Appendix B

New Treatment System Description
Under construction or in Design

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1. ***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:

There are currently four active projects to upgrade the Sand Island Wastewater Treatment Plant (SIWWTP). Two, The Plant Expansion Project and the Biosolids Reuse Project, are in the design phase and two, the Disinfection Facility / Effluent Pump Station and the New Headworks / Clarifiers 7 & 8 (Unit I - Phase IIA), are under construction. These upgrades are designed to increase the dry weather design flow from 82 million gallons per day (MGD) to 90 MGD. They are also designed to improve treatment so that the plant will more readily and reliably achieve its permitted 30 percent removal of BOD and 65 percent removal of suspended solids and to achieve the mandated 16,000 maximum enterococcus limit in the treated effluent. The present average daily flow is roughly 65.6 MGD, 80 percent of the current plant design capacity and 73 percent of the upgraded plant design capacity.

This section addresses these four projects and describes the treatment process once they are in place. Information on the phasing of construction to ensure that compliance is maintained is also presented. The construction schedule is provided as Attachment B.1.

Treatment Process after Completion of all Projects

A site plan of the Sand Island WWTP (Tax Map Key: 1-5-41-5) showing the plant as it will be when these projects are complete is shown as Figure B-1. Existing facilities occupy the western portion of the plant site. New facilities are under construction in the northwest (headworks), north-central (clarifiers), south-central (disinfection/effluent pump station) and central-east (digester) sections of the existing plant. The plant upgrades utilize approximately 25 percent of the eastern portion of the site originally set aside for plant expansion and for secondary facilities, if they become necessary at some future time.

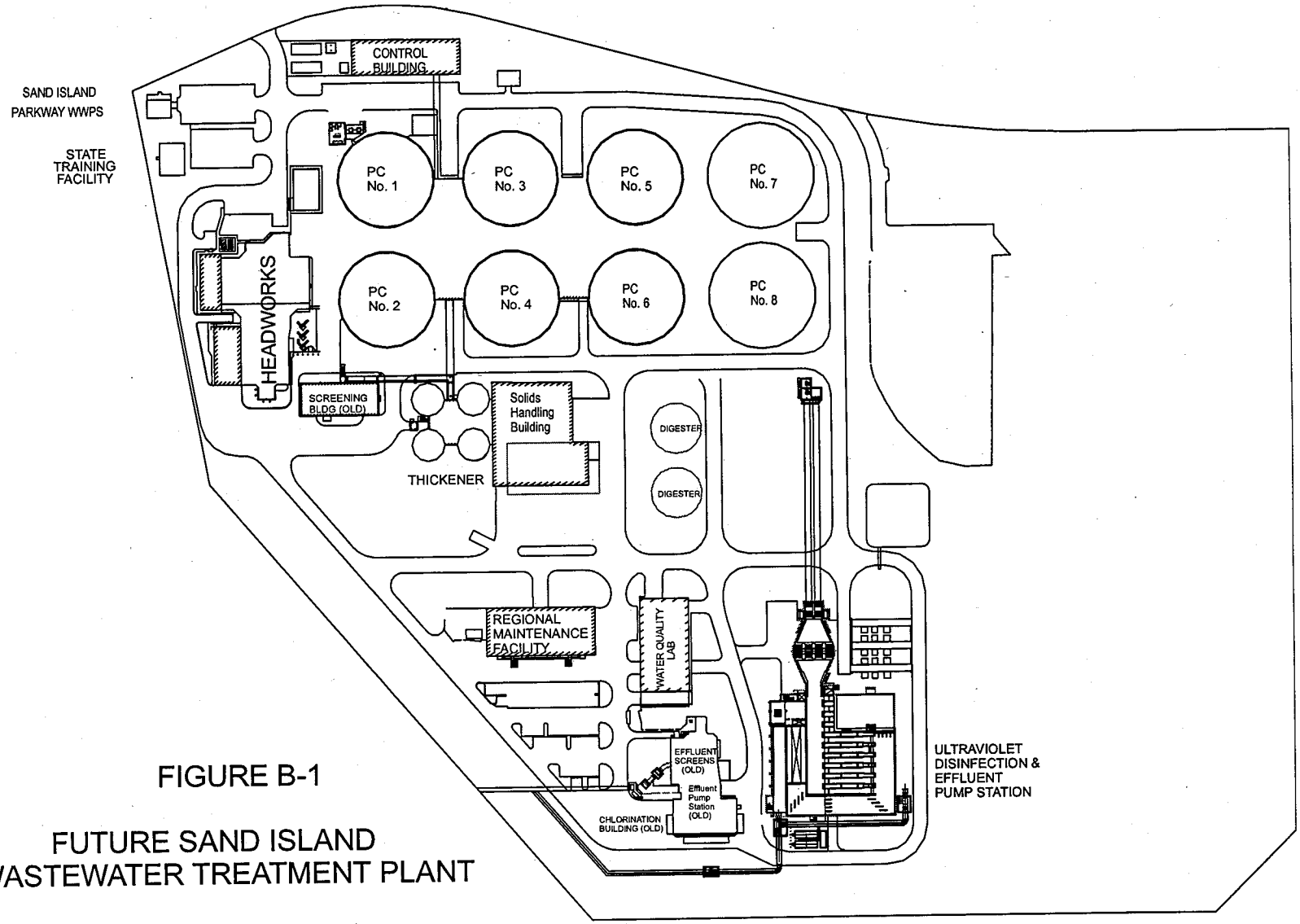


FIGURE B-1

FUTURE SAND ISLAND
WASTEWATER TREATMENT PLANT

Liquid Stream Processes

The plant liquid stream flow diagram is shown in Figure B-2. Design criteria of the SIWWTP liquid stream treatment facilities are presented in Table B-1. Dissolved Air Flotation treatment is eliminated in the plant expansion project since the old clarifiers are being optimized for gravity treatment.

