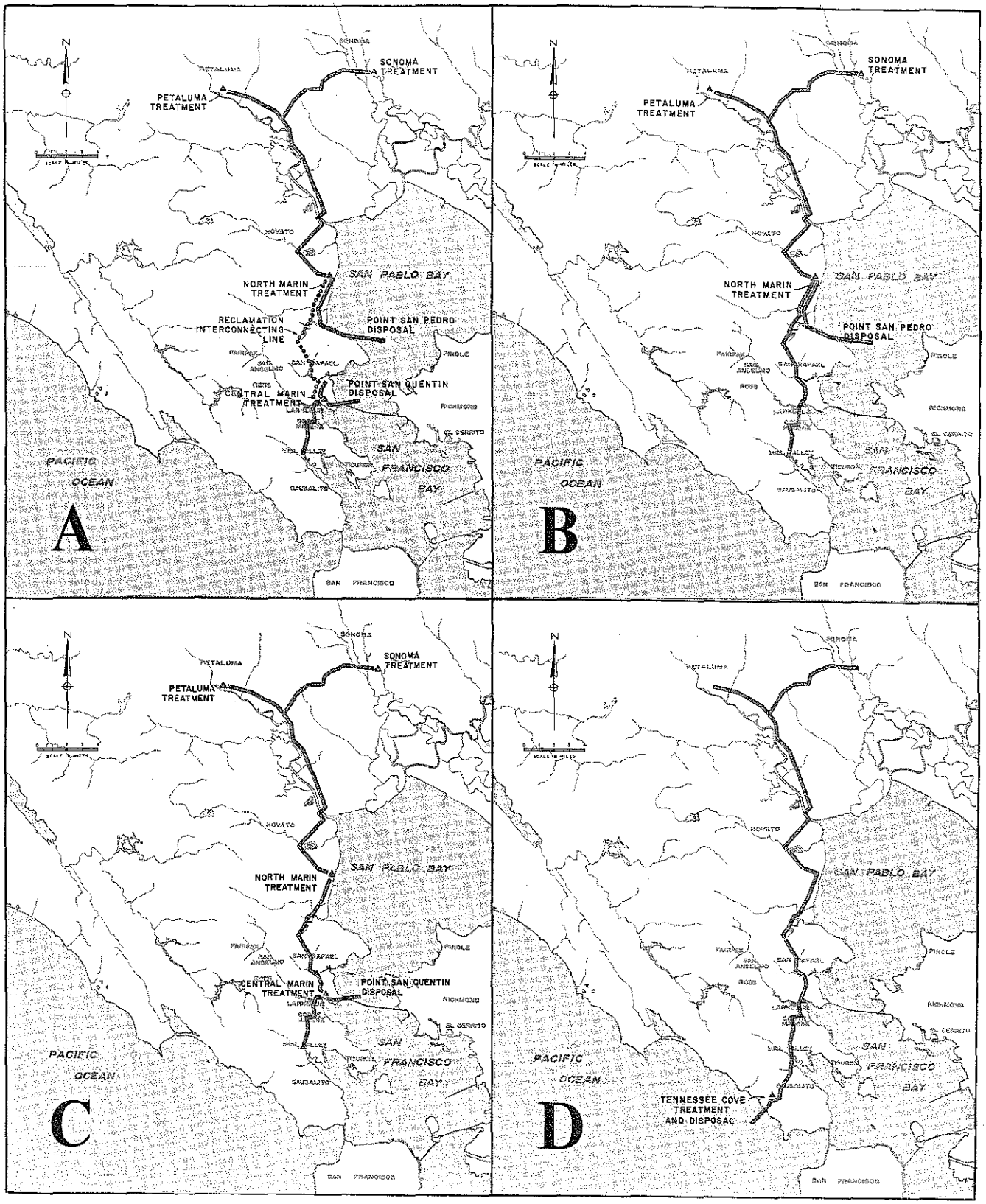
Alternative C -- This Alternative Program would provide for the same basic consolidations as for Alternative A, except that the intertie between north and central Marin would be constructed as part of Phase 1 and there would be combined discharge of all treated wastewater from a single outfall offshore from Point San Quentin.

Phase 2 and Phase 3 of this Alternative Program would involve essentially the same facilities, meeting the same objectives as for Alternative Plan A.

Alternative D -- This Alternative Program would provide for consolidation of all wastewater treatment and disposal facilities for transport to a point of final disposal to the offshore waters of the Pacific Ocean near Tennessee Cove in South Marin.

This Alternative would involve abandonment of all 15 existing treatment plants in the combined regional area as well as the existing 15 points of disposal. At the same time, there would be constructed one new regional treatment plant in the Tennessee Cove area.

There would be no planned major reclamation and reuse Phase associated with this Alternative Program.



REGIONAL ALTERNATIVE PROGRAMS

As the result of the further evaluation process summarized hereinafter, Alternative Program A did become the recommended Program of each of the three subregional studies.

Evaluation Process Summarized

The evaluation process which supported the recommendation for Alternative Program A implementation is established in each subregional study. In particular, Chapter 7 of the Central Marin subregional study summarizes the steps followed in the evaluation process which included separate consideration of the following areas of special interest:

Criteria of Consolidation -- Fundamental to the evaluation of Program alternatives has been recognition of applicable criteri of consolidation including; (1) all alternatives must meet the same high water quality objectives; (2) alternatives should account for the essential need for system reliability to meet objectives on a continuous basis; (3) the advantages of consolidation reflected in economies of scale must be carefully evaluated; (4) there must be recognition of the mandate for consolidation "where feasible" as part of State grant Regulations; (5) consolidations should be considered which enhance the chances of wastewater reclamation for beneficial reuse; (6) concentrations of residual pollutants should not unduly tax the assimilating capacity at the point(s) of discharge; (7) alternatives should account for the possible meeting of a "zero discharge of pollutants" objective required in the future; and (8) alternatives should account for all non-economic and environmental factors.

Economic Evaluation -- Basic to the economic evaluation of Program alternatives was the developing of cost curves setting forth estimated costs for various elements of a proposed Program, including costs for treatment, pumping and transport facilities. Use of cost curves for both capital and operating costs were utilized so as to provide a uniform basis of comparison. Costs were projected on the basis of carrying the Program to the year 2000 with interest assumed at 6%. Final economic evaluation was made on the basis of "present worth" comparison of all Program costs, capital and maintenance and operation. A summary of the economic evaluation of the regional Alternative Programs considered is shown in Table 9. As part of the economic evaluation sensitivity factors were considered, including changes in interest rates and ultimate growth. The evaluation of these sensitivity factors did not alter the economic standings of Alternatives.

TABLE 9 Summary of Overall Costs of Alternative Regional Programs

Alternative Program	Initial Construction Cost to 1980 (millions $)	Total Present Worth* (millions $)	Average Annual Costs* (millions$)
A	$ 73.1	$ 96.6	$ 7.4
B	$ 90.5	$112.7	$ 8.7
C	$ 80.6	$104.9	$ 8.1
D	$106.0	$129.8	$10.0

*At 6% interest, includes Maintenance and Operating Costs to year 2003.

Non-Economic Evaluation -- Each of the subregional studies provided essentially the same type of evaluation of non-economic factors as they related to each of the Alternative Programs being considered. Among these factors were included relative advantages and disadvantages of each alternative in respect to, (1) ability to meet water quality objectives, (2) reliability, (3) reclamation potential, (4) flexibility in respect to future changed conditions, (5) environmental impact of treatment and transport facilities, (6) regionalization, and (7) implementation and others.

Summary of Evaluation

The evaluation of alternative programs is summarized in varying detail within each of the separate subregional studies. The evaluation provided in Chapter 7 of the Central Marin Study deals most specifically with the basic factors, and tempered by the results of some subsequent discussions, these factors are summarized as follows:

Economic -- Alternative A is least costly both on the basis of Present Worth and initial cost.

Water Quality Objectives -- All Alternatives are considered essentially equal in ability to meet water quality objectives.

Reliability -- If assessment of "reliability" is limited to number of treatment plants, (the fewer number of plants, the more reliable is the Program), then Alternative D is most reliable (1 plant), followed by Alternative B (3 plants), and A and C (4 plants).

If transport of treated wastewater over long distances and diversity of large-sized treatment plants and alternate points of disposal are considered to result in added system reliability, then Alternatives A and C would be more reliable than Alternatives B and D, with Alternative A being most advantageous in this regard.

It was concluded that no Alternative Program provides clear advantages in respect to reliability, all Programs are considered reliable.

Reclamation Potential -- Alternatives B and C are considered to provide enhanced possibilities for early large-scale reclamation and beneficial reuse. Alternative C preserves the added opportunity of local reuse in the Central and south Marin subregions. Alternative A provides the same advantages as a lternative C, but by postponing the intertie between north and central-south brings in an uncertainty factor which does not exist in Alternatives B and C. Alternative D essentially eliminates the possibilities of large-scale reclamation.

It was concluded that in the face of some uncertainty of Phase 2 implementation, Alternative Programs B and C are most advantageous in respect to reclamation potential, with some added advantage to Alternative C.

Flexibility -- Assuming completion of Alternative Programs, Alternatives A and C appear to provide some added flexibility in respect to local reclamation, while Alternatives B and C are somewhat more flexible in respect to meeting a possible future "zero discharge of pollutants" objective.

It was concluded that no Alternative Program provides clear advantages in respect to flexibility.

Environmental Impact -- In respect to long-term environmental impact of the Alternative Programs, it is considered that the same factors relating to "reliability" are significant. In respect to construction impact, Alternative A is preferred and Alternative D is least desirable. In respect to impact upon the receiving water, it appears that no Alternative Program has clearly defined advantages, although there may be more uncertainty in this regard related to the ocean discharge of Alternative D.

It was concluded that there is no clearly established advantage in respect to overall environmental impact between Alternative Programs A, B and C, but Alternative D was considered to be least desirable.

Regionalization -- In respect to regionalization, if consolidation of facilities is accepted as the criteria for regionalization, then Alternative Programs D, B, C and A would be ranked in that decending order. However, it is noted that thirteen existing treatment plants are abandoned in facor of 4 subregional plants instead of 3 in the case of Alternative B and 1 in the case of Alternative D, so it is considered that all Alternatives provide a high degree of regionalization and acceptable level of consolidation.

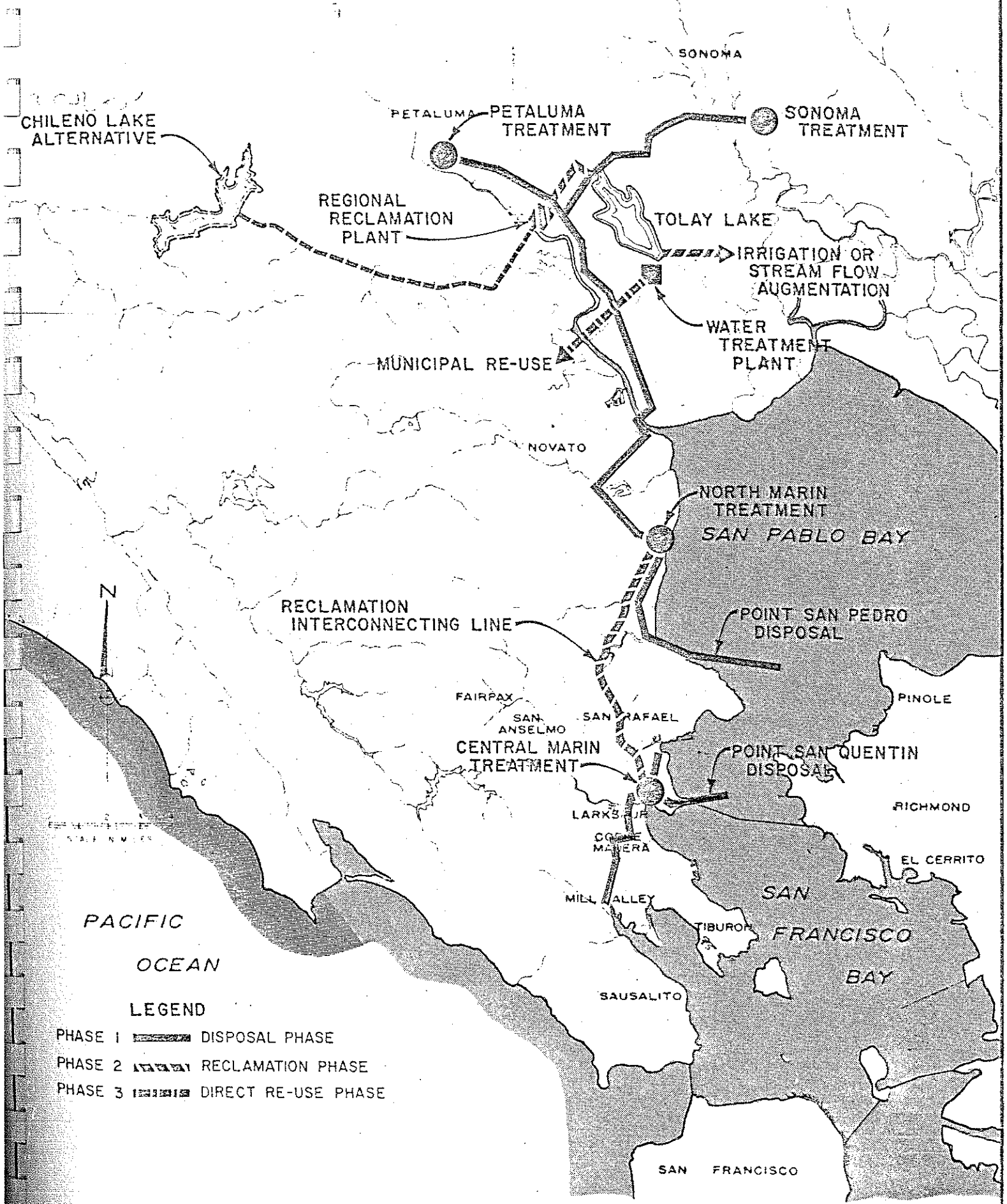
It was concluded that while Alternative Program D provides for maximum regionalization, there is no clearly established advantage in this regard between the Alternatives.

Implementation -- In respect to ease of implementation, it is considered that Alternative A, by reason of both lowest cost and least complicated existing institutional restraints, would be susceptible of easiest implementation.

It was concluded that Alternative Program A is most advantageous in

respect to the factor of implementation.

On the basis of the economic and non-economic evaluations provided as part of the three separate subregional studies, and as partially summarized above, it was concluded that Alternative Program A is the best apparent alternative for meeting both subregional and regional, area-wide, long-range needs.



SOUTH-CENTRAL-NORTH MARIN / SOUTH SONOMA
WATER QUALITY MANAGEMENT PROGRAM

BEST APPARENT REGIONAL PROGRAM

ADDITIONAL EVALUATION

ADDITIONAL EVALUATION

As discussed hereinbefore, the results of the evaluation of Alternatives found in each of the three subregional studies led to the common recommendation to adopt Alternative Program A as the best apparent alternative means of meeting combined, regional, long-range needs.

However, it is also observed that the results of each subregional study indicated that the essential cost differences between Alternative Programs A, B and C, while representing a spread of some 21% on an initial cost basis, the difference is reduced to some 10% on a Present Worth basis. It is considered that this difference alone is not sufficient to eliminate Alternatives B and C from consideration. Further, it is acknowledged that several of the non-economic factors utilized in the preliminary evaluation of Alternatives are subjective in nature and deserving of more intensive study prior to making the important final decisions as to which Program should be implemented.

It has appeared therefore, quite aside from the mandate from the Regional Water Quality Control Board to do so, and in addition to the required environmental impact analysis, there remains a need for additional evaluation of the regional alternatives.

Consistent with these needs for additional evaluation, added information has been developed and provided the Coordinating Committee as summarized hereinafter.

This additional evaluation has taken the form of more intensive review of, (1) eliminating from further consideration Alternative Program D for the reasons noted, (2) Alternative Program effectiveness within the framework of Alternative Program sequencing or staging, (3) presentation and discussion of most significant questions which have been asked in respect to the earlier evaluation of Alternative Programs, and (4) revised economic evaluation based upon most recent State and Federal Guideline criteria for cost/effectiveness alanysis.

ELIMINATING OF ALTERNATIVE D

As part of the additional evaluation, the total consolidation for ocean disposal Alternative D has been dropped from further consideration. The reasons for this decision were threefold, (1) clearly excessive cost, (2) absence of definable reclamation potential, and (3) established negative environmental impact.

In connection with the third factor noted above, it is observed that the Tennessee Cove area, the only logical point where a regional treatment and disposal system could terminate, is within the newly established Golden Gate National Recreation Area, part of the Federal Park system. Aside from the obvious limitations which this factor represents, counsel from the established Environmental Subcommittee of the Marin Municipal Water District indicated very strong reservations against any discharge of wastewater to the ocean in any case. This decision was based upon both expressed concerns relating to the relatively sensitive aquatic environment of the ocean and commitment to the concepts of wastewater reclamation for beneficial reuse as an essential conservation measure, which concepts Alternative D would be contrary to.

ALTERNATIVE PROGRAM EFFECTIVENESS

The purpose of the studies summarized hereinbelow has been to evaluate the overall effectiveness of the Alternative Programs, particularly in respect to alternative implementation sequences, or staging, for achieving a large-scale wastewater reclamation program.

The physical features of the three regional wastewater management programs under consideration are very similar in many respects; and therefore, the selection of a regional program may be altered depending on the timing for implementing a large-scale wastewater reclamation and reuse program. For example, a different regional program might be selected if development of large-scale reclamation and reuse is deemed too far in the future to even consider than if there already existed a proven demand for a great amount of reclaimed water somewhere.

Accordingly, the following four implementation sequences have been defined against which the three alternative regional wastewater reclamation programs will be evaluated in respect to both economics and effectiveness.

Implementation Sequence I - Phase I - Disposal: On this basis of evaluation, it would be assumed that the plan would include adequate wastewater treatment and disposal only with no planned-for future program of large-scale reclamation and reuse in the future.

This evaluation answers the question, "What if large-scale reclamation is not really a relevant factor and should be ignored in respect to determining the best alternative to meet wastewater disposal objectives and requirements only?"

Implementation Sequence II - Phase I - Disposal, Phase II - Reclamation: On this basis of evaluation it would be assumed that the plan would include both inadequate wastewater treatment and disposal (1st Phase) and large-scale reclamation and reuse (2nd Phase, assumed by year 1985).

This evaluation will answer the question, "Does the evaluation of alternative plans favor a different alternative if future large-scale reclamtion is assumed to be an integral part of each alternative?"

Implementation Sequence III - Phase I - Reclamation and Disposal: On this basis of evaluation it would be assumed that the plan would include both adequate wastewater treatment and disposal and large-scale reclamation and reuse, both as part of the first phase project.

This evaluation will answer the question, "Does the evaluation of alternative plans favor a different alternative if large-scale reclamation is assumed to be included as part of initial Phase I project construction?"

Implementation Sequence IV - Phase I - Reclamation: On this basis of evaluation it would be assumed that the plan would include adequate wastewater treatment for reclamation and would eliminate the outfall pipeline(s) otherwise required for disposal.

This evaluation will answer the question, "Does the evaluation of alternative plans favor a different alternative if the program is totally dedicated to reclamation from its inception and to the exclusion of disposal facilities?"

No Program: To provide a baseline for comparison, the alternative of not undertaking any program will be compared against the alternative implementation sequences.

Considering the four implementation sequences, along with the three alternative regional wastewater management programs, makes a total combination of eleven different alternatives which must be evaluated. A twelfth combination between Plan A and Implementation Sequence IV does not exist because the intertie between Central and North Marin would not be of adequate size to accomplish immediate reclamation of all wastes.

Economics

The estimated project cost for each alternative plan under each implementation sequence is given in Table _____.

Additional Effectiveness Evaluation

The questions relating to "effectiveness" of alternatives has been evaluated through the use of a numbering system as shown in Table and derived through consideration of the factors summarized as discussed hereinafter. It should be noted that the basis for establishing the numbering system, utilizing factors of "importance" and "magnitude," has been a comparison with the impact of the proposed alternative plan impact upon the environment and other conditions as they exist now, including impact from presently nonconforming wastewater treatment and disposal facilities.

a. Environment:

(1) Water Quality Objectives: It is considered that all alternatives will meet water quality objectives. On the basis of more detailed evaluation of impact upon the receiving waters through Dr. Gustafson's work and through discussions with the State Department of Fish and Game staff, it is concluded that Alternatives C and A have a small advantage in this respect over Alternative B because of the added discharge at the somewhat preferred Point San Quentin discharge. It is assumed that this impact will be positive.

In Sequence IV the advantage of no disposal system would be partially offset by the fact that some initial discharge, presumably to a local creek, would be inevitable, at least during early years of the plan until the reuse potential is fully developed.

The alternative of No Project would not meet water quality objectives and therefore would have a highly negative impact on water quality.

TABLE 10 Showing Cost/Effectiveness Evaluation of Alternative Regional Plans

FACTOR	Implement. Sequence 1 1st Phase - (Disposal) PLAN A	PLAN B	PLAN C	Implement. Sequence 2 1st Phase - (Disposal) 2nd Phase - (Reclamation) PLAN A1	PLAN B1	PLAN C1	Implement. Sequence 3 1st Phase - (Reclamation and Disposal) PLAN A2	PLAN B2	PLAN C2	Impl. Seq. 4 1st Phase - (Reclamation) PLAN B3	PLAN C3	No Project
COSTS - IN MILLION DOLLARS												
Initial Capital Costs (1973-1978)	73	90	81	73	90	81	117	129	119	141	142	
Total Program Capital Costs (1973-2000)	91	104	99	147	155	149	147	154	149	173	173	
Average Annual Capital Costs (1975-2000)	6	7	6	8	9	8	9	10	9	12	12	
Average Annual O & M Costs (1975-2000)	2	2	2	3	3	3	4	4	4	5	5	
Total Average Annual Costs (1975-2000)	8	9	8	11	12	11	13	14	13	17	17	
Total Present Worth (1973) All Costs	97	113	105	134	147	140	154	166	159	222	227	
EFFECTIVENESS												
a. Environmental												
(1) Water Quality Objectives	+4/5	+4/5	+5/5	+4/5	+4/5	+5/5	+4/5	+4/5	+5/5	+5/5	+5/5	-5/5
(2) Biology - Flora, Fauna	-3/3	-4/4	-2/2	-3/3	-4/4	-2/2	-3/3	-4/4	-2/2	-2/2	-2/2	0
(3) Land Planning Compatibility	-3/3	-2/2	-3/3	-4/3	-3/2	-4/3	-4/3	-3/2	-4/3	-3/2	-4/3	-5/5
(4) Aquatic Life	+4/5	+4/5	+5/5	+4/5	+4/5	+5/5	+4/5	+4/5	+5/5	+5/5	+5/5	-5/5
(5) Air Quality	-3/3	-2/2	-3/3	-4/3	-3/2	-4/3	-4/3	-3/2	-4/3	-3/2	-4/3	-5/5
(6) Construction Impact	-3/4	-4/4	-4/3	-3/4	-4/4	-4/3	-3/4	-4/4	-4/3	-4/3	-4/3	0
(7) Population Growth Potential	-3/5	-4/5	-3/5	-3/5	-4/5	-3/5	-3/5	-4/5	-2/5	-4/5	-3/5	+5/5
(8) Noise Impact	-2/1	-1/1	-2/1	-3/1	-2/1	-3/1	-3/1	-2/1	-3/1	-2/1	-3/1	-5/1
(9) Aesthetics	-3/3	-3/2	-3/3	-4/3	-3/2	-4/3	-4/3	-3/2	-4/3	-3/2	-4/3	-5/5
(10) Cultural	-1/2	-2/2	-1/1	-1/2	-2/2	-1/2	-1/2	-2/2	-1/2	-1/2	-1/2	-3/3
b. Resource Utilization												
(1) Land	-3/2	-2/2	-3/2	-3/2	-2/2	-3/2	-3/2	-2/2	-3/2	-1/2	-2/2	-5/2
(2) Water	-1/5	-1/5	-1/5	+2/5	+2/5	+2/5	+3/5	+3/5	+3/5	+3/5	+3/5	-5/5
(3) Energy	-2/5	-3/5	-3/5	-3/5	-4/5	-4/5	-5/5	-4/5	-4/5	-4/5	-4/5	-1/5
(4) Secondary Resources Use	-1/5	-2/5	-1/5	-3/5	-2/5	-2/5	-4/5	-5/5	-4/5	-5/5	-4/5	-1/5
c. Flexibility												
(1) Reclamation	+2/5	+1/5	+2/5	+3/5	+2/5	+3/5	+3/5	+2/5	+3/5	+2/5	+3/5	-2/5
(2) Treatment	+3/3	+4/3	+3/3	+3/3	+4/3	+3/3	+3/3	+4/3	+3/3	+4/3	+3/3	-5/3
(3) Disposal	+3/3	+4/3	+4/3	+3/3	+4/3	+4/3	+3/3	+4/3	+4/3	+5/3	+5/3	-5/3
(4) Changes in Land Use Planning	+2/2	+1/2	+2/2	+2/2	+1/2	+1/2	+2/2	+1/2	+2/2	+1/2	+2/2	+5/2
d. Reliability												
(1) Treatment	+3/5	+2/5	+3/5	+3/5	+2/5	+3/5	+4/5	+3/5	+4/5	+3/5	+4/5	-5/5
(2) Transport	+4/4	+3/4	+4/4	+4/4	+3/4	+4/4	+4/4	+3/4	+4/4	+3/4	+4/4	0
(3) Disposal	+4/4	+3/4	+3/4	+4/4	+3/4	+3/4	+4/4	+3/4	+3/4	+1/4	+1/4	-5/4
(4) Reclamation	+2/5	+2/5	+3/5	+3/5	+3/5	+4/5	+4/5	+4/5	+5/5	+4/5	+5/5	-3/5
(5) Disaster	+3/2	+1/2	+2/2	+3/2	+1/2	+2/2	+3/2	+1/2	+2/2	+1/2	+2/2	+4/2
e. Planning Objectives												
(1) Local Agencies	+3/5	+2/5	+3/5	+3/5	+2/5	+3/5	+3/5	+2/5	+3/5	+2/5	+3/5	-3/5
(2) State & Federal	+2/5	+3/5	+2/5	+2/5	+3/5	+2/5	+2/5	+3/5	+2/5	+3/5	+2/5	-5/5
f. Implementation												
(1) Public Acceptance	+4/4	+2/4	+3/4	+5/4	+3/4	+4/4	+4/4	+2/4	+3/4	+1/4	+2/4	-2/4
(2) Financial Possibility	+4/4	+2/4	+3/4	+4/4	+2/4	+3/4	-2/4	-3/4	-3/4	-5/4	-5/4	+5/5
(3) Institutional Complexity	-2/3	-4/3	-3/3	-2/3	-4/3	-3/3	-4/3	-5/3	-4/3	-5/3	-4/3	+5/5

(2) Biology - Flora, Fauna: It is recognized that there will be some disruption of existing flora and fauna, mostly on a short-term basis, as the result of any project construction. The potential damage through a marsh and natural areas related to Alternatives A and B outfall to Point San Pedro is condidered to be an added impact beyond that of Alternative C construction. It is assumed that this impact will be negative.

It is considered the Implementation Sequence IV will result in somewhat less impact in this category by reason of no outfall pipeline construction.

The alternative of No Project will have no impact on the flora and fauna.

(3) Land Planning Compatibility: It is considered that all alternatives will have some impact in respect to land planning, primarily related to treatment plant existence. It is assumed that this impact will be negative.

This impact will be slightly greater under program A and C since there will be four treatment plants, rather than three as under Plan B. Implementation sequences are assumed to have a slightly greater impact on land planning capability because of the possible existence of a tertiary treatment plant.

Under the No Project alternative, the impact will be significantly negative because the fifteen existing treatment plants in the subregion will continue to exist.

(4) Aquatic Life: It is considered that all alternatives will result in improved conditions in respect to aquatic life. For the same reasons noted in respect to water quality objectives impact, Alternative C is somewhat more advantageous than Alternative B or A. It is assumed that this impact will be positive.

It is considered that Implementation Sequence IV will result in an additional improvement in respect to this category by reason of no direct disposal.

The No Project alternative will have a considerable continued negative impact on aquatic life because of the continued existence of the multiple shallow water discharges around the bay.

(5) Air Quality: It is considered that all alternatives will have some adverse impact upon air quality as the result of wastewater treatment plant operation. This impact will be slightly more for Alternatives A and C than will be the case for B because of one less treatment plant. It is assumed that this impact will be negative.

It is considered that Implementation Sequences II, III, and IV will result in added impact in this category because of the existence of "tertiary" treatment plant facilities and their operation.

The No Project alternative will have a significant detrimental effect on air quality because of the continued existence of the fifteen treatment plants in the area, which are not now equipped with odor control features.

(6) Construction Impact: It is considered that all alternatives will have some impact during project construction. The needed construction of a large pipeline through the City of San Rafael related to Alternatives B and C and the need to construct the Point San Pedro outfall under Plans A and C is considered to be an added impact. It is assumed that this impact will be negative.

It is considered that Implementation Sequence IV will result in somewhat less impact in this category by reason of no outfall pipeline construction.

There would be no construction impact if No Project is undertaken.

(7) Population Growth Potential: While it is considered that all alternatives will provide the means of serving additional population, the staging of treatment plants in respect to capacity will serve to limit population growth potential to agreed-upon limits. Because of the necessity of construction of the raw sewage intertie line between North and Central Marin related to Alternative B with a commingling of capacity in a larger plant, it is considered that Alternative B has a slightly greater impact in this category. It is assumed that this impact will be negative.

Under the alternative of No Project, the population growth potential would be severely restricted because of a lack of adequate sewage treatment facilities. It is assumed that this impact will be positive.

This environmental factor would be evaluated differently showing little or no impact of the project on population growth potential if positive growth controls are adopted on a planning agency level.

(8) Noise Impact: It is considered that all alternatives will have some impact in respect to noise of facility operation. It is considered that Alternative Plan B will have a somewhat

less impact by reason of one less treatment plant. It is assumed that this impact will be negative.

Under alternative Implementation Sequences II, III, and IV there will be slightly more noise impact because of the possible existence of a tertiary treatment plant.

The noise impact will be substantially greater under the No Project alternative because of the continuation of the fifteen existing treatment plants, which are not now equipped with noise control features.

(9) Aesthetics: It is considered that all alternatives will have some impact upon local aesthetics by reason of treatment and pumping plant existence. Alternative B impact in this category will be somewhat less by reason of one less treatment plant. It is assumed that this impact will be negative.

Under alternative Implementation Sequences II, III, and IV there will be further impact on the aesthetics because of the possible existence of a tertiary treatment plant.

The impact on aesthetics without any project will be significantly greater because of the continued existence of fifteen treatment plants which are generally lacking in basic architectural and aesthetic amenities.

(10) Cultural: It is assumed that there will be some cultural disruption in this category by reason of construction through developed areas with added impact from Alternatives B and C construction due to thelarge pipeline through the City of San Rafael. Further, there may be some disruption to archaeological sites by the construction of the Point San Pedro outfall under Plans A and B. It is assumed that this impact will be negative.

If No Project is implemented, there may be no disruption of cultural sites due to construction, but our overall cultural status will be lessened by the lack of good water quality control.

b. Resource Utilization:

(1) Land: All alternatives will utilize some additional existing land to accommodate new facilities. Alternative B will result in somewhat less impact by reason of one less treatment plant. It is assumed that this impact will be negative.

It is considered that Implementation Sequence IV will result in somewhat less impact in this category by reason of no outfall pipeline existence.

Without any project, the impact on our land resource will be greater because of the continuation of fifteen existing treatment plants.

(2) Water: It is considered that all alternatives under Implementation Sequences II, III, and IV which involve reclamation will result in a positive impact in this category by reason of providing means for beneficial reuse of reclaimed wastewater. Conversely, Sequence I will have a secondary negative impact in this category by reason of utilization of added source water in the future, constituting increased wastewater volume. Implementation Sequences III and IV will provide still added positive impact in this category by reason of early reclamation.

The No Project alternative will result in a negative impact on the water resources because a large-scale reclamation and reuse program could not be implemented, and local reclamation projects could not utilize a significant portion of the wastewater of the area.

(3) Energy: It is considered that all alternatives will utilize additional energy for facility operation with still added energy requirements associated with the reclamation facilities. Alternatives B and C will utilize slightly more energy because they involve greater pumping requirements in the full-sized intertie between Central and North Marin. It is assumed that this impact will be negative.

The continuation of local treatment facilities if No Project were implemented will have a lesser impact on energy resources.

(4) Secondary Resource Use: It is assumed that all alternatives will utilize natural resources in some form as a function of treatment plant operation. Under Alternative B there will be a slightly greater need for secondary resources to control odors because raw sewage will be transported for a greater distance.

There will be significant added use of resources in the form of various chemicals as part of reclamation plant operation. It is assumed that this impact will be negative. The early operation of a reclamation plant under Implementation Sequences III and IV will use secondary resources for a longer time.

The alternative of No Project will utilize a minimum of additional secondary resources.

c. Flexibility:

(1) Reclamation: All alternative sequencing programs are considered to be flexible in respect to accommodating reclamation facilities. Although Implementation Sequence I is slightly less flexible, it is considered that Implementation Sequences III and IV will maximize the impact in this category.

It is considered that Alternative B has somewhat less flexibility in this category by reason of removing reclaimed wastewater source from South and Central Marin areas for possible future local reuse. This impact is assumed to be positive.

The alternative of No Project is only flexible in respect to achieving local reclamation programs. This impact is assumed to be negative.

(2) Treatment: It is considered that all alternatives will provide flexibility in respect to changed conditions relating to treatment needs in the future. Alternative B may have some advantage in respect to this category of impact by reason of one less treatment plant. This impact is assumed to be positive.

The alternative of No Project is not flexible in respect to changed conditions because of the multiplicity of treatment plants. This impact is assumed to be negative.

(3) Disposal: It is considered that all alternatives have some flexibility in respect to future changed conditions for disposal, with Alternatives B and C providing somewhat more flexibility by reason of the single outfall. It is assumed that this impact will be positive.

It is considered that Implementation Sequence IV will have added flexibility in this category of impact by reason of no prior disposal system.

The alternative of No Project is considerably less flexible in respect to meeting changed disposal conditions because of the continued existence of the numerous shallow water discharges.

(4) Changes in Land Use Planning: It is considered that all alternatives have flexibility in respect to possible changes in future land use planning by reason of the anticipated staging. However, it is considered that Alternative B has somewhat less flexibility in this category of impact by reason of the necessity to construct transport facilities for untreated sewage from all of South and Central Marin County sized to ultimate capacity as part of first stage construction. It is assumed that this impact will be positive.

The alternative of No Project is very flexible in respect to possible changes of future land use planning because of the high degree of local control.

This impact would be rated differently if positive planning and growth controls were to be adopted at a planning agency level.

d. Reliability:

(1) Treatment: Because of the large sizes of treatment plants related to all alternatives, it is considered that all alternative treatment plant facilities may be operated with equal reliability. It is considered that the existence of one additional large treatment plant, as in the cases of Alternatives A and C, provides some slight added impact in this category. It is assumed that this impact will be positive.

It is considered that Implementation Sequences III and IV will have some added reliability in this category by reason of the added treatment provided for reclamation as part of initial Phase I construction.

If No Project is implemented, the treatment reliability will continue to be very low. It is assumed that this impact will be negative.

(2) Transport: It is considered that all alternatives will have a high reliability factor in respect to transport facilities. The existence of an additional untreated wastewater transport line through San Rafael associated with Alternative B is considered to lessen the impact of this alternative. It is assumed that this impact will be positive.

With No Project, the reliability of transportation facilities is of little importance because treatment will be accomplished locally.

(3) Disposal: It is considered that all alternatives will have a high reliability factor in respect to disposal since effluent will be disposed of to the deep waters of the bay. It is considered that the two-point disposal system of Alternative A has a slight advantage in this category. It is assumed that this impact will be positive.

It is considered that Implementaton Sequence III provides somewhat more reliability by reason of early construction of reclamation facilities resulting in less volume for disposal.

The no disposal facility feature of Implementation Sequence IV mitigates against the otherwise added reliability because of the possible necessity of disposal in any case, but at a less desirable point.

Under the No Project alternative the reliability of disposal is considered to be poor because water quality objectives will not be met; and if there is a breakdown in treatment facilities, the waste will be discharged directly to shallow confined waters, where they have the greatest environmental impact. It is assumed that this impact will be negative.

(4) Reclamation: All alternatives are considered to be reliabile in respect to achieving the reclamation objective since even under Implementation Sequence I the program is flexible in respect to achieving local as well as large-scale reclamation. Alternatives B and C are considered to be somewhat more advantageous in this category of impact by reason of having provided the north/south intertie as part of initial Phase I construction. However, Alternative B does not provide for the availability of treated effluent for local reclamation in Central Marin. It is assumed that this impact will be positive.

It is considered obvious that Implementation Sequences III and IV will maximize the impact in this category by reason of reclamation facilities being constructed as part of initial Phase I construction.

If No Project is implemented, there will be very little flexibility in respect to achieving large-scale reclamation. It is assumed that this impact will be negative.

(5) Disaster: It is considered that all alternatives will have a high degree of resistance to disaster, such as earthquake, by reason of judicious design in this regard. The two-plant and two-outfall feature of Alternative A is considered to be somewhat more advantageous in this category of impact, whereas the existence of a single plant and raw sewage interceptor in Plan B is considered less reliable in the event of a disaster. It is assumed that this impact will be positive.

The No Project alternative is considered to be somewhat resistant to disaster because of the dispersed nature of the treatment facilities.

e. Planning Objectives:

(1) Local Agencies: Assuming that local agency planning objectives are to maximize effectiveness through strategic consolidation of wastewater treatment and disposal facilities, then it is considered that all alternatives will assist in meeting these objectives. Alternatives A and C may be somewhat more advantageous at this point by reason of greater local control of treatment facilities and capacity allocation. It is assumed that this impact will be positive.

If No Project is implemented, there will be almost complete local control; however, many agencies may be subject to enforcement actions by the State, thus frustrating the local control ability. It is assumed that this impact will be negative.

(2) State and Federal: It is assumed that the same factors applying to local agency planning objectives will apply, with the emphasis on Plan B rather than Plans A and C, because of the greater consolidation involved. It is assumed that this impact will be positive.

The No Project alternativewould have even a greater negative impact in respect to State and Federal planning objectives.

f. Implementation:

(1) Public Acceptance: It is assumed that all alternatives will be acceptable to the public and can be made supportable. Alternatives A, C, and B may be somewhat more acceptable in that order by reason of ascending initial capital cost requirements. Implementation Sequence II is assumed to be more supportable than the other sequences because of its flexibility and staging features. It is assumed that this impact will be positive.

The alternative of undertaking No Project at all is assumed to be least acceptable because of the continued degradation of environmental quality.

(2) Financial Feasibility: While it is considered that all alternatives are feasible of being financed by the public, it is considered that Alternatives A, C, and B in that order will be more feasible by reason of ascending capital costs requirements. It is assumed that this impact will be positive.

It is considered that Implementation Sequences III and IV may be relatively much more difficult in respect to gaining financing approval for implementation by reason of much higher initial capital cost requirements. It is assumed that this impact will be negative.

The No Project alternative is considered to be completely feasible by reason of its zero cost.

(3) Institutional Complexity: It is assumed that all alternatives will involve difficulties from the standpoint of institutional involvements. However, because of the separation of North and South Marin feature of Alternative A, it is considered that this alternative will result in somewhat less impact in this regard, with Alternative B having the most impact. It is assumed that this impact will be negative.

It is considered that Implementation Sequences III and IV will result in added impact in this category by reason of the complexities of administering the reclamation program.

There are few institutional complexities if No Project is undertaken.

g. Summary:

Applying the considerations noted above and assigning a numbering system as part of the evaluation technique has resulted in the summary shown in Table .

From Table a summary of general conclusions may be made as follows:

(1) All alternative regional plans under all four implementation sequences result in positive overall effectiveness.

(2) The "No Project" alternative results in a negative effectiveness.

(3) While there do not appear to be major differences in effectiveness between the alternative programs, it does appear that Alternatives A and C are somewhat preferred over Alternative B.

(4) Assuming different implementation sequences does not basically change the effectiveness ranking of the Alternative Programs.

SIGNIFICANT QUESTIONS

During the course of presenting the three subregional study results to the sponsoring agencies, and as the result of reviews by Regional Water Quality Control Board and State Water Resources Control Board Staff, questions have been raised in connection with the prior evaluation of regional Alternative Programs A, B and C within the categories of, Costs, Effectiveness, Reclamation and Other. A summary of these questions and discussion related thereto are presented as follows:

a. Costs: Questions which have been raising concerning cost factors relating to comparisons between the Alternative Regional Programs basically ask,

> "Are there any modifications which reasonably could be considered which would alter the previous economic comparisons of Alternative Programs?" Included in the additional evaluation, specific responses relate to the following:

(1) IF "EXCESSIVE" STORM WATER INFILTRATION WERE EXCLUDED FROM THE SUBREGIONAL SEWERAGE SYSTEMS IN THE SOUTH AND CENTRAL MARIN SUBREGIONAL AREAS, WOULD THE RESULTANT NEED FOR A SMALLER SIZE INTERCONNECTING PIPELINE TO EFFECT THE IMMEDIATE NORTH/SOUTH CONSOLIDATION OF PROGRAM B BE SUFFICIENTLY LESS COSTLY THAT THE ECONOMIC BALANCE WOULD SHIFT IN FAVOR OF PROGRAM B?

Discussion

It is quite true that there is a considerable amount of storm water infiltration associated with the South and Central Marin Sewerage systems. Detailed analysis has been made which indicates that if these peak flows could be reduced through an intensive program of sewer system re-building and repairs so that peak flows do not exceed a 3:1 ratio to average dry-weather flows, a savings resulting from smaller pipeline size related to Program B would amount to some 5 million dollars. If such a reduction were feasible, a cost savings would accrue to Alternate Programs A and C also, but the impact upon the overall economic analysis of Alternatives would still be a "narrowing of the gap" between Alternatives A and B by possibly 3 million dollars on a Present Worth basis.

A difficulty associated with this economic sensitivity factor, however, is that in order to effect a savings in wastewater transport and treatment facility size by peak storm water flow reduction, preliminary estimates suggest that expenditures in possibly excess of 20 million dollars in sewerage system repairs and reconstruction would be required (to be verified by infiltration/inflow analysis). On this basis, then, it does not appear that a cost-effectiveness relationship exists which could actually result in a Program cost reduction through reduction in "excessive" storm water infiltration.

In any case, apparently this factor will not in a significant way alter the basic comparison of Alternative Program costs comparisons.

(2) IF THERE ARE CONTINUING SAVINGS IN OPERATING AND MAINTENANCE COSTS OF THE SINGLE TREATMENT PLANT OPERATION OF ALTERNATIVE PROGRAM B, WHICH ON A PRESENT WORTH BASIS NEARLY OFFSET THE CAPITAL COST ADVANTAGE OF ALTERNATIVE PROGRAM A, THEN WHY IS THERE SUCH A SIGNIFICANT PRESENT WORTH COST ADVANTAGE STILL RELATED TO PROGRAM A?

Discussion

There are still additional costs associated with Program B which are offsetting to the operation and maintenance cost savings of single plant operation including, (1) construction and operating costs of a separate raw sewage pumping station to pump South and Central Marin sewage to the North Marin treatment plant site, and (2) cost for chlorine, air, or peroxide addition to the raw, untreated sewage from South and Central Marin in order to prevent excessive septicity. In addition, and of most importance, a cost factor which appears in the Present Worth analysis as being favorable to Alternative Program A is the time delay in construction of the much smaller dry-weather transport line between the North and South. The time factor shows as interest saved on the delayed investment in Present Worth, as does the lower cost of the smaller line of Program A.

(3) IF THE PROPOSED NORTH MARIN SUBREGIONAL TREATMENT PLANT WERE TO BE LOCATED SOUTH OF THE HAMILTON FIELD AFB SITE, THIS WOULD REDUCE THE LENGTH OF THE LARGE AND EXPENSIVE NORTH/SOUTH INTERCONNECTING LINE AS WELL AS THE OUTFALL. WOULD THIS MODIFICATION NOT CHANGE THE ECONOMICS IN FAVOR OF ALTERNATIVE B?

Discussion

from

There are basically three general sites which were considered for the North Marin subregional treatment plant, 1) Hamilton Field AFB, 2) existing Las Gallinas Valley S. D. plant, and 3) McNears Point. The McNears Point site has been abandoned for serious consideration for reasons both of difficulty to reach with a North/South transport system and also its sensitive location in relationship with planned park areas.

By utilizing the Las Gallinas Valley S. D. treatment plant site in the economic analysis of Alternatives, there would be a savings under Alternative Program B resulting from shortening by about 15,000 feet of the assumed 72-inch North/South interconnecting line under Alternative Program B, and corresponding length of 102-inch outfall from the subregional treatment plant. However, this savings would be partially offset by the need to increase by a corresponding length the 54-inch raw sewage transport line from the Novato area to the south plant site and the 48-inch effluent transport line from Petaluma and Sonoma. The resultant overall net savings under Alternative Program B appears to be about 1.8 million dollars, not enough to basically alter the comparison of Alternative Program costs comparisons.

It is noted that Alternative Program C economics would not be affected by either of the plant site location changes.

Summary of Cost Factors

During the review of reasonably possible modifications to the Alternative Programs which could basically alter the prior economic comparisons, it does not appear that such factors do exist. On an overall economic comparison basis, it continues to be shown that Alternative Program A is the most economical, while Alternative Program C and B follow in that order.

However, it is recognized that the economic differences between the Alternative Programs, particularly on an overall Present Worth basis, are not compelling and the cost differential favoring Programs A and C over B could be narrowed somewhat by reason of plant site shift to the South. The signigicant initial capital cost differences favoring Alternatives A and C remain in any case.

The possibilities continue to exist that factors other than economics and, in particular, effectiveness factors related to the environment and reclamation, could be developed and shown to be of sufficient significance to favor implementation of either Alternative Programs B or C over the apparently more economical Program A.

b. Effectiveness: Questions which have been asked concerning effectiveness factors relating to comparisons between the Alternative Regional Programs have been included within at least the following basic categories:

(1) OVERALL ENVIRONMENTAL EFFECTIVENESS, IN PARTICULAR ALTERNATIVE PROGRAMS' IMPACT IN RESPECT TO WATER QUALITY, FLORA AND FAUNA, LAND PLANNING COMPATIBILITY, AQUATIC LIFE, AND AIR QUALITY?

Discussion

A thorough and detailed environmental impact study and report has been completed in draft form at the time of this writing and is summarized hereinafter. The summary speaks in more detail to the foregoing areas of overall environmental concerns.

Basically, however, it does appear that the relative overall environmental impact of the Alternative Programs within the categories noted will not be significant from a numerical standpoint.

As a matter of preference, the single point, San Quentin offshore disposal location is favored by State Departments of Fish and Game and Public Health over the San Pedro Point site because of its closer proximity to the Golden Gate. Also, there has been some concern established in the EIR in respect to potential damage to the marsh land areas over which a possible major outfall line under Alternative Program B would travel to reach Point San Pedro.

Other than the foregoing, and recognizing the subtleties which may exist in respect to other as yet to be discussed factors, studies to date do not indicate significant variations between the three basic Alternative Programs in respect to overall environmental impact, including meeting of water quality objectives, land planning compatibility, construction impact, noise impact, aesthetics and cultural.

(2) OVERALL EFFECTIVENESS OF ALTERNATIVE PROGRAMS IN RESPECT TO RESOURCE UTILIZATION, INCLUDING LAND, WATER, ENERGY AND SECONDARY RESOURCES USE?

Discussion

All Alternative Programs utilize substantially the same amount of land required for transport facilities. The single treatment plant alternative of Program B utilizes less land than would the two Alternative A and C Programs.

It is not considered that any of the Alternative Programs would differ in meaningful ways in respect to receiving water utilization. Similarly, there do not appear to be meaningful differences between the Alternative Programs related to energy or secondary resources use, such as chlorine or other chemicals used during treatment.

However, in respect to this category of interest, it should be noted that if and when "tertiary" treatment is considered, such as will be the case under Programs A1, B1, C1 and B2 and C2 as discussed hereinafter, secondary resource use, including energy, could be substantial. As an example, it has been estimated that for tertiary treatment to remove 1000 lbs. of residual pollutants, it requires use of some 10,000 lbs. of natural resources, such as lime, carbon, methanol, chlorine, etc., and the production of these treatment elements will indirectly result in the emission of 4,000 lbs. of pollutants.

(3) EVALUATION OF FLEXIBILITY OF ALTERNATIVE PROGRAMS TO MEET CHANGED CONDITIONS IN THE FUTURE, PARTICULARLY IN RESPECT TO RECLAMATION, TREATMENT AND DISPOSAL?

Discussion

If it is accepted that there would be no future hindrances to the construction of the North/South interconnecting line, then it would appear that Alternative Programs A and C have some advantage over Program B in respect to possible changes in local reclaimed wastewater reuse market. That is, while the engineering studies, based upon present known factors minimized a future South/Central Marin reclaimed wastewater reuse market, if such a market were to be developed in the future, Alternative Program B would provide the least amount of flexibility in respect to making possible the meeting of this local market by reason of having exported out of the South/Central Marin area raw, untreated sewage.

Conversely, the availability of highly treated wastewater in the South/Central Marin areas, as would be the case under Alternative Programs A and C, maximum flexibility to meet a potential future local reclamation for South/Central Marin reuse market appears to be preserved.

The expressed concern that if the North/South interconnecting line is not constructed as part of Phase 1 Program's implementation, then "the line will never be built," could alter the argument in favor of Alternative Program C, or possibly Program B.

In respect to treatment, there may not be any substantial difference related to flexibility of Alternative Programs. There is some opinion which suggests that in respect to possibilities of tertiary treatment required to meet future discharge, or reuse standards, a single treatment plant as under Alternative Program B offers more flexibility than would a two plant Program such as under Alternatives A and C. This economic factor may not be particularly significant in the scale of plants under consideration and also noting that costs for tertiary treatment are less subject to economies of scale than for primary or secondary treatment. In any case, the economic comparison and its significance can be seen in the costs analysis of Alternative Programs A1, B1 and C1.

In respect to flexibility factors associated with disposal alternatives, it could be argued that the two point disposal system of Alternative Program A has added flexibility to meet changed future conditions over the single point disposal system of Alternatives B and C. It could also be argued that the single point south disposal system at Point San Quentin related to Alternative Program C offers better flexibility in respect to more stringent future disposal requirements by reason of its somewhat more remote location from the more environmentally sensitive areas of San Pablo Bay.

In respect to a possible future requirement of zero discharge, even during peak wet-weather, Alternative Program A appears to offer the least flexibility, while Alternatives B and C could be considered as being equal.

In respect to flexibility related to future changes in land-use planning, the least capital cost system, Alternative Program A, probably is advantageous, particularly if land use planning results in lower than anticipated future contributing populations.

(4) EVALUATION OF THE RELIABILITY OF ALTERNATIVE PROGRAMS TO MEET OBJECTIVES IN RESPECT TO TREATMENT, TRANSPORT, RECLAMATION AND DISASTER?

Discussion

There continues to be some disagreement within regulating agencies as to the relative reliability of alternative programs involving one, two, or more treatment plants. While there is no question that "small" treatment plants usually do not provide the same reliability as do "large" treatment plants, the distinction between "small" and "large" is relative. There is more prominent thinking today, that overall reliability in respect to protection of receiving waters from water pollution can be achieved by spreading the residual pollution load through multiple "reasonably" sized treatment plants as the alternative to very large sized regional treatment works.

It would appear that while there is no reason to assume that a "small" treatment plant could not be operated in a reliable manner through expenditure of sufficient funds, nevertheless a higher level of reliability could be assumed for a plant of sufficient size as to normally, (1) have continuous, 24-hour supervision, (2) have multiple process units, (3) have full laboratory control, (4) have standby power, and (5) have highly qualified operating personnel. Assuming that as part of the accepted Program there will be concerted effort to achieve the foregoing elements of plant reliability for the four plants of Alternatives A and C, or the three plants of Alternative B, then there may not be reason to expect a significant degree of reliability difference between the three Alternative Programs in respect to treatment plant operation.

In respect to reliability of transport systems, it is probably true that all three Alternative Programs are essentially the same. However, it might be argued in favor of Alternatives A and C that transport of treated effluent can be accomplished more reliabily than transport of raw sewage, as would be the case for Alternative B south of the single, north Marin treatment plant.

In respect to reliability to meet the demands for reclamation, the arguments are probably substantially the same as for treatment plant reliability.

The disaster reliability factor possibly favors the two point independent disposal, two treatment Alternative A and, to a lesser extent, the two treatment plant, single point disposal system of Alternative C.

c. Reclamation: Questions which have been asked concerning wastewater reclamation for beneficial reuse potential associated with each of the Alternative Programs are probably the most complex of all evaluation factors.

Accepting the importance, and in fact the essential nature, of wastewater reclamation as being the ultimate goal of any water quality management program, they key question remains as to which Alternative Program will facilitate to best advantage the reaching of this goal? To evaluate the questions and answers in this area of special concern, questions are raised in at least the following categories:

(1) REALISTICALLY, WHAT IS THE RECLAIMED WASTEWATER REUSE MARKET AT THE PRESENT TIME AND IN THE FUTURE, AND WHAT IS ITS SIGNIFICANCE TO THE DECISION ON ALTERNATIVES?

Discussion

From an overall water resources standpoint, Marin and South Sonoma Counties have a clear need to develop additional sources of water supply, of which reclaimed wastewater may be most logical. The extent of this need may be somewhat tempered by more recent emphasis upon growth limitations within both Counties. However, from the combined standpoints of water supply needs and conservation of natural resources, it is agreed that every effort should be made to encourage and develop a program which will enhance the prospects for wastewater reclamation for beneficial reuse, the ultimate objective of all of the Alternative Programs under consideration.

Defining the potential market for reclaimed wastewater at the present time is somewhat complicated by the facts that, 1) State Health Department restrictions prohibit the use of reclaimed wastewater as a potable water supply resource (this condition may change in the future), and 2) the cost for providing reclaimed wastewater, including the costs for separate distribution systems to meet irrigation water supply needs, is currently high.

The subregional studies identified a limited reclaimed wastewater reuse market for landscape irrigation in the Central Marin area and a much larger reuse market for agricultural irrigation in the South Sonoma County area. The Central Marin landscape irrigation potential reuse market is estimated to be between 700 and 1,000 acre feet per year, against a predicted available 15,000 acre feet per year from South/Central Marin. The agriculture irrigation potential in South Sonoma County has been estimated to be about 41,000 acre feet per year against an estimated future available 40,000 acre feet per year from North Marin/South Sonoma. A potential large scale wastewater reuse market has also been identified in the Napa/Solano County area but its extent and timing is quite uncertain at the present time.

It is important to note, however, that the reuse market, especially in the South Sonoma area, would be significantly dependent upon some form of subsidy to realize. The agricultural irrigation water market is dependent upon a cost of irrigation water of between $3.50 and $20.00 per acre foot, depending upon the crop to be irrigated. A subsidy of from between $13.00 and $58.00 per acre foot could be necessary to meet these support levels, and at this time it is quite problematical as to where this subsidy would be directed.

It also appears that the projected volume of wastewater from the North Marin/South Sonoma subregional area is nearly adequate to meet the presently identified potential large-scale irrigation water reuse market, independently of the South/Central Marin subregion supply. This was one of the basic factors which suggested postponing construction of the intertie line and costs related thereto between the subregions as shown for Alternative Program A. Under Alternative A, the interconnecting line would be constructed in the future only at such time as the reuse market actually is developed to the point where the South /Central Marin wastewater could be reused at a north location.

Inasmuch as all three Alternative Programs ultimately provide the means whereby the same potential reclaimed wastewater reuse market can be met, there appears to be no substantive difference between the Alternatives in this regard. The possible exception to this assumption would be in the case of Alternative A, where it has been argued that if the intertie line between South/Central Marin and North Marin/South Sonoma is not constructed as part of Phase 1 of the Program, the chances of its being built at a future date simply to serve the cause of reclamation may be remote.

In summary, it does appear quite certain that a potential large-scale reclaimed wastewater reuse market does exist in the south Sonoma area. There is a limited market in the Central Marin subregional area and very little potential market within the South Marin subregion. The time at which the South Sonoma reuse market can be developed appears to be uncertain by reason of the unfavorable economics of this market which currently exists. In any case, all three Alternative Programs do provide the means whereby the large-scale reclaimed wastewater reuse market could be accomplished and Alternative Programs A and C enhance the possibilities of meeting the limited Central Marin market as well.

(2) WHAT ABOUT THE RECREATION LAKE?

Discussion

The subregional engineering studies identified a recreation lake in the South Sonoma County area as being a very real possibility for reclaimed wastewater beneficial reuse. Two potential lake sites were shown and studied, particularly as part of the North Marin/South Sonoma subregional study, Tolay Lake and Chileno Lake. The recreation lake need has been attested to by County recreation departments and the efficacy of reclaimed wastewater for recreation lake water sources has been demonstrated at Santee and Indian Creek (near Lake Tahoe).

The concept of the recreation lake feature of the proposed water quality management programs is that with the construction and use of a recreation lake with use of reclaimed wastewater, the lake also becomes a storage reservoir from which increasing demands may be made for a variety of water supply purposes, beginning with agriculture irrigation water and, ultimately, direct supplemental potable water supply. All three Alternative Programs assume this progression.

The limitations relative to recreation lake construction at the present time are primarily related to excessive costs and resource requirements for tertiary treatment. To ascribe the recreation lake costs to Phase 1 construction of the water quality management program would probably double the initial construction costs, with no encouragement to believe that State and Federal grant monies would be available for the lake and prerequisite tertiary treatment construction and operation costs, inasmuch as studies to date do not indicate a favorable cost/effectiveness relationship. This factor may change in time, however, which has been the primary factor in assuming that the recreation lake feature of any of the Alternative Programs would be subsequent in time to the 1st Phase construction.

Another possibly misunderstood factor relating to the recreation lake feature is that the lake would not in itself provide the means of accomplishign a zero discharge of wastewater. The only loss of water from the lake would be through evaporation and percolation, this loss being considered minor in relation to the total volume of wastewater expected from the three subregional areas. In the absence of developing a total wastewater reuse market there would, of necessity, have to be a discharge from the recreation lake, particularly in any case during winter months during the foreseeable future.

As a possible recreation lake relates to the alternative Programs, it is seen that filling and replenishment of the lake itself could be accomplished easily through utilization of South Sonoma and North Marin wastewater only and into the future, until such time as a reuse market could be developed exceeding the supply, which, according to the earlier studies, may not occur for some time, if ever, into the future. Under these circumstances, it would appear that each of the three Alternative Programs are essentially equal in ability to meet the needs for a recreation lake.

(3) WHAT ABOUT ZERO DISCHARGE?

Discussion

There is language in the most recent Federal law which points towards an ultimate national goal of zero discharge of pollutants to the environment. Whether this will be interpreted to mean zero discharge of highly treated wastewater is problematical at the present time. In any case, it does suggest that any Program should have the capability of being expanded in such a way as to accomplish a zero discharge objective in the future, and in this regard, all three Alternative Programs may be so modified, with Program A required the most changes.

The assumption here is that land disposal of the total combined subregional wastewater could be accomplished to best advantage in the Sonoma County area and as an integral part of the expected future large-scale reuse program for agriculture irrigation.

Summary of Reclamation Factors

There is a limited reclaimed wastewater reuse market in the South and Central Marin areas at the present time. There is an uncertain future reclaimed wastewater market in the same area, relating primarily to current prohibitions against direct or indirect reuse as a supplemental, fresh, potable water supply source. Alternative Programs A and C would enhance the possibilities of satisfying whatever reclaimed wastewater reuse potential as does and will exist in the South and Central Marin areas. Alternative Program B would essentially eliminate the use of reclaimed wastewater in the South and Central Marin areas.

There is a much larger potential reclaimed wastewater reuse market in the South Sonoma County area, particularly for agricultural irrigation and recreation lake water replenishment, with ultimate probabilities of meeting a supplemental, fresh potable water supply need. To realize both the present and potential future reclaimed wastewater market, however, would require a very significant financial subsidy to account for the approximate doubling of the initial costs for the wastewater management program Phase 1.

All three Alternative Programs envision a progression of facility additions which would see three phases of improvements; Phase 1 with high levels of treatment prior to Bay disposal, Phase 2 with added tertiary treatment combined with recreation lake and/or agricultural irrigation, and Phase 3 with still added treatment and direct, potable water supply reuse possibly resulting in zero discharge.

All three Alternative Programs accommodate the foregoing, although it can be argued that Alternative Programs B and C facilitate the meeting of these objectives to better advantage than does Program A.

If it could be predicted that an early reclaimed wastewater reuse market will be realized in the South Sonoma area, a market which exceeds in volume the available amounts from the North Marin/South Sonoma areas independently, then the early construction of the interconnecting North/South line inherent with Alternatives B and C would seem to favor these Alternatives over Program A.

Alternative Programs A and C appear to offer the greatest amount of flexibility in respect to changed future conditions relating to reclaimed wastewater reuse within the combined, regional area.

d. Other: Questions have been asked concerning a number of other factors thought to be important considerations related to the Alternative Program's evaluation, including public acceptance, financial feasibility, institutional complexity and meeting of State and Federal planning objectives.

(1) PUBLIC ACCEPTANCE OF ALTERNATIVE PROGRAMS?

Discussion

This is obviously not an easy question to answer. The opinion has been expressed that "the public will not accept any alternative program which does not provide for reclamation in the first phase of implementation." This statement of opinion should, of course, be given careful consideration, and its acceptance as fact would appear to dictate a modification of all Alternative Programs to include Program Phase 2, providing for the interconnecting North/South line to be constructed initially, as well as tertiary treatment and the recreation lake.

In other respects related to public acceptance, however, at the present there do not appear to be compelling factors of known consequence which would seem to bear upon the matter, other than possibly costs, which presumably would favor Alternative Program A, then C and B in that order.

In respect to financial feasibility, all three Alternative Programs are dependent upon full State and Federal grants for implementation. The significantly higher first cost of Alternative Program B could be a detraction from a financial feasibility standpoint, but probably not crucially so.

In respect to institutional complexity, unquestionably Alternative Programs B and C offer more complications at the present time. However, these complications may not be of such significance as to thwart implementation of either Alternatives B or C if other factors make either of these Programs most advisable.

In respect to the meeting of State and Federal planning objectives, it is probably true that Alternative Program B would be somewhat favored by some in the State approving agency because of the three plant versus four plant feature, while Alternative Programs A and C might be considered at least equal in this regard on a Federal level.

RE-EVALUATION OF ECONOMICS

The economic evaluation of Alternative Programs derived from the earlier studies is as summarized in Table 9.

Subsequent to the completion of the subregional studies and the prior economic evaluations, which included the evaluation of the economics of each Alternative Program, the Federal Environmental Protection Agency promulgated new Regulations describing specific guidelines for an acceptable cost/effectiveness analysis.

As part of the guidelines, it is noted that the planning period for the cost/effectiveness analysis, "shall be 20 years," and interest rate, "of 7 percent per year will be used." Also, a prescribed service life for purposes of affixing a cost for replacement must be included in the analysis.

To ascertain the significance of the foregoing prescribed elements of a required cost/effectiveness analysis as applied to the Alternative Programs under present additional evaluation, the prior economic analysis summarized in Table 9 was modified to include the foregoing prescribed elements. This re-evaluation results in the cost analysis shown in Table 11.

Table 11 - Revised Summary of Overall Costs of Alternative Regional Programs

Alternative Program	Initial Constr. Cost (Million $'s)	Total Present Worth (Million $'s)*	Average Annual Costs (Million $'s)*
A	73.1	102.9	9.7
B	90.5	123.8	11.7
C	80.6	112.7	10.6

*At 7% interest rate, 20-year Program life and depreciation.

To provide a comparison of the estimated additional costs related to Alternative Programs B and C beyond those of Alternative A, the summary set forth in Table 12 has been prepared. The costs established in Table 12 are based upon the revised estimates shown in Table 11.

Table 12 - Summary of Increased costs of Alternative Programs B and C Over Costs of the Apparent Best Alternative A

Additional Cost Item	Alternative Program B	Alternative Program C
Additional Initial Cost, Million $'s	17.4	7.5
Percent Increased Initial Costs	23.8	10.3
Additional Present Worth, Million $'s	20.9	9.8
Percent Increased Present Worth	20.0	9.5
Additional Total Average Annual Costs, Million $'s	2.0	0.9
Percent Increased Total Average Annual Costs	20.0	10.0

While the estimates of cost shown in Table Nos. 11 and 12 provide a basis upon which the significant differences between the Alternative Programs may be seen, it is considered of some interest to relate the differences in cost to the lowest level of service unit. Accordingly, estimates have been made as to the possible typical costs related to each Alternative Program which would accrue to a single family dwelling unit equivalent, assuming that such a figure can be derived simply by applying the projected total regional population for 1980 divided by 3, against the average annual total Program costs and applied uniformly over the entire regional service area. The cost estimates derived in this way may provide an indication of what actual costs, "to the nation" would be, but the real costs to local users would in fact include the reduced costs resulting from State and Federal grants. Based on the foregoing factors, the figures shown in Table 13 have been prepared.

Table 13 - Estimated Average Annual Costs of Alternative Programs for Equivalent Single Family Dwelling Unit(1)

Basis of Comparison	Alternative Program A	Alternative Program B	Alternative Program C
Without Grants, $'s/year	85	102	93
With Grants,(2) $'s/year	44	52	48

(1) Based on 1980 median population projections and 3 persons per dwelling unit applied to estimated average annual costs as determined through revised estimates of Table 10.

(2) Assuming 75% State and Federal grants applied to capital costs.

ENVIRONMENTAL IMPACT

E N V I R O N M E N T A L

I M P A C T

As observed, the evaluations of Alternative Programs discussed hereinbefore did include consideration of numerous noneconomic factors as well as the economic comparison of Alternatives.

Subsequent to the time that the three separate subregional engineering studies were completed, including the evaluations of Regional Alternative Programs summarized herein, the governing Board of all participating agencies authorized the preparation of environmental impact reports pursuant to meeting specific requirements of the National Environmental Policy Act of 1969 and the California Environmental Quality Act of 1970.

The overview EIR has been undertaken jointly by participating and coordinating agencies within all three subregions of North Marin/South Sonoma, Central Marin, and South Marin. The overview EIR was undertaken by the engineering consortium of J. Warren Nute, Inc., Jenks & Adamson, and Yoder-Orlob-Trotter & Associates, in consultation with Dr. Joel G. Gustafson, Dr. James P. Mackey, Dr. P. H. McGauhey, Mr. Joseph D. Coons, and others.

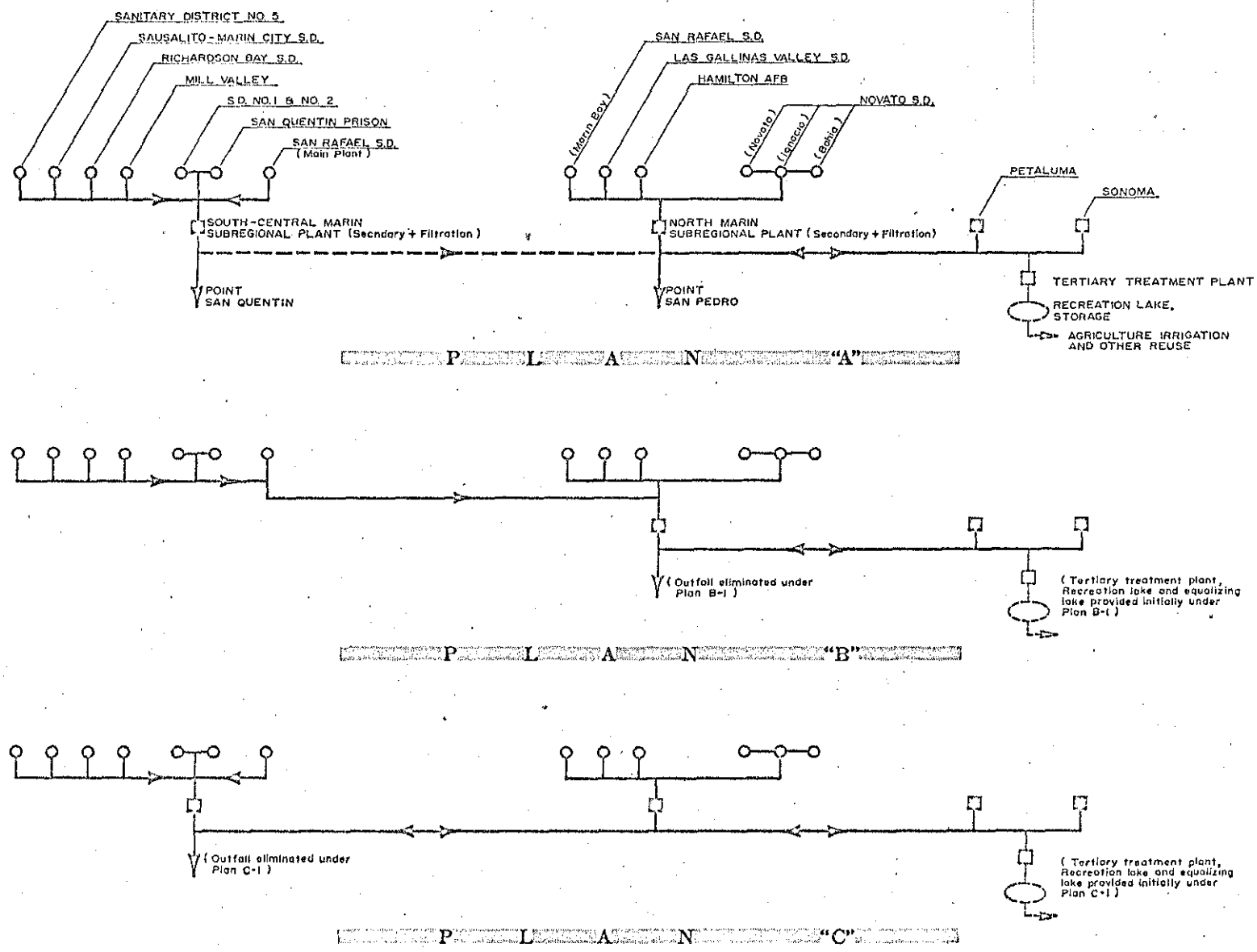
The EIR deals specifically with all identified environmental impacts of the best apparent Alternative Program, Alternative A, as well as with the corresponding and different impacts associated with the remaining candidate Alternatives, B and C.

A fundamental purpose of the separate environmental impact studies has been to provide a still further basis upon which a final decision can be made as to which Alternative Program should be implemented.

The following provides a verbatim summary of the environmental impact of the regional consolidation project along with (1) a summary of the environmental impacts of the best apparent Alternative Program, Alternative A, and (2) a comparison of the different environmental impacts associated with Alternatives B and C.

Project Description

The proposed project involves the regional consolidation of wastewater treatment and disposal facilities in Eastern Marin County and Southern Sonoma County for the purposes of enhancing the aquatic environment by meeting long-range water quality objectives as well as by facilitating the implementation of both local and large-scale wastewater reclamation in the region. A schematic layout of the Alternatives is shown in Figure VI-3.



SCHEMATIC LAYOUT OF

ALTERNATIVE AREA-WIDE, REGIONAL WASTEWATER TREATMENT, DISPOSAL AND RECLAMATION PLANS

FIGURE VI-3

Environmental Setting

The project service area lies in the northwesterly portion of the San Francisco Bay Area and is tributary to both San Pablo Bay and Central San Francisco Bay. The overall project service area covers a total of 462 square miles and has a present population of 257,000.

Environmental Impact of Alternative A

The overview Environmental Impact Report has been written around Alternative A as the best apparent program against which Alternatives B and C have been compared.

The Alternative A program has been divided into 17 basic project elements as itemized in Table I-1. Using a 1 to 5 rating system, with the magnitude of the impact indicated by the upper left number and the importance of the impact indicated by the lower right number, an environmental evaluation of the construction impacts and long-term impacts for each project element are given in Tables III-1 and III-2, respectively.

The various environmental impacts of the Alternative A program are summarized briefly below:

Construction Impacts: The construction of the project will cause significant short-term impacts on the environment consisting of (a) disturbance to land forms, (b) disturbance to flora and fauna along interceptor pipeline routes, (c) disturbance to the aquatic environment where pipelines are constructed in the water, and (d) disturbance to human activities, such as traffic and commerce, where facilities are constructed in developed areas.

Most of the construction impacts of the project can be mitigated to some extent; however, most disturbances will be unavoidable, and a certain amount of time will be necessary for recovery and reestablishment of the original flora and fauna.

Long-Term Impacts: The primary long-term environmental impact of the project, which is in essence the reason for undertaking the project, will be the improvement of the aquatic environment by relocating existing waste discharges from the nearshore and confined waters of the bay and estuary system to the deep waters of the bay, as well as the upgrading and consolidation of existing wastewater treatment facilities. Most of the existing treatment facilities in the Eastern Marin and Southern Sonoma area presently discharge treated effluent to the nearshore waters of the bay, which are known nursery areas for fish and other aquatic organisms. The upgrading and relocation of the wastewater discharges to the deep waters of the bay will provide greater dilution and dispersion and thereby greater protection of the environment.

TABLE I-1 Eastern Marin-South Sonoma Wastewater Management Program
Summary of Phase One Facilities

Project Element No.	Basic Facility	Map Desig.	Description	ACTION New Const.	Enlarge or Modify	Aban-don	MATERIAL HANDLE Raw Sewage	Effluen
NORTH MARIN-SOUTH SONOMA SUBREGION								
Stage I								
1.	Sonoma Interceptor	PS-S1	Treatment Plant Pumping Station		X			X
		S-1	Force Main	X				X
2.	Petaluma Interceptor	PS-P2	Pumping Station	X				X
		P-2	Force Main	X				X
3.	Petaluma-Sonoma Interceptor	P-3, 4, 5	Force Main	X				X
4.	Pt. San Pedro Regional	PS-R1	Pumping Station	X				X
	Outfall Conveyance	N-3, 4	Force Main	X				X
		O-1	Submarine Outfall	X				X
Stage II								
5.	North Marin Regional Treatment	TP-NM	Regional Treatment Plant	X			X	
6.	Bahia Interceptor	PS-B1	Pumping Station	X			X	
		B-1	Force Main	X			X	
		TP-B	Bahia Treatment Plant			X		
7.	Novato Interceptor	PS-N1	Novato Pumping Station		X		X	
		TP-N1	Novato Treatment Plant			X		
		PS-N2	Ignacio Pumping Station		X		X	
		TP-N2	Ignacio Treatment Plant			X		
		PS-H	Pumping Station		X		X	
8.	Hamilton Air Force Base	H-1	Force Main	X			X	
	Interceptor	TP-4	Base Treatment Plant			X		
9.	Las Gallinas Interceptor	PS-L	Las Gallinas Pumping Station	X			X	
		L-1, 2	Force Main	X			X	
		TP-L	Las Gallinas Treatment Plant			X		
10.	Marin Bay Interceptor	PS-M	Marin Bay Pumping Station	X			X	
		M-1	Force Main	X			X	
		TP-M	Marin Bay Treatment Plant			X		
CENTRAL MARIN SUBREGION								
Stage I								
11.	Central Marin Regional Treatment	TP-CM	Regional Treatment Plant	X			X	
12	San Rafael Interceptor	PS-SR	Pumping Stations		X		X	
		SR-1	Force Main	X			X	
		TP-SR	San Rafael Treatment Plant			X		
13	San Quentin Interceptor	PS-SQ	Pumping Stations	X			X	
		SQ-1	Force Mains	X			X	
		TP-SQ	San Quentin Treatment Plant			X		
14.	Pt. San Quentin Regional	PS-CM1	Pumping Stations	X				X
	Outfall Conveyance	CM-1	Force Mains	X				X
		O-2	Submarine Outfall	X				X
Stage II								
15.	Regional Interconnect	PS-CM2	Pumping Station		X			X
		CM-2	Force Main	X				X
SOUTH MARIN SUBREGION								
16.	Shoreline Interceptors	SM-1	Force Mains & Pumping Stations	X			X	
		SM-2	Force Mains & Pumping Stations	X			X	
		TP-Sm 1, 2, 3, 4	South Marin Treatment Plants			X		
17.	Southern Marin Connection to Central Marin	SM-3	Force Mains & Pumping Stations	X			X	

TABLE III-1 Summary of Major Construction Impacts for Each Project Element of the Marin-South Sonoma Wastewater Management Program

Environmental Impact Area	Project Element Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Overall Project	Estimated Recovery Time
1. EARTH																			
a. Soils	2/2	1/1	2/2	2/2	3/3	1/1		1/1	2/2	2/3	3/3		1/1	1/1	2/2	1/2		2/2	2
b. Landforms	3/3	1/1	2/2	2/2	5/4	2/2	1/1	1/1	2/2	2/3	4/4	1/1	1/1	2/2	1/1	2/3		2/2	3
2. WATER																			
a. Surface	2/2	1/1	4/3	3/3					1/1	2/2	2/2			3/3	3/3	3/4	3/3	3/3	1
b. Quality	3/4	1/1	3/4	4/2	1/1	1/1		1/1	2/3	2/3	2/2		2/2	4/3	1/1	2/3	2/2	3/3	4
3. AIR QUALITY	3/2	2/1	3/2	2/2	4/2	2/1		1/1	3/2	2/3	3/2	2/2	2/2	1/1	2/3	2/4	2/3	2/2	4
4. PROCESSES																			
a. Floods			2/4	2/4	2/4	2/2			2/1	2/4					2/3			2/4	1
b. Erosion	3/3	1/1	2/2	3/4	2/2	1/1			1/1	2/3	3/4		1/1	1/1	1/1	2/2	2/2	2/2	3
c. Deposition	3/3	1/1	2/2	4/5	2/2	1/1			1/1	2/3	3/4		2/2	4/4	2/2	2/3	2/2	2/2	2
5. FLORA																			
a. Trees	2/1		1/1	1/1		1/1				2/2	1/1					1/3		2/2	5
b. Shrubs	2/1			1/1						2/2	1/1					1/2		2/2	3
c. Grass	2/1	2/1	2/2	2/2	3/2	2/1	1/1	1/1	2/2	2/1	2/2				2/1	2/2		3/2	1
d. Crops	2/2	1/1	2/2		2/2	1/1												2/2	1
e. Marsh Plants		1/3	3/4	2/4					1/2	2/4				2/1	1/2	1/2	1/2	3/4	4
f. Aquatic Plants				1/1										1/1				1/1	<1
g. Endangered Species	3/4	2/4	2/4	1/2		1/2			1/2	1/2	2/3				1/2	1/1	1/1	3/4	4
6. FAUNA																			
a. Birds	2/2	1/1	2/3	3/4	1/1	2/2		1/1	2/2	2/3	2/2		2/4	2/4	2/2	2/4	2/4	3/3	2
b. Land Animals	3/3	1/1	2/2	2/2	2/2	1/1		1/1	2/2	2/2	2/2				1/1	1/1	1/1	2/2	2
c. Fish and Shellfish	3/2		3/2	4/5						1/2			2/2	3/4	1/1	2/4		3/3	2
d. Benthic Organisms			1/1	4/5		2/2				2/1			2/2	4/5	1/1	2/3		3/3	2
e. Endangered Species	2/3	1/2	3/4	3/4	1/1	1/1			2/3	3/4	1/1		2/3	2/3	2/3	2/3	3/4	2/3	4
7. LAND USE																			
a. Wetlands		1/2	1/2	2/3						2/3			2/2					2/2	2
b. Agriculture	1/1	1/1	1/1		2/2	1/1			1/1									1/1	1
8. RECREATION																			
a. Fishing			1/1	1/1						1/1				2/5				3/3	<1
b. Boating			2/2	2/2		1/1				2/3			1/2	4/4		2/4		3/3	<1
c. Swimming			1/1							1/1								1/1	<1
d. Hunting		1/1	1/1						1/1									1/1	<1
e. Bird Watching									1/1	2/2								2/3	<1
9. AESTHETICS AND HUMAN INTEREST																			
a. Scenic Views	2/3	1/1	1/1	2/4	1/1	1/1			1/1	2/4	2/2			2/2		1/1	2/3	2/2	3
b. Open Space Qualities	2/2	1/1	1/1	2/4	2/1	1/1			1/1	2/4								2/2	5
c. Landscape				1/2												2/2		1/1	3
d. Parks and Reserves									1/1	1/1							2/2	2/2	2
e. Archaeological Sites	1/2	1/2	3/5	3/5		2/3				2/4							2/2	3/5	
10. CULTURAL STATUS																			
a. Health and Safety	1/1	1/2	1/1	1/2	1/1	1/1		1/1	1/1	2/2	1/1	2/4	1/1	1/1	2/2	2/3	2/3	2/3	1
b. Commerce	2/2											1/2			4/4	3/5	2/5	3/5	3
c. Traffic Flow	4/3		3/3	3/3		2/2				3/2	2/2	2/3	3/4	3/4	3/3	4/5	3/5	4/5	<1
d. Schools																2/4	2/4	2/4	<1

TABLE III-2 Summary of Major Long-Term Impacts for Each Project Element of the Marin-South Sonoma Wastewater Management Program

Environmental Area	Project Element Number																	Overall Project
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1. EARTH - Landform				2/2										2/2				2/2
2. WATER QUALITY	+3/3	+3/3	+3/3	2/2		+1/1	+3/3	+1/1	+3/3	+1/1		+2/2	+1/1	1/1	+2/2	+3/4	+3/4	+3/3
3. ATMOSPHERE - Quality					2/2	1/2	2/2	1/1	2/2	1/1	3/5	2/2	1/1			2/3	2/3	2/2
4. PROCESSES - Floods					2/4													1/3
5. FLORA - Aquatic Plants				2/3										1/1				2/2
6. FAUNA																		
a. Fish and Shellfish	1/1	+2/2	+2/2	1/2		+1/1	+2/2	+1/1	+2/2	+1/1			+2/2	+1/1		+3/3	+3/3	+2/3
b. Benthics				1/2												+2/2	+2/2	+1/1
c. Insects	2/2				2/2	+2/2	+2/2		+2/2	+1/1	2/2	+2/2	+1/1			+3/3	+2/2	1/1
7. LAND USE																		
a. Open Spaces					2/2	3/4	2/3		3/4	3/5								3/3
b. Wetlands										2/5								2/5
c. Agriculture					2/1										+4/4			+2/2
d. Residential					2/3													1/2
e. Commercial					2/3						3/4							1/2
8. RECREATION																		
a. Fishing	+1/1	+2/1	+2/2	1/1		+1/1	+1/1		+1/1	+1/1				1/3		+2/2	+2/2	+1/1
b. Boating		+1/1	+1/1	1/1		+1/1	+1/1		+1/1			+1/1	2/2			+2/2	+2/2	+1/1
9. AESTHETICS AND HUMAN INTEREST																		
a. Open Space Qualities					1/1	2/5	2/5		3/5	3/5			1/1		+3/3			2/5
b. Archaeological Sites	1/1	1/1	3/3	3/3		2/2				3/3					1/1	1/1	1/1	2/4
c. Parks and Reserves									+2/2							+3/5	+3/5	+2/3
10. CULTURAL STATUS																		
a. Health and Safety	2/2	1/1	2/2	2/2	2/2	2/2	3/3	1/1	2/2	1/3	2/3	2/2	1/1	1/1	3/3	3/4	3/4	4/4
b. Employment					+3/3	1/1	2/2		2/2	1/1	+3/3	2/2				2/2	2/2	2/2
11. ECOLOGICAL RELATIONSHIPS																		
a. Salinization	2/4	1/2	1/2	1/1										+2/2				1/1
b. Eutrophication	2/2	+3/3	+3/3	1/1		+1/1	+2/2		+2/2	+1/1		+2/2	+1/1			+3/3	+3/3	+2/3

The consolidation of treatment facilities will have an overall positive long-term environmental impact by improving operational reliability and eliminating existing treatment facilities which now find themselves incompatible with adjacent land uses. The treatment plants which will remain as regional facilities will have long-term impacts on adjacent land uses which will have to be mitigated through careful architectural design and landscaping as well as incorporation of modern odor control and noise control features.

Secondary Impacts: The project will have the secondary impact of being able to meet wastewater disposal needs from the present as well as anticipated future population of the area and will enhance the feasibility of implementing both local and large-scale wastewater reclamation programs.

Mitigation Measures Proposed to Minimize the Impact

Most of the short-term construction impacts of the project can be mitigated to some extent by placing appropriate restrictions on the construction activity. Dredging activities will be restricted by all applicable requirements in respect to construction procedures and spoil disposal. A certain amount of time will be necessary for recovery and reestablishment of the original flora and fauna along pipeline routes.

The long-term environmental impact of the four treatment plants to remain as regional facilities will be mitigated through careful architectural design and landscaping as well as through incorporation of modern odor control and noise control features.

Probable Adverse Environmental Effects Which Cannot Be Avoided

While every effort will be made to minimize impacts due to dredging and construction activities, some impacts can only be reduced and will not be completely eliminated. There will be some degradation to water quality, fish, shellfish, and benthic organisms due to the dredging activities as well as disruption of flora and fauna in undeveloped areas and disruption of traffic and commerce during pipeline construction in developed areas.

The pumping stations and treatment plants will be equipped with modern odor control measures; however, even the best odor control equipment is not fail-safe and can be subject to failure. Careful architecturally designed landscape treatment of the pumping stations and treatment plants can further serve to psychologically mitigate any problems due to the failure of odor control measures.

Comparison of Environmental Impact of Regional Alternatives

The four basic alternative regional wastewater management programs have been described in the preceding chapter on Regional Alternatives. For reasons stated therein, Alternative D has been eliminated from further consideration; and thus, the further comparison of the environmental impact of alternatives will be limited to Plans A, B, and C.

To provide a basis for further evaluation, it should be emphasized that as a result of implementation of any one of the three alternative regional consolidation programs--Plan A, B, or C--which have been retained for further consideration ane evaluation, a total of fourteen existing wastewater discharges will be eliminated, and a total of thirteen existing treatment plants will be retired. The treatment function for Eastern Marin County will be consolidated into either one or two regional treatment plants, and both the Petaluma and Sonoma treatment plants will be retained.

Under all three regional programs, all existing wastewater discharge to confined waters of the bay and estuary system will be eliminated. In addition, under all three programs, the interceptor facilities between Northern Marin County and Southern Sonoma County will be reversible to allow the transport of treated effluent to Southern Sonoma County for future reclamation and reuse.

All three plans involve a high degree of consolidation of treatment and disposal facilities but differ in the following major respects:

1. The point of disposal of treated wastewater--either Point San Pedro (Plan B), Point San Quentin (Plan C), or both (Plan A).

2. Whether or not there should be a single regional treatment plant for Eastern Marin County (Plan B) or two regional treatment plants for Eastern Marin County (Plan C).

3. The timing for construction size and material to be handled in the interconnecting line between Central Marin and North Marin.

The facility elements which each program has in common, along with the material handled, are tabulated in Table VI-1. An evaluation of the differing project elements of the three plans is summarized in Table VI-2 and is discussed below.

Point of Disposal

The specific project elements which will differ because of the alternative points of disposal will be Project Element 4, the Point San Pedro regional outfall, and Project Element 14, the Point San Quentin regional outfall.

Construction Impacts: Construction of the Point San Pedro outfall facility has a much greater environmental impact than does the Point San Quentin outfall since this facility will traverse diked mudflat areas, cross Gallinas Creek, and will be constructed along the presently undeveloped and important natural habitat area along the north side of Point San Pedro. The Point San Quentin outfall will be constructed in primarily developed areas and will have little additional effect on the terrestrial environment other than disruption to traffic and human activities.

Long-Term Impacts: The long-term environmental impact of discharging treated wastewater through a deep water outfall at either Point San Pedro or Point San Quentin will be minimal. The Bay Modeling as performed by Water Resources Engineers reveals that water quality objectives will be

TABLE VI-1 Summary of Phase One Facilities for Alternative Eastern Marin-South Sonoma Wastewater Management Programs

Action No.	Basic Facility	Alternative Plan A	Alternative Plan B	Alternative Plan C	Material Handled Raw Sewage	Material Handled Effluent
NORTH MARIN-SOUTH SONOMA						
1, 2, & 3	Interceptors from Sonoma and Petaluma	X	X	X		X
4	Point San Pedro Regional Outfall	X	X			X
5	North Marin Regional Treatment	X	X	X	X	
6,7,8,9 & 10	North Marin Raw Sewage Interceptors	X	X	X	X	
CENTRAL MARIN						
11	Central Marin Regional Treatment	X		X	X	
12 & 13	Central Marin Raw Sewage Interceptors	X	X	X	X	
14	Pt. San Quentin Regional Outfall	X		X		X
15	Regional Interconnect	X (Stage II)	X (Stage I)	X Stage I)	Plan B	Plans A & C
SOUTH MARIN						
16	Shoreline Interceptors	X	X	X	X	
17	Connection to Central Marin	X	X	X	X	

TABLE VI-2 Detailed Environmental Evaluation of Project Elements Common to Plans A, B, and C

Impact	Point of Disposal Project Elements 4 & 14			Treatment Plants Project Elements 5 & 11			Regional Interconnect Project Element 15		
	A	B	C	A	B	C	A	B	C
Construction Impact									
Soils	2/2	3/3		2/2	2/2	2/2	1/1	2/2	2/2
Flora	3/3	4/4	1/1	2/2	2/2	2/2	2/2	3/3	3/3
Fauna	3/3	4/4	2/2	3/2	2/2	3/2	2/2	3/3	3/3
Water Quality	3/3	4/4	2/2	2/2		2/2			
Wetlands	3/3	4/4							
Recreation	3/3	3/3	3/3						
Archaeological Sites	3/5	4/5							
Traffic	3/3	3/2	3/3				3/3	5/5	5/5
Commerce	2/2		2/2				3/3	5/5	5/5
Long-Term Impacts									
Water Quality Objectives	+4/5	+4/5	+5/5						
Fish and Shellfish	3/5	4/5	2/5						
Recreation	2/2	3/2	1/2						
Air Quality				3/4	2/2	3/4			
Land Use				4/5		4/5			
Flooding				3/4	4/4	3/4			
Utilities							2/2	3/3	3/3
Secondary Impacts									
Reliability	5/5	3/5	3/5	+3/3	+3/3	+3/3	2/2	4/4	2/2
Local Reclamation				+4/3	+2/3	+4/3			
Large-Scale Reclamation							+2/3	+3/3	+3/3

met at either or both points of discharge. Because of their depth and favorable locations in respect to circulation of tidal water, both Point San Pedro and Point San Quentin represent two of the best points of discharge in the entire San Francisco Bay system.

There is a body of opinion among marine biologists and the Department of Fish and Game that the closer the discharge is to the Golden Gate, the less impact it will have on marine life because of the quicker dilution of the effluent by the ocean. According to this body of opinion, a single outfall at Point San Quentin would be preferable. This suggested effect on water quality due to the proximity to the Golden Gate is not substantiated by the computer modeling for the two outfall sites under consideration in the Marin and South Sonoma wastewater management program.

Dr. Gustafson, in his studies summarized in the Environmental Impact Statement, points out that in the absence of a guarantee that any characteristics of the receiving water would exceed the tolerance of any fishes if the entire discharge were to be at Point San Quentin, that a dual discharge of lesser concentrations of effluent at both outfall sites might be preferable. Furthermore, Dr. Gustafson points out that in the interest of safety, it would seem better to be served by the option of two treatment plants and two outfall lines.

In summary, although the computer modeling of the bay system shows little difference between the long-term water quality characteristics of the bay between a discharge at Point San Pedro or Point San Quentin, there is a body of opinion that a discharge point closer to the Golden Gate is preferable. On the other hand, a dual discharge at both sites might be preferable in terms of assuming lesser concentrations of effluent and better safety and reliability in protecting the environment.

Secondary Impacts: Since both outfall lines will be transporting treated effluent, no connection could be made to provide sewer service to undeveloped areas. Consequently, there should be no secondary or growth-inducing impacts attributable to either outfall conveyance system.

Summary: The primary difference between the two points of discharge under consideration is the greater construction impacts attributable to the Point San Pedro outfall conveyance system.

On a long-term basis, there is a body of opinion which prefers the outfall at Point San Quentin because it is closer to the Golden Gate. In terms of assuring protection of the aquatic environment and better dispersion of the effluent, a dual outfall system may be better.

Accordingly, in respect to the overall environmental impact of the point(s) of disposal, Plan C is most preferred, with Plan A next, and Plan B least preferred.

Number of Subregional Treatment Plants

A second major difference between the three alternative regional wastewater management programs is the number of regional treatment plants to be utilized. In Plans A and C there would be four regional treatment plants, and in Plan B there would be three treatment plants.

Under all three plans, the Petaluma, Sonoma Valley, and North Marin areas will each operate a subregional treatment plant; and therefore, the difference between the three regional plans becomes a question as to whether or not there should be a treatment plant in Central Marin. Under Plan B Project Element No. 11 is eliminated; and the Northern Marin Treatment Plant, Project Element No. 5, will be about twice as large in capacity as it would be under Plan A or C.

