II GENERAL INFORMATION AND BASIC DATA REQUIREMENTS

Treatment System Description

1. On *which of the following are you basing your application: a current discharge, improved discharge, or altered discharge, as defined in 40 CFR 125.58? [40 CFR 125.59(a)]* (Updated: Cross reference - Part II, Section A.I, page II.A-1.)

   Response:

   This reapplication is based on an "altered discharge" of various combinations of primary, secondary, and tertiary treated effluent, brine from reverse osmosis, and tertiary filter backwash. The anticipated design flow increases to 44 mgd in 2020. The requested monthly average Biochemical Oxygen Demand, 5-Day (BOD_5) limit is an increase from 160 milligrams per liter (mg/1) to 200 mg/1. The TSS limit will not be changed. This reapplication will demonstrate that the proposed altered discharge will not significantly impact the receiving water quality and benthic ecosystem.

2. *Description of the Treatment/Outfall System [40 CFR 125.62(a) and 125.62(e)]*

   a. *Provide detailed descriptions and diagrams of the treatment system and outfall configuration which you propose to satisfy the requirements of section 301 (h) and 40 CFR Part 125, Subpart G. What is the total discharge design flow upon which this application is based?*

      Response:

      Background. The Honouliuli WWTP facility and deep ocean outfall are located on the southwestern side of Oahu, as shown on Figure II.A.2-1. Construction of the deep ocean outfall was completed in February 1979. The primary treatment plant was completed and fully operational in December 1984.

      The City & County had completed construction on September 19, 1996 of a secondary treatment facility designed to treat up to 0.57 m3/sec (13 mgd). The plant was originally designed to fulfill effluent reuse under the State Department of Health (DOH) Consent Order 89-CW-EOW-6, dated June 1993. The plant has been operational since September 20, 1996. Approximately 2 mgd (yearly average) of secondary effluent mixed with hypochlorite for partial disinfection had been reused in plant operations from July 1, 1998 until the tertiary plant began operations.

      The City contracted with USFilter Corporation (now named Veolia Water) for the Construction and operation of a 0.53 m3/sec (12 mgd) tertiary facility for reuse of effluent. The tertiary facility was constructed to fulfill a Supplemental Environmental Project under a May 1995 Consent Decree, 94-00765 DAE, with the Environmental Protection Agency (EPA) and the DOH. The facility started processing secondary effluent on September 18, 2000.

The tertiary facility is currently owned by the City's Board of Water Supply.

The service area for this system (Figure II.A.2-1) extends from Halawa to Barbers Point to Mililani and consists primarily of residential communities interspersed with small business centers. Thus, wastewater treated at the Honouliuli WWTP facility is essentially of domestic type.

The facility's current primary treatment liquids capacity is estimated to be 38 mgd. Solids treatment capacity is estimated at 29 mgd. A solids handling upgrade project is to be completed in 2006, which will bring the solids handling capacity to the level of the liquids handling facilities.

Among the requirements from the Consent Order with the DOH dated June 30, 1993, and the Consent Decree dated May 15, 1995, with the EPA and the DOH, to be met by the City & County of Honolulu (city), are implementation of 40 CFR Part 403 into its pretreatment program; semiannual inspection of all industrial users and analyses of the process wastewater discharge; development and implementation of a Spill Reduction Action Plan for its collection system; and development and implementation of sludge reuse and effluent reuse programs.

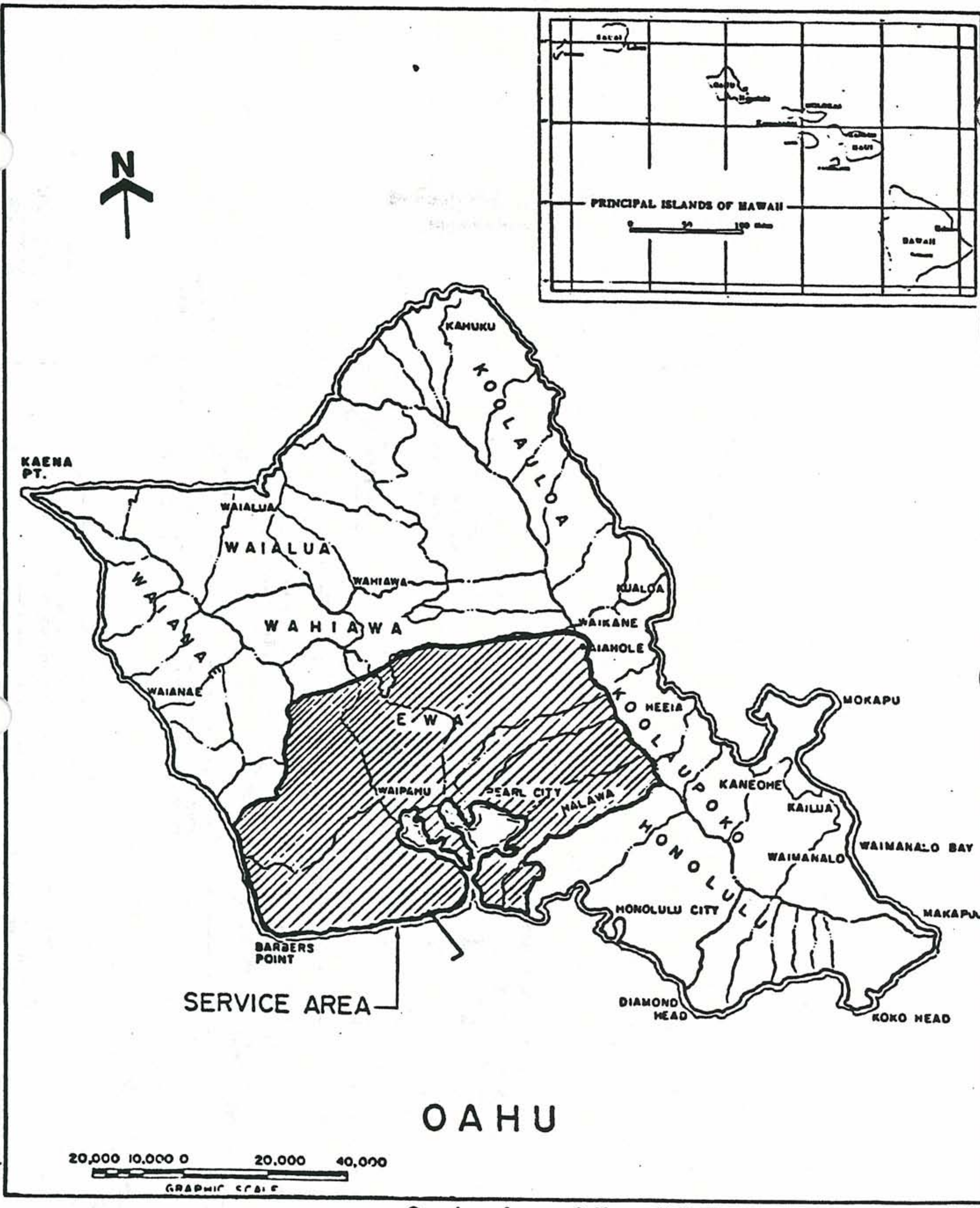
Current Treatment **Process.**

Update: A current flow diagram which includes the secondary and tertiary treatment process is shown in Figure II.A.2-2b. An alternative discharge scheme is shown in Figure II.A.2-2c. Summaries of the liquid and solid treatment systems are presented in Tables II.A.2-1 and II.A.2-2.

A. Primary Treatment System

The liquid primary treatment system of the facility comprises pretreatment, primary treatment, disinfection when required, and effluent disposal. Pretreatment involves screening to remove large objects, grit removal, and pre-aeration to freshen the sewage. The raw sewage entering the facility is screened to remove large objects. The removed material is hauled to the landfill. The screened flow then passes directly to the wet well of the influent pump station where the sewage is pumped to the grit chamber, which is at an elevation compatible to sustain gravity flow through the treatment plant and ocean outfall. Grit is removed from the wastewater flow through the use of the aerated grit chamber-type process. Grit is collected by means of conveyors and elevated to grit washers for eventual disposal off site. Immediately following the aerated grit chambers, the pre-aeration process increases the dissolved oxygen content of the wastewater.

After pre-aeration, the wastewater flows through an open, rectangular concrete channel to the inlets of the primary clarifiers, where physical separation of settleable and floatable solids from the liquid takes place. Bottom sludge collectors in each clarifier scrapes the settled solids toward a central hopper, while surface skimmers remove the floating scum to the



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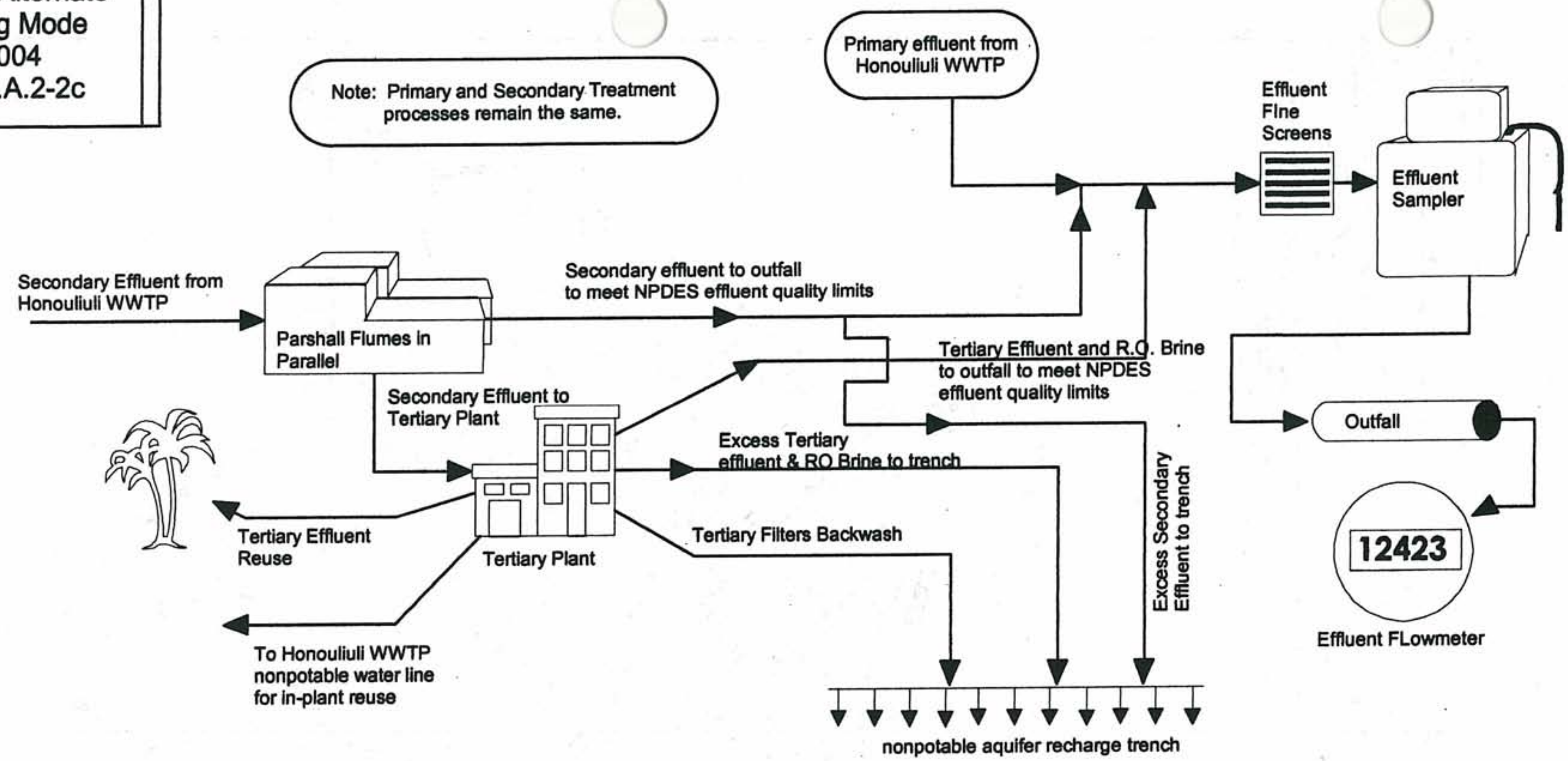
Service Area of Honouliuli Outfall
301(h) Waiver Reapplication
Honouliuli Wastewater Treatment Plant
Honouliuli, Oahu, Hawaii

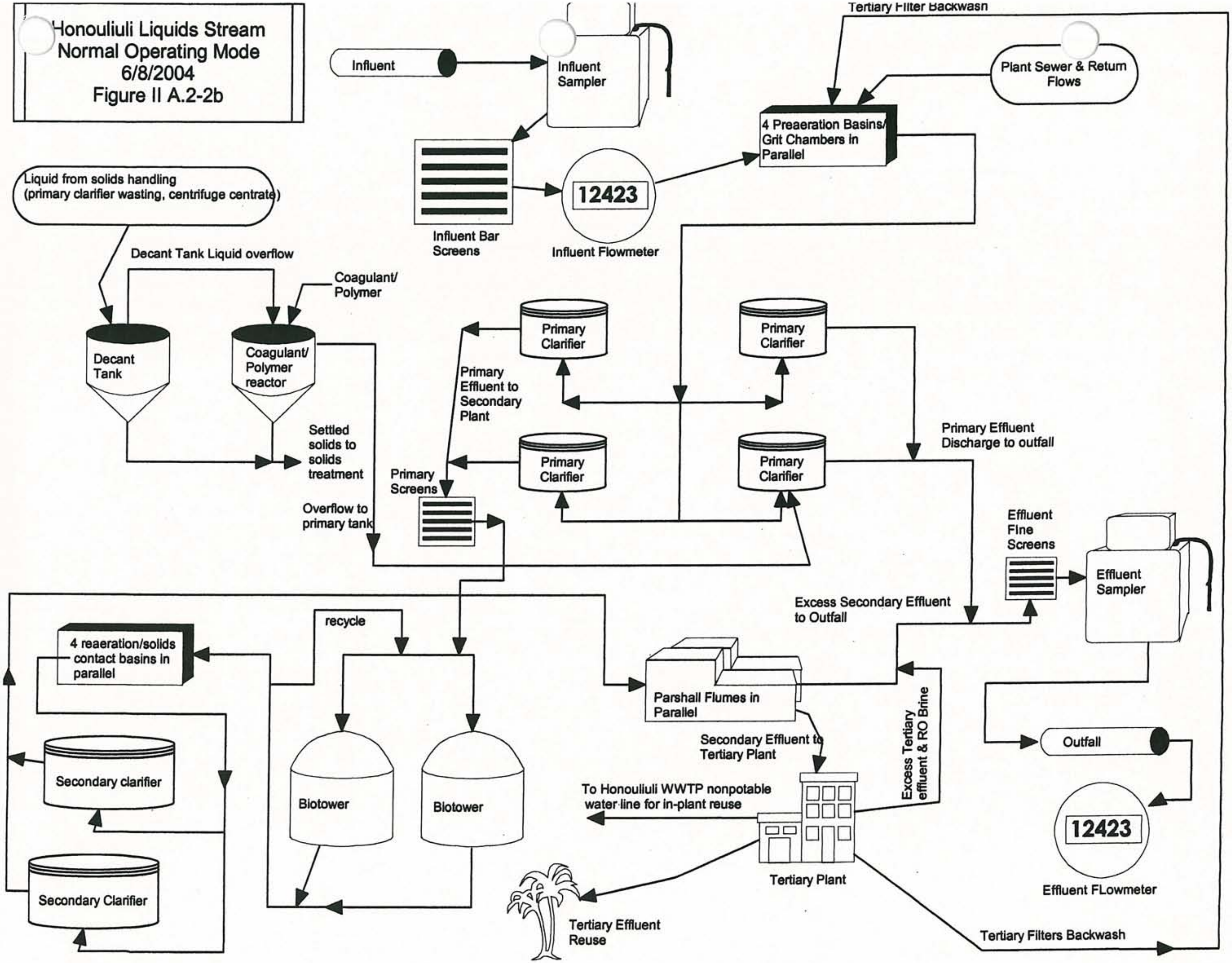
FIGURE II.A.2-1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
jcl	31038.1.01	DR	7/95	

Honouliuli Alternate Operating Mode
6/8/2004
Figure II.A.2-2c



Honouliuli Liquids Stream
Normal Operating Mode
6/8/2004
Figure II A.2-2b



scum collection trough.

B. Secondary treatment system

(From *Honouliuli Wastewater Treatment Plant Unit 1A---Secondary Treatment Facilities Optimization Study*, April 1999, GMP Associates)

A design flow of up to 13 mgd of the effluent from the primary clarifiers is diverted through two adjustable V-notch weir gates to the secondary plant. The flows travel by gravity through two manually-cleaned bar screens to the biotower pumping station (BPS). Flow to the secondary treatment system is then controlled by the number of pumps on line.

Vertical turbine pumps in the BPS lift screened primary effluent with biotower effluent recycle to motorized rotating distribution arms at the top of the biotowers. Fans at the bottom of the biotowers provide enough oxygen to prevent anaerobic conditions from developing.

Some of the treated effluent from the biotowers is recycled to the BPS while the rest of the effluent flows to the solids contactor.

The solids contactor consists of four parallel channels aerated by fine-bubble air diffusers. The contactor accepts biotower effluent and return sludge from the solids reaerator and secondary clarifiers. This mixing enhances flocculation in the contactor.

Effluent from the solids contactor flows to the secondary clarifiers where settleable and floatable material are removed. The clarifiers are deep, have large influent feed wells, and utilize a multiport "vacuum" sludge collection system.

Most of the sludge removed by the multiport collection system is distributed in the channels of the solids reaerator. The solids reaerator consists of four aerated channels or passes. Fine-bubble diffusers in the reaeration channels aerate the return sludge to enhance its flocculation characteristics by maintaining aerobic conditions and "freshening" the sludge prior to the solids contactor. Alternately, sludge can be pumped directly from the solids clarifiers to the solids contactor.

After the secondary clarifiers, the secondary effluent flows through two Parshall flumes. The Parshall flumes measure the flow rate from both clarifiers. The secondary effluent mixes with the primary and tertiary effluent prior to effluent screening. The combined effluent flows directly to the fine screens and then to the Barbers Point Ocean Outfall for final disposal.

Most of the sludge from the secondary clarifiers is pumped to the solids reaerator or solids contactor. The small amount of sludge that is "wasted" is pumped to the gravity belt thickeners. Sludge from the gravity belt thickeners is then pumped to the storage/blend tanks. [Heavier particles and scum are returned from the secondary clarifiers to the preaeration basin.]

C. Tertiary Treatment System

C.1. R-1 System [10 mgd design production]

[R-1 stands for the high quality classification (but below reverse osmosis) given by the State Department of Health to effluent reuse water.]

Secondary treated effluent are taken downstream of the Parshall flumes and piped to the Reuse Pump Station. The R-1 lift pumps pump the secondary effluent to the sand filters. Hypochlorite is added to minimize algae and slime formation. Polyaluminum chloride or similar polymer is added to assist with coagulation. The water passes through a rapid mixer and flocculation tanks prior to sand filters. The water then proceeds to the pulsed bed sand filter. The water is distributed to the filter cells and filters down through the media to be collected by the clearwell. An Air Mix Routine is used to extend the run time before the backwashing is needed. Backwash water is taken from the clear well and run through the filters then collected in the mudwells where it is discharged to the Microfiltration/Hydroclear Spent Backwash Pump Station. The backwash water is then pumped back to the Honouliuli Preaeration Tanks.

Filtrate from the clearwell flows to disinfection. The filter effluent is monitored for turbidity. Should the turbidity exceed 2 NTU, the water will automatically be diverted back to the Reuse Pump Station.

R-1 water disinfection is achieved using medium pressure ultraviolet (UV) treatment. The disinfected water is then pumped to the two 2.57 million gallon storage tanks. The UV system is monitored for proper operation. If a problem develops, the system will shut down, preventing water from entering the storage tank. A bypass line back to the reuse pump station is used to restart the system and insure proper R-1 disinfection.

All non-conforming R-1 water is returned to the reuse pump station. All screenings and backwash water is recycled back to the Honoululi WWTP preaeration basin.

C.2. Reverse Osmosis System [2.0 mgd design production]

(From *Engineering Report,* Honouliuli *Wastewater Reclamation Facility,* August 25, 1999, US Filter, with corrections by Ken Windram of Veolia Water.)

The secondary effluent is received at the RO lift station [from the Parshall flumes] and pumped to the building housing the membranes and the microfiltration units. Chlorine is added through the hypochlorite systems.

The RO stream is prefiltered through 2 self-cleaning strainers (500 micron screens) to remove debris that could adversely impact the microfilters. The strainers are capable of backwashing themselves. The backwash go to the backwash tank and then on to the preaeration tanks.

After running through the prefilters, the stream is run through the continuous microfiltration membranes (CMF). The membranes use a 0.2 micron hollow fiber membrane with a shell-sided feed. The membranes are cleaned using a gas backwash. The backwash water is sent to a concrete tank where it is then pumped to the Honouliuli WWTP preaeration basins. The cleaning of the microfiltration membranes are done as necessary using citric acid and caustic cleaner. The used cleaning solution is then sent to the backwash tank and then on to the preaeration tanks.

Filtrate from the CMF system is fed to the covered RO feed tank. Chlorination is done to maintain a residual level of free chlorine to prevent microbiological growth on the membranes.

From the RO feed tank, water is pumped to the Reverse Osmosis units located within the same building and treated with an antiscalant and sodium bisulfite. The RO units consist of RO skids fully equipped with a high-pressure feed pump. After the RO treatment, the water is then fed to a 1.2 million gallon RO storage tank for distribution the the RO users in Campbell Industrial Park.