TABLE B-1
SAND ISLAND WASTEWATER TREATMENT PLANT
LIQUID TREATMENT PROCESS COMPONENTS

Design population [De Facto in the thousands for- 2015]*	506
* East Mamala Bay Facilities Plan, 1995	
Flow Projections to 2015 [MGD]*	
Average Daily Design	90
Peak Wet Weather	214
Influent Sewer Diameter [inches]	
Ala Moana Force main	
Original	60/78
Current	78/66/78
Hart Street Force main	
Old	48
New	48
Sand Island Parkway Force main	12/14
Fort Shafter Force Main	24
Screening	
Influent Bar Screens	
Number	6
Openings [inches]	0.25
Channel width [feet]	5
Hydraulic capacity, peak flow per screen, mgd	54.2
Grit Removal	
Aerated Grit Removal Channels	4
Grit Accumulation Sections per Channel	3

TABLE B-1 SAND ISLAND WASTEWATER TREATMENT PLANT LIQUID TREATMENT PROCESS COMPONENTS (CONTINUE)	
Primary Clarifiers - Old	
Number	6
Diameter [feet]	150
Average Sidewall Depth [feet]	12
Primary Clarifiers - New	
Number	2
Diameter [feet]	150
Average Sidewall Depth [feet]	15
* average flow for the following calculations is 90 mgd distributed to 5 original and one new clarifiers.	
Detention Time [hours] (average flow)*	2.86
Overflow rate, [gal/sf/day] (average flow)*	849
Maximum Hydraulic Capacity per clarifier [mgd] - Old	30
Maximum Hydraulic Capacity per clarifier [mgd] - New	37.5
Effluent Screens	
Number	3
Openings [inches]	0.25
Effluent Pumps	
Number	4
Design Flow per pump	
Capacity [MGD]	67.5
Total Head [feet]	90
Maximum Flow (high tide/low tide - modeled MGD)	
Two pumps 218 rpm - maximum speed 300 hp motors	117/142
Three pumps 218 rpm - maximum speed 300 hp motors	138/179
Two pumps 1,700 hp diesels	213/246
Three pumps 1,700 hp diesels	256/270+

Influent Flow Management

Influent to the plant is received from two major and two smaller pump stations and force mains. Projected* 2015 flows for these pump stations (average flow/design peak flow) are Ala Moana (66/143 mgd) and Hart Street (22/63 mgd). These pump stations serve the eastern and western areas of Honolulu, respectively. The Sand Island Parkway Pump Station (0.4/2.7 mgd) is located on the SIWWTP site and serves Sand Island. The Fort Shafter Pump Station (1.4/6.0 mgd), which is owned and operated by the U.S. Army, serves the Fort Shafter Military Reservation,

U.S. Army Hospital and Military Housing Subdivisions. Flows from these pump stations are monitored and recorded by the city SCADA system.

Headworks Grit Chamber

The influent force mains empty into an influent receiving chamber in the headworks. Influent flows are sampled as they leave this chamber. To insure representative influent sampling this chamber is equipped with two 15 hp mixing pumps. From the receiving chamber the influent flows to six screening channels. Each channel is 5 feet wide and equipped with a 6 mm continuously cleaned screen. Each screen is rated for a maximum flow of 54 MGD. Following the bar screens each channel is equipped with a parshall flume to control flow depth and measure flow. The parshall flumes discharge to a divided cross channel.

The cross channel provides flow to four aerated grit removal channels. Each aerated grit channel (AGC) is designed to handle a maximum flow of 68 mgd. Screened debris and grit is transferred via screw conveyors and is collected in storage hoppers for removal by trucks to a sanitary landfill.

Influent Distribution Channels

Downstream from the AGCs, the influent flows by gravity through side-by-side influent channels, which are interconnected at each end and at each clarifier. The two channels are used to convey the screened, degritted wastewater from the headworks and to distribute it to the primary clarifiers. By using isolation valves, either channel can be isolated for cleaning and maintenance. Influent channel modifications, needed to increase the plants hydraulic capacity, will be done under the Plant Expansion Project.

Primary Clarifiers

Although the plant will have eight 150-foot diameter primary clarifiers, any five can provide treatment for normal flows. Five or six clarifiers are expected to be in normal use. Clarifiers not in use are available to handle peak wet weather flows. The six existing 12-foot sidewall DAF clarifiers will be refurbished and optimized for gravity treatment. To improve settling, prevent washout the clarifiers will be equipped with Stanford baffles. To improve flow distribution and eliminate short circuiting they will also be equipped with energy dissipating BEX HNS influent nozzles. In addition the influent and effluent piping will be renewed and the underflow pumps and piping replaced. The clarifiers will continue to use conventional mechanical scraper arms for removal of both settled solids from the clarifier bottoms and floatables from the water surface.

