

# APPENDIX I

## Major Pump Stations

### Major All-Weather Pump Stations

Figure I-1 illustrates the drainage basins serviced by the major pump stations.

#### North Shore Pump Station

The North Shore Pump Station is a dry- and wet-weather pump station that was constructed in 1982. In dry weather, North Shore Pump Station pumps 13 to 34 mgd to the Channel Transport/Storage (T/S) system. Present dry-weather flows average 13.9 mgd (2003–2007 dry-weather average). In wet weather, the North Shore Pump Station is capable of pumping 150 mgd of combined flows to the NPF, which has a maximum primary treatment capacity of 150 mgd. A flow diagram of the North Shore Pump Station is provided in Figure I-2. The North Shore Pump Station can be locally controlled in automatic or manual modes; limited remote control capability is available from the Southeast Water Pollution Control Plant (SEP) during dry-weather operation only. The North Shore Pump Station is equipped with four 15 mgd, 300 hp, dry-weather pumps, and two 75 mgd, 875 hp, wet-weather pumps. The dry-weather pumps are equipped with eddy-current clutch, variable-speed drives. The dry-weather side of the North Shore Pump Station consists of two influent channels (east and west). There are mechanically cleaned coarse bar screens (2-inch spacing) in each of the dry-weather channels. Downstream grinders are available to macerate the screenings and return them to the flow stream, or alternatively, operations personnel may choose to collect the screenings in dumpsters. The wet-weather side of the North Shore Pump Station consists of one influent channel equipped with a mechanically cleaned bar screen with 2-inch spacing. The North Shore Pump Station can be controlled either automatically or manually. Overflow alarms and T/S levels are transmitted electronically to Central Control at the SEP.

Ventilation at the North Shore Pump Station was modified and improved in 1996 as part of the North Shore Pump Station Reliability Improvements Project. Air drawn from the bar screen areas (i.e., process areas) is exhausted through two activated carbon units located on the North Shore Pump Station roof. Sodium hypochlorite (NaOCl) at 14% or ferrous chloride (FeCl<sub>2</sub>) at 35% concentration can be added to the untreated wastewater for odor control and to suppress the formation of hydrogen sulfide gas. Chemicals are injected into the collection system upstream of the North Shore Pump Station dry-weather sump. NaOCl may also be injected into the 36-inch force main (from the North Shore Pump Station to the Channel Pump Station) to control odors in the Channel T/S structure.

The existing four pumps provide adequate redundancy in dry weather. Only two of the 15-mgd pumps are required to handle the typical dry-weather flow. The remaining two

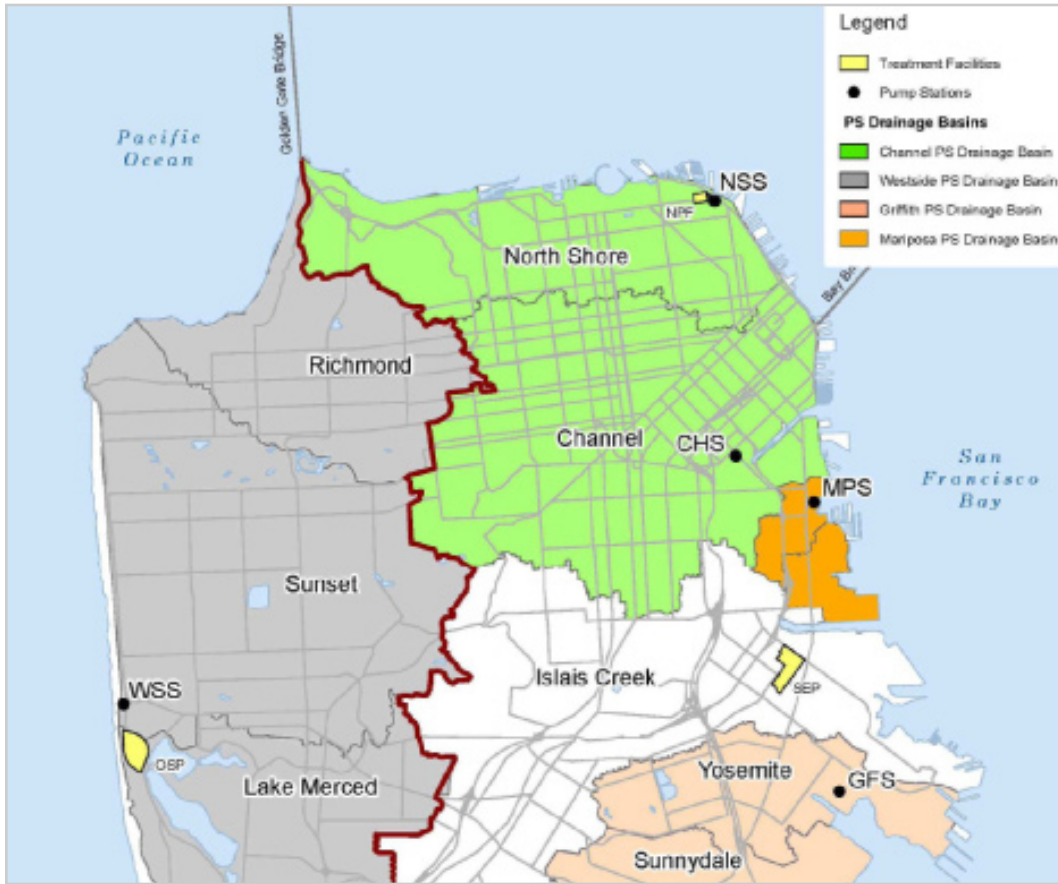


Figure I-1. Drainage Basins Served by Major Pumps Stations

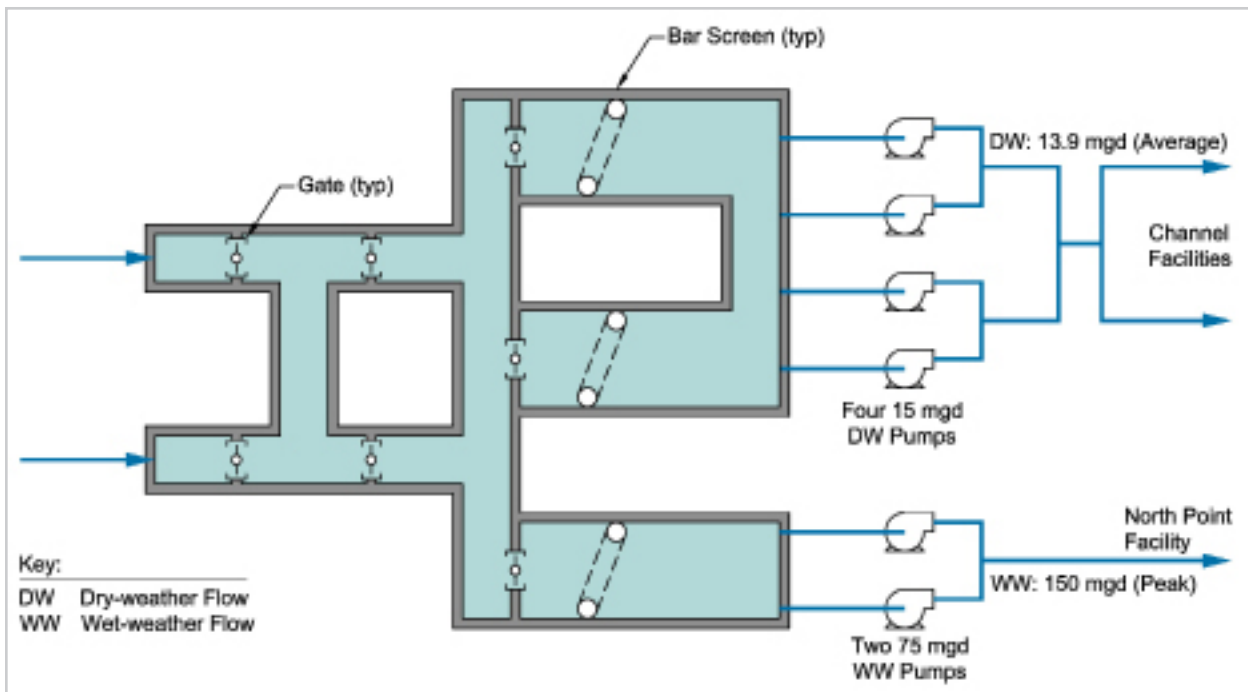


Figure I-2. North Shore Pump Station Flow Schematic

15-mgd pumps provide 100% redundancy in dry weather. There is no immediately available redundancy for the wet-weather pumps. Both 75-mgd pumps are required to handle the maximum wet-weather flow. In an emergency, the dry-weather pumps can be used to pump a small volume of wet-weather flow to the North Point Wet-Weather Facility.