Construction Impacts: The environmental impact of constructing a larger North Marin treatment plant, as under Plan B, is not significantly greater than the impact of constructing the basic plant, as under Plan A or C. The site of the Central Marin treatment plant has already been disturbed by human activity, and thus, the construction impacts will be minimal.

Long-Term Impacts: The North Marin treatment plant will be constructed in a flood plain area, and a large enough site will have to be acquired to allow suitable ponding area for flood control. Since additional land would be needed under Plan B, the ponding area for flood control would have to become proportionally larger. Although the proposed site of the North Marin treatment plant is now relatively isolated, adjacent lands could be developed in the future and eliminate this isolation.

The Central Marin treatment plant could have a definite long-term impact on adjacent land uses in terms of possible odors and noise. In order to be compatible with the adjacent land uses and mitigate long-term environmental impacts, the Central Marin treatment plant will have to be designed with full architectural amenities and modern odor control and noise control features. The site should be large enough to be attractively landscaped and properly screened from view.

In summary, a large North Marin treatment plant, as under Plan B, will have a larger long-term impact on the environment. If a Central Marin treatment plant is constructed, as under Plan A or C, it will have long-term impacts on adjacent land uses unless suitable mitigation measures are incorporated into the site development and plant design.

Secondary Impacts: The secondary impacts in respect to the number of regional treatment plants to be constructed deal with questions of overall system reliability and the availability or nonavailability of suitable effluent for local reclamation and reuse purposes in Central Marin County.

In terms of an overall wastewater management system, there is a basic question as to whether or not one regional treatment plant would be more reliable than two regional treatment plants. With small plants (less than 1 or 2 mgd), it is generally conceded that economics dictates that a small plant cannot have the same fail-safe features and have the same level of staff competence as can a larger treatment plant to assure maximum reliability. With larger treatment plants, duplicate process units can be provided, fail-safe controls can be utilized, and staffing can be on a continuous 24-hour basis.

Although there is a body of opinion that believes reliability is directly proportional to size, the question of overall ability to achieve adequate reliability appears to become moot in comparing two large treatment plants against one larger treatment plant because all the necessary fail-safe features and proper staffing can be provided with both plants.

The ability to economically achieve local reclamation and reuse in Central Marin depends upon the availability of a treated secondary effluent in the area. Under Alternative Plans A and C, treated effluent would be available in Central Marin County.

Under Alternative Plan B, the only way to produce effluent for use in Central Marin would be to operate a "scalping" plant to treat as much sewage as is needed for reuse purposes. However, if the cost of operating a scalping plant is added into the unit cost of reclaimed water, the project is not economically feasible. Although on an overall water resources management basis, the quantity of wastewater which could be used for local landscaping purposes is small in comparison to the total ultimate discharge from a Central and South Marin regional treatment facility of 22,000 acre feet per year, the fact that some water is reused may become important in Marin County's present water-short situation.

Summary: The primary differences between the environmental effects of having three or four regional treatment plants are: (1) the long-term impacts the Central Marin treatment plant will have on adjacent land use, and (2) the secondary impacts of not having treated effluent available for reclamation and reuse in Central Marin County if there is no regional treatment plant in Central Marin, as under Plan B.

The long-term adverse environmental impacts of the Central Marin treatment plant on the adjacent land uses can be mitigated by proper architectural amenities, landscape screening, and positive odor and noise controls.

Not having treated effluent available for reclamation and reuse in Central Marin County under Plan B, where there is a North Marin regional treatment plant serving Eastern Marin County, cannot be mitigated economically. However, the amount of reclaimed water which could be used for landscape irrigation purposes may not be significant in an overall water resources management picture.

Accordingly, in respect to the environmental impacts due to the number of subregional treatment plants, Plans A and C are preferred over Plan B.

Regional Interconnecting Line

A third major difference between the three alternative regional plans is the size and timing of the construction of a regional interconnecting line between Central and South Marin and North Marin designated in Project Element No. 15.

The regional interconnecting line becomes necessary when enough large-scale reclamation and reuse opportunities are developed in North Marin County and Southern Sonoma County to require additional effluent from Central and South Marin. The large-scale reclamation and reuse opportunities are in the form of possible agricultural irrigation and development of a recreational lake. However, these opportunities are not yet developed and, at this time, can only be stated in the form of potential.

Under Plan A, the regional interconnecting line would only be of sufficient size to transport the average dry weather flows of treated effluent from the Central and South Marin areas to the North Marin area as necessary for reuse.

Under Plans B and C, the regional interconnecting line would be constructed as a part of the initial disposal program and would be large enough to convey all sewage flows between the subregions.

Construction Impact: The interconnecting line between Central Marin and North Marin will be constructed through developed areas of San Rafael and diked mudflat areas of North Marin. Under Plans B and C, the pipeline would be larger; and therefore, the construction impacts will be larger.

Aside from a disturbance to farming and to wildlife in the diked mudflat area, the primary impact will be to traffic, commerce, and human activities of constructing the line through the highly developed downtown San Rafael area. Under Plans B and C, the construction activity for such a large pipeline will cause major disruption to traffic and commerce in San Rafael.

Long-Term Impacts: Once the interconnecting pipeline is constructed, there should be few, if any, noticeable long-term impacts. The pipeline will occupy streets and easements and thereby make those areas unavailable for construction of other underground utilities.

Secondary Impacts: There are two secondary impacts associated with Project Element No. 15 due to (1) possible hazard to the environment in the event of a break or catastrophe, and (2) possible future unwillingness under Plan A of the public to support construction of an interconnecting line to make available additional water for reclamation and reuse unless it is constructed as a part of the initial project.

In respect to reliability and possible hazard to the environment, the interconnecting pipeline does not cross any known active faults; however, it does cross diked mudflat areas which may be subject to instabilities during an earthquake. Under Plans A and C, the interconnecting pipeline will be carrying treated effluent, whereas under Plan B the interconnecting pipeline will be carrying untreated sewage. Accordingly, the environmental damage in the event of a catastrophe and breaking of the interconnecting line will be a great deal less under Plans A and C.

In respect to possible future public unwillingness to support construction of the interconnecting line between Central Marin and North Marin, it is true that under Plan B or C the line will have to be constructed as a part of the initial project, whereas under Plan A it could be delayed and possibly never would be constructed. Under Plan A the only reason that the line should be constructed would be if a sufficient demand for reclaimed water were developed, presumably in the North Marin or South Sonoma area, to require the additional effluent from Central and South Marin. On the other hand, if the pipeline were constructed initially, as under Plan B or C, there is no guarantee that a reclamation potential will be developed to require the effluent from Central Marin. Furthermore, even though the pipeline under Plan B or C is larger than that under Plan A, the peak wet weather flows from Central Marin could not be transported to Southern Sonoma County without constructing a much larger reversible interceptor system between Marin and Sonoma Counties.

Summary: The construction of the interconnecting pipeline from Central Marin to North Marin will primarily cause a disruption to traffic, commerce, and other human activities in downtown San Rafael. These impacts become particularly severe with construction of the larger line under Plan B or C.

There are no long-term impacts associated with Project Element No. 15.

Secondary impacts include possible damage to the environment in case of a break, which will be much less under Plan A or C because only treated effluent will be discharged. In respect to achieving reclamation, the existence or nonexistence of this interconnecting line does not in itself promote the development of a large-scale reclamation or reuse program.

Accordingly, in respect to the environmental impact of the interconnecting pipeline, Plan A is most preferred, with Plan C next, and Plan B least preferred.

No Project Alternative

The alternative of not undertaking any project has been considered and involves the continued treatment of wastewater at the existing facilities and continued disposal of effluent at the existing point of discharge for each agency. A continuation of the present conditions is unacceptable

since Federal and State water quality objectives will not be met, and the aquatic environment will not be adequately protected.

Overall Summary of Alternative Regional Programs

In overall summary of the environmental impact of the Alternative Programs, particularly as it relates to the differeing project elements, the following conclusions are presented:

1. In respect to the environmental impact of the point(s) of disposal, Plan C is most preferred, with Plan A next, and Plan B least preferred.

2. In respect to the environmental impacts due to the number of subregional treatment plants, Plans A and C are preferred over Plan B.

3. In respect to the environmental impact of the interconnecting pipeline, Plan A is most preferred, with Plan C next, and Plan B least preferred.

4. The alternative of not undertaking any project is environmentally unacceptable.

Short-Term Use Versus Long-Term Productivity

The proposed project will enhance the long-term productivity of the San Francisco Bay, especially with respect to fish, shellfish, and water-related recreation. It will also facilitate future water reclamation and reuse projects, thereby conserving a valuable resource in short supply. To attain these benefits, there will be some short-term loss of productivity due to construction-related activities and some possible long-term hazard to public health and the environment in the event of a catastrophe.

Irreversible and Irretrievable Commitments of Resources

The irreversible and irretrievable commitments of resources relate to the commitment of resources for the project construction and long-term operation. The type and degree of treatment which have been selected constitute an optimum resource commitment toward meeting water quality objectives.

The Growth-Inducing Impact of the Project

The project does not of itself have any growth-inducing impact. Its purpose is to accommodate such growth as the various responsible political bodies may permit within their respective areas by providing adequate sewage treatment facilities on a timely and economical basis.

Existing facilities for the project service area, even where their original design capacities are adequate for present population levels, are in many cases not able to achieve those capacities under the increased stringency of more recent discharge requirements; and in some cases, cannot operate as they are presently constructed at any capacity. Thus, some expenditures on and expansion of sewage treatment facilities are required to accommodate existing population levels and sewer connections. The project would provide this renovation and expansion through new facilities which would accommodate both existing and predicted additional populations.

Such environmental impact as may be expected from the levels of growth proposed by the various responsible bodies should be evaluated as a part of the decision-making processes of these bodies; the decisions relative to this project are fundamentally those of how, rather than whether, to provide the required sewage treatment facilities for anticipated populations.

COMBINED EVALUATION

COMBINED EVALUATION

Combining the results of the additional economic, "effectiveness" and environmental impact evaluations of Alternative Programs set forth hereinbefore in summary form has been done and is presented in Table 14.

TABLE 14 - Summary of Separate Evaluations of Alternative Programs

Evaluation Factor		Alternative Program A	Alternative Program B	Alternative Program C
Economic				
Initial Cost, Million $'s		73.1	90.5	80.6
Present Worth, Million $'s		102.9	123.8	112.7
Average Total Annual Costs, Million $'s		9.7	11.7	10.6
Average Total Annual Cost for Equivalent Single Family Unit, $'s (without grants)		85	102	93
Economic Evaluation Ranking		1	3	2
Effectiveness				
Water Quality Objective		Excellent	Excellent	Excellent
Reliability		Good	Good	Good
Reclamation Potential		Good	Good	Excellent
Flexibility		Good	Good	Good
Overall Environmental Impact		Good	Good	Good
Regionalization		Good	Excellent	Excellent
Implementation		Excellent	Adequate	Good
Effectiveness Evaluation Ranking		2	3	1
Environmental				
Construction Impacts	Soils	2/2	3/3	2/2
	Flora	2/2	3/3	2/2
	Fauna	3/3	3/3	3/3
	Water Quality	3/3	3/3	3/3
	Wetlands	3/3	4/4	2/2
	Recreation	3/3	4/4	-
	Archaeological Sites	3/3	3/3	2/2
	Traffic	3/5	4/5	4/5
	Commerce	3/3	4/5	4/5
Long-Term Impacts	Water Quality Objectives	+4/5	+4/5	+5/5
	Fish and Shellfish	3/5	4/5	2/5
	Recreation	2/2	3/2	1/2
	Air Quality	3/4	2/2	3/4
	Land Use	4/5	3/5	4/5
	Flooding	3/4	4/4	3/4
	Utilities	2/2	3/3	3/3
Environmental Evaluation Ranking		2	3	1

A P P E N D I X

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

RESOLUTION NO. 73-12

REGARDING MARIN/SONOMA SUBREGIONAL STUDIES COORDINATION

I. WHEREAS, the dischargers in Marin and Southern Sonoma Counties are participating in the development of three subregional water quality management programs, and

II. WHEREAS, these subregions have been divided as follows:

Southern Marin Subregion
- Sausalito-Marin City Sanitary District
- Sanitary District No. 5
- City of Mill Valley
- Richardson Bay Sanitary District

Central Marin Subregion
- Sanitary District No. 1
- San Rafael Sanitation District (Main Plant)

North Marin-Sonoma
- Sonoma Valley County Sanitation District
- City of Petaluma
- Marin County Sanitary District No. 6
- Las Gallinas Valley Sanitary District
- San Rafael Sanitation District (Marin Bay Plant)
- Hamilton Air Force Base, and

III. WHEREAS, the subregional studies for the North Marin-Sonoma and Central Marin Subregions have been completed and the dischargers in these subregions are preparing to move into the project report stage for grant applications, and

IV. WHEREAS, the dischargers in Southern Marin are preparing a project report for grant application, and

V. WHEREAS, in order to obtain a grant for construction of sewerage facilities, these projects must receive certification from the Regional Board, and

VI. WHEREAS, the subregional study reports for Central Marin and North Marin-Sonoma have indicated the possibility of alternative facility plans involving consolidation of the three subregions, and

VII. WHEREAS, these alternative plans include alternatives for consolidation of treatment and/or discharge for all dischargers in the three subregions, including the alternative of one treatment facility and discharge point for all the waste flows in the three subregions, and

VIII. WHEREAS, Section 2131 of the State Water Resources Control Board Grant Regulations states:

"Consolidation of wastewater treatment systems shall be required in all cases where feasible and desirable to accomplish good water quality management" and

IX. WHEREAS, both the State and Federal Grant regulations require a thorough evaluation of alternatives before a grant will be issued, and

X. WHEREAS, the Marin County Board of Supervisors has formed the Wastewater Planning Coordinating Committee to further study the possibilities of consolidation of the subregions. This committee is comprised of representatives of each subregional group but does not provide for direct representation of all the dischargers in each subregion, and

XI. WHEREAS, the Wastewater Planning Coordinating Committee can only recommend a course of action to the various subregions, and

XII. WHEREAS, agreement among the dischargers in the subregions will be necessary for any alternative involving consolidation of subregions to proceed; now

XIII. THEREFORE, BE IT RESOLVED, that this Regional Board commends the efforts of the Wastewater Planning Coordinating Committee.

XIV. BE IT FURTHER RESOLVED, that this Regional Board finds that full evaluation of alternatives involving consolidation of subregional facilities will be necessary prior to any grant certification by the Regional Board.

XV. BE IT FURTHER RESOLVED, that this Regional Board finds that, in order to assure this evaluation, any project report submitted by the three subregions for facilities for the subregional programs must be accompanied by an "over-view" report and environmental impact statement which fully evaluates the consolidation alternatives.

XVI. BE IT FURTHER RESOLVED, that this Regional Board recommends that early effort be made, either through the Wastewater Planning Coordinating Committee or other appropriate arrangement, to provide for direct representation of all discharging agencies in the guidance of the development of the over-view report.

I, Fred H. Dierker, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Quality Control Board, San Francisco Bay Region on June 26, 1973.

_____

Executive Officer

Appendix B

AB 1232

How We Got Here and Where Do We Go From Here

Almonte Sanitary District

March 21, 2011

An examination of the issues surrounding AB 1232 and SASM Member Agency response.

Table of Contents

The Regulatory Environment:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

STATE WATER RESOURCES CONTROL BOARD

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, San Francisco Bay Region

CALIFORNIA LEGISLATURE

MARIN LAFCO

FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT)

CALIFORNIA CODES WATER CODE SECTION 13260-13274

SANITARY DISTRICT ACT OF 1923: [CAL. HSC. CODE § 6400 - 6408]

CORTESE-KNOX-HERTZBERG LOCAL GOVERNMENT REORGANIZATION ACT OF 2000

AB 1232

Recent Evolution of Regulatory Requirements:

Increasing EPA awareness and scrutiny of sanitary system overflows (SSOs) began in 2001 as a nationwide proposal for adoption of Capacity, Management, Operation, and Maintenance (CMOM) requirements for all wastewater agencies which include satellite collections systems like Almonte, Homestead Valley, Alto and Richardson Bay that collect and discharge wastewater to a publically owned treatment works (POTW) such as SASM. (see below for a chronology of CMOM by CMOM.net)

Welcome to CMOM.net, a reliable source of information about the US EPA's **Capacity, Management, Operations, and Maintenance (CMOM)** regulations.

CMOM.net is maintained by members of the Collection Systems Committee of the Water Environment Federation (WEF).

2009/03/29

This entry is being posted to give the status of CMOM following the inauguration of the Obama administration.

Eight years after the original proposed rulemaking was quashed by the Bush administration (see below), there is no change in the status of the SSO Proposed Rule, which contained CMOM. It was never moved for publication in the Federal Register nor adopted during the Bush administration and there has been no publication action to date by US EPA.

What has happened in lieu of publishing the SSO Rule has been activity in two areas:

1) A guidance document (http://www.cmom.net/cmom_guide_for_collection_systems.pdf) was published by US EPA in 2005 that contains most of what was in the original SSO Rule concerning CMOM. By referring to it as a "guidance" document, it avoided the rule-making process that would have spelled certain death during the Bush administration.

2) Individual US EPA regional offices - who have the authority to act independently of US EPA Headquarters - have taken action to create and enforce CMOM regulations in different parts of the country. Some states that have regulatory authority delegated to them by US EPA have also taken action to develop CMOM requirements for the collection system agencies under their jurisdiction. An example of one of the most wide-ranging state actions is the California "Collection Systems Waste Discharge Requirements". http://www.waterboards.ca.gov/water_issues/programs/sso/index.shtml

Of note, cloned pieces of the original CMOM language as well as the later guidance document have found their way into the regulatory language of both the US EPA regional offices and the states that have taken action.

2003/01/31

- At the conference planning meeting of the Water Environment Federation's (WEF) Collection Systems Committee, it was announced that the proposed SSO/CMOM rule had not yet been submitted to the Office of Management and Budget for financial analysis. (See more about OMB's role below.)

This delay is likely to cause the rule to not be released for publication until sometime in the Fall of 2003, with publication in the Federal Register most likely in the Spring of 2004.

2002/11/15

- At the meeting of the Water Environment Federation's (WEF) Government Affairs Committee Wet Weather Group, officials from US EPA announced with reasonable certainty that the SSO rule (which incorporates the CMOM provisions) would be delivered in November 2002 to the Office of Management and Budget for financial analysis. (OMB's input is required in order to establish the likely impact of imposing a regulation.) WEF's Government Affairs Committee is preparing a document for consideration by OMB that addresses the funding/need gap that the SSO rule is likely to create.

Following the review by OMB, the SSO rule would be scheduled for comment in the Federal Register, most likely in the Spring of 2003. There is considerable consensus for moving ahead with publishing the rule even though there are continuing disagreements in the industry about portions of the rule, specifically the affirmative defense and stormwater blending proposals. Publishing the rule will at least allow undisputed portions to be implemented including CMOM and the permitting of satellite collection systems.

2001/11/08

- EPA announces that Tracy Mehan the Asst. Administrator for the Office of Water has given the go-ahead for the development of the SSO/CMOM Notice of Proposed Rulemaking. This action effectively re-starts the process that had been halted in January by the then-incoming Bush administration.

The contents of a note from Kevin Weiss at EPA reads as follows:

"I am pleased to announce that Tracy Mehan, the Assistant Administrator for the Office of Water, has given OWM (*Office of Water Management, ed.*) the go ahead and work on the SSO/CMOM NPRM. As you know, Administrator Browner signed a draft SSO NPRM on January 4, 2001. However, in accordance with the memorandum of January 20, 2001, from the Assistant to the President and Chief of Staff, entitled A Regulatory Review Plan,@ published in the Federal Register on January 24, 2001, 66 FR 7701, EPA withdrew the SSO NPRM from the office of Federal Register to give the Administrator an opportunity to review it.

Since January, EPA has received a number of comments on the January, 2001 draft NPRM. Tracy Mehan has directed OWM to develop an SSO/CMOM NPRM that:
- proposes regulations consistent with those recommended by the SSO Federal Advisory Subcommittee on October, 1999;
- summarizes in the preamble the comments received since January, 2001; and
- provides preamble discussion regarding those comments.

I continue to strongly believe that broad-based NPDES permit requirements for CMOM, reporting, record keeping and public notice for SSOs as well as expanding NPDES program to municipal satellite collection systems will ultimately have a dramatic impact on changing the way the nation invests in its sewer infrastructure, which in turn will improve the performance of these systems and lead to reduced health risks.

We will keep you posted as we work through this effort."

2001/01/20

The incoming Bush administration issues a memo calling for a "Regulatory Review Plan" requiring a review of all pending regulations by the new administrators.

EPA withdraws the Notice of Proposed Rulemaking (NPRM) for CMOM.

Note: The EPA address also contains links to EPA's CMOM documents.

2001/01/04

USEPA Administrator signs the Notice of Proposed Rulemaking (NPRM) for CMOM. This begins the process of publication in the Federal Register which, in turn, will provide for a public comment period.

Federal, State and Regional Board Regulatory and Enforcement Action:

RWQCB 13267 Letter dated July 7, 2005
SWRCB Order No. 20006-0003-DWQ issued May 2, 2006

As noted, in the absence of federal rulemaking, continued development, implementation and enforcement of SSO/CMOM requirements fell to regional EPA offices and state and local water boards.

Preliminary preparation for developing a SSMP program and online SSO reporting system began as a collaborative effort between our local RWQCB and The Bay Area Clean Water Agencies (BACWA), as local sewer agencies, concerned about the scope and impact, both in terms of manpower, dollars and the functionality of the proposal in accomplishing common goals sought to provide input. (See: Appendix, A) Marin agencies began actual SSO reporting in 2004 when the RWQCB's online reporting system went live. The online reporting and SSMP development process culminated on July 7, 2005 with the issuance of a "13267" letter requiring sewer system authorities to prepare a Sewer System Management Plan (SSMP) pursuant to Section 13267 of the California Water Code. The SSMP was to be implemented in phases with complete adoption and implementation of the SSMP by August 31, 2008. On May 2, 2006 the State Water Resources Control Board issued Order No. 2006-0003-DWQ on May 2, 2006 which imposed similar SSMP requirements statewide.

All of our agencies developed, adopted and implemented the required SSMP pursuant to both the RWQCB letter and SWRCB Order No. 2006-0003-DWQ. Almonte adopted their SSMP in August 2006.

Federal and State Enforcement Actions:

Beginning in August 2007 the EPA began a series of Clean Water Act Compliance Evaluation Inspections of SASM and its member agencies. Almonte, Alto, Homestead Valley and Tamalpais Community Service District were inspected in August 2007. SASM and Richardson Bay in October 2007. The City of Mill Valley was inspected on February 12, 2008. (http://www.epa.gov/region9/water/npdes/compliance.html)

These inspections were quickly announced and rather short in duration, maybe a few hours. Our agencies attempted to provide requested information to the inspectors, however, some information was provided in a form that was agency specific, not in a form that the inspectors were expecting (such as hot spot cleaning programs represented in vendor cleaning contracts). Some information provided to the inspectors, such as excel spread sheets documenting cleaning, repairs, emergencies, etc. over many years or district maps that color-coded lines as they were cleaned as a tracking mechanism were omitted from the report.

A major complaint from some of the inspected agencies, especially Richardson Bay and Almonte, is that these reports were quickly prepared, posted to the EPA website immediately after the spills from SASM prior to being transmitted to the inspected agencies for comment or correction. (See press report below).

(San Francisco, California -- 02/12/2008) - Following the recent large sewage spills to the San Francisco Bay from a Marin Co. treatment plant, the E.P.A. today finalized and released inspection reports for 5 of 6 sewage collection systems that flow to the Sewerage Agency for Southern Marin wastewater facility.

The EPA's October inspections confirmed that the sewage collection systems for Almonte, Tamalpais, Alto, Homestead Valley and Richardson Bay have significantly deteriorating sewage pipes that are overwhelmed by rainwater during wet weather, which affect operations of the Sewerage Agency for Southern Marin plant and its discharge to San Francisco Bay waters.

"The public may be surprised to learn we have many neglected sewage collection systems, which are small, underfunded and undermanaged. These systems will continue to pose threats to San Francisco Bay if communities fail to upgrade and maintain their systems sustainably," said Alexis Strauss, the EPA's Water Division director for the Pacific Southwest region. "We at the E.P.A. will continue, as we've done elsewhere in California, to work with the California Regional Water Quality Control Boards and the systems directly to achieve long-overdue assessment, repair and replacement."

"The best way to deal with sewer spills is to prevent them from ever occurring," said John Muller, chair to the San Francisco Bay Regional Water Board. "I would prefer to work with local government and other leaders to make sure the Bay Area has the finest infrastructure possible. That is how we all should protect water quality."

On Friday the Regional Water Board issued an order to the SASM requiring a full report on the recent spills to the Bay, and requiring the agency to audit its operations. The audit report is due April 7.

Deteriorating pipes, combined with extreme peak flows from rainwater, overwhelmed the SASM facility, causing the Jan. 25 flows to exceed capacity at the emergency holding basins at the plant, and overflowed to San Francisco Bay waters. The subsequent Jan. 31 spill occurred when the treatment plant failed to operate all of its discharge pumps designed to achieve higher levels of treatment offsite, thus also leading to another spill to Bay waters.

When sewage spills occur, prompt posting of affected beaches is required to protect the public. Co. health departments should be prepared to post waterways immediately when these types of discharges occur.

The Sewerage Agency of Southern Marin treats wastewater from about 28,000 people in the Mill Valley area. The sewage is collected from homes and businesses in networks of sewer pipes that are owned and maintained by 5 separate sanitary districts and the city of Mill Valley.

Almonte's inspection report excerpted below is reflective of the reports issued to other SASM members.

USEPA Region 9 SSO Inspection Report Almonte Sanitary District

Background

On 8/7/2007, USEPA Region 9 and its contractor inspected the Almonte Sanitary District's (the "District") sanitary sewer system located in Mill Valley, California. Spills and sanitary sewer overflows (SSOs) from the sewer system are prohibited by the Clean Water Act. Additionally, spills and SSOs from the District's system are prohibited by Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, WQO No. 2006-0003. The District is an enrollee under the Statewide General Waste Discharge Requirements. Additionally, the Agency is required to comply with the San Francisco Bay Regional Water Quality Control Board's July 2005 Section 13267 of the California Water Code letter that establishes earlier deadlines for submittal of Sewer System Management Plan (SSMP) components than the SSMP deadlines present in WQO No. 2006-003. As such, the Agency must comply with both the Section 13267 letter and WQO No. 2006-003 requirements.

The primary purpose of the inspection was to document the history of sewage spills, determine the adequacy of the District's spill response and prevention programs, evaluate sewer maintenance activities, and assess the accuracy and reliability of its spill reporting procedures. The District's representative during the inspection was Mr. Bonner Buehler. Mr. Max Kuker from PG Environmental, LLC led the inspection accompanied by Mr. Rick Sakow from USEPA Region 9. The weather at the time of inspection was sunny.

The District owns and operates approximately 5.5 miles of gravity sewer pipe. The District does not own or operate any pump stations or force mains. Sanitary sewage generated within the District gravity flows to the Sewage Agency of Southern Marin (SASM) wastewater treatment plant. According to Mr. Buehler, the District has approximately 780 sewer connections in its collection system. The District also has three restaurants discharging to the collection system. Discharges from the SASM wastewater treatment plant into Raccoon Strait (Central San Francisco Bay) are regulated under NPDES Permit No. CA0037711.

The District currently estimates their average dry weather flow at 110,000 to 130,000 gallons per day (gpd) and their average peak wet weather flow at approximately one million gallons per day (mgd), indicating a peaking factor of approximately 7.5 to 9. The District is billed by the SASM wastewater treatment plant based on the number of connections rather than flow which provides no incentive to reduce I&I. Mr. Buehler stated that SASM completed a significant Inflow and Infiltration (I&I) study, but did not specify if the Almonte system was included in the report. Upon further investigation SASM personnel stated that the I&I study was conducted by Black and Veatch for all member agencies in 1983/1984, but that a project was underway to summarize current I&I reduction measures through the member agencies and to identify and evaluate potential I&I projects throughout the WWTP's collection system as a whole. According to Mr. Buehler, the District has not undertaken any activities to prevent I&I in the collection system because capacity has not been a major cause of spills and overflows for the District.

The District currently and historically has had an un-written agreement with Roto-Rooter for system maintenance and spill response. This agreement is for 'on-call' sewer maintenance, blockage, and spill response. The extent of sewer maintenance completed by Roto-Rooter was unclear due to a lack of documentation provided to the inspectors. According to Mr. Buehler, if an individual calls his office to report an overflow or blockage, the individual is directed to call Roto-Rooter, which investigates and corrects the problem. Roto-Router provides documentation to Mr. Buehler regarding the volume of the spill, the cause of the spill, and the corrective actions taken to mitigate the spill, along with an invoice for its services. The invoices are tracked via a spreadsheet briefly describing the invoice, the service provided, and the amount charged. The District does not have any staff or equipment for spill response.

Under section 301(a) of the Clean Water Act (CWA), it is unlawful for any person to discharge any pollutant from a point source into "waters of the United States" except in compliance with a NPDES permit. The Almonte Sanitary District does not have an NPDES permit that authorizes the discharge of sewage spills. Therefore, any sewage spill from the District's collection system that flows to "waters of the United States" constitutes a violation of the Clean Water Act.

Findings

1. Occurrence of spills**.** Discharges to waters of the United States without a permit are prohibited under Section 301(a) of the Clean Water Act. Additionally, as per Part C.1 Prohibitions of the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, WQO No. 2006-0003, any spill that results in a discharge of untreated or partially treated wastewater to waters of the United States is prohibited. The District reported two sewage spills in calendar year 2005, three sewage spills in calendar year 2006 and one spill through May 1, 2007 from its collection system. These spills were reported to the San Francisco Bay Regional Water Quality Control Board. According to the reports, all of the reported spills were blockages as a result of root intrusion. Based on 5.5 miles of gravity sewers in the Almonte Valley Sanitary District, the spill rate was 36 spills/100 miles/yr in 2005 and was 54.5 spills/100 miles/yr in 2006. A listing of the reported spills is provided in Table 1 below.

Since May 2007, the District has been required to report all sewage spills to the State Water Resources **Control Board via the California Integrated Water Quality System (CIWQS) website. The spills reported to** the CIWQS system were not included in this report.

Table 1. Reported Spills from January 1, 2005 through April 30, 2007 from the District's Collection System Incident Date	**SSO Estimated Volume (gal)**	**SSO Estimated Volume Recovered**	**SSO Destination**	**Cause of SSO**	
May 1, 2007	10	0	STREET/CURB & GUTTER	BLOCKAGE	ROOTS
November 4, 2006	300	0	STREET/CURB & GUTTER	BLOCKAGE	ROOTS
April 19, 2006	150	0	YARD/LAND	BLOCKAGE	ROOTS
February 13, 2006	200	0	YARD/LAND	BLOCKAGE	ROOTS
December 31, 2005	600	0	BUILDING/STRUCTURE	BLOCKAGE	ROOTS
February 5, 2005	300	0	STREET/CURB & GUTTER	BLOCKAGE	ROOTS

2. **Failure to maintain adequate records for reported and unreported spills.** As per Part B.5 of Monitoring and Reporting Program (MRP) No. 2006-0003-DWQ, the District is required to maintain records of all SSOs. A review of District files indicated that the field "Sanitary Sewer Overflow Report" used by Roto-Rooter for reporting of spills was not consistently completed with all of the required information. For example, the June 30, 2007 report (see attachment 3) has not been completed in its entirety with all of the required information as listed on the form. The report does not include the Caller's Name, Spill Start Time, Name of City Staff or Contractor Dispatched, Source of Spill, Cause of Spill, Final Spill Destination, or Date and Name of individual responsible for completing

the Field Report. In addition, the “Time Call Received" was recorded on the field log to be 5:15 (no AM or PM), providing insufficient documentation as to if the response was immediate or whether 12 hours elapsed prior to stopping the spill.

3. **Failure to contain and mitigate the impacts of an SSO**. As per Part D.3 of the State Water Resources Control Board Order No. 2006-0003-DWQ, in the event of a spill, the enrollee shall take all feasible steps to contain and mitigate the impacts of an SSO. The District does not have the staff, equipment, or training to respond to and contain spills and mitigate the impacts. This is demonstrated in Table 1 and by the fact that the District is not able to recover sewage after it exits the collection system. The District relies on a verbal agreement with Roto-Router to respond to spills and correct problems which may have caused the spill. The average distance between Mill Valley and Roto-Rooter in Novato is approximately 18 miles; therefore, it is unlikely that a response time would be less than 25 minutes. Other factors could lengthen the time considerably, e.g., traffic on US 101. The response time for Roto-Router varies, but according to Mr. Buehler, typically ranges between 0.5 and 1 hour. The quicker response times are typically due to spills occurring during normal Roto-Router working hours because the responders may be conducting maintenance or other activities in an area closer to the District. There is no written or verbal agreement between the District and Roto-Router regarding the maximum response time for SSOs. In addition, the District is limited to tasking Roto-Rooter with small jobs (under $15,000 for any one project) without procuring the work through a contract with a bid and proposal process. This limitation could possibly prevent Roto-Rooter from properly responding, in the event of a catastrophic spill.

4. **Efforts to reduce I&I and wet weather peaking ratios.** While acknowledging that the inspection focus and time spent on-site was limited, it appeared that the District has no, or limited, incentive to investigate or minimize I&I flows because capacity has not been a major cause of spills and overflows for the District. In addition, the District is billed by SASM per connection rather than for the actual flow to the WWTP. As mentioned previously, the District has an apparent peaking factor of approximately 7.5:1 to 9:1. This significant difference in dry weather and wet weather flows has a significant impact on the SASM WWTP. The District is encouraged to initiate a more aggressive approach to I&I reduction and to actively participate in SASM sponsored studies and activities. Focused and sustained efforts to reduce I&I and ultimately reduce wet weather peaking ratios will benefit both the District and SASM by reducing unnecessary and costly wastewater treatment plant upgrades, and the potential for blending and/or bypasses at the wastewater treatment plant.

Summary

The information gathered during the inspection indicates a lack of adequate documentation of maintenance and spill records, reporting, and tracking. The lack of this documentation appears to stem from a failure to implement a mechanism to clearly track the operation and maintenance of the sewer system, spills and associated activities, and planning for future maintenance activities. These mechanisms are essential for enabling the District to evaluate its activities to decrease the number or eliminate spills completely from its sewer system. Tracking spills and maintenance is important to identify areas where increased maintenance may be necessary. For example, Mr. Buehler stated that the entire system (approximately 5.5 miles) is cleaned annually, but the documentation provided to the inspection team did not clearly substantiate the statement. Mr. Buehler also stated that Roto-Rooter is responsible for tracking their maintenance activities, but again the documentation provided did not appear to be a sufficient tracking system to adequately document activities. The evaluation of the tracking of spills and maintenance is important to identify areas where increased maintenance may be necessary.

The District should augment their current spill data acquisition and tracking to collect all required information for all SSOs and vital information such as what was the source and mechanism of initial identification of a spill (e.g., resident via government pages listing for Sanitary District) and response time. The District collected relevant information on a field tracking form that was completed by field teams; however, better tracking and evaluation of the information could allow for future performance tracking and reporting.

The District has no equipment or staff available to contain or mitigate SSOs, and relies on Roto-Rooter to correct problems as they arise. According to Mr. Buehler, Roto-Rooter should be cleaning and repairing "hot-spot" areas within the system as part of routine maintenance as time allows; however, as stated previously, the inspection team could not verify that these activities were completed by the documentation provided by the District. According to Mr. Beuhler, routine maintenance would include both cleaning and if necessary TV inspection of the "hot-spot" areas. Mr. Buehler did not maintain a list of hot-spot areas for the District's system, but provided a Roto-Rooter document "Roto-Rooter Plumbing, Contract Listing" of those locations. The inspection team was not able to determine if the frequency of cleaning and TV inspection listed on this document was actually completed. In addition, since no written contractual agreement has been prepared between the District and Roto-Rooter defining on-going maintenance requirements for the collection system, routine maintenance may be overlooked or not completed.

From the information gathered during the inspection it appears the routine and event driven maintenance of the District's sanitary sewer collection system has been and will continue to be contracted to Roto-Rooter. The use of the contractor is indicative of a reactive program rather than proactive program and response times tend to be slower. Additionally, the details provided in work orders to the contractor, records of work performed by the contractor and spill response and reporting were judged to be minimal. SSO frequency was increasing when measured on a SSO per 100 miles/year basis, but it was unclear if this was indicative of more overflows or an improved reporting process. The data shows that additional efforts remain necessary to reduce the occurrence of SSOs. The majority of the spills were the result of blockages from root intrusion which are directly related to and attributable to operation and maintenance issues.

According to the District's SSMP, adopted by the Almonte Board of Directors August 28, 2006, the District is in the process of developing and electronic preventative maintenance and cleaning tracking program. The District did not provide any evidence that this activity had been initiated. The District is encouraged to prioritize the development of this tracking system to be completed as soon as possible.

I eventually communicated to the EPA concerns about conclusions and statements contained in the reports (see below) based on the limited time and scope of the actual onsite inspections, failure to clarify or update document requests, etc. and the lack of review afforded our agencies prior to publication of the reports.

- "The use of the contractor is indicative of a reactive program rather than proactive program and response times tend to be slower" is simply opinion stated as fact with no supporting evidence provided.

- The assertion that the District has no personnel or equipment for spill response is untrue. The district manager lives in the district and as a matter of district policy, responds to all spills occurring in the district and many times is the first responder on site. While we do not

own rodding or flushing equipment Almonte does have expertise and equipment to mitigate the impact of spills.

- Use of a "spills per 100 miles" equivalency is extremely misleading for agencies that have relatively small collection systems and inflate the actual impact of a limited number of relatively small spills.

- There seemed to be little interest in following up the initial inspection by requesting clarification or additional information when questions arose, as reflected in comments in the report about the ability to understand documents provided or to verify assertions made by district personnel during the inspection.

Regulators Issue Orders:

RWQCB Cleanup and Abatement Order No. R2-2008-0010 issued 2/8/2008
EPA Administrative Order Docket No. CWA-309(a)-08-030 issued 4/10/08

Federal, state and local regulatory agencies responded swiftly following the spill of January 31, 2008, both in reaction to that spill itself but also in response to the massive amount of press coverage of the January 31, 2008 spill and the subsequent revelation that another "spill" had occurred on January 25, 2008.

On February 8, 2008, the RWQCB issued Cleanup and Abatement Order No. R2-2008-0010 (Available here: http://www.swrcb.ca.gov/rwqcb2/board_decisions/adopted_orders/2008/R2-2008-0010.pdf).
The order required SASM to cleanup and abate the effects of partially treated sewage discharged into Richardson Bay and take other necessary remedial action to prevent threatened conditions of pollution or nuisance.

Among other requirements, SASM was instructed to hire and independent external auditor to conduct a comprehensive audit to "demonstrate that the ongoing threat of discharge of wastes into the waters of the State and the threat to create a condition of pollution and nuisance have been abated by verifying the Discharger's effectiveness in complying with Order No. R2-2007-0056, Attachment D, Section I.D., Federal Standard Provisions for Proper Operation and Maintenance.

The EPA, having already conducted Clean Water Act Compliance Evaluation Inspections for most of the SASM member agencies, moved forward with the issuance of orders of its own. On April 4, 2008, administrative orders were issued to SASM and its member agencies and the Sausalito-Marin City Sanitary Districts and their satellite systems, the city of Sausalito and Tamalpais Community Services District.

Administrative Orders Issued for Marin County Sewage Collection Systems

Sanitary Districts of Southern Marin
Click for a larger view

The U.S. Environmental Protection Agency today issued enforcement actions requiring nine sewage collection systems in the Sausalito and Mill Valley areas of southern Marin County, Calif. to address chronic sewage spills, improve sewer maintenance and implement long-term programs to renew aging sewer pipes. The deteriorated condition of the sewer systems became evident in January 2008 when heavy rains overwhelmed the systems resulting in large spills to Richardson Bay and San Francisco Bay.

The EPA enforcement orders were issued to the cities and sanitary districts that convey wastewater to the sewage treatment plants operated by the Sewerage Agency of Southern Marin in Mill Valley and the Sausalito-Marin City Sanitary District at Fort Baker.

» Press Release 4/10/08

Adminstrative Order (amended) for Sewerage Agency of Southern Marin (PDF) (31 pp, 1.8M)

- Almonte Sanitary District
- Alto Sanitary District
- City of Mill Valley
- Homestead Valley Sanitary District
- Richardson Bay Sanitary District
- Tamalpais Community Services District

Adminstrative Order for Sausalito-Marin City Sanitary District - Amended (PDF) (34 pp, 1.5M)

- City of Sausalito
- Tamalpais Community Services District

Deteriorated conditions of the sewer systems became evident when heavy rains overwhelmed the systems causing several large sewage spills into Richardson Bay and San Francisco Bay in January 2008. Rainwater infiltrated into cracked pipes, causing January 25 flows to exceed the capacity of the emergency holding basin at the SASM wastewater treatment plant, where 2.45 million gallons overflowed to Richardson Bay. Another spill occurred on January 31 when operators at the SASM treatment plant failed to operate all of its discharge pumps leading to a 2.7 million gallon spill to Richardson Bay. In Sausalito, the January 25 storm led to a 63,000 gallon spill from a sewer manhole on Marinship Way.

EPA inspections of the collection systems revealed that they have a history of chronic spills. Most spills are relatively small volume and caused by roots growing into cracks in the pipes. This pattern of spills is commonly found in aging sewer systems in which many pipes were installed in the 1950's and earlier. During winter storms, rainwater leaking

into defective pipes leads to even greater problems including large volume spills and disruption of wastewater treatment plants.

Sewage spills are reported to the State Water Resources Control Board and these reports are available to the public on the Board's Web site EXIT Disclaimer.

The EPA orders require the sewer systems to employ a number of strategies to reduce sewage spills. In the short-term, the systems are required to implement aggressive sewer cleaning programs aimed at the most problematic pipes. The systems are also required to inspect their sewer pipes and measure wet weather flows that are passed on to the sewage treatment plants. Finally, the systems must develop plans to manage excess flows and implement long-term programs to repair and replace deteriorated sewer pipes.

The wastewater collection and treatment systems in southern Marin County are managed by several small sewer districts and cities. The small size and fragmented nature of the sewer agencies has made it difficult to adequately fund and effectively manage wastewater. As the sewer systems have aged and deteriorated, the cost of repair and rehabilitation has increased considerably placing further strain on the small districts and cities.

The Sewerage Agency of Southern Marin treats wastewater from about 28,000 people in the Mill Valley area. The sewage is collected from homes and businesses in networks of sewer pipes that are owned and maintained by five separate sanitary districts and the city of Mill Valley.

Sausalito-Marin City Sanitary District treats wastewater from about 16,500 people in Sausalito, Marin City and Tam Valley.

With the Orders, EPA encourages the cities and sewer districts to coordinate their responses to the orders and collaborate in actions to finance, operate and renew their wastewater infrastructure.

EPA and its contractor conducted compliance evaluation inspections of the Marin County sewage collection systems last fall and earlier this year.

- Mill Valley Inspection Report (PDF) (13pp, 130K)
- Sausalito-Marin City Sanitary District Inspection Report (PDF) (38pp, 4M)
- City of Sausalito Inspection Report (PDF) (26pp, 1.5M)
- Almonte Sanitary District Inspection Report (PDF) (23 pp, 1.29M)
- Alto Sanitary District Inspection Report (PDF) (21 pp, 915K)
- Homestead Valley Sanitary District Inspection Report (PDF) (18 pp, 650K)
- Richardson Bay Sanitary District Inspection Report (PDF) (19pp, 649K)
- Tamalpais Community Services District Inspection Report (PDF) (23 pp, 1.4M)
- Sewerage Agency of Southern Marin Inspection Report (PDF) (19 pp, 990K)

*Home phone numbers and names of private citizens that appear in the report attachments have been redacted from the Web posting of the inspection reports.

Agency Compliance Record:

The EPA Order required the SASM and its member agencies to submit a Sewage Spill Reduction Action Plan (SSRAP) as detailed in the order and to implement their current programs for controlling sewage spills. The agencies were also required to immediately implement improvements to their current programs that are consistent with the requirements contained in the order. If a program currently being implemented by SASM or the member agencies fails to meet the requirements of the Order, SASM or a member agency, as appropriate, must implement the improvements necessary to satisfy the Order. To the extent that an existing program satisfies the requirements of the Order, SASM or a member agency may submit a description of its program for review and approval by EPA.

The main elements of the order are detailed below:

I. ELIMINATION OF COLLECTION SYSTEM SPILL

II. SPILL RESPONSE, RECORDKEEPING, NOTIFICATION & REPORTING

III. COLLECTION SYSTEM MAINTENANC AND MANAGEMENT

IV. COLLECTION SYSTEM ASSESSMENTS

V. CAPACITY ASSURANCE

VI. INFRASTRUCTURE RENEWAL

VII. IMPLEMENTATION STUDY AND REPORT

VIII. PLAN REVIEW AND APPROVAL

IX. QUARTERLY SPILL REPORTS

X. ANNUAL PROGRESS REPORTS

To a large extent these elements are similar to those contained in the existing SSMP regulatory requirements. However, the order required EPA review and approval of existing SSMP and agency programs and practices as well the requirement to conduct new investigations to detail existing conditions and/or demonstrate compliance or future corrective action.

To facilitate agency response to the order, SASM and its member agencies retained RMC Water and Environment, a respected consulting firm, to assist in response to and implementation of the order. SASM and its member agency are currently in compliance with the order as reflected in the compliance timetable below:

ATTACHMENT 2: Finding of Violation and Order Docket No. CWA-309(a)-08-030

Sewerage Agency of Southern Marin and its Member Agencies

Timetable of Order Requirements

October 15, 2008

II.A.	Submit Spill Response Plan
III.A.2.	Submit Progress Report on Cleaning and Root Control Plan
III.B.3.	Submit Progress Report on MMS Implementation
III.D.	Submit FOG Program Report
IV.A.2	Submit Initial Assessment Report
IV.B.1.	Install flow meters
V.A.	Submit and Implement Short-Term Contingency Plan
VII.B.	Submit Progress Report on Implementation Study Report

April 15, 2009

III.A.1.	Submit Cleaning and Root Control Plan
III.B.1.	Obtain and Implement MMS
III.B.2.	Link MMS to GIS map
III.C.1.	Submit Pump Station Report
III.C.2.	Submit Pump Station Certification
III.C.3.	Submit Pump Station Upgrade Plan
IV.A.1.	Submit Inspection and Assessment Plan
VII.	Submit Implementation Study Report

October 15, 2009

IV.A.3.	Submit Condition Assessment Progress Report

October 15, 2010

IV.A.4.	Submit Final Condition Assessment Report
IV.B.3.	Submit Capacity Assessment Report
V.B.1.	Submit Capacity Assurance Plan
VI.A.	Submit Rehabilitation and Replacement Plan

October 15, 2013

V.B.2.	Complete Short-Term Improvements

Quarterly Spill Reports Due Each January 15, April 15, July 15, and October 15, beginning July 15, 2008:

IX.A.	Quarterly Spill Reports

Annual Reports Due Each October 15, beginning 2008:

III.C.4.	Pump Station Reliability
IV.B.2.	Flow Monitoring Reports
VI.B.	Infrastructure Renewal Program

Annual Reports Due Each October 15, beginning 2009:

III.A.3.	Cleaning and Root Control Program

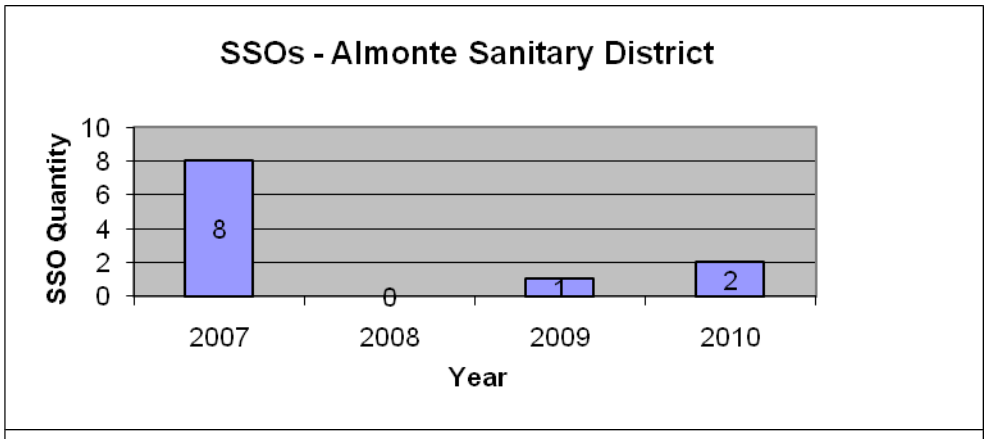
* Plan subject to review and approval by EPA pursuant to paragraph VIII of this Order.

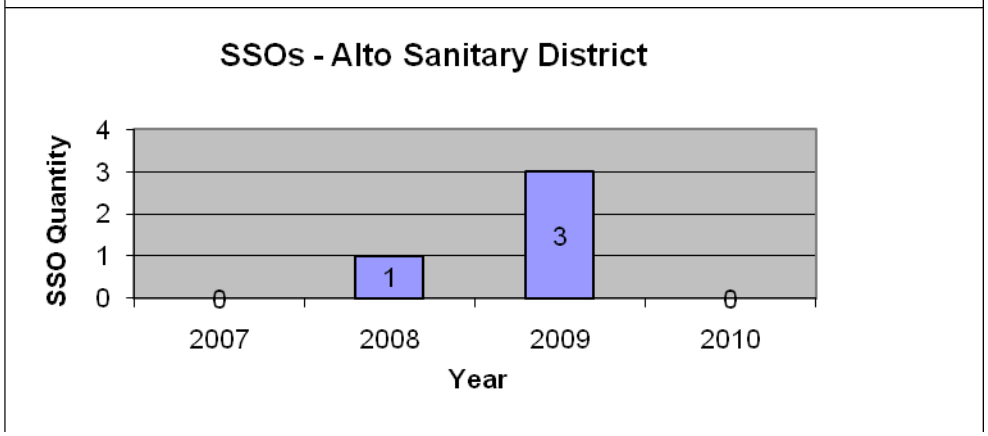
Agency SSRAP submittals are available under "other documents" at almontesd.org here: http://www.almontesd.org/documents.php

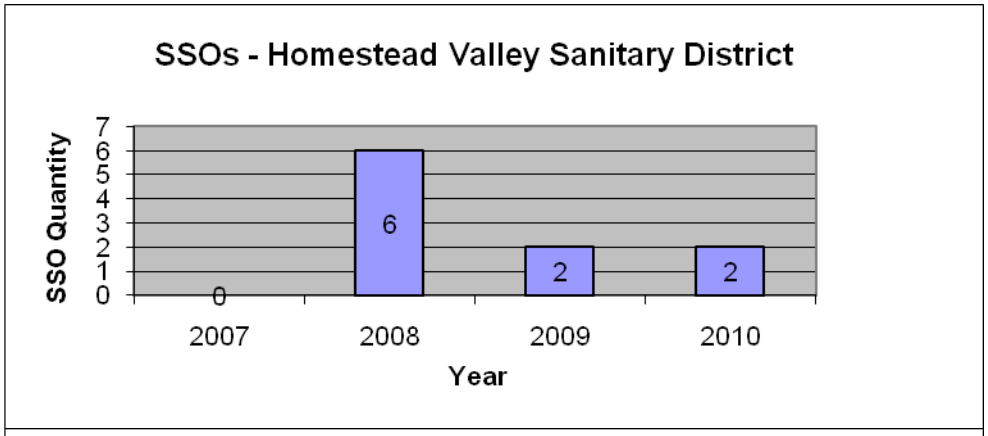
SASM and its member agencies are in compliance with the requirements of all orders issued by regulators.

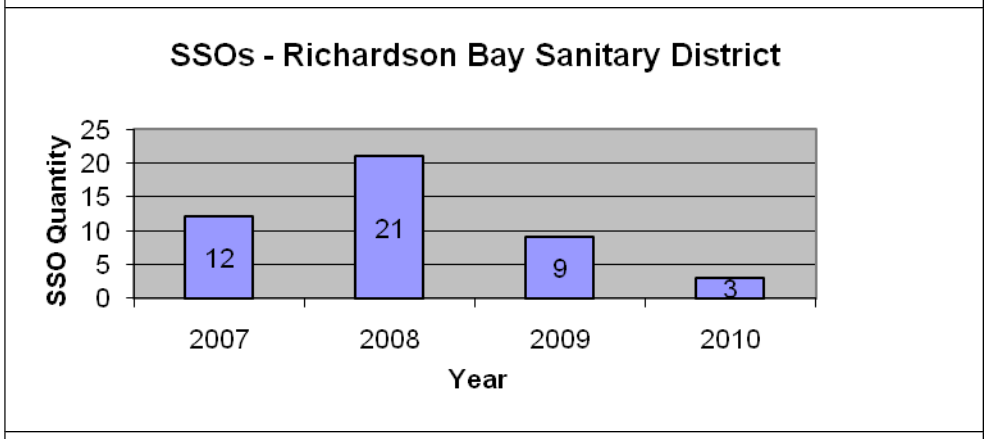
Agency Success in Reducing SSOs:

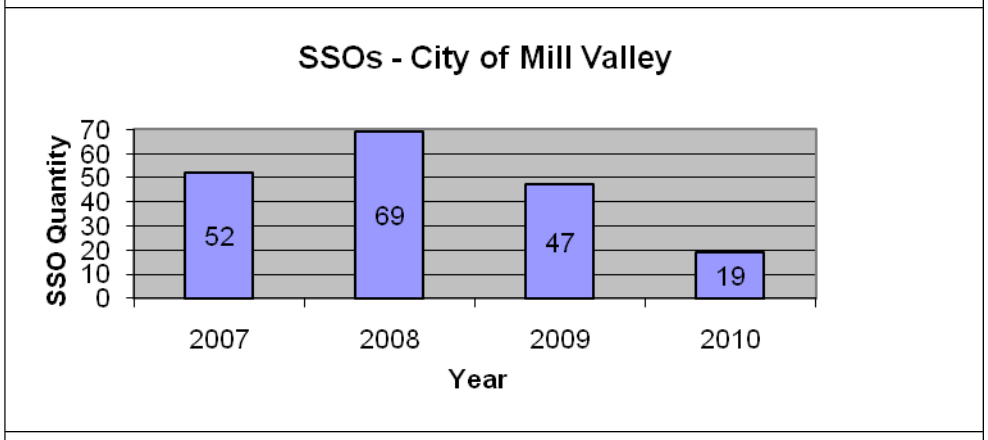
SASM and its member agencies have made a concerted effort to reduce both the number and volume of SSOs. The information graphed below is from the CIWQS database.

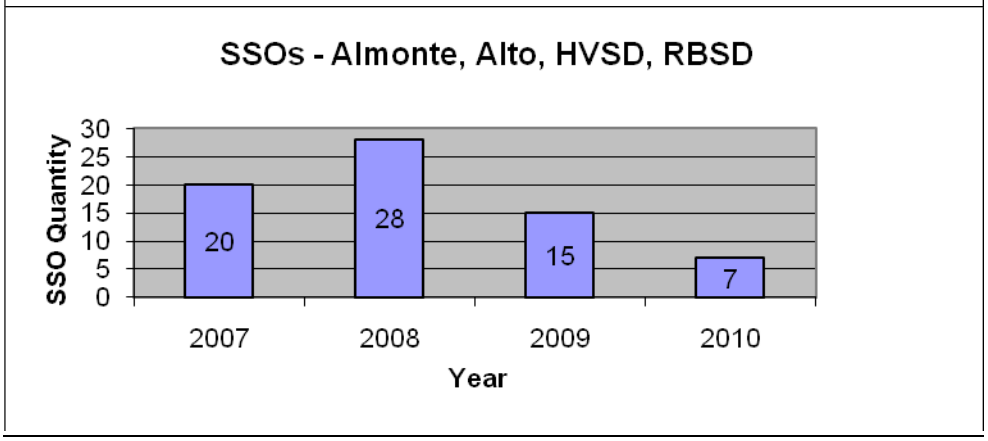


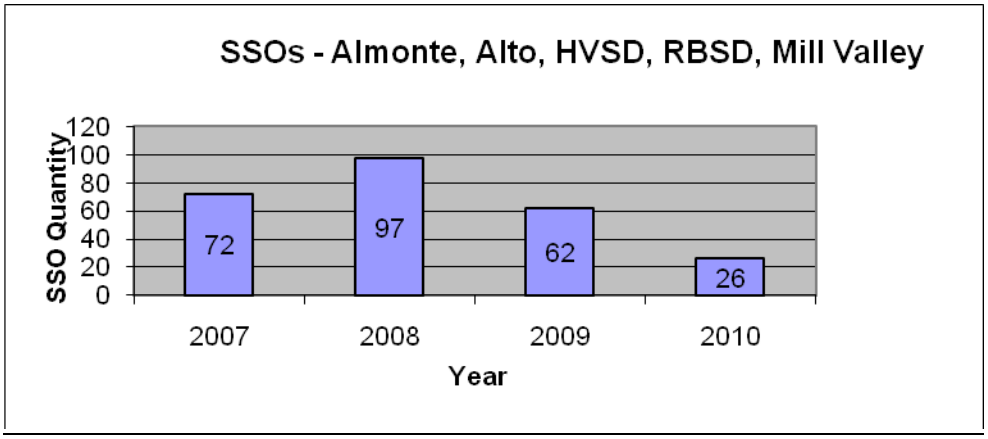



SSOs - Homestead Valley Sanitary District
SSO Quantity
7
6
5
4
3
2
1
0
0
6
2
2
2007
2008
2009
2010
Year


SSOs - Richardson Bay Sanitary District
SSO Quantity
25
20
15
10
5
0
12
21
9
3
2007
2008
2009
2010
Year


SSOs - City of Mill Valley
SSO Quantity
70
60
50
40
30
20
10
0
52
69
47
19
2007
2008
2009
2010
Year


SSOs - Almonte, Alto, HVSD, RBSD
SSO Quantity
30
25
20
15
10
5
0
20
28
15
7
2007
2008
2009
2010
Year



Although a "zero-spill" record is the goal of every agency, SSOs continue to occur despite agency implementation of best management practices (BMPs) and are more of a problem for some agencies than others due to a variety of factors. Please note the number of SSOs experienced by the four sanitary districts, Almonte, Alto, Homestead Valley and Richardson Bay are substantially less than those experienced by the City of Mill Valley even though the four districts have about equivalent miles of sewer in their respective collection systems. These four sanitary districts have had aggressive cleaning programs in place for years.

The analysis of spill volumes below indicates that spills occur infrequently, are of relatively small volume, are responded to and resolved rapidly, pose little threat to public health and are likely to have little impact on "waters of the state" which have been interpreted to include spills that may reach a storm drain (although the storm drain may be far away from any creek, stream, marsh or bay).

Spill Volume Analysis (5 Agencies – Almonte, Alto, Homestead Valley, Richardson Bay and Mill Valley)
Previous 4-Years

	Almonte	Alto	Homestead Valley	Richardson Bay	City of Mill Valley
2010	150	0	35	540	2,589
2009	150	150	700	1,158	11,171
2008	0	15	100	2,315	11,316
2007	1,580	0	0	1,575	10,124
Total SSO Vol.	1,880	165	835	5,588	35,200
Total SSOs	10	4	10	45	187
Avg. Gal/SSO	188	41	84	124	188
Total Volume Recovered (5 agencies)		6,347			
Total Number SSOs		256			
Avg. Gal/SSO Recovered		25			

Previous 2-Years

	Almonte	Alto	Homestead Valley	Richardson Bay	City of Mill Valley
2010	150	0	35	540	2,589
2009	150	150	700	1,158	11,171
Total SSO Vol.	300	150	735	1,698	13,760
Total SSOs	3	3	4	12	66
Avg. Gal/SSO	100	50	184	142	208
Total Volume Recovered (5 agencies)		2,537			
Total Number SSOs		88			
Avg. Gal/SSO Recovered		29			

Last 1-Year

	Almonte	Alto	Homestead Valley	Richardson Bay	City of Mill Valley
2010	150	0	35	540	2,589
Total SSO Vol.	150	0	35	540	2,589
Total SSOs	2	0	2	3	19
Avg. Gal/SSO	75	0	18	180	136
Total Volume Recovered (5 agencies)		580			
Total Number SSOs		26			
Avg. Gal/SSO Recovered		22			

Spill Volume Analysis (4 Agencies – Almonte, Alto, Homestead Valley, Richardson Bay)

Previous 4-Years

	Almonte	Alto	Homestead Valley	Richardson Bay
2010	150	0	35	540
2009	150	150	700	1,158
2008	0	15	100	2,315
2007	1,580	0	0	1,575
Total SSO Vol.	1,880	165	835	5,588
Total SSOs	10	4	10	45
Avg. Gal/SSO	188	41	84	124
Total Volume Recovered (4 agencies)		580		
Total Number SSOs		69		
Avg. Gal/SSO Recovered		8		

Previous 2-Years

	Almonte	Alto	Homestead Valley	Richardson Bay
2010	150	0	35	540
2009	150	150	700	1,158
Total SSO Vol.	300	150	735	1,698
Total SSOs	3	3	4	12
Avg. Gal/SSO	100	50	184	142
Total Volume Recovered (4 agencies)		580		
Total Number SSOs		22		
Avg. Gal/SSO Recovered		26		

Previous 1-Years

	Almonte	Alto	Homestead Valley	Richardson Bay
2010	150	0	35	540
Total SSO Vol.	150	0	35	540
Total SSOs	2	0	2	3
Avg. Gal/SSO	75	0	18	180
Total Volume Recovered (4 agencies)		580		
Total Number SSOs		7		
Avg. Gal/SSO Recovered		83		

Collection Agencies Blamed for SASM spills of 2008

The assignment of blame for the January 25, 2008 SASM spill focused on "deteriorated" collection systems and the small districts that operate them for allowing wet-weather I&I to "overwhelm" the SASM treatment plant. Even the January 31, 2008 spill focused on the wet-weather component although it clearly resulted from operator error.

The EPA press release below and your comments in quoted in the Marin IJ on February 6, 2008 and March 10, 2008 are representative of many of the public and governmental comments reported in the press coverage.

U.S. EPA orders Marin County sewage collection systems to address chronic sewage spills

Release date: 04/10/2008

Contact Information: Wendy Chavez, 415/947-4248, chavez.wendy@epa.gov

(San Francisco, Calif. -- 04/10/2008) The U.S. Environmental Protection Agency today issued enforcement actions requiring nine sewage collection systems in the Sausalito and

Mill Valley areas of southern Marin County, Calif. to address chronic sewage spills, improve sewer maintenance and implement long-term programs to renew aging sewer pipes.

Deteriorated conditions of the sewer systems became evident when heavy rains overwhelmed the systems causing over 5 million gallons of sewage to flow into Richardson Bay and San Francisco Bay earlier this year.

“These small, underfunded and undermanaged systems will continue to pose threats to San Francisco Bay if communities fail to upgrade and maintain their systems sustainably,” said Alexis Strauss, the EPA’s Water Division director for the Pacific Southwest region. “We urge the systems to begin to work together and invest in long-overdue assessment, repair and replacement of their wastewater infrastructure.”

Marin IJ 2/6/08

Assemblyman Jared Huffman, D-San Rafael, said the spills highlight local sewage agencies' failure to maintain their pipes and plants.

And, he said, the spills point to the need to break free of the "parochial" nature of small local sewer boards that ring Richardson Bay and to create a governmental structure that will resolve problems. The situation reflects a "fractured governance system" where small, low-profile boards operate with little public discussion of possible problems.

The spills are "serious stuff and it's unacceptable," he said.

Marin IJ 3/10/08

ASSEMBLYMAN Jared Huffman says consolidating the "little banana republics" that run Southern Marin's sewerage system may be the key to fixing problems that have prompted massive sewage spills.

Huffman says analyzing the problem is a starting point.

"I don't come to the table with any locked-in view of the solution, but I want to make sure we're all talking about the problem and getting some tools to deal with it," said Huffman, D-San Rafael, the most outspoken proponent of consolidating smaller sewer districts.

Huffman is pushing for meetings between district officials to examine mergers and other ideas. He also would consider a pipe-funding ballot measure he compared to the multiyear fire flow tax used by the Marin Municipal Water District.

"Any benefits you would see of the highly localized control are more than overshadowed by the downsides you see," Huffman said. "Who pays when all the contaminated sewage spills into Richardson Bay? We all have an interest in making sure that stops."

He said the frequency of fines levied on Bay Area sewage districts highlights flaws in the system.

Independent Studies: Agencies Wet-Weather Impact on SASM Treatment Plant

The assignment of blame for the January 25, 2008 SASM spill focused on "deteriorated" collection systems and the small districts that operate them for allowing wet-weather I&I to "overwhelm" the SASM treatment plant. Even the January 31, 2008 spill focused on the wet-weather component although it clearly resulted from operator error.

However, review and analysis by two independent consultants tell an entirely different story. These studies were conducted to address requirements imposed by the RWQCB cleanup and abatement order and the EPA's administrative order.

The first, conducted by John Larson as a part of the Larry Walker Associates independent audit required by the cleanup and abatement order, analyzed the flows to the WWTP for the January 25, 2008 storm event and demonstrates that flows to the SASM plant from its member agencies were in accordance with design expectations.

The second, conducted by RMC Flow and Environment as part of the SSRAP requirement of the EPA order, confirms that SASM's member agencies have not allowed their lines to deteriorate over the past 30 years based on original flow and I&I design parameters (Black & Veatch 1980 Sewer System Evaluation Survey). For a detailed examination of the original plant wet-weather design please see (Appendix: B, September 16, 2008 letter to EPA). (The RMC report is excerpted below, highlighting added)

Section 4 Capacity Assessment

4.1 Introduction

4.1.1 Purpose

This portion of the SSRAP submittal presents the results of the collection system capacity assessment to comply with subsection IV.B.3 of the Order. This subsection of the Order requires that the agencies identify areas, sources, and quantities of infiltration/inflow (I/I) in the collection system; identify bottlenecks to conveying wet weather flows; and discuss the impact of flows from one agency to another and on SASM's wastewater treatment plant (WWTP).

This capacity assessment for SASM and its member agencies is based on flow monitoring data obtained during the 2008/09 and 2009/10 wet weather seasons and hydraulic modeling of the SASM conveyance system and key portions of the member agency collection systems. The capacity assessment has been used to develop a Capacity Assurance Plan as required under Section V.B of the Order (see Section 5 of this report) and to complete the Pump Station Reliability Certification

4.5 Design Event

Since flow response to wet weather events varies with storm rainfall (as well as other factors), quantifying I/I in the system and identifying hydraulic constraints must be referenced to a "design" condition or "design event." In the case of SASM, the design event has been defined as the storm of January 25, 2008, a notable event in recent memory that resulted in high flows to the SASM WWTP and a major wet weather spill. Another recent large storm event that has been used by some agencies as a design condition, the storm of December 31, 2005, caused widespread surface flooding and drainage problems in many areas of Marin County, including the SASM service area; therefore, it was not considered appropriate for SASM for use in assessing wastewater system capacity. Rainfall amounts for the January 25, 2008 storm were obtained for two rain gauges in Mill Valley and one gauge maintained by TCSD at its district offices on Bell Lane. The design event rainfall pattern is depicted in **Figure 4-10** for the TCSD and one of the Mill Valley rain gauge sites.

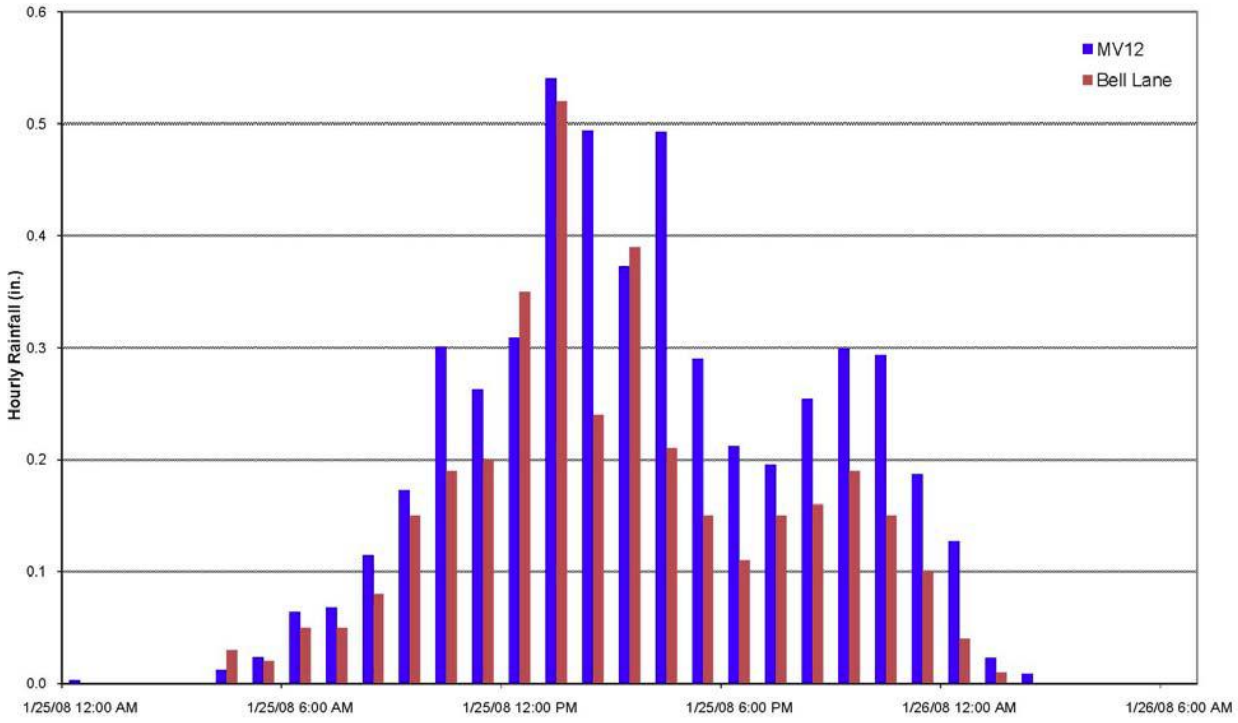


Figure 4-10: Design Rainfall Event

Based on available rainfall depth-duration-frequency statistics, the January 25, 2008 storm is estimated to have been an approximate 20-year return frequency event in the Mill Valley area for 24-hour duration, and a 5- to 10-year frequency event for shorter (e.g., 4- to 6-hour) durations. Therefore, this storm is considered an appropriate event for assessment of both collection system and WWTP capacity.

The I/I estimates and system capacity analysis results presented in the remaining sections of this Capacity

Assessment are based on the analysis of the system, using the hydraulic model, for the design wet weather

4.8 Impact to SASM from Member Agency Collection Systems

The peak wet weather flow to the SASM WWTP for the design event is predicted by the model to be approximately 31 mgd. This is very close to the original design peak wet weather flow capacity of the WWTP of 32.7 mgd and slightly lower than the peak influent of flow of 33 mgd that was recorded at the plant during the January 25, 2008 storm event (the actual influent flow may have been slightly lower based on 2009 influent meter calibration records).

To validate the predicted modeled peak flow, the model was also run for a synthetic rainfall event assumed to have a total 24-hour rainfall amount of 4.82 inches, representing a 20-year return frequency event for the Mill Valley area1, and an SCS Type IA temporal rainfall distribution. (Note: for this model run, the rainfall was assumed to be the same throughout the SASM service area. While this assumption does not reflect the actual variation of rainfall with location and elevation, it provides a reasonable approach for assessing the total flow in the system.) The peak flow to the WWTP based on the synthetic 20-year return frequency rainfall event was approximately 32 mgd, again very close (within 3 percent) to the original WWTP design flow and the model-predicted and recorded flow for the January 25, 2008 event.

These results indicate that the flows to the SASM WWTP are similar to those projected during the design of the system, and that *overall flows do not appear to have changed significantly over the past 25 to 30 years*. However, the peak wet weather flows in the SASM system are still very high, representing a design event peak flow to the WWTP of about 15 times summertime average dry weather flow. These high peak flows result in surcharging of SASM pipelines and, in some cases, adverse backwater impacts on member agency sewers. Furthermore, it appears that the *distribution* of flows within the system may be different than originally estimated, resulting in more severe capacity deficiencies in some areas of the system than had been previously calculated. Flows from Alto, Almonte, HVSD, and Mill Valley have the most significant capacity impacts on the SASM system, as indicated by the areas of predicted high surcharge during peak wet weather conditions.

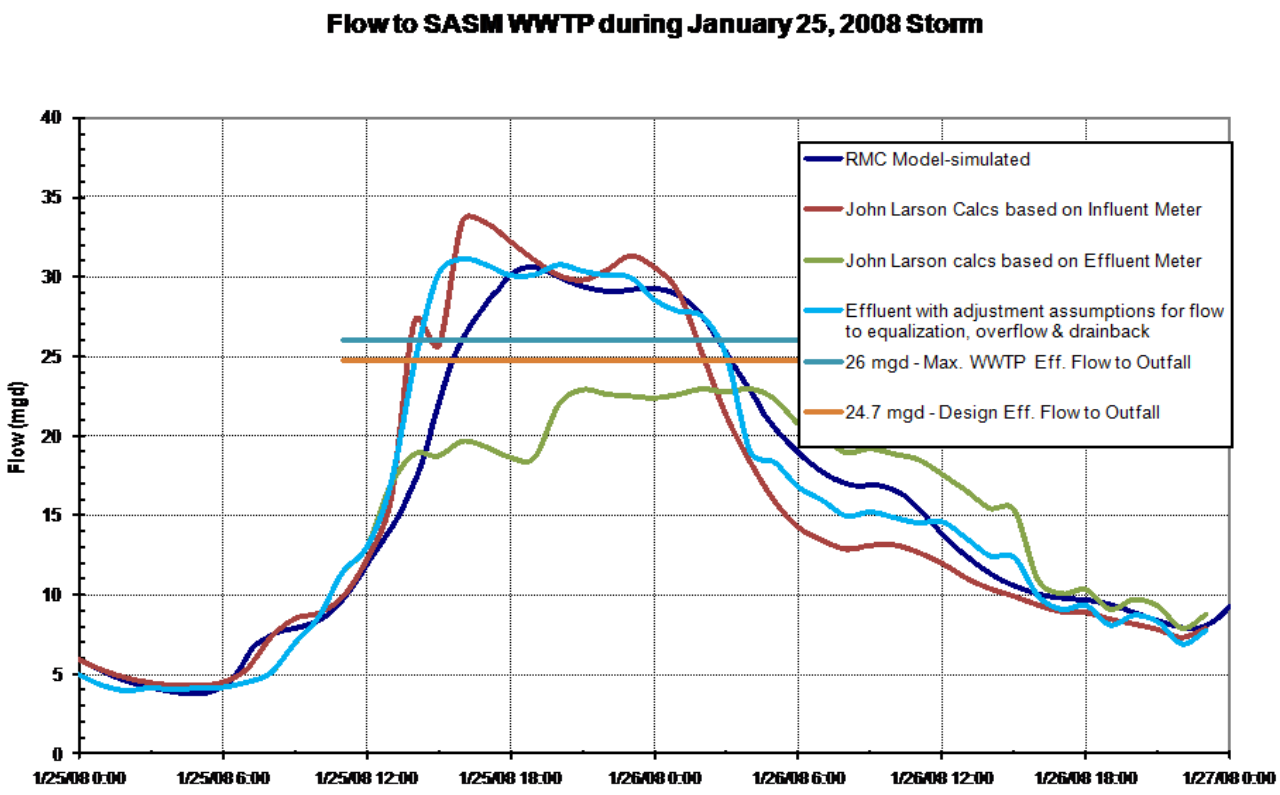
Table 4-2 summarizes the contribution by agency to the average dry weather and total design event peak wet weather flow to the SASM WWTP. Note that in this table, the peak flows by agency represent the sum of the sub-basin peak flows, which is about 5 percent higher than the modeled peak flow to the WWTP due to flow attenuation and existing capacity restrictions in the system. It should also be noted that I/I into SASM pipelines cannot be specifically isolated and may be included in the estimated flow values for some of the member agencies, most notably Almonte. As noted previously, all of the flow

meters used to isolate Almonte flows were installed on SASM pipelines. The SASM pipelines upstream of the Almonte flow meters comprise 15 to 20 percent of the total length of sewers tributary to these meters and may be subject to significant infiltration.

1 California Department of Water Resources precipitation depth-duration-frequency data for Mill Valley (Table C-1,

Sewerage Agency of Southern Marin, Sewer System Evaluation Survey, Black & Veatch, 1980)

Independent Studies: Causes of SASM spills of 2008



The graph above is based on the original John Larson graph and analysis of the storm flows recorded by the SASM influent and effluent meters during the January 25, 2008 storm. It has been modified by RMC to include additional curves based on the RMC model-simulated flows, influent flows derived from a combination of actual effluent flows augmented by flows pumped to the equalization basins, spill volumes reported to regulators and flows drained back from the equalization basin for treatment and disposal. I have also included two horizontal reference lines, the first at 24.7 mgd which represents original design effluent flow. The second, at 26 mgd, represents expected when all six effluent pumps are online and pumping to the outfall at Raccoon Straight (see: Appendix C, SASM wet-weather SOP)

Item 5 below, from the findings section of RWQCB Cleanup and Abatement Order No. R2-**2008-0010, indicate that SASM reported influent flows of 44 MGD received from its member** agencies. (http://www.swrcb.ca.gov/rwqcb2/board_decisions/adopted_orders/2008/R2-2008-0010.pdf)

5) On January 25, 2008, during heavy rain, the Discharger reported influent to the treatment plant was 44 MGD, which exceeded the design capacity of the plant. For about a six-hour period, an estimated 2.45 million gallons of screened wastewater bypassed the plant and discharged to Richardson Bay from the equalization ponds.

Although the original SASM influent flow recorders do show short-duration peak flows of 44 mgd, it was clear to investigators and former plant staff, that these short-duration peaks and precipitous plunges in recorded flow, were anomalies caused most likely by surcharging of the influent flow meter, high water levels in the influent wet well and automatic closing and subsequent opening of the main head-gate which accounts for the ping-pong flow pattern.

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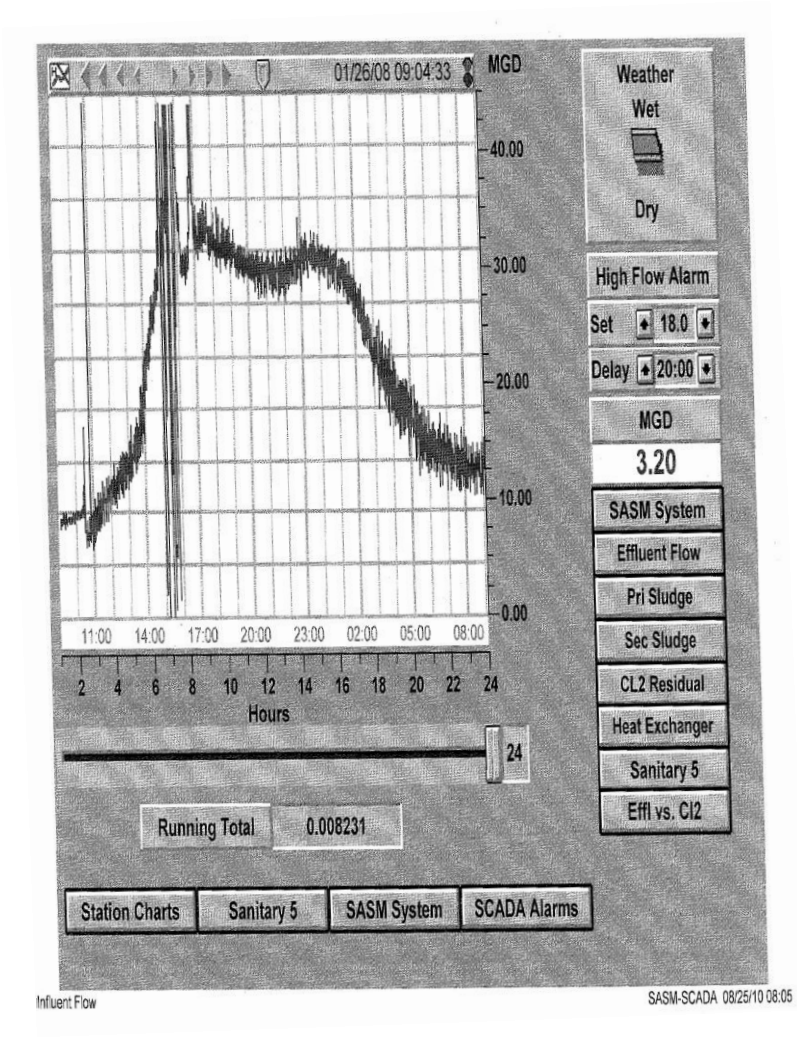

what is also clear from the multi-curve graph of the various influent flows is that effluent flow green line) remained substantially below both the 24.7 mgd original design flow and the 26 mgd expected flow based on all of the effluent pumps (6) operating. Examination of plant records indicate that plant

staff ran only five of the six available effluent pumps during the storm event. Typically, according to longstanding procedure, only flow in excess of the pumping capacity of the six effluent pumps, approximately 26 mgd, is to be pumped to the equalization basins (see attachment 3, WWTP wet-weather SOP). This is done to conserve storage and minimize potential discharges to the bay. In terms of the multi-curve graph, this means that flows below the horizontal lines but above the green effluent curve were pumped to the equalization basins instead of being treated and pumped out the outfall resulting in premature filling of the equalization ponds which in turn eventually filled and overflowed via the plants old outfall structure to Richardson Bay as the rain continued throughout the day.

Calculations indicate that had staff operated the plant per SASM's wet-weather SOP, which would have maximized pumping through the plant at 26 mgd, the equalization basins would have had sufficient capacity to contain flows from the storm without discharging to the bay.

Subsequent to the spills, SASM substantially increased equalization volume to over 3 million gallons to guard against future spills. Also, all recirculation and effluent pumps have been replaced to assure maximum secondary treatment and effluent pumping capacity. SASM also has a history of strict compliance with reporting, sampling and posting requirements for spills (see: Attachment 5)

The bottom line is that SASM member agencies' collection systems performed pretty much as expected based on the original plant design. They may even be performing better than designed based on pump station improvements made over the years that should have increased the expected peak flows received at the treatment plant.

The original design expectations for plant and member agency collection system performance (on which EPA and SWRCB grant funding was based) was that SASM and its members' collection systems and the SASM treatment facility could successfully, collect, treat and dispose of flows related to a 20 year storm event (sewage and I&I flows with a 32.7 mgd peak). This still appears to be the case.

Proactive and collaborative actions taken by the various agencies:

SASM and its member agencies, both boards and staff, have been characterized by some government officials, special interest groups, politicians, residents and members of the press, etc. as being small, parochial, dysfunctional, fragmented, underfunded, undermanaged, self-interested, and by implication environmentally insensitive, narrow-minded, self-serving, short-sighted and frugal to a fault. Officials or employees who are incapable of cooperative, collaborative behavior and unwilling, unable or incapable of providing effective operation of the agencies they serve. Nothing could be further from the truth. All of our agencies, both elected officials and staff, have spent years working to provide cost-effective, environmentally-responsible service to their communities.

The Sewerage Agency of Southern Marin, by its inherent structure, is a collaborative enterprise.
Formed in 1979 to spearhead improvements required by the Clean Water Act and made possible through federal and state grant funding programs, SASM and its member agencies have largely succeeded in providing cost-effective and environmentally responsible wastewater collection, treatment and disposal services to its residents. SASM has contracted operation of its facilities to the

City of Mill Valley (the largest SASM member representing about 50% of the service area) since the plant went online in 1983. By and large, Mill Valley has operated the plant well and SASM (with the exception of the January 2008 spills) has enjoyed a fairly exemplary compliance record. Over the years SASM and its member agencies have frequently collaborated on projects or investigate issues and possible solutions to common problems, many times related to wet weather issues.

History and Common Challenges:

Most if not all wastewater agencies in Marin County are in the same boat, saddled with leaky sewers, both private laterals and public pipes, that make handling wet-weather flows a challenge. All have traveled the same path regarding I&I. Collection systems are concerned with keeping the sewage in the ground and flowing. Treatment plants are concerned with treating the waste they receive - ultimately discharging the effluent to some receiving water, all in accordance to ever more stringent permit requirements.

In order to qualify for grant funding in the 1980's when federal and state monies made upgrading aging and inadequate facilities possible, agencies were required to take a stab at tightening up their collection systems. To qualify for grants, the EPA required a cost-effective analysis of collection systems to identify and correct "excessive infiltration and inflow conditions in sewer systems" (please see Appendix: B for a discussion of the original design process)

These studies showed vast amounts of infiltration and inflow entering our pipes during storms, which can as a surprise to no one operating a treatment plant or collection system. For years agencies had bypassed wet-weather storm flows directly to the bay. This was done with full knowledge of the RWQCB. Agencies were required to only eliminate I&I that was economically feasible, defined essentially to mean "cheaper to fix the pipes than to build a bigger treatment plant. Because I&I reduction is so expensive to cure and pursuing a "convey and treat" strategy is generally more cost-effective, most plants were built to accommodate large peaking factors of 10 or greater. SASM's original peaking factor based on a 32.7 mgd peak and a 2.9 mgd average dry weather flow was 11.3. When calculated based on actual dry weather flow received, these peaking factors are even greater, as RMC noted up to 15 times summertime dry weather flow.

Most agencies, while recognizing that in a perfect world they would have tight sewers and less wet weather headaches, have found it cheaper to pursue a "convey and treat strategy" rather than fixing leaky pipes. This is partly because a significant portion of the leaking pipes are privately owned sewer lines and it has been difficult to find a strategy that effectively motivates homeowners to fix their lines. Also, it has proven more cost-effective to convey and treat the sewage than to fix the pipes. Relief sewers, larger pump stations and force mains, larger treatment, storage and disposal facilities have been the corrective measures of choice. This strategy makes a lot of sense. It helps prevent wet-weather related SSOs and conveys the sewage to POTWs for treatment and discharge according to permit standards designed to protect the receiving waters and public health.

The recently completed Central Marin Sanitation Agency (CMSA) wet weather improvements are an example. From the CSMA website
http://www.cmsa.us/assets/documents/WWIP/20100526144917437.pdf

During winter, rainwater flows into manholes and cracks in home laterals and sewer pipelines, dramatically increasing flows and exceeding the capacity of the plant. Over $50 million in Wet Weather Improvement Projects are underway to expand the facilities capacity. We have completed the expansion of our storage pond, which doubles its capacity to 7 million gallons.

The purpose of the Wet Weather Improvements Project was to increase the Central Marin Sanitation Agency's treated capacity from 90 Million Gallons per Day (MGD) to 125 MGD and hydraulic capacity from 90 MGD, at highest tides, to over 155 MGD. This was done to ensure that the plant would meet NPDES permit requirements and not overflow wastewater or partially treated effluent into the drainage systems adjacent to the plant.
Why didn't CMSA simply fix the pipes? Because it was cheaper to accommodate the additional flows at the treatment plant rather than eliminate them at the source. Given the sea change in regulatory enforcement posture (essentially strict liability for spills), witness the huge fines levied on SASM, agencies are reluctant to risk fines for spills, even those due to extreme storm events in excess of a 20 yr. return frequency, while the agency waits years for the repair or replacement of leaky pipes to produce significant reductions in I&I.

What SASM has done to investigate and address the problem of wet weather flows and other SASM-wide issues, Examples of Collaborative Action:

- Southside Sewer System Surcharge Study: Begun in 1997 and spanning many years SASM and four of its members (Almonte, Tamalpais Valley, Homestead Valley, City of Mill Valley) collaborated on projects to address surcharging in the sewer system serving the agencies. This collaboration resulted in various improvements such as pump station upgrades, sewer improvements, and ultimately in the construction of the Rosemont pump station force main directly to the SASM plant. (see Appendix: D)
- Private sewer lateral testing: The SASM Board directed staff in November 1997 to research the feasibility of implementing a private lateral certification program in the SASM service area. (see: Appendix E)
- Response to Spills of 2008: SASM and its members responded in a variety of collaborative efforts in response to the RWQCB, SWRCB and EPA including hiring counsel, consultants and engaging staff in various responses to the continuing regulatory requirements. This included joint efforts on the EPA SSRAP plan. Common contract with maintenance and emergency contractor
- Common GIS program: The agencies collaborated on purchase and implementation of a common GIS system (SSGIS) to aid in managing their collection systems.
- Joint Sewer Rehab Project: In 2010, four agencies had a joint project valued at over a million dollars to rehabilitate sewers in Almonte, Alto, Homestead Valley and Richardson Bay.
- SASM continues to supply laboratory services to member agencies as well as other treatment plants (Sausalito-Marin City and Sanitary District No. 5). This includes fish bioassay, various lab analysis (Coliform, BOD, SS, salinity, chlorine residual, turbidity, etc.)

- Monthly District Manager Meeting: Managers from SASM and its members meet at least monthly to discuss issues that impact all the agencies.
- Richardson Bay collection system surcharging: In response to the huge storm on December 31, 2005 and surcharging experienced in Richardson Bay, SASM undertook actions to address a variety of problems. The letter and agenda items provided are indicative of the collaborative approach taken between staff on a routine basis: (see below pg. 30-33) sorry for the poor quality of some scans as some originals were on purple paper.

RICHARDSON BAY SANITARY DISTRICT

500 Tiburon Blvd., Tiburon, CA 94920 Tel 415.388.1345 Fax 415.388.1339

David Coe, General Manager
Sewerage Agency of Southern Marin
26 Corte Madera Avenue
Mill Valley, CA 94941

February 7, 2006

David,

In furtherance to our recent telephone conversations regarding the storm event of December 30 – 31, 2005 and the surcharging problems Richardson Bay Sanitary District experienced at our Belveron Gardens and Hawthorne Terrace Pump Stations and those SASM had at the Trestle Glen Pump Station, Richardson Bay requests that SASM proceed with implementing Alternate 3. as described in the 1999 Trestle Glen Sewage Pumping System Investigations prepared by Nute Engineering at SASM's request.

As we discussed, I have asked Nute Engineering to begin planning for increasing the pumping capacity at Belveron Gardens, Del Mar and Hawthorne Terrace pump stations in an effort to alleviate collection system surcharging and provide greater pumping redundancy at these stations. Hopefully, this work will be completed prior to winter 2006. This will substantially increase the pumping burden on the Trestle Glen station.

As a first step, SASM implemented Alternative 1A of the above referenced report which entailed replacement of an existing 50 HP pump with a 100 HP pump in an attempt to resolve the pumping capacity and surcharge problems at the Trestle Glen station while minimizing large scale improvements to the station's electrical system. Although a decided improvement, the recent storm has demonstrated that additional pumping capacity at Trestle Glen is required.

I realize that increasing the flow to the SASM WWTP presents additional problems in dealing excessive storm water flows but in light of the new SSMP requirements, now seems the time to deal with the issues of collection system surcharging, pumping capacity and storm water equalization.

If you would like to meet to discuss the issues, I am available at your convenience. Perhaps a joint meeting with Nute Engineering would be appropriate.

Sincerely,

Bonner Beuhler
District Manager

Agenda Explanation
SASM Board Meeting
March 16, 2006

Item No. 8

Treatment Plant wet weather capacity issues

The SASM wastewater treatment plant was completed in 1984. Projects to reduce rainwater infiltration and inflow into the SASM-wide collection system were completed in 1986. The plant has a theoretical influent peak flow handling capacity of 32.7 mgd. The reality is that this flow rate can be exceeded without causing SASM to violate discharge requirements. Since 1986, the influent flow to the plant has exceeded 32.7 mgd on 8 occasions and violations have only occurred on two of those days. On November 5, 1994 and on December 31, 2005, the capacity of SASM's wet weather storage ponds was exceeded and overflows of dilute raw sewage to Richardson Bay occurred. On one other occasion (February 3, 1998) thanks to a very long steady rainfall, the influent flow capacity was not exceeded but an overflow was nonetheless experienced.

Date	November 5, 1994	February 3, 1998	December 31, 2005
Peak influent flow rate, mgd (1)	45	31	39
Storm return period, years (2)	85	13	27
Overflow volume, gallons	1,600,000	125,000	1,400,000

(1) Theoretical influent design capacity = 32.7 mgd

(2) A statistically derived figure based on data provided by the Marin County Flood Control District.

All of these overflows were reported to the State Office of Emergency Services, the Health Department, and to the Regional Water Quality Control Board. Because all SASM facilities worked perfectly well and as designed, no fines or enforcement actions were imposed. There also was no negative impact to the public or environment as a result of these overflows due to the tremendous amount of storm water runoff in each case. As a result of the 1998 overflow, SASM implemented a $30,000 project to raise the berm around the storage ponds in order to increase storage capacity by about 27%.