A clean-in-place CIP membrane cleaning skid is provided for the RO system. After the RO system cleaning, the cleaning solution is neutralized and sent to the microfiltration/hydroclear backwash.

Each RO unit is equipped with a product water flush which is used between membrane cleanings to periodically flush the RO membranes with RO product water and/or a biocide solution. The RO product flush goes to the RO feed tank to be pumped back to the RO system. Reject from the RO process is sent to the R1 process or the Parshall Flumes.

RO reject or brine (containing relatively high dissolved solids) is piped to both the UV Channel and the Secondary Effluent Parshall Flume. Automatic throttle valves are provided in each of these lines. The RO brine is sent to the Parshall flumes and eventually the outfall when the R1 flows are low. As the R1 flows increase, more RO brine will be mixed with the R1 product water. Initially, almost all RO brine will go to the Parshall Flumes.

Table II.A.2-1. Honouliuli WWTP Liquid Treatment Process Components

Liquid Treatment Components

	38 mgd 1993	Future 44 mgd 2020
a. Grit removal		
Grit chamber		
Number	4	4
Width (feet)	20	20
Length (feet)	60	60
Average depth (feet)	11.5	11.5
Design loading		
Detention time (minutes)		
Average flow	12	12
Peak flow	5	5.3
Maximum air supplied (scfm/l.f.) to grit chamber	5	5
Maximum air supplied (scfm/l.f.) to influent channel	5	5
Mechanical equipment		
Grit collector		
Number	3+ standby	4
Width - nominal (feet)	2.75	2.75
Length - nominal (feet)	60	60
Grit washer		
Number	2	4
Grit capacity (c.f./hour)	81	216
b. Pre-aeration		
Tanks		
Number	3+ standby	4
Width (feet)	20	20
Length (feet)	150	150
Average depth (feet)	13.5	13.5
Design loading		
Detention time (minutes)		
Average flow	34	45.2
Peak flow	13.8	20.6
Maximum air supplied (scfm/l.f) to pre-aeration tank	10	10

Table II.A.2-1 (Continued)

Liquid Treatment Components

		38 mgd 1993	Future 44 mgd 2020
	Maximum air supplied (scfm/l.f.) to effluent channel	5	5
c.	Blowers (grit and pre-aeration)		
	Number	3+1 standby	3+1 standby
	Capacity per blower (scfm)	2,380	2,380
	Discharge pressure (psig)	7.5	7.5
d.	Primary clarifier		
	Tanks		
	Number	3+ standby	4
	Diameter (feet)	145	145
	Side water depth (feet)	10	10
	Design loading		
	Overflow rate (gpd/square feet)		
	Average flow	767	770
	Detention time (hours)		
	Average flow	2.34	2.33
	Weir loading (gpd/feet)		
	Average flow	15,600	16,040
	Primary sludge pumps		
	Number	4+4 standby	4+4 Standby
	Capacity per pump (gpm)	80/360	80/360

Sources: STV/Lyon Associates, Inc. January 1993. Honouliuli Outfall Annual Assessment, NPDES 301(h) Waiver, January—December 1992.

M&E Pacific, Inc. October 1983. Reapplication for Secondary Treatment Modification, Honouliuli Treatment Facility.

UPDATED:
Secondary Treatment Facilities (Ewa Water Reclamation Facilities)
[Water to be taken offsite for reuse, with excess discharged through outfall]

e. Biotowers

Number	2
Media depth (feet)	20
Diameter (feet)	100
Each volume (gallons)	157,080
Organic loading (lb/BOD_5/1000 feet)	45
Hydraulic Loading at 0% recycle (gpm/ft^2)	0.57
Ventilation, induced (SCFM/FT^3)	1

f. Solids Contactor Channels

Number	4
Length (feet)	105
Width (feet)	8
Sidewater Depth (feet)	12
Each Volume (gallons)	75,400
Detention time (min) at 1,200 mg/L MLSS, 3 units operating)	22

g. Solids Reaeration Channels

Number	4
Length (feet)	24
Width (feet)	8
Sidewater Depth (feet)	12
Each Volume (gallons)	17,230
Detention time (min) at 1,200 mg/L MLSS, 3 units operating)	35

h. Secondary Clarifiers (Center Feed, Peripheral Discharge, vacuum-type 16-port sludge collector)

Number	2
Sidewater Depth (feet)	16
Diameter (feet)	100
Each Volume (gallons)	940,000
Hydraulic Loading at 13 mgd average flow (gpd/ft_2)	1,655
Sludge withdrawal rate at 5% solids (MGD)	3.3 to 5.6

Tertiary Facilities (owned by Board of Water Supply, City & County of Honolulu,and operated by Veolia Water) [Water to be taken offsite for reuse, with excess discharged through outfall]

i. Hydro-clear® Sand Filter

Filter cells	7
Filter area, each cell (ft^2/cell)	360
Filter media effective size (mm)	0.45, w 1.7 uniformity coeff.
Backwash rate (GPM/ft^2)	12
Hydraulic gradient through filter (ft)	8 (approx.)
Air rate (CFM @ 3.0 PSI)	525

j. UV System

Peak/Avg design flowrate (mgd)	12/10
Median partical size (μm)	< 21
Maximum TSS (mg/L)	5
UV Transmission (minimum)	55% @ 253.7 nm
UV Design Dose (μ@-s/cm^2)	140,000
No. of UV Channels	1
Redundant Equipment	33%
Total No. of lamps	256

k. Continuous Microfiltration Membranes (CMF)

Number	6

l.. Reverse Osmosis Units

Number of skids	6
Membrane count per skid	84
Membrane size (inches)	8 dia. X 40 long
Nominal production (gpm)	1400
Product recovery (%)	60
Recommended operating range (gpm)	1200 to 1600

Table M.A.2-2. Honouliuli WWTP Solids Treatment Process Components

Solids Process Components

a. Gravity thickener

Tanks

Number	1+ standby	2+ standby
Diameter (feet)	40	40
Side water depth (feet)	10	10
Surface area (square feet)	1,257	1,257

Design loading

Hydraulic, gallons/day	754,000	1,508,400
Solids, lbs./day	21,500	41,000
Unit hydraulic, gallons/day/square feet	600	600
Unit solids, lbs ./day/square feet	17	16
Under flow Concentration, %	5	5

b. Sludge conditioning

Heat treatment system

Number	1	2
Size, gph	7,500	7,500

Design loading

Hydraulic, gallons/day	169,700	297,200
Solids, lbs./day	55,500	106,200
Unit hydraulic loading, gph/tank	7,000	6,200
Solids solubilization, %	20	20

Decant tank

Number	1+ standby	2+standby
Diameter (feet)	40	40
Side water depth (feet)	8	10
Surface area (square feet)	1,257	1,257

Design loading

Solids, lbs./day	42,700	87,800
Unit hydraulic loading, gallons/day/square feet	135	118
Unit solids, loading, lbs./day/square feet	36.5	35
Under flow concentration, %	8	8

c. Mechanical dewatering process

Centrifuge

Number	1 + 2 standby	4 + 2 standby
Size (nominal [inch x inch])	24x60	24x60

Design loading

Hydraulic, gallons/day	64,000	122,400
Solids, lbs./day	42,700	81,700
Unit hydraulic, gpm/tank	22	21
Unit solids, lbs./hour/tank	890	850

Sources: STV/Lyon Associates, Inc. January 1993. Honouliuli Outfall Annual Assessment, NPDES 301(h) Waiver, January—December 1992.

M&E Pacific, Inc. October 1983. Reapplication for Secondary Treatment Modification, Honouliuli Treatment Facility.

UPDATE:

Existing Secondary Treatment Facilities (Ewa Water Reclamation Facilities)
[Water to be taken offsite for reuse, with excess discharged through outfall. However, waste sludge is thickened and mixed with primary sludge prior to sludge treatment.]

d. Gravity Belt Thickeners

Number of units	2
Belt Width (ft.)	6.5
Sludge feed rate (GPM)	130 – 260
Sludge Discharge rate (GPM)	15-40
Inlet sludge concentration (% solids)	0.5
Outlet sludge concentration (% solids)	4

Tertiary Facilities (Constructed by US Filter)
[Water to be taken offsite for reuse, with excess discharged through outfall.]

e. No solids treatment. All backwash with waste solids goes to Honouliuli WWTP preaeration tanks for treatment.

Screens for final removal of any large particulate matter that pass through the primary clarifiers are available upstream of the outfall inlet. Provisions for chlorination of the plant effluent are available when water quality monitoring dictates the need for disinfection. However, the chlorination system will need to be upgraded in order to provide routine disinfection.

The solids that are separated from the wastewater during treatment are combined and thickened, conditioned by heat treatment, and dewatered by centrifuge. UPDATE: The solids are then either disposed of in a landfill or processed further into a soil amendment product. Currently, most of the sludge is processed by the Navy's Composting Center at Barbers Point.

The existing outfall portion of the treatment system consists of an 84-inch reinforced concrete pipe extending in a straight line from the Honouliuli plant to the shoreline and a 78-inch reinforced concrete pipe extending from the shore out to the deep ocean. The length of the land portion of the pipe is 9,166 feet; that of the ocean portion is 8,776 feet. A 1,750-foot-long, multiple-port diffuser (two ports every 24 feet) disperses and discharges the effluent at a depth of approximately

200 feet. Port size varies from 3.4 to 3.75 inches. The ultimate design capacity of the outfall is 112 mgd.

Total Discharge Design Flow. The total design inflow, calculated on anticipated population increases and development within the service area is shown in Table H.A.2-3. Discharge flow of wastewater may vary from variations in inflow and by the amounts diverted for water reuse programs. However, for the purpose of this application and in attempt to be conservative, water reuse was not included in discharge flow projections.

Table II.A.2-3. Anticipated Honouliuli WWTP Flows (mgd)

	Year		
	2010	**2015**	**2020**
Average Dry weather	33.42	35.11	36.75
Average Wet weather	39.46	41.62	43.79
Annual Average	36.14	38.16	39.99

Source: Wilson Okamoto & Associates, Inc. March 31, 1995. Wastewater Flow Projections Summary

b. *Provide a map showing the geographic location of the proposed outfall(s) (i.e., discharge). What is the latitude and longitude of the proposed outfall(s)?* (No change: Cross reference - Part II, Section A.2.b, page II.A-14.)

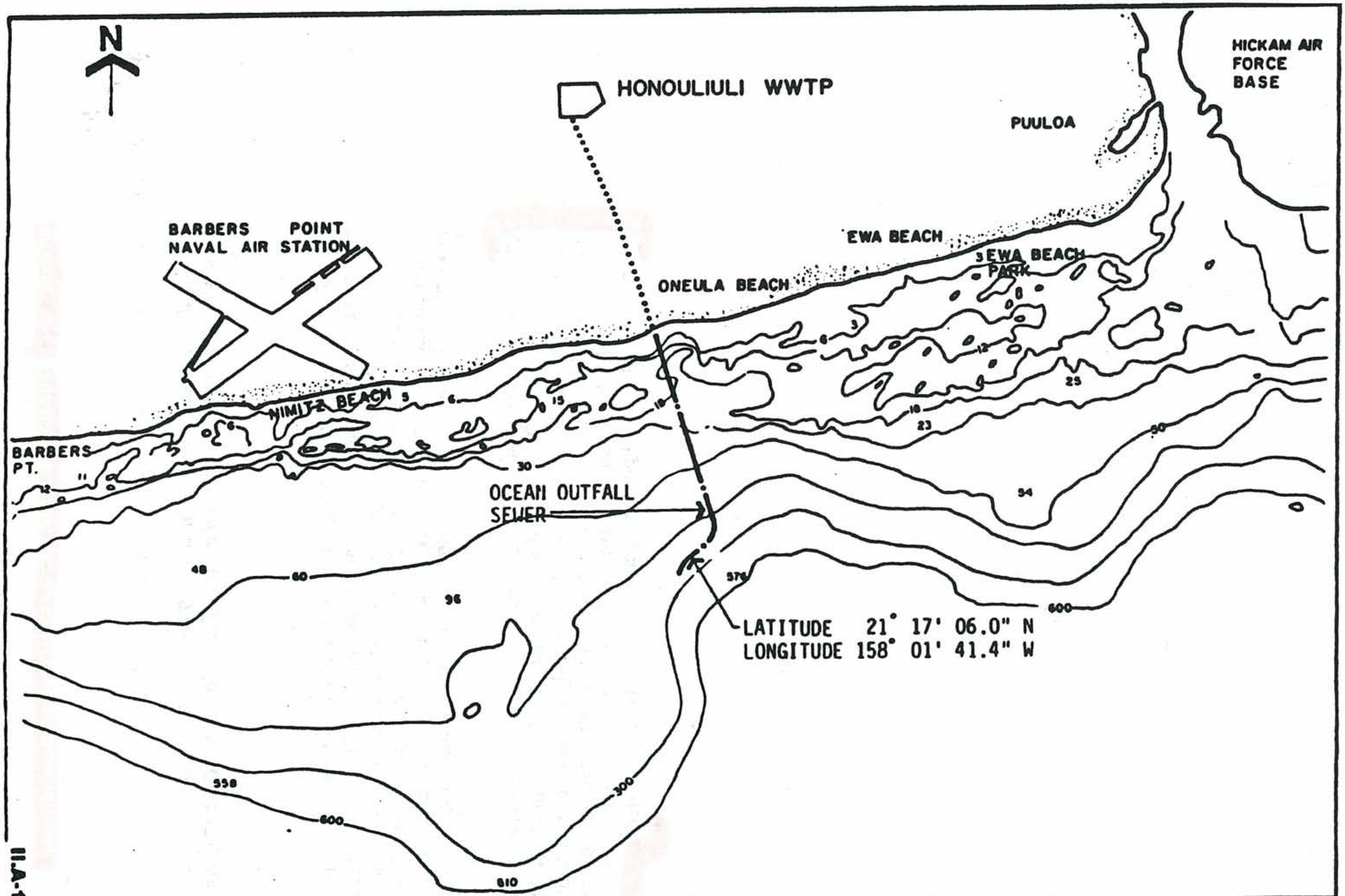
Response:

The location of the Honouliuli Wastewater Treatment Plant and outfall system is shown on Figure II.A.2-4.

c. *For a modification based on an improved or altered discharge, provide a description and diagram of your current treatment system and outfall configuration. Include the current outfall's latitude and longitude, if different from the proposed outfall.* (Modified: Cross reference - Part II, Section A.2.c, page II.A-16.)

Response:

UPDATE: New facilities have been added as described in the previous sections. The outfall configuration will remain the same. However, much of the effluent will be reused rather than being discharged through the outfall. In June 2004, for example, an average of about 6.2 MGD of effluent was delivered to golf courses and industrial users. The reuse volume for June 2004 is historically one of the highest volumes; however, additional customers are being sought. Also, in the future, an aquifer recharge trench may be used for discharge of secondary and



Honouliuli Ocean Outfall Sewer Location Plan
301(h) Waiver Reapplication
Honouliuli Wastewater Treatment Plant
Honouliuli, Oahu, Hawaii

FIGURE II.A.2-4

Harding Lawson Associates
Engineering and Environmental Services

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED DATE
jcl	31038.101	DR		7/95	

tertiary flows. The goal is to achieve up to 10 mgd or more of reuse.

II.A.3.

3. *Primary or equivalent treatment requirements [40 CFR 125.60]*

a. *Provide data to demonstrate that your effluent meets at least primary or equivalent treatment requirements as defined in 40 CFR 125.58(r). [40 CFR 125.60]* (No cross reference.)

Response:

As defined in 40 CFR 125.58(r), primary or equivalent treatment is "treatment by screening, sedimentation, and skimming adequate [sic] to remove at least 30 percent of the biochemical oxygen demanding material and of suspended solids in the treatment works influent, and disinfection, where appropriate." Tables II.A.3-1 through II.A.3-5 present the monthly and annual averaged data for influent and effluent BOD_5, suspended solids and flow for 1991 through 1994 and portion of 1995.

On an annual average basis, the BOD_5 removal rate was 30 percent or above from 1991 through 1994. On an annual average basis, the Honouliuli WWTP meets the definition of "primary" treatment. On a monthly average basis, the rate of BOD_5 removal was less than the 30 percent minimum requirement for four months in 1994. From the definition provided in 40 CFR 125.58(r), the basis by which compliance with the 30 percent removal criteria is not provided.

Table II.A.3-1. 1991 Monthly and Annual Average BOD_5 and Suspended Solids Data

	Flow	BOD_R			Suspended Solids		
		Influent	Effluent	Percent	Influent	Effluent	Percent
Month	Fm³/sec1	fniE/n	fmii/11	Removal	(mem	(mem	Removal
January	1.04	195.1	108.1	45	265.4	60.8	77
February	1.00	202.7	106.7	47	260.0	63.3	76
March	1.09	215.7	105.0	51	288.4	62.6	78
April	0.97	211.7	102.9	51	260.7	53.8	79
May	1.03	224.6	115.2	49	283.8	55.5	80
June	1.06	224.0	107.8	52	301.9	56.3	81
July	1.05	212.0	105.3	50	252.1	55.0	78
August	1.05	244.6	98.7	60	340.9	54.1	84
September	1.03	223.8	109.0	61	245.8	50.8	79
October	1.05	213.2	102.4	52	265.2	56.7	79
November	1.02	210.0	107.7	49	241.4	53.6	78
December	1.04	230.5	108.6	53	279.7	55.9	80
Annual Average	1.03	217.3	106.5	51	273.8	56.5	79

Source: STV/Lyon Associates. January 1993. Data from Honouliuli Outfall Annual Assessment, NPDES 301(h) Waiver, January—December 1991, Ewa, Oahu, Hawaii.

Table II.A.3-2. 1992 Monthly and Annual Average BOD_5 and Suspended Solids Data

	Flow	BODg			Suspended Solids		
		Influent	Effluent	Percent	Influent	Effluent	Percent
Month	(m^3/sec)	fms/n	fmg/1)	Removal	(mem	(mem	Removal
January	1.02	254.2	114.4	55	301.2	54.8	82
February	1.03	231.9	122.3	47	256.8	51.6	80
March	1.01	266.5	138.1	48	269.5	53.4	80
April	1.03	234.7	129.1	45	242.3	48.4	80
May	1.03	209.7	126.4	40	216.8	58.6	73
June	1.01	218.1	130.7	40	211.8	47.0	78
July	1.01	203.7	130.6	36	203.9	55.1	73
August	1.03	211.4	122.6	42	200.3	50.8	75
September	1.02	208.6	124.5	40	198.2	46.8	76
October	1.04	210.9	115.0	45	209.2	49.7	76
November	1.07	193.6	115.0	41	192.7	53.9	72
December	1.16	208.6	119.5	43	204.4	52.1	75
Annual Average	1.04	221.0	124.0	44	225.6	51.8	77

Source: STV/Lyon Associates. January 1993. Data from Honouliuli Outfall Annual Assessment, NPDES 301(h) Waiver, January—December 1992, Ewa, Oahu, Hawaii.

Table II.A.3-3. 1993 Monthly and Annual Average BOD_5 and Suspended Solids Data

		BOD_B			Suspended Solids		
	Flow	Influent	Effluent	Percent	Influent	Effluent	Percent
Month	fm^3/sec)	fms/n	fmg/1)	Removal	fmg/11	fme/1)	Removal
January	1.16	233	141	39	206	59.5	71
February	1.12	226	140	38	210	59.5	72
March	1.11	244	150	39	224	62.5	72
April	1.09	255	132	48	267	62.0	77
May	1.13	238	135	43	255	52.5	79
June	1.11	245	128	48	313	57.5	82
July	1.11	242	130	46	309	53.0	83
August	1.07	210	117	44	220	47.5	78
September	1.07	203	101	50	214	48.5	77
October	1.05	194	110	43	224	53.5	76
November	1.05	224	139	38	222	54.5	75
December	1.05	231	150	35	256	52.0	80
Annual Average	1.09	229	131	43	243	55.2	77

Source: Oceanit Laboratories, Inc. October 1994. 1993 Honouliuli Annual Assessment Report, Volume I.

Table II.A.3-4. 1994 Monthly and Annual Average BOD_5 and Suspended Solids Data

		BOD_B			Suspended Solids		
	Flow	Influent	Effluent	Percent	Influent	Effluent	Percent
Month	fm^3/sec)	fmg/11	fme/1)	Removal	fme/1)	fme/1)	Removal
January	1.10	217	147	32	225	52	77
February	1.12	208	134	36	228	57	75
March	1.07	216	146	33	223	55	75
April	1.06	231	157	32	226	60	73
May	1.10	214	157	27	190	53	72
June	1.12	234	165	29	209	51	76
July	1.17	241	170	29	208	67	68
August	1.16	248	186	25	215	62	71
September	1.15	242	164	32	250	56	78
October	1.15	263	172	35	294	77	74
November	1.14	283	148	48	312	53	83
December	1.15	261	170	35	289	63	78
Annual Average	1.12	238	160	33	239	59	75

Source: City & County of Honolulu. 1994. Preliminary NPDES Monthly Reports.

Table II.A.3-5. 1995 Monthly and Annual Average BOD. and Suspended Solids Data

Month	Flow (m^3/sec)	BOD_5 Influent (mg/l)	BOD_5 Effluent (mg/l)	BOD_5 Percent Removal	Suspended Solids Influent (mg/l)	Suspended Solids Effluent (mg/l)	Suspended Solids Percent Removal
January	1.14	236	159	33	270	60	78
February	1.17	263	162	38	292	60	79
March	1.14	274	161	41	334	66	80
April	1.15	274	156	43	327	62	81
May	1.16	273	155	43	325	56	83
June	1.10	229	138	40	262	59	78
July	1.10	212	119	44	237	58	76
August	1.10	244	134	45	291	61	79
Annual average	1.13						

Source: City & County of Honolulu. 1995. Preliminary NPDES Monthly Reports.

Update: The following is additional data taken in 1999.