### Channel Pump Station

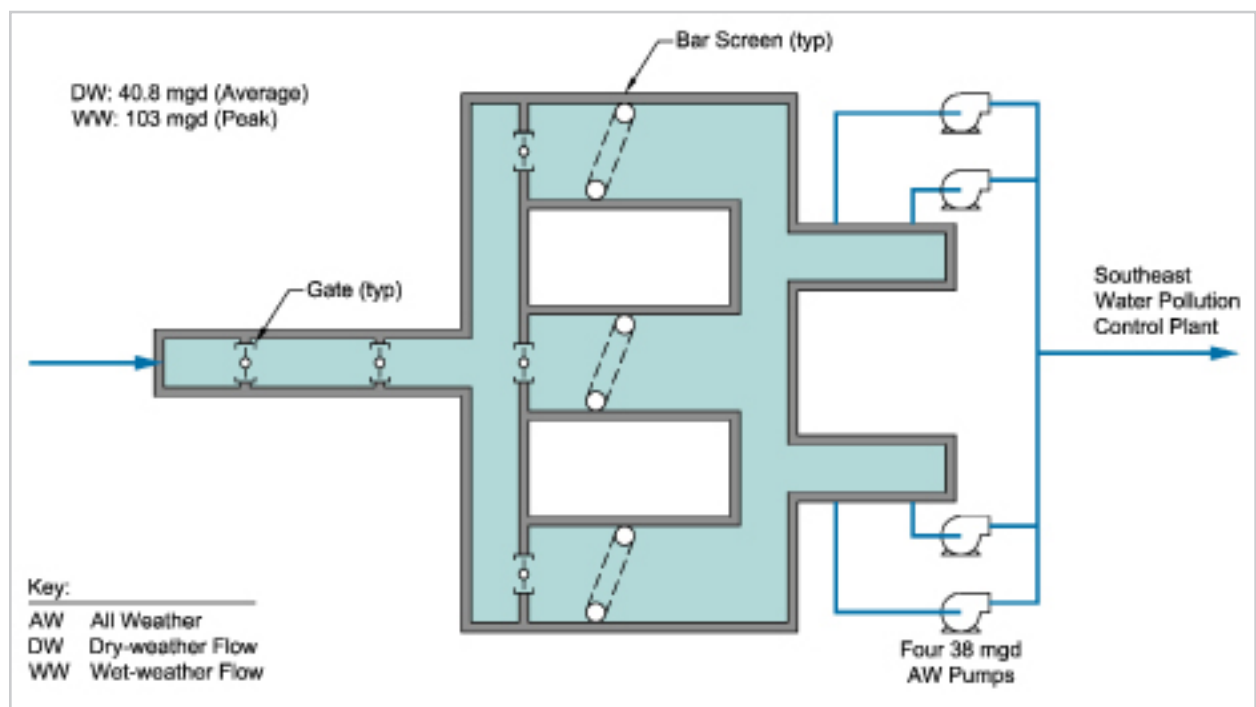
The Channel Pump Station, shown in Figure I-3 and Figure I-4, is a dry- and wet-weather pump station, which operates 24 hours per



**Figure I-3. Channel Pump Station**

day, 7 days a week, and was constructed in 1979. In dry weather, the Channel system receives and transports wastewater pumped from the North Shore Pump Station and brought by gravity flow from the Channel drainage area sewers. The Channel Pump Station pumps the wastewater through the 66-inch Channel Force Main directly to the SEP. Dry-weather flows from the Channel and North Shore areas average 40.8-mgd (2003–2007 dry-weather average). In wet weather, with North Shore flows diverted to the North Point Wet-Weather Facility, the Channel Pump Station is capable of pumping 103 mgd of combined flows from the local drainage area to the SEP.

The Channel Pump Station consists of a storage structure, two inlet gates in series, three mechanically cleaned bar screens, four main 38-mgd, 900-hp centrifugal lift pumps, and a discharge-side force main to the SEP (see Figure I-4). Maximum pump capacity at 465 rpm is rated at 50-mgd with one pump, 88 mgd with two pumps, and 103 mgd with three pumps. Flow is discharged through the 66-inch Channel Force Main. The existing four pumps provide adequate redundancy.



**Figure I-4. Channel Pump Station Flow Schematic**

Only two 38-mgd pumps are required to handle the typical dry-weather flow. The remaining two 38-mgd pumps provide 100% redundancy in dry weather. Only three 38-mgd pumps are required to handle the typical wet-weather flow. The single remaining 38-mgd pump provides 33% redundancy in wet weather.

Exhaust fans are provided throughout the station, and air conditioning is provided for the control room. Two 6,000-gallon hypochlorite tanks are located within a concrete containment basin at the Channel Pump Station. Two positive displacement/metering pumps feed hypochlorite into the inlet channel of the station, upstream of the three bar screens.

The mode of Channel Pump Station operations remains the same in wet or dry weather. Overflow and power failure alarms, as well as pump status and levels, are monitored remotely at the SEP.

The maximum flow from the Channel Pump Station is restricted by the size of the force main. The Channel Pump Station has the capacity to be expanded to six pumps, but an additional force main between the Channel Pump Station and the SEP will be required to provide capacity for the increased flow.

### Mariposa Pump Station

The Mariposa Pump Station, shown in Figure I-5, includes both a dry- and a wet-weather pump station. The flow diagram for the Mariposa Pump Station is shown in Figure I-6 on the following page.

The dry-weather pump station is a separate structure located south of the wet-weather pump station. The dry-weather pump station was originally constructed in 1954; the wet-weather pump station was constructed in 1993 along with the T/S structure. The Mariposa Pump Station pumps both dry- and wet-weather flows from the Mariposa T/S structure to the gravity sewer at 21st and Illinois streets, which then flow to the SEP.

