

Chapter 1

Development of the Sewer System Master Plan

This report is a summary of the results of a five-year (2005 to 2009) master planning effort for the San Francisco sewer system. The Sewer System Master Plan (SSMP) was prepared by a team consisting of the San Francisco Public Utilities Commission (SFPUC), the Wastewater Enterprise (WWE) staff, and outside consultants. Technical memoranda, background information, and a more detailed presentation of materials that support this report are presented in supplementary volumes and appendices. The implementation plans for the SSMP are described in a companion Sewer System Improvement Program (SSIP) report. The topics considered in this chapter include: the purpose of the master plan, a review of previous master plans, the consideration of environmental justice in the planning process, the participants in the current planning process, and the vision and structure of the SSMP. The information presented is intended to provide the reader with an understanding of the many complex elements that go into the preparation of a master plan.



Purpose of a Master Plan

The purpose of a master plan is to provide an assessment of the current situation and, in the light of known and assumed conditions, provide a framework for future actions. A master plan is a useful tool for evaluating complex systems such as the sewer system of a large city. Its preparation affords an opportunity for all those involved to take the long, broad view — like that from a glider at 10,000 feet above the landscape on a cloudless day. Finally, a master plan is prepared to provide guidance for future generations.

The periodic preparation of a master plan is an important activity of the SFPUC in carrying out its mission. To appreciate the guiding principles, goals, and objectives of the current SSMP and the methodology used in its development, it is useful to review the mission of the SFPUC.

The mission of the SFPUC is to provide its customers with high quality, efficient and reliable water, power and wastewater services in a manner that values environmental and community interests and sustains the resources entrusted to its care.

Previous Sewer System Master Plans

The City of San Francisco has prepared a master plan for its sewer system every 35 to 40 years. The last master plan was prepared in 1974. This current SSMP is the fourth wastewater master plan prepared by the City (Figure 1-1). The previous master plans, prepared in 1899, 1935, and 1974, were prompted by public health and regulatory requirements. The achievements of the first three master plans are presented below. The current SSMP was not carried out because of pressing specific regulatory concerns or significant public nuisances (as were the past master plans). Rather, the focus of this SSMP is with the issues related to the provision of reliable, resilient, sustainable, and environmentally acceptable operation and management of the sewer system through

addressing both critical near-term needs and long-term issues.

1899 Master Plan

The boomtown development of San Francisco, as a result of the California Gold Rush in 1848, propelled the city into a period of rapid growth that transformed it into the largest city on the West Coast at the time. To support this burgeoning population, the original collection system was designed to carry combined wastewater and stormwater flows to the shoreline and by 1899 over 300 miles of combined sewers had been completed. At this point, the City's first coordinated sewerage plan was developed (Grunsky, 1899). The main accomplishments were:

- Development of a standardized, coordinated sewer design to provide effective drainage
- Construction of four pump stations
- Consolidation to eliminate on-land discharges
- Construction of 700 miles of combined sewers

1935 Master Plan

The 1935 Master Plan led to the construction of the first treatment plants — the Richmond-Sunset Plant (1938), the North Point Water Pollution Control Plant (1951), and the Southeast Water Pollution Control Plant (1952). Operation of these primary treatment facilities combined with discharge of the treated sewage through deepwater outfalls significantly reduced nearshore water pollution. In addition, the amount of untreated combined wastewater bypassed to the bay and ocean were substantially reduced. The main accomplishments were:

- Consolidation of sewer districts
- Construction of three primary wastewater treatment plants
- Construction of offshore deepwater effluent outfalls
- Elimination of dry-weather sewage overflows