The two new clarifiers, with 15 foot side wall depth, will have Stanford baffles, energy dissipating BEX HNS influent nozzles and conventional scraper systems for removal of settled solids and floatables. The new clarifiers must be operational before modifications to the influent and

effluent channels can proceed. Upgrading the existing clarifiers is part of the plant expansion project, which includes a new effluent collection system to the north and south of the existing clarifiers and separate cut throat inlet boxes for each clarifier allowing the flow to each clarifier to be adjusted independently.

Emergency Power Generation

To increase system operability the new headworks includes a 1250 kw emergency generator capable of operating all systems related to the headworks as well as providing power for operation of the Parkway SPS.

The plant expansion project includes an emergency generator capable of operating the clarifiers (center drives and underflow pumps) during prolonged power outages.

The facility will have backup power to operate all essential equipment in the event power is lost to the plant.

Chemical Addition

To improve flexibility and to better control plant performance chemicals will be able to be added at various points in the treatment process. These points include locations upstream of the aerated grit chambers, at each clarifier, the thickener tanks and the sludge holding tanks. Chemicals to be used include ferric chloride, polymer and hypochlorite.

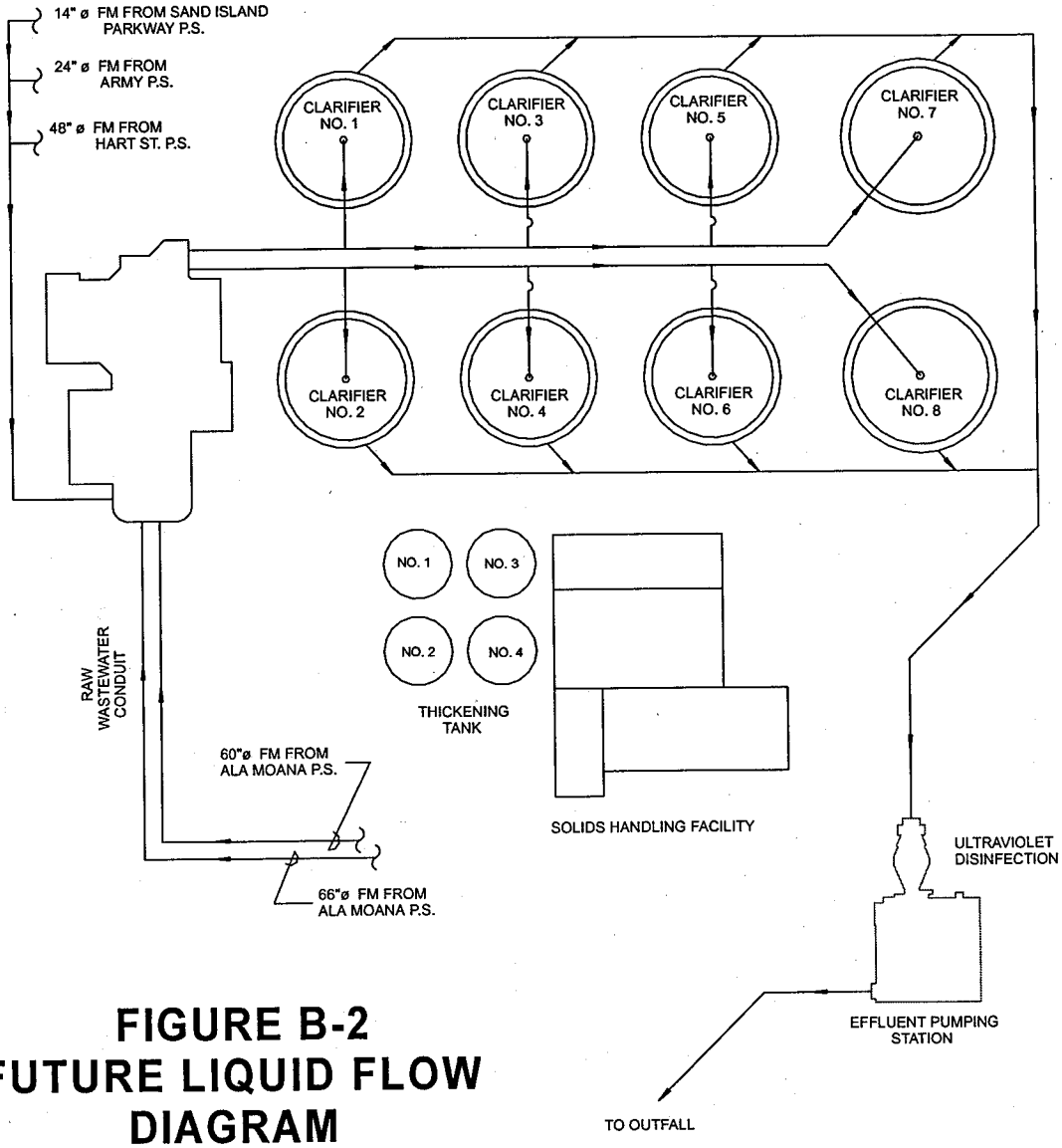


FIGURE B-2
FUTURE LIQUID FLOW DIAGRAM

Effluent Channels

Effluent from the clarifiers flows over V-notched weirs into effluent launders and then flows into the effluent channels and conduits to the effluent screening facility. Screened material is currently combined with sludge and hauled to the landfill. A major feature of the plant expansion project, the final project in the current SIWWTP upgrade, is the installation of a new effluent collection system. This system, installed to the north and south of the old clarifiers, will transport the effluent to the new effluent channels constructed as part of the Disinfection/Effluent Pump Station Project. Once the new effluent channels are in service the existing effluent channels will be refurbished and made part of the modified influent distribution system to allow the flow to each clarifier to be individually controlled. The plant expansion project is the final step in increasing the plant's hydraulic capacity to 270 mgd.