The Mariposa Pump Station consists of two 1.5-mgd, 20-hp, submersible centrifugal

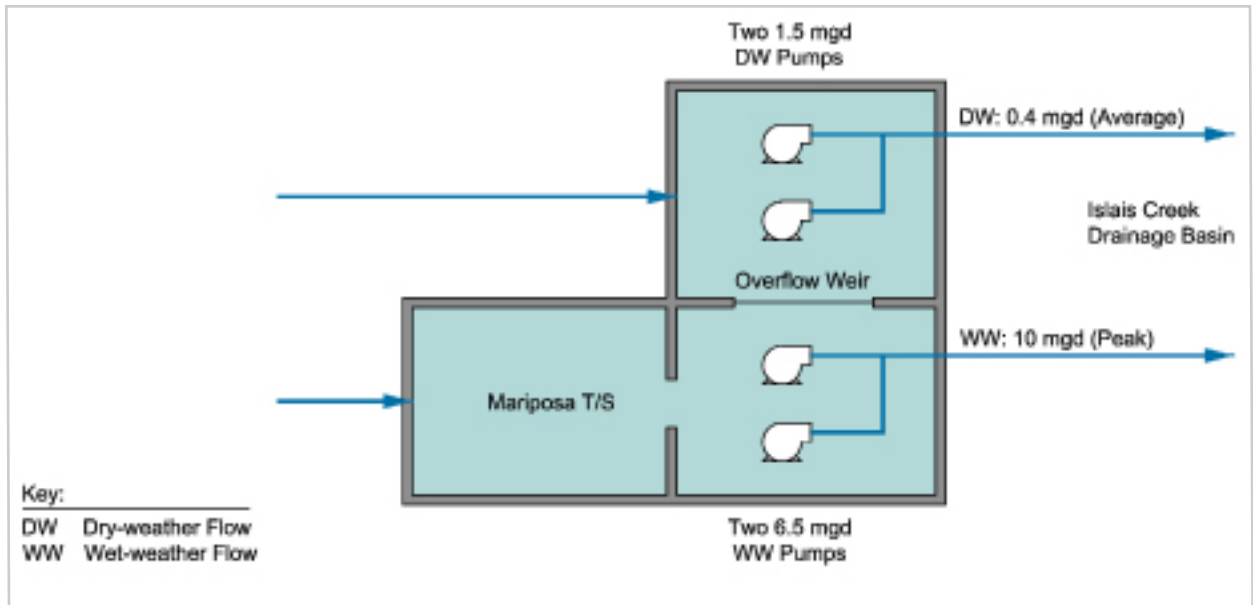
pumps for dry weather and two 6.5-mgd, 77-hp, submersible centrifugal pumps for wet weather. During wet weather, a system of baffles and a weir keep debris in the T/S structure and prevent the discharge of solids into the bay. As wastewater in the T/S structure rises upstream to a level that exceeds the capacity of the dry-weather pump station, flow spills over a weir into the wet-weather T/S structure and into the wet-weather pump station. Installed between the two wet-weather pumps is a dewatering pump that can automatically pump the flow from the T/S structure to the dry-weather sump when the wet-weather pumps shut off. If necessary, the dry-weather pump station can continue to operate simultaneously during wet weather. Magnetic flow meters are located on the pumps' discharge headers.

The Mariposa Pump Station is automatically controlled by water surface level in the T/S structure immediately upstream of the station. Overflow and power failure alarms at the Mariposa Pump Station are monitored at the SEP. Two ventilation fans provide air for the wet-weather manifold room and flow meter vault. An activated carbon odor control unit is installed outside the dry-weather station to remove odorous gases from the dry-weather sump area.

The two existing pumps provide adequate redundancy in dry weather. Only one 1.5-mgd pump is required to handle the typical dry-weather flow (<0.6 mgd – the 2003 to 2007 dry-weather average). The



**Figure I-5. Mariposa Pump Station**



**Figure I-6. Mariposa Pump Station Flow Schematic**

remaining 1.5-mgd pump provides 100% redundancy. Both 6.5-mgd pumps are required to handle the typical wet-weather flow. In an emergency, the dry-weather pumps can be used to pump some wet-weather flow.

### Griffith Pump Station

The Griffith Pump Station, shown in Figure I-7 is a dry- and wet-weather pump station constructed in 1989. The Griffith Pump Station flow diagram is shown below in Figure I-8. The Griffith Pump Station pumps dry-weather flow from the lower Yosemite areas combined with dry-weather flow from the Sunnydale to the Hunters Point tunnel, which then flows by gravity to the SEP. Dry-weather flow from the upper Yosemite area also gravitates to the SEP via the Hunters Point Tunnel. The Griffith Pump Station also pumps wet-weather flows from Yosemite and Sunnydale to the SEP via the Hunters Point Tunnel.

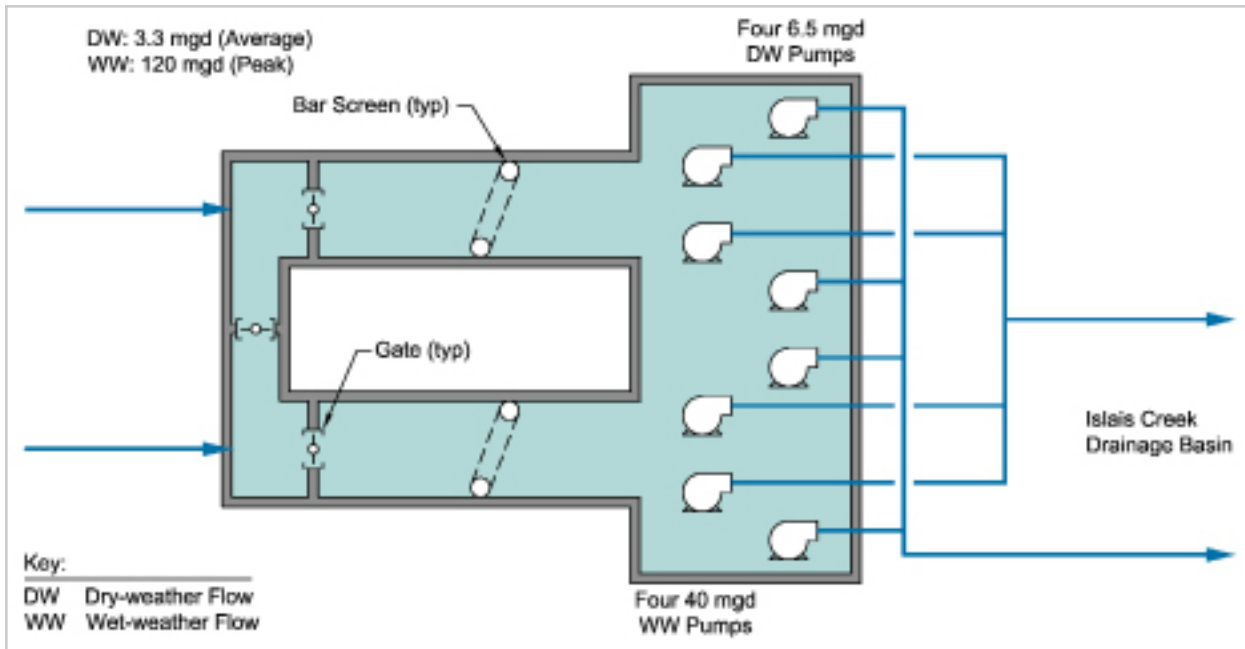
The Griffith Pump Station consists of four 6.5-mgd, 60-hp, submersible centrifugal pumps for dry weather and four 40-mgd, 316-hp, pumps for wet weather. Concrete walls divide the pump station into “flood-

able” and “nonfloodable” areas to protect equipment. The channels leading to each floodable pump chamber are equipped with mechanical, catenary bar screens. Four submersible pumps, two for dry weather and two for wet weather operation, are installed in each chamber. The floodable side includes the inlet channels, main pump chambers, dewatering room, and main pump discharge manifold room. The nonfloodable side houses ventilation fans, switchgear, controls, water pumps, and other equipment that are vulnerable to flooding.

The dry-weather and wet-weather pump manifolds have separate discharge lines. The



**Figure I-7. Griffith Pump Station**



**Figure I-8. Griffith Pump Station Flow Schematic**

20-inch dry-weather forcemain discharges to a sewer outside the station at Griffith Street and Shafter Avenue that then flows on to meet the Hunters Point Tunnel sewer at Griffith Street and Palou Avenue, and eventually arrives at the SEP for treatment. The 66-inch wet-weather forcemain also discharges directly into the Hunters Point Tunnel sewer.

A magnetic flow meter is located on the discharge header of the dry-weather pumps, and another is located on the discharge header of the wet-weather pumps. The Griffith Pump Station is automatically controlled by water surface level in the Yosemite Outfalls Consolidation facilities T/S structure and is monitored by Central Control at the SEP.