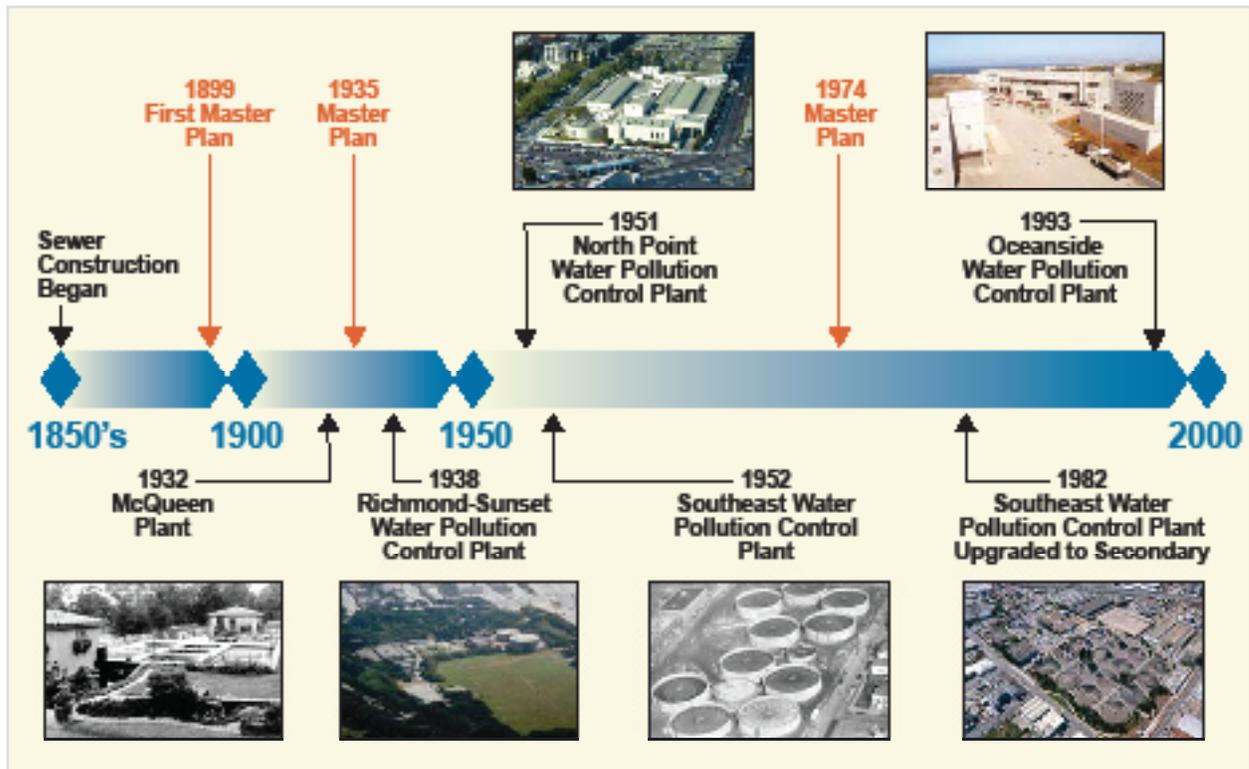


Figure 1-1. SFPUC Wastewater System Development Timeline

- Construction of additional combined sewers - 900 miles total
- Construction of 56 sewage diversion structures
- Construction of 35 miles of intercepting sewers
- Construction of additional pump stations - 22 total

1974 Master Plan

The 1974 Master Plan was developed in response to the “Clean Water Act” (Federal Water Pollution Control Amendments of 1972 (33 U.S.C. §1251)) and led to construction projects, which were implemented over an approximately 25-year period. The main accomplishments resulting from this plan were:

- Provision of secondary treatment for all dry-weather flows
- Decommissioning of the Richmond Sunset Water Pollution Control Plant and construction of the Oceanside Water Pollution Control Plant

- Upgrade and expansion of the Southeast Water Pollution Control Plant
- Construction of the Southwest Ocean Outfall
- Provision of expanded wet-weather treatment
- Construction of 17 miles of transport/storage structures and large connecting sewers to provide 197 million gallons of storage
- Reduction wet-weather overflows to an average of 4.4% of the total annual flow
- Improvement of combined wastewater discharge water quality by providing transport/storage (T/S) box flow-through treatment equivalent to wet-weather primary treatment

Environmental Justice and the Master Planning Process

The SFPUC recently adopted an environmental justice policy (San Francisco Public Utilities Commission, 2009) that affirms and

commits to the goals of environmental justice to prevent, mitigate, and lessen disproportionate environmental impacts of its activities on communities in all SFPUC service areas and to ensure that public benefits are shared across all communities. The SFPUC defines environmental justice as:

The fair treatment of people of all races, cultures, and incomes and believes that no group of people should bear a disproportionate share of negative environmental consequences resulting from the operations, programs, and/or policies of the SFPUC.