Effluent Screening Facility

From the clarifiers the effluent flows to the Effluent screens, which are designed to remove solids from the effluent. The majority of this material is growth that has sloughed off surfaces and floats on the surface. Like the current effluent screening facility are four effluent screening channels, three of which are active. The fourth channel is blocked until higher flows warrant installation of a fourth effluent screen. Each channel has a rated capacity of 68 mgd.

UV Disinfection Facility

After being screened the effluent enters the UV Disinfection facility. There are 6 channels, four of which are being equipped with three pass, medium pressure UV disinfection units. The design treatment flow is 30 mgd per channel for 120 mgd treatment capacity of wastewater of 20 percent transmissivity. Actual hydraulic capacity is higher and if transmissivity is greater than 20 percent then higher flows can be treated to the specified standard of 16,000 CFU for enterococcus. When flows exceed 120 mgd, which has historically occurred less than 0.1 percent of the time, and the four UV channels are unable to accommodate the flow additional channels can be opened or the excess wastewater will overflow a weir directly into the pump chamber, bypassing the disinfection channels. The disinfection facility is equipped with emergency generators capable of operating the UV disinfection units.

Effluent Pump Station

After passing through the UV disinfection channels the effluent flows to the pump chamber. Effluent can flow from the effluent pump station to the outfall by gravity, however the projected gravity flow is only 30/90 mgd at high/low tide, therefore the pumps are expected to be in use for over half of the day. The effluent pump station will be equipped with four pumps with a provision to add an additional pump in the future. Each pump has a

design capacity of 67.5 MGD at 90 ft of head. Three pumps will have dual drives and one will be diesel driven. The dual drive units consist of 300 hp electric motors and 1,700 hp diesel engines. Low flows will be handled by the electric drives. As flows increase beyond the point where it can be pumped using the electric motors, the diesel engines will be started. Using diesel engines the rated flow exceeds the rated hydraulic capacity of the rest of the treatment plant.

In Plant Water System

The plant currently uses chlorinated effluent for plant wash-down. This system, located at the old effluent forebay, has the capacity to add up to 240 gallons per day of hypochlorite to treat in excess of 60,000 gallons of reuse water per day. This system is expected to be retained for the immediate future.

Solids Stream Processes

The flow diagram for wastewater solids removal is shown on Figure B-3. Design criteria for the Sand Island WWTP solids stream processes are presented in Table B-2.

Sludge Thickeners

Sludge collected in the primary clarifiers underflow is pumped to one of two (in future one of four) sludge thickener tanks. Here it is thickened from less than 0.5 percent solids to approximately 5 percent solids. Hypochlorite is added to enhance settling and prevent nitrification.

Wet Sludge Storage Tanks

From the sludge thickener tanks the thickened sludge is pumped to one of four wet sludge storage tanks. These tanks equalize flow and store sludge when down stream equipment is undergoing maintenance. In the interim mode of operation, after heat treatment is discontinued and before the solids beneficial reuse project is operational, ferric chloride will be added to the wet sludge storage tanks to control odor and enhance dewatering.

Clarifier Scum Treatment

Scum from the clarifiers, which is currently dissolved in warm heat treated sludge, will be concentrated and mixed with the thickened sludge before it is sent to the centrifuges. Once the sludge digester is on line the scum will be concentrated, mixed with the thickened sludge and pumped to the sludge digester (part of the solids beneficial reuse project).

Sludge Treatment and Dewatering

From the wet sludge storage tanks the treated thickened sludge is pumped to the centrifuges. From the centrifuges the dewatered sludge cake is conveyed to the sludge storage hoppers. Ten wheel dump trucks then load sludge from the hoppers and haul the sludge to Waimanalo Gulch Sanitary Landfill.

Beneficial Reuse Project

Once the solids beneficial reuse project is completed all sludge will be sent to it for processing. The Beneficial Reuse Project will take sludge from the wet sludge storage tanks to a 2.3 million gallon fully mixed digester. After digestion the sludge will be pumped to centrifuges and then conveyed to a drier/pelletizer to create a soil amendment product. The sludge drier will utilize waste gas from the digester as fuel. The dried product will meet the requirements of "exceptional quality" sludge and may be applied without restrictions in agricultural and landscaping applications.

Figure B-4 shows the combined liquid and solid flow schematic.

