HEAL THE OCEAN
OCEAN WASTEWATER DISCHARGE INVENTORY FOR THE STATE OF CALIFORNIA

Heal the Ocean divers inspect outfall © Jim Knowlton

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ABOUT HEAL THE OCEAN:

Heal the Ocean is a highly successful non-profit citizen's action group in Santa Barbara, California, with nearly 3,000 members. Since its formation in 1998, the organization has been using sophisticated technology (DNA, virus testing, GIS mapping), to pinpoint sources of ocean pollution, for the purpose of initiating and facilitating a halt to pollution practices. Heal the Ocean has also hired engineers, scientists, hydrologists and researchers to assess problem areas, to conduct testing, and to perform cost feasibility studies for better technological methods of handling human waste.

Heal the Ocean is the first environmental organization to conduct DNA studies in the environment (the group collaborated with Santa Barbara County Environmental Health Services to perform a DNA study of Rincon Creek in 1999). HTO has also initiated septic-to-sewer conversions in areas of Santa Barbara County where improperly placed septic systems are suspected of polluting the environment. The group is one of the first environmental organizations in the nation to conduct virus studies in the ocean, and to commission cost feasibility engineering studies for upgrading wastewater treatment plants to full tertiary capability.

In addition, Heal the Ocean staff and volunteers actively gather environmental facts by going out in the field with video cameras, and HTO divers have made video documentaries of sewer outfalls. The group successfully campaigned to end one of California's last 301(h) sewage waivers not only by hiring excellent lawyers and researchers, but by making a dive on the sewer outfall to show the Regional Water Quality Control Board what the sea looked like in the area of sewage deposition. Visit us on our website, at www.healtheocean.org.

ACKNOWLEDGMENTS

Heal the Ocean wishes to acknowledge the help of our 3,000 supporters, and in particular we thank the following for the wonderful financial generosity that makes our work possible: Jack & Kim Johnson, Brian & Laurence Hodges of the WWW Foundation, The Ann Jackson Family Foundation, Mr. & Mrs. Tom Crawford of The John G. Braun Charitable Annuity Trust, Adam & Kara Rhodes of the WWW Foundation, Yvon Chouinard, Thomas & Cynthia Dabney of The Christopher Foundation, Julia Louis-Dreyfus & Brad Hall of The Hall Charitable Fund, Patagonia, our numerous anonymous donors – and last but not least, the Groundswell Society and the wonderful surfers of the Rincon Clean Water Classic, who have been surfing every year to raise funds to aid in our fight to clean up one of the world's greatest surf breaks.

Hillary Hauser, executive director
Heal the Ocean

Heal the Ocean
Ocean Wastewater Discharge Inventory for the State of California

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Background:

There are 37 direct-to-ocean sewage outfalls discharging into the Pacific Ocean off the California coast – from the Oregon border to San Diego/Tijuana – that could affect the health of swimmers, surfers, windsurfers and divers, who consider their use of the ocean to be part of the California lifestyle. The following statistics are extracted from a four-month survey conducted by Heal the Ocean into the records of the state of California's Regional Water Quality Control Boards, NPDES permits, National Oceanic and Atmospheric Administration (NOAA) nautical charts, or direct telephone contact with the discharger or public works departments of the coastal cities included in this survey.

Over 1.5 billion gallons of sewage per day (dry weather flow) is discharged directly into the Pacific Ocean, as follows:

	Millions of gallons per day
North Coast (Mendocino to Crescent City)	10
San Francisco Region	27
Central Coast (Santa Cruz to Carpinteria)	70
Los Angeles Region (Oxnard to Terminal Island (including Avalon & San Clemente islands)	796
Orange County	320
San Diego Region	286
Total	1,509

Almost 44 billion tons of mass solids (sewage sludge) per year is deposited into the Pacific Ocean, as follows:

	Millions of tons per year
North Coast (Mendocino to Crescent City)	214
San Francisco Region	406
Central Coast (Santa Cruz to Carpinteria)	1,073
Los Angeles Region (Oxnard to Terminal Island (including Avalon & San Clemente islands)	15,000
Orange County	14,000
San Diego Region	13,300
Total	43,993

Of the 37 wastewater treatment facilities, 17 or 44% are discharging into the "surf zone" of the ocean – into waters 50 feet or less. In these areas, the likelihood of contact of sewage to humans recreating in the ocean is not only high but probable.

In some areas the sewage is discharged directly into the ocean waves (1.9 million gallons per day (mgd) in Crescent City, 0.17 mgd in Shelter Cove).

In the Central Coast (Region 3), the Ragged Point Inn dumps .013 mgd of sewage over a cliff!

The following short outfalls deposit secondary-treated sewage into the inshore, recreational zone of the ocean off California:

		Distance from shore	Depth of Water
Crescent City	1.9 mgd	Into waves	0’
Arcata	1.7 mgd	Marsh channel (tide takes it out)	2’
Eureka	5.2 mgd	4,100 ft.	22’
Shelter Cove	.17 mgd	Into waves	0’
Fort Bragg	1.3 mgd	650 ft.	27’
Daly City	6.8 mgd	2,500 ft.	32’
Half Moon Bay	2.2 mgd	1,900 ft.	37’
Carmel/Pebble Beach	1.6 mgd	600 ft.	35’
Ragged Point Inn	.013 mgd	Cliff discharge	0’
San Simeon	.05-.1 mgd	600 ft.	20’
Avila/Port San Luis	.03 mgd	2,240 ft.	29’
Montecito	1.0 mgd	1,550 ft.	22’
Summerland	0.15 mgd	740 ft.	19’
Carpinteria	1.7 mgd	1,000 ft.	25’

Almost 24 million gallons per day of sewage goes into the ocean off California daily in 20 to 30 ft. of water or less, at a distance less than a mile from the shore.

Large sewage deposits are being made by sewage plants into waters only slightly deeper (40 to 50 ft. range), including:

		Distance from shore	Depth of Water
Cayucos/Morro Bay	1.4 mgd	2,900 ft.	50’
Pismo Beach	1.1 mgd	4,400 ft.	55’
Oxnard	21.0 mgd	5,280 ft.	48’

About 23 million gallons per day of sewage goes into the ocean daily in mid-waters only slightly deeper (40 to 50 ft. range).

The 37 ocean outfalls along the California coast are currently considered to be “meeting state standards,” because the current California Ocean Plan, which is the basis for the standards, is outdated, and inadequate to protect public health. The Ocean Plan needs revision to reflect the risks we now know wastewater discharges pose. Nor does the current Ocean Plan reflect any consideration for the increase in water sports throughout the state, which has occurred for many reasons – among which are a population increase, as well as technological equipment advances, such as wetsuits, that encourage more people into the water.

Current state standards by which the health of California's beaches is measured (namely, whether or not it is safe for people to recreate in the ocean) have been based on a bacteria standard, a measurement of the amount of total coliform, fecal coliform and enterococcus in seawater.

These "indicator bacteria" do not in themselves cause illness in humans, but as Heal the Bay (Santa Monica), points out in its explanation of the grading system it uses in its Beach Report Card program to guide ocean-users, a 1996 health effects study conducted by the University of Southern California under the direction of the Santa Monica Bay Restoration Project (SMBRP) established a direct connection between levels of these indicator bacteria and human illness).[1]

These illnesses include stomach flu, ear infection, upper respiratory infection and skin rash.

While measurements of these indicator bacteria may be helpful in determining healthfulness or non-healthfulness of swimming or surfing in the ocean on a given day, they are inadequate in two areas:

1) They do not pinpoint pollution sources. In particular, fecal coliform measurements cannot differentiate between birds, mammals, dogs, or humans. The measuring of pollution cannot take the place of eradicating that pollution.

2) Indicator bacteria can be absent when hepatitis A and enteric (coxsackie and polio) viruses are present. These viruses, which can only be present in human fecal matter, indicate a true health risk.

Heal the Ocean has conducted virus tests at a number of Santa Barbara County's most popular swimming beaches, on warm, sunny days when creeks are not running and when storm drains are not emptying, when indicator bacteria are absent and the beaches are earning an "A" grade – and the samples reveal the presence of both hepatitis A and enteric viruses. These samples were processed in the USC laboratory of Dr. Jed Fuhrman. (APPENDIX A)

The argument that these viruses were "not viable" (dead) is moot. Dead or alive (and the USC laboratory scientists say a dead virus cannot be measured), these viruses got into the ocean from human sources. Since the creeks were not running, the entry of these viruses into the ocean can, by logic, only be from 1) direct human deposition (homeless problem), 2) contaminated groundwater (perhaps from upstream septic systems or broken sewer pipes) flowing unseen into the sea, 3) illegal dumping of bilges from boats, or 4) sewage from sewage treatment plants.

In samples taken from the final settling ponds of two Santa Barbara-area sewage treatment plants, both hepatitis A and enteric viruses were detected, sometimes in very high concentrations, or "bands." These same viruses were detected in ocean water samples taken from nearby beaches. The tested sewage, about to be released into the ocean, had gone through full secondary treatment, meeting state standards for ocean disposal.

NOTE: Heal the Ocean makes it clear that its virus testing has not been systematic, nor has it ever been Heal the Ocean's intent to provide a regular virus testing service for the community. These tests were performed solely to determine if viruses are present in the ocean (indicating human pollution) on open, "Grade A" days, and more than once we found this to be the case.

Because many of California's sewer outfalls are depositing sewage in very shallow water – the recreational zone, where people swim – Heal the Ocean commissioned Dr. Howard Kator, an environmental microbiologist from Virginia, for a report on the human health aspects of coming into contact with secondary-treated sewage.

Information from Dr. Kator's report, "Concerns and risk factors associated with discharges of secondary treated sewage into very shallow coastal waters" (APPENDIX B), was included in the Natural Resources Defense Council (NRDC) "Swimming in Sewage" report presented to Congress in February 2004.[2]

"There is considerable evidence that exposure to polluted marine bathing waters results in an increased frequency of human disease symptoms (Henrickson et al. 2001)," Kator notes. "Most epidemiologic studies confirm that swimmers have an increased risk of disease compared with nonswimmers (Cabelli et al. 1983, Griffin et al. 2003). Disease symptoms include eye-ear, respiratory, gastrointestinal disorders and infrequently more serious conditions. Pathogens associated with outbreaks attributed to marine recreational waters have generally not been identified but are assumed to be viruses."[3]

The Beaches Environmental Assessment and Coastal Health (BEACH) Act has established an October 2005 deadline for states with coastal recreational waters to develop new water quality standards for bacteria. But as noted in the NRDC "Swimming in Sewage" report, two scientists (Rose and Katonik), state that "...viruses and protozoa have relatively long survival times and low infective doses (the smallest dose that can cause infection), whereas bacteria require a high infective dose."[4]

The NRDC report concludes that the long survival times and low infective dose of viruses and protozoa raise serious questions about reliance on bacterial standards as indicator of clean water. [5]

In its report, "Managing Wastewater in Urban Coastal Waters," the National Research Council reports, "The United States continues to have periodic outbreaks of hepatitis A from the consumption of shellfish from areas contaminated by sewage, even when bacterial standards are being met."[6]

The state of California cannot continue with the old standards when it is now known that the die-off, or inactivation, of human viral pathogens in seawater takes days, while the coliform bacteria used in testing for sewage contamination die-off is several hours. The bacteria standard may provide plant operators with a measure of plant performance, but is an inadequate indicator of contamination or risk to ocean users.

A recent World Health Organization (WHO) analysis (APPENDIX C) provides a simple qualitative chart of health risks related to different degrees of sewage treatment and types of discharges. This chart indicates that tertiary wastewater poses very low risks to humans, even with short outfalls (those discharging into body contact areas).

The WHO chart indicates that *very low health risks can also be obtained if sewer outfalls are extended beyond the shallow, inshore "recreational" zone – where people swim, surf or dive – to a minimum of a mile offshore, and/or a minimum depth of 60 feet of water.* In establishing safe depths and distance from shore, consideration must be given to local ocean conditions and the amount of sewage discharged.

Areas such as San Francisco, where there are combined storm drains (CSOs), large pulses of stormwater enter the sewerage system due to infiltration and inflow (I&I), and present human risks during rainy periods that are not present during dry periods due to wastewater systems being overwhelmed. The CSOs present a risk to both those actually using the water, as well as beach-goers and people on land downwind of the contaminated water, because studies have shown that infection is possible by breathing pathogens present in aerosols.

Building tertiary treatment plants, or adding capacity to existing plants to fully treat or store CSOs or I&I flows that are over plant capacity would involve an overlong process of individual site analysis, self-monitoring report review, hearings and perhaps cost feasibility studies on a case by case basis. Any panel considering a new Ocean Plan for the state of California should put this problem on its agenda for study.

In the meantime, to solve an immediate health threat to ocean users without adding a cost to the state of California (the minimal financial burden would be on the users of the wastewater facilities), wastewater treatment plants discharging into the shallow zone of the Pacific Ocean off California should be required to install longer sewer outfalls. Regulations establishing minimum distance from shore as one mile, and minimum depth of water, 60 feet, would not only solve the I&I and CSO problems, they would reduce the risk of ocean users coming into contact with sewage. Considering the WHO information, it can be assumed that a sewage discharge occurring more than a mile from shore reduces the human health risk category by more than 90% (from what it would be with a short outfall or discharge at the shoreline).

These statistics, in relation to the WHO information, indicate that 10 California wastewater discharges pose a high public health risk, 22 a medium risk, 3 a low risk, and 2 a very low risk. By most standards – especially for those who assume they can use the ocean of California without getting sick – these results are unacceptable.

Heal the Ocean believes that California coastal communities do not own the Pacific Ocean as their private disposal field. The time has come to bring practical and technological advances to wastewater treatment. Heal the Ocean has conducted cost/feasibility studies for tertiary treatment for the five wastewater treatment plants discharging into the ocean off Santa Barbara County, and has received cost estimates for sewer outfall extension. Both are affordable – less than most people pay for cable television.

References:

[1] Haile, R. W. et al, *An Epidemiological Study of Possible Adverse Health Effects of Swimming in Santa Monica Bay***,** Santa Monica Bay Restoration Project, 1996. 70 pp.

[2] N. Stoner, M Merkel, M. Dorfman, Natural Resources Defense Council, *Swimming in Sewage; The Growing Problem of Sewage Pollution and How the Bush Administration is Putting Our Health and Environment at* Risk, 2004. 75pp.

[3] Kator, H., *"Concerns and Risk Factors Associated with Discharges of Secondary Treated Sewage into Very Shallow Coastal Waters,"* Heal the Ocean, Santa Barbara, CA, May, 2003. 10 pp.

[4] Katonik and Rose, *The Beaches Environmental Assessment and Coastal Health (BEACH) Act*; *Adoption of coastal recreation water quality criteria and standards by states.* 2000. *p. 28.*

[5] N. Stoner, M Merkel, M. Dorfman, Natural Resources Defense Council, *Swimming in Sewage; The Growing Problem of Sewage Pollution and How the Bush Administration is Putting Our Health and Environment at* Risk, 2004. 75pp.

[6]Table 9.10, from "Monitoring Bathing Waters: A Practical Guide to the Design and Implementation of Assessments and Monitoring Programmes," Chapter 9: *Approaches to Microbiological Monitoring*. Spon Press, UK. 352 pp. © 2000 World Health Organization (WHO).

CALIFORNIA OCEAN WASTEWATER DISCHARGE INVENTORY

Discharger, Wastewater Treatment and Volume, Discharge Location

For
Heal the Ocean
Santa Barbara, California

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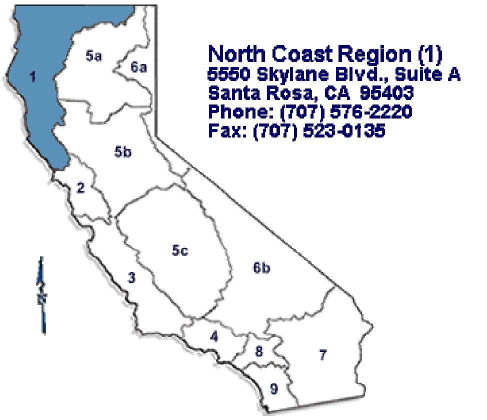
REGIONAL WATER QUALITY BOARD REGIONS WITH OCEAN DISCHARGES

Region 1



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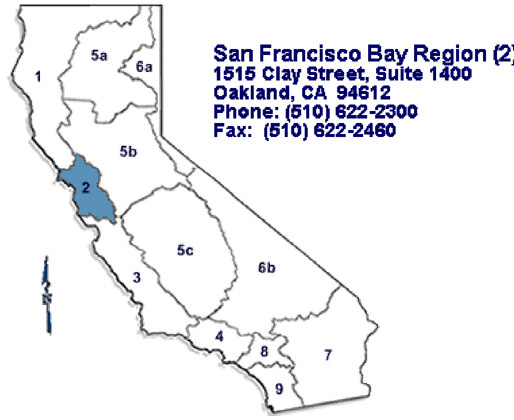

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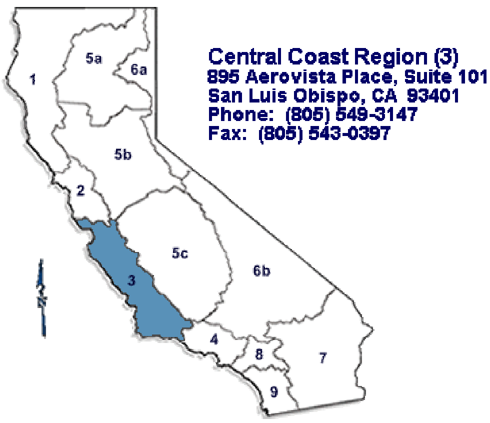

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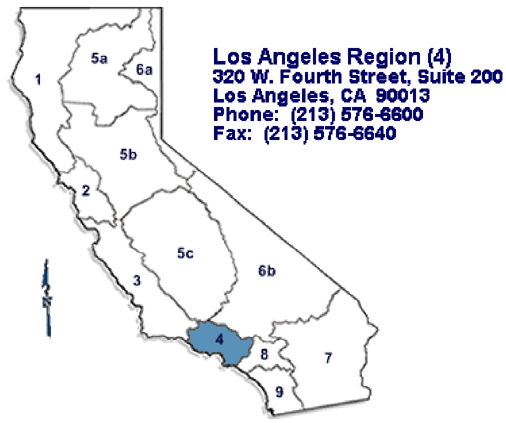

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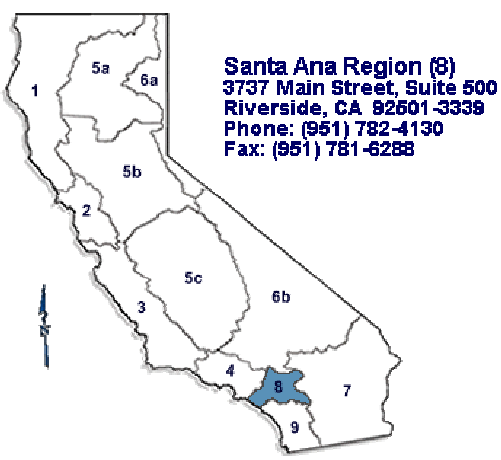

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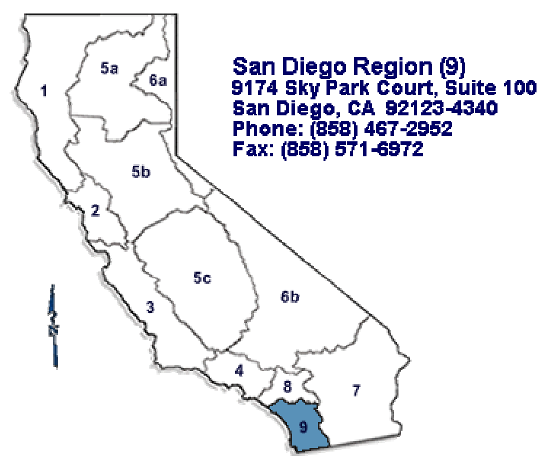

NORTH COAST REGION 1:

Crescent City

Arcata
Eureka
College Of The Redwoods

Shelter Cove

Fort Bragg
Mendocino

SAN FRANCISCO REGION 2:

San Francisco
Daly City
Half Moon Bay

NORTH COAST REGION (1) OCEAN DISCHARGER SUMMARY INFORMATION

DISCHARGER (NPDES NO.)	TREATMENT PROCESSES	WASTEWATER CHARACTERISTICS			DISCHARGE LOCATION		COMMENTS
		MASS SOLIDS LOAD (m tons/yr)	MAX DESIGN FLOW (MGD)	AVG DRY WEATHER FLOW (MGD)	DISTANCE FROM SHORE (Feet)	WATER DEPTH (Feet)	
Crescent City[1] (CA0022756)	Secondary with disinfection	39	1.9	1.9	"Short outfall"	0	Plant near hydraulic and organic capacity
Arcata[2] (CA002271)	Secondary and oxidation lagoons with disinfection	35	2.3	1.7	Humboldt Bay Discharge	2 Marsh Channel	Treatment includes artificial wetlands; tide takes wastewater into Humboldt Bay
Eureka[3] (CA0024449)	Blend of disinfected secondary with primary	108+	8.6	5.2	4100	22	Discharges without disinfection of primary effluent occur due to high inflow and infiltration.
Shelter Cove[4] (CA0023027)	Secondary with disinfection	4	0.77	0.17	Surf zone	0	
Fort Bragg[5] (CA0023078)	Secondary with disinfection	27	2.2	1.3	650	27	Options for eliminating wet weather problems are being evaluated
Mendocino[6] (CA0022870)	Tertiary with disinfection	1	0.3	0.05	996	<20	Tertiary effluent reused except when irrigation isn't needed

Municipalities or agencies discharging wastewater through the noted outfall include:
1. Crescent City and unincorporated Del Norte County areas
2. City of Arcata and the Glendale area
3. Greater Eureka area
4. 850 residential units plus commercial and public facilities
5. Fort Bragg Municipal Improvement District
6. City of Mendocino

SAN FRANCISCO BAY REGI0N (2) OCEAN DISCHARGER SUMMARY INFORMATION

DISCHARGER (NPDES NO.)	TREATMENT PROCESSES	WASTEWATER CHARACTERISTICS			DISCHARGE LOCATION		COMMENTS
		MASS SOLIDS LOAD (m tons/yr)	MAX DESIGN FLOW (MGD)	AVG DRY WEATHER FLOW (MGD)	DISTANCE FROM SHORE (Feet)	WATER DEPTH (Feet)	
San Francisco[1] (CA 0037681)	Secondary for up to 43 MGD, then primary until the system capacity is reached. Flows below capacity are discharged through the SWOO ocean outfall, while those above capacity are discharged from the shoreline after some screening and solids settling. .	271	43 (secon.), 65 (second. and primary blend)	18	19,800 (SWOO ocean outfall)	87	During wet weather about 87% of the combined wastewater and stormwater, that is a blend of primary and secondary effluents without disinfection, is discharged from the outfall. About 13 % of the time, essentially untreated wastewater that is not disinfected is discharged at 7 shoreline locations at China, Baker, Ocean, and Funston recreation beaches, and Mile Rock Bluff.
Daly City[2] (CA0037737)	Secondary with disinfection	102	25	6.8	2,500	32	
Half Moon Bay[3] (CA0038598)	Secondary	33	15	2.2	1,900	37	Discharges directly to the Monterey Bay National Marine Sanctuary

Municipalities or agencies discharging wastewater through the noted outfall include:
1. City and County of San Francisco
2. Daly City, Town of Colma, and portions of San Mateo County
3. City of Half Moon Bay, and Montara and Granada Sanitary Districts

CENTRAL COAST REGION

Santa Cruz
Watsonville
Monterey Regional
Carmel/Pebble Beach

Ragged Point
San Simeon

Cayucos/Morro Bay

Avila/Port San Luis
Pismo Beach

Goleta
Santa Barbara
Montecito
Summerland
Carpinteria

CENTRAL COAST REGI0N (3) OCEAN DISCHARGER SUMMARY INFORMATION

DISCHARGER (NPDES NO.)	TREATMENT PROCESSES	WASTEWATER CHARACTERISTICS			DISCHARGE LOCATION		COMMENTS
		MASS SOLIDS LOAD (m tons/yr)	MAX DESIGN FLOW (MGD)	AVG DRY WEATHER FLOW (MGD)	DISTANCE FROM SHORE (Feet)	WATER DEPTH (Feet)	
Santa Cruz[1] (CA0048194)	Secondary with disinfection	123	17	9.1 (2002)	5,280	110	
Watsonville[2] (CA0048216)	Secondary	113	12	7.5 (2000-2002)	7,350	64	Discharges to the Monterey Bay National Marine Sanctuary (MBNMS)
Monterey Regional[3] CA0048551)	Secondary	214	30	29.6 (2001)	8,400	100	52% of wastewater treated is recycled. Treats Pacific Grove dry weather urban runoff. Discharges to the MBNMS
Carmel/ Pebble Beach[4] (CA0047996)	Secondary with disinfection	24	3	1.6 (2001)	600	35	17% of wastewater treated is recycled. Discharges to the MBNMS and the Carmel Bay ABS
Ragged Point Inn (CA0049417)	Secondary	0.2	0.015	0.013	Cliff discharge		Proposes to disinfect and reuse wastewater to minimize cliff discharges to MBNMS
San Simeon (CA0047961)	Secondary with disinfection	1.6	0.2	0.05-0.1 (2002)	600	20	Chemical toilet waste disposal. Discharges in the MBNMS
Cayucos/Morro Bay (CA0047881)	Primary and secondary blended with disinfection	21	2.4	1.4 (2002)	2,900	50	Secondary treatment given to about 1 MGD, remainder is given primary treatment before mixing with secondary effluent
Avila/Port San Luis[5] (CA0047830)	Secondary with disinfection	0.5	0.2	0.03 (2003)	2,240	29	
Goleta[8] (CA0048160)	Primary and secondary blended with disinfection	282	9.0 4.4 sec. 4.6 pri.	4.8 (2001)	5,800	90	An upgrade to full secondary treatment is planned under a settlement for 2014.

Santa Barbara (CA0048143)	Secondary with disinfection	176	11	8.5 (2001-2003)	8,720	70	Up to 4.3 MGD can be recycled. I&I problems
Montecito (CA0047899)	Secondary with disinfection	21	1.5	1.0 (2001)	1,550	22	
Summerland (CA0048054)	Secondary with disinfection	3	0.3	0.15 (2003)	740	19	"Tertiary" except when filters are being changed
Carpinteria (CA0047364)	Secondary with disinfection	35	2.5	1.7 (2000)	1,000	25	

Municipalities or agencies discharging wastewater through the noted outfall include:

1. Santa Cruz, City of Scotts Valley
2. Watsonville, Freedom, Salsipuedes, and Pajaro Sanitation Districts
3. Monterey, Pacific Grove, Del Rey Oaks, Sand City, Seaside, Salinas, Former Fort Ord, Boronda, Castroville, Moss Landing
4. Carmel by the Sea, Pebble Beach, Carmel Highlands, Highland Inn
5. Avila Beach, Port of San Luis, State Parks
6. Pismo Beach
7. Arroyo Grande, Oceano, Halcyon, Grover Beach
8. Goleta, UC Santa Barbara, portion of Santa Barbara County, Santa Barbara Municipal Airport.

REGIONS 4, 8 and 9:

Oxnard
Hyperion (LA City)
JWPCP (LA County)
Terminal Island (LA City
Orange County
AWMA (Aliso Creek)
SERRA (San Juan Creek)
Avalon, Catalina Island
Oceanside
Carlsbad
Encina
San Clemente Island
San Diego Point Loma
San Diego South Bay /Tijuana B.C.

LOS ANGELES REGI0N (4) OCEAN DISCHARGER SUMMARY INFORMATION

DISCHARGER (NPDES NO.)	TREATMENT PROCESSES	WASTEWATER CHARACTERISTICS			DISCHARGE LOCATION		COMMENTS
		MASS SOLIDS LOAD (m tons/yr)	MAX DESIGN FLOW (MGD)	AVG DRY WEATHER FLOW (MGD)	DISTANCE FROM SHORE (Feet)	WATER DEPTH (Feet)	
Oxnard[1] (CA0054097)	Secondary	224 (2000)	32	21	5,280	48	
Hyperion[2] (LA City) (CA0109991)	Secondary	7,400 (2002)	450	425	26,525	187	2 additional outfalls used in emergencies. Some wastewater reclaimed and reused. Plant treats dry weather storm water runoff
JWPCP[3] (LA County) (CA0053813)	Blended primary and secondary with disinfection	7,390 (2003)	350	320	10,000	200	Discharged effluent in 2003 met secondary TSS and BOD requirements. Not clear when the JWPCP discharges blended primary and secondary effluent
Terminal Island[4] (LA City) (CA0053856)	Tertiary with disinfection	22 (2000)	60	30	Into LA Outer Harbor		This plants treats wastewater from domestic sources and heavy industry. Reuse is being practiced
Avalon[5] (CA0054372)	Secondary	11 (2000)	1.2	0.6	400	130	
San Clemente Island (CA110175)	Secondary	0.15 (2000)	?	0.02	?	?	?= data not found. WTP treats wastes from a US Navy Auxiliary Landing Field

Municipalities or agencies discharging wastewater through the noted outfall include:

1. City of Oxnard
2. Communities of Los Angeles, Beverly Hills, San Fernando, W. Hollywood, Santa Monica, Inglewood, Universal City, Alhambra, Pasadena, S. Pasadena, Culver City, and El Segundo
3. Los Angeles County in the RWQCB 4 watershed except cities discharging to the Hyperion or Terminal Island WTPs
4. Terminal Island in the Los Angeles-Long Beach Harbor, communities of Wilmington, San Pedro and a portion of Harbor City.
5. City of Avalon on Catalina Island

SANTA ANA REGI0N (8) OCEAN DISCHARGER SUMMARY INFORMATION

DISCHARGER (NPDES NO.)	TREATMENT PROCESSES	WASTEWATER CHARACTERISTICS			DISCHARGE LOCATION		COMMENTS
		MASS SOLIDS LOAD (m tons/yr)	MAX DESIGN FLOW (MGD)	AVG DRY WEATHER FLOW (MGD)	DISTANCE FROM SHORE (Feet)	WATER DEPTH (Feet)	
Orange County[1] (CA0110604)	Blended primary and secondary with disinfection	14,000 (2002)	516	320	23,780	195	*9/10/04 Draft Order* requires upgrading treatement to full secondary with nitrification to remove ammonia toxicity

Municipalities or agencies discharging wastewater through the noted outfall include:

1. Communities of Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Long Beach, Rossmore/Los Alamitos, Newport Beach, Orange, Placentia, Santa Ana, Seal Beach, Stanton, Sunset Beach, Tustin, Villa Park, Westminster

SAN DIEGO REGION (9) OCEAN DISCHARGER SUMMARY INFORMATION

DISCHARGER (NPDES NO.)	TREATMENT PROCESSES	WASTEWATER CHARACTERISTICS			DISCHARGE LOCATION		COMMENTS
		MASS SOLIDS LOAD (m tons/yr)	MAX. DESIGN FLOW (MGD)	AVG DRY WEATHER FLOW (MGD)	DISTANCE FROM SHORE (Feet)	WATER DEPTH (Feet)	
AWMA[1] (CA0107611)	Secondary with disinfection	200 (2000)	32.2	17.6	6,700	170	
SERRA[2] (CA0107417)	Secondary with disinfection	285 (2000)	30.0	18.7	10,334	100	
Oceanside[3] (CA0107433 , CA0108031) and (CA0109347)	Secondary without disinfection, and some disinfected tertiary	80 (2000)	27.6	12.3	8,050	102	Discharges may be impacting shellfish harvesting and body contact sport uses
Encina[4] (CA0107395)	Secondary or better	284 (2000)	38.0	22.9	7,000	135	Discharges may be impacting shellfish harvesting and body contact sport uses
San Elijo[5] (CA0107981 & CA0107999)	Secondary and tertiary	45 (2000)	20.2	15.0	6,800	110	
Point Loma[6] (CA0107409)	Chemical assisted primary	9,850 (2003)	240	170 (2003)	23,760	310	
South Bay [7] (CA0108928) & (CA010945)	IWTP- Chemical assisted primary	2,572 (2003)	25	25 (2003)	18,500	93	The International plant (IWTP) will go to full secondary within 4 years under a Dec. 6, 2004 agreement.
	SBWRP-Secondary and tertiary	22.1 (2003)	15	4.1 (2003)			

Municipalities or agencies discharging wastewater through the noted outfall include:

1. Laguna Niguel, Lake Forest, Laguna Beach, Irvine
2. Capistrano Beach, Dana Point, San Clemente, Santa Margarita, San Juan Capistrano
3. Oceanside, Oceanside Vista, Fallbrook, Camp Pendleton
4. Carlsbad, San Marcos, Vista, Leucadia
5. Escondido, Cardiff by the Sea
6. San Diego, Del Mar, El Cajon, Lakeside, National City, Chula Vista, Coronado, Imperial Beach
7. San Ysidro, Chula Vista, Imperial Beach, Tijuana B.C.

APPENDICES

APPENDIX A
Heal the Ocean Virus Testing
Conducted in the laboratory of Dr. Jed Fuhrman, USC

Summer 2001

Beach Location	Hepatitis A	Enteric Viruses
Arroyo Burro Beach	Yes	No
Arroyo Burro Creek	No	No
Butterfly Beach	Yes	No
Carpinteria State Beach	No	No
El Estero sewage treatment plant	No	Yes
Goleta Beach	No	Yes
Goleta Sanitary District	No	Yes
Goleta Slough	No	No
Hope Ranch Beach	No	No
Leadbetter Beach	Yes	Yes
Summerland Beach	Yes	No

Fall 2000

Beach Location	Hepatitis A	Enteric Viruses
Arroyo Burro Beach	No	No
Butterfly Beach	No	No
Carpinteria State Beach	No	No
El Estero sewage treatment plant	Yes	Yes
Goleta Beach	No	No
Leadbetter Beach	No	No
Summerland Beach	No	No

Summer 2000

Beach Location	Hepatitis A	Enteric Viruses
Arroyo Burro Beach	No	No
Butterfly Beach	Yes	No
Carpinteria State Beach	Yes	No
East Beach at Mission Creek	Yes	No
Goleta Beach	No	No
Hope Ranch Beach	No	No
Leadbetter Beach	No	No
Summerland Beach	Yes	No

Winter 1999

Beach Location	Hepatitis A	Enteric Viruses
Arroyo Burro Beach	No	Yes
Butterfly Beach	No	Yes
Carpinteria State Beach	No	Yes
East Beach at Mission Creek	No	Yes
Goleta Beach	No	No
Hope Ranch Beach	No	No
Las Palmas Creek (Hope Ranch)	No	No
Leadbetter Beach	No	No
Summerland Beach	No	Yes

Fall 1999

Beach Location	Hepatitis A	Enteric Viruses
Arroyo Burro Beach	No	No
El Estero sewage treatment plant	Yes	Yes
Goleta Sanitary District	No	Yes
Goleta Beach East	Yes	No
Goleta Beach West	No	Yes
Hope Ranch Beach	No	No
Las Palmas Creek (Hope Ranch)	Yes	No
Leadbetter Beach	Yes	Yes
East Beach at MissionCreek	No	Yes

APPENDIX B

Brief report identifying issues of concern related to the discharge of secondary and tertiary treated sewage into shallow coastal waters used for recreational purposes

Howard Kator
Environmental Microbiologist
119 Rich Neck Road
Williamsburg, VA 23185

5-16-03

Hilary Hauser
HEAL THE OCEAN
P.O. Box 90106
Santa Barbara, California 93190

Dear Hilary:

Appended is a brief report identifying issues of concern related to the discharge of secondary and even tertiary treated sewage into shallow coastal waters used for recreational purposes. I hope this report meets your expectations and will be useful in HEAL THE OCEAN's continuing efforts to involve people and improve coastal water quality.

Sincerely,

Howard Kator
Environmental Microbiologist
119 Rich Neck Road
Williamsburg, VA 23185

Title: Concerns and risk factors associated with discharges of secondary treated sewage into very shallow coastal waters.

Introduction

Worldwide, domestic wastewater discharges represent one of the most significant threats to the coastal oceans. The majority of the world's populations live along the coasts where sewage is discharged untreated. From a public health perspective, continued emphasis on better treatment of sewage for discharge into estuarine and marine environments remains a costly but essential societal obligation.

Domestic sewage contains pathogenic microorganisms that can cause serious human diseases. Sewage contamination of fresh and marine waters is a means whereby disease causing microorganisms can be transmitted to people engaged in recreational activities or through consumption of edible filter-feeding shellfish. The United States is among those nations whose coastal waters do not generally receive untreated municipal sewage discharges.

Although sewage treatment in the United States has significantly eliminated many debilitating waterborne diseases (e.g., cholera, typhoid fever), sewage also contains a myriad of chemical toxicants including heavy metals, a variety of household organic chemicals including pesticides and petroleum hydrocarbons, and other chemicals contained in soaps, cosmetic preparations, as well as common everyday pharmaceuticals (pharmaceuticals and personal care products or PPCPs) whose effects on marine life are not well understood and until recently unrecognized (National Research Council 1999). Many of these chemicals pass through sewage treatment facilities unscathed and are known to be endocrine disrupters of aquatic animals. Compounds of concern include the nonylphenols, extremely pervasive compounds found in plastics, pesticides, and other industrial and domestic detergents. Natural and synthetic human estrogens (birth control pills) excreted in human urine may interfere with the developmental physiology and reproduction of aquatic marine organisms. As we learn more about these compounds, it is very likely that the costs of their disposal will be very high indeed.

Sewage also contains antibiotics (Halling-Sorensen et al. 1998) which can select for antibiotic resistant bacteria in the environment and bacterial viruses that carry antibiotic resistance and toxin genes (Miller 1998, Muniesa and Jofre 2000). Concerns relate to disease causing naturally-occurring marine bacteria which incorporate these elements and become unresponsive to antibiotic therapy.

Protection of public health and the indigenous coastal biota are essential and recognized reasons to justify improved discharge quality or to minimize effects, effluent relocation to achieve greater dilution. Treatment to reduce nutrient loading to coastal waters is a second important benefit to prevent the occurrence of undesirable species and harmful algal blooms.

Pathogens. The introduction of human pathogens into marine/estuarine environments is a concern on both local and global scales. Enteric pathogens continue to pose significant risks to fishing, recreational bathing and shellfish-consuming populations (Henrickson et al. 2001, Griffin et al. 2003). Important disease causing waterborne pathogens include bacterial pathogens such as *Vibrio cholerae*, the shigellae and salmonellae, enteric viruses such as the caliciviruses (e. g., Norwalk agent) and hepatitis A, and protists such as *Cryptosporidium*. Many of these microorganisms have been responsible in recent years for disease outbreaks associated with exposure to marine and fresh waters.

The microbiological quality of coastal waters is directly affected by point sources such as sewage treatment plants, riverine discharge, storm derived runoff and possibly, contaminated ground water flow. The feces of marine mammals have been implicated in certain situations on the northwest coast of the United States as sources of indicator organisms. In recent years microbiological studies have demonstrated greater persistence of certain enteric pathogens in marine waters than previously recognized. Nutrient enrichment of coastal waters and sediment may provide conditions that prolong pathogen survival.

Many countries in the world discharge untreated or inadequately treated sewage into coastal waters. Population growth, landuse alterations, changes in animal populations, intensive agricultural practices, use of waste stabilization ponds, soil transport, and medical therapeutics are some factors which influence the kinds and properties of pathogenic enteric microorganisms transported to marine waters and their fates. Understanding relationships between landuse and the occurrence of fecal indicators and pathogens is an important goal for remediation of coastal waters.

Risk of disease at coastal bathing beaches. There is considerable evidence that exposure to polluted marine bathing waters results in an increased frequency of human disease symptoms (Henrickson et al. 2001). Numerous prospective epidemiologic studies have been conducted to quantify risk associated with exposure to recreational bathing (e. g., Cabelli et al. 1982, 1983; Kay et al. 1994) and to derive quantitative relationships with indicator microorganisms (Cabelli et al. 1983). The latter study is the basis for current EPA recreational water microbiological indicator criterion. Most epidemiologic studies confirm that swimmers have an increased risk of disease compared with nonswimmers (Cabelli et al. 1983, Griffin et al. 2003). Disease symptoms include eye-ear, respiratory, gastrointestinal disorders and infrequently more serious conditions. Pathogens associated with outbreaks attributed to marine recreational waters have generally not been identified but are assumed to be viruses. There is also some evidence to suggest certain pathogens associated with exposure to bathing waters may be passed from person to person. Illnesses associated with recreational waters of nonenteric etiology have been attributed to the staphylococci (Favero 1985: Charoenca and Fujioka 1991, 1995) and *Pseudomonas aeruginosa* (Seyfried and Cook 1984). Evidence presented suggests that sediments can be a reservoir for staphylococci and routine monitoring for this group has been proposed for recreational marine waters (Charoenca and Fujioka 1991). Monitoring for this group is not required and the presence or absence of staphylococci would not be reflected by the fecal coliform indicator.

Submerged swimmers can also be exposed to sewage-derived chemicals which can enter through the mouth, eyes, ears and nose. Recent studies using artificial skin have shown that toxic and other sewage-derived chemicals in the water can possibly enter the body through a process known as dermal adsorption (Moody and Chu 1995). Chronic exposure to chemicals through this mechanism could affect the immune system.

Factors which must be considered with regard to discharge of sewage into shallow coastal waters used for recreational purposes. Even in developed countries such as the United States, significant health risks have been attributed to beach exposure and the frequency of beach closures appears to have accelerated in recent years ((Henrickson et al. 2001)). The National Resources Defense Council (2001) reported a doubling of beach closings (fresh and marine) from 1999 to 2000. Causes of increased frequencies of beach closures are complex and may be related to population increases, beach usage, degree of sewage treatment, increased volumes of sewage discharge, changes in coastal water quality, runoff, climate changes and improved surveillance.

Dispersion of the sewage discharge plume. An obvious concern with coastal discharges is that they be situated in well characterized waters where the chance of pathogen transport (hence disease risk) into beach waters is minimized. The dispersal dynamics of a sewage plume are complex and subject to many hydrographic factors including dilution volume, stratification, surface and bottom currents, their seasonal directions, internal waves, seasonal and short-term wind directions, bottom topography, density and volume of effluent, and climate. These factors should be evaluated over the range of seasonal and climatic conditions which are normal to coastal environments. Adequate seasonal coverage is not only important because of environmental factors, but because some pathogens such as hepatitis A show seasonal patterns of occurrence. It is not unreasonable to assume that under certain conditions shallow water discharges such as those into Santa Barbara waters would move in the direction of bathing areas.

Published studies have shown that differences in density between the effluent and its constituents and surrounding waters will affect effluent fate and transport. Particle-associated viruses and bacteria would behave differently than buoyant components and could be deposited in sediment and later transported inshore by wave action. If the dispersion and dilution characteristics of the plume and the concentration of viruses in the effluent are known, predictions of viral concentrations bracketing a range of release efficiencies could be calculated, Dye or isotopic methods have been used to trace discharge plumes for modeling purposes. Biological (bacteria or virus) or chemical (fecal sterols) indicators can be used to study transport of microorganisms and to evaluate the influence of weather and wind patterns.

Effectiveness of sewage treatment and disinfection against some enteric viruses. Secondary sewage treatment utilizes microorganisms within the treatment plant to biochemically digest under favorable oxygen regimes settled sewage solids from the primary sedimentation step. Secondary treatment is expected to reduce biological oxygen demand (BOD) and suspended solids by 85-90%, and to remove 90-99% of coliform bacteria. This process generally can reduce the pathogenic bacterial and viral load by values which may range from 99 to 90%, respectively. Actual values vary and depend on a variety of factors such as plant design, processing time within the plant, loading, and disinfection contact times.

Treatment of sewage is not a stoichiometric process because the characteristics and composition of the material received varies, the volume, hence the holding time may be affected by weather conditions (i. e., significant precipitation events), environmental temperatures affect sewage treatment processes, and therefore the efficiency of pathogen removal may also be expected to vary. Departures from ideal conditions do occur and the quality of the effluent can fluctuate. Importantly, there is always a range of treatment efficiency with regard to bacterial and viral removal. Although laboratory studies with cell-culture adapted strains of hepatitis A can demonstrate effective removal through disinfection, similar studies have not been done with wild-type hepatitis viruses in actual effluents because of analytical limitations.

Secondary sewage treatment effluents are generally disinfected, usually with chlorine or UV light. One study has shown that ozone is an effective disinfectant for hepatitis A in the laboratory (Vaughn et al. 1990). There is considerable evidence that enteric viruses are differentially affected by disinfection (Seyfried et al. 1984, IAWPRC 1991). Viruses especially resistant to chlorine disinfection and UV include hepatitis A and norvoviruses such as Norwalk agent. Studies to evaluate a bacterial virus known as a male-specific bacteriophage, (which is similar in gross structure and size to hepatitis A virus) as a viral indicator show it present at comparatively high levels in secondary effluents after chlorination. By comparison, bacterial indicator concentrations were reduced to counts on the order of one magnitude or undetectable. Because the minimal infectious dose of viruses is assumed to be very low, disinfected effluent free of indicator bacteria provides a false sense of safety because the effluent can still contain infectious virus at comparatively high levels.

Tertiary treatment is a laudable goal for all ocean discharges because it raises the standard of effluent quality to a higher level than secondary treatment. Tertiary treatments can be focused on nutrient removal, such as reductions in phosphate and nitrogen levels or employ additional disinfection through UV or microfiltration.

Inadequacy of bacterial indicators and standards to reflect health risk. The basic rationale of the indicator concept is that it should reflect the presence of pathogens. When this concept was conceived in the early 1900's first applied to marine waters in the United States viral pathogens were not considered. In the years that followed bacterial standards were pressed into action by extension to also predict viral presence. Standardized methods for routine detection of viral pathogens in marine waters do not exist and viral presence is highly variable. A variety of "indicator" viruses have been studied as alternative indicators (IAWPRC 1991) but none thus far have been formally adopted for marine or recreational waters.

Numerous reports in the technical literature have shown that bacterial indicators such as the fecal coliform or the enterococci are poor or inappropriate predictors of viral pathogens (e. g., Jiang et al. 2001, Noble and Fuhrman 2001) owing to the protracted persistence of the latter and their resistance to disinfection. Many investigators have reported the presence of enteric viruses in waters meeting the more stringent water quality criterion for shellfish growing waters (Richards 1985). Recent studies using new molecular techniques to detect some enteric viruses support older studies showing that bacterial indicator densities are not predictive of viral presence (Griffin et al. 2003). Jiang et al. (2001) detected enteric adenoviruses in Southern California beach waters which at times did not exceed the water quality standard. Detection of adenovirus in southern California nearshore waters implies that other equally or more resistant enteric viruses are likely to persist in coastal waters. Adenoviruses can be ingested orally and are known to cause sore throat, diarrhea, fever and nausea. An approved routine laboratory test to detect hepatitis A virus is still unavailable. Monitoring STP effluents based on conventional bacterial indicators must therefore be used with caution to assess effluent quality as this provides no information on viral water quality.

The derivation and validity of the current federal water quality criterion used to assess and regulate the sanitary quality of marine recreational waters has been questioned (Fleisher 1991). The fact that the EPA criterion for marine waters is to apply universally to all US coastal waters seems a poor assumption given the observation that environmental conditions which influence pathogen and indicator persistence differ markedly by region. In general, the research community has shown that waters meeting coliform bacterial standards do not adequately reflect the health risks.

Other studies suggest that some bacterial indicators and pathogens when exposed to seawater enter a kind of dormant state but still remain viable and capable of causing disease (Roszak et al. 1984, Pommepuy et al. 1996, Caro et al. 1999). Microorganisms in this state are called viable-but-nonculturable (VBNC), meaning that they will not be detected using culture-based methods such as the approved total and fecal coliform MPN tests. An assessment of sanitary water quality populated with indicator bacteria in the VBNC state will lead to an underestimation of the health risk.

Persistence of pathogens in sediments. Given that a secondary or even tertiary effluent can contain disinfection-resistant viral pathogens, we have very little data on their persistence in natural marine waters. Aside from many reports demonstrating that certain viruses can survive under in vitro conditions much longer than bacterial pathogens (months as opposed to days), field experiments to understand the effects of salinity, seasonal temperature, sunlight, and sediment on viral pathogen persistence remain to be conducted. As noted, the lack of routine detection methods for pathogenic viruses limits survival studies of any type. The older literature shows increased survival when viruses are associated with sediment and organic particles (Richards 1985). Shiaris et al. (1987) observed a protective effect of intertidal sediments on indicator bacteria. Discharge of effluent at shallow depth may provide conditions more favorable for association of pathogens with sediment. Not only is the vertical path length shorter, but near shore sediments with high suspended particulates may provide conditions more conducive to pathogen survival and resuspension than deeper discharge areas.

There is a comparatively small body of literature suggesting that sediment resuspension will facilitate transport of bacteria and viruses into the water column. Sediment resuspension processes on beaches can be caused by waves or by actions of the bathers themselves could be expected to result in increased exposure to pathogens.

Surveillance frequency. The ability to detect fluctuations in indicator and perhaps pathogen densities is affected by sampling frequency. Given the very dynamic nature of beach environments sampling frequencies ideally should be continuous and integrative and adjusted in response to usage, storm events, or shifts in hydrographic parameters that might be anticipated to lead to adverse discharge quality and increased potential health risk. Unfortunately continuous integrative samplers are not yet available for any pathogen. Sampling and processing costs will usually present practical limits to high frequency discrete or grab sampling with extended spatial coverage. Thus, it is unlikely that all contamination events at beaches will be detected using minimal sampling regimens now followed. Results from a World Health Organization (WHO) workshop on recreational waters

(November, 1998) showed that densities of indicator organisms in coastal beach waters varied greatly over time with little predictability, within and between days and locations. Overall, it is very unlikely given the current state of monitoring that exceedances of indicator densities and pathogen presence, hence disease risk, will be detected for a proportion of the time.

Dissemination of antibiotic resistance elements into coastal waters. As previously noted widespread and permissive use of antibiotics in agriculture and for human therapeutic use where antibiotics are ineffective have resulted in a explosion of drug resistance among environmental bacterial species (e. g., Rice et al. 1995). Genetic elements conferring such resistance can be found in bacteria (Al-Jebouri 1985) and bacterial viruses discharged in sewage. Considerable evidence now exists that genetic information coding for antibiotic resistance is commonly transferred between microorganisms organisms through common mechanisms such as transduction and conjugation, whereby genetic elements conferring resistance to antibiotics and toxics can be exchanged in the environment (Boyd and Hartl 1997, Davison, J. 1999). Genetic exchanges can occur in sediment or for example within the gastrointestinal tracts of animals. While the effect of discharged genetic elements may not present an immediate health concern owing to exposure to disinfected effluents, it does provide a source of antibiotic resistance or other virulence elements to bacteria indigenous to the marine environment. Such bacteria may include bacterial genera capable of causing opportunistic infections in humans exposed to coastal waters, e. g., *Vibrio* spp. and the nontuberculous mycobacteria, thereby rendering treatment potentially more difficult, protracted and costly.

Conclusions

Pearson (1975) describes various scenarios associated with the location of sewage discharge outfalls into coastal waters and considers reciprocal relationships between discharge quality and distance of outfall dispersion system from shore. He concludes that longer outfall dispersion systems are more effective, providing more dilution of nonconservative elements and more “decay” time for removal of coliform microorganisms. He suggests that moving discharge outfalls inshore based on improved levels of treatment will not provide an appropriate level of effluent dilution nor will it reduce adverse environmental impacts. Based on his comments desirable goals to improve coastal beach water quality in the Santa Barbara area would therefore be (a) to locate discharges as far offshore as possible and (b) to apply advanced tertiary treatment to the discharge for the effective removal of viral pathogens, nutrients and harmful or ecologically disruptive chemicals. Goal (b) will require development of sampling approaches and routine methods to detect and verify the effectiveness of viral removal.

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APPENDIX C

Potential human health risks arising from exposure to sewage
World Health Organization (WHO), 2000.[6]

Level of treatment	Discharge type		
	Directly on beach	**Short outfall**[1]	**Effective outfall**[2]
None[3]	Very high	High	NA
Preliminary	Very high	High	Low
Primary (including septic tanks)	Very high	High	Low
Secondary	High	High	Low
Secondary plus disinfection	Medium	Medium	Very low
Tertiary	Medium	Medium	Very low
Tertiary plus disinfection	Very low	Very low	Very low
Lagoons	High	High	Low

[1] The relative risk is modified by population size; relative risk is increased for discharges from large populations and decreased for discharges from small populations.

[2] Assumes that the design capacity has not been exceeded and that climactic and oceanic extreme conditions are considered in the design objective (i.e. no sewage on the beach zone.

[3] Includes combined sewer overflows.

RECOMMENDATIONS

The regulations guiding California's Ocean Plan, or any use of the ocean for waste deposal, must be expanded to include public health along with the health of sea animals and the ocean environment.

In regulating the effects of waste disposal in the ocean it is incumbent on regulatory agencies to move beyond the practice of approving waste disposal permits based on discharger's self-monitoring programs, and to initiate proactive measures to protect not only the nearshore areas of the ocean – the coast – but public health as well.

In its assessment of potential human health risks arising from exposure to sewage, the World Health Organization indicates that *very low health risks can be obtained if sewer outfalls are extended beyond the shallow, inshore "recreational" zone – where people swim, surf or dive – to a minimum of a mile offshore, and/or a minimum depth of 60 feet of water.*

In establishing safe depths and distance from shore, consideration must be given to local ocean conditions and the amount of sewage discharged, but proper proactive reform can be initiated immediately, to require wastewater dischargers to extend their sewer outfalls to a minimum of a mile offshore, and/or a minimum depth of 60 feet.

Additionally, sewer districts, as well as the state water quality regulatory agencies, must begin now to compile the information needed for future upgrade to full tertiary treatment. Actual construction costs will certainly rise from the date of study completion, but information gained will serve as a valuable guide for present decision-making.

Such general studies are not expensive. Heal the Ocean expended $15,000 for a cost feasibility study to determine the cost, per ratepayer, for tertiary upgrade of all five wastewater treatment plants discharging into the Santa Barbara Channel.

Based on the information contained in this report, Heal the Ocean respectfully makes the following recommendations:

1) **That all sewer outfalls be extended to a minimum of a mile offshore, and/or a miminum depth of 60 feet of water, depending on which comes first. And that a state water quality regulatory agency develop deadlines for sewer districts to submit design engineering and plan submittals for outfall extension.**

2) **That each California wastewater treatment plant discharging sewage into the Pacific Ocean be required to perform a cost feasibility study for full tertiary treatment, calculating the monthly and annual rate increase per ratepayer, with each study to be completed within two years, and submitted to a state water quality regulatory agency.**