Honouliuli WWTP Primary effluent data, 1999							
1999	Flow (ft3/s)	BOD (mg/L)			Suspended Solids (mg/L)		
		Influent	Effluent	% removal	Influent	Effluent	%removal
May	1.17	289	--	--	315	66	77%
June	1.16	279	171	36%	304	75	74%
July	1.18	312	176	38%	345	63	81%
August	1.18	302	157	49%	337	59	81%

Update: Except for the 1999 data above, the City does not have primary effluent data after September 1996. The reason is that the secondary effluent facilities began operating on September 20, 1996. The discharge through the outfall, which the City continued sampling, was no longer just primary after that date. In addition, after September 18, 2000, tertiary treated effluent was added to the outfall discharge. The City and County of Honolulu will be performing additional testing of the primary effluent, as well as the various secondary and tertiary streams. The additional results will be submitted at a later date.

b. *If your effluent does not meet primary or equivalent treatment requirements, when do you plan to meet them? Provide a detailed schedule, including design, construction, start-up and full operation, with your application. This requirement must be met by the effective date of the new section 301 (h) modified permit. (No cross reference.)*

Response:

Effluent from the Honouliuli WWTP generally meets primary or equivalent treatment requirements, as defined in 40 CFR 125.58(r). During the four months between May and August 1994, the removal of BOD_5 fell below the 30 percent removal rates. The cause is suspected to be illegal dumping of waste water which contains relatively high levels of soluble BOD_5.

When it was determined that an increase in soluble BOD_5 had affected Honouliuli WWTP's operating standards, the city implemented emergency procedures to reduce effluent BOD and stepped up its search for illegal discharge through its significant industrial user program.

During the following year (1995), average influent BOD_5 and suspended solids concentrations increased but primary treatment standards were met, and current data indicate that the problem may have been solved by the city's response.

Update: Excess secondary and tertiary treated wastewater not needed for irrigationmay be disposed of in the outfall, providing an overall higher level of treatment. Also, as another backup, plant operators have developed experience using polymers. Starting in 1994, and until the secondary facilities came on line, polymers were used to enhance treatment.

4. *Effluent Limitations and Characteristics [40 CFR 125.61(b) and 125.62(e)(2)]*

a. *Identify the final effluent limitations for five-day biochemical oxygen demand (BODJ, suspended solids, and pH upon which your application for a modification is based:* (Modified: Cross reference - II.A.3.a, page II.A-19.)

Response:

BOD_5:	200 mg/1
Total suspended solids:	95 mg/1
pH:	6 to 9 (range)

Since the date which these limits were set (1991), the annual average influent BOD_5 concentration has risen from 217.3 mg/1 in 1992 to 238.1 mg/1 in 1994, while the maximum monthly average influent BOD_5 concentration increased from 244.6 mg/1 in 1991 to 283 mg/1 in 1994. The increase in waste concentration may be the result of the city's new building codes which mandate water-saving appurtenances on all new construction. The Honouliuli WWTP service area includes Oahu's second city, a large housing and commercial development which is specified in the city's master plan as the most rapid growth area on the island. Based on the increasing influent BOD_5 concentrations, the city is requesting an increase in the effluent BOD_5 limitation. Using the maximum monthly average influent BOD_5 concentration of 283 mg/1 from 1994, maximum effluent BOD_5 concentration under primary treatment requirements will be 198 mg/1 (30 percent removal). Thus, a new monthly average BOD_5 effluent limit of 200 mg/1 is requested to accommodate the observed increase in influent BOD_5 over the past year and through the planning period.

How can BOD go ↑ when R1 water is blended? Should go ↓.

The 1991 301(h) permit waiver specified monthly average discharge limits for BOD_5 at 160 mg/1, suspended solids at 95 mg/1, and pH between 6 to 9 range. The city proposes to maintain existing limits for pH and total suspended solids (TSS), but requests changing the BOD_5 limits from 160 mg/1 to 200 mg/1 to accommodate the measured increase in influent BOD_5.

Update: Since much of the effluent will be taken offsite for reuse, mass emissions will be greatly reduced compared to prior years. Therefore, the percent removals would not be as important a criteria to measure overall pollution.

Also, current influent qualities, as follows, continue to support the request for a BOD limit of 200 mg/L.

What happens when R1 is All reused?

Honouliuli WWTP: average from July 1, 2003 to June 30, 2004			
	Flow (mgd)	Bod (mg/l)	TSS (mg/l)
Influent:	27	275	305
30% removal:		193	214

b. *Provide data on the following effluent characteristics for your current discharge as well as for the modified discharge if different from the current discharge:* (Updated: Cross reference - II.A.3.b, page II.A-20.)

Flow (m^3/sec):
- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

BOD_5 (mg/l) for the following plant flows:
- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

Total suspended solids (mg/l) for the following plant flows:
- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

Toxic pollutants and pesticides (ug/l):
- *list each toxic pollutant and pesticide:*
- *list each 304(a)(l) criteria and toxic pollutant and pesticides*
- *pH*
- *minimum*
- *maximum*

Dissolved oxygen (mg/l, prior to chlorination) for the following plant flows:
- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

Immediate dissolved oxygen demand (mg/l) (Updated: Cross reference - II.A.3.b, page II.A-20.)

Flow Projections. The City & County of Honolulu flow projections for the Honouliuli WWTP up to the Year 2020 are shown in Table II.A.4-1. The flow projections are based on sewered population projections and per capita-day factors. As stated previously and in Section II.A.6, Honouliuli's wastewater is predominantly domestic; therefore, minimal industrial or commercial flows are included.

BOD_5 and Suspended Solids. Projected BOD_5 and suspended solids concentrations (Table II.A.4-1) are based on an annual average effluent of 200 mg/1 BOD_5 and 95 mg/1 suspended solids The projected values for the other conditions (minimum hourly, average dry weather, average wet weather, and maximum hourly) were derived from the same ratios of the current flow rates.

Toxic Pollutants and Pesticides. Toxic pollutants refer to pollutants listed as toxic under Section 307(a)(l) of the Clean Water Act or under 40 CFR 122, Appendix D. Within the list of toxic pollutants, pesticides are listed. Added to this list of pesticides are Demeton, Guthion, Malathion, Mirex, Methoxychlor, and Parathion, as required by the NPDES permit. Projected toxic pollutant and pesticide concentrations are anticipated to be similar to the measured 1994 concentrations because the type of waste water that the facility will continue to receive is predominantly domestic. Refer to Chapter III, Part H, Section 2 of this report.

pH. Projected pH values (Table II.A.4-1) are based on effluent range limitation of 6 to 9 pH units.

Dissolved Oxygen. Dissolved oxygen concentrations have not been measured in the effluent. Thus, as similar to the 1983 reapplication, the worst case of 0 mg/1 is assumed.

Table II.A.4-1. Projected effluent values, based on primary treated effluent

	Year				
Flow (m^3/sec):	**1994 (actual)**	**2005**	**2010**	**2015**	**2020**
Minimum daily	0.92	1.23	1.30	1.37	1.45
Average dry weather	1.11	1.38	1.46	1.54	1.61
Average wet weather	1.14	1.63	1.73	1.82	1.92
Maximum daily	1.59	2.13	2.24	2.37	2.48
Annual average	1.12	1.50	1.58	1.67	1.75
BOD_5 (mg/1):					
Minimum flow	190	238	238	238	238
Average dry weather	164	205	205	205	205
Average wet weather	156	195	195	195	195
Maximum flow	176	220	220	220	220
Annual average	160	200	200	200	200
Suspended Solids (mg/1):					
Minimum flow	63	105	105	105	105
Average dry weather	58	93	93	93	93
Average wet weather	60	97	97	97	97
Maximum flow	61	98	98	98	98
Annual average	59	95	95	95	95

Toxic Pollutants and pesticides (ug/l): Refer to Chapter III, Part H, Section 2.

Table II.A.4-1(continued)

pH:	**1994**	**2000**	**2005**	**2010**	**2015**	**2020**
Minimum (monthly average)	6.61	6.0	6.0	6.0	6.0	6.0
Maximum (monthly average)	7.13	9.0	9.0	9.0	9.0	9.0
Dissolved oxygen (mg/1):	0	0	0	0	0	0
Immediate dissolved oxygen Demand (mg/1):	1	1	1	1	1	1

Immediate Dissolved Oxygen Demand. The present and projected immediate dissolved oxygen demands are estimated to be similar to that of the estimate calculated in the 1983 reapplication.

5. **Effluent Volume and Mass Emissions [40 CFR 125.62(e)(2) and 125.67]**

a. *Provide detailed analyses showing projections of effluent volume (annual average, m^3/sec) and mass loading metric tons per year (mt/yr) of BOD_5 and suspended solids for the design life of your treatment facility in five-year increments. If the application is based upon an improved or altered discharge, the projections must be provided with and without the proposed improvements or alterations.* (Updated: Cross reference - Section II.A.4, page II.A-25.)

Response:

The service area of Honouliuli WWTP includes Oahu's planned second city, which has been under construction for the past five years. Population growth and expanded development are expected to result in increased hydraulic loading steadily through Year 2020.

The average annual flow estimates, BOD_5 concentration, and total suspended solids for the present through the year 2020 are shown in Table II.A.4-1 and reproduced in Table II.A.5-1. Values for 1994 are the actual annual average, but future projections shown are based on existing discharge limits (Table II.A.5-2, Figure II.A.5-1) or proposed modified limits (Table II.A.5-3, Figure II.A.5-2).

UPDATE: The projected mass emissions are conservative since they are based on primary effluent discharges and do not consider effluent reuse.

Table II.A.5-1. Projected Effluent Characteristics through Year 2020. Annual Average Values

	Year				
	1994	2005	2010	2015	2020
Flow (m^3/sec)	1.12	1.50	1.58	1.67	1.75
BOD_5 (mg/liter)	160	200	200	200	200
Suspended solids (mg/liter)	**59**	**95**	**95**	**95**	**95**

Mass emissions rates are calculated on the basis of existing permit limits and proposed permit modifications, as illustrated in Tables II.A.5-2 and II-A.5-3, respectively.

Table II.A.5-2. Projected Mass Emissions Based on Existing Permit Limitations for BOD_5 and Suspended Solids*

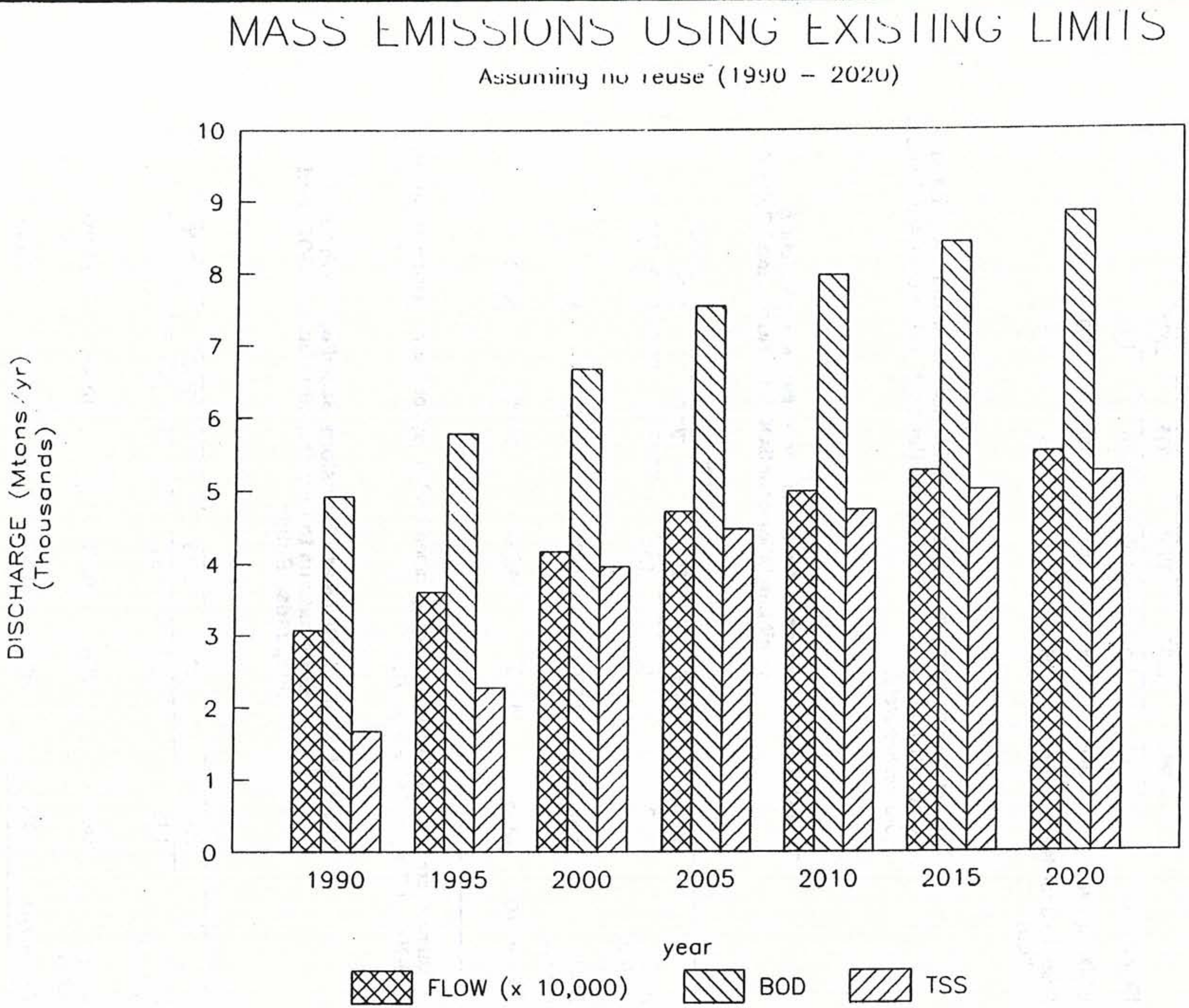
	Year				
	1994	2005	2010	2015	2020
Flow (m^3/sec)	1.12	1.50	1.58	1.67	1.75
BOD_5 (mt/yr)	5,655	7,550	7,980	8,420	8,830
TSS (mt/yr)	2,079	4,480	4,740	5,000	5,240

* Estimates are based on 24-hour-per-day operation for 365 days per year. Existing limits are BOD_5 = 160 mg/1, TSS = 95 mg/1.

Table II.A.5-3. Projected Mass Emissions Based on the Proposed Modifications to Permit Limitations for BOD_5 and Suspended Solids

	1994	2005	2010	2015	2020
Flow (m^3/sec)	1.12	1.50	1.58	1.67	1.75
BODg (mt/yr)	5,655	9,450	9,990	10,500	11,100
TSS (mt/yr)	2,079	4,480	4,740	5,000	5,240

* Estimates axe based on 24-hour-per-day operation for 365 days per year. Proposed modification to monthly average discharge limits are BOD_5 - 200 mg/1, TSS (no change) - 95 mg/1.



Harding Lawson Associates
Engineering and
Environmental Services

Projected MERS - Existing Limits
Honouliuli Wastewater Treatment Plant
Ewa Beach, Oahu, Hawaii

FIGURE **II.A.5-1**

DRAWN | JOB NUMBER 31038.201 | APPROVED | DATE 9/95 | REVISED DATE

b. *Provide projections for the end of your five-year permit term for 1) the treatment facility contributing population and 2) the average daily total discharge flow for the maximum month of the dry weather season.*

Response:

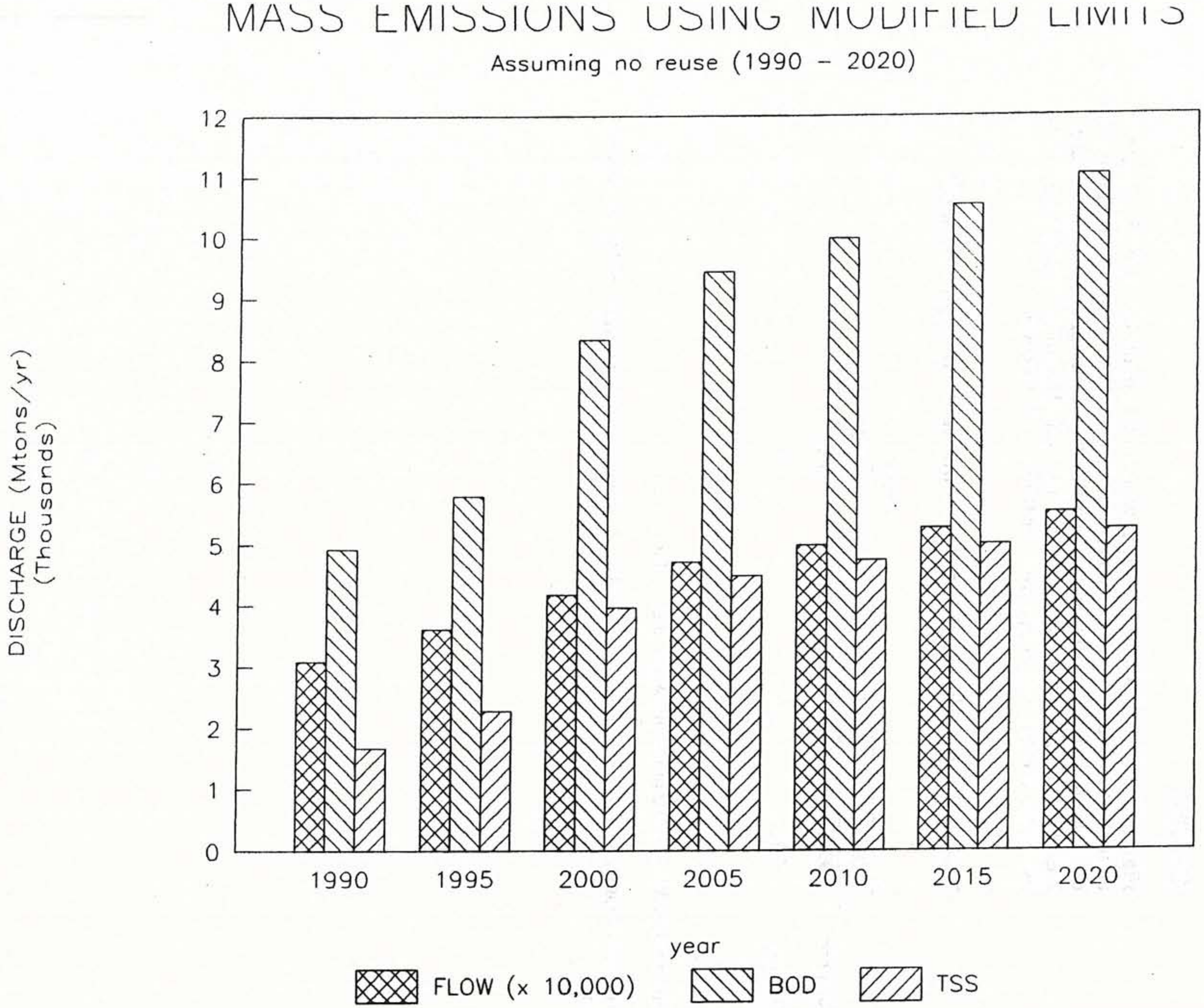
Figures for the projected population within the Honouliuli WWTP service area and the average daily discharge rate for the maximum month during the dry season (DWF) are shown in Table II.A.5-4. Demographic estimates are based on an updated model from the Honolulu Planning Department. Flow estimates are maximum dry weather flows in m^3/second.

Table II.A.5-4. Projected Population Increase Through Year 2020

	Year			
	2005	**2010**	**2015**	**2020**
Population*	290,251	312,502	327,313	342,419
DWF Flow (m^3/sec)	2.22	2.32	2.41	2.50

* Prepared by Wilson Okamoto and Associates. March 31, 1995.

Estimates of maximum dry season flow are based on 24-hour-per-day operation for 365 days per year.



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Engineering and
Environmental Services

Projected MERS - Proposed Limits
Honouliuli Wastewater Treatment Plant
Ewa Beach, Oahu, Hawaii

FIGURE **II.A.5-2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
jcl	31038.201	pr	9/95	

Pages II.A-23 - A-28 present in 1995 application, but not included in 2004 Application

B. Receiving Water Description

1. *Are you applying for a modification based on a discharge to the ocean [40 CFR 125.58(n)] or to a saline estuary [40 CFR 125.58(v)]? [40 CFR 125.59(a)]* (Update)

Response:

Location of Discharge. The Honouliuli WWTP discharges treated effluent into the Pacific Ocean via Mamala Bay, a broad indentation of the southern coastline of Oahu.

The following section discusses the location of the Honouliuli WWTP outfall in relation to the general features of Mamala Bay, Also described are the bathymetry and other basic hydrographic considerations, including total volume of freshwater and marine waters flowing into and out of the bay. It is important to note that the discharge is not located in a saline estuary.

While the question may be responded to with a short answer, the Mamala Bay area is very important and the subject of much study in recent years. More recently, it has been the focus of a large-scale special study undertaken by the Mamala Bay Commission. The City & County of Honolulu provided funds for this commission as an outcome of a settlement agreement over litigation involving the Sand Island and Honouliuli WWTPs and issues centered on the appropriate level of treatment and impacts of these two wastewater discharges on the water quality of Mamala Bay.

The characteristics of Mamala Bay are important to the understanding of the interpretation and explanations given in several other sections of the application; therefore, this information can be helpful as background to the discussions to follow on receiving water. The information has not changed since the 1983 application.

Oceanographic Extent of Mamala Bay. Mamala Bay is on the southeast coast of Oahu and extends from Diamond Head in the east to Barbers Point in the west, covering an estimated shoreline distance of about 21.9 miles (35.1 kilometers). The United States Geological Survey (USGS) 7.5-minute topographic maps indicate the approximate location at the Diamond Head boundary is longitude 157°49'W and latitude 20°N, and the approximate location at the Barbers Point shoreline boundary is longitude 158°06'30"W and latitude 21°N.