The issue of environmental justice is especially important in the development of an SSMP that is responsive to the citizens of San Francisco. For this reason, the SFPUC ensured that the public had extensive opportunities to become involved in the development of both the overall SSMP and its recommendations through the vigorous public outreach process discussed in the following section.

Participants in the Current Planning Process

The SSMP team consisted of the SFPUC, WWE staff, and the joint venture consultant team (aka BCM Joint Venture) of Brown and Caldwell, Carollo Engineers, and AECOM (Metcalf and Eddy). Throughout the SSMP process, the team sought the advice and counsel of the following:

- SFPUC Commissioners
- San Francisco Citizens
- Citizens’ Advisory Committee (CAC) to the SFPUC
- Technical Advisory Committee (TAC) to the WWE
- San Francisco Planning and Urban Research Association (SPUR)
- Sustainable Watershed Alliance (SWALe)

By conducting an open planning process involving all of these participants, the SSMP preparation process exceeded local and

State planning and meeting requirements, and was also consistent with the U.S. Environmental Protection Agency Definition of Environmental Justice (U.S. Environmental Protection Agency, 2008a). The nature of the participants’ involvement and the impacts of their goals, ideas, and suggestions on the SSMP are presented below.

SFPUC Commissioners

The five-member Commission (Table 1-1) provided policy-level direction and review throughout the SSMP development. During the course of preparing the SSMP, the SFPUC held three workshops (fall and winter, 2005 – 2006) and four progress meetings (June 2006, November 2006, November 2007, and May 2008) with the WWE. All WWE staff presentations to the SFPUC were open to the public. At the workshop sessions the WWE staff provided SSMP overview, reported the results of baseline public opinion research, and sought direction on levels of service. At the progress meetings, the WWE staff provided the Commissioners with planning alternatives under consideration and sought

Table 1-1. SFPUC Commissioners during Master Planning Process	
Commissioners	Dates of Service
Current	
F. X. Crowley (President)	2008 - present
Francesca Vietor (Vice President)	2008 - present
Ann Moller Caen	1997 - present
Anson B. Moran	2009 - present
Juliet Ellis	2008 - present
Past	
Ryan Brooks	2003 - 2008
David Hochschild	2007 - 2008
E. Dennis Normandy	1994 - 2008
Richard Sklar	2004 - 2008
Adam Werbach	2003 - 2007

advice on the structure and content of the SSMP report.

The Commissioners set out the following guiding principles for the SSMP¹:

- The SSMP should, as much as possible, minimize the discharge of effluent to the bay even if this requires some increase in the amount of effluent being discharged to the ocean.
- The SSMP should result in the least possible impact on the Bayview/ Hunters Point community.
- The SSMP should provide sufficient redundancy to function if facilities became

inoperable due to an earthquake or a breakdown.

- The SSMP should minimize the use of natural resources and maximize the output of energy.
- The SSMP should emphasize non-engineering solutions over engineering solutions.

San Francisco Citizens

Public input was solicited through focus groups, formal and informal surveys, and SFPUC-sponsored workshops and meetings throughout the development of the SSMP (Table 1-2).