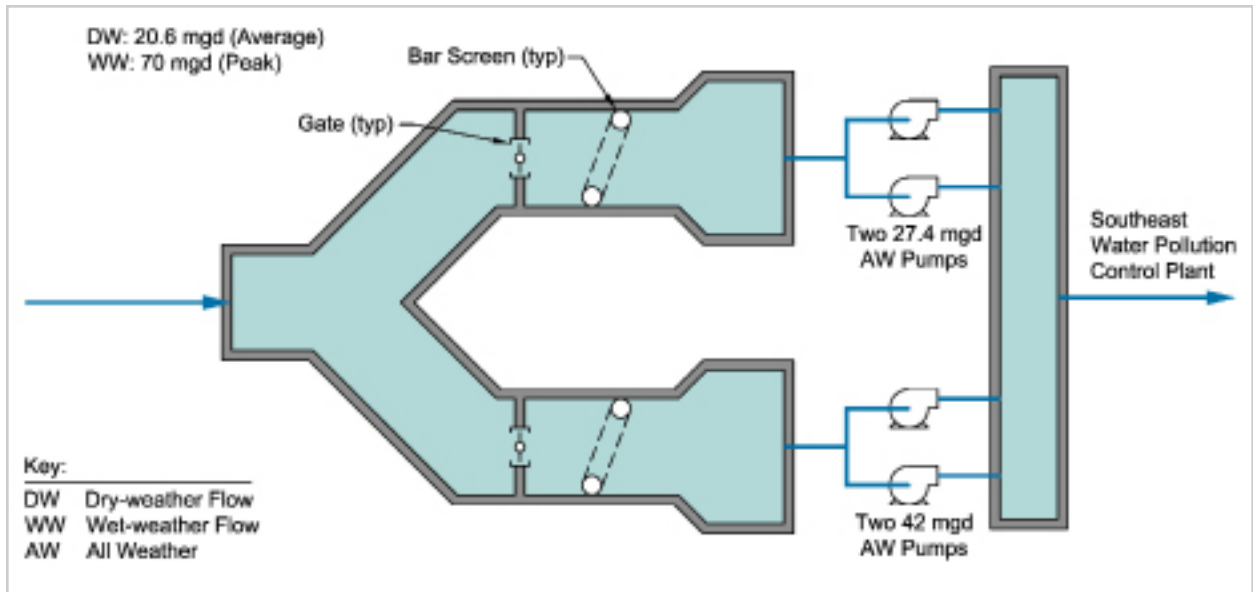
The ventilation system supplies air to all areas within the station. Exhaust fans and an activated carbon unit remove odorous (and potentially unsafe) air from the channels and pump chambers before being discharged outside to the atmosphere. For personnel safety, gas detectors are installed in the station to provide an alert when the hydrogen sulfide level reaches 20 parts per million. When a lower explosive limit of more than 50% is detected, all control

levels will raise the water levels by 4 feet to contain the combustible material in the T/S structure.

The existing dry-weather pumps provide adequate redundancy during dry weather, as only two pumps are required to handle the typical dry-weather flow of 3.3 mgd; 33% redundancy is provided during wet weather. Three wet-weather pumps are required to handle the 120-mgd maximum wet-weather flow. To mitigate the City’s risk, a spare wet-weather pump is maintained in stock.

### Southeast Lift Station

The Southeast Lift Station is a dry- and wet-weather pump station. The Southeast Lift Station flow diagram is shown below in Figure I-9. This pump station is located at the headworks of the SEP and serves as the initial lift station for gravity flow from the Islais Creek Drainage area. The pump station was constructed in 1981. The Southeast Lift Station is equipped with two 27.4-mgd, 350-hp lift pumps and two 42-mgd, 450-hp lift pumps. Flow entering the Southeast Lift Station is split into two channels, which lead to a north and south wet well. A mechanically cleaned coarse bar rack removes debris



**Figure I-9. Southeast Lift Station Flow Schematic**

from each channel. Pump control at the Southeast Lift Station is coordinated with pump control at the Channel Pump Station to achieve an even diurnal flow through the SEP. The Southeast Lift Station can be operated via remote control from the SEP. The existing four pumps provide adequate redundancy during dry weather. Only one pump is required to handle the average dry-weather flow (20.6 mgd was the 2003 through 2007 dry-weather average) from the Islais Creek Drainage Basin. Two pumps are required to handle the wet-weather flow (70 mgd). This station provides 100% redundancy during wet weather.

### Westside Pump Station

The Westside Pump Station, pictured in Figure I-10 is a dry- and wet-weather pump station. It was constructed in 1985. The Westside Pump Station flow diagram is shown in Figure I-11

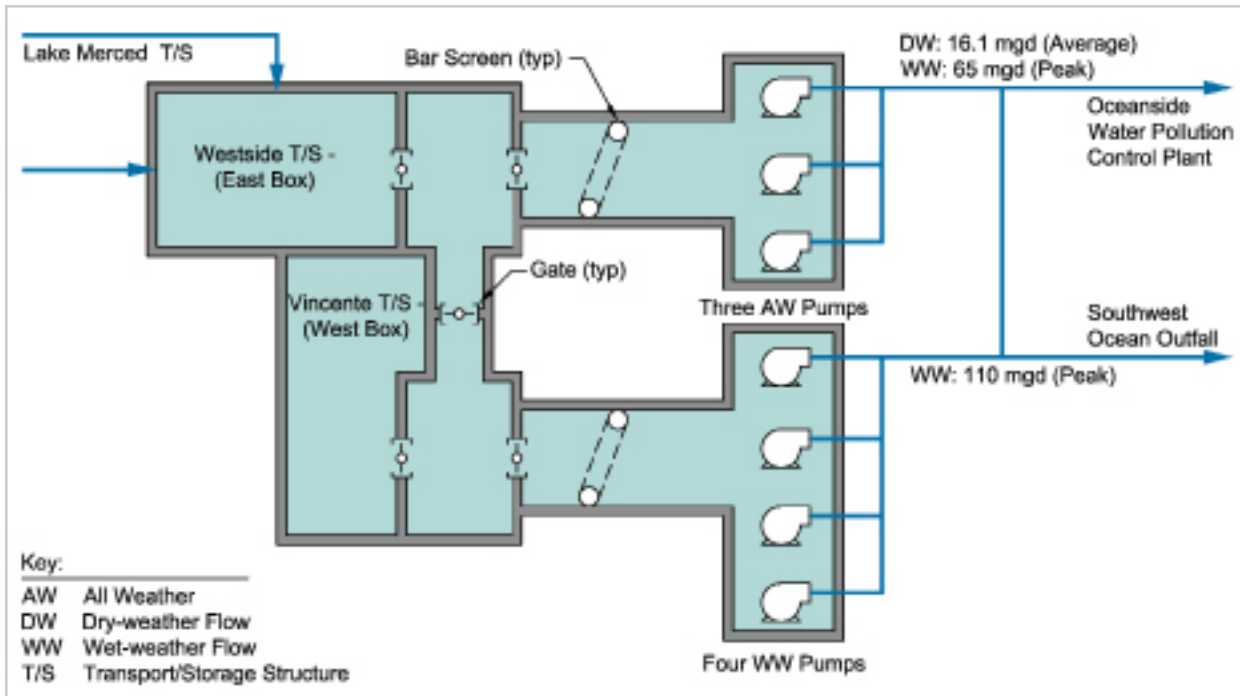
The Westside Pump Station receives dry-weather and wet-weather flows from the west side of San Francisco by way of the Westside T/S structure, the Lake Merced T/S structure, and the Richmond T/S structure. Dry- and wet-weather flows are pumped by the Westside Pump Station to the Oceanside Water Pollution Control Plant

(OSP) for treatment. Decanted wet-weather flows are pumped by the Westside Pump Station to the Southwest Ocean Outfall for discharge into the Pacific Ocean. The Westside Pump Station provides operational flexibility that allows the operators at the OSP to control the rate of flow entering the plant at all times.