At this time there does not appear to be any external pressure on SASM to improve SASM's wet weather performance. Nonetheless, staff is of the opinion there are opportunities that should be explored and possibly implemented to further improve SASM's ability to reduce the possibility of overflows from the treatment plant. The draft budget that will be submitted to the Board in April will contain two project recommendations to address these opportunities.

Increase equalization pond volume

Nute Engineering has provided a budget estimate of $670,000 to increase the capacity of SASM's south pond by 1,400,000 gallons (64%). An improvement of this magnitude would enable SASM to handle all but the most rare storm event

Infiltration/inflow study

The highest peak wastewater flows are caused by rainwater intrusion into the sewer system. Rainwater enters through ground water movement into sewer line cracks and joints (infiltration) or through direct connections to sewer lines from roof leaders, storm drains and manhole covers (inflow). SASM implemented a series of projects in the 1980's to reduce inflow and infiltration (I/I). It is estimated these improvements resulted in a 23% system-wide reduction in I/I.

It has been 20 years since this work was completed. It makes sense to take a fresh look at feasible ways of reducing I/I. The scope of this proposed project is to 1.) inventory the SASM sewer systems; 2.) survey I/I rehabilitation actions taken over the last 20 years; 3.) develop strategies for reducing I/I; and 4.) estimate the cost of implementing these strategies. Nute Engineering has submitted a proposal to conduct this study for $50,000.

This item is submitted for discussion only in advance of budget recommendations to be made in April, 2006.

David Coe
General Manager

Agenda Explanation
SASM Board Meeting
March 16, 2006

Item No. 9

Trestle Glen Pump Station capacity

During the 1990's, SASM experienced surcharging of the Trestle Glen Pump Station wet well which lead to problems in the Richardson Bay Sanitary District collection system. At the request of RBSD, SASM commissioned a study of alternatives to increase the capacity of the pump station. The study was completed by Nute Engineering in 1999 and included three phases of improvement for expanding the capacity of the station. SASM implemented Phase 1 in 2000 at a cost of $45,000. The project was accomplished using in-house staff and involved replacing one existing 50 hp pump with a 100 hp pump and included a variety of electrical modifications.

Surcharging in and around the Trestle Glen Station once again occurred on December 30, 2005. RBSD District Manager Bonner Beuhler cites this event in the attached letter and requests that SASM implement Phase 3 of the 1999 Nute recommendations. Note that RBSD is planning to improve three pump station that will result in an increase in flow to Trestle Glen. Phase 3 includes replacing the two remaining 50 hp pumps with 100 hp pumps and replacing the engine generator and entire electrical system to accommodate the larger power requirements. Staff has received an updated estimate from Nute to implement Phase 3. The 1999 construction estimate was $233,000. The current estimate is $770,000 for construction plus $140,000 for engineering - a total of $910,000. There are many reasons for the dramatic increase according to Ed Nute. These reasons will be discussed at the Board meeting.

Given the magnitude of this project, Mr. Beuhler is currently assessing alternative approaches that might accomplish the same objective at a lower cost.

This item is submitted for discussion only in advance of a budget recommendation to be made in April, 2006.

David Coe
General Manager

Consolidation: An Answer in Search of a Problem?

Much has been made over the past seven plus years about the need for collaboration among or consolidation of the sanitation agencies of southern Marin. What began as a dispute over whether or not Tamalpais Community Services District (in an attempt to save money for their ratepayers) would end their contract for treatment services with Sausalito-Marin City Sanitary District and send all of their sewage to SASM has devolved into a fight between three small and one not-so-small sanitary districts and LAFCO about the benefits local governance. LAFCO's position has been bolstered by AB 1232, state legislation that gives LAFCO the ability to unilaterally consolidate four agencies against their wishes. Throw into the mix a couple of cursory Grand Jury reports, a contested LAFCO study, 2 sewage spills, $1.6 million in fines, hundreds of thousands in consultant fees, lawyers, politicians, environmental groups, a severe recession, the RWQCB, SWQCB and EPA, newspaper editorials, press releases, a host of elected officials and employees who think way too much about sewage and are doing their jobs as best they can, mix together with a variety of complex technical issues and philosophical debates - "water cooler discussions" with no real right or wrong answers and it's not so unusual that everyone seems to have an opinion about some aspect or issue but little agreement on the facts.

Here are some facts that I think all should agree on:

- The sanitary districts in southern Marin have been in existence for around sixty years. Over that time, tens if not hundreds of residents have volunteered to serve their communities in dealing with a host of issues that most would prefer not to worry about
- Over those years, there has been no public outcry about rampant sewer overflows not being responded to, no history of complaints to public health officials regarding sewage exposure or public nuisance, no complaints to regulators about SSOs going unreported
- No recall efforts, no scandals involving enrichment at the public expense, no outcry about the rates being charged or taxpayer money being squandered
- Compensation for the directors is very modest, the costs of local governance are minimal
- Districts have consistently attempted to fully comply with all regulatory requirements in a timely manner, all have met or exceeded the requirement of the EPA order
- SSOs within the SASM agencies have decreased substantially, with the four smaller agencies leading the way
- Almonte, Alto, Homestead Valley and TCSD have all gone through Prop. 218 rate increases. Mill Valley has just approved their own. Richardson Bay presently has sufficient reserves and income to finance their O&M and CIP needs. All agencies have committed to an aggressive infrastructure replacement program
- Two independent reports confirm that SASM member agency flows are the same as they were 30 years ago and have not been allowed to deteriorate
- These same reports indicate that the spills in January 2008 were not attributable to excessive flows from SASM's member agencies
- The cost to ratepayers will likely rise due to EPA pressure to reduce I&I rather than simply convey and treat the sewage. Unfortunately, in the short term, because of the threat of fines many agency will feel pressured to do both resulting at some point in overbuilt facilities
- The lack of state or federal funding means that the cost all improvements will come from local coffers.

Why AB 1232?

With regard to AB 1232, the legislative history and legislative analysis of the bill provides some interesting observations and concerns. (See Appendix: F)

Legislative analysis of an early draft of the bill excerpted below:

SUMMARY: Allows the Marin County Local Agency Formation Commission (LAFCO), when specific conditions are met, to initiate and approve the consolidation of small wastewater agencies, without protest hearings. Specifically, this bill:

1) Provides the Marin LAFCO, after notice and hearing, with the power to initiate and approve a reorganization or consolidation of small wastewater agencies, without protest hearings, if all of the following conditions exist:

    a) The Marin LAFCO, in its municipal services review (MSR) of the wastewater agencies, completed within the last 10 years, makes findings or determinations related to reorganization or consolidation, that if implemented, would improve the financial and service level benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers;

    b) The wastewater agencies have not implemented LAFCO's findings or determinations as provided in the MSR; and,

    c) The wastewater agencies affected have had three or more illegal discharges in the last five years, based on violations identified by the San Francisco Regional Water Quality Control Board (SFRWQCB) that exceed 5,000 gallons of untreated or partially treated wastewater to waters of the state.

LAFCO LAW: PROCESS FOR CONSOLIDATION OF DISTRICTS

1) Current law specifies various ways that special districts and other agencies can be reorganized and modified, including consolidation, dissolution, including dissolution with annexation, a merger, or establishment of a subsidiary district. AB 1232 focuses on consolidation – the formal restructuring transactions that would combine two or more agencies into a single organization and would require a formal LAFCO review and approval process – as the means to modify special districts. A consolidation can be initiated by a petition of registered voters or landowners, by a resolution of the governing body of an affected local agency, or by LAFCO itself.

BACKGROUND OF MARIN SITUATION

2) AB 1232 originates from problems in eleven sewer services agencies located in southern Marin County, including six sanitary districts, three cities, one community services district and one joint powers agency. Three of the agencies operate wastewater treatment plants – Sanitary District No. 5 (Tiburon), the Joint Powers Agency (Sewerage Agency of Southern Marin – SASM), and the Sausalito-Marin City Sanitary District (SMCSD). Ten of the eleven agencies operate sewerage collection systems and pumping stations. All of the special districts providing sanitary sewer services are governed by

independent boards, except for SASM, whose members are appointed by each of its six member agencies.

3) The author notes that "the frequency and size of illegal sewage spills of raw or partially treated sewage are increasing often because of the improper sewer system maintenance. By providing limited new authority to a LAFCO, AB 1232 would increase the cost effectiveness and efficiency of small wastewater agencies and reduce the impacts on water quality due to illegal sewage spills. The San Francisco Bay Regional Water Quality Control Board reports that over 2,000 separate illegal sewage spills occurred in the bay and coastline between 2004
and 2007. Over 500 of the spills exceeded 1,000 gallons. One of the largest spills was 2.5 million gallons in Marin County which illegally discharged both untreated and partially treated sewage into the San Francisco Bay."

PROVISIONS OF AB 1232

4) This bill sets up a process that would allow Marin LAFCO to force the consolidation of small wastewater districts, when specific conditions are met, without protest hearings. The specific conditions provided in the bill are the following:

   a) Small wastewater agencies provide services for up to 10,000 service connections; and

   b) The Marin LAFCO's MSR (completed in the prior 10 years) recommends consolidation or reorganization that, if implemented, would improve the financial and service level benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers.

   c) The wastewater agencies affected have had three or more illegal discharges of untreated or partially untreated wastewater that exceed 5,000 gallons in the previous five years, as identified by the San Francisco Regional Water Quality Control Board.

IS CONSOLIDATION OF DISTRICTS THE ANSWER?

5) Protest proceedings are established in existing law to allow registered voters and landowners to give oral or written protests against a change of organization. AB 1232 removes the ability of the Marin LAFCO to hold protest hearings for public input and for an affected district to speak and deliberate in a public forum on the issue of forced consolidation and whether it is the best option for the community. Protest proceedings are removed from the bill because, according to the author, "there has been strong local agency resistance to consolidation. That resistance has made it impossible under existing laws to implement the LAFCO consolidation recommendation because existing law requires a majority of voters in the affected districts to approve the consolidation."

6) There is the potential that a district would be forced, against its will, under the provisions of this bill, to consolidate with other districts or agencies. An unwilling district could then sue LAFCO because LAFCO would be the entity that initiates the forced consolidation. The Committee may wish to consider whether Marin LAFCO would ever use this process, given the legal implications.

7) In their initial letter of concern, the California Association of Sanitation Agencies (CASA), writes:

"CASA's major concern is that LAFCOs have little expertise in water quality or wastewater treatment issues. CASA feels the more appropriate way to address sanitary sewer overflows (SSOs) is pursuant to existing statutory and regulatory requirement under the Clean Water Act and Porter Cologne Act, or direct consolidation such as designating agencies to be consolidated in legislation. To provide a consistent, statewide regulatory approach to address SSOs, the State Water Resources Control Board adopted Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans and report all SSOs to the State Water Board's online SSO database. Consequently, we feel that the [CAL] EPA, State Water Board, and Regional Boards are in a far better position to address SSOs than are LAFCOs. In fact it is our understanding that the particular agencies contributing to recent spills are currently under EPA orders."

8) Clean Water Action and San Francisco Baykeeper, writing in support of AB 1232, note that "illegal sewage spills of raw or partially treated sewage occur frequently in the Bay Area when heavy rains infiltrate aging pipes and overwhelm poorly maintained sewer systems. This problem has been particularly evident in Marin, where small wastewater agencies have had a history of capacity and compliance issues….the problem is a systemic one and requires a change to the wastewater management framework." Additionally, "small wastewater agencies, like the eleven small agencies in southern Marin, are often unable or unwilling to bear the high cost of maintenance and repair of sewer lines and treatment plants."

9) In their opposition letter, Ross Valley Sanitation District (located in central Marin County), notes that "(1) it is unfair for any LAFCO to impose reorganization or consolidation of any public agency without the opportunity for a protest hearing, and (2) if the bill is intended to affect southern Marin then the language should be explicit to southern Marin."

10) While consolidation of smaller agencies may increase administrative effectiveness and provide for better management of those agencies, there are no guarantees that consolidation is the answer to the question of how to prevent illegal sewage discharges. There may be other avenues to pursue that would help sanitary districts update their aging infrastructure including federal and state grants or funding, or heavier enforcement if negligence is found on the part of the sanitary districts. The Committee may wish to consider whether the approach in the bill is the correct approach to address illegal sewage discharges.

11) Right now this bill gives Marin LAFCO the power, under narrow circumstances, to initiate consolidation of agencies without protest hearings. The Committee may wish to consider whether it makes more sense to have SFRWQCB serve as the petitioner for the reorganization or consolidation through Marin LAFCO because of SFRWQCB 's expertise in water quality issues and enforcement actions related to sewage spills.

12) This bill will set a precedent of giving LAFCO more power than under current law. This bill, if signed into law, could pave the way for other instances where power could be taken away from agencies and their customers and given to LAFCO. The Committee may wish to consider the future implications that this bill may set.

<u>THRESHOLDS, TIMELINES AND BILL SCOPE</u>

13) AB 1232 specifies several thresholds and timelines that would need to be met in order for consolidation to be forced by the Marin LAFCO. First, the bill specifies that there must be three or more sewage discharges of 5,000 gallons in a five-year period. Second, the definition of small wastewater agencies applies to those sanitary districts that have 10,000 service connections or less. Lastly, the municipal services review done by the commission has to be completed within the prior 10-year period and make findings that reorganization or consolidation would improve the financial and service level benefits, increase operational efficiency, and provide cost savings for the ratepayers. The Committee may wish to discuss whether these thresholds are appropriate.

14) AB 1232, if signed into law, will take effect on January 1, 2011. The assumption for the smaller wastewater agencies in southern Marin is that they have a few years to figure out a plan to consolidate on their own terms, and then can initiate consolidation before the bill's effective date. However, this is not explicitly spelled out in the bill. The Committee may wish to consider giving a date certain to have LAFCO start the consolidation process, but only if a solution has not been reached locally by the agencies.

15) Currently AB 1232 only deals with Marin County, because of the unique nature of the problems in southern Marin. The Committee may wish to ask the author to narrow the scope of the bill further, specifically to the agencies in southern Marin County, and provide for a one-time special statute, rather than setting up a process that can be used in the future anywhere in Marin County.

REGISTERED SUPPORT / OPPOSITION:

Support
Clean Water Action
San Francisco Baykeeper

Opposition
Ross Valley Sanitary District

Analysis Prepared by: Debbie Michel / L. GOV. / (916) 319-3958

Of interest is that the AB 1232's original focus seemed to be on environmental protection, in that the original bill had three thresholds or triggers that had to be met before LAFCO could consolidate agencies without protest. Provision c) below required the affected agencies to have had 3 or more spills that exceeded 5,000 gallons in the past 5 years to the waters of the state.

This would have given the affected agencies the ability to demonstrate that they had complied with the bill in a concrete way. In fact, the four agencies targeted by LAFCO (Almonte, Alto, Homestead Valley and Richardson Bay) would not have triggered the consolidation provision because they have not had 3 or more spills that exceed 5,000 gallons to the waters of the state

a) Small wastewater agencies provide services for up to 10,000 service connections; and

b) The Marin LAFCO's MSR (completed in the prior 10 years) recommends consolidation or reorganization that, if implemented, would improve the financial and service level benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers.

c) The wastewater agencies affected have had three or more illegal discharges in the last five years, based on violations identified by the San Francisco Regional Water Quality Control Board (SFRWQCB) that exceed 5,000 gallons of untreated or partially treated wastewater to waters of the state.

AB 1232 Moves Forward:

As the bill proceeded, the Senate substantially narrowed the focus by targeting only SASM and its member agencies and removing objective triggers such as c) above and substituted language that that is ambiguous in its expectations and vague as to how compliance is demonstrated.

> (i) It is the intent of the Legislature that SASM and its member districts take action immediately to increase the effectiveness and efficiency of its operations in order to provide more cost-effective customer service and to reduce the impacts on water quality due to illegal sewage spills. It is also the intent of the Legislature that if SASM and its member districts do not act to address the inefficiencies of their operations, that the Marin LAFCO shall have the authority to require consolidation of SASM and its member districts into one new district.

The agencies are required to reduce the impacts on spills but there are no concrete guidelines or benchmarks to signal compliance. Also, the requirement to "immediately increase the effectiveness and efficiency of their operations to provide more cost-effective customer service" suffers from the same lack of specificity – determination of compliance is apparently left simply to LAFCO's discretion. Failure to address "inefficiencies" of their operations is apparently what is required to trigger LAFCO's authority to consolidate.

There are a couple of admonishments contained in the commentary that bear repeating:

The first is CASA's point that LAFCO's have little expertise in running sanitary districts and that many aspects of district operation are governed by terms and conditions contained in EPA orders.

In their initial letter of concern, the California Association of Sanitation Agencies (CASA), writes:

"CASA's major concern is that LAFCOs have little expertise in water quality or wastewater treatment issues. CASA feels the more appropriate way to address sanitary sewer overflows (SSOs) is pursuant to existing statutory and regulatory requirement under the Clean Water Act and Porter Cologne Act, or direct consolidation such as designating agencies to be consolidated in legislation. To provide a consistent, statewide regulatory approach to address SSOs, the State Water Resources Control Board adopted Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans and report all SSOs to the State Water Board's online SSO database. Consequently, we feel that the [CAL] EPA, State Water Board, and Regional Boards are in a far better position to address SSOs than are LAFCOs. In fact it is our understanding that the particular agencies contributing to recent spills are currently under EPA orders."

The second is the admonition that:

> While consolidation of smaller agencies may increase administrative effectiveness and provide for better management of those agencies, there are no guarantees that consolidation is the answer to the question of how to prevent illegal sewage discharges. There may be other avenues to pursue that would help sanitary districts update their aging infrastructure including federal and state grants or funding, or heavier enforcement if negligence is found on the part of the sanitary districts. The Committee may wish to consider whether the approach in the bill is the correct approach to address illegal sewage discharges.

Additionally, I would note there is no guarantee that consolidation will increase administrative effectiveness or provide for better management.

The last observations and concerns come from a document for the Senate Local Government Committee, Senator Patricia Wiggins, Chair. (See attachment D)

3. Resetting the threshold. For their first three decades, LAFCOs couldn't initiate proposals to change special districts' boundaries. The 1993 bill that let LAFCOs initiate district proposals balanced that new power by reducing the protest threshold needed to trigger an election from 25% to 10% (AB 1335, Gotch, 1993). It's easier to force an election if LAFCO initiated the proposal. If legislators worry that it's too easy for Marin County's small sewer districts to rally their constituents to protest a LAFCO-initiated reorganization, then the Committee may wish to consider restoring the 25% protest threshold instead of sidestepping protests.

5. Progressive or Populist? California's boundary change statutes reflect the state's curious blend of Progressive and Populist political impulses. The Progressive Era touted representative government, expert advice, and orderly government. The Populist cause championed direct democracy, common sense, and responsive governments. While the two goals aren't antithetical, reconciling them can be hard. By creating LAFCOs composed of local elected officials whose decisions must follow expert plans, the Cortese-Knox-Hertzberg Act clearly reflects the Progressive tradition. By requiring petitions, allowing protests, and providing for voter review, the Act also acknowledges Populist themes. More than a century ago, the United States Supreme Court explained that there is no constitutional right to vote on local boundaries. The Cortese-Knox-Hertzberg Act's provisions for protest hearings that may lead to elections are statutory opportunities, not constitutional rights. What the Legislature has created, it can waive.

Does LAFCO Need AB 1232?

To LAFCO's credit, the proposed review process should allow for a comprehensive examination and discussion of the issues.

However, it seems to me that the value of local governance is really a question for the local community to answer. Also, implementation of suggested changes identified by LAFCO is not guaranteed by simply consolidating the districts. LAFCO may point to *potential* savings from various courses of action but final evaluation and implementation will be left to elected public officials, regardless of their ultimate number, but whose job it is to make those determinations.

Currently, LAFCO has the power now to initiate consolidation proceedings. If their arguments for consolidation are so persuasive they should encourage a full public debate and allow the merits of their positions to carry the day. The districts subject to consolidation still would have to muster the required protest threshold to trigger an election and prevail.

LAFCO's arguments may not be as cut and dried as they claim. Below is an excerpt for their own 2005 study upon which they rely to demonstrate the benefits of consolidation. Please note the highlighted section below which apparently represents the objective conclusions of the consultant.

Important Drivers for Change, highlights two drivers for change, SSMP/SSO requirements and investment in infrastructure replacement that have already been addressed to a significant degree in complying with the terms and conditions of the EPA administrative order. ,

Why Isn't This Happening Now? (Barriers to Change)

There are many reasons why these changes have not occurred to date. As illustrated in Figure 6-6, the agency survey, in sharp contrast to the generally positive support for collaboration, was more negative about the benefits of political consolidation. For starters, the current agencies, as structured, have been providing generally good levels of service, at affordable and fairly stable sewer rates. They have been operating in compliance with historic regulatory and permit requirements. Moreover, the decentralized agency structure with independent board/city council oversight provides an organization structure and governance structure that places a very high priority and importance on local control of sewer rates and service level polices. They believe that local control and low overhead organizations will allow them to maintain low sewer services rates. The sewer agencies are also staffed by competent managers, engineers, operators and staff. The existing agency structure has evolved with development within the small individual areas for which they provide service. Residents with questions or issues know the part-time GMs and can call them at their residence

The general thrust of objections seems to focus around loss of local control coupled with increased overhead expenses and paperwork to administer multi-agency activities. Individual agencies talk about personal relationships and attention to follow-up on service-related questions. The implication is that this kind of personalized customer follow-up and prompt response, for example to a blockage incident, would not occur in an integrated agency. There seems to be a general belief that the status quo is quite stable.

Important Drivers for Change.

Circumstances are changing and some level of change to the methods and structure of the Southern Marin sewer agencies may be inevitable. The opportunity exists to proactively chart the course and manage the process. The current 11-agency structure is no longer the ideal configuration for serving the highly urbanized areas they now serve in Southern Marin County. Major investments in aging collection system infrastructure replacement and rehabilitation represent a brand new investment cycle for these agencies. The estimated replacement cost for providing current modern sewer collection piping for the 242 miles of collection system range from $130 to $260 million in 2005 dollars. This investment cycle will begin over the next 10 years, sooner for some agencies.

In addition, the SSMP/SSO requirements, as discussed in the report, impose a new regulatory program with the need for significant increases in operational expenses to competently implement the program. Two of the three agencies with treatment plants also anticipate significant future capital investment needs. Some of the agencies have recently implemented or are planning rate increases (e.g., Mill Valley from the $243/EDU to $297 per EDU; Belvedere from $700 per EDU to $900 per EDU as part of SD#5 annexation). The City of Sausalito, SD #5 and TCSD are also

planning rate increases. The upcoming investment cycle will gain advantage through either JPA-based collaboration and/or actual political consolidations.

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(the full report is available here:
http://lafco.marin.org/staff_reports/pdf/Sewer%20Services%20Report%20FINAL_29Jul05.pdf)

Rates Are Going Up For Everyone:

As noted, the EPA's has focused on and encouraged reduction of I&I as the preferred approach to reduce high wet-weather flows. This emphasis coupled with the willingness to use enforcement actions such as substantial fines and/or administrative orders, consent decrees, etc. to drive the point home has gotten the attention of the wastewater community. The problem for collection and treatment plant operators is that they are operating facilities that were designed to meet certain criteria, in SASM's case - a 20-year return storm.

Unfortunately, the current enforcement posture of regulators (EPA, SWRQB and RWQCB) has not provided assurance that agencies experiencing SSOs or unauthorized discharges related to storm events in excess of their plant design will not be subject to substantial fines and/or other enforcement action.

Without that guidance from regulators as to what they considered an appropriate design event (above which fines or other enforcement action will not result) agencies are forced to either undertake costly short-term improvements to guard against potential fines or roll the dice, hoping that the next big storm in excess of current plant design capabilities does not occur before long-term infrastructure replacement reduces I&I to manageable levels. Presently, agencies seem to prefer to err on the side of caution.

This will add to the overall cost of doing business. At some point these long-term infrastructure improvements will reduce or eliminate the original need for these short-term improvements. Maybe doing both is the right thing to do. However, it is the job of regulators to make specific determinations as to what is required to protect water quality and public health. Zero-tolerance and strict liability for SSOs or "illegal discharges" under all circumstances is a tough task master.

Some question whether all of the attention to SSOs and wet-weather discharges has actually produced concrete, verifiable improvement in water quality or produced significant gains in protecting public health. While large spills, especially dry weather spills, do pose a significant threat to the environment or public health, most spills that occur in our districts are small (averaging substantially less than 200 gallons over the past 4 years) and are rapidly responded to.

Large releases such as the controlled release from SASM's treatment plant on January 25, 2008 typically do not produce long-term impacts on the nearby receiving waters because of their extremely dilute nature and the additional flushing from storm runoff. Urban runoff may actually present a greater ongoing threat to receiving waters than the relatively rare releases from treatment works resulting from extremely large storm events.

Simply reporting SSOs to a database and tracking trends without connecting their impacts to actual quantifiable benchmarks such as receiving water quality or spill related health problems provides little evidence to demonstrate that just reducing SSO numbers has actually solved a real problem. Impairment of receiving waters can occur for any number of reasons. The recent adoption of the TMDL for coliform in the bay is an example. While SSOs may be a component in raising bacterial levels, there may be many more significant causes, such as urban runoff, existing bird and animal populations, etc. that play a more decisive roll.

The point is that in an environment of limited or decreasing resources, it becomes increasingly important that action is taken to address real, scientifically-confirmed problems and that proposed solutions are prioritized by their effectiveness in providing concrete, verifiable solutions.

APPENDICES A-F

Appendix A

More detail on SSMP elements to be developed over next few months. Final draft to be presented at SSO workshops. Detailed final SSMP elements will be included in the 13267 letter.

Attachment to SSO Work Plan

Draft Outline of Sewer System Management Plans For Further Discussion

1. **Goals**
   a. Reduce frequency and severity of SSOs
   b. Provide plan and schedule for measures to be implemented, the measures should include steps to achieve the following goals:
      (1) To properly manage, operate and maintain all parts of ~~your~~ the collection system;
      (2) To provide adequate capacity to convey base flows and peak flows; and
      (3) To reduce~~stop,~~ and mitigate the impact of~~,~~ sanitary sewer overflows.

2. **Organization**
   a. Identify personnel responsible for implementing the SSMP.
   b. Identify chain of communication for reporting SSOs.

3. **Legal Authority** (can be waived for systems with average daily flow of 1.0 mgd or less)

   The SSMP should include legal authority, through sewer use ordinances, service agreements or other legally binding procedures to,
   a. I/I control;
   b. Proper design and construction of sewer and connections;
   c. Proper installation, testing, and inspection of new and rehabilitated sewers; and

4. **Measures and Activities** (elements d through h can be waived for systems with average daily flow of 1.0 mgd or less)

   a. *Collection System Map*, Maintain an up-to-date map of the collection system.
   b. *Facilities & Equipment*, Provide adequate operation and maintenance facilities and equipment.
   c. *Prioritizing*, Prioritize appropriate SSMP preventive ~~and~~ maintenance activities.
   d. *Structure deficiencies*, Identify and prioritize structural deficiencies and implement short-term and long-term rehabilitation actions to address them.
   e. *Routine Maintenance Schedule*, Establish a routine preventive operation and maintenance schedule.
   f. *Capacity Assessment*, Establish a framework to assess the current capacity of the collection system.
   g. *Replacement Inventories*, Provide equipment and replacement parts inventories.
   h. *Training*, Provide training on a regular basis for staff on collection system operations, maintenance, and monitoring.
   i. Special considerations for the level of measures and activities will be needed for small communities with fewer resources.

5. **Design and Construction Standards** (can be waived for systems that have no significant new installations)

   a. Identify design and construction standards and specifications for the installation of new sewer systems and for rehabilitation and repair of existing sewer systems; and
   b. Identify procedures and standards for inspecting and testing the installation of new sewers, pumps, and other appurtenances; and for rehabilitation and repair projects.

More detail on SSMP elements to be developed over next few months. Final draft to be presented at SSO workshops. Detailed final SSMP elements will be included in the 13267 letter.

6. **Monitoring, Measurement and Program Modifications**
   Monitor the effectiveness of each SSMP element, update SSMP elements and modify SSMP elements to keep it updated, accurate and available for audit, as appropriate.

7. **Overflow Emergency Response Plan** (The plan should coordinate with storm water programs, if applicable)

   a. *Notification,* Provide SSO notification procedures;
   b. *Response,* Develop and implement a plan to respond to SSOs;
   c. *Reporting,* Develop procedures to report and notify SSOs per SSO Monitoring and Reporting Program; and
   d. *Containing and Cleaning Up,* Develop steps to contain sewage and prevent sewage discharges to surface waters, and to minimize or correct any adverse impact from SSOs.

8. **Fats, Oils, and Grease (FOG) Control Program**

   The collection system owner or operator should evaluate ~~of~~ its service area to determine if a FOG control program is needed. Recommended elements for FOG control program: ~~If enough evident shows that a FOG control program, or certain elements of FOG control program, is not necessary, the program or those elements of the program can be waived.~~

   a. *Identification & Sewer Cleaning*, Identify sections of the sewer system subject to grease blockages and establish a cleaning maintenance schedule for each section;
   b. *Source Control,* Develop and implement source control measures, for all sources of grease and fats that may be discharged to the sewer system, for each section identified in item (a) above;
   c. *Facility Inspection*, Authority to inspect grease producing facilities, enforcement authorities; and
   d. *Legal Authority*, Legal authority to prohibit discharges to collection system.

9. **System Evaluations and Capacity Assurance Plan**

   Prepare and implement a capital improvement plan to provide hydraulic capacity of key sewer system elements under peak flow conditions. The recommended elements of the Plan are,
   a. *Evaluation Steps,* Evaluate portions of the collection system experiencing SSOs due to hydraulic deficiency;
   b. *Capacity Enhancement Measures,* Establish a short- and long-term capital improvement program to address identified hydraulic deficiencies; and
   c. *Plan updates,* ~~Update the Plan annually.~~ Update the plan on a regular basis as specified in the SSMP.

10. **SSMP Audits** (This item can be waived for collection systems with average daily flow of 2.5 mgd or less)

    As part of the SSMP, each collection system owner or operator should conduct an internal audit, appropriate to the size of the system and the number of overflows, and submit a report

Attachment 1

Work Plan for:
Program to Inform San Francisco Bay Area Collection Systems About (1) Proper Reporting of Sanitary Sewer Overflows, and (2) Recommended Elements of a Sewer System Management Plan

Bay Area Clean Water Agencies, Collection Systems Committee

Introduction

Sanitary Sewer Overflows (SSOs) from collection systems occur due to one or more of the following causes: blockages formed in the sewer due to grease, roots, and other debris; exceedance of sewer capacity (such as during wet weather); vandalism; pump station mechanical failures; power outages; deterioration of the collection system due to age; construction material failures; contractor activities and actions; and lack of proper operation and maintenance. Some SSOs are preventable with adequate and appropriate source control measures and operation and maintenance of the wastewater collection system. Knowledge of when and why these overflows occur is the first step in preventing their occurrence. In addition, steps can be taken to prevent many SSOs using a Sewer System Management Plan (SSMP) customized for each agency.

The Bay Area Clean Water Agencies (BACWA) is committed to working with Bay Area collection system agencies to develop documentation materials, which can be used, by agencies to report SSOs and to improve the operations and maintenance of their collection systems. It is anticipated that this program, to be initiated and funded by BACWA, will be adopted as a resolution by the San Francisco Bay Regional Water Quality Control Board at a public hearing.

Purpose of Program

The San Francisco Bay Regional Water Quality Control Board (Regional Board) has information indicating that some collection system agencies may be inconsistently reporting the occurrence of sanitary sewer overflows (SSOs). Inconsistent reporting may be due to lack of information about what and how to report. The intent of this program is to inform collection system agencies about the importance of proper reporting so that the Regional Board can obtain more consistent reporting of SSOs in the region, and recommended elements of an SSMP. This program is the first step in determining if additional requirements are needed for collection systems owners and operators to improve management, operations, maintenance, and capital improvements in order to minimize SSOs to the maximum extent practicable.

Task 1 - Develop Final Reporting Format for Collection Systems

The Bay Area Clean Water Agencies (BACWA) will build upon the work conducted to date between Regional Board staff and the BACWA Permits Committee to finalize the reporting format for SSOs, for presentation at workshops to collection system agencies (see Task 3 below for information about workshops). The first step is to develop the form, or information needed in SSO reports. The second step is to develop a system for reporting those data electronically into a

database similar to the Electronic Reporting System (ERS) for self-monitoring of treatment plant effluent discharge. Development of the e-reporting system will be funded through the Work Plan process. BACWA and the Regional Board will explore funding options that include BACWA budget system, workshop fees, and Supplemental Environmental Projects through Mandatory Minimum Penalties.

It is anticipated that the majority of the discussions will be held under the auspices of the newly formed BACWA Collection Systems Committee. Regional Board staff will be requested to review the draft reporting form and provide comments as appropriate. A draft reporting form, which includes the timing and content for reporting SSOs, will be completed by BACWA following adoption of this program as a resolution by the Regional Board. It is hoped that the content of the final form will be agreed upon by BACWA and Regional Board staff within two months of the resolution date.

Task 2 – Develop Outline for Sewer System Management Plan

The Bay Area Clean Water Agencies (BACWA) will build upon the work conducted to date between Regional Board staff and the BACWA Permits Committee to finalize a detailed outline for the development of a Sewer System Management Plan (SSMP) by individual collection system agencies. A draft outline is attached, which is based on draft U.S. EPA regulations and other Regional Board orders. Regional Board staff will be requested to review any changes to draft SSMP outline and provide comments. It is anticipated that a final SSMP elements will be agreed upon by BACWA and Regional Board and presented at workshops organized by BACWA (see Task 3 below for information about workshops). A finalized draft SSMP outline will be completed by BACWA within ten weeks of adopting this program as a resolution by the Regional Board. Elements of the SSMP may be modified through the Workshop process based on input from the participants.

Task 3 – Conduct Workshops for Collection System Agencies

One-day workshops would be held at multiple locations around the San Francisco Bay Area to inform and educate collection system agencies about SSO reporting and development of SSMPs. The following elements are currently expected to be included in the agenda for the workshops:

- National and local goals for reducing sanitary sewer overflows
- Why uniform reporting is important
- Training on reporting format developed under Task 1 above
- Desired elements of spill response and mitigation (including estimation of spill volumes)
- Public notification standards
- How to investigate the cause of a spill
- Water Quality sampling and when it's appropriate
- Regional Board procedure for enforcement of major spills, including what will be expected of the agency in the event of a major spill
- Description of sewer system management plan outline
- Examples of a good sewer system management plan, including case studies

It is hoped that at least one Regional Board staff member can participate as a speaker at the workshops to provide relevant information and show their support of the program.

A draft agenda for the workshops (same for each location) would be prepared by BACWA within four months of the date of the Regional Board resolution. Regional Board staff will be requested to review the draft agenda and provide comments. BACWA will coordinate the workshop details, such as locations, speakers, audio-visual equipment, refreshments, and other logistics associated with conducting the workshops. A flyer would be prepared with agenda and registration information, and sent to potential attendees.

The one-day workshops would be held at five locations around the Bay Area, estimated by geography at this time as follows:

- Marin County
- North Bay (Napa and Sonoma Counties)
- East Bay (Alameda, Contra Costa, and Solano Counties)
- South Bay (Santa Clara County and southern portions of Alameda and San Mateo Counties)
- Peninsula (San Francisco and San Mateo Counties)

It is expected that the workshops can be scheduled to occur within ten months following Regional Board adoption of the resolution.

Cost and Schedule

BACWA will fund the program except for Regional Board participation. It may be necessary to charge a nominal fee for attendance at the workshops. The schedule for elements of this program is described in the individual tasks above and summarized in the attached bar chart.

Attachment: Draft Outline of Sewer System Management Plans for Further Discussion

Appendix B

RICHARDSON BAY SANITARY DISTRICT
300 Tiburon Blvd., Tiburon, CA 94920 Tel 415.388.1345 Fax 415.388.1339

September 16, 2008

Ken Greenberg
Water Division (WTR-7)
U.S. Environmental Protection Agency, Region 9 (WTR-9)
75 Hawthorne Street
San Francisco, CA 94105

Re: Sewerage Agency of Southern Marin ("SASM"), et al., Administrative Order Docket No. CWA-309(a)-08-030

Dear Mr. Greenberg:

As a result of the overflows of dilute raw or partially treated wastewater on January 25 and 31, 2008 from the Sewerage Agency of Southern Marin (SASM) facility, the California Regional Water Quality Control Board (RWQCB) for the San Francisco Bay Region issued Cleanup and Abatement Order No. R2-2008-0010. As a part of this order, Item No. 4 required SASM to hire an independent external auditor to conduct a comprehensive audit to "demonstrate that the ongoing threat of discharge of wastes into the waters of the State and the threat to create a condition of pollution and nuisance have been abated.

This audit was completed by Larry Walker Associates on August 31, 2008 and transmitted to the RWQCB on September 2, 2008. SASM and its member agencies received the report via email on September 3, 2008.

The information and analysis contained in the Larry Walker Associates' independent audit report and additional information, analysis and documentation provided below, calls into question the accuracy and sufficiency of certain facts as described in the Findings used in support of the above referenced EPA order. In addition, while many of the facts detailed in support of the order may be true on their face, these facts nonetheless fail to rise to a level of such seriousness or are indistinguishable from facts and conditions that exist in many, if not most, other sewer collection systems subject to EPA regulation but not subject to similar orders. There is insufficient evidence to support the order or justify inclusion of each and every satellite collection agency tributary to the facility owned by the Sewerage Agency of Southern Marin and operated under contract by the City of Mill Valley.

Therefore, I request that EPA administrative order: Sewerage Agency of Southern Marin ("SASM"), et al., Administrative Order Docket No. CWA-309(a)-08-030 be rescinded or in the alternative, that the EPA remove the Richardson Bay and Almonte Sanitary Districts as named parties in the Order.

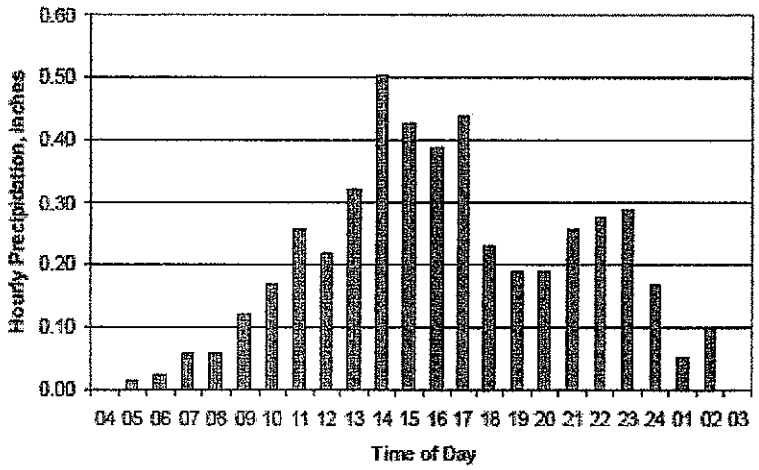
This request is based on the following facts and analysis:

Larry Walker Associates Independent Audit Report:
The final section of this audit deals with an analysis of the storm event of January 25 and 26, 2008 and how it impacted collection systems of the SASM member agencies and ultimately in the amount and timing of wastewater actually received by SASM.

Rainfall:

The storm event on January 25 and 26, 2008 was characterized as a long duration, moderate intensity event with an overall duration of 22 hours, a peak 60 minute intensity of 0.49 inches/hour and an average intensity of 0.22 inches per hour. The January 25 and 26, 2008 event approached the intensity of a 20 year return interval storm (0.22 inches per hour at 22 hours, Larry Walker Associates report).

Figure 3: January 25 and 26, 2008 Hourly Precipitation



Source: Linda Vista Drive Rain Gauge (KCAMILLVI2)

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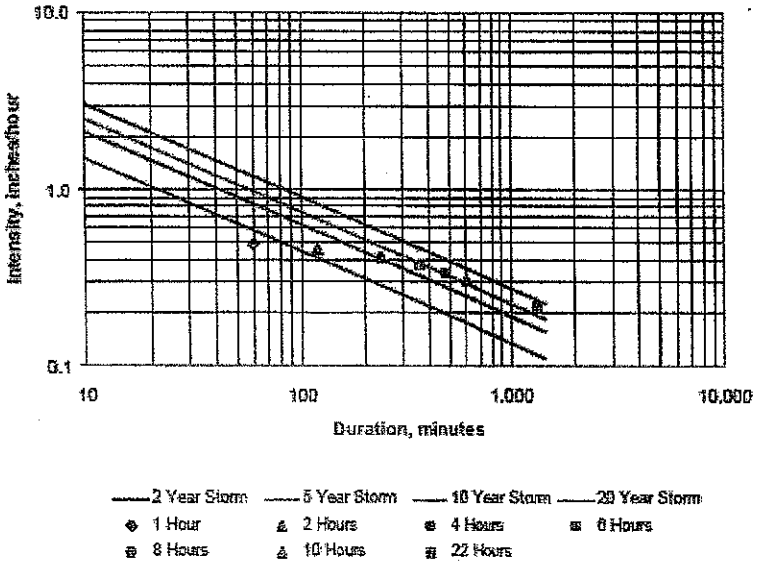
[10] Reassessment of Coyote Creek Channel Management Requirements, Philip Williams & Associates, January 10 2005 (http://www.co.marin.ca.us/ depts/pw/main/floodcontrol/Z3/PWA_Final_Repor_01_10_2005.pdf).

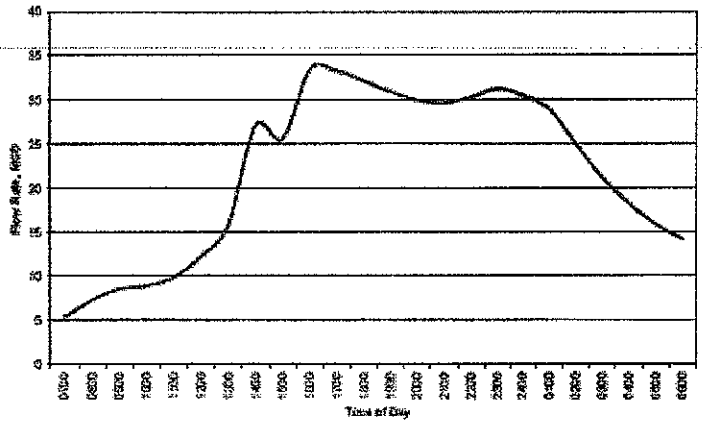
Figure 5: January 25 and 26, 2008 Storm Return Interval Analysis[11]



I&I and Influent Flow:

The impact of the January 25 and 26, 2008 storm and the satellite collection systems response to it is shown below in the influent flow received at the SASM Wastewater treatment plant.

Figure 4: SASM Wastewater Treatment Plant Influent Flow for January 25 and 26, 2008



Source: SASM SCADA Influent Flowmeter Data

Although the Peak hourly flow rate was originally reported by SASM staff as **44 million gallons per day**, the actual peak flow was **33.5 million gallons per day** for a relatively short period of time.

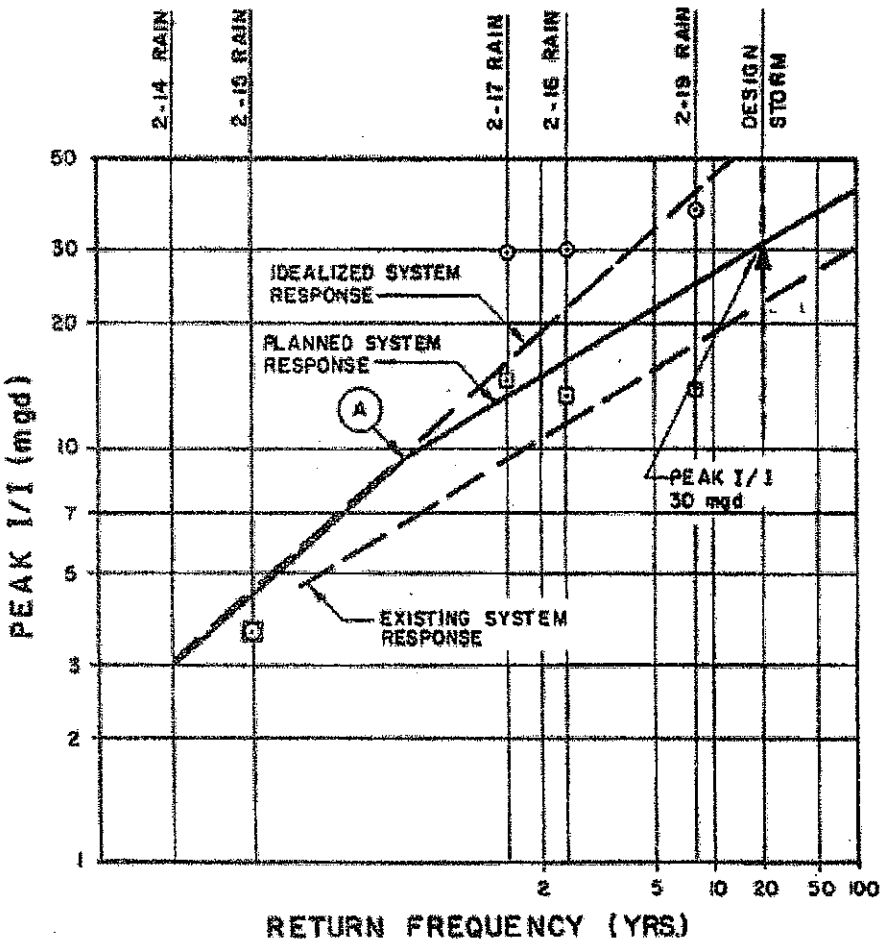
The actual 33.5 million gallon peak corresponds closely to the anticipated peak design flow of 32.7 million gallons per day based on the original twenty year return storm design and is essentially equivalent given the accuracy of the parshall flume used to measure SASM influent flow.

During the original design phase of the SASM treatment facilities and as a prerequisite for Federal and State grant funding, Black and Veatch prepared a Sewer System Evaluation Survey to determine expected peak wet weather flows, quantify excessive infiltration and provide the necessary background information.

The expected rate of peak I&I is shown below as the planned system response curve. (Black & Veatch 1980 Sewer System Evaluation Survey).

Figure 7-3

PEAK RATE OF I/I vs. RETURN FREQUENCY FOR MILL VALLEY NETWORK



LEGEND*

- ⊙ I/I RATE EXTRAPOLATED FROM SUBAREAS
- ⊡ I/I RATE CALCULATED FROM OVERFLOW DATA WITH GATE CLOSED
- (A) MAXIMUM CAPACITY OF EXISTING SYSTEM INCLUDING SURCHARGE UNDER PLANNED OPERATING CONDITIONS

. (Black & Veatch 1980 Sewer System Evaluation Survey)

The Larry Walker Audit approximated Member Agency Contribution to the January 25 and 26, 2008 Peak Flows and is detailed below:

Table 3: Member Agency Contribution to January 25 and 26 Peak Flows

Service Areas	Peak Hour Flow, MGD[1]	Service Area, Acres[2]	Peak Hour Flow, GPAD	Peak RDI/I Flow, GPAD[3]
Kay Park plus 40% of Almonte SD	1.3	146	9,000	8,300
Alto SD plus Homestead Valley SD plus Mill Valley plus 60% of Almonte SD	22.6	3,852	5,900	5,300
Richardson Bay SD	9.6	1,926	5,000	4,400
Total	33.5	5,924		
SASM Member Agency Average[4]				5,100

Notes:
1. MGD = million gallons per day
2. Service areas were estimated using Member Agency CAD maps and Mill Valley GIS.
3. Peak hour RDI/I rates were estimated using the peak hour flow on January 25 and subtracting groundwater infiltration (GWI) + base wastewater flow (BWF) estimated at 175 gallons per connection per day.
4. SASM Member Agency Average was estimated using the peak hour treatment plant influent flow divided by the total service area.

This compares closely with the design flows from the 1980 Black & Veatch study:

Table 7-8. WATERSHED DESIGN FLOW SUMMARY

Watershed Source	Design[a] ADWF	Design[c] I/I	Design PWWF
Mill Valley[b]	1.9	21.5	23.4
Salt Works[b]	0.4	3.1	3.5
Ricardo Road[b]	0.3	2.1	2.4
Trestle Glen[d]	0.3	3.1	3.4
Total	2.9	29.8	32.7

[a]Concept approval dated October 23, 1979.

[b]Distribution of 2.6 ADWF and 3.9 PDWF approved by State in accordance with Addendum to Facilities Plan dated July, 1979.

[c]Result of SSES and Cost-Effectiveness Analysis conducted Dec-Mar' 1980.

[d]10% Design Submittal by J. Warren Nute, Inc.

DESIGN FLOWS

The projected design wastewater flows to be treated and disposed of in the SASM service area are presented in Table 7-8. The flows are tabulated as average dry weather flow, inflow/infiltration, and peak wet weather flow which is the sum of average dry weather flow (ADWF) and I/I. The Mill Valley design flow includes the flow contribution from the Almonte, Alto, Homestead, and Kay Park S.D. The Salt Works, Ricardo Road, and Trestle Glen watersheds are included in the Richardson Bay system. The SASM treatment facility will be designed to treat a peak wet weather flow of 32.7 mgd (2.9 ADWF and 29.8 I/I).

The maximum daily flow, maximum weekly flow, and maximum monthly flow were also determined and are presented in Table 7-9. These flows were

Table 7-9. SASM TREATMENT FACILITY DESIGN FLOW SUMMARY

Description	Flow
Peak Wet Weather Flow	32.7 mgd
Maximum Daily Flow	24.7 mgd
Maximum Weekly Flow	15.0 mgd
Maximum Monthly Flow	8.5 mgd

establishing a relationship between total precipitation, total I/I, and storm return frequency. An I/I storm flow hydrograph was also developed through utilization of the SSES flow data and is presented in Appendix C. It was assumed that the storm hydrograph shape is valid for other rainstorms; therefore, hydrographs of varying precipitation or of known peak flow rates can be synthesized.

By combining the maximum flow data and the synthesized hydrographs presented in Appendix C, an additional analysis of treatment plant process size could be developed. It is recognized that the headworks of the SASM treatment facilty will be required to pump the peak wet weather flow of 32.7 mgd. However, equalization storage facilities within the treatment plant will reduce the size of the secondary plant process. The required volume of the equalization storage basin was calculated against the reduction of peak flows. A curve of this relationship is presented in Figure 7-7. This curve will be used in the design effort to size the equalization basin and the secondary treatment facilities.

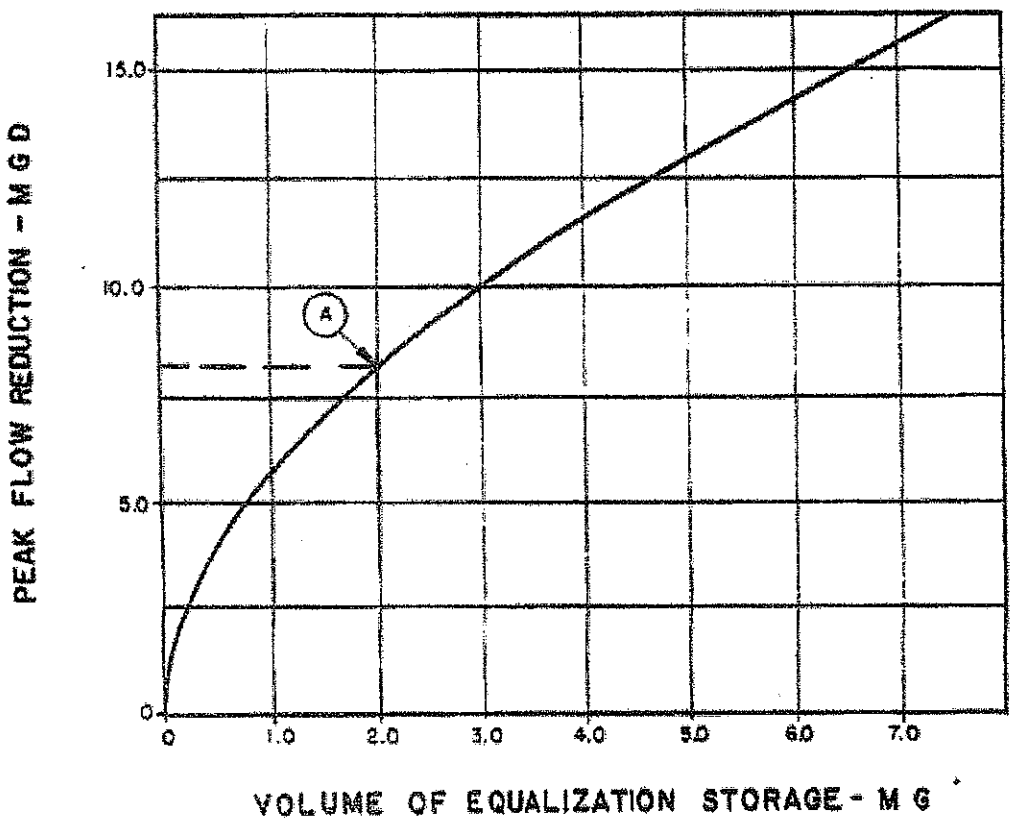
The selected design peak flows are based on 20-year recurrence interval probability analyses and when reduced by cost-effective I/I reductions and equalization storage, represent the most cost-effective design value for the treatment facilities during the storm period.

Figure 7-7 from the 1980 Black & Veatch report shows the required equalization capacity was originally sized at 2.0 million gallons. The SWRCB final inspection report dated October 22, 1984, states that the Equalization basin was designed to operate with a 1.6 million gallon capacity at 2.0 feet

of freeboard with a maximum capacity of 3.6 million gallons at zero freeboard. The plant O&M manual reflected this error which was incorrect due to translation errors in converting acre-feet to gallons. Actual zero freeboard capacity was determined to be approximately 2.3 million. The discovery of this calculation error led to a survey of the EQ basins and a subsequent project that added additional capacity to the ponds in 2000. (see attached memos)

Figure 7-7

REDUCTION OF PEAK I/I vs. EQUALIZATION STORAGE FOR SASM SERVICE AREA



(A) 8 M G D REDUCTION IN PEAK FLOW RATE AVAILABLE FROM 2.0 M G EQUALIZATION STORAGE AT TREATMENT PLANT

Inflow and Infiltration (I&I) Reduction:

The December 1977 Southern Marin Planning Unit Report prepared by J. Warren Nute, Inc., Jenks & Harrison, Trotter/Yoder and Bartle Wells & Associates discusses the need for a comprehensive evaluation of I&I to comply with the Federal and State requirements necessary to receive grant funding.

Federal Water Pollution Control Act of 1972

The need to eliminate excessive infiltration and inflow conditions in sewer systems received considerable emphasis in the Federal Water Pollution Control Act of 1972. The act states that:

> The Administration shall not approve any grant after July 1, 1973 for treatment works ... unless the applicant shows to the satisfaction of the Administrator that each sewer collection system discharging into such treatment works is not subject to "excessive" infiltration.

The Federal definition of what constitutes "excessive" infiltration is as follows:

> Excessive Infiltration/Inflow--the quantities of infiltration/inflow which can be economically eliminated from a sewer system by rehabilitation, as determined by a cost-effectiveness analysis that (for the design life of the treatment works) compares correcting the infiltration/inflow conditions with increasing the treatment works capacity to provide the required wastewater treatment for the quantities of infiltration/inflow.

Accordingly, since implementation of the Eastern Marin-South Sonoma Wastewater Management Program depends upon receipt of substantial Federal and State grant assistance, it is essential that the program participants proceed with the necessary investigations to determine whether or not excessive infiltration/inflow exists.

For the purpose of identifying the various components of extraneous water entering the sewer system, the following definitions have been set forth in the Federal Rules and Regulations published in the FEDERAL REGISTER on February 28, 1973:

> INFILTRATION--The water entering a sewer system and service connections from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include, and is distinguished from, inflow.
>
> INFLOW--The water discharged into a sewer system and service connections from such sources as, but not limited to, roof leaders, cellar, yard, and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers and combined sewers, catch basins, storm waters, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.
>
> INFILTRATION/INFLOW--The total quantity of water from both infiltration and inflow without distinguishing the source.

Scope of the Wet Weather Flow Control Analysis

As now proposed in the Rules and Regulations, for the conduct of the sewer system evaluations which were published in the FEDERAL REGISTER on February 28, 1973, the first step in the evaluation consists of the preparation of an infiltration/inflow analysis to determine if possible excessive infiltration/inflow exists in the system. If it is shown that possible excessive infiltration/inflow conditions exist, then the applicant for grant assistance must undertake a systematic sewer system evaluation survey to determine the location, flow rate, and cost for correction of each definable element of the total infiltration/inflow problem.

The required cost-effective analysis to reduce I&I to qualify for grant funding was as described in the 1980 Black & Veatch Report below:

COST-EFFECTIVE ANALYSIS

A cost-effectiveness analysis was conducted to determine how much infiltration/inflow may be economically removed from the system and how much may be economically accommodated in the treatment and disposal facilities. The peak wet weather flow from the sewer system, which must be ultimately treated and disposed of, was determined by balancing the cost of sewer system rehabilitation against the cost of conveyance, treatment, and disposal. The cost-effectiveness analysis was prepared separately for the Mill Valley and Richardson Bay networks and is shown in Figures 7-5 and 7-6, respectively.

An estimate of the cost-effectiveness of I/I reduction must be made before the I/I reductions can be evaluated against the incremental cost reduction of smaller collection, treatment, and disposal facilities. The estimated unit costs of I/I correction/rehabilitation tasks used in this analysis are presented in Table 7-6. The correction methods for inflow sources are relatively simple and have been estimated as 75 percent effective. The rehabilitation methods for infiltration sources have been estimated as 40 percent effective.

Detailed cost estimates were also prepared for treatment costs associated with flow rates of 15 through 40 mgd and are shown in Appendix D. The cost estimates were calculated in 5 mgd increments. The resulting cost curves for I/I correction, conveyance, treatment, and outfall facilities are plotted, respectively, in Figures 7-5 and 7-6.

The most cost-effective I/I reduction value is detemined by adding each of the individual cost elements. The lowest point on the combined cost curve corresponds to the most cost-effective I/I reduction value. For the Mill

Figure 7-5

COST EFFECTIVE ANALYSIS MILL VALLEY NETWORK

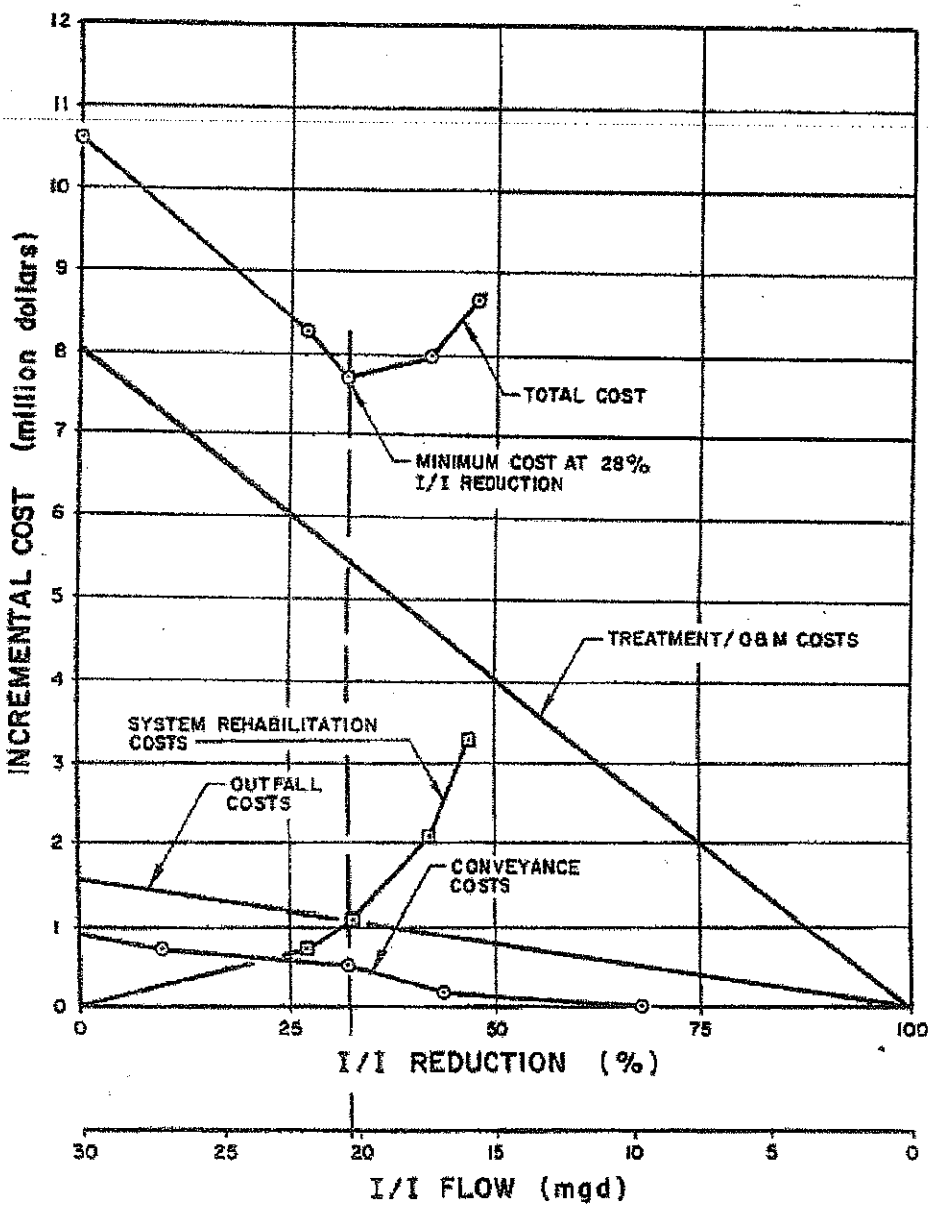
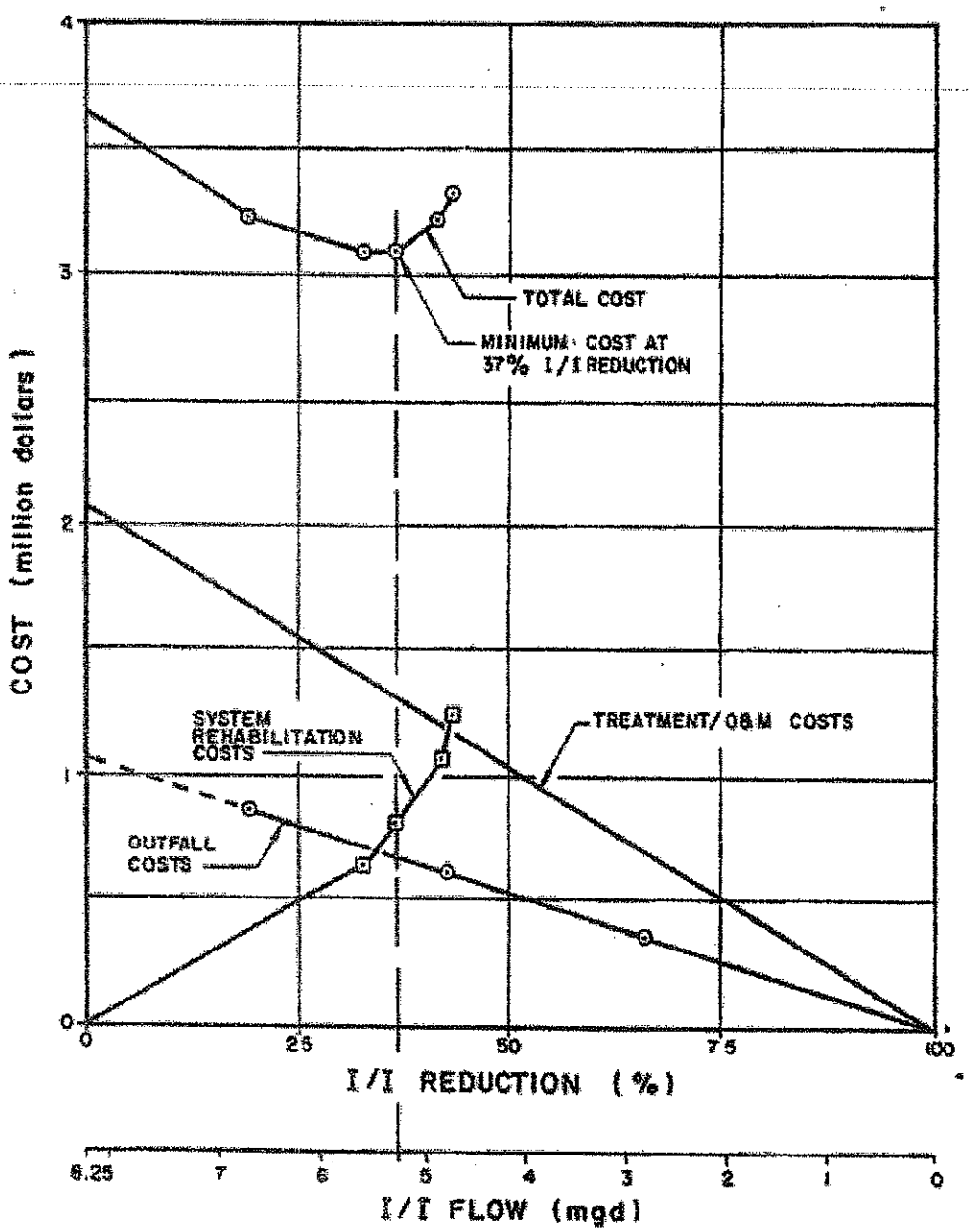


Figure 7-6
COST EFFECTIVE ANALYSIS
RICHARDSON BAY NETWORK [a]



a SALT WORKS AND RICARDO/ROAD WATERSHED, ONLY

Table 7-6. ESTIMATED COSTS I/I CORRECTION/REHABILITATION

Task	Cost,$/lf
Physical Survey	0.35
Rainfall Simulation (smoke testing)	0.20
Cleaning & Internal Inspection	2.34
Inflow Corrections	1.25
Infiltration Corrections	
Grouting (95%)	5.35
Excavation/Replacement (5%)	35.00
Flow Monitoring	0.43

Valley network it appears cost-effective to reduce the I/I from 30 mgd to 21.5 mgd or 28 percent. For the Richardson Bay network, it appears cost-effective to reduce the I/I from 8.25 mgd to 5.2 mgd, or 37 percent. A summary of the cost-effectiveness analysis is presented in Table 7-7.

Table 7-7. COST-EFFECTIVE PEAK RATE OF I/I
SASM SERVICE AREA

Service Area	Projected[a] Peak Rate of I/I 20-yr Return Frequency, mgd	Cost-Effective[b] Peak Rate of I/I 20-yr Return Frequency, mgd	% Reduction
Mill Valley	30.0	21.5	28
Richardson Bay[c]	11.7	8.3	29
SASM (Total)[c]	41.7	29.8	28

[a] No corrections to collection system
[b] Cost-effective corrections to collection system
[c] Includes Trestle Glen watershed

The SASM treatment plant went online in the fall of 1983 prior to the construction of relief sewers and I&I reduction efforts. In a July 26, 1985 letter, Black & Veatch discussed the I&I Collection System Rehabilitation Project.

BLACK & VEATCH
ENGINEERS—ARCHITECTS

TEL. (415) 944-5770

3470 BUSKIRK AVENUE
MAILING ADDRESS: P.O. BOX NO. 4247
WALNUT CREEK, CALIFORNIA 94596

F
1419

Sewerage Agency of Southern Marin
I/I Collection System Rehabilitation
Project No. C-06-2466-100
10 Percent Design Submittal

B&V Project 11453.400
July 26, 1985

Sewerage Agency of Southern Marin
P.O. Box 1029
Mill Valley, CA 94942

41.8 - (.28)(41.8) = 30.1
or 32.7

Attention: Mr. David Coe

Gentlemen:

Enclosed is the 10 percent design submittal for the subject project for your submission to the state.

Concept approval for this project contains two points that should be reviewed and evaluated based upon this 10 percent design. A goal of reducing the peak wet weather flow by 28 percent was identifed in the 1980 SSES and carried into the concept approval. This 28 percent was based upon an estimated peak I/I rate of 41.8 mgd. This flow was estimated because flows above 7 mgd could not be measured by the old treatment facilities, and a recommended treatment plant design peak I/I rate capacity of 32.7 mgd. Since 1980 the new treatment plant has been in operation for two wet weather periods and the I/I reduction goal should be reevaluated based upon actual operating data.

The goal of the collection system rehabilitation program should now be to eliminate and/or transport all collection system overflows to the treatment plant and reduce peak I/I rate to a level that the treatment plant can process in accordance with discharge standards, except 85 percent removal. Based upon the five significant storms during the last two seasons, the peak I/I rate appears to the about 41 mgd without relief facilities in operation. Because peak I/I rates are sustained for a shorter duration than estimated in 1980 and because of the conservative nature of design hydraulics, the firm plant capacity may be nearer 35 mgd peak I/I rate. Thus, the reduction goal seems to be about 6 mgd, without consideration of the relief facilities currently under construction.

Estimated reduction after repair of the defects identified from smoke testing is 5.3 mgd. This is about half of the concept approval stated goal and about 85 percent of what may be necessary without knowing the effect of relief facilities. In either case, the second point in the concept approval letter that must be evaluated in light of this information is that a second phase of rehabilitation will be necessary as provided for in the concept approval.

After the state staff has completed their review of this submittal package, we recommend that we hold a study session with the state staff to review the status of the program and to evaluate the alternative action steps available. This will ensure that we all fully understand and agree with the course of action. The basic options are as follows:

1. Proceed with identified rehabilitation and monitor the results of both the rehabilitation and relief facilities during the 1986-87 wet weather season and scope a second rehabilitation phase to achieve the remaining reduction required.

2. Increase the scope of this rehabilitation phase in an attempt to ensure achieving the necessary reduction in one phase. The additional work would be televising the highest priority areas as identified in the 1980 SSES, and applying the most effective rehabilitation methods identifed in the 1983 pilot project.

If you have any questions, please call at your convenience.

Very truly yours,

BLACK & VEATCH

David A. Requa

er
Enclosure

Of note were the observations based on two years of actual plant operation and five significant storm events and also the recommendation to eliminate and/or transport all collection system overflows and to reduce I&I to levels that allow the treatment plant to comply all permit requirements except the 85 percent removal.

In a January 29, 1986 letter to the SWRCB seeking to expedite approval of the Phase I I&I plans and specifications, David Coe provided a summary to date of SASM's I&I project.

S A S M
SEWERAGE AGENCY OF SOUTHERN MARIN

A Joint Powers Agency
- Almonte S.D.
- Alto S.D.
- City of Mill Valley
- Homestead Valley S.D.
- Richardson Bay S.D.
- Tamalpais C.S.D.

F
1419

January 29, 1986

Virginia Dong
State Water Resources Control Board
Division of Clean Water Grants
P.O. Box 100
Sacramento, CA 95801

Subject: I/I Rehabilitation Project
Project No. C-06-2466-120

Dear Ms. Dong:

As you know, we are trying to complete the SASM I/I Rehabilitation Project that you and Ms. Sergent are currently reviewing as quickly and efficiently as possible. It is necessary that this project be constructed prior to the 1986 winter rain, which ordinarily begins in November, so that the effectiveness of our efforts can be ascertained. Failure to do so could result in a one year delay in our efforts.

As per Ms. Sergent's conversation with Black & Veatch, we expect to receive plans and specifications approval about February 7. Based on this key date, we anticipate the following schedule:

2-7-86	SWRCB approval on plans and specs
	Incorporate corrections into P and S
2-24-86	Advertise for bids
3-26-86	Open bids
4-1-86	Submit application for ATA to State
5-1-86	Receive ATA from State
5-5-86	Date of Notice to Proceed
11-1-86	Substantial completion required
11-21-86	Required completion

As you can see, this schedule will be cutting it pretty close. Your assistance in meeting this schedule is critical.

If there is any way we can facilitate your assistance in meeting this schedule, please contact us. Your continued helpful consideration of our efforts in this regard will be appreciated.

Very truly yours,

David A. Coe
Manager

SASM'S INFLOW/INFILTRATION PROJECT

INFLOW - Rainwater that enters the sanitary sewer system through direct connection (crossconnected storm drain or area drain, uncapped pipes or cleanouts, connected roof drains, broken pipes, etc.)

INFILTRATION - Groundwater that enters the sanitary sewer through joints, pipe walls and cracks in pipe. Significant during rain due to saturated ground.

COMPARATIVE FLOW DATA FOR SASM SERVICE AREA

Dry Weather: 3 MGD = Daily Flow

6 MGD = Peak Flow

Wet Weather: 20 year storm

12 MGD = Inflow

29 MGD = Infiltration

41 MGD = Total Amount of Rainwater Entering Sewer

44 MGD = Total Peak Flow to Plant for 20 Year Storm

Actual highest flow observed at the plant to date is 38 MGD.

PLANT SIZE VERSUS I/I REHABILITATION

Excess wet weather flow can be handled by building a bigger treatment plant or by reducing flow to the plant by fixing pipeline leaks. A cost comparison was conducted in 1980 resulting in the decision to build a treatment plant with capacity to treat 32 MGD and to reduce rainwater inflow from 41 MGD to 29 MGD (12 MGD or 29% reduction).

The plant has been built and is in operation with a design peak capacity of 32 MGD.

The work of reducing Inflow to the sewer is underway at this time.

THE I/I REDUCTION PROGRAM

1980 SSES - Determined level of I/I problem, established cost effective level of I/I reduction, and recommended pilot program to verify.

1981 to 1983 Pilot Program - Demonstrated through actual rehabilitation in a 76 acre area that 30% reduction in I/I could be achieved in a cost effective way. Recommendation to proceed to smoke test and television inspect entire sewer system tributary to SASM Plant. State approved smoking all but held off on T.V. approval.

1984 Smoke Test - Identified 292 cost effective repairs on public sewers and 177 repairs on private sewer systems. Recommended and received go-ahead to T.V. inspect only 10% of system.

1985 Television Inspection and Rehabilitation Design - Inspection and design completed and submitted to State for O.K. to go out to bid.

1986 I/I REHABILITATION CONSTRUCTION PROJECT

Anticipated Construction Period: June through December

Estimated Construction Cost: $610,000

Work Will Include:

	Number of Locations	Number of Feet
Manhole rehabilitation & replacement	40	
Sewer Replacement	115	5600
Slip Line Existing Sewer	9	2170
Repair Sewer by External Banding	4	
Joint Repair (clean, test & seal)	29	6410
Miscellaneous	16	
	*****	
	213	

Work will be conducted in 147 different locations in the City of Mill Valley

I/I PROJECT COSTS

SSES.....	210,000
Pilot Study.....	118,000
Pilot Rehab by Hill Valley.....	77,000
Design Relief Sewer.....	61,000
Build Relief Sewer.....	525,000
Inspect Relief Sewer.....	35,000
Design I/I Rehabilitation.....	357,000
Build I/I Rehab (Phase I).....	610,000
Inspect I/I Rehab.....	149,000
Design & Build Phase II.....	?
	*********
	$2,107,000+

Total commitment to reimburse by the State and EPA for this work is approximately $1,790,000.

ADDITIONAL NOTES

Private Property I/I Reduction. A program is currently underway under SASM's administration to correct problems on private property.

I/I Relief Sewer. Although not discussed elsewhere in these notes, this project has been an important part of the overall sewer improvement program. Costs for this project are reflected above.

I/I Rehabilitation - Phase II. It has been recognized from the outset that the first Rehab project may not achieve the target reduction in I/I and that a second project may be necessary. Staff is currently attempting to gain authorization from the State to proceed with the preliminary work on this second project at this time.

As noted in both the Black & Veatch letter of July 25, 1985 and David Coe's Additional Notes above, the Phase I I&I reduction plan was expected to fall significantly short in achieving the 28% reduction in I&I. SASM submitted a request for grant funding of a Phase II I&I reduction project to achieve full compliance with the 28% I&I reduction as an integral part of the wastewater facility design. This request was denied as detailed in the April 11, 1986 letter from the SWRCB Division of Clean Water grants below.

STATE OF CALIFORNIA
GEORGE DEUKMEJIAN, Governor

STATE WATER RESOURCES CONTROL BOARD
DIVISION OF CLEAN WATER GRANTS
PAUL R. BONDERSON BUILDING
901 P STREET
P.O. BOX 100
SACRAMENTO, CALIFORNIA 95801
(916) 324-0938

RECEIVED
S.A.S.M.
APR 17 1986

F
1418
cc: JOE CANELLO
DAVID REQUA

APR 11 1986

BY: _____
FILE: _____

In Reply Refer
to: 550:AR

Mr. David Coe, Manager
Sewerage Agency of Southern Marin
450 Sycamore Avenue
Mill Valley, CA 94941

Dear Mr. Coe:

SEWERAGE AGENCY OF SOUTHERN MARIN, PROJECT NO. C-06-2466-120, REQUEST FOR AMENDMENT TO CONCEPT APPROVAL

We have reviewed your December 23, 1985 report titled "Request For Amendment to Concept Approval of I/I Rehabilitation Project." Central to this request is a grant increase request to cover the estimated cost of completing the Phase II rehabilitation work with Phase I rehabilitation work.

Your request is denied for the following reasons: The requisite grant monies are not available this fiscal year and the funding outlook for the future is uncertain; and, a grant increase of $1,452,250 was previously awarded (June 24, 1985) in order to reduce peak wet weather flows by 28 percent. It was understood that this increase would suffice to achieve the 28 percent reduction. The February 6-7, 1985 State Water Resources Control Board Workshop Agenda states "This grant increase is requested to cover the Infiltration/Inflow (I/I) collection system work and the relief sewer needed to complete the total project." Even if grant funds were available, an additional increase for a second change in scope would have to be approved by the State Board and would require justification why the previous increase was insufficient. Also the June 17, 1983 letter from Mr. Dave Requa to Mr. Robert Bradford and the December 22, 1983 Concept Approval amendment indicated that the total estimated cost of the I/I correction is $1,100,000 to $1,500,000. Your December 1985 report indicates the total cost is now approximately $2,600,000. An additional increase to fund work (Phase II) that was covered by the previous increase cannot be justified at this point.

Since there are sufficient grant funds for your identified Phase I work and you have received plans and specifications approval, we can only approve continuation of Phase I. Also, one of the conditions of Concept Approval indicated that work may only continue through 1987 in order to limit the "open endedness" of the rehabilitation - monitoring work. Therefore, the grants program's responsibility will only continue through Phase I completion.

Please contact me at (916) 322-5456 or Alan Ratcliff at (916) 324-0938 if you have any questions or comments.

Sincerely,

S. J. Houck

Sandra J. Houck
Senior WRC Engineer

cc: Mr. Dave Requa
Black & Veatch Consultants
P.O. Box 4247
Walnut Creek, CA 94596

Mr. Richard Condit
CRWQCB, San Francisco Bay Region (2)
1111 Jackson Street, Room 6040
Oakland, CA 94607

Based on the above correspondence the status of collection system I&I rehabilitation and treatment plant response approaching the winter of 1986/87 was as follows:

1. The Phase I grant funded I&I reduction project was forecast to reduce I&I by about 5.3 mgd or about half of the 28% reduction called for in the integrated SASM facility design (plant upgrade, flow equalization and I&I reduction);
2. The SASM request for additional grant-funded I&I work was denied;
3. Based on two years of wet weather experience (5 significant storm events over 83/84 and 84/85) Black & Veatch estimated peak flows to SASM at about 41.0 million gallons without relief sewers in operation;
4. "Because peak I&I rates are sustained for a shorter duration than estimated in 1980 and because of the conservative nature of design hydraulics, the firm capacity (of the WWTP) may be nearer 35 mgd peak I&I rate" rather than the 32.7 million gallon peak I&I design;
5. Black & Veatch recommended that the goal of the collection system rehabilitation program should now be "***to eliminate and/or transport all collection system overflows to the treatment plant and reduce peak I&I rate to a level that the treatment plant can process in accordance with discharge standards, except 85% removal.***"

Original Goal of Removing Excessive Infiltration Apparently Met:

As noted above, SASM was required to remove "excessive infiltration" as a condition of Federal and State eligibility for grant funding. The Federal definition of what constitutes "excessive infiltration" operative at the time of design and construction is as follows:

> Excessive Infiltration/Inflow—the quantities of infiltration/inflow which can be economically eliminated from a sewer system by rehabilitation, as determined by a cost-effectiveness analysis that (for the design line of the treatment works) compares correcting the infiltration/inflow conditions with increasing the treatment works capacity to provide the required wastewater treatment for the quantities of infiltration/inflow.

Based on the influent flow analysis for January 25 and 26, 2008 storm provided in the Larry Walker Associates audit report, it appears that the wastewater contributions from the SASM member agencies, both individually and in the aggregate, essentially duplicate the expected amounts reflected in the original design estimates for a twenty year return frequency storm, which the January 25th storm approximated.

Despite the following circumstances:

1. Projections that the grant funded Phase I I&I rehabilitation project would only achieve only about half of the required 28% reduction in "excessive infiltration";
2. Grant funding for a Phase II I&I rehabilitation program was denied;
3. The construction of I&I relief sewers that have added to expected influent flow peaks;
4. The construction of pump station improvements (Camino Alto, Trestle Glen, Sutton Manor and Rosemont) designed to decrease collection system surcharging and eliminate wet weather SSOs but that add to the expected peak flows received by SASM;
5. Population growth and new construction within the SASM area;
6. The normal aging and deterioration of not only District sewers but of private laterals connected to SASM member agency sewers;

SASM and its member agencies have, in the normal course of repairing and replacing their sewer lines over the past 20 years, eliminated the Phase I "excessive infiltration" peak shortfall of approximately

5.0 million gallons projected by Black & Veatch and achieved a level of I&I reduction that complies with the original design requirements of eliminating "excessive infiltration" by a 28% reduction of the expected peak wet weather flow.

Collection System Repair and Rehabilitation Efforts:

In the course of meeting with the EPA during their August and October 2007 inspections, in correspondence regarding the factual accuracy and conclusions contained in those reports and in responding to the subject order, SASM member agencies have provided the EPA with documentation of significant repair and rehabilitation efforts spanning many years.

Beginning in 1987, Richardson Bay has spent millions replacing all of its antiquated pneumatic ejector pump stations with state of the art submersible stations that dramatically increased pumping capacity and reduced or eliminated wet weather collection system surcharging. To date, 12 stations were converted and 4 new stations were added. In response to the significant storm over the New Year's holiday in 2005/06, 3 stations were upgraded to almost double the pumping capacity and RBSD just rehabilitated 4 of the 12 because they were 20 years old. In addition, RBSD has replaced thousands of feet of sewer line (both gravity and force main) and spent hundreds of thousands of dollars on replacement and repair efforts. Currently out to bid is a job to replace 6,000 plus feet of some of the oldest sewers in the District.

Almonte has pipe burst a number of lines that were subject to problematic SSOs and has diligently repaired problems as they are discovered.

The City of Mill Valley routinely repairs or replaces sewer lines in conjunction with their street repair program.

Tam Valley Community Services District replaced substantially all the sewers in the area connected to SASM.

Alto and Homestead Valley have engaged in a number of joint sewer replacement efforts as well as other repair efforts.

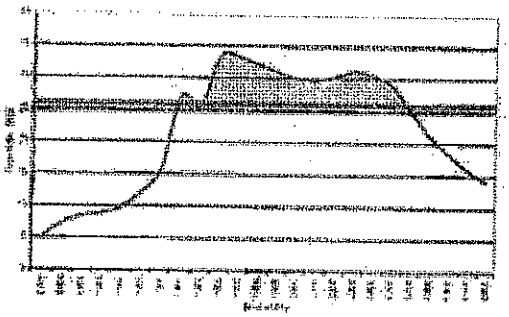
As a result of the agency actions described above, the collection systems of the SASM member agencies performed as designed and delivered to SASM quantities of wastewater within original design parameters and in within their contractual capacity allocations with SASM . Of note is that to my knowledge there were no reported wet weather related SSOs in the entire collection system tributary to SASM during the January 25 and 26, 2008 storm.

In Conclusion:

A fair reading of the entire Larry Walker Associates audit indicates that operational choices made by SASM staff made prior to and on the days of the January 2008 spills were the major factors contributing to the spills rather than the volume of wastewater received, although influent flows to the treatment plant were in the upper design range.

There remains a question as to whether the spill resulting from the January 25 and 26, 2008 storm could have been entirely avoided. More analysis would be needed to determine if the storage capacity of the equalization basins would have ultimately been exhausted even if SASM staff had operated the plant to maximize plant throughput and effluent pumping in order to conserve equalization storage capacity. In the modified influent flow graph below, the redline represents the historic maximum

effluent pumping rate of approximately 26.0 mgd (six pumps running) and the yellow area under the curve is the amount of water that would have had to have been stored in the equalization basins. This does not take into account storage in the SASM treatment processes.



Overflows from the SASM equalization ponds due to extreme wet weather events have occurred on four occasions since the facility went online in 1983. The first in November 1994 was the result of a storm with a hundred year return frequency. The second, in February 1998, resulted from a protracted storm similar to the one on January 25 and 26, 2008, the third occurred during the major storm of New Years 2006 and the last on January 25 and 26, 2008.

Storms that produce protracted moderate to heavy rainfall such as this one, especially when preceded by substantial rainfall that results in saturated soil conditions are the most problematic for facilities that rely on equalization to moderate peak flows.

The common thread for wastewater agencies is that storm events significantly in excess of WWTP or collection system design parameters are likely to result in overflows somewhere in the system. SASM is not unique in this regard.

The Larry Walker Associates report notes that a storm event of this magnitude (January 25 and 26, 2008) would have been problematic for many of the wastewater collection and treatment facilities in the San Francisco Bay Area.

In the past, the regulatory community has taken into account the magnitude of storm events, the limitations of facilities to deal with wet weather events in excess of facility design and the mitigating factors of an extremely dilute overflow and significant dilution provided by rain, runoff, tidal flushing, etc.

In the end, it is incumbent on agencies to comply with all spill response protocols and provide regulators with timely and accurate information so that there is a factual basis to guide enforcement action. It is equally important that regulators remain objective, weigh and consider all information provided, act diligently in their investigation, delay action until all the facts are known and then take reasonable enforcement actions that reflect culpability and lead to realistic and affordable corrective actions.

Respectfully submitted,

Bonner Beuhler

Bonner Beuhler
Manager, RBSD and Almonte Sanitary District

Appendix C

SEWERAGE AGENCY OF SOUTHERN MARIN
WASTEWATER TREATMENT PLANT
WET WEATHER FLOW MANAGEMENT

Date Approved/Revised: 11/08,12/09, 10/10	**Procedure for maximizing flow management aimed to prevent spills.**	**Author: S. Danehy/J.Carson**
SOP No.:		**Approved By: S. Danehy**
Page 1 of 4		

SUMMARY:

The SASM WWTP is designed for an average daily flow of 3.6 MGD. The plant hydraulic capacity is far greater than the average daily flow rating. Briefly, the plant is capable of processing an equalized flow of 24.7 MGD. That means flows through the plant may be sustained at a rate the results in a daily flow of 24.7 MGD.

As noted, the plant is designed to handle significantly higher flow rates. However, each process unit throughout the plant is limited hydraulically. For example, the Influent Pump Station is capable of pumping 48 MGD. The Primary Settling Tanks are able to handle approximately 28 MGD (depending on recirculation pump throughput). The Trickling Filters can handle 30 MGD, Secondary Clarifiers about 26 MGD and the Effluent Pumps about 26MGD. So from this brief example, the restricted flow through the Plant is created by the Primary Settling Tanks.

As records show, flows can easily exceed 28 MGD for various periods of time. The duration of storm events drives the amount of excess flow and the plant's ability to manage and store high flows, especially over 28 MGD. Flows over 28 MGD need to be diverted to the Equalization Ponds. The Ponds had a total storage capacity of 1.5 MGD and were upgraded to 3.3 MGD in 2008. Once the Ponds are full, excess water into the Ponds will overflow the Emergency Outfall, which is an unpermitted discharge.

DEFINITIONS:

Blending: Observation of recirculation wet well water overflowing into the Effluent wet well through 12" portholes located between the wet wells.
Spill: Overflowing the North Pond overflow box.

PERSONNEL:

All SASM Treatment Plant Staff. On call operators must get approval from CPO/ Plant Manager prior to calling another operator in for help.

SAFETY:

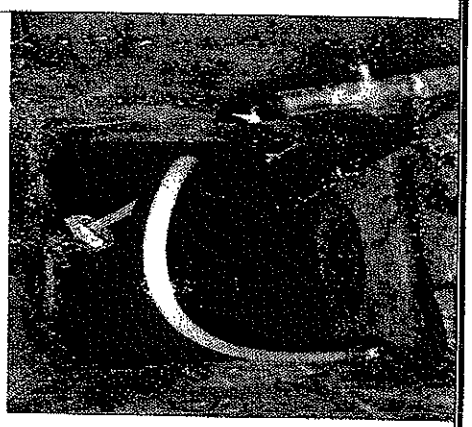
Use proper PPE for sampling kits, and use adequate lighting in sampling areas. ALWAYS communicate changes in plant process to each other and place tags on the operations control room panel. Anyone leaving the WWTP during the event must stay in constant contact with a WWTP staff attendee.

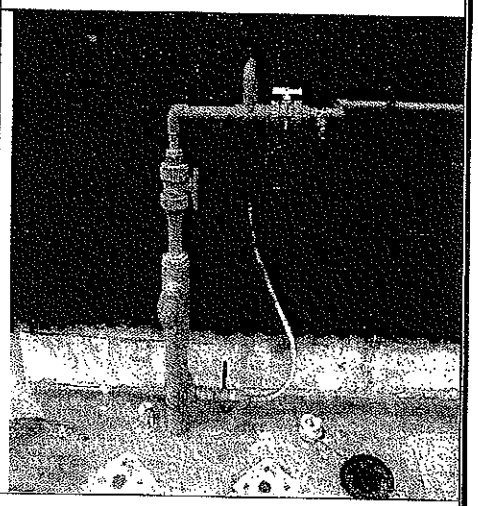
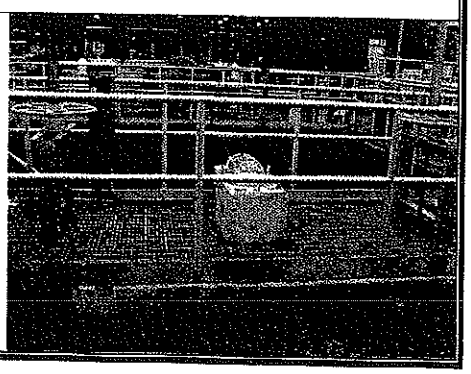
RESOURCES:

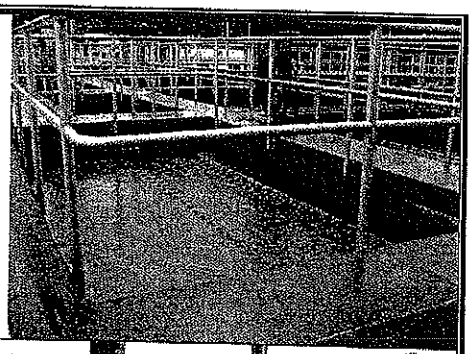
All Operations staff, WWTP equipment, Southern Marin Sanitary Agencies, and WARN network.

PROCEDURES: **The strategy for processing wet weather flows shall be:**

- EXAMPLE OF PROCEDURE -

STEP	ACTION	PICTURE
1	All Influent flows below 28 MGD shall be processed through the WWTP with NO flow to the Equalization Ponds (unless the Primary Settling Tanks OR the Secondary Clarifier Splitter Box is in imminent danger of overflowing).	
2	All Effluent Pumps shall be set up for Auto operation at all times.	
3	TWO (2) Influent pumps VFD shall always be set up in Automatic Mode, with one in local. Influent pumps 4 and 5 shall be set up in automatic mode. Influent pumps 6 and 7 shall be in the OFF position (ready for operation to the Ponds). If Pumps 6,7 are not in the OFF position, pumps will start at lower flow rate (between 22 and 24 MGD)(this will add flow prematurely to the Ponds). One VFD may be used on Hand for flow management.	
4	Recirculation Pumps 1 through 6 are to remain in Auto and are designed to pump 5.0 MGD each (30 MGD total). Recirc. Pump Discharge header interconnect butterfly valve must be in the OPEN position.	
5	Recirculation Wet Well is monitored on SCADA and has a high level alarm that activates at 12.7 feet alerting Operations (Autocon Panel, SCADA) that blending may begin soon at 13.0 feet. Upon awareness of this alarm, immediately visually inspect/ observe the level at the marked porthole as shown in the photo to right and LOG alarm.	