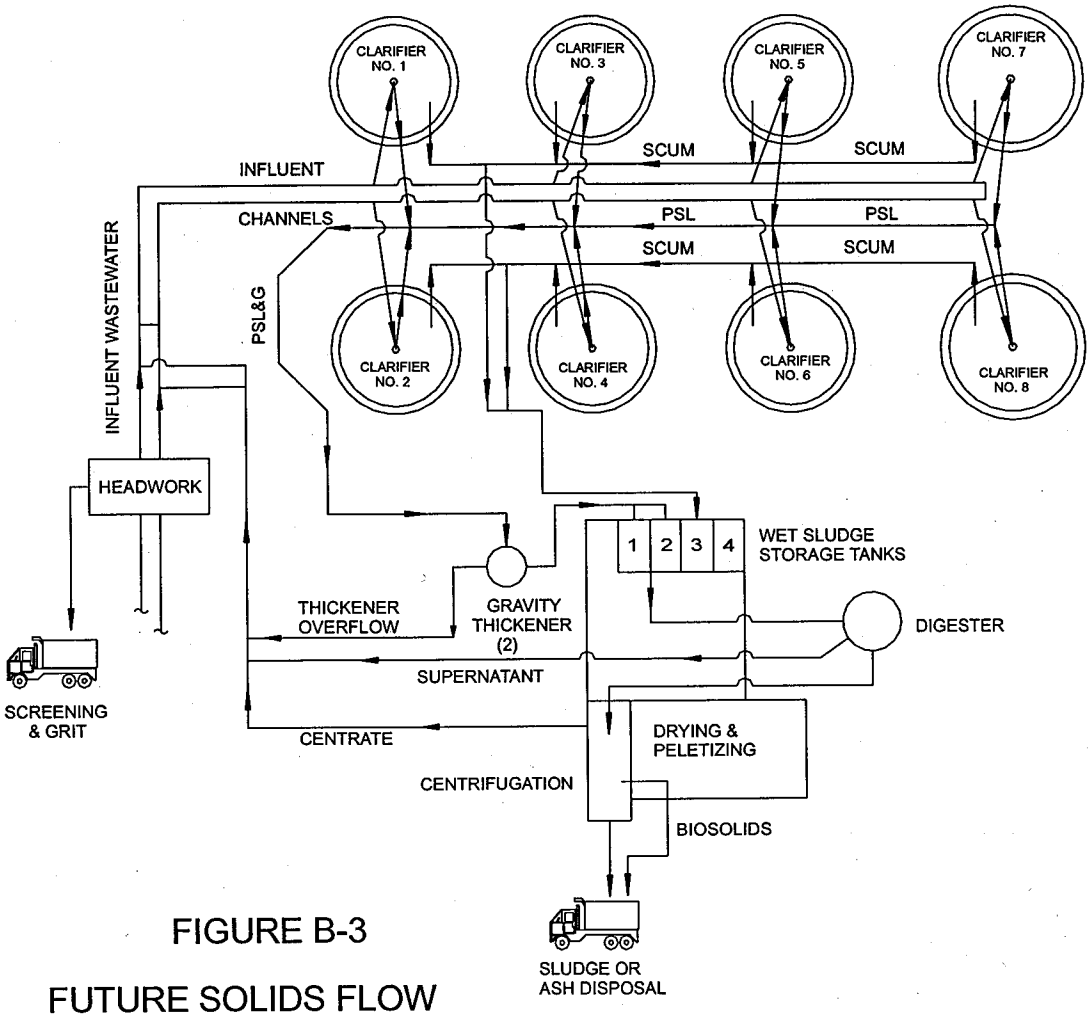


FIGURE B-3

FUTURE SOLIDS FLOW DIAGRAM FOR REMOVAL GRAVITY CLARIFICATION

TABLE B-2 SAND ISLAND WASTEWATER TREATMENT PLANT FUTURE SOLIDS HANDLING PROCESS COMPONENTS	
Sludge Thickening	
Gravity Thickening Tanks (two Decant tanks to be refurbished)	
Number	4
Diameter [feet]	50
Solids Loading [lb/sf/day] three in service/one standby	
Maximum	30
Average	7.7
Sludge Pumps	
Number	8
Capacity per pump [gpm]	35-110
Wet Sludge Storage Tanks	
Number of Storage Tanks	4
Effective Storage Volume per unit [ft^3]	10,550
Grinders	
Number	3
Capacity per unit [gpm]	100
Sludge Transfer Pumps	
Number	4
Capacity per unit [gpm]	35-110
Sludge Digester	
Number	1
Volume [thousand gallons]	2,300
Capacity dry tons per year [dtpy] Gallons per day [gpd]	10,000 164,000
Effluent pumping capacity (supernatant pumps gallons per day)	360,000
Sludge Dewatering	
Centrifuges	
Number	2
Capacity per unit	
Maximum [gpm]	250
Estimated solids content of sludge cake [percent]	25
Sludge Drier triple pass drying drum	
Number	1
Inside Diameter [feet] approximate	8
Length [feet] approximate	30
Rated Capacity lbs water evaporation per hour	8,800
Wet Solids Loading (Sludge cake lbs/hr]	
Emergency Standby Power System	
Headworks - Engine-Generator Unit kw	1250
Clarifier Building - Engine Generator kw	>570
Disinfection Facility - Engine Generators and Pump Engines	

TABLE B-2 SAND ISLAND WASTEWATER TREATMENT PLANT FUTURE SOLIDS HANDLING PROCESS COMPONENTS (CONTINUE)	
Engine Generators	3
Kw	2200
Diesel Pump Engines	4
Hp	1700
Old Effluent Pump Station - Engine Generator Unit kw	675
Reference	

Summary and Cost of System Upgrades

Projects included in the SIWWTP upgrade are: a new force main from the Hart Street WWPS to SIWWTP; the Interim Chemical Treatment Facility; The Clarifier Refurbishment Project; Upgrades to the Hart Street WWPS; Upgrades to the Ala Moana WWPS; Upgrades to the Parkway WWPS; Phase I Part 2A which includes the new headworks and two new clarifiers; The Disinfection Facility and Effluent Pump Station; the Beneficial Reuse Project; and the Plant Expansion Project. At the end of 2002 the contracted value of these projects, including planning, design, equipment and construction was $233.4 million. Within five years the City will complete all projects at an additional cost estimated to be over $135.5 million.