1. From the minutes of the November 14, 2006 SFPUC Commission meeting

Table 1-2. Summary of Public Outreach Activities

Activity	Details
Public Participation Plan	Prepared draft plan in February 2006 and updated in 2007
Public Opinion Research	Conducted citywide focus groups in October 2006 Conducted citywide statistically designed survey in December 2006
Contact Database	Prepared database in December 2006 and updated periodically.
Public Forums	Conducted three series of public workshops: March 2006, January 2007, September 2007 Held briefings/presentations with more than 60 organizations and stakeholders Provided opportunity for public comment at monthly meetings of the CAC Wastewater Subcommittee, meetings of the Technical Advisory Committee, and workshops for the SFPUC Commission
Web site	Launched Web site February 2006 and updated regularly
Other Surveys	Mailed response cards to 350,000 households in March 2006 Posted several online surveys on Web site.
Media	Placed extensive outdoor ads and ads in newspapers to publicize launch of master plan Placed ads before each round of workshops to encourage participation Conducted tours of sewer system with media Issued event advisories to press before all workshops
Communication Materials	Mailed trilingual citywide brochure March 2006 Distributed trilingual newsletter and e-newsletter to extensive list in the summer of 2006 and fall of 2007 Placed informational kiosks at more than 70 libraries citywide and updated with new inserts Distributed video of wastewater system in the fall of 2007

Public Workshops

Three workshops were held during the development of the SSMP to inform, update, and seek input from the public. Each workshop was held at several locations throughout the city to provide comprehensive coverage of the citizens. Each workshop consisted of an open-house session, a presentation (Figure 1-2), and ample time for discussion. The public workshops also provided the opportunity for one-on-one meetings between citizens and WWE staff.

The first workshop (March 2006) dealt with sewer system issues, SSMP objectives, and SSMP schedule. The second workshop (January 2007) sought public comment on draft proposed alternatives. The third workshop (November 2007) addressed alternatives, the draft recommended alternative, costs, and the proposed capital improvement plan.

Focus Groups

Four citywide focus groups were used to help develop the questions for a random-sample survey designed to provide a statistically-reliable assessment of San Franciscans' perceptions (concerns) about the sewer system.

Survey

A random public opinion survey was conducted to assess citywide perceptions about the sewer system. An analysis of the 8,000 survey responses to the public opinion survey ranked the concerns about the sewer system as follows:

- Aging Infrastructure - 54%
- Overflows - 25%
- Flooding - 15%
- Biosolids Disposal - 11%
- Odors - 9%

Citizens' Advisory Committee

The CAC was formed (City Ordinance No. 58-04) to provide recommendations to the SFPUC General Manager, the SFPUC, and the Board of Supervisors on the SFPUC long-term strategic, financial, and capital



Figure 1-2. Public Stakeholder Meeting

improvement plans. The 17-member CAC has three subcommittees: water, wastewater, and power. The wastewater subcommittee met monthly to review and comment on the SSMP development process, as well as to review and comment on wastewater collection and treatment activities and operations (standing agenda item). The CAC wastewater subcommittee members are listed in Table 1-3.

Technical Advisory Committee

To provide an independent technical perspective, the WWE established a Technical Advisory Committee. The TAC members were selected to represent a broad range of experience in the planning and design of wastewater management facilities and associated technologies.

Evolution of the TAC

Originally named the Technical Review Committee (TRC), the TRC was formed in 1995 and provided technical review and advice for San Francisco wastewater projects over the past 15 years. The original TRC comprised six members. Following concurrence of the SFPUC staff, TRC members, and public stakeholders, the TAC was renamed and expanded in 2005 to eight members to include experts on biosolids, odors, and collection system alternatives (Table 1-4).

Table 1-3. Citizens' Advisory Committee Wastewater Subcommittee Members

Member	Affiliation
Robin Chiang	Friends of Islais Creek
Jennifer Clary ¹	Clean Water Action, Alliance for a Clean Waterfront, San Francisco Sustainable Watershed Alliance
Richard Hansen	Richmond District Democratic Club
Alex Lantsberg ¹	Alliance for a Clean Waterfront, San Francisco Sustainable Watershed Alliance
Jack Lendvay ¹	Professor at University of San Francisco Department of Environmental Science
David Pilpel ¹	Sierra Club, Sunshine Task Force
Judy West ¹	The Madrina Group
Laurie Schoeman ¹	Literacy for Environmental Justice
Laura Tam ¹	San Francisco Planning and Urban Research Association

Note: 1. Current members

TAC Workshops

Six TAC workshops were held to familiarize the TAC with the sewer system, to review planning and technical issues and constraints, and to receive input on the SSMP. Reports of the TAC meetings are on file and are presented in full in the supporting volumes to this report.