6	**For Blending: Fill out blending time form located on wet weather clip board. The blending time on this form must match the operations log book blending time.**	
7	**If blending occurs (recirculation wet well flowing out 12" porthole into effluent wet well) notify the Chief Plant Operator or General Manager immediately and begin sampling at sampling point (between Effluent pumps 4 and 5) and. Sample Kit with instructions is located in Operations Control Room. Surges through plant due to power outage must be reported to CPO/Plant Manager immediately. (grab samples info in red binder)** **Reminder to start SD5 sampler.** **Immediately log blending time in main ops log book.**	
8	**Sampling location for NON-GLASS containers.** **START SD5 Sampler**	
9	**REMINDER START SD5 automatic sampler.**	
10	**Closely observe the Secondary Clarifier Inlet Channel, this may overflow in extreme high flow conditions >20 MGD. In the event of possible overflow (within 2 inches of free board), one of the six recirculation pumps must be shut down.**	

11	**Closely observe the Primary Settling Tanks water level. These tanks may overflow in extreme high flows >24 MGD. Divert the influent wet well flows to the ponds using 6, 7 pumps when the water level reaches 4 inches from the Primary Tanks deck. The goal is to pump 28 MGD through the primary tanks or until the primary tanks are within 4 inches of overflowing.**	
12	**Flows in excess are diverted to the Equalization Ponds. Use Pumps 6 and/or 7 to pump to the Ponds (not both). The Main Drain Gate and North Pond Gate at the valve box shall remain OPEN. If more capacity is needed, the South Gate will be Opened.** **Time to fill both ponds: one pump = <10 hours.** **Two pumps = <5 hours.**	
13	**The North Pond Overflow Box communicates the pond level using ultrasonic instrumentation. If the electronic instrument fails, a measuring stick is attached for backup. The high level alarm for the overflow box is tied into SCADA at 6.9 feet, the overflow height is approximately 8.3 feet.** **At 6.9 feet level, a decision will be made by CPO to open South Pond, or manage lift station pumps.**	
14	**Overflow from the North Pond Box requires sampling: Grab a sampling Kit located in the Operations Control Room and follow procedures.** **Chief Plant Operator/ General Manager required at this time and must be notified immediately upon box overflow.**	

15	Emergency Spill Sampling location for North pond.	

Over 15 MGD Operator Reminders

- **Blending/ Spill events must be reported to CPO/ Plant Manager IMMEDIATELY.**
- **Remember SD5 for auto sampler.**
- **Place one grit pump on HAND above 15MGD, second per CPO.**
- **Monitor SD5 bisulfate residual (call SD5 if any abnormality!).**
- **Verify Recir. Pump common discharge header valve is OPEN.**
- **Verify Headworks wetwell interconnect is OPEN.**
- **Verify enough hypo is in Day tank.**
- **Verify next operator to come in (CPO must be notified FIRST!)**
- **Verify South Pond is drained.**
- **Verify proper valving to ponds.**
- **Switch Headworks Low level cut-off float to BYPASS (operator judgement).**
- **Shut off Ferric pump.**

Appendix D

S A S M
SEWERAGE AGENCY OF
SOUTHERN MARIN

A Joint Powers Agency

- Almonte S.D.
- Alto S.D.
- City of Mill Valley
- Homestead Valley S.D.
- Richardson Bay S.D.
- Tamalpais C.S.D.

September 30, 1997

Memo to: Tom Roberts, Almonte Sanitary District
Larry Glazier, Homestead Valley Sanitary District
Ed Marshall, City of Mill Valley
Mark Miller, Tamalpais Community Services District

From: David Coe

Subject: Southside Sewer System Surcharge Study

Ed Nute's report is attached. We will meet with Ed at ~~1~~2:00 pm on Wednesday, October 15th at the Treatment Plant to discuss the report.

Please feel free to call Ed at 453-4480 in advance of the meeting.

P.O. Box 1029 - Mill Valley, California 94942 Tel: (415) 388-2402 Fax: (415) 381-8128

CITY OF MILL VALLEY

26 CORTE MADERA AVENUE
MILL VALLEY, CALIFORNIA 94941
TELEPHONE: (415) 388-4033

SEND INVOICE TO:
City of Mill Valley
P.O. Box 1029
Mill Valley, CA 94942

PURCHASE ORDER
NO. 16230

DATE: 11/7/97

TO:
SASM
PO Box 1029
Mill Valley, CA 94942

DELIVER TO: Public Works Dept
26 Corte Madera Ave
Mill Valley, CA 94941

SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS

1. Purchase order number must appear on all documents in connection with this order.
2. Unless otherwise stated, prices are F.O.B. destination.
3. All authorized freight charges must be prepaid and itemized on invoice.
4. Deliveries rejected for cause shall be held at vendor's risk and removed at vendor's expense.
5. Back orders not deliverable in 30 days are to be cancelled.
6. Purchase order must be signed below.

SPECIAL INSTRUCTIONS:

ACCOUNT CODE	ITEM NO.	QUANTITY ORD'D	UNIT	DESCRIPTION	UNIT PRICE	EXTENDED AMOUNT
)8-68629-90				Southside sewer system surcharge study		
				Stage A-1 construction Not to exceed....		$10,000.00
				Dave Coe: Include PO# on all invoices		
				RECEIVED S. A. S. M. NOV 10 1997		
					SALES TAX	
					TOTAL AMOUNT	$10,000.00

ORDERED BY: Cesar Jaime, Sen Civ Eng

Deborah Nell
PURCHASING OFFICER

NUTE

NUTE
ENGINEERING

Civil and Sanitary
Consultants

907 Mission Ave.
San Rafael, CA 94901
(415) 453-4480
Fax (415) 453-0343

September 26, 1997

SASM copy to: Tom Roberts, Almonte SD
Larry Glazier, HVSD
Ed Marshall, Mill Valley
Mark Miller, TCSD

Mr. David A. Coe, Manager
Sewerage Agency of Southern Marin
Post Office Box 1029
Mill Valley, California 94942

from: David Coe, SASM
9/29/97

Re: **SASM Southside Sewer System Surcharge Study**
Letter of Transmittal

Dear David:

As authorized, we have completed our investigation of the surcharging problems and wet weather overflows in the Southside Sewer System. Agencies affected by this study are SASM, the City of Mill Valley, the Almonte and Homestead Valley Sanitary Districts, and the Tamalpais Community Services District.

In brief summary, we recommend that SASM undertake a staged approach to eliminating the wet weather overflows. Stage 1 involves connecting the Almonte Sanitary District sewer to the Tamalpais Community Services District's Rosemont Pump Station and isolating the Camino Alto Pump Station to prevent it from receiving sewage which may backflow from the Miller Avenue sewers. Also, we recommend that a 40 horsepower pump be installed at the Camino Alto Pump Station.

Subsequent stages involve modernization of the Camino Alto Pump Station and constructing a facility to relieve the surcharging in the Southside Sewer System if necessary.

We recommend that SASM monitor the results of these system improvements as each stage is implemented.

Very truly yours,

NUTE ENGINEERING

By W. Edward Nute
W. Edward Nute

lm

09266371.SAS

SEWERAGE AGENCY OF SOUTHERN MARIN

SOUTHSIDE SEWER SYSTEM SURCHARGE STUDY

During wet weather, several sewer lines in the southern part of the SASM service area surcharge and overflows have occurred from a number of manholes. The affected south side sewer lines consist of the two sewers located in Almonte Blvd used by the Almonte Sanitary District and the Tamalpais Community Services District (TCSD) and the sewer main through Tamalpais High School and the sewer main on Miller Avenue which serves portions of the Homestead Valley Sanitary District and the City of Mill Valley.

In the 1980's SASM undertook investigations into the sources of excess wet weather infiltration/inflow (I/I) and "cost effective" I/I corrections were made in Mill Valley and in the Almonte Sanitary District. In addition, two relief sewers were constructed, one from Almonte Blvd to the Camino Alto Pump Station and another on Sycamore Avenue between Camino Alto and the SASM treatment plant.

Wet weather overflows continue to occur from certain manholes in the south side sewers. Accordingly, the purpose of these investigations is to identify methods which will eliminate the wet weather overflows.

BACKGROUND

The original sewers were constructed in Mill Valley in the late 1800's as the area began to develop as a resort for San Franciscans. Raw sewage was discharged to the Arroyo Corte Madera del Presidio until the Mill Valley treatment plant was constructed in the late 1940's after the failure to form the Southern Marin Sanitation District.

In the early 1950's, the Almonte and Homestead Valley Sanitary District constructed sewers to eliminate failing septic tanks and contracted with the City of Mill Valley for sewage treatment and disposal.

In 1952, the County established a Sewer Maintenance District to serve the Kay Park development and a pump station and discharge line along Almonte Blvd was constructed to tie into the Mill Valley sewer system near Tamalpais High School.

In 1979, the sanitation agencies of Southern Marin established the Sewerage Agency of Southern Marin (SASM) which improved and expanded the Mill Valley treatment plant and constructed an outfall to Raccoon Straight.

WET WEATHER FLOW PROBLEM

Essentially all of the sewer lines in the southern portion of SASM were constructed before 1960 using vitrified clay pipe with cement or tar joints. These types of joints are subject to deterioration over time and the resulting leaks allow ground water and rain water to infiltrate into sewers causing them to become overloaded and possibly overflow during wet weather.

Wet weather overflows were an accepted "fact of life" until the early 1970's when the Environmental Protection Agency and State Water Pollution Control Boards began issuing requirements prohibiting raw sewage discharges. In the wastewater planning studies of the late 1970's it was concluded that the infiltration and inflow of extraneous rain water and ground water was a widespread problem in Southern Marin as well as in the rest of Marin County. It was further concluded that after eliminating the direct drainage connections to the sanitary sewers should allow treatment plants to be designed with sufficient capacity to handle the predicted peak flows.

As a result of these studies, SASM undertook a program to eliminate the more obvious sources of I/I together with construction of several relief sewers to increase the hydraulic capacity of the sewer system leading to the SASM plant. However, during heavy rainfalls, overflows still occur from the sewers in Almonte Blvd and Miller Avenue.

Over the long term, the infiltration/inflow in the tributary sewer systems should be reduced through sewer system rehabilitation. This is a long term and expensive program and does not address the immediate need of eliminating wet weather overflows.

STUDY OBJECTIVE

The objective of the studies summarized herein has been to identify improvements which will reduce the surcharging and frequency of wet weather overflows from the Southside Sewer System of SASM.

SCOPE OF WORK

Consistent with the study objective outlined above, the investigations of the Southside Sewer System included the following:

1. Prepare a system map showing the basic Southside Sewer System.

2. Determine the elevations of the manhole rims and inverts of the Southside Sewer System using available records and levels taken in the field to assure the elevations are on a uniform datum.

3. Inspect the Camino Alto Pump Station and prepare a system curve for the existing pumps and force main.

4. Investigate both short-term and long-term methods to increase the hydraulic capacity of the Southside Sewer System and prepare cost estimates for alternative improvements.

5. Identify manholes in the Southside system where surcharge monitors could be installed to monitor the water level during wet weather.

SOUTHSIDE SEWER SYSTEM

The Southside Sewer System consists of a variety of pipelines owned by different agencies. As defined in this study, the Southside Sewer System extends from Tam Junction (the intersection of Almonte Blvd and Shoreline Hwy) on the south to the junction with Mill Valley's 30" trunk sewer on Miller Avenue just northwesterly of Reed Street. Also included is the SASM relief sewer which connects to the Almonte and TCSD sewers on Almonte Blvd and runs to the Camino Alto Pump Station.

The major sewers of the Southside Sewer System are shown on Figure 1 and are described below from south to north.

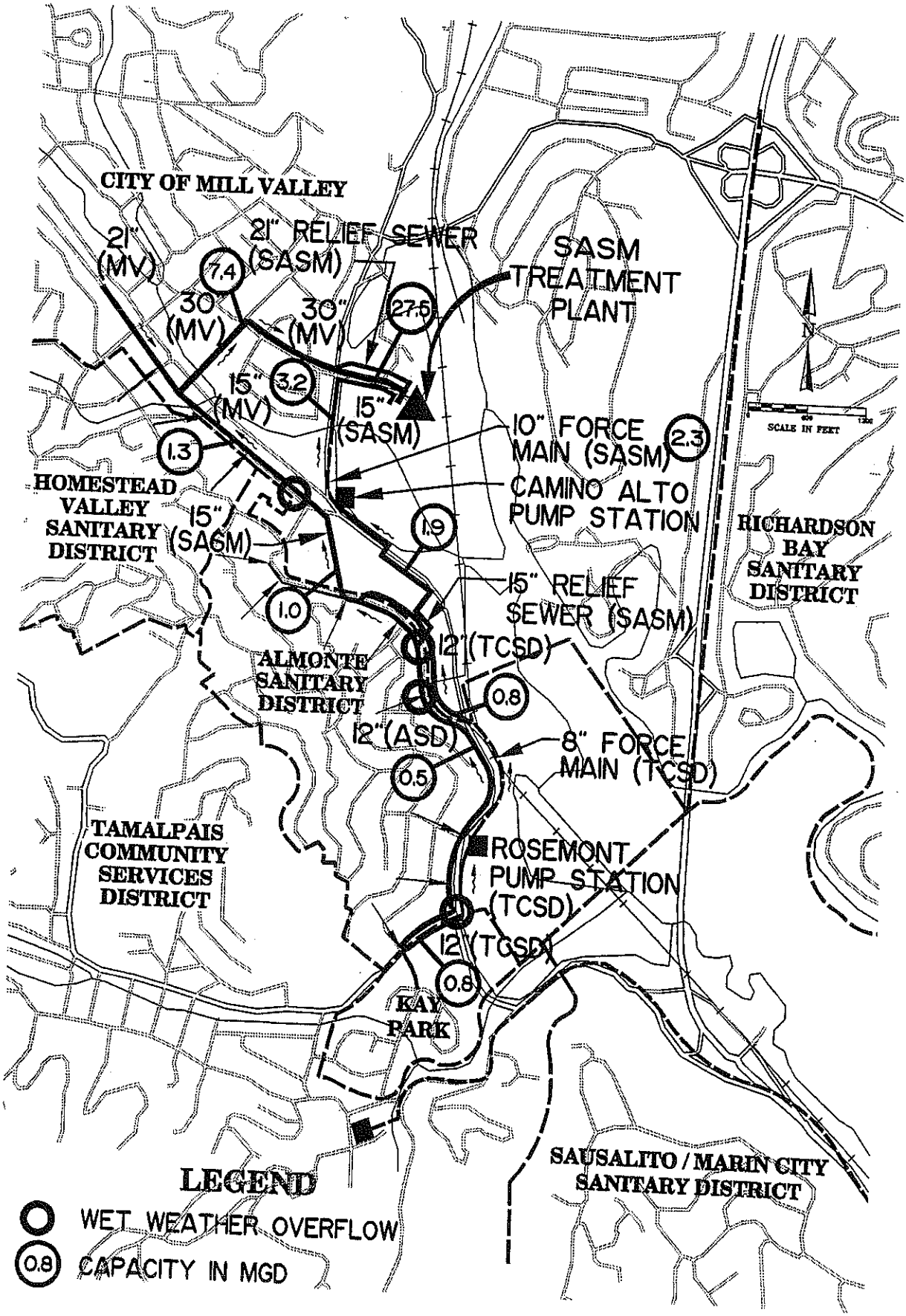
TCSD/Kay Park System The portion of the TCSD known as Kay Park is located at the most southerly portion of the SASM sewer area. The Kay Park system connects to the SASM system via the Rosemont Pump Station, which was recently improved. The Rosemont Pump Station discharges through an 8" force main and then discharges to a 12" gravity sewer in Almonte Blvd.

This 12" gravity sewer parallels the Almonte Sanitary District's 12" sewer and finally connects to the Almonte sewer just south of the point where the 15" SASM sewer runs through Tamalpais High School.

Almonte Sanitary District System In the early 1950's, the Almonte Sanitary District constructed sewers within their District. The basic sewer system consisted of collection sewers serving the hillside homes and connecting to a 12" and 15" sewer constructed at a very flat grade in the County Road, now Almonte Blvd. This 12" and 15" sewer runs northerly where it connects to the 15" SASM sewer which runs through Tamalpais High School.

Mill Valley/Miller Avenue Sewers The Mill Valley portion of the Southside Sewer System is a 15" line which continues northerly on Miller Avenue from the front of Tamalpais High to Mill Valley's 30" trunk sewer. This 30" trunk sewer serves most of Mill Valley to the west, crosses through Sycamore Park just northwesterly of Reed Street, and then runs easterly on Sycamore Avenue, crosses Camino Alto and terminates at the SASM plant headworks.

Homestead Valley - Sewers from Homestead Valley connect to the Mill Valley sewer system in Miller Avenue at three locations; Evergreen Avenue, Reed Street and from an easement running downhill from La Verne Avenue just south of Reed Street.



SOUTHSIDE SEWER SYSTEM SURCHARGE STUDY
SYSTEM LAYOUT

FIGURE 1

SASM Facilities SASM owns the following facilities in the Southside area:

- A 15" sewer which runs through Tamalpais High School from Almonte Blvd to Miller Avenue.

- A 15" relief sewer constructed in 1985, which was designed to take excess wet weather sewage flows from the Almonte Sanitary District and TCSD sewers in Almonte Blvd south of Rising Road and convey them to the Camino Alto Pump Station. Weirs in manholes are provided on each sewer so only the excess flow will be diverted to the SASM relief sewer. Because of utility conflicts, the relief sewer does not have a straight grade, but has two sags before it reaches the Camino Alto Pump Station.

- The Camino Alto Pump Station receives flow from the 15" relief sewer as well as a local 8" sewer and pumps through a 10" force main to a 15" gravity sewer which discharges to the SASM plant.

- A 21" relief sewer on Sycamore Avenue between Camino Alto and the SASM plant parallels Mill Valley's 30" trunk sewer and provides excess capacity to convey wet weather flows.

SOUTHSIDE COLLECTOR SEWER OPERATION

The capacities of the Southside sewers are shown in Figure 1 and the profiles are shown in Figure 2. This system was designed to flow from south to north to the Mill Valley 30" trunk sewer. However, these sewers, particularly along Almonte Blvd are laid on a very flat grade and the sewage flow is very sluggish. Mill Valley's 30" trunk sewer only has a capacity to handle 7.4 million gallons per day (mgd) and it very likely surcharges during heavy rainfalls.

The elevations are such that under surcharged conditions this entire system fills up and overflows will occur from manholes with the lowest rim elevations. These manholes with low rim elevations are indicated on Figure 1. Under surcharge conditions, the sewage is stored in these lines until such time as the wet weather flows abate and the 30" trunk sewer can again allow the sewage to flow normally.

The relief sewer which SASM constructed to the Camino Alto Pump station is now only used when the water level in the Almonte and TCSD sewers rises to an elevation which allows it to flow over the two weirs. However, during surcharge conditions, sewage could actually flow backwards through these lines from the Mill Valley system and end up at the Camino Alto Pump Station and could overload it. In order for the relief sewer to operate properly and not overload the Camino Alto Pump Station it will be necessary either to prevent sewage from flowing backward through these lines under surcharge conditions or to greatly increase the station's pumping capacity.

MAYBE NOT. WHY NOT THE C.A. RELIEF SYSTEM HELP TO SOLVE SOME OF THE MILLER AVE. PROBLEM?

SOUTHSIDE SEWER SYSTEM SURCHARGE STUDY
SEWER PROFILE

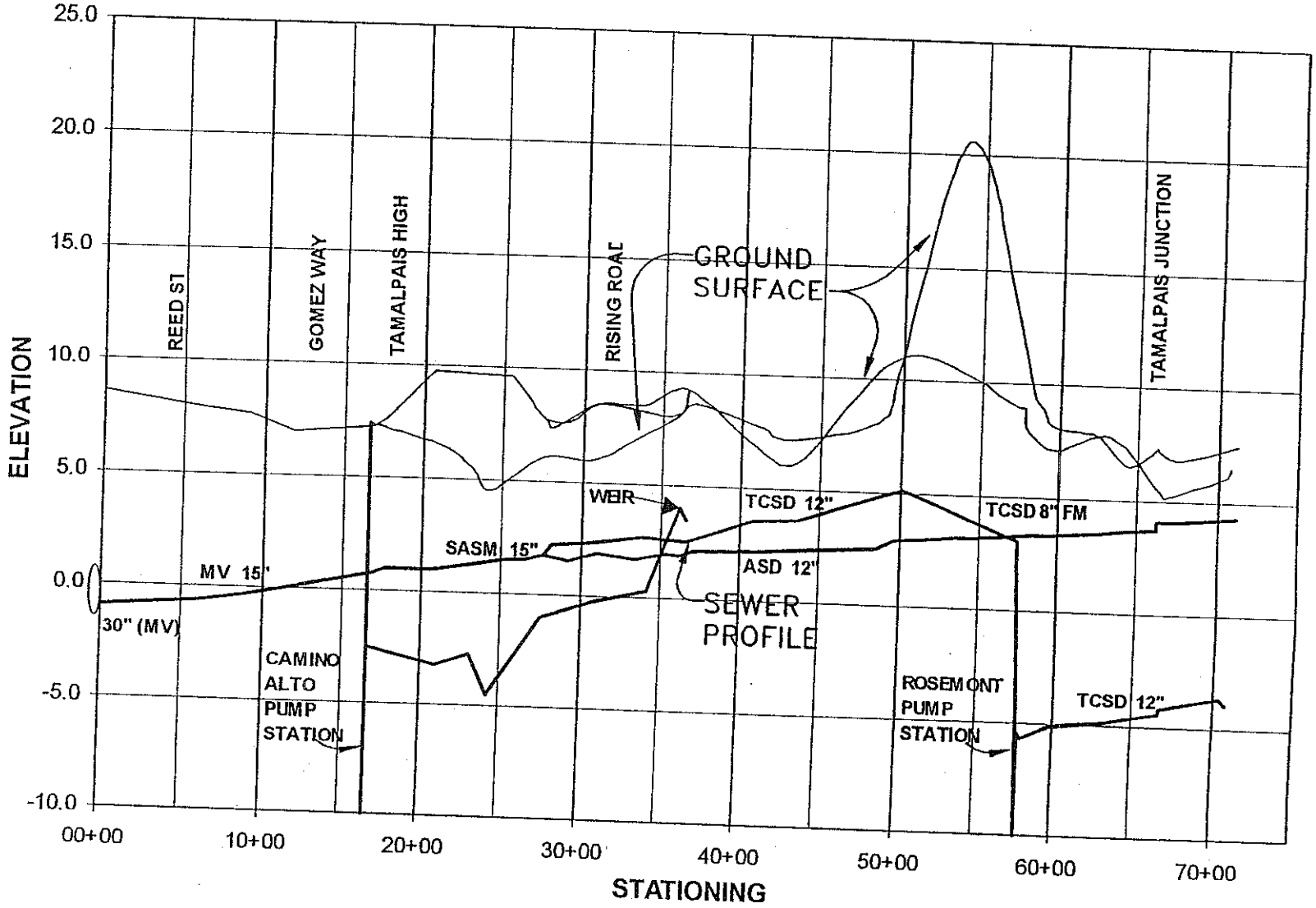


FIGURE 2

MILLER AVENUE SEWERS

Miller Avenue contains the primary sewers which serve Mill Valley and receives the flow from the Homestead Valley Sanitary District at three locations. Miller Avenue also contains northerly portion of the 15" Collector sewer described above which serves Almonte Sanitary District and the Kay Park area of the TCSD. Approximately 200 feet northwesterly of Reed Street a 30" trunk sewer runs northeasterly through easements to Sycamore Avenue. The 30" sewer continues southeasterly along Sycamore Avenue, across Camino Alto and terminates at the headworks of the SASM treatment plant. This 30" trunk sewer is laid on a very flat grade and has a capacity of only 7.4 mgd. Under surcharge conditions, the capacity of this 30" sewer could approach 16 mgd.

In 1985, a parallel 21" relief sewer was constructed on Sycamore Avenue between Camino Alto and the SASM plant. The 21" relief sewer on Sycamore Avenue receives overflow from the 30" trunk sewer and has apparently eliminated the major overflows from this sewer. The combined capacity of the 30" and 21" sewers is 27.5 mgd. Surcharging very likely occurs upstream in the 30" trunk sewer which will cause surcharging in the Miller Avenue sewers and the Southside Collector Sewers as well as overflows from manholes with low rim elevations. Under surcharge conditions, sewage from the Miller Avenue sewers can backup through the Southside Collector sewer and overflow the weirs into the Camino Alto relief sewer and overwhelm the Camino Alto Pump Station.

PROBLEM AREAS

There are three areas along the Southside Collector Sewer where manholes tend to overflow during wet weather:

- The manhole on the Almonte Sanitary District collector at Tam Junction i.e. at the intersection of Shoreline Hwy and Almonte Blvd.
- Manholes on both the Almonte and TCSD collector sewers in Almonte Blvd between Wisteria Way and Rising Road.
- Manholes on Miller Avenue in the vicinity of Gomez Way.

The manholes at the first two locations are very shallow, approximately 2.5 to 4 feet, so it does not take much surcharging before the sewage can overflow into the street. The manhole at Tam Junction is at the far extremity of the Southside system and sewage must flow for a mile and a quarter before it reaches the 30" Mill Valley trunk sewer.

As the sewage starts to surcharge in the Southside Collector Sewer it will flow over the weirs in the two manholes on the Almonte and TCSD sewers in Almonte Blvd opposite Rising Road into the relief sewer leading to the Camino Alto Pump Station. When the sewage flows over the weirs, the water level in this system will be lowered thus in theory preventing the manholes from overflowing. However there are two problems with this configuration.

- Operation of the weir may not relieve the overflowing manhole at Tam Junction because the elevation of the weir on the Almonte sewer is 4.0 and the elevation of the manhole rim at Tam Junction is only 6.5 which is only a differential of 2.5 feet.

- If the Miller Avenue sewers are also surcharged, the overflow into the Camino Alto relief sewer can become uncontrollable and will overload the Camino Alto Pump Station because sewage can flow from both the south and the north. GUARANTEES A BIG PROBLEM IN MILLER AVE. A SMALL PROBLEM NOW.

In order to control this problem either the use of the relief sewer must be restricted by valving off a portion of the collector sewer to prevent the backflow of the sewage from Miller Avenue, or the surcharge of the Southside Sewer System must be relieved. This could be accomplished by constructing an interceptor sewer on Camino Alto between Miller and Sycamore Avenues, constructing a relief sewer parallel to Mill Valley's 30" trunk sewer, or by increasing the pumping capacity of the Camino Alto Pump Station. These alternatives are discussed below.

In the long term the wet weather flows should be reduced by eliminating infiltration inflow in the sewer systems and from private laterals. Because of the age and type of sewer pipe and joints in the tributary systems, it can be concluded that the I/I problem is widespread and reduction of wet weather flows by sewer system rehabilitation will be expensive and take many years. On the other hand, the problem of raw sewage overflows is an immediate one and can most easily be fixed by increasing the hydraulic capacity of the sewer system.

CAMINO ALTO PUMP STATION

The Camino Alto Pump Station is a wet well/dry well sewage pump station located at the northeast corner of Camino Alto and Miller Avenue. This pump station was constructed in 1973 and initially contained two pumps, a 15 HP single-speed pump and a 6 and 15 HP two-speed pump. In 1985, a third 8.4 and 15 HP two-speed pump was installed along with a 60 KW engine generator set. The calculated pumping capacity with the existing force main and with all three pumps running at 15 HP is 2.3 mgd.

The pump station pumps through a 10" diameter force main 1,080 feet long, located in the easterly side of Camino Alto. On the north side of the Arroyo Corte Madera del Presidio, the force main discharges to a 15" diameter gravity sewer which runs northerly along Camino Alto and then easterly on Sycamore Avenue to the SASM wastewater treatment plant. The last 200 feet of this sewer is 18" in diameter.

The existing pump station is closely designed around three 15 HP pumps with a 10" discharge force main and a 15" gravity sewer. Individually, each of the three pumps can pump 1.7 mgd. The combined pumping capacity of the Camino Alto Pump Station using all three pumps is 2.3 mgd. The limitations on increasing the pumping capacity are as follows:

Inlet Sewers - The inlet sewers are not limiting and have the potential to deliver more sewage to the Camino Alto Pump Station than it can presently pump. At the present time, there is an 8" and 15" sewer tributary to the Camino Alto Pump Station. Potentially, the 14" sewer, which was plugged off in 1985, could be reactivated.

- The 8" sewer runs easterly along Miller Avenue and serves the Redwoods and Pickleweed condominium developments. This is a local sewer and should have sufficient capacity to handle sewage from the connected residential development.

- The 15" relief sewer is laid on a grade of 0.225% and has a capacity of 1.9 mgd. Under surcharged conditions, this sewer could deliver more flow, possibly as much as 2.7 mgd; however, the manhole covers would need to be sealed to avoid overflows.

- When the relief sewer was constructed in 1985, the existing 14" sewer connecting the 15" sewers in front of Tamalpais High School was blocked off. If this line were reconnected, potentially an additional 5.0 mgd of flow could be received by the Camino Alto Pump Station assuming the two 15" sewers were surcharged.

Pump Station Structure - The Camino Alto Pump Station structure has sufficient room for the three existing sewage pumps. There is enough physical room to replace the existing pumps with larger pumps, but it would be difficult to install a fourth pump in the pump room. The pump station could be converted to a submersible station using the dry well as the pump pit.

Pump Suction Piping - The pump suction piping and inlet valve is 10" diameter. The eccentric reducers into the pumps are installed upside-down so that they can trap air and cause air locking and/or cavitation. These eccentric reducers should be inverted, which will require raising the pumps a few inches.

In order to reduce the possibility of cavitation, the velocity through the pump suction pumping should be limited to 5 ft/sec. This limits the pumping rate of each pump to 1,225 gpm (1.76 mgd). The velocity through the suction piping can be higher but cavitation is likely to occur which increases maintenance and reduces pump life.

When all three pumps are running, the flow through each pump is quite a bit less than the flow when one pump is operating alone because of the steepness of the system curve. Thus, at the pump station's peak pumping capacity of 2.3 mgd with all the pumps pumping, the flow through each pump is 0.77 mgd (533 gpm) which represents a velocity of around 2.2 ft/sec through the 10" suction piping.

Discharge Piping - The pump discharge piping and valves are 8" in diameter. Velocities in the discharge piping should be kept below 8 ft/sec, which limits the pumping rate of each pump to 1,250 gpm (1.80 mgd). As with the suction piping, when the pump station is pumping the peak rate of 2.3 mgd, each pump is pumping at a rate of 533 gpm which represents a velocity of 3.3 ft/sec through the 8" discharge piping.

CAN THESE BE EXCEEDED DURING WET WEATHER PUMPING GIVEN LIMITED DURATION OF HIGH FLOW CONDITION?

Electrical Equipment - The pump motors have size 2 starters. Size 2 starters will not operate motors larger than 15 HP. The wiring is also sized for 15 HP motors.

Engine Generator Set - The existing engine generator set is 60 KW which can drive the 3 - 15 HP motors plus the auxiliary equipment. The existing engine generator set does not have any surplus capacity to provide standby power for larger horsepower pumps.

Discharge Force Main - The discharge force main is 10" in diameter. Velocities in force mains should be limited to 8 ft/sec, which limits the peak pumping capacity of the Camino Alto Pump Station to 1,960 gpm, i.e., 2.8 mgd.

Discharge Gravity Sewer - The gravity sewer which receives the pump station discharge from the 10" force main is 15" diameter vitrified clay pipe laid on a grade of 0.59%. At an "n=0.013" friction factor for vitrified clay pipe, the capacity of this sewer when running full is 2,220 gpm, i.e., 3.2 mgd. The final 200 feet of 18" sewer is laid on 0.59% grade and has a capacity of 5.2 mgd when flowing full.

Possible Backup to 60 Camino Alto - A serious limitation to increasing the capacity of the Camino Alto Pump Station, as presently configured, is the fact that the lateral from the Mill Creek Apartments at 60 Camino Alto is connected to the manhole on the north side of the Arroyo Corte Madera del Presidio bridge. This manhole also receives the flow directly from the 10" force main from the Camino Alto Pump Station. Any surcharging in this manhole could back up into the plumbing of this housing complex. If a check valve were installed on the lateral to prevent a backup, surcharging might keep the check valve closed and prevent the sewage from being discharged into the sewer. Accordingly, the flow in the gravity sewer should be kept well below the capacity of the 15" sewer of 3.2 mgd.

DESIGN CRITERIA FOR SEWAGE PUMPING FACILITIES

Pump stations and force mains should be conservatively designed and should incorporate redundancy and reliability features. Ideally, standby pumping should be provided at all pump stations; however, at some pump stations this may be impractical.

"Wastewater Pumping Station Reliability Recommendations" dated October 1996, was prepared for the California Regional Water Quality Control Board San Francisco Bay Region. The objective of these criteria is to provide guidance for improving reliability features and operational procedures of sewage pump stations so as to minimize overflows and bypasses. The recommendations for sewage pump stations and force mains include the following:

- Provide peak flow pumping capacity with the largest pumping unit out of service.
- Protect the pump station from flooding by locating motors and electrical equipment above the level of maximum flooding.

- Provide a standby source of power for major equipment, lighting and instrumentation systems.

- Provide adequately sized pump suction and discharge piping.

- Use corrosion resistant materials.

- Telemeter alarms from each pump station to a central alarm panel or directly to maintenance personnel.

The existing Camino Alto Pump Station complies with most of the recommendations except the following:

- The station lacks adequate capacity for peak flow pumping with one pump out of operation under surcharge conditions if flows from Mill Valley back up through the SASM relief sewer.

INFLUENT SEWER IS LOWER THAN THE DRYWELL FLOOR.

- The pump motors and electrical equipment are located in the dry well which is below grade on a floor with an elevation of near zero mean sea level datum. Although the dry well is sealed from the sewage and the entrance to the pump station is above flood level, the possibility still exists that a pipe could break and flood the dry well.

PUMP STATION UPGRADING

The Camino Alto Pump Station equipment and electrical work, together with its discharge force main and sewer are all closely designed around a pumping capacity of 2.3 mgd. Larger pumps could be installed in the pump station, which would require modification of the wiring and electrical work and a larger engine generator. However, the 10" force main and 15" gravity sewer becomes limiting between 2.8 and 3.2 mgd. The most serious limitation is the downstream sewer which has a connection from the residential development at 60 Camino Alto, which means that it cannot be allowed to surcharge.

The existing 15" relief sewer alone can deliver up to 2.7 mgd to the Camino Alto Pump Station. Additional flows up to almost 8.0 mgd could be delivered to the pump station by reactivating the 14" interconnecting line from the Tamalpais High sewer.

It would be best to upsize in all three pumps to obtain the combined pumping rate of 2.8 mgd to avoid cavitation in the suction piping. The impellers on the existing pumps would be changed and the 15 HP motors would be replaced with 25 HP motors. The motor speed would remain 1,160 rpm. When one pump is pumping, the velocity through the 10" suction piping would be 6.1 ft/sec and the velocity through the 8" discharge piping would be 9.6 ft/sec. When all three pumps are pumping, the suction piping velocity would be 2.7 ft/sec and the discharge piping velocity would be 4.1 ft/sec.

In order to accommodate larger horsepower pumps, the motor control center and engine generator would have to be replaced and adjustable frequency drives should be installed on all these pumps. The new motor control center should be installed on top of the station so there is no possibility of flooding.

As an alternative, one pump could be enlarged by changing the impeller size and installing a 40 HP motor. In this case, some cavitation would most likely occur in the suction piping requiring increased maintenance. With proper lockouts, the two small pumps could be prevented from operating when the large pump is operating. The existing engine generator would be able to start the one 40 HP motor with the appropriate "soft start" equipment. The one 40 HP pump would be able to pump 2.8 mgd but the two 15 HP pumping together would still only pump about 2.3 mgd. This modification could be achieved for around $16,000 and could be the first step in modernizing this pump station. When the pump station is finally modernized, use of 3 - 25 HP pumps should be considered in order to keep pump suction velocities low.

In order to obtain a large increase in the capacity of the Camino Alto Pump Station, it will be necessary to construct a new discharge force main along with increased pumping capacity. To obtain a large increase in pumping capacity, it would be most expedient to convert the Camino Alto Pump Station to a submersible type station.

ALTERNATIVE PROJECTS

The purpose of this study is to develop a project or projects which will reduce the surcharging in the Southside Sewer System and reduce the frequency of wet weather overflows from manholes. Basically there are three locations where manholes overflow, (1) from the Almonte Sanitary District sewer at Tam Junction, (2) from the Almonte Sanitary District and TCSD sewers on Almonte Blvd southerly of Rising Road and (3) from the Mill Valley sewer on Miller Avenue near Gomez Way.

In order to address the immediate problem of reducing wet weather sewage overflows the following strategies have been considered:

1. Divert wet weather flows from the most remote portions of the Southside sewer system directly to the Camino Alto pump station and restrict sewage from other parts of the system from flowing to Camino Alto.

2. Provide a relief point for the Southside Sewer System so that it does not surcharge.

WORST CASE FOR MILLER. PUSHES MOST OF ALMONTE WW Q TO MILLER & NO RELIEF

These two strategies are reflected in the following alternatives:

ALTERNATIVE A - Under Alternative A, a portion of the Southside Collector Sewer would be valved off and the flow received by the Camino Alto Pump Station would be restricted to only the wet weather flows from the Rosemont Pump Station and that portion of the Almonte Sanitary District southerly of Rising Road. As a first Stage, the Almonte Sanitary District sewer on Almonte Blvd opposite Rosemont Avenue would be connected to the deeper TCSD sewer serving Kay Park and tributary to the Rosemont Pump Station. Such a diversion would eliminate the overflowing

manhole at Tam Junction. The Rosemont Pump Station has recently been modernized and now has a greater pumping capacity than before. A flow meter has also been installed at the pump station so the existing flow as well as the results of any diverted flow from the Almonte Sanitary District sewers can be quantified.

As a part of this initial step, the capacity of one of the pumps at the Camino Alto Pump Station should be increased by installing a 40 HP motor as described above. Use of the 40 HP motor is not ideal because of the high velocities in the suction piping and when the pump station is eventually modernized, the pumps should be more closely matched.

1ST STEP

It might be possible that the increased capacity of 2.8 mgd achieved by the 40 HP pump would be sufficient to eliminate the wet weather overflows from the Southside Sewer System. This effect should be monitored during the wet season.

EXPENSIVE. DON'T SEE THAT MUCH IS GAINED.

As the second Stage, the 12" TCSD gravity sewer on Almonte Blvd which receives the discharge from the Rosemont Pump Station should be slip lined with a 10" diameter force main thus eliminating the possibility of sewage overflows from the shallow manholes on the TCSD sewer. As an interim measure, these manhole lids should be sealed in Stage 1. In addition, the existing 8" asbestos cement force main from the Rosemont Pump Station would be "pipe-burst" and replaced with a 10" force main with a valve to the Camino Alto relief sewer. At Rising Road, a plug or valve would be installed in both the Almonte and TCSD sewers in order to divert only the wet weather flows from the south to the Camino Alto relief sewer and prevent sewage from backing up from Mill Valley. This would help eliminate wet weather overflows from the Almonte Sanitary District collector on Almonte Blvd. ?

During dry weather, the sewage could continue to flow through the Southside Collector to the Miller Avenue sewer. It is possible that the SASM relief sewer could be used for dry weather as well as wet weather flows; however the relief sewer was not constructed on a uniform grade because of utility conflicts and there are two sags in the line. Wet weather flows would be more likely to keep the sags clean. THIS IS OUR EXPERIENCE

Northwesterly of Rising Road sewage would continue to flow through Tamalpais High to the Mill Valley sewer system on Miller Avenue. It is possible that once the sewage from Kay Park and approximately one-half of the Almonte Sanitary District is removed from this line that the frequency of overflows from manholes on Miller Avenue will be reduced. If wet weather overflows persist in the Miller Avenue sewers and reduction of I/I is not immediately possible then it may become necessary to construct a relief sewer on Camino Alto (Alternative B), construct a relief sewer on Sycamore Avenue (Alternative C), or enlarge the Camino Alto Pump Station (Alternative D). I WOULD EXPECT THIS OPPOSITE

Since there is no way to easily measure wet weather flows in surcharging sewers it is not possible to precisely predict the ability of the Rosemont or Camino Alto Pump Stations to handle the diverted flows. Accordingly Alternative A should be implemented in stages so that the effect of each stage on the existing facilities can be evaluated.

As a final stage to this alternative, it is recommended that the Camino Alto Pump Station be modernized and the pumping capacity be increased to the capacity of the existing 10" force main and gravity sewer. Depending on the results achieved by diverting the Kay Park and southerly Almonte Sanitary District flows and preventing the backflow of sewage from Mill Valley it might be possible to delay the modernization of the Camino Alto Pump Station.

The following are the estimated costs for the various stages of the Alternative A project:

Stage A-1 Connect the Almonte Collector to the TCSD sewer at Rosemont Avenue, install temporary plugs in the Almonte and TCSD sewers on Almonte Blvd near Rising Road to prevent flows from backing up from Mill Valley, and install a 40 HP pump in the Camino Alto Pump Station. Stage A-1 is shown in Figure 3.

SUGGEST MORE INCREMENTAL APPROACH
1. 40 HP pump
2. MONITOR
3. ASD to TCSD RELIEF & SEWER TCSD MH'S
4. MONITOR
5. RETESTESS

40 LF 12" Sewer across Almonte Blvd	$12,000
Seal Manholes TCSD Sewer	2,000
Temporary Plugs	1,000
Install 40 HP Pump at Camino Alto Pump Station	16,000
Subtotal Construction Cost	$31,000
Contingencies and Incidentals	9,000
TOTAL ESTIMATED COST	$40,000

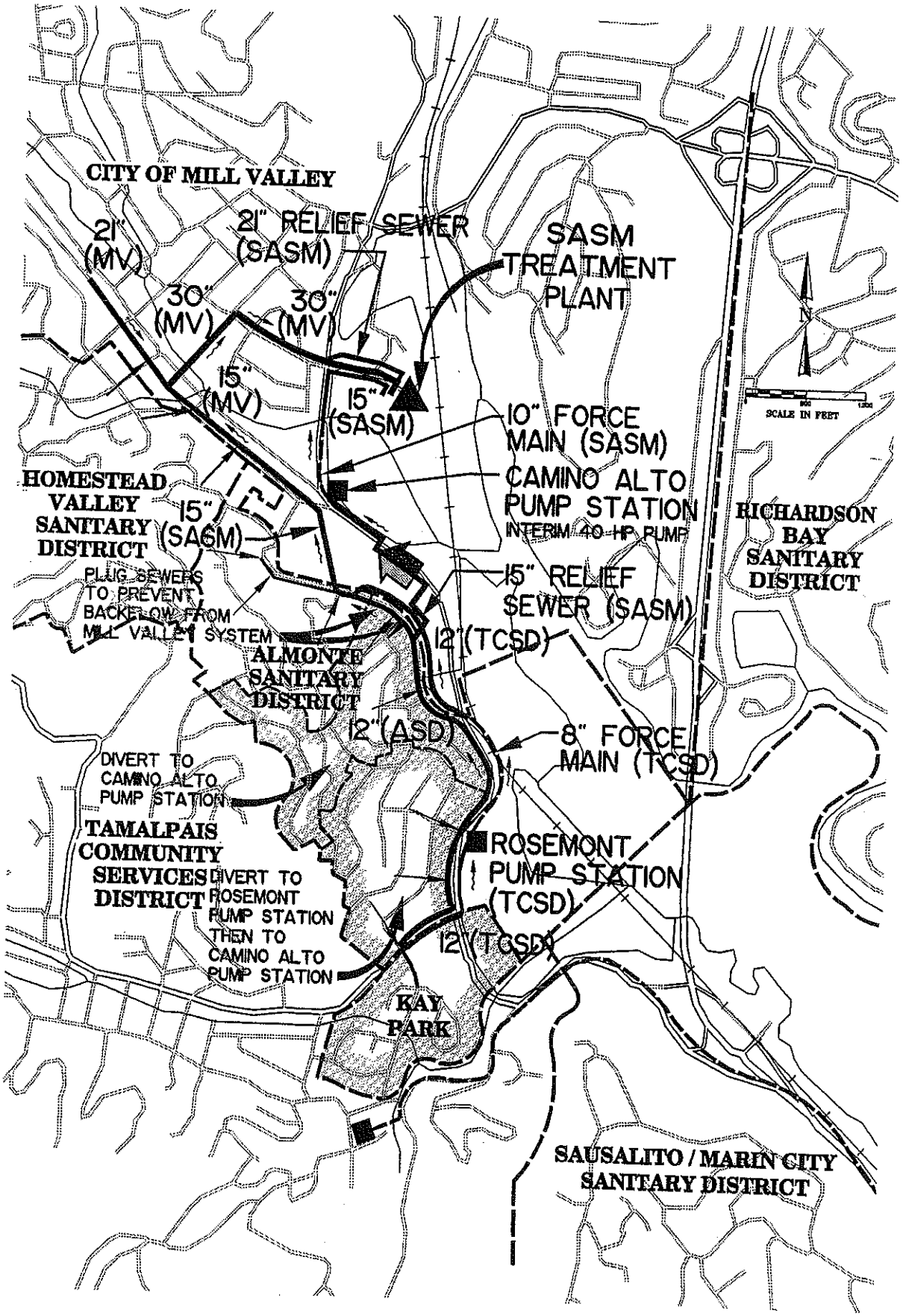
Stage A-2 Replace and extend the Rosemont force main with a 10" line to the Camino Alto relief sewer. Construct a valved manhole on the Almonte collector sewer at Rising Road to divert wet weather flows to the Camino Alto relief sewer.

40 LF 12" Sewer across Almonte Blvd	@ $200/LF	$ 8,000
880 LF 10" Force Main - Pipeburst exist 8" ACP	@ $70/LF	61,600
1320 LF 10" Force Main - Slipline exist 12"VCP	@ $60/LF	79,200
2 Only Valves in 10" Force Main	@ $3,000	6,000
1 Only Valved Manhole at Rising Road	@ $6,000	6,000
Subtotal Construction Cost		$152,800
Contingencies and Incidentals		47,200
TOTAL ESTIMATED COST		$200,000

As a minimum, Stages A-1 and A-2 must be undertaken in order to eliminate the overflowing manholes on Almonte Blvd.

MAYBE NOT

Stage A-3 Improve and modernize the Camino Alto Pump Station in order to provide 2.8 mgd pumping capacity as limited by the existing 10" force main and downstream sewer. In order to increase the pumping capacity, new impellers would be installed in the existing three sewage pumps and new 25 hp motors will be installed. New electrical equipment including adjustable frequency drives for each pump would be provided and will be housed in a new motor control center mounted above grade where there is no possibility of flooding. Standby power for two of the 25 HP pumps could continue to be provided by



SOUTHSIDE SEWER SYSTEM SURCHARGE STUDY
STAGE A-1

FIGURE 3

the 60 KW engine generator set with proper lockouts. The estimated cost of this Stage is as follows:

3 Only Pump Impellers w/Installation	$ 5,000
3 Only 25 HP Motors	9,000
Estimated Electric Controls w/AFD's	65,000
1 Only 60 KW Engine Generator Set Replacement	60,000
Estimated Miscellaneous Improvements	20,000
Subtotal Construction Cost	$159,000
Contingencies and Incidentals	51,000
TOTAL ESTIMATED COST	$210,000

ALTERNATIVE B - Under Alternative B, a new interceptor sewer would be constructed on Camino Alto between Miller Avenue and Sycamore Avenue. The purpose of this relief sewer would be to prevent the Southside Sewer System from surcharging. Unfortunately, the elevations would not allow this sewer to replace the Camino Alto Pump Station. An added expense to this alternative is the need to construct a siphon under the bridge over Arroyo Corte Madera del Presidio. The capacity of this relief sewer should be at least 5.0 mgd, requiring a 24" line, which is the combined capacity of the two 15" sewers under surcharged conditions.

1,400 LF 24" Sewer	@ $180/LF	$252,000
1 Only Double Siphon		200,000
5 Only Manholes Directional Drilled	@ $3,500	17,500
Subtotal Construction Cost		$469,500
Contingencies and Incidentals		140,000
TOTAL ESTIMATED COST		$610,000

ALTERNATIVE C - Under Alternative C, a new relief sewer would be constructed parallel to Mill Valley's 30" trunk sewer. The estimated cost of a new 24" relief sewer from Miller Avenue to the SASM treatment plant is given below.

2,670 LF 24" Relief Sewer	@ $150/LF	$400,500
9 Only Manholes	@ $3,500	31,500
Subtotal Construction Cost		$432,000
Contingencies and Incidentals		128,000
TOTAL ESTIMATED COST		$560,000

ALTERNATIVE D - Under Alternative D, the capacity of the Camino Alto Pump Station will be increased to handle all surcharged flow from the Southside Collector Sewer including reconnection of the 14" intertie sewer in front of Tamalpais High. Under this alternative the Camino Alto Pump Station would be enlarged to handle a flow of 8.0 mgd which is the calculated flow which can be delivered through a combination of the 15" relief line and a restoration of the 14" sewer connection in front of Tamalpais high. Since the existing Camino Alto Pump Station has an existing capacity of 2.3 mgd and the downstream force main has a capacity of 2.8 mgd under

this alternative the pump station would have to be significantly enlarged and a new 18" force main would have to be constructed from the pump station to the SASM plant.

The impellers in the three existing pumps could be enlarged and 40 HP motors could be installed. A new 120 KW engine generator set would be installed. The estimated cost of this alternative is as follows:

Camino Alto Pump Station Improvements:	
Reconnect 14" Sewer at Tamalpais High	$ 10,000
Estimated Mobilization and Temporary Pumping	20,000
3 - New Pump Impellers	5,000
3 Only - 40 HP motors	12,000
1 Only - 120 KW Engine Generator Set	72,000
Estimated Piping and Mechanical	40,000
Estimated Structural Work	10,000
Estimated Electrical Controls w/AFD	90,000
Estimated Miscellaneous	20,000
Force Main to SASM Plant:	
2,200 LF 18" Force Main @ $160	352,000
Estimated Air Release Valves and Connections	12,000
Subtotal Construction Cost	$643,000
Contingencies and Incidentals	97,000
TOTAL ESTIMATED PROJECT COST	$840,000

MONITORING

Considering the high cost of the major sewer construction in Alternatives B, C and D, it would be reasonable to undertake Stages A-1 and A-2 first and evaluate the results after each stage to determine the nature of the future enlargement necessary. Stage A-1 is the only way to eliminate the overflows from the manholes at Tam Junction and along Almonte Blvd. If the Camino Alto Pump Station is still overwhelmed or if overflows still occur on Miller avenue then the decision may need to be made to undertake the major enlargement of the Camino Alto Pump Station or to construct another relief sewer on Sycamore Avenue.

The operation of the Southside Sewer System should be monitored over the next few years so that an evaluation can be made of the effectiveness as each project stage is implemented. The monitoring outlined below will have the following specific purposes:

1. Evaluate the capacity of the Rosemont Pump Station to accept more flows from the Almonte Sanitary District

2. Evaluate the capacity of the Camino Alto Pump Station to accept the flows diverted from the Southside Collector Sewer

3. Evaluate the surcharge characteristics of the 30" sewer on Sycamore Avenue

The following are the recommended monitoring procedures:

1. Analyze flow records from the flow meter at the Rosemont Pump Station.
2. Analyze pump run times at the Camino Alto Pump Station.
3. Install and monitor surcharge gauges in the following manholes:

   Manhole at Tam Junction on the Almonte Sanitary District sewer

   Two manholes which contain the overflow weirs to the Camino Alto relief sewer

   Manhole on Miller Avenue at Tamalpais High

   Manhole on Miller Avenue on the 30" sewer

   Two manholes on Sycamore Avenue on the 30" sewer

4. Investigate the connection at 60 Camino Alto to determine its location and elevation with respect to the SASM sewer which receives flow from the Camino Alto Pump Station.
5. Smoke test the Southside Collector sewers including Mill Valley's 30" trunk sewer and the SASM relief sewers to determine if there are any direct drainage connections or overflows.

SUMMARY EVALUATION

The Southside Collector Sewer System extends some 6,500 feet from Tam Junction to the 30" trunk sewer on Miller Avenue north of Reed Street. During wet weather, this collector sewer surcharges and overflows occur at several locations on Almonte Blvd and Miller Ave.

In 1985, a relief sewer was installed from Almonte Blvd to the Camino Alto Pump Station with the intention to direct excess wet weather flow and pump these flows directly to the SASM Treatment Plant. However, during wet weather when the Southside System surcharges, the excess flow exceeds the pumping capacity of the Camino Alto Pump Station.

The Camino Alto Pump Station has a pumping capacity of 2.3 mgd. The pumping capacity could be increased to 2.8 mgd without enlarging the force main or downstream sewer. A major capacity increase in the Southside Collector sewer system will involve either construction of a new interceptor sewer on Camino Alto, construction a new relief sewer to Mill Valley's 30" trunk line, or a major enlargement of the Camino Alto Pump Station. A summary of the costs of these alternatives is given below.

In order to address the immediate problem of reducing wet weather sewage overflow, the following program is recommended:

1. As a first stage, it is recommended that wet weather flows be diverted from the most remote portions of the Southside Sewer System directly to the Camino Alto Pump Station and that sewage from other parts of the system be prevented from flowing to Camino Alto. This involves construction of a connection from the shallow Almonte Sanitary District Collector sewer at Tam Junction to the deeper TCSD sewer serving Kay Park and sealing manholes on the TCSD sewer in Almonte Blvd at an estimated cost of $20,000.

2. As a second stage, it is recommended that a new 10" force main be installed from the Rosemont Pump Station, together with valves, to isolate the Shoreline Hwy Collector on Almonte Blvd near Rising Road. The estimated cost of this initial project is $200,000.

3. Before proceeding with a project to relieve the remaining wet weather surcharging of the Southside Collector Sewer, it is recommended that the flow meter at the Rosemont Pump Station be monitored and surcharge gauges be installed at various manholes in the Southside Collector Sewer. The pumping times of the Camino Alto Pump Station should also be monitored.

4. The results of the wet weather monitoring outlined above should be analyzed to determine whether any of the wet weather overflows persist. If wet weather overflows continue, then it will be necessary to decide how the surcharging of the Southside Intercepter can be further relieved.

5. The alternatives for relieving the surcharging of the Southside interceptor should be analyzed further.

SUMMARY OF ALTERNATIVES

	ALTERNATIVE A SEPARATION OF SEWER AVENUES	ALTERNATIVE B CAMINO ALTO INTERCEPTOR	ALTERNATIVE C SYCAMORE AVE RELIEF SEWER	ALTERNATIVE D CAMINO ALTO P.S. ENLARGEMENT
Stage A-1	$ 40,000	$ 40,000	$ 40,000	$ 40,000
Stage A-2	200,000	200,000	200,000	200,000
Stage A-3	210,000	210,000	210,000	
Alternative B Project		610,000		
Alternative C Project			560,000	
Alternative D Project				840,000
TOTAL	$450,000	$1,060,000	$1,010,000	$1,080,000

ABBREVIATIONS

gpm - gallons per minute
HP - horsepower
KW - kilowatt
mgd - millions gallons per day
ft/sec - feet per second

S A S M
SEWERAGE AGENCY OF SOUTHERN MARIN

A Joint Powers Agency

- Almonte S.D.
- Alto S.D.
- City of Mill Valley
- Homestead Valley S.D.
- Richardson Bay S.D.
- Tamalpais C.S.D.

Date: October 16, 1997

Memo to: Almonte Sanitary District, Tom Roberts
Homestead Valley Sanitary District, Larry Glazier
City of Mill Valley, Ed Marshall
Tamaplais Community Services District, Mark Miller

From: David A. Coe
Manager

Subject: SouthSide Sewer System Surcharge Study
Stage A-1 construction

We hired Nute Engineering to conduct the Southside Sewer System Surcharge Study in June. Ed Nute presented the results of his study to us yesterday in a meeting at SASM. Nute's complete report is attached.

As a group, we agreed to implement a modified version of Nute's "Stage A-1" recommendation as follows:

Connect Almonte sewer to TCSD Rosemont pump station $12,000
40 feet of 12" sewer in Almonte Boulevard
Install adjustable overflow point on Almonte sewer

Seal manholes on TCSD sewer in Almonte boulevard $2,000

Install 40 HP pump at Camino Alto pump station $16,000

Contingency $10,000

Total $40,000

We also agreed to request approval of a four way split of this cost from our respective governing bodies as follows:

Almonte Sanitary District $10,000

Homestead Valley Sanitary District $10,000

City of Mill Valley $10,000

Tamalpais Community Services Distrcit $10,000

P.O. Box 1029 - Mill Valley, California 94942 Tel: (415) 388-2402 Fax: (415) 381-8128

Pending approval of all four agencies, SASM staff will proceed to manage the construction of all Stage A-1 projects.

SASM staff will also conduct wet weather monitoring this winter as recommended in Nute's report.

Please report the position of your agency regarding funding of this work as soon as possible.

enclosure
c: Ed Nute, w/o enclosure
SASM Board of Directors, w/o enclosure

Attending the October 15, 1997 SSSSSS meeting

ASD	Robert Rames, Tom Roberts
HVSD	Larry Glazier
MV	James Powell, Ed Marshall
TCSD	Bob Bunce, (Mark Miller was called away as the meeting began)
SASM	David Coe, Bonner Beuhler

Appendix E

Agenda Explanation
SASM Board Meeting
April 16, 1998

Item No. 7
Private sewer lateral testing
The Board directed staff in November, 1997 to research the feasibility of implementing a private lateral certification program in the SASM service area.

Infiltration into the sewer system during periods of heavy rainfall continues to be a problem. Minor overflows occur at some points in the collection system and Treatment Plant flows have exceeded the capacity of the plant on two occassions in the past four years as a result of rainwater intrusion into the sewer system.

One approach to reducing the amount of rainwater intrusion into the sewer system is to inspect and repair private property sewer laterals. SASM conducted extensive study of the SASM service area in the early 1980's in order to determine the source of rainwater inflow and infiltration. These studies indicated that in terms of frequency, as much as 20% of the points of rainwater intrusion may be coming from private property laterals. Over 600 private property problems were identified by smoke testing the entire sewer system. Most of these were determined to be very minor, however, SASM initiated a program to require 172 property owners to make repairs in 1985 and 1986. Staff is not aware of any other activities since that time to correct problems with private property laterals.

Staff has surveyed all major wastewater treatment agencies in Marin County and determined that there are no programs in this county that are designed to deal with private property problems. It appears however that there are many such programs in the East Bay. Staff contacted two East Bay Cities (Alameda and Albany) and learned that these Cities and others in the East Bay have implemented programs to reduce rainwater intrusion into private laterals.

Alameda requires inspection, testing (and repair if necessary) of private laterals whenever property that is over 25 years old is sold. This program has been in place since 1989 and experience shows that about 85% to 90% of the laterals tested in the older parts of town require replacement. Alameda's staff estimates the cost of inspection and testing at about $300 (includes installation of a 2-way cleanout) and lateral replacement from $2,500 to $5,000. This program was poorly received at first but is now considered to be business as usual. There is no data on benefit or reduction in rainwater intrusion.

SASM Board Meeting, April 16, 1998
Item No. 7 - Private sewer lateral testing (continued)

Albany's program is a little over two years old and testing is required for any property that is sold. Albany's staff advises that approximately five inspections per week are performed and data for the period January, 1996 through September, 1997 shows an average of one lateral replacement per week. Albany staff estimates the cost of testing at $625 to $925 and lateral replacement at $1,500 to $2,000. Nute Engineering estimates that the annual reduction in rainwater intrusion as a result of this program is about 60,000 gallons per day.

Albany's population is 17,000 and SASM's population is 25,000. The sewer systems and homes are similar in age - from very old to fairly old with some new development. If the Albany procedure and estimates are extrapolated for the SASM service area, it is possible that over a ten year period, a reduction in rainwater intrusion of 880,000 gallons per day might be realized at an approximate cost to property owners of $5,000,000 ($5.7 million dollars per MGD). These are extremely rough estimates. 880,000 gpd represents 2.8% of SASM's peak wet weather flow.

There are approximately 10,000 private property sewer laterals in the SASM service area. If the Albany estimates are applied to SASM, and **all** private laterals are inspected and repaired, the calculated reduction in peak wet weather flow is 2.2 MGD or 7% of SASM's peak wet weather flow. This suggests that the majority of the rainwater intrusion problem exists in the public systems.

SASM legal counsel, Bill Esselstein, was asked for a cursory opinion on this matter. He advises that SASM probably can't require the Member Agencies to specifically adopt a private property lateral inspection and repair program. However, if SASM can demonstrate great risk (eg. routine exceedance of plant capacity due to rainwater intrusion) and an inability to feasibly correct in another way, SASM can require the Member Agencies to restrict wet weather discharge to their proportionate share of the plant capacity. Wet weather capacity rights are easily established, but staff is unsure how compliance would be measured.

This item is submitted for discussion and/or action at the discretion of the Board.

David A. Coe
Manager

PRIVATE PROPERTY LATERAL REPAIR
PERFORMANCE ESTIMATES

FLOW REDUCTION

$\frac{25,000}{17,000} \times 60,000 \text{ gpd} \times 10 \text{ yrs} = \frac{880,000 \text{ gpd}}{10 \text{ yr}}$

% FLOW REDUCTION

$\frac{880,000}{32,000,000} = 2.8\%$

LATERAL REPLACEMENT COST

$\frac{880,000}{1,070} = 822 \times \frac{\$2500}{\text{LATERAL}} = \$2,055,000$ ~~\$2,000,000~~

TESTING COST

822 x 5 = 4110 (REASONABLE? ABOUT 1/3 OF HOMES IN SAME SERVICE AREA SOLD IN 10 YEARS? I GUESS)

4110 x 700 = $2,877,000

TOTAL COST

2,055,000 + 2,877,000 = $4,932,000

SAY $5,000,000

UNIT COST

$\frac{\$5,000,000}{880,000 \text{ gpd}} = \frac{\$5.70}{\text{GPD}} = \frac{\$5,700,000}{\text{MGD}}$

APPROXIMATELY 10,000 PRIVATE PROPERTY LATERALS IN SMSM

IF 1 IN 5 NEED REPAIR (PER ARBAWA), POSSIBLE MAX. REDUCTION IF ARC ARE REPAIRED

2000 x 1070 = 2.15 MGD

Private property sewer lateral testing and repair

4/6/98

Bill Esselstein's first cut response ...

SASM probably can't require MA's to specifically adopt a private property lateral inspection and repair program.

However, if SASM can demonstrate great risk (eg routine excession of plant capacity due to I/I) and an inability to correct in any other way, SASM can require MA's to meet certain standards (eg maximum flow rates that don't exceed MA capacity rights).

DC. How to measure compliance? If it can be done (and I am doubtful), the cost will be prohibitive.

Bill does not know of any other Regional Agency that has placed I/I standards on its Members.

ALAMEDA LEE JONES 510-748-4563

INSTALL LINERS (2 INAM CO.) 100-300

INCLUDES EXFIL. TEST

REPLACE LATERAL 2500-5000

85%-90% NEED IT IN OLD PIPES

60'S - MOST O.K.

BEGAN IN '89

POORLY REC'D AT 1ST. NO BIG DEAL NOW.

NO DATA ON BENEFIT OR REDUCTION IN I/I

Appendix F

Date of Hearing: May 13, 2009

ASSEMBLY COMMITTEE ON LOCAL GOVERNMENT
Anna Marie Caballero, Chair
AB 1232 (Huffman) – As Amended: May 7, 2009

SUBJECT: Local agency formation commissions: powers and duties.

SUMMARY: Allows the Marin County Local Agency Formation Commission (LAFCO), when specific conditions are met, to initiate and approve the consolidation of small wastewater agencies, without protest hearings. Specifically, this bill:

1) Provides the Marin LAFCO, after notice and hearing, with the power to initiate and approve a reorganization or consolidation of small wastewater agencies, without protest hearings, if all of the following conditions exist:

   a) The Marin LAFCO, in its municipal services review (MSR) of the wastewater agencies, completed within the last 10 years, makes findings or determinations related to reorganization or consolidation, that if implemented, would improve the financial and service level benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers;

   b) The wastewater agencies have not implemented LAFCO's findings or determinations as provided in the MSR; and,

   c) The wastewater agencies affected have had three or more illegal discharges in the last five years, based on violations identified by the San Francisco Regional Water Quality Control Board (SFRWQCB) that exceed 5,000 gallons of untreated or partially treated wastewater to waters of the state.

2) Defines "small wastewater agencies" to mean sanitation districts and local governments that provide sewer and wastewater collection or treatment services to 10,000 service connections or less.

3) States that the provisions of this measure will become effective on January 1, 2011.

4) Makes findings and declarations about the impact of illegal sewage spills.

5) Declares that this bill is a special statute because of the unique circumstances applicable to the County of Marin.

EXISTING LAW:

1) Establishes the procedures for the organization and reorganization of cities, counties, and special districts under the Cortese-Knox-Hertzberg Local Reorganization Act of 2000 (Act).

2) Allows a LAFCO to initiate proposals for changes or organization, including consolidation.

3) Defines "change of organization" in the Act to include consolidation of cities or special districts.

4) Defines "proceedings" to mean proceedings taken by the LAFCO for a proposed change of organization or reorganization.

5) Provides for noticing requirements for a protest hearing, and specifies that during the hearing the LAFCO shall hear and receive any oral or written protests, objections, or evidence that is made, presented or filed.

6) Provides that a proposal for change of organization must be abandoned if a majority protest is deemed to exist.

7) Requires a LAFCO to revisit its municipal service reviews and adopted spheres of influence every five years.

FISCAL EFFECT: Unknown

COMMENTS:

LAFCO LAW: PROCESS FOR CONSOLIDATION OF DISTRICTS

1) Current law specifies various ways that special districts and other agencies can be reorganized and modified, including consolidation, dissolution, including dissolution with annexation, a merger, or establishment of a subsidiary district. AB 1232 focuses on consolidation – the formal restructuring transactions that would combine two or more agencies into a single organization and would require a formal LAFCO review and approval process – as the means to modify special districts. A consolidation can be initiated by a petition of registered voters or landowners, by a resolution of the governing body of an affected local agency, or by LAFCO itself.

BACKGROUND OF MARIN SITUATION

2) AB 1232 originates from problems in eleven sewer services agencies located in southern Marin County, including six sanitary districts, three cities, one community services district and one joint powers agency. Three of the agencies operate wastewater treatment plants – Sanitary District No. 5 (Tiburon), the Joint Powers Agency (Sewerage Agency of Southern Marin – SASM), and the Sausalito-Marin City Sanitary District (SMCSD). Ten of the eleven agencies operate sewerage collection systems and pumping stations. All of the special districts providing sanitary sewer services are governed by independent boards, except for SASM, whose members are appointed by each of its six member agencies.

3) The author notes that "the frequency and size of illegal sewage spills of raw or partially treated sewage are increasing often because of the improper sewer system maintenance. By providing limited new authority to a LAFCO, AB 1232 would increase the cost effectiveness and efficiency of small wastewater agencies and reduce the impacts on water quality due to illegal sewage spills. The San Francisco Bay Regional Water Quality Control Board reports that over 2,000 separate illegal sewage spills occurred in the bay and coastline between 2004 and 2007. Over 500 of the spills exceeded 1,000 gallons. One of the largest spills was 2.5

million gallons in Marin County which illegally discharged both untreated and partially treated sewage into the San Francisco Bay."

4) In 2004, the Marin County Grand Jury (Grand Jury) released a report on the southern Marin districts entitled "Southern Marin Sewers – So Many Districts, So Few Users." The Grand Jury reviewed the operations of the eleven agencies and found that, for the most part, these agencies "appear to be operating in a responsible and environmentally sound manner." The Grand Jury pointed out that the "the unique patchwork quilt of agencies, however, lacks a forum for cooperatively examining transcend district boundaries." The Grand Jury recommended:

   a) A periodic forum for interagency information sharing, discussion, and dispute resolution be established;

   b) A facilitator-run meeting of the eleven agencies involved in southern Marin's wastewater collection be held to identify opportunities for consolidation, collaboration, and cooperation; and,

   c) The opportunities identified in the facilitated meeting become the basis for an in-depth study of consolidation options.

5) In 2005, to reduce water quality problems and to increase system efficiencies, the Marin County LAFCO conducted an MSR and recommended a consolidation plan for the eleven small wastewater agencies in southern Marin County. The report concluded that the operation of numerous separate agencies with duplicated staff, and over 40 elected officials, is not a cost effective way to manage the single purpose service of wastewater collection and treatment. The MSR identified significant cost savings for the ratepayers that would occur if agency functions were consolidated.

6) In a November 7, 2008, memo from the Executive Director of the Marin County LAFCO to members of the LAFCO, it was noted that the "Commission's actions in 2005 [through the MSR] recognized the need for evolutionary change to southern Marin sewer agencies and emphasized the efficiencies available from functional consolidation as a preparation for eventual political consolidation. SASM and its member agencies then initiated but quickly discontinued a series of cooperative actions to achieve those efficiencies" meaning that the districts in southern Marin did convene meetings, as suggested in the Grand Jury report, to identify opportunities for collaboration and consolidation, but the collaborative approach was stopped shortly thereafter.

PROVISIONS OF AB 1232

7) This bill sets up a process that would allow Marin LAFCO to force the consolidation of small wastewater districts, when specific conditions are met, without protest hearings. The specific conditions provided in the bill are the following:

   a) Small wastewater agencies provide services for up to 10,000 service connections; and

   b) The Marin LAFCO's MSR (completed in the prior 10 years) recommends consolidation or reorganization that, if implemented, would improve the financial and service level

benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers.

c) The wastewater agencies affected have had three or more illegal discharges of untreated or partially untreated wastewater that exceed 5,000 gallons in the previous five years, as identified by the San Francisco Regional Water Quality Control Board.

IS CONSOLIDATION OF DISTRICTS THE ANSWER?

8) Protest proceedings are established in existing law to allow registered voters and landowners to give oral or written protests against a change of organization. AB 1232 removes the ability of the Marin LAFCO to hold protest hearings for public input and for an affected district to speak and deliberate in a public forum on the issue of forced consolidation and whether it is the best option for the community. Protest proceedings are removed from the bill because, according to the author, "there has been strong local agency resistance to consolidation. That resistance has made it impossible under existing laws to implement the LAFCO consolidation recommendation because existing law requires a majority of voters in the affected districts to approve the consolidation."

9) There is the potential that a district would be forced, against its will, under the provisions of this bill, to consolidate with other districts or agencies. An unwilling district could then sue LAFCO because LAFCO would be the entity that initiates the forced consolidation. The Committee may wish to consider whether Marin LAFCO would ever use this process, given the legal implications.

10) In their initial letter of concern, the California Association of Sanitation Agencies (CASA), writes:

"CASA's major concern is that LAFCOs have little expertise in water quality or wastewater treatment issues. CASA feels the more appropriate way to address sanitary sewer overflows (SSOs) is pursuant to existing statutory and regulatory requirement under the Clean Water Act and Porter Cologne Act, or direct consolidation such as designating agencies to be consolidated in legislation. To provide a consistent, statewide regulatory approach to address SSOs, the State Water Resources Control Board adopted Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans and report all SSOs to the State Water Board's online SSO database. Consequently, we feel that the [CAL] EPA, State Water Board, and Regional Boards are in a far better position to address SSOs than are LAFCOs. In fact it is our understanding that the particular agencies contributing to recent spills are currently under EPA orders."

11) Clean Water Action and San Francisco Baykeeper, writing in support of AB 1232, note that "illegal sewage spills of raw or partially treated sewage occur frequently in the Bay Area when heavy rains infiltrate aging pipes and overwhelm poorly maintained sewer systems. This problem has been particularly evident in Marin, where small wastewater agencies have had a history of capacity and compliance issues....the problem is a systemic one and requires a change to the wastewater management framework." Additionally, "small wastewater

agencies, like the eleven small agencies in southern Marin, are often unable or unwilling to bear the high cost of maintenance and repair of sewer lines and treatment plants."

12) In their opposition letter, Ross Valley Sanitation District (located in central Marin County), notes that "(1) it is unfair for any LAFCO to impose reorganization or consolidation of any public agency without the opportunity for a protest hearing, and (2) if the bill is intended to affect southern Marin then the language should be explicit to southern Marin."

13) While consolidation of smaller agencies may increase administrative effectiveness and provide for better management of those agencies, there are no guarantees that consolidation is the answer to the question of how to prevent illegal sewage discharges. There may be other avenues to pursue that would help sanitary districts update their aging infrastructure including federal and state grants or funding, or heavier enforcement if negligence is found on the part of the sanitary districts. The Committee may wish to consider whether the approach in the bill is the correct approach to address illegal sewage discharges.

14) Right now this bill gives Marin LAFCO the power, under narrow circumstances, to initiate consolidation of agencies without protest hearings. The Committee may wish to consider whether it makes more sense to have SFRWQCB serve as the petitioner for the reorganization or consolidation through Marin LAFCO because of SFRWQCB 's expertise in water quality issues and enforcement actions related to sewage spills.

15) This bill will set a precedent of giving LAFCO more power than under current law. This bill, if signed into law, could pave the way for other instances where power could be taken away from agencies and their customers and given to LAFCO. The Committee may wish to consider the future implications that this bill may set.

THRESHOLDS, TIMELINES AND BILL SCOPE

16) AB 1232 specifies several thresholds and timelines that would need to be met in order for consolidation to be forced by the Marin LAFCO. First, the bill specifies that there must be three or more sewage discharges of 5,000 gallons in a five-year period. Second, the definition of small wastewater agencies applies to those sanitary districts that have 10,000 service connections or less. Lastly, the municipal services review done by the commission has to be completed within the prior 10-year period and make findings that reorganization or consolidation would improve the financial and service level benefits, increase operational efficiency, and provide cost savings for the ratepayers. The Committee may wish to discuss whether these thresholds are appropriate.

17) AB 1232, if signed into law, will take effect on January 1, 2011. The assumption for the smaller wastewater agencies in southern Marin is that they have a few years to figure out a plan to consolidate on their own terms, and then can initiate consolidation before the bill's effective date. However, this is not explicitly spelled out in the bill. The Committee may wish to consider giving a date certain to have LAFCO start the consolidation process, but only if a solution has not been reached locally by the agencies.

18) Currently AB 1232 only deals with Marin County, because of the unique nature of the problems in southern Marin. The Committee may wish to ask the author to narrow the scope of the bill further, specifically to the agencies in southern Marin County, and provide for a

one-time special statute, rather than setting up a process that can be used in the future anywhere in Marin County.

REGISTERED SUPPORT / OPPOSITION:

Support

Clean Water Action
San Francisco Baykeeper

Opposition

Ross Valley Sanitary District

Analysis Prepared by: Debbie Michel / L. GOV. / (916) 319-3958

SENATE LOCAL GOVERNMENT COMMITTEE
Senator Patricia Wiggins, Chair

BILL NO: AB 1232
AUTHOR: Huffman
VERSION: 6/24/09

HEARING: 7/8/09
FISCAL: No
CONSULTANT: Detwiler

SPECIAL DISTRICTS IN MARIN COUNTY

Background

A 2004 Marin County Grand Jury report called, "So Many Districts, So Few Users," looked at the 11 local governments that provide sewer services in southern Marin County. The Grand Jury recommended more interagency cooperation and an in-depth study of consolidation options. The Sewerage Agency of Southern Marin (SASM) runs one of the five wastewater treatment plants in that part of Marin County. Serving fewer than 30,000 residents, SASM is a joint powers agency composed of six member agencies:

- City of Mill Valley.
- Almonte Sanitary District.
- Alto Sanitary District.
- Homestead Valley Sanitary District.
- Richardson Bay Sanitary District.
- Tamalpais Community Services District.

Each member agency has its own collection system to transport sewage to SASM's wastewater treatment plant in Mill Valley.

In April 2009, the San Francisco Bay Regional Water Quality Control Board imposed a $1.6 million fine against SASM for discharging untreated and partially treated wastewater into Richardson Bay in January 2008.

In a May 2009 report called, "Southern Marin sewers: Cracks in the system," the Marin County Grand Jury recommended that SASM consolidate into one central agency and begin planning for institutional consolidation.

To control cities and special districts' boundaries, the Cortese-Knox-Hertzberg Act created a local agency formation commission (LAFCO) in each county. Among a LAFCO's statutory purposes is "encouraging orderly formation and development of local agencies based on local conditions and circumstances."

To guide their boundary decisions, the LAFCOs must prepare and regularly revise a sphere of influence for each city and special district that sets out the city and district's future service area and boundaries. Before preparing a sphere of influence, the LAFCO must conduct a municipal service review that examines the area's demographics, capacity of public facilities and public services, financial abilities, opportunities for sharing public facilities, and governmental ac-

countability. A LAFCO's decision on a proposed boundary change must be consistent with its adopted spheres of influence.

Marin County LAFCO's 2004 municipal service review and sphere of influence update noted that a 1984 study identified alternatives for consolidating SASM's member agencies to reduce operating costs. That 2004 document also looked at the advantages, incentives, disadvantages, and obstacles involved in reorganizing SASM, including functional consolidations, institutional consolidations, and the creation of a regional sanitary district. The LAFCO report sketched the possible consolidation of the Almonte, Alto, Homestead Valley, and Richardson Bay sanitary districts into a single sanitary district that collects sewage. In turn, the consolidated sanitary district, the City of Mill Valley, and the Tamalpais Community Services District could reorganize as a sanitary district responsible for collecting, treating, and disposing sewage. The City would no longer be in the sewer business.

Because SASM's member agencies are unlikely to propose institutional changes, some observers want the Marin County LAFCO to initiate a consolidation or reorganization. However, they worry that the low threshold for protests could trigger an election and block the changes.

Existing Law

A "consolidation" is a boundary change that combines two or more special districts into a single district. A "reorganization" collects two or more boundary changes into a single proposal. For example, the dissolution of five special districts and the formation of a new district to replace them could be a single reorganization.

The procedures for boundary changes require four, but sometimes five, steps:

- Initiation and filing a detailed application with LAFCO.
- LAFCO review and approval, after public notice and hearing.
- Another public hearing by LAFCO to measure protests.
- An election, if there were significant protests.
- Completion of the formal documents.

For most special districts, there are three ways to propose a consolidation or reorganization:

- A petition signed by 5% of the registered voters in each district.
- A resolution adopted by any local agency that contains territory in any of the districts.
- A resolution adopted by the LAFCO.

Before a LAFCO can initiate a consolidation or reorganization of special districts, the proposal must be consistent with its own studies, including spheres of influence or municipal service reviews. The LAFCO must also determine that:

- The public service costs will be the same or less than the costs of alternative means of providing services.
- The proposal promotes public access and accountability for community services needs and financial resources.

If a LAFCO initiates the consolidation or reorganization and then approves the proposal, the commission's resolution must make the same two determinations.

After a LAFCO approves a boundary change, it must conduct another noticed public hearing to measure protests by the affected registered voters and landowners. The amount of protests determines whether an election is needed. For example, if the LAFCO approves a special district consolidation or reorganization that was initiated by a petition or by a local agency's resolution:

- *No election is needed* if the protests are either less than 25% of the voters or less than 25% of landowners who own less than 25% of the land value.
- *An election is required* if the protests are either at least 25% of the voters or at least 25% of the landowners who own at least 25% of the land value.
- *Proceedings stop* if a majority of the voters protest.

For a boundary change initiated by the LAFCO, an election is required if the protests are either at least 10% of the voters or at least 10% of the landowners who own at least 10% of the land value.

Proposed Law

Assembly Bill 1232 authorizes the Marin County Local Agency Formation Commission (LAFCO) to initiate and approve a reorganization or consolidation of the Sewerage Agency of Southern Marin and its member agencies, without protest hearings.

AB 1232 allows the Marin County LAFCO to impose terms and conditions on this reorganization or consolidation that would require the Sewerage Agency of Southern Marin and its member agencies to pay for the commission's costs.

The bill's provisions become effective on January 1, 2011.

AB 1232 contains extensive legislative findings and declarations in support of its provisions. The bill contains a statement justifying its special provisions.

Comments

1. Connect the dots. Winter storms can overwhelm sewer systems when the collection lines can't carry the combined volume of wastewater and runoff. In addition to these acute incidents, older sewage collection systems have trouble coping with the chronic problems of inflow and infiltration of groundwater into old, cracked pipes and homeowners' lateral connections. Because southern Marin County's sewer systems suffer from both acute and chronic problems, the solutions require political leadership, managerial skill, fiscal resources, and considerable time. Protecting water quality requires sound public works. Sound public works requires adequate funding. Adequate funding requires an institutional structure and political culture that's committed to success. Smaller, fragmented institutions have a harder time than larger organizations when it comes to finding resources and focusing attention on solving problems. AB 1232 doesn't mandate the consolidation of SASM's member agencies, but it removes statutory and political obstacles that could block their reorganization. Clean water depends on clear decisions.

2. Cracks and gaps. Big governments with more money don't always make better decisions than small agencies that are closer to their constituents. By pushing the consolidation of SASM's member agencies, the Legislature may distract local officials from their primary mission to improve water quality. The Regional Water Quality Control Board's $1.6 million fine got the local officials' attention and work is underway to reduce inflow and infiltration, limit sewage spills, and cut inefficiencies. With local officials already cooperating with each other, SASM doesn't need the Legislature's interference. Legislators should be concerned about results and not how local officials organize themselves. Pay attention to the performance and leave the details up to local conditions and circumstances.

3. Resetting the threshold. For their first three decades, LAFCOs couldn't initiate proposals to change special districts' boundaries. The 1993 bill that let LAFCOs initiate district proposals balanced that new power by reducing the protest threshold needed to trigger an election from 25% to 10% (AB 1335, Gotch, 1993). It's easier to force an election if LAFCO initiated the proposal. If legislators worry that it's too easy for Marin County's small sewer districts to rally their constituents to protest a LAFCO-initiated reorganization, then the Committee may wish to consider restoring the 25% protest threshold instead of sidestepping protests.

4. A law or a lever? The Marin County LAFCO can already initiate the consolidation or reorganization of SASM and its member agencies. The key change in AB 1232 is sidestepping the protest hearings --- effectively avoiding an election. The bill delays that provision until January 2011. In the meantime, the political pressure which may result from AB 1232 could nudge SASM's member agencies into a closer functional relationship or even change their institutional structure.

The Committee may wish to consider whether AB 1232 could be an effective lever that moves local decision makers without ever being used.

5. Progressive or Populist? California's boundary change statutes reflect the state's curious blend of Progressive and Populist political impulses. The Progressive Era touted representative government, expert advice, and orderly government. The Populist cause championed direct democracy, common sense, and responsive governments. While the two goals aren't antithetical, reconciling them can be hard. By creating LAFCOs composed of local elected officials whose decisions must follow expert plans, the Cortese-Knox-Hertzberg Act clearly reflects the Progressive tradition. By requiring petitions, allowing protests, and providing for voter review, the Act also acknowledges Populist themes. More than a century ago, the United States Supreme Court explained that there is no constitutional right to vote on local boundaries. The Cortese-Knox-Hertzberg Act's provisions for protest hearings that may lead to elections are statutory opportunities, not constitutional rights. What the Legislature has created, it can waive.

6. Hearts and minds. One reason that Marin County's small sewer districts persist is that they use property tax revenues to subsidize their customers' sewer rates. Because these districts levied their own property tax rates before Proposition 13, four of SASM's special districts got property tax revenues in 2006-07 to support their sewer activities:

Almonte Sanitary District	$91,417
Alto Sanitary District	42,679
Homestead Valley Sanitary District	152,183
Richardson Bay Sanitary District	1,252,223
Total	$1,538,502

Without these tax subsidies, local sewer bills would be higher. To promote economic efficiency by relying on more realistic prices and market-like mechanisms, legislators could shift property tax revenues away from these enterprise districts and send them to the county government to support countywide public safety, social services, and public health programs. Without the additional revenues, southern Marin County's sewer districts would have to explore new efficiencies and possible consolidations. Proposition 1A (2004) permits this legislative intervention, but it takes a 2/3-vote bill. To paraphrase the late President Lyndon Baines Johnson: *Get them by their wallets and their hearts and minds will follow.*

7. Special legislation. The California Constitution prohibits special bills when a general law could apply. Nevertheless, special legislation is permitted when legislators explain why statewide statutes won't work in particular circumstances. In addition to legislative findings that recount Marin County's situation, AB 1232 also declares the need for special legislation.

Assembly Actions

Assembly Local Government Committee:	5-2
Assembly Floor:	48-27

Support and Opposition (7/2/09)

Support: Clean Water Action, Pacific Coast Federation of Fishermen's Association, San Francisco Baykeeper, Save The Bay.

Opposition: Einar Asbo.

CONCURRENCE IN SENATE AMENDMENTS
AB 1232 (Huffman)
As Amended June 24, 2009
Majority vote

ASSEMBLY: 48-27 (May 21, 2009) SENATE: 22-16 (August 27, 2009)

Original Committee Reference: L. GOV.

SUMMARY: Allows the Marin County Local Agency Formation Commission (Commission) to initiate and approve, after notice and hearing, a reorganization or consolidation of the Sewerage Agency of Southern Marin (SASM) and its member districts, without protest hearings.

The Senate amendments:

1) Narrow the scope of the bill to focus specifically on the reorganization or consolidation of SASM and its member districts.

2) Allow the Commission, if it initiates and approves the reorganization or consolidation, to impose terms and conditions on the reorganization or consolidation that would require SASM and its member agencies to be responsible for payment of the Commission's costs incurred in association with the reorganization or consolidation.

EXISTING LAW:

1) Establishes the procedures for the organization and reorganization of cities, counties, and special districts under the Cortese-Knox-Hertzberg Local Reorganization Act of 2000 (Act).

2) Allows a local area formation commission (LAFCO) to initiate proposals for changes or organization, including consolidation.

3) Defines "change of organization" in the Act to include consolidation of cities or special districts.

4) Defines "proceedings" to mean proceedings taken by the LAFCO for a proposed change of organization or reorganization.

5) Provides for noticing requirements for a protest hearing, and specifies that during the hearing the LAFCO shall hear and receive any oral or written protests, objections, or evidence that is made, presented or filed.

6) Provides that a proposal for change of organization must be abandoned if a majority protest is deemed to exist.

7) Requires a LAFCO to revisit its municipal service reviews and adopted spheres of influence every five years.

AS PASSED BY THE ASSEMBLY, this bill:

1) Provided the Commission, after notice and hearing, with the power to initiate and approve a reorganization or consolidation of small wastewater agencies, without protest hearings, if all of the following conditions exist:

   a) The Commission, in its municipal services review (MSR) of the wastewater agencies, completed within the last 10 years, makes findings or determinations related to reorganization or consolidation, that if implemented, would improve the financial and service level benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers;

   b) The wastewater agencies have not implemented the Commission's findings or determinations as provided in the MSR; and,

   c) The wastewater agencies affected have had three or more illegal discharges in the last five years, based on violations identified by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) that exceed 5,000 gallons of untreated or partially treated wastewater to waters of the state.

2) Defined "small wastewater agencies" to mean sanitation districts and local governments that provide sewer and wastewater collection or treatment services to 10,000 service connections or less.

3) Stated that the provisions of this measure will become effective on January 1, 2011.

4) Made findings and declarations about the impact of illegal sewage spills.

5) Declared that this bill is a special statute because of the unique circumstances applicable to the County of Marin.

FISCAL EFFECT: None

COMMENTS: Current law specifies various ways that special districts and other agencies can be reorganized and modified, including consolidation, dissolution, including dissolution with annexation, a merger, or establishment of a subsidiary district. This bill focuses on consolidation – the formal restructuring transactions that would combine two or more agencies into a single organization and would require a formal LAFCO review and approval process – as the means to modify special districts. A consolidation can be initiated by a petition of registered voters or landowners, by a resolution of the governing body of an affected local agency, or by LAFCO itself.

This bill originates from problems in eleven sewer services agencies located in southern Marin County, including six sanitary districts, three cities, one community services district and one joint powers agency. Three of the agencies operate wastewater treatment plants – Sanitary District No. 5 (Tiburon), SASM, and the Sausalito-Marin City Sanitary District. Ten of the eleven agencies operate sewerage collection systems and pumping stations. All of the special districts providing sanitary sewer services are governed by independent boards, except for SASM, whose members are appointed by each of its six member agencies.

The author notes that "the frequency and size of illegal sewage spills of raw or partially treated sewage are increasing often because of the improper sewer system maintenance. By providing limited new authority to a LAFCO, this bill would increase the cost effectiveness and efficiency of small wastewater agencies and reduce the impacts on water quality due to illegal sewage spills. The San Francisco Bay Regional Water Quality Control Board reports that over 2,000 separate illegal sewage spills occurred in the bay and coastline between 2004 and 2007. Over 500 of the spills exceeded 1,000 gallons. One of the largest spills was 2.5 million gallons in Marin County which illegally discharged both untreated and partially treated sewage into the San Francisco Bay."

To reduce water quality problems and to increase system efficiencies, in 2005 the Marin County LAFCO conducted an MSR and recommended a consolidation plan for the eleven small wastewater agencies in southern Marin County. The report concluded that the operation of numerous separate agencies with duplicated staff, and over 40 elected officials, is not a cost effective way to manage the single purpose service of wastewater collection and treatment. The MSR identified significant cost savings for the ratepayers that would occur if agency functions were consolidated.

This bill would allow the Marin County LAFCO to force the consolidation or reorganization of SASM and its member districts, without protest hearings. Protest proceedings are established in existing law to allow registered voters and landowners to give oral or written protests against a change of organization. This bill removes the ability of the Marin LAFCO to hold protest hearings for public input and for an affected district to speak and deliberate in a public forum on the issue of forced consolidation and whether it is the best option for the community. Protest proceedings are removed from the bill because, according to the author, "there has been strong local agency resistance to consolidation. That resistance has made it impossible under existing laws to implement the LAFCO consolidation recommendation because existing law requires a majority of voters in the affected districts to approve the consolidation."

While consolidation of SASM and its member districts may increase administrative effectiveness and provide for better management of those agencies, there are no guarantees that consolidation is the answer to the question of how to prevent illegal sewage discharges. There may be other avenues to pursue that would help sanitary districts update their aging infrastructure including federal and state grants or funding, or heavier enforcement if negligence is found on the part of the sanitary districts. The Legislature may wish to consider whether the approach in the bill is the correct approach to address illegal sewage discharges.

This bill, if signed into law, will take effect on January 1, 2011. The assumption for SASM and its member districts is that they have a few years before the bill's effective date to figure out a plan to consolidate on their own terms, and then can initiate consolidation before the bill takes effect.

Analysis Prepared by: Debbie Michel / L. GOV. / (916) 319-3958

ASSEMBLY THIRD READING
AB 1232 (Huffman)
As Amended May 7, 2009
Majority vote

LOCAL GOVERNMENT 5-2

Ayes: Caballero, Arambula, Davis, Krekorian, Skinner

Nays: Knight, Duvall

SUMMARY: Allows the Marin County Local Agency Formation Commission (LAFCO), when specific conditions are met, to initiate and approve the consolidation of small wastewater agencies, without protest hearings. Specifically, this bill:

1) Provides the Marin LAFCO, after notice and hearing, with the power to initiate and approve a reorganization or consolidation of small wastewater agencies, without protest hearings, if all of the following conditions exist:

   a) The Marin LAFCO, in its municipal services review (MSR) of the wastewater agencies, completed within the last 10 years, makes findings or determinations related to reorganization or consolidation, that if implemented, would improve the financial and service level benefits, improve government accountability, improve operational efficiencies, and provide cost savings for the ratepayers;

   b) The wastewater agencies have not implemented LAFCO's findings or determinations as provided in the MSR; and,

   c) The wastewater agencies affected have had three or more illegal discharges in the last five years, based on violations identified by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) that exceed 5,000 gallons of untreated or partially treated wastewater to waters of the state.

2) Defines "small wastewater agencies" to mean sanitation districts and local governments that provide sewer and wastewater collection or treatment services to 10,000 service connections or less.

3) States that the provisions of this measure will become effective on January 1, 2011.

4) Makes findings and declarations about the impact of illegal sewage spills.

5) Declares that this bill is a special statute because of the unique circumstances applicable to the County of Marin.

EXISTING LAW:

1) Establishes the procedures for the organization and reorganization of cities, counties, and special districts under the Cortese-Knox-Hertzberg Local Reorganization Act of 2000 (Act).

2) Allows a LAFCO to initiate proposals for changes or organization, including consolidation.

3) Defines "change of organization" in the Act to include consolidation of cities or special districts.

4) Defines "proceedings" to mean proceedings taken by the LAFCO for a proposed change of organization or reorganization.

5) Provides for noticing requirements for a protest hearing, and specifies that during the hearing the LAFCO shall hear and receive any oral or written protests, objections, or evidence that is made, presented or filed.

6) Provides that a proposal for change of organization must be abandoned if a majority protest is deemed to exist.

7) Requires a LAFCO to revisit its municipal service reviews and adopted spheres of influence every five years.

FISCAL EFFECT: None

COMMENTS: Current law specifies various ways that special districts and other agencies can be reorganized and modified, including consolidation, dissolution, including dissolution with annexation, a merger, or establishment of a subsidiary district. This bill focuses on consolidation – the formal restructuring transactions that would combine two or more agencies into a single organization and would require a formal LAFCO review and approval process – as the means to modify special districts. A consolidation can be initiated by a petition of registered voters or landowners, by a resolution of the governing body of an affected local agency, or by LAFCO itself.