Concrete walls divide the pump station into “floodable” and “nonfloodable” areas to protect equipment. The floodable area contains the inlet channels, main pump chambers, dewatering room, and main pump discharge manifold room. The nonfloodable area houses fans, switchgear, controls, water pumps, and other equipment vulnerable to flooding. The floodable area is divided into an east pump chamber (east chamber, supplied by the Westside T/S East Structure)



**Figure I-10. Westside Pump Station**



**Figure I-11. Westside Pump Station Flow Schematic**

and a west pump chamber (west chamber, supplied through the Westside T/S Vicente West Structure).

The east chamber is equipped with three pumps, and the West Chamber is equipped with four pumps. The east chamber contains one Flygt 3501 and two Flygt 3531 submersible centrifugal pumps, each driven by a variable frequency drive (VFD), for a total capacity of 53 to 66 mgd. The west chamber contains one Flygt 3531 and three Flygt 3501 submersible centrifugal pumps, each driven by a VFD, for a total capacity of 106 to 130 mgd. The capacity range is due to variable liquid levels in the sumps. The 3531 Flygt pumps are equipped with 335-hp motors and the 3501 Flygt pumps are equipped with 325-hp motors.

The channel leading to each pump chamber is equipped with a mechanically cleaned bar screen. The east chamber bar screen has 1.5-inch openings, and the west chamber bar screen has .75-inch openings. The 1.5-inch spacing at the east chamber bar screen provides adequate screening to protect the east chamber main lift pumps while alleviating excessive buildup of screenings and

eliminating the need for increased screenings handling and storage capabilities at the Westside Pump Station. The .75-inch spacing in the west chamber bar screen prevents debris from clogging the openings of the diffusers at the Southwest Ocean Outfall. It should be noted that the east chamber should not be used to pump flow to the Southwest Ocean Outfall since the larger bar rack openings could result in clogging of the diffusers. In the event that the east chamber is used to pump flow to the Southwest Ocean Outfall, an alarm will sound at the Westside Pump Station and the OSP.

The three pumps in the east chamber pump dry-weather influent flow, via a 48-inch forcemain, to the pretreatment building at the OSP. Dry-weather capacity of the east chamber is 66 mgd with all three pumps operating, 46 mgd with two 3531 Flygt pumps operating, and 50 mgd with one 3531 Flygt pump and one 3501 Flygt pump operating. The three existing east chamber pumps provide adequate redundancy for the dry-weather peak flow of 30 mgd. The four pumps in the west chamber normally pump decanted wet-weather flows from



the Westside T/S Vicente West Structure to the Southwest Ocean Outfall, with a total capacity range of 6 to 120 mgd.

## Major Wet-Weather Pump Stations

In addition to the all-weather pump stations described above, additional pump capacity is provided during wet weather by a network of minor pump stations and two major wet-weather pump stations – the Bruce Flynn Pump Station and the Sunnydale Pump Station. The drainage basins served by the major wet-weather pump stations are shown in Figure I-12.

## Bruce Flynn Pump Station

The Bruce Flynn Pump Station, shown in **Figure I-13**, was constructed in 1996 and was designed for wet-weather operation. A flow diagram of the Bruce Flynn Pump Station is given in **Figure I-14** on the following page. The Bruce Flynn Pump Station provides additional capacity to supplement the Southeast Lift Station during wet weather, lifting inflow into the SEP. Figure I-12 illustrates the watershed areas serviced by the Bruce Flynn Pump Station. For the last several years, Bruce Flynn Pump Station has been operated during dry weather to provide a consistent influent flow regime at the SEP.



**Figure I-12. Drainage Basins Served by Major Wet-Weather Pump Stations**

The Bruce Flynn Pump Station consists of six 30-mgd–each, 430-hp, submersible centrifugal pumps. The flow to the Bruce Flynn Pump Station splits into two channels that lead to two sumps, each equipped with three 30-mgd pumps. Each channel is equipped with a mechanically cleaned bar screen. A grinder located downstream of each bar screen macerates screenings and returns them to the flow stream. A magnetic flow meter is located on each pump discharge. Additionally, there are two submersible dewatering pumps that pump dewatered

flow directly to the southeast influent control structure.

The Bruce Flynn Pump Station ventilation system supplies air to all areas in the station. Exhaust fans remove odorous air from the channels and sump chambers. A carbon absorber scrubs the air before discharging it to the atmosphere. Sodium hypochlorite can be used to control odors in the T/S structures and sumps. Sodium hypochlorite lines are tied into the 30-inch flushing line in the manifold room.

The Bruce Flynn Pump Station can be operated remotely from the SEP, and overflow and power failure alarms, as well as pump statuses and T/S structure levels, are monitored from the SEP central control. Only four pumps are required to handle a maximum flow of 110 mgd. The remaining pumps provide 50% redundancy.



Figure I-13. Bruce Flynn Pump Station

### Sunnydale Pump Station

The Sunnydale Pump Station, shown in Figure I-15 was constructed in 1988 and is only operated in wet weather. The Sunny-

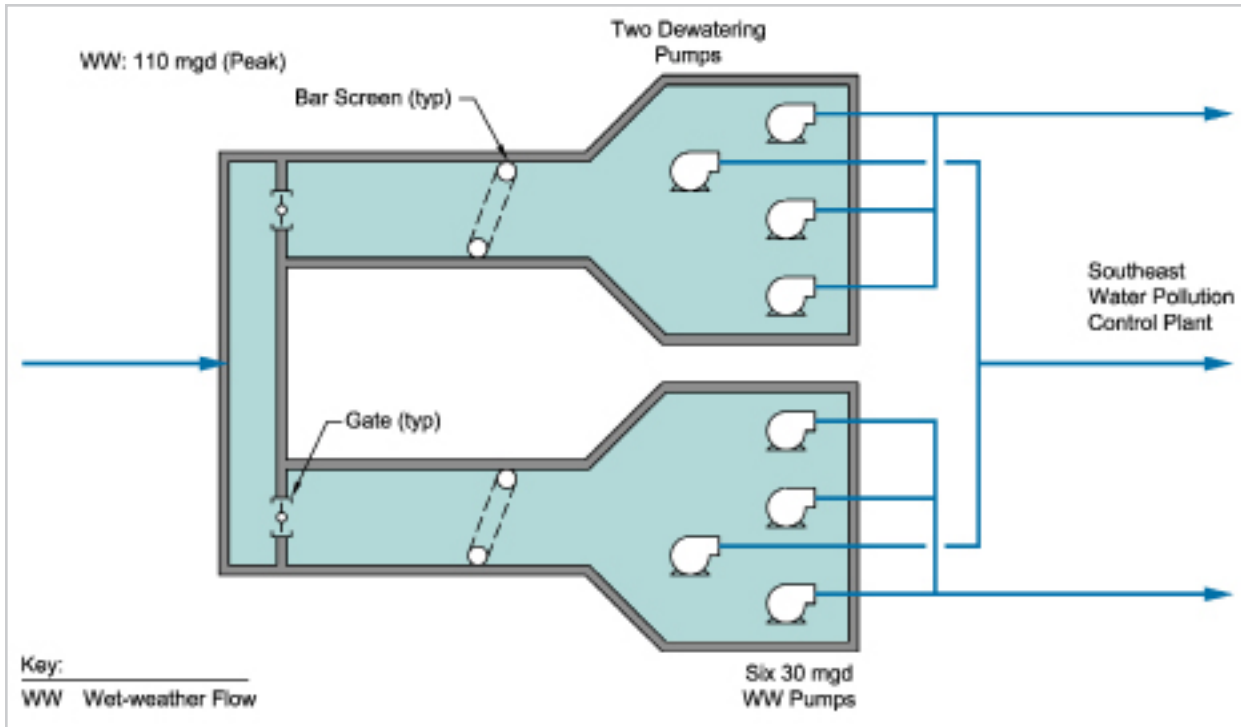


Figure I-14. Bruce Flynn Pump Station Flow Schematic

dale Pump Station receives flow from the Sunnydale T/S structure and overflow from the Sunnydale Tunnel and pumps flow to the upstream end of the Candlestick tunnel, which in turn flows by gravity to the Yosemite T/S structure. This flow is ultimately pumped again by the Griffith Pump Station.

The Sunnydale Pump Station consists of three variable-speed, 21-mgd, 316-hp submersible centrifugal pumps. A 42-inch magnetic flow meter is located on the discharge header of the pumps, but this meter is scheduled to be replaced by a 44-inch magnetic flow meter between 2007 and 2008. The Sunnydale Pump Station is controlled automatically by water surface level in the Sunnydale facilities' T/S structure. The Sunnydale Pump Station pumping rate is limited to 50 mgd to keep from



Figure I-15. Sunnydale Pump Station

overburdening the downstream facilities (Yosemite T/S and the Griffith Pump Station). The Sunnydale Pump Station is monitored by the SEP, including overflow and power failure alarms as well as pump statuses. The flow diagram for the Sunnydale Pump Station is shown in Figure I-16.

Ventilation in the dry well areas is adequate as the pump station is positively ventilated with seven air changes per hour–11 changes per hour for T/S access safety. There is one change per hour for the T/S structure – a carbon sorption vessel removes odorous elements contained in this exhausted air.

## Major Effluent Pump Station

### Booster Pump Station

The Booster Pump Station (Figure I-17) receives treated effluent from the SEP through a 6-ft diameter gravity pipe and pumps the flow to the San Francisco Bay through the Southeast Bay Outfall. Any flow from the SEP beyond the maximum capacity of the Booster Pump Station discharges to Islais Creek via the Quint Street Outfall during wet weather.

The Booster Pump Station was first constructed in 1967 to pump the primary effluent from the SEP to the bay. Two 35 mgd pumps were installed to handle the peak wet-weather flow of 65 mgd from the SEP. The SEP was expanded in 1982 to provide

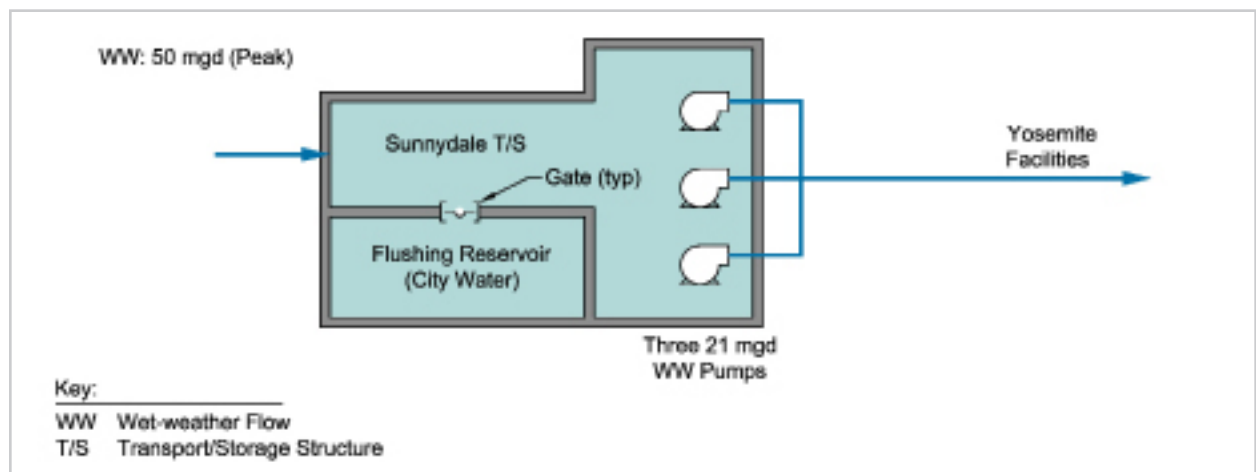


Figure I-16. Sunnydale Pump Station Flow Schematic



**Figure I-17. Booster Effluent Pump Station**

secondary treatment for all the bayside dry-weather flow. To avoid dry-weather flow discharging to Islais Creek, in 1988 an additional pump was installed and the existing pumps were upgraded with new impellers to provide greater capacity. However, actual field experience revealed that the Booster Pump Station actual flow could not reach the design capacity of 110 mgd; under the most favorable conditions, the maximum flow was around 100 mgd. Additionally, the pump station did not have redundant pumping capacity, should one of the primary units fail.

To address these dual concerns, in 1996 the plant configuration was changed to allow for the separation of the primary and secondary final effluents during wet weather. Only secondary effluent from the SEP can now discharge to the Islais Creek during wet weather. The Booster Pump Station receives mostly primary effluent when the SEP is in 250-mgd mode. Further upgrades to the Booster Pump Station were effected in 2002 to provide backup capacity. The three orig-

inal pumps were replaced with four new pumps. Current operations rely on two pumps during dry weather, and three pumps during wet weather. The fourth pump is available to provide automatic backup if a primary pump fails.

## Minor Pump Stations

### Minor All-Weather Pump Stations

#### Hudson Avenue Pump Station

The Hudson Avenue Pump Station is a dry-weather and wet-weather pump station located at Hudson Avenue and Hunters Point Boulevard, in the Big J Auto junkyard. Hudson Avenue Pump Station consists of a single submersible pump (0.25 mgd) in a standard-size manhole. The pump discharges into a catchbasin on Hunters Point Boulevard. The controls are located in the Hudson Avenue Overflow Control Box. The Hudson Avenue Pump Station was constructed to prevent property flooding during wet weather. There is no alarm

connection to the SEP; if the pump fails, the property owner notifies the SEP operations for service.

### Palace of Fine Arts Pump Station

The Palace of Fine Arts Pump Station comprises of two facilities, which serve a two-acre drainage area that includes the Palace of Fine Arts and its surrounding lagoon and landscaped areas. The Palace of Fine Arts Pump Station has a rated capacity of 0.43 mgd and an annual flow of 17 MG. The dry-weather facility handles the sanitary flow from the Palace of Fine Arts building while the wet-weather facility handles storm runoff, lagoon drainage, and overflows during wet weather. Flow from both facilities is pumped to the Marina transport sewer.

A 12-inch pipe running beneath Palace Drive collects and transports sanitary flow as well as discharges from custodial sinks within the Palace of Fine Arts building. The flow is transported to the dry-weather wet well where it is pumped by two float-controlled submersible pumps and discharged into the Marina transport sewer. An alternating float switch sequences the pumps each time they start.

Stormwater from the Palace of Fine Arts drainage area is collected and transported via a series of 4-inch, 8-inch, and 10-inch pipes to a collection structure. From the collection structure, stormwater flows through a common pipe to the Palace of Fine Arts Pump Station wet-weather wet well. Lagoon drainage and overflows are transported through a 15-inch pipe to a diversion structure and then into the wet-weather wet well where flow is pumped by two bubbler level-controlled submersible pumps and discharged into the Marina transport sewer.

Prior to 1990, excessive flows spilled over a weir within the diversion structure into a 24-inch overflow line that subsequently discharged into the San Francisco Bay at the foot of Lyon Street. In 1990, this line was inadvertently filled with concrete, causing excess runoff to back up within the drainage

area. Excess flows are now pumped by the Palace of Fine Arts Pump Station wet-weather pumps to the Marina transport sewer. Station flows are calculated daily from elapsed time meter readings for each pump.

### Pine Lake Pump Station

The Pine Lake Pump Station was constructed in 1944, and capacity was increased in 1954 and again in 1997. It serves a drainage area of 60 acres (wet weather) and 19 acres (dry weather). It has a rated capacity of 0.20 mgd and an average dry-weather flow of 0.01 mgd. Sewage flows into the Pine Lake Pump Station through an 8-inch line and is screened and then pumped at the primary (i.e., dry-weather) wet well by two centrifugal lift pumps. Discharge is via a 3-inch forcemain to a 2-foot-by-3-foot sewer located on Wawona Street. When the primary wet well is overwhelmed, influent flow will discharge through a 12-inch line to the secondary wet well. Two centrifugal lift pumps are used to pump down the secondary (i.e., wet-weather) wet well. Discharge is through an 8-inch forcemain to a 2-foot-by-3-foot sewer located on Wawona Street. The secondary wet well is equipped with a 12-inch overflow line into Pine Lake.

From Wawona Street (2-foot by 3-foot sewer), the sewer line intercepts 34th Avenue by way of a 5-foot-diameter circular sewer line. The 34th Avenue line then intercepts Vicente Avenue by way of another 5-ft sewer line. From Vicente Avenue, the 5-foot sewer line conveys the combined storm runoff and sewage to the east chamber of the Westside T/S structure.

### Sea Cliff #1 Pump Station

The Sea Cliff #1 Pump Station is a sanitary station constructed in 1929 to serve a small three-acre drainage area near the west end of Sea Cliff Avenue. Discharge from the China Beach Recreational Center building also contributes to the influent flow at the Sea Cliff #1 Pump Station. In 1995, two Flgyt 10-hp submersible lift pumps

replaced the original Krogh 7-hp vertical lift pumps. Flow from the Sea Cliff #1 Pump Station is pumped to a manhole along El Camino Del Mar. From this manhole, flow travels via gravity to the Sea Cliff #2 Pump Station. Stormwater is collected from a separate stormwater sewer on Sea Cliff Avenue, which connects to an 18-inch corrugated metal pipe, which, in turn, discharges at the base of the cliff onto China Beach. Overflow from the Sea Cliff #1 Pump Station sump is directed into this stormwater pipe. To provide emergency standby power, a manual electric transfer switch and connector for a portable generator (60kW) were installed near the fence line entrance to the Sea Cliff #1 Pump Station in 1998. This small facility has a rated capacity of 0.78 mgd, an average dry-weather flow of 0.005 mgd, and an annual flow of approximately 2.0 MG.

The Sea Cliff #1 Pump Station is equipped with an overflow recorder and timer, including a high sump level/overflow alarm system. A programmable logic controller (PLC) controls the lift pumps according to sump level indications; the PLC also provides remote monitoring of the pump station at the OSP. There are future plans to provide remote control of Sea Cliff #1, via telemetry, at the OSP.

### Sea Cliff #2 Pump Station

The Sea Cliff #2 Pump Station was originally constructed in 1940 and was renovated in 1995. It serves a 16.7-acre drainage area located in the eastern portion of the Sea Cliff neighborhood. The facility has a rated capacity of 0.90 mgd with an average dry-weather flow of 0.34 mgd and an annual flow of around 97 MG. Sanitary sewage and wet-weather runoff are lifted from the pump inlet to a drop manhole located at 25th Avenue and Lake Street by means of three heavy duty, dry-pit submersible, centrifugal, nonclog PLC-controlled Flygt pumps (1.4 mgd). From the manhole, the discharge flows by gravity to the OSP via the Richmond Transport to the east chamber of the West-side Transport.

An electrically actuated 12-inch gate valve controls combined sewer flows from the 9.4-acre Western Subdrainage into the Sea Cliff #2 Pump Station and enables storage behind a 104-inch deep weir wall in the overflow control structure across a 6-foot sewer. The 7.3-acre Eastern Subdrainage is served by sanitary sewers that also collect some of the area's stormwater. The remainder of the Eastern Subdrainage stormwater is collected at the Sea Cliff #3 sump and is pumped to the 36-inch-diameter storage sewer in Sea Cliff Avenue. Flows from the Western Subdrainage and the storage sewer enter Sea Cliff #2 Pump Station from Sea Cliff Avenue through an 8-inch line. Overflow from the Sea Cliff #3 Pump Station enters the station from the north east in an 8-inch line that transitions into a 15-inch line.

### Tennessee Pump Station

The Tennessee Pump Station, which was constructed in 1966 and upgraded in 1993 serves a small neighborhood drainage area (2.4 acres for dry weather and 15 acres for wet weather) near the intersection of Tennessee and Tubbs streets. The Tennessee Pump Station has a rated capacity of 2.16 mgd and an average dry-weather flow of 0.03 mgd. The annual flow is approximately 17 MG. Dry-weather flow enters the station from an 8-inch sewer running south along Tennessee Street. During wet weather, two storm water inlets, which are located at the south end of Tennessee Street, also feed into the station.

Influent flow entering the Tennessee Pump Station is pumped by two Pacific Pump Company 5-hp vertical bubbler level-controlled wet-pit pumps through an 8-inch forcemain to a 27-inch sewer flowing south along Tennessee Street. This station has no overflow facilities. In the event of pump failure, a portable pump is used to pump down the station sump to a manhole located in the center of the intersection of Tennessee and Tubbs streets. Station flows are calculated using readings from the pumps'

elapsed time-run meters, which are located on the station control panel.

### Twentieth Street Pump Station

The Twentieth Street Pump Station, constructed in 1993, serves a 51-acre dry-weather and a 9-acre wet-weather drainage area near the eastern end of 20th Street. Both dry- and wet-weather flows from the service area gravity sewers are pumped by the Twentieth Street Pump Station to the 21st Street gravity flow connection structure through a 10-inch-diameter forcemain. Flows from the 22nd Street Outfall are conveyed through a 54-inch line to the Twentieth Street Pump Station. Storage capacity of Twentieth Street Pump Station is equal to about one day of local dry-weather flow (approximately 48,000 gallons). If flows exceed both the pumping capacity and storage volume of the Twentieth Street Pump Station, they will overflow the outfall weir and discharge through the Twentieth Street Overflow structure to the San Francisco Bay at Pier 70. Baffle walls in the overflow structure remove floatables prior to discharge. Two submersible, fixed-speed pumps are controlled by a wet well level bubbler. Total capacity of the two pumps is 3 mgd. Stationary bar racks are installed around the pumps to protect them from large floating objects and other debris.

## Minor Wet-Weather Pump Stations

### Berry Street Pump Station

The Berry Street Pump Station is a wet-weather-only, below-grade facility that collects stormwater runoff from Third, Fourth, and Fifth streets between Townsend and Berry streets. The Berry Street Pump Station is equipped with two 4.6-mgd submersible pumps. With both pumps in operation, the total effluent flow is 9.2 mgd.

The wet well is 30-foot-by-11-foot-by-23-foot deep. The sump water level is measured by an ultrasonic level indicator. The Motor Control Center Panel, when open, allows

access to the pump controls, PG&E meter readings (kWh), elapsed time pump readouts (for pump motors), and a lead-lag alternator switch.

### Cesar Chavez [Army Street Circle] Pump Station

The Cesar Chavez Pump Station pumps groundwater accumulation and storm-water runoff from the area under the Army Street Circle (at Cesar Chavez and US 101). Three 2.3-mgd bubbler-controlled submersible pumps give the facility a total capacity of 6.9 mgd. The station pumps discharge through a 14-inch forcemain into a 24-inch sewer located approximately 150 foot east of the pumping unit. Flows are calculated by means of elapsed runtime meters located inside the pumping station on the pump control panel.

The Cesar Chavez Pump Station is divided into two separate units. The generator building houses both the emergency power generator and the station control switchboards and is located under the Potrero Street onramp to US 101 south. The pump building is located between the eastbound Cesar Chavez exit to Bayshore Boulevard and the south Potrero Street exit to Bayshore Boulevard, approximately 150 foot north of the generator building.

As this station has no overflow facilities, a continuous source of electric power is required. Emergency electricity is supplied by a Minneapolis-Moline 115 kilowatt natural gas-driven motor generator unit during periods of PG&E power failure.

### Davidson Wet-Weather Pump Station

The Davidson Wet-Weather Pump Station, constructed in 1998, is located at 1682 Davidson Avenue. This pump station is a below-ground facility consisting of one submersible wet-weather pump and a small sump pump. The wet-weather pump operates based upon level in the wet well and discharges to the Selby Street Combined Sewer Discharge structure. The purpose of the station is to protect the adjacent low-

lying businesses from localized flooding at the northwest terminus of Davidson Avenue.

### Geary Underpass Pump Station

The Geary Underpass Pump Station was built in 1960 as a wet-weather facility. In 2006 the station electrical utilities were upgraded. Two fixed-speed, 2.3-mgd magnetic probe-controlled, submersible-type pumps provide a capacity of 4.6 mgd. The discharge from these pumps flows into a 6-foot-by-4-foot elliptical sewer located at the northeast corner of the Geary Boulevard and Fillmore Street intersection. The primary purpose of this station is to minimize flooding of the Geary Boulevard underpass. Since there are no overflow points at this station, continuous electric power must be supplied.

### Harriet-Lucerne Wet-Weather Pump Station

The Harriet-Lucerne Wet-Weather Pump Station, located at the corner of Harriet and Brannan Streets, was constructed in 2005 to address flooding from the low-lying areas of Lucerne (1-99 block) and Harriet streets (400 block). The pump station is designed to operate in wet weather only.

Dry-weather flow enters the dry-weather side of the sump from a sewer that drains the parking lot on the 500 block of Townsend, the 1-99 block of Lucerne Street, the building side sewers on the southeast side of the 700 block of Brannan, and the 400 block of Harriet Street. The dry-weather flow then gravitates through a duckbill check valve to the Brannan Street sewer.

When combined sewage flow exceeds the capacity of the dry-weather system, it overflows the weir into the Harriet-Lucerne Wet-Weather Pump Station sump. The Harriet-Lucerne Wet-Weather Pump Station consists of three 14-hp Flygt submersible main pumps and one 3-hp Flygt submersible sump pump. The pump discharge for the main pumps increases from 2.3 mgd (one pump) to 5.9 mgd (two pumps) to 7.3 mgd

when all three pumps are activated. Flow is discharged through a 16-inch forcemain to the 6th Street sewer at Brannan and 6th streets.

### Merlin/Morris Pump Station

The Merlin/Morris Pump Station is a wet-weather below-grade facility that pumps combined sewage from the low points of the Merlin/Morris drainage area (Harrison Street, between Merlin and Morris streets) during wet weather to a gravity sewer in 5th Street. The Merlin/Morris Pump Station is equipped with two submersible pumps, each of which has a maximum capacity of 4.6 mgd. With both pumps in operation, the total flow is 9.2 mgd.

The station is equipped with an inline grinder and manually cleaned bar screen (2-inch bar spacing). The wet well has a capacity of 10,152 gallons and the influent water level is measured by bulb-type floats that are in a stilling well located inside the wet well. The Motor Control Center Panel, when open, allows access to the pump controls, grinder controls, PG&E meter readings (kWh), elapsed time readouts (for pump motors), and a lead-lag alternator switch.

### Rankin Wet-Weather Pump Station

The Rankin Wet-Weather Pump Station, located outside of the Bruce Flynn Pump Station on the corner of Rankin and Davidson streets, is a wet-weather pump station designed to pump combined sewage from the surrounding areas into the dry-weather compartment of the existing Rankin/Custer three-chamber sewer. As the level increases in the Rankin Wet-Weather Pump Station in response to storm-water runoff, an ultrasonic level sensor will start the two Flygt submersible pumps (1.5 mgd). The pumps will lift the flow into the dry-weather compartment of the three-chamber sewer, which then gravitates from the dry-weather compartment to the SEP. During wet weather, combined flow from the catchbasins in the area will first fill the dry-weather compartment of the three-chamber sewer. When this compartment is



full, combined sewage will flow over a weir into the wet-weather compartment. If the water level continues to rise, flow from the local catchbasins will be diverted into the effluent compartment. (Catchbasins in the area are connected to the sewer with check valves to prevent backflow. Other catchbasins are connected directly to the effluent compartment.)

The Rankin Wet-Weather Pump Station sump is approximately 13-foot-by-5-foot-by-26-foot deep and is connected to the dry-weather compartment of the Rankin/Custer three-chamber sewer, which is a 9-foot-by-8-foot T/S structure approximately 790 foot in length. The pumps are located directly below the 4-foot-by-5-foot concrete cover provided for maintenance.

#### Sea Cliff #3 Pump Station

The Sea Cliff #3 Pump Station was constructed in 2006 to supplement stormwater collection from a separately sewered section of the Eastern Subdrainage. The Sea Cliff #3 Pump Station consists of two 3-hp pumps (0.38 mgd) that discharge to a 36-inch-diameter storage sewer in Sea Cliff Avenue. Flows from the Western Subdrainage and this storage sewer enter Sea Cliff #2 Pump Station from Sea Cliff Avenue through an 8-inch line. Overflow from the Sea Cliff #3 Pump Station (when the level in the sump exceeds 70%) enters the station from the north east in an 8-inch line that transitions into a 15-inch line.

The water level in the sump is measured by a Multitrode probe. In auto mode, pumps turn on and off at preset levels. Sump levels (0 to 100% in 10% increments), pumps' on/off status, and high-alarm condition indications are displayed on a Multitrode MT2SPC unit and are transmitted to the OSP. The pumps alternate lead and lag positions for each cycle.

#### Shotwell Wet-Weather Pump Station

The Shotwell Wet-Weather Pump Station, located on the 300 block of Shotwell Street at 17th Street, was constructed in 2006 to

address flooding on the 300 block of Shotwell Street (between 17th and 18th Streets) due to both stormwater runoff from 17th and 18th Streets and the results of surcharging of the 17th Street sewer. The Shotwell Wet-Weather Pump Station controls are located across the street from the sump at the northeast corner of Shotwell and 17th Streets. The pump station is designed to operate in wet weather only.

Dry-weather flow enters the dry-weather side of the Shotwell Wet-Weather Pump Station sump from the 300 block of Shotwell Street, and flows by gravity through a duck-bill valve to the 17th Street sewer.

When combined sewage flow exceeds the capacity of the dry-weather system, it overflows the weir into the pump station sump. The Shotwell Wet-Weather Pump Station consists of three 10-hp Flygt submersible main pumps and one 2.7-hp Flygt submersible sump pump. The pump discharge for the main pumps increases from 1.8 mgd for one pump to 3.0 mgd when two pumps are in operation. The third pump is a standby pump. Flow is discharged through a 12-inch forcemain to the 17th Street sewer.

#### Zoo Wet-Weather Pump Station

The San Francisco Zoological Gardens Wet-Weather Pump Station receives both dry- and wet-weather flow from the Zoo and areas south (e.g., Harding Park, Recreation Center for the Handicapped, National Guard Armory) through a 54-inch sewer main into the sump. During dry weather, the sewage flows by gravity from the Zoo Wet-Weather Pump Station wet sump to the Westside T/S structure. During wet weather, the gravity flow from the Zoo Wet-Weather Pump Station to the Westside T/S structure is impacted by the increasing level. When the level in the Zoo Wet-Weather Pump Station wet sump starts to rise, five centrifugal pumps lift the sewage from the Zoo Wet-Weather Pump Station to the Westside T/S structure.

The Zoo Wet-Weather Pump Station is normally unmanned; the five pumps are operated automatically from the Zoo Wet-Weather Pump Station PLC based at sump level. The pumps operate only during wet weather, but levels and other pump station parameters are continuously monitored and can be controlled via the OSP Distributed Control System.