TAC Consensus Statements

During the conduct of the SSMP, the TAC was asked to develop consensus statements for a series of technical questions posed by the SSMP planning team. The answers to the questions posed by the team were useful in the development of specific elements of the SSMP. The full text of the questions posed and the corresponding TAC consensus statements can be found in the appendices to the supporting volumes. Briefly, the TAC concluded that:

- The SSMP should not consider full separation of the existing collection system; rather criteria for sewer separation should be formulated for redevelopment areas.
- Treated effluent discharges are less likely to impact the environment negatively if discharged to the ocean rather than the bay. It was also noted that future discharge regulations to the bay would likely be more stringent than those for ocean discharge.

- The 5-year design storm and 5-year storm period should continue to be used for hydraulic modeling of the collection system and treatment plants. The long-term effects of climate change on these design parameters should continue to be evaluated.
- A wide range of sustainable technologies and programmatic options suitable for San Francisco have been reviewed and evaluated by the SSMP team. It is recommended that the WWE continue with its research and development program to investigate new and innovative technologies that may enhance the sustainability of the wastewater collection and treatment systems.
- Application of the Integrated Urban Watershed Planning in the development of the SSMP will allow the SFPUC to achieve a more sustainable sewer system.

San Francisco Planning and Urban Research Association (SPUR)

Through research, education, and advocacy, SPUR promotes good planning and good government in the San Francisco Bay Area. SPUR's history dates back to 1910, when a group of young City leaders came together to improve the quality of housing after the 1906 earthquake and fire. Since then, SPUR has been involved with most major city planning decisions.

Table 1-4. Technical Advisory Committee Members and Their Expertise

Member	Expertise
George Tchobanoglous, Ph.D. (Chair) University of California, Davis ¹	Small, decentralized wastewater treatment systems
David Jenkins, Ph.D. (Vice-Chair) University of California, Berkeley ¹	Centralized activated sludge and biological wastewater treatment systems
Robert Gearheart, Ph.D. Humboldt State University ¹	Large-scale wastewater wetlands
Darla Inglis, Ph.D. ² Director Central Coast Low Impact Development Center (formerly of Seattle Public Utilities)	Implementation of natural stormwater drainage and collection systems in urban environments
Michael Josselyn, Ph.D. San Francisco State University ¹ Wetland Research Associates	Stormwater and urban wetlands
Larry Kolb, Ph.D. ³ California Regional Water Quality Control Board	Regulatory requirements on CSOs, impacts of CSOs on bay water quality
Cecil Lue-Hing, Ph.D. ² Director of Research and Development for Metropolitan Water Reclamation District of Greater Chicago ¹	Wastewater biosolids and odor control
Joe Middlebrooks, Ph.D. University of Nevada, Reno ¹	Alternative wastewater treatment technologies

Notes:

1. Retired/Emeritus

2. Added in 2005

3. Original TRC member from the Regional Water Quality Control Board was Blair Allen; changed to Larry Kolb in 2004.

SPUR provided guidelines for their members’ use in evaluating how the SSMP objectives would meet the group’s goals for the sewer system (Tam, 2008). Their goals are:

- Minimize sewer overflows and flooding
- Maximize low-impact tools to retain and reuse stormwater and to benefit environmental restoration
- Establish seismic reliability
- Maximize the beneficial reuse of resources extracted from wastewater, including biofuels, biosolids, and reclaimed water
- Design the system to respond to a range of climate change scenarios
- Adopt a rate structure that reflects the contribution of stormwater to the system
- Collaborate with other City departments to achieve multiple benefits from investments

- Set ambitious quantifiable performance measures

Sustainable Watershed Alliance (SWALe)

SWALe, the “environmental watchdog for a wise wastewater plan,” is a loose association of 18 environmental advocacy groups (Arc Ecology, Bayview Office of Community Planning, Clean Water Action, Farallones Marine Sanctuary Association, Friends of the Urban Forest, India Basin Neighborhood Association, Literacy for Environmental Justice, Madrina Group, Mission Creek Conservancy, Neighborhood Parks Council, Plant*SF, San Francisco Baykeeper, San Francisco Bicycle Coalition, San Francisco Tomorrow, Sierra Club, San Francisco Chapter, Transportation for a Livable City, Treasure Island Wetlands