Summary

Improvements

- New force main from Hart Street WWPS to SIWWTP
- Two additional clarifiers to increase plant dry weather capacity to 90 mgd
- New Effluent pump station to increase pumping capacity from 194 to 270 mgd.
- Disinfection Facility to reduce discharged enterococcus bacteria to a maximum of 18,000 CFU/100 ml
- New headworks with:
  - Improved influent screens
  - Aerated grit removal (will remove grit, freshen sewage, reduce odors)
- Upgrade existing clarifiers and increase hydraulic capacity:
  - Optimize clarifiers for gravity removal adding Stanford baffles and energy dissipating influent nozzles.
  - Modify influent channels to allow separate flow control to each clarifier.
  - Installing new effluent duct system to increase plant hydraulic capacity.
- Increased emergency power generation capabilities to fully power facility during commercial power outages.

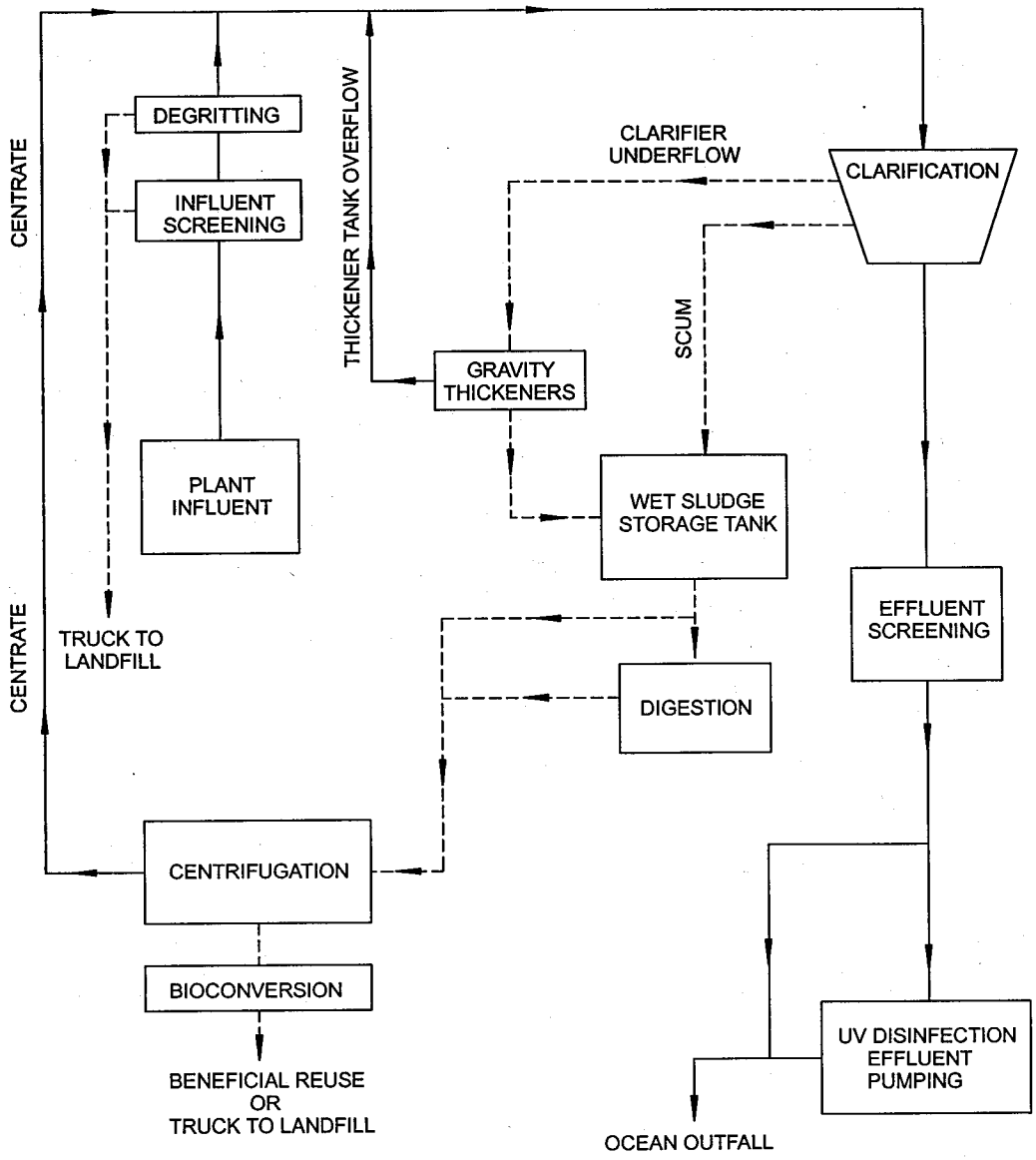
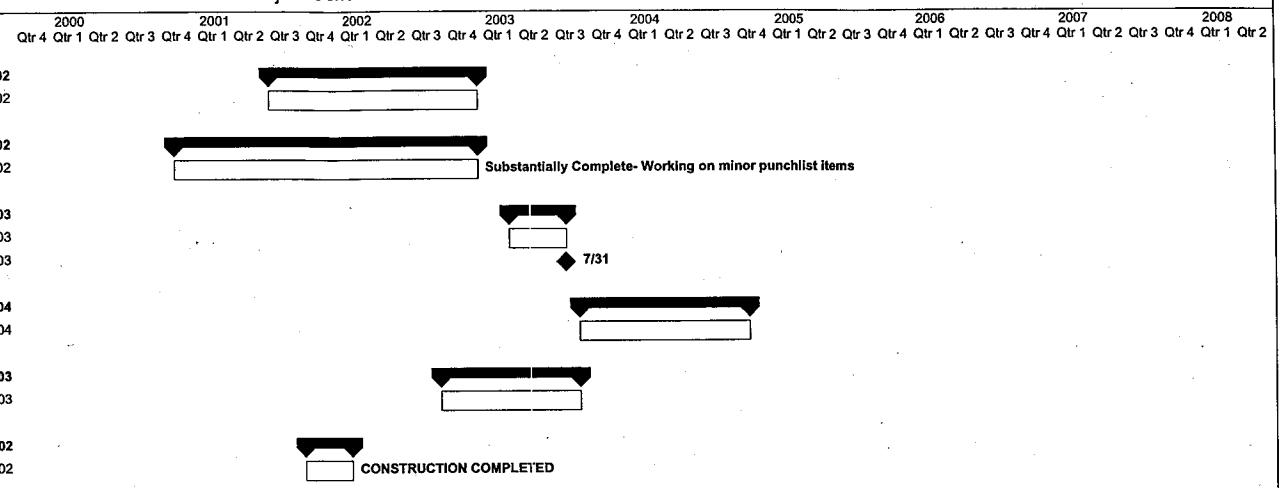