Bathymetry. According to Stearns' *Geology of the State of Hawaii,* the geomorphology of Oahu is best described as basaltic volcanic domes or shields, forming what is known as the Hawaiian Ridge (Stearns, 1985). As the island sank, the ancient shoreline terrace, which was shaped by littoral processes, was submerged (Armstrong, 1983) and formed coastal shelves. These are evident in the nearshore bathymetry beyond the fringing reefs of Mamala Bay, where the area is known at the Kahipa-Mamala shelf, and is typical of submerged shelves in Hawaii, which are chiefly drowned coral reefs and marine sediments resting on volcanic or sedimentary rock. Geologically, this shelf has been dated somewhere in the Kasan age (i.e., second of four classical glacial stages of the Pleistocene Epoch which started two million years ago and ended with the Holocene Epoch 11,000 years ago).

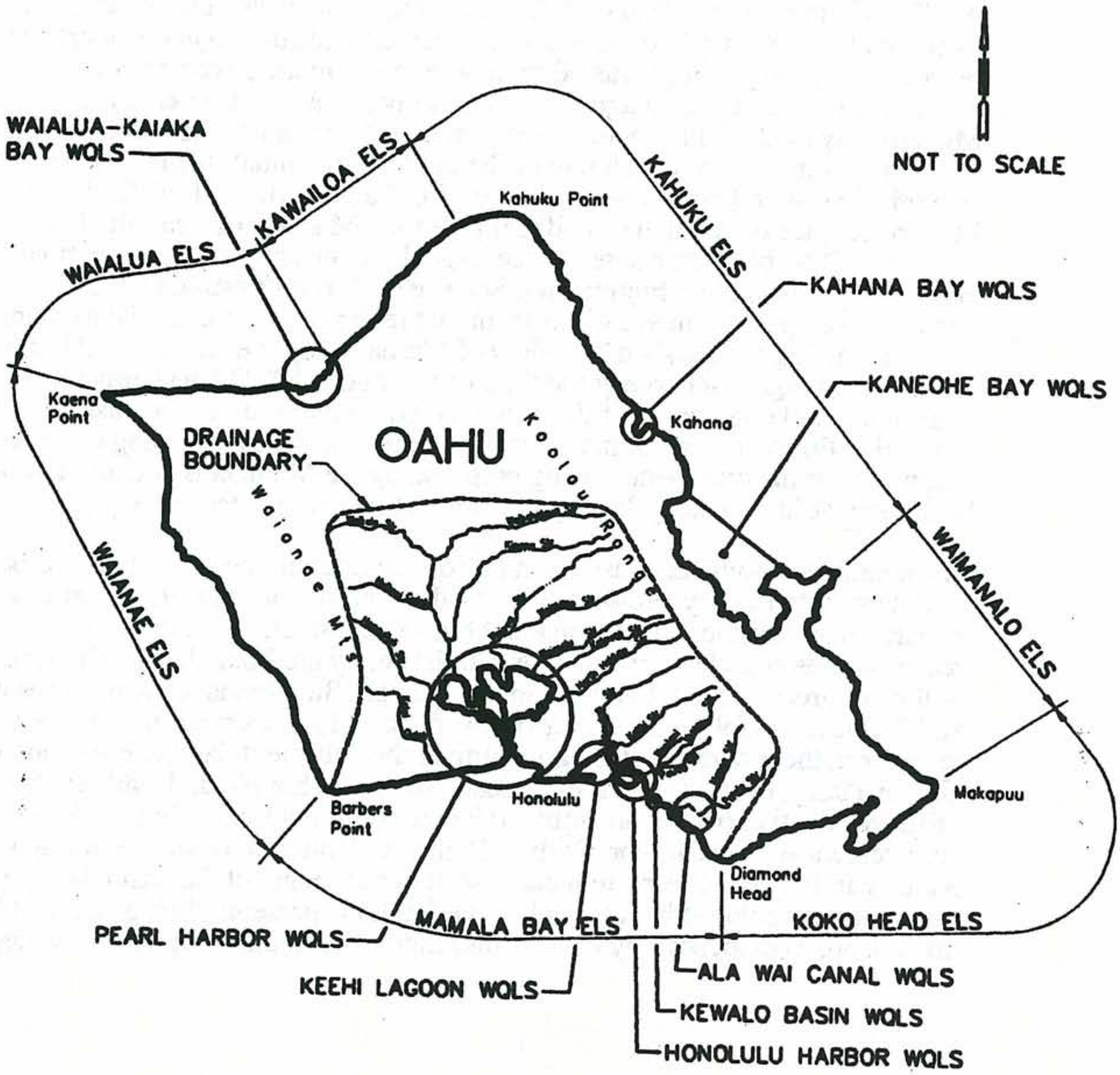
Physically, the Kahipa-Mamala shelf extends to a depth of approximately 350 feet (107 meters), at an estimated 1.5 miles (2.4 km) offshore from Diamond Head to Pearl Harbor channel from where it varies up to 3.6 miles (5.8 km) offshore just southwest of Barbers Point. The Honouliuli ocean outfall diffuser lies on this shelf at a maximum depth of about 200 feet (61 meters) and begins approximately 1.3 miles (2.1 km) offshore.

Drainage Basin Features. The freshwater falling as rainfall on the urbanized drainage basin tributary to Mamala Bay turns into runoff containing nutrients and sediment which is discharged into the bay from a few key drainage courses such as Pearl Harbor, the Ala Wai Canal and major storm drains. The tributary drainage basin is bounded to the north (inland) by an east-west line extending from Windward Oahu to Schofield Saddle, onto the west by a line from Barbers Point to the ridge line of the Waianae Mountain Range, and to the east by the Koolau Mountain Range, and a line oriented to the northeast to the Koolau Mountain Range ridge line. The entire drainage area tributary to Mamala Bay covers approximately 221 square miles (572 square kilometers), or approximately 36 percent of the land surface of Oahu.

Over half of the Mamala Bay runoff drains into the Pearl Harbor lochs, whereas the remaining drainage area comprises the westerly portion of the Ewa Plain including Barbers Point, and the Honolulu-Waikiki drainage area to the east.

There are six perennial streams identified statewide in the *Hawaii Stream Assessment* (DLNR, 1990a) which flow into the Pearl Harbor lochs, two perennial streams flowing into the Keehi Lagoon, one perennial stream flowing into Honolulu Harbor and a stream system flowing into the Ala Wai Canal in Waikiki. The locations of these streams are shown on Figure II.B.1-1. In addition to these streams, there are local drainage systems (including overland flow) and intermittent streams contributing storm runoff either into the perennial streams or directly into the bay.

The first major study of the Island of Oahu's water quality estimated the volume of Mamala Bay at approximately 13.9 x 10^9 cubic yards or 2.8 x 10^{12} million gallons (1.06 x 10^{16} cubic meters) (Engineering Science et al., 1971). This estimate was based on a tide range of 2.1 feet (0.6 meters) with the average tidal exchange estimated to be 16,000 million gallons per day (mgd). With the inclusion of shoreline areas (Pearl Harbor, Keehi Lagoon, Honolulu Harbor, Kewalo Basin, and



LEGEND

ELS EFFLUENT LIMITATION SEGMENT

WQLS WATER QUALITY LIMITED SEGMENT

Source: 208 Water Quality Management Plan for the City & County of Honolulu, November 2001

Figure II.B.1-1 Water Quality Limited Segments on Oahu
Honouliuli Wastewater Treatment Plant Ewa Beach, Oahu, Hawaii

Ala Wai Harbor and Ala Wai Canal), the average tidal exchange estimates were increased by another 5,200 mgd. The estimated losses due to net evaporation (excess over precipitation) was 60 mgd with the estimated average contribution due to runoff of the entire drainage basin at 260 mgd or about 1.6 percent of the Mamala Bay tidal exchange and approximately 5 percent of the shoreline tidal exchange. A more recent estimate of the total mean annual freshwater flow at the five principal shoreline locations, presented in Table II.B.1-1, is about 168.4 mgd; i.e., a difference of about 100 mgd from the total Mamala Bay runoff. This difference is probably attributed to the large drainage areas which encompass the entire bay used from the Engineering Science et al. runoff estimate of 260 mgd. If one uses average current velocities from that report, the average tidal exchange volume crossing the seaward boundary of Mamala Bay is estimated at 27,200 mgd. Including sewage discharge at the time of the study (1971), an estimated 5,600 mgd shoreward component of deep flow is required to preserve a mass balance. Given the differences in estimates, it is obvious that estimates using more recent ocean current measurements (being prepared by the Mamala Bay Commission) will be of interest for updating the net transport estimates for Mamala Bay.

As mentioned above, land use has a profound effect on the quantity and types of pollutants into the bay. However, the loads of pollutants carried to Mamala Bay by stream and surface runoff have not been well documented in the past; and recent studies completed, but not yet published, by the Mamala Bay Commission will be of great interest. Land use in the Mamala Bay drainage basin varies widely and includes the following major types of uses: (1) conservation and forest reserves in the mountains; (2) agriculture in the Schofield Saddle, Ewa and Pearl Harbor Plains; (3) military bases at Pearl Harbor, Schofield and Barbers Point; (4) urban-residential, resort and commercial areas throughout the basin; (5) industrial park centers at Pearl Harbor, Barbers Point and Honolulu (near Keehi Lagoon and Sand Island); and (6) recreation parks scattered throughout the basin. Historically important agricultural land (mainly cane fields) is presently being converted to urban land, as evidenced by the communities of Mililani, Waipio, and Kunia.

Table II.B.1-1. Mamala Bay Principal Shoreline Features[1]

Subbasin Receiving Water	Overland Drainage Area[2] (square miles)	Peak Runoff Flow[3] fcfs)	Mean Annual Freshwater Flow[2] fmgdl
Ala Wai Canal	16.7	24,030	21
Kewalo Basin	0.77	755	0.7
Keehi Lagoon	15.95	31,300	20.6
Honolulu Harbor	11.0	17,200	11.1
Pearl Harbor	111	Not Available	115
Total	155.42	—	168.4

1. Note that values are approximate and that the intent of this table is to present the order of magnitude of the subbasin drainage characteristics.
2. Hawaii Department of Health. 1993. *Revised Total Maximum Daily Estimates for Six* Water *Quality limited Segments Island of O'ahu, Hawaii.*
3. Hawaii Department of Land and Natural Resources. 1990. Peak discharge is according to the Honolulu drainage standards, as referenced by the 1990 Winter *Quality Management Plan for the City & County of Honolulu.*

State Department of Health Hydrographic Classification. The Hawaii Department of Health is the delegated state agency responsible for planning, implementation, and administration of the federal Clean Water Act requirements for the state of Hawaii, including the administration of the National Pollutant Discharge Elimination System (NPDES) permit program.

Effluent limitations were made to mitigate potential impacts of point-source discharges. However, the high mass pollutant emissions from nonpoint sources continue to degrade water quality in receiving waters. Those basins that cannot meet state water quality standards (WQS) of the Hawaii Administrative Rules (HAR), Chapter 11-54, without additional action to control nonpoint sources were identified by the state.

Historically, Hawaii's harbors, bays, and nearshore water quality were impacted by the natural and human-induced pollution of an urbanizing coastal area. In the past, point-source discharges from industrial and municipal processes into shallow nearshore waters caused widespread pollution. In 1973, the state had divided all coastal waters into "designated" basins for the purpose of planning and water quality management, as required in Section 303(e), P.L. 92-500, of the Federal Water Pollution Control Act of 1972. Also, part of the classification scheme, based on water quality information, classified areas into what are known as the water quality limited segments (WQLSs) and effluent limitation segments (ELSs). A discussion of these two classifications is important to the identification of strategies to meet applicable water quality standards.

Water quality limited segments. These are receiving water (e.g., coastal) areas where the Department of Health (DOH) has determined the existing water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards even after effluent limitation requirements on point sources discharges are applied.

Effluent limitation segments. Those are remaining coastal areas where water quality is being met and will continue to meet applicable water quality standards or where water quality will meet applicable water quality standards after application of effluent limitation requirements.

The Clean Water Act, under Section 208, also required planning studies be completed to determine what strategies and policies were necessary to meet water quality goals. In its Section 208 Water Quality Plan, the City & County of Honolulu (city) has identified six Hydrographic Areas (HA) on Oahu which are designated HA-I through HA-VI. Each HA is based on common hydrological characteristics. The Mamala Bay drainage basin includes a portion of HA-III and most of HA-VI. The 1990 Water Quality Management Plan for the City & County of Honolulu has identified four WQLS in HA-III (Ala Wai Canal, Kewalo Basin, Honolulu Harbor, and Keehi Lagoon) and one in HA-VI (Pearl Harbor) within the Mamala Bay drainage basin. Four HA-III WQLS are shown on Figure II.B.1-1.

Of the six WQLSs, only one is considered fully water quality limited, namely Ala Wai Canal. For this WQLS, a Total Maximum Daily Load (TMDL) is recommended for total nitrogen and total phosphorous. A TMDL is the average daily weight of the pollutant that can be assimilated such that the water body can meet the water quality standard. The most effective way to reduce nutrient and sediment loads entering nearshore waters may be through erosion control.

2. *Is your current discharge or modified discharge to stressed waters as defined in 40 CFR 125.58(z)? If yes, what are the pollution sources contributing to the stress? [40 CFR 125.59(b)(4) and 125.62(f)]* (No Change.)

Response:

Introduction. The discharge is not into stressed waters.

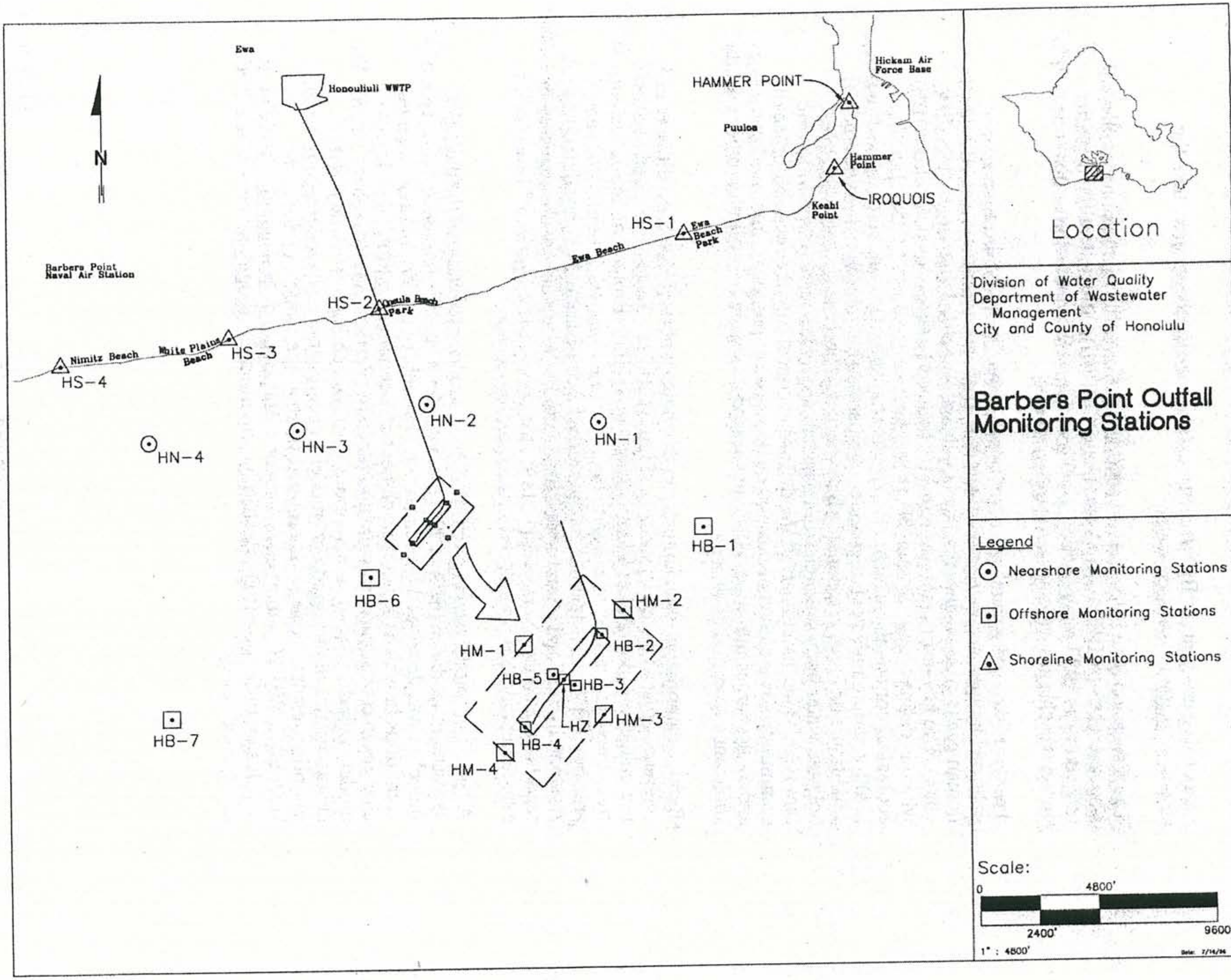
Several definitions are required to explain the basis for this conclusion. First, the definition of "stressed waters" is considered. Next, the definition of balanced indigenous population (BIP) is discussed because it is used to characterize the presence or absence of stressed water. Thirdly, the definition of the term "gradient," applied in marine biology literature, is useful because it is used as an index (measurement) of BIP. If a BIP exists in the discharge area, then the discharge is not to "stressed waters."

The discussion here is focused on additional information that has been collected since the 1983 NPDES Form A and Honouliuli 301(h) Reapplication (hereafter referred to as 1983 reapplication), and reconfirms the conclusion at that time (1983) that the discharges were not into stressed waters.

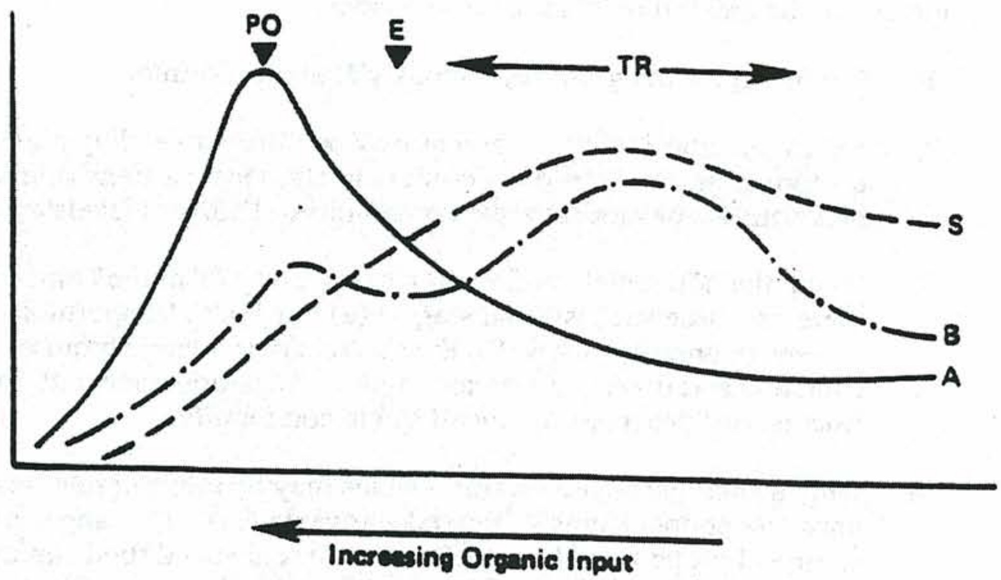
The term "stressed waters" refers to "ocean waters in which the absence of a balanced indigenous population of shellfish, fish, and wildlife is caused solely by human perturbations other than the applicant's modified discharge" (U.S. EPA, 1994). The key term in this definition is balanced indigenous population (BIP), which is defined in the Section 301(h) regulations [Subpart 125.58(f)] as "an ecological community which: 1) exhibits characteristics similar to those of nearby, healthy communities existing under comparable but unpolluted environmental conditions; or 2) may reasonably be expected to become reestablished in the polluted water body segment from adjacent waters if sources of pollution are removed." The second part of the definition concerning the reestablishment of communities is included because of its relevance to proposed, improved discharges and to discharges into waters that are stressed by sources of pollution other than the applicant's modified discharge.

Benthic sampling is done annually in the vicinity of the Honouliuli diffuser and reference areas at locations shown in Figure II.B.2-1. Samples are used to define the indigenous population and its natural variability. Biological indices calculated from the data are used to evaluate both the zone of initial dilution (ZID) and the area beyond the ZID that can be considered a comparable but unpolluted habitat. As done in the Sand Island application, and in the annual benthic assessment reports prepared by Nelson et al., 1995, the concept of a "gradient" is useful for evaluating any stresses induced in the receiving waters.

A "gradient" model (see Figure II.B.2-2) is introduced because of the biological assessment guidance (EPA, 1994) that includes a specific reference to this type of a model. It was developed by Pearson and Rosenberg in 1978 for assessment of conditions in which organic enrichment of a certain magnitude may lead to changes in community structure and function (Pearson and Rosenberg, 1978). The model is used as a comparative tool to evaluate changes. By studying the characteristics of the "gradient" model and comparing the model against benthic sampling results, it can be determined whether the model applies to the Honouliuli WWTP outfall environment. If the model does not apply, (which is the conclusion of Section II.D), the benthic environment should not be characterized as "stressed waters."