Project, Visitation Valley Planning Alliance). SWALe's overarching principle is that all water is a resource. SWALe stated that this principle must form the basis of the SSMP. SWALe developed seven policy goals and associated metrics that could be used to determine whether their overarching principle was being met. These goals are summarized below:

- Redress environmental injustices
- Reduce pollutant loading to the bay and ocean
- Minimize volume of water entering the system
- Build in sewer system reliability and flexibility
- Provide environmental benefits
- Address climate change
- Achieve economic and environmental sustainability

Structure and Vision of the SSMP

All of the participants involved in the SSMP planning process were unified in their desire to develop a sustainable, flexible sewer system that will allow the City to respond to regulatory changes, climatic conditions, emergencies, and innovative technology. Thus, the overarching themes of the SSMP are *sustainability* and *integrated urban watershed management*. Application of the principles of sustainability and integrated urban watershed management to the SSMP is considered in this section.

Sustainability

Sustainability² in the SSMP will be achieved by applying the Sustainability Criteria in which environmental, social, and economic factors are balanced with engineering design to develop feasible solutions to problems.

² Sustainable development has been defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

Integrated Urban Watershed Management

To achieve sustainable sewer system management the entire watershed and "sewershed," must be considered all the way from the most upstream locations through the collection system to the treatment facilities and the disposal or reuse of the treated effluent and biosolids." Integrated Urban Watershed Management is considered in greater detail in Chapter 5.

Guiding Principles

The guiding principles reflect the core values, aspirations, and the vision of the public and the SFPUC for the wastewater collection, treatment, and discharge facilities. These principles helped focus the SSMP goals and objectives, guided planning decisions, and sustainability improvements. The development of the SSMP guiding principles and goals and objectives received considerable input and review from the SSMP Project Team, SFPUC Commissioners, the TAC, the CAC, and members of the public.

The guiding principles for the SSMP are to:

- Protect public health and safety, and the environment
- Ensure the long-term sustainability of the sewer system
- Strive to ensure that all sectors of the community are protected from nuisances associated with the sewer system and that no community bears a disproportionate share of the negative environmental consequences resulting from system operations
- Promote environmental stewardship that includes the sustainable use of natural resources

Living Document

The SSMP will be updated in response to changing system needs, technological advancements, and regulatory requirements. This ensures that the SSMP can be maintained as a living document.

Goals and Objectives

The overall goal of the SSMP is to provide the basis for the near- and far-term development of a reliable, efficient, and sustainable system for sewage and stormwater collection, treatment, and discharge. In keeping with the guiding principles, the SSMP recommendations will ensure that the WWE will continue to meet the following specific objectives.

Protect Public Health and the Environment

The implementation of the SSMP recommendations must:

- Maintain compliance with all current local, State, and Federal regulations applicable to the building and operation of wastewater collection, treatment, and disposal systems
- Design new system components that will accommodate foreseeable future wastewater collection, treatment, and disposal regulations

Protect Worker Health and Safety

The WWE will design and operate the collection system and treatment facilities that will:

- Improve indoor air quality of system buildings for workers
- Increase the safety and ease of maintenance of key equipment

Minimize Impacts to Ratepayers

Implementation of SSMP recommendations will produce a well-run system for the lowest cost possible by:

- Considering both capital and life-cycle costs, in keeping with asset management principles, when prioritizing renewal and replacement and capital projects for implementation
- Designing projects to meet multiple objectives to maximize benefits to the residents of the city
- Increasing operational efficiency
- Minimizing energy costs and maximizing the use of renewable power

- Accelerating implementation of capital intensive projects to minimize the impact of escalating costs on the overall cost of the capital improvement plan

Improve Seismic Reliability

Seismic design and operation standards have evolved considerably since the wastewater system was first constructed. Seismic reliability will be achieved by:

- Retrofitting critical collection and treatment structures
- Designing new system components to meet current seismic standards and code requirements
- Identifying and upgrading critical facilities to reduce damage during a seismic event
- Providing redundant conveyance and treatment facilities to improve service following a major seismic event or other emergency

Improve System Reliability and Flexibility

To achieve reliability and flexibility, the implementation of the SSMP recommendations will:

- Promote policies that improve sewer performance and require individual dischargers to reduce sewer impacts
- Prioritize sewer renewal and replacement based on risk and consequences of failure
- Improve frequency of routine cleaning and inspection of the collection system to reduce blockages and sewer failures
- Provide comprehensive source control to address pollutants of concern that impact the collection system and/or treatability of wastewater
- Protect collection system assets from the impact of rising seawater level
- Design new system components to accommodate foreseeable future regulatory, technological, and demand changes
- Design equipment and treatment processes to allow efficient operation and maintenance

- Identify and rehabilitate critical facilities whose structural integrity threatens the ability to meet regulatory requirements
- Provide redundancy and automation to increase sustainability of operations

Reduce Community Impacts

Implementation of the SSMP recommendations will reduce the negative community impacts while providing safe and reliable wastewater collection and treatment by:

- Constructing improvements that reduce odors from the collection system, the wastewater treatment facilities, and the biosolids reuse sites
- Improving customer service response to flooding and odor complaints
- Designing stormwater management projects that provide community amenities
- Employing stormwater controls that reduce the potential of neighborhood flooding

Promote Environmental Stewardship

To promote environmental stewardship, WWE will:

- Increase the use of Low Impact Development and green infrastructure where feasible to reduce, reuse, and/or delay stormwater flows
- Reduce the creation, use, and release of toxic compounds into the air and receiving waters
- Select processes and equipment that minimize energy use

Enhance Sustainable Use of Natural Resources

In order to maximize the use of renewable resources, the WWE will:

- Incorporate improvements in water conservation and demand management
- Increase stormwater harvesting/reuse and wastewater reuse
- Employ biosolids reuse methods
- Design new facilities and systems to promote resource reuse and conservation

- Increase/enhance pollution prevention
- Use Leadership in Energy and Environmental Design (i.e., LEED) guidelines in the design and rehabilitation of all new system buildings

Sewer System Improvement Program

Implementation of the SSMP

Through implementation of the SSIP, major capital projects will be planned, designed, and constructed to address the challenges presented in the SSMP. As such, the goals for this program, developed from the broad goals and objectives summarized above, have been further refined and are presented briefly below. The goals and accompanying levels of service are developed further and are presented in detail in the companion SSIP Report that has been prepared for SFPUC Commission endorsement.

SSIP Guiding Principles and Goals

Reduce pollutant loading to the bay and Guiding principles developed for the SSIP continue and refine the guiding principles of the SSMP. These principles focus development of SSIP goals and objectives, levels of service, implementation strategies, and capital improvement projects and include:

- protect public health, safety, and the environment;
- ensure the long-term sustainability and reliability of the sewer system;
- minimize sewer system burdens on all sectors of the community and ensure that no sector of the community bears a disproportionate share of the burdens of system operations;
- promote environmental stewardship, including the sustainable use of natural resources;
- address the effects of climate change on the wastewater collection and treatment facilities;

- where technically and economically feasible, develop and implement new technologies to treat wastewater and biosolids in an efficient, sustainable, and environmentally benign fashion; and
- maximize employment and educational opportunities.
- ensure the long-term sustainability and r

SSIP goals consistent with the guiding principles were developed to address the deficiencies in the current sewer system, the foreseeable future challenges, and to ensure that the SFPUC continues to meet its core mission. The goals are to:

- provide a reliable and flexible system that can respond to catastrophic events;
- minimize flooding;
- provide benefits to impacted communities;
- modify the system to adapt to climate change; and
- achieve economic and environmental sustainability.

From these refined SSIP goals, the SFPUC commissioners will endorse levels of service that will shape the final capital project selection, implementation strategy, and design criteria.