FIGURE B-4
FUTURE LIQUID & SOLID FLOW SCHEMATIC

Sand Island Wastewater Treatment Plant Program Management
Project Schedules

ID	Task Name	Start	Finish
44			
45	**Replace DAF Piping**	**Tue 7/3/01**	**Fri 12/20/02**
46	Construction - 100% COMPLETED - Benificial Use	Tue 7/3/01	Fri 12/20/02
47			
48	**Refurbish Flotator Clarifier 1, 2, 5 & 6 Project**	**Tue 11/7/00**	**Fri 12/20/02**
49	Construction - 99% COMPLETED	Tue 11/7/00	Fri 12/20/02
50			
51	**Interim Ferric Chloride Project**	**Mon 3/10/03**	**Thu 7/31/03**
52	Estimated Construction Period	Mon 3/10/03	Thu 7/31/03
53	Start Use	Thu 7/31/03	Thu 7/31/03
54			
55	**In-vessel Bioconversion Facility**	**Wed 9/3/03**	**Wed 11/3/04**
56	Bioconversion Construction Contract	Wed 9/3/03	Wed 11/3/04
57			
58	**PCB Characterization for SI WWTP**	**Sun 9/15/02**	**Wed 9/3/03**
59	Soil sampling	Sun 9/15/02	Wed 9/3/03
60			
61	**Repair EPS Discharge Lines**	**Mon 10/1/01**	**Thu 1/31/02**
62	Construction - COMPLETED	Mon 10/1/01	Thu 1/31/02



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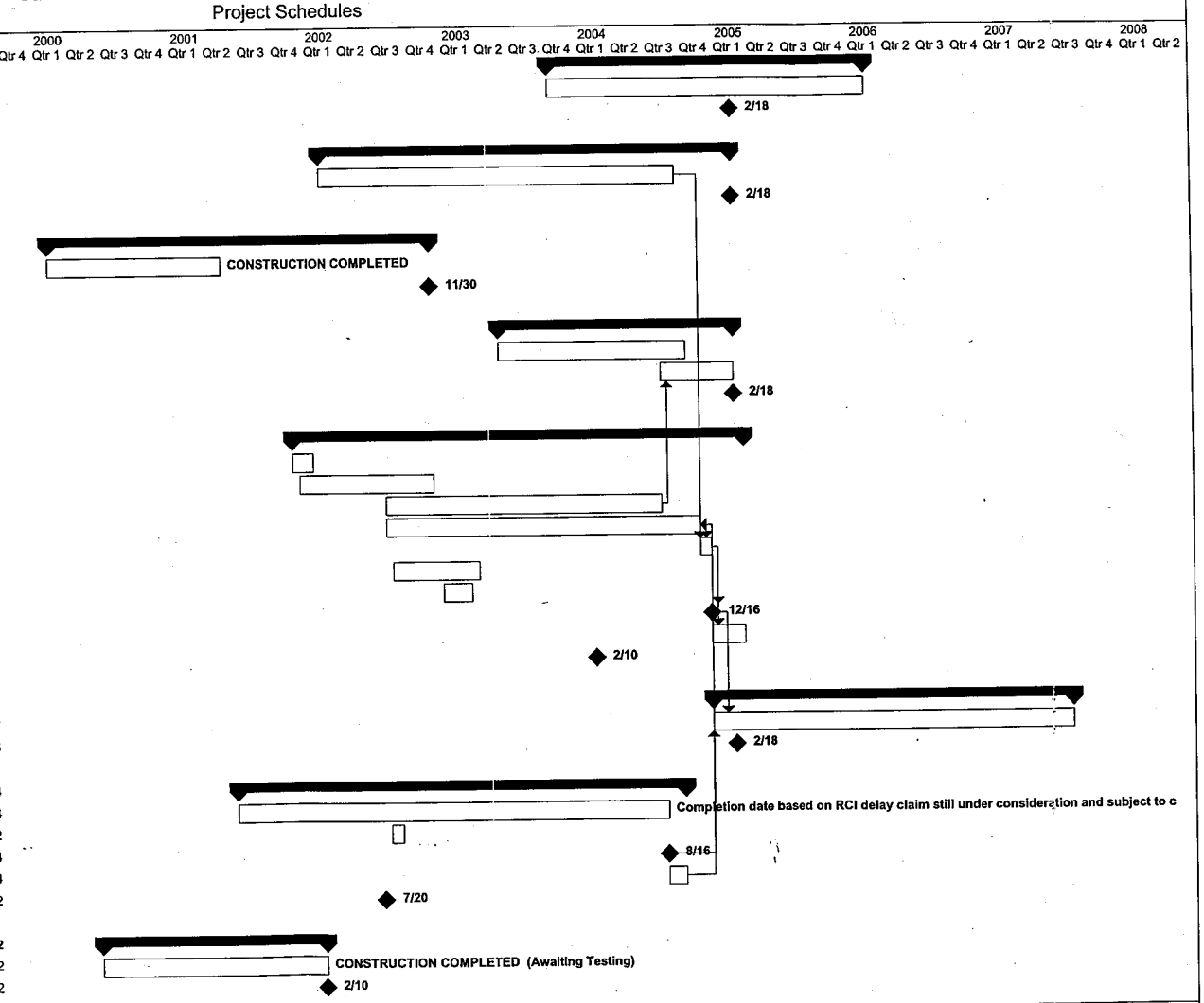
Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Sand Island Wastewater Treatment Plant Program Management
Project Schedules