Ewa
Honouliuli WWTP
N
Hickam Air Force Base
HAMMER POINT
Puuloa
Hammer Point
IROQUOIS
Keahi Point
HS-1
Ewa Beach Park
Ewa Beach
Barbers Point Naval Air Station
HS-2
Oneula Beach Park
White Plains Beach
HS-3
Nimitz Beach
HS-4
HN-1
HN-2
HN-3
HN-4
HB-1
HB-2
HB-3
HB-4
HB-5
HB-6
HB-7
HM-1
HM-2
HM-3
HM-4
HZ
Location
Division of Water Quality
Department of Wastewater Management
City and County of Honolulu
Barbers Point Outfall Monitoring Stations
Legend
Nearshore Monitoring Stations
Offshore Monitoring Stations
Shoreline Monitoring Stations
Scale:
0
2400'
4800'
9600'
1" : 4800'



S = Species numbers
A = Total abundance
B = Total biomass
PO = Peak of opportunists
E = Ecotone point
TR = Transition zone

Generalized depiction of changes in species numbers, total abundances, and total biomass along a gradient of organic enrichment (Perason and Rosenberg 1978).

Figure II.B.2-1 should be reviewed during the following discussion. In the gradient model, benthic species in sediments in the vicinity of the discharge are few in number and diversity. Further away, the number of species rises. The ecotone point (see Figure II.B.2-1) is "a transition zone within which is a community poor in species, abundance, and biomass. On the heavily polluted side of this point, the community is composed of a few pollution-tolerant opportunistic species. On the less polluted side of the ecotone point the different transitory assemblages gradually approach the composition of the community in the unpolluted environment" (Pearson and Rosenberg, 1978). In summary, the Pearson and Rosenberg gradient model can be defined by these characteristics:

1) Communities integrate continuously along a continuum.

2) Environments along the gradient may be differentiated by the presence of an ecotone point. An ecotone point is understood as a transition region between two or more diverse communities. Biomass levels are low.

3) Along the horizontal continuum moving away from the point of enrichment, there are these successional stages: (a) the peak of opportunists with few species in great numbers; (b) the ecotone point where biomass is low and evenness and diversity increase; and (c) transition zone with initially great fluctuations progressing toward stable community.

4) Only a small group of benthic species may be referred to as organic enrichment opportunists; they take advantage of (a) changes in physical-chemical properties of the sediments; (b) enhanced food supply; and (c) reduced biological interaction that allows development of large populations.

"As the degree of enrichment decreased, these essential specific characteristics gradually change to encompass populations with a much wider range of ecological and reproductive characteristics but this less genetic flexibility, whilst community complexity increases with the increasing predictability of the environment." (EPA, 1994). Note that Pearson and Rosenberg considered gradients to occur both spatially and temporally.

The scales over which gradients have been measured, both in terms of space and time, are useful to define for the discussion of BIP. In terms of horizontal distance from point sources of organic enrichment, most of the experience in temperate marine waters (Pearson and Rosenberg, 1978) was on a scale of a few hundred meters. Vertical effects of enrichment in sediments were less than 10 centimeters (cm); often much less (e.g., 4 to 7 cm). Dollar (1986) reported the effects of particulate organic matter were principally within a distance of 70 meters of the Sand Island diffuser, and to a depth of less than 4 cm in the sediment column.

The time scale for changes in community structure, i.e., gradients to manifest, can be considered to be relatively rapid in tropical marine waters as compared to temperate regions. Examples are cited by Pearson and Rosenberg (1978) of *Capitella capitata* (a polychaete worm species that is a key indicator of organically enriched sediments) colonizing suitable unoccupied areas on the ocean bottom in a few years. However, there are other examples of colonization of unoccupied areas by this worm in a period measured in months. The life cycle of this species varies from 30 days to one year, and one female has approximately 10,000 eggs. In the tropics, many larvae are planktotrophic which increases wide distribution and colonization potential.

Dollar (1979) provided information on observed rapid recovery for the benthic community when the discharge of raw sewage was abated in the shallow waters off Sand Island. The report provides an order of magnitude to time associated with changes in gradients. It was found that dead expanses of coral *(Porites compressa)* at the extreme periphery of regions where sewage has previously stressed coral regenerated when discharge of raw sewage from the old Sand Island outfall ceased. The time period for regeneration was between 1978 and 1979 to levels equivalent to control areas. In summary, for certain organisms, the time period by which noticeable effects of organic enrichment can be measured, is within a few years. Therefore, the duration of the five-year benthic monitoring program is sufficient to enable identification of pollution (enrichment effects, if any).

The introductory discussion was provided to explain the rationale for the summary of ongoing monitoring of macrobenthos in the vicinity of the Sand Island outfall diffuser where more dramatic changes from a relocation of the discharge and upgrading of treatment were noted. The Honouliuli treatment plant was likewise constructed to handle the flows of a number of small discharges which had been discharging into Pearl Harbor and to move the location for effluent discharge into deep offshore waters.

Detailed explanations concerning anticipated effects of the proposed Honouliuli modified discharge and determination of a lack of impacts on the marine environment are contained in the answers to questions in Section III.D. In addition to the macrobenthos study, study results that analyzed phytoplankton, fish, and coral communities are also summarized there with details in Appendix C.

The three indicators that are used to study macrobenthic communities in the Pearson and Rosenberg gradient model are number of species, abundance, and biomass. Each of these parameters are generally portrayed along a profile that is intended to be parallel to the principal axis of dispersion of the effluent discharge. Points along the profile represent individual sample locations. For the Honouliuli discharge studies, biomass is not measured; therefore only species richness and abundance can be depicted. The location of the various sampling locations are shown on Figure II.B.2-2. Note that there are two reference stations (HB1 and HB7) and five zones of initial dilution (ZID) stations (HZ, HB2, HB3, HB4, and HB5) and a near-field station (HB6).

The results of ongoing macrobenthos/sediment surveys (Nelson et al., 1986; 1991; 1992a; 1994a; and 1994b) are shown on Figures II.B.2-3 and II.B.2-4 for mollusk and nonmollusk species abundance and numbers. Because of the small size of the organisms, reliable estimates of biomass are difficult to make and are not reported in the macrobenthic surveys. The sample stations are located upcurrent, within zone of initial dilution, and downcurrent of the diffuser.

As seen in these two figures, the species abundance and numbers are variable, but on the whole not disproportionately higher or lower along the profile. By combining the six surveys to date done over a nine-year period, it can be seen that the benthic population is relatively stable.

Provide a description and data on the seasonal circulation patterns in the vicinity of your current and modified discharge(s). [40 CFR 125.62(a)] (Updated.)

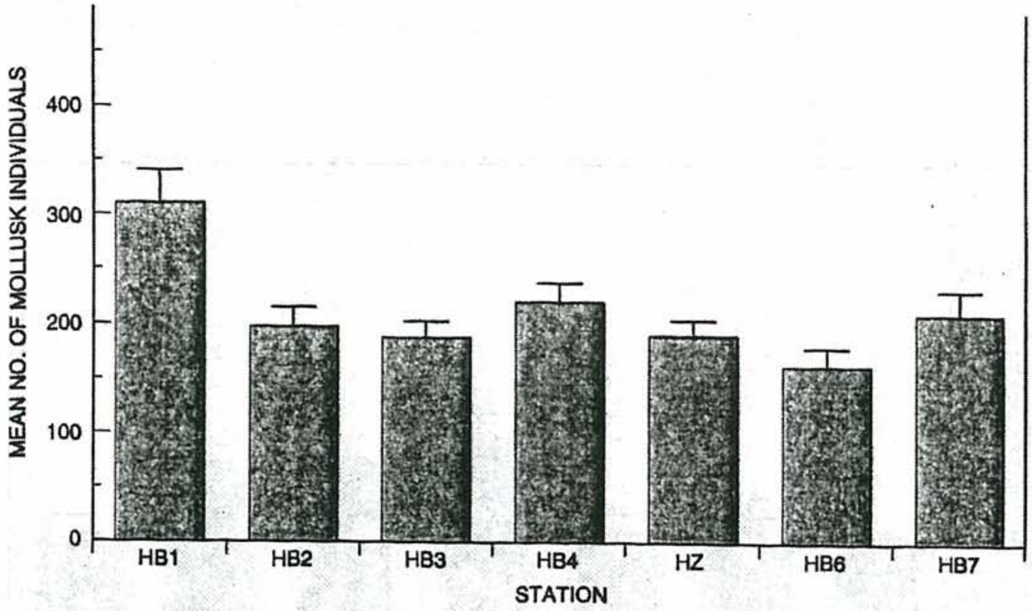
Response:

Current Conditions. The basic descriptions of seasonal circulation patterns provided in the 1983 reapplication questionnaire are repeated here. These are primarily based on four documents that provided much of the information that is relevant concerning circulation patterns in Mamala Bay. The original sources of information for the 1983 reapplication are classical references for Oahu (Bathens, 1978; and Laevastu et al., 1964). In addition to these sources, information is presented from the 1990 current monitoring undertaken by Look Laboratory at the University of Hawaii and reported in detail in an analysis and testimony prepared for the 1993 Evidentiary Hearing by Dr. Edward Noda (Noda, 1993).

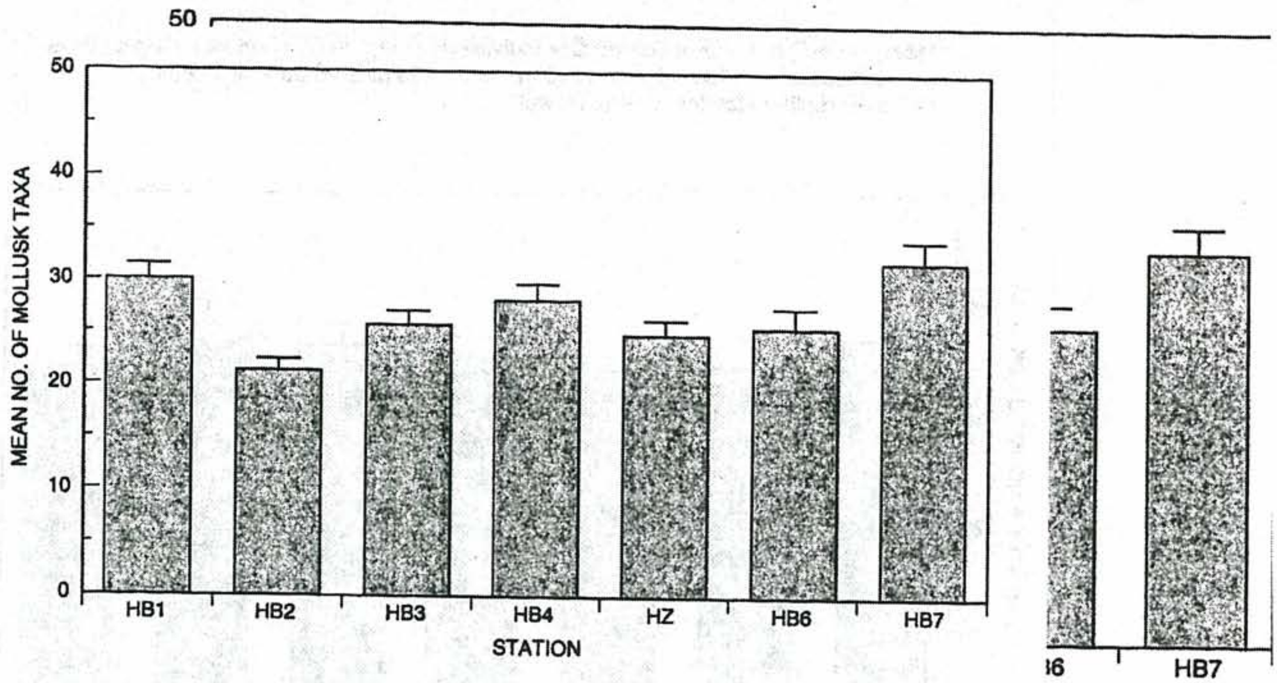
The conclusions of the 1983 reapplication were that:

> . . . the studies have shown that the circulation is complex, varies seasonally in some locations but not others, and that the relative importance of the modifying forces such as tides, winds, and offshore eddies varies with location. In most nearshore locations, the semidiurnal tide and the underlying "permanent" current are the main driving forces influencing the circulation. The diurnal tide and a combination of seasonal and annual changes tend to make the current patterns more complex. The surface layers (approximately the top 5 meters) are influences by the prevailing winds. (M&E Pacific, 1983a).

The prevailing near-surface circulation pattern around the Hawaiian Islands is shown in Figure II.B.3-1 based on reference (Bathens, 1978).



Mean (+1 SE) number of mollusk individuals compared among sampling stations for data collected in 1986 and from 1990 through 2003 at Barbers Point Ocean Outfall sampling stations, O'ahu, Hawai'i



Mean (+1 SE) number of mollusk taxa compared among sampling stations for data collected in 1986 and from 1990 through 2003 at Barbers Point Ocean Outfall sampling stations, O'ahu, Hawai'i

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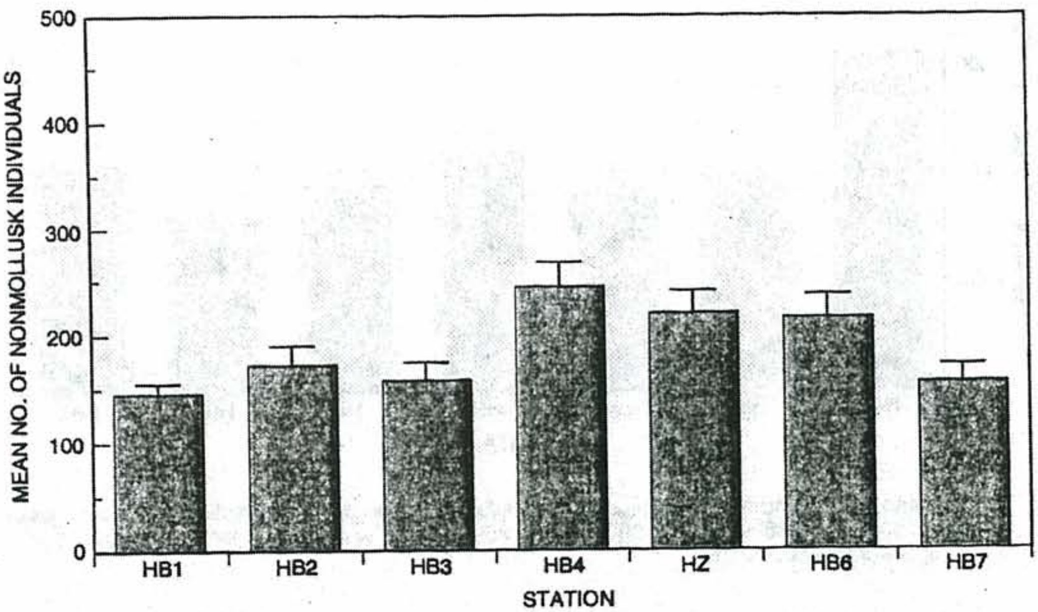
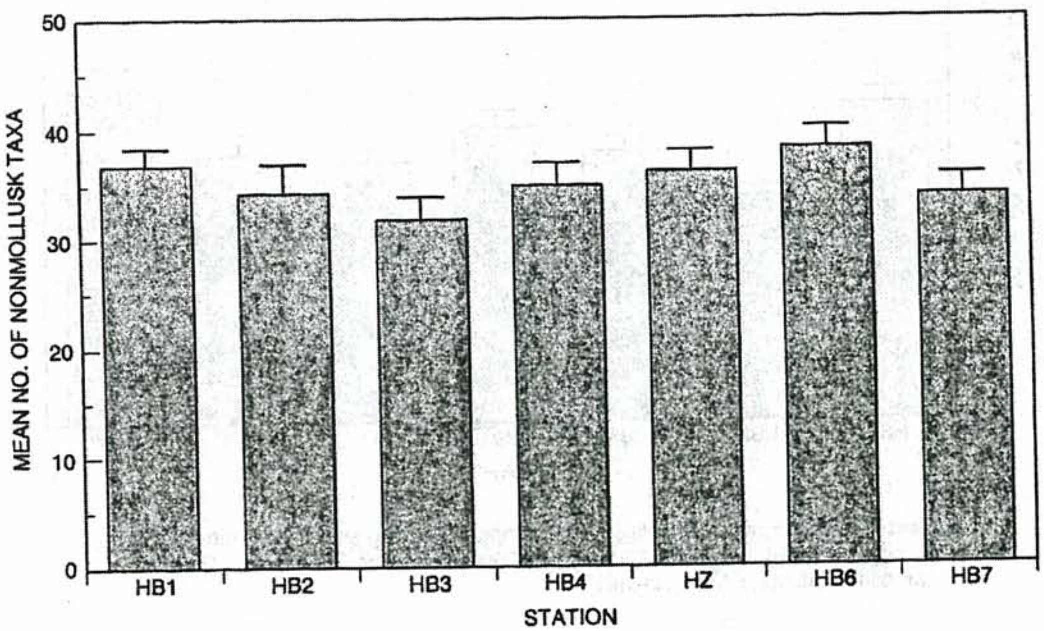
Figure II.B.2-3 Mollusk Species Abundance at HWWTP Monitoring Stations



Mean (+1 SE) number of nonmollusk individuals compared among sampling stations for data collected in 1986 and from 1990 through 2003 at Barbers Point Ocean Outfall sampling stations, O'ahu, Hawai'i



Mean (+1 SE) number of nonmollusk taxa compared among sampling stations for data collected in 1986 and from 1990 through 2003 at Barbers Point Ocean Outfall sampling stations, O'ahu, Hawai'i

Figure II.B.2-4 Nonmollusk Species Abundance at HWWTP Monitoring Stations

THE OCEAN

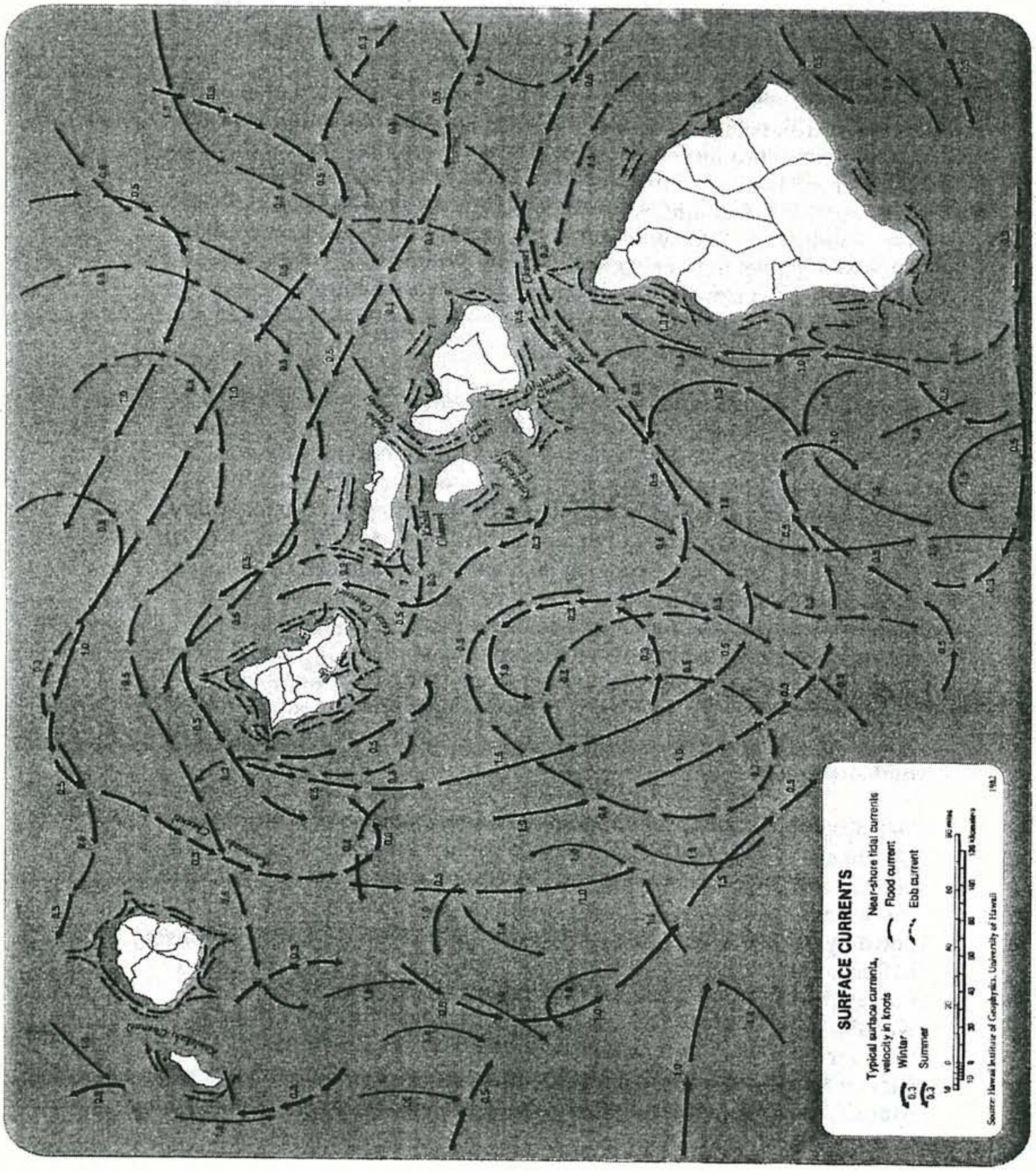


FIGURE II.B.3-1
PREVAILING CURRENTS IN HAWAIIAN WATERS

Two comprehensive studies of general circulation patterns in the Hawaiian

Islands (Laevastu et al., 1964) and Engineering Science et al., (1971). This 1971 Engineering Science, report described circulation conditions around Oahu and the significant findings cited below:

> The speculation, based upon the present evidence is that an East Pacific Gyre exists and that the position of this gyre changes seasonally. During late spring, summer, and early fall months the East Pacific Gyre is probably centered south southeast of the Island of Hawaii. If so, this gyre would produce a general north or northwest flow in the area of the Hawaiian Archipelago. Though the Hawaiian Islands would break up this basic flow into more complex patterns around the islands, the water would generally approach the island of Oahu from the southeast. During the winter months the location of the East Pacific Gyre probably moves southward. This would allow the west wind drift north of the Hawaiian Archipelago to also move slightly southward. The result would be that the flow approaching the Hawaiian Archipelago would be basically from the northeast and therefore the flow would reach Oahu from the north or northeast.
>
> During the winter months of November through February the flow approaches the windward coast of Oahu from the northeast. This flow is divided off Kaneohe Bay. The northern portion moves northwest toward Kahuku Point. The southern portion is diverted around the east coast of Oahu, flows parallel to the east coast of Oahu, Maunalua Bay, and continues moving around Diamond Head into Mamala Bay. As will be shown later, this flow becomes increasingly influenced by the wind as it moves toward Mamala Bay. Once in the bay the net westward transport decreases and the influence of the coastline confirmation (bathymetry) deflects this flow to the southwest. During both the winter and summer months (excepting kona storms) a southwest transport off Barbers Point turns westward offshore and moves toward Kaena Point. The result is that anticyclonic eddies may form off the southern portion of the Waianae coast.
>
> During the late spring, summer, and early fall months of April to October, the flow approaches Oahu from the southeast. The northern portion of this flow moves around Makapuu Point, flows parallel to the shore across Waimanalo Bay, across Kailua Bay, and is deflected to the north by Mokapu Point. Once around Mokapu Point this flow probably deflects shoreward again under the influence of the tradewinds and moves parallel to the shore northwestward to Kahuku Point. At Kahuku Point it begins flowing to the north again slowly shifting to the west far offshore. The southern portion of the flow dividing at Makapuu Point moves along the entire south coast of Oahu into Mamala Bay, resulting in a southwest transport leaving the bay during the summer months.

> At Barbers Point a portion of this flow probably meets water moving southeastward along the Waianae coast. The result is a possible formation of cyclonic eddies off Barbers Point and off the Waianae coast primarily during the last spring and early fall. Eddies would more likely occur with the changing tide during the periods when the tradewinds are strong. The configuration of the coastline off both the windward side of Oahu and the leeward side from Makapuu Point to Barbers Point strongly influences the flow throughout the year in the shallow areas (less than 30 ft deep) close to the shoreline. Behind prominent points, as Kawaihoa Point (Koko Head), eddy patterns may develop and change with each changing tide. (Chin and Roberts, 1985).

These prevailing currents and eddy conditions described above are shown on Figure II.B.3-1. Note that the predominant direction is from east to west in both seasons (summer and winter). Locations of large scale (30 to 80 kilometer across) eddies are shifted between seasons, but in both cases are at least 10 kilometers south of Oahu's southern shore.

The Engineering Science et al. (1971) study analyzed the components of current within approximately 10,000 feet of the Oahu coast and concluded the tidal contribution to the total current is significant. Table II.B.3-1 shows the tidal component can range between approximately two-thirds to four-fifths of the total current. The tidal current, therefore, masks the prevailing Pacific North Equatorial Current flow, which is generally westerly, resulting in nearshore current patterns as shown in Figure II.B.3-1 (Armstrong, 1983).

The 1983 reapplication described the importance of tidal components:

> Hawaii has predominately semidiurnal tidal variations with a pronounced diurnal inequality. The average tidal change per 24 hours is 0.72 m (2.36 ft). The semidiurnal tidal wave approaches Oahu from the northeast as a progressive wave, with the flow separating and moving around the island.
>
> Common amplitudes of the semidiurnal currents are 20 to 30 cm/sec (reference II.B(29)). At most locations in Hawaii the maximum current occurs in the interval between two hours before Honolulu high water and one hour after. The velocities associated with the diurnal tidal current are much smaller than those corresponding to the semidiurnal tide. At most current meter stations, the diurnal component was only 10 to 15 cm/sec. The coherence with the Honolulu sea level was also low.

Table II.B.3-1. Estimates of the Contribution to the Total Currents Due to the Semidiurnal and Diurnal Tides at the Honouliuli Outfall (1990 to 1995)

			Average Total Current				Average Tidal Current				Phase of a Maximum Velocity Related to Honolulu **		
			Ebb Tide		Flood Time		Ebb Tide		Flood Time				
Location	Depth Range [feet]	Month	Average Vel. [kts]	Average Dir. [Mag]	Average Vel. [kts]	Average Dir. [Mag]	Estimated Semidiurnal Amplitude [kts]	Estimated Diurnal Amplitude [kts]	Estimated Semidiurnal Amplitude [kts]	Estimated Diurnal Amplitude [kts]	Semidiurnal [hrs]	Diurnal [hrs]	Estimated Tidal Contribution To the Total Current [Percent]
Sand Island Outfall	0-40	Jun-Jul	0.50	195	0.45	260	0.22	0.10	0.29	0.15	+ 1/2	0	69
Waikiki	0-30	Jul	0.60	107	0.50	136	0.20	0.15	0.20	0.10	-1	+ 1/2	60
Pearl Harbor Entrance	0-100	Nov	0.40	172	0.40	282	0.16	0.10	0.10	0.10	0	-1/2	58
Sand Island Deep	150-250	Nov	0.20	171	0.25	230	0.17	0.11	0.23	0.14	-12	0	86
Sand Island Deep	250-350	Dec-Jan	0.25	178	0.20	190	0.19	0.12	0.21	0.10	-1/2	+ 1/2	83
Sand Island Deep	150-250	Sep	0.20	185	0.25	170	0.19	0.11	0.21	0.13	0	+1	89
Barbers Point	0-60	Aug-Sep	0.65	158	0.40	192	0.30	0.10	0.25	0.15	-1	-1 1/2	71
Barbers Point, East	0-40	Jul	0.25	133	0.20	260	0.20	0.08	0.17	0.15	-1/2	-1	81
Barbers Point West	0-40	Jul	0.60	260	0.40	155	0.22	0.10	0.26	0.05	-1 1/2	-2	67

* Degrees from magnetic north.
** Phase represents the amount of time (hrs) to add (+) or subtract (-) from the time at which the change of Honolulu tides occur,
kts = Knots (1 knot = 1.1 miles per hour).

Source: Reference II.B(25) as cited in Sand Island 301 (h) application of August 1994 prepared for City & County of Honolulu by Barrett Consulting Group

> Measurements off Diamond Head indicate the predominance of the semidiurnal tidal currents, with flood tide current moving west and ebb currents moving east, parallel to the shoreline (Laevastu et al., 1964). Similar measurements northwest of Barbers Point show semidiurnal tidal current reversals, but with the opposite flood and ebb tide directions. This indicates that the area of convergence of the flood current and divergence of the ebb current lies between Diamond Head and Barbers Point. This convergence/divergence area is located west of Pearl Harbor in the vicinity of Ewa Beach. Between Sand Island and Diamond Head the currents reverse in phase with those at Diamond Head, but with more irregularities in the current meter records.

This combination of "permanent" flow across Mamala Bay and the tidal flow can be expected to produce reversing currents with a net southwest transport. (The net transport direction in Mamala Bay are shown on Figure II.B.3-2). The effects of wind and bathymetry, however, also influence circulation in Mamala Bay. Small-scale eddies resulting from flow past prominent point such as Diamond Head may cause irregularities in the observed currents and have been observed in Mamala Bay during past studies. (M&E Pacific, 1983a).

The Mamala Bay Study provides another perspective of the circulation patterns within Mamala Bay. The study reiterates the complexities of the circulation patterns with similar mention of tidal and wind generated components and particular mention of the presences and interactions of an internal wave. After a year and a half of monitoring (January 1994 to July 1995) using more sophisticated measuring devices than had been applied in the previous studies, the Mamala Bay Study concludes that previous studies were generally consistent with the findings of the Mamala Bay Study; however, the Mamala Bay Study does site a greater contribution of an easterly current when compared against the other studies.

Generally, the contribution of the tide to current velocity is highest (from approximately 80 to 90 percent based on Table II.B.3-1) in the deep subsurface layer (200 feet to 300 feet depth) off Honouliuli. In the surface layer (less than 100 feet depth) the estimated tidal contribution declines (e.g., to approximately 60 percent) but is still significant. One can expect the tidal correlation to decrease in the shoreward direction as other factors such as land-generated stream discharge, rip currents, and wind-driven surface currents create more complex conditions. The basic conclusion of the 1983 reapplication is still valid and has been confirmed in recent work by Noda.

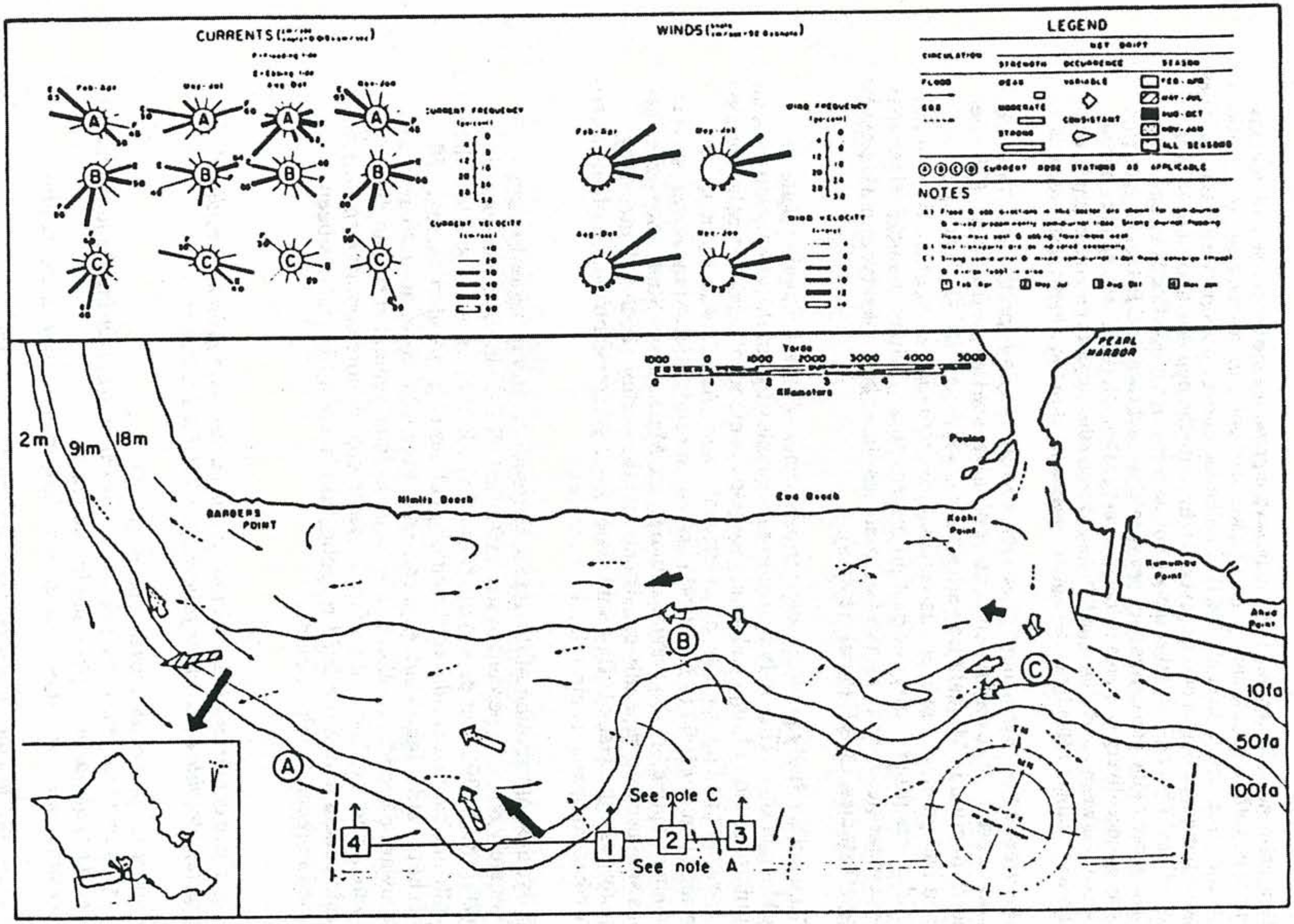
4. *Oceanographic conditions in the vicinity of the current and proposed modified discharge(s). Provide data on the following: [40 CFR 125.62(a)]*

   Lowest ten percentile current speed (m/sec)
   Predominant current speed m/sec) and direction (true) during the four seasons
   Period(s) of maximum stratification (months)
   Period(s) of natural upwellmg events (duration and frequency, months)

   Density profiles during period(s) of maximum stratification

(No Change.) <u>Response:</u>

Refer to Appendix D for a detailed description of oceanographic conditions and currents in the vicinity of the Honouliuli outfall.



SOURCE: Bathens, K. 1978. Circulation Atlas for Oahu, Hawaii. University of Hawaii, SEAGRANT-MR-78-05. p. 26

Figure II.B.3-2 Current and Wind Rose of the W-S Sector, Pearl Harbor to Barbers Point

5. *Do the wceiving waters for your discharge contain significant amounts of effluent previously discharged from the treatment works for which you are applying for a section 301 (h) modified permit? [40 CFR 125.57(a)(9)]* (Update.)

   Response:

   Mamala Bay is a moderately shallow embayment stretching more than 20 miles on the south coast of Oahu. Circulation of Malama Bay is dominated by oceanic flows as well as tidal currents. The critical initial dilution of 200 brings Honouliuli WWTP's effluent within all existing water quality standards at the ZID boundary. Effluent is quickly diluted and transported offshore during most months of the year and under the majority of ocean conditions. The waters of Malama Bay are not stressed due to effluent or runoff (Section II.B.2) and there are no known indications that effluent is reintroduced to the ZID.

6. *Ambient water quality conditions during the period(s) of maximum stratification: at the zone of initial dilution (ZID) boundary, at other areas of potential impact, and at control stations. [40 CFR 125.62(a)]* (Updated.)

   6a. *Provide profiles (with depth) on the following for the current discharge location and for the modified discharge location, if different form the current discharge:*

   - *BOD_5(mg/l)*
   - *Dissolve oxygen (mg/1)*
   - *Suspended solids (mg/1)*
   - *pH*
   - *Temperature (°C)*
   - *Salinity (ppt)*
   - *Transparency (turbidity, percent light transmittance)*
   - *Other significant variables (e.g., nutrients, 304(a)(l) criteria and toxic pollutants and pesticides, fecal coliform bacteria)*

   6b. *Provide available data on the following in the vicinity of the current discharge location and for the modified discharge location, if different from the current discharge: [40 CFR 125.612(b)(l)]*

   - *Dissolved oxygen (mg/1)*
   - *Suspended solids (mg/1)*
   - *Ph*
   - *Temperature (°C)*
   - *Salinity (ppt)*
   - *Transparency (turbidity, percent light transmittance)*
   - *Other significant variables (e.g., nutrients, 304(a)(l) criteria and toxic pollutants and pesticides, fecal coliform bacteria)*

6c. *Are there other periods when receiving water quality conditions may be more critical than the period(s) of maximum stratification? If so, describe these and other critical periods and data requested in 6.a. for the other critical period(s). [40 CFR 125.62(a)(l)]*

Response:

Refer to Appendix B for a complete list of receiving data and available water quality profiles. No indications have been found which suggest that more critical periods exist than during periods of maximum stratification. BOD_5 profiles are not available and are not required by the NPDES monitoring program. Suspended solids data are very limited since most samples, when taken, have been less than 1 mg/1.

7. *Provide data on steady state sediment dissolved oxygen demand and dissolved oxygen demand due to resuspension of sediments in the vicinity of your current and modified discharges) (mg/l/day).* (Updated.)

Response:

Refer to Appendix F, Attachment 3, for a complete description of the analysis performed. Results will be summarized here in the final draft.

C. Biological Conditions

Provide a detailed description of representative biological communities (e.g., plankton, macrobenthos, demersal fish, etc.) in the vicinity of your current and modified discharge(s): within the ZID, at the ZID boundary, at other areas of potential discharge-related impact, and at reference (control) sites. Community characteristics to be described shall include (but not be limited to) species composition; abundance; dominance and diversity; spatial/temporal distribution; growth and reproduction; disease frequency; trophic structure and productivity patterns; presence of opportunistic species; bioaccumulation of toxic materials; and the occurrence of mass mortalities. (Update: Cross reference - II.C.l, page II.C-1.)

Response [updated]:

The requested detailed information has been provided in this application in various appendixes including Appendix C and its various supporting Attachments. Appendix C contains description of plankton, macrobenthos, fish populations observed via either submersible, video footage taken using a Remote Operated Vehicle (ROV) or by scuba divers, the inshore patch coral reef community and marine birds, mammals, and turtle populations.

Appendix J addresses bioaccumulation of toxic materials in local fish that are representative of both commercial and recreational fisheries and summarizes bioaccumulation data and compares the results with data sets from other areas.

Rare, threatened and endangered species that are found in the region and the vicinity of the Honouliuli discharge are described in Appendix C and Section III.D. This section of the application contains a summary overview of the general marine biological conditions as summarized from the various supporting appendices.

Description of General Conditions. The City & County of Honolulu's Honouliuli WWTP discharge area is into the offshore waters of Mamala Bay off the Ewa Plain to the southwest of Pearl Harbor, Oahu, Hawaii. Mamala Bay is centered seaward around the city of Honolulu and encompasses an area of about 185 square kilometers extending from Diamond Head on the east to Barbers Point on the west, a distance of about 33 kilometers. The area is a gently sloping coastal plain derived from lava flows. The volcanic-derived island mass constitutes the major source of sediment for the sea floor off Oahu. Pearl Harbor, a major freshwater source to the area, discharges into Mamala Bay 4 kilometers east of the outfall. The harbor is a major source of nutrients and bacteria derived form an extensive developed watershed area. Outflow of freshwater from Pearl Harbor averages an estimated 115 million gallons a day (Barrett Consulting Group, Inc., 1994a). Pearl Harbor estuary is an important source of freshwater to Mamala Bay and a source of many potential pollutants that can impact water quality in the area.

Features and activities other than waste discharges, which may influence biological conditions in the area, include: 1) rainfall/surface-water runoff from local harbors and rivers; 2) runoff from flood control channels and storm drains; and 3) the presence of the other wastewater discharges (Sand Island outfall and Fort Kamehameha treatment plant).

The sediments along the Mamala Bay coastal zone and narrow-shelf deposit show a regular, rather uniform pattern of medium-grained sands along the shore to depth of the outfall.

Bottom sediments are typically dominated by sand and occasional shell fragments (near the outfall).

There is an extensive sport and commercial fishery in the offshore area, most of which are many miles offshore. Commercial landings from the nearshore area are very limited, but recreational harvesting for food is extensive for both fish, sea urchins and algae (limu).

There are no distinct habitats of limited distribution, either within or beyond on the zone of initial dilution (ZID) of the Honouliuli outfall. Distinctive habitats such as coral reefs do exist shoreward of the diffuser site at depths ranging from 10 to 20 meters (AECOS, 1979a) with live coral coverage ranging from 0 to 60 percent with the most frequently observed value of 20 percent or less. These reefs are separated from the outfall diffuser by a minimum of 2,000 meters (AECOS, 1979a). The outfall pipe's armored rocks form the most distinctive habitat in the area and provide habitat, holes, crevices, and attachment sites for various species. The rocks form a large artificial reef, which increases productivity and faunal diversity.

Description of Shoreline and Ocean Bottom off Ewa Beach. The ocean bottom in the vicinity outfall is composed of a wide, predominately flat calcium carbonate (limestone) platform, which is an erosional remnant of the extensive, geologically ancient emergent reef that forms the Ewa Plain. The distance from the shoreline to the 20-meter-depth contour is approximately 2 kilometers, indicating that the bottom topography has a very gentle slope. Sloping gradually increases from the shoreline out to well beyond the 100-meter-depth contour. The surface of this reef platform is relatively barren, characterized by short algal turf cover and a layer of sediment composed of sand. In some areas, shallow, sand-filled channels intersect the reef platform, resulting in a limited groove and ridge system. In some of the deeper areas, there are extensive sand deposits. The nearshore area has a rather solid limestone bottom averaging about 35 percent coverage, while sand and rubble cover approximately 62 percent of the area surveyed by the "Ewa Marine Biological Monitoring Program" (AECOS, 1979a). This is characteristic of the nearshore regions. Offshore, the entire ocean floor consists of sand and rubble.

Description of Biological Conditions. (Note that references cited herein are contained in the reference listings for the appendixes from which the material was summarized.)

The City & County of Honolulu's existing monitoring program is performed under the provisions of its 301(h) modified National Pollutant Discharge Elimination System (NPDES) Permit and requires the city to conduct an Ocean Monitoring Program of the Honouliuli Barbers Point Outfall. The present comprehensive program includes a benthic monitoring program to characterize sediments and benthic infauna, rig-fishing to collect fish for bioaccumulation analyses, and a hard-bottom diving survey of nearshore areas to assess the impacts on nearshore coral-reef areas. The city is not required to monitor plankton (nor are any other Hawaiian or West Coast coastal dischargers) or make observations of marine birds, reptiles or mammals. However, information on plankton, turtles, marine birds and marine mammals has been included in this application and is summarized below and in Appendix C.

The city has conducted monitoring of the Barbers Point outfall since 1986 in a consistent and routine manner.

Plankton. Plankton consist of the small drifting plants (phytoplankton) and animals (zooplankton) of the water column. Phytoplankton are responsible for most of the primary productivity in the sea. Their rate of production is driven by the rate of nitrogen input (mainly through up welling) to the euphotic zone. Wastewater can be a major local source of nitrogen input if it reaches the euphotic zone. In the case of the new Honouliuli outfall, the nitrogen input contributed by the effluent is relatively minor on a regional scale (Laws, 1993).

Phytoplankton. Phytoplankton are tiny plants that are responsible for most of the photosynthetic production of organic matter in the sea and an important components of marine food chains. The abundance of phytoplankton is commonly measured by the concentration of chlorophyll a, a pigment found in all plants.

The City & County of Honolulu is not required to monitor plankton but does conduct water column measurements related to water clarity, such as light transmittance and secchi depth and nutrients and chlorophyll a to demonstrate compliance with State of Hawaii Water Quality Standards. Analysis of such data has shown that wastewater discharge effects on light transmittance are not measurable in comparison to natural seasonal changes in coastal waters (Laws, 1993). These and other studies, which have been done to assess the impacts of wastewater on light transmittance, water clarity and phytoplankton (or chlorophyll a), are discussed further in the testimony of Dr. Edward Laws given as part of the Evidentiary Hearing (June 24, 1993). Dr. Laws analyzed data for the period 1985 to 1992 and found that there was a definite spatial pattern in the surface chlorophyll a values offshore of the Ewa Plain. He showed that the values tended to become smaller with increasing distance from Pearl Harbor and a statistically significant difference between surface chlorophyll a concentrations and distance from the mouth of Pearl Harbor.

Zooplankton. The city is not required to monitor zooplankton. However, the known patchiness and seasonal variability of zooplankton make sampling difficult and hard to interpret.

The only reported study of zooplankton that has been done under the 301(h) program for a deep water marine discharge (69 meters deep) was undertaken by the City & County of Honolulu as part of their 301(h) application for the Sand Island Treatment Plant, which serves most of the greater Honolulu area (AECOS, 1982). This one-year study consisting of monthly sampling at several stations yielded inconclusive results. It showed that there was high variability and no apparent outfall influence. Further studies were not required as part of the 301(h) monitoring program, indicating the difficulty in drawing conclusions from such sampling data.

Marine Algae. Dr. Isabella Aiona Abbott of the University of Hawaii at Manoa, Department of Biology, is the recognized expert on local algae, particularly the use of algae as food. Dr. Abbott has indicated that edible seaweed, known locally as ogo, is grown in aquaculture at ponds on the north end of Oahu. There are four species of *Gracilaria* that are grown. Two are native species, a third has been brought in from Florida, and a fourth is now entering the market.

The old name *Gracilaria bursapertoris* is now *Gracilaria parvispora.* This is the most widely used species. Other species include *G. comopifolia, G. tiki,* and *G. cornia.* All are used in a finely chopped state with raw fish.

Dr. Abbott reports that there is no commercial harvest of seaweed due to limited wild stocks.

Old-timers indicated that the seaweed harvest in the nearshore shallows used to be much more popular. Harvests of ogo along Malama Bay decreased from an annual volume of 90,000 pounds in the 1960s to near 0 after construction of upgraded wastewater treatment facilities to handle the wastewater discharges that entered Pearl Harbor and Waikiki (DLNR, 1992).

Shellfish resources. There are about 1,000 species of marine mollusks in Hawaii, ranging in size from the giant triton (16 inches) to such tiny forms as *Tricolia variabilis* at 0.10 inch.

Offshore in deeper waters of Mamala Bay, there have been observed beds of the mollusk genus Pinna. There have been Pinna beds. Dr. Kay says that many of them were wiped out in 1982 by Hurricane Iwa and they have never recovered.

Other species of shellfish which are deemed edible, and potentially harvested for human consumption, include eehinoderm species such as sea urchins. One common sea urchin, *Echinothrix diadema* (wana), has poisonous spines. This and other species are collected, and the gonads are eaten raw or used in making sushi.

In the Hawaiian language, shelled mollusks are known collectively as pupu (now used to refer to hors d'oeuvre) which probably related to the longstanding use of such small mollusks as opihi (limpet) and pipipi (Nerita) as snacks. The tiny black nerite (family Neritidae) called pipipi and littorines in the family Littorinidae called pupu kolea and less than an inch long. They are usually boiled before being eaten. Limpets are larger animals often eaten (called opihi) and are eaten raw.

Coral Reef Community. In a 1994 report prepared to support the renewal of the Sand Island Treatment Plant 301(h) modified NPDES Permit, Dr. Richard Brock prepared a summary description of fish and macrobenthic invertebrate communities and addressed other biological conditions in Mamala Bay (Brock, 1994e). With regard to distinctive habitats in Mamala Bay, he noted the following:

> Among the distinctive habitats in Mamala Bay are coral reefs. However, relative to many other locations around Oahu (e.g., Kahe Point, Ko'Olina, Hanauma Bay, Maile, Nanakuli, Makaha, etc.), coral reefs are not well-developed in Mamala Bay. Dollar (1979) found an overall mean coverage of 13.6 percent for 29 stations established through the central part of Mamala Bay. The qualitative study by AECOS, Inc., (1979a) suggests that coral cover is not particularly great at most sites examined in less than 20m depth in Mamala Bay. However, as noted by AECOS, Inc., (1979a), coral coverage may locally attain 60 to 80 percent but the scale of this coverage is usually small, not encompassing areas greater than 200 m^2.
>
> At three permanently marked stations, Brock (1994a) has coral coverage estimates that range from 2 to 26 percent an a transect with an overall mean of 11 percent. Personal qualitative observations made through much of Mamala Bay since 1950 to present suggest that in the depth range from shore to the 20m isobath, mean coral coverage is about 5 to 7 percent overall (Brock, personal observations). Thus on scales greater than several hundred square meters, coral reefs as a distinctive habitat, are not well-developed in the shallow waters (less than 20m of depth) of Mamala Bay. As noted previously, below 20 m in depth much of the substratum of Mamala Bay is comprised of sand and coral rubble. Hard substratum is a necessary requisite for the settlement and growth of hermatypic (reef) corals. Since this substratum type is not a major component of the deeper areas, coral communities are not well developed in these areas. Thus, the hard bottom that is necessary for the growth of coral is rare or absent.

Fish. The Honouliuli (Barbers Point) outfall structure attracts large numbers of fish (1 to 2 fish per square meter) of a variety of species (13 to 29) which have been observed by biologists from a submersible (1981 to 1986) and more recently by viewing video footage taken of three transects along the outfall pipe (Brock, 1995). A greater number of species are seen on the outfall than are observed over soft bottoms of a similar depth (Russo, 1989).

The information on fish collected in the monitoring program does not lend itself to statistical analysis and should be considered qualitative. The only statistically significant information that can be derived is the relative number of fish per unit area surveyed, as reported in the annual assessment reports (Brock, 1995).

In his comparative studies of fish abundance between December 1981 and September 1986, Russo found that the outfall attracted fish and that there were a few dominant species (Russo, 1989). He found the following:

> At the 66 m isobath off Hawaii there is little hard substrata available for the establishment of hard bottom communities. Soft bottom communities normally persist at this depth or greater. Corals can colonize at these depths if hard substrata is available but none were seen on the outfall structure. The new outfall substrata (pipe and rock) may afford attachment sites for sessile organisms, refuge for invertebrates and fish, and feeding and breeding habitats for fish species normally found in shallower reef environments. The outfall may have certain physical features common to natural reefs in the area, which may attract various fish species and provide them with spatial reference points for aggregation.
>
> The effluent discharge at the Barber's Point diffuser may inhibit coral growth in the zone of initial dilution (ZID) and thereby prevent colonization of the area by fish species strictly associated with corals (e.g., parrotfishes: Scaridae). However, a large number of fish species normally associated with shallower pristine environments off Hawaii (e.g. families Acanthuridae, Pomacentridae, Chaetodontidae, Labridae, and Balistidae) are attracted to the Barber's Point diffuser.

During 1981 to 1986, 42 species of fish have been observed at the outfall, with 10 species accounting for most of the estimated abundance, based on annual observations. (See Table C-l of Appendix C, Attachment 4). There is considerable year-to-year variation. The most abundant fish included the introduced blue-striped snapper *(Lutjanus kasmira);* three species of damselfish *{Chromis vemtor, C. leucanus,* and *C. hanui);* the butterfly fish *Chaetodon miliaris;* and the goatfish *Mulloidichthys flaviolmeatus.*

The number of fish species observed varied considerably over time throughout the observational surveys. The number of species ranged from 13 to 39 per monitoring period and averaged 23 species. Fish abundance was highly variable and ranged from 192 to 1,172 fish per survey. Occasional large schools of fish of a single species (100 to 500 per school) were observed, causing the large differences in abundances noted.

The number of fish generally increased northward, ranging from a mean of 118 to 299 individuals at Stations SD8 and SD13, respectively. The mean number of fish per quarter ranged from 127 to 249 individuals, with no obvious pattern. The total number of fish averaged 1,544 individuals per survey.

During 1992 through 1995, 43 species of fish have been observed from viewing video tapes taken at three locations along the outfall as provided in the 1995 Honouliuli 301(h) NPDES Permit reapplication. Between 16 and 26 species were noted during any one survey. Observations were more difficult due to the quality of the tape and inability to stay on station as was possible with the submersible. The video abundance estimates were much lower due to the more limited field of vision. Also, specific identifications were more difficult, so species differences were not always noted. Again, snapper and chromis were the most common. Also, wrasses are more abundant and a school of surgeonfish was observed.

An indepth coverage of the fish census survey is provided in Appendix C.

There have been no observed incidences of external signs of disease, and the parasite incidence appears to be exceedingly low. There have been no instances of fin erosion or tumors observed in fish. Appendix C, Attachment 3 provides a summary of the fish histopathology examines, as required by the Honouliuli 301(h) NPDES Permit.

Rig-caught Fish. Rig fishing using a hook-and-line technique is performed to catch fish near the outfall diffuser for analysis to determine the bioaccumulation of toxic pollutants. (See Appendix C, Attachment 3 for details.)

This program is designed to catch fish that are more representative of hard substrate areas because trawling or other net capture techniques would not be effective at sampling fish in an area with the variable substrate that exists in the area. Three species of fish have been analyzed (akule, ta'ape and menpachi).

Mammals. The waters off the island of Oahu contain relatively few species of marine mammals (Tomich, 1990). They are represented to varying degrees by as many as various species of cetaceans, including whales, dolphins, and porpoises, and pinnipeds (such as the occasional rare monk seal), which occur as year-round residents, seasonal migrants, occasional visitors, or as rare occurrences. They may migrate over extensive distances, forage over large areas, and consume substantial quantities of food (averaging 1,000 tons/day). Marine mammals are an important element of the marine food web and represent the top carnivores. The most important marine mammal (due to its listing as an endangered species) is the Hawaiian monk seal. Another listed species is the humpback whale, *Megaptera noveaeangliae,* of which there are about 1,000 animals inhabiting the north Pacific, many of which winter in Hawaiian waters, particularly in the deeper waters off Maui. Humpbacks have been recorded off Oahu during the months of November through April (Tomich, 1990).

The great mobility of marine mammals requires that their habitat utilization must be considered much beyond the local study area of the Honouliuli. Some cetaceans can transit the local study area in a few hours. Additional write up on mammals are provided in Appendix C.

Existing Benthic Conditions. Sampling of the benthic environment around the city's outfall is conducted annually at seven stations established along the depth of the diffuser (61 meters). Samples are collected for analysis of benthic infauna, sediment grain-size characteristics, and sediment chemical parameters (including concentrations of priority pollutants). A detailed discussion of benthic conditions including geochemistry and biota can be found in Appendix C. Annual benthic infaunal sampling reports are prepared by the researchers of the University of Hawaii Water Resources Research Center, who conduct the studies under contract to the city. The same contractors have performed the analyses of the benthic biota and prepared the written reports since 1986, making for a very consistent data base that lacks the biases often found when personnel are changed. There are detailed descriptions of benthic conditions and extensive supporting materials which describe the offshore benthic characteristics measured during the surveys in each of the project reports (Nelson et al., 1986, 1991, 1992a, 1992b, 1994a, 1994b and 1995).

Supplementing the benthic sampling results are observations of fisheries and macroinvertebrates made, based on video footage of the outfall diffuser area made using a remote-operated vehicle (ROV) and diving surveys of fixed transects in the shallower nearshore areas. The results of this survey are presented in Appendix C.

Remote-Operated Vehicle (ROV) Reconnaissance Survey. Biomonitoring of the Barber's Point outfall was initiated in the early 1980's to assess fish and benthic communities both before (December 1981) and after discharge (March 1983) via observations from the submersible Makalii to make visual and photographic transects (Russo, 1982). Transects were made on each side of the pipe and a species list and count was made. The submersible observations continued through 1990. After this date, and through 1998, the City relied on observations derived through the use of Remotely Operated Vehicle (ROV) which took video footage of the outfall along three designated transects. This work was done by Dr. Richard Brock of the University of Hawaii under a contract with the City. These qualitative summaries provide some information on which species are present, but are inadequate for making any meaningful type of assessment of changes over time. An excellent summary of the survey work completed over the years (1992-03) is presented in the last report (Brock 2003). The key summary of the findings over the eleven year period surveyed is presented below:

Because the diffuser of the Barbers Point Ocean Outfall lies below safe diving depths, a remotely controlled video camera system was used to determine the status of the marine fish communities and selected diurnally exposed macroinvertebrate species residing on the diffuser. Video reconnaissance was completed over the entire 534-m length. Three visual "transects," which "sampled" approximately 31% of the total diffuser length, were established on the diffuser pipe. Commencing in 1992, video samplings of the diffuser fish communities have been carried out annually, except in 2000 when the equipment malfunctioned. The results of the eleven annual surveys to date indicate that the diffuser fish communities are dominated by species that are either small as adults or juveniles of larger species, probably as a result of the presence of only small-scale shelter created by small armor rock and gravel used in constructing the discharge pipe. Because of poor camera resolution, differing angles of the camera, small fish sizes, and the fishes' nature to flee from the approaching camera, the fish census data are highly variable and should be viewed as more qualitative than quantitative in nature. Despite this variability from transect to transect and year to year, the mean number of individual fish per transect showed statistically significant changes over the twelve-year period. Not unexpectedly, a related parameter, the mean number of square meters examined to find an individual fish also showed statistically significant changes.

The size of the area searched to find an individual fish is directly related only to the number of fishes counted because the area searched on a given transect does not vary among the different survey years. Thus, if the mean number of fishes censused per transect shows a statistically significant change, the measure of the mean number of square meters examined to find an individual fish should show a similar significant change, which it does. However, application of another statistical test (Student–Newman–Keuls test) did not find a clear statistical separation among the means over the eleven sampling years. This lack of clear statistical separation among the means for the different years, as well as the fact that the decrease in numbers of fishes seen per transect does not follow any temporal trend, suggests that the changes are due to factors such as water clarity or camera angle and resolution and not due to any real change occurring in the diffuser fish communities. The application of statistical procedures to the data derived using a video camera to census fish and invertebrates is probably not appropriate because of a number of drawbacks inherent with the use of a remotely operated video camera, including variability due to water clarity, camera angle relative to the substratum, and camera resolution. Thus little significance should be attached to any change noted in this study of the fish or macrobenthic communities residing on the Barbers Point diffuser because of the variable quality of the data generated by use of the remotely controlled video system.

As indicated, the ROV fish survey has not been a reliable way of counting the number of fish species in the vicinity of the outfall diffuser. However, because of the great depths encountered, it is the most practical way.

Marine Turtles. Prior to Hurricane Iniki, green sea turtles *(Chelonia mydas)* were usually seen in the vicinity of Sand Island Transect 6 (located off the Honolulu International Airport reef runway at depths ranging from 9.1 to 11.6 meters) (Brock, 1994a). These turtles have not been observed in this particular area since the hurricane, and Brock (1994a) speculated that this is due to the loss of resting habitat as a resulting of infilling by coral rubble. However, during the September 1993 field work during transect studies in the nearshore waters, green turtles were seen in other areas (about 200 meters east) of transect sites 5 and 6 near the reef runway (Brock, 1994a).

Three green sea turtles (Chelonia mydas) were encountered during the 1999 field survey nearshore diver survey (Brock, 1999). Two of these were seen in the vicinity of Station BP-1. One turtle was seen resting on the transect line for Transect BP-1-A on 11 January; the second turtle was seen swimming adjacent to Transect BP-1-B. The resting turtle had an estimated straight-line carapace length of 75 cm; it had no visible tumors or tags. The second turtle was approximately 45 cm in straight-line carapace length; it also showed no evidence of tags or tumors. The third turtle was encountered on 15 January in the vicinity of Transect BP-3-B. This turtle, which was about 55 cm in straight-line carapace length, also showed no evidence of tumors or tags.

Three green sea turtles (Chelonia mydas) were encountered during the 2000 field survey. Two of these were seen in the vicinity of Station BP-1 on 10 May. One turtle was resting about 5 m from the line for Transect BP-1-A; the second turtle was seen swimming adjacent to Transect BP-1-B. The resting turtle had an estimated straight-line carapace length of 70 cm; it had no visible tumors or tags. The second turtle was approximately 50 cm in straight-line carapace length; it also showed no evidence of tags or tumors. The third turtle was encountered on 12 May in the vicinity of Transect BP-3-B. This turtle, which was about 50 cm in straight line carapace length, also showed no evidence of tumors or tags.

Three green sea turtles (Chelonia mydas) were encountered during the 2001 field survey. Two of these were seen in the vicinity of Station BP-1 on 29 June. One turtle was resting on the line for Transect BP-1-A; the second turtle was swimming adjacent to Transect BP-1-B. The resting turtle had an estimated straight-line carapace length of 80 cm; it had no visible tumors or tags. The second turtle was approximately 60 cm in straight-line carapace length; it also showed no evidence of tags or tumors. The third turtle was encountered on 3 July in the vicinity of Transect BP-3-B. This turtle, which was about 75 cm in straight-line carapace length, also showed no evidence of tumors or tags.

Three green sea turtles (Chelonia mydas) were encountered during the 2002 field survey. Two of these were seen in the vicinity of Station BP-1 on 21 May. One turtle was resting on the line for Transect BP-1-A; the second turtle was swimming in the vicinity of the two transects about 20 minutes later. The resting turtle had an estimated straight-line carapace length of 70 cm; it had no visible tumors or tags. The second turtle was approximately 80 cm in straight-line carapace length; it also showed no evidence of tags or tumors. The third turtle, encountered on 30 May in the vicinity of Transects BP-1-A and BP-1-B during physical parameter measurements on the surface, is probably one of the two seen during the previous biological survey. This turtle, which was about 75 cm in straight-line carapace length, also showed no evidence of tumors or tags. In general, individual turtles are commonly seen surfacing for air while transiting from Honolulu Harbor to 'Ewa Beach. Most of the individuals seen appear to be subadults.

In general, individual turtles are commonly seen surfacing for air while transiting from Honolulu Harbor to 'Ewa Beach. Most of the individuals seen appear to be subadults. Recent year observation could suggest that the sightings are of resident turtles

Outfall Pipe as an Artificial Reef. The characteristics of the Ewa coastal shelf and the lack of the relief and structure make the outfall pipe structure itself an important structure, which serves an artificial reef that exerts a significant impact on the adjacent community from both physical and biological interactions. The pipe can disrupt the flow of bottom currents and increase local water movement as it disrupts laminar flow across the bottom.

The pipe attracts certain larger predatory species such as reef-associating fishes and macro-invertebrates. It is not known to what degree these interactions may, in turn, influence the adjacent sedimentary structure and benthic community composition. Prior to wastewater discharge, placement of the pipe and reef onto the Balanced Indigenous Population (BIP) sand bottom community was probably enough to alter the fish community.

There are few larger sessile invertebrates that are typical of hard substrate climax communities. Corals, sponges and other attached invertebrates are not present on the pipe or adjacent armor rock in noticeable abundance. This confirms what is known from other regions where observations have shown that the rates of recruitment decrease as a function of depth.

Benthic Infauna. (See Appendix C for details.) Benthic infaunal populations are known to respond to wastewater particulates when the deposition of material and resultant flux of particulate material to the seabed results in increased organic loading of sediments (i.e., higher total organic carbon) (Word, 1978; Pearson and Rosenberg, 1978). Deposited effluent particulates may also introduce contaminants such as trace metals and potentially harmful organic compounds (e.g., PCBs, pesticides) if they are present in significant concentrations in the effluent; this is not the case at Honouliuli. Infauna and epifauna are dependent upon the flux of organic material (from dead or decaying marine organisms and input from the land) to the sea floor as a source of food. However, excessive depositions can result in by-products of oxidative metabolism resulting in sediments becoming anoxic in areas of excessive organic loading (i.e., higher sulfides) resulting in unacceptable conditions for survival.

The benthic biota of the sand platform and shelf offshore of Ewa Beach near the Honouliuli outfall have been described from seven site-specific surveys done since 1986 which are detailed and cited in Appendix C with a summary of results presented in Attachment 2.

The biotic composition and species abundance patterns of the outfall environment are very similar to those described for other sandy environments throughout Mamala Bay. The dominant species components, described in detail in the annual assessment reports are mollusks and polychaetes that typify the mid- to outer-Mamala Bay shelf.

Species Richness. Species richness during the fourteen discharge surveys (1986, 1990-2002) (seven stations) are shown in Appendix C, Table C-4 and C-5. For non-mollusk, this range from 62 to

Abundance. Statistical mean abundance per station over the fourteen year surveys are provided in Appendix C, Tables C-4 and C-5.

Differences in total abundance found among various sampling stations, particularly at the reference stations (HBl and HB7) are related to the presence of polychaetes.

Dominant Species. Dominant species are defined as those species which comprise 75 percent of total infauna by abundance. Higher numbers indicate an equitable distribution of species while low numbers are indicative of few species present in high numbers. Low dominance numbers typify polluted areas where opportunistic species comprise a large portion of total community abundance. Trends may be affected by natural processes of disturbance and colonization that occur regularly in the coastal zone. Monitoring has shown no outfall-related changes in dominance, as presented in Appendix C, Attachment 2 (Nelson et al., 1995).

Major Taxa, Species Composition, Indicator Species. Abundances of each of the major taxa (polychaetes, crustaceans, mollusks, echinoderms and other taxa) did not differ significantly between ZID stations and the reference site. (See Appendix C, Attachment 2, for details.) Mollusks and polychaetes were the dominant group of organisms, a situation that typifies natural benthic communities of coastal sediments throughout the world. The relative proportions of the major taxa were representative of coastal benthic communities. Dominant species in the ZID region were typical members of benthic communities of the outer shelf.

Polychaetes. Differences in polychaete densities were not statistically significant between ZID and reference sites. The abundances were similar to the trends for near-field and reference areas (Appendix C, Attachment 2).

Species of capitellid polychaetes (considered to be "pollution-tolerant" or opportunistic), many of which are found in high numbers in organically enriched environments, were low in abundance during the surveys, even in the ZID region. Few *Capitella capitata* were sampled in the ZID region. Abundances ranged from 0 to 2 with an average of c^1 as is typical of unpolluted habitats. *Capitella capitata* is a small, surface deposit feeding species (or species complex) that has a short generation time and, following colonization, can rapidly expand its numbers in areas of rich organic loading. Populations exceeding 500 per m^2 typify organically polluted areas of the Southern California Bight where different sediment conditions exist which are more suitable for organic enrichment to occur.

Crustaceans. Amphipods the major crustacean community components. These crustaceans brood their young, can be motile, with many species that are sensitive to organic flux and sediment chemistry redox conditions. Two prevalent ostracods, *Eriopisella sechellenoir* and *Konatopus paao* are community dominants of the shelf and are known to increase in areas of increased food supply where sediments are not anoxic.

Mollusks. Regular sampling programs in the vicinity of the outfall and in reference stations within Mamala Bay show 40 to 60 species of mollusks commonly occurring with the area. Micro-mollusks are dominated by the *dialidae, rissidae,* and *various* infaunal genera. The large mollusk *pinna sp.* is well represented in the study area. Mollusk populations have been relatively stable over the past five years, with the exception of disturbances resulting from large storms (Nelson et al., 1994a). Abundances of mollusks ranged from 1,000 to 3,000 per m^2 in the study area. No influence of the outfall has been noted from species diversity or total abundance of mollusks (Kay and Kawamoto, 1983).

Benthic Invertebrate Communities. The nearshore areas off Ewa Beach are considered deficient in marcroinvertebrate abundance compared to other areas of the south coast of Oahu. This lack of organisms appears to be due to the lack of suitable substrate complexity which offers shelter and the constant abrasion from shifting sand and force of breaking waves that is found on the nearshore platform. The most abundant species of benthic invertebrate found are the Scleractinian (reef building) corals which are a relatively small component of bottom cover. Other dominant macroinvertebrates include colonial "soft" corals *Palythoae tuberculosa* and *Anthelia edmondsoni.* There are also encrusting sponges of a variety of species which are difficult to identify taxonomically. Motile macrobenthic species are rare in occurrence and include several species of sea cucumbers that are seen scattered over the limestone reef platform where wave action is not intense. Sea urchins are generally scarce with the common urchins inhabiting interstitial spaces within the reef framework. A complete summary of the species found during the Ewa Monitoring Program is contained in Appendix C, Attachment 2, Part 2.

Coral Community Structure. The entire Ewa region in the nearshore can be considered suboptimal environment for coral colonization and growth, as indicated by the low coverage estimates ranging from 0 to 41 percent along the three transects (Ewa Marina Biological Monitoring Program). The number of coral species in a given transect range from 0 to 7 while the dominant species was *Porites lobata* which accounted for 64 percent of the total coral coverage. More information on the coral coverage in Mamala Bay is provided in Appendix C.

Algal Community Structure. The reef flat is characterized by a low species diversity but a high biomass. A total of 30 species of algae were observed during the Ewa Marina Surveys with as many as 23 species being found in a single area. The listing of the species observed is shown in Appendix C, Attachment 2, Part 2. Algae form an important local food for populations of green sea turtles *{Chelonia mydas)* that inhabit the area. Turtles are known to feed on algae in intertidal areas and prefer to feed on *Codium, Ulva, Caulerpa, Turbinaria,* and *Spyridia* (Marine Research Consultants, 1991). In the Hawaiian Islands the dominant turtle forage species are *Pterocladia sp.* and *Amansia sp.,* which are not found in the area. *Hypnea,* the predominant algal species observed in the Ewa area, has been cited as a minor component of turtle grazing (Marine Research Consultants, 1991).

Reef Fish Community Structure. The Ewa Marina Biological Monitoring Program showed on individual transects where fish were counted that the number of species ranged from 8 to 36 with the number of individuals ranging from 23 to 372. Species diversity ranged from 1.55 to 3.05. During the entire survey a total of 1,326 individuals were noted with 63 species being represented. The most abundant fish was the black-finned chromis *{Chromis vanderbilti).* The black-finned chromis is a small, planktivorous damsel fish that forms feeding schools numbering into the hundreds of individuals. Additional information is provided in Appendix C.

The reef community of fish is dependent upon the physical structure of the bottom and areas with little structural relief and coral cover, such as occur off Ewa Beach that are poor habitats for reef fish. Few fish are noted in most of the area and those that are observed include trigger fishes and hawk fish which often inhabit barren areas and take shelter in small crevices or in isolated coral colonies. A listing of the fish found during the surveys is shown in Table C-1 in Appendix C. During the course of survey work observation showed this area to be subject to substantial fishing pressure which has had a noticeable impact on abundance, size, and behavior of sought after species.

Pearl Harbor Nearshore Area. Pearl Harbor estuary is an important source of freshwater to Mamala Bay and a source of many potential pollutants that can impact water quality in the area. According to Brock (1994a):

> Pearl Harbor has a water surface area of more than 21 km and at one time accommodated more than 50 Hawaiian fish ponds (AECOS, 1979a). Parts of the harbor have been heavily modified by the military, but wetland habitat is still present particularly in Middle and West Lochs. Freshwater input to the harbor is high, ranging from 50 mgd during the dry season to 100 mgd during the wet season (Cox and Gordon, 1970). This large volume of freshwater creates an estuarine environment in the landward portions of the harbor that is one of the largest such areas in the state of Hawaii.
>
> The most complete study of the aquatic resources of Pearl Harbor was completed by Evans (1974). Particularly important from the standpoint of distinctive habitats, is the fact that the estuarine portions of Pearl Harbor are an important nursery area for many commercially important fish species including striped mullet or ama'ama *(Mugil cephalus),* a number of jacks or ulua (family Carangidae) as well as the baitfish or nehu *[Stolephorus purpureus).* Pearl Harbor is a primary source of this baitfish which is used by and is the mainstay of the pole-and-line fishery for skipjack tuna (Uchida, 1966). Some of the estuarine areas serve as important waterbird habitat. However, since Pearl Harbor has a narrow and restricted entrance to Mamala Bay located about 10km from the Honouliuli deep ocean outfall and sewage inputs within it, the biota of Pearl Harbor will not be considered further in the present analysis of Mamala Bay.

Bioaccumulation of Toxic Materials. The accumulation of trace metals in sediments is common near ocean outfalls, and can be one of the most obvious effects of a wastewater discharge. A discussion on the sediment priority pollutant and pesticide results are presented in Appendix J.

2a. *Are distinctive habitats of limited distribution (such as kelp beds or coral reefs) located in areas potentially affected by the modified discharge? [40 CFR 125.62(c)]* (Updated: Cross reference - II.C.29, page II.C-6.) [updated]

Response:

There are no distinct habitats of limited distribution, either within or beyond on the ZID of the Honouliuli outfall. Distinctive habitats such as coral reefs do exist shoreward of the diffuser site at depths ranging from 10 to 20 meters (AECOS, 1979a) with live coral coverage ranging from 0 to 60 percent with the most frequently observed value of 20 percent or less. These reefs are separated from the outfall diffuser by a minimum of 2,000 meters (AECOS, 1979a). The outfall pipe's armored rock forms the most distinctive habitat in the area and provide habitat, holes, crevices, and attachment sites for various species. It forms a large artificial reef which increases productivity and faunal diversity.

2b. *If yes, provide information on type, extent, and location of habitats.* (Updated: Cross reference - II.C.2b, page II.C-6.) [no change]

Response:

For the basis of this application, benthic communities surrounded the Honouliuli outfall are not considered distinctive habitats.

3a. *Are commercial or recreational fisheries located in areas potentially affected by the discharge? [40 CFR 125.62(c) and (d)]* (Modified: Cross reference - II.C.3.a, page II.C-7.) [no change]

Response:

Data reviewed for this application and presented in this application (Appendix C) indicate that commercial fisheries are either unaffected or enhanced by the outfall structure and discharge activities. Refer to Appendix C for further discussion.

3b. *If yes, provide information on types, location, and value of fisheries.* (Modified: Cross reference - II.C.3.b, page II.C-7.) [no change]

Response:

This question is not applicable.

D. State and Federal Laws

1. *Are there water quality standards applicable to the following pollutants for which a modification is requested:*

   - *Biochemical oxygen demand or dissolved oxygen?*
   - *Suspended solids, turbidity, light transmission, light scattering, or maintenance of the euphotic zone?*
   - *pH of receiving water?*

   (Updated.)

   <u>Response</u>

   The state of Hawaii has adopted Water Quality Standards applicable for dissolved oxygen, turbidity, light transmission (extinction) and pH of the receiving water. In addition, there are other Water Quality Standards for toxic pollutants, nutrient levels, e.g., nitrogen and phosphorous, and other physical characteristics such as temperature and salinity. According to the State classification scheme, the receiving waters of Mamala Bay are Class A - "Wet" and "Dry" Open Coastal Waters (See Figure II.D.1-1). The applicable standards for the three pollutant categories (and other water quality standards) can be found in the Hawaii Administrative Rules Title 11, Chapter 54, Water Quality Standards, which are contained in Appendix E.

   The specific values for the water quality standards for which a waiver can be sought are as follows:

   - Dissolved oxygen shall not be less than 75 percent saturation, determined as a function of ambient water temperature and salinity;
   - Turbidity, expressed in nephelometric turbidity units (NTU) shall not exceed the following values as the associated exceedence frequency:

     - 0.50 NTU............ 50 percent to time (geometric mean)
     - 1.25 NTU............ 10 percent of time
     - 2.00 NTU ...... 2 percent of time

   - Light extinction coefficient (k units) shall not exceed the following values at the associated exceedence frequency:

     - 0.20 k units .... 50 percent of time (geometric mean)
     - 0.50 k units .... 10 percent of time
     - 0.85 k units .... 2 percent of time

Inland Waters	
Water Types	Ecological Subtypes
A. Freshwater	1. Streams 2. Ditches and flumes 3. Springs and seeps 4. Natural lakes 5. Reservoirs 6. Elevated wetlands 7. Low wetlands
B. Mixohaline and Saline	8. Coastal wetlands 9. Estuaries Anchialine 10. pools

Marine Waters	
Water Types	Bottom Subtypes
C. Embayments 1. Wet 2. Dry 3. Seasonally wet	11. Lava rock shorelines 12. Sand beaches 13. Solution benches 14. Marine pools and protected coves 15. Artificial basins
D. Open Coast 1. Wet 2. Dry 3. Seasonally wet	16. Nearshore reef flats 17. Offshore reef flats 18. Wave-exposed reef communities 19. Protected coral communities 20. Soft bottom communities 21. Deep benthos
E. Transition	
F. Open Ocean	

Figure II.D.1-1Summary Classification of State Waters

- pH of the receiving water shall not deviate more than 0.5 pH units from a value of 8.1, except at coastal locations where and when freshwater discharges may depress pH.

2. *If yes, what is the water use classification for your discharge area? What are the applicable standards for your discharge area for each of the parameters for which a modification is requested? Provide a copy of all Applicable Water Quality Standards or a citation to where they can be found.* (Update.)

Response

The applicable Water Quality Standards are contained in Hawaii Administrative Rules, Title 11, Department of Health, Chapter 54, Water Quality Standards, which have undergone periodic revision since the preparation of the 1983 application. A copy of these standards is provided in Appendix E.

The waters in the vicinity of the Honouliuii outfall are classified in accordance with the State of Hawaii Water Quality Standards (State of Hawaii, Department of Health, 1992b) as Marine, Open Coastal, Class A "wet" waters that extend from the shoreline to the 100-fathom (600 feet) bathymetric contour.

Classes of waters are established by standards in order that beneficial uses can be identified and protected. "Class A" marine waters are those having recreational purposes and aesthetic enjoyment. Any other use is permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters.

Open coastal waters are further characterized as being "wet" or "dry" in order to account for freshwater discharge along the shoreline. Dry, open coastal waters are those which receive less than 3 million gallons per day (mgd) of freshwater discharge per mile of shoreline, while wet, open coastal waters receive in excess of 3 mgd per mile. The Honouliuii WWTP outfall discharges into an area classified as "wet" open coastal water. Around May 2000, the City initiated effort to have the designation changed from "dry" to "wet" as an amendment to the existing 208 Plan. A public hearing was held around June 2000. In addition, an additional categorization scheme considers the type of marine bottom ecosystem being protected. The Honouliuii outfall is in an area with a Class II marine bottom ecosystem classified as reef flats and reef communities.

Table II.D.2-1 summarizes the basis of marine water classification according to State of Hawaii DOH standards and identifies the classification for ocean waters which overlay the Honouliuii WWTP outfall. Figure II.D.2-1 illustrates the types and classification of Oahu's open coastal waters. Open coastal waters are also subject to specific criteria by the DOH regarding water quality parameters shown in Table II.D.2-2. These parameters are not to be exceeded as a result of the discharge beyond the zone of mixing. The first two parameters, light extinction and turbidity, are not to be exceeded beyond the zone of initial dilution.

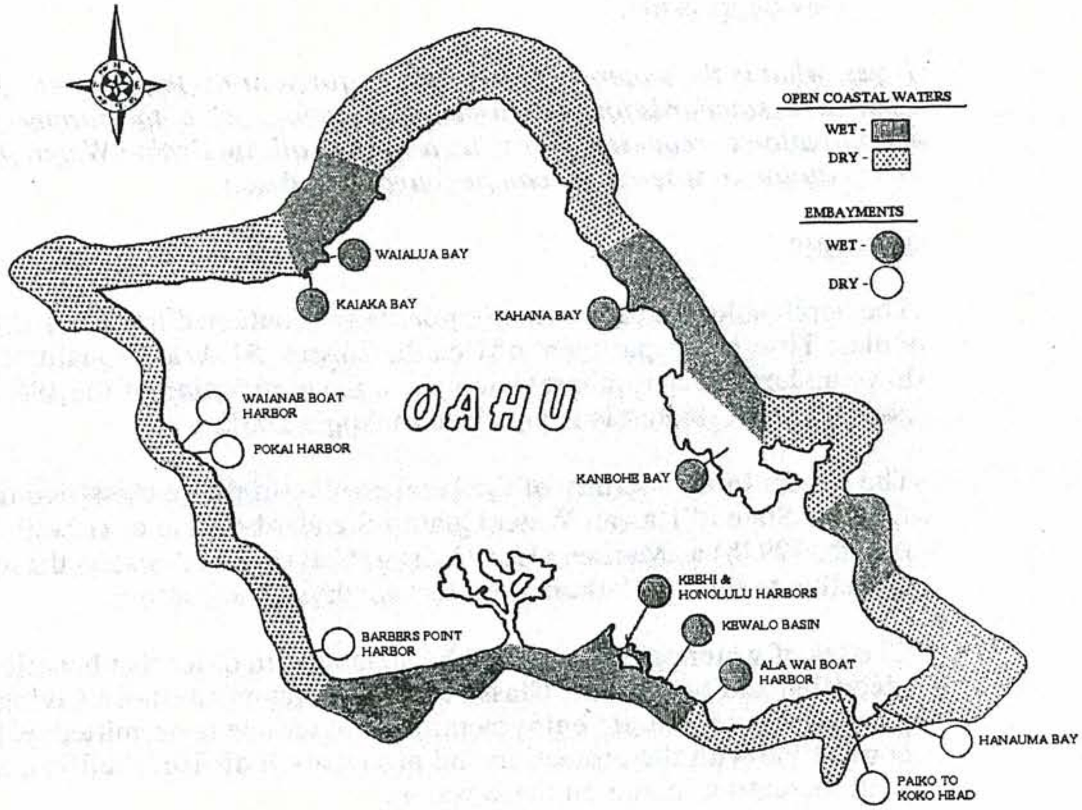


Figure II.D.2-1 Types and Classification of Open Coastal Waters and Embayments

Table II.D.2-1. Ecological Basis for Classification of State Marine Waters[1]

Class	Hydrology	Bottom Subtypes
AA	Open coastal	Sand beaches
A	Wet[1]	Lava rock shorelines and solution benches
	Dry[2]	Marine pools and protected coves Artificial basins Reef flats and reef communities Soft bottom communities[2]

1. Hawaii Administrative Rules, Title 11, Chapter 54. Department of Health, Water Quality Standards 10/29/92.
2. Relevant classification for Honouliuli WWTP outfall.

Table II.D.2-2. Specific Criteria for Open Coastal, Class A, "Wet" Waters

Parameter	Geometric Mean not to Exceed the Given Value	Not to Exceed the Given Value More than 10% of the Time	Not to Exceed the Given Value More than 2% of the Time
Light extinction Coefficient [k units]	0.10	0.30	0.55
Turbidity [nephelometric turbidity units]	0.20	0.50	1.00
Total nitrogen [µg N/L]	150.00	250.00	350.00
Ammonia nitrogen [µg NH_4-N/L]	3.50	8.50	15.00
Nitrate+Nitrite Nitrogen [µg(NO_3+NO_2)-N/L]	5.00	14.00	25.00
Total phosphorous [µg P/L]	20.00	40.00	60.00
Chlorophyll a [µg/L]	0.30	0.90	1.75

Dissolved oxygen – Not less than 75% saturation

1. pH units shall not deviate more than 0.5 units from a value of 8.1.
2. Temperature - shall not vary more than 1°C from "ambient conditions."
3. Salinity- shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors.

3. *If there are no directly corresponding numerical applicable water quality standards approved by the EPA, provide data to demonstrate that water quality criteria established under Subsection 304(a)(l) of the* Water *Quality Act are met at or beyond the boundary of the ZID under critical environmental and treatment plant conditions in the waters surrounding or adjacent to the point at which your effluent is discharged. [Subpart 125.62(a)(l)]* (No Change.)

   Response:

   This section is not applicable since there are numerical applicable water quality standards at and beyond the boundary of the ZID in receiving waters surrounding or adjacent to the point at which effluent is discharged. The NPDES 301(h) permit number HI0020877 for Honouliuli WWTP specifies applicable water quality standards. For receiving water quality standards beyond the ZOM, the NPDES 301(h) permit refer to Class A - "Wet" "Open Coastal Waters" found in the Hawaii Administrative Rules Title 11, Chapter 54, Water Quality Standards; as shown in the appendix for Section II.D.

4. *Will the modified discharge: [Subpart 125.59(b)(3)]*

   - *Be consistent with applicable State and coastal zone management program(s) approved under the Coastal Zone Management Act of 1972 as amended, 16 U.S.C. 1451 et seq.? [See 16 U.S.C. 1456 (c)(3)(A)]*

   - *Be located in a marine sanctuary designated under Title III of the Marine Protection, Research, and Sanctuaries Act (MPRSA) as amended, 16 U.S.C. 1431 et seq,or in an estuarine sanctuary designated under the Coastal Zone Management Act as amended, 16 U.S.C. 1461? If located in a marine sanctuary designated under Title HI of the MPRSA, attach a copy of any certification or permit required under the regulations governing such marine sanctuary. [See 16 U.S.C.432(f)(2)]*

   - *Be consistent with the Endangered Species Act of 1973 as amended, 16 U.S.C. 1531 et seq.? Provide the names of any threatened or endangered species that inhabit or obtain nutrients from waters that may be affected by the modified discharge. Identify any critical habitat that may be affected by the modified discharge and evaluate whether the modified discharge will affect threatened or endangered species or modify a critical habitat. [See 16 U.S.C. 1536 (a)(2)]*

   (No change.)

State Coastal Zone Management Program. *Is your modified discharge located in an area which is included in a state coastal zone management program(s) which has been approved under the Coastal Zone Management Act of 1972, as amended?*

Response:

Yes.

An update letter has been sent to the Office of State Planning, State of Hawaii, to certify that the discharge is consistent with the provisions of the Hawaii Coastal Zone Management Program. A response letter from the Office of State Planning is pending.

Marine and Estuarine Sanctuaries. *Is your discharge located in a marine or estuarine sanctuary designated under Title II of the Marine Protection, Research and Sanctuaries Act of 1972, as amended, or under the Coastal Zone Management Act of 1972?*

Response:

No.

The Honouliuli outfall is not located in an estuary or marine sanctuary. An update letter was sent to the U.S. National Marine Fisheries Service to verify this fact, along with an update letter to the National Ocean Service (NOS) regarding the sanctuary boundary determination (Appendix E). A response from the NOS is pending.

Endangered or Threatened Species. There is no evidence to expect that the discharge will jeopardize the continued existence of an endangered or threatened species (as determined by the Secretary of the Interior under the Endangered Species Act of 1973) and will not result in the destruction or modification of the habitat of such species. Letters asking for confirmation that habitats of endangered species will not be affected by the discharge have been sent to the U.S. Fish and Wildlife Service and to the National Marine Fisheries Service (copy of letter attached in Appendix E, Attachment 3).

There are two endangered or threatened species that inhabit Hawaiian marine waters: the humpback whale and the green sea turtle. There are no areas in Hawaii that are presently designated as a Critical Habitat (as determined in 50 CFR Sections 17.95, 19.96, or Part 228).