This bill originates from problems in eleven sewer services agencies located in southern Marin County, including six sanitary districts, three cities, one community services district and one joint powers agency. Three of the agencies operate wastewater treatment plants – Sanitary District No. 5 (Tiburon), the Joint Powers Agency (Sewerage Agency of Southern Marin – SASM), and the Sausalito-Marin City Sanitary District. Ten of the eleven agencies operate sewerage collection systems and pumping stations. All of the special districts providing sanitary sewer services are governed by independent boards, except for SASM, whose members are appointed by each of its six member agencies.

The author notes that "the frequency and size of illegal sewage spills of raw or partially treated sewage are increasing often because of the improper sewer system maintenance. By providing limited new authority to a LAFCO, this bill would increase the cost effectiveness and efficiency of small wastewater agencies and reduce the impacts on water quality due to illegal sewage spills. SFBRWQCB reports that over 2,000 separate illegal sewage spills occurred in the bay and coastline between 2004 and 2007. Over 500 of the spills exceeded 1,000 gallons. One of the largest spills was 2.5 million gallons in Marin County which illegally discharged both untreated and partially treated sewage into the San Francisco Bay."

To reduce water quality problems and to increase system efficiencies, in 2005 the Marin County LAFCO conducted an MSR and recommended a consolidation plan for the eleven small

wastewater agencies in southern Marin County. The report concluded that the operation of numerous separate agencies with duplicated staff, and over 40 elected officials, is not a cost effective way to manage the single purpose service of wastewater collection and treatment. The MSR identified significant cost savings for the ratepayers that would occur if agency functions were consolidated.

This bill sets up a process that would allow Marin LAFCO to force the consolidation of small wastewater districts, when specific conditions are met, without protest hearings. Protest proceedings are established in existing law to allow registered voters and landowners to give oral or written protests against a change of organization. This bill removes the ability of the Marin LAFCO to hold protest hearings for public input and for an affected district to speak and deliberate in a public forum on the issue of forced consolidation and whether it is the best option for the community. Protest proceedings are removed from the bill because, according to the author, "there has been strong local agency resistance to consolidation. That resistance has made it impossible under existing laws to implement the LAFCO consolidation recommendation because existing law requires a majority of voters in the affected districts to approve the consolidation."

There is the potential that a district would be forced, against its will, under the provisions of this bill, to consolidate with other districts or agencies. An unwilling district could then sue LAFCO because LAFCO would be the entity that initiates the forced consolidation. The Legislature may wish to consider whether Marin LAFCO would ever use this process, given the legal implications.

This bill will set a precedent of giving LAFCO more power than under current law. This bill could pave the way for other instances where power could be taken away from agencies and their customers and given to LAFCO. The Legislature may wish to consider the future implications that this bill may set. Additionally, the Legislature may wish to consider whether it makes more sense to have SFBRWQCB serve as the petitioner for the reorganization or consolidation through Marin LAFCO because of SFBRWQCB's expertise in water quality issues and enforcement actions related to sewage spills.

In their initial letter of concern, the California Association of Sanitation Agencies (CASA), writes: "CASA's major concern is that LAFCOs have little expertise in water quality or wastewater treatment issues. CASA feels the more appropriate way to address sanitary sewer overflows (SSOs) is pursuant to existing statutory and regulatory requirement under the Clean Water Act and Porter Cologne Act, or direct consolidation such as designating agencies to be consolidated in legislation. To provide a consistent, statewide regulatory approach to address SSOs, the State Water Resources Control Board adopted Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans and report all SSOs to the State Water Board's online SSO database. Consequently, we feel that the [CAL] EPA, State Water Board, and Regional Boards are in a far better position to address SSOs than are LAFCOs. In fact it is our understanding that the particular agencies contributing to recent spills are currently under EPA orders."

Currently this bill only deals with Marin County, because of the unique nature of the problems in southern Marin. The Legislature may wish to ask the author to narrow the scope of the bill

further, specifically to the agencies in southern Marin County, and provide for a one-time special statute, rather than setting up a process that can be used in the future anywhere in Marin County. In their opposition letter, Ross Valley Sanitation District (located in central Marin County), notes that "(1) it is unfair for any LAFCO to impose reorganization or consolidation of any public agency without the opportunity for a protest hearing, and (2) if the bill is intended to affect southern Marin then the language should be explicit to southern Marin."

While consolidation of smaller agencies may increase administrative effectiveness and provide for better management of those agencies, there are no guarantees that consolidation is the answer to the question of how to prevent illegal sewage discharges. There may be other avenues to pursue that would help sanitary districts update their aging infrastructure including federal and state grants or funding, or heavier enforcement if negligence is found on the part of the sanitary districts. The Legislature may wish to consider whether the approach in the bill is the correct approach to address illegal sewage discharges.

This bill specifies several thresholds and timelines that would need to be met in order for consolidation to be forced by the Marin LAFCO. First, the bill specifies that there must be three or more sewage discharges of 5,000 gallons in a five-year period. Second, the definition of small wastewater agencies applies to those sanitary districts that have 10,000 service connections or less. Lastly, the municipal services review done by the commission has to be completed within the prior 10-year period and make findings that reorganization or consolidation would improve the financial and service level benefits, increase operational efficiency, and provide cost savings for the ratepayers. The Legislature may wish to discuss whether these thresholds are appropriate.

This bill, if signed into law, will take effect on January 1, 2011. The assumption for the smaller wastewater agencies in southern Marin is that they have a few years to figure out a plan to consolidate on their own terms, and then can initiate consolidation before the bill's effective date. However, this is not explicitly spelled out in the bill. The Legislature may wish to consider giving a date certain to have LAFCO start the consolidation process, but only if a solution has not been reached locally by the agencies.

Analysis Prepared by: Debbie Michel / L. GOV. / (916) 319-3958 FN: 0000775

Appendix C

RETURN TO
EAM

SEWERAGE STUDY

COUNTY OF MARIN

BROWN and CALDWELL consulting engineers

1967

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CHAPTER 1
INTRODUCTION

In recent years the natural scenic and climatic assets of Marin County have attracted an increasing number of people to the county. As a result, those portions of the county most accessible to the other bay area metropolitan centers have lost much of the small-town atmosphere of 30 years ago and have assumed many of the characteristics of a major urban area. The continuing trend of increasing population has brought to Marin County many of the problems common to any rapidly-growing urban area, not the least of which concerns the collection, treatment and disposal of sewage.

At present, many areas of the county are faced with serious sewerage problems which are significant not only from the standpoint of public health, but also because they involve such matters as recreational activity, orderly community growth, and the value of land and property. Among the factors contributing to both present and anticipated future problems, the most significant are:

1. The county is divided by steep ridges into numerous individual watersheds, making infeasible the development of any unified scheme for regional gravity sewerage. The result has been the formation of a large number of independent sewerage agencies of small size and local concern without regard for the possible advantages of long-range regional planning.

2. Increased sewage flows have in some areas resulted in degradation of receiving water quality at the same time that increased recreational use of receiving waters has caused a demand for improved water quality. The net result is that 12 of the 14 major sewerage agencies within the county which discharge to receiving waters were listed by the Regional Water Quality Control Board in March, 1966 as being in violation of discharge requirements established by the Board.

3. Excessive storm water infiltration occurs in most of the older sewage collection systems during periods of moderate to heavy rainfall to the extent that sewage transmission and treatment facilities are overloaded. During and immediately after any appreciable rainfall, it is necessary to bypass raw sewage to drain channels, creeks and estuaries to prevent sewage from backing up into streets and houses.

4. A wide diversity of opinion exists between developers, administrative agencies and control agencies regarding the part which septic tanks and leaching systems should play in the orderly development of unsewered areas. In some areas which are not tributary to existing sewerage systems, development is presently stalled, pending the adoption of a technically sound and workable policy regarding septic tanks and similar individual disposal systems.

Objectives and Scope of Sewerage Study

The present conditions of sewerage service indicate the need for a comprehensive plan under which provision would be made for the systematic, orderly, and economical construction of the sewerage facilities required to serve the county for an extended future period. Such a plan can be developed by means of a comprehensive engineering study which takes into account and evaluates all facts pertinent to the needs of both the local agencies and the county as a whole.

Recognizing the need for long-range sewerage planning, the Board of Supervisors of the County of Marin engaged the engineering firm of Brown and Caldwell to make the necessary engineering studies and to prepare a report setting forth recommended sewerage improvements. Under an agreement dated March 15, 1966, the work of the study included, but was not limited to, the following phases:

1. A review of county and city land-use maps and population projections for areas subject to urban development, to the extent that these maps and projections govern sewerage planning.

2. A review of the physical environment as it affects sewage collection, treatment and disposal. Topography, geology, climate and oceanographic factors were considered important to the study.

3. The establishment of sewerage service areas and subareas as defined by topography and other considerations, and an estimate of the distribution of future population and of land use in each of the sewerage service areas.

4. The analysis of existing sewerage systems and their proposed expansions within the county with respect to their adequacy, deficiencies, and suitability for incorporation into a long-range plan either as temporary or as permanent works. The analysis was limited to major trunk and interceptor sewers and to treatment and disposal works. Current costs of sewerage service and sources of revenue were reviewed.

5. The determination of existing sewage and wastewater characteristics with respect to volume, composition, and the seasonal effects of rainfall.

6. The development of unit design factors and criteria for preliminary design based on experience in Marin County and including allowances for trends which will affect their future values.

7. The investigation of present and probable future requirements for disposal of sewage and waste-

water, including a review of the beneficial uses of receiving waters, both fresh and salt, and where necessary, the investigation of tidal movement and dispersion at appropriate discharge points.

8. An investigation of the effectiveness of individual waste disposal systems and the development of data for inclusion in a county ordinance relating to construction, monitoring, and operation of individual systems.

9. An investigation of the possible uses, the economy, and the future need for water reclaimed from sewage effluents in Marin County.

10. The development of preliminary layouts and costs of alternative plans for sewage and wastewater collection, treatment, and disposal systems to meet the needs of the county for the next 50 to 60 years.

11. A detailed description of the recommended plan.

12. The development of a program for stage construction of the recommended sewerage works to correct present deficiencies and keep pace with the developing needs of the county.

13. A review of governmental structures for provision of sewerage service, including the contractual relationships between existing agencies and the possible need for the formation of additional agencies to provide for the construction and operation of works common to more than one agency.

14. Preparation of the report. Along with description of all recommended facilities and estimates of the cost of each increment in the long-range program, the report contains background data in sufficient detail to substantiate the findings and recommendations. Design assumptions and criteria are fully described to permit their review and up-dating before construction of later stages of the recommended program.

Extent of Study Area

Basically, the area studied in detail includes the entire county of Marin from the Golden Gate north to the Sonoma county line and from San Francisco Bay west to the Pacific. On the three sides of the county bounded by water, definition of the study area certainly presents no problem. Along the northern boundary, however, the county line divides four watersheds, with a portion of each watershed falling in each of the two counties. Since greatest economy in construction and operation of a sewerage system is generally achieved by planning based on watershed boundaries rather than political boundaries, sewerage in the northern area has been considered on the basis of topography. Long-range sewerage projects recommended for northern Marin County thus, in some cases, have a capacity allowance for the naturally tributary area in Sonoma County.

Information and Data Available to Survey

Full use has been made of previous studies and reports prepared by agencies of Marin County. Additional information has been obtained from cities and local sewerage agencies and their consultants, from the Regional Water Quality Control Boards, the U.S. Army Corps of Engineers, and from various state agencies.

Operating records of treatment plants have been referred to wherever they were available. Size and location of sewer lines and capacities of pumping stations have been taken from available records, and generally have not been verified in the field. Measurements of area and distance were made on U.S. Geological Survey topographic maps, using 1" = 2000' scale for detailed work, and 1" = 5280' scale for county-wide considerations.

Literature and other references cited by superscrips in the text of the report are listed in Appendix A. Unnumbered references listed in Appendix A were used as sources of background material but are not specifically referred to in the text. For simplicity, abbreviations have been used in this report for many technical and nontechnical terms. Each abbreviation is defined where it first appears, and all abbreviations are listed alphabetically in Appendix B.

Acknowledgments

Successful completion of a study of this type is dependent on the advice and cooperation of a great many individuals and organizations. We are particularly indebted to John F. Barrows, Assistant County Administrator, for his valuable advice and direction in policy matters; to Paul Zucker, County Planning Director, and his staff, who have devoted countless hours to the definition and discussion of Marin County's future; and to William L. Desmond, Director of Environmental Health, Marin County Department of Public Health, long an advocate of planned sewerage and a prime mover behind the authorization of this report, whose knowledge of present and historical sanitary conditions in Marin County has been a great asset to us.

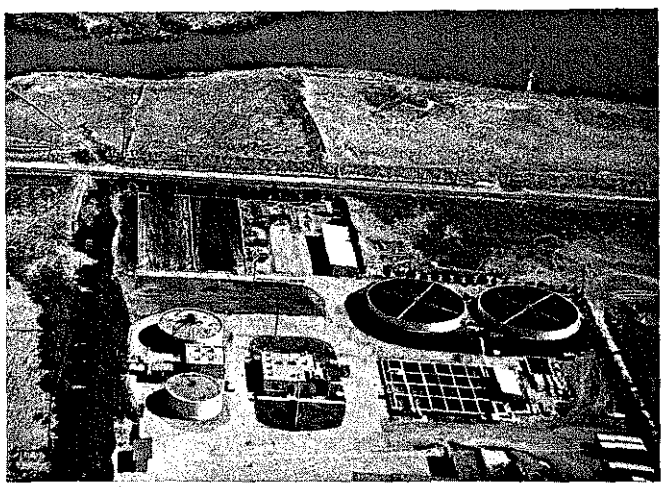
The collection, analysis and interpretation of the data upon which this report is based could not have been accomplished without the willing and generous help of a group of dedicated people too numerous to mention. We wish to express our gratitude to all of the directors and the administrative and operating personnel of the public agencies, their consultants, the state and regional agencies, and the many private citizens who have so generously contributed to this phase of the work.

The cover photograph is by courtesy of Aero Photographers, Inc.

CHAPTER 4
EXISTING SEWERAGE SYSTEMS

One of the basic objectives of the present study is that of determining the extent to which existing sewerage facilities can be incorporated into a long-range program of sewerage improvements. Accordingly, all major components of existing systems were evaluated in terms of their ability to meet future needs. Information presented in this chapter was derived from interviews with officials of the various sewerage agencies, from a review of plans and reports, and from field investigations.

Responsibility for providing sewerage service in Marin County is divided among three cities, eleven sanitary districts, one county sanitation district, four sewer maintenance districts, two public utility districts, two county water districts, one municipal water district, and seven state and federal agencies, including military installations. Of the 24 cities and county agencies, 19 are presently engaged in the operation of sewerage facilities. The remaining five are either in various stages of planning for sewerage service or are inactive.



MILL VALLEY SEWAGE TREATMENT PLANT provides secondary treatment for sewage from communities at the head of Richardson Bay.

The present status of sewerage in Marin County is indicated in Fig. 4-1, while Tables 4-1, 4-2, and 4-3 give a brief resume of pertinent statistical information on each public sewerage agency. Together, the various agencies operate and maintain about 700 miles of sewers, 92 pumping stations, and 12 sewage treatment plants. Three additional treatment plants are operated by state and federal agencies, and one by a private developer. Available information indicates that there remain only two locations within the county where raw sewage is continuously discharged to surface waters. Both situations, at the towns of Tomales and Bolinas, are well known to all state and local control agencies and are discussed in detail later in this report.

Despite the multiplicity of agencies and facilities, only about 67 percent of the county residents are served by public sewers. The remaining residents rely on individual disposal systems, principally in the form of septic tanks, for disposal of sanitary wastes.

In the case of most of the public sewerage agencies, watershed boundaries have played an important part in the definition of service areas. As an aid in the description of existing sewerage facilities, and in keeping with the concept that sewerage can be most economically accomplished by considering topographic rather than political boundaries, existing systems are grouped and described by the major watershed in which they occur. State and federal agencies are described separately at the end of this chapter.

Richardson Bay Watershed

Within the Richardson Bay watershed, responsibility for sewerage service is divided among ten public agencies. Four of these, the city of Mill Valley, Sausalito-Marin County Sanitary District, Richardson Bay Sanitary District, and Sanitary District No. 5, operate sewage treatment plants. The remaining agencies operate collection systems and contract with one or the other of those four for sewage treatment. In addition, Seafirth Estates operates a small private sewage collection system and treatment plant serving 30 homes on the north shore of the Tiburon Peninsula. Land area within the Richardson Bay watershed totals 20 sq mi, of which 14.5 sq mi is encompassed by sewerage agencies, and over 13 sq mi is reported to be sewered. Principal sewerage facilities within the Richardson Bay watershed are shown in Fig. 4-2.

City of Mill Valley. Incorporated in 1900, Mill Valley ranks as one of the oldest communities in Marin County. The corporate limits presently contain an area of 3.8 sq mi and a population of 12,000. The sewage collection system comprises two pumping stations and 57 miles of sewers ranging in size from 6 to 30 inches.

The first sewers, some of which are still in use, were constructed about 1892 and discharged raw sewage to Arroyo Corte Madera Del Presidio, commonly known as Widow Reed Creek. In 1912 the town constructed one of the first Imhoff tanks in the State, but it was abandoned about 1918 because of odor complaints, and sewage was again discharged raw to the creek. In 1926 the raw sewage outfall was extended

to Widow Reed Slough at the head of Richardson Bay near the present point of discharge.

The first units of the present plant were constructed in 1952, and consisted of the inlet works, operations building and pumping station, a rectangular primary sedimentation tank 82 ft by 16 ft by 10 ft deep, and a heated sludge digester with a capacity of 30,000 cu ft. Additions in 1958 comprised a second primary sedimentation tank and two secondary sedimentation tanks identical to the first, two 80-ft diameter standard rate trickling filters, a second digester with a capacity of 47,000 cu ft, and a centrifuge for sludge dewatering.

The present design capacity of the treatment plant is 1.6 mgd (million gallons per day). Peak hydraulic capacity, as limited by the maximum permissible flow through the sedimentation tanks, is 4 mgd. Flows in excess of this amount must be bypassed directly to Richardson Bay. The influent pumping station has an installed pumping capacity of 16.7 mgd, of which 10.2 mgd is electric motor driven and 6.5 mgd is engine driven. The hydraulic capacity of the headworks preceding the pumps, however, limits the practical maximum pumping rate to about 10 mgd.

In addition to the flow from Mill Valley, the plant treats sewage from Homestead, Alto, and Almonte Sanitary Districts, and Kay Park Sewer Maintenance District. The total average dry weather flow as measured at the plant during the summer of 1965 was 1.36 mgd. Laboratory test records for the summer of 1966 show plant efficiency to be 85 percent in terms of BOD (biochemical oxygen demand) removal and 80 percent in terms of suspended solids removal.

As is often the case with older sewerage systems,

Table 4–1. Sewerage Agency Statistics, Fiscal Year 1965–66

	Date agency formed	Area, square miles		Population	
		Total	Sewered	Total	Connected
Sanitary Districts					
Number 1	1922	18.0	12.8	36,400	36,000
Number 2	1901	3.1	3.1	9,000	9,000
Number 5	1924	1.4	1.2	7,000	6,500
Number 6	1925	15.0	10.0	30,000	27,400
Almonte	1949	0.5	0.3	1,500	1,500
Alto	1950	0.2	0.2	1,000	1,000
Homestead Valley	1931	0.7	0.7	2,400	2,400
Las Gallinas Valley	1954	6.6	6.6	24,000	24,000
Richardson Bay	1949	2.4	2.4	9,000	9,000
Sausalito-Marin City	1952	3.3	a	10,000	a
Tamalpais Valley	1954	1.5	a	4,500	a
County Sanitation Districts					
San Rafael	1947	9.7	9.2	30,000[b]	29,000[b]
Sewer Maintenance Districts					
Kay Park Number 2	1953	0.07	0.07	530	530
Murray Park	1949	0.10	0.10	a	a
San Quentin Village	1964	0.01	0.01	100	100
Tomales[c]	1956	0.17	a	a	a
Public Utility Districts					
Bolinas	1926	1.8	a	380	a
Bolinas Beach[d]	1939	0.7	0	600	0
County Water Districts					
Stinson Beach[d]	1962	10.9	0	550	0
Cities					
Belvedere	1896	0.6	0.6	2,600	2,600
Larkspur	1908	2.8	2.8	8,750	8,750
Mill Valley	1900	3.8	3.8	12,000	12,000

Based on data submitted by sewerage agencies or obtained from County of Marin.

[a] Information not available.

[b] Based on population estimates by Marin County Development Association. San Rafael Sanitation District personnel estimate about 20,000.

[c] Tomales Sewer Maintenance District is presently inactive.

[d] At present there are no sewers in the district.

Table 4–2. Summary of Financial Information for Sewerage Agencies, Fiscal Year 1965–66

Agency	Assessed valuation $1,000,000	Tax levy[a]	Service charge[b] dollars	Connection fee dollars	Bonds outstanding $1,000		Annual O & M cost $1,000	
					General obligation	Revenue	Treatment only	Total
Sanitary Districts								
Number 1	71.11	0/14	0	0	16	0	59.6	129.0
Number 2	21.43	31/120	0	150[c,d]	962	0	21.1[e]	101.4
Number 5	9.25	5/44	0	[f]	39	0	[g]	54.7
Number 6	39.98	11/50	0	0	418	0	55.9[h]	167.1
Almonte	3.04	16.5/41.5	18	300[c]	45	87	10.0[i]	17.7
Alto	2.51	5/50	0	65	13	0	1.9[i]	2.9
Homestead Valley	4.34	13/47.5	0	175[c]	15	0	11.0[i]	16.5
Las Gallinas Valley	40.56	4.5/21	12	100[c]	967	275	53.0	112.9
Richardson Bay	16.43	0/50	0	400[c]	0	0	[j]	161.7
Sausalito-Marin City	26.08	0/16	12	35[c]	645	0	25.0	55.3[k]
Tamalpais Valley	5.92	12/33	29	350[c]	126	116	15.8[l]	41.7
County Sanitation Districts								
San Rafael	72.88	6/37	0	125[c]	470	0	[g]	122.0
Sewer Maintenance Districts								
Kay Park Number 2	0.84	0/49	0	[f]	0	0	3.4[i]	6.0
Murray Park	0.32	0/71	0	125[c]	0	0	[g]	2.0
San Quentin Village	0.08	0/155	0	[f]	0	0	[g]	0.6
Tomales[m]	0.07	0	0	0	0	0	0	0
Public Utility Districts								
Bolinas	1.73	0/145.5[n]	0	200[c]	25	0	0	1.2[o]
Bolinas Beach[p]	1.17	0/186[q]	0	0	75[q]	0	0	0
County Water Districts								
Stinson Beach[p]	2.76	0/27[n]	0	0	0	0	0	0
Cities								
Belvedere	12.1	42/75.3	0	150	445	0	11.8[r]	28.4
Larkspur	10.1	7/75	0	125[c]	10	0	21.1[e]	44.1
Mill Valley	30.0	15.5/32	0	235[c]	330	0	52.8	80.9

Based on data submitted by sewerage agencies or obtained from County of Marin.

[a] Portion of general tax levy designated for sewerage except as noted. Cents per $100 assessed valuation. Bond redemption rate/Total rate.

[b] Yearly, unless otherwise indicated.

[c] Charge for single-family connection. Multiple dwellings and commercial charged on the basis of fixture units.

[d] The district also imposes an annexation fee of $250 per gross acre.

[e] Amount paid to Sanitary District No. 1 for sewage treatment.

[f] Charge based on fixture units.

[g] Information not available.

[h] O & M costs; Novato plant, $37,200, Ignacio plant, $18,700.

[i] Adjusted amount paid to Mill Valley for sewage treatment.

[j] Cost for treatment only at the Trestle Glen Plant not available. $18,100 paid to Sausalito-Marin City Sanitary District for sewage treatment.

[k] Does not include O & M for City of Sausalito sewers.

[l] Amount paid to Sausalito-Marin City Sanitary District for sewage treatment.

[m] District is presently inactive.

[n] Total district tax rate, no specific rate for sewerage only.

[o] Total cost for maintaining water and sewer lines.

[p] At present, there are no sewers in the district.

[q] Total district tax rate and outstanding bonds are for water service only.

[r] Amount paid to Sanitary District No. 5 for sewage treatment.

storm water infiltration creates serious problems for the Mill Valley collection system and treatment plant. Overloaded sewers are not a new problem. Records of the State Department of Public Health, Bureau of Sanitary Engineering[9] indicate that problems of this nature have been more or less persistent for more than 40 years.

Under present conditions, moderate rainfall re-

Table 4–3. Sewerage System Statistics, By Agency

Agency	Sewers			Number of pumping stations	Treatment plants			
	Miles	Year first constructed	Diameter range inches		Type[a]	Year first constructed[b]	Capacity average mgd	Discharges to
Sanitary Districts								
Number 1	135	1895	4-36	8	ST	1949-62	4.5	Corte Madera Creek
Number 2	31	1906	4-27	12				c
Number 5	48	1924	6-18	6	P	1949-61	1.6	Racoon Strait
Number 6	130	1949	6-30	9	STA	1948-56-64	2.7	Novato Creek
					ST	1956	0.9	Novato Creek
					SA	1966	0.2	Petaluma River
Almonte	d	1953	6-15	0				f
Alto	3.5	1940[e]	6-8	0				f
Homestead Valley	7	1948	6-12	0				f
Las Gallinas Valley	80	1951	6-24	11	ST	1955-59-65	2.1	San Pablo Bay
Richardson Bay	d	1945	6-15	9	ST	1958	0.3	Richardson Bay[g]
Sausalito-Marin City	34	1893	6-24	7	P	1952	2.0	San Francisco Bay
Tamalpais Valley	d	1955	4-14	1				h
County Sanitation Districts								
San Rafael	83	1920[e]	6-27	14	IA	1949-62-65	5.0	San Rafael Bay
					IT	1962	0.16	San Pablo Bay
Sewer Maintenance Districts								
Kay Park Number 2	2.0	1952	6-12	1				f
Murray Park	d	d	6	0				c
San Quentin Village	0.4	1964	4-6	1				i
Tomales[j]	0.2	d	4-8	0	k			Keys Creek
Public Utility Districts								
Bolinas	1.7	1906	6-8	0	k			Bolinas Bay
Bolinas Beach[l]	0							
County Water Districts								
Stinson Beach[l]	0							
Cities								
Belvedere	10	1900	6-15	9				m
Larkspur	29	1908[e]	6-18	2				c
Mill Valley	57	1892	6-30	2	ST	1952-58	1.6	Richardson Bay

Based on data submitted by sewerage agencies

[a] P, primary treatment; I, intermediate treatment; S, secondary treatment; A, activated sludge; T, trickling filters.

[b] Where two years are shown, second indicates major enlargement.

[c] Sewage treated at Sanitary District No. 1 plant.

[d] Information not available.

[e] Approximate value.

[f] Sewage treated at Mill Valley plant.

[g] Sewage generated in approximately one-half of the district is treated at Sausalito-Marin City plant.

[h] Sewage treated at Sausalito-Marin City plant.

[i] Sewage treated at San Quentin plant and then discharged to San Francisco Bay.

[j] Tomales Sewer Maintenance District is presently inactive.

[k] Discharged untreated.

[l] At present there are no sewers in the district.

[m] Sewage treated at Sanitary District No. 5 plant.

sults in sewage flows which exceed the capacity of the plant treatment units. Severe or prolonged rainfall causes sewage flows in excess of the capacity of the plant inlet works and pumping station. In the latter case, flow in the influent sewer must be throttled and excess flow bypassed by gravity to the bay. Since the bypass is several feet higher than the inlet sewer, sewage backs up in the collection system causing manholes to overflow at low points in the system, notably at Ryan Avenue. Recent efforts to pinpoint the sources of infiltration in the older portions of the collection system by television inspection of pipe interiors have been largely unsuccessful due to inadequate access and misalignment of the sewers.

The treatment plant is now approaching its design capacity and the City of Mill Valley has engaged a consultant to prepare preliminary plans and cost estimates for the construction of additional sedimentation tanks. Planning has not, however, proceeded to the design phase.

Almonte Sanitary District. The Almonte Sanitary District collects sewage from a small area southeast of Mill Valley and delivers it by gravity to the Mill Valley trunk sewer system. Of the total district area of 0.5 sq mi, nearly half consists of undeveloped tide marsh and mud flats.

Prior to district formation in 1949, sewage disposal was accomplished through individual septic tanks under sanitary conditions described by the State Bureau of Sanitary Engineering as "extremely unsatisfactory",[9] including "a great deal of difficulty with overflowing sewage". Sewers ranging in size from 6 to 15 inches were constructed in 1951, and the entire district population of 1500 is now reported to be connected to the collection system.

Treatment of sewage from Almonte Sanitary District is performed at the Mill Valley plant under a contract which apportions treatment costs on the basis of assessed valuation.

Storm water infiltration causes wet weather flows which exceed the capacity of the 15-in. trunk sewer and result in overflowing manholes during major storms.[10] This problem is reportedly due in part to inadequacies in the Mill Valley trunk sewers which receive the flow from Almonte, but in any case the district is faced with the necessity for corrective action.

Alto Sanitary District. The Alto Sanitary District comprises an area of less than 150 acres located north of Mill Valley and adjacent to Highway 101. The first sewers were constructed sometime prior to 1945, discharging to a community septic tank which in turn discharged to Widow Reed Slough. After formation of the sanitary district in 1950, a pumping station was constructed at the southern boundary to lift all of the district's sanitary sewage into the Mill Valley trunk sewer system.

Some 3.5 miles of 6- and 8-in. sewers now serve the entire district population of about 1000 persons. The system is apparently functioning satisfactorily, and no unusual problems are reported. Sewage treatment is provided at the Mill Valley plant under a contract with terms similar to that for Almonte Sanitary District.

Homestead Valley Sanitary District. Residential development of the Homestead Valley area began shortly after the turn of the century and was fairly extensive by the end of World War I. As early as 1926 the City of Mill Valley undertook assessment proceedings to finance construction of sewers in Homestead, but the number of protests by the Homestead residents was sufficient to cause abandonment of the project. Although the Homestead Valley Sanitary District was formed in 1931, the area continued to rely on septic tanks until 1948. In 1944 the sanitary conditions were described by the State Bureau of Sanitary Engineering[9] as follows: "As characterizes individual sewage disposal in this part of Marin County, the sanitary conditions are extremely unsatisfactory. For over 20 years pollution of the creek and numerous premises has continued unabated. Since July 14 of last year, the Marin County Health Department reports 14 sewage disposal complaints."

Construction of sewers was finally undertaken in 1948. The system now consists of seven miles of sewers ranging in size from 6 to 12 in. and serving all of the district's 2400 residents. Sewage is delivered by gravity to the Mill Valley trunk system and is treated by Mill Valley under a contract similar to that for Almonte and Alto Sanitary Districts.

Kay Park Sewer Maintenance District. The sewerage system for the subdivision known as Kay Park No. 2 is a tiny anachronism which offers mute testimony to the lack of regional sewerage planning in the Richardson Bay watershed. Constructed in the early 1950's on the tidal marshlands at the mouth of the Tamalpais and Tennessee Valleys, Kay Park contained the first sewers in that general area. A pumping station and 4000 ft of gravity sewer and force main were constructed to convey the sewage to the Mill Valley system. About a year later, Almonte Sanitary District constructed a trunk sewer which parallels the Kay Park sewer and force main throughout its entire length. Some three years after Kay Park connected to Mill Valley, Tamalpais Sanitary District constructed its trunk sewer along the southern

edge of Kay Park and located its main pumping station on the Kay Park district boundary. Logically, the entire Kay Park area should have sewered directly to the Tamalpais Valley pumping station.

Serving an area of about 50 acres, Kay Park Sewer Maintenance District has a total population of 530, all connected to the system. Storm water infiltration into the collection system is excessive. Though the total magnitude of infiltration is small because of the district size, the unit infiltration rate is the highest of any encountered in Marin County. As with Homestead, Almonte and Alto, Kay Park contracts with Mill Valley for sewage treatment.

Sausalito–Marin City Sanitary District. As its name implies, the Sausalito-Marin City Sanitary District encompasses the City of Sausalito and the adjacent unincorporated area of Marin City. The 10,000 residents within the district's 3.3 sq mi area are served by a sewage collection system comprising 34 miles of sewers from 6 to 24 in. in diameter, seven pumping stations, and a primary treatment plant. In addition to serving its resident population the district provides sewage treatment on a contract basis for Tamalpais Valley Sanitary District, Fort Baker, and the Strawberry Point area of Richardson Bay Sanitary District.

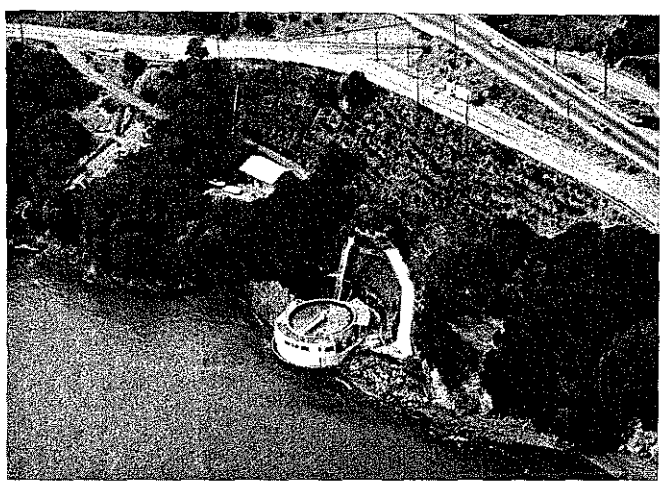
Ranking with Mill Valley as one of the oldest communities in Marin, the City of Sausalito was also one of the first to construct sewers. From 1893 when the first sewers were constructed until the present bay front interceptor sewer and treatment plant were placed in operation in 1953, sewage was discharged raw to San Francisco Bay at a number of points along the waterfront. All sewage is now intercepted and pumped to the treatment plant, which is located on the shore of San Francisco Bay about 800 ft south of the Sausalito city limit.

The primary-type treatment plant was imaginatively designed to fit an extremely limited site at the foot of the steep coastal bluff. It consists of a 55-ft diameter, 9.5-ft deep clarifier constructed on top of a 75-ft diameter, 13-ft deep heated sludge digester. Plant effluent is discharged through an outfall line about 300 ft in length which terminates 30 ft below the surface of the bay. Digested sludge is also discharged through the outfall line on a falling tide.

The plant has a design capacity of 2.0 mgd, compared to a measured average dry weather flow of 1.37 mgd during the summer of 1965. The peak hydraulic capacity of the plant is not precisely known. However, the plant superintendent reports that the clarifier will carry hydraulically the maximum flow which can be pumped to the plant by the Main Street pumping station, which handles all flow from the district, and by the Fort Baker pumping station. Pumping system curves for the Main Street station presented in a 1959 report to the district by M. Carlton Yoder,[11] together with the known characteristics of the Fort Baker station, indicate that the probable peak flow arriving at the plant is 8 mgd.

Historically, the Sausalito-Marin City system has suffered both from stormwater infiltration and from salt water infiltration into bay front sewers. Since Tamalpais Valley and Richardson Bay Sanitary Districts both contribute flow to the upper end of the Sausalito-Marin City system, it is difficult to say precisely where the storm water infiltration occurs. Records indicate that the problem is common in some degree to all three districts. During periods of heavy rainfall, typically two or three times a year, the Sausalito-Marin City district has found it necessary to relieve the overburdened trunk system by opening a bypass valve near the U.S. 101 highway bridge and bypassing up to 2 mgd or more of raw sewage to Richardson Bay. Records kept by the district indicate that in the last four years this bypass has been opened nine times for a total period of 169 hours.

In 1958 M. Carlton Yoder conducted a study of salt water infiltration into Sausalito-Marin City bayfront sewers[11] which indicated heavy infiltration at high tidal elevations. While not all of the conditions have been corrected, the district feels that the locations of all trouble spots are known and that correction is only a matter of allocating the necessary money and manpower.



TREATMENT PLANT of the Sausalito-Marin City Sanitary District discharges primary effluent to deep water in San Francisco Bay.

Tamalpais Valley Sanitary District. Tamalpais Valley was the last populated area in the Richardson Bay watershed to construct a public sewerage system. In 1954 the Tamalpais Valley Sanitary District was formed, and a sewage collection system was con-

structed the following year. Prior to 1954, the entire area depended on septic tanks, with resulting sanitary conditions comparable to those described for Homestead Valley and Almonte.

Tamalpais Valley Sanitary District encompasses an area of 1.5 sq mi containing a present population of 4500. Sewage from the district is conveyed by gravity to a pumping station located at the mouth of Tennessee Valley, from whence it is pumped through some 9200 ft of 15- and 16-in. force main to the upper end of the Sausalito-Marin City gravity trunk system. All but 3300 ft of the force main is owned by Sausalito-Marin City Sanitary District and is used jointly by that district as well as by Tamalpais Valley and Richardson Bay Sanitary Districts. The Tamalpais Valley pumping station is reported to have a pumping capacity of about 2.5 mgd[12] which at present exceeds the capacity of the force main system to which the flow is discharged. Provision was made in station design for doubling the present installed pump capacity.

A 1963 report on system capacity by Edward B. Beattie[12] indicates that the district sewage collection system has a capacity adequate for present flows even under wet weather conditions. Reported values for storm water infiltration are lower than the average for the Richardson Bay watershed, due in part, no doubt, to the fact that the sewers were recently constructed and show the benefits of improved construction and techniques.

Treatment of Tamalpais Valley sewage is performed at the Sausalito-Marin City plant under a contract which apportions the cost of treatment on the basis of the ratio of total annual flow from Tamalpais Valley to the total annual flow at the plant.

Richardson Bay Sanitary District. The Richardson Bay Sanitary District serves the Strawberry area and about half of the area on the Tiburon Peninsula which drains to Richardson Bay. The first sewers were installed in the Strawberry area in 1945 after individual septic tanks throughout the area had failed. Treatment was initially provided by community septic tanks which discharged to the bay, and by 1948 three such systems were in service. Shortly after formation of the district in 1949, two trickling filter "package" plants were constructed to serve newly developed areas. In 1953, a pumping station and force main were constructed to deliver sewage from the Strawberry area to the Sausalito-Marin City system for treatment. At that time the community septic tanks were abandoned and one of the small trickling filter plants was converted to a pumping station. In 1958 the second trickling filter plant was replaced by the Trestle Glen plant, which now treats sewage collected from the district area to the east of Strawberry.

The present district boundary encompasses a total area of 2.4 sq mi containing 9000 residents, all of whom are reported to be connected to the sewerage system. District facilities include a sewage collection system having sewers ranging in size from 6 to 15 in., eight pumping stations in the collection system, a terminal pumping station at Ricardo Road which transfers flow to the Sausalito-Marin City system, and the Trestle Glen sewage treatment plant.

Storm water infiltration into the sewage collection system has been a problem for many years. During periods of heavy rainfall raw sewage must be bypassed to Richardson Bay to prevent surcharged manholes from overflowing into the streets. The problem is particularly severe in that portion of the collection system tributary to the Ricardo Road pumping station. In a 1963 report to the district board of directors[13] J. Warren Nute reported that during the winter of 1962-63 the Ricardo Road pumping station operated at full capacity for a total of 293.5 hours, equivalent to 12-1/4 days. It may be assumed that during a major portion of this period sewage was being bypassed to the bay upstream of the pumping station. Somewhat ironically, the records from Sausalito-Marin City indicate that during 80 hours of this period Sausalito-Marin City Sanitary District was bypassing sewage to the bay at a point near the Ricardo Road force main connection. The rate of bypass at this point is unknown, but was probably at least equal to the flow pumped by the Ricardo Road Station. At the Trestle Glen plant the chief operator states that wet weather flows occasionally exceed the capacity of secondary treatment units but that it has not been necessary to bypass raw sewage ahead of the plant.

Sewage flow from Richardson Bay Sanitary District during the dry weather summer months of 1965

TRESTLE GLEN PLANT of Richardson Bay Sanitary District provides secondary treatment for a dry weather flow of 0.15 mgd.

averaged 0.5 mgd, of which 70 percent was pumped to Sausalito-Marin City Sanitary District and 30 percent was treated at the Trestle Glen sewage treatment plant. The latter plant has a design capacity of about 0.3 mgd. Laboratory tests indicate that the plant is achieving a BOD reduction of 88 percent and a suspended solids reduction of 87 percent. Plant units include an influent pumping station with a capacity of 1 mgd, a primary and a secondary clarifier each 30 ft in diameter, a 24-ft diameter high-rate trickling filter, two 26-ft diameter spirovortex mixing tanks, and an unheated digester with a capacity of 10,500 cu ft. Chlorinated plant effluent is discharged through a short outfall line to the adjacent mud flats of Richardson Bay. Early in 1967, a digested sludge incineration unit was placed in operation, replacing the open air drying beds previously used.

Sanitary District No. 5. Most of the eastern end of the Tiburon Peninsula lies within the boundary of Sanitary District No. 5. Formed in 1922, the district now comprises a total of 1.4 sq mi and contains 7000 residents, 6500 of whom are served by the district sewerage system.

The first sewers in the area were constructed in 1924, and until 1949 all sewage was discharged raw to San Francisco Bay. District facilities now include six pumping stations, some 48 miles of sewers and force mains ranging in size from 6 to 18 inches, and a primary sewage treatment plant. In addition to treating the sewage from District 5, the treatment plant serves the City of Belvedere under a contractual arrangement which bases treatment charges on total sewage flow from the city.

First constructed in 1949, the treatment plant was expanded in 1961 to its present design capacity of 1.6 mgd. Average dry weather flow during the summer of 1965 amounted to 0.7 mgd for the district and Belvedere combined.

Principal plant units consist of an influent pumping station with a capacity of about 7 mgd, two rectangular primary sedimentation tanks, each 56 ft by 14 ft by 10 ft deep, a heated primary digester with a capacity of 16,500 cu ft, a 5300 cu ft unheated secondary digester, and a 2600 cu ft chlorine contact chamber. Peak hydraulic capacity of the treatment units is reported to be 7.5 mgd. Plant effluent is discharged directly to Raccoon Strait, and digested sludge is trucked away for agricultural use. The limited data available on treatment efficiency indicate that results obtained are typical for a well-operated primary treatment plant.

Sanitary District No. 5 has agreed to assume sewerage responsibility for a proposed subdivision in the Paradise Cove area. A 60-acre area near Paradise Cove has been annexed to the district, and current plans require the developer to build a small secondary treatment plant to be operated by district personnel.

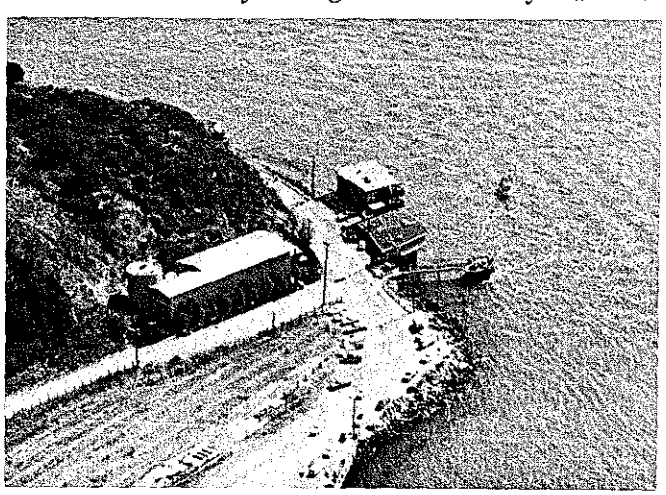
City of Belvedere. Incorporated in 1896, the City of Belvedere is entirely residential in character and occupies an area of about 0.6 sq mi consisting principally of Belvedere Island and the adjacent lagoon. The first sewers, installed over 60 years ago, conveyed sewage to the southern tip of the island, where it was discharged raw into Raccoon Strait.

Except for local improvements and expansion of the collection system, this mode of operation prevailed until 1961. At that time the collection system was further improved and a terminal pumping station and force main were constructed to convey all of the city's sewage to the Sanitary District No. 5 plant for treatment. The city sewerage system now serves all of the 2600 city residents by means of 9 pumping stations and some 10 miles of sewers and force mains ranging in size from 6 to 15 inches.

Storm water infiltration into the collection system is very high on a unit basis, but because of the small area involved, peak wet weather flows are usually within manageable limits. The terminal pumping station on the city system has a capacity of 1.5 mgd, and maintenance personnel report that this capacity has been exceeded only once in the last four years. When peak flow exceeds pumping capacity, a manually-operated bypass is opened and excess flow is diverted to the old raw sewage outfall, which terminates about 20 ft below the surface of Raccoon Strait.

Corte Madera Watershed

Public sewerage within the Corte Madera watershed is controlled by five agencies: Sanitary Districts

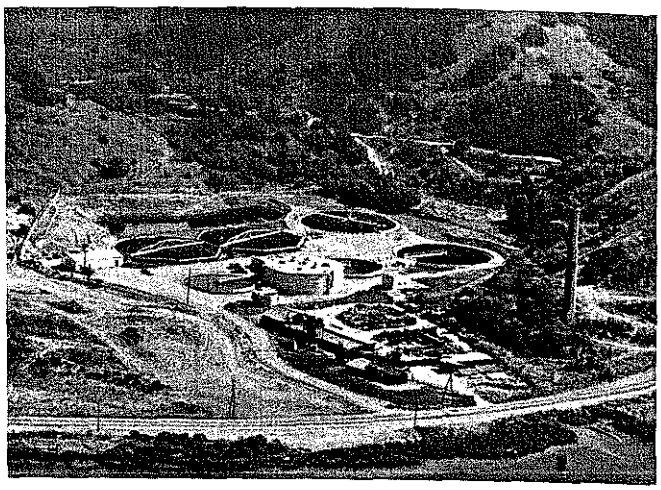


PRIMARY TREATMENT PLANT at left serves Sanitary District No. 5 and the City of Belvedere. Structures at right are private homes on the shore of Raccoon Strait.

No. 1 and 2, the City of Larkspur, and the Murray Park and San Quentin Village Sewer Maintenance Districts. Together, these agencies cover 21 of the 30 sq mi of land area within the watershed. In addition, the State of California operates a sewerage system which serves San Quentin Prison. The latter system is described in the section on state and federal agencies.

The only public sewage treatment plant in the watershed is operated by Sanitary District No. 1. Sewage from the other public agencies is conveyed to the District 1 plant for treatment with the exception of San Quentin Village Sewer Maintenance District, which is served by the San Quentin system.

Of the total present watershed population of 56,000, about 50,000 are connected to public sewerage systems. Principal sewerage facilities within the watershed are shown in Fig. 4-2.



SECONDARY TREATMENT PLANT of Sanitary District No. 1 discharges chlorinated effluent to the mouth of Corte Madera Creek.

Sanitary District No. 1. As first organized in 1899, Marin County Sanitary District No. 1 included Kentfield, Ross, and the southerly part of San Anselmo. The district was reorganized in 1922 under the 1918 Sanitary District Act, and by 1936 had grown to substantially its present size of 18 sq mi. All but a few hundred of the district's 36,400 residents live within the sewered area of 13 sq mi. The remaining 5 sq mi within the district boundaries is almost totally undeveloped.

The earliest history of the sewer system is vague; however, several miles of trunk and lateral sewers appear to have been in service prior to 1923. In that year a major trunk, which is still in service, was constructed from Manor to Greenbrae. The 1923 project also included construction of an Imhoff tank near Greenbrae discharging to Corte Madera Creek. This situation existed until 1949, when the first units of the present treatment plant were completed.

Enlarged in 1962, the sewage treatment plant now has a design capacity of 4.5 mgd and a peak hydraulic capacity of at least 15 mgd. The latter figure is based on the actual flow through the plant as recorded on January 4, 1966. Dry weather flow during the summer of 1965 averaged 3.6 mgd.

The treatment plant affords secondary treatment by means of a two-stage biologic filtration process. Principal plant units include two primary clarifiers, each 70 ft in diameter, two primary trickling filters, each 110 ft in diameter, a 95-ft diameter secondary trickling filter which is expandable to 170 ft, a 100-ft diameter secondary clarifier, and a heated sludge digester with a capacity of 130,000 cu ft. The lagoon originally employed for digested sludge has been abandoned, and sludge is now dewatered by centrifuge. Chlorinated plant effluent is discharged through a short outfall to the mouth of Corte Madera Creek. Plant records show the plant to be achieving a 90 percent efficiency in the removal of both BOD and suspended solids.

The sewage collection system comprises about 135 miles of sewers from 4 to 36 inches in diameter and includes eight pumping stations. As in many other areas of Marin County, the system has inadequate capacity to carry peak wet weather flows. The State Bureau of Sanitary Engineering, in a report dated May 28, 1945,[14] reported five major points of wet weather overflow along the route of the main trunk sewer and stated that the overflows had been reported since shortly after the trunk was constructed in 1923. To date, no additional sewers have been constructed to augment the capacity of the 1923 trunk. On the contrary, expansion of the collection system to serve a burgeoning population has caused a steady increase in sewage flows. As a result, the five points of overflow mentioned in the 1945 Bureau of Sanitary Engineering report now overflow with an increasing frequency, and in addition, overflowing manholes are common along the route of the trunk sewer during moderate to heavy rains. To complicate matters, the upper end of the Sanitary District No. 1 service area receives the heaviest rainfall of any sewered area in Marin County.

Operating personnel report that all of the eight pumping stations have adequate capacity to pump the peak flows which arrive at the stations. Sewage overflows at the pumping stations therefore occur only in the unusual event of power outage or equipment failure.

Sanitary District No. 2. Sanitary District No. 2 was officially incorporated in 1901, and in 1906 the first major sewer construction program was undertaken. From that date until 1950 sewerage system

enlargements consisted of the construction of local sewers as the need arose.

Shortly after completion of the Sanitary District No. 1 sewage treatment plant in 1949, District 2 negotiated an agreement with District 1 for sewage treatment. The original agreement, which granted District 2 a capacity right of 0.175 mgd in the District 1 plant, was renegotiated in 1960 to provide District 2 a capacity right of 1.175 mgd based on average dry weather flow. The cost of treatment is proportioned on the basis of total flow.

The present boundary of Sanitary District No. 2 encompasses an area of 3.1 sq mi containing 9000 residents, most of whom are connected to the sewerage system. The collection system comprises about 31 miles of gravity sewers and force mains ranging in size from 4 to 27 inches. Because much of the district lies on the marsh lands adjacent to San Francisco Bay, a total of 12 pumping stations are required.

Many sewers in the hilly portion of the district are 50 to 60 years old, of substandard construction, and some are badly deteriorated. Some storm drain connections to sanitary sewers have been discovered and corrected, but others undoubtedly exist. Storm water infiltration, as a consequence, is very high. Some sewers built in the reclaimed marshlands have suffered the effects of settlement, which has resulted in cases of sheared and broken pipes. Groundwater infiltration into the low lying sewers, while not as serious as the storm water problem, adds a year-round increment to sewage flows.

Since 1957 the district has been engaged in a continuing program to upgrade its collection system. Starting in 1963, a ten-year program was undertaken with the objective of gradually replacing about seven miles of older sewers, and when completed it is anticipated that major sources of storm water entry will have been largely eliminated.

City of Larkspur. Incorporated in 1908, the City of Larkspur now covers an area of 2.8 sq mi containing a population of 8750. The city retains responsibility for sewage collection within its boundaries, and in addition accepts flow from the collection system of tiny Murray Park Sewer Maintenance District. Sewage from the city is pumped to the nearby main trunk of Sanitary District No. 1.

The first sewers were constructed in Larkspur some time prior to incorporation, and until 1949 sewage was discharged raw into Corte Madera Creek. In 1949 Larkspur negotiated an agreement with Sanitary District No. 1 for the treatment of Larkspur sewage in the new District 1 plant. The agreement is similar in scope and terms to that between Districts 1 and 2, except that Larkspur's capacity right is limited to 0.5 mgd.

The total length of sewers in the Larkspur system is about 29 miles with pipe sizes ranging from 6 to 18 inches. The city operates two pumping stations, including the terminal station which delivers sewage to Sanitary District No. 1.

No accurate information on wet weather flows is available for the Larkspur system. However, city personnel report that except for a single four-inch overflow point which operates during heavy rainfall, it is not necessary to bypass raw sewage from the collection system.

Murray Park SMD. The Murray Park Sewer Maintenance District was formed in 1949 to provide public sewerage to an area of about 60 acres which is naturaly tributary to the City of Larkspur but lies outside the city limit. All service and maintenance functions are performed by the City of Larkspur.

San Quentin Village SMD. The San Quentin Village Sewer Maintenance District was formed in 1964 to serve the small residential area which houses prison employees. Prior to formation of the district the 60 or so homes in the village discharged raw sewage to San Francisco Bay. In 1965 a pumping station was constructed to divert the sewage flow to the San Quentin Prison sewerage system. Though it exists as a public sewerage agency of Marin County, the district may for all practical purposes be considered a part of the prison sewerage system.

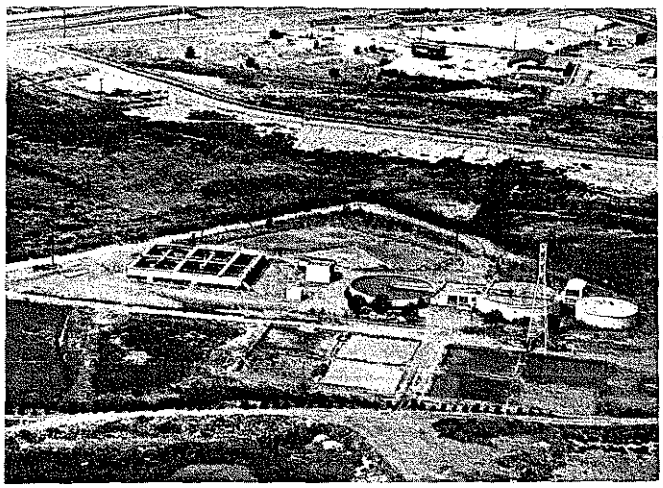
San Rafael Watershed

The area which drains to San Rafael Bay, a total of about 11 sq mi, is identified as the San Rafael watershed. San Rafael County Sanitation District is the only public sewerage agency within the watershed and includes within its boundaries all but about 2 sq mi of the watershed. Principal sewerage facilities of San Rafael County Sanitation District are shown in Fig. 4-3.

Substantially all of the 30,000 residents within the San Rafael watershed are included in the San Rafael County Sanitation District and are connected to the district sewers. Early history of the sewerage system is vague, but it is reported that the first sewers were installed prior to 1920. The present system consists of 14 pumping stations, about 83 miles of sewers and force mains ranging in size from 6 to 27 inches, and two treatment plants.

The main San Rafael treatment plant is located on the marshland at the shore of San Rafael Bay and discharges to the bay. The treatment process is modified activated sludge, and provides an intermediate degree of treatment higher than primary but lower

than secondary treatment by the conventional activated sludge process.



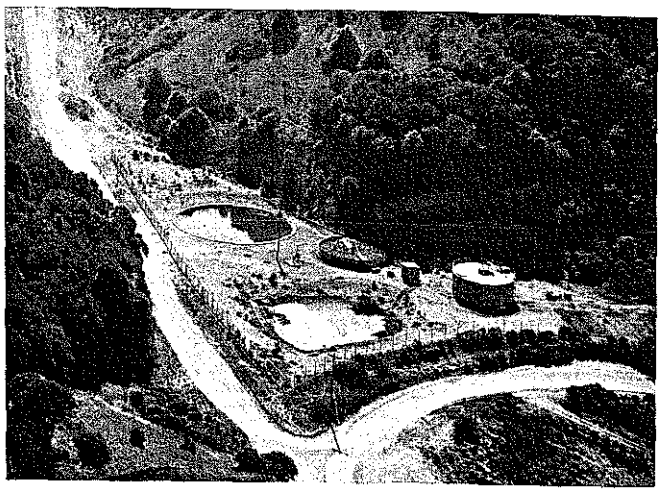
SAN RAFAEL SANITATION DISTRICT sewage treatment plant provides an intermediate degree of treatment by a modification of the activated sludge process.

The original plant units, constructed in 1949, consist of a 70-ft diameter primary clarifier, a 76,000 cu ft capacity heated sludge digester, and an operations building. Additions in 1962 included an aeration tank, two 40-ft square secondary clarifiers, and an unheated secondary digester with a capacity of 39,000 cu ft. The rectangular aeration tank has a capacity of 14,500 cu ft. Currently nearing completion is a construction project which includes two additional secondary clarifiers, identical to the 1962 additions, and pile foundations for a future second aeration tank.

Design flow for the present plant is reported to be 5 mgd, compared to an average dry weather flow of 2.3 mgd recorded during the summer of 1965. Treatment plant efficiency, based on five laboratory test reports during 1965 and 1966, averaged 77 percent for removal of BOD and 75 percent for removal of suspended solids.

The second treatment plant operated by San Rafael County Sanitation District is a small intermediate treatment plant which serves the Peacock Gap development on Point San Pedro. Designed for a sewage flow of 0.16 mgd, the plant is presently treating a dry weather flow of a little more than half that amount. Plant units include a primary clarifier, a trickling filter and an unheated sludge digester. Disinfected plant effluent is discharged through a short outfall line to San Pablo Bay, and digested sludge is discharged to a lagoon on the plant site. No data are available on plant operating efficiency.

The San Rafael sewerage system has its share of difficulties caused by storm water infiltration. During the rainy season, sewage flows frequently exceed the capacity of treatment facilities and necessitate the bypassing of raw sewage to the bay. Plant records indicate that during the two-year period from July 1964 to May 1966, all or a portion of the flow was bypassed at the plant during 57 days. The capacity problem is not confined to the treatment plant. Overflowing manholes in the collection system are reportedly a common occurrence during rainy weather.



MARIN BAY PLANT of San Rafael County Sanitation District provides intermediate treatment for sewage from the Peacock Gap area and discharges to San Pablo Bay.

Las Gallinas Watershed

The drainage area which comprises the watersheds of Gallinas, Santa Margarita, and Miller Creeks is designated as the Las Gallinas watershed. The western half of the 21-sq mi watershed area is very sparsely inhabited, while the eastern half contains over 23,000 residents. A single public sewerage agency, Las Gallinas Valley Sanitary District, provides sewerage service within the watershed. Principal sewerage facilities within the watershed are shown in Fig. 4-3.

The most recently formed of the major operating public sewerage agencies in Marin County, Las Gallinas Valley Sanitary District serves the fastest-growing area in the county. From its formation in 1954 when it included 245 acres, the district had grown by 1966 to 4200 acres, or 6.6 sq mi. Virtually the entire watershed population of 24,000 is included within the district and connected to the sewerage system.

The first sewers in the area were constructed in 1947 and 1948 in the Portola Gardens development, followed shortly thereafter by developments in San Rafael Meadows, Gallinas Village and Terra Linda. In each case the developer constructed a small treatment plant to serve the local area. Shortly after its formation the district began to annex the separate developments and retire the plants or convert them to raw sewage pumping stations. With the connection

of the Gallinas Village system in the summer of 1966 the process was completed, and the district now retains full responsibility for the collection and treatment of all sewage within the watershed.

The district collection system now includes about 80 miles of sewers, from 6 to 24 in. in diameter, and 11 pumping stations. A central treatment plant is located east of Gallinas Valley and about a mile from the shore of San Pablo Bay.

TREATMENT PLANT of the Las Gallinas Valley Sanitation District employs the biologic filtration process for secondary treatment and discharges to the shallow waters of San Pablo Bay.

The first units of the present treatment plant were constructed in 1955, and consisted of a 41,200 cu ft capacity digester and half of the present primary trickling filter. Expansion in 1959 added two 65-ft diameter clarifiers and expanded the trickling filter to its full diameter of 110 ft. The third increment of expansion in 1965 added a second digester with a capacity of 70,000 cu ft, a 90-ft diameter secondary clarifier, a 90-ft diameter secondary trickling filter which is expandable to 150 ft, and chlorination facilities. Chlorinated plant effluent is discharged to San Pablo Bay via a channel dredged some 8000 ft across the mud flats to mean lower low water. Digested sludge is discharged to a lagoon on the plant site.

The present plant can provide secondary treatment for a design flow of 2.1 mgd. During the summer of 1965 the average dry weather flow was measured at 1.35 mgd. After connection of Las Gallinas Village and installation of a new plant flow meter, the measured flow in the fall of 1966 was 1.85 mgd. Plant records show treatment efficiencies averaging 86 percent for removal of suspended solids and 89 percent for BOD removal.

Since most of the sewers in the district have been constructed within the last 15 years, construction practices were generally better and infiltration rates are therefore lower than in much of the county. By-passes are installed in all trunk lines upstream of pumping stations, but district personnel report that actual overflows are rare except in cases of stoppage or mechanical failure. Occasional overflows were reported upstream of the Terra Linda pumping station, attributed primarily to a lack of pumping capacity rather than a lack of trunk capacity. An additional pump was installed in this station in 1966, and the capacity of the force main to the treatment plant was increased.

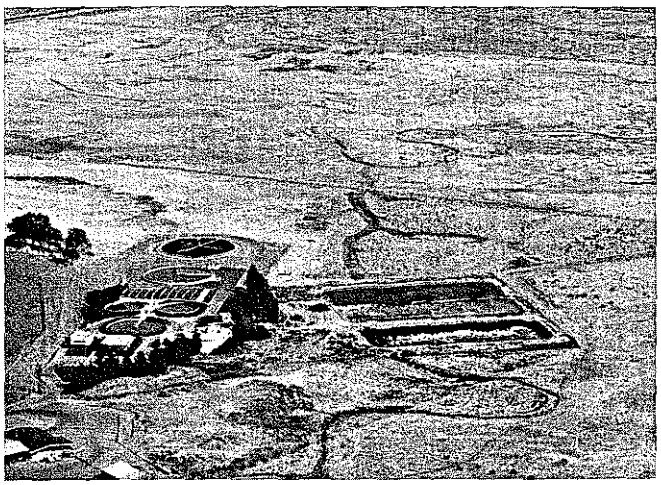
Novato Creek Watershed

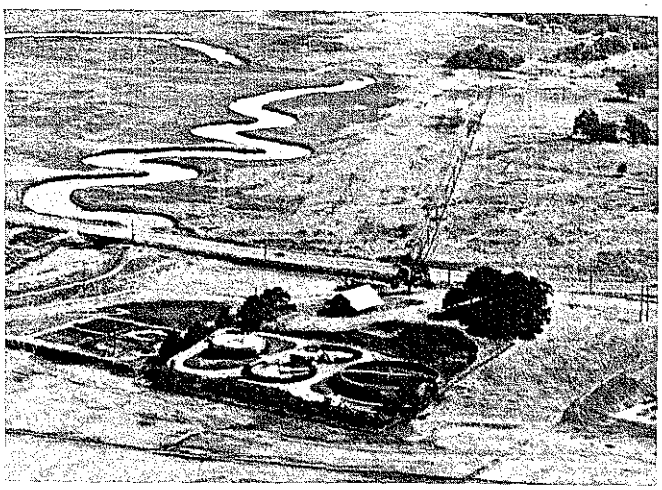
The Novato Creek watershed, one of the largest drainage basins in the county, covers an area of over 50 sq mi and contains a present population of about 32,500. The developed portions of the basin are served by a single public sewerage agency, Sanitary District No. 6. Hamilton Air Force Base maintains its own sewage collection system and treatment plant to serve the major portion of the base, though part of the barracks and family housing are connected to the Sanitary District No. 6 collection system. The Hamilton Field sewerage system is discussed later in this chapter. Principal sewerage facilities within the watershed are shown in Fig. 4-3.

Although it was formed in 1925, Sanitary District No. 6 remained essentially inactive until 1947. In 1948 and 1949 construction was completed on the first units of the collection system and the Novato treatment plant. Rapid population growth has since occasioned major expansions both of the district boundaries and of the sewage collection and treatment facilities. The district boundary now encompasses 15 sq mi containing 30,000 people, over 27,000 of whom are connected to the sewerage system. The remainder still rely on individual disposal systems, principally septic tanks.

The district has already expanded its borders beyond the northern boundary of the Novato Creek watershed and now includes some areas which are topographically tributary to the Petaluma River. A long-range plan prepared for Sanitary District No. 6 in 1965 by Jenks and Adamson[15] considered the ultimate service area of the district to include all of the San Antonio Creek watershed which lies adjacent to the Petaluma River. The Jenks and Adamson report has been used as a major source of reference for information on Sanitary District No. 6.

About two-thirds of the district area of 15 sq mi is presently served by sewers. The sewerage system comprises some 130 miles of sewers from 6 to 30 in. in diameter, nine pumping stations, and three treatment plants known as the Novato, Ignacio and Bahia plants. The Novato and Ignacio plants have both been in service for ten years or more, while the





TWO TREATMENT PLANTS of Sanitary District No. 6 discharge effluent to Novato Creek. The Novato plant (left) has a design capacity of 2.7 mgd, and the Ignacio plant (right) is designed for 0.9 mgd. Both plants provide secondary treatment.

Bahia plant was under construction as this report was written.

The Novato treatment plant, which was constructed in three stages, now has a rated design capacity of 2.7 mgd compared to the 1965 average dry weather flow of 1.55 mgd. The treatment process is a combination of biologic filtration and modified activated sludge treatment using the spirovortex system. Laboratory test results since the latest additions went into service in 1964 show that the plant is achieving an over-all suspended solids removal of 90 percent and a BOD removal of 86 percent.

Principal plant units include a 90-ft diameter primary clarifier, a 100-ft diameter trickling filter, a 6000-sq ft deck aerator, two 55-ft diameter vortex-type mixing tanks, a 75-ft diameter secondary clarifier, and a heated sludge digester with a capacity of 70,000 cu ft. Chlorinated plant effluent is discharged to Novato Creek and digested sludge is discharged to sludge lagoons.

The Ignacio plant is a smaller plant which serves a separate collection system to the south of Novato. Designed for a flow of 0.9 mgd, the plant is presently treating an average dry weather flow of 0.6 mgd. Laboratory reports do not show the strength of the raw sewage, but assuming these values to be the same as at Novato, the Ignacio plant is achieving removal rates of 95 percent of suspended solids and 94 percent of BOD.

Principal plant units consist of primary and secondary clarifiers, each 65 ft in diameter, a 120-ft diameter trickling filter, and a heated sludge digester with a capacity of 70,000 cu ft. Chlorinated plant effluent is discharged to Novato Creek and digested sludge is dewatered on sludge drying beds.

When completed, the Bahia plant will provide extended aeration treatment for a design flow of 0.2 mgd utilizing 29,000 cu ft of aeration tank capacity and two final settling tanks, each 36 ft long, 6 ft wide, and 12.5 ft deep. A third tank identical in size to the settling tanks will provide aerobic digestion of the waste activated sludge. The plant will serve a developing area along the Petaluma River north of Novato and will discharge to the river.

Problems of lack of capacity in the district sewerage system are confined to wet weather periods and then occur primarily in that portion of the system tributary to the Novato plant. During and immediately after heavy rainfall the major portion of the trunk system undergoes serious surcharging despite the fact that the treatment plant influent pumping station is running at full capacity and two auxiliary engine-driven pumps are bypassing raw sewage directly to Novato Creek. The surcharge often reaches the point where manholes overflow. Jenks and Adamson[15] report that the present problem is due primarily to a lack of terminal pumping capacity rather than a lack of trunk capacity. During the period from January 1965 through February 1966 plant records show that the Novato sewage treatment plant bypassed raw sewage to Novato Creek on 19 days for a total of 226 hours.

Bolinas Watershed

The Bolinas watershed covers an area of 28 sq mi and includes the popular recreation areas of Stinson Beach and Bolinas. While there are only about 1,000 permanent residents in the drainage area, the summer population is approximately doubled by vacationers and summer homeowners. The unusual recreational opportunities afforded by the area surrounding Bolinas Lagoon attract additional thousands of swimmers, picknickers, surfers and bird watchers who use the area on a daytime basis. As many as

15,000 day visitors may crowd the available facilities on a summer weekend.

Three separate local agencies, Stinson Beach County Water District, Bolinas Beach Public Utility District, and Bolinas Public Utility District, have the authority to provide public sewerage service. Of these, only the latter actually provides any sewerage service. Bolinas Beach Public Utility District is concerned primarily with supplying water to the district residents. Stinson Beach County Water District, while formed specifically for the purpose of providing sewerage for the Stinson Beach area, has not yet proceeded beyond the study stage, of which this report is the culmination.

Bolinas and Bolinas Beach Public Utility Districts have proposed a consolidation of the two districts into a single entity, to be called Bolinas Community Public Utility District. Consolidation was approved by the voters in the two districts in February 1967 and will become effective on July 1, 1967.

Bolinas Beach Public Utility District. Organized in 1939, Bolinas Beach Public Utility District encompasses an area of about 450 acres, most of which lies on the top of Bolinas Mesa. While it is legally empowered to engage in sewerage, the district has taken no steps toward the development of a sewerage system, and all of the residents depend on septic tanks for sewage disposal. Performance of septic tanks has been spotty, and leaching system failures resulting in surfacing of septic tank effluent have been reported. In at least one case a homeowner was served with an eviction notice by Marin County authities because of the public health hazard created by failure of his leaching system. Topography prohibits sewering the area by gravity into the Bolinas sewage collection system.

Population figures for Bolinas Beach Public Utility District are contradictory, probably due to the large number of homes which are occupied only during the summer. Based on census data and water connections it appears that the summer population is about 600 and the winter population about half that number.

Bolinas Public Utility District. The first sewerage agency in the Bolinas area was Bolinas Sanitary District, formed in 1906. That same year the first sewers were constructed, apparently discharging raw sewage into Bolinas Lagoon under the wharf. The district was later reorganized as Sanitary District No. 3, and in 1927 the collection system was extended to a portion of Bolinas Mesa. It is believed that the outfall line was extended at that time to its present location on the west bank of the channel at the mouth of the lagoon. In any event, records of the Bureau of Sanitary Engineering show that the original outfall, at that location, broke off in 1939 and was replaced by a cast iron outfall line in 1940.

Bolinas Public Utility District was organized in 1926 for the primary purpose of developing a water supply for the district residents. In 1962 Sanitary District No. 3 entered into an agreement transferring funds to Bolinas Public Utility District, and the following year Sanitary District No. 3 was dissolved. Bolinas Public Utility District how holds full responsibility for water and sewerage service within the 1.8 sq mi district area. Size and location of district sewers are shown on Fig. 9-5.

Present district resident population is estimated to be 380. In a report prepared for Bolinas Public Utility District by Kennedy Engineers in 1964[16] the maximum summer population was estimated at 540.

Stinson Beach County Water District. The Stinson Beach area relies entirely on septic tanks and subsurface leaching systems for sewage disposal. The Marin County Health Department has received over the years a number of complaints about overflowing septic tanks, and in June 1961, the Board of Supervisors directed the Sanitation Division to conduct a survey of the adequacy of sewage disposal in the Stinson Beach area. The resulting report stated in summary, "It is our considered opinion that a public health problem does exist in this area, and its solution lies with the formation of some sort of a publicly-owned district in order that the problem can be uniformly dealt with both at the present time and in the future."

On November 6, 1962, the Stinson Beach County Water District was formed for the purpose of providing sewerage service to the area. With the intent of providing a base for unified sewerage planning, the district boundary was established to include virtually all of the area adjacent to Bolinas Lagoon which is not included in Bolinas Public Utility District. The total district area of 11 sq mi includes only about 550 permanent residents, virtually all of whom live in Stinson Beach. Summer residents swell the total to about 1200, and as many as 13,000 day visitors have been accommodated at Stinson State Beach.

Shortly after its formation the district engaged a consulting engineer to undertake studies both of a sewerage system for the district and of the possibilities of joint sewerage action with the other agencies within the watershed. The complexity of the problems involved indicated the need for a study of wider scope, and further action has been withheld pending the completion of this study.

Joint Sewerage Action. Residents of the Bolinas

watershed generally endorse the common goal of protecting the local marine environment from pollution due to sewage discharge. There has been, however, wide disagreement as to how this goal can best be achieved. In the interest of better understanding the situation as it now exists, it is worthwhile to present a brief chronological summary of the major events of the last five or six years which concern the status of sewerage in the Stinson Beach-Bolinas area. The chronology of events was abstracted principally from a May 1964 report by the San Francisco Bay Area Regional Water Quality Control Board.[17]

September 21, 1961.

The Regional Water Quality Control Board adopted Resolution No. 372 prohibiting the continued discharge of raw sewage by Sanitary District No. 3.

September, 1961.

The Marin Department of Public Health recommended formation of a public sewerage agency to serve the Stinson Beach area.

November 6, 1962.

Stinson Beach County Water District was formed.

February 2, 1963.

Sanitary District No. 3, Bolinas Beach Public Utility District, and Stinson Beach County Water jointly appealed to the Marin County Board of Supervisors for assistance in conducting a sewerage study of the entire Bolinas watershed.

April 18, 1963.

The Regional Water Quality Control Board adopted Resolution No. 458 ordering Sanitary District No. 3 to cease and desist violation of Resolution No. 372. Resolution No. 458 is still in effect, though enforcement has been held up pending the outcome of this study.

July 1, 1963.

Bolinas Public Utility District formally assumed the authority of Sanitary District No. 3.

July 5, 1963.

Bolinas Public Utility District authorized the engagement of Mr. G. A. Horstkotte as engineering consultant for the district. Mr. Horstkotte subsequently recommended that Bolinas Public Utility District proceed on its own to solve its sewerage problems, and as a result the district withdrew its support from the area-wide study.

September 20, 1963.

Bolinas Public Utility District engaged Kennedy Engineers to conduct a study and recommend an appropriate method of sewage treatment and disposal.

September, 1963 (approximate).

Stinson Beach County Water District engaged M. Carleton Yoder to study collection, treatment and disposal of sewage for Stinson Beach.

February, 1964.

Kennedy Engineers[16] recommended that Bolinas Public Utility District build a small treatment plant near Wharf Road with discharge through the existing outfall, a project not considered feasible for joint Bolinas-Stinson Beach sewage treatment.

May, 1964.

M. Carleton Yoder[18] recommended further consideration of joint sewerage action between Stinson Beach County Water District and Bolinas Public Utility District, possibly on the basis of land disposal of effluent.

November, 1964.

Kennedy Engineers, in a report to Bolinas Public Utility District,[19] found land disposal of sewage effluent to be infeasible in view of the Water Quality Control Board prohibition of effluent discharge to Bolinas Lagoon.

December 17, 1964.

The Water Quality Control Board adopted Resolution No. 617, a long-range plan and policy for pollution control in the Stinson Beach-Bolinas area. In addition to establishing receiving water quality objectives from Rocky Point to Point Reyes National Seashore, Resolution No. 617 requires dischargers to report on the feasibility of joint sewerage action.

July, 1965.

Marin County Board of Supervisors, upon recommendation of the Department of Public Health, authorized a study aimed at preparing a county-wide sewerage master plan and designated the Bolinas watershed for special detailed consideration.

March 15, 1966.

Marin County Board of Supervisors executed a contract with Brown and Caldwell for preparation of the countywide sewerage study and report. All three Stinson Beach-Bolinas districts agreed to participate with the county in the cost of the detailed study of the Bolinas watershed.

April 1, 1967.

Brown and Caldwell submitted to the county an interim report setting forth a long-range sewerage plan for the Bolinas watershed. All of the information contained in the interim report is also included in this report.

Tomales Bay Watershed

The Tomales Bay watershed, with a present population of only about 3000, contains a single small public sewerage agency, the Tomales Sewer Maintenance District. Fewer than 400 people reside in the district, and the remainder of the watershed population is scattered along the shores of the bay in a number of small unincorporated communities.

Once a thriving agricultural community, the un-

incorporated town of Tomales has over the years lost most of its commercial activity to Petaluma, which is now only 20 minutes away by car. The only industry, a cheese factory, ceased operation about 1958. The remaining residents of the town, as well as the union high school and grade school, either use individual disposal systems or discharge sewage raw to Keys Creek. As early as 1926 the State Bureau of Sanitary Engineering characterized the condition of Keys Creek below Tomales as "truly shocking."

In 1953 the North Coastal Region Water Quality Control Board adopted requirements prohibiting the discharge of untreated sewage to Keys Creek. Tomales Sewer Maintenance District, formed in 1956, subsequently submitted to the State Department of Public Health two plans for collection and treatment of sewage. Neither plan received the approval of the Department of Public Health, and the district is now inactive, standing with Bolinas as one of the two agencies in the county which now discharge raw sewage to the waters of the state.

County-wide Sewerage Agencies

By virtue of their roles as principal water purveyors in the county, Marin Municipal Water District and North Marin County Water District have assumed the responsibility for meeting county-wide water requirements as the need arises. Each agency has the statutory authority to provide sewerage service as well, and each is presently engaged in preliminary planning for sewerage of areas which lie within the water districts but outside the planning area of other public sewerage agencies. At the time this report was written neither agency was engaged in the actual construction or operation of sewerage facilities.

The policy of both agencies with regard to annexations, service area planning, and provision of sewerage service is presented in a Joint Statement of Policy prepared in 1965.[20] In reference to sewerage service, the statement reads as follows: "The Districts are willing to consider the possibility of sewer service in presently unsewered areas lying outside the logical master plan areas of existing sanitary agencies which may be within or without the boundaries of the present Water Districts. The Districts acknowledge their power to undertake the waste disposal, but believe that the public health aspects of individual waste disposal systems are the primary responsibility of the county of Marin. The Districts recognize the need for over-all coordination of waste disposal programs, particularly those in presently undeveloped areas, and will cooperate in achieving this objective."

The present boundaries of the two water districts and the mutually-accepted boundary for future planning are shown on Fig. 4-1. Marin Municipal Water District has accepted responsibility for sewerage in the developing community of Marincello, while North Marin County Water District has begun preliminary planning for sewerage service in a recently-annexed area along the eastern shore of Tomales Bay.

State and Federal Agencies

Seven state and federal agencies operate separate sewage collection and disposal systems within Marin County. Of these, only Hamilton Air Force Base, San Quentin Prison, and Samuel P. Taylor State Park are of major concern to this study. The others are Fort Baker, Forts Barry and Cronkhite, Mill Valley Air Force Base, and Angel Island State Park.

Fort Baker, which now pumps its sewage to the Sausalito-Marin City sewage treatment plant, is expected to be abandoned before long. Forts Barry and Cronkhite, which utilize a septic tank and subsurface leaching field for sewage disposal, will also soon be abandoned.

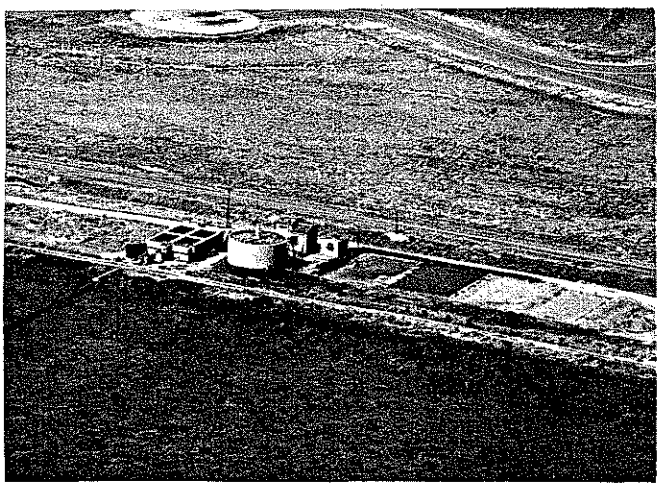
Mill Valley Air Force Base is a radar installation situated on the top of Mt. Tamalpais at the extreme southern end of the Lagunitas Creek watershed. The normal base complement of about 150 persons is a stable figure, and the present technique of hillside spray disposal of sewage effluent should remain adequate for future needs.

Angel Island State Park uses a septic tank for sewage treatment, discharging the chlorinated effluent to Raccoon Strait. The number of persons visiting Angel Island State Park will undoubtedly show a future increase commensurate with increases in population and small boat ownership. However, the park is entirely administered by the state and is located next to Raccoon Strait, which is one of the most suitable areas in San Francisco Bay for efficient sewage effluent disposal. Angel Island may therefore be excluded from Marin County sewerage planning.

Hamilton Air Force Base. Aside from that portion of the housing area which is served by Sanitary District No. 6, all sewage from Hamilton Air Force Base is conveyed to the base treatment plant which is located on the shore of San Pablo Bay. Constructed and operated by the Air Force, the plant provides primary treatment and separate sludge digestion for a present average flow of about one mgd. Effluent is discharged to the adjacent tidal flats of San Pablo Bay.

The Chief Civilian Engineer at Hamilton reports that studies have been made of the economic feasibility of delivering sewage from the base to either Sanitary District No. 6 or Las Gallinas Valley Sanitary District. The studies showed that the cheapest alternative was for Hamilton to continue to treat the

sewage at its own plant. As a result, the firm of Consoer, Townsend and Associates was engaged to design secondary treatment facilities for the present plant. Construction drawings for the expanded plant, which will have a capacity of 1.5 mgd, are now completed, and construction is expected to begin in 1967. When construction is completed, base personnel expect that the plant will be adequate for the ultimate requirements of the base.



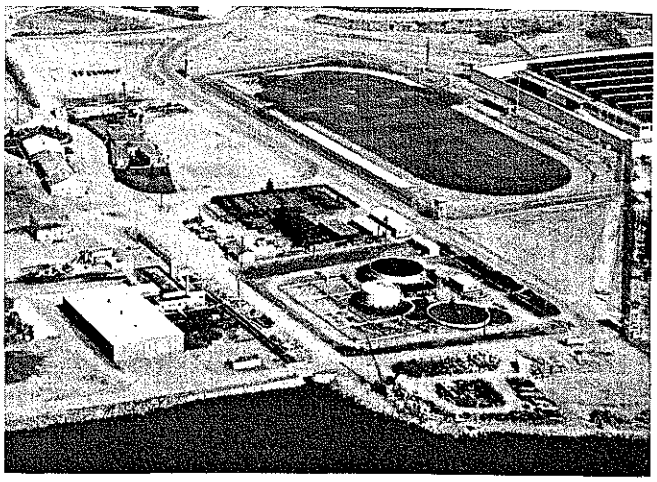
HAMILTON AIR FORCE BASE sewage treatment plant discharges effluent to the shallow waters of San Pablo Bay after primary treatment. Secondary treatment will soon be added.

San Quentin State Prison. Located on the south side of Point San Quentin, the state prison accommodates an inmate population of about 3800. Sewage from the prison and from San Quentin Village Sewer Maintenance District is treated at the prison plant, which is located about 3500 ft east of the Sanitary District No. 1 plant.

Prison sewage comprises not only the domestic wastes from the inmates, but also the wastes from the prison industrial complex. Both fresh and salt water are used in the prison, the former at a rate of about 1 mgd and the latter 0.4 mgd. The sewage, as a result, is about one-third sea water. Present plans call for abandonment of the salt water system in the near future and use of fresh water only.

The sewage treatment plant consists of an influent pumping station, a 60-ft diameter primary clarifier, a 60-ft diameter trickling filter, and a 25,000 cu ft capacity unheated sludge digester. Chlorinated effluent is discharged through a short outfall line to San Francisco Bay. The plant is designed for a flow of about 1.0 mgd, compared to a 1965 average dry weather flow of 0.93 mgd. Peak hydraulic capacity of the plant is not precisely established, but is known to be at least equal to the maximum pumping rate of about 3.5 mgd.

Although the plant is designed to provide an intermediate degree of treatment by circulating flow from



SAN QUENTIN PRISON sewage treatment plant serves the prison community. After intermediate treatment the sewage is discharged to the adjacent shallow waters of San Francisco Bay.

the primary clarifier through the trickling filter and back to the clarifier, the average plant efficiency of 37 percent BOD removal reported for 1965 is little better than that normally attainable by primary treatment alone. A request has been submitted by prison authorities for $200,000 to finance construction of another trickling filter and a secondary clarifier, thus providing full secondary treatment. State officials have also indicated that they would consider with favor a plan to abandon the San Quentin plant if this study shows a centrally located plant to be economically advantageous.

Samuel P. Taylor State Park. Samuel P. Taylor State Park includes over 2500 acres of rugged hillsides and redwood canyons at the lower end of San Geronimo Valley. Lagunitas Creek, a year-round stream at this location, runs through the park for more than three miles. In a typical year monthly park attendance by both campers and day visitors will vary from an August high of 40,000 to a December low of 2000. Attendance by 2500 or more persons can be expected on several days during the summer.

The park has its own sewerage system, which consists of about a mile of 4-in. to 8-in. sewers, two lift stations, a sewage treatment plant, and a hillside spray field for land disposal of effluent. The treatment plant has a design capacity of 50,000 gallons per day and provides secondary treatment by means of primary and secondary sedimentation tanks, a standard rate trickling filter, and an unheated sludge digester. Plant effluent is pumped to a four-acre hillside disposal site and sprayed over a wooded area where the ground is heavily covered with forest litter.

No flow or treatment data are available, but based on a sewage flow of 10 gallons per visitor per day the plant is operating at about half capacity on the maximum day of use.

CHAPTER 5
SEWAGE CHARACTERISTICS

Design of facilities for collection, treatment, and disposal of sewage is dictated primarily by the loadings anticipated during the design period under consideration. In order to develop estimates of future loadings it is necessary first to determine unit quantities for the components affecting both the volume of sewage and its strength and composition. Since the characteristics of sewage may vary from one community to the next, depending on the physical and economic environment, unit quantities for design purposes must be based on an evaluation of the sewage characteristics in the area under study. Where indicated, appropriate allowances for future change must be included.

Definition of Terms

As a preface to a discussion of sewage characteristics, it is helpful to define some of the terms used in this report.

Sewage. A combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, together with such ground, surface and storm waters as may be present.

Domestic Sewage. Sewage principally derived from the sanitary conveniences of residences or produced by normal residential activities.

Commercial Sewage. Sewage generated in predominantly business or commercial districts, including not only sanitary wastes, but also the wastes from the commercial activities themselves. Typically, commercial sewage might include wastes from restaurants, laundromats, and service stations.

Industrial Wastes. Liquid wastes from manufacturing and industrial processes as distinct from sanitary wastes.

Infiltration. The unintentional entry of water into the sewage collection system from the surrounding soil. Common points of entry include broken pipe and defective joints in the pipe or in walls of manholes. Infiltration may result from sewers being laid below the ground water table or from saturation of the soil by rain or irrigation water.

Direct Storm Inflow. Rain water which enters the sewage collection system through known openings in sewage conduits. Points of entry may include roof and patio drain connections, catch basin connections, and holes in the tops of manhole covers in flooded streets. Direct storm inflow is distinguished by the rapidity with which it begins and ends after a period of rainfall. Storm water infiltration, on the other hand, may persist for an extended period after the cessation of rainfall.

Storm Water Inflow. Water originating as rainfall which finds its way into the sewage collection system either by infiltration or by direct inflow.

Dry Weather Flow. Sewage flow during periods of no rainfall. Rates of flow exhibit hourly and daily variations. A certain amount of infiltration may be present.

Wet Weather Flow. Sewage flow during periods of moderate to heavy rainfall. Storm water inflow may increase the wet weather flow to a rate many times greater than the dry weather flow, and unless provided for in sewerage system design can produce hydraulic overloads which result in sewage overflows to public streets or watercourses.

Biochemical Oxygen Demand. The quantity of oxygen required to support biologic oxidation of the organic matter contained in sewage. Usually referred to as BOD, this characteristic defines the strength of a sewage and often determines the degree of treatment which must be provided to produce a required effluent quality.

Suspended Solids. The suspended material transported in sewage. Suspended solids and BOD are two principal criteria used in defining the strength of a sewage or the quality of an effluent. The quantity of suspended material removed during treatment varies with the type and degree of treatment and has an important bearing on the size of many mechanical and process units.

SEWAGE VOLUME

Study of sewage flows in the existing sewerage systems of Marin County provides a rational basis for projection of future flows. With minor exceptions, all of the sewage collected by public sewerage agencies is treated before discharge, and each of the major treatment plants contains a recording flow meter. The data available to this study therefore included several years of flow records for each major sewerage agency. Because of the difficulties inherent in measuring sewage flows, the accuracy of a single set of flow records is often open to question. Where data are available from several different sources, as in the present case, the overall reliability of the figures derived as a basis for design is considerably enhanced.

A total of ten agencies, including San Quentin Prison, maintain flow records of a length and accuracy suitable for use in this study. Between them, these agencies account for about 90 percent of the sewage collected in Marin County. A summary of

the average dry weather flow (ADWF) and peak wet weather flow (PWWF) for the ten agencies is shown in Table 5-1. The dry weather flows, recorded during the summer of 1965, may be considered quite accurate. The wet weather flows, due to bypasses, overflows, and limits in meter capacity, must in most cases be regarded as estimates only. Wherever peak flows exceeded meter capacity or where bypasses were known to occur an attempt was made to estimate the probable quantity of unmeasured flow by inspecting bypass structures and questioning operating personnel.

The first week of January, 1966, was selected for determination of wet weather flows, because a major storm during that week resulted in heavy rainfall throughout Marin County. A recording rain gage maintained by the Marin County Department of Public Works at its Mill Valley corporation yard shows that heavy rainfall during the last week of December, 1965, was followed by two clear days on January 1 and 2, light rain on January 3, and heavy rain on January 4 and 5. Maximum 24-hour rainfall on the 4th and 5th as indicated on the rain gage charts amounted to 3.17 inches, a rainfall intensity which may be expected to recur about once in three years. Since a review of flow records indicates that at most plants a lesser storm will produce flows of comparable magnitude, sewage flows during the selected period are considered representative of the peak wet weather flows which must be accommodated in the design of future sewerage facilities.

For each of the plants for which records are available, a graph was drawn showing dry weather flow during a typical seven-day summer period and wet weather flow during the week of January 1-7, 1966. The resulting flow charts are presented as Figs. 5-1 through 5-10. The rainfall plot, repeated for comparison with wet weather flows at the various plants, presents hourly rainfall as recorded at Mill Valley.

Sausalito-Marin City Sewage Flow

Reference to Fig. 5-1 shows that dry weather sewage flows at the Sausalito-Marin City sewage treatment plant follow a regular and predictable pattern, as is the case with most of the public sewerage agencies investigated. The minimum daily flow is quite high, amounting to about 44 percent of the daily average. A portion of the daily minimum is attributable to the sea water infiltration which is known to occur in certain parts of the collection system.

Dry weather flow during the months of June, July, August and September of 1965 averaged 1.37 mgd. Based on the estimated 1966 population of 16,100 for the tributary area, including Sausalito, Marin City, Tamalpais Valley, Fort Baker, and a portion of Richardson Bay Sanitary District, the unit dry weather flow was 85 gcd (gallons per capita per day). This compares favorably with a 1959 estimate of 68.5 gcd by Yoder,[11] which was based on a high population estimate obtained by projecting 1950 census data. Corrected on the basis of 1960 census figures, Yoder's computed per capita flow rate is 82 gcd.

Table 5-1. Summary of Present Sewage Flows

Plant	ADWF mgd	PWWF mgd
Sausalito-Marin City	1.37	11[a]
Mill Valley	1.36	13[a]
Richardson Bay S.D., Trestle Glen	0.15	1[a]
Sanitary District No. 5	0.82	5
Sanitary District No. 1	3.58	15[b]
San Quentin	0.94	3.6
San Rafael, Main Plant	2.31	9[b]
Las Gallinas Valley S.D.	1.85	10[a]
Sanitary Dist. No. 6, Novato Plant	1.55	14[a]
Sanitary Dist. No. 6, Ignacio Plant	0.61	2
Total	15	85

[a] Estimated.

[b] Measured at plant. Large unknown quantities were bypassed.

The graph of wet weather flow clearly illustrates the effect of rainfall on sewage flows. During the first two days of January, flow was consistently higher than during the corresponding dry weather period as a result of storm water inflow from the heavy rains during the preceding week. Most of the storm water inflow undoubtedly occurred in the form of infiltration from the rain-saturated soil. Within a few hours after the start of heavy rain on January 4, sewage flow increased sharply as a result of direct storm inflow to the collection system. At mid-day the operator opened the bypass near the US 101 highway bridge, and the flow at the plant immediately dropped 2 mgd, the amount being bypassed to Richardson Bay. Despite the open bypass, flow continued to increase and by evening exceeded the capacity of the plant flow meter. For a period of 10 hours thereafter the chart trace continuously exceeded the meter capacity of 6 mgd, and it is logical to assume that for at least a portion of that period the influent pumping station was operated at its maximum capacity of about 8 mgd. It is further reported by Nute[13] that during major storms overflows occur in the tributary portion of Richardson Bay Sanitary District. The peak wet weather flow, then, consists of 8 mgd pumped to the plant, 2 mgd bypassed by Sausalito, and perhaps 1 mgd or more of overflow in Richardson Bay Sanitary District and at other unreported points, making a total peak wet weather flow of at least 11 mgd. Within a few hours after rainfall stopped the peak flow rate

dropped sharply to a value representative of the sum of normal dry weather flows plus storm water infiltration.

The difference between normal dry weather flow and peak wet weather flow represents the storm water inflow rate, which in this case amounts to 10.4 mgd. It is interesting to note that in 1959 Yoder[11] by a different process arrived at an estimated storm water inflow rate of 10.5 mgd.

For purposes of estimating future quantities of storm water inflow it is convenient to express that constituent in terms of gallons per day per unit of area. For the sewered area of approximately 2400 acres tributary to the Sausalito-Marin City system,

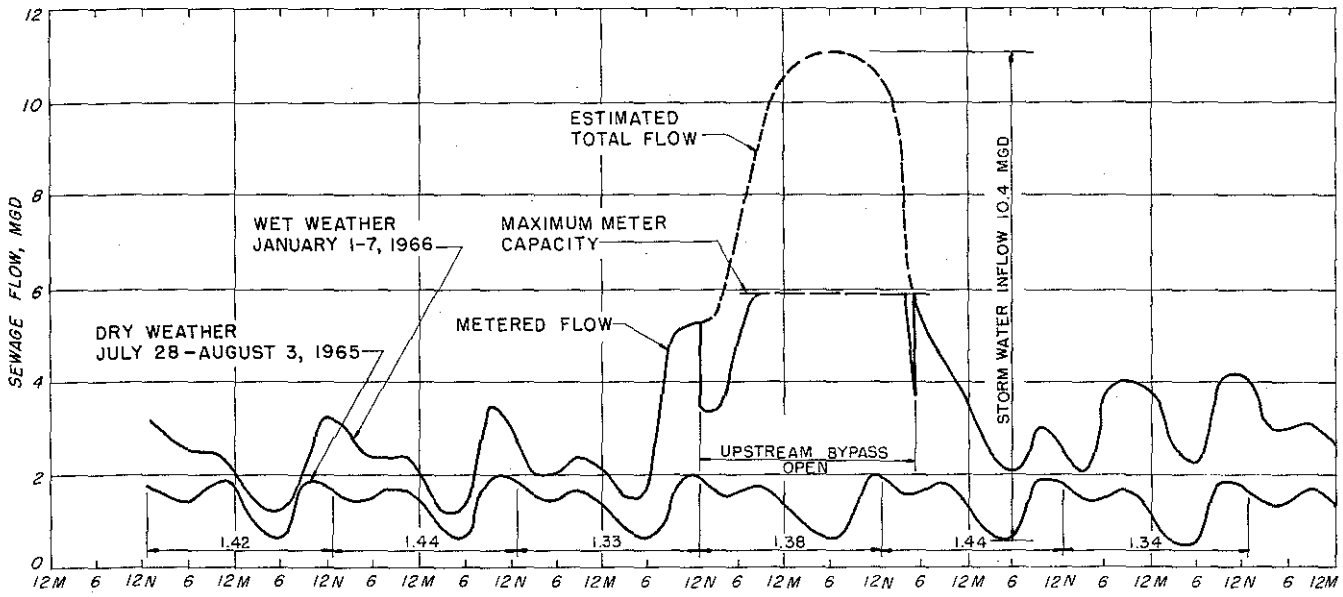


Fig. 5–1. Hourly Variation in Flow at Sausalito Sewage Treatment Plant

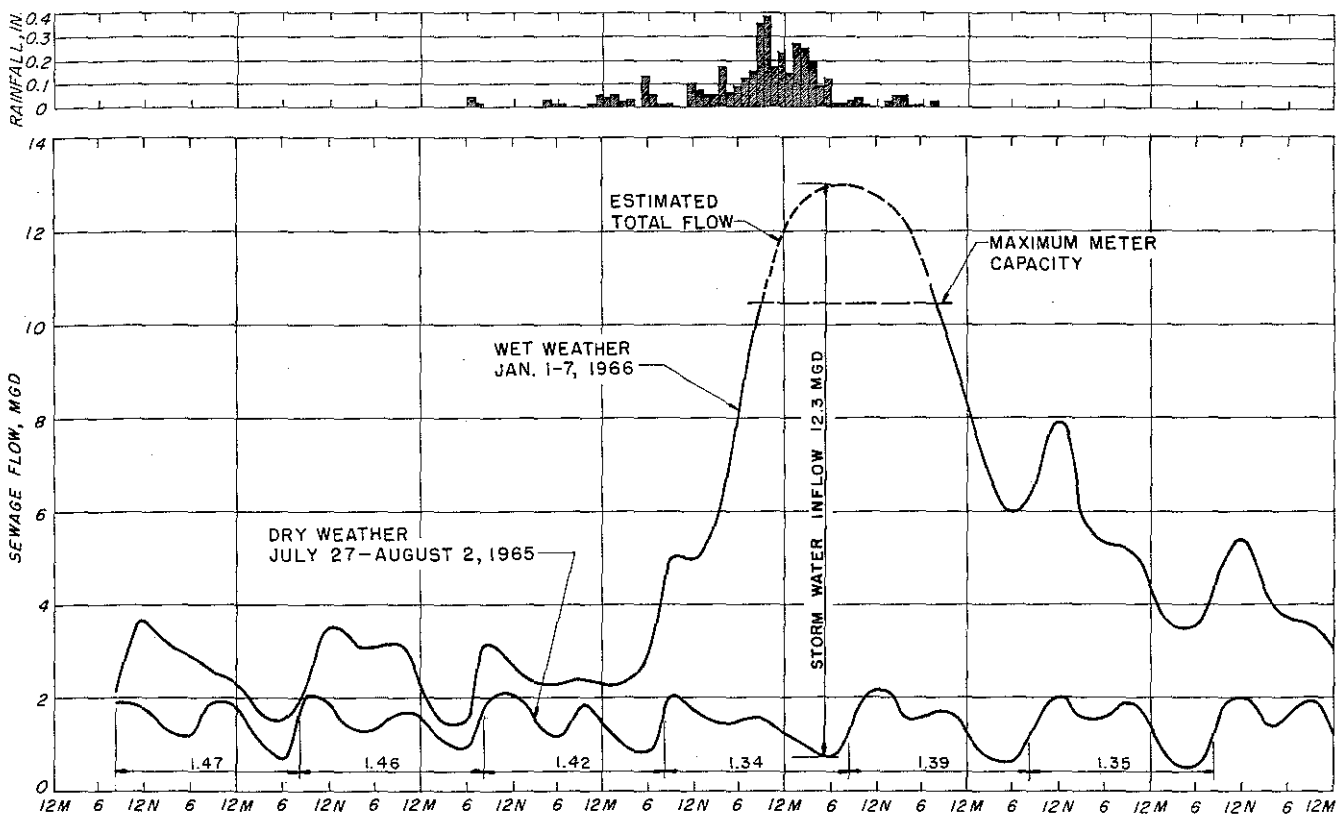


Fig. 5–2. Hourly Variation in Flow at Mill Valley Sewage Treatment Plant

a storm water inflow rate of 10.4 mgd may be expressed as 4300 gad (gallons per acre per day). That value represents a uniform areal rate of inflow and no attempt has been made to determine whether all portions of the tributary area are equally susceptible to storm water inflow.

Mill Valley Sewage Flow

As at Sausalito, the Mill Valley dry weather flow chart (Fig. 5-2) indicates high daily minimum flows, suggesting that some infiltration is occurring at a fairly constant rate in the tributary collection systems. Typically, the daily minimum flow is 50 percent or more of the average daily flow. During the months of June, July, August and September of 1965, the average daily flow at the Mill Valley treatment plant was 1.36 mgd, equivalent to 84 gcd for the 16,200 residents in the five tributary agencies.

The pattern of wet weather flow for the first week in January, 1966, is similar to Sausalito except that storm water inflow dropped off more slowly after rainfall stopped. For two days or more the flow rate was still two to three times higher than the equivalent dry weather flow. On January 4 and 5, the peak flow at the treatment plant exceeded the 10.5-mgd capacity of the flow meter for 22 hours. During this period the plant influent sluice gate was throttled, forcing an unmeasured quantity of sewage to bypass by gravity to Richardson Bay. During a portion of this period sewage was also overflowing the manhole at Ryan Avenue. The peak flow in the trunk sewers is estimated at 13 mgd, but there is no way of knowing what the flow might have been if all storm water inflow could have been accommodated in the sewers without surcharge. The selected value of 13 mgd for peak flow may well be a low estimate.

Of the 13 mgd peak wet weather flow, 12.3 mgd may be attributed to storm water inflow. For the sewered area of approximately 2440 acres included in the five tributary agencies, this represents a uniform areal storm water inflow rate of 5000 gad. While admittedly high, this figure is considered to be entirely consistent with observed and reported conditions.

Richardson Bay Sanitary District Sewage Flow

A graph of sewage flow at the Trestle Glen sewage treatment plant, which serves about a third of Richardson Bay Sanitary District, is shown in Fig. 5-3. Dry weather flow is normal, with little or no infiltration indicated. For the dry weather months of June, July, August and September, 1965, average flow was 0.15 mgd. Unit dry weather flow, as reported by Nute in 1963,[13] amounts to 70 gcd.

The wet weather flow graph on Fig. 5-3 shows that shortly after the start of heavy rainfall on January 4 the flow at the plant rose to 0.7 mgd. For about three hours, a portion of the flow was bypassed before receiving secondary treatment, but as flow continued to increase the secondary treatment process was bypassed completely for 48 hours. Since the flow meter is installed on the effluent from the secondary treatment process, no record is available for the peak flow period. However, the plant operator states that the flow did not exceed the influent pumping station capacity of one mgd. The latter figure is assumed to be the maximum flow during the storm period.

Sanitary District No. 5 Sewage Flow

Sewage flow from Sanitary District No. 5 and from the city of Belvedere is recorded at the District 5 plant (Fig. 5-4). The high minimum dry weather flow rates indicate the presence of appreciable amounts of ground water infiltration, probably originating in the low-lying areas adjacent to Belvedere Lagoon. Dry weather sewage flow measurements for the Belvedere Lagoon area, conducted by Brown and Caldwell in 1960,[21] indicated a per capita flow of 102 gcd, of which one-third was estimated to consist of infiltration.

Plant records of average daily flow are lacking for the summer season of 1964 and are rather inconsistent for the summer of 1965, varying from a reported average daily flow of 0.59 mgd in June to 1.01 mgd in August.

For the six-month period from April through September, 1965, the average daily flow was 0.82 mgd, equivalent to 90 gcd for the combined areas of Belvedere and Sanitary District No. 5.

The graph of wet weather flow on Fig. 5-4 shows peaks of rather short duration associated with rainfall. This is due in part, no doubt, to the fact that the collection system is comparatively small, and direct storm inflow has a short travel period to reach the plant. The flow at the plant on January 5 reached a peak of 5 mgd, of which 4.5 mgd represented storm water inflow. During the storm period, flow in the Belvedere collection system exceeded system capacity, and an unmeasured portion was bypassed through the old raw sewage outfall. This additional flow increment is ignored, because the Sanitary District 5 plant superintendent reports that his unofficial rainfall records showed a substantially higher rainfall at Tiburon than was recorded at Mill Valley. The probability of recurrence of the total peak flow condition may therefore be too low to be accepted as a design condition.

Based on a developed area of 900 acres, 4.5 mgd of storm water inflow represents an average unit rate of 5000 gad. A 170-acre section of Belvedere investigated by Brown and Caldwell in 1960[21] also showed

a storm water inflow rate of 5000 gad.

Sanitary District No. 1 Sewage Flow

Sewage flow from Sanitary Districts No. 1 and 2 and the city of Larkspur is measured at the District 1 sewage treatment plant. The graph of dry weather flow (Fig. 5-5) shows that daily minimum flow is about 40 percent of average daily flow, due in part to infiltration which is known to occur continuously in the marshland sewers. In a system of this size, however, maximum and minimum points are naturally somewhat dampened out by the flow time in the collection system. The unit flow rate of 73 gcd, computed on the basis of a population of 49,000 and a summer average flow of 3.58 mgd, does not indicate the presence of major quantities of infiltration. A report by Brown and Caldwell in 1961[22] derived a unit flow rate of 76 gcd for the Corte Madera area, which at that time had a population of about 6000.

The graph of wet weather flow clearly shows the effect of both storm water infiltration and direct storm inflow. Although the peak flow at the plant on January 5, 1966, exceeded 15 mgd, of which nearly 13 mgd represented storm water inflow, unknown additional quantities were being bypassed at five points along the trunk sewer or were lost at overflowing manholes. The plant flow records indicate only that the unit rate of storm water inflow exceeds 1500 gad. Based on wet weather flow measurements made in connection with a 1961 study for Sanitary District No. 2,[22]

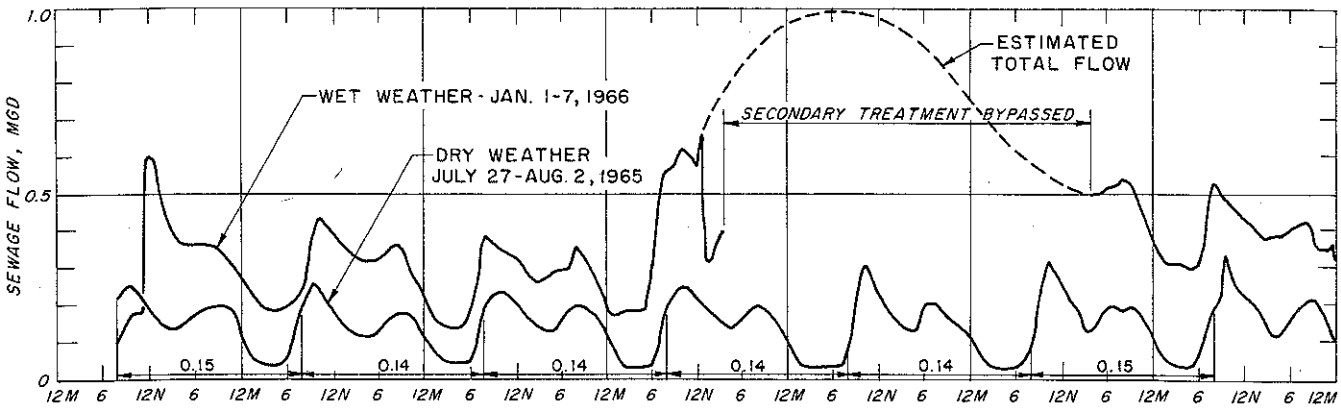


Fig. 5–3. Hourly Variation in Flow at Richardson Bay Sanitary District Sewage Treatment Plant

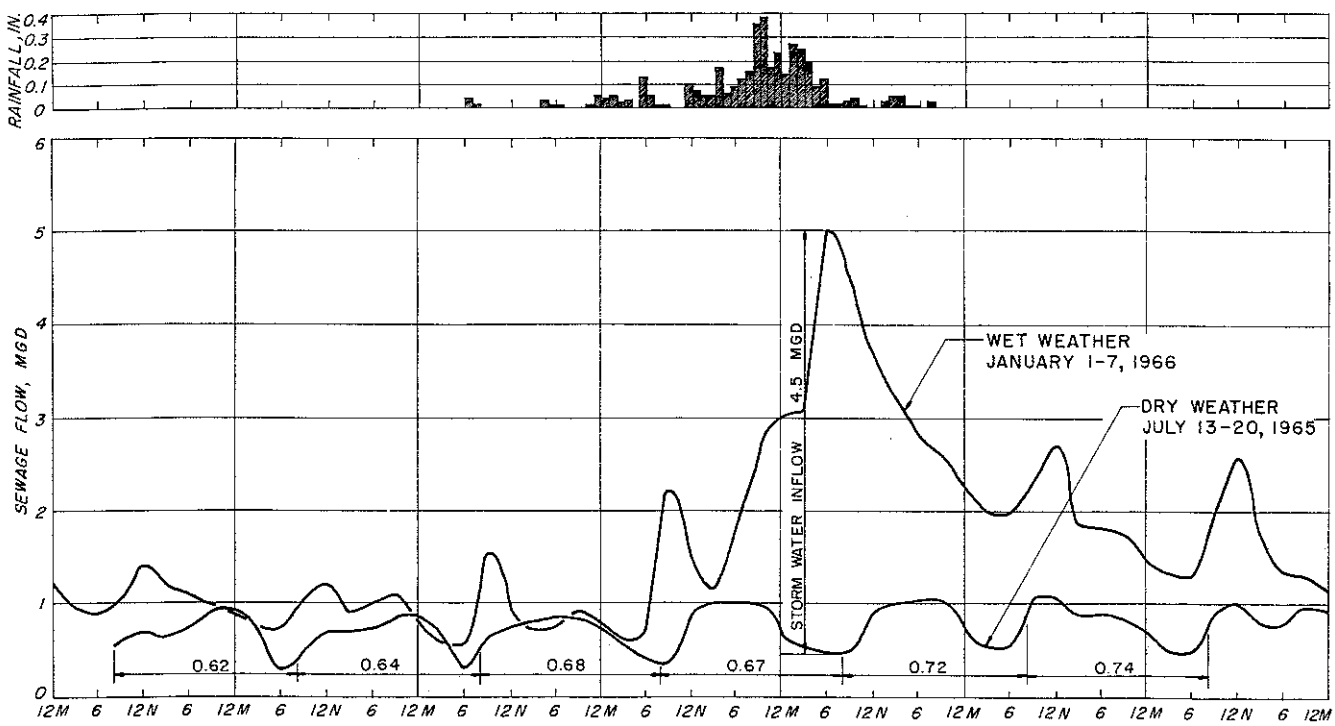


Fig. 5–4. Hourly Variation in Flow at Sanitary District No. 5 Sewage Treatment Plant

Brown and Caldwell concluded that a unit storm water inflow rate of 4000 gad was appropriate for all of the District 2 service area except for portions sewered since 1957. Those portions were assumed to have sewers of better construction with lower storm water inflow rates.

San Quentin Sewage Flow

As might be expected, sewage flows at San Quentin bear no relationship to those of a normal residential community. In addition to the domestic sewage from the inmate population of 3800, a significant industrial waste volume originates in the prison's shops. Daily water use amounts to about 1 mgd of fresh water and 0.4 mgd of salt water, with approximately two-thirds of the total showing up as sewage.

Average dry weather sewage flow in 1965 amounted to 0.94 mgd. As indicated on Fig. 5-6, the sewage flows exhibit a fairly predictable pattern. Infiltration is practically non-existent as evidenced by the fact that wet weather and dry weather flows are virtually identical except during periods of rainfall. The peaks on January 7 and August 3 may be due to periodic dumping of industrial wastes. The peak wet weather flow of 3.6 mgd, recorded on January 5, 1966, included about 3 mgd of direct storm inflow. Within a few hours after rainfall stopped the flow rate dropped to a level typical for dry weather.

For an institution such as San Quentin, present patterns of water use and sewage flow may be expected to remain virtually unchanged in the future. Since no expansion of the prison complex is contemplated, the measured values for wet and dry weather flow are adequate for planning purposes.

San Rafael Sewage Flow

Dry weather flow as measured at the San Rafael sewage treatment plant during the summer of 1965 averaged 2.31 mgd (Fig. 5-7). For the estimated connected population of 27,500, this represents a unit flow of 84 gcd. An additional 1500 persons in the Peacock Gap area of San Rafael County Sanitation District contributed sewage to the Marin Bay plant at a dry weather rate of 63 gcd. The difference in unit flow rates is probably due at least in part to the fact that Peacock Gap is strictly residential, while the San Rafael main plant receives a combination of domestic, commercial and industrial sewage.

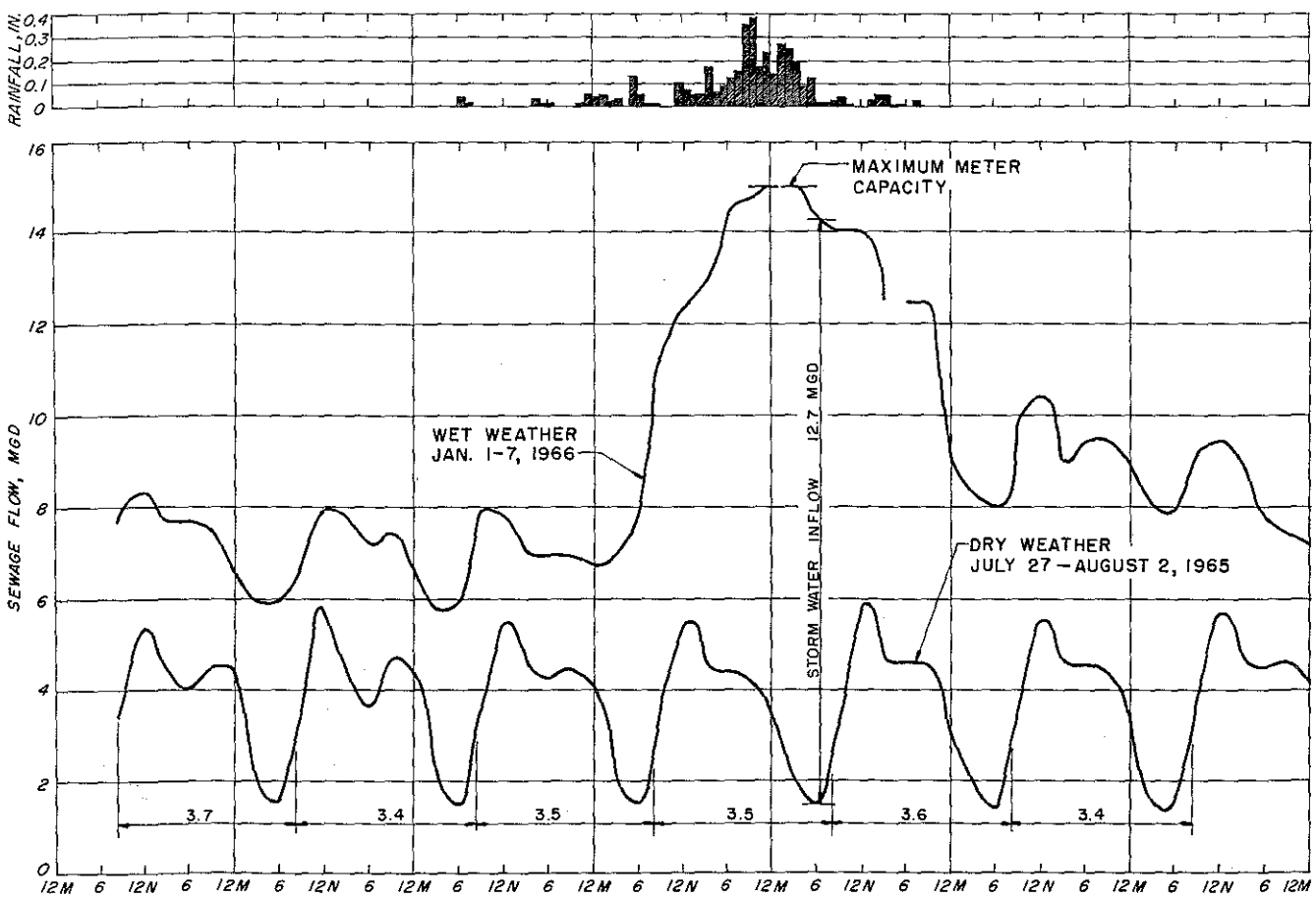


Fig. 5–5. Hourly Variation in Flow at Sanitary District No. 1 Sewage Treatment Plant

The collection system tributary to the main plant is reported to receive some salt water infiltration, though the low minimum dry weather flows (Fig. 5-7) would indicate that the problem is not serious.

A small amount of rainfall causes a sharp rise in sewage flow at the main treatment plant. The wet weather flow graph indicates that the maximum capacity of the plant flow meter was exceeded at 6 a.m., January 4, nearly six hours before the start of the major storm on January 4th and 5th. At that time total storm water inflow amounted to over 8 mgd, representing a uniform areal unit rate of 1600 gad. Shortly thereafter the plant operator began to bypass a portion of the flow, and it is impossible to determine the magnitude of the peak flow during the storm. The operator reports that large amounts of grit are received at the plant during high storm flows, suggesting the possibility that some catch basins and street inlets are connected to the sanitary sewers.

Las Gallinas Sewage Flow

During the summer months of 1965 sewage flow at the Las Gallinas Valley Sanitary District sewage treatment plant averaged 1.35 mgd. This figure does not include sewage from Las Gallinas Village, which did not join the district until 1966. For purposes of comparison of wet and dry weather flows, 1965 summer flow is shown on Fig. 5-8.

In the spring of 1966 a new flow meter was installed at the plant, and during that summer the Las Gallinas Village system was connected to the district sewers. A check of dry weather flow in October,

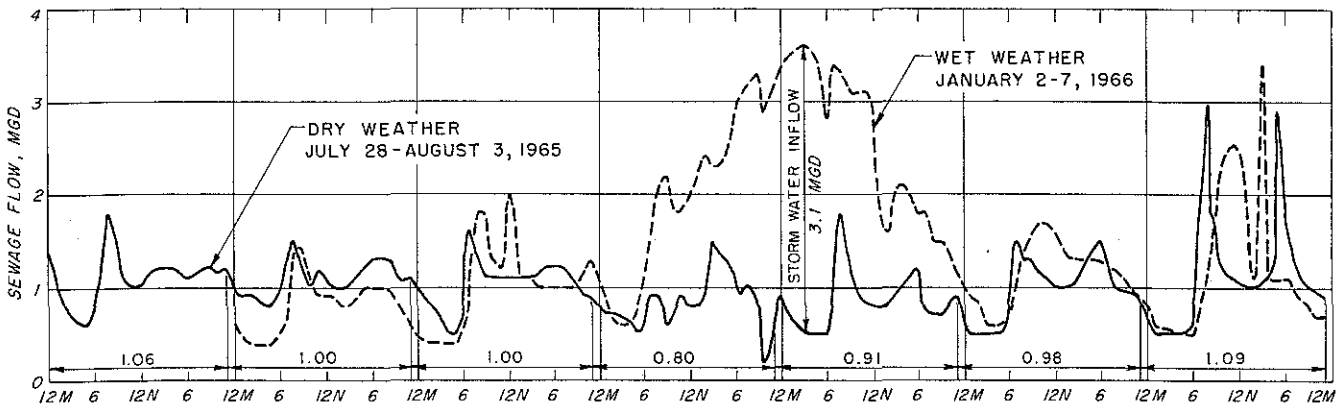


Fig. 5–6. Hourly Variation in Flow at San Quentin Sewage Treatment Plant

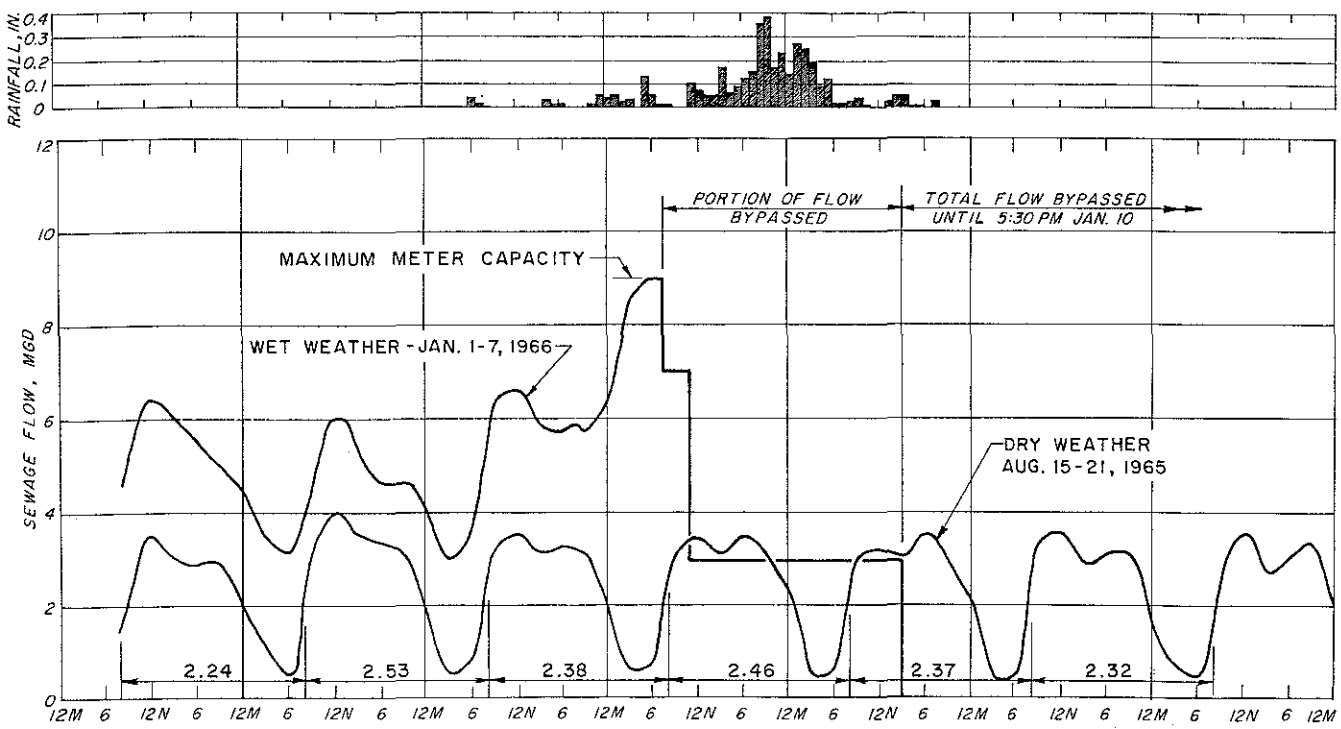


Fig. 5–7. Hourly Variation in Flow at San Rafael Sewage Treatment Plant

1966 showed that the flow had increased to 1.85 mgd. Part of the increase is believed to be attributable to improved meter accuracy, and the latter figure is accepted as representative. Based on the district's estimate of 24,000 connected population, a dry weather flow of 1.85 is equivalent to a unit rate of 77 gcd.

Wet weather flow peaks in the Las Gallinas system do not appear to be as severe as in many other areas of Marin County, but because of the limited capacity of the plant flow meter it is difficult to estimate the magnitude of the peaks. The peak flow shown on Fig. 5-8 was estimated from a survey of pump capacities and running times at all of the pumping stations which deliver sewage to the treatment plant. Most of the pumps are equipped with running time meters which are read daily by district personnel. Using the district estimates of pump capacity and the running time records for January 5, 1966, the probably peak flow was estimated to be 9 to 10 mgd. This includes an estimated 2 mgd bypassed upstream of the Terra Linda pumping station, believed to be the only significant quantity bypassed during the storm.

The district service area in 1965 prior to the annexation of Las Gallinas Village was 3700 acres, substantially all of which is developed. For an area of 3700 acres and a storm water inflow rate of 9 mgd the uniform unit rate of inflow is 2400 gad.

Sanitary District No. 6 Sewage Flow

Sewage flows from Sanitary District No. 6 are measured at two points, namely, the Novato and Ignacio sewage treatment plants. For the four summer months of 1965 the average daily flow was 1.55 mgd at the former and 0.61 mgd at the latter, for a total district flow of 2.16 mgd. Connected population was estimated by the District Manager of 18,900 for Novato and 8,500 for Ignacio, the latter figure including the 3,900 residents of Hamilton Air Force Base. On this basis unit dry weather flows amount to 82 gcd for Novato and 72 gcd for Ignacio. The Ignacio figure probably reflects the typically lower per capita water use at military installations. On a district-wide basis, the dry weather flow was 79 gcd, which is the same value developed by Jenks and Adamson[15] using 1964 flow figures.

Graphs of hourly sewage flows for the Ignacio and Novato treatment plants are presented in Figs. 5-9 and 5-10. The low minimum dry weather flows indicate that neither system receives appreciable amounts of infiltration during the dry season.

The graph of wet weather flow at the Novato plant (Fig. 5-10) shows severe problems occasioned both by direct storm inflow and by storm water infiltration. On the first three days of January flows were more than twice the normal dry weather rate as a result of infiltration of rainfall which occurred during the preceding week. Immediately after the start of rainfall on January 4, the flow rate increased beyond the capacity of the plant flow meter and remained continually above meter capacity for nearly two days after rainfall stopped. The peak flow arriving at the plant was estimated by district personnel to be about 14 mgd, and additional quantities were lost through overflowing manholes at various points in the collection system.

Of the 9600 acres included in Sanitary District No. 6 about 6300 acres is undeveloped or is tributary to the Ignacio plant or the Bahia plant. Assuming the peak storm flow at the Novato plant to be 14 mgd, substantially all of which represents storm water inflow, the unit rate of storm water inflow for the 3300-acre tributary area is 4200 gad. In 1965 district personnel studied a 290-acre area in Novato and concluded that the storm water inflow rate was approximately 4000 gad.

Storm water inflow in the system tributary to the Ignacio plant (Fig. 5-9) is a lesser problem. The maximum meter capacity of 2 mgd was exceeded for a few hours at the height of the storm, but the pattern of pump starts and stops on the meter chart shows that the peak flow was not far above 2 mgd. Developed area tributary to the Ignacio plant, including portions of Hamilton Air Force Base, amounts to about 1900 acres. For a storm water inflow rate of 2 mgd, the unit rate of inflow is 1100 gad, the lowest rate encountered in this study.

Dry Weather Flow Summary

A summary of all dry weather flow data developed in the course of this study and in other recent engineering studies for Marin County communities is presented in Table 5-2. The unit flow values vary from a low of 55 gcd for Tamalpais Valley to a high of 102 gcd for Belvedere, with a county-wide average of 79 gcd. As might be expected, the widest variation in values occurs in the smallest communities, where local conditions or standards of development create the maximum deviation from the norm for the county as a whole. For areas with a population of more than 3000, the unit flow varies only from 70 to 90 gcd, and for communities larger than 10,000 the variation is from 73 to 85 gcd. It is apparent that for purposes of a county-wide study the figure of 79 gcd for present dry weather sewage flow may be accepted with confidence.

Collected as they were at the terminal point for each sewerage agency, the dry weather flow data represent all of the liquid wastes of the community, whether domestic, commercial or industrial in origin.

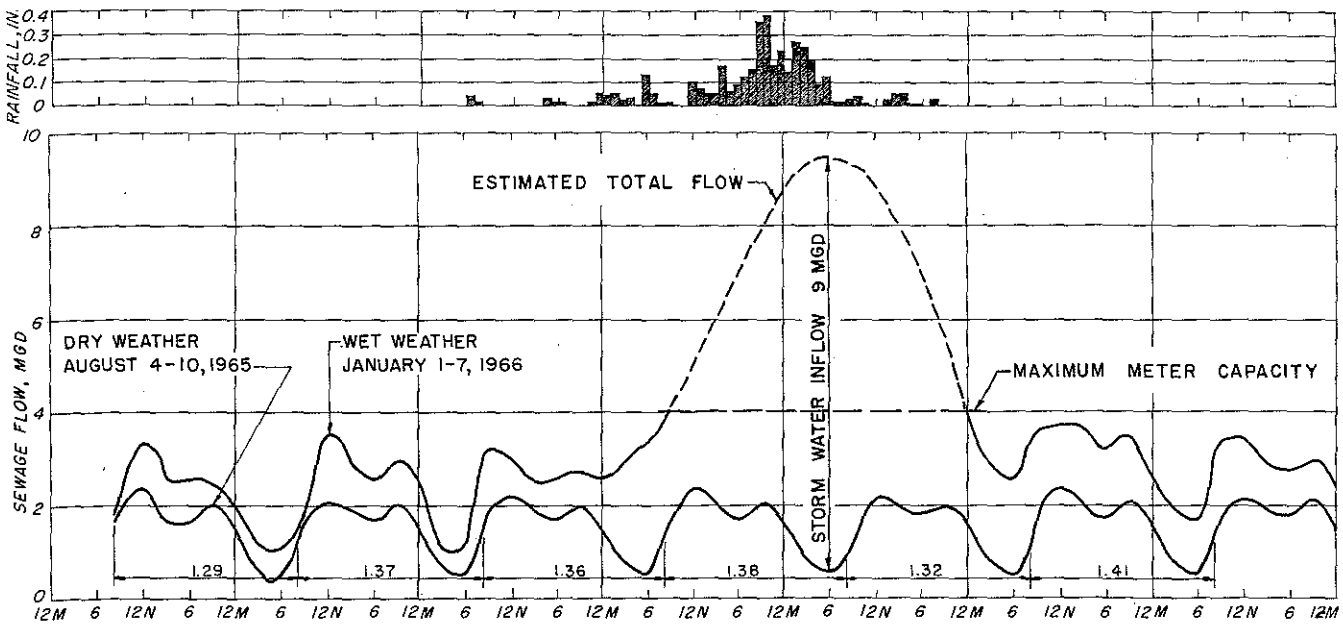


Fig. 5–8. Hourly Variation in Flow at Las Gallinas Sewage Treatment Plant

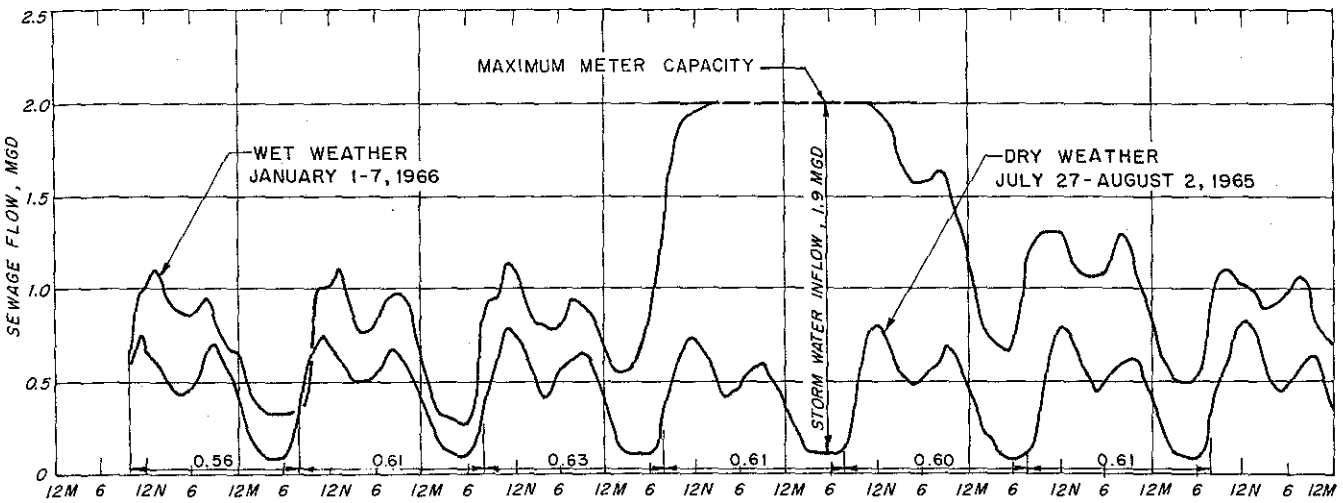


Fig. 5–9. Hourly Variation in Flow at Ignacio Sewage Treatment Plant

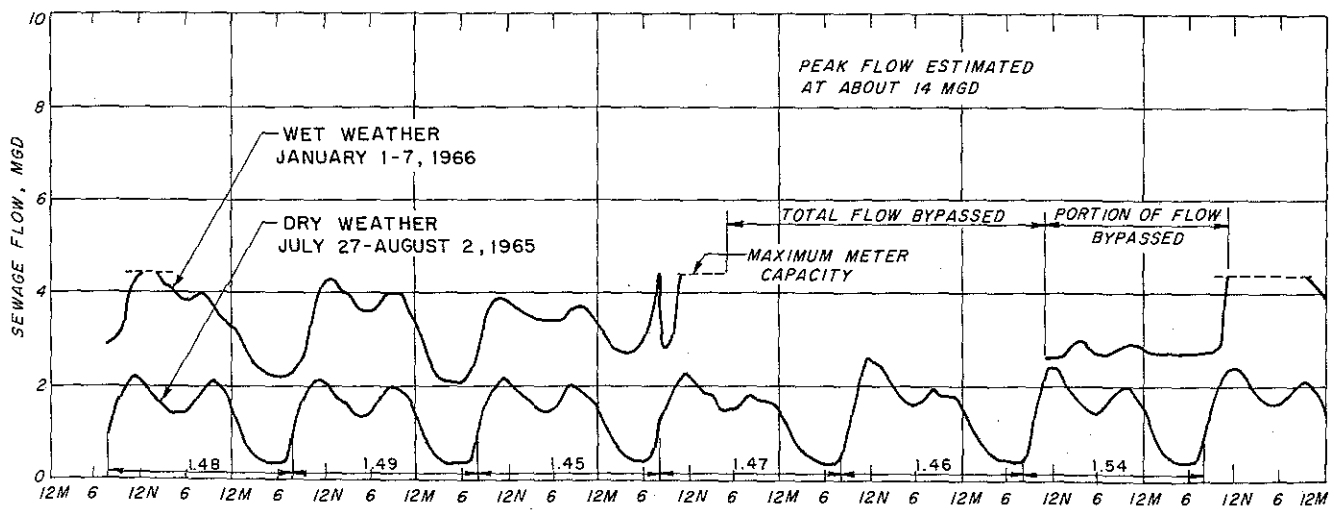


Fig. 5–10. Hourly Variation in Flow at Novato Sewage Treatment Plant

Table 5–2. Dry Weather Sewage Flow

Agency	Population	Dry weather flow		Date of study	Reference[a]
		mgd	gcd		
Sausalito-Marin City Sanitary District	7,800	0.64	82	1959	11
Sausalito-Marin City Sanitary District, Tamalpais Valley Sanitary District, Fort Baker, and portion of Richardson Bay Sanitary District	16,100	1.37	85	1966	
Tamalpais Valley Sanitary District			55	1963	12
Mill Valley, Almonte Sanitary District, Homestead Valley Sanitary District, Alto Sanitary District, Kay Park Sewer Maintenance District	16,200	1.36	84	1966	
Richardson Bay Sanitary District	5,700	0.4	70	1963	13
Belvedere	2,200	0.22	102	1960	21
Sanitary District No. 5 and Belvedere	9,100	0.82	90	1966	
Sanitary District No. 2	6,000	0.45	76	1961	22
Sanitary Districts No. 1 and 2, and Larkspur	49,000	3.58	73	1966	
San Rafael Sanitation District					
Main plant	27,500	2.31	84	1966	
Marin Bay plant	1,500	0.09	63	1966	
Las Gallinas Valley Sanitary District	24,000	1.85	77	1966	
Sanitary District No. 6	24,000	1.90	79	1965	15
Ignacio plant	8,500	0.61	72	1966	
Novato plant	18,900	1.55	82	1966	
Average, all observations			79		
Average, 1966 observations			79		

[a] See Appendix A.

Since Marin County presently has a minor amount of industry and is almost completely devoid of industries which produce significant amounts of process wastes, the industrial component of each community may be included in the unit flow allotted to each community resident. Similarly, the commercial areas in Marin are mostly of the community service type, and on an area-wide basis their wastes may be expressed in terms of the unit flow per community resident. Thus, it is not considered necessary for the purposes of this study to attempt to determine what portion of present sewage flows is attributable to industrial or commercial activity.

The fact that present commercial and industrial flows are not of sufficient significance to warrant separate consideration is borne out by inspection of the flow records at the San Rafael County Sanitation District main plant. Though the San Rafael area accounts for about half of the total county commercial activity, and in 1964 provided nearly three-fourth of the total industrial employment, the per capita dry weather flow as measured at the main plant is only 6 percent higher than the county average. Furthermore, no perceptible drop in flow occurs on weekends, as would be expected if industrial flows were significant.

In like fashion no separate allowance need be made for dry weather infiltration. Since the areas for which flows were measured represent all sections of the county, the average dry weather unit flow includes an amount of infiltration which is typical for the county as a whole. High infiltration in local areas such as that which occurs at Belvedere must be considered in local planning, but on a county-wide basis these areas will be offset by others where no dry weather infiltration occurs.

Wet Weather Flow Summary

Wet weather sewage flows throughout much of the county exceed not only the capacity of the various treatment plants but also the capacity of the sewage collection and trunk systems. The Ignacio system of Sanitary District No. 6 appears to be the only system in the county which was capable of conveying and treating all of the flow generated within the service area during the wet weather period selected for investigation.

A summary of unit storm water inflow rates mea-

sured in the course of this study and reported by previous investigators is presented in Table 5-3. Measured unit rates vary from 1100 gad for Ignacio to 9300 gad for Kay Park Sewer Maintenance District, with only three of the 12 measurements falling below 4000 gad. Unfortunately, in two of the largest service areas, Sanitary District No. 1 and San Rafael County Sanitation District, such large quantities of flow escaped measurement through bypasses and manhole overflows that no meaningful estimate of peak flow could be obtained. The figures in Table 5-3 consist in each case of measured or estimated peak flow at a treatment plant or pumping station plus estimated losses at known upstream points. Quantities which escaped through overflowing manholes are in addition to the listed figures.

Peak wet weather flow is composed of three components. These are (1) the normal dry weather sewage flow, (2) storm water infiltration, and (3) direct storm inflow. A glance at Figs. 5-1 through 5-10 clearly indicates that direct storm inflow, which occurs while rain is falling, is the major component of the peak rate of flow. Typical points of direct storm inflow include holes in manhole covers where street drainage is inadequate to prevent flooding of the covers, catch basins and street inlets connected to the sanitary sewers, and roof and patio drain connections. Most of these points of entry can be economically corrected through a vigorous program of inspection and enforcement. The urgent need to undertake such a program should be recognized by each agency which suffers from high wet weather flows. As a part of this program each agency should adopt and rigorously enforce a sewer use ordinance which prohibits roof and area drain connections to the sanitary sewers. The cost of eliminating direct storm inflow is far less than the cost of constructing trunk sewers and plants to convey and treat it.

Storm water infiltration, while lower in volume than direct storm inflow, is of importance in sewerage planning because it may persist for many days after rainfall has stopped. Infiltration rates shown in Table 5-3 were determined from Figs. 5-1 through 5-10 by measuring the greatest difference between the dry weather flow and the wet weather flow either before the start of rainfall or 24 hours after rainfall

Table 5–3. Storm Water Inflow Rates

Agency	Area, acres[a]	Infiltration gad	Total inflow gad	Date of study	Reference[b]
Sausalito-Marin City Sanitary District, Tamalpais Valley Sanitary District, and portion of Richardson Bay Sanitary District	2,400	950	4,300	1966	
Tamalpais Valley Sanitary District	370		1,300	1963	12
Richardson Bay Sanitary District (portion tributary to Sausalito)	610		4,100[c]	1959	11
Mill Valley, Almonte Sanitary District, Homestead Valley Sanitary District, Alto Sanitary District, and Kay Park Sewer Maintenance District	2,440	1,400	5,000	1966	
Kay Park Sewer Maintenance District	44		9,300[c]	1964	10
Sanitary District No. 5 and Belvedere	900	900	5,000	1966	
Belvedere	170		5,000	1960	21
Sanitary Districts No. 1 and 2, and Larkspur	8,700	750		1966	
Sanitary District No. 2	183		4,000[d]	1960	22
San Rafael Sanitation District	5,000	600		1966	
Las Gallinas Valley Sanitary District	3,700	350	2,400	1966	
Sanitary District No. 6					
Novato area	290		4,000	1965	15
	3,300	800	4,200	1966	
Ignacio area	1,900	250	1,100	1966	

[a] Area measured is developed and sewered, with average population density ranging from 5 to 10 persons per acre.

[b] See Appendix A.

[c] Computed from reported flow and measured service area.

[d] For areas sewered prior to 1957.

had stopped. Infiltration rates obtained in this fashion vary from 250 gad for the Ignacio system to 1400 gad for Mill Valley, with a median value of about 800 gad.

Points where storm water enters the sewers by the process of infiltration through loose joints and broken pipes are more difficult to locate and more costly to correct than are the points of direct storm inflow. New techniques of television inspection may be employed to advantage in locating and correcting deficiencies in lateral and trunk sewers. Where the difficulty lies principally in poorly laid or deteriorated house sewers, however, the cost of detection and correction is usually prohibitive. Unfortunately, in many cases defective house sewers have proved to be the principal source of storm water inflow. A 1956 sewerage study for Central Contra Costa Sanitary District[42] determined that in certain areas defective house sewers were responsible for more than 80 percent of the total storm water inflow, which was measured at unit rates as high as 7500 gad. Defective house sewers have been identified as a major source of storm water inflow in the older sections of Sanitary District No. 2, and similar conditions no doubt exist throughout the county.

SEWAGE COMPOSITION

Of the many biological and chemical characteristics of sewage, the two of principal concern in selection and design of the treatment process are BOD and suspended solids. For specific purposes, such as water reclamation or reuse of effluent, knowledge of the concentration of various mineral constituents may also be required.

Not all of the plants in Marin County maintain systematic records of the strength of sewage arriving at and leaving the plant. In several cases the only tests routinely conducted are those required to complete the quarterly reports to the Regional Water Quality Control Board, and these reports deal only with the quality of the plant effluent. Nevertheless, ten of the principal plants in the county maintain records which are useful in assessing sewage strength. These data, together with plant efficiencies calculated where sufficient data are available, are presented in Table 5-4. For those plants which have been recently enlarged, effluent quality and calculated efficiency are based on analyses made after the enlargements were placed in operation.

As is commonly the case with BOD and suspended solids tests on raw sewage, the values listed vary over a fairly wide range. Furthermore, the analyses at each plant represent a different flow rate and a different total tributary population. The most meaningful information on sewage strength characteristics can be obtained by calculating sewage strength in terms of applied load per capita (Table 5-5). The loadings thus calculated, which are representative of three-fourths of the county population for BOD and half the population for suspended solids, show that on a county-wide basis the average contribution is 0.16 pcd (pounds per capita per day) of BOD and 0.18 pcd of suspended solids. These values are typical for California communities which are predominantly residential in character.

The mineral content of sewage is a composite of the mineral content of the water supply, the minerals added as waste materials, and the minerals present in ground and surface waters which may enter the sewage collection system. The areas of Marin County where groundwater infiltration occurs on a year-round basis are principally the low-lying areas adjacent to the bay. Groundwater in those areas has ap-

Table 5-4. Sewage Strength

Plant	BOD				Suspended solids				Plant efficiency, percent	
	Influent		Effluent		Influent		Effluent			
	Mg/l	No. of samples	Mg/l	No. of samples	Mg/l	No. of samples	Mg/l	No. of samples	BOD	SS
Mill Valley	245	4	37	4	202	17	41	17	85	80
Richardson Bay Sanitary District	243	2	28	6	193	2	25	6	88	87
Sanitary District No. 5			143	2			52	3		
Sanitary District No. 1	196	7	19.6	11			24	11	90	
San Rafael main plant	237	5	54	5	269	5	66	5	77	75
Las Gallinas	323	7	36	2	253	18	36	18	89	86
Sanitary District No. 6										
Novato Plant	256[a]		36	6	347[a]		34	6	86	90
Ignacio Plant			16	7			19	7		
San Quentin Prison	172[b]		112[b]						35	

[a] Average values reported by Jenks and Adamson.[15]

[b] Average of reported monthly values for 1964 and 1965.

Table 5–5. Calculated Loadings

Plant	Tributary population	ADWF mgd	BOD mg/l	BOD lbs/day	Suspended solids mg/l	Suspended solids lbs/day
Mill Valley	16,200	1.36	245	2,760	202	2,280
Richardson Bay Sanitary District	2,100	0.15	243	300	193	240
Sanitary District No. 1	49,000	3.58	196	5,840		
San Rafael main plant	27,500	2.31	237	4,560	269	5,180
Las Gallinas	24,000	1.85	323	4,970	253	3,900
Sanitary District No. 6 Novato plant	18,900	1.55	256	3,300	347	4,480
Total	137,700			21,730		16,080
Per capita loadings		79[a]		0.16		0.18

[a] See Table 5-2.

proximately the same mineral content as sea water. Determinations of chloride concentration have in fact been used in several Marin County studies aimed at pinpointing sections of sewerage systems with high rates of groundwater infiltration.

From 1955 through 1962 the Department of Water Resources conducted a study of the mineral quality of sewage effluents throughout the State of California.[23] In the course of this study 12 composite samples of the effluent from six different Marin County treatment plants were collected and analyzed for mineral constituents. The plants sampled were those with an average dry weather flow in excess of 0.5 mgd (Sausalito, Mill Valley, Sanitary District No. 1, San Rafael main plant, Las Gallinas, and Novato). At least one analysis from each of the first four plants shows the presence of significant amounts of salt water infiltration. A summary of the Department of Water Resources analyses is presented in Table 5-6.

For domestic sewage, the mineral content can be accurately predicted by adding to the minerals in the water supply the mineral quantities which are

Table 5–6. Chemical Analyses of Sewage Effluents

Determination	Marin County sewage effluents[a] Average	Maximum	Minimum	Water supply average	Normal mineral pick-up[b]	Calculated effluent quality[c]	Las Gallinas effluent June, 1961
Cations							
Calcium (Ca)	42	114	16	19	-4	15	16
Magnesium (Mg)	84	288	25	12	+4	16	28
Sodium (Na)	556	2,230	74	9	+63	72	98
Potassium (K)	30	92	13	< 1	+10.7	12	14
Ammonium (NH_4)	32	45	19			32	29
Anions							
Sulfate (SO_4)	144	562	40	14	+28	42	40
Chloride (Cl)	990	4,090	85	15	+41	56	102
Nitrate (NO_3)	8.5	58	0.2			8	0.9
Phosphate (PO_4)	24	32	5			24	
Bicarbonate (HCO_3)	256	314	78	81	+189	270	296
Total hardness ($CaCO_3$)	450	1,470	154	98	+13	111	154
Silica (SiO_2)	19	23	15			19	21
Boron (B)	0.6	1.4	0.4		+0.5	0.6	0.4
Fluoride (F)	1.6	3.2	0.2	0.12		1.6	1.0
Total dissolved solids	2,010	7,600	467	135	+293	428	467
pH		7.8	6.6			7.4	7.8

All results are expressed as mg/l except pH.

[a] Source of data: DWR Bulletin No. 68-62, 12 analyses at 6 different plants from 1956 to 1961.

[b] Normal change in concentration after domestic use. Source: DWR "Residential Unit Water Use Survey, Monterey Hills Tract, Los Angeles County, for March 1962 - March 1964" February, 1966.

[c] Obtained by adding normal mineral pickup to average concentration in water supply. Where data are lacking on water supply or mineral pickup, values are average for Marin County sewage effluents. Not applicable in areas where salt water infiltration is anticipated.

normally added as domestic waste materials. The Department of Water Resources, in a study which covered a two-year period,[24] derived the quantity of mineral pickup associated with domestic water use in a Southern California community. By adding normal mineral pickup to the average chemical analysis of Marin water supplies, an anticipated effluent mineral quality was obtained (Table 5-6) which is assumed to be applicable to domestic and commercial sewage effluents where no salt water infiltration is present. For comparison, an analysis of Las Gallinas sewage effluent is included in the table. At the time the sample was collected the Las Gallinas system was located almost entirely in areas where salt water infiltration would not be expected to occur.

A comparison of the tabulated values indicates that the calculated domestic sewage effluent mineral quality compares very closely with the analysis of Las Gallinas effluent. Both are markedly lower in mineral content than the average of all analyses for the county because of the salt water infiltration which occurs in other parts of the county.

UNIT DESIGN QUANTITIES

Unit quantities developed from the analysis of Marin County sewage characteristics provide the basic information necessary for planning and design of sewerage works. These unit design factors must include allowances for anticipated future changes not only in the standard of living of the contributory population and the characteristics of the service area, but also in the materials and techniques of sewer construction. A tabular summary of the design factors referred to in the following discussion is given in Table 5-7.

Sewage Volume

Each of the several components of sewage volume discussed previously must be considered separately in determining applicable design factors.

Domestic and Commercial Sewage. The present average dry weather sewage flow amounts to 79 gcd. This flow consists of domestic sewage, commercial sewage generated in community-service type commercial areas, minor amounts of industrial wastes, and the small amount of groundwater infiltration which occurs even in dry weather. Between 80 and 90 percent of the total is estimated to consist of domestic sewage.

Historically, the trend has been toward increased uses of household water. For example, labor-saving appliances such as garbage grinders, automatic home laundries, and dishwashers increase the consumption of household water and therefore increase domestic sewage flow. It is interesting to note that Mill Valley, which now has a unit dry weather sewage flow of 84 gcd, was estimated by the State Bureau of Sanitary Engineering in 1945[9] to have a flow of only 60 gcd. Similarly, the dry weather sewage flow from Sanitary District No. 1 was measured at 46 gcd in 1940,[14] compared to the present flow of 73 gcd. In the expectation that the past trend will continue in the future, an average contribution of 100 gcd is considered suitable for planning purposes. This value allows for a future increase of 25 percent above the present county-wide average of 79 gcd.

The maximum rate of dry weather sewage flow is always higher than the average rate by a ratio which varies with the contributory population. Typically, the ratio varies from 2.5 to 1 for a population of 1000 to 1.5 to 1 for a population of 100,000 or more. Maximum flow rates were computed by the use of Fig. 5-11, which shows the relationship between contributory population and the ratio of peak to average dry weather domestic sewage flow.

Industrial Wastes. Areas presently devoted to industry in Marin County are negligible, and industrial wastes need to be considered only for those cases where land use planning designates large areas for industrial development. As discussed in Chapter 2,

Table 5-7. Unit Design Loadings

Volume	
Domestic and commercial sewage	
Average flow, gcd	100
Peak flow, gcd	a
Industrial wastes	
Average flow, gad	3,500
Peak flow, gad	10,000
Storm water infiltration	
All existing sewered areas except Las Gallinas and Ignacio, gad	1,000
Las Gallinas Valley Sanitary Dist., gad	400
Ignacio area, gad	300
All future sewered areas, gad	300
Total storm water inflow[b]	
All existing sewered areas except Las Gallinas and Ignacio, gad	5,000
Las Gallinas Valley Sanitary Dist., gad	3,000
Ignacio area, gad	1,500
All future sewered areas, gad	1,000
BOD	
Domestic and commercial sewage, pcd	0.20
Industrial wastes, pad	7
Suspended solids	
Domestic and commercial sewage, pcd	0.22
Industrial wastes, pad	7

[a] Depends on contributory population. See Fig. 5-11.

[b] Includes storm water infiltration.

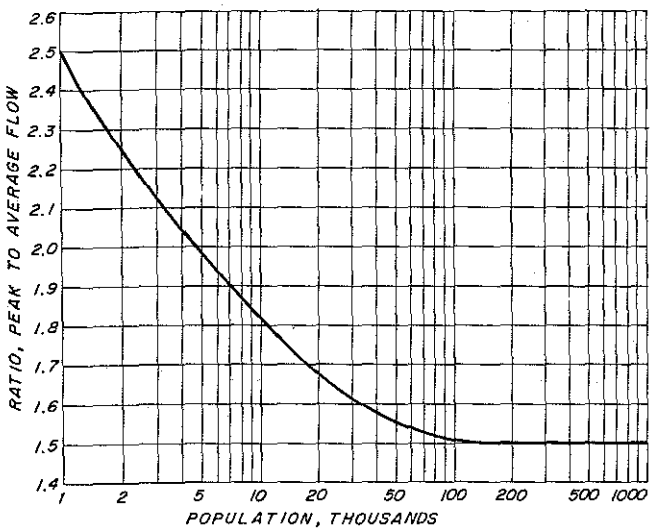


Fig. 5–11. Ratio of Peak to Average Flow of Sanitary Sewage

it is expected that industries locating in Marin will be primarily of the light industrial and manufacturing variety which are neither large water users nor producers of problem wastes. Typical waste flow for this type of industrial development, as determined through the analysis of similar developments in various California communities, is 3500 gad. Since the waste flow is usually confined to an eight-hour period, the peak rate has been taken as 10,000 gad. This is roughly the same flow which would result if the area should develop as multi-family residential instead of industrial.

Storm Water Inflow. Improvements in construction practices, coupled with new developments in pipe jointing techniques, have demonstrated in many communities that both infiltration and direct storm inflow can be reduced to values substantially below present rates. Provision of adequate storm drainage, coupled with a continuing program aimed at locating and eliminating obvious sources of inflow, could bring about significant flow reductions in several Marin communities. Wherever possible, construction of sanitary sewers in new areas should always be accompanied by construction of adequate storm drainage, thereby eliminating many of the common sources of direct storm inflow.

The infiltration component of storm water inflow was taken as 1000 gad for all presently-sewered areas of the county except Las Gallinas Valley Sanitary District and the Ignacio area, where flow measurements indicate that lower rates of 400 gad and 300 gad, respectively, should be applied. For all new construction it is assumed that quality materials and methods will be employed which will limit infiltration to 300 gad.

Total storm water inflow, which includes storm water infiltration, was assumed to be 5000 gad for all areas except Las Gallinas Valley and Ignacio, where again flow measurements indicate that 3000 gad and 1500 gad, respectively, are more appropriate. In the case of areas to be sewered in the future, it has been assumed that adequate storm drainage will be provided and that appropriate legislation will be enacted and enforced to prevent direct connection of storm water inlets and roof and area drains. On this basis an allowance of 1000 gad is considered adequate to account for storm water inflow in areas with a population density of 5 or more persons per acre. For areas developed to a lower density, a lower rate of storm water inflow can be expected to occur. As population density decreases, the length of sewer line per acre also decreases, offering less opportunity for storm water to enter the sewers. At the same time, however, the sparser development results in more length of sewer line per resident. As a rational approach to the problem of storm water inflow in areas with a density of less than five persons per acre, total inflow has been taken as 250 gad plus 150 gad times the population density in persons per acre. Use of this formula will give an inflow rate of 400 gad for one person per acre and 1000 gad for five persons per acre.

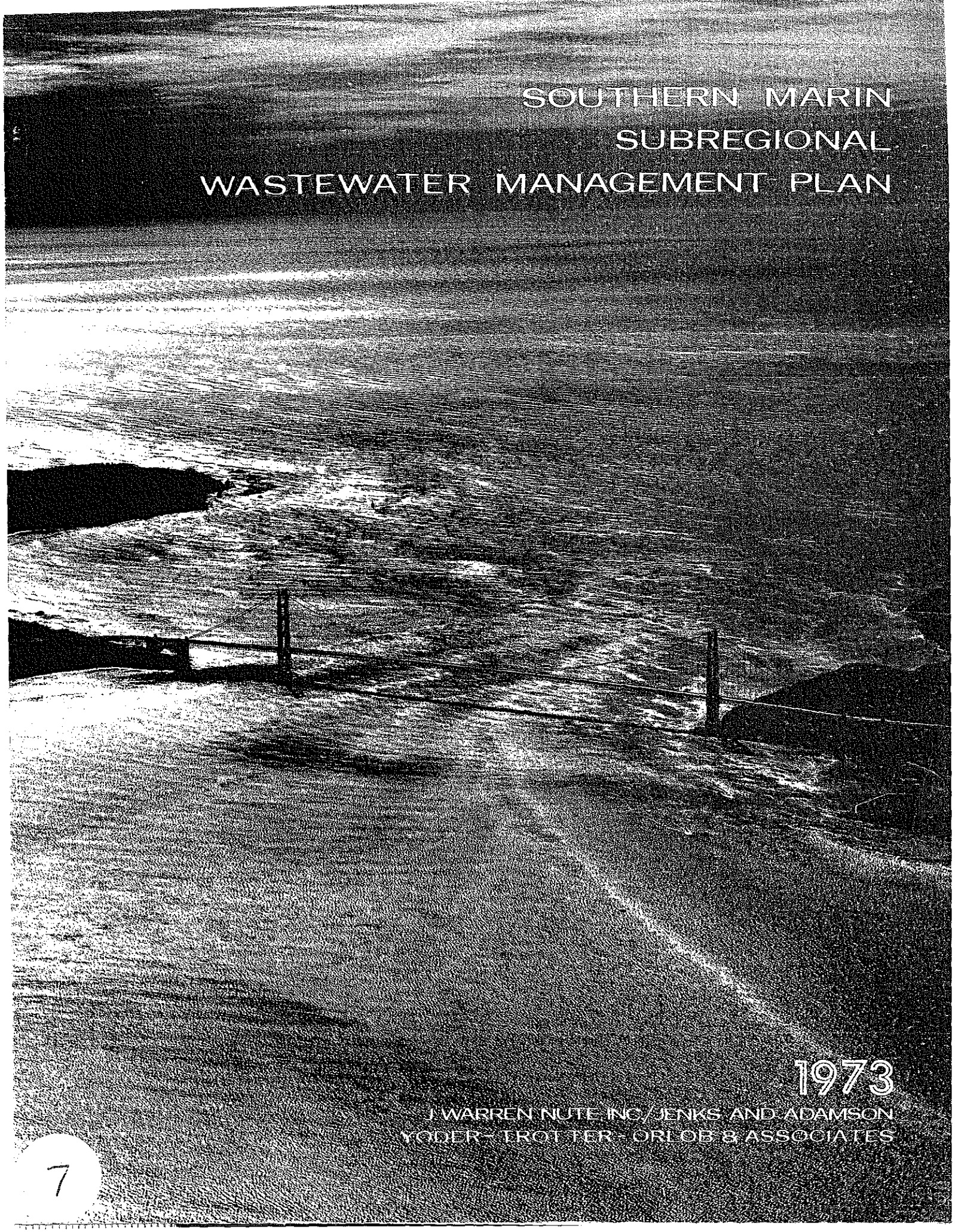
Sewage Composition

In recent years a general increase in the strength of sanitary sewage has been noted in many cities, primarily as a result of increased use of garbage grinders both in private homes and in some commercial enterprises, notably food markets. In the case of domestic and commercial sewage, therefore, unit values for design purposes were selected as 0.20 pcd for BOD and 0.22 pcd for suspended solids. These values represent about a 25 percent increase over the present county-wide average of 0.16 and 0.18 pcd for BOD and suspended solids, respectively. Combined with the anticipated increase in per capita water use, the effect of the increase in strength will be to maintain BOD and suspended solids approximately at present levels in terms of milligrams per liter of sewage (mg/l).

Wastes from the type of industrial development anticipated for Marin County are primarily sanitary in character, though they may also include fairly large amounts of cooling water and minor amounts of process wastes. It is anticipated that the industrial wastes will have a strength no greater than that of domestic sewage, and the strength may therefore be expressed in terms of equivalent population loadings. On this basis the industrial areas would have a population equivalent of 35 persons per acre, and the

corresponding figure of 7 pad (pounds per acre per day) has been assumed for both BOD and suspended solids.

The mineral quality of Marin sewage will vary widely depending on the amount of salt water infiltration which occurs. For those drainage areas tributary to San Francisco Bay, it has been assumed that the ratio of tidal flat to upland development will remain about the same as at present and that present sources of salt water infiltration will go uncorrected. The mineral content of future sewage effluents in these areas has therefore been taken for design purposes as equal to the average of present effluents as shows in Table 5-6. In those watersheds which drain to the Pacific Ocean, on the other hand, there are no significant tideland areas where salt water infiltration is likely to occur. For these drainage areas the mineral quality of sewage effluents has been assumed to be equal to the calculated effluent quality shown in Table 5-6.



SOUTHERN MARIN SUBREGIONAL WASTEWATER MANAGEMENT PLAN

1973

J. WARREN NUTE, INC./JENKS AND ADAMSON
YODER-TROTTER-ORLOB & ASSOCIATES

7

SOUTHERN MARIN

SUBREGIONAL

WASTEWATER MANAGEMENT PLAN

Prepared for

SOUTHERN MARIN SUBREGIONAL SEWERAGE AGENCY

Almonte Sanitary District

Alto Sanitary District

City of Belvedere

Homestead Valley Sanitary District

Kay Park Sewer Maintenance District

City of Mill Valley

Richardson Bay Sanitary District

Sanitary District No. 5

Sausalito-Marin City Sanitary District

Tamalpais Valley Community Services District

J. WARREN NUTE, INC./JENKS AND ADAMSON
YODER - TROTTER - ORLOB & ASSOCIATES

1973

Chapter 1

INTRODUCTION

The recent environmental awakening has led both the citizenry and the regulatory agencies to take a much closer look at the aquatic environment and the waste treatment and disposal practices necessary to protect that environment. In general, this review of the aquatic environment has led to a substantial upgrading of waste discharge requirements, not only in the bay area, but throughout the state and the nation. As a result, the sewerage agencies in the southern Marin area are currently faced with making substantial modifications to their wastewater treatment and disposal facilities.

There are a number of reasons why major improvements are required in the existing waste treatment and disposal systems. First, the Regional Water Quality Control Board has identified several potential water quality problems in Richardson Bay. Specifically, the Board is concerned about the relatively high algal concentrations present and the public health hazard associated with the discharges from the two secondary treatment plants tributary to Richardson Bay. Another problem common to the southern Marin area is the bypassing of untreated wastewater to Richardson Bay during wet weather periods when either trunk sewers or treatment plants are unable to handle these exceptionally high flows. This problem is partly the result of limited capacity in trunk sewer and treatment facilities but, it is more a problem of substantial infiltration that occurs during wet weather periods. Previous studies have found peak wet weather sewage flows to be between five and ten times average dry weather flows. It is these very high wet weather flows that, in the past, have necessitated the bypassing of untreated wastewater to Richardson Bay. Bypassing has become a considerable concern of all regulatory agencies and the Regional Water Quality Control Board now intends to prohibit all such bypassing.

Another recent development that will necessitate major improvement to certain of the southern Marin treatment plants is the recent Environmental Protection Agency (EPA) requirement that necessitates secondary treatment at all plants. As a result of this requirement, the two primary treatment plants in southern Marin are faced with installation of full secondary treatment.

In summary, each of the four existing wastewater treatment and disposal systems must be modified substantially to come into compliance with recently enacted state and federal requirements. The two secondary treatment plants currently discharging to Richardson Bay are faced with transporting their effluents to other, more acceptable waters prior to disposal. The two primary treatment plants, although they are discharging at acceptable locations, are faced with providing full secondary treatment in order to comply with the EPA requirements regarding minimum levels of treatment. Thus, each of the four dischargers in the southern Marin area is faced with substantial modifications to its existing facilities. These mutual needs on the part of all four dischargers

suggests a coordinated effort and consideration of a regional approach in solving these related problems. This is the primary reason for undertaking these present studies on a subregional basis.

There have been two previous regional wastewater management studies that have addressed themselves to southern Marin water pollution control needs. These are the 1967 County Sewerage Study prepared by Brown and Caldwell (1) and the 1969 Bay-Delta Study prepared by Kaiser Engineers (2). Both of these studies recommended a solution to the Richardson Bay problems which involved the collection and transmission of untreated wastewater westward over the Marin peninsula to a regional treatment plant near the coastline and the discharge of primary or advanced primary treated wastewater to the ocean in the vicinity of Tennessee Cove. While it has been only a short time since these studies were completed, there are numerous reasons why the plan recommended in these studies should not be implemented prior to further study. Both of the previous studies were completed just prior to the start of the great environmental awakening that has spread across the country. Both studies recommended treatment systems for ocean disposal that would not be adequate based on recently upgraded standards for ocean disposal. Further, over the past several years, there has been a growing concern and awareness of the sensitivity of the ocean environment to waste discharges. In the past, the ocean was considered a great sink capable of diluting and receiving all the waste discharges with only minimal treatment. This is not the case today and, in fact, in Marin County there is a great concern over the possibility of even discharging a highly treated waste to the ocean. This concern is further magnified because the southern Marin coastline is a part of the Golden Gate National Recreation Area.

Another reason why previous recommendations must now be reevaluated is the growing feeling, among not only the people of Marin County but noted experts and officials throughout the nation, that reclamation and reuse of our wastewater is inevitable. If reclamation is inevitable, wastewater treatment and disposal systems should be so designed as to facilitate future reclamation. Past regional studies have not examined the possibility of reclamation in enough detail to determine how best reclamation can be facilitated.

In summary, past recommendations must be reevaluated because of new ocean discharge requirements, because of increased concern as to the sensitivity of the ocean environment, especially in the Tennessee Cove area, and because of the concern and interest in water reuse rather than wastewater disposal.

Another change that has taken place in the few years since the two past planning studies were completed is the availability of much greater federal and state aid on construction projects. Back in the late 1960's, only 30 and possibly 33 percent federal aid was available for construction of wastewater treatment and disposal facilities. Today, 75 percent federal aid in combination with 12-1/2 percent state aid means that the local agencies must now pay only 12-1/2 percent of the total project cost. Thus, it is possible that past projects having high initial construction costs may have been dismissed from consideration because of the inability of the local area to finance them. Today, this reason for eliminating a particular project does not exist.

AUTHORIZATION

Subsequent to the completion of the Bay-Delta Study in 1969, a number of subregional wastewater management studies were initiated throughout the bay area. The purpose of these subregional studies was to evaluate solutions to the problems in a particular area in greater detail than was possible under the comprehensive, 9-county Bay-Delta Study.

In 1970, seven sewerage agencies in the Richardson Bay watershed banded together and asked the Marin Municipal Water District to act as their agent. The purpose of combining these seven agencies was to conduct a subregional wastewater management study for the southern Marin area. A joint powers agreement was entered into between each one of the seven agencies and the Marin Municipal Water District. The resulting new district was called Improvement District "A" of the Marin Municipal Water District. Subsequent to the formation of Improvement District "A", an additional agency have entered the joint powers agreement and became a part of District "A". Recently, Improvement District "A" was disbanded and nine agencies have entered into a joint powers agreement for the formation of the Southern Marin Subregional Sewerage Agency.

On November 10, 1971, the water district, acting on behalf of District "A" and its supporting agencies, entered into a contract with a joint venture of consulting firms familiar with the area to conduct the necessary studies. The joint venture consisted of the three consulting engineering firms of J. Warren Nute, Inc., Jenks & Adamson, and Yoder-Trotter-Orlob & Associates.

DEFINITION OF STUDY AREA

The southern Marin area, or the Richardson Bay watershed, includes the following sewerage agencies:

Almonte Sanitary District
Alto Sanitary District
City of Belvedere
Homestead Valley Sanitary District
Kay Park Sewer Maintenance District
City of Mill Valley
Richardson Bay Sanitary District
Sanitary District No. 5 of Marin County
Sausalito-Marin City Sanitary District
Tamalpais Valley Community Services District

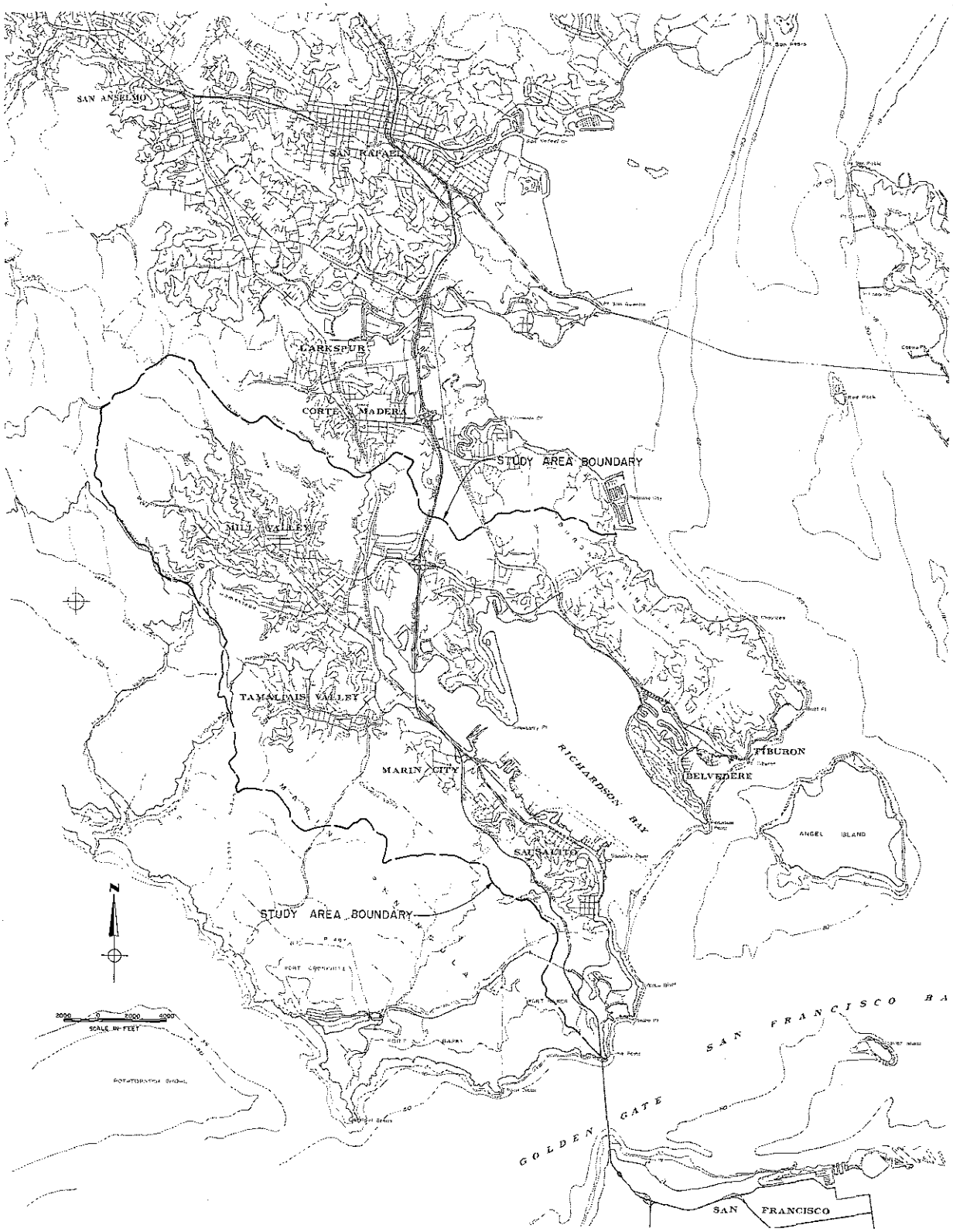
The study area for the southern Marin subregional wastewater management study is shown in Figure 1-1. There are four existing wastewater treatment plants to serve these ten agencies. The Sausalito-Marin City Sanitary District has a primary plant discharging to San Francisco Bay serving not only that district, but also Tamalpais Valley Community Services District and the Strawberry portion of Richardson Bay Sanitary District. The City of Mill Valley has a secondary treatment plant discharging to the northwest portion of Richardson Bay and serving not only the city, but the Homestead Valley Sanitary District, the Almonte Sanitary District, the Kay Park Sewer Maintenance District, and the Alto Sanitary District. The portion of the Richardson Bay Sanitary District not sewered to the Sausalito-Marin City plant is served by the Trestle Glen plant operated and maintained by that district. This is a small secondary treatment plant which discharges to the northeastern shore of Richardson Bay. Sanitary District No. 5 has a primary treatment plant which serves not only the district, but also the City of Belvedere, and discharges to Raccoon Strait.

PURPOSE AND SCOPE OF STUDY

This study was divided into two major phases. The objective of the first phase was to conduct a subregional wastewater planning study for the purpose of developing a realistic solution to the problems facing the southern Marin area now and in the future. As a part of Phase One, all possible alternative management plans were to be evaluated in sufficient detail to select a recommended

FIGURE 1-1

SOUTHERN MARIN STUDY AREA



plan, and a draft report was to be prepared. The objective of the second phase of this study was to prepare preliminary engineering design and cost estimates for the recommended wastewater management plan and to produce a final report covering both phases of the study.

In addition to the immediate study area, it is also necessary to consider the adjacent subregional areas shown in Figure 1-2.

In accordance with the contract, the engineers were charged with performing the following tasks during Phase One of this study.

A. Conduct a thorough review of all previous engineering studies pertinent to the southern Marin wastewater management needs.

B. Review with the Regional Water Quality Control Board the present and projected ocean and bay water quality and effluent standards as well as grant requirements of state and federal agencies to determine the treatment requirements for given disposal locations under both dry and wet weather flow conditions.

C. Review the potential market and time elements for reclaimed wastewater in or adjacent to the study area and develop the necessary basis for evaluating its impact on disposal alternatives.

D. Develop alternative subregional wastewater management systems involving treatment, conveyance, disposal, and reclamation for stage construction on the basis of foregoing data along with all necessary related capital and annual cost data. These alternative wastewater systems should be developed and evaluated on the basis of capital and annual costs and on the basis of sensitivity changes in certain projections involving water quality standards, wastewater reclamation, and regional consolidation.

E. The study shall include an analysis of the present and future worth of the existing wastewater facilities. Particular attention shall be given to the work underway at the present time to correct wet weather flow problems and relate this information to any influence the wet weather flow may have on both disposal locations and wastewater management systems feasibility and cost.

F. The information derived by this study and the analysis contained in the study shall be reviewed from time to time as the study progresses in depth with the Regional Water Quality Control Board and their staff to assure complete coordination with the body, the Environmental Protection Agency, and the State of California Resources Agency, the Advisory Committee of Improvement District "A", ABAG, and other interested groups and agencies.

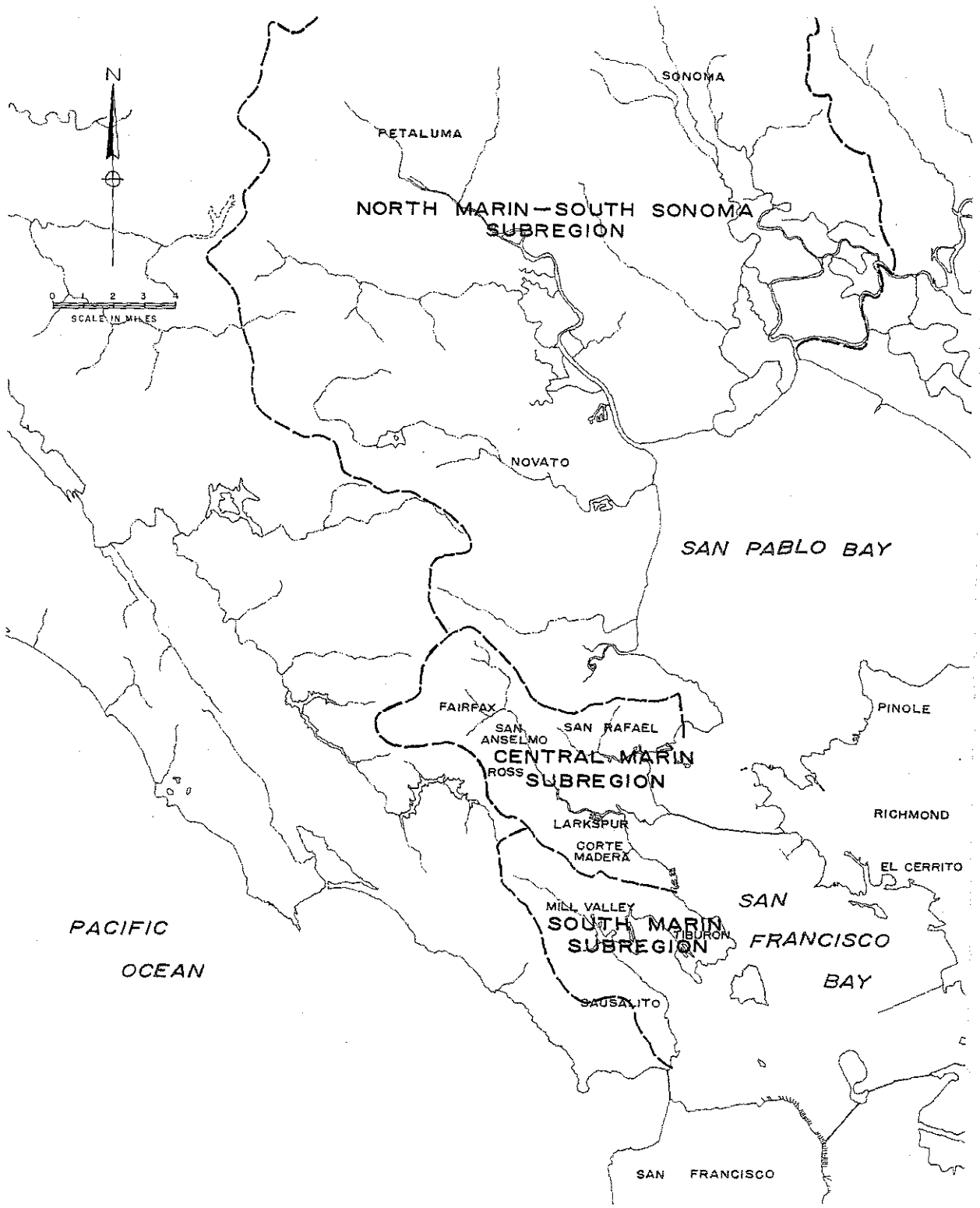
G. Phase One of the study shall be concluded with a detailed draft report which will be prepared presenting the findings and recommendations as they relate to the disposal of wastewaters for Improvement District "A". Specific items which will be included in the draft report are:

   1. Findings and recommendations relating to the point of discharge for wastewater disposal.

   2. Water quality and wastewater requirements.

FIGURE 1-2

MARIN - SONOMA SUBREGIONS



3. A description of the alternative systems to provide for wastewater management.

4. A comparison and evaluation of the various combinations.

In Phase Two, the engineers were to perform the following tasks:

A. The study shall include sufficient preliminary engineering layouts to develop accurate cost estimates for the interceptor line and routes, pumping plant locations and capacities.

B. Recommended modification to existing facilities and associated cost estimates.

C. Produce a final report covering both Phases One and Two of this study.

CONDUCT OF STUDY

Initial phases of the work were concerned primarily with assessing and evaluating previous reports and information pertient to the study. Data relative to existing wastewater facilities and present wastewater flows and loadings were obtained from the various sewerage agencies. Past and projected land use and population figures were obtained from various sources, including previous engineering studies, the local agencies, and the county. Based on the variations in previous projections, a design range of population was projected, including high, median and low values. Based on present wastewater flows and characteristics, unit design values were developed. These were used in conjunction with the population projections, to develop projections of wastewater loadings through the year 2000.

Information was obtained from various state and federal agencies regarding water quality objectives in the receiving waters under consideration. These were used along with the projected waste loadings and mathematical models of the bay to determine what levels of treatment and points of disposal are necessary to comply with state and federal requirements. At the same time, a reconnaissance level investigation was conducted to determine the potential use of reclaimed wastewater in and adjacent to the study area.

Using the information developed regarding existing facilities, waste flow projections and treatment and disposal requirements, alternative plans for treatment and disposal were developed and evaluated. These alternatives were then compared on the basis of economics, environmental impact, and reclamation potential and on the basis of other qualitative factors. Based on this comparison, a recommended treatment and disposal plan was developed. This plan was then used in conjunction with the information developed on reclamation to develop a recommended wastewater management plan for southern Marin.

STUDY LIAISON

Throughout this study, the engineering consortium has maintained close liaison with the agencies involved in this study. The three groups involved include the staff and board of the Marin Municipal Water District, the Advisory Committee to Improvement District "A", subsequently the board of the Southern Marin Subregional Sewerage Agency, and the Environmental Advisory Subcommittee to the Advisory Committee. The Advisory Committee included a board member or council member from each of the ten sewerage agencies participating in this study. The Environmental Advisory Sub-

committee was made up of 24 environmentally concerned people, many of them active in local conservation groups. The membership of the Environmental Advisory Subcommittee included people from throughout the entire Marin Municipal Water District, which includes the southern Marin area, the central Marin area and extends all the way to Hamilton Field.

The consortium has maintained close liaison with the staff of the water district. In addition, we have made several progress reports to the district Board of Directors. We have met with and reported to the Advisory Committee on a monthly basis, since January 1972. We have met twice a month with the Environmental Advisory Subcommittee starting in October of 1971 until November of 1972.

The engineering consortium has received a considerable amount of valuable input from each of these groups. The Environmental Advisory Subcommittee has been especially helpful in making the engineers aware of the concerns of environmentalists in Marin County. In addition, this committee has issued a number of resolutions which have expressed their feelings regarding environmental protection and wastewater reclamation. Also, this committee has issued several special reports. One on the environmental sensitivity of alternative discharge locations includes written comments from various local conservation groups. Another special report suggests means of minimizing environmental impact of wastewater management plans. Finally, one report suggested specific water quality criteria necessary to insure environmental protection. Each of these special reports and the resolutions passed by the Environmental Advisory Subcommittee is reprinted in Appendix G. One resolution of special interest is the one passed February 10, 1972, suggesting specific criteria to help guide this wastewater management study.

ORGANIZATION OF THE REPORT

This final report contains the findings and recommendations of the wastewater management study. In addition, sufficient detail is presented in this report to justify the conclusions reached and to allow periodic updating of this study in the future.

The report is organized as follows:

Chapter 2 contains a summary of the study, the recommendations and an implementation schedule. The remainder of the report contains the detailed information and data necessary for the development and analysis of alternative management plans and the selection of a recommended plan.

Chapter 3 contains a brief historical background of the southern Marin area and describes various physical and environmental characteristics of the area.

Chapter 4 has a description of the ten sewerage agencies involved in this study and their existing wastewater facilities.

Chapter 5 contains the basic planning information and projections that are necessary to develop alternative wastewater management plans. This information includes land use and population projections.

Chapter 6 contains the methods and projections of waste loads to the year 2000.

Chapter 7 contains the wastewater treatment and disposal requirements necessary for alternative management plans.

Chapter 8 is an analysis of the wastewater reclamation potential in southern Marin and adjacent areas.

Chapter 9, alternative plans for wastewater transport, treatment and disposal are developed and analyzed. Based on this analysis, a recommended plan for wastewater treatment in southern Marin County is proposed.

Chapter 10, the recommended wastewater management plan is described and a cost summary of the necessary facilities is presented. A detailed description of the proposed facilities and a detailed cost estimate is included in this chapter.

The appendices to this report include Appendix A which lists the abbreviations used in this report; Appendix B which includes a glossary of technical terms used in this report; Appendix C which lists the references used; Appendix D which includes the design criteria for sewers, pump stations, treatment facilities, and outfalls; Appendix E which contains the criteria which was used to economically evaluate the alternative management plans; Appendix F which presents the detailed costs for each alternative; Appendix G which includes the resolutions and special reports of the Environmental Advisory Subcommittee; and Appendix H which answers some commonly asked questions about the study.

ACKNOWLEDGMENTS

For their assistance during this study, we wish to express our appreciation to the staff of the Marin Municipal Water District, and especially to Mr. William R. Seeger, General Manager and Chief Engineer, and to Mr. John T. Schulte, Administrative Officer of the Southern Marin Subregional Sewerage Agency. We further wish to acknowledge the Advisory Committee and the Environmental Advisory Subcommittee for the many hours and the valuable comments and suggestions which they have contributed to this study.

Chapter 4

EXISTING WASTEWATER FACILITIES

In order to develop alternative wastewater management plans, it is essential that all existing wastewater treatment and disposal facilities be evaluated as to their present capabilities. In this chapter each of the existing treatment facilities are described along with the responsibility of each of the sewerage agencies.

GENERAL

The southern Marin study area encompasses the Richardson Bay watershed and contains ten separate agencies with various degrees of responsibility for sewage collection, treatment, and disposal. Four of the sewerage agencies operate their own sewage treatment and disposal facilities. The other six agencies contract with three of the four agencies for treatment and disposal.

The various sewerage agencies in southern Marin, along with the basic sewerage facilities, are shown in Figure 4-1. A general background of the development of the southern Marin sewerage agencies and a background on each existing agency is given below.

BACKGROUND

The first sewers in the southern Marin area were constructed in the communities of Sausalito and Mill Valley in the late 1800's. However, sewage was discharged untreated to the bay, and creeks and sloughs tributary to the bay, until the end of World War II.

On March 11, 1946, the State Board of Public Health adopted a resolution prohibiting the discharge of raw, untreated sewage to the waters of the State of California. Most wastewater dischargers into San Francisco Bay, including all the dischargers into Richardson Bay, were faced in 1946 with both the legal requirements and the basic civic responsibility to provide adequate wastewater treatment prior to bay discharge.

Subsequently, a considerable amount of discussion and effort was in evidence in the southern Marin area toward formation of a coordinated program of wastewater treatment and disposal. This discussion led to the Southern Marin Sanitation District which embraced the major portion of the Richardson Bay watershed. Two separate engineering studies by Harry N. Jenks on behalf of the Southern Marin Sanitation District recommended construction of common-use facilities involving collection of all southern Marin County sewage and transport for treatment and disposal into Richardson Bay at Marinship as an initial alternative. Following the failure of a district bond issue in November of 1946, a second alternative program was devised which involved transport of sewage generated within the district boundaries to a common point for treatment and disposal into the Pacific

Ocean at Tennessee Cove. With failure of this second alternative program offered by the Southern Marin Sanitation District, the district dissolved, leaving the local sewering agencies with the continuing problem of how best to meet the requirements for wastewater treatment.

It is necessary to recognize this background of failure of the Southern Marin Sanitation District in order to understand the present southern Marin situation with ten separate sewerage agencies and four separate sewerage treatment plants. Consequently, in order to solve the then pressing pollution problem, each community had to proceed on its own as best it could.

Now facing a complete prohibition of discharge of any sewage-bearing wastes to Richardson Bay, the southern Marin sewerage agencies have come together in these present studies to develop a coordinated wastewater management program to meet this new water quality objective. It is sincerely hoped that the studies summarized herein will lead to a successful program which can be implemented to the benefit of all of southern Marin.

ALMONTE SANITARY DISTRICT

The Almonte Sanitary District collects sewage from a small area southeast of Mill Valley and delivers it by gravity to the Mill Valley trunk sewer system. Of the total district area of 0.5 square miles, nearly half consists of undeveloped tide marsh and mud flats.

Prior to district formation in 1949, sewage disposal was accomplished through individual septic tanks under sanitary conditions described as extremely unsatisfactory. There was a great deal of difficulty with overflowing sewage to the watercourses. In 1951, sewers ranging in size from 6 to 15 inches were constructed, and the entire district population of 1,500 is now reported to be connected to the collection system.

Treatment of sewage from Almonte Sanitary District is performed at the Mill Valley plant under a contract which apportions treatment costs on the basis of assessed valuation.

To solve a stormwater infiltration problem which causes overflowing manholes along the 15-inch trunk sewer, the City of Mill Valley is now constructing a pumping station which will intercept sewage flows from the Almonte and Kay Park areas and pump them directly to the Mill Valley treatment plant.

ALTO SANITARY DISTRICT

The Alto Sanitary District comprises an area of less than 150 acres located north of Mill Valley and adjacent to Highway 101. The first sewers were constructed sometime prior to 1945, discharging to a community septic tank which , in turn, discharged to Widow Reed Slough. After formation of the sanitary district in 1950, a pumping station was constructed at the southern boundary to lift all of the district's sanitary sewage into the Mill Valley trunk sewer system.

Some 3.5 miles of 6 and 8-inch sewers now serve the entire district population of about 1,000 people. Sewage treatment is provided at the Mill Valley plant under a contract with terms similar to that for Almonte Sanitary District.

CITY OF BELVEDERE

The City of Belvedere was incorporated in 1896 and is entirely residential in character. The city occupies an area of about 0.6 square miles consisting principally of Belvedere Island and the

adjacent lagoon. The first sewers, installed over 60 years ago, conveyed sewage to the southern tip of the island, where it was discharged into Raccoon Strait.

Except for local improvements and expansion of the collection system, this mode of operation prevailed until 1961, at which time a pumping station and force main were constructed to convey all of the city's sewage to the Sanitary District No. 5 plant for treatment.

Stormwater infiltration into the collection system is very high on a unit basis, but because of the small area involved, peak wet weather flows are usually within manageable limits.

HOMESTEAD VALLEY SANITARY DISTRICT

The Homestead Sanitary District was established by the Board of Supervisors on July 7, 1931 under the Sanitary District Act of 1919 after an election which favored its formation. This election was precipitated by a controversy between residents in the area and the Board of Supervisors, in which the latter attempted to construct sewers in the Homestead Valley area. The Board of Supervisors finally abandoned the proceedings on assurance that the sanitary district would diligently proceed with construction of sewers.

In 1932, the district was recognized under the Sanitary District Act of 1923 as the Homestead Valley Sanitary District. Some sewers were constructed in the lower part of the district which connected to Mill Valley's outfall line on Miller Avenue. However, this arrangement was unsatisfactory since the tide would occasionally back the sewage into houses. Plans for the sewers in the rest of the district were prepared by 1933. The sanitary board, however, did not proceed because of the problem of tidal backups in the Mill Valley outfall.

Between 1933 and the end of World War II, the district concerned itself with inspection of septic tank installations. With increasing development following the war, the sanitary board undertook the installation of sewers in the district. In 1948, the district sold bonds and, with the assistance of a state grant, a contract was awarded to construct sewers which now form the major part of the present sewer system.

In order to dispose of the sewage from Homestead Valley, the sanitary district negotiated a contract with Mill Valley which granted the district a license to use the city's system. The capital and operating costs of the Mill Valley treatment plant are allocated on the basis of the respective assessed valuations of the two agencies.

In 1970, the Homestead Valley Sanitary District undertook an analysis of their sewer system. This analysis determined that stormwater infiltration to the sewer system is a problem. As a result, over the last two years, the district has been conducting an extensive smoke testing and infiltration correction program.

KAY PARK SEWER MAINTENANCE DISTRICT

The Kay Park Sewer Maintenance District serves an area of about 50 acres and has a population of 530. The Kay Park sewerage system was constructed in the early 1950's on the tidal marsh lands at the mouth of the Tamalpais and Tennessee Valleys. Kay Park contained the first sewers in that general area.

A pumping station and 4,000 feet of gravity sewer and force main were constructed to convey the sewage to the Mill Valley system. As with Homestead, Almonte and Alto, Kay Park contracts with Mill Valley for sewage treatment.

Stormwater infiltration into the Kay Park collection system is very high; and, at the present time, the Kay Park Sewer Maintenance District, in conjunction with the Tamalpais Community Services District, is undertaking an extensive infiltration correction program. The Tamalpais Valley Community Services District has agreed to take over the Kay Park system once the sewers are brought up to standard.

CITY OF MILL VALLEY

The community of Mill Valley began in the late 1800's as a resort for residents of San Francisco. The first sewers were constructed by subdividers in 1892. The city was incorporated in September of 1900, and following the earthquake of 1906, Mill Valley rapidly changed from a resort community to a year-round residential community.

Originally, the first sanitary sewers, some of which are still in use, discharged raw sewage into Arroyo Corte Madera del Presidio in the vicinity of Evergreen Avenue. In 1912, the city constructed an Imhoff tank on the west side of Miller Avenue between Reed and Evergreen Avenues, and the effluent from the tank was discharged into a tidal slough approximately 600 feet northeast of the Tamalpais High School.

The odor from the Imhoff tank proved to be more offensive than the odor from the previously used Arroyo, and for this reason, the tank was abandoned in 1919. In 1926, the outfall sewer line was extended further down the slough to a point in the vicinity of the railroad bridge over the Arroyo.

In 1946, a new trunk line system and an outfall sewer was constructed, terminating in the vicinity of the present treatment plant. In 1948, a pumping station was built, and the effluent was discharged into the Widow Reed Slough. The first units of the present treatment plant were constructed in 1952.

Much of the sewage collection system serving Mill Valley is quite old and is subject to large stormwater inflow and infiltration flows exceeding 800 percent of the average design capacity of the treatment plant. Most of the existing trunk sewers are inadequate to handle the wet weather flows. Similarly, the treatment plant cannot handle the peak flows and, consequently, during wet weather a great deal of pretreated or partially treated sewage overflows to the bay.

Recognizing this deficiency, in 1967 the voters in the city passed a $500,000 bond issue for improvement and upgrading the existing sanitary sewer system. Recently, the city has undertaken a smoke testing program and general system rehabilitation program to rebuild and seal manholes and broken sewers.

Contracting Agencies

Four separate sewerage agencies contract with the City of Mill Valley for sewage treatment and disposal. The agencies are the Homestead Valley Sanitary District, the Almonte Sanitary District, the Alto Sanitary District, and the Kay Park Sewer Maintenance District.

Treatment Plant

The city's present sewage treatment plant is located on Sycamore Avenue east of Camino Alto. The original plant built in 1952 provided a primary degree of sewage treatment and discharged effluent into the head end of Richardson Bay.

In 1958, the plant was enlarged to provide secondary treatment utilizing trickling filters; and, in recent years, a sludge centrifuge has been added. The present plant design capacity is 1.3 mgd with the capacities of the principal units listed in Table 4-1.

Present Needs

Although the Mill Valley treatment plant provides secondary treatment with effluent disinfection, there is essentially a prohibition of discharge of any sewage-bearing wastes to Richardson Bay. In June 1971, the Regional Water Quality Control Board issued a cease and desist order from discharging wastewaters not in compliance with the Board's strict requirements, and therefore, the city needs either advanced treatment facilities or a new point of discharge in deep water. The only deep waters available are a considerable distance from Mill Valley, thereby necessitating careful consideration of a coordinated subregional approach to meeting the new water quality objectives.

Table 4-1. CITY OF MILL VALLEY TREATMENT PLANT SIZE AND CAPACITY OF PRINCIPAL UNITS

Plant Design Capacity - 1.3 mgd - Secondary

BASIS OF DESIGN	
Design Population	18,000
Design Flow	
Average Dry Weather, mgd	1.3
Peak Dry Weather, mgd	2.7
Peak Wet Weather, mgd	15.1
Design Loading	
Biochemical Oxygen Demand, mg/l	230
Biochemical Oxygen Demand, ppd	2,840
Suspended Solids, mg/l	225
Suspended Solids, ppd	2,780

PRIMARY CLARIFIER	
Number	2
Length, ft.	82
Width, ft.	16
Side Water Depth, ft.	10
Detention Time, hrs.	3.6

SECONDARY SEDIMENTATION TANKS	
Number	2
Length, ft.	82
Width, ft.	16
Side Water Depth, ft.	10
Detention Time, hrs.	3.6

TRICKLING FILTERS	
Number	2
Diameter, ft.	80
Side Water Depth, ft.	6
Volume, 1,000 cu. ft.	60

CHLORINE CONTACT TANK	
Number	1
Length, ft.	16
Width, ft.	16
Depth, ft.	15
Detention Time, min.	30

SLUDGE DIGESTER (Heated)	
Number	1
Diameter, ft.	40
Side Water Depth, ft.	24
Volume, 1,000 cu. ft.	30

SLUDGE DIGESTER	
Number	1
Diameter, ft.	50
Side Water Depth, ft.	24
Volume, 1,000 cu. ft.	47

SLUDGE BEDS	
Number	4
Length, ft.	146
Width, ft.	51
Depth, ft.	1.17
Volume, 1,000 cu. ft.	35

PLANT OUTFALL	
Diameter, in.	30
Length, ft.	900

In 1958, the plant was enlarged to provide secondary treatment utilizing trickling filters; and, in recent years, a sludge centrifuge has been added. The present plant design capacity is 1.3 mgd with the capacities of the principal units listed in Table 4-1.

Present Needs

Although the Mill Valley treatment plant provides secondary treatment with effluent disinfection, there is essentially a prohibition of discharge of any sewage-bearing wastes to Richardson Bay. In June 1971, the Regional Water Quality Control Board issued a cease and desist order from discharging wastewaters not in compliance with the Board's strict requirements, and therefore, the city needs either advanced treatment facilities or a new point of discharge in deep water. The only deep waters available are a considerable distance from Mill Valley, thereby necessitating careful consideration of a coordinated subregional approach to meeting the new water quality objectives.

Table 4-1. CITY OF MILL VALLEY TREATMENT PLANT SIZE AND CAPACITY OF PRINCIPAL UNITS

Plant Design Capacity - 1.3 mgd - Secondary

BASIS OF DESIGN	
Design Population	18,000
Design Flow	
Average Dry Weather, mgd	1.3
Peak Dry Weather, mgd	2.7
Peak Wet Weather, mgd	15.1
Design Loading	
Biochemical Oxygen Demand, mg/l	230
Biochemical Oxygen Demand, ppd	2,840
Suspended Solids, mg/l	225
Suspended Solids, ppd	2,780

PRIMARY CLARIFIER	
Number	2
Length, ft.	82
Width, ft.	16
Side Water Depth, ft.	10
Detention Time, hrs.	3.6

SECONDARY SEDIMENTATION TANKS	
Number	2
Length, ft.	82
Width, ft.	16
Side Water Depth, ft.	10
Detention Time, hrs.	3.6

TRICKLING FILTERS	
Number	2
Diameter, ft.	80
Side Water Depth, ft.	6
Volume, 1,000 cu. ft.	60

CHLORINE CONTACT TANK	
Number	1
Length, ft.	16
Width, ft.	16
Depth, ft.	15
Detention Time, min.	30

SLUDGE DIGESTER (Heated)	
Number	1
Diameter, ft.	40
Side Water Depth, ft.	24
Volume, 1,000 cu. ft.	30

SLUDGE DIGESTER	
Number	1
Diameter, ft.	50
Side Water Depth, ft.	24
Volume, 1,000 cu. ft.	47

SLUDGE BEDS	
Number	4
Length, ft.	146
Width, ft.	51
Depth, ft.	1.17
Volume, 1,000 cu. ft.	35

PLANT OUTFALL	
Diameter, in.	30
Length, ft.	900

RICHARDSON BAY SANITARY DISTRICT

The Richardson Bay Sanitary District was formed in 1949 as a consolidating agency for the several small community sewage disposal systems along the north shore of Richardson Bay. The district has continued as a consolidating agency and, finally, in 1963 extended sewerage service to the Hawthorne Terrace area adjacent to Tiburon and thereby eliminated the Hawthorne Terrace Sewer Maintenance District.

Prior to the district's formation, the first sewer system was installed in the Strawberry area about 1945 to serve the Bayview Terrace subdivision after septic tanks throughout the tract had failed. A collecting system was constructed in the rear of the houses to intercept septic tank effluent, and an outfall line was run to the Salt Works Canal which discharged without further treatment into the bay.

In 1946, development of the Strawberry Point properties was started with the construction of homes along Belvedere Drive. Two community septic tanks were installed by the developer to serve this tract with approval of the County Health Department.

Subsequently, in 1948, a third community septic tank was installed on the west slope to serve the Strawberry Manor tract. This tank was located south of Ricardo Road with an outfall to the bay on the east side of De Silva Island. Approval of these facilities by the county health authorities was with the understanding that they were temporary in nature and that they would have to be replaced with better treatment and disposal facilities in the near future. It became evident to the new residents of these tracts that the facilities provided by the developer would soon become entirely inadequate; and, since the proposed Southern Marin Sanitation District had been rejected by the voters, the residents of the Strawberry area formed the Richardson Bay Sanitary District in February 1949. Upon its formation, the district became the owner of the three community sewage disposal systems.

To solve the problem of the east side of Strawberry, a small package-type sewage treatment plant was constructed in 1950 on the Tiburon Highway adjacent to the Salt Works Canal. A second biofilter package treatment plant was constructed by the developer of Belveron Gardens at the location of the present Trestle Glen plant. Each plant was designed to provide complete secondary treatment for a population of 800.

Rapid growth of the Strawberry Point area had, by 1953, made the Salt Works Canal plant and the two community septic tanks on the west side entirely inadequate. After studies to seek the most economical solution, the district contracted with the Sausalito-Marin City Sanitary District for treatment of sewage at their new plant near Fort Baker rather than attempt to enlarge the Salt Works Canal plant or to construct another package-type plant to serve the west side of Strawberry Point.

Connection to the Sausalito system was made into an 8-inch force main with limited capacity which connected with a larger main at Marin City. This line was replaced by the Sausalito-Marin City District in 1959 with a 16-inch pipeline to serve both the Richardson Bay and Tamalpais Valley systems.

It has been expected that the connection to the Sausalito system would provide adequate service for the future needs of the areas served by the Ricardo Road and Salt Works pumping stations. However, the Sausalito system is of limited capacity to handle peak flows, and operating experience has indicated that the present system will be inadequate to serve the ultimate needs of the district.

Trestle Glen Treatment Plant

That portion of the district served by the original package treatment plant at Trestle Glen was growing rapidly, and by 1956 it became evident that the plant should be enlarged. About 1,200 persons were being served by the plant which amounted to about a 50 percent overload, and the degree of treatment was rapidly deteriorating.

In view of the high degree of treatment necessary at the Trestle Glen location, the design for the enlarged plant incorporated a modified activated sludge process known as the Spiro-Vortex system. The plant was designed to serve a population of 4,000 and to be constructed in two stages. The first stage was constructed in 1958, and the secondary clarifier was constructed in 1963. The present capacities of the plant and principal units is listed in Table 4-2.

Table 4-2. RICHARDSON BAY SANITARY DISTRICT TRESTLE GLEN TREATMENT PLANT SIZE AND CAPACITIES OF PRINCIPAL UNITS

Plant Design Capacity - 0.3 mgd - Secondary

BASIS OF DESIGN	
Design Population	4,000
Design Flow	
Average Dry Weather, mgd	0.3
Peak Wet Weather, mgd	1.0
Design Loading	
Biochemical Oxygen Demand, ppd	680
Suspended Solids, ppd	680
INFLUENT PUMPS	
Plant Pumping Units	3
Capacity, each, gpm	100
SCREENING UNITS	
Barminutors	2
Max. Capacity, each, mgd	1.7
PRIMARY CLARIFIER	
Number	1
Diameter, ft.	30
Side Water Depth, ft.	7.5
Detention Time, hrs.	3.2
MIXING TANKS	
Number	2
Diameter, ft.	26
Depth, ft.	6
Total Capacity, gal.	47,600
SUPERATE FILTER	
Number	1
Diameter, ft.	24
Media Volume, cu. yds.	17
RECIRCULATION PUMPS	
Number	2
Capacity, each	
Low Speed, gpm	3,300
High Speed, gpm	4,500
AUXILIARY AIR BLOWERS	
Number	2
Capacity, each, scfm	300
SECONDARY CLARIFIER	
Number	1
Diameter, ft.	30
Side Water Depth, ft.	6
Detention Time, hrs.	2.5
SLUDGE THICKENER	
Number	1
Diameter, ft.	15.67
Side Water Depth, ft.	7
Surface Area, sq. ft.	193
Volume, gal.	10,100
SLUDGE INCINERATOR	
Number	1
Capacity, Dry Solids, lbs/hr	85
Combustion Temp., deg F	1,600
EFFLUENT SPRAY FIELD	
Area, sq. ft.	8,000
Disposal Capacity, mgd	0.025
PLANT OUTFALL	
Diameter, in.	18
Length, ft.	200
Depth below MSL, ft.	0

Present Needs

In February 1971, the Regional Water Quality Control Board adopted stringent new waste discharge requirements for the Trestle Glen plant. The new requirements mandate a very high degree of tertiary treatment and, in essence, essentially prohibit future discharge of sewage effluent at this point. In June 1971, they issued a cease and desist order from discharging wastewaters not in compliance with those requirements.

SANITARY DISTRICT NO. 5

Sanitary District No. 5 was formed in 1922 and serves most of the easterly end of the Tiburon peninsula.

The first sewers in the area were constructed in 1924 and until 1949 all sewage was discharged untreated to San Francisco Bay. District facilities now include six pumping stations, some 48 miles of sewers and force mains ranging in size from 6 to 18 inches and a primary sewage treatment plant. In addition to treating the sewage from District No. 5, the treatment plant serves the City of Belvedere under a contractual arrangement which bases treatment charges on total sewage flow from the city.

Sanitary District No. 5 has assumed sewerage responsibility for a proposed subdivision in the Paradise Cove area on the east side of the Tiburon peninsula. A 60-acre area near Paradise Cove has been annexed to the district, and the developer built a small secondary treatment plant to be operated by district personnel.

Treatment Plant

The district's treatment plant, originally constructed in 1949, was expanded in 1961 to its present design capacity of 1.4 mgd.

Principal plant units consist of an influent pumping station with a capacity of 7 mgd, two rectangular primary sedimentation tanks, a heated primary digester, a smaller unheated secondary digester, and a chlorine contact chamber. Peak hydraulic capacity of the treatment units is reported to be 7.5 mgd. Plant effluent is discharged directly to Raccoon Strait and digested sludge is trucked away for agricultural use. The plant outfall extends only 24 feet offshore into Raccoon Strait. The present capacities of the plant and principal units are listed in Table 4-3.

Present Needs

The district needs to extend the plant outfall into Raccoon Strait to beyond the 200-foot limit to comply with the shallow water discharge prohibition and to upgrade the treatment level to a minimum of secondary treatment by 1977 to conform to the Federal Water Pollution Control Act. If the district undertakes these improvements on its own, it could conceivably meet all water quality requirements until 1983 at which time the best practicable treatment technology shall be utilized. The district is presently investigating, on a pilot plant basis, the possible use of a new tertiary treatment process to upgrade effluent quality.

At the district's small Paradise plant, there may eventually be need to expand service to additional areas on the north side of the Tiburon peninsula. Many of the present homes now have septic tanks which are failing and causing potential health problems. To expand service to this area, it will probably be best to make a connection to either the southern Marin subregional system to be developed herein or to the Corte Madera system to the north.

Table 4-3. SANITARY DISTRICT NO. 5 TREATMENT PLANT
SIZE AND CAPACITIES OF PRINCIPAL UNITS

Plant Design Capacity - 1.4 mgd - Primary

BASIS OF DESIGN	
Design Population	10,900
Design Flow	
Average Dry Weather, mgd	1.4
Peak Wet Weather, mgd	7.4
Design Loading	
Biochemical Oxygen Demand, ppd	2,100
Suspended Solids, ppd	2,800

PRIMARY CLARIFIER	
Number	2
Length, ft.	56
Width, ft.	14
Side Water Depth, ft.	10
Detention Time, hrs.	2

CHLORINE CONTACT TANK	
Number	1
Length, ft.	30
Width, ft.	10
Side Water Depth, ft.	8.5
Detention Time, min.	30

SLUDGE DIGESTER (Heated)	
Number	1
Diameter, ft.	25
Side Water Depth, ft.	34
Volume, 1,000 cu. ft.	16.5

SLUDGE DIGESTER	
Number	1
Diameter, ft.	18
Side Water Depth, ft.	20
Volume, 1,000 cu. ft.	5.3

PLANT OUTFALL	
Diameter, in.	24
Length, ft.	70
Depth below MSL, ft.	0

SAUSALITO-MARIN CITY SANITARY DISTRICT

In the face of the need to provide adequate sewage treatment and disposal facilities after the failure of the Southern Marin Sanitation District, the Sausalito-Marin City Sanitary District was formed by the vote of the people residing within the corporate limits of the City of Sausalito and the Marin City area with the election of a 5-man District Board of Directors. A bond election was presented by the board to the electorate on April 8, 1952, which approved the expenditure of $775,000 by the district for construction of a system of intercepting sewers, pumping, and treatment works.

The major project was completed in 1953 and eliminated all sewage pollution from the entire shoreline of Sausalito and Marin City from Richardson Bay Highway Bridge on the north to Fort Baker on the south, a distance of some four miles. This accomplishment was made possible through installation of a series of sewers and pressure mains ranging in size from 10 to 24 inches intercepting raw sewage that formerly flowed directly into the bay through the numerous individual outlets along the waterfront. The force mains, serving two booster stations and three main pumping plants, handle the flow between successive gravity sections and the treatment plant itself. The plant is located on the rocky shore of San Francisco Bay at the foot of the bluff some 800 feet south of the city limits.

In respect to operating experience related to district collection sewer and pumping plant system, it may be pointed out that while functionally the system has worked well, inherent problems in respect to stormwater infiltration, both within the district and derived from contracting agencies sewerage

systems, has resulted in some necessary bypassing in the past. This inherent weakness of the system, mainly the result of antiquated "leaky" local sewers, has been mitigated through recent improvements providing increased pumping plant capacity.

Nevertheless, it is acknowledged that basic improvements must be made to the old sewer systems in order to insure that no bypassing of untreated wastewater occurs in the future under expected conditions of peak loading.

Contracting Agencies

The Sausalito-Marin City Sanitary District basically accepts sewage for treatment and disposal. The district provides treatment and disposal for the sewage from the City of Sausalito, while the city retains responsibility for maintenance of the sewer system.

Furthermore, an essential aspect of the original Sausalito-Marin City district formation was an agreement to serve the wastewater treatment and disposal needs of adjacent Fort Baker, a consideration which entered into the favorable negotiations for the treatment plant and outfall line sites. Subsequent to district formation, the district entered into service agreements with Richardson Bay Sanitary District to provide wastewater treatment and disposal for a portion of that district's service area, as well as an agreement to serve Tamalpais Valley Community Services District.

Treatment Plant

The district treatment plant provides a primary degree of treatment and has a design capacity of 2.4 mgd. The plant utilizes a unique arrangement of plant structures, whereby the entire plant was built within an 80-foot circle to overcome extraordinary space limitations at this location. To accomplish this, the clarifier was constructed on top of the sludge digestion tank, with the control house adjacent to the clarifier. Ordinarily, these are separate structures, comprising a dispersed layout. The plant effluent is discharged through a submarine outfall extending 400 feet offshore and terminating in 30 feet of water. The sizes and capacities of the principal treatment units are listed in Table 4-4.

Table 4-4. SAUSALITO-MARIN CITY SANITARY DISTRICT TREATMENT PLANT SIZE AND CAPACITY OF PRINCIPAL UNITS

Plant Design Capacity - 2.4 mgd - Primary with Chemical

BASIS OF DESIGN	
Design Population	23,500
Design Flow	
Average Dry Weather, mgd	2.4
Peak Wet Weather, mgd	8.3
Design Loading	
Biochemical Oxygen Demand, ppd	3,350
Suspended Solids, ppd	3,350

PRIMARY CLARIFIER	
Number	1
Diameter, ft.	55
Side Water Depth, ft.	9.5
Detention Time, hrs.	1.7

SLUDGE DIGESTER (Heated)	
Number	1
Diameter, ft.	75
Side Water Depth, ft.	13
Volume, 1,000 cu. ft.	57.5

PLANT OUTFALL	
Diameter, in.	20
Length, ft.	300
Depth below MSL, ft.	30

A distinct asset in respect to the treatment plant site location is its proximity to deep waters. Enormous volumes of bay water pass over the submarine outfall and greatly minimize the effects of the discharge. This provides one of the most strategic points of wastewater discharge to be found in the entire San Francisco Bay area.

Present Needs

Since the Sausalito-Marin City Sanitary District plant does not discharge to Richardson Bay, it is not faced with the same discharge prohibition as two of the other southern Marin agencies. The plant outfall extends beyond the 200-foot limit from the extreme low waterline of the bay and with slight modification of the outfall diffuser, the plant can meet all present water quality requirements in the bay.

There is a need, however, to upgrade the present degree of treatment from primary to full secondary by 1977, to meet the basic requirements of the Federal Water Pollution Control Act Amendment of 1972. Construction of a full secondary plant is a major undertaking, particularly at the present plant site and, therefore, Sausalito should carefully consider other alternatives.

TAMALPAIS VALLEY COMMUNITY SERVICES DISTRICT

The Tamalpais Valley Sanitary District was formed in January 1954 and was the last sanitary district to be formed in the Richardson Bay watershed. Prior to its formation, the community of Tamalpais Valley depended on individual septic tanks for sewage treatment and disposal.

The first subdivisions of land took place in the early 1900's and, as the valley developed, the use of septic tanks for sewage disposal became increasingly unsatisfactory, with many overflowing septic tanks. The district constructed a sewage collection system in 1954 and entered into an agreement with the Sausalito-Marin City Sanitary District for sewage treatment and disposal.

Sewage from the district is pumped to the Sausalito system via a 15-inch and 16-inch force main from the district pumping station at the mouth of the Tennessee Valley.

In 1967, the Tamalpais Valley Sanitary District was reorganized as the Tamalpais Valley Community Services District, expanding their public services.

SUMMARY

Each of the southern Marin sewerage agencies have present needs in respect to meeting more stringent waste discharge requirements. Both Sausalito and Tiburon must upgrade their treatment plants to full secondary treatment and Mill Valley and Richardson Bay Sanitary District must remove their discharges from Richardson Bay. These mutual needs suggest a coordinated effort, which is the primary reason for undertaking these present studies on a subregional basis.

Appendix D

EASTERN MARIN SOUTHERN SONOMA WASTEWATER FACILITIES PLAN

Volume II

SOUTHERN MARIN PLANNING UNIT

V. WARREN NUTE, INC. / JENKS AND HARRISON / TROTTER-YODER & ASSOCIATES

BARTLE WELLS ASSOCIATES

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Chapter 2
SUBREGIONAL ALTERNATIVE ANALYSIS

INTRODUCTION

The regional alternatives developed as part of prior studies involving the southern Marin planning area were summarized in Part I, Chapter 6. As a result of prior analysis, it was concluded that a large scale regional project involving south, central, and north Marin, as well as Sonoma County, would not be the most cost effective wastewater management plan. Local alternatives involving both southern and central Marin appeared to be more acceptable from both economic and environmental standpoints.

This chapter summarizes the analysis of subregional alternatives conducted in the "Marin Sonoma Wastewater Program Analysis," 1975, and further screens various subalternative combinations of the smaller sanitary districts within the southern Marin area.

SCREENING OF ALTERNATIVES

Many alternatives for the southern Marin area were identified and evaluated in the previous regional and subregional studies. The basic feasibility of local disposal alternatives for the four souther Marin discharging agencies is summarized in Table 2-1.

Land disposal options in southern Marin County are severely limited. Agriculture near urban areas is essentially nonexistent and much of the land is already committed to watershed for the municipal water supply or for open space or parklands.

Wastewater reclamation potential in southern Marin, which is discuss in the following chapter, is generally limited to golf course and park irrigation and possibly for marsh creation or enhancement. Marsh enhancement is discussed in detail in Volume I, Chapter 8.

A marsh creation project would require pilot investigations to determine sizing requirements and operational procedures that would mitigate possible nuisance effects, such as mosquito propagation. Implementation of such a project would require several years and is considered only as a possible second stage project after implementation of a subregional project with a primary discharge location outside of Richardson Bay. Reclamation potential in southern Marin could therefore only utilize a small portion of the wastewaters generated in the area and is not considered as an option to plans utilizing discharge to San Francisco Bay.

Table 2-1 SUMMARY OF BASIC FEASIBILITY OF LOCAL DISPOSAL ALTERNATIVES

Service Area	All Year Local Disposal to Confined Waters	Bay Disposal with 10:1 Minimum Initial Dilution	Total Land Disposal	Seasonal Land Disposal with Local Winter Discharge
Tiburon-Sanitary District No. 5	---	Excellent	Poor	Poor
Richardson Bay Sanitary District	Poor	Moderate	Poor	Moderate
Mill Valley	Poor	Moderate	Poor	Poor
Sausalito - Marin City	---	Excellent	Poor	Poor

The actual evaluation of alternatives summarized in this chapter consisted of a three-step process. The first step consisted of screening alternatives from previously developed information in the South Marin Subregional Wastewater Management Plan and comparing those results to possibly changed conditions or criteria to ascertain if previous conclusions are still valid. The next step was to refine cost estimates and criteria for comparison of alternatives selected for evaluation by the initial screening process. Based upon the economics, environmental, reclamation, and intangible factors, the more viable alternatives have been identified and analyzed in greater detail in Chapter 4.

EVALUATION CRITERIA

The monetary evaluation of alternatives has been based upon a determination of capital, operation and maintenance, and replacement costs for each alternative and comparison on a total present worth basis. Present worth of total annual cost, both capital and operation and maintenance, is based on an interest rate of 7 percent and an economic life of twenty years.

In addition to the economic evaluation, various factors, including environmental and social impacts, are included in the overall cost effectiveness analysis. A separate Environmental Impact Report (EIR/EIS) for the entire Marin-Sonoma planning area is being prepared by J. B. Gilbert & Associates. This EIR/EIS will evaluate the specific social and environmental impacts for each of the more viable alternatives analyzed in Chapter 4.

SUBREGIONAL ALTERNATIVES SCREENING

There are four existing discharging agencies in southern Marin County: the Sausalito-Marin City Sanitary District, the City of Mill Valley, the Richardson Bay Sanitary District, and Sanitary District No. 5 serving Tiburon and Belvedere. Agencies which contract with the above include the City of Sausalito, Tamalpais Community Services District, Almonte Sanitary District, Homestead Valley Sanitary District, Alto Sanitary District, Kay Park Sewer Maintenance District, and the City of Belvedere.

Two of the southern Marin discharging agencies, the Sausalito-Marin City Sanitary District and Sanitary District No. 5, have excellent points of disposal to the deep waters of the bay at Yellow Bluff and Raccoon Straits, respectively. However, these two agencies have only primary treatment facilities and in order to comply with the federal law, they will have to upgrade their facilities to provide full secondary treatment.

The other two discharging agencies, the City of Mill Valley and the Richardson Bay Sanitary District, have secondary treatment facilities but discharge to the shallow waters of Richardson Bay. Since the Regional Water Quality Control Board has adopted a prohibition of discharge to Richardson Bay, these two agencies must relocate their discharge points to the deep waters of San Francisco Bay.

Description of Alternatives

The following alternatives have been selected for evaluation herein:

PLAN SM-1 involves continued operation of independent treatment plants and outfalls with Tamalpais Valley disconnecting from the

Sausalito system and reconnecting to the Mill Valley system. The Richardson Bay Sanitary District would treat all its wastewater at an expanded Trestle Glen treatment plant. The Sausalito-Marin City and Sanitary District No. 5 treatment plants would be upgraded to provide full secondary treatment and discharge to the nearby deep waters of the bay. The Mill Valley and Richardson Bay Sanitary District treatment plants would be upgraded to provide nitrification and effluent filtration and effluent would be discharged to Richardson Bay intermittently on high tides through shallow water outfalls. This is a theoretical alternative since the Regional Water Quality Control Board has prohibited discharge to Richardson Bay.

PLAN SM-2 involves an independent Sausalito discharge to the deep waters of the bay without either Tamalpais Valley or Richardson Bay Sanitary District wastewater. The remainder of the subregion would retain each of its treatment plants and discharge effluent through a common outfall off Raccoon Straits. All treatment plants would provide full secondary treatment.

PLAN SM-3 involves construction of a regional treatment plant in southern Marin and disposal of all effluent to land. A storage lake and land disposal area are assumed to be in the Golden Gate National Recreation Area.

Evaluation of Alternatives

Economic Evaluation - A schematic of each alternative, together with the total present worth and initial capital cost, is shown in Table 2-2.

Environmental Impacts - With respect to water quality, each of the alternatives would have a beneficial effect due to improved treatment. Plan SM-1 would be less advantageous due to the lower dilution capacity of Richardson Bay, while Plan SM-3 would eliminate all discharge but would have an adverse effect on land and air quality due to the spraying of effluent on hillside areas in the Golden Gate National Recreation Area.

Social Impacts - Social impacts of Plans SM-1 and SM-2 are negligible, although Plan SM-3 would have a negative effect by utilizing park areas for waste disposal.

Flexibility - Due to the long length of pipeline carrying treated effluent, Plan SM-3 would be very flexible for reclamation and reuse. It would also not be subject to changes in discharge requirements. Plan SM-1 would not be flexible in regards to changes in discharge requirements which could necessitate additional treatment processes.

Reliability - Reliability in respect to ability to meet discharge requirements appears to be similar for each alternative.

Sausalito system and reconnecting to the Mill Valley system. The Richardson Bay Sanitary District would treat all its wastewater at an expanded Trestle Glen treatment plant. The Sausalito-Marin City and Sanitary District No. 5 treatment plants would be upgraded to provide full secondary treatment and discharge to the nearby deep waters of the bay. The Mill Valley and Richardson Bay Sanitary District treatment plants would be upgraded to provide nitrification and effluent filtration and effluent would be discharged to Richardson Bay intermittently on high tides through shallow water outfalls. This is a theoretical alternative since the Regional Water Quality Control Board has prohibited discharge to Richardson Bay.

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Social Impacts - Social impacts of Plans SM-1 and SM-2 are negligible, although Plan SM-3 would have a negative effect by utilizing park areas for waste disposal.

Flexibility - Due to the long length of pipeline carrying treated effluent, Plan SM-3 would be very flexible for reclamation and reuse. It would also not be subject to changes in discharge requirements. Plan SM-1 would not be flexible in regards to changes in discharge requirements which could necessitate additional treatment processes.

Reliability - Reliability in respect to ability to meet discharge requirements appears to be similar for each alternative.

Table 2-2 SOUTHERN MARIN PROJECT ALTERNATIVES SCREENING

Plan	Total Present Worth	Initial Capital $1,000	Sausalito	San. Dist. 5	Richardson Bay	Mill Valley
SM-1	$31,490	$19,010	S	S	NH_3+F	NH_3+F
SM-2	36,280	23,870	S	S	S	S
SM-3	69,410	57,310				S

Reclamation - Plan SM-1 would be conducive to small-scale reclamation projects located near the local treatment facilities. The long effluent outfall to Tiburon proposed in Plan SM-2 would promote reclamation along its entire length. Plan SM-3 would utilize raw sewage intercepters and would abandon local treatment facilities which would make reclamation more difficult.

Evaluation Summary

Since Plan SM-1 proposes to retain local treatment and disposal into Richardson Bay, implementation of this alternative is problematical with respect to the discharge prohibition to Richardson Bay. With the assumed treatment level of nitrification and effluent filtration, one must consider this alternative as an absolute minimum degree of treatment with a high probability for increased treatment requirements should discharge be allowed to Richardson Bay.

Plan SM-2 retains and upgrades each existing plant to a secondary level of treatment. Effluent from the Sausalito area would be discharged at Yellow Bluff, while effluent from the remaining communities in the planning unit would be conveyed to Tiburon and discharged into Raccoon Straits. When compared to Plan SM-1, this plan has a higher initial capital cost and a higher present worth cost because of the higher capital investment in pipelines to Tiburon. However, since all effluent would be disposed of outside of Richardson Bay, there would be a reduced risk of having to undertake future modifications due to adoption of more stringent discharge requirements.

A final alternative, Plan SM-3 involves construction of a consolidated plant for land disposal in southern Marin. Again, implementation of this plan is a very problematical solution because much of the land is either contained in the Golden Gate National Recreational Area or is part of the Marin Municipal Water District watershed. In either case, discharge of wastewater onto these lands would not be compatible with existing and proposed uses. Even if allowed, this alternative is the most costly of those evaluated.

From strictly an economic basis, Plan SM-1 is the most economical. However, it must be remembered that this plan is only theoretical because it involves continued discharge into Richardson Bay. Accordingly, it is concluded that Plan SM-2 is the best treatment and disposal alternative entirely within the southern Marin planning area because of its better discharge location.

COMBINED SOUTHERN AND CENTRAL MARIN ALTERNATIVE SCREENING

The southern Marin and central Marin planning units each serve discrete watersheds in eastern Marin County, which are separated by the Corte Madera Ridge and Tiburon peninsula. The elevation of this ridge varies from160 feet at Highway 101 to over 1,000 feet as it joins the slopes of Mt. Tamalpais. There are, however, two

abandoned railroad tunnels through the ridge which, if used for a connecting pipeline right-of-way, could allow a low-level connection between the planning units.

Description of Alternatives

The previous subregional reports assumed that a low-level connection could be made and recommended a single consolidated facility at Point San Quentin. These previous evaluations of alternatives for central Marin identified a single consolidated treatment and disposal facility as the most economical plan for central Marin. To test the validity of the previous recommendation regarding southern Marin's participation in a common facility, four additional alternatives involving combined facilities were screened.

PLAN S/CM-1 is a combination of the two least costly plans for the separate planning units. For southern Marin, this plan would be the theoretical alternative of independent facilities with continued discharge into Richardson Bay, Yellow Bluff, and Raccoon Straits. For central Marin, the plan consists of a consolidated facility with discharge offshore of Point San Quentin.

PLAN S/CM-2 is a combination of Plan SM-2 for southern Marin and Plan CM-3 for central Marin. Plan SM-2 provides for independent treatment and disposal at Sausalito with the remaining dischargers retaining the existing plants and discharging through a common outfall into Raccoon Straits. Plan CM-3 involves the consolidated treatment and disposal facilities for central Marin.

PLAN S/CM-3 is the plan previously recommended in the individual subregional reports. This plan involves construction of a single regional treatment plant in central Marin to serve both planning units with deep water disposal of the effluent off Point San Quentin. It is assumed that a low-level connection through one of the railroad tunnels would be available for the intercepter from Mill Valley to central Marin.

PLAN S/CM-4 is a variation of the single consolidated facilities of Plan S/CM-3 but allows for the continued local discharge of wastewater from Sausalito and Tiburon-Belvedere into the deep waters of San Francisco Bay.

PLAN S/CM-5 involves construction of a consolidated regional treatment plant in central Marin serving all of southern and central Marin with total land disposal of all effluent in western Marin.

Alternatives Evaluation

Economic Evaluation - A schematic of each alternative, together with the total present worth and initial capital cost, is shown in Table 2-3.

Environmental Impacts - With respect to water quality, each of the alternatives would have a similar beneficial impact due to improved treatment and disposal. Plan S/CM-5 would have an adverse impact on land quality due to the disposal of effluent on hillside areas. Plan S/CM-3 would have lesser impacts on land since six treatment plants would be eliminated, although a larger land area would be necessary at the regional plant site.

Implementation - Plan S/CM-5 would be the most difficult to implement due to the large land areas required. Plan S/CM-3 would also be difficult to implement since it would require consolidation of the greatest number of local agencies.

Flexibility and Reliability - Flexibility for future changes would be greatest for Plan S/CM-5 since it eliminates discharge, followed by Plan S/CM-3 since a single treatment facility would be easier to upgrade. Plan S/CM-1 would be less flexible due to continued discharge to Richardson Bay. Since larger treatment plants and deep water disposal are utilized in Plans S/CM-3 and S/CM-4, they would also be considered the most reliable.

Reclamation - Plans S/CM-3, S/CM-4, and S/CM-5 would make local reclamation in the southern Marin area more difficult. Reclamation in Ross Valley and the western Marin area would be encouraged by Plan S/CM-5. Plans S/CM-1 and S/CM-2 would facilitate small scale local reclamation in both southern and central Marin.

Evaluation Summary

The estimated costs for the combined southern and central Marin alternatives are summarized in Table 2-3. On an overall present worth basis, Plan S/CM-4, involving a consolidated southern and central Marin facility with Sausalito and Tiburon remaining separate, is the least expensive alternative. Plan S/CM-3, involving a total consolidation of southern and central Marin facilities, is slightly more expensive. This same close ranking between these two plans was found to exist in the Southern Marin Subregional Report, which indicated that the selection should be determined on the basis of intangible and environmental factors.

The separate alternatives for the two planning units, Plan S/CM-1 and S/CM-2, are more expensive, on a present worth basis than Plan S/CM-3. Considering that discharge into Richardson Bay is problematical because of Regional Water Quality Control Board policies, Plan S-CM-1 can be omitted from further consideration.

Table 2-3 COMBINED SOUTHERN AND CENTRAL MARIN ALTERNATIVES SCREENING

Plan	Total Present Worth[a]	Initial Capital $1,000	SAUS	S.D.S.	R.B.	M.V.	S.D.I	S.Q.	S.R.
S/CM-1 (SM-1 + CM-3)	76,260	47,620	S	S	NH_3+F	NH_3+F	S	○	○
S/CM-2 (SM-2 + CM-3)	81,050	52,480	S	S	S	S	S	○	○
S/CM-3	75,230	54,440	○	○	○	○	S	○	○
S/CM-4	73,140	49,940	S	S	○	○	S	○	○
S/CM-5	125,010	98,610	○	○	○	○	○	○	S

[a]ENR = 3800
$1,000, 7 percent at 20 years

Instead of discharging treated wastewaters into the bay, another alternative would be to distribute treated effluent onto land as envisioned in Plan S/CM-5. Obviously, a substantial area would be required if all wastewaters are to be disposed of in this manner; and, furthermore, the land would have to be able to receive this water without adverse environmental or social impact. Assuming that large parcels of land are available, probably in western Marin County, the overall costs on a present worth basis of Plan S/CM-5, exclusive of land costs or possible credits, is 1.7 times that of the most economical alternative. Without an identified potential use of the water, the large cost differential for this total land disposal option becomes very significant and, accordingly, will not be considered further.

Based on the above evaluations, Plan SM-2, involving separate treatment in southern Marin and discharge to the deep waters of San Francisco Bay, and Plan S/CM-4, combining southern and central Marin facilities with Sausalito remaining separate, have been retained for further detailed analysis in Chapter 4.

Plan SM-2 is the least costly plan for separate southern Marin facilities which removes discharge from Richardson Bay. This plan would be easier to implement than a combined subregional facility since fewer local agencies would have to consolidate. Plan SM-2 would also promote local reclamation projects in the southern Marin study area since more treated effluent would be locally available.

Plan S/CM-4 is the least costly combined southern-central Marin Plan. This plan would retain separate treatment with deep water disposal at Sausalito and Sanitary District No. 5. Although this requires two additional treatment plants than Plan S/CM-3, it would be somewhat easier to implement since fewer agencies would need to consolidate and also would require less pipeline construction through the Sausalito area which would have adverse short-term environmental and social impacts due to disruption of traffic and commercial activities.

The following section evaluates various subalternatives which are applicable to both Plans SM-2 and S/CM-4. This subalternative evaluation will determine the most cost effective combination of local sanitary districts within the southern Marin area.

SUBALTERNATIVE EVALUATION SCREENING

As described in Chapter 1, the Sausalito-Marin City treatment plant currently serves Tamalpais Valley and a portion of Richardson Bay Sanitary District. The existing Sausalito trunk line does not have capacity to handle projected peak wet weather flows from these presently-served areas. The Marin-Sonoma Wastewater Program Analysis

evaluated costs for rerouting Tamalpais Valley from Sausalito to Mill Valley and treating all of Richardson Bay Sanitary District flows at an enlarged Trestle Glen treatment plant as a subalternative to Plan SM-1.

In order to determine the most cost effective combination of transportation, treatment, and disposal costs, six combinations involving Tamalpais Valley Community Services District and three separate drainage areas within Richardson Bay Sanitary District were evaluated for inclusion with either Mill Valley, Richardson Bay, or Sausalito. These six subalternatives are applicable to either of the two viable alternatives SM-2 and S/CM-4. Also included in this analysis are three possible routings for transporting flows from southern Marin to central Marin in Plan S/CM-4.

Figure 2-1 shows the pipeline routings and treatment plant locations for Plan SM-2. Alternate pipelines, which would be included under the various six subalternatives, are shown "dashed." The effluent line from Mill Valley to Tiburon would be nearly six miles long and would be either 24 or 27 inches in diameter depending on the subalternative. Storage provided at the Mill Valley Plant would equalize the projected 3-hour wet weather peak flows to allow a smaller pipeline sized for the daily wet weather flow.

Figure 2-2 shows the location and pipeline routings for Alternative S/CM-4 facilities. Flows from the Salt Works, Ricardo Road, and Tamalpais Valley pump stations would either continue to be pumped to Sausalito, or be rerouted to Sanitary District No. 1, depending on the subalternative utilized. Also shown in Figure 2-2 are three possible pipeline routings to Sanitary District No. 1. Route TG would follow the abandoned Northwest Pacific right-of-way east of Highway 101. The force main would be routed through the abandoned railroad tunnel between Trestle Glen and Corte Madera which would minimize the pumping head and power requirements.

Route HW would utilize the existing bicycle path which parallels Highway 101 between Mill Valley and Corte Madera. At the bottom of the hill near Corte Madera, the line would cross under the highway and follow the railroad right-of-way as in Route TG.

Route MV would follow the abandoned railroad right-of-way on the west side of Highway 101 from the existing Mill Valley plant site about one and one-half miles north, then it would rise over the hill to Corte Madera, and then follow the frontage road on the east side of the highway to Sanitary District No. 1 facilities.

Route MV would require pumping flows over a hill 300 feet in elevation while the highway cut utilized in Route HW would be 160 feet in elevation. Pipelines for these two routes could decrease in size downstream of the high point to fully utilize the elevation head and help maintain higher velocities during low flows. Route TG would have a maximum elevation of 80 feet where the line from Mill

Figure 2 - 1

SOUTHERN MARIN ALTERNATIVE SM-2

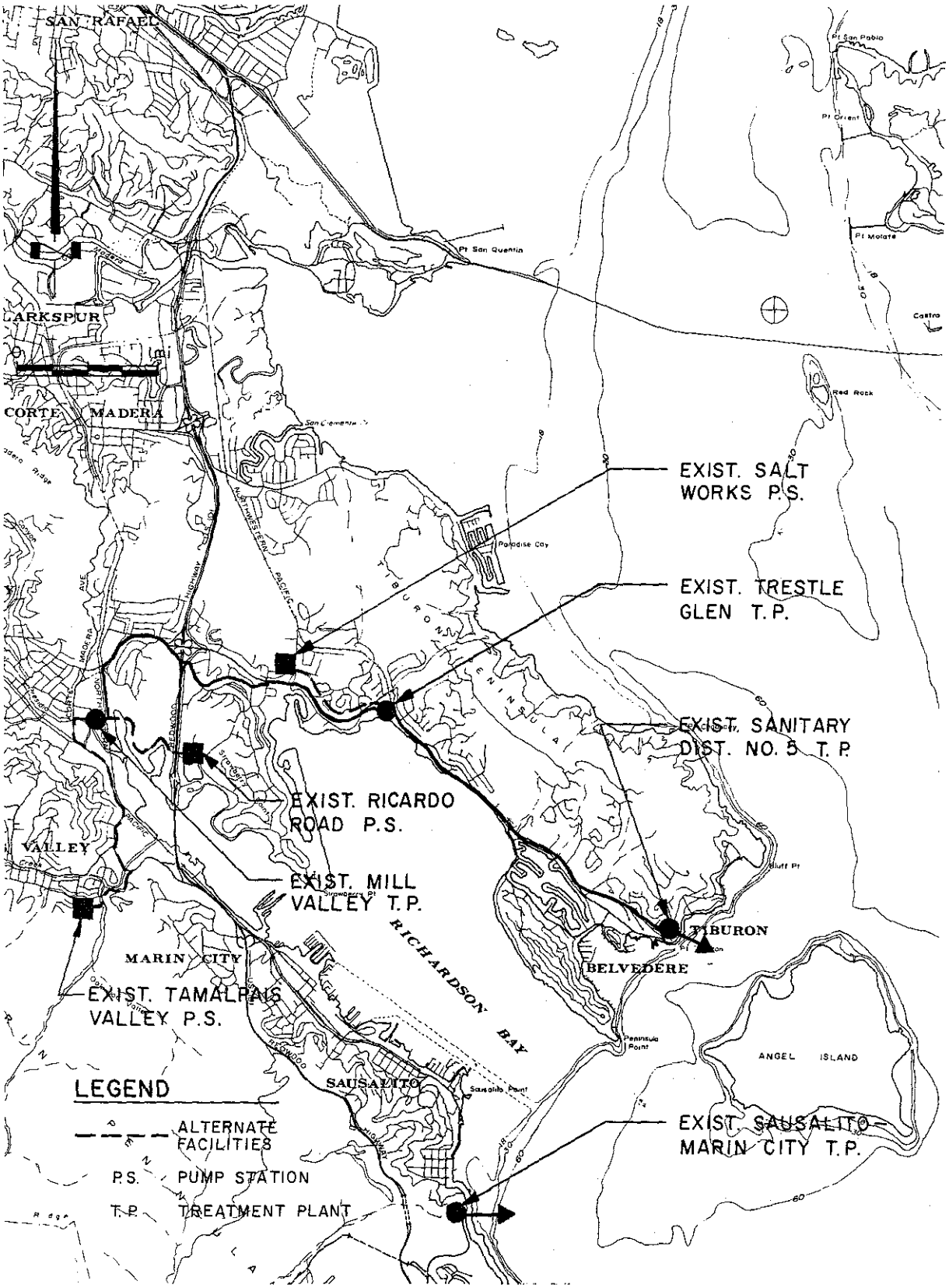
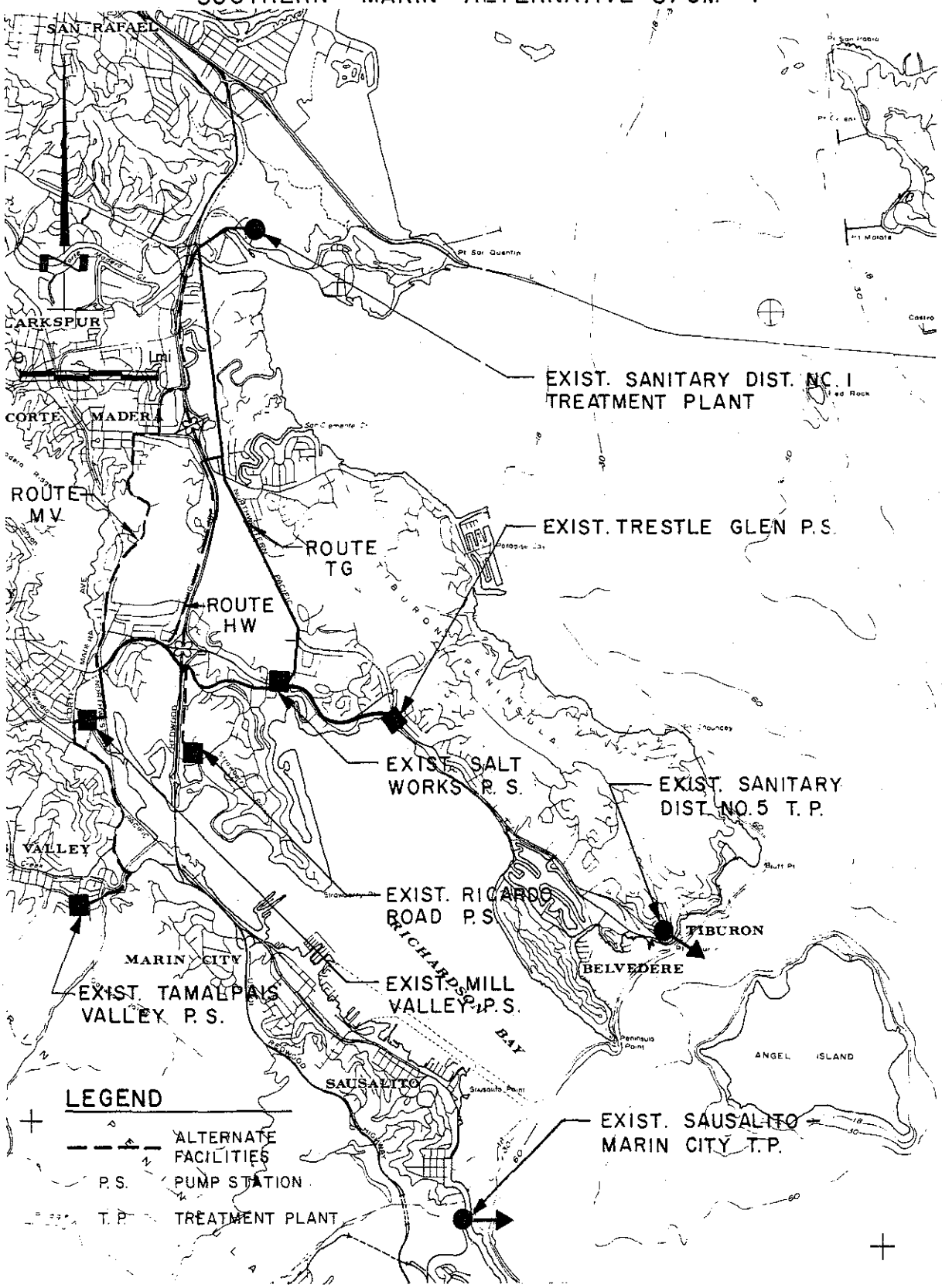


Figure 2 — 2

SOUTHERN MARIN ALTERNATIVE S/CM- 4



Valley crosses Strawberry Point and 60 feet through the railroad tunnel and would, therefore, allow the lowest pumping pressures and power usage. Wet weather peak flows would be equalized at Mill Valley in order to minimize pipeline and pumping costs.

Subalternatives SA-1 to SA-6

Six subalternatives, involving Tamalpais Valley and the three separate drainage areas within Richardson Bay Sanitary District, are summarized in Table 2-4. The particular areas which would be treated or pumped at the four existing plants are shown along with projected dry and wet weather flows for the year 1998. Pipelines were sized for 20-year return level wet weather flows in 1998, while treatment facilities were based on average dry weather flows estimated for 1988. One of the most important factors in the subalternatives analysis is the capacity of the existing Sausalito trunk system which presently handles flows from Tamalpais Valley, Ricardo Road, and Salt Works pump stations. In order to handle peak wet weather flows projected for these areas, various improvements at pumping stations and pipelines leading to the Sausalito-Marin city treatment plant would be necessary. In all of the subalternatives, Sanitary District No. 5, in Tiburon, would retain its present service area and would not vary in capacity.

Subalternative SA-1 - The present service pattern would be retained under Plan SA-1. As shown in Figure 2-3, Ricardo Road, Salt Works, and Tamalpais Valley would continue to be treated at the Sausalito-Marin city plant, while Mill Valley and Trestle Glen would retain their present service areas. In order to accommodate projected wet weather flows, a parallel 12-inch force main would be constructed from Ricardo Road pump station to Marin City and a 22-inch force main would extend from Marin City nearly four miles to the Sausalito treatment plant.

Subalternative SA-2 - Subalternative SA-2, shown in Figure 2-4, would separate Salt Works pump station from the Sausalito system and include it with the Trestle Glen plant for treatment or transport north to Sanitary District No. 1. About 6,700 feet of 18-inch force main would be constructed between Marin City and Sausalito to parallel an existing gravity pipe with insufficient capacity. Locust and Main Street pump stations in Sausalito would also be modified to provide additional capacity. Mill Valley would retain its present service area.

Subalternative SA-3 - Subalternative SA-3, shown in Figure 2-5, would separate Ricardo Road and Salt Works from Sausalito and include them with Mill Valley for treatment or pumping. Only pump station modifications would be required in the Sausalito trunk system to handle the wet weather flows from Tamalpais Valley and the Sausalito-Marin City area. Trestle Glen would retain its present service area. A 14-inch pipeline about one mile long would connect Ricardo Road and Salt Works areas to Mill Valley. A more costly longer route, avoiding the marshland area, could be used, depending on the environmental impacts of the shorter route.

Table 2-4 SOUTHERN MARIN SUBALTERNATIVE DESIGN FLOWS, MGD (1998)

Facility	Subalternative					
	SA-1	SA-2	SA-3	SA-4	SA-5	SA-6
Sausalito						
Areas	S+TV+RR+SW	S+TV+RR	S+TV	S+RR	S+RR+SW	S
ADWF	2.35	1.90	1.58	1.32	1.77	1.0
PWWF	17.7	14.6	12.3	10.4	13.5	8.1
Mill Valley						
Areas	MV	MV	MV+RR+SW	MV+TV	MV+TV	MV+TV+RR+SW
ADWF	1.95	1.95	2.72	2.53	2.53	3.3
PWWF	24	24	29.6	28.2	28.2	33.6
Richardson Bay						
Areas	TG	TG+SW	TG	TG+SW	TG	TG
ADWF	0.23	0.68	0.23	0.68	0.23	0.23
PWWF	2.7	6.0	2.7	6.0	2.7	2.7
Tiburon						
Areas	T	T	T	T	T	T
ADWF	0.98	0.98	0.98	0.98	0.98	0.98
PWWF	9.0	9.0	9.0	9.0	9.0	9.0

Abbreviations:

ADWF - Average Dry Weather Flow
PWWF - Peak Wet Weather Flow over 3 hours, 20-year return period
PWWF = 1.5 x Daily Wet Weather Flow
S - Sausalito-Marin City
MV - Mill Valley
TG - Trestle Glen Pump Station
SW - Salt Works Pump Station
RR - Ricardo Road Pump Station
TV - Tamalpais Valley
T - Tiburon - Sanitary District No. 5

Figure 2 – 3

SOUTHERN MARIN SUB-ALTERNATIVE SA-I

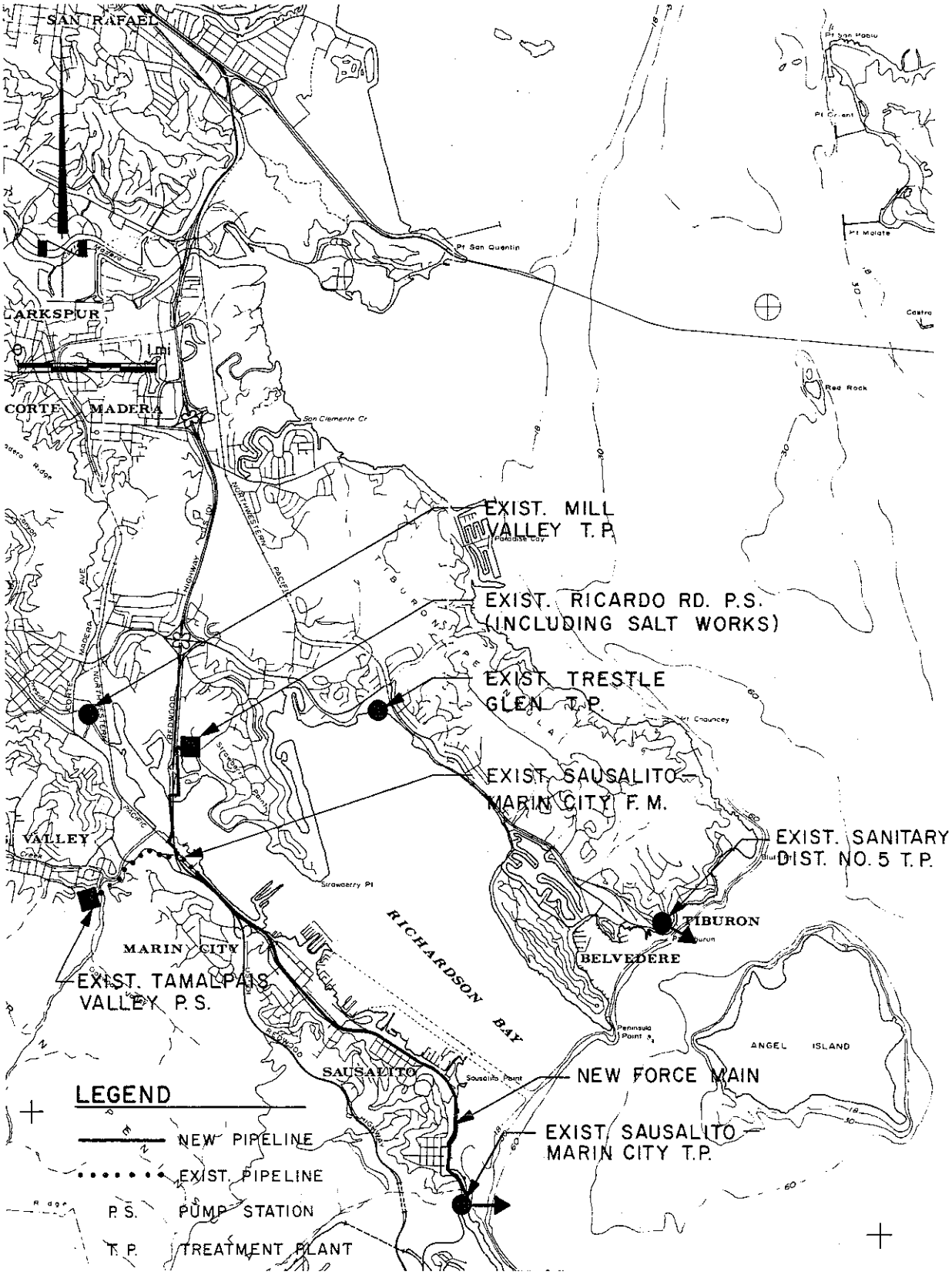


Figure 2-4

SOUTHERN MARIN SUB-ALTERNATIVE SA-2

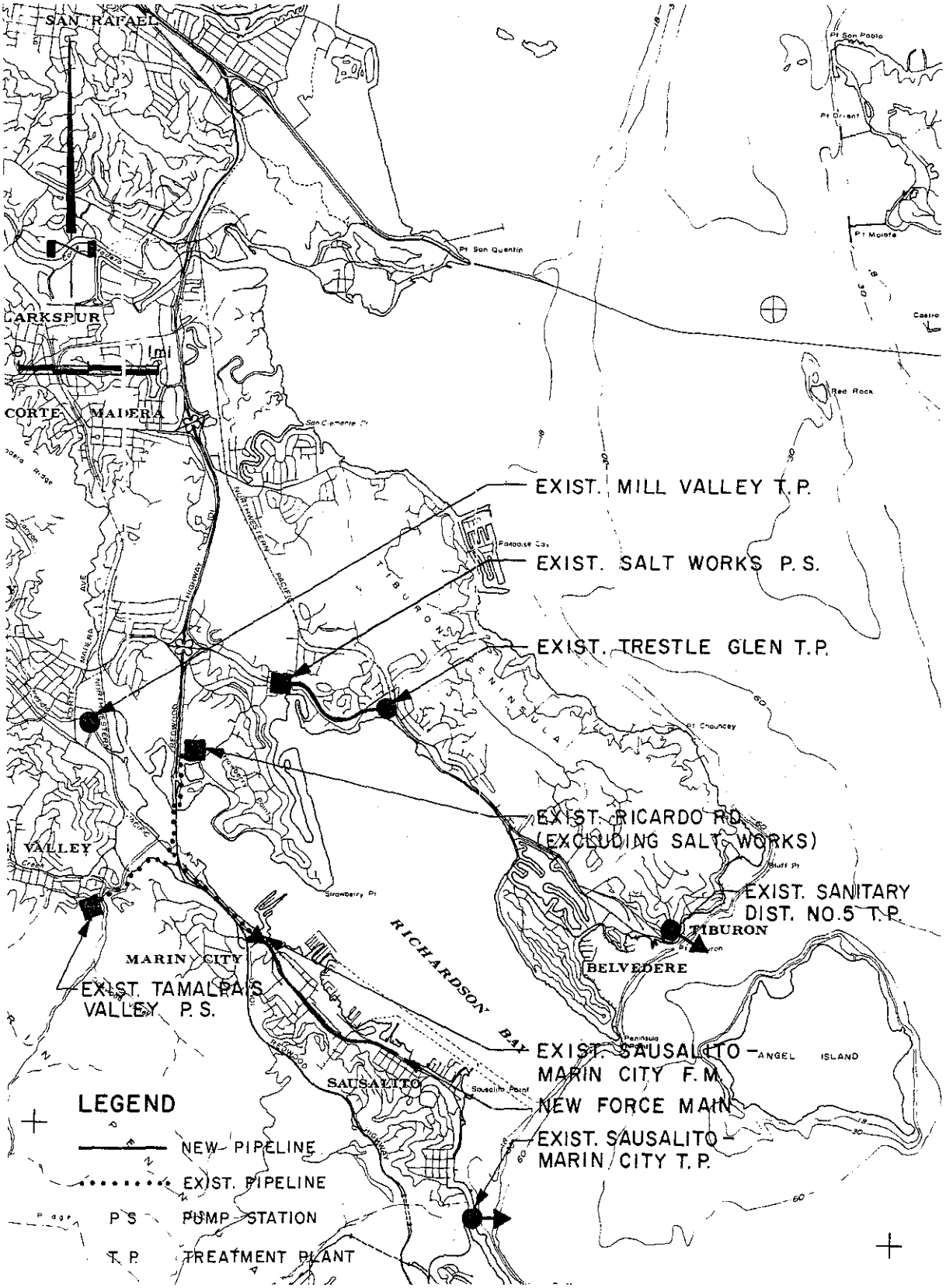
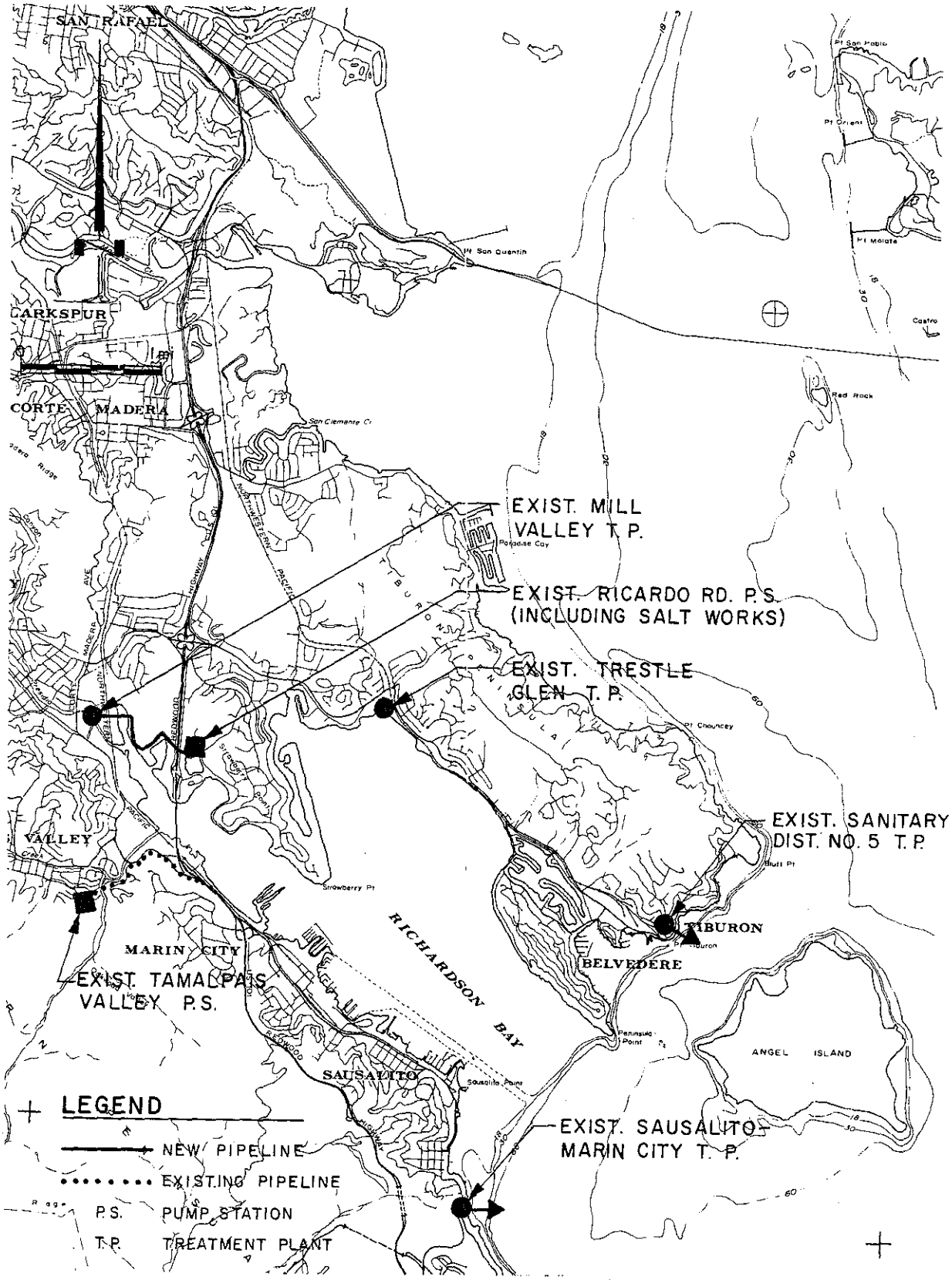


Figure 2 — 5
SOUTHERN MARIN SUB-ALTERNATIVE SA-3



Subalternative SA-4 - Subalternative SA-4, shown in Figure 2-6, would transport flows from Tamalpais Valley to Mill Valley and from Salt Works to the Trestle Glen treament plant. Ricardo Road pump station would continue to pump into the Sausalito-Marin city system which would have sufficient capacity to handle the projected flows without major modifications. The pipeline from Tamalpais Valley would be about two miles long and 14 inches in diameter.

Subalternative SA-5 - Subalternative SA-5, shown in Figure 2-7, would separate Tamalpais Valley flow to Mill Valley while Ricardo Road and Salt Works areas would continue to pump into the Sausalito-Marin City trunk system. Trestle Glen would retain its present drainage area. The force main from Ricardo Road pump station would be paralleled by a 12-inch force main and a 6,700 foot long gravity line between Marin City and Sausalito would be paralleled by a 16-inch force main. Pump station modifications in Sausalito would also be required to transport the peak wet weather flows.

Subalternative SA-6 - Under Subalternative SA-6, shown in Figure 2-8, Tamalpais Valley, Salt Works, and Ricardo Road would all be removed removed from the Sausalito system and pumped to Mill Valley for either local treatment or transport to Sanitary District No. 1. No modifications would be necessary in the Sausalito-Marin city trunk system.

Monetery Evaluation

A summary of the estimated costs for the various subalternatives combined with the two major alternatives, SM-2 and S/CM-4, are presented in Table 2-5. The total present worth values, including operation and maintenance and replacement costs over a 20-year life at 7 percent interest, are shown together with the estimated capital and O&M costs. Alternative S/CM-4 includes the incremental capital and O&M costs for treatment at Sanitary District No. 1. Treatment costs for the various alternatives were based on the results of detailed analyses of each of the plants which are presented in Chapter 4.

While cost differences for the various subalternatives are within 5 - 7 percent, Subalternative SA-3, which would reroute the Ricardo Road and Salt Works area to Mill Valley, while retaining Tamalpais Valley with Sausalito-Marin City, has the lowest present worth and capital costs for both Alternatives SM-2 and S/CM-4. Alternate Route TG is the least costly route in combination with Plan SA-3, partially due to its lower power costs.

Figure 2 – 6

SOUTHERN MARIN SUB-ALTERNATIVE SA-4

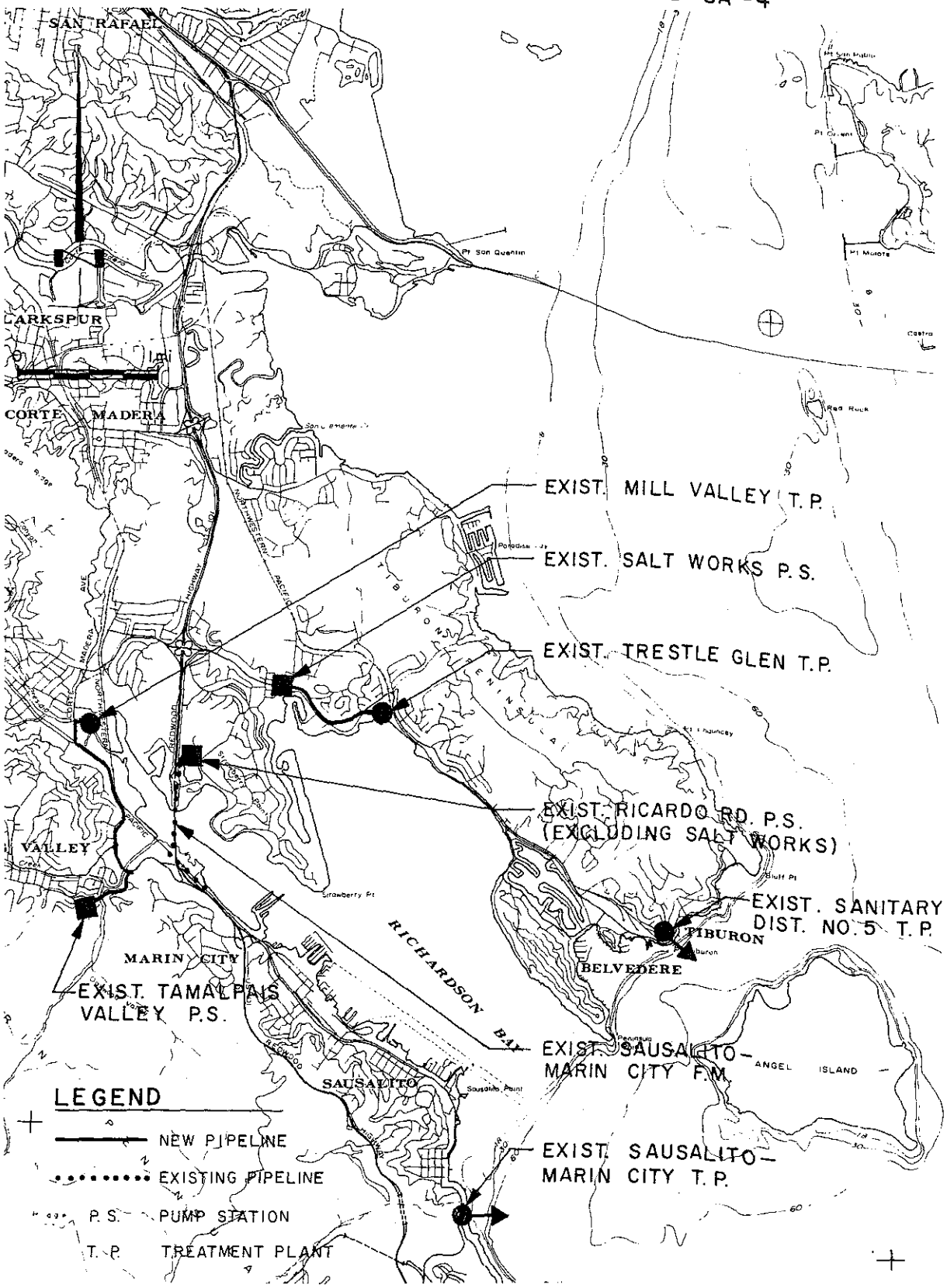


Figure 2 — 7

SOUTHERN MARIN SUB-ALTERNATIVE SA-5

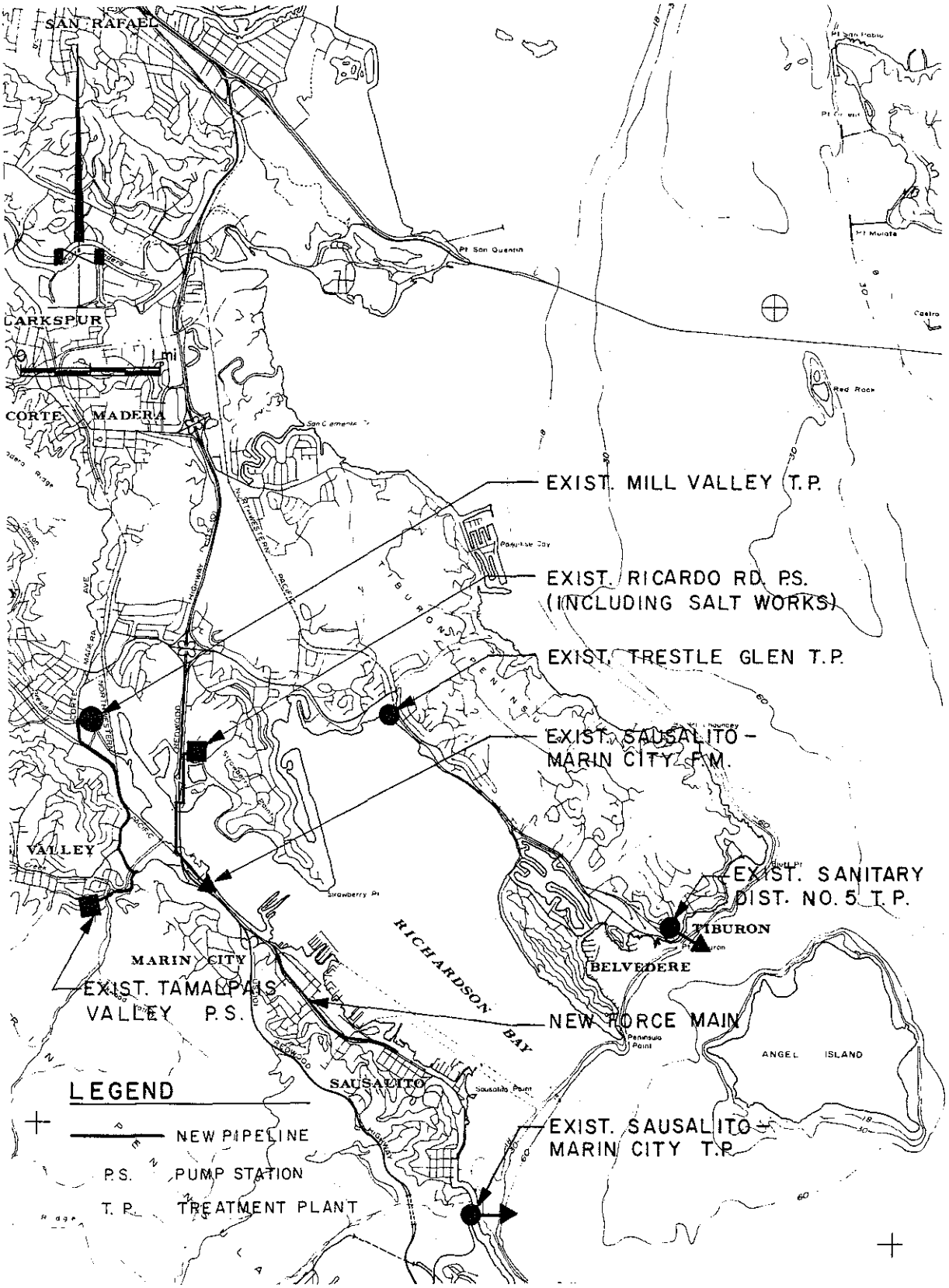


Figure 2 - 8

SOUTHERN MARIN SUB-ALTERNATIVE SA-6

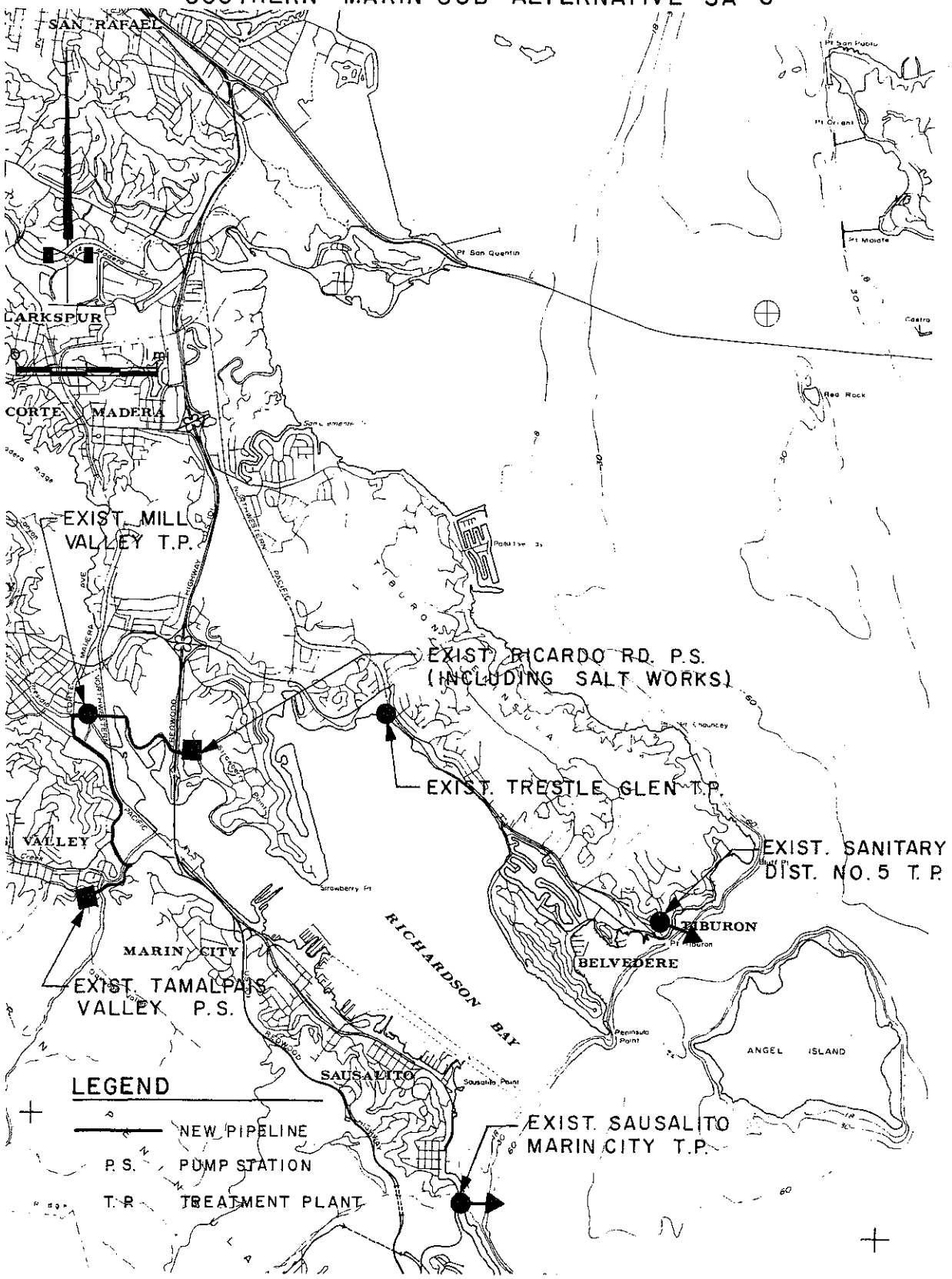


Table 2-5 SOUTHERN MARIN SUBALTERNATIVES COST SUMMARY ($1,000)

	Subalternative Costs $1,000[a]					
	SA-1	SA-2	SA-3	SA-4	SA-5	SA-6
ALT SM-2						
Initial Capital Cost	16,970	16,170	15,970	16,630	16,780	16,740
Annual O&M (1980)	730	740	760	750	770	800
Total Present Worth[b]	23,270	22,670	22,550	23,130	23,500	23,770
ALT S/CM-3						
Initial Capital Cost						
Route TG	20,540	19,400	18,920	19,760	20,090	19,440
Route MV	20,290	18,920	19,060	19,200	19,770	19,330
Route HW	20,260	18,840	18,980	19,120	19,690	19,250
Annual O&M (1980)						
Route TG	550	560	540	530	550	520
Route MV	580	600	580	580	590	580
Route HW	560	570	560	550	570	550
Total Present Worth[b]						
Route TG	24,860	23,900	23,270	24,000	24,490	23,630
Route MV	24,960	23,860	23,850	23,990	24,610	24,040
Route HW	24,720	23,540	23,500	23,670	24,160	23,660

[a]Dry weather treatment facilities only, ENR = 3800

[b]Present worth - 1977, 7 percent, 20 years

Nonmonetary Evaluation

In order to further evaluate the six subalternatives and the three pipeline routes, various nonmonetary factors were evaluated as summarized below.

Environmental Impacts - Environmental impacts (of the subalternatives) would be primarily related to pipeline construction. Subalternatives SA-1 and SA-5 would require the greatest amounts of pipeline construction, primarily along the Sausalito waterfront, while Subalternative SA-3 would require the least pipeline construction. Route MV, which passes through more developed areas, would have greater impact due to construction activities than the other routes which would utilize the railroad right-of-way much of the distance.

Scarce Resources - Routes MV and HW, which would pump over higher elevations, would utilize greater amounts of power than Route TG which would pass through the abandoned railroad tunnel. Pumping requirements for the other subalternatives do not vary significantly.

Ability to Implement - Subalternatives SA-1 and SA-2 would be more easily implemented than the others, since there are existing agreements between the various wastewater agencies which would be connected together. The other subalternatives would require new agreements and cost arrangements between the various agencies.

Flexibility and Reliability - Since the subalternatives involve the same number of pump stations and treatment plants, all of which will have standby power capability, the flexibility and reliability of the plants are equal.

SUBALTERNATIVE SM-2A

An additional refinement of subregional Alternative SM-2 would involve pumping flows from the Trestle Glen treatment plant to Mill Valley for treatment. Although higher capital costs would be incurred due to pipeline construction, annual operation and maintenance costs would be lower since one larger treatment plant would be operated and maintained.

A 12-inch force main about three miles long would be necessary to pump the flows from the Trestle Glen plant to the Ricardo Road pump station. The pipeline from Ricardo Road to the Mill Valley plant would be increased from 14 to 21 inches in diameter to accommodate the increased flow. Additional treatment capacity for 0.21 mgd average dry weather flow would be provided at the 2.63 mgd Mill Valley plant. The 30-inch effluent force main from Mill Valley to Raccoon Straits would remain the same size.

Estimated capital and annual O&M costs are presented in Table 2-6. Capital cost for transporting Trestle Glen to Mill Valley would be 1.35 million dollars versus 415 thousand dollars for separate treatment. Annual operation and maintenance costs would be 120

Table 2-6 COST SUMMARY - SUBALTERNATIVE SM-2A
ABANDON TRESTLE GLEN PLANT FOR TREATMENT AT MILL VALLEY

	Cost
Trestle Glen Separate Treatment SM-2	
Upgrade Trestle Glen Plant	$ 415,000
Annual Operation and Maintenance at Trestle Glen Plant	120,000
Total Present Worth[a]	$ 1,575,000
Trestle Glen to Mill Valley SM-2A	
Increased Capital Cost	
Pipeline Trestle Glen to Ricardo Rd. PS 15,000 lf 12-inch force main	$ 780,000
Increase Pipe Size Ricardo Rd. to Mill Valley 5,500 lf 21-inch vs 14-inch	143,000
Additional Treatment Plant Cost @ Mill Valley 0.21 mgd	315,000
Pump Station Modifications at Trestle Glen	110,000
Total Capital Cost	$ 1,348,000
Annual Operation and Maintenance Costs	
Trestle Glen Pumping	$ 12,000
Pipeline Maintenance	3,000
Increased O&M at Mill Valley	20,000
Total Annual Cost	$ 35,000
Total Present Worth[a]	$ 1,606,000

[a] 7 Percent Interest, 20-year period

thousand dollars for separate treatment, while combined treatment is estimated to cost 35 thousand dollars, including pumping and pipeline maintenance costs. Total present worth for both alternatives, including 20 years of operation and maintenance costs, is nearly equal.

Although greater impacts due to pipeline construction would be incurred with combined treatment, Subalternative SM-2A, it would eliminate one treatment plant. Reclamation potential for each of the alternatives would be equal since the effluent force main would pass next to the Trestle Glen plant in either case. Although Richardson Bay Sanitary District will be contracting with Mill Valley for treatment of flows from its Ricardo Road and Salt Works drainage areas, combined treatment Subalternative SM-2A would be more difficult to implement, since it would require abandoning an existing treatment facility.

Although combined treatment would significantly reduce annual operation and maintenance costs, its higher capital costs offset the savings on a present worth basis. Since separate treatment would be easier to implement and would have a slightly lower total cost, it is retained in Alternative SM-2.

PARADISE COVE SUBALTERNATIVES

As discussed in Chapter 1, Sanitary District No. 5 currently operates and maintains a small package treatment plant at Paradise Cove on the north side of the Tiburon Peninsula. The plant, with a capacity of 25,000 gallons per day, was installed to serve a proposed subdivision near the Paradise Cove area which is over a mile from any existing sewer system; however, the subdivision has not been developed and the plant serves only three connections. Due to the present ban on water connections, additional flows to the treatment plant are not likely in the near future.

The Paradise Cove plant provides extended aeration treatment with disposal through a 4-inch outfall extending 500 feet offshore into a minimum of 10 feet of water. The plant meets Regional Water Quality Control Board requirements, except in regard to dechlorination. The plant is maintained during three visits per week by Sanitary District No. 5 personnel.

Three subalternatives have been evaluated regarding the continued use of the Paradise Cove treatment plant.

ALTERNATIVE PC-1 would retain the plant in operation. Operation and maintenance costs, including power, are estimated at $5,000 per year, which has a present worth value of $50,000.

ALTERNATIVE PC-2 would abandon the package plant and pump the untreated wastewater to the Richardson Bay Sanitary District over the ridge of Paradise Drive. The pipeline would be 7,500 feet long with a

minimum size of 6 inches to allow for maintenance. Capital cost, including the pump station, would be $280,000 and annual maintenance costs would be an estimated $1,600. Total present worth of this alternative would be $278,000.

ALTERNATIVE PC-3 would abandon the plant and transport the untreated wastewater to the main sewer system on the south end of the Tiburon Peninsula. This plan would also facilitate the connection of the Tiburon Oceanographic and Wildlife Center located about two-thirds the distance to the main sewer line. The force main required would be 14,000 feet long. Capital cost for this alternative would be $516,000 and annual O&M $2,200. Total present worth of this alternative would be $503,000.

Environmental effects of the discharge are likely to be negligible, since the effluent is of high quality, very low in volume, and receives good dilution. Short term impacts from constructing a force main to either the Richardson Bay or Sanitary District No. 5 system would be significant, since 1.5 to 3 miles of force main would be required. Growth-inducing aspects of the 6-inch force main would also be significant, since it would pass through much undeveloped area and would have more than a 25,000-gallon-per-day capacity.

Due to the small number of connections and the high cost of connecting to either the Richardson Bay or Sanitary District No. 5 systems (five to ten times more costly on a present worth basis) it is recommended that the Paradise Cove plant remain in service. Should future development dramatically increase the connections to the Paradise Cove area, or if existing sewer systems from either Corte Madera, Richardson Bay, or Sanitary District No. 5 expand closer to the Paradise Cove area, then abandoning the package plant may be more feasible. In the meantime, if no additional connections are foreseen, annual operation and maintenance costs may be significantly lower if the three houses were served by septic tank or other small scale treatment systems and effluent disposed by subsurface leach fields.

Subalternatives Evaluation Summary

Based on the cost analysis and other relevant factors considered, Subalternative SA-3 is selected for further analysis in conjunction with both Alternatives SM-2 and S/CM-4. This subalternative is the least costly and would require the least amount of pipeline construction. Tamalpais Valley would continue to pump into the Sausalito-Marin City system for treatment and disposal. Ricardo Road and Salt Works pump stations would either be routed to Mill Valley for treatment or pumped to Sanitary District No. 1. Only pump station modifications to the Sausalito system would be required to handle the peak wet weather flows from Tamalpais Valley.

Route TG is the least costly route and would require the least amount of power. It is selected as the most viable routing for transport of southern Marin flows to central Marin in Alternative S/CM-4. Since this routing follows the abandoned railroad right-of-way most of its distance, adverse impacts due to traffic disruption are minimized.

Subalternative SM-2A, which would route flows from the Richardson Bay Sanitary District's Trestle Glen plant to the City of Mill Valley for treatment, does not result in savings on a present worth basis and would be more difficult to implement; therefore, SM-2A is not considered further.

Due to its small flows and long distances to alternate treatment facilities, Paradise Cove will continue in operation and discharge offshore.

SUMMARY

This chapter has presented the screening of alternatives for the southern Marin subregion, as well as combined south and central Marin alternatives. Based on these studies, two subregional alternatives, SM-2 and S/CM-4, have been identified for further detailed evaluation in Chapter 4.

Plan SM-2, the least costly plan for separate southern Marin facilities, would upgrade the four existing treatment facilities with a common outfall for Mill Valley, Richardson Bay Sanitary District, and Sanitary District No. 5 to Raccoon Straits. Sausalito would discharge in a separate outfall at its present location at Yellow Bluff.

Plan S/CM-4, the least costly combined southern-central Marin alternative, would abandon treatment facilities at Mill Valley and Richardson Bay Sanitary District and pump raw wastewater to central Marin for treatment and disposal near San Quentin. Treatment facilities at Sanitary District No. 5 and Sausalito would be upgraded to provide secondary treatment with separate discharges to deeper bay waters at Raccoon Straits and Yellow Bluff respectively.

In addition to the two major subregional alternatives, various subalternative combinations of the smaller sanitary districts within the southern Marin area have been analyzed. It was determined that subalternative SA-3, which retains Tamalpais Valley Sanitary District with Sausalito-Marin City and reroutes the Salt Works and Ricardo Road areas of Richardson Bay Sanitary District to Mill Valley or central Marin, is the most cost effective. The small Paradise Cove plant, serving only three connections, will remain in service.

Chapter 6
APPARENT BEST ALTERNATIVE

INTRODUCTION

Evaluations reviewed in Chapter 4 indicated that Alternative SM-2 is the apparent best subregional alternative for the southern Marin area. Under this plan, the four existing treatment facilities would be upgraded and continue in operation. Secondary effluent from the Mill Valley and Richardson Bay Sanitary District, which is presently discharged into Richardson Bay, would be transported to deeper waters of San Francisco Bay at the end of the Tiburon peninsula.

The Sausalito-Marin City and Sanitary District No. 5 treatment facilities would be upgraded to provide secondary treatment, with each discharging into San Francisco Bay offshore of the treatment facilities.

SUMMARY COMPARISON OF MAJOR SOUTH MARIN ALTERNATIVES

The purpose of this section is to review and summarize the comparison of South Marin Alternatives as developed in prior chapters. It should be noted that the alternatives analysis summarized in Chapter 4 did not include any costs for treating wet weather flows, which were developed in Chapter 5. In addition, as a result of subsequent local discussions and environmental considerations additional mitigation measures are deemed necessary for any treatment plants located in Central Marin under Plan S/CM-4 because of their proximity to populated areas.

The final alternatives which were evaluated are summarized below:

> Alternative SM-2 involves upgrading treatment facilities at Sanitary District No. 5 in Tiburon, Mill Valley, and Richardson Bay Sanitary District with a combined outfall from Mill Valley to Raccoon Straits. Sausalito-Marin City would upgrade to secondary treatment and have a separate discharge offshore of Yellow Bluff.
>
> Alternative S/CM-4 involves upgrading Sanitary District No. 5 in Tiburon and Sausalito-Marin City to secondary treatment with independent outfalls to deep waters of San Francisco Bay. Mill Valley and Richardson Bay would pump to Sanitary District No. 1 in Central Marin for treatment and disposal.

Monetary Comparison of Alternatives

The monetary comparison of the two alternatives is summarized in Tables 6-1 and 6-2. The cost estimates include the cost of wet weather treatment to meet Maintenance Level B conditions and the cost of miscellaneous improvements at Sanitary District No. 1 which will be required in order to assure that the plant is compatible with adjacent land uses.

A summary comparison of alternatives is shown in Table 6-3. Based on the comparison of alternatives developed in prior chapters and summarized above, Alternative SM-2 has been selected as the apparent best alternative for Southern Marin.

Alternative SM-2 has been chosen because it is the least costly alternative having a lower present worth and initial capital cost. Implementation of Alternative SM-2 would be significantly easier since existing treatment facilities and local agencies would be utilized and additional land for treatment at Central Marin would not be required. Due to the long length of force main carrying treated wastewater from Mill Valley to Tiburon, local reclamation opportunities would be enhanced.

Studies summarized in Chapter 5 conclude that it is more economical for the Southern Marin agencies to treat high wet weather flows rather than have extensive sewer rehabilitation projects to decrease infiltration and inflow. Therefore, the systems are not subject to excessive infiltration/inflow and, with the exception of the City of Belvedere, do not require sewer system evaluation surveys.

This chapter provides a detailed description of the apparent best subregional alternative including the local treatment facilities at Sausalito-Marin City, Sanitary District No. 5, Mill Valley, and Richardson Bay Sanitary District which are incorporated into the subregional plan. Also presented are cost estimates including wet weather facilities, and plan for project implementation, financing and operation.

DETAILED DESCRIPTION OF PROPOSED PROJECT

The major feature of apparent best subregional alternative is the six mile long 30-inch diameter outfall line from the Mill Valley treatment plant to Raccoon Straits offshore of Tiburon. As shown in Figure 6-1, the outfall would cross under Highway 101 at the north end of Strawberry Point to the Richardson Bay Sanitary District Trestle Glen treatment plant. Treated effluent from the Trestle Glen plant would be pumped into the force main which would be routed along the existing bicycle path on the southern edge of the Tiburon peninsula much of the distance to Point Tiburon. Secondary effluent from the upgraded Sanitary District No. 5 plant would be connected

Table 6-1 COST SUMMARY ALTERNATIVE SM-2, $1,000

Item	Capital Cost		Annual Operation and Maintenance Cost[a]		Present Worth
	1978	1988	1978/88	1988/98	
Sausalito-Marin City Treatment	3,300	-	215	218	5,588
wet weather facilities (ML-B)	-	-	-	-	-
Sanitary District No. 5 - Tiburon	2,590	-	170	173	4,402
wet weather facilities (ML-B)	50	-			50
Mill Valley Treatment Facilities	5,760	-	318	323	9,147
wet weather facilities (ML-B)	1,620	-	-	-	1,620
Richardson Bay S.D. - Trestle Glen	460	50	123	126	1,799
wet weather facilities (ML-B)	40	-	-	-	40
Force main ext. Salt Works to Ricardo Rd.	185				
Main and Locust Street Pump Stations	100				
Salt Works Pump Station	120		20	21	5,371
Ricardo Road Pump Station	90				
Equalization at Mill Valley	150				
Force Main Ricardo Road to Mill Valley	385				
Force Main Mill Valley to Raccoon Strait	4,126				
TOTALS	18,976	50	846	861	28,017

[a]1978 dollars, inflation not considered

Table 6-2 COST SUMMARY ALTERNATIVE S/CM-4, $1,000

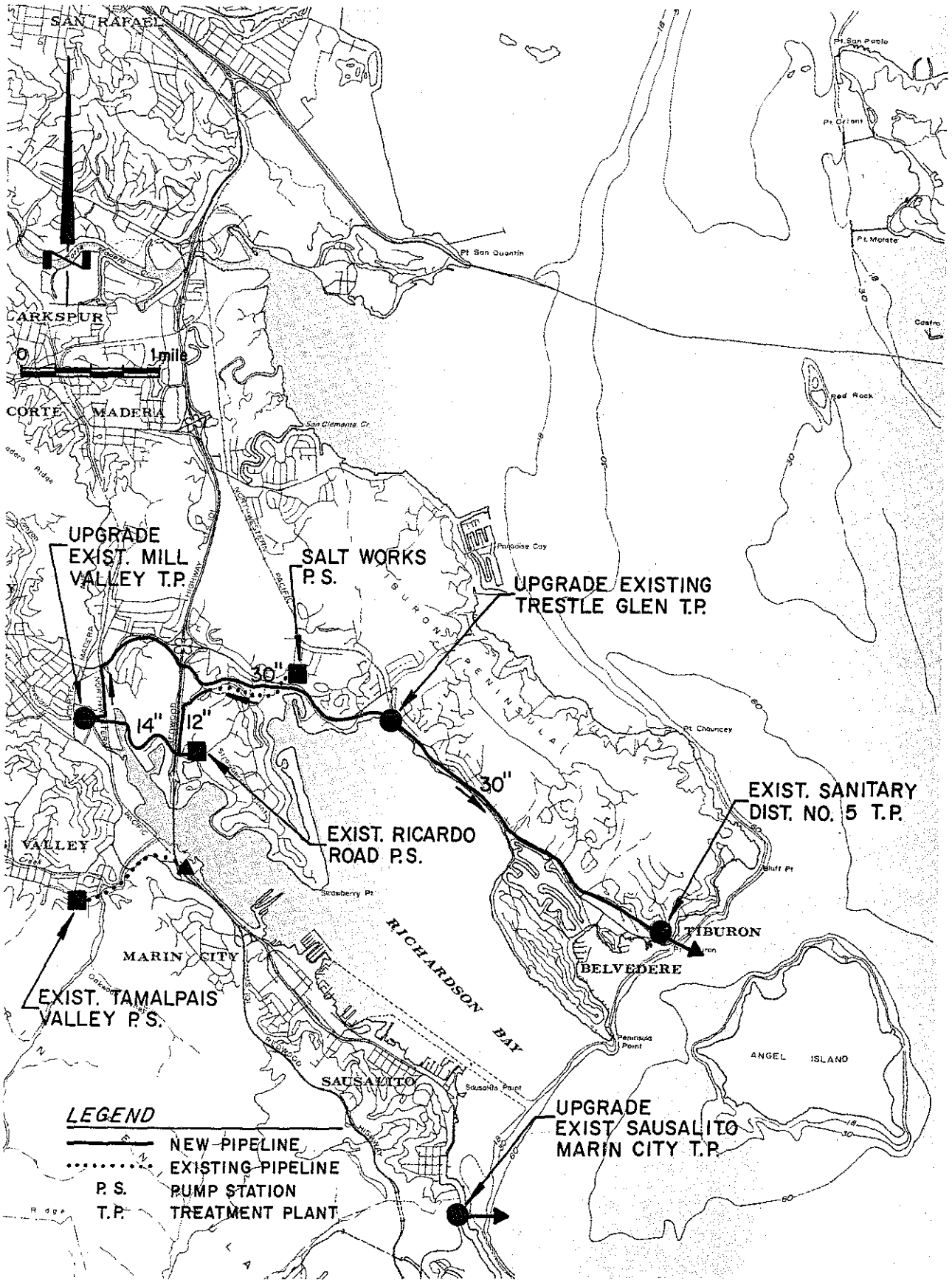
Item	Capital Cost		Annual Operation and Maintenance Cost		Present Worth
	1978	1988	1978/88	1988/98	
Sausalito-Marin City Treatment	3,300	-	215	218	5,588
wet weather facilities (ML-B)	-				-
Tiburon Treatment	2,720	-	170	173	4,532
wet weather facilities (ML-B)	50				50
Sanitary District No. 1 (Ross Valley) Treatment Facilities	5,750	361	154	155	7,568
wet weather facilities	1,700		40	40	2,124
misc. improvements	2,600		-	-	2,600
Main & Locust Street Pump Stations	100				
Trestle Glen Pump Station	110				
Salt Works Pump Station	150				
Ricardo Road Pump Station	90				
Mill Valley Pump Station	2,000		94	95	9,860
Mill Valley Equalization	50				
Force Main Mill Valley to Salt Works	2,003				
Force Main Salt Works to SD #1	3,848				
Force Main Trestle Glen to Salt Works	312				
Force Main Ricardo Road Mill Valley F.M.	198				
TOTALS	24,981	361	673	681	32,322

Table 6-3 SUMMARY COMPARISON OF MAJOR SOUTH MARIN ALTERNATIVES

Factor	SM-2	S/CM-4
Cost Effective Analysis ($1,000)		
Initial Capital Cost	18,976	24,981
O&M Cost, 1978	846	673
Present Worth Cost	28,017	32,322
Environmental Impact	Good	Good
Social Impact	Fair	Fair
Additional Considerations		
Scarce Resources	Fair	Fair
Flexibility & Reliability	Good	Fair
Ability to Implement	Good	Poor
Compatibility with Local Planning	Fair	Fair
Bypass Analysis	Adequate	Adequate
Flood Protection	Adequate	Adequate
Land Use	Fair	Fair
Public Acceptability	Fair	Poor

Figure 6-1

APPARENT BEST ALTERNATIVE - SOUTHERN MARIN



to the outfall line in order to utilize a common outfall and diffuser which would extend 300 feet offshore into Raccoon Straits and provide a minimum 30:1 initial dilution.

A common dechlorination facility located at Tiburon would allow a chlorine residual to be maintained in the outfall between Mill Valley and Tiburon. Maintaining a chlorine residual in the outfall would be necessary if the wastewater is to be reclaimed for irrigation along the route and would also help disinfection during high wet weather flows as well as prevent in-line slime growths.

An analysis of various combinations of the sanitary districts and drainage areas within the Southern Marin subregion conducted in Chapter 2 determined that the most cost effective system would involve removal of the Richardson Bay Sanitary District's Ricardo Road and Salt Works drainage areas from the Sausalito-Marin City system. These two areas would be rerouted to Mill Valley for treatment, while Tamalpais Valley would continue to be served by the Sausalito-Marin City system. The force main from Salt Works pump station would be extended to the Ricardo Road pump station and a 14-inch line approximately one mile long would be constructed from Ricardo Road pump station to the Mill Valley plant.

The Sausalito-Marin City treatment facilities would be upgraded to provide secondary treatment and a new separate outfall and diffuser would be constructed into San Francisco Bay just offshore of the treatment facilities.

Design criteria used in the sizing of the transportation treatment and disposal facilities are presented in Table 6-4. Design criteria utilized in the development of the apparent best treatment alternatives for each of the four treatment facilities are presented later in the chapter. A preliminary hydraulic profile of the outfall line to Raccoon Straits is shown in Figure 6-2.

Sausalito-Marin City Sanitary District Treatment Plant Improvements

The proposed project constituting the apparent best alternative at Sausalito-Marin City consists essentially of the following basic elements:

Grit Removal

Primary Treatment Backup

Secondary Treatment

Sludge Thickening

Primary Digestion and Sludge Dewatering

Chlorination/Dechlorination Facilities

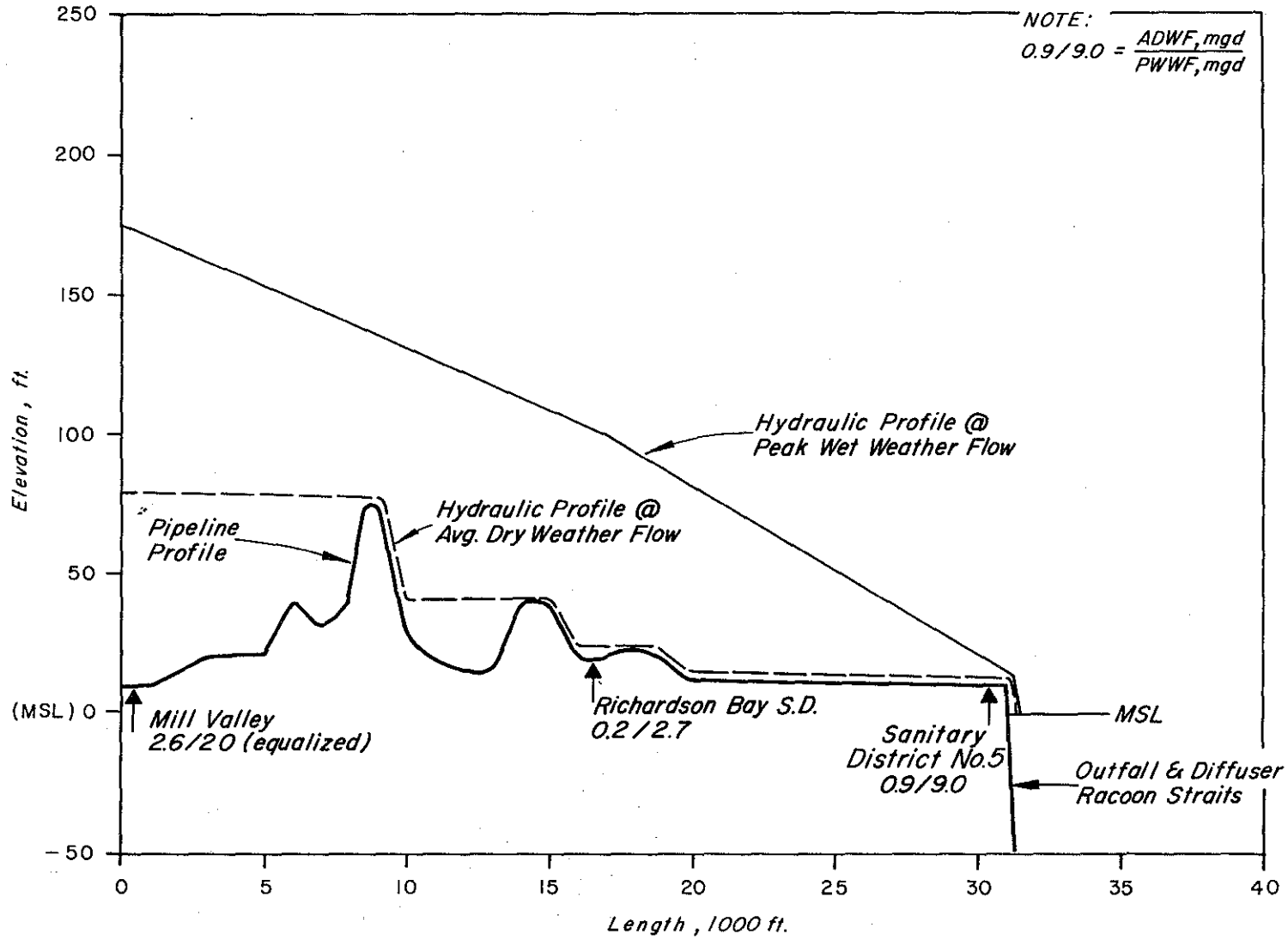
Table 6-4 DESIGN CRITERIA
APPARENT BEST ALTERNATIVE - SOUTHERN MARIN

		Treatment Facility and Subareas[a]			
		Sausalito-Marin City	Mill Valley	Trestle Glen	Sanitary District No. 5
Item	Year	S+TV	MV+RR+SW	TG	T
Average dry weather flow, mgd	1988	1.49	2.62	0.21	0.91
	1998	1.58	2.74	0.23	0.98
BOD load, lb/day	1988	3,010	5,460	470	1,580
	1998	3,200	5,690	510	1,730
Daily wet weather flow, mgd	1988	7.9	19.3	1.8	5.8
	1998	8.2	19.7	1.8	6.0
Peak 3-hr wet weather flow, mgd (20-year recurrence level)	1988	11.9	29.0	2.7	8.7
	1998	12.3	29.6	2.7	9.0

[a]Subarea abbreviations:
S - Sausalito-Marin City
TV - Tamalpais Valley
MV - Mill Valley
RR - Ricardo Road
SW - Salt Works
TG - Trestle Glen
T - Sanitary District No. 5 - Tiburon

Figure 6-2

PRELIMINARY HYDRAULIC PROFILE
EFFLUENT OUTFALL, MILL VALLEY TO RACOON STRAITS



Standby Power

Control Building

Bay Outfall Line and Diffuser

Miscellaneous Improvements

In connection with the specific process elements of the proposed project, it should be recognized that governing factors of existing facilities and sites are of major significance.

As previously discussed, the existing primary clarifier becomes somewhat oversized in respect to projected average dry weather flows. However, this existing condition mitigates against the problem of high loadings associated with a relatively high peak wet weather flow condition. Also, the existing digester, as previously discussed, is considered unsuited for use as a primary tank because of its very shallow depth, which does not permit adequate mixing and heating. However, this tank utilized as a secondary digester with the high theoretical detention time should provide good separation of solids as part of the enlarged plant.

The restricted site, both in respect to property lines and elevations, mandates a unique design in respect to integrating structures. And in the case of the proposed new primay digester, the use of a tall, small diameter tank is commended as a means to conserve space, while at the same time take advantage of a tank configuration which allows for good mixing characteristics.

Access to the proposed plant enlargements can be accomplished through extension of the existing roadway around in front (Bayward) of the existing structures by constructing a causeway in tidal waters. It is not considered feasible to approach the new facilities location directly from the land, inasmuch as the land at that point is virtually a sheer cliff.

The resultant plant design, dictated in large part by site and existing plant conditions, will be unique in its demonstration of what can be accomplished in spite of significant limitations.

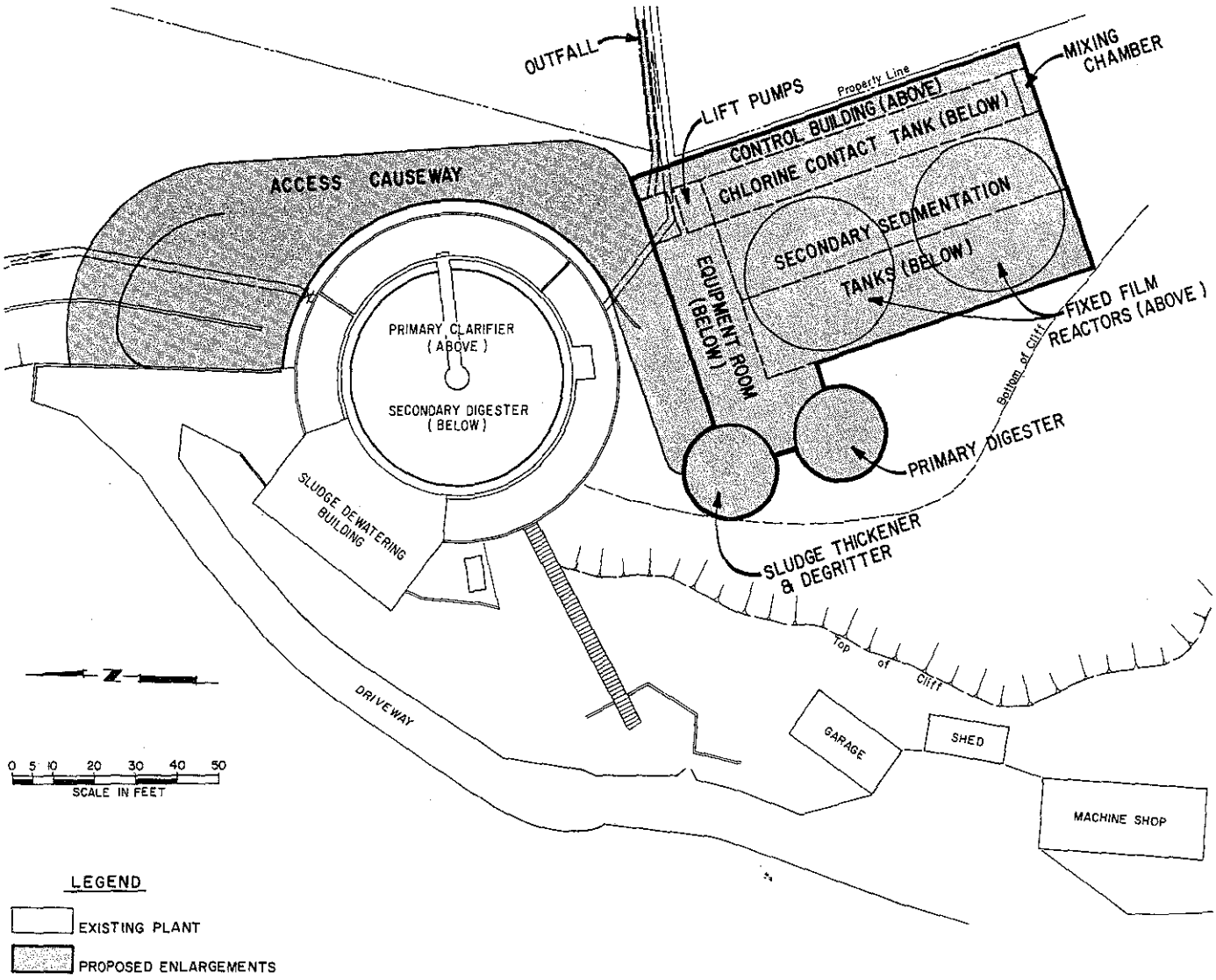
The proposed treatment enlargements, in relationship to existing plant facilities, are shown graphically in Figure 6-3.

A detailed description of the basic elements of the proposed project is provided as follows:

Grit Removal - The necessary grit removal will be accomplished through furnishing and installing a cyclone type degritter, together with a classifier, to receive and degrit underflow from the existing primary clarifier on a continuous basis, with pumping rate of 200 gpm. The degritted underflow will be resettled in the sludge thickeners.

Figure 6-3

SAUSALITO-MARIN CITY SANITARY DISTRICT PROPOSED ENLARGEMENTS IN RELATION TO EXISTING WASTEWATER TREATMENT PLANT



Primary Treatment Backup - The necessary primary treatment backup will be provided by oversizing the proposed two secondary sedimentation tanks on the basis of operating each tank in series with 1,200 gpd/ft^2 overflow rate. The tanks will be partially covered to support the fixed film reactors above and to provide access. The two tanks will be 16 ft width by 78 ft length by 11 ft SWD.

Secondary Treatment - The necessary secondary treatment will be provided by two fixed film reactors, each 36 ft in diameter by 25.1 ft SWD. The plastic media will be contained in a steel and plastic enclosure, all located above the secondary sedimentation tanks, chlorine contact tank and pump room. Three feed pumps will be provided, one being a backup for either of the other two. Pumps will be variable speed, with maximum capacity to pump 1/2 normal peak dry weather flows of 2.3 mgd.

Included as part of the secondary treatment process element will be the two secondary sedimentation tanks previously described as coincidentally providing the needed primary treatment backup.

Sludge Thickener - The necessary sludge thickener will be constructed as a separate circular tank with thickener mechanism, scum baffle and skimmer. The tank will be 18 ft square by 10 ft SWD. The tank will be covered to support the grit removal system and to confine odors.

Primary Digestion and Sludge Dewatering - The necessary primary sludge digester will be provided by a single digester tank, 20 ft diameter by 45 ft SWD. The silo configuration will most easily accommodate the integrated plant structure concept within limited available space. Adequate mixing will be provided through gas recirculation and heating by means of external heat exchanger.

Chlorination/Dechlorination Facilities - The necessary chlorination for disinfection will be provided through use of existing chlorinators, which will be relocated to a separate room of the new control house. Similarly, the existing dechlorination system, a sulfonator unit and appurtenances, will be relocated. A new chlorine contact tank will be constructed as part of the plant improvements, to insure 40-minutes contact time at average peak dry weather flows.

Standby Power - Additional standby power will be provided through installation of an engine-generator unit utilizing diesel oil. The unit will be adequate to provide standby power for all necessary plant systems, probably 75 kw capacity.

Control Building - Within and upon the integrated plant structure, the necessary control house will be constructed. This building will house, in addition to the chlorination/dechlorination equipment, a control room, office, laboratory, locker room, lunch room and storage. As part of this improvement, a revision will be made of the electrical control system and instrumentation so that visual indicators, metering, and basic controls will be provided in the control room.

Bay Outfall Line and Diffuser - The necessary Bay outfall line for effluent disposal will consist of approximately 300 ft length of 30-inch diameter cast iron pipe with bell joints, or welded steel line and coated pipe, together with a 100-ft diffuser section with ports designed to insure a minimum of 25:1 initial dilution.

Miscellaneous Improvements - At the plant site there will be a need to construct some miscellaneous improvements, including connections to existing plant. A significant improvement will be a necessary new access road causeway to reach the new plant addition.

Also, there is a specific need at the existing Main Street pumping plant which provides pumping of the entire incoming wastewater flow. Consistently relatively large size rocks cause damage to the comminutors. A sump ahead of the comminutors is proposed to collect rocks.

Flow Diagram - A flow diagram of the enlarged wastewater treatment plant as proposed is as previously shown in Figure 4-1, utilizing the fixed film reactor alternative for secondary treatment.

Basic design criteria of the enlarged wastewater treatment plant as proposed is shown in Table 6-5.

Expected Effluent Quality - Expected effluent quality of the enlarged treatment plant as proposed is summarized in Table 6-6.

Summary of Treatment Plant Operation - Operation of the enlarged wastewater treatment plant as proposed may be described in narrative form, as follows:

> All incoming flow will pass through the existing primary clarifier. During periods of peak wet weather flow and at any time when needed, chemical flocculants may be added through use of the existing polymer feed system at the treatment plant, preceded by the alum feed system at the existing Main Street pumping plant. Effluent from the primary clarifier will go to the new reactor feed lift station and thence to one of the two new fixed film reactors. Depending upon flow rate, a portion of the effluent from the reactors will be returned as recirculation to the reactors, while the effluent passes to one of the two new secondary sedimentation tanks. At such times as the primary clarifier is out of operation, incoming wastewater can be bypassed directly to the No. 1 secondary sedimentation tank, thence to the fixed film reactors and then to the No. 2 secondary sedimentation tank in series operation. From the secondary sedimentation tanks, flow will go to the new mixing chamber for mixing with chlorine solution, thence to the new chlorine contract tank, with sulfur dioxide being added for dechlorination just prior to discharge to deep water through the new effluent line and diffuser.

Table 6-5 SUMMARY OF LOADINGS AND DESIGN CRITERIA FOR PROPOSED SAUSALITO-MARIN CITY FACILITIES

Item	Value
Flow	
Average dry weather (ADWF), mgd	1.49
Peak dry weather flow rate (PDWF), mgd (1.7:1)	2.50
Peak wet weather flow rate (PWWF), mgd (5.75:1)	8.60
Primary Clarifier (Existing)	
Diameter, ft	55
Depth, ft	9.5
Overflow rate at ADWF, gpd/ft^2	627
Detention time at ADWF, hrs	2.7
Overflow rate at PWWF, gpd/ft^2	2,510
Detention time at PWWF, hrs	0.5
Fixed Film Reactor (New)	
Number reactors	2
Diameter reactors, ft	36
Depth reactor media, ft	25.1
Treatability factor, "k"	0.5
Hydraulic loading (Q), gpm/ft^2	0.2
Recirculation (Re) at ADWF, gpm/ft.2	48
BOD loading, lbs/1,000 c.f./day	2
Secondary Sedimentation Tanks	
Number sedimentation tanks	2
Length tanks, ft	78
Width tanks, ft	16
Depth tanks, ft	11
Overflow rate in parallel at ADWF, gpd/ft^2	600
Detention time in parallel at ADWF, hrs	3.3
Overflow rate in series at ADWF, gpd/ft.2	1,200
Detention time in series at ADWF, hrs	1.65
Chlorine Contact Tank	
Number tanks with center baffle	1
Length tank, ft	85
Width tank, ft	11
Depth tank, ft	10
Detention time at PDWF, min.	40

Table 6-5 SUMMARY OF LOADINGS AND DESIGN CRITERIA FOR PROPOSED SAUSALITO-MARIN CITY FACILITIES (continued)

Item	Value
Sludge Thickener (New)	
Number thickeners	1
Diameter thickener, ft	18
Combined sludge solids loading, lbs/day/ft^2	9
Primary Digester (New)	
Number primary digesters	1
Diameter digester, ft	20
Depth digester, ft	48
Volume digester, c.f.	15,070
Total solids loading, lbs/c.f./day	0.15
Detention time (at 5% solids), days	20.5
Secondary Digester (Existing)	
Number secondary digesters	1
Diameter digester, ft	75
Depth digester, ft	13
Volume digester, c.f.	57,400
Detention time (at 5% solids), days	78
Sludge Dewatering	
Number vacuumfilters	2
Size vacuum filters, ft^2	113
Design capacity, lbs/hr D.S. (combined sludge)	395

Raw sludge will be pumped continuously from the primary clarifier for degritting ahead of resettling and thickening, together with a continuous return of secondary sludge from the secondary sedimentation tanks in the new sludge thickener. Combined, thickened sludge will be pumped to the new primary digester on a time clock sequence from the sludge thickener, with overflow to the existing secondary digester. Supernatant will be returned to incoming wastewater from the secondary digester, with digested sludge being pumped to the new and existing vacuum filters for dewatering and transport to final disposal as a soil conditioner, or dump.

Table 6-6 SUMMARY OF EXPECTED EFFLUENT QUALITY

Constituent	Units	30-Day Average	7-Day Average	Maximum Daily	Instantaneous Maximum
Settleable Matter	ml/l/hr	0.1	-	-	0.2
BOD. (5-day)	mg/l	30	45	60	-
Suspended Solids	mg/l	30	45	60	-
Grease & Oil	mg/l	10	20	-	-
Chlorine Residual	mg/l	-	-	-	0.0
Coliform (mean)	MPN/100	200	400		

Toxicity - survival test organisms in 96-hr bioassay
90% of not less than 50% survival

City of Mill Valley Treatment Facilities

The apparent best alternative for the City of Mill Valley consists of upgrading and enlarging the existing biofilter treatment facilities. This alternative was selected over biofilter-activated sludge or activated biofilter-activated sludge treatment because it is the least costly alternative in annual operating and maintenance costs as well as on a present worth basis. It also requires less power comsumption and is simpler to operate than the other processes. The major components of the proposed treatment facilities would consist of the following:

New headworks and influent pump station

Aerated grit removal

Conversion of existing secondary clarifiers to primaries, including odor control

Use of existing primaries for wet weather flow treatment

One additional wet weather primary clarifier

Chemical addition facilities for wet weather flow

Enlargement and rehabilitation of existing biofilters

New secondary clarifiers

Additional microstrainer

Filtration facilities for wet weather flows

New chlorine contact facilities

Rehabilitation of existing sludge digestion and dewatering facilities

New effluent pump station

A schematic flow diagram of the proposed treatment process and a preliminary site plan of the existing treatment plant and proposed additions are included in Figures 6-4 and 6-5, respectively.

The existing influent pump station which is over 30 years old and is hydraulically insufficient would be abandoned and a new headworks and influent pump station with a 30 mgd peak wet weather flow capacity would be constructed. Flow would be pumped to an aerated grit removal system located adjacent to the existing clarifiers. The grit removal system would be covered to provide odor control. After grit removal, the wastewater would be given primary treatment in the converted secondary clarifiers which would be rehabilitated and covered to provide odor control. The existing 6-foot deep rock biofilters would be rehabilitated and enlarged by replacing the rock with a 10-foot depth of plastic or horizontal redwood media. The existing walls would also be increased in height and the biofilter mechanisms replaced. New feed and recirculation pumping would be provided to operate the biofilters in series. Flow recirculation would be provided as required during low flow periods to maintain minimum wetting rates.

Biofilter effluent would be clarified in the new secondary clarifiers and then microstrained in order to insure that suspended solids and BOD requirements are not exceeded. A new larger microstrainer would be added along with the two existing units in order to provide standby capability in case one microstrainer is out of service. After microstraining, the treated effluent would be disinfected in a new chlorine contact basin and then pumped through the 6-mile long 30-inch outfall to Raccoon Straits just offshore of Tiburon.

Sludge from the primary and secondary clarifiers would be pumped to the rehabilitated existing anaerobic digesters. The existing secondary digester will be provided with standby mixing capability. Digested sludge would be mechanically dewatered and disposed of at a landfill site.

A new control building containing office space, laboratory, lunchroom, and locker room facilities would be constructed. The City's existing corporation yard would be relocated to the abandoned sludge drying bed area in order to provide room for the new pumping station and clarifiers.

Figure 6-4
SCHEMATIC FLOW DIAGRAM
APPARENT BEST TREATMENT ALTERNATIVE
CITY OF MILL VALLEY

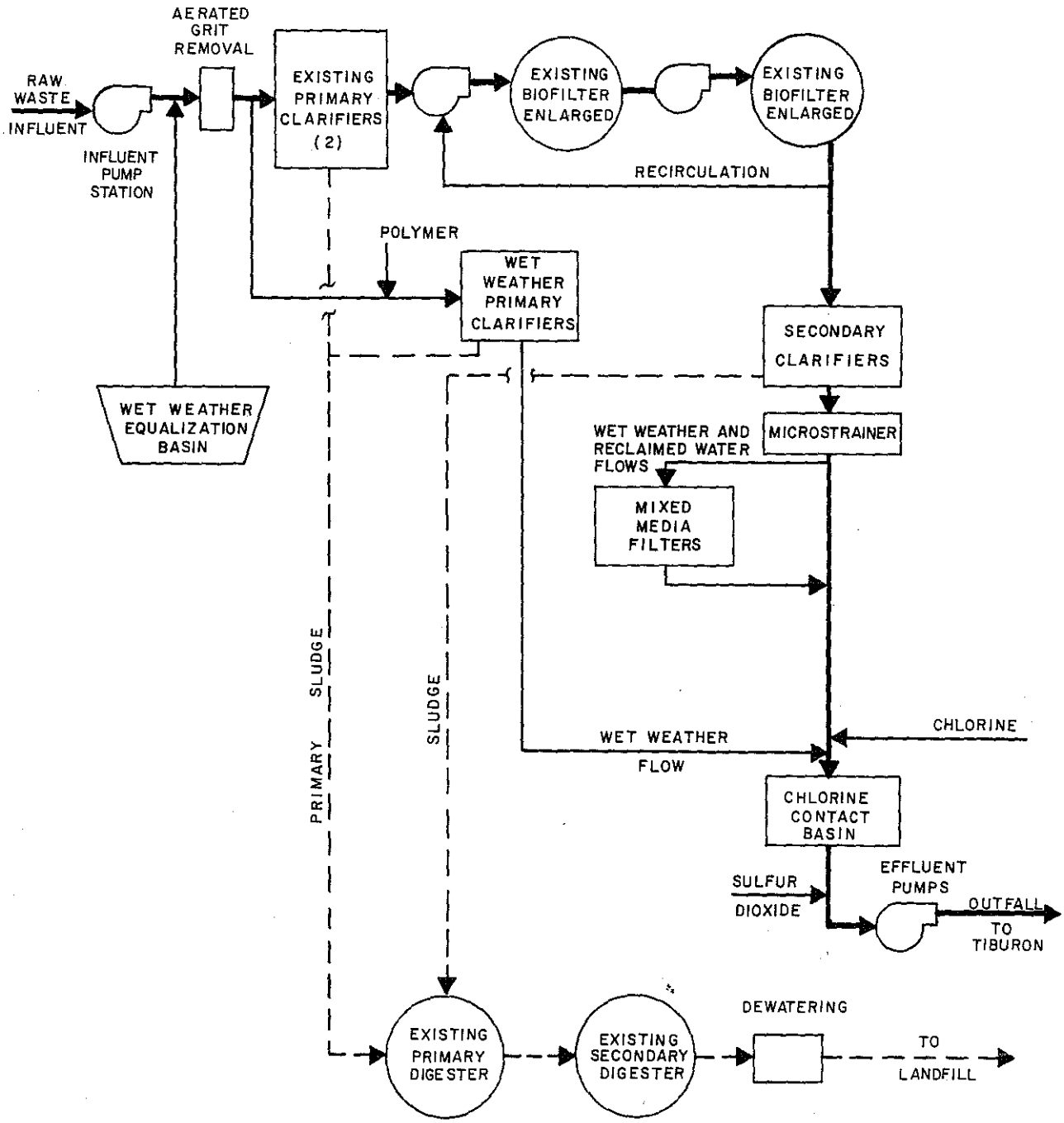
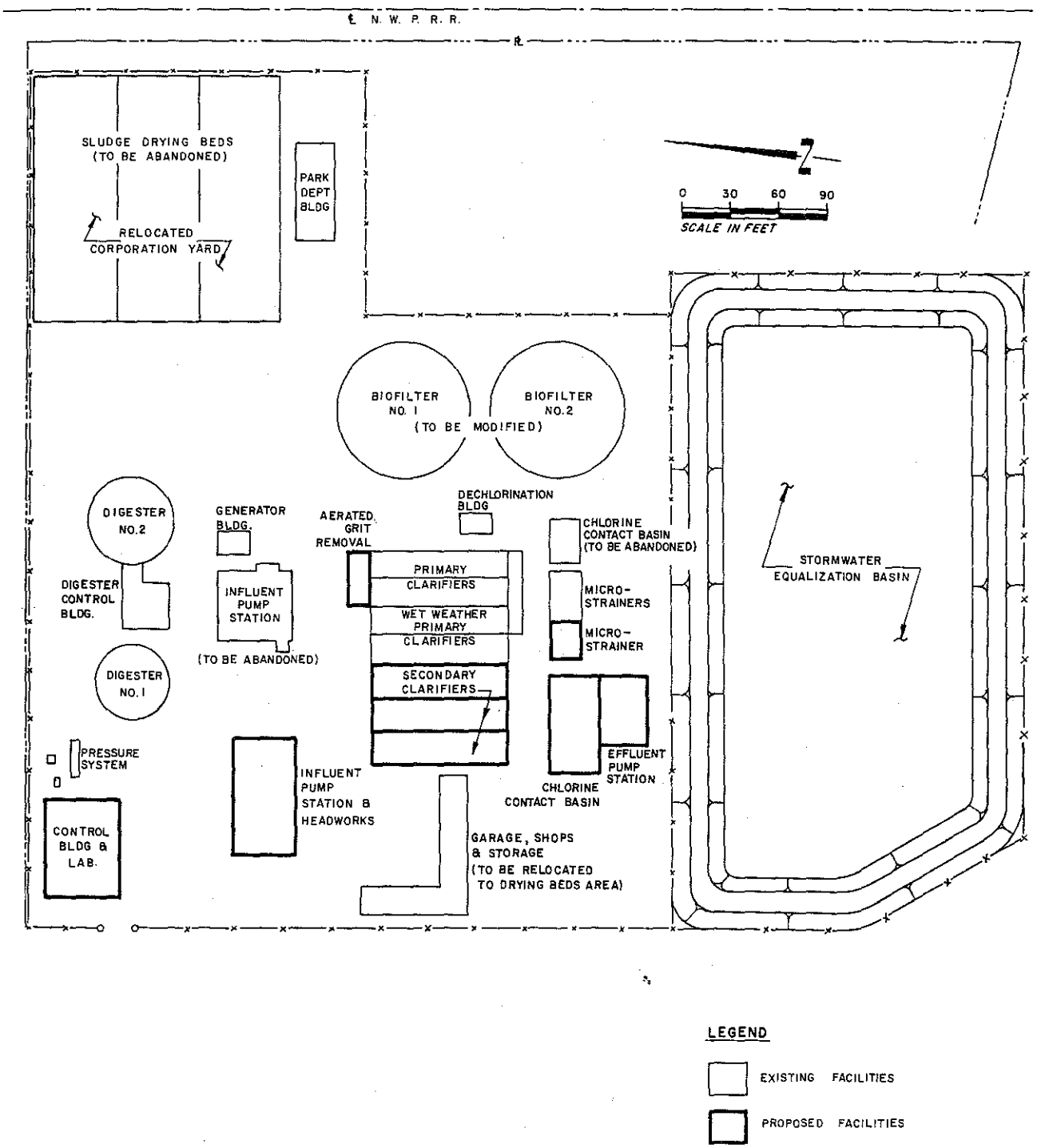


Figure 6-5
SITE PLAN - CITY OF MILL VALLEY
APPARENT BEST TREATMENT ALTERNATIVE



As develped in Chapter 5, requirements for wet weather Maintenance Level B would be achieved by diverting flows in excess of 5.2 mgd (two times average dry weather flow) to wet weather primary clarifiers. Chemicals would be added to allow higher overflow rates through these primary clarifiers which would operate only during high wet weather flows.

In order to achieve secondary effluent requirements for a two year storm as specified under Maintenance Level B, the flow through the secondary treatment process would be filtered prior to blending with the diverted primary effluent. The microstrainers will decrease the solids loading on the filters allowing the filters to be reduced in size. In addition to high wet weather flows, the media filters could be utilized during dry weather periods to produce reclaimed water which may have to meet stringent disinfection and turbidity requirements.

In addition to the wet weather clarifiers and filters, 1.2 million gallons of equalization volume is necessary in order to equalize the projected 3-hour peak wet weather flows of 30 mgd to the daily wet weather flows estimated at 20 mgd. This equalization volume allows the effluent pumping station and the 6-mile outfall to Raccoon Straits to be sized for 10 mgd less capacity providing a significant cost savings. This storage would be utilized only during high wet weather flows. Wet weather flows would be stored for a short period generally less than six hours and then returned to the influent pump station.

The most economical means of constructing this storage would be in a shallow earthen pond located adjacent to the treatment facilities. Due to the bay mud prevailing on much of the site, the maximum levee height would be 5 feet with a 3-foot maximum water depth.

Design criteria for the proposed additions are presented in Table 6-7. The treatment facilities have been sized for projected 1988 flows and loadings. Since flows are expected to increase only 4 percent from 1988 to 1998, the facilities are expected to have sufficient operating flexibility to accommodate the projected increase without major additions or modifications.

A summary of expected effluent quality is presented in Table 6-8.

Richardson Bay Sanitary District Trestle Glen Treatment Plant Improvements

As concluded in the studies summarized in the previous chapters, it is proposed that the existing Trestle Glen treatment plant be maintained to provide secondary treatment for the Trestle Glen watershed of the Tiburon peninsula and that the treated effluent be discharged through a common outfall off Raccoon Straits.

With the continued use of the Trestle Glen treatment plant, it was determined that the plant needs are related to improvement of the

Table 6-7 SUMMARY OF LOADINGS AND DESIGN CRITERIA FOR THE APPARENT BEST ALTERNATIVE PROJECT - CITY OF MILL VALLEY

DESIGN LOADINGS, 1988	
Average dry weather flow, ADWF mgd	2.63
Peak dry weather flow, PDWF mgd	4.2
Peak wet weather flow, PWWF mgd (20 year return level)	30
Daily wet weather flow, DWWF, mgd (20 year return level)	20
Biochemical Oxygen Demand, lbs/day	5,460
Suspended Solids, lbs/day	5,190
PRIMARY CLARIFIERS (Existing) (2)	
Size each, ft.	16 x 82
Total surface area $ft.^2$	2,600
Side water depth, ft.	10
Overflow rate ADWF, $gal/ft.^2/day$	1,000
PWWF $gal/ft.^2/day$	2,000
Capacity ADWF, mgd	2.6
PWWF, mgd	5.2
Detention time, @ 2.6 mgd, hrs.	1.8
@ 5.2 mgd, hrs.	0.9
WET WEATHER PRIMARY CLARIFIERS (2-Existing) (1-New)	
Size each, ft. (Exist)	16 x 82
(New)	20 x 95
Total surface area, $ft.^2$	4,500
Side water depth, ft.	10
Overflow rate, PWWF, $gal/ft.^2/day$	2,000
Capacity, PWWF, mgd	9.0
Detention time, PWWF, hrs.	0.9
WET WEATHER EQUALIZATION BASIN	
Volume, MG	1.25
Depth, ft.	3
Area, $ft.^2$	56,000
BIOFILTERS (2) MODIFIED	
Diameter each, ft.	80
Height each, ft.	10
Volume, $ft.^3$	100,000
Treatability factor, "K"	0.055
Hydraulic loading series operation, $gpm/ft.^3$	0.39
Hydraulic loading inc. recycle, $gpm/ft.^2$	0.75
BOD loading $lb/day/1000\ ft.^3$	40

Table 6-7 SUMMARY OF LOADINGS AND DESIGN CRITERIA FOR THE APPARENT BEST ALTERNATIVE PROJECT - CITY OF MILL VALLEY, Continued

SECONDARY CLARIFIERS (3)	
Overflow rate, ADWF, gal/day/ft^2	700
PWWF	1,200
Surface area, ft^2	3,800
Size each, ft	16 x 82
Side water depth, ft	10
Detention time @ ADWF, hrs	2.6
@ PDWF, hrs	1.6
MICROSTRAINERS (2-Existing) (1-New)	
Size, exist, diameter x width, ft	7.5 x 5
new, diameter x width, ft	10 x 10
Total Surface area, ft^2	550
Hydraulic loading, gpm/ft^2	5.0
WET WEATHER MIXED MEDIA FILTERS	
Design flow rate, mgd	5.2
Loading rate, gpm/ft^2	6.0
Surface area, ft^2	600
CHLORINE CONTACT BASIN	
Contact time, ADWF, minutes	60
PDWF, minutes	40
Volume ft^3	15,000
EFFLUENT PUMP STATION	
Capacity, mgd	20
ANAEROBIC DIGESTERS, Existing	
Primary digester, Volume, ft^3	52,100
Loading rate, lbs volatile solids/ft^3/day	0.15
Capacity, lbs volatile solids/day	7,800
Secondary digester volume, ft^3	31,000
SLUDGE DEWATERING	
Capacity lbs/hour	500
Capacity, gpm	30

Table 6-8 SUMMARY OF EXPECTED EFFLUENT QUALITY - MILL VALLEY

Constituent	Units	30-Day Average	7-Day Average	Maximum Daily
Raccoon Straits Discharge				
Settleable matter	ml/l/hr	0.1	-	0.2
BOD (5-day)	mg/l	30	45	60
Suspended solids	mg/l	30	45	60
Grease and oil	mg/l	10	20	-
Chlorine residual	mg/l	-	-	0.0[a]
Coliform (mean)	MPN/100 ml	200	400	
Toxicity - survival test organisms in 96-hour bioassay 90% of not less than 50% survival				
Reclaimed Water for Landscape Irrigation				
BOD		15	25	35
Suspended solids		15	25	35
Coliform (mean)	MPN/100 ml	2.2	23	

[a]At Raccoon Straits.

plant's solids handling capabilities, aeration capability, chlorination and dechlorination facilities, and odor control measures.

In respect to the treatment of wet weather flows, it was determined that for a Raccoon Straits discharge, achievement of Maintenance Level B would provide adequate protection of the receiving water. The only plant modification necessary for Maintenance Level C would involve the construction of chemical addition facilities and a pipe connection between the primary clarifier and plant outfall to allow the blending of primary effluent with the effluent from the secondary process when the wet weather flow rate exceeds twice the dry weather flow rate.

It was also determined in Chapter 3 that there is a significant potential for using reclaimed wastewater from the Trestle Glen plant to irrigate nearby landscaped areas. The City of Tiburon McKegney Field is now being irrigated with over 10,000 gallons per day of effluent from the Trestle Glen plant. In order to provide effective and reliable disinfection and a consistent quality product water, it is recommended that media filters be provided at the Trestle Glen plant to filter essentially all of the effluent produced.

Also included in the proposed plant improvements will be the construction of an effluent pumping station which will pump effluent through the proposed outfall to Raccoon Straits to be used in common with Mill Valley and Sanitary District No. 5.

It should be noted that proposed improvements to the Trestle Glen treatment plant will utilize most of the existing plant facilities and will not increase the treatment capacity beyond the present design capacity of 0.3 mgd.

The following specific elements of the proposed Trestle Glen treatment plant improvements are proposed:

- Headworks Improvements
- Aeration Equipment
- Sludge Digestion System Improvements
- Process Units Covering
- Chlorination—Dechlorination Improvements
- Standby Power
- Piping Revisions
- Media Filters
- Effluent Pumping Station
- Miscellaneous Improvements

The proposed improvements are described in more detail below.

Headworks Improvements – The plant headworks piping will be reconstructed to provide a single influent box and allow sampling of the plant influent at one point.

Aeration Equipment – Surface aerators over air diffusers will be installed in the two aeration basins in order to maintain a dissolved oxygen level of 4.0 mg/l in the mixed liquor.

Sludge Digestion Improvements – It is proposed that the existing sludge digester will be recommissioned, and the existing sludge incinerator will be abandoned. The existing sludge incinerator was installed in 1967 in order to reduce odors at the plant. However, approximately 270,000 cu. ft. of natural gas is utilized per month in the incineration of sludge at a cost of $450 per month. With the recommissioning of the existing sludge digester, this resource and cost will be saved, and methane gas will be produced.

In order to recommission the existing digester, a boiler and heat exchanger will be added, and a sludge mixing pump will be provided. The existing digester is currently being used to store reclaimed water, and thus, an alternative water storage should be provided.

Digested sludge will be dewatered with the centrifuge, which is now being used for the sludge incinerator. The dewatered sludge will be hauled to a legal disposal site for final disposal.

Process Units Covering – In order to further reduce odors, it is proposed that the primary clarifier, superate filter, and aeration tanks be enclosed. The enclosures will be ventilated, and the exhaust air will be scrubbed to reduce odors.

Chlorination–Dechlorination Improvements – The existing chlorination and dechlorination equipment will be moved to an enclosed building, and a residual chlorine analyzer will be added for more reliable process control.

Standby Power – Standby power will be provided for the plant facilities in the form of an engine generator set. The engine generator set will have a rating of 150 kw.

Piping Revisions – In order to properly handle peak wet weather flows, piping will be provided to allow the blending of effluent from the primary clarifier with secondary effluent.

Media Filters – Two media filters will be provided to polish the effluent which is to be used for landscape irrigation. Each of the two filters will be 6 feet in diameter with a media depth of 3 feet.

Effluent to be discharged to Raccoon Straits will not need to be filtered.

Effluent Pumping Station – An effluent pumping station will be provided which will pump effluent through the common outfall off Raccoon Straits.

Miscellaneous Improvements – As a part of the proposed plant improvements, certain specific improvements will be included which are necessary

to complete the installation and make a properly functioning system. These miscellaneous improvements will consist primarily of construction of an enlargement to the control building to provide space for an office, employee changing, and a lunchroom.

Plant Layout – The proposed plant layout in relation to the existing structures is shown in Figure 6–6.

Flow Diagram – The proposed plant flow diagram is shown in Figure 6–7.

Design Criteria – The basic design criteria for the proposed improved treatment plant is summarized in Table 6–9.

Expected Effluent Quality – The expected effluent quality from the improved Trestle Glen treatment plant is summarized in Table 6–10 for both the Raccoon Straits discharge and for the reclaimed water.

During wet weather the blended effluent quality will meet Federal Secondary Treatment Standards as necessary to achieve receiving water Maintenance Level C conditions.

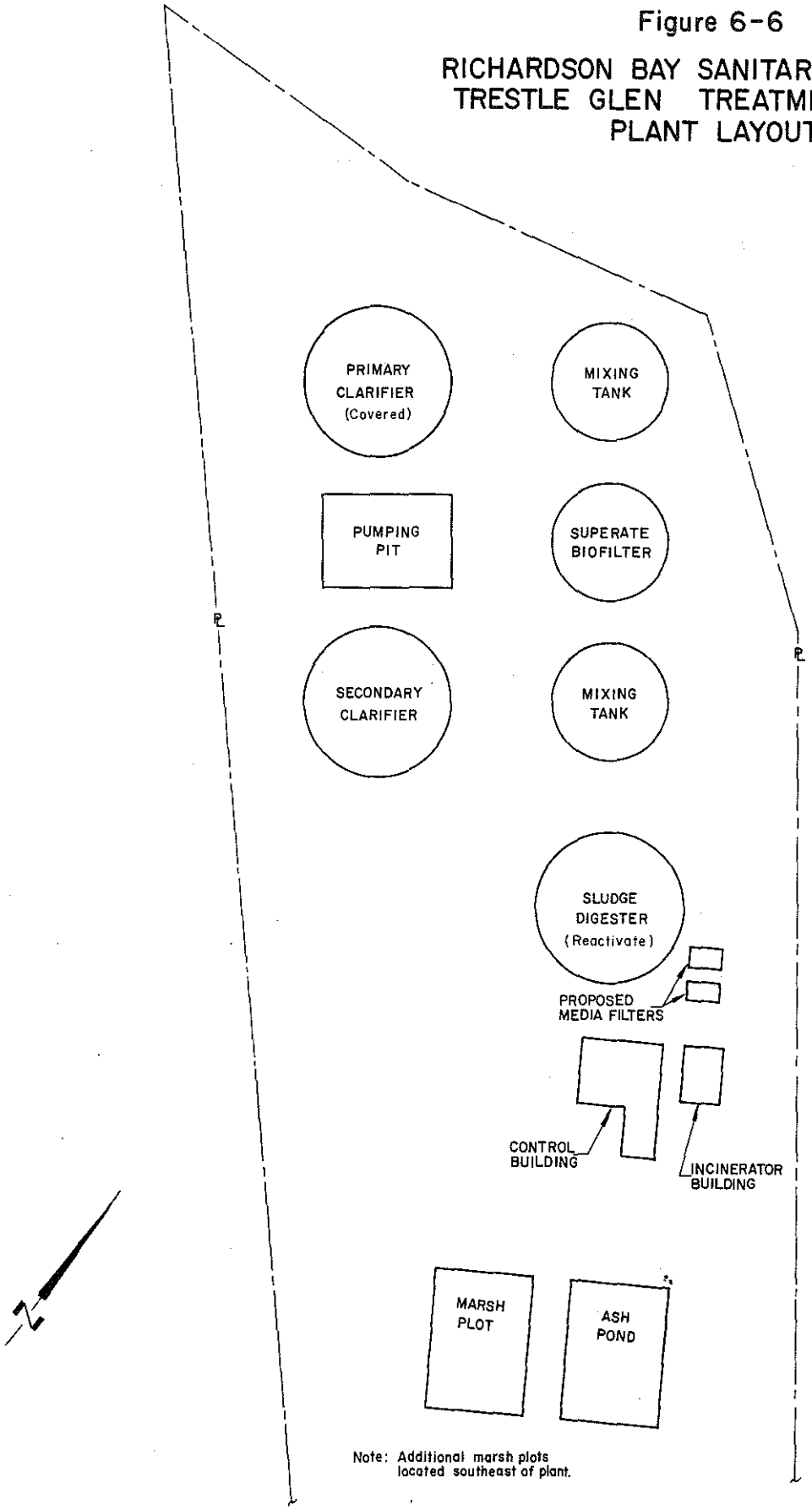
Summary of Treatment Plant Operation – Operation of the improved Trestle Glen treatment plant as proposed may be described in narrative form as follows:

Flows from the Reedlands and Belveron Gardens areas will be pumped at the plant pumping station, and the remaining sewage flows from Little Reed Heights, Del Mar, and Hawthorne Terrace enter the primary clarifier by gravity. All incoming flow will be ground up by two separate barminutors prior to entering the primary clarifier. During periods of peak wet weather flows, a portion of the effluent from the primary clarifier will flow directly to the chlorine contact chamber, while the remainder of the flow will enter the secondary treatment process. Recirculation pumps will recirculate the sewage over the superate biofilter and thence to the two aeration tanks, each of which will also be equipped with surface aerators. Effluent from the aeration tanks will flow to the secondary clarifier. Activated sludge from the secondary clarifier will be returned to the aeration system, and a portion will be wasted from the system. Grit will be removed from the underflow from the primary clarifier by pumping it through a cyclonic degritter and grit washer. The degritted primary sludge and waste activated sludge will be resettled in the sludge thickener, and the thickened sludge will be pumped to the sludge digester. Digested sludge will be dewatered by means of a sludge centrifuge and hauled to a legal disposal site.

Effluent from the secondary clarifier will be disinfected with the injection of chlorine. Effluent to be reclaimed for landscape irrigation use will be pumped through the media filters prior to distribution for use. The remaining effluent will be pumped by means of the effluent pumping facilities to the common outfall off Raccoon Straits.

Figure 6-6

RICHARDSON BAY SANITARY DISTRICT
TRESTLE GLEN TREATMENT PLANT
PLANT LAYOUT



Note: Additional marsh plots located southeast of plant.

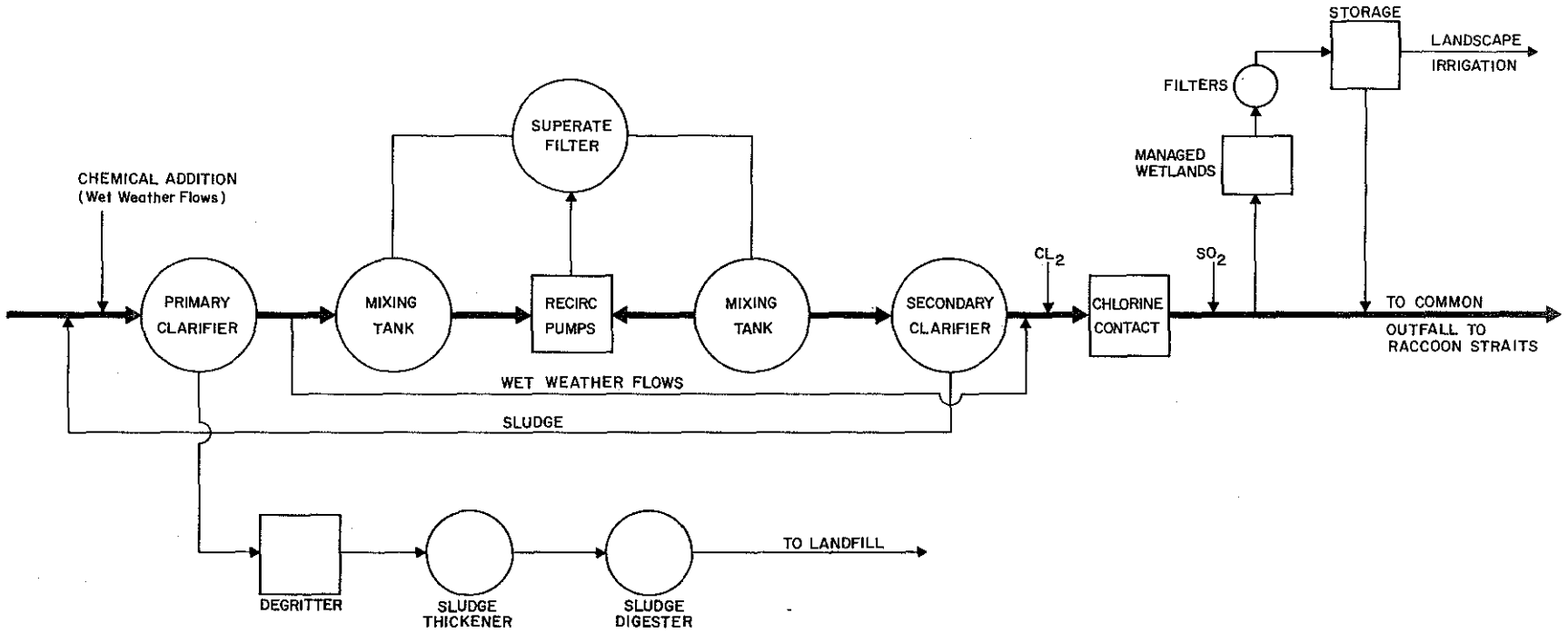


Figure 6-7

RICHARDSON BAY SANITARY DISTRICT
TRESTLE GLEN TREATMENT PLANT
PROPOSED PROCESS FLOW DIAGRAM

Table 6-9 DESIGN CRITERIA FOR THE PROPOSED IMPROVEMENTS TO THE RICHARDSON BAY SANITARY DISTRICT TRESTLE GLEN TREATMENT PLANT

Item	Value
Basic Data - 1988 Design Year	
Design Population (Existing Plant)	4,000
Average Dry Weather Flow (ADWF), mgd	0.30
Peak Dry Weather Flow (PDWF), mgd	0.45
Peak Daily Wet Weather Flow (DWWF), (0-5-yr Return), mgd	1.0
Peak 3-hr Wet Weather Flow (PWWF), (0.5-yr Return), mgd	1.5
BOD, 5 day, lbs/day	680
Suspended Solids, lbs/day	680
Headworks (Existing)	
Barminutors	2
Maximum Capacity, mgd	1.7
Plant Pumping Units	3
Capacity, each, gpm	100
Primary Clarifier (Existing)	
Number	1
Diameter, ft	30
Side Wall Depth, ft	7.5
Surface Area, sq ft	707
Volume, gal	39,770
Overflow rate at avg dwf, gpd/ft^2	424
Detention time at avg dwf, hrs	3.2
Aeration Tanks (Existing)	
Number	2
Diameter, ft	26
Depth, ft	6
Total Volume, 1,000 cf	6.37
BOD applied, lbs/day	476
BOD removed, lbs/day	426
MLSS, mg/l	2,000
F:M ratio	0.53
MCRT, days	4
BOD loadings, lbs/day/1,000 cf	75
Detention time at avg dwf, hrs	3.8

Table 6-9 DESIGN CRITERIA FOR THE PROPOSED IMPROVEMENTS TO THE RICHARDSON BAY SANITORY DISTRICT TRESTLE GLEN TREATMENT PLANT (Continued)

Item	Value
Aerators	
Superate Filter (Existing)	1
Diameter, ft	24
Surface Aerators	2
Capacity, each, scfm	500
Secondary Clarifier (Existing)	
Number	1
Diameter, ft	30
Side Wall Depth, ft	6
Surface Area, sq ft	707
Volume, gal	31,815
Overflow rate at avg dwf, gpd/ft^2	424
Detention time at avg dwf, hrs	2.5
Sludge Thickener (Existing)	
Number	1
Diameter, ft	15.7
Side Water Depth, ft	7
Surface Area, sq ft	193
Volume, gal	10,100
Solids loading, lbs/day/sq ft	3.5
Sludge Digester (Existing—to be recommissioned for service)	
Number	1
Diameter, ft	30
Side Wall Depth, ft	15
Volume, cu ft	10,600
Solids loading, lbs/cu ft/day	0.058
Detention time, days	43
Sludge Dewatering	
Sludge centrifuge, number	1
Capacity, lbs dry solids/hr	85

Table 6-9 DESIGN CRITERIA FOR THE PROPOSED IMPROVEMENTS TO THE RICHARDSON BAY SANITARY DISTRICT TRESTLE GLEN TREATMENT PLANT (Continued)

Item	Value
Chlorination-Dechlorination (new arrangement)	
Number of Chlorinators	2
Chlorinator Capacity, each, lbs/day	500
Chlorine Contact time at avg dwf, hrs	0.7
Number of Sulfonators	1
Sulfonator Capacity, lbs/day	30
Media Filters (0.3 mgd capacity)	
Number	2
Diameter, each, ft	6
Media depth, ft	3
Hydraulic application rate, gpm/ft^2	4
Effluent Pumps	
Number	3
Combined capacity, mgd	2.7

Table 6-10 SUMMARY OF EXPECTED EFFLUENT QUALITY FROM THE TRESTLE GLEN TREATMENT PLANT

Constituent and Units	30-Day Average	7-Day Average	Daily Maximum
Raccoon Straits Discharge			
Biochemical Oxygen Demand, BOD, mg/l	30	45	60
Suspended Solids, mg/l	30	45	60
Settleable Solids, ml/l	0.1	0.1	0.2
Grease and Oil, mg/l	10	-	20
Coliform Bacteria, MPN/100 ml	23	240	10,000
Reclaimed Water for Landscape Irrigation			
Biochemical Oxygen Demand, BOD, mg/l	15	25	35
Suspended Solids, mg/l	15	25	35
Coliform Bacteria, MPN/100 ml	2.2	23	240

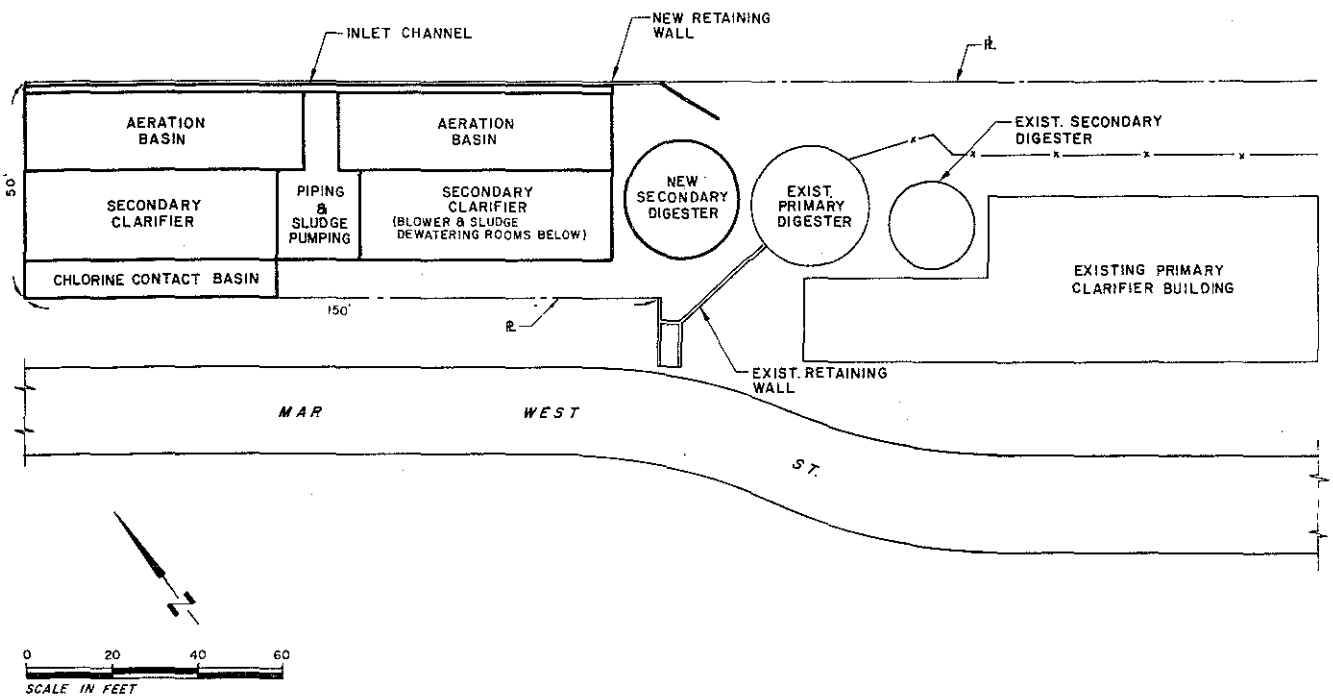
Sanitary District No. 5 Treatment Plant Improvements

The apparent best treatment alternative for Sanitary District No. 5 consists of air activated sludge treatment. This alternative was selected because it is the least costly treatment process on a capital cost and present worth basis and would be more reliable in meeting discharge requirements as well as possible future changes in treatment requirements. The major components of the proposed project would consist of the following:

- Diffused air aeration basins and blowers
- Secondary clarifiers and return sludge pumps
- Primary anaerobic digester
- Sludge dewatering modifications
- Standby power generator
- Control building additions

A schematic flow diagram of the proposed treatment process is shown in Figure 6-8. The existing influent pumping and primary treatment facilities would be fully utilized in the proposed project. Following primary treatment, flow would be piped to the secondary treatment structure located adjacent to the existing plant as shown in Figure 6-9.

Figure 6-9
SITE PLAN-SANITARY DISTRICT NO. 5
APPARENT BEST TREATMENT ALTERNATIVE



Primary effluent would enter the activated sludge aeration basins which would provide a 6-hour detention time with oxygen supply and mixing accomplished by diffused air. The activated sludge organisms would be separated in the secondary clarifiers and returned to the aeration basins. Clarified secondary effluent would be disinfected in the chlorine contact basin and discharged through the combined outfall along with effluent from Mill Valley and Richardson Bay Sanitary District into Raccoon Straits about 200 feet offshore of Point Tiburon.

During high wet weather flows, chemicals would be added to the primary clarifiers to increase removal of BOD and suspended solids. In order to meet Maintenance Level B requirements of secondary effluent for 2 year recurrence level storms, the secondary treatment facilities would be operated at twice the average daily flow rate and primary and secondary effluent blended to meet the effluent standards.

Sludge from the primary clarifiers along with waste activated sludge from the secondary clarifier underflow would be anaerobically digested in the existing primary digester. Digested sludge would be allowed to thicken in the new secondary digester before being mechanically dewatered and trucked to a landfill site.

The expansion site owned by the Sanitary District is only 50 feet by 150 feet in size and consists of steeply sloped land. In order to fit the secondary treatment additions on this site, extensive excavation and retaining wall construction will be necessary.

The secondary treatment structure, as shown in Figure 6-9, would have common wall construction for the aeration basins, secondary clarifiers, and chlorine contact basin. The sludge pumping and transfer piping would be located within the treatment structure along with air blowers and sludge dewatering facilities which would be constructed under one of the secondary clarifiers.

A new anaerobic digester will be constructed in order to provide secondary digester capacity and provide additional operating flexibility. The digester will be 25 feet in diameter and 34 feet high and provided with standby mixing capability.

Additional office space, lunchroom, and locker room facilities will be constructed above the existing board meeting room, while the laboratory facilities would remain at their present location under the primary clarifier. A standby generator will be provided to maintain essential plant operations in the event of a power failure.

Design criteria for the proposed additions are presented in Table 6-11. The treatment facilities have been sized for projected 1988 flows. Since 1998 flows are expected to increase only 8 percent from the 1988 flows, the treatment facilities are expected to have sufficient operating flexibility to accommodate the increase without major additions or modifications.

A summary of expected effluent quality is presented in Table 6-12.

Table 6-11 SUMMARY OF LOADINGS AND DESIGN CRITERIA
APPARENT BEST ALTERNATIVE PROJECT -
SANITARY DISTRICT NO. 5

DESIGN LOADINGS - 1988	
Average dry weather flow ADWF mgd	0.91
Peak dry weather flow, PDWF mgd	2.1
Peak wet weather flow, PWWF (5 year return level) mgd	6.9
Daily wet weather flow, DWWF (5 year return level) mgd	4.6
Biochemical Oxygen Demand lbs/day	1,580
Suspended Solids, lbs/day	1,580
PRIMARY CLARIFIERS (Existing) - (2)	
Size each, ft	14 x 56
Total surface area, ft^2	1,570
Overflow rate @ ADWF $gal/ft^2/day$	580
@ DWWF	2,900
Detention time @ ADWF, hrs	3.2
@ DWWF, hrs	.63
AERATION BASINS (2)	
Food to microorganism ratio (F:M)	0.35
MLVSS, mg/l	2,000
Detention time, ADWF, hrs	6.4
SRT, days	8
Volume, ft^3	32,500
SECONDARY CLARIFIERS (2)	
Overflow Rate, ADWF, gpd/ft^2	520
PDWF gpd/ft^2	1,200
Surface Area, ft	1,750
Solids loading, ADWF, $lbs/ft^2/day$	17
CHLORINE CONTACT BASIN	
Detention Time @ ADWF, min	60
@ PDWF, min	27
Volume, ft^3	5,100
PRIMARY DIGESTERS (Existing)	
Size, diameter x height	25 x 34
Volume, ft^3	16,800
Total Solids loading $lbs/ft^3/day$	0.15
Detention time (@3% solids), days	15

Table 6-11 SUMMARY OF LOADINGS AND DESIGN CRITERIA
APPARENT BEST ALTERNATIVE PROJECT -
SANITARY DISTRICT NO. 5, Continued

SECONDARY DIGESTER	
Size, diameter x height	25 x 34
Volume	16,800
Detention time (@ 3% solids) days	15
SLUDGE DEWATERING	
Vacuum filter - design loading, $lbs/hr/ft^2$	4.0
Surface Area, ft^2	100

Table 6-12 SUMMARY OF EXPECTED EFFLUENT QUALITY

Constituent	Units	30-Day Average	7-Day Average	Maximum Daily	Instantaneous Maximum
Settleable matter	ml/l/hr	0.1	-	-	0.2
BOD (5-day)	mg/l	30	45	60	-
Suspended solids	mg/l	30	45	60	-
Grease and oil	mg/l	10	20	-	-
Chlorine residual	mg/l	-	-	-	0.0
Coliform (mean)	MPN/100	200	400		

Toxicity - survival test organisms in 96-hour bioassay
90% of not less than 50% survival

DETAILED ESTIMATE OF COST FOR PROPOSED PROJECT

A summary of estimated costs for the Southern Marin subregion are presented in Table 6-13. Additional costs for wet weather treatment facilities required under Maintenance Level B, as developed in Chapter 5, are included in the table. Capital costs of additional facilities required for Maintennce Level A would be 4.54 million dollars additional or about 25 percent of the entire project. The additional costs required by Maintenance Level A provide for treatment of large storm flows which occur only infrequently. Since the outfall locations in Southern Marin provide excellent dilution capability, infrequent bypassing of diluted wet weather flows allowed under Maintenance Level B should not be detrimental to the water quality of San Francisco Bay.

Detailed project costs for the four treatment facilities are presented in the following tables. Costs are estimated on the basis of 1978 dollar value and costs escalated to assumed 1979 construction year on the basis of a 10 percent increase.

Project Costs Versus Local Funding Needs

State and Federal grant regulations restrict grant funding to that project capacity needed to serve populations as projected by the State Department of Finance Series D-100 curves. For wastewater treatment plant construction, grant eligible costs are further limited to capacities to meet 10-year projected needs. The subaggregation of DOF Series D-100 projections for the Southern Marin service area in comparison with project design population capacity is summarized in Table 6-18.

Grant regulations are such that the cost for increased capacity beyond that needed for the State Department of Finance (DOF) Series D-100 projections will be borne by the local sewering agencies on the basis of 100 percent of the incremental increase in project costs. It will not be possible to determine the cost for wastewater treatment plants having a capacity to serve the DOF Series D-100 projected 1988 population. This determination could only be made on the basis of actual design and obtaining of construction bids for two plants with corresponding capacities, as noted above. However, an estimate can be made on the assumption that capital costs increase at a rate of 0.7 power of capacity, which is represented by the slope of generally accepted cost curves for this type of work. It should be noted that actual incremental cost increases will be determined from final estimates of each individual process unit, as agreed upon with State Water Resources Control Board Staff. For preliminary planning purposes, the factor for computing the fraction of costs eligible for grant participation is presented in Table 6-18. An example calculation for the City of Mill Valley;

$$\text{Eligible cost factor} = \left(\frac{\text{DOF D-100}}{\text{Design Popul.}}\right)^{0.7} = \left(\frac{19,401}{21,000}\right)^{0.7} = 0.95$$

Using the factors presented in Table 6-18, the estimated grant participation and local funding needs are summarized in Table 6-19.

Table 6-13 SOUTHERN MARIN SUBREGION ESTIMATED PROJECT COST[a]

Item	Size	Cost
1978 Construction		
Sausalito-Marin City treatment and outfall	1.5 mgd	$ 3,300,000
Wet weather facilities Maintenance Level B[b]		-0-
Mill Valley treatment expansion	2.6 mgd	5,760,000
Wet weather facilities Maintenance Level B		1,620,000
Trestle Glen treatment	0.2 mgd	460,000
Wet weather facilities Maintenance Level B		40,000
Sanitary District No. 5 treatment	0.9 mgd	2,590,000
Wet weather facilities Maintenance Level B		50,000
Main and Locust pump station modification		100,000
Salt Works pump station modification		120,000
Ricardo Road pump station modification		90,000
Equalization at Mill Valley		150,000
Force main extension Salt Works to Ricardo Road	12 inch	185,000
Force main Ricardo Road to Mill Valley	14 inch	385,000
Force main and outfall Mill Valley to Raccoon Straits	30 inch	4,126,000
TOTAL 1978 CONSTRUCTION		$18,976,000
1988 Construction		
Trestle Glen treatment modification		$ 50,000

[a]ENR = 3800. Includes contingency and engineering
[b]Wet weather treatment costs for Maintenance Level B San Francisco Bay Basin Plan - Costs for Maintenance Levels A&C presented in Chapter 5

Table 6-14 PRELIMINARY CONSTRUCTION COST ESTIMATE PROPOSED PROJECT SAUSALITO-MARIN CITY TREATMENT FACILITIES

Estimated	Access causeway	$ 250,000
Estimated	Site protection during construction	175,000
Estimated	Foundation preparation	50,000
350 c.y.	Foundation concrete	52,000
1,400 c.y.	Structural concrete, in place	490,000
2 only	Secondary sedimentation tank mechanisms	80,000
3 only	Reactor feed pumps	15,000
2 only	Reactor mechanisms	40,000
51,000 c.f.	Reactor media	140,000
3 only	Secondary sludge pumps	12,000
1 only	Sludge thickener mechanism	25,000
2 only	Sludge pumps	10,000
1 lot	Sludge degritting system	10,000
1 lot	Digester heating & mixing systems	50,000
1 only	Digester sludge dewatering filter	30,000
Estimated	Process pipework	270,000
Estimated	Standby power additions	50,000
1 lot	Miscellaneous ironwork	36,000
Estimated	Chlorination/dechlorination system modification	80,000
Estimated	Control house, laboratory and appurtenances	90,000
Estimated	Connections and revisions to existing work	85,000
Estimated	Electrical work & instrumentation	200,000
300 L.F.	30-inch outfall	100,000
300 L.F.	30-inch diffuser section	40,000
	Sub-total, Construction Costs	$2,540,000
	Escalation to Construction Year (1979)	250,000
	Technical Services	250,000
	Legal & Fiscal	10,000
	Administrative	5,000
	Project Contingencies	245,000
	ESTIMATED PROJECT COSTS	$3,300,000

Table 6-15 PRELIMINARY CONSTRUCTION COST ESTIMATE PROPOSED RICHARDSON BAY SANITARY DISTRICT TRESTLE GLEN TREATMENT PLANT

Plant Improvements		
1 lot	Headworks equipment	$ 10,000
1 lot	Aeration equipment	10,000
1 lot	Digester heating and mixing equipment	40,000
1 lot	Sludge dewatering equipment	50,000
1 lot	Piping and misc. ironwork	20,000
1 lot	Odor control equipment	50,000
1 lot	Wet weather chemical feed equipment	15,000
Estimated	Control building enlargement	40,000
Estimated	Emergency power	20,000
Estimated	Electrical work	25,000
Estimated	Painting	15,000
Estimated	Media filters	45,000
	Subtotal	$340,000
Effluent Pumping Station		
Estimated Effluent Pumping Station Complete		40,000
	Subtotal Construction Cost	$380,000
	Escalation to Construction Year (1979)	40,000
	Technical Services	40,000
	Legal & Fiscal	3,000
	Administrative	2,000
	Project Contingencies	35,000
	ESTIMATED TOTAL PROJECT COST	$500,000

Table 6-16 PRELIMINARY CONSTRUCTION COST ESTIMATE PROPOSED PROJECT CITY OF MILL VALLEY TREATMENT FACILITIES[a]

Item	Cost
Headworks and pumping	$1,650,000
Aerated grit removal	150,000
Control building and laboratory	260,000
Primary sedimentation modifications including odor control	195,000
Wet weather clarifier modification and additions	270,000
Chemical addition equipment	115,000
Biofilter and recirculation pumping	775,000
Secondary clarifiers	650,000
Microstrainer additions	200,000
Wet weather equalization basin	115,000
Digester and dewatering modifications	230,000
Chlorination-dechlorination	240,000
Wet weather filtration facilities	510,000
Effluent pump station	380,000
Site work and landscaping	50,000
SUBTOTAL CONSTRUCTION COST	$5,790,000
Escalation to Construction Year 1979	580,000
Technical Services	580,000
Legal & Fiscal	5,000
Administrative	5,000
Project Contingencies	570,000
TOTAL CAPITAL COST	$7,530,000

[a]ENR = 3800 includes wet weather facilities for Maintenance Level B

Table 6-17 PRELIMINARY CONSTRUCTION COST ESTIMATE PROPOSED SANITARY DISTRICT NO. 5 TREATMENT FACILITIES

Item	Costs
Excavation and retaining wall	$ 300,000
Aeration and clarifier structure	575,000
Aeration basin mechanical	95,000
Secondary clarifier—mechanical	100,000
Return sludge pumping	65,000
Blower room mechanical	50,000
Chlorine contact basin and feed equipment	105,000
Wet weather chemical feed equipment	40,000
Anaerobic digester	155,000
Sludge dewatering modifications	65,000
Standby power	50,000
Modification to existing plant	30,000
Control building additions	50,000
Painting and sitework	50,000
Piping	150,000
Electrical and instrumentation	150,000
SUBTOTAL CONSTRUCTION COST	$2,030,000
Escalation to Construction Year 1979	200,000
Technical Services	200,000
Legal & Fiscal	5,000
Administrative	5,000
Project Contingencies	200,000
TOTAL CAPITAL COST	$2,640,000

[a]Wet weather Maintenance Level B

Table 6-18 COMPARISON OF DEPARTMENT OF FINANCE SERIES D-100 POPULATION PROJECTIONS AND PROPOSED DESIGN CAPACITY PROJECTIONS FOR SOUTH MARIN

	For Design Year 1988		
Service Area	DOF Series D-100 Projections	Design Capacity Projections	Grant Eligibility Factor[1]
Richardson Bay SD	10,427	9,900	1.00
Mill Valley	19,401	21,000	0.95
Sausalito-Tam. Valley	15,980	18,250	0.91
Tiburon	6,645	8,750	0.82
Combined outfall[2]	36,473	39,650	0.94
Totals	88,926	97,550	

[1]Formula $a^{0.7}/b^{0.7}=c$

a = D-100 population projection
b = local agency population projection
c = grant eligibility factor

[2]Mill Valley, Tiburon, and Richardson Bay.

Table 6-19 SUMMARY OF LOCAL FUNDING NEEDS FOR SOUTHERN MARIN WASTEWATER MANAGEMENT PROGRAM[a]

Project	Total Cost	Grant Eligible Amount[b]	Grant Amount[c]	Local Cost
Sausalito-Marin City SD				
Treatment plant	$ 3,300,000	$ 3,000,000	$ 2,625,000	$ 675,000
Main and Locust pump station	100,000	91,000	80,000	20,000
Sanitary District No. 5	2,640,000	2,164,000	1,894,000	746,000
Mill Valley				
Treatment plant	7,380,000	7,011,000	6,135,000	1,245,000
Equalization storage	150,000	143,000	125,000	25,000
Richardson Bay Sanitary District				
Trestle Glen treatment plant	500,000	500,000	438,000	62,000
Salt Works pump station	120,000	120,000	105,000	15,000
Ricardo Road pump station	90,000	90,000	79,000	11,000
Force main-Ricardo Rd. to Mill Valley	385,000	385,000	337,000	48,000
Force main extension Salt Works to Ricardo Road	185,000	185,000	162,000	23,000
Force main and outfall-Mill Valley to Tiburon	4,126,000	3,892,000	3,405,000	721,000
Total	$18,976,000	$17,581,000	$15,385,000	$3,591,000

[a]ENR 3800 mid-1979 dollars, the construction mid-point
[b]Based upon grant eligibility factors developed in Table 6-12
[c]87.5% of grant eligible costs

IMPLEMENTATION SCHEDULE

The present studies, together with the separate Environmental Impact Report/Statement, as well as Financing/Administration Study, constitutes the required facilities planning, Step 1, pursuant to the state and federal grant regulations.

Implementation of the proposed project will be carried forward in accordance with a time schedule to be modified, approved, and included in the revised NPDES Permit for waste discharge.

A list of suggested implementation steps for preliminary planning purposes is set forth in Table 6-20.

In connection with the implementation steps shown in Table 6-20, it should be noted that numerous institutional agreements and approvals, in addition to those related to the two major participating agencies, will be required. These approvals begin with the San Francisco Bay Conservation and Development Commission (BCDC), and U. S. Corps of Engineers, as well as Regional Water Quality Control Board, Association of Bay Area Governments (ABAG), State Lands Commission, and numerous other agencies, whose approval of various elements of the project must be obtained.

INSTITUTIONAL MEANS OF CONSTRUCTING AND OPERATING PROPOSED PROJECT

The recommended institution arrangements in South Marin are discussed in the attached Financing Plan.

OPERATION AND MAINTENANCE PROGRAM

The financing plan following this chapter has recommended that a Joint Powers Authority (JPA) construct, operate, and administer the regional sewerage project. The utilization of a JPA could allow for more efficient operation of the four treatment facilities. One function of the JPA could be a jointly owned wastewater testing laboratory. Presently each of the four agencies operating treatment facilities contract with private laboratories to perform many of their required tests. Each agency currently performs simpler tests such as settleable matter, turbidity, plant and dissolved oxygen, while only Mill Valley and Sanitary District No. 5 perform BOD tests.

Based on the current types and numbers of tests required of the four agencies and average testing costs for private labs, an estimate of private lab costs are presented in Table 6-21. In addition, costs incurred by the agencies for sample collection, transporting and reporting are estimated at $50,000 per year, for a total private lab estimate of $100,000.

Table 6-20 SUGGESTED IMPLEMENTATION STEPS FOR PROPOSED SOUTHERN MARIN PROJECT

Step	Work To Be Done
1	Receive revised NPDES Permit.
2	Complete and submit for SWRCB approval, Project Report, including EIR/EIS, together with Step 2 grant application.
3	Receive SWRCB Step 2 grant offer and approval
4	Complete institutional arrangements necessary to implement project.
5	Authorize commencement of final engineering Step 2 contract.
6	Submit all necessary construction permit applications to local, state and federal agencies.
7	Complete financing arrangement for project, including any necessary bond issues
8	Complete work of Step 2, final engineering, submit to SWRCB for final approval.
9	Receive SWRCB approval, authorize advertisement for project construction bids.
10	Receive all necessary local, state and federal construction permits.
11	Receive construction bids, commence construction.
12	Complete project construction.
13	Meet all NPDES Permit requirements.

Annual cost estimates for a jointly owned lab are also presented in Table 6-21. Based on one full-time and 2 part-time employees who would also pick up the samples and use a computerized reporting system, the jointly owned lab is estimated to cost $67,900 or two thirds of using the private labs. Therefore, the jointly owned lab appears to be cost effective and should be included as part of the apparent best alternative project.

The lab would likely be centrally located in either the Strawberry Shopping Center or Shelter Bay areas.

Estimated Operation and Maintenance Costs

Estimated annual operation and maintenance costs for the four treatment facilities and the outfall from Mill Valley to Raccoon Straits are shown in Table 6-22.

Staffing Requirements

Based on analysis of the federal Environmental Protection Agency Manual, "Estimating Staffing for Municipal Wastewater Treatment Facilities," staffing requirements for the various facilities have been estimated. If the joint lab concept is fully utilized, these staffing estimates may be adjusted downward.

Sausalito-Marin City - Treatment facilities are estimated to require 6,500 hours per year or 4.4 persons based on 1,500 hours per person per year. The 4.4 persons are in addition to those assigned to maintenance and operation of the Districts trunk sewers and lift stations. It appears that the existing five District employees could be supplemented by one additional staff member with maintenance capabilities.

The Clean Water Grant Regulations will require the plant superintendent to hold a Class III State Certification and all remaining plant operators to hold at least a Class I.

City of Mill Valley - Treatment plant expansion requires approximately 9,000 hours per year for operation, maintenance, laboratory, and supervision. Based on 1,500 hours per person per year, 6 operators would be required to operate the plant. Therefore, it would be necessary to add one additional operator when the new facilities are put into operation. Recommended staffing patterns would have the plant attended 16 hours per day during weekdays and 8 hours a day during weekends.

The Clean Water Grant Regulations classify the existing plant and the proposed expanded plant as a Class III facility and, therefore, the plant superintendent must hold a Grade III certificate and all other operators at least a Grade I.

Richardson Bay Sanitary District - Trestle Glen plant would be upgraded while remaining essentially the same size. Therefore, it is estimated that the existing staff size will be adequate for the proposed project. The plant is currently attended 8 hours per day 7 days a week.

Table 6-21 ANNUAL COST SUMMARY
SOUTHERN MARIN JOINT LABORATORY FACILITY

	Private Laboratory	Jointly Owned Laboratory
Collecting, transporting and reporting - by local agencies	$ 50,000	
Annual testing costs	50,000	
Total Annual Cost	$100,000	
Wages and benefits:		
1 lab technician		$ 15,000
2 part-time assistants		10,000
Employee benefits		6,000
Office expenses & supplies, computer		9,800
Building rent and maintenance		8,000
Lab equipment annual cost - 7%-10 yrs.		5,100
Automotive & reserve		8,000
Lab supplies		6,000
Total Annual Cost		$ 67,900

Table 6-22 SUMMARY OF ESTIMATED OPERATION AND MAINTENANCE COSTS FOR THE PROPOSED SOUTH MARIN WASTEWATER MANAGEMENT PROGRAM FOR 1978/88[a]

Facility	Operators[a]	Power	General Maintenance and Replacement	Laboratory	I/I Treatment[b]	TOTAL
Sausalito-Marin City Treatment Plant	106,000	42,000	50,000	12,000	5,000	215,000
Mill Valley Treatment Plant	111,000	52,000	90,000	20,000	35,000	318,000
Richardson Bay S.D. Trestle Glen Plant	80,000	20,000	10,000	10,000	3,000	123,000
Sanitary District No. 5 Treatment Plant	70,000	22,000	58,000	15,000	5,000	170,000
Outfall - Mill Valley to Raccoon Straits	10,000	-	5,000	5,000	-	20,000

[a]1978 dollars - inflation not included, does not include collection system O&M
[b]Maintenance Level B

Sanitary District No. 5 – Treatment facilities are currently operated by a staff of five persons including a Grade IV superintendent. These personnel also maintain the collection system and its 21 pump stations. The 1976–77 budget estimates that the treatment plant operation and maintenance accounts for 65 percent of the total staff time, or about 3.25 persons. The plant is currently attended 14 hours per day during weekdays and 8 hours per day on weekends.

Based on an analysis of the federal Environmental Protection Agency Manual, "Estimating Staffing for Municipal Wastewater Treatment Facilities," the proposed treatment additions would require approximately 6,500 hours per year for operation, maintenance, laboratory, and supervision. Based on 1,500 hours per person per year, 4.4 people would be necessary to operate the plant. Therefore, it would be necessary to add one additional operator when the new facilities are put into operation. The existing shift schedule will be adequate for the new facilities.

The new facilities will be classified as activated sludge 5 mgd or less and will require the plant superintendent to hold a Class III State Certification and the remaining operators a Class I.