ID	Task Name	Start	Finish
1	**Ala Moana Pump Station Modifications**	**Fri 10/17/03**	**Wed 2/15/06**
2	AMPS Modifications Construction	Fri 10/17/03	Wed 2/15/06
3	Finish Construction (NPDES Permit)	Fri 2/18/05	Fri 2/18/05
4			
5	**Hart Street Pump Station Project**	**Mon 2/11/02**	**Fri 2/18/05**
6	Construction	Mon 2/11/02	Fri 9/17/04
7	Finish Construction (NPDES Permit)	Fri 2/18/05	Fri 2/18/05
8			
9	**Hart Street Pump Station Force Main Replacement**	**Tue 2/8/00**	**Sat 11/30/02**
10	Construction - COMPLETED	Tue 2/8/00	Tue 5/15/01
11	Finish Construction (NPDES Permit)	Sat 11/30/02	Sat 11/30/02
12			
13	**SI Parkway Pump Station Modifications**	**Fri 5/30/03**	**Fri 2/18/05**
14	Piping & Equipment	Fri 5/30/03	Mon 10/11/04
15	Electrical & Landscaping	Fri 8/6/04	Thu 2/17/05
16	Finish Construction (NPDES Permit)	Fri 2/18/05	Fri 2/18/05
17			
18	**Headworks Project (SIWWTP Unit 1 Phase 2A)**	**Wed 11/21/01**	**Tue 3/15/05**
19	Air Quality Permit (7/23/01 to 1/10/02)	Wed 11/21/01	Thu 1/17/02
20	Headworks Structure	Tue 12/11/01	Thu 12/5/02
21	Headworks Equipment	Thu 8/1/02	Thu 8/5/04
22	PC 7 & 8, Piping & Misc Structures	Thu 8/1/02	Tue 11/16/04
23	Tie-in	Wed 11/17/04	Thu 12/16/04
24	PCB Soil Sampling & Remediation	Mon 8/19/02	Thu 4/3/03
25	PCB Overexcavation	Sun 12/29/02	Fri 3/14/03
26	Beneficial Occupancy	Thu 12/16/04	Thu 12/16/04
27	Landscaping/Miscellaneous	Fri 12/17/04	Tue 3/15/05
28	Finish Construction (NPDES Permit)	Tue 2/10/04	Tue 2/10/04
29			
30	**SI WWTP Primary Treatment Expansion**	**Fri 12/17/04**	**Wed 8/15/07**
31	Expansion Construction	Fri 12/17/04	Wed 8/15/07
32	Finish Construction (NPDES Permit)	Fri 2/18/05	Fri 2/18/05
33			
34	**UV Disinfection Project**	**Fri 6/15/01**	**Fri 10/1/04**
35	Construction Contract - ongoing	Fri 6/15/01	Mon 8/16/04
36	PCB Remediation	Wed 8/7/02	Fri 9/6/02
37	Beneficial Occupancy	Mon 8/16/04	Mon 8/16/04
38	Final Completion/Testing/Acceptance	Mon 8/16/04	Fri 10/1/04
39	Finish Construction (NPDES Permit)	Sat 7/20/02	Sat 7/20/02
40			
41	**Interim Chemical Treatment Facility (ICTF) Project**	**Mon 6/12/00**	**Sun 2/10/02**
42	ICTF Construction - COMPLETED	Mon 6/12/00	Sun 2/10/02
43	Finish Construction (NPDES Permit)	Sun 2/10/02	Sun 2/10/02



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Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone