FINAL

Sanitary Sewer Master Plan Update

Prepared for
City of Los Altos
Los Altos, California
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List of Abbreviations

ASCE	American Society of Civil Engineers
BC	Brown and Caldwell
BSF	Base Sanitary Flow
CAR	Condition Assessment Rating
CC	circumferential cracks
CCTV	Closed Circuit Television
CIP	Capital Improvement Program
CIPP	Cured in Place Pipe
City	City of Los Altos
CL	longitudinal crack
CMMS	Computerized Maintenance Management System
CMOM	Capacity, Management, Operations and Maintenance
CPI	Consumer Price Index
CWS	California Water Services
du	dwelling unit
DWF	Dry Weather Flow
E2	E2 Consulting Engineers
EPA	Environmental Protection Agency
FL	longitudinal fractures
FOG	Fats, Oils and Grease
fps	feet per second
FTEs	full time equivalents
FY	Fiscal Year
GASB 34	Governmental Accounting Standards Board Statement 34
GIS	Geographic Information System
gpd	gallons per day
gpd/du	gallons per day/dweling unit
GWI	Groundwater Infiltration
HDPE	High Density Polyethylene
HSV	hole with soil visible
I/I	infiltration and inflow
JSS	Joint Sewer System
lf	lineal feet
LUE	Land Use Element
MACP	Manhole Assessment and Certification Program
Master Plan Update	Sanitary Sewer Master Plan Update
mg	million gallons
mgd	million gallons per day
Mountain View	City of Mountain View
NASSCO	National Association of Sewer Service Companies
O&M	Operations and Maintenance
OPR	O&M Pipe Ratings
PACP	Pipeline Assessment and Certification Program
Palo Alto	City of Palo Alto
PCR	Pipe Condition Rating
PVC	Poly-vinyl chloride
PWWF	Peak Wet Weather Flow
RAWS	Remote automated weather station
RCP	Reinforced Concrete Pipe
RDI/I	Rainfall Dependent Infiltration and Inflow
Regional Board	San Francisco Bay Regional Water Quality Control Board
Regional Plant	Palo Alto Regional Water Quality Control Plant
SPR	Structural Pipe Ratings
SSMP	Sewer System Management Plan
SSO	Sanitary Sewer Overflow
SWRCB	State Water Resources Control Board
TC	thoroughfare commercial
Town	Town of Los Altos Hills
U.S.	United States
USA	Underground Service Alert
USEPA	United States Environmental Protection Agency
UV	Ultra-Violet
V&A	Villalobos and Associates
WDR	Waste Discharge Requirements

WERF	Water Environment Research Foundation
WRCC	Western Regional Climate Center

Executive Summary

This Executive Summary summarizes the findings and recommendations of the Sanitary Sewer Master Plan Update (Master Plan Update) prepared for the City of Los Altos (City). The Master Plan Update is based on assessments of the hydraulics, physical condition and maintenance of the collection system, and recommends improvements to provide adequate hydraulic capacity and to improve the reliability of the collection system. The financial impacts of the recommendations are also evaluated. The recommended improvement projects will be implemented over the next 15 years.

The City last prepared sewer master plans in 1959 and 2005. The City retained Brown and Caldwell (BC) to prepare this update to the 2005 Sanitary Sewer Master Plan. Much of the information in the 2005 Master Plan has not changed or it was determined that it was not necessary to update. At the beginning of each section of this Master Plan Update there is an indication which parts of the section in the 2005 Master Plan has been changed in this 2012 Master Plan Update. The remaining portions of the section have been copied from the 2005 Master Plan for this update.

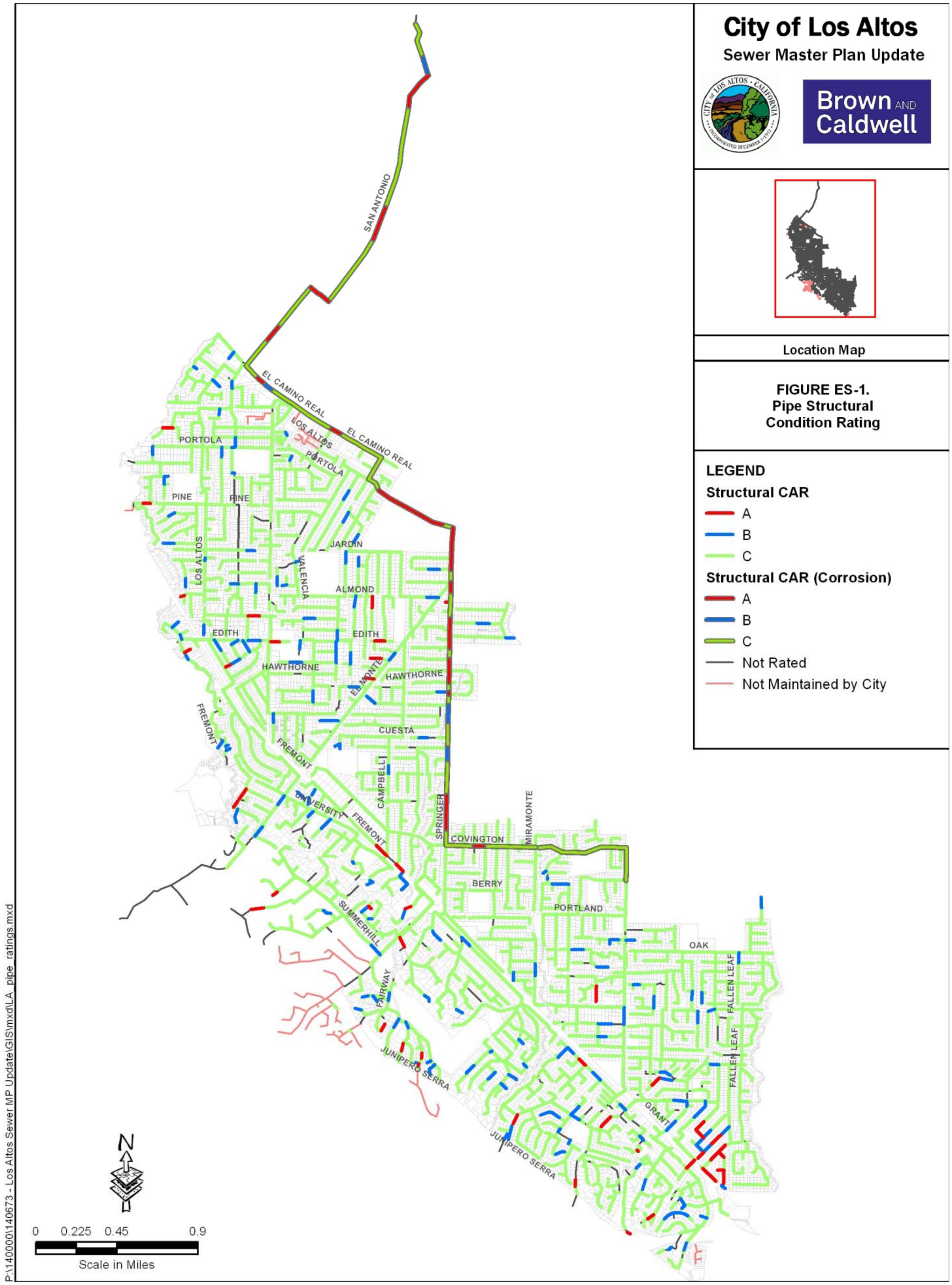
Background

The City provides sanitary sewer services to most residents and businesses within the City. The City also provides sewer services to the unincorporated area within the City's sphere of influence, a portion of the Town of Los Altos Hills (Town), and a small portion of the City of Mountain View (Mountain View). Wastewater is conveyed to the Palo Alto Regional Water Pollution Control Plant (Regional Plant) for treatment and disposal. The City has rights to discharge up to 3.6 million gallons per day (mgd) average annual dry weather flow to the Regional Plant. This does not include the metered flow that Mountain View adds to the City's system. It does include insignificant amounts of flow from Mountain View at two other locations that are not metered.

The City owns and maintains the collection system within the City and its sphere of influence including a limited number of pipes within the Town and the trunk sewer that connects the City to the master metering station for the Regional Plant. The City's collection system includes approximately 140 miles of sewer of which most is 6-inch and 8-inch vitrified clay pipe.

Condition Assessment

The condition assessment of the collection system was based on closed circuit television (CCTV) inspection data collected by the City since 2005. Since 2005, approximately 93 percent (121 miles) of the City's collection system (excluding the outfall trunk) was CCTV inspected. The results, shown on Figure ES-1, indicated that less than 5 percent of the inspected pipes were in poor condition (Structural Pipe Rating (SPR) Category A). These pipes are included as Priority 1 capital projects. Also, the trunk sewer outfall, last inspected in 2002 (pipe) and 2009 (manholes), shows signs of moderate to severe corrosion in 36 reaches. The City has rehabilitated several reaches since the last master plan; however, additional rehabilitation is recommended. These pipes are included as Priority 1, 2, and 3 capital projects, depending on the degree of corrosion. Each of the City's pump stations have been rehabilitated or replaced since 2005 and are in good condition.


City of Los Altos
Sewer Master Plan Update
Brown AND Caldwell
Location Map
FIGURE ES-1.
Pipe Structural
Condition Rating
LEGEND
Structural CAR
A
B
C
Structural CAR (Corrosion)
A
B
C
Not Rated
Not Maintained by City
SAN ANTONIO
EL CAMINO REAL
LOS ALTOS
PORTOLA
PINE
JARDIN
VALENCIA
ALMOND
EDITH
HAWTHORNE
EL MONTE
CUESTA
FREMONT
UNIVERSITY
CAMPBELL
SPRINGER
COVINGTON
MIRAMONTE
BERRY
PORTLAND
SUMMERHILL
FAIRWAY
JUNIPERO SERRA
OAK
FALLEN LEAF
GRANT
N
0 0.225 0.45 0.9
Scale in Miles
P:\140000\140673 - Los Altos Sewer MP Update\GIS\mxd\LA_pipe_ratings.mxd

Operation and Maintenance Assessment

The City has a staff of 6.25 full time equivalents (FTEs) to perform maintenance in the City's collection system. Maintenance activities include complaint response, sewer cleaning, manhole inspections, and operating and maintaining three pump stations. In order to evaluate the effectiveness of the City's maintenance programs, performance of the collection system was evaluated using seven parameters. This evaluation concluded that the collection system performance was average to good compared to State and National averages. Modifications made to the City's Operations and Maintenance (O&M) program since 2005 (adjusted cleaning frequencies, sewer inspection and repair, and the root foaming program) have resulted in significant improvement to O&M performance parameters, particularly dry weather stoppages and Sanitary Sewer Overflows (SSO).

Hydraulic Assessment

The hydraulic assessment was based on hydraulic modeling of the City's collection system under current and future design conditions. Flow projections were based on flow monitoring data, the Town's 2004 Sewer Master Plan, and the City's General Plan 2002 to 2020. Flows were updated with changes to the City's 2009 General Plan Housing Element. The City and Mountain View are largely built out and only minor increases in flow are anticipated. The Town has many under-developed parcels and parcels that are currently on septic tanks. Ultimately, these parcels are expected to connect to the collection system which will cause an increase in flow. Current and future base average daily flows are summarized in Table ES-1. Peak wet weather flows were projected to be five times greater than average daily flows.

Table ES-1. Average Daily Flow Projections[1]

Agency	Current Flow, mgd	Build Out Flow, mgd
City	2.64	2.73
Town of Los Altos Hills	0.24	0.56
Subtotal	**2.88**	**3.29**
Mountain View[2]	0.94[2]	1.19[3]
Total	**3.83**	**4.48**

1Average daily flow is base sanitary flow plus groundwater infiltration (GWI). The Town of Los Altos Hills is the only area that appeared to have GWI.

2Alma meter readings August 2010 to February 2011.

3.Estimated.

The hydraulic assessment was developed as part of the 2005 Master Plan and was reviewed as part of this Master Plan Update. No changes to the hydraulic model were determined to be needed for the 2012 Update. Pipes and pump stations identified in 2005 with hydraulic deficiencies have been corrected, are currently in design, or the project is no longer needed due to flow re-routing.

Capital Improvement Program

The Capital Improvement Program (CIP) was developed to mitigate structural deficiencies. Improvement projects to mitigate hydraulic deficiencies have been completed since 2005. Capital projects were prioritized into four categories. Annual projects have been included as their own category. Each category is considered critical towards the implementation of the overall plan. Annual projects, Priority 1 and Priority 2 projects should be completed first because they include projects that, if not completed, put the City at risk of an SSO.

- **Annual Projects.** Chemical root treatment program, FOG program and GIS updates.
- **Priority 1.** Structural Reach Replacement for Category A deficiencies, 30-day Maintenance Problem Areas and Complete South Sewer Replacement.
- **Priority 2.** Corrosion Rehabilitation for the trunk sewer outfall.
- **Priority 3.** Structural Reach Replacement for Category B deficiencies, 60 to 90-day Maintenance Problem Areas and Corrosion Rehabilitation for moderate corrosion in the trunk sewer outfall.
- **Priority 4.** Future pipe inspection programs, Master Plan and SSMP updates.

The CIP projects are listed in Table ES-2 and shown on Figure ES-2. Capital costs for annual and other reoccurring projects such as Sewer Root Foaming and the Fats, Oils and Grease (FOG) program are based on the number of times they are planned to occur during the 15 year CIP duration.

Table ES-2. Capital Improvement Program[1]					
Priority	Project Designation	Project Name	Construction Cost/ Recurring Cost	Contingency/ No. of Years	Capital Cost
Annual	GIS	Annual GIS Updates	$50,000	x15	$750,000
Annual	CRT	Annual Chemical Root Treatment	$200,000	x15	$3,000,000
Annual	FOG	Annual FOG Program	$50,000	x15	$750,000
		Subtotal Annual	$300,000	-	$4,500,000
1	H1-2011	South Sewer Replacement, Ph. 2	$404,400	$121,300	$525,700
1	S1-2011	CAR A Sewer Replacement, Ph. 1	$2,038,800	$611,600	$2,650,400
1	M1-2011	30-Day Maintenance Problem Areas	$1,694,700	$508,400	$2,203,100
		Subtotal Priority 1	$4,137,900	$1,241,300	$5,379,200
2	C2-2011[2]	CAR A Corrosion Rehabilitation, Ph. 1	$402,100	$120,600	$522,700
2	C3-2011[2]	CAR A Corrosion Rehabilitation, Ph. 2	$2,715,700	$814,700	$3,530,400
		Subtotal Priority 2	$3,117,800	$935,300	$4,053,100
3	S2-2011	CAR A Sewer Replacement, Ph. 2	$5,302,400	$1,590,700	$6,893,100
3	C4-2011	CAR B Corrosion Rehabilitation	$556,400	$166,900	$723,300
3	M2-2011	60-Day Maintenance Problem Areas	$1,435,300	$430,600	$1,865,900
3	M3-2011	90-Day Maintenance Problem Areas	$2,468,600	$740,600	$3,209,200
		Subtotal Priority 3	$9,762,700	$2,928,800	$12,691,500
4	Master Plan	Master Plan Update	$300,000	-	$300,000
4	SSMP[3]	Bi-Annual SSMP Update	$20,000	x7	$140,000
4	CCTV[4]	Future Sewer Main Video	$240,000	x5	$1,200,000
4	CADB[4]	Condition Assessment/Database Updates	$90,000	x5	$450,000
		Subtotal Priority 4	$650,000	-	$2,090,000
		TOTAL			$28,713,800

[1]*Proposed year of project implementation used for financial analysis shown in Appendix K, Table 2.*

[2]*Approximately $1,311,000 was encumbered by the City in FY11/12 for work included in these projects.*

[3]*Bi-annual expense starting in FY14/15.*

[4]*Annual expense starting in FY17/18.*

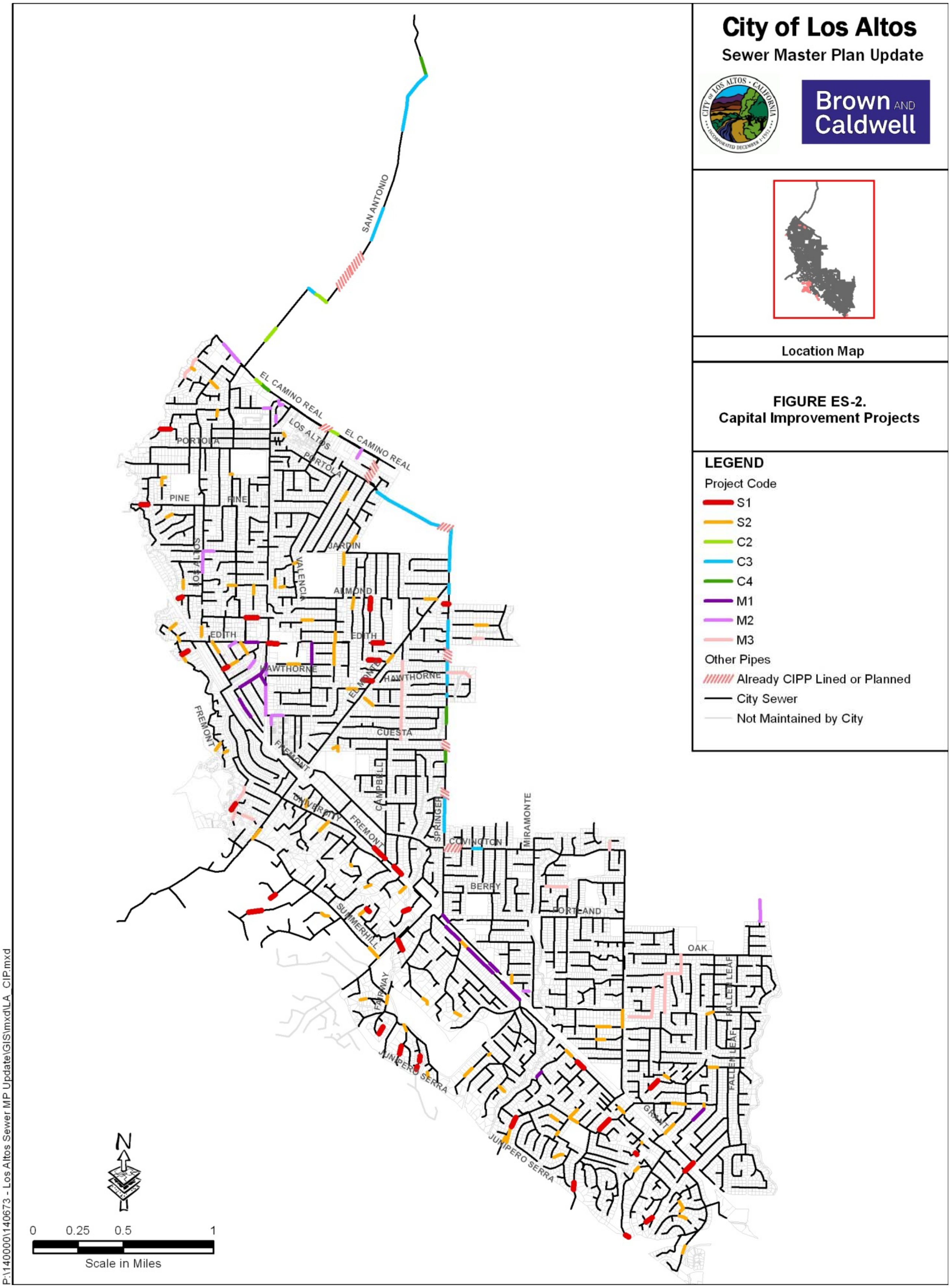


FIGURE ES-2.
Capital Improvement Projects

P:\140000\140673 - Los Altos Sewer MP Update\GIS\mxd\LA_CIP.mxd

Other Recommendations

Several other recommendations were developed as part of the Master Plan Update. These recommendations are listed below.

- The City should continue their current preventive maintenance program for the collection system as it has been effective at reducing SSOs and stoppages. Cleaning frequencies can be modified as Maintenance Problem area projects are implemented and the FOG program is expanded.
- The City should continue its current chemical root treatment program at one-third of the system per year.
- The City should re-start its CCTV inspection program again prior to the next Sewer Master Plan Update in ten years.
- The City's FOG control program should be expanded. The City anticipates that this effort would be performed by a consultant.
- New or replacement equipment is needed for sewer maintenance.
- The City's geographic information system (GIS) should be updated annually with new data, map changes, or inspection results uploaded to MapGuide.
- Maintenance staff should be increased by filling the Maintenance Leadworker position that was previously eliminated with the creation of the Sewer Supervisor position.
- At the end of this CIP cycle in approximately 15 years, the City should consider implementing a cyclic replacement program to replace substandard 6-inch sewer pipe with 8-inch sewer pipe.

Financial Assessment

A financial assessment of the impacts of the complete CIP and other recommendations was made. The CIP was projected to be implemented over 15 years due to the risk of identified projects. The assessment considered the impacts to the City and Town, and incorporated the flow projections developed for this Master Plan Update.

Sewer service charge rates recommended in this Master Plan Update are projected to increase by approximately 6 percent per year. Adoption of this increase will require a vote. The increased charges will result in increased sewer bills for most customers as the projected rate of reduction in sewer flow is expected to decrease and finally stop. Sewer system rates and charges for the City developed in this report are not intended to be adopted for implementation without a formal rate study. According to the City, the future rate study may also include an evaluation of the current rate methodology.

Single Family Monthly Bills based on adopted charges and charges recommended in the 2005 Master Plan and 2012 Master Plan Update for Fiscal Year (FY)4–FY22 are shown on Figure ES-3.

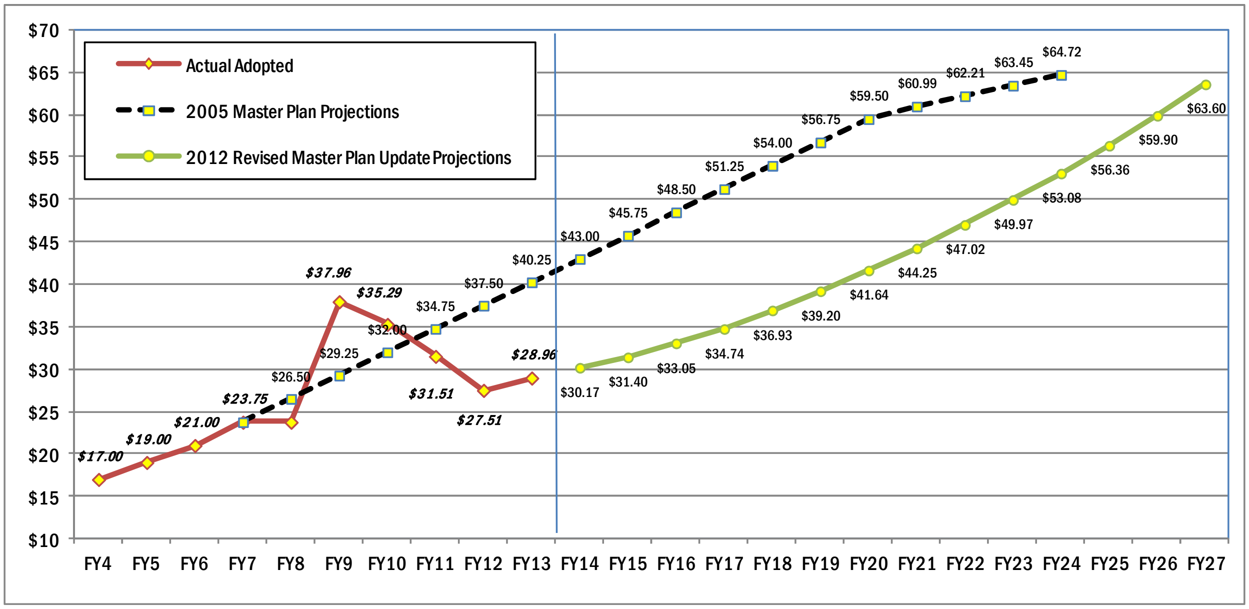


Figure ES-3. Single-Family Monthly Bills Based on Adopted Charges and Charges Recommended in the 2005 Master Plan and 2012 Master Plan Update, FY4–FY22

Section 1

Introduction

The City of Los Altos (City) owns and maintains a wastewater collection system in the City and the unincorporated area located within the City's sphere of influence. The collection system conveys wastewater from the City, the unincorporated area south of the City, the Town of Los Altos Hills (Town), and a portion of the wastewater flow from the City of Mountain View (Mountain View) to the Palo Alto Regional Water Pollution Control Plant (Regional Plant).

The City last prepared sewer master plans in 1959 and 2005. The City retained Brown and Caldwell (BC) to prepare this update to the 2005 the Sanitary Sewer Master Plan. Much of the information in the 2005 Master Plan has not changed or it was determined that it was not necessary to update. At the beginning of each section of this Master Plan Update there is an indication which parts of the section in the 2005 Master Plan has been changed in this 2012 Master Plan Update. The remaining portions of the section have been copied from the 2005 Master Plan for this update.

This Master Plan Update is structured to provide a long-range comprehensive plan to guide the upgrade, expansion and rehabilitation of the system owned by the City. Evaluation of the City's system also includes pockets of unincorporated area. The study considers hydraulics, operation and maintenance practices, and structural conditions of the system.

The 2012 updates to the 2005 Introduction include:

- 2012 Scope of Work.
- Collection system map.
- Summary of Addendum No. 7 to the Joint Sewer System Agreement.
- Summary of 2007 Agreement between City and Town.
- State Waste Discharge Requirements and Sewer System Management Plan requirements.

1.1 Scope of Work

The Scope of Work of the Master Plan Update includes the tasks that are outlined below. Completed work tasks were originally documented in several technical memoranda and submitted to the City for review. These technical memoranda are incorporated into sections of this report and have been updated to reflect changes to the City's system since the 2005 Master Plan.

Data Reconnaissance. Reviewed existing reports, studies, and other background information and data pertinent to the Master Plan Update. Identified information and data required for the study.

Review of Legal and Regulatory Issues. Reviewed the legal and regulatory requirements with which the City must comply in providing wastewater collection and transportation to the Plant. Provided an assessment of interagency agreements affecting the City.

Capacity, Management, Operations and Maintenance/Sewer System Management Plan (CMOM/SSMP) Audit. Evaluated current policies, practices and programs of the City against CMOM/SSMP regulations, and identify potential gaps.

Hydraulic Assessment. Evaluated and identified hydraulic capacity deficiencies in the wastewater collection system under current and future conditions.

Structural Assessment. Developed and applied a systematic structural assessment program to evaluate a portion of the sewers using field inspection information.

O&M Assessment and City's Current Standards and Specification Assessment. Reviewed and evaluated equipment and tools used by the City's maintenance staff to perform maintenance on the collection system. Recommended modifications to the equipment, tools and staffing for improving sewer system operations and performance for reducing long-term life-cycle costs for system maintenance and rehabilitation.

Capital Projects. Developed and prioritized capital projects to improve hydraulic capacity and address structural problems.

Financial Analysis. Assessed the financial and economic implications of the Master Plan Update and recommended sewer rate structures to the City's service area.

Final Report. Prepared the Master Plan Update report that summarizes the findings and recommendations.

1.2 Study Area

The study area of the Master Plan Update is called the Los Altos Basin which includes the following areas:

- The area within the City's sphere of influence that does not discharge to Mountain View or Cupertino, the unincorporated area within the City's sphere of influence, and the trunk sewer to the Regional Plant. This area is referred as the "City" in this Master Plan Update.
- The portion of the Town that discharges to the City's collection system. This area is referred to as the "Town" in this Master Plan Update.
- The areas within Mountain View that discharge to the City's collection system. One area is bounded by Alma Street and El Camino Real, from approximately Rengstorff Avenue to Mountain View's northerly limit. Another area is located north of US101.

This Master Plan Update evaluated the hydraulic and structural conditions of the collection systems in the City only. For the other areas, the hydraulic and structural conditions of the sewers were not evaluated; however, the total projected flows from each area were included in the hydraulic evaluation to determine the impact of these flows on the City's collection systems.

1.3 Wastewater Treatment

The Regional Plant is located at the foot of Embarcadero Road in the City of Palo Alto (Palo Alto) by the San Francisco Bay. In 1968, Mountain View and the City joined Palo Alto to construct the regional treatment facilities. Since 1972, the Regional Plant has provided secondary wastewater treatment and it added tertiary treatment facilities in 1978. It provides wastewater treatment to Palo Alto, the City, Mountain View, the Town, East Palo Alto Sanitary District and Stanford University. The Regional Plant's average day dry weather flow capacity is 38 million gallons per day (mgd) and the City's share is 3.6 mgd.

1.4 Existing Collection System

The City owns the wastewater collection system within its jurisdiction and sphere of influence, including a limited number of pipes within the Town. The collection system owned and maintained by the City includes three pump stations and approximately 140 miles of sewers, ranging in size from 6 inches to 42 inches in diameter. The three pump stations are Pine Lane, Van Buren, and Blue Oak Lane, all owned by the City. The flows from the study area are conveyed to the Regional Plant through a 42-inch diameter gravity sewer. Figure 1-1 depicts the collection system and pumping stations in the study area and the connections from the Town and Mountain View to the City, and from the City to Mountain View and Cupertino.

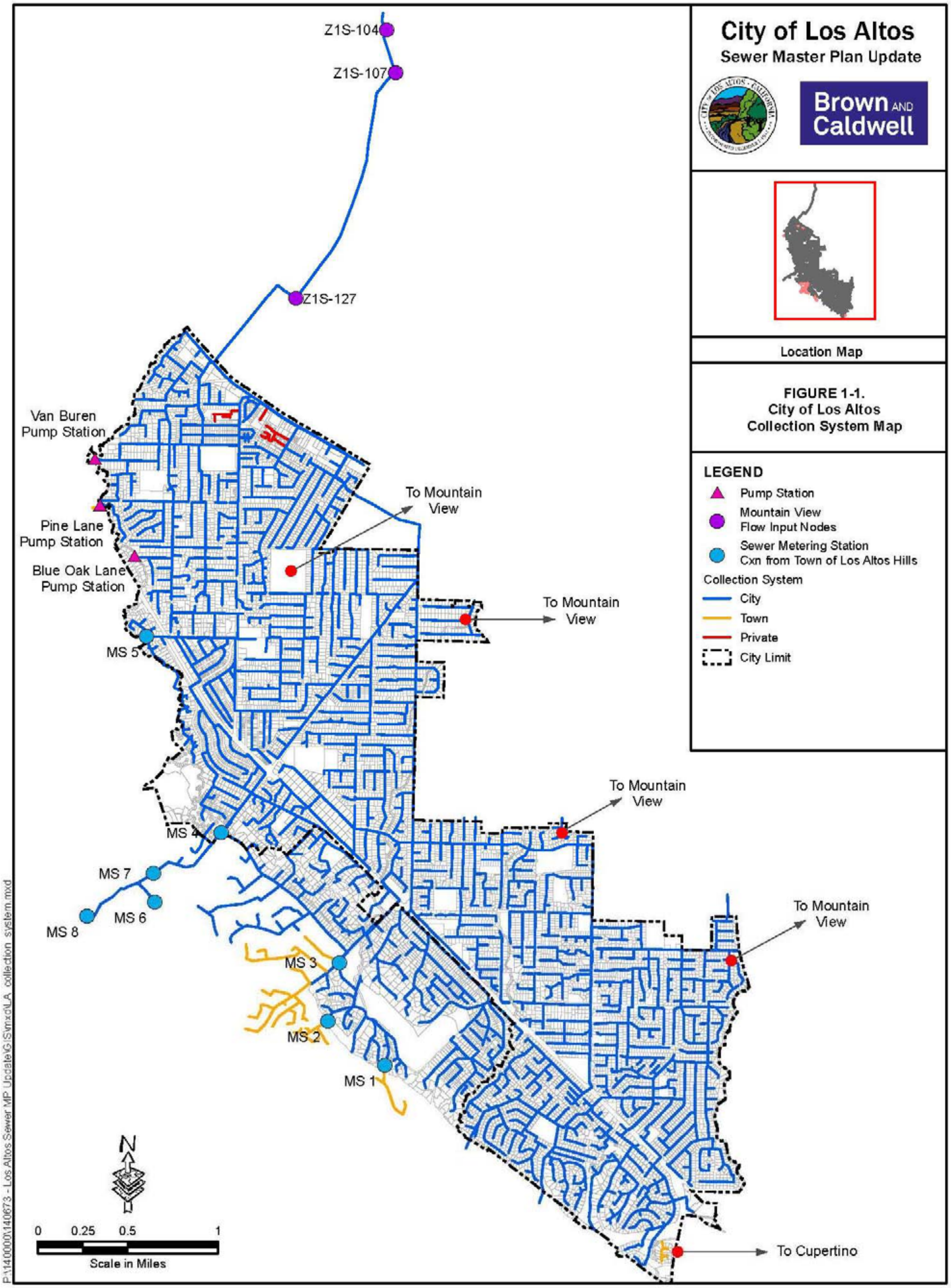


FIGURE 1-1. City of Los Altos Collection System Map

1.5 Interagency Agreements

This section summarizes the interagency agreements between the City, Town, Mountain View and Palo Alto. This section was not prepared or reviewed by an attorney, and it is not intended and should not be relied upon, as legal advice. Its purpose is to assist in the recognition and analysis of public policy issues.

Joint Sewer System Agreements. The City entered into a joint agreement with Mountain View and Palo Alto on October 10, 1968 to provide additional sewage transmission, treatment and disposal facilities to meet the requirements of the Regional Board. The main items in the agreement are described below:

- Palo Alto was selected to own, maintain and upgrade the wastewater treatment facilities, and the City and Mountain View purchased capacity rights in the sewer pipeline and treatment system.
- Each city is required to perform an engineering study to redefine future needs when flow from its respective area reaches 80 percent of their acquired rights. This Master Plan Update identifies that the City is at 80 percent of their acquired rights and the projected ultimate flows fall below the allotted flow limit.
- Each city has the right to rent or purchase capacity from others in the joint system.
- Palo Alto is responsible for billing each of the member agencies its proportionate share for the construction, maintenance and upgrading of the facilities. Costs are allocated based on each city's purchased capacity.
- Palo Alto is responsible for measuring and recording flow from each of the agencies.
- Excessive infiltration or inflow into the sewer system is not allowed by the cities.
- Sewage received by the party of the agreement from outside their territorial limits will be regarded as part of the party's capacity allocation.
- The basic agreement has an initial term of 50 years.
- The City's capacity at the Regional Plant is 3.6 mgd dry weather flow and 3.8 mgd annual average flow, and the interceptor between the City and the Regional Plant is 12.0 mgd for peak wet weather flow.

The basic agreement has been amended several times. Following is a summary of each addendum:

Addendum 1. December 5, 1977 – Provided for upgrading the treatment plant with nitrification, filtration and chlorination facilities in order to meet the advanced treatment requirements.

Addendum 2. January 14, 1980 – Amended the method of allocating expenses to the member agencies. In the basic agreement, costs for maintenance and operation were proportioned based on the flow. This addendum changed the method to include allocation costs based on chemical oxygen demand, suspended solids and ammonia as well as flow.

Addendum 3. April 9, 1985 – Provided for enlargement of the Regional Plant to the second stage and adjusted the allocated capacity of treatment plant units to the member agencies.

Addendum 4. July 3, 1990 – To account for the allocation of debt service on the utility revenue bonds, proceeds of the bond were used to pay for construction of improvements to the treatment facility.

Addendum 5. July 31, 1992 – Revised the basic agreement to provide for payment of interest on any excess payment and any underpayment by a party, and to amend certain provisions of Addendum 4.

Addendum 6. March 16, 1998 – Provided approval to rebuild the existing treatment plant and allocate costs to the member agencies.

Addendum 7. April 15, 2009 – Provided approval to design, construct and implement an ultra violet treatment system (Ultra-Violet [UV] Treatment Project), and allocate costs to the member agencies.

The basic agreement prohibits excessive infiltration and inflow (I/I) by any of the member agencies into the joint sewer system. Excessive I/I is generally considered to be I/I that is cost effective to remove.

Industrial Waste Control Agreement. The City entered into an agreement with Palo Alto that required the City to adopt and enforce its industrial waste ordinance. The ordinance is required to conform to the legal requirements contained in Federal Pretreatment Regulation published at 40 CFR 403. The agreement also requires the City to update the annual waste survey annually, issue industrial waste permits and take legal actions required to enforce the ordinance. Palo Alto performs this work for the City.

San Antonio Trunk Sewer. Prior to the Joint Sewer System (JSS), wastewater from the City and Mountain View was treated at a sewage treatment plant near the border of the cities. In 1961, Mountain View purchased capacity in the trunk sewer influent to the treatment plant. The treatment plant was abandoned when the new JSS was constructed. The new influent interceptor for the JSS began at the site of the abandoned treatment plant. The latest agreement with Mountain View is dated March 24, 1970 and is included in Appendix A. The agreement specifies that Mountain View has rights to 2 mgd of capacity in the trunk sewer which represents approximately 10 percent of the trunk sewer capacity. The agreement also specifies that flow entering the trunk sewer should be metered. The original meter measuring flow from Mountain View was out of service for several years. It was back in service in December 2004. An earlier agreement, dated May 10, 1966, is also included in Appendix A. It describes areas of Los Altos that are served by Mountain View and vice versa.

Town of Los Altos Hills. The City has had sewer maintenance agreements to convey wastewater and provide limited maintenance for the Town's sewer collection system since 1961. The latest agreement is dated January 26, 2007 (subsequently amended on July 1, 2007) and is included in Appendix B. The main items in the agreement that may affect the recommendations of the Master Plan Update are described below:

- The Town is entitled to discharge 339,900 gallons per day (gpd) of maximum daily flow (or 124.06 million gallons per year maximum annual flow) to the City. This total flow rate is inclusive of base sanitary flow, infiltration and inflow. There are financial penalties for exceeding the maximum allowable flow. During wet weather, the Town is allowed to exceed the daily flow allowance in the same proportion as the City exceeds their average dry weather flow, without penalty. The Town is not permitted to exceed its annual flow allowance.
- The City is responsible for installing and maintaining flow metering stations to monitor Town flows. The Town will fund the operation and maintenance of the stations.
- When Town flows reach 80 percent of the maximum allowable flow, they are required to perform an evaluation to address future capacity needs. The Town is responsible for 100 percent of the costs for increasing the size of a joint-use main within the City to accommodate projected flows from the Town.
- The Town can purchase additional capacity from one of the other "partners" in the Regional Plant and amend the agreement.
- The Town retains ownership of sewers within the Town's corporate limits with some noted exceptions at the border of the two cities: Summerhill Avenue and Magdalena Avenue (Exhibit C of the 1985 agreement shown in Appendix B), the El Monte trunk sewer (Exhibit D of the 1985 agreement shown in Appendix B), the Adobe Creek sewer (Exhibit E of the 1985 agreement shown in Appendix B), and O'Keefe Lane (Exhibit F of the 1985 agreement shown in Appendix B).
- The City is the sole provider of sewer service to Foothill College.
- The Town is responsible for maintenance and operation of the Town collection system.

- The City will bill the Town for actual costs of Town flow based on monitoring data. The costs will include the Town's portion of the Regional Plant bills to the City and the cost of operation and maintenance of City-owned facilities equal to 50 percent of the Town's cost of treatment. The Town is also responsible for its share of capital projects (greater than $10,000) for repair of joint-use mains in the City.

1.6 Regulatory Review

This section summarizes current and potential regulatory requirements and rules. This section is intended to provide general discussion of the subject matter covered. To the extent it addresses laws, regulations or court decisions of any jurisdiction, it is not intended as a precise, detailed or thorough summary of the pertinent legal authorities.

Government Accounting Standards Board 34. The Government Accounting Standards Board 34 (GASB 34) was established in 1984 to set accounting and reporting standards for state and local governments. In 1999, GASB 34 was designed to improve financial reporting. Specifically, GASB 34 outlines the economic resources measurement focus and accrual basis of accounting for all governmental financial reporting.

GASB 34 requires local government financial reports to include standardized accounting of assets, liabilities, revenues and expenses by major funds. This requires local governments to account for their assets in their financial statements either by depreciation or a modified method that is based on the actual condition of the assets. Both approaches require a complete inventory of assets and their original construction costs. If original construction costs are not available, they should be estimated for current replacement cost and adjusted to the original construction date. With the depreciation approach, depreciation is calculated by applying straight line depreciation to the useful life of the asset.

The modified approach requires the actual condition of the assets to be determined every three years. This information is used to estimate actual asset values. The modified approach requires more information and is more complicated to apply than the depreciation approach. With the depreciation method, some assets may be older than the estimated remaining life and consequently local government financial reports should indicate these assets have no financial value, even though they continue to function adequately. This issue is avoided with the modified approach.

Appendix C contains a thorough assessment of the compliance and implementation of GASB 34. The City is using the depreciation method to comply with GASB 34.

CMOM/SSMP. This section summarizes current regulatory requirements and legal decisions that have influenced the development of this Master Plan Update, and is intended to provide a general discussion of the subject matter covered. To the extent it addresses laws, regulations, or court decisions of any jurisdiction, it is not intended as a precise, detailed, or thorough summary of the pertinent legal authorities.

The United States Environmental Protection Agency (USEPA) began drafting CMOM regulations in the mid-1990s to require owners and operators of publicly-owned wastewater collection systems to improve the operations of wastewater collection systems and minimize SSOs. SSOs occur when wastewater escapes the collection system as a result of blockages or capacity restrictions in the system. The State of California, through its State Water Resources Control Board (SWRCB), issued SSMP requirements to achieve the SSO reduction goals of CMOM.

SWRCB Order No. 2006-003 provides a statewide general Waste Discharge Requirements (WDR) for all publicly-owned sanitary sewer collection systems in California with more than one mile of sewer pipe. Agencies meeting these criteria must develop an SSMP that includes at least 11 mandatory elements, which are identified in Table 1-1. The agency's SSMP must be approved by the collection system's governing body, which the City has done. The WDR also requires uniform reporting of all SSOs to a statewide electronic database maintained by the SWRCB. All elements of the SSMP were required to be in place by specified dates prior to August 1, 2009 for sewer agencies serving populations between 10,000 and 100,000.

Table 1-1. SSMP Components

Components	Major Goals
1. Goals	Properly manage, operate and maintain all parts of the sanitary sewer system.
2. Organization	Clearly identify the parties responsible for the plan; management, administration and maintenance; and the chain of communication for SSO reporting.
3. Legal Authority	Demonstrate through ordinances, agreements or other legally binding procedures that the agency has the legal authority to: a) prevent illicit discharges into the sewer system; b) require that sewers and connections be properly designed and constructed; c) ensure access for maintenance, inspection and repairs; d) limit the discharge of FOG; e) and enforce violation of sewer ordinances.
4. O&M Program	a) Maintain an up-to-date map; b) Regular preventive maintenance activities; c) Develop a prioritized rehabilitation and replacement plan; d) Provide training; e) Provide equipment and replacement part inventories.
5. Design and Performance Provisions	a) Design and construction standards and specifications; b) Procedures and standards for inspecting and testing new sewers.
6. Overflow Emergency Response Plan	a) Proper notification procedures; b) Overflow response program; c) Overflow notification procedures; d) Emergency Response Plan procedures; e) Traffic and crowd control procedures; f) Program to ensure reasonable steps are taken to contain SSO.
7. Fog Control Program	a) Public education and outreach plan; b) FOG disposal plan; c) Legal authority to prevent discharges; d) Grease removal device requirements; e) Authority to inspect grease producing facilities; f) Identification of areas prone to FOG blockages; g) Development and Implementation of FOG source control measures.
8. System Evaluation and Capacity Assurance Plan	a) Evaluation of areas experiencing SSO discharge; b) Develop design criteria; c) Develop a CIP to address identified hydraulic deficiencies; d) Develop a schedule of completion dates.
9. Monitoring, Measurement and Program Modifications	a) Maintain information to establish and prioritize SSMP activities; b) Monitor the implementation and effectiveness of each element; c) Assess the success of the preventive maintenance program; d) Update program elements as necessary; e) Identify and illustrate SSO trends.
10. SSMP Audits	Conduct a program audit at least every two years to evaluate the effectiveness of the SSMP.
11. Communication Program	Communicate on a regular basis with the public on the development, implementation and performance of the SSMP.

Each collection system agency is required to perform an annual audit to identify any deficiencies in their performance and the steps that may be necessary to correct them. Specific requirements of the audit are listed in the WDR document provided in Appendix D. Proposed revisions to the WDR are currently out for comment and changes to the WDR are expected in 2013. SSMP updates would not be required until the next required SSMP update in at least 2 years. The most significant proposed changes (that have not already been incorporated in the City's current SSMP and this Master Plan Update) include a Staff Assessment Program, Contingency Planning (Risk Assessment) and Performance Targets. It is anticipated that these efforts will be performed by current staff.

Section 2
Condition Assessment

An assessment was performed to determine the condition of the City's sewers and pump stations, and to recommend improvements to address condition problems. The assessment was based on existing information and additional information collected during this study, as well as interviews with the City's maintenance staff. The recommendations are developed into capital improvement projects and prioritized in Section 7.

The 2012 updates to the 2005 Condition Assessment include:

- Analysis of CCTV inspection data collected by the City since 2005.
- Revision of the pipeline condition assessment evaluation using Pipeline Assessment and Certification Program (PACP) procedures.
- Summary of corrosion analysis of trunk sewer performed for the City by Villalobos and Associates.
- Update of the previous condition assessment of the City's pump stations because the City has rehabilitated the pump stations to address the issues previously identified.

2.1 Pipelines and Manholes

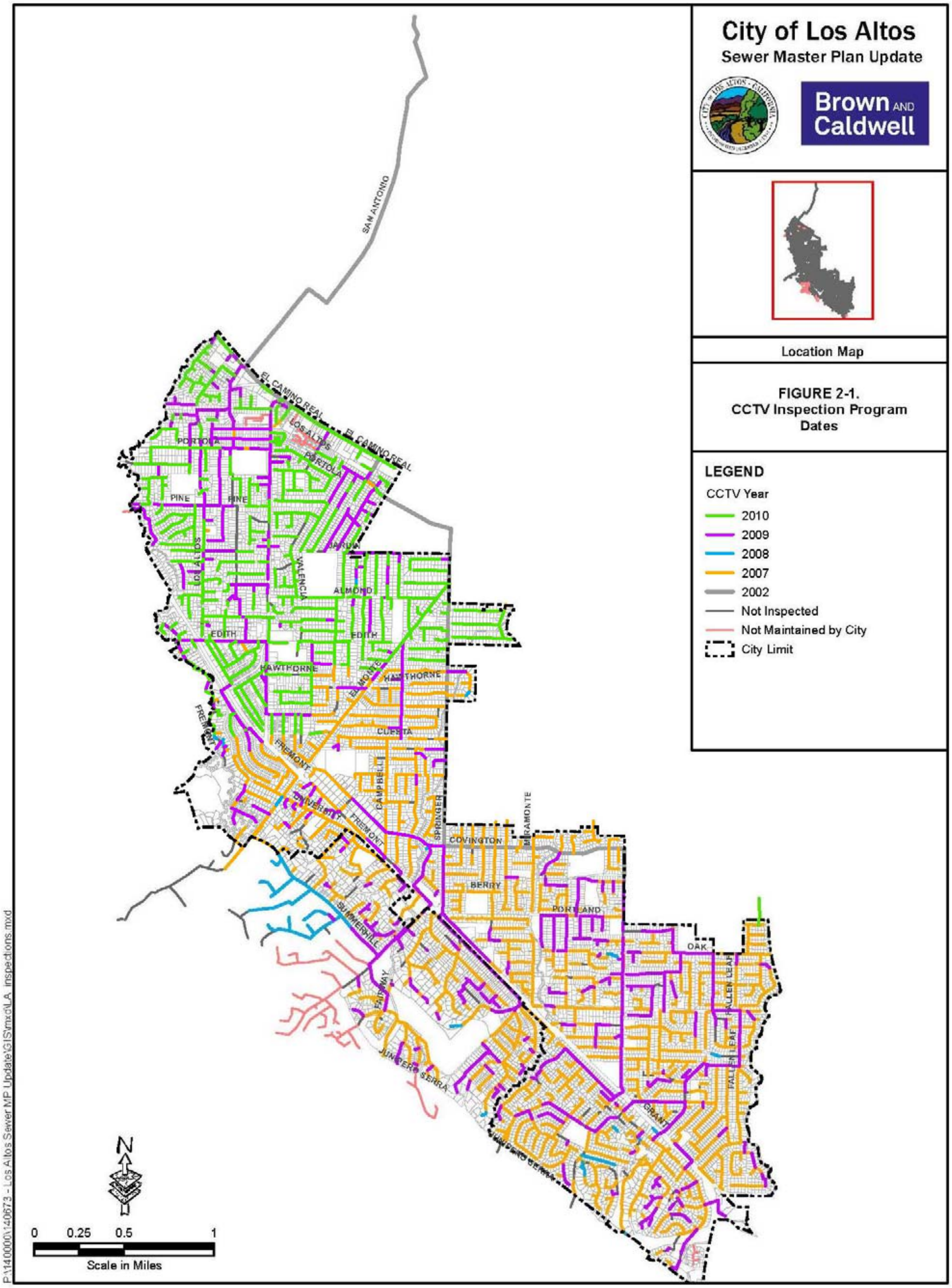
The primary source of information on the condition of sewer pipes is CCTV inspection data. Information from CCTV inspection was used to develop a condition rating for each inspected sewer reach. CCTV information was also used to identify reaches with isolated severe defects that require spot repairs.

2.1.1 CCTV Inspections

Following the completion of the 2005 Master Plan, the City obtained updated CCTV inspection information for the majority of the collection system between 2007 and 2010. CCTV information on small-diameter mains collected prior to 2007 was not used in this analysis. CCTV inspection information from 2002 for the large-diameter reinforced concrete pipe (RCP) trunk sewers was included in this analysis. The locations of CCTV inspections are shown by year on Figure 2-1. Only those inspections whose Pipe ID could be linked to the City's GIS Pipe ID were included. Inspections of approximately 150 reaches were excluded because they did not link into the City's GIS sewer system data base. Inspected pipe reaches owned by the Town and Cupertino were also excluded from this analysis.

Approximately 641,500 lineal feet (lf) of pipeline in 2,810 reaches of 18-inch and smaller diameter sewers were inspected between 2007 and 2010. This corresponds to about 93 percent of the small diameter collection system by length (of 693,000 lf total). Pipe inspections are summarized by diameter in Table 2-1.

Table 2-1. Summary of CCTV Inspection		
Diameter, inches	No. Reaches	Length, feet
6	2,407	540,022
8	227	54,823
10	24	6,822
12	96	24,330
15	51	13,931
18	5	1,455
24	2	738
27	5	1,050
30	8	3,425
33	2	391
39	1	991
TOTAL	2,828	647,977


City of Los Altos
Sewer Master Plan Update
Brown AND Caldwell
Location Map
FIGURE 2-1.
CCTV Inspection Program Dates
LEGEND
CCTV Year
2010
2009
2008
2007
2002
Not Inspected
Not Maintained by City
City Limit
SAN ANTONIO
EL CAMINO REAL
LOS ALTOS
PORTOLA
PINE
EDITH
ALMOND
HAWTHORNE
CUESTA
FREMONT
CAMPBELL
SPRINGER
COVINGTON
MIRAMONTE
BERRY
PORTLAND
OAK
FALLEN LEAF
GRANT
SUMMERHILL
FAIRWAY
JUNIPERO SERRA
0 0.25 0.5 1
Scale in Miles
P:\140000\140673 - Los Altos Sewer MP Update\GIS\mxd\LA_inspections.mxd

In 2002, the City inspected almost 32,000 lf of large diameter (≥ 24 inches) sewers. The large diameter sewers are constructed of RCP and comprise the trunk sewer system that runs through the City and extends to the Regional Plant. Inspection summaries were provided for the large diameter sewer inspections. These summaries included general statements about the degree of corrosion and highlighted specific areas with exposed rebar. The large diameter pipe had very few structural defects other than corrosion. In 2009, the City contracted Villalobos and Associates (V&A) to review the 2002 inspection videos and regenerate inspection logs using the PACP inspection standard developed by National Association of Sewer Service Companies (NASSCO). V&A also performed surface manhole inspections of 85 manholes and confined space entry inspections of 18 manholes in 2009. The final report from that assessment is included as Appendix E.

2.1.2 CCTV Inspection Data

CCTV inspection databases from the four years of inspections were provided for analysis. The CCTV contractors created the databases using various CCTV data collection software packages, such as WinCan and Posm, that are based on Microsoft Access. Observed defects in all of the databases were coded using the PACP coding system. Some of the databases included fields that listed the overall pipe segment scores and ratings, while others contained only the defect codes and/or scores. The City has standardized a reporting format for the sewer segments which is included in the City's GIS sewer database. PACP defect codes and severity ratings that were used for condition assessment are listed in Table 2-2.

Table 2-2. Summary of CCTV Defect Observations with PACP Condition Grading Criteria

Type of Defect	Defect Description		PACP Code	PACP Condition Grade by Additional Grading Criteria													
				None	Clock		Percent								Degrees		
					9-3	4-8	≤10	>10	≤20	≤30	>30	≤50	>50	≥75	≤10	≤20	>20
Structural Defects																	
Holes, Broken, Collapsed and Deformed	Collapse		XP	5													
	Hole,		H		5	4											
		Void Visible	HVV	5													
		Soil Visible	HSV	5													
	Broken,		B		5	4											
		Void Visible	BVV	5													
		Soil Visible	BSV	5													
	Deformed		D				4	5									
Cracks and Fractures	Crack,	Circumferential	CC	1													
		Longitudinal	CL	2													
		Spiral	CS	2													
		Multiple	CM	3													
	Fracture,	Circumferential	FC	2													
		Longitudinal	FL	3													
		Spiral	FS	3													
		Multiple	FM	4													
Joint Displacement	Joint Offset,	Medium	JOM	1													
		Large	JOL	2													
	Joint Separated,	Medium	JSM	1													
		Large	JFL	2													

Table 2-2. Summary of CCTV Defect Observations with PACP Condition Grading Criteria

Type of Defect	Defect Description		PACP Code	PACP Condition Grade by Additional Grading Criteria													
				None	Clock		Percent								Degrees		
					9-3	4-8	≤10	>10	≤20	≤30	>30	≤50	>50	≥75	≤10	≤20	>20
	Angular,	Medium	JAM	1													
		Large	JAL	2													
Lining and Repair Failures	Lining Failure,	Detached	LFD	3													
		Defective End	LFDE	3													
		Blistered	LFB	3													
		Buckled	LFBK	3													
		Wrinkled	LFW	3													
		Service Cut Shifted	LFCS	3													
		Overcut Service	LFOC	3													
		Undercut Service	LFUC	3													
	Weld Failure,	Longitudinal	WFL	2													
		Circumferential	WFC	2													
		Spiral	WFS	2													
		Multiple	WFM	3													
	Pipe Replaced,	Defective	RPRD	4													
	Patch Repair,	Defective	RPPD	4													
	Localized Liner,	Defective	RPLD	4													
Corrosion (Structural) Defects																	
Corrosion	Surface Roughness Increased (Chemical)		SRI(C)	1													
	Surface Spalling (Chemical)		SSS(C)	2													
	Surface Aggregate Visible (Chemical)		SAV(C)	3													
	Surface Aggregate Projecting (Chemical)		SAP(C)	3													
	Surface Aggregate Missing (Chemical)		SAM(C)	4													
	Surface Reinforcement Visible (Chemical)		SRV(C)	5													
	Surface Reinforcement Projecting (Chemical)		SRP(C)	5													
	Surface Reinforcement Corroded (Chemical)		SRC(C)	5													
	Surface Missing Wall (Chemical)		SMW(C)	5													
	Surface Corrosion, Metallic Pipe		SCP	3													
Operations And Maintenance Defects																	
Roots	Roots, Fine,	Barrel	RFB	2													
		Connection	RFC	1													
		Joint	RFJ	1													
		Lateral	RFL	1													
	Roots, Tap,	Barrel	RTB	3													
		Connection	RTC	2													
		Joint	RTJ	2													
		Lateral	RTL	2													
	Roots, Medium,	Barrel	RMB	4													
		Connection	RMC	3													

Table 2-2. Summary of CCTV Defect Observations with PACP Condition Grading Criteria

Type of Defect	Defect Description		PACP Code	PACP Condition Grade by Additional Grading Criteria												
				None	Clock		Percent							Degrees		
					9-3	4-8	≤10	>10	≤20	≤30	>30	≤50	>50	≥75	≤10	≤20	>20
		Joint	RMJ	3													
		Lateral	RML	3													
	Roots, Ball,	Barrel	RBB	5													
		Connection	RBC	4													
		Joint	RBJ	4													
		Lateral	RBL	4													
Deposits and Obstacles	Deposits, Attached,	Grease	DAGS				2		3	4	5						
		Ragging	DAR				2		3	4	5						
		Encrustation	DAE				2		3	4	5						
		Other	DAZ				2		3	4	5						
	Deposits, Ingress,	Fine	DNF				2		3	4	5						
		Gravel	DNGV				2		3	4	5						
		Other	DNZ				2		3	4	5						
	Deposits, Settled,	Fine	DSF				2		3	4	5						
		Gravel	DSGV				2		3	4	5						
		Hard/Compacted	DSC				2		3	4	5						
		Other	DSZ				2		3	4	5						
	Obstacle, Wall	Intruding through	OBI				2		3	4	5						
		In Joint	OBJ				2		3	4	5						
		Pipe Material	OBM				2		3	4	5						
	Debris	Construction	OBN				2		3	4	5						
	Cable	External Pipe or	OBP				2		3	4	5						
		Rocks	OBR				2		3	4	5						
		Built Into Structure	OBS				2		3	4	5						
		Other	OBZ				2		3	4	5						
Infiltration	Infiltration,	Stain	IS	2													
		Weeper	IW	2													
		Dripper	ID	3													
		Runner	IR	4													
		Gusher	IG	5													
Defective and Intruding Laterals and Seal Material	Defective Tap,	Factory	TFD	2													
		Break In/Hammer	TBD	3													
	In/Hammer	Capped Break	TBC	2													
		Saddle	TSD	2													
	Intruding,	Tap, Factory	TFI				2		3	4	5						
	In/Hammer	Tap, Break	TBI				2		3	4	5						
		Tap, Saddle	TSI				2		3	4	5						
		Sealing Ring	ISSR				2		3	4	5						

Table 2-2. Summary of CCTV Defect Observations with PACP Condition Grading Criteria																	
Type of Defect	Defect Description		PACP Code	PACP Condition Grade by Additional Grading Criteria													
				None	Clock		Percent								Degrees		
					9-3	4-8	≤10	>10	≤20	≤30	>30	≤50	>50	≥75	≤10	≤20	>20
	Hanging	Sealing Ring,	ISSRH				2		3	4	5						
	Broken	Sealing Ring,	ISSRB				2		3	4	5						
		Sealing Grout	ISGT				2		3	4	5						
	Other	Seal Material,	ISZ				2		3	4	5						
Alignment Changes	Line,	Left	LL												1	2	4
		Left and Up	LLU												1	2	4
		Left and Down	LLD												1	2	4
		Right	LR												1	2	4
		Right and Up	LRU												1	2	4
		Right and Down	LRD												1	2	4
		Up	LU												1	2	4
		Down	LD												1	2	4
Water Level	Miscellaneous, Underwater	Camera	MCU	4													
		Water Level, Sag	MWLS							2		3	4				
		Water Mark	MWM										4	5			

The major difference between the new CCTV data collected and coded using the PACP rating system and the 2005 Master Plan inspection data is how sags and offset joints are weighted. PACP gives a very low weighting to offset joints (1 or 2) while the 2005 Master Plan gave higher weightings. PACP also considers sags to be an O&M problem rather than a structural problem. Therefore, many pipes that had offset joints and/or sags would receive much lower structural defect scores now than they received previously. The rating system used to compile the inspection data is discussed in the following section.

2.1.3 Pipe Condition Evaluation

Three procedures were used to evaluate the condition of sewer mains.

- The first procedure developed structural pipe ratings and O&M pipe ratings for each reach based on the number and types of defects.
- The second procedure identified the most severe structural defect on each reach that may have to be corrected to reduce the risk of a pipe failure.
- The third procedure evaluated corrosion in the 24-inch through 42-inch-diameter RCP trunk sewer. This latter analysis is addressed in a separate report commissioned by the City, which is included in Appendix E.

2.1.3.1 Structural and O&M Pipe Ratings

Structural Pipe Ratings (SPR) were developed using structural defect types, including holes, broken, collapsed and deformed pipe; cracks and fractures; joint displacement; and lining and repair failures. Each structural defect was given a PACP Structural Condition Grade (see Table 2-2) that was used to develop the SPR for the pipe reach. For each pipe reach, the SPR was obtained by multiplying each defect condition grade by the number of occurrences of the defect and then summing the scores for all defects.

An example of the rating calculation is provided below: A pipe has one occurrence of a longitudinal crack (CL), three circumferential cracks (CC), four longitudinal fractures (FL) and a hole with soil visible (HSV), resulting in a SPR of 22.

1 CL	x	2	=	2
3 CC	x	1	=	3
4 FL	x	3	=	12
1 HSV	x	5	=	5
SPR			=	22

The RCP trunk sewer corrosion evaluation also employed the SPR rating methodology, which was used to rank order pipes with similar degrees of corrosion. Corrosion is typically a continuous defect, so SPRs for trunk sewer pipes are generally much higher than those for pipes with discrete structural defects. Therefore, trunk sewers were excluded from the SPR analysis because the results are incompatible.

O&M Pipe Ratings (OPR) were developed using O&M defect types, including roots, deposits and obstacles, infiltration, defective and intruding laterals, alignment changes, and sags (high water levels). Each O&M defect was given a PACP O&M Condition Grade (Table 2-2) that was used to develop the overall OPR for the pipe reach. For each pipe reach, the OPR was obtained by multiplying the defect condition grades by the number of occurrences of each defect, and summing the scores for all defects. The trunk sewer condition assessment did not address O&M defects.

2.1.3.2 Condition Assessment Ratings

This rating method is commonly used in the industry to identify pipes requiring rehabilitation and to prioritize rehabilitation projects. The Condition Assessment Rating (CAR) was developed by grouping the SPRs of all the inspected pipes into ranges representing similar structural conditions. Pipes within each defined SPR range receive CARs of A, B, or C. Pipes falling into Category A are in the worst structural condition, while pipes in category C are in good structural condition. Category B pipes are in moderate structural condition; however, they may degrade and require rehabilitation in the future. It should be noted that pipes with one serious defect may not receive a high SPR; therefore, CAR category A was expanded to include pipes with any grade 4 or 5 defect regardless of SPR. Typically, spot repairs are used to correct such deficiencies.

The CARs assigned by the current analysis cannot be correlated directly with the CARs from the 2005 Master Plan since the defect rating systems are different. For example, the 2005 Master Plan classified sags as structural defects, while PACP classifies them as O&M defects. Also, minor offset joints received heavier weightings in the 2005 Master Plan than in the PACP coding system. Therefore, many pipes that previously received high SPRs due to sags and offset joints now fall into categories B and C.

CARs are defined as follows:

- **Category A:** Priority Rehabilitation:
  - SPR of 10 or greater with worst defect grade 3, 4, or 5, OR
  - SPR less than 10 and any grade 4 or 5 defect.
  - V&A assigned PACP grade 4 or 5 corrosion.
- **Category B:** Monitor with periodic reinspection, optional rehabilitation:
  - SPR of 10 or greater and not in category A (multiple low grade defects), OR

  - SPR less than 10 with worst defect grade 3 (moderate defects).
  - V&A assigned PACP grade 3 corrosion.
- **Category C:** Stable:
  - Remaining pipes with no defects or SPR less than 10 and worst defect grade 1 or 2.
  - Lower grade corrosion.

The SPRs for the Los Altos pipes ranged from 0 to 60 for the 2,810 pipes inspected, excluding trunk sewers. Statistics are as follows:

- 49 pipes (approximately 2 percent) received an SPR of 10 or greater.
  - Of those pipes, 36 also had worst defect scores of 3, 4, or 5, placing them into CAR category A.
- 262 pipes (about 9 percent) received an SPR of 3 through 9.
  - Of those pipes, 92 had worst defects of 4 or 5, also placing them into CAR category A.

The number of inspected pipes in each category are as follows:

- **Category A:** 128 pipes (4.5 percent).
- **Category B:** 84 pipes (3 percent).
- **Category C:** 2,598 pipes (92.5 percent).

Results of the pipe condition rating are shown on Figure 2-2 and in Appendix O. The City provided a list of pipe reaches that it has rehabilitated since completing CCTV inspection. Pipe ratings in Appendix O have been updated to a rating of C if they are on that list, and the rating prior to rehabilitation is shown in the last column. Graphs depicting the SPRs and OPRs of the inspected pipelines are provided on Figures 2-3 and 2-4, respectively. Based on BC's experience and the above analysis, the City's collection system is in good overall structural condition relative to other Bay Area collection systems of similar age and pipeline material.

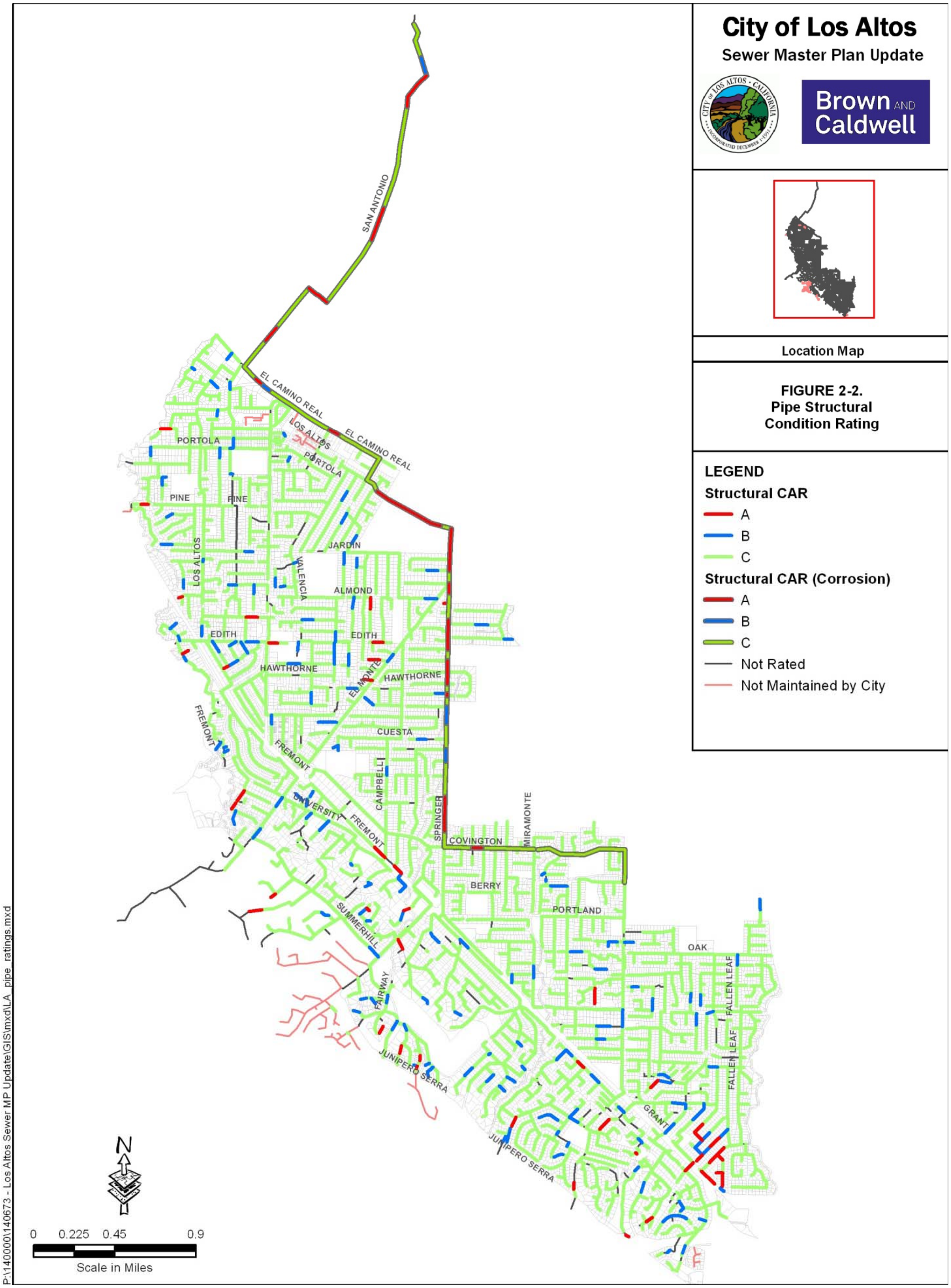


FIGURE 2-2.
Pipe Structural
Condition Rating

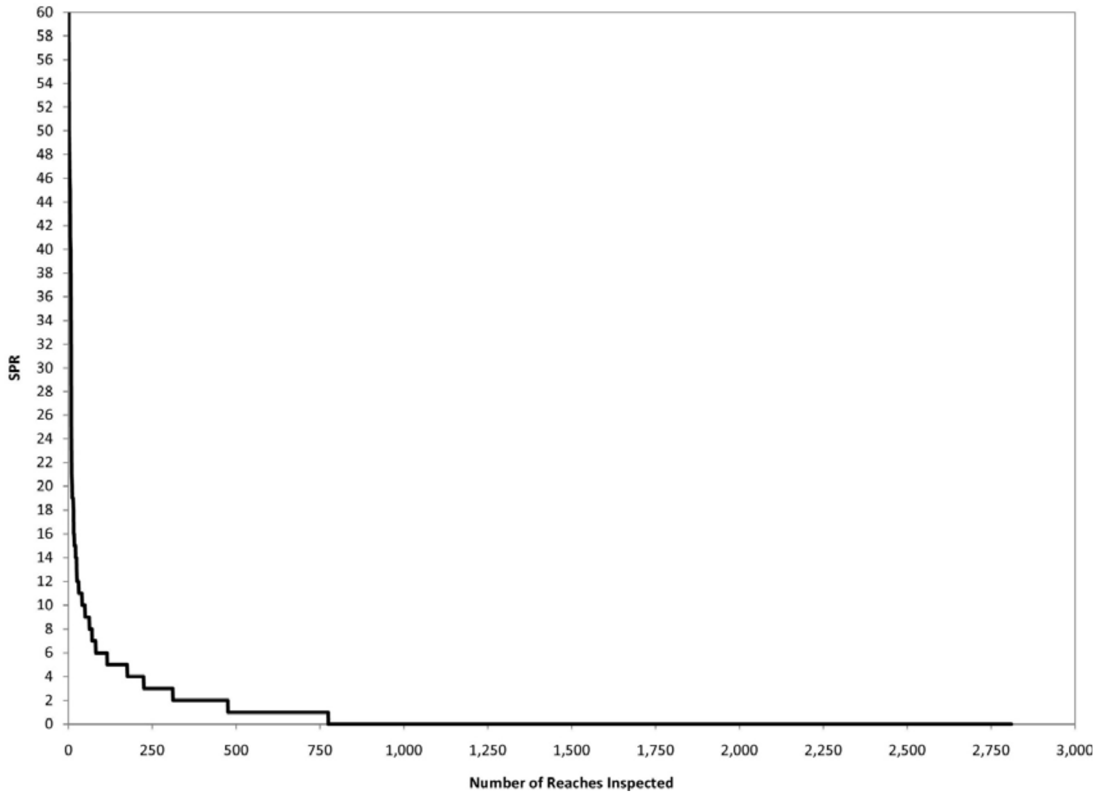


Figure 2-3. Structural Pipe Rating Scores

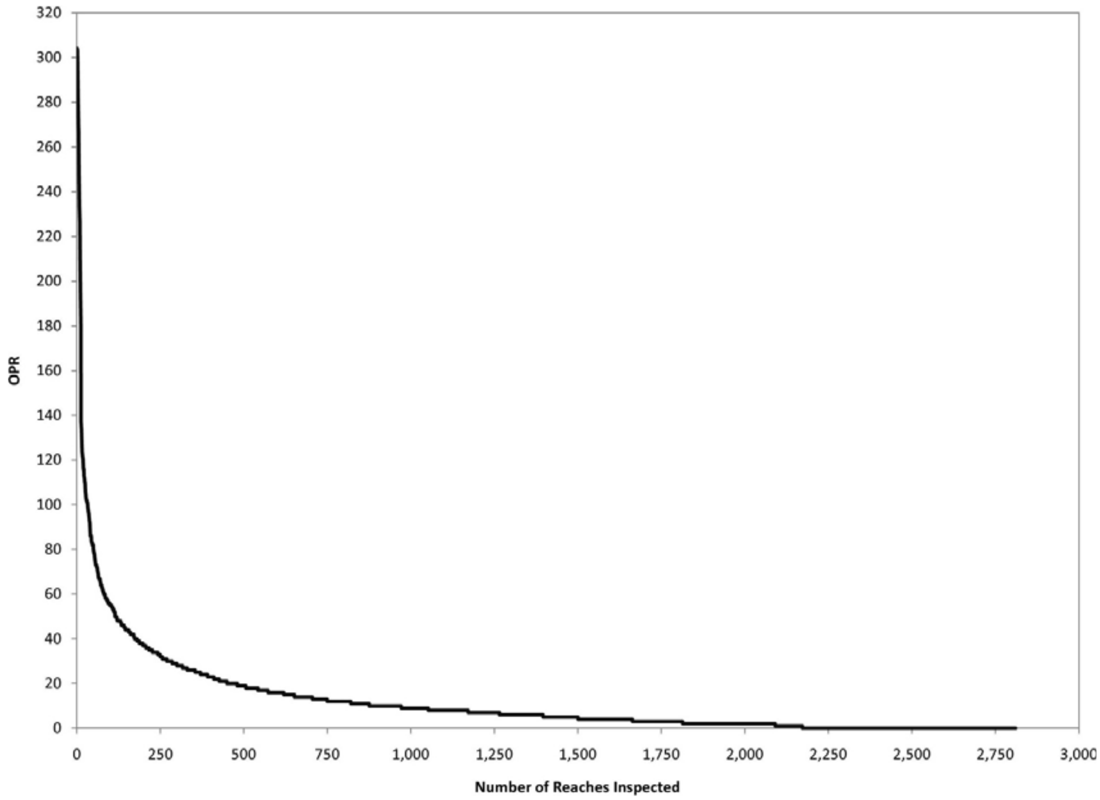


Figure 2-4. O&M Pipe Rating Scores

2.1.3.3 Severe Structural Defects

PACP grade 4 and 5 structural defects, excluding corrosion, and the number of occurrences are listed in Table 2-3. A total of 92 category A pipes had SPRs between 4 and 9 with worst defect scores of 4 or 5, and were selected for rehabilitation or replacement projects. Two pipes had two defects each, for a total of 94 defects. No collapsed pipes or other cases requiring emergency repairs were noted during CCTV inspections.

Table 2-3. Severe Defects

Code	Description	PACP Grade	Number Occurrences
XP	Collapsed Pipe	5	-
H	Hole	4/5	3
HSV	Hole Soil Visible	5	4
HVV	Hole Void Visible	5	2
B	Broken	4	28
BSV	Broken Soil Visible	4	14
BVV	Broken Void Visible	4	17
D	Deformed	4/5	1
FM	Fracture Multiple	4	25
		TOTAL	94

2.1.3.4 Corrosion

The results of the 2002 RCP CCTV inspections identified moderate to severe corrosion in many reaches. Often trunk sewer system concrete corrosion can be difficult to accurately assess from CCTV inspections. As concrete corrodes, corrosion products such as gypsum are formed. Gypsum is a soft material that has no structural strength, but can mask the extent of corrosion.

Although the City has not conducted additional CCTV inspections to qualify trunk sewer corrosion, it did contract with V&A to reevaluate the 2002 inspection data, as noted above. The final V&A report (Table 4-3 Updated, Appendix E) indicates that 43 pipe reaches show signs of moderate to severe corrosion, corresponding to NASSCO PACP defect grades of 3, 4 and 5.The reaches are located throughout the trunk sewer, and not just in specific areas or in specific diameter pipes. The report recommends rehabilitation of nine of those reaches (Table 5-1, Appendix E) and additional inspection of 16 other reaches (Table 5-2, Appendix E); however, the pipeline rehabilitation projects recommended by BC include all reaches identified by V&A as having grade 5, 4, and 3 corrosion. Some of the reaches have been rehabilitated since the report, and are not included in the CIP, as discussed in Section 7.

The City plans to re-televise the RCP trunk sewer in FY12.

2.1.4 Manholes

The City collected updated manhole inspection data for trunk sewer manholes in 2009. The inspection program is described in the V&A report in Appendix E. The report lists 85 topside manhole inspections (V&A Table 2-1) and the detailed results of 18 confined space entry inspections (V&A Table 4-4). The trunk sewer manholes were determined to be in satisfactory condition, with only three manholes showing signs of moderate corrosion.

For the 2005 Master Plan, manhole condition information was collected during the 2002 and 2003 CCTV inspection programs, during the 2002 Flow Monitoring Program, and from discussion with City maintenance staff. Manhole condition information was noted on the CCTV inspection forms used for the 2002 and 2003 CCTV inspection and on the monitor site report forms from the 2002 Flow Monitoring Program. These programs observed approximately 600 manholes.

The manhole inspections identified very few defects. The overall observation during the 2003 CCTV inspection program was that manholes were in good condition, which was confirmed by City maintenance staff. The results from the previous manhole assessment are presented in Table 2-4. Besides the 2009 trunk manhole inspections discussed above, no additional manhole inspections were carried out for this master plan update.

Table 2-4. Manholes with Defects

MH No.	Debris	Roots	Corrosion	Hole	Base Defective	Other
K6S-115	X					
J6S-405		X				
J6S-110		X				
C2S-516		X				
C2S-504					X	
C2S-208					X	
E3S-611						Metal rod
B1S-201					X	
B1S-305	X					

C2S-406					X	
H2S-104					X	
I3S-608					X	
I3S-607					X	
I3S-309					X	
E1S-604						Could not locate
F1S-309						MH low, need to raise
F1S-308						Could not locate
F1S-302					X	
F2S-409	X					
F2S-405					X	
B2S-303			X			
I6S-405			–			City revisited in 2012, no corrosion observed
A2S-408		X				
Unnumbered manhole on Distel, 19 feet U/S of B3S-503						Hole on easterly side
B3S-503			X			From 2009 uinspection: V&A corrosion rating of 2 (mild corrosion)
A2S-506			X			
Z1S-104			X			

Manhole inspections did not consider manhole steps. The most common problems with manholes were misshapen bases followed by roots. Only two manholes were identified as having concrete corrosion, but one of them did not appear corroded when revisited by City maintenance staff. Corrosion of trunk sewer manhole is difficult to determine from visual inspection. Additional inspection techniques, such as scratch and penetration tests, are recommended to better determine the extent of manhole corrosion during future inspections.

2.2 Pump Stations

A mechanical and electrical condition assessment was performed at three pump stations maintained by the City as part of the 2005 Master Plan. Since that time, each pump station has been rehabilitated and/or replaced. An inspection and condition assessment was not performed as part of this Master Plan Update. An inspection and assessment is recommended when the City performs another master plan update in approximately ten years.

Section 3

Operation and Maintenance Assessment

This section presents the results of an assessment of the City's maintenance practices, equipment and staffing levels for the collection system. The assessment is based on information provided by the City. BC performed a review of the City's construction and inspection standards and specifications for the 2005 Master Plan – the standards and specifications were not reviewed in 2012. The recommended modifications and improvements to current practices to improve system performance and reduce long-term life cycle costs are outlined in Section 8.

The 2012 updates to the 2005 Operations and Maintenance assessment include:

- Inclusion of goals from the City's SSMP.
- New SSO data.
- Changes in the maintenance agreement between the City and the Town.
- Updated recommended staffing levels.

3.1 Maintenance Agreement

The City owns and maintains the sewers within the City limits and a limited number of sewers in the Town and unincorporated areas of the County that discharge to the City's collection system. The City has an agreement with the Town for the transportation, treatment and disposal of Town sewage. This agreement is discussed in more detail in Section 1. The City no longer provides maintenance service for the portion of the Town system that discharges to the City's collection system.

3.2 References

During the assessment, the City's current O&M equipment and practices and construction standards and specification were compared with industry recognized standards. Two published documents utilized for this comparison are:

- "Optimization of Collection System Maintenance Frequencies and System Performance." American Society of Civil Engineers (ASCE), 1999.
- "Effective Practices for Sanitary Sewer and Collection System Operations and Maintenance." Water Environment Research Foundation (WERF), 2003.

The ASCE study consisted of a survey of 42 sewer agencies in the United States with the goal of assisting other local government agencies in the evaluation of their own sewer maintenance and reinvestment programs. The WERF study consisted of a survey of 28 sewer agencies in the United States (U.S.) with the objective of developing a toolkit of effective operations and maintenance practices for use by utility managers.

Unpublished data from a 2001 U.S. Environmental Protection Agency (EPA) Region 9 survey of 33 collection systems in California, Arizona and Hawaii was also used for comparative purposes. The data is presented in Appendix F.

The assessment in this section compares the City's collection system performance and maintenance levels to other U.S. wastewater agencies documented in these references.

3.3 Information Sources

O&M information for this assessment was provided by the City. Much of the information was generated during a meeting with O&M staff in which SSMP performance parameters were reviewed. A summary of the data collected is provided in the following sections.

3.4 Collection System Performance

The key to assessing the City's O&M procedures is understanding the current performance of the collection system and the needed performance for the City to be in compliance with the goals in the City's SSMP. Additional information about SSMP is provided in Section 1.

3.4.1 Current Performance

Information on current performance was provided by the City and covers the City's service area. The City currently tracks the following system performance indicators: dry weather stoppages; SSOs; stoppage response time; pipe failures; pump station failures; and odor complaints. These indicators were utilized to assess the City's collection system performance by comparing the City's performance with the performance of sewer agencies reported in the ASCE, WERF and USEPA surveys. The ASCE, WERF and USEPA survey averages are listed in parentheses for each performance parameter. Based on the averages reported in the three studies, the City's system performs relatively well. Modifications made to the City's O&M program since 2005 have resulted in significant improvement to O&M performance parameters.

3.4.1.1 Dry Weather Stoppages

The City averages approximately two dry weather stoppages/100 miles/year. (WERF: 16 stoppages/100 miles/year; ASCE: 13 stoppages/100 miles/year; Los Altos 2005: 33 stoppages/100 miles/year.) Assessment: Significantly less dry weather stoppages than the reported average and a significant improvement from data reported in 2005.

3.4.1.2 Dry Weather SSOs

Dry weather SSO data for the City are presented in Table 3-1. The average is approximately 6 SSOs/100 miles/year. (EPA Region 9 Survey: 6.1 overflows/100 miles/year; WERF: 2 overflows/100 miles/year; ASCE: 4.5 overflows/100 miles/year; Los Altos 2005: 9 overflows/100 miles/year.) Assessment: Approximately equal to the reported average and an improvement from data reported in 2005.

Table 3-1. Annual Dry Weather SSO Data

Cause	2007	2008	2009	2010
Grease	2	0	1	2
Roots	4	0	5	2
Damaged Pipe	0	0	0	0
Multiple Causes	0	5	1	0
Other[1]	2	3	5	2
Total	8	8	12	6
SSOs per 100 miles of sewer	5.8	5.8	8.7	4.3

[1]*Other reasons include debris, construction debris and vandalism.*

3.4.1.3 Wet Weather SSOs

Wet weather SSOs are the direct result of a rain event that inundates the system with extraneous water. The City reported no wet weather SSOs since 1997, when overflows occurred on San Antonio Road and Bayshore Boulevard due to a back up from the treatment plant. (WERF: 2 overflows/100 miles/year; ASCE: 4.5 overflows/100 miles/year.) Assessment: Fewer wet weather SSOs than the reported average.

3.4.1.4 Stoppage Response Time

The City reported that it takes an average of 13 minutes to respond to a reported stoppage. (WERF/ASCE: data not reported; Los Altos 2005: 30 minutes.) Assessment: No reported average, but the City's performance is good based on experience assessing other sewer agency performance. Additionally, improvements have been made to further reduce the response time from 2005 data.

3.4.1.5 Pipe Failures

The City reported having no emergency pipe failures. (WERF: 4.1 failures/100 miles/year; ASCE: 4.1 failures/100 miles/year; Los Altos 2005: 1.4 failures/100 miles/year.) Assessment: Fewer emergency pipe failures than the reported average and an improvement from data reported in 2005.

3.4.1.6 Pump Station Failures

The City reported no recent pump station failures. (WERF: 1.0 failures/100 miles/year; ASCE: 0.006 failures/pump station/year; Los Altos 2005: 0.24 failures/100 miles/year.) Assessment: Fewer pump station failures than the reported average and an improvement from data reported in 2005.

3.4.1.7 Odor Complaints

The City has not had any recent reported odor complaints. (WERF/ASCE: data not reported.) Assessment: The City has prevented odors from being a problem with the collection system.

3.4.2 Performance Goals

SSMP regulations require the establishment of capacity, management, O&M goals. The basic goals for SSMP are:

- Properly manage, operate and maintain all parts of the collection system.
- Provide capacity to convey base and peak flows.
- Minimize the frequency and severity of SSOs.
- Mitigate the impact of SSOs.

Goals 1, 3, and 4 are related to the City's O&M program. From the above analysis, the City's maintenance program performs well versus the national or state averages for each of the reported system performance parameters. Modifications to the City's O&M program since 2005 have resulted in significant reductions to dry weather SSOs and stoppages. Also, the City's improved stoppage response time has reduced the impact of SSOs, allowing 98 percent of the SSO volume to be returned to the sewer in 2010. It should be noted that meeting national averages is not by itself adequate to demonstrate acceptable performance of the collection system. The requirement of state and federal regulations is to prevent all SSOs. The purpose of SSMP is to ensure adequate management, operation and maintenance of collection systems to minimize SSOs among other things. The data received for this Master Plan Update indicates improved performance of the collection system.

3.5 Analysis of Existing Maintenance Programs

The existing maintenance program analysis considers current maintenance activities, staffing, equipment and tools, and automation. Each component is discussed below.

3.5.1 Current Maintenance Activities

The City has a maintenance program and it is documented in the SSMP. A summary of the City's current maintenance activities is provided below.

Complaint Response. The City responds to customer complaints about sewer service. Complaints are generally related to sewer stoppages or overflows; generally due to root intrusion in the service lateral. Response is performed by the collection system staff during work hours and the standby worker during off work hours. Response includes assessing the complaint and resolving the problem. The majority of the complaints are related to stoppages in the main or lateral sewer. During work hours, a cleaning crew is diverted to remove stoppages. The City reports that its average initial response time is approximately 13 minutes. During non-work hours, the City has staff on stand-by to address complaints.

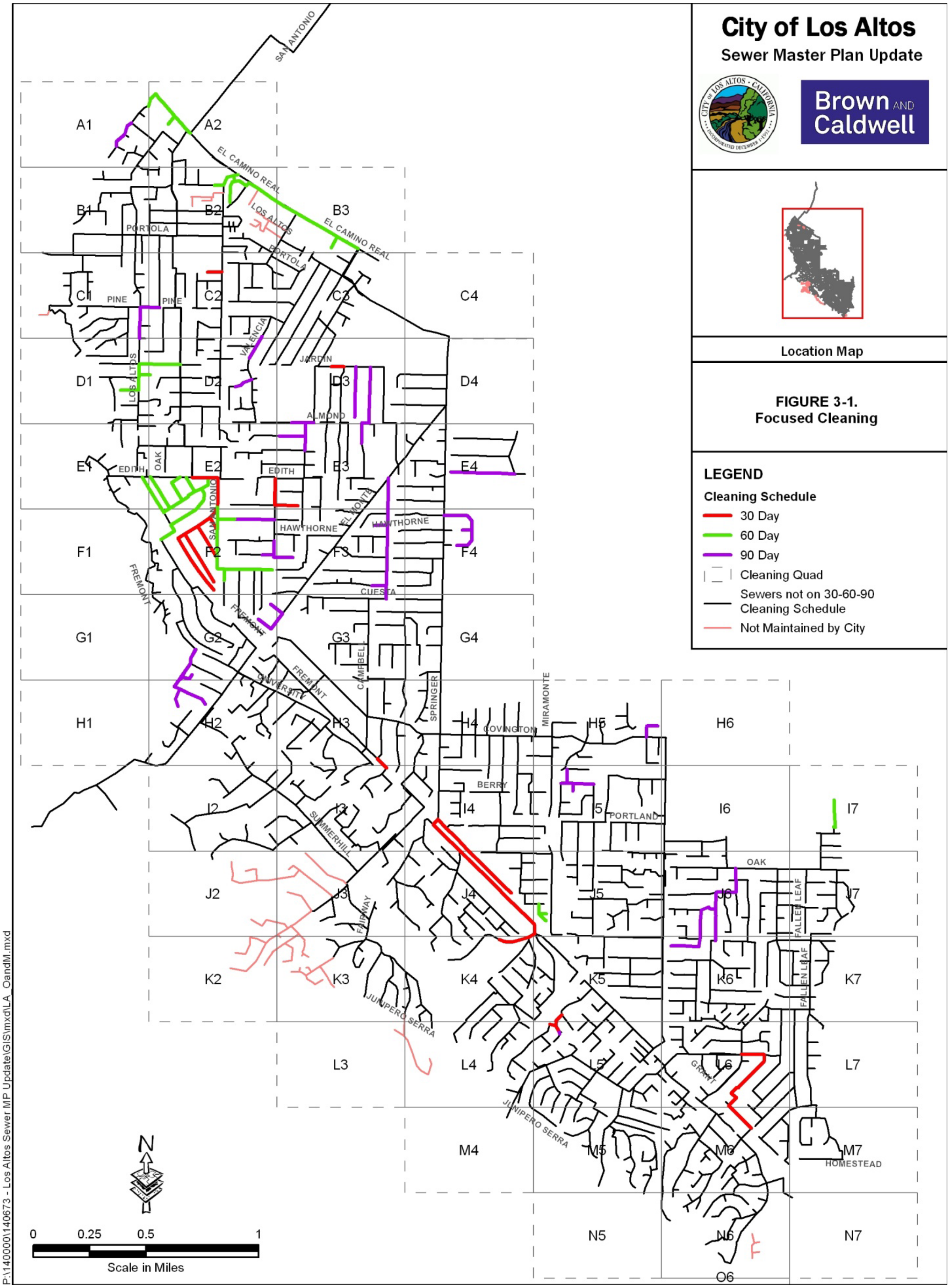
Sewer Main Cleaning. The primary sewer maintenance activity is sewer main cleaning. The City's maintenance service area is divided into quadrants, which are delineated by GIS grid lines. Sewer cleaning in the City includes focused cleaning on specific reaches with histories of stoppages and cyclic cleaning of the remainder of the sewer mains within the City up to 12 inches in diameter.

The focused cleaning program cleans 67,000 lf of sewer on 30-, 60-, or 90-day cycles which is approximately nine percent of the sewers within the City and County. Information on the focused cleaning program is summarized in Table 3-2 and presented on Figure 3-2. The downtown area has the highest percentage of sewers in the focused cleaning program. This is due to the high concentration of restaurants and potential for grease stoppages. The City currently performs cyclic cleaning of sewers in the City and County that are not in the focused cleaning program, with a goal of completing the system every 18 months. The 18-month cycle is aggressive compared with industry standards, but it has significantly lowered the City's dry weather stoppage and SSO rates over the past six years and is achievable with current staffing resources.

Focused cleaning is performed primarily by jetting. Root cutting is performed with chain flail attachments on the jetters or with mechanical cutters. The City also has a chemical root control program with application to one-third of the system each year. This program has been in effect for three years and its effectiveness has not yet been assessed through CCTV inspections, though stoppage and SSO rates are decreasing.

Table 3-2. Focused Cleaning Program

Cleaning Frequency (days)	City/County Cleaning (lf)
30	19,781
60	20,082
90	27,260
Total (feet)	67,123
Total (feet/year)	466,904


City of Los Altos
Sewer Master Plan Update
Brown AND Caldwell
Location Map
FIGURE 3-1.
Focused Cleaning
LEGEND
Cleaning Schedule
30 Day
60 Day
90 Day
Cleaning Quad
Sewers not on 30-60-90 Cleaning Schedule
Not Maintained by City
N
0
0.25
0.5
1
Scale in Miles
P:\140000\140673 - Los Altos Sewer MP Update\GIS\mxd\LA_OandM.mxd
SAN ANTONIO
EL CAMINO REAL
LOS ALTOS
PORTOLA
PINE
VALENCIA
JARDIN
ALMOND
EDITH
OAK
SAN ANTONIO
HAWTHORNE
EL MONTE
CUESTA
FREMONT
UNIVERSITY
CAMPBELL
SPRINGER
MIRAMONTE
COVINGTON
BERRY
PORTLAND
SUMMERHILL
FAIRWAY
JUNIPERO SERRA
GRANT
FALLEN LEAF
HOMESTEAD
A1
A2
B1
B2
B3
C1
C2
C3
C4
D1
D2
D3
D4
E1
E2
E3
E4
F1
F2
F3
F4
G1
G2
G3
G4
H1
H2
H3
H4
H5
H6
I2
I3
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I6
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K7
L3
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L5
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M4
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M6
M7
N5
N6
N7
O6

Sewer Repairs. City collection system staff perform minor repairs of sewer mains. Major repairs or improvements are performed by outside contractors.

Sewer Inspections. Over the past five years, the City has completed CCTV inspection of 93 percent of its system, not including the large diameter trunk sewers greater than 24-inches in diameter. These sewers were inspected as part of the 2005 Master Plan. The City conducts visual surface manhole inspections as part of the focused and cyclic cleaning programs and when following up on stoppages. The City also conducts visual inspection of the ground surface above gravity sewers in creeks to identify potential leaks and after street resurfacing to locate buried manholes. When roots are observed protruding into the main from a service lateral, the homeowner is notified by letter.

Grease Control. The City has an ordinance that prohibits the discharge of grease into the sewer system. Grease removal devices are required for all commercial and industrial facilities with grease generating activities. Recently, staff from the Regional Plant performed an inspection and inventory of all restaurants in the City, identifying some without grease traps or interceptors. The City has followed-up with some of these businesses, but needs more staff resources to do so. The City also has information about grease control on its web site.

Pump Stations/Force Mains. The City performs weekly visits to each of the three pump stations to read run time meters, check for debris and address other problems. Comprehensive pump maintenance is performed every two years. No maintenance is needed on the force mains because they are extremely short and have no air release valves. The City provides all routine maintenance for the three pump stations. Van Buren lift station was recently upgraded. Pine Lane lift station no longer receives flow from the Town and was moved into the street. The City's newest lift station, Blue Oak Lane, was installed in 2010 to serve an area that was annexed by the City (formally in the County). All lift stations include grinder pumps and 2-inch diameter force mains.

Odor Control. The City rarely receives odor complaints. Since odors are not a problem, the City has no official odor control program in place. If complaints are received, the City flushes the sewer lines and attempts to plug holes in the manhole lids where odors may be escaping the system.

Service Laterals. The City does not have any responsibility to maintain service laterals including the portion in the public right-of-way. However, the City currently repairs laterals that are located in the public right-of-way. As part of the procedures for responding to service complaints, the City determines if the lateral between the property line and the main is plugged. If a cleanout is available at the property line, City staff rods the "lower" lateral if needed at that time at no cost to the customer. The City also televises this portion of the lateral if needed.

Flow Monitoring. The City conducted flow monitoring of the sewer system during the 2005 Master Plan to establish flow rates for dry and wet weather. Other than the Palo Alto master meter, the City is in the process of implementing a program to monitor all flows entering the City from the Town as required by the City's agreement with the Town.

Corrosion. Over 93 percent of the pipe material in the City's GIS is identified as vitrified clay pipe (VCP) which is inert and does not need corrosion control. However, inspections performed over the past five years indicate that some of the VCP is incorrectly identified and the pipe material is actually asbestos cement, which is susceptible to corrosion. A condition assessment on the City's reinforced concrete trunk sewers to Palo Alto showed deterioration due to corrosion. Four projects to address this problem have been identified and are included in the CIP.

3.5.2 Staffing

The City's budgeted staff (excluding administrative staff) for wastewater collection system operation and maintenance is provided in Table 3-3. The five maintenance workers make up two, two-person sewer cleaning teams and one, one-person initial responder team. One team, combined with the straight or combo flush truck is responsible for the City's focused 30-, 60-, 90-day cleaning cycle. The other team is responsible for 30-, 60-, 90-day cleaning as needed, quadrant cleaning (cyclic), follow-up cleaning, supplemental cleaning and mainline CCTV of sewer mains with the lateral camera. The initial responder also performs Underground Service Alerts (USAs), lift station inspections and sewer lateral rodding. Two associate level engineers (1.25 FTE) manage the City's ongoing CCTV and root foaming projects and provide mapping and GIS updates. Since the 2005 study, the Sewer Supervisor was filled by the person previously performing the Maintenance Leadworker position. The Leadworker position was eliminated at that time, but this position is critical to the overall operation of the department and would be useful for direction of the maintenance worker staff.

Table 3-3. Current Sewer Maintenance Staffing Level

Position	FTE
Sewer Supervisor	1.0
Maintenance Worker II	1.0
Maintenance Worker II	1.0
Maintenance Worker II	1.0
Maintenance Worker II	1.0
Associate Civil Engineer	1.25
TOTAL	6.25

3.5.3 Equipment and Tool Inventory

An inventory of the equipment and tools used by the City to maintain the wastewater collection system is provided in Table 3-4. The estimated remaining life of each of these items was calculated based on the date of purchase and the City's estimated length of service. Specialized attachments are often used with these tools to perform specialized maintenance tasks such as root removal or dislodging grease stoppages.

3.5.4 Automation

The City currently utilizes some limited automated functions within their operations and maintenance program. Each of the City's pump stations (except Van Buren) is equipped with a telephone-based alarm system to alert staff in the event of a problem or failure. The City has a GIS that includes the collection system and uses the Computerized Maintenance Management System (CMMS) software OPRA to manage work orders.

3.6 Design and Construction Standards and Specifications

Standards and specifications address design and construction of new sewers, sewer repairs and sewer rehabilitation. The City's current public sewer construction standards, details and specifications were adopted in 2010 and include instructions for construction, inspection and testing of sewer construction activities. Specialized sections for CCTV inspection and root foaming are also included.

Table 3-4. Current Equipment and Tool Inventory				
Description	Year	Use	Typical Useful Life (years)	Estimated Replacement Year
Tractor/Backhoe	2001	Sewer repairs	15	FY15-16
Flushing Truck (Jetter)	2003	Sewer flushing	10	FY14-15
Vac-Con Sewer Cleaner (Combination Jet/Vacuum)	2011	Sewer flushing/vacuuming	10	FY20-21
Dump Truck (2-Yard)	2005	Haul sewer debris	10	FY14-15
Sewer Supervisor Truck	2011	Supervisor vehicle	10	FY20-21
Service Truck	2011	24-hour standby vehicle	5	FY15-16
Pickup Truck	2004	Sewer service truck	10	FY13-14
Compactor/Rammer	NA	Sewer trench compaction	10	FY 15-16
Gas Generator	2007	Portable power for hand tools and lighting	5	FY15-16
Diesel Generator	1996	Emergency backup generator	10	FY12-13
Sectional Rodder	2007	Root removal from sewer lines	10	FY16-17
Lateral Rodder (2)	2011	Sewer lateral and easement rodding	5	FY 15-16
Root Cutters (2)	2007	Sewer pipe cleaning	5	FY16-17
CCTV Lateral Camera	2011	Televising sewer laterals	5	FY16-17
Portable Trash Pumps (2)	2002	Sewer bypass pump	10	FY12-13
Mobile Radios (12)	2009	Field vehicle communication	5	FY14-15
Gas Detection Monitor (4)	2010	Confined space entry	10	FY19-20
Safety Tripod	1995	Confined space entry	10	FY16-17

Section 4

Hydraulic Model Development

This section discusses the development of the hydraulic model. The hydraulic model was developed as part of the 2005 Master Plan and was reviewed as part of this Master Plan Update. No changes to the hydraulic model were determined to be needed for the 2012 Update. The Pine Lane Pump Station flow from the Town no longer enters the City. The 2005 Master Plan hydraulic analysis determined that the hydraulic deficiency downstream of the pump station would no longer be deficient should the pump station flows be re-directed. Therefore, this section is essentially the same as in the 2005 Master Plan.

The hydraulic model, along with the flow projections, was used to evaluate capacity needs for current and future flow conditions and to complete the hydraulic assessment portion of the Sewer Master Plan Update. The development of the hydraulic model included the selection of the hydraulic modeling program, the approach used to convert available information for the hydraulic model network, and development of input nodes and tributary areas used to load projected wastewater flows into the model.

Information on current and future wastewater flows is presented in Section 5 and the results of the hydraulic assessment are presented in Section 6.

4.1 Hydraulic Model Selection

Two basic types of hydraulic modeling programs are available for collection systems: static and dynamic. Dynamic models have the ability to describe the elevation of the hydraulic grade line over time as flow conditions change. Static models can only estimate hydraulic conditions at a specific point in time. Dynamic models require information on both upstream and downstream boundary conditions. Static models require only that the upstream boundary condition (flow input) be described. Static models are typically easier to understand and use. Fully dynamic models can more fully evaluate complex hydraulic conditions such as weirs, overflows, surcharging and backwatering. For this project, the dynamic model MOUSE was selected. Using MOUSE allows surcharging under peak flow conditions to be accurately evaluated. This can potentially reduce the cost of capital improvements to address capacity problems for communities that are near build-out such as the City.

MOUSE has a state-of-the-art interface and is easy to manipulate. In the future, if the City wants to convert to another model, the conversion would not be onerous since a complete set of physical attribute information for the pipes and manholes will be available in the model and City GIS. MOUSE can also be expanded in the future to include storm water modeling.

4.2 Network Development

The City provided BC with a copy of the most recent GIS data. The GIS provided basic information on pipes and manholes that were needed to develop the hydraulic model. The City's GIS includes information on the pipelines slope, length and diameter.

The City's sewer system hydraulic model includes nearly 140 miles of gravity sewer pipes ranging in size from 6 to 42 inches in diameter. With the exception of three small lift stations, wastewater flows by gravity from the City service to the Regional Plant. Figure 4-1 shows the modeled sewer network. Information on the model sewers is summarized in Table 4-1.

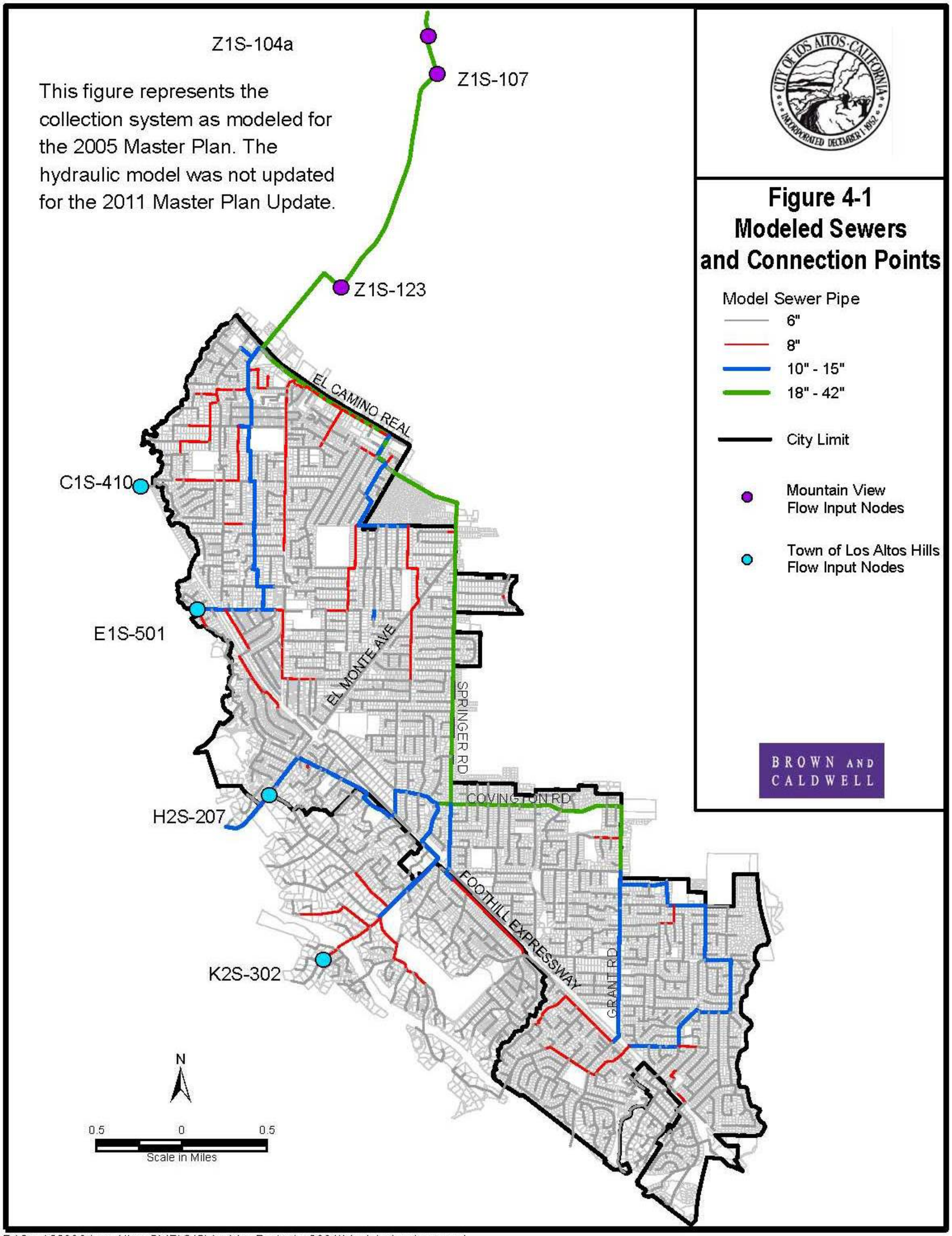

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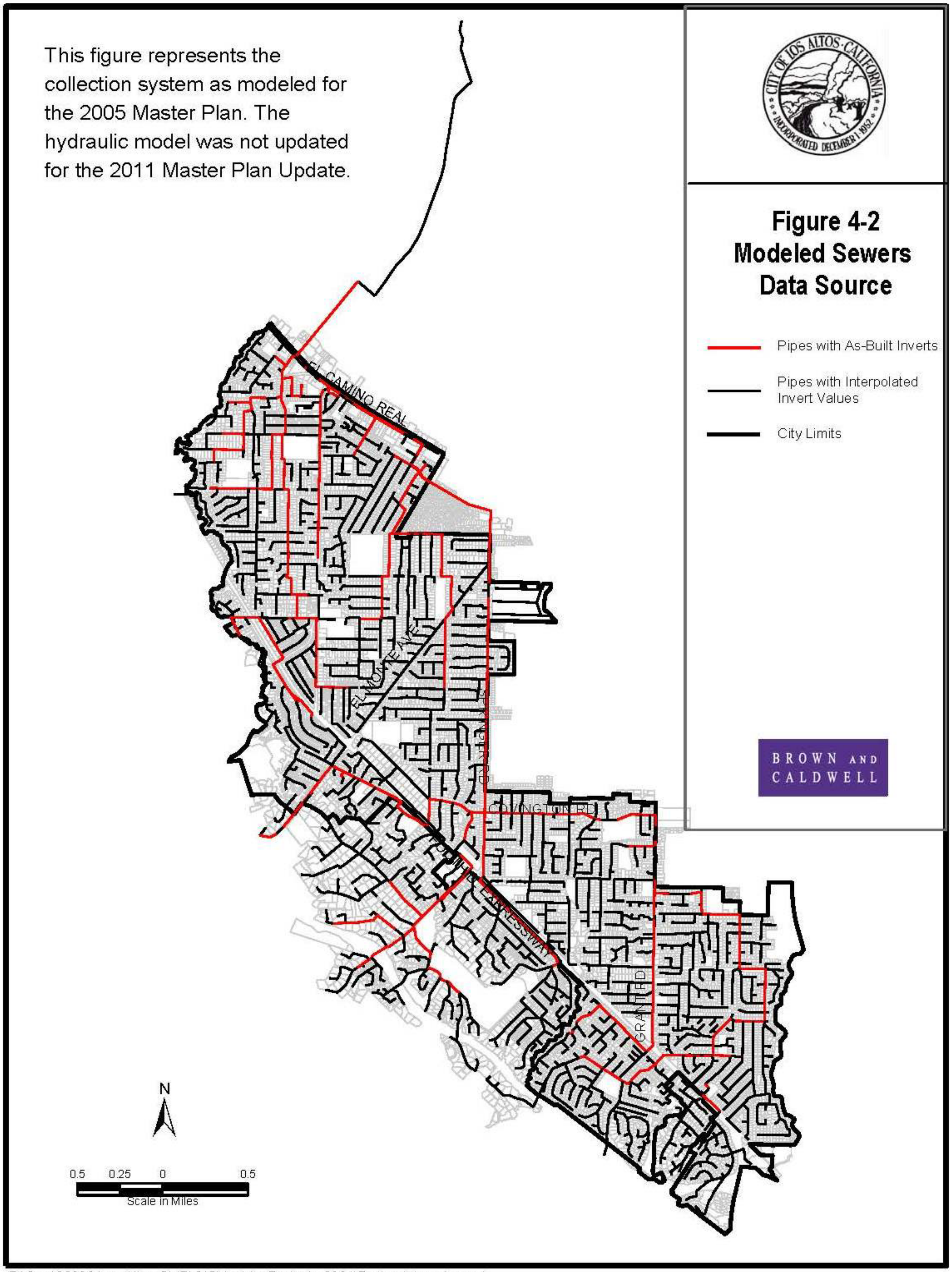
Table 4-1. Summary of Modeled Pipe Network	
Diameter, inch	Length, feet
4	140
6	578,997
8	62,135
10	6,893
12	29,007
15	15,231
18	1,461
24	6,339
27	4,808
30	18,913
33	549
36	302
39	4,632
42	1,676
Total	**731,084**

The hydraulic model requires the invert elevations of the pipelines to accurately predict the elevation of the hydraulic grade line. This information was not available from the City's GIS. BC and City staff concluded the best method to populate the pipeline database with invert elevations was to review as-built and record drawings for the major trunk sewers. Information from the review was then added to the pipeline database. A computer routine was developed to calculate the invert elevations for the remaining pipelines based on the elevations from the City's as-built plans and the pipeline slope and length information. The derived elevations were added to the pipeline database. Figure 4-2 indicates the lines in the collection system with as-built invert elevations and the lines with calculated invert elevations.

The three pump stations in the collection system were not included in the hydraulic model. One is too small and the other two are at the upstream ends of the model. However, the pump stations were included in the assessments for this Master Plan Update.

4.3 Input Nodes and Tributary Basins

Flow is added to the hydraulic model at input nodes. Input nodes are located at the termination of each reach of modeled sewer and intermediate locations between the upstream and downstream ends of the model network. Approximately 3,200 input nodes are used to enter flow into the modeled network. Input nodes include most manholes and the upstream ends of the model network.



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Wastewater from the Town enters the model at four input nodes. These nodes correspond to the actual connections between the Town's collection system and the City's collection system. The 2012 Update determined one of these connections no longer exists after the flow from the Town that entered the City through Pine Lane Pump Station was redirected to the Palo Alto collection system. The City's collection system also receives wastewater from Mountain View at three locations.

Tributary basins were identified for each input node within the City's collection system. Tributary basins were developed on a parcel basis using the GIS and the Thiessen polygon technique. The Thiessen polygon technique is a mathematical method used to assign the centroid of each parcel to the nearest input node. The resulting tributary basins were reviewed to identify parcels that are not included in a tributary basin or parcels near the boundary of two tributary basins. The tributary basin boundaries were adjusted and parcels were assigned to the most appropriate input nodes.

Tributary basins were not developed for the portions of the Town and Mountain View that discharge to the City's collection system. The collection system in these areas was not included in the GIS and the hydraulic model does not extend into these areas. Wastewater flows from these areas were calculated with other information as discussed in Section 5.

Section 5

Flow Monitoring and Flow Projections

This section presents the results of the City's flow monitoring program in the winter of 2002 and the current (2011) and future flow projections for the City, Town, and Mountain View.

The 2012 updates to the 2005 Flow Monitoring and Flow projections include:

- Confirm that existing flows in 2011 are essentially the same as in 2005.
- Update future flows based on the 2009 Housing Element.
- Update flows from the Mountain View based on the 2010 Sewer Master Plan.

Flow projections for the City are based on land use information from the City's General Plan 2002-2020, the City's 2009 Housing Element, and unit flow factors developed from water use and wastewater flow data. Flow projections for the Town are based on information from the Town's Sewer Master Plan and additional analysis performed for this Master Plan Update. Flows from Mountain View are based on flow data and population data.

The current and future flow projections are used to perform the hydraulic assessment which is discussed in Section 6.

5.1 Flow Components

Typically, wastewater consists of three components: base sanitary flow (BSF), groundwater infiltration (GWI), and rainfall dependent infiltration and inflow (RDI/I). These components are shown generically on Figure 5-1. BSF and GWI, during dry weather, constitute dry weather flow (DWF). BSF is generated from residential, commercial, industrial and public sources that discharge into the wastewater collection system. BSF varies during the day in a diurnal pattern with the lowest flow during early morning hours when most people are asleep and businesses are closed, and the peak dry weather flow in mid-morning after people get ready for their day's activities. GWI occurs when groundwater levels are above the inverts of the collection system pipes and when the collection system has faulty joints or other defects that allow infiltration. RDI/I occurs during wet weather conditions and causes the wastewater flow to increase.

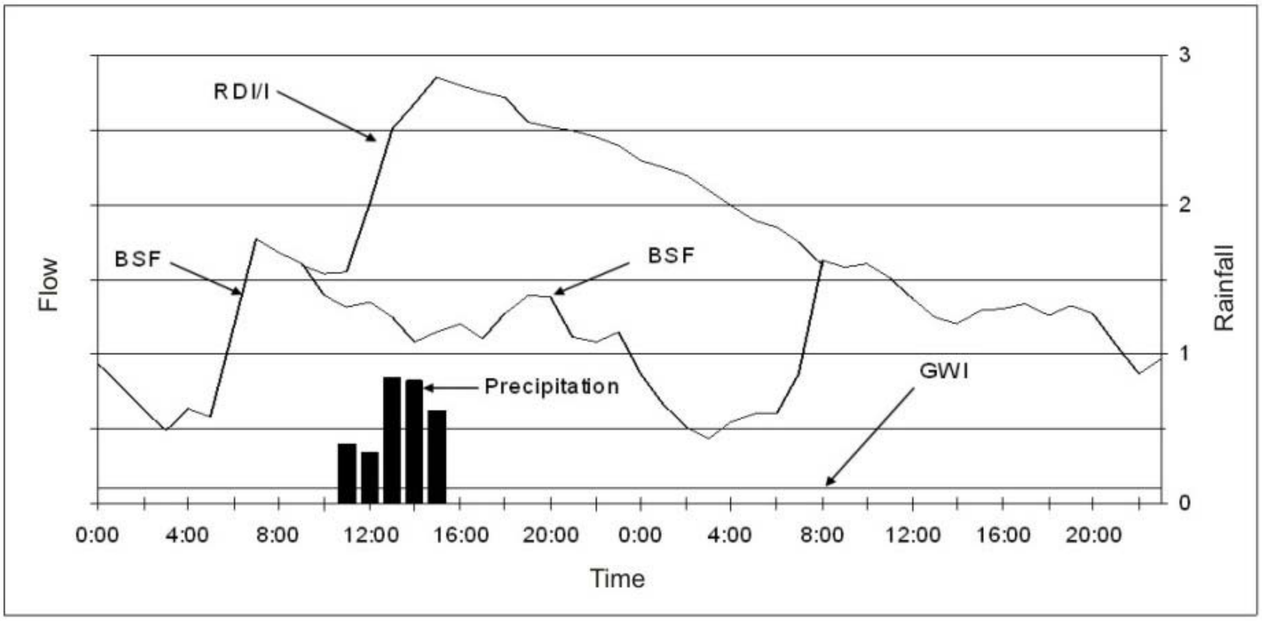


Figure 5-1. Generic Wastewater Components

GWI is infiltration that is not directly related to a specific rainfall event. GWI rates are a function of the condition of the collection system and the proximity of the collection system pipelines to groundwater. Gravity sewers constructed prior to the 1960's were typically vitrified clay pipes with rigid concrete mortar joints. This type of pipeline is highly susceptible to GWI because the rigid joint material deteriorates rapidly and allows ground water to infiltrate. The majority of the sewers in the Town and City are in this category. Additionally, a large portion of the Town's collection system was constructed in or near creeks and waterways.

5.2 Flow and Rainfall Data

Flow data are available from the master meter at the Regional Plant, the temporary flow monitoring for the City in 2002, a permanent flow meter located on the principle connection of a portion of the Mountain View collection system to the City's trunk sewer, and temporary flow monitoring for the Town.

Regional Plant Master Meter. Average daily flow data were obtained from the master meter from 1998 through 2002 and for April through June 2010. The flows were already adjusted by Regional Plant staff to remove the flow contribution from Mountain View. Mountain View has a flow meter located near the connection to the City's trunk sewer at manhole Z1S-123. This meter did not operate for several years including 2002. The Regional Plant staff estimated Mountain View's average daily flow contribution to the flow in the City's trunk to be 0.7 mgd based on previous flow data and subtracted 0.7 mgd from the daily flow measured by the master meter. The resulting flow data represents the combined flow from the City and the portion of the Town that connects to the City's collection system. Flow and precipitation data are presented in Appendix G.

The average daily dry weather flow from August and September 2002 was 2.86 mgd. The average daily flow from February 20, 2002 through March 5, 2002 was 3.01 mgd. No precipitation occurred during this period. The higher average daily flows during February and March may be attributed to greater GWI. The average daily dry weather flow for June 2010 was 3.45 mgd. No precipitation occurred during June 2010, however, there was 5.2 inches of rain from April 1, 2010 through May 27, 2010 according to data from the Western Regional Climate Center (WRCC) RAWS for the Los Altos meter (http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?caCALT). The higher average daily flow may be attributed greater GWI. The flow from the Town that previously entered the City's collection system through the Pine Lane Pump Station is now being diverted to the Palo Alto collection system. This flow was estimated to be 0.05 mgd in 2002 (0.11 mgd in the future) and is not included in the master meter flow any longer.

The largest measured daily flow including 0.7 mgd for Mountain View during the 2002 flow monitoring period was 4.15 mgd on March 23, 2002. This day received the second most rain during the monitoring period. In comparison, between 1998 and 2002 the highest daily flow was 7.40 mgd. The largest daily flow including the flow for Mountain View from April 1, 2010 to July 1, 2010 was 6.54 mgd on a day with 1.6 inches of rain. The 2010 flow does not include flow from the Town that previously entered through the Pine Lane Pump Station.

2002 Flow Monitoring. The 2002 flow monitoring program was conducted for the City by E2 Consulting Engineers (E2), located in Emeryville, California. Flow monitoring data was collected at eight sites from February 19, 2002 until April 12, 2002 and three rain gauges were installed to record rainfall depth. Flow monitor locations are summarized in Table 5-1 and shown on Figure 5-2.

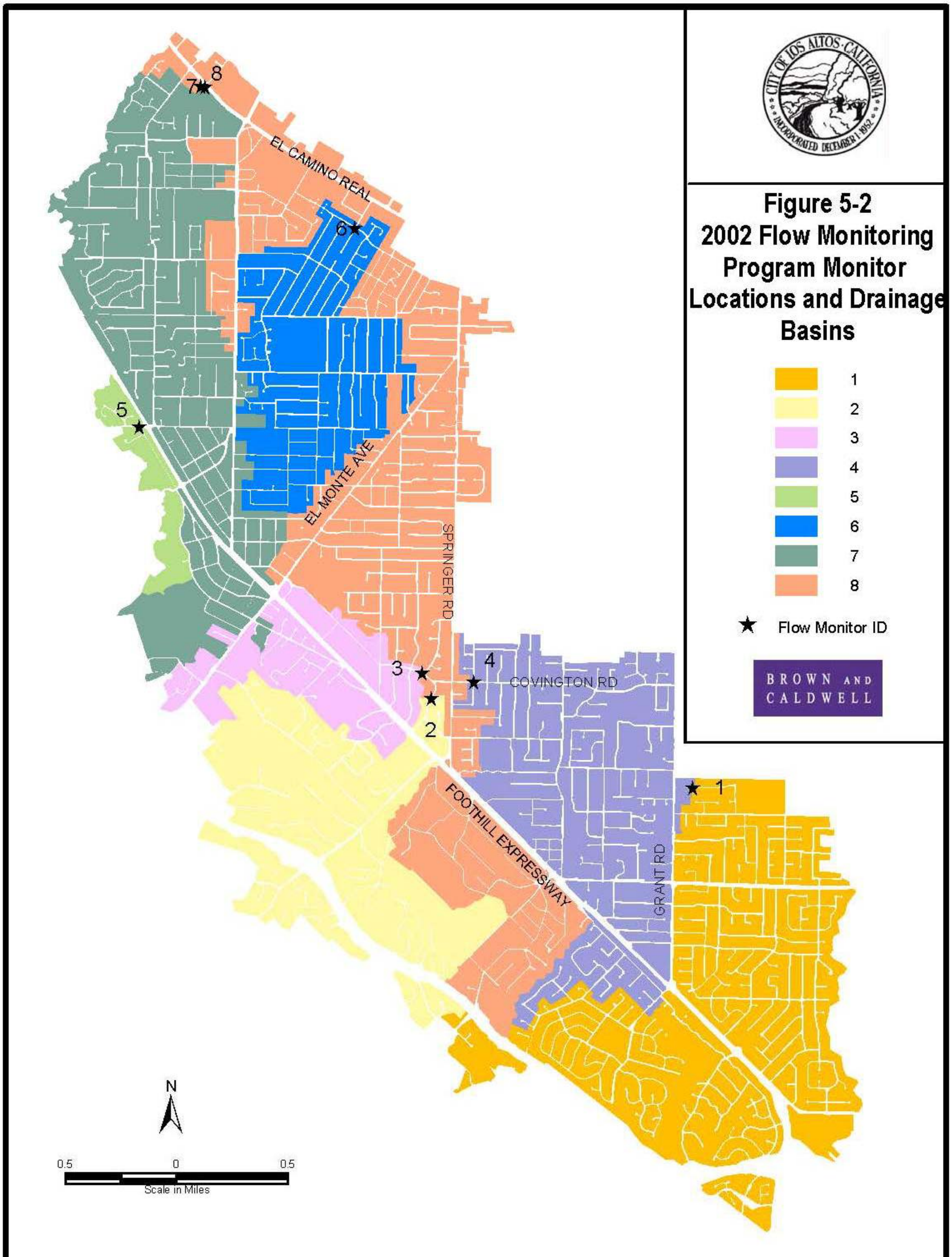
Table 5-1. 2002 Flow Monitoring Program Monitor Locations

Flow Monitoring Number	Manhole	Location	Pipe Size, inch
1	I6S-405	1360 Miravalle Avenue	15
2	H4S-411	1052 Riverside Drive	12
3	H4S-404	630 Covington Road	15
4	H4S-509	900 Spencer Way	24
5	E1S-602	300 W. Edith Avenue	12
6	C3S-204	300 Marich Way	10
7	A2S-407	4410 El Camino Real	18
8	A2S-408	El Camino Real at Del Medio Avenue	30

A drainage basin is defined as a collection of pipes and parcels that drain through a point. In this case, drainage basins were delineated by flow monitor locations. The drainage basins upstream of flow monitors 1, 2, 3, and 5 are terminal basins. The basins upstream of the other monitors also include flow from one or more of the terminal basins. The drainage basins are shown in Figure 5-2.

Flow measured during the program included flow from the Town, although flow monitors were not located to directly measure the Town's flow. Flow from Mountain View was not measured.

Maintenance, data collection and calibration of the flow monitors were conducted weekly by E2. The depth and velocity of sewage flow was measured by hand with a carpenter's ruler and recorded. Instantaneous depth and velocity were also recorded. Comparisons of measured and metered depth and velocity data were conducted to verify the accuracy of the flow monitors.



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Flow Calculation. Two methods were used to calculate flow: the depth-versus-flow, and area and velocity calculation.

The depth-versus-flow method utilizes the calibration depth and velocity data to develop a best-fit relationship between depth and velocity. The curve derived from this calculation should match the field calibration measurements with a correlation coefficient of 95 percent or better. The curve is also used to create a continuous flow hydrograph for each flow monitoring site.

The area and velocity calculation was used to calculate the hourly flow. The calculation is a modified version of the continuity equation that uses the following: flow is equal to the cross-sectional area (calculated based on pipe diameter and measured depth), multiplied by the recorded velocity. E2 correlated velocity values with depth values within their computer program in order to establish a site-specific, measured depth-versus-velocity relationship over a wide range of depth values. These relationships factor in the site-specific characteristics (i.e., debris, slope and roughness conditions).

Rainfall. Rainfall was measured by E2 using three tipping bucket rain gauges. The rain gauges recorded the occurrence of only two storms during the flow monitoring period. These storms occurred on March 17 and 23, 2002. Table 5-2 shows the total rainfall depth recorded for each storm event at each rain gage.

Table 5-2. Total Rainfall Depth

Rain Gage	Depth, inch	
	March 17, 2002	March 23, 2002
1	0.55	0.36
2	0.59	0.34
3	0.53	0.33

Flow Data Summary. Table 5-3 lists both average and peak DWF and peak wet weather flow (PWWF) calculated by E2 for the two storms that occurred during the monitoring period.

Table 5-3. Flow Monitoring Results

Flow Monitor	Dry Weather Flow, mgd		Peak Wet Weather Flow, mgd	
	Average	Peak	March 17, 2002	March 23, 2002
1	0.46	0.95	1.11	1.04
2	0.32	0.52	0.67	0.53
3	0.29	0.77	0.93	0.52
4	1.03	1.42	1.41	1.41
5	0.08	0.13	0.14	0.12
6	0.33	0.78	0.71	0.61
7	0.95	1.73	1.55	1.46
8	2.70	4.59	5.08	5.16

The average DWF listed above is based on flows from February 20, 2002 through March 5, 2002. No rain occurred during this period. The peak flows are the peak hourly flow recorded during the same dry weather period or during the indicated storms.

Since the City does not experience capacity related SSOs and projected growth is very small, additional flow monitoring was determined not to be needed in 2010.

Mountain View Permanent Flow Meter. The permanent flow meter is located near the connection to the City's trunk sewer at manhole Z1S-123 and is used by Regional Plant staff for determining wastewater billing purposes. The meter was out of service from some time before 2002 until December 2004. Before the meter went out of service in 2002, the average daily flow was 0.7 mgd. After the meter returned to service in 2004, the average daily flow was 0.9 mgd. Flow meter data for August 2010 through February 2011 also averaged 0.9 mgd.

Town Flow Monitoring. Temporary flow monitoring was performed in the Town as part of their Master Plan. Dry weather flow monitoring occurred at four locations from October 3, 2002 to October 18, 2002 and wet weather flow monitoring occurred at two locations from February 13, 2003 to March 12, 2003. Rainfall occurred on seven days during the wet weather flow monitoring program.

5.3 Dry Weather Flow Projections

Current and future dry weather projections were developed for the City, Town and Mountain View. The projections for each agency are discussed below. The City collection system currently provides service to most residents within the City, an unincorporated area, part of the Town, and small portions of Mountain View that discharge into the City's main trunk sewer. This section presents the approach for developing flow projections for each of these areas.

5.3.1 City Flow Projections

Flow projections for the City and unincorporated areas are based on the City's GIS, General Plan 2002-2020, the City 2009 Housing element and flow data.

Geographic Information System Data. The City provided GIS data for the parcels in the City and the unincorporated area that discharges to the City's collection system for the 2005 report. The parcel data are the basis for the flow projections.

Land Use. Existing and future land use for the City and unincorporated area are based on City's General Plan 2002-2020 and information from James Walgren, the City's Director of Community Development. The unincorporated area that discharges to the City's collection system is within the City's sphere of influence and is included in the General Plan 2002-2020. The discussion presented in this section includes both the area within the City and within the unincorporated area.

The City's land use information was applied to the GIS parcels and adjusted to reflect the land uses from the General Plan 2002-2020. The City has 15 land use codes. These were consolidated into 11 land use designations for this Master Plan Update. The consolidation of land use categories is summarized in Table 5-4. The General Plan residential land uses are based on the number of dwelling units (du) per net acre. The area of streets and freeways are not included.

Table 5-4. Land Use Categories		
Land Use Code	Master Plan Description	General Plan Description
Residential		
SF-L	Single Family large lot	Single Family (0-2.0 du/Net Acre)
SF	Single Family	Single Family (3.0-4.0 du /Net Acre) Single Family (5.0-10.0 du /Net Acre)
MF	Multi Family	Low Density Multi Family (8.0-15.0 du /Net Acre) Medium Density Multi Family (16.0-38.0 du /Net Acre) Senior Housing (7.5-28.0 du /Net Acre)
Non-Residential		
DC	Downtown Commercial	Downtown area
NC	Neighborhood Commercial	Includes several locations
TC	Thoroughfare Commercial	El Camino Real corridor
PI	Public and Institutional	
S	Public and Private School	
PC	Planned Community	
OS	Open Space	
P	Parks	

The current land use is shown on Figure 5-3 and current and future land use acres are summarized in Table 5-5. A listing of land use by basin is presented in Appendix H. The land use figure and tables were developed for collection system planning purposes only and should not be used for other purposes. The portions of the City that do not discharge wastewater to the City's collection system are not included in the figure or table. The area is net acres and does not include streets.

Table 5-5. Land Use			
Land Use Code	Description	Existing area, acres	Future area, acres
Residential			
SF-L	Single Family large lot	428	428
SF	Single Family	2,621	2,621
MF	Multi Family	84	84
Non-Residential			
DC	Downtown Commercial	43	43
NC	Neighborhood Commercial	41	41
TC	Thoroughfare Commercial	58	60
PI	Public and Institutional	113	113
S	Public and Private School	156	156
PC	Planned Community	67	67
OS	Open Space	126	126
P	Parks	21	21
VAC	Vacant	2	0
	Total	3,760	3,760

According to the General Plan 2002-2020, the City is essentially a built-out community with most of the development occurring between 1950 and 1970. Only two acres were designated as vacant. The City's projected population growth is very low. The population in 2000 was 27,693 and the projected population in 2020 is 28,741. This represents only a 3.8 percent increase in population over almost 20 years. The General Plan 2002-2020 Land Use Element (LUE) lists the following future development and redevelopment that will affect wastewater flows and the 2009 Element update in Table 33B of Appendix B identifies the portion of development that has occurred or is in progress:

Thoroughfare Commercial

- Of 234 potential new units in the El Camino Real corridor, 107 were built by 2009.
- Table 33 from the 2009 Element reports 8.3 acres of vacant land, with 45 potential units, a small adjustment from the original 2 acres of vacant land in the El Camino Real area (Thoroughfare Commercial) and one parcel near downtown that will be single-family residential described in the General Plan 2002-2020 LUE.

Downtown Commercial

- Of the 77 potential new units in Downtown, 22 were either entitled or built by 2009.

Neighborhood Commercial

- Of the 60 potential new units near Foothill Plaza, 42 were built or entitled by 2009.

El Retiro San Inigo (Jesuit Retreat Center)

The 50 potential units in El Retiro San Inigo (Jesuit Retreat Center) will change the existing land use from commercial or vacant to mixed use. Mixed use has commercial use on the ground floor and multi-family use on the floors above. El Retiro is a Planned Community area and the new dwelling units in El Retiro San Inigo will be single family.

Other

According to Table 2 in the Quantified Objectives section of the City 2009 Housing Element (2009 Housing Element), the total estimated number of housing units the City expects to be built or entitled between January 2007 and June 2014 when the next Housing Element period ends is 543 units. The estimated make up of these units are 254 single-family units, 252 multi-family units, 21 second units, and 16 density bonus units.

In the Future Development Potential section of Appendix B: Housing Needs Assessment of the City 2009 Housing Element it states that “it is reasonable to expect that future multi-family and mixed-use projects in Los Altos will continue to be built at densities very close to or exceeding the maximum allowed for the zone.”

In the Areas with Redevelopment and Re-use Potential section of Appendix B: Housing Needs Assessment of the City 2009 Housing Element it states that “Incentives to build housing along El Camino Real, such as allowing additional building stories and increasing allowable floor area, are included in the draft Land Use Element update. Table 34 in this section estimates that there are approximately 24.4 acres of underutilized property that has development or reuse potential with a possible increase from 26 existing units to 284 units.

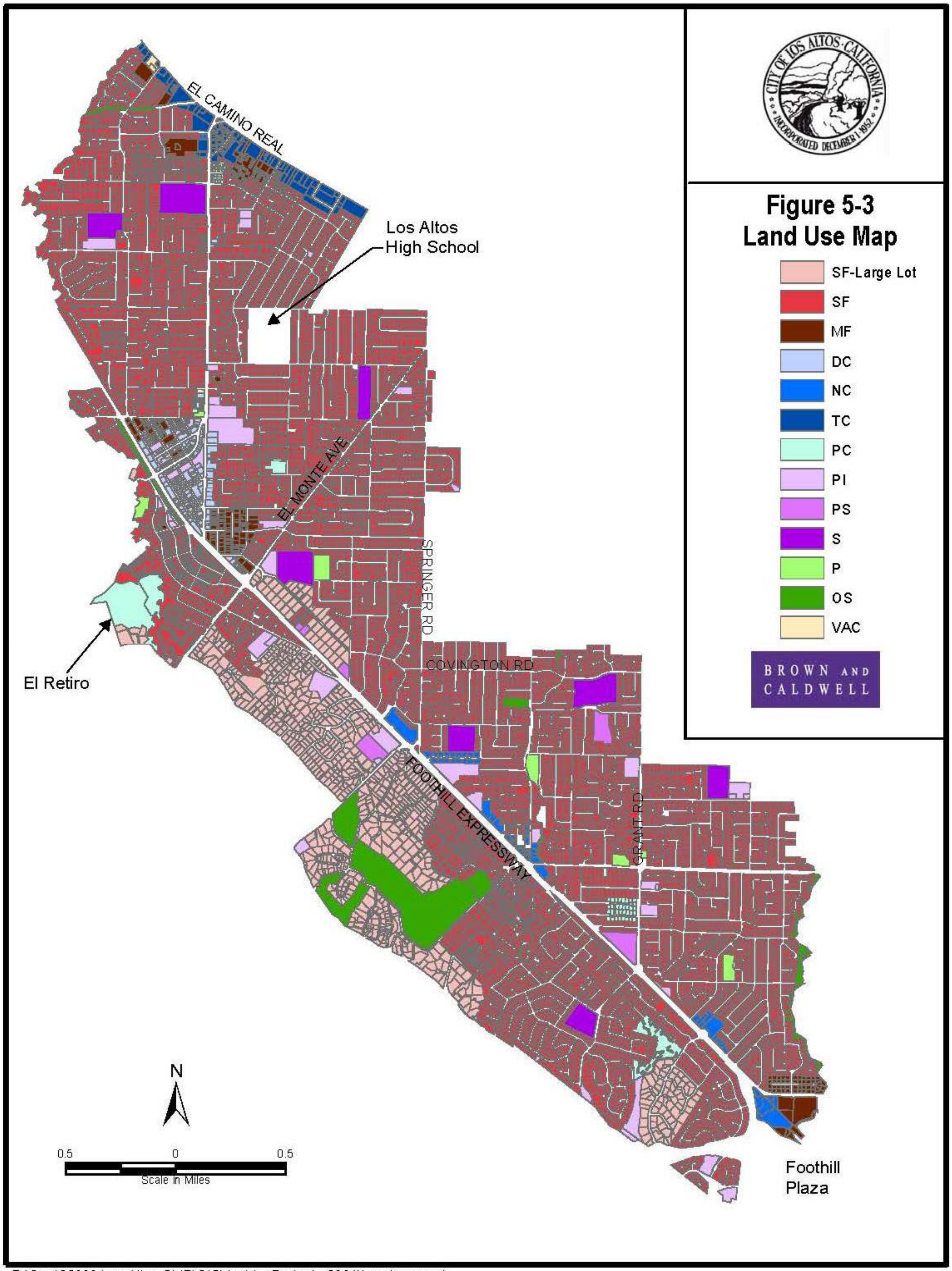

Figure 5-3
Land Use Map

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The City estimates that approximately 100 existing homes are currently on septic tanks and not connected to the collection system. It is anticipated that these homes will eventually connect to the collection system. The Infrastructure and Waste Disposal Element did not identify the specific parcels that are on septic tanks. Since only 100 parcels are on septic tanks, the flow impact of connecting these parcels to the collection system is insignificant to this Master Plan Update and will not be considered.

Base Sanitary Flow. BSF was projected using parcel land use information, parcel size, and unit flow factors. The exception to this approach was single-family and large lot single-family residential. BSF for these land uses was projected on a per parcel basis.

Typical unit flow factors based on BC's experience were assigned to each of the land use categories and the total amount of flow was calculated for each drainage basin. Flow totals were compared to the master meter 2002 flow data and adjustments were made to the unit flow factors until the best overall match was made. Flow data from the 2002 flow monitoring was also compared to the flow projections. The unit flow factors for each type of land use are listed in Table 5-6.

Table 5-6. Unit Flow Factors (Current/Future)

Land Use Designation Code	Land use Generalized for Modeling Purposes	Unit Flow Factor, gpd/acre	Unit Flow Factor, gpd/parcel
DC[1]	Downtown Commercial	500/770	n/a
NC[2]	Neighborhood Commercial	500/1,370	n/a
TC[3]	Thoroughfare Commercial	500/1,090	n/a
S	Public School	1,200/1,200	n/a
PC[4]	Planned Community	500/840	n/a
PI	Public	500/500	n/a
PS	Private School	1,200/1,200	n/a
SF – Large	Single-family large lot	n/a	280/280
SF	Single family	n/a	200/200
MF	Multi family	2,250/2,250	n/a
OS	Open Space	0/0	n/a
P	Park	0/0	n/a
VAC[5]	Vacant	0/n/a	n/a

[1]*Future flow based on 500 gpd + (77 du x 150 gpd/du)/43 acres.*

[2]*Future flow based on 500 gpd + (60 du x 150 gpd/du)/10.3 acres. This unit flow factor only applies to Foothill Plaza.*

[3]*Future flow based on 500 gpd + (234 du x 150 gpd/du)/60 acres.*

[4]*Future flow for El Retiro is based on 500 gpd + (60 du x 200 gpd/du)/35 acres. Future flows for other Planned Community areas are based on 500 gpd/acre.*

[5]*Two vacant parcels are located in the El Camino Real corridor and future flow is based on the TC unit rate. The other vacant parcel is located near downtown and future flow is based on the SF unit rate.*

The unit flow for multi-family residential is based on 150 gallons per day/dwelling unit (gpd/du) and 15 du per acre. Multi-family dwelling units typically have fewer residents than single-family dwelling units. This typically results in multi-family dwelling units having about 75 percent of the flow of single-family dwelling units (75 percent x 200 gpd = 150 gpd).

In 2005, the projected current BSF from the City using the above unit flow rates was 2.64 mgd and the projected BSF from the Town was 0.22 mgd (see below). The 2011 revised BSF from the Town is approximately 0.19 mgd with the Town flow diverted from the Pine Lane Pump Station to the Palo Alto collection system. The combined 2005 BSF was 2.87 mgd which matches very closely to the average daily flow at the master meter during August and September 2002 of 2.86 mgd.

Winter water data for the City was also evaluated to confirm the BSF projections. Data from 2004 was provided by California Water Services (CWS) and is the average of all water customers within the City. The evaluation is based on water data from January and February 2004. These winter months were selected because water used for irrigation should be minimal due to the cooler temperature and rainfall. The water data is summarized in Table 5-7.

Table 5-7. City Winter Water Use Data

Month	Average Water Use per Account, 100 cubic feet per month	Average Daily Water Use per Account, gpd
January	12.32224	297
February	12.0606	311
	Average	304

Water use during this period averaged about 304 gpd per account in the City. BSF is estimated to be about 80 percent of water use during this period. There were approximately 11,461 accounts in the City and unincorporated area. The resulting total projected BSF is 2.79 mgd. This amount is within six percent of the projected City BSF of 2.64 mgd and supports using the unit flow factors in Table 5-7 to project flows.

In the future, several commercial areas within the City are planned to redevelop to mixed use. Future unit flows for these areas are based on commercial plus multi-family residential. The number of multi-family residential dwelling units per acre was determined for each area by dividing the total number of new multi-family dwelling units for the particular area as identified in the General Plan 2002-2020 by the total number of acres in the particular area. Flow from the vacant area located within the El Camino Real corridor was projected using the unit flow factor for thoroughfare commercial (TC) and flow from the vacant parcel near downtown was projected using the single-family unit flow rate.

The 2005 projected future BSF for the City was 2.70 mgd. This represented about a two percent increase in BSF. Based on the 543 units the City estimated to be built or entitled in the 2009 Housing Element, the additional future flow would be approximately 0.09 mgd, making the projected future base flow approximately 2.73 mgd, which represents about a four percent increase in BSF.

Groundwater Infiltration. No evidence of groundwater infiltration was found in the City's collection system.

5.3.2 City of Mountain View

Wastewater from the Mountain View collection system enters the Los Altos trunk sewer at three manholes from the downstream end of the City's trunk sewer as shown in Figure 5-4.

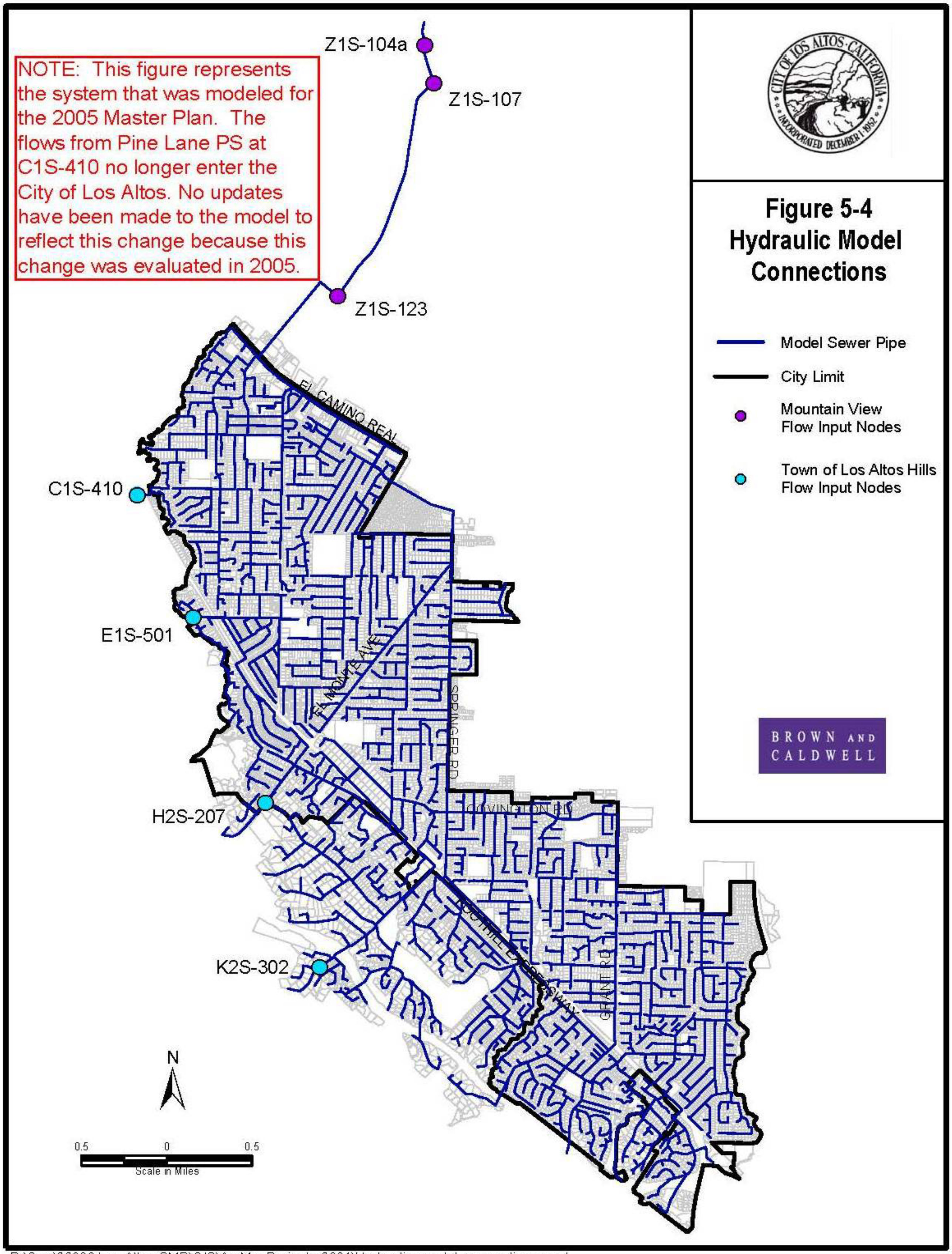

Figure 5-4
Hydraulic Model Connections

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Base Sanitary Flow. The connection at manhole Z1S-123 has a flow meter that measures flow from Mountain View. The other two connections to the City's trunk sewer have much smaller flows. The meter stopped working sometime before 2002 when the flow from Mountain View was about 0.7 mgd. When it stopped working, Regional Plant staff used 0.7 mgd for the Mountain View flow until the meter began operating again in December 2004. The average daily flow in December 2004 was 0.9 mgd. Average daily flows were higher from January through April 2005; however, the increase is likely due to RDI/I because of the high rainfall levels that occurred during this period.

In 1991, Mountain View completed a sewer master plan (1991 Master Plan). According to flow monitoring performed for the 1991 Sewer Master Plan, the Los Altos collection system discharges 0.12 mgd of average daily flow to the Mountain View collection system at three locations and the Mountain View collection system discharges 0.4 mgd of average daily flow to the Los Altos collection system (Table 4-2, 1991 Sewer Master Plan). This discharge is associated with manhole Z1S-123. The 1991 Master Plan also projected the future flow at this connection to be 0.5 mgd. Both the current and future flows in the 1991 Master Plan are less than the flows measured by flow meter upstream of manhole Z1S-123 before the meter stopped functioning sometime before 2002 and after the meter resumed functioning in December 2004. Consequently, the flow projections in the 1991 Master Plan will not be included in this Master Plan and the Mountain View flow in 2002 is assumed to have been 0.7 mgd and the future flow is assumed to be 0.9 mgd.

Flow projections at the connection to the City's trunk sewer at manhole Z1S-104a are based on available Mountain View employment data. The industrial/commercial area upstream of manhole Z1S-104a has an estimated employment of 1,952 people. The 1991 Master Plan listed the unit flow rate for employment at 15 gpd/person. The projected average daily flow is 0.03 mgd which is used for current and future conditions.

According to City staff, the flow at the third connection at manhole Z1S-107 is very small and insignificant for the purposes of this master plan. No flow from Mountain View is included in the hydraulic assessment at this connection.

In August 2010, Mountain View updated its master plan. The August 2010 update included current and ultimate base sanitary flow projections to the City of 0.57 mgd and 0.66 mgd, respectively. These flows are similar to projections from the 2005 Master Plan.

Groundwater Infiltration. The available flow data do not indicate any GWI from Mountain View.

5.3.3 Town of Los Altos Hills

Flow projections for the Town are based on connections and unit flow rates.

Connections. The City currently has an agreement with the Town to convey flow from the eastern portion of the Town to the Regional Plant. Land use within the Town service area is nearly all large parcel single-family units (> 1 acre). The agreement between the City and the Town allows a total of 339,900 gpd maximum daily flow or 124.06 million gallon per year maximum annual flow. It is the Town's responsibility to allocate capacity rights among property owners within the Town. In 2002, the estimated number of actual connections to the collection system was 716 parcels.

According to the Town's 2004 Sanitary Sewer Master Plan, a total of only 1,669 connections will ultimately be made to the Town's system. Since the Town's 2004 Sanitary Sewer Master Plan is based on buildout conditions, 1,669 connections will be used to project future flows. According to the Town's Master Plan, all current and future developed parcels will be sewered and no septic tank systems will remain.

At the time of the 2005 Master Plan, the Town's 2004 Master Plan identified three active connections to the City's collection system and the number of parcels associated with each connection. This information was adjusted to reflect four active connection points identified by the City. These connection points are shown on Figure 5-4. The number of connections for current and future conditions is listed in Table 5-8 and was used to project current and future flows.

Table 5-8. Projected Number of Connections in Town

Connection Point	Allocation Percentage	Number of Parcels	
		Current	Future
C1S-410 (Pine Lane PS)	16.5	118	275
E1S-501	3.2	23	53
H2S-207	45.4	325	758
K2S-302	34.9	250	583
TOTAL	100.0	716	1669

In 2008, the Town completed a land use element update to their 2002 Housing Element. The update addressed factors contributing to preserving community character and did not appear to modify the previous land use projections.

Base Sanitary Flow. The Town's 2004 Master Plan performed temporary flow monitoring with four flow monitors for one week in October 2002 to develop unit flow factors for BSF. Two flow meters were located in the portion of the Town discharging to the City's collection system and are referred to as the Los Altos sewer basin. The other two flow meters were located in areas discharging to the Palo Alto collection system. The results of the flow monitoring indicated unit flow rates of 140, 220, 370, and 400 gpd/connection.

The Town's 2004 Master Plan also evaluated winter water use data for the Los Altos sewer basin and determined the average unit flow factor for the entire basin to be 378 gpd/connection assuming that 90 percent of winter water use results in wastewater flow. The Town's 2004 Master Plan hydraulic analysis was based on the unit flow factors developed from the dry weather flow monitoring and not on the analysis of winter water use.

For the 2005 Master Plan, a separate analysis was performed to project BSF from the Town. The flow meter Los Altos-2 had very low flows which resulted in a calculated BSF unit flow rate of only 140 gpd/connection. This unit rate is very low and outside of the range of typical unit flow factors based on BC's experience. Consequently, information related to this monitor Los Altos-2 was not considered in the following analysis.

BSF unit flow rates were calculated using winter water billing information and flow data from the other three flow monitors from the 2004 Master Plan. Water billing information was obtaining from the California Water Service for January and February 2004. As with the analysis of water use data for Los Altos, winter months were selected because water used for irrigation should be minimal. The water use data are summarized in Table 5-9.

Table 5-9. Town Winter Water Use Data		
Month	Water Use per Parcel, 100 cubic feet per month	Daily Water Use per Parcel, gpd
January	15.73294	380
February	15.38427	411
	Average	396

Water use during this period averaged about 396 gpd per parcel in the Town. BSF is estimated to be about 80 percent of water use during this period. This percentage is the same as used in the analysis of base sanitary flows for the City. The resulting BSF unit rate is approximately 310 gpd/connection.

The average BSF unit flow rate was also calculated using information from the dry weather flow monitoring reported in the 2004 Master Plan with the exclusion of the information associated with flow monitor Los Altos-2. The calculated BSF unit rate was 296 gpd/connection, which is within five percent of the BSF based on winter water data. The BSF unit rate for the Town for this master plan is 310 gpd/connection. The projected current and future BSF was 0.22 mgd and 0.52 mgd, respectively. With the flow from the Pine Lane Pump Station redirected to the Palo Alto collection system, the 2010 and future BSF from the Town are 0.19 mgd and 0.43 mgd, respectively.

Groundwater Infiltration. The 2004 Master Plan determined GWI rates of 10, 80, 90, and 130 gpd/connection for the four dry weather flow monitor basins. The rate of 10 gpd/connection is much lower than the other rates and was based on data from monitor Los Altos-2. If the information from this meter is not considered, the average GWI unit rate is 90 gpd/connection. This rate will be used for this Master Plan Update. The current and future projected GWI was 0.06 mgd and 0.15 mgd, respectively. With the flow from the Pine Lane Pump Station redirected to the Palo Alto collection system, the 2010 and future projected GWI from the Town are 0.05 mgd and 0.13 mgd, respectively.

Dry Weather Flows

The updated dry weather flows are summarized in Table 5-10 below. The City's capacity at the Regional Plant is 3.6 mgd. The current flow is 80 percent of the City's capacity. The projected build out flow is 3.29 mgd, which is less than the City's allowed flow of 3.6 mgd.

Table 5-10. 2009 Dry Weather Flow Projections by Agency (Current/Future)[1]		
Agency	Current Flow, mgd	Build Out Flow, mgd
City	2.64	2.73
Town of Los Altos Hills[2]	0.24	0.56
Subtotal	2.88	3.29
Mountain View[3]	0.57	0.66
Total	3.45	3.95

[1]*Average daily flow is base sanitary flow plus groundwater infiltration (GWI). The Town of Los Altos Hills is the only area that appeared to have GWI.*

[2]*Flow from the Pine Lane Pump Station was removed from the Town of Los Altos Hills contribution. The previous current and future BSF from the Town of Los Altos Hills were 0.22 and 0.52 mgd, respectively. The revised current and future BSF are 0.19 and 0.43 mgd, respectively. The current/future GWI also changed from 0.06/015 mgd to 0.05/0.13 mgd.*

[3]*Mountain View flows have been updated based on the City of Mountain View Sewer Master Plan August 2010.*

Diurnal Flow Patterns

Base flow varies hourly throughout a day. MOUSE, the hydraulic modeling program being used for this Master Plan, accounts for the hourly variation in flow with the use of a diurnal hydrograph. A typical diurnal hydrograph was developed using the 2002 flow data and was applied to the average daily flow to simulate hourly flows in the collection system. The diurnal hydrograph is shown on Figure 5-5.

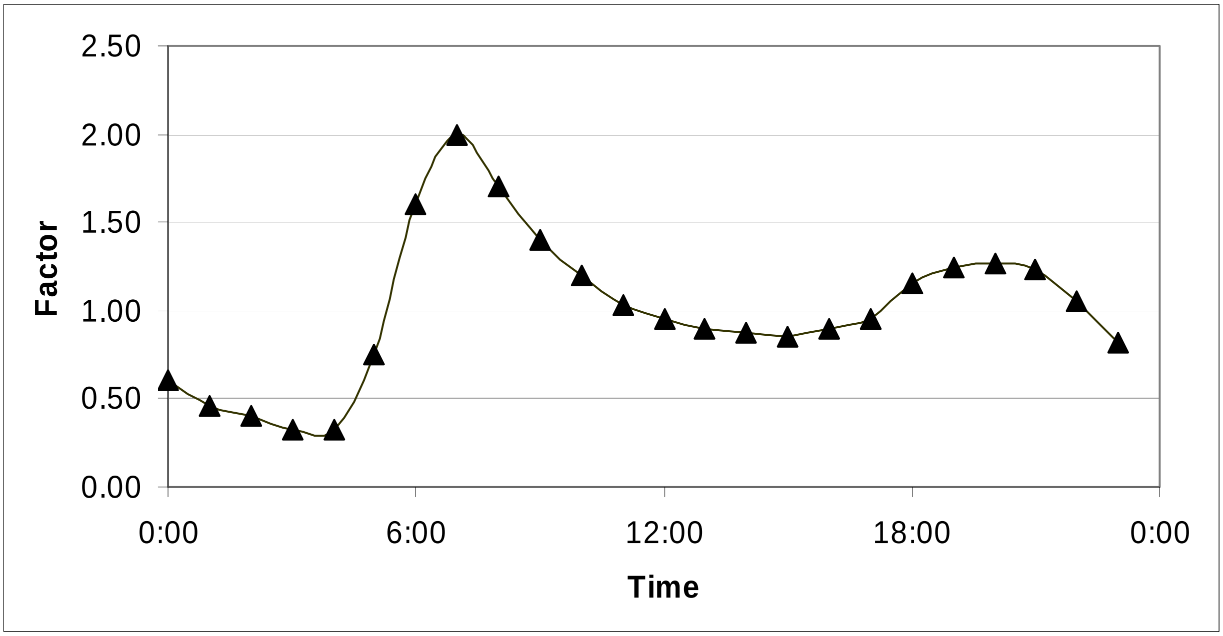


Figure 5-5. Diurnal Curve

The resulting projected dry weather flow peaking factor (peak hourly flow/average daily flow) are summarized in Table 5-11 along with the dry weather peaking factor calculated from the 2002 flow monitoring data using data from the dry period of February 20 through March 5, 2002. Peak dry weather flows are generally considered to be in good calibration if model flows and monitor flows are within about 15 percent. The table shows good calibration of dry weather peaking factors except for flow monitors 3 and 4.

Table 5-11. Peak Dry Weather Flow Calibration

Flow Monitor	Flow Monitor Dry Weather Peaking Factor	Model Dry Weather Peaking Factor
1	2.06	1.84
2	1.63	1.89
3	2.66	1.95
4	1.37	1.74
5	1.63	1.80
6	2.22	1.85
7	1.78	1.78
8	1.71	1.66

5.4 Wet Weather Flow Projections

Wet weather flow includes BSF, GWI and RDI/I. BSF and GWI are discussed above. This section discusses the development of RDI/I and the peak wet weather flows used for the hydraulic assessment.

Design Wet Weather Flows. Wet weather flows are dependent on several factors including rainfall amount. For the Bay Area, wet weather flows are typically projected using a design storm event. Many sewer agencies located near the Bay have adopted design storm events with recurrence frequencies of either 5 years or 10 years. Design storms adopted by several nearby sewer agencies are listed in Table 5-12 below.

Table 5-12. Sewer Agency Design Storm Criteria

Agency	Design Storm Criteria
San Jose	10-year, 24-hour
Milpitas	10-year, 4-hour
San Mateo County	Historic 5-year
Palo Alto	5-year and 20-year, 6-hour
San Mateo	5-year, 6-hour
Union Sanitary District	Historic 10-year

As discussed in Section 1, the San Francisco Bay Regional Water Quality Control Board (Regional Board) has authority to regulate the City's collection system. The Regional Board has not adopted specific standards for design storms. However, it has not objected to the design storm criteria used by various nearby agencies.

2002 Flow Monitoring Program Wet Weather Flow Data Analysis. The City's 2002 flow monitoring program was conducted in February and March in the anticipation of wet weather. As noted above, only two small storms occurred during the flow monitoring period. These storms were on March 17, 2002 and March 23, 2002 and they averaged about 0.55 inches and 0.35 inches of precipitation, respectively. The corresponding daily flows for these days were 4.10 mgd and 4.15 mgd as measured by the master meter with adjustments of adding 0.7 mgd to include Mountain View flow. In comparison, large storms between 1998 and 2002 often resulted in more than 5 mgd of flow. Although these were relatively small storms, the flow data from the 2002 flow monitoring program was further analyzed in an attempt to characterize wet weather flows under design storm conditions.

R factors are defined as the ratio of RDI/I volume to wastewater volume and are the basis of a widely used methodology to project RDI/I under design storm conditions. The R factor indicates the percentage of RDI/I that enters the wastewater collection system. R factors were calculated for each drainage basin using the 2002 flow monitor data. Table 5-13 lists the R factors for both rainfall events for each drainage basin.

Table 5-13. R Factors		
Drainage Basin	R Factor	
	March 17, 2002	March 23, 2002
1	0.0102	0.0149
2	0.0051	0.0101
3	0.0206	0.0236
4	0.0017	0.0024
5	0.0022	0.0088
6	0.0013	0
7	0	0
8	0.0062	0.0014

The R factors listed show that the collection system had only a slight response to the rainfall events. Based on BC's experience, R factors of 0.05 or greater represent significant RDI/I and R factors between 0.02 and 0.05 represent moderate RDI/I. However, these typical R factors are based on larger storms with recurrence intervals of at least 2 years. The 2-year, 24-hour precipitation for Los Altos is 2.10inches which is considerably greater than the 0.55 inches and 0.35 inches of 24-hour precipitation that occurred during the 2002 flow monitoring program. Los Altos' 2-year 24-hour precipitation is based on Santa Clara County procedures. The low levels of rainfall that occurred during the monitoring period may not have triggered RDI/I responses that occur during larger storms. The R factor analysis is consequently considered inconclusive.

Additional analysis was performed on the 2002 flow monitoring program data. Table 5-14 lists the wet weather peaking factor which is the peak hourly flow divided by the average daily flow at each monitor site. Under some circumstances, RDI/I can result in significant increase in peak flows while having minor affect on total flow volume which is measure by R factors.

Table 5-14. Wet Weather Peaking Factors			
Flow Monitor	Peaking Factor Over Average DWF		
	Peak Dry	March 17, 2002	March 23, 2002
1	2.06	2.41	2.26
2	1.63	2.09	1.66
3	2.66	3.21	1.79
4	1.38	1.37	1.37
5	1.63	1.75	1.50
6	2.32	2.15	1.85
7	1.82	1.63	1.54
8	1.70	1.88	1.91

As indicated in Table 5-13, the peak dry weather flow is greater than the peak wet weather flow for both storms at flow monitors 4, 6 and 7 and for one storm at flow monitors 3 and 5. This is likely attributed to insufficient rainfall to activate a RDI/I response.

Based on the above analysis, wet weather flow data from the 2002 flow monitoring program was inadequate to project wet weather flows for this Master Plan Update. Insufficient rainfall occurred during the flow monitoring program to allow adequate characterization of RDI/I in the study area. Consequently, another method was used to project wet weather flows. As previously noted, flow monitoring was determined not to be needed in 2010 so the wet weather flow projections from the 2005 Master Plan were not updated.

Master Meter Wet Weather Flow Analysis. Daily flow and precipitation data were available from the master meter from 1998 through 2002. The data was ordered by daily rainfall volume and the eight largest rainfall days are listed in Table 5-15 and plotted on Figure 5-6. Master meter daily flow data was adjusted to account for Mountain View flow by adding 0.7 mgd.

Table 5-15. Flows During Large Storms 1998 to 2002

Date	Rainfall Volume, inches	Master Meter Flow Daily Flow, mgd	Adjusted Flow Daily Flow, mgd
February 3, 1998	5.5	6.70	7.40
February 8, 1998	2.75	6.20	6.90
January 25, 2000	2.5	4.17	4.87
December 20, 2002	2.5	4.50	5.20
January 24, 2000	2.25	5.13	5.83
December 16, 2002	2.2	5.40	6.10
February 14, 2000	2.0	4.89	5.59
December 29, 2001	2.0	3.09	3.79

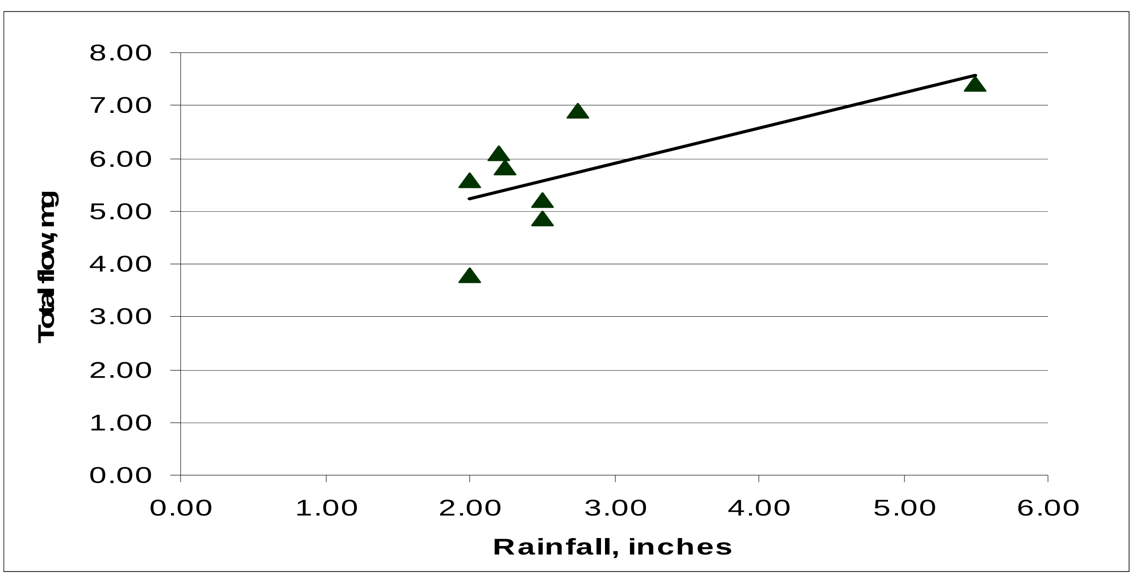


Figure 5-6. Large Storms 1998 - 2002

The 5-year and 10-year 24-hour precipitation volumes for the City were calculated using intensity-duration-frequency information from Santa Clara County and adjusting the precipitation volumes to correspond to Los Altos in accordance with the standard procedures. The 5-year and 10-year 24-hour precipitation volumes are 2.8 inches and 3.5 inches, respectively.

As seen on Figure 5-6, the data has considerable scatter. A linear regression was performed using the features of EXCEL and equation of the trend line is:

$$\text{Flow} = 0.6673 \times \text{Rainfall} + 3.8993$$

The projected flow volumes associated with the 5-year 24-hour and 10-year 24-hour precipitations are 5.77 million gallons (mg) and 6.25 mg, respectively.

Only daily flow data was available from the master meter and daily flow data cannot be directly used to determine peak hourly flows. Therefore, the diurnal curve was modified to have peaking factors of 3, 5, 7 and 9 as could occur during wet weather. The modifications were developed using BC's experience from other master plans and are included in Appendix I. The modified diurnal curves were applied to the average daily flow from the City, Town and Mountain View. GWI in the Town was included since the GWI is associated with wet weather. The resulting flow volumes were calculated to be 4.42 mg, 5.92 mg, 7.89 mg and 8.87 mg for the 3, 5, 7 and 9 peaking factors.

The best match between the projected 5-year and 10-year flow volumes and the calculated flow volumes occurred with the 5 peaking factor. The calculated flow volume of 5.92 mg is within 3 percent of the 5-year flow volume of 5.77 mg and 5 percent of the 10-year flow volume of 6.25 mg. The other calculated volumes associated with peaking factors of 3, 7 and 9 were considerably smaller or greater than the projected 5-year and 10-year volumes. Based on this analysis, wet weather flows for the hydraulic assessment will be projected using a diurnal curve with a 5 peaking factor.

Section 6

Hydraulic Assessment

This section presents the results of the hydraulic evaluation of the collection system under current and future conditions, and identifies recommended improvements. The criteria to assess the hydraulic adequacy of the collection system and to develop hydraulic improvements are also presented. The recommended improvements are developed into capital projects in Section 7.

The 2012 Updates to the 2005 Hydraulic Assessment include:

- Pipeline Projects 1 and 2 are still needed.
- Pipeline Project 3 is no longer needed.
- Pump station projects are completed.

6.1 Evaluation Criteria

The hydraulic evaluation criteria applies to existing sewers and to proposed relief and replacement sewers that may be needed to provide additional hydraulic capacity in the existing collection system. Criteria are also included to evaluate the existing pump stations and associated force mains.

6.1.1 Flow

The hydraulic performance assessment was performed using current and future wet weather flow conditions as described in Section 5. PWWF are simulated using a hydrograph with a peaking factor of 5. The hydrograph used for this analysis is shown on Figure 6-1. MOUSE automatically normalizes hydrographs so that the total flow over a 24-hour period is equal to the average daily DWF. For wet weather conditions, the daily flow can actually greatly increase as demonstrated by the master meter flow data presented in Section 5. In order to perform the hydraulic analysis with peak hourly flows that are five times greater than the average DWF, a special hydraulic assessment hydrograph was developed based on BC's experience with other RDI/I evaluations and master plans. The hydraulic assessment hydrograph simulates high flow conditions over a three-hour period. This period is considered appropriate for smaller collection systems such as the City's.

Flow information for each input node in the hydraulic model is presented in Appendices L and M for current and future conditions, respectively. The revised flows discussed in Section 5 indicate very small changes in current and future flows. Therefore, the original flow information is reported in these Appendices.

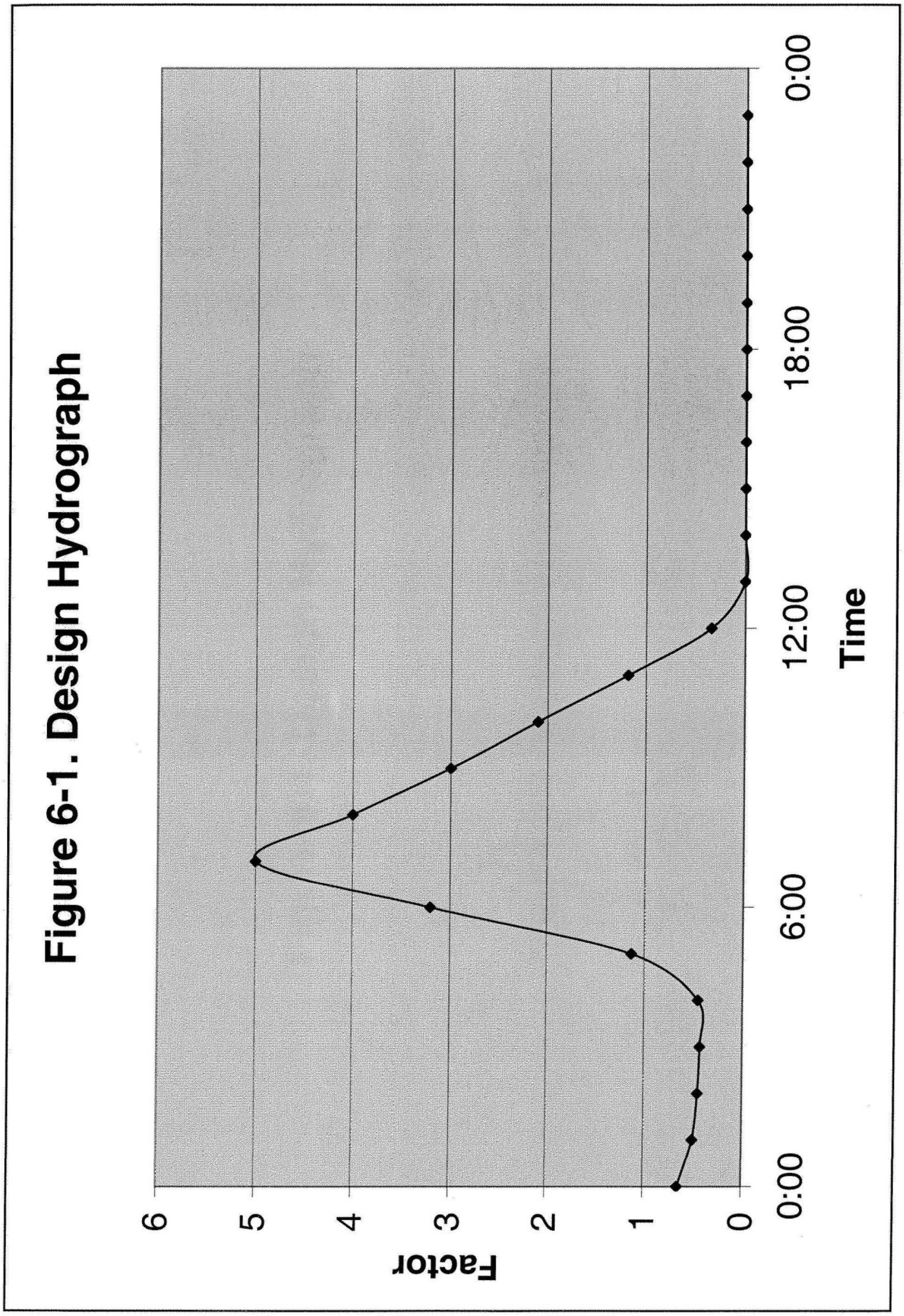


Figure 6-1. Design Hydrograph

6.1.2 Gravity Sewers

The hydraulic assessment of gravity sewers was based on surcharging which occurs when the hydraulic gradeline is above the crown of the pipe. Surcharging is the best indicator of pipes at risk of causing SSOs because of insufficient hydraulic capacity and was used to identify hydraulic capacity projects. Smaller diameter sewer mains such as 6-inch and 8-inch diameter pipes are often designed for the hydraulic gradeline to be at two-thirds of the pipe diameter. Hydraulic capacity projects are not proposed for small diameter pipes that do not surcharge but are more than two-thirds full under peak wet weather flow conditions because of the lower risk of causing an SSO and because the peak wet weather flows used in this analysis are expected to occur once every 5 to 10 years. The flow depths in these smaller diameter sewers, though, should be considered when prioritizing sewers for repairs or replacement. Information on the depth of flow as well as other hydraulic parameters in each sewer reach included in the hydraulic model is contained in Appendix N.

Two types of surcharging can occur. The first type is related to inadequate hydraulic capacity. The second type of surcharge is referred to as backwater. Backwatering often occurs where small diameter pipes connect to larger diameter pipes and the pipes have the same invert elevation. This type of connection is usually designed to match the crown elevations of the pipes to avoid backwater. As discussed in Section 4, many of the invert elevations in the model network were estimated since record information was not available in the City's GIS. Given this uncertainty of invert elevations, backwater conditions were not used to identify hydraulic projects.

A hydraulic capacity analysis was used to help determine if surcharging was caused by inadequate hydraulic capacity or by backwatering. The hydraulic capacity analysis compared the PWWF to the pipe hydraulic capacity.

New pipes are constructed to obtain minimum velocities to minimize deposition of sediment and other material. The minimum design velocity for sewer mains is typically two feet per second. MOUSE calculates the velocity of the design flow in the collection system and this information is presented in Appendix N. The velocity information was not used to identify hydraulic problems in the collection system for three reasons. First, much of the invert elevation information contained in the hydraulic model was estimated. Since the velocity calculations performed by MOUSE are highly dependent on the invert elevations, the velocities may not be very accurate. Second, improving the velocity in a reach requires constructing a new larger pipe and/or changing invert elevations. Both approaches can be very costly. And third, solids deposition can often be controlled by preventive maintenance at a much lower cost than reconstructing portions of the collection system.

6.1.3 Relief Sewers

Relief sewers were sized to provide additional hydraulic capacity so that the collection system will operate within the evaluation criteria requirements presented above.

Minimum size. The minimum size for relief sewers is 8-inch diameter. Relief sewers that are 8 inches in diameter were designed to operate two-thirds full. Larger relief sewers were designed to operate full under peak flow conditions.

Slope. Relief sewers were developed using the slope of the existing sewers. During predesign of the relief sewers, actual invert elevations should be determined and the slope of the relief sewer should be adjusted to ensure adequate velocities.

Replacement. Relief sewer will replace the existing sewer unless the relief sewer is more than two pipe sizes larger than the existing sewer. In those situations, additional analysis will be performed. This approach recognizes that much of the collection system is approaching 50 years in age which is its likely useful life. Replacing an existing older sewer with a new sewer now avoids having to potentially perform additional construction along the alignment to replace the existing sewer in a few years.

6.1.4 Force Mains

The maximum velocity criterion for force mains is 7 feet per second (fps). Additional assessment of force mains including surge analysis and field evaluation of head loss are beyond the scope of this Master Plan Update. The maximum velocity criterion is considered as an approximate indicator of the need to perform further assessment of a force main. The preferred minimum velocity is 2 fps.

6.1.5 Pump Stations

The pump stations need firm capacity that matches or exceeds the PWWF for current and future conditions. Firm capacity is based on one pump being out of service. Pump capacity information was provided by the City.

6.2 Assessment of Existing Collection System

This section presents the results of the hydraulic modeling. The hydraulic evaluation of gravity sewer utilized the model network and the current and future PWWF projections developed for this study.

6.2.1 Gravity Sewer

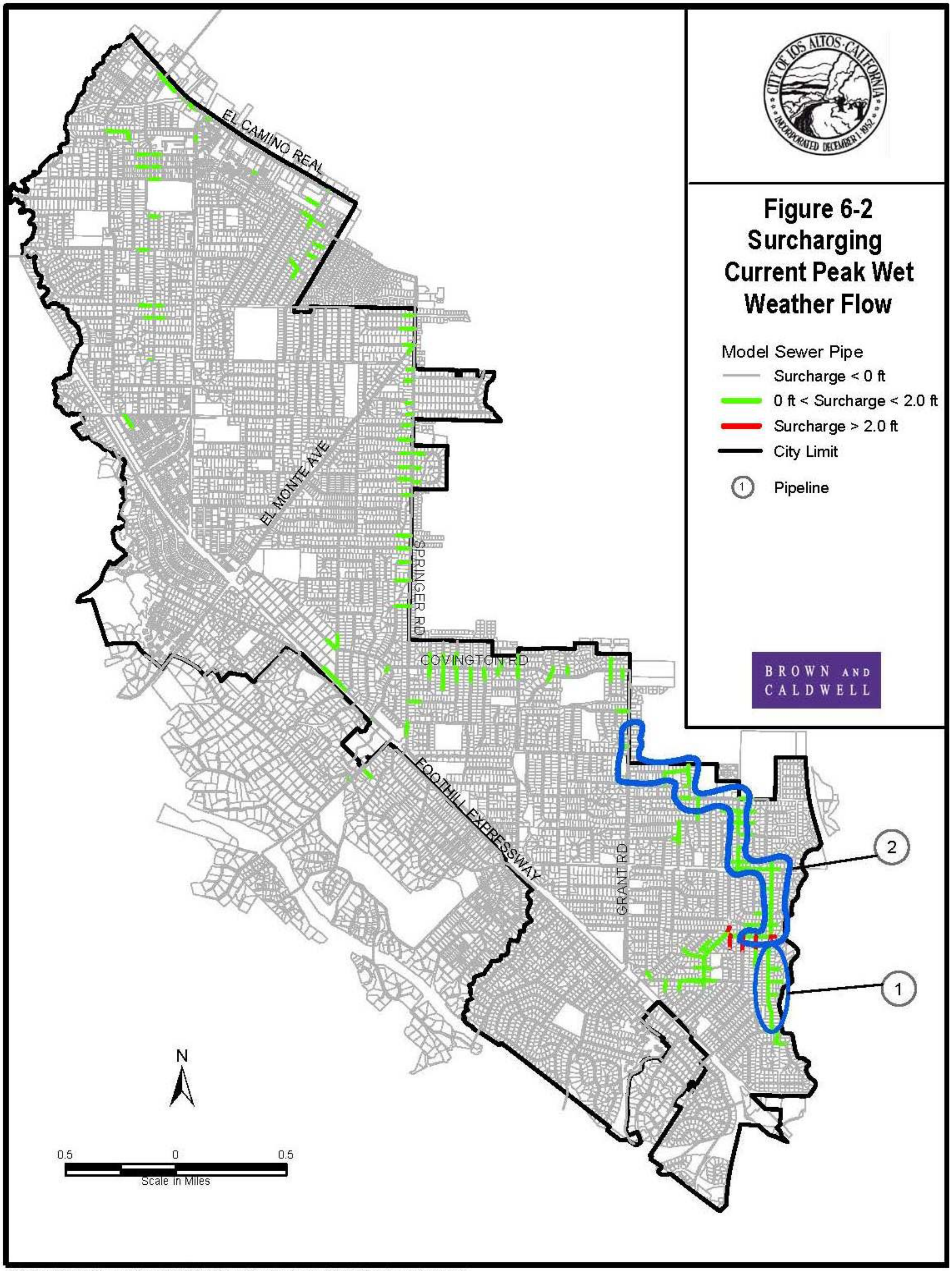
Pipes with surcharging are shown on Figure 6-2 and 6-3 for current and future PWWFs. The results of the capacity analysis of current and future PWWFs are shown on Figure 6-4 and 6-5, respectively. Both hydraulic capacity and backwater surcharging occurred under current and future PWWF conditions. Under current PWWF conditions, hydraulic capacity surcharging occurred in two areas which are labeled pipelines 1 and 2 on the figures. Under future PWWF conditions, pipe reaches in three areas were originally projected to surcharge. The three pipe reaches are discussed below. However, Pipeline 3 is no longer expected to be under capacity in the future because the Town flow that originally entered the City through the Pine Lane Pump Station has been redirected to the Palo Alto collection system. The figures also show other surcharging and capacity issues that occur under current and future peak flow conditions, but which are not included in the pipeline 1, 2, or 3 areas. The surcharging is caused by backwatering and the capacity issues are localized and do not cause surcharging. Gravity sewer improvements are not needed to address these issues.

Pipeline 1. Pipeline 1 is a 6-inch diameter pipeline that conveys wastewater on Fallen Leaf Lane from manhole M7S-104 at Louise Lane to manhole K7S-408 at Morton Avenue. The hydraulic assessment of the pipeline indicated surcharging of less than two feet under current and future peak flow conditions. This project is currently under design and construction.

Pipeline 2. Pipeline 2 conveys wastewater from the City in a 12-inch diameter and 15-inch diameter sewer from manhole L6P-201 at the intersection of Holt Avenue and Newcastle Drive to manhole I6S-401 at Portland Avenue and Grant Road where the pipeline connects to the trunk sewer. Minor surcharging of less than two feet occurs in portions of the existing pipeline under current and future peak flow conditions. Many pipe reaches downstream of Fremont Avenue and Truman Avenue would not surcharge. Surcharge in the upstream reaches of the pipeline increase to just over 2 feet on Morton Avenue. This project is currently under design and construction.

Pipeline 3. Pipeline 3 is no longer expected to be under capacity in the future because the Town flow that originally entered the City through the Pine Lane Pump Station has been redirected to the Palo Alto collection system. This project extended from manhole C1S-410 to B2S-111.

Since the 2005 Master Plan, the City has identified an additional area of surcharge that would not have been detected by the hydraulic modeling. This area is located downstream of a private pump station at the Springwood Apartments off of Homestead Road. The pump station discharge surcharges the 6-inch diameter sewer line at the Foothill Crossing Shopping Center and the 6-inch diameter sewer on Deodora Drive. The City plans to investigate this additional area of surcharge and will likely need to upsize these sewers.



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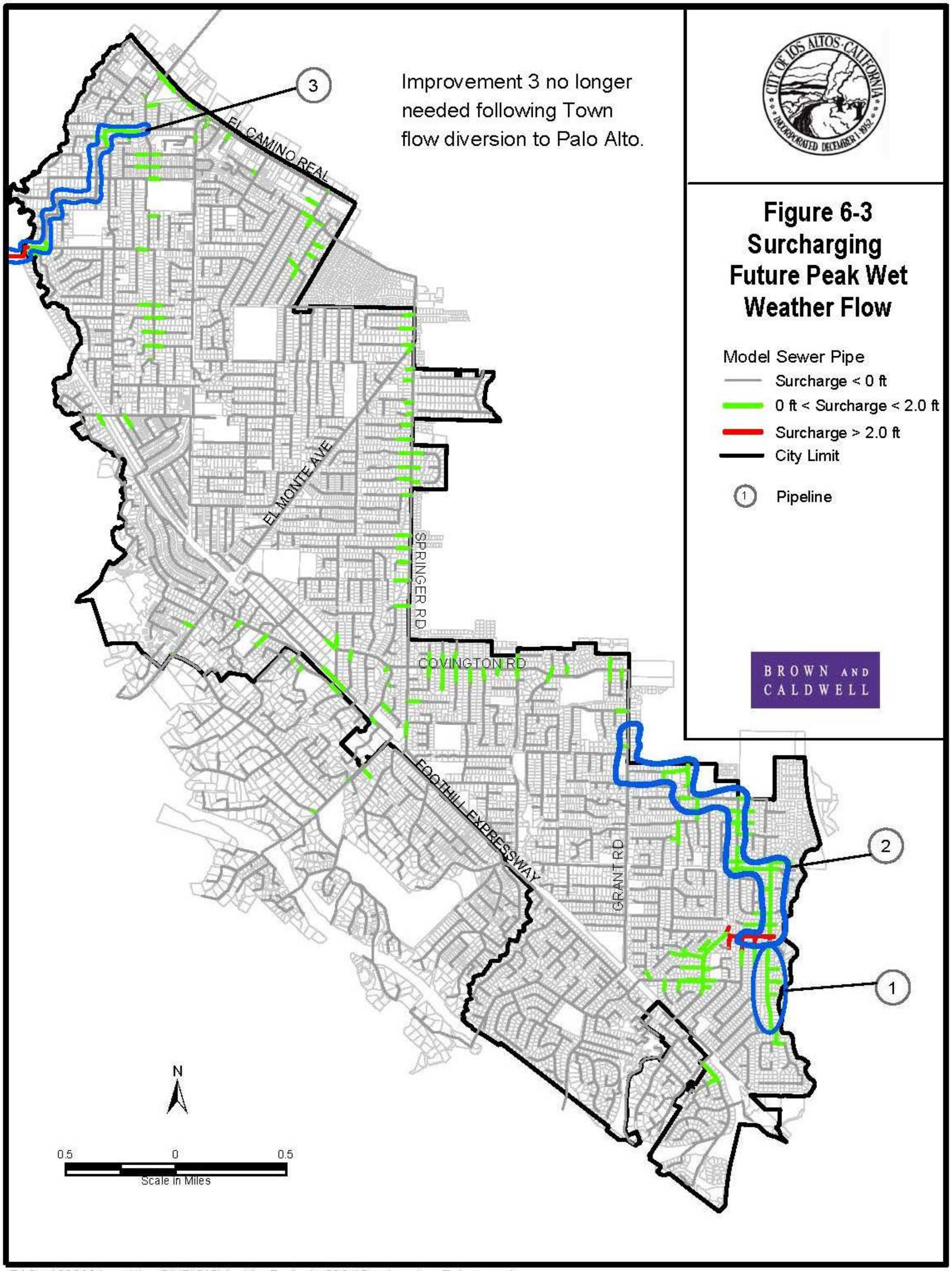

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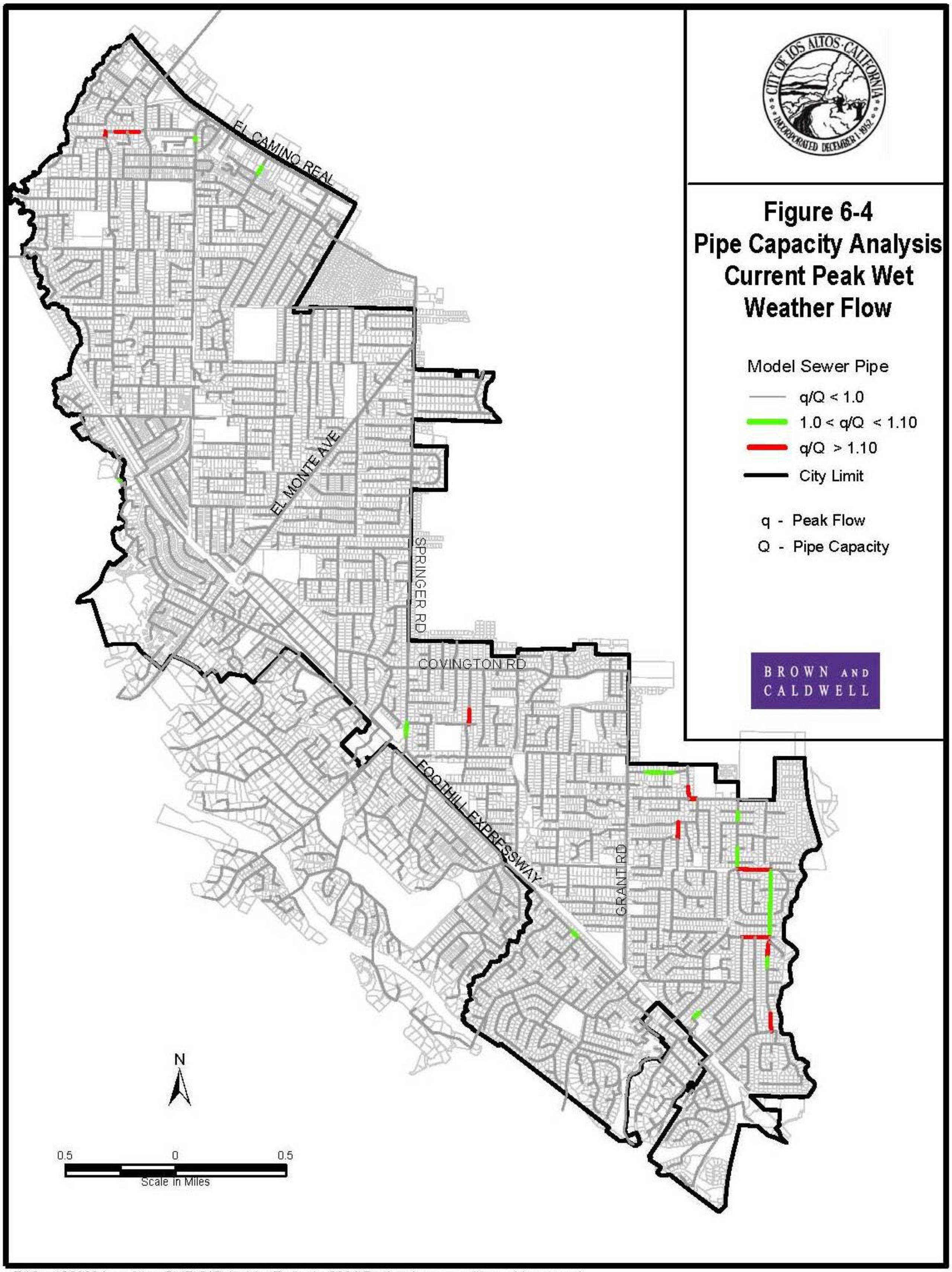

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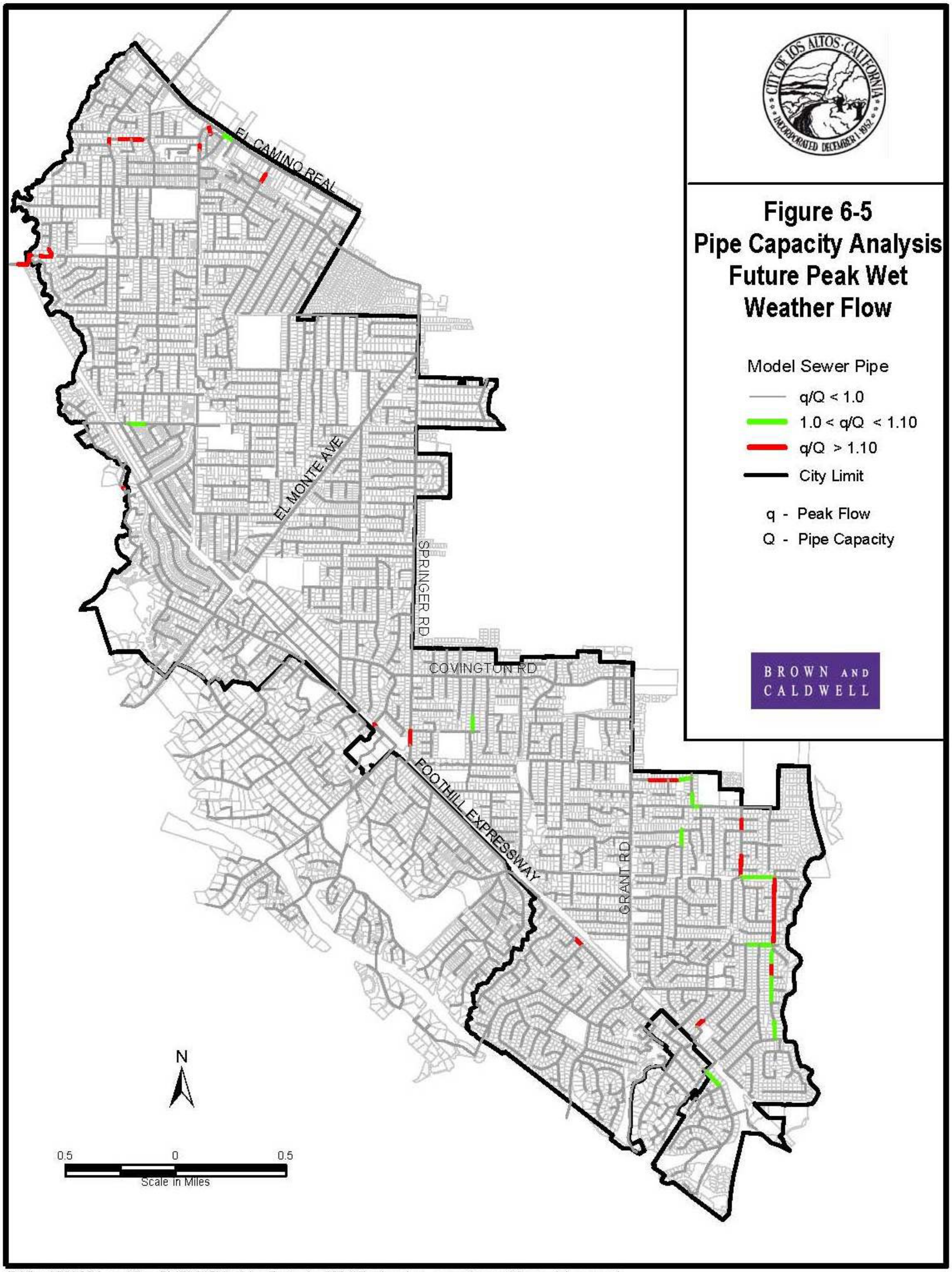

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6.2.2 Pump Stations

Recommended pump station improvements from the 2005 Master Plan have been implemented. An updated pump station hydraulic assessment is not included as part of the Master Plan Update.

6.3 Hydraulic Improvements

Hydraulic capacity projects are needed for gravity sewers.

6.3.1 Gravity Sewers

The proposed improvements to the collection system are shown on Figure 6-6. The hydraulic model indicated that the surcharging in pipeline 2 under future wet weather flow conditions reduced the peak flows in pipeline 1. The surcharging in pipeline 2 caused some of the peak wastewater flow to be temporarily stored in the collection system until the surcharging in pipeline 2 dissipated. When the capacity problems in pipeline 2 were addressed in the model, the peak flow in pipeline 1 downstream of the pipeline 2 improvements increased identifying additional problems. Improvements were developed to address all hydraulic problems and to prevent capacity-related surcharging in the improved collection system.

The proposed improvements to the existing collection system to handle current and future wet weather flows are discussed below. The improvements correspond to the pipelines discussed in the assessment of gravity sewers.

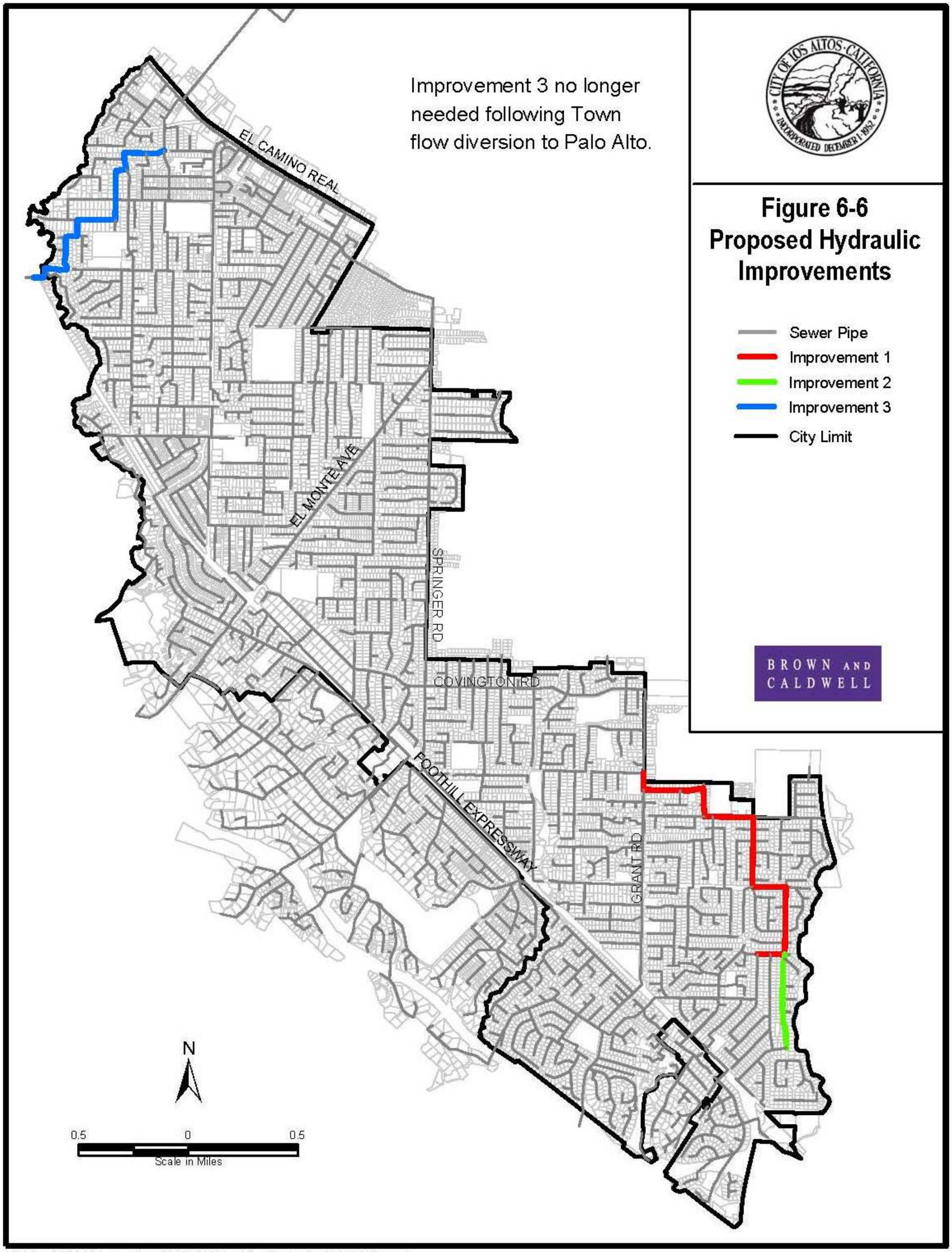
Improvement 1. The surcharging in the upper reaches of the pipeline can be alleviated with 4,743 lf of 15-inch diameter replacement sewer for the existing 12-inch diameter sewer starting at manhole K6S-618 at the intersection of Alford Avenue and Morton Avenue and extending to manhole J6S-306 at Truman Avenue and Oak Avenue. This would also eliminate the surcharging in about 1,600 feet of pipeline further upstream of manhole K6S-618. The existing 15-inch diameter sewer from manhole J6S-306 to manhole I6S-401 should be replaced with 3,707 lf of new 18-inch diameter sewer to prevent future surcharging.

Improvement 2. The existing 6-inch diameter sewer should be replaced with 2,258 lf of new 8-inch diameter sewer from manhole L7S-411 to manhole K76-408 at Fallen Leaf Lane and Morton Avenue. The depth of the future design flow in the 8-inch diameter pipeline will be less than two-thirds of the pipe diameter.

Improvement 3 is no longer required after the flow from the Town entering the Pine Lane Pump Station was redirected to the Palo Alto collection system.

6.3.2 Pump Stations

Recommended pump station improvements from the 2005 Master Plan have been implemented. No additional improvements are needed at this time.



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Section 7

Capital Projects

This section presents recommended wastewater collection system capital projects. These capital projects are located within the City's collection system including the unincorporated area. The bases of the capital projects are the results of the collection system hydraulic assessment, physical assessment and maintenance assessment. This section provides summaries of pipeline construction and rehabilitation methods and capital projects for both pipelines and pumping stations.

The 2012 Update to the 2005 Capital Projects includes:

- Updating status of capital projections listed in the 2005 Master Plan.
- New capital projects based on the updated condition assessment.
- Updated estimated capital costs.

Capital projects recommended in the 2005 Master Plan are presented in their entirety in the respective sections in this section. However, project statuses have been updated to reflect information gathered from the City's Capital Project Status Detail Reports (March 2012) and other sources. Projects listed as being "In Design" are not included in the recommended CIP described in Section 8, because funds through design and construction have already been encumbered. Projects that have been completed, that have recently gone out for competitive bid for construction, or are currently listed as being "Under Construction" were removed from the recommended CIP. Funds for those projects are considered encumbered, so their budgets do not enter into the financial analysis.

7.1 Pipeline Projects

Pipeline projects were identified from the condition assessment, hydraulic assessment and information provided by the City on maintenance problem areas. The condition assessment identified several pipe reaches with localized severe defects, which should be addressed by performing repairs.

All hydraulic projects that were identified in the 2005 Master Plan have been completed, scheduled and encumbered, or abandoned. There are no additional hydraulic projects included in this Master Plan Update. The updated CIP includes pipes in need of repairs, replacement, and corrosion rehabilitation.

7.1.1 Construction Methods

This section briefly describes some typical construction methods for mainline sewer capital projects. Unit costs were developed for each construction methods and are presented later in this section.

7.1.1.1 Open Cut

Open cut is the traditional construction method of excavating a trench and installing a new pipe. Open cut construction is often needed for pipelines with serious structural or hydraulic capacity deficiencies, significant sags, and where trenchless construction is typically more expensive and not practical. Spot repairs are typically performed using open cut construction.

7.1.1.2 Bore and Jack

Bore and jack is a trenchless method to install new pipe where open cut construction is difficult or prohibited. Bore and jack is typically used for crossing freeways, highways, railroads and streams. It and other related methods including microtunneling, often are more costly per foot of installed pipe than open cut.

7.1.1.3 Pipe Bursting

Pipe bursting is a trenchless method to install a new plastic pipe of the same or larger diameter in the alignment of an existing pipe. The method requires excavation for pits to insert and retrieve the pipe bursting head and at service lateral connections. The method is often used for upsizing 6-inch sewers with 8-inch sewers and for sewer work in easements where access for open cut construction is difficult. Pipe bursting is also used in areas where surface restoration would be costly or where construction would cause extension disruption to traffic. Flow bypassing is often required during pipe bursting. Pipe bursting generally does not eliminate long sags, but City experience has shown that it can be effective at eliminating short sags. Sometimes a short point repair is necessary to eliminate the sag after the pipeburst run is complete, simply raising the pipe invert and properly bedding the new pipe at the appropriate elevation.

7.1.1.4 Sliplining

This trenchless technology is recommended for pipelines with minor structural deficiencies, corrosion and root intrusion. Sliplining products include high density polyethylene (HDPE), Poly-vinyl chloride (PVC), and Hobas. Sliplining reduces the cross sectional area of the pipeline and its hydraulic capacity. It is not recommended for 6- or 8-inch diameter sewers because the resulting pipeline is less than 8 inches in diameter which is the recommended minimum diameter for sewer pipe. Sliplining does not eliminate sags.

7.1.1.5 Cured in Place Pipe (CIPP)

CIPP is a trenchless method that installs a resin liner inside an existing pipe without excavation. The method can be used to address structural problems, root intrusions and corrosion. The liner thickness and resin material are varied to provide structural rehabilitation of the existing pipe. Flow bypassing is required and sags are not eliminated.

7.1.1.6 Plastic Lining

Plastic lining is a trenchless technology recommended for rehabilitating larger corroded pipes, particularly RCP. This process provides a corrosion barrier that prevents further corrosion. Available processes appropriate for the City’s sewers include Rib Loc and Danby. Flow bypassing is often required.

7.1.2 Hydraulic Projects

Results of the hydraulic assessment in Section 6 were used to develop hydraulic improvements for the collection system. Three pipelines were identified during the 2005 Master Plan as having hydraulic capacity problems that require relief sewers. During the development of the 2012 Update, one hydraulic project was determined not to be needed any longer. The recommended projects are shown on Figure 7-1.

Design criteria for new 8-inch diameter sewer pipe is to flow two-thirds full, and new larger sewer pipe is designed to flow full under peak flow conditions.

H1 South Replacement Sewer

Project H1 consists of 4,180 lf of new 15-inch diameter sewer and 4,280 lf of new 18-inch diameter sewer. The project starts at manhole K6S-618 at the intersection of Alford Avenue and Morton Avenue and ends at manhole I6S-402 at Paula Court and Grant Road. The existing sewer can be abandoned or removed following construction. The alignment is located in residential streets. Service laterals from nearby houses are connected to the existing sewer and will need to be connected to the new sewer.

Project Update. The majority of this project has been incorporated into the City's CIP under two project numbers: South Sewer Main Replacement – Phase I (Project No. 10-14) and Phase II (Project No. 11-14). Phase I was adopted in FY09-10 and Phase II in FY10-11 with a budget of $1,172,500 each, for a total of $2,345,000. As of the publication of the Update, Phase I project is complete and Phase II is out to bid and award is expected in March 2013. Therefore, Phase I and Phase II have been removed from the recommended CIP (Section 8) and from the financial analysis (Section 9).

Since the initiation of Design and Construction of these projects, several utility conflicts have been identified and approximately 1,000 lf of the project has been delayed to a future phase. Additional CIP funding will be needed to complete this phase.

H2 Fallen Leaf Lane Replacement Sewer

Project H2 consists of 2,260 lf of new 8-inch diameter sewer from manhole L7S-411 at Jones Lane and Fallen Leaf Lane to manhole K7S-408 at Fallen Leaf Lane and Morton Avenue. The existing sewer can be abandoned or removed following construction. The project alignment is in residential streets. Service laterals from nearby houses are connected to the existing sewer and will need to be connected to the new sewer. Project H2 connects to the new sewer constructed by H1. H2 design should be coordinated with the construction of H1 to ensure the projects connect together properly.

Project Update. This project has been incorporated into the City's CIP as Fallen Leaf Lane Sewer Main Replacement (Project No. 11-15). It was adopted in FY10-11 with a budget of $430,000. As of the publication of this document, this project is out to bid and award is expect in March 2013. Therefore, this project has been removed from the recommended CIP (Section 8) and from the financial analysis (Section 9).

H3 North Replacement Sewer

Project H3 consists of 6,210 feet of 10-inch diameter sewer. The existing sewer will not be needed after the construction of the new sewer. This allows the new sewer to be constructed parallel to or in the same alignment as the existing sewer. The project starts at manhole C1S-410 on Saltamontes Way, at the border of the Town and the City, and crosses the Foothill Expressway. Bore and jack construction may be required for the crossing to minimize traffic disruption. Downstream of the Foothill Expressway, the alignment of the existing sewers is located along residential streets and in easements. Pipe bursting may be an appropriate construction method, particularly in easements because of limited access for construction equipment. Service laterals from nearby houses are connected to the existing sewer and will need to be connected to the new sewer. The project ends at manhole B2S-111 at the intersection of Mercedes Avenue and Loucks Avenue. The sewer upstream of manhole C1S-410 is owned by the Town and is not considered in this Master Plan Update.

Project Update. Since the 2005 Master Plan, flow from the Town was diverted away from the Pine Lane Pump Station and into the Palo Alto collection system. This removed excess PWWF entering the City collection system, thereby eliminating the projected hydraulic deficiencies. Project H3 is no longer needed, and has been removed from the recommended CIP and financial analysis.

7.1.3 Structural Projects (2005 Master Plan Status Update)

Projects addressing structural problems are identified with an "S" and projects addressing corrosion are identified with a "C." This section presents a status update for the structural projects presented in the 2005 Master Plan.

S1 Pipe Condition Rating (PCR) A

This project consisted of 1,780 lf of new 8-inch diameter pipe to replace existing 6-inch diameter pipe. A total of 14 individual reaches were included, which are scattered through the City's collection system. The reaches had condition scores greater than or equal to 30 (old rating system) as presented in 2005 Master Plan Chapter 2, indicating that they typically have multiple structural defects and should be replaced. All pipe reaches were anticipated to be replaced using open cut because defects include sags which are difficult to correct using trenchless methods.

Project Update. This project was incorporated into the City's CIP as Sewer Main Replacement – Sewer Master Plan Project PCR A, Phase I (Project No. 08-06). It was adopted in FY08-09 with a budget of $455,000. The March 2012 Capital Project Status Detail Report indicates that the project was completed in 2011. Accordingly, this project has been removed from the recommended CIP and financial analysis. Additional CAR A reaches were identified in 2007 through 2010 CCTV inspections and included as Project S1-2011, described below.

S2 Annual Spot Repairs

This project was to be performed annually to address the most critical spot repairs for sewer pipes and manholes that are identified during CCTV and manhole inspections. The first year project included the severe defects listed in 2005 Master Plan Tables 2-5 and 2-6 that are not included in other projects. Other pipe reaches and manholes should be selected for rehabilitation from the 2005 CCTV inspection data.

Project Update. Many reaches included in this project have been repaired and/or replaced since 2005. The CCTV data collected between 2007 and 2011 was much more comprehensive than the data available during the preparation of the 2005 Master Plan. New CCTV inspections cover over 90 percent of the collection system. Project S2-2011 was developed based on that information, and addresses 84 specific reaches in need of priority spot repairs. It should replace this project. Accordingly, old project S2 has been removed from the recommended CIP and financial analysis.

S3 ACP Replacement

This project consisted of replacing 1,760 feet of 6-inch and 8-inch diameter ACP that is deteriorating. The ACP was used to construct 10 sewer reaches which are scattered in various parts of the collection system.

Project Update. This project was incorporated into the City's CIP as Asbestos Concrete Pipe Sewer Main Replacement (Project No. 08-01). It was adopted in FY08-09 with a budget of $359,243. The March 2012 Capital Project Status Detail Report indicates that the project was completed in 2011. Accordingly, this project has been removed from the recommended CIP and financial analysis.

The City notes that during the CCTV inspection activities since the 2005 Master Plan, additional pipes constructed of ACP have been identified in the system.

S4 PCR B

This project consisted of rehabilitation of approximately 90,300 lf of sewers up to 24-inch-diameter with project condition rating B (see 2005 Master Plan Appendix E). It is anticipated that this work will occur annually. Additional CCTV inspection of the collection system is recommended. The results should be evaluated and the new results should be prioritized with the results to date to identify specific reaches for rehabilitation each year.

Project Update. This project is out of date and is no longer relevant since it was based on CCTV inspection data that has largely been superseded. Now that most of the collection system has been CCTV inspected, new projects have been developed based on the updated condition rating system to address reaches in need of replacement or rehabilitation. Accordingly, project S4 PCR B has been removed from the recommended CIP and financial analysis.

C1 Corrosion Rehabilitation A

This project consists of CIPP of approximately 1,600 lf of pipe in four reaches of the trunk sewer. The reaches are within sections encompassing approximately 16,000 lf. The CCTV inspection logs for the trunk sewer identified exposed rebar four times without recording the length. Exposed rebar indicates severe corrosion which often extends further upstream and downstream of where exposed rebar was visible. Consequently, it is proposed to rehabilitate each entire reach of pipe with exposed rebar and not to rehabilitate only the area with observed exposed rebar.

Project Update. Five reaches from the project areas were incorporated into the City's CIP as Sewer Main Corrosion Rehabilitation Project A (Project No. 09-28). It was adopted in FY09-10 with a budget of $1,080,000. The March 2012 Capital Project Status Detail Report indicates that the project has been completed. Additional reaches were included in Annual Sewer Repair (Project No. 11-04), Annual Sewer Repair (Project No. 12-04), and Sewer Collection System Upgrades (Project No. 12-10), which are currently in design according to the March 2012 Status Report.

Reaches that have been CIPP rehabilitated are shown on Figure 7-1 with a red diagonal hatch symbol. The remaining reaches in the areas that were included in the original C1 project have been incorporated into new CIPP projects described below. Accordingly, old project C1 has been removed from the recommended CIP and financial analysis.

C2 Corrosion Rehabilitation B, C and D

These projects consist of additional CIPP rehabilitation of the trunk sewer. The total length to be rehabilitated is approximately 22,010 lf and pipe sizes range from 24-inch to 42-inch. The trunk sewer rehabilitation is divided into three projects to be more manageable for the City and to provide flexibility to the City to rehabilitate the reaches that are most corroded as determined from future, more in-depth inspections of the trunk sewer pipe.

Project Update. This project was never initiated. It has been replaced with three new CIPP projects, C2-2011 through C4-2011, which address moderate to severe corrosion in the large-diameter RCP trunk sewer in three stages. Accordingly, old project C2 has been removed from the recommended CIP and financial analysis.

7.1.4 Maintenance Problem Areas Project

The City identified 21 sewer reaches of 6-inch diameter vitrified clay pipe with maintenance problems that can be addressed by a capital project. The total length of the reaches is 3,400 lf and many reaches are located in easements. The sewer reaches are located in various areas of the collection system.

The projected rehabilitation method for these reaches is pipe bursting to replace the existing 6-inch diameter pipe with 8-inch diameter pipe. Given the relatively small amount of pipe and the commonality of the projected rehabilitation method, all problem reaches are consolidated into one project. The Maintenance Problem Area project is designated with an "M."

M1 Maintenance Problem Areas

Project M1 (as identified in the 2005 Master Plan) consisted of replacing 3,400 lf of 6-inch diameter pipe with 8-inch diameter pipe. The expected construction method is pipe bursting. Project information is summarized in Table 7-11.

Project Update. Some reaches from this project were incorporated into the City's CIP as Sewer Main Replacement - Sewer Master Plan Project M1 (Project No. 08-07), and others were replaced as part of the City's on-going Annual Sewer Repair projects. Project No. 08-07 was adopted in FY08-09 with a budget of $675,000. The December 31, 2009 Capital Project Status Detail Report indicated that the project was "Under Construction" and listed it as being 99 percent complete at that time. Accordingly, this project has been removed from the recommended CIP and financial analysis.

7.1.5 New Projects

New projects were developed to address pipe reaches with structural and maintenance problems that were identified through the comprehensive CCTV inspection program carried out between 2007 and 2010. Pipe reaches that have recently been repaired or replaced by the City were removed from the projects developed in this section. It is possible that some additional pipe reaches still included in these projects have already been repaired or replaced. The City should cross-check the reaches presented here with CIP and/or emergency projects undertaken after the 2005 Master Plan was developed.

S1-2011 CAR A Sewer Replacement, Phase 1

This project includes 33 pipe reaches in CAR category A with PCR 10 or greater and whose worst defect is three or greater (as identified during the 2007-2010 CCTV inspections). These reaches typically have multiple moderate to severe structural defects, and should be replaced with new pipe.

The project consists of approximately 6,925 lf of 6-inch diameter pipe in 30 reaches, 650 lf of 8-inch pipe in two reaches, and a single 330 lf reach of 12-inch pipe. The 6-inch-diameter pipe should be replaced with 8-inch-diameter pipe using open cut or pipe bursting. Information on reaches included in S1-2011 is listed in Appendix J and the project locations are shown on Figure 7-1.

S2-2011 CAR A Sewer Replacement, Phase 2

This project includes 84 pipe reaches in CAR category A with PCR less than 10 and whose worst defect grade is four or five, indicating that they have one or two severe structural defects that should be repaired. In lieu of repairing individual spot defects, the City prefers to replace the entire reach, particularly on 6-inch diameter pipes that will ultimately be upsized to 8-inch diameter. Information on reaches included in S2-2011 is listed in Appendix J and the project locations are shown on Figure 7-1.C2-2011

CAR A Corrosion Rehabilitation, Phase 1

This project consists of CIPP rehabilitation of five reaches (approximately 1,350 lf) of severely corroded RCP trunk sewer. Reaches were selected for this project if the V&A CCTV inspection review indicated any PACP Grade 5 corrosion. The rehabilitation consists of approximately 475 lf of 27-inch-diameter, 485 lf of 30-inch-diameter, and 390 lf of 33-inch-diameter RCP. Reaches are listed in Appendix J and locations are shown on Figure 7-1.

C3-2011 CAR A Corrosion Rehabilitation, Phase 2

This project consists of CIPP rehabilitation of 25 reaches (approximately 8,575 lf) of corroded RCP trunk sewer. Reaches were selected for this project if the V&A CCTV inspection review indicated any PACP Grade 4 corrosion. The rehabilitation consists of approximately 270 lf of 24-inch-diameter, 6,935 lf of 30-inch-diameter, 310 lf of 36-inch-diameter RCP and 1,560 lf of 39-inch-diameter RCP. Reaches are listed in Appendix J and locations are shown on Figure 7-1.

C4-2011 CAR B Corrosion Rehabilitation

This project consists of CIPP rehabilitation of six reaches (approximately 1,670 lf) of corroded RCP trunk sewer. Reaches were selected for this project if the V&A CCTV inspection review indicated any PACP Grade 3 corrosion. The rehabilitation consists of approximately 310 lf of 27-inch-diameter RCP, 810 lf of 30-inch-diameter RCP, and 550 lf of 42-inch-diameter RCP. Reaches are listed in Appendix J and locations are shown on Figure 7-1.

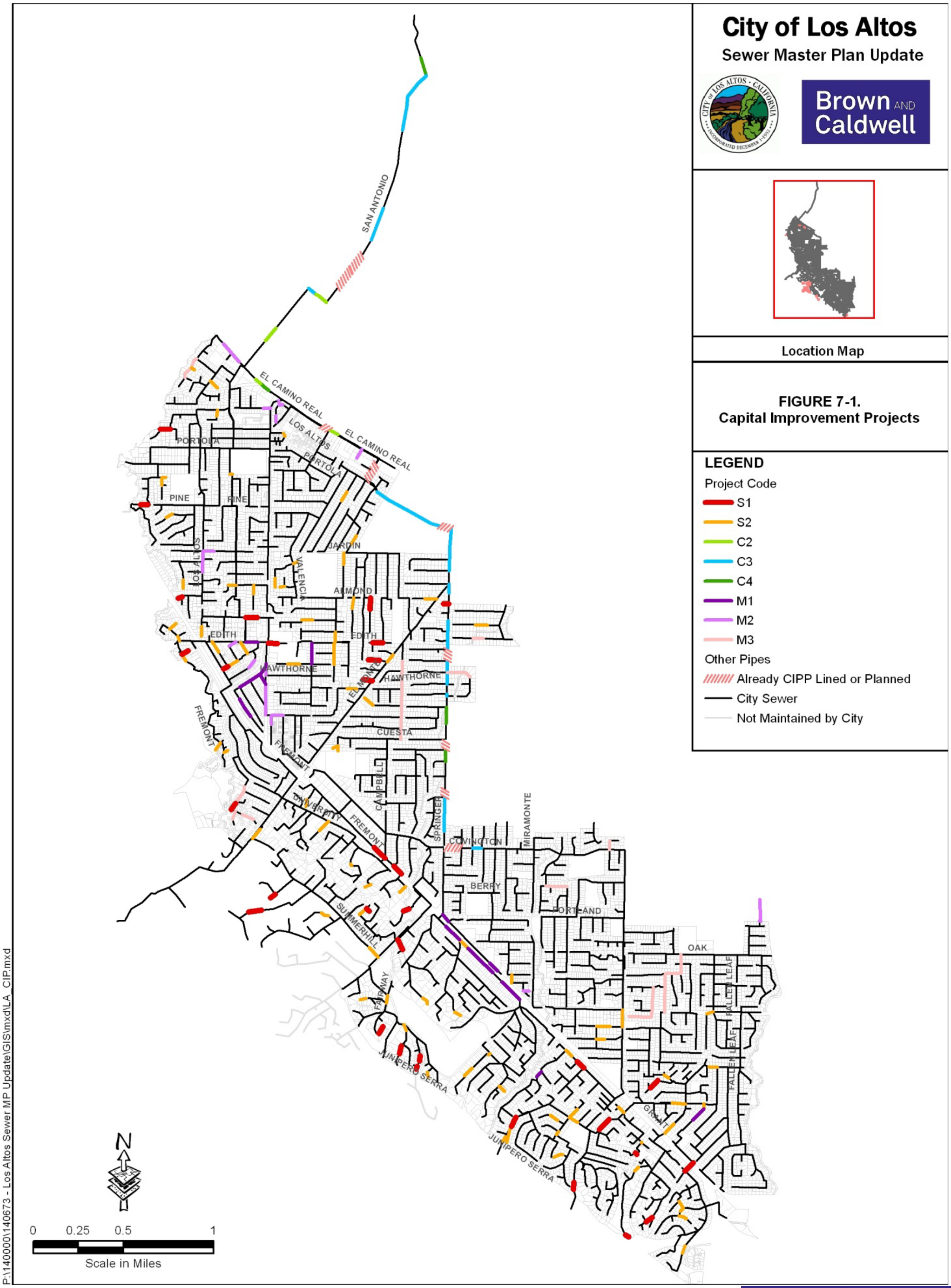
M1-2011 through M3-2011

Projects M1, M2, and M3 were developed to address pipes on the focused cleaning schedule that also have severe sags according to 2007-2010 CCTV inspection data. Severe sags are defined as PACP grade three and four sags (MWLS) where the water depth is at or above 50 percent of the pipe height and pipes where the inspection camera became submerged (MCU). Such sags can cause accumulation of debris and grease which necessitates frequent cleaning. This is confirmed by the high correlation between pipes with severe sags and pipes on the focused cleaning schedule. Projects were prioritized by cleaning schedule: Project Nos. M1, M2 and M3 address areas within the 30-, 60-, and 90-day focused cleaning schedules, respectively.

Pipes with severe sags should be replaced by open trench construction. They are not good candidates for pipe bursting or sliplining methods, both of which are unable to correct sags. 6-inch-diameter pipes should be replaced with 8-inch-diameter pipes, but larger diameters do not require upsizing. Reaches are listed in Appendix J and locations are shown on Figure 7-1. Table 7-1 summarizes the length of pipe to be replaced by diameter and project.

Table 7-1. Maintenance Projects M1, M2, and M3

Pipe Diameter	M1 (30-day), lf	M2 (60-day), lf	M3 (90-day), lf	Total by Diameter
6-inch	3,715	3,785	7,000	14,500
8-inch	2,535	1,840	2,675	7,050
10-inch	370	--	--	370
TOTAL	6,620	5,625	9,675	21,920


City of Los Altos
Sewer Master Plan Update
Brown AND Caldwell
Location Map
FIGURE 7-1.
Capital Improvement Projects
LEGEND
Project Code
S1
S2
C2
C3
C4
M1
M2
M3
Other Pipes
Already CIPP Lined or Planned
City Sewer
Not Maintained by City
SAN ANTONIO
EL CAMINO REAL
LOS ALTOS
PORTOLA
PINE
JARDIN
VALENCIA
ALMOND
EDITH
HAWTHORNE
CUESTA
FREMONT
CAMPBELL
SPRINGER
UNIVERSITY
COVINGTON
MIRAMONTE
BERRY
PORTLAND
OAK
FALLEN LEAF
GRANT
SUMMERHILL
FAIRWAY
JUNIPERO SERRA
EL MONTE
0 0.25 0.5 1
Scale in Miles
N
P:\140000\140673 - Los Altos Sewer MP Update\GIS\mxd\LA_CIP.mxd

7.2 Pump Station Projects

An update to the 2005 pump station capital projects is provided in the following sections. All three recommended projects have since been completed or are in progress, and no additional pump station projects are proposed in this Master Plan Update.

7.2.1 Pine Lane Pump Station

Projects P1 (pump station relocation study) and P2 (Pine Lane Option 1, flow diversion and pump station relocation) were incorporated into the City's CIP as Bullis (Pine Lane) Sewer Pump Station Replacement (Project No. 08-09) and Pine Lane Sewer Pump Station (Project No. 09-37). They were adopted in FY08-09 and FY09-10 with budgets of $60,000 and $636,000, respectively. The December 31, 2009 Capital Project Status Report indicated that the relocation study has been completed. The November 2010 Capital Project Status Detail Report indicates that project P2 is currently "Under Construction" and listed it as being 38 percent complete at that time. Accordingly, both projects have been removed from the recommended CIP and financial analysis.

7.2.2 Van Buren Pump Station

This project was incorporated into the City's CIP as Van Buren Lift Station Rehabilitation (Project No. 08-08). It was adopted in FY08-09 with a budget of $216,420. The November 2010 Capital Project Status Detail Report indicates that the project is currently "Under Construction" but listed it as being 99 percent complete at that time. Accordingly, this project has been removed from the recommended CIP and financial analysis.

7.2.3 O'Keefe Pump Station

The City no longer owns or maintains this pump station. Accordingly, it has been removed from the recommended CIP and financial analysis.

7.3 Other Projects

Several other capital projects were identified during the development of the 2005 Master Plan. They are described here, with a status update section following each project description where applicable.

7.3.1 Permanent Flow Meters

The City should install four permanent flow meters to measure the flow at the connection points to the Town sewer collection system. The flow data could be used for billing purposes. Special prefabricated manholes with flumes would be required to meter the connection points to the Town. The cost of permanent monitors is typically $20,000 per installation, depending upon site conditions, pipe diameter and flow conditions. A site assessment is required to determine the best locations of the flow meters. The assessment should consider hydraulics in the sewers, traffic control and access for future maintenance, and accessibility to electrical power.

Project Update. This project was incorporated into the City's CIP as Sewer Metering Stations (Project No. 06-12). It was adopted in FY06-07 with a budget of $236,150. The November 2010 Capital Project Status Detail Report indicates that the project is currently "Under Construction" but listed it as being 97 percent complete at that time. Accordingly, this project has been removed from the recommended CIP and financial analysis. This project included the installation of eight permanent flow meters. Five meters measure flow from the Town and were funded by the Town.

7.3.2 Master Plan Update

Due to the new regulations and potential changes to land use due to redevelopment, it is recommended that the City update its Master Plan every 10 years. Costs range from $300,000 to $600,000 depending on whether or not flow monitoring and/or condition assessment activities are included. The next Master Plan update is scheduled for FY21-22.

7.3.3 SSMP Update

The City should update its SSMP following audits, as required every two years. A SSMP update with recertification is required every five years. The next planned update will likely need to incorporate proposed revisions to the Waste Discharge Requirements. An bi-annual capital cost of $20,000 has been allocated to cover the costs of this update.

7.3.4 Computerized Maintenance Management System Update

The City should acquire an improved CMMS and implement a work order system to digitally track cleaning, stoppages, SSOs and other maintenance. Historical maintenance data can be linked to the GIS for analysis of repeat problem areas. This process will allow the City to adjust maintenance activities to prevent stoppages and develop reports for annual audits required for the SSMP. The CMMS should manage CCTV inspection data. Inspection data should be collected in a format that is compatible with the CMMS.

Project Update. The City is now utilizing the OPRA CMMS for collection system management. Accordingly, this project has been removed from the recommended CIP and financial analysis.

7.3.5 Future CCTV Inspection, Condition Assessment and Database Updates

Approximately five years prior to the next Master Plan update, the City should begin reinspecting its collection system. The program can be implemented in the same manner that the City has been executing its CCTV program over the past five years. The timing is such, that this information can be included in the next Master Plan update report. An annual capital cost of $330,000 has been allocated to cover the costs of inspection, condition assessment and updates to the City's MapGuide database.

7.3.6 Root Control

The City is implementing a chemical root treatment program to control root growth in the collection system. The program should include initial cutting of roots followed by application of chemical treatment. This approach should control root growth for about three years. The City should start this program by chemically treating sewers located in easements where root control is a significant problem. The City should treat approximately 90,000 lf per year. Chemicals should be coordinated with the Regional Plant. Chemical root treatment requires specialized training and the City should consider outsourcing this work. The estimated cost for cutting roots and application of chemical treatment is $3 per lf. The annual capital cost is $270,000.

Project Update. The City has implemented the root control program and is now treating approximately one-third of the system each year. Accordingly, an annual budget placeholder has been included in the recommended CIP and financial analysis.

7.3.7 GIS Updates

Current and updated maps are critical to the operation and maintenance of the collection system. An annual capital cost of $50,000 has been allocated to cover the costs of updating the City's GIS with information from new capital projects, inspection and maintenance data.

7.3.8 FOG Program

The City currently lacks resources to fully implement its FOG Program. An annual capital cost of $50,000 has been allocated to cover the costs of a consultant to provide more resources for additional inspections and follow-up and to educate customers contributing excessive FOG to the collection system.

7.4 Capital Costs

This section presents the basis for the unit costs developed for estimating the construction costs and capital costs of recommended capital improvements. The recommended rehabilitation method cost index and the development of the capital costs of gravity sewer pipeline construction and rehabilitation are presented. The total capital investment necessary to complete a project consists of expenditures for construction, engineering services, contingencies, and such overhead items as legal and administrative services and financing. The two components of capital costs are described below.

7.4.1 Unit Pipeline Construction Costs

Construction costs presented in the 2012 Master Plan Update represent preliminary cost estimates of the materials, labor and services necessary to build the proposed projects. The cost estimates are indicative of the cost of construction in the study area. In considering cost estimates, it is important to realize that changes during final design, as well as future changes in the cost of material, labor and equipment, will cause comparable changes in the estimated costs. Unit costs used in this study were obtained from a review of pertinent sources of reliable construction cost information. Construction cost data given in this report is not intended to represent the lowest prices that can be achieved, but rather it is intended to represent planning-level estimates for budgeting purposes.

The cost per lf for pipeline construction includes pavement removal and replacement, sheeting and shoring, traffic control, trenching, bedding, backfill, utility relocations, reconnected laterals, and manholes. Table 7-2 presents unit construction costs for construction and rehabilitation of gravity sewer pipelines. These costs include a 30 percent construction contingency. Costs were developed assuming that construction was for sewers 5 to 15 feet deep that will require trench shoring. Costs for construction of new large diameter sewers may significantly increase if extensive utility relocation and traffic control are required.

Table 7-2. Gravity Sewer Pipe Unit Construction Costs

Diameter, inches	Open Cut,1 $/foot	Pipe Bursting,2 $/foot	Cured in Place Pipe, $/foot
6	n/a	n/a	n/a
8	255	255	n/a
10	270	270	n/a
12	323	323	n/a
15	404	404	n/a
18	475	475	n/a
21	n/a	n/a	n/a
24	n/a	n/a	240
27	n/a	n/a	270
30	n/a	n/a	300
33	n/a	n/a	330
36	n/a	n/a	360
39	n/a	n/a	390
42	n/a	n/a	420

[1]Costs are based on construction in streets with minor traffic control.

[2]Pipe bursting costs are based on size of new pipe.

n/a = not applicable

7.4.2 Contingencies, Engineering and Overhead

Capital costs include construction costs and contingencies plus additional costs related to project design and implementation. Engineering and overhead are assumed to be 30 percent of the construction cost. It is appropriate to allow for the uncertainties unavoidably associated with planning-level layout of projects. Allowances in preliminary estimates are needed to account for factors such as unexpected geotechnical conditions, extraordinary utility relocation and alignment changes. All of these factors can increase project cost.

Engineering services associated with projects include preliminary investigations and reports, site and route surveys, geotechnical explorations, preparation of drawings and specifications, construction services, surveying and staking, and sampling and testing of materials. Overhead charges cover such items as legal fees, financing expenses, administrative costs and interest during construction.

7.4.3 Cost Estimates

Cost estimates for the capital projects are summarized in Table 7-3. All costs are in 2011 dollars. Details of the cost estimates for pipeline projects are presented in Appendix J. Some costs occur in multiple years, but Table 7-3 lists only the first-year cost. The costs for succeeding years are anticipated to be approximately the same. The cost allocation methodology is presented in Section 9.

Table 7-3. Capital Project Cost Estimates

Project Designation	Project Name	Existing Diameter, inches	Length, feet	Recommended Diameter, inches	Proposed Method	Construction Cost	Cost Escalation	Capital Cost
H1-2011	South Sewer Replacement, Ph. 2	12, 15	1,000	15, 18	Open Cut	$404,400	$121,300	$525,700
S1-2011	CAR A Sewer Replacement, Ph. 1	4, 6, 8, 12	7,900	8, 12	Open Cut	$2,038,800	$611,600	$2,650,400
S2-2011	CAR A Sewer Replacement, Ph. 2	6 - 15	20,380	8 - 15	Open Cut	$5,302,400	$1,590,700	$6,893,100
M1-2011	30-Day Maintenance Problem Areas	6, 8, 10	6,620	8, 10	Open Cut	$1,694,700	$508,400	$2,203,100
M2-2011	60-Day Maintenance Problem Areas	6, 8	5,625	8	Open Cut	$1,435,300	$430,600	$1,865,900
M3-2011	90-Day Maintenance Problem Areas	6, 8	9,680	8	Open Cut	$2,468,600	$740,600	$3,209,200
C2	CAR A Corrosion Rehabilitation, Ph.1	27, 30, 33	1,350	n/a	CIPP	$402,100	$120,600	$522,700
C3	CAR A Corrosion Rehabilitation, Ph. 2	24, 30, 36, 39	8,575	n/a	CIPP	$2,715,700	$814,700	$3,530,400
C4	CAR B Corrosion Rehabilitation	27, 30, 42	1,670	n/a	CIPP	$556,400	$166,900	$723,300
Master Plan	Master Plan Update	n/a	n/a	n/a	n/a	$300,000	-	$300,000
	DISCRETE PROJECTS	**SUBTOTAL**	**62,800**			**$17,318,400**	**$5,105,400**	**$22,423,800**
Project Designation	**Project Name**	**Existing Diameter, inches**	**Length, feet**	**Recommended Diameter, inches**	**Proposed Method**	**Construction Cost**	**No. of Years**	**Capital Cost**
SSMP	Bi-Annual SSMP Update	n/a	n/a	n/a	n/a	$20,000	x7	$140,000
CCTV	Future Sewer Main Video	n/a	n/a	n/a	n/a	$240,000	x5	$1,200,000
CADB	Condition Assessment/Database Updates	n/a	n/a	n/a	n/a	$90,000	x5	$450,000
CRT	Annual Chemical Root Treatment	n/a	n/a	n/a	n/a	$200,000	x15	$3,000,000
GIS	Annual GIS Updates	n/a	n/a	n/a	n/a	$50,000	x15	$750,000
FOG	FOG Program	n/a	n/a	n/a	n/a	$50,000	x15	$750,000
	RECURRING PROJECTS	**SUBTOTAL**	**n/a**			**$650,000**	**-**	**$6,290,000**
	ALL PROJECTS	**TOTAL**						**$28,713,800**

Section 8

Recommendations and Capital Improvement Program

This section presents recommendations and the CIP. This section completely supersedes the Recommendations and Capital Improvement Program from the 2005 Master Plan. Recommendations include structural repairs, repairs to reduce operation and maintenance practices, and rehabilitation of the reinforced concrete pipe outfall. Project prioritization and costs are included in the CIP.

8.1 Recommended Modifications to Operation and Maintenance Practice

The following program enhancements are recommended to improve the City's O&M program and ultimately reduce stoppages, SSOs and backups.

8.1.1 Cleaning and Root Control

The City should continue its current cleaning and root control program. Since 2005, this program has contributed to reducing dry weather SSOs by 33 percent and stoppages by 94 percent. Information obtained about the maintenance requirements of the pipes should continue to be managed by the CMMS and evaluated using the capabilities of the GIS.

The focused cleaning program should continue to be modified as structural improvements are made to the system and as improvements are made with the FOG program. Reducing focused cleaning program cleaning frequencies could be accomplished by addressing the primary causes of frequent maintenance through spot repairs, sewer rehabilitation, chemical root control, and/or grease control. This will reduce the likelihood of SSOs and would make the City's cleaning crews more available for cyclic cleaning and other work.

The current cleaning program for the City's collection system is outlined in Table 8-1. At this time, no additional staff or equipment is needed to clean the sewers. However, the Maintenance Leadworker position should be filled.

Table 8-1. Future Sewer Main Cleaning Program

Cleaning Frequency	Cleaning, feet	% of System
30-day (focused)	20,000	3
60-day (focused)	20,000	3
90-day (focused)	27,000	4
18-month (cyclic)	621,000	84
Total Cleaning per Year	882,000	

The City should evaluate the effectiveness of sewer cleaning in removing roots and grease by performing post-cleaning CCTV inspection or by monitoring the amount of debris removed from the system. These inspections could be incorporated into the CCTV inspection program discussed below.

8.1.2 CCTV Inspections

Approximately 93 percent of the sewer pipes have been inspected since the 2005 Master Plan. The City should inspect the remainder of these lines in the next 1-2 years. The City should re-inspect the collection system on a 10-year cycle so that data can be reviewed as part of a regular master plan update. It is not required that recently-rehabilitated pipes be televised during this first 10-year period unless the City desires to confirm the effectiveness of the repairs. Critical defects should be identified for spot repairs and deteriorated reaches should be identified for potential rehabilitation or replacement. Pipe reaches that are shown by repeated CCTV results to be in good condition and stable, should be inspected less frequently. Cleaning frequencies should be updated for each pipe reach using the results of the CCTV inspections and maintenance staff experience.

Regular manhole inspections should be performed as part of sewer cleaning and/or CCTV sewer inspection. The City needs to refine its inspection procedures and tracking system for manhole inspections to ensure they are compliant with PACP/Manhole Assessment and Certification Program (MACP) standards.

8.1.3 Grease Control

The City should expand its grease control program to include inspections of grease interceptors every 12 months in areas with high grease accumulations in sewers. The City should also require food processing establishments to adopt best management practices to minimize grease discharges to the collection system. A public education program could help reduce grease from residences.

8.1.4 Pump Stations

The City should perform periodic pump maintenance as recommended by the pump manufacturer. This work will likely be performed by a contractor unless it is minor and can be performed with existing staff.

8.1.5 Tools and Equipment

The recommendations for tools and equipment are based on the remaining life analysis of existing tools and equipment and the recommended changes to the O&M program. The recommendations are presented in Table 8-2.

Table 8-2. Recommended New Equipment and Tools			
Description	Use	Estimated Replacement Year	Justification
Gas Generator	Portable power for hand tools and lighting	FY15-16	Replacement
Root Cutters (2)	Sewer pipe cleaning	FY16-17	Replacement
Safety Tripod	Confined space entry	FY16-17	Replacement
Dump Truck (2-Yard)	Haul sewer debris	FY12-13	Replacement
Pickup Truck	Sewer service truck	FY12-13	Replacement
Diesel Generator	Emergency backup generator	FY12-13	Replacement
Portable Trash Pumps (2)	Sewer bypass pump	FY12-13	Replacement
Flushing Truck (Jetter)	Sewer flushing	FY14-15	Replacement
Sectional Rodder	Root removal from sewer lines	FY14-15	Replacement
Mobile Radios (12)	Field vehicle communication	FY14-15	Replacement
Compactor/Rammer	Sewer trench compaction	FY15-16	Replacement
Lateral Rodder (2)	Sewer lateral and easement rodding	FY15-16	Replacement
Service Truck	24-hour Standby vehicle	FY15-16	Replacement
Tractor/Backhoe	Sewer repairs	FY15-16	Replacement
CCTV Lateral Camera	Televising sewer laterals	FY16-17	Replacement
Gas Detection Monitor (4)	Confined space entry	FY17-18	Replacement
Sewer Supervisor Truck	Supervisor vehicle	FY20-21	Replacement
Vac-Con Sewer Cleaner (Combination Jet/Vacuum)	Sewer flushing/vacuuming	FY20-21	Replacement

8.2 Capital Improvement Program

The CIP is developed below.

8.2.1 Prioritization

Projects should be phased based on their priority. Projects were prioritized based on the following criteria. Annual projects have been included as their own category. Each category is considered critical towards the implementation of the overall plan. Annual projects, Priority 1 and Priority 2 projects should be completed first because they include projects that, if not completed, put the City at risk of an SSO.

- **Annual Projects.** Chemical root treatment program, FOG program and GIS updates.
- **Priority 1.** Structural Reach Replacement for Category A deficiencies, 30-day Maintenance Problem Areas and complete South Sewer Replacement.
- **Priority 2.** Corrosion Rehabilitation for advanced corrosion in the trunk sewer outfall.
- **Priority 3.** Structural Reach Replacement for Category B deficiencies, 60 to 90-day Maintenance Problem Areas and Corrosion Rehabilitation for moderate corrosion in the trunk sewer outfall.

- **Priority 4.** Future pipe inspection programs, Master Plan and SSMP updates.

8.2.2 Recommended Program

The recommended capital improvement program is presented in Table 8-3. Maintenance related capital projects, the FOG program, and chemical root treatment were assigned to Priority 1 because they should be implemented in the near future to reduce stoppages and SSOs. Future Master Plan updates were assigned to Priority 4.

The capital costs listed in Table 8-3 are in current (2011) dollars. The CIP is assumed to cover a period of 15 years. Information on total capital cost to implement the CIP is provided in Section 9.

Table 8-3. Capital Improvement Program[1]

Priority	Project Designation	Project Name	Construction Cost/ Recurring Cost	Contingency/ No. of Years	Capital Cost
Annual	GIS	Annual GIS Updates	$50,000	x15	$750,000
Annual	CRT	Annual Chemical Root Treatment	$200,000	x15	$3,000,000
Annual	FOG	Annual FOG Program	$50,000	x15	$750,000
		Subtotal Annual	$300,000	-	$4,500,000
1	H1-2011	South Sewer Replacement, Ph. 2	$404,400	$121,300	$525,700
1	S1-2011	CAR A Sewer Replacement, Ph. 1	$2,038,800	$611,600	$2,650,400
1	M1-2011	30-Day Maintenance Problem Areas	$1,694,700	$508,400	$2,203,100
		Subtotal Priority 1	$4,137,900	$1,241,300	$5,379,200
2	C2-2011[2]	CAR A Corrosion Rehabilitation, Ph. 1	$402,100	$120,600	$522,700
2	C3-2011[2]	CAR A Corrosion Rehabilitation, Ph. 2	$2,715,700	$814,700	$3,530,400
		Subtotal Priority 2	$3,117,800	$935,300	$4,053,100
3	S2-2011	CAR A Sewer Replacement, Ph. 2	$5,302,400	$1,590,700	$6,893,100
3	C4-2011	CAR B Corrosion Rehabilitation	$556,400	$166,900	$723,300
3	M2-2011	60-Day Maintenance Problem Areas	$1,435,300	$430,600	$1,865,900
3	M3-2011	90-Day Maintenance Problem Areas	$2,468,600	$740,600	$3,209,200
		Subtotal Priority 3	$9,762,700	$2,928,800	$12,691,500
4	Master Plan	Master Plan Update	$300,000	-	$300,000
4	SSMP[3]	Bi-Annual SSMP Update	$20,000	x7	$140,000
4	CCTV[4]	Future Sewer Main Video	$240,000	x5	$1,200,000
4	CADB[4]	Condition Assessment/Database Updates	$90,000	x5	$450,000
		Subtotal Priority 4	$650,000	-	$2,090,000
		TOTAL			$28,713,800

[1]Proposed year of project implementation used for financial analysis shown in Appendix K, Table 2.

[2]Approximately $1,311,000 was encumbered by the City in FY11/12 for work included in these projects.

[3]Bi-annual expense starting in FY14/15.

[4]Annual expense starting in FY17/18.

8.3 Other Recommendations

In addition to capital costs associated with the correction of capacity and structural deficiencies, other needs for the City's collection system have been identified. These include cyclic replacement of 6-inch diameter sewers, staffing, and keeping the City's GIS, sewer master plan and SSMP up to date. These recommendations are further described in the following sections.

8.3.1 Cyclic Replacement

The City has approximately 582,000 lf of 6-inch diameter sewers not included in the CIP presented in the previous sections. Six-inch diameter sewers can cause recurring operations and maintenance problems, as well as having limited hydraulic capacity. The City should consider a cyclic program to replace 6-inch diameter sewers with 8-inch diameter sewers, which is now the standard minimum sewer main size according to several engineering standards such as 10 State Standard and many local agencies. If this were undertaken on a 20-year cyclic program, the City would need to replace 29,100 lf of 6-inch diameter sewer per year at a present day construction cost of $6,600,000 per year. A 50-year program would require replacement of 11,640 lf of sewer per year at a present day construction cost of $3,841,000 per year. The City should consider implementing cyclic replacement after the CIP presented in this Master Plan Update is completed in 2022.

Cyclic replacement projects should be prioritized by condition assessment ratings (structural and maintenance) and by operations and maintenance requirements. Future CCTV inspections and maintenance records will allow identification of priority areas. Projects should be grouped geographically, either by sewershed, neighborhood, or cleaning quadrant.

8.3.2 Master Plan Update

The City should update its Master Plan in ten years. The next update can include detailed prioritization, project phasing, and budgeting for eventual cyclic 6-inch diameter sewer replacement.

8.3.3 SSMP Update

The City should update its SSMP following audits, as required every two years. A SSMP update with recertification is required every five years. The next planned update will likely need to incorporate proposed revisions to the Waste Discharge Requirements.

8.3.4 GIS Updates

The City should update and maintain its GIS since it is a critical repository for collection system network, modeling and O&M data. GIS can be used to track cleaning frequencies, SSO and stoppage locations, and allow the City to modify and optimize cleaning and other maintenance activities. Updates should be made at least annually, either by City staff or outsourced.

8.3.5 Staffing

Since the last Master Plan, the Sewer Supervisor position has been filled, but the maintenance leadworker position was eliminated. While the new sewer supervisor has been able to fill the need for managerial expertise (O&M and SSMP reporting activities, tracking and managing chemical root treatment and CCTV inspection programs, further implementation and monitoring of the grease control program, and coordinating other capital and repair projects), this has left a gap in terms of supervisory expertise needed to direct the maintenance workers. This function is important for a well managed collection system. The only recommended new position at this time is:

- 1.0 FTE – Maintenance Leadworker

Section 9

Financial and Economic Analysis

This section presents the results of a financial and economic analysis of the impact of the 2012 Update costs upon the City's sewer system rates and annual cash balances. The study period is FY11-12 through the end of FY27 (15 years). FY12 serves as a historical, benchmark year with actual expenditures, cash and rates. This section completely supersedes the Financial and Economic Analysis from the 2005 Master Plan.

Sewer system rates and charges for the City developed in this chapter are **not intended to be adopted for implementation without a formal rate study.** The rates and charges presented are intended to serve as one of the variables that will enable the City to evaluate its long-term financial plan and method of implementation of the Master Plan Update. According to the City, the future rate study may also include an evaluation of the current rate methodology.

The financial and economic analysis presented in this section is a projection of future capital, operation and maintenance costs presented in the Master Plan Update and provided by the City. Actual costs and ending cash balances in the future will vary from these projections due to a variety of circumstances such as bid prices, inflation, labor costs, unforeseen changes in the collection system, and actual rate increases adopted by the City. For example, the Master Plan Update was prepared assuming at 5-year (starting in FY12) capital project budget of $8.715M while the actual adopted 5-year CIP budget was $8.412M. The difference between the projected and actual budgets has a negligible impact on the overall financial and economic analysis.

Detailed data used to prepare figures and tables shown in this section are included in Appendix K.

9.1 Methodology and Objectives

The methodology used to prepare this financial analysis involved a sequence of steps that are summarized below:

- Obtain data on customers and planned expenditures.
- Project annual changes in the number of customer accounts and wastewater flow.
- Project annual operations and maintenance, capital and other expenditures.
- Develop and project annual sewer charges and revenue from sewer charges.
- Project annual cash flow.

The overall objective of this financial analysis was to develop a plan for funding the capital projects listed in the Master Plan Update. The overall objective is a composite of two, subsidiary objectives. The two subsidiary objectives are:

- Fund all capital and equipment replacement expenditures with revenue from sewer rates and/or use of available cash (no new debt issuance; maintain minimum cash balance of approximately 25 percent of annual budget).
- Implement level or gradual sewer rate increases in the City.

The subsidiary objectives cannot be maximized simultaneously since the objectives have an inverse relationship. For example, maximizing annual expenditures on capital improvements will have a negative impact on the objective of implementing level or gradual sewer rates.

9.2 Capital Improvement Project Expenditures

The City's collection system requires a number of capital improvement projects including correcting structural problems and remediating sulfide-related corrosion. The list of capital projects is presented in previous sections. The total capital cost for all projects is approximately $27,402,800 (in 2011 dollars). This cost includes all annual and reoccurring capital project costs for FY13-27 (fifteen years).

The prioritization of capital projects listed in the previous sections is based on engineering considerations. However, the actual implementation and funding of capital projects has several additional constraints that affect the timing of capital projects. Examples of these constraints are:

- Availability of City staff to administer project bids and manage contracts.
- Coordination with street improvement projects.
- Cash available for annual CIP expenditures.

Since all constraints cannot be identified at this time, three CIP expenditure scenarios were considered and are shown in Figure 9-1. The three scenarios are:

1. Annual CIP costs based on the prioritization in Section 8.
2. Average annual CIP costs based on the total CIP costs and 15 year implementation
3. Current annual CIP expenditures increased in steps to fund all new CIP projects

The bars in the figure show the fiscal year expenditures for each scenario; the lines show the cumulative total expenditures for each scenario. CIP costs are escalated at a rate of 3 percent per year which results in a total CIP expenditure of $35,225,000 over 15 years. Scenario 3 was selected to provide the most flexibility to the City in implementing the CIP projects.

The projected amount of revenue for capital expenditures included in the amount of revenue projected from sewer rates is approximately $1,534,000 in FY13 and increases at a rate of approximately 6 percent each year. For example, in FY14 the projected amount of revenue for capital expenditures is $1,623,300 ($1,534,000 plus $89,300) and in FY15 the projected amount of revenue for capital expenditures is $1,717,800 ($1,623,300 plus $94,500).

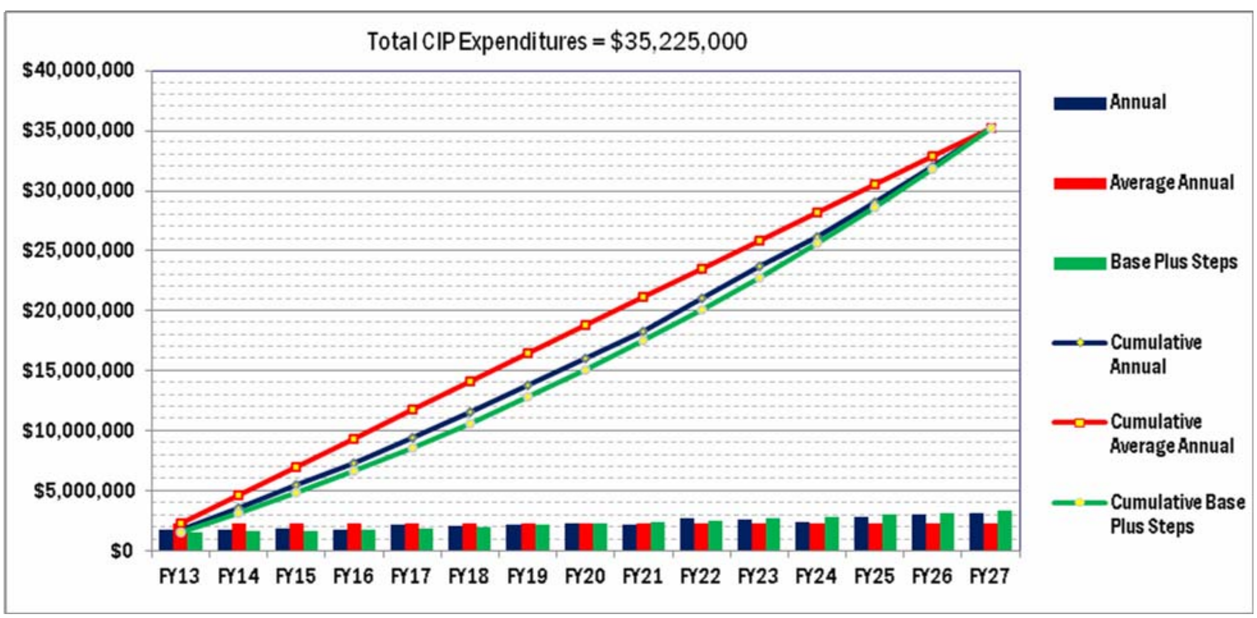


Figure 9-1. Annual and Cumulative Capital Project Expenditures

9.3 Customer Accounts and Sewer Flow

The City provides sewage collection service in the City, a portion of the Town, and an unincorporated County area. The number of parcels with sewer service in the City and County was used to develop projections of sewer flow. Parcel data for FY9-12 were taken from annual reports prepared by Harris and Associates (Harris).[1] Data on the number of City and County parcels used in the FY12 Harris report is shown in Figure 9-2. The number of parcels with sewer service in the City is projected to increase at a rate of 30 per year for during FY13-17 and 15 per year for during FY18-27.

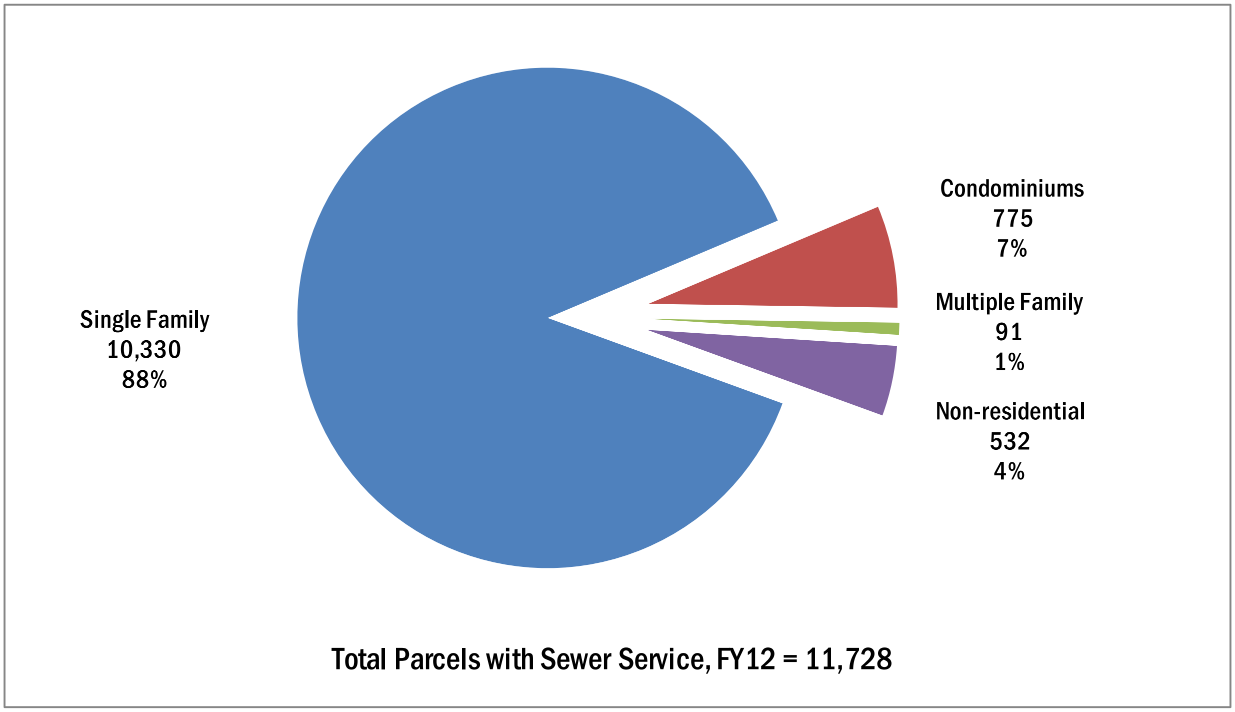


Figure 9-2. Projected FY12 Parcels with Sewer Service

[1] The annual reports by Harris and Associates are for the development of the Sewer Service Charge. Each annual report contains the following statement "Usage data includes all parcels in the City of Los Altos and in unincorporated Santa Clara County served by the City of Los Altos' sewer program. The City's program uses capacity and facilities provided to the program by the City of Mountain View to serve some parcels in the City of Los Altos. These parcels are charged a sewer service charge by the City of Los Altos, and data for these parcels is included in the [totals]. The City of Los Altos compensates the City of Mountain View for access to the Mountain View sewer system by providing the Mountain View's sewer program with access to a similar volume of service from the Los Altos system. Parcels located in Mountain View, but connected to the Los Altos sewer system, are receiving service from the Mountain View sewer program and are not included in the above table or subject to Los Altos' sewer service charge. Additionally, the City of Los Altos sells sewer services, in bulk, to the Town of Los Altos Hills, and the Town uses these services to serve parcels located in Los Altos Hills. Usage by parcels in Los Altos Hills is not shown in the [totals] because these parcels are not subject to the Los Altos sewer service charge. Instead, the full cost of the services indirectly provided by the City of Los Altos to these Los Altos Hills parcels is covered by the direct payment to the City from the Town of Los Altos Hills. Costs of these services are not spread to parcels directly served by the City of Los Altos sewer program."

The amount of sewer flow for parcels in the City and County is based on the number of parcels with sewer service and the estimated average flow per parcel. Sewer flow for parcels used in the FY12 Harris report is shown in Figure 9-3.

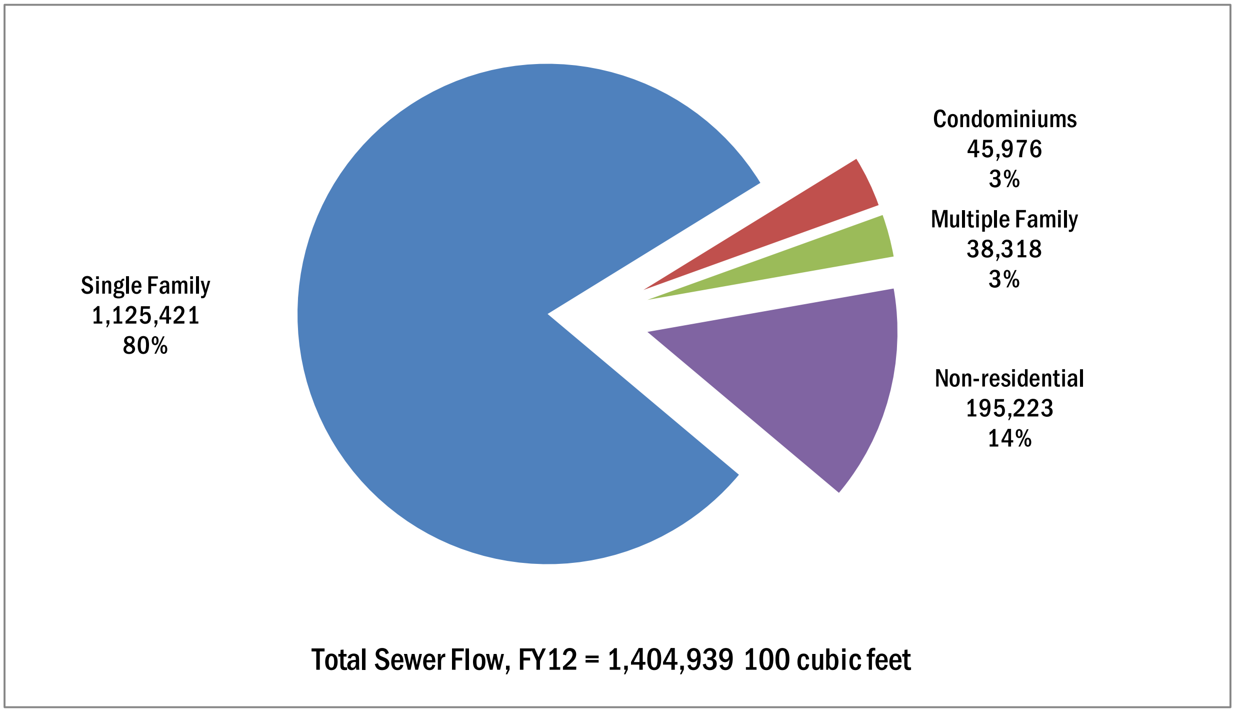


Figure 9-3. Projected FY12 Sewer Flow

Average sewer flow per parcel for the two customer classes with the most parcels (single family and condominiums) has decreased by 28 percent and 23 percent, respectively, over the past three years. This decrease in flow is one of the reasons that the average sewer bills for single family and condominiums customers have decreased for the past three years. Single family and condominium average annual sewer flow for FY9-27 is shown in Figure 9-4. Total annual sewer flow for FY9-27 is shown in Figure 9-5.

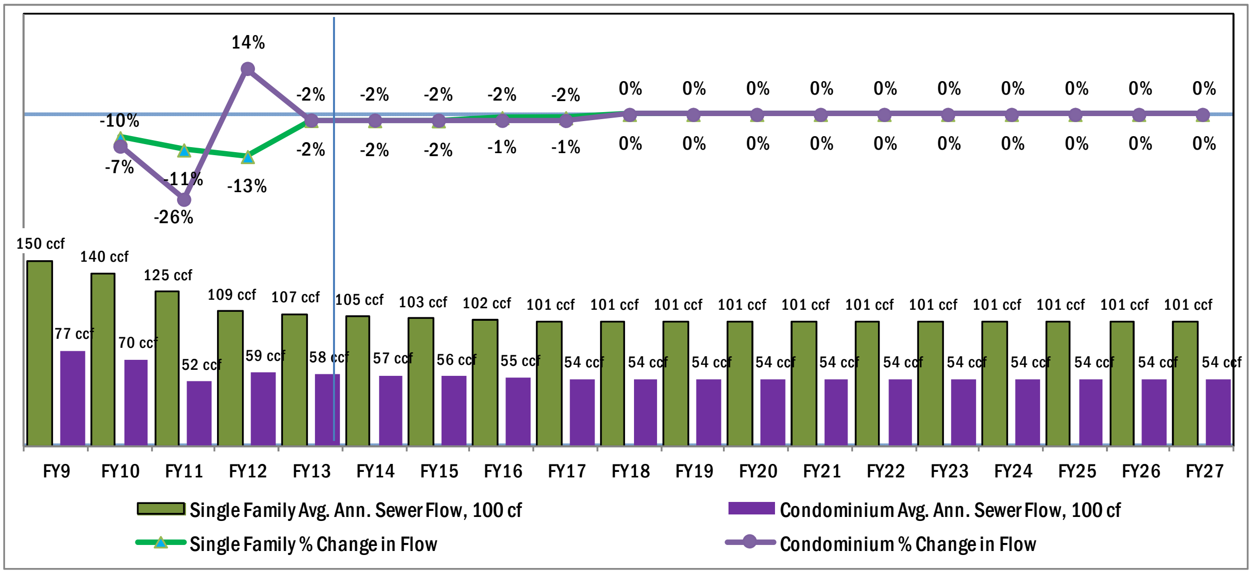


Figure 9-4. Single Family and Condominium Average Annual Sewer Flow, FY9–27

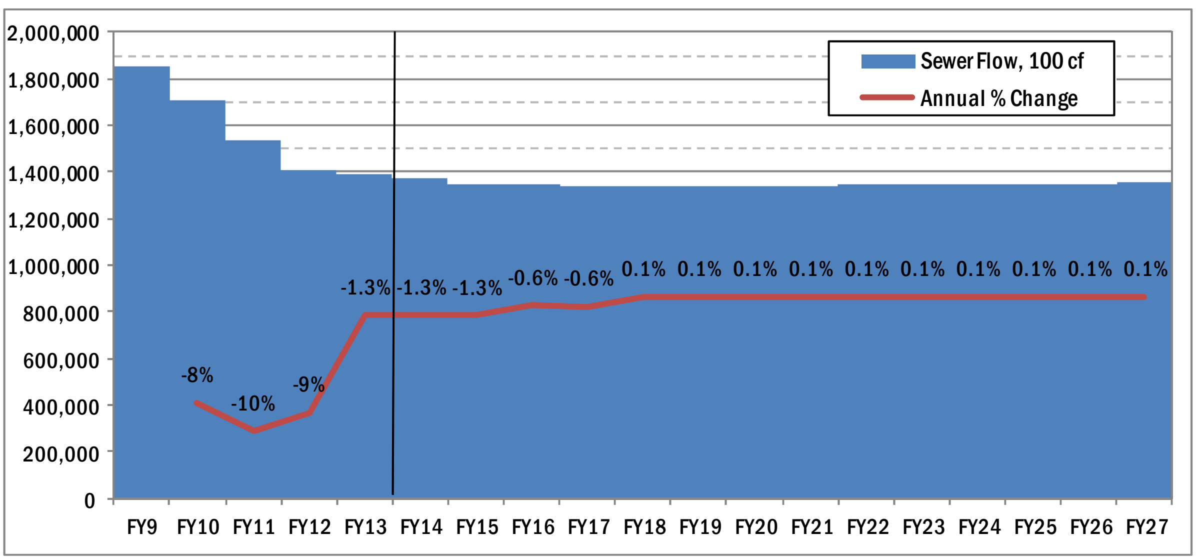


Figure 9-5. Total Sewer Flow, FY9–27

9.4 Operations and Maintenance (O&M) Expenditures

O&M costs budgeted for FY11, FY12 and FY13 were provided by the City. Projected O&M costs for the remainder of the study period were developed from the FY13 budget values for personnel, maintenance and capital outlay with an additional $100,000 for a new Maintenance Leadworker. The FY13 and Maintenance Leadworker costs were escalated by 3 percent per year. Treatment plant costs include the City's share of O&M costs and the costs for improvements at the Regional Plant. O&M costs are escalated by 1 percent per year for FY14-16 and by 3 percent per year for FY17 onward. Treatment plant O&M costs are escalated at a lower rate for FY14-16 commensurate with the lower sewer flows expected during that time period. O&M costs for FY9 and FY10 were taken from the Harris annual reports for those years. Palo Alto's Long Range Facilities Plan: Financial Analysis indicates that the Regional Plant will have significant additional debt beginning in FY14. The Partner Agency Sewer Fund Bond/SRF Aggregate Debt Service Allocation spreadsheet shows that the City's allocation of new debt costs associated with a revenue bond will be $11,664,146 from FY14-27. O&M expenditures, treatment plant expenditures, capital expenditures and ending cash balances for FY9-27 are shown in Figure 9-6.

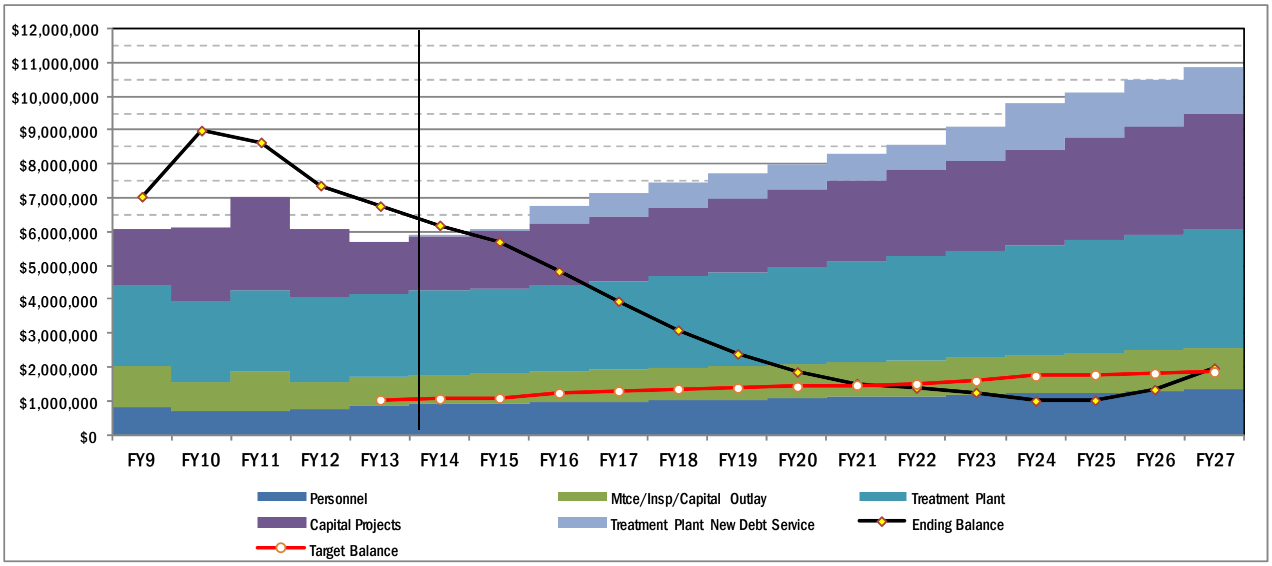


Figure 9-6. Operating and Capital Expenditures and Ending Cash Balances, FY9–27

9.5 Sewer Service Charges

Sewer service charge rates were developed for FY13-27 using the same methodology as is used currently to develop the sewer service charge rate and monthly bills for each customer. The current methodology is shown in Figure 9-7 below. The figure below is Figure 7 from the *Draft Annual Report for the Sewer Service Charge for FY11-12* prepared by Harris and Associates.

Sewer Service Charge Rate = (annual budget) ÷ (total estimated sewer usage) = **$/unit of use**

The table below shows the Sewer User Fee Rate for FY 2011-12, as well as the maximum allowable sewer rate for this fiscal year.*

FY 2011-12 Fee Budget	**Units of Sewer Use**	**FY 2011-12 Sewer Fee Rate**	FY 2011-12 Maximum Rate	FY 2010-11 Maximum Rate
$4,256,686	**1,404,847**	**$3.03 / Unit**	$3.19 / Unit	$3.15 / Unit

SF-CPI % increase, Dec-Dec: 1.5%

* A Maximum Sewer Fee Rate was set for fiscal year 2010-11 and is increased automatically each year by the annual change in the Consumer Price Index (CPI), All Urban Consumers, for the San Francisco – Bay Area area, as of January of each year.

Figure 9-7. Current Methodology for Development of the Sewer Service Charge Rate

The annual budget and total estimated sewer usage (flow) used for development of past, current and projected sewer service charge rates (using the current methodology) are shown in Figure 9-8 for FY9-27. As noted previously, the reduction in flow from customers in the single-family and condominium classes has contributed to the reduction in total sewer flow. For FY9-12, the reduction in total sewer flow was matched, in percentage terms, by a reduction in the annual budget. Reductions in the annual budget were based on data and calculations developed by the City and Harris and Associates.

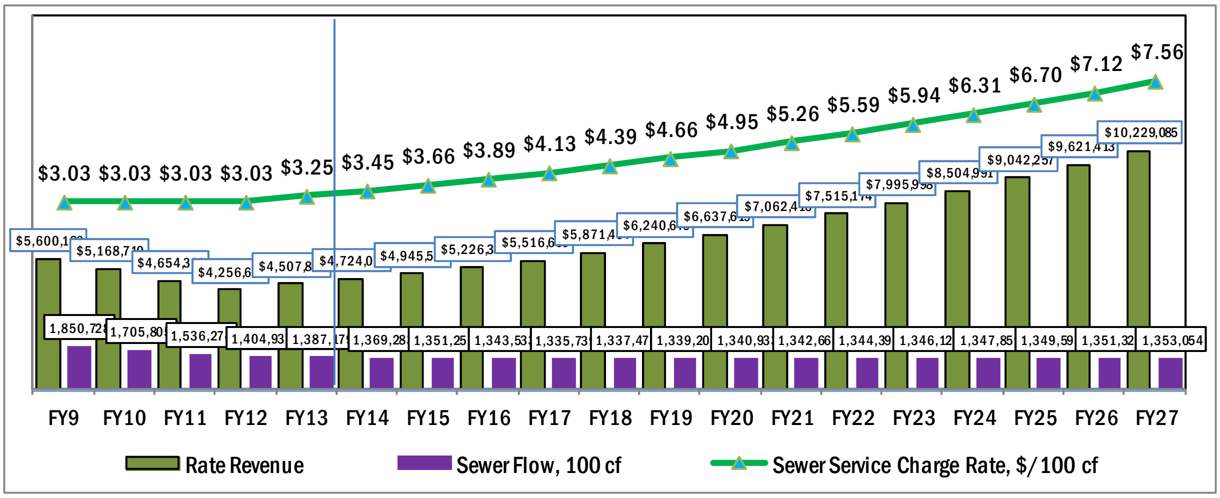


Figure 9-8. Rate Revenue, Sewer Flow (100 cf), and the Sewer Service Charge Rate, FY9–27

In FY13, the City increased the sewer service charge rate to the “Maximum Rate” currently allowable without the need to implement Proposition 218 procedural requirements. The methodology used for development of the “Maximum Rate” for the sewer service charge rate shown in Figure 7 from the Harris study. The methodology used for development of the “Maximum Rate” for the sewer service charge rate shown in the Harris study was used to project the maximum rate for the sewer service charge rates for FY14-27. Maximum rates for FY10-12 were calculated by Harris in their annual studies. The annual change in the Consumer Price Index (CPI), All Urban Consumers, for the San Francisco – Bay Area, as of January of each year, needed to project the maximum rate for sewer service charge rates is 2 percent. Annual sewer service charge rates and maximum allowable rates are shown in Figure 9-9 for FY9-27. When the applied rate exceeds the maximum allowable rate, the City must seek voter approval of the increase. Applied sewer service charge rates are projected to exceed the maximum allowable rate in FY14. Starting in FY14, rate increases for Single Family parcels will average 6 percent per year through FY27. Approximately 32 percent of the rate increase can be attributed to the new debt service at the Palo Alto Regional Water Quality Control Plant.

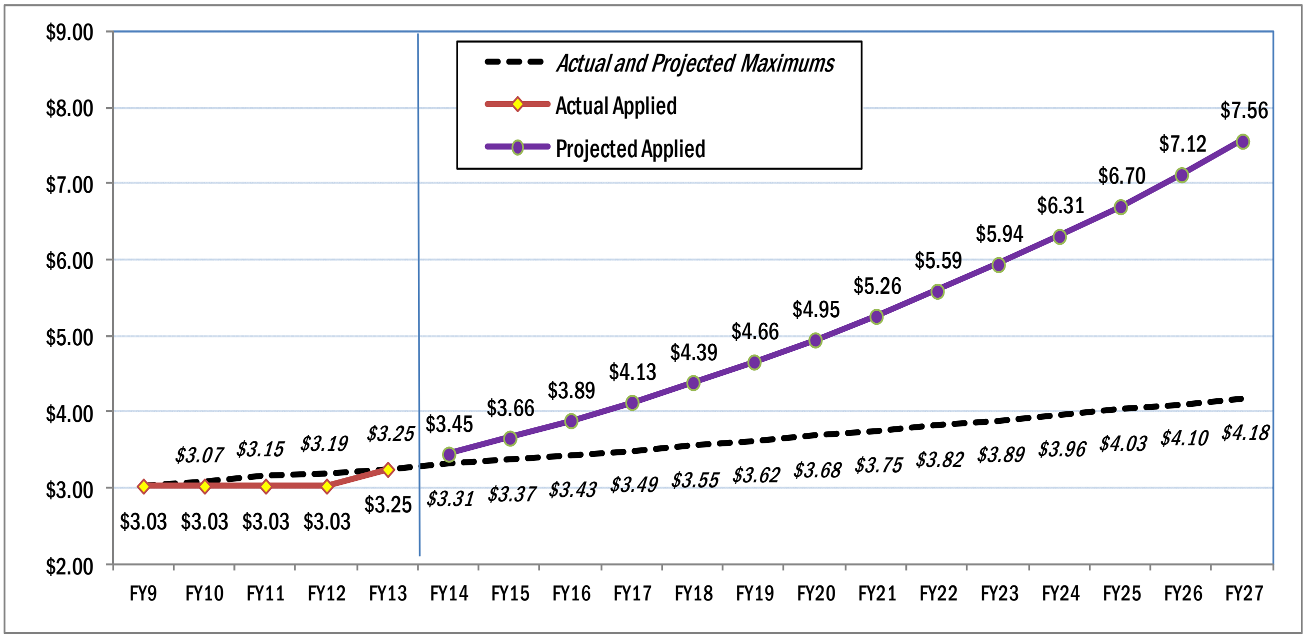


Figure 9-9. City Annual Sewer Service Charge Rates and Maximum Allowable Service Charge Rates, FY9–27

9.6 Average Sewer Flow and Monthly Bills for Single-Family and Condominium Customers

Average sewer flow per parcel for the two customer classes with the most parcels (single family and condominiums) has decreased by 28 percent and 23 percent, respectively, over the past three years. This decrease in flow is one of the reasons that the average sewer bills for single-family and condominiums customers have decreased for the past three years. Single Family average sewer flow and monthly bills for FY9-27 are shown in Figure 9-10. Condominium average sewer flow and monthly bills for FY9-27 are shown in Figure 9-11.

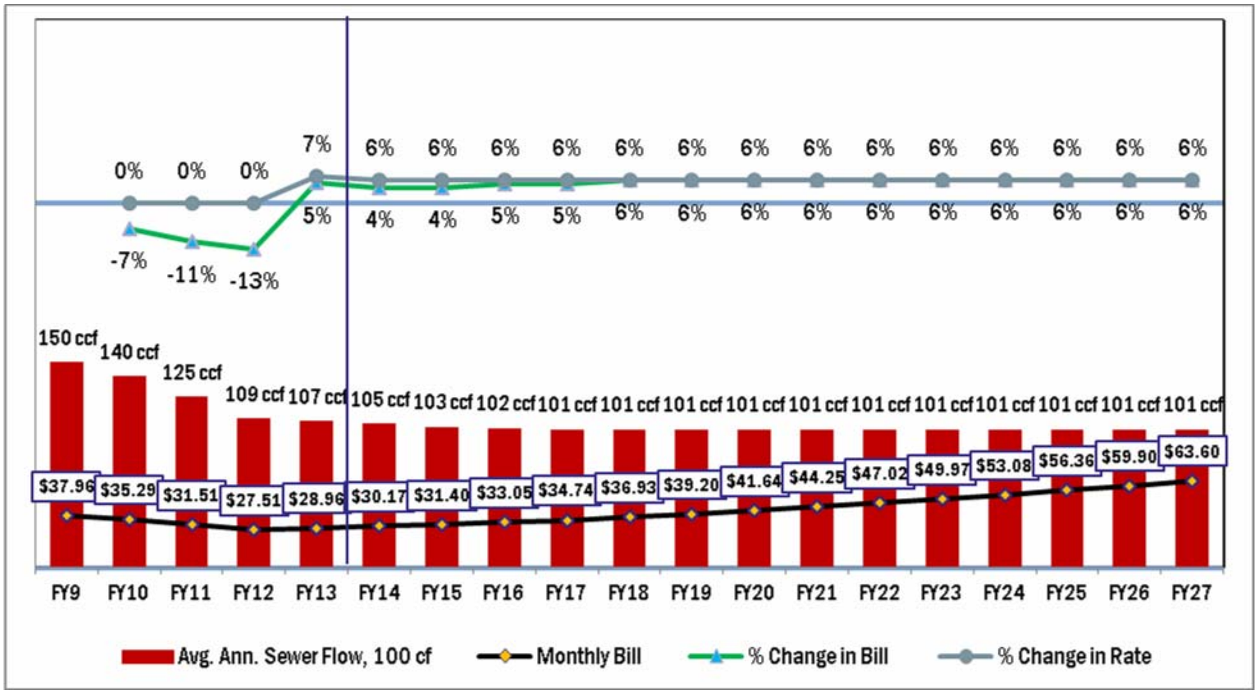


Figure 9-10. Single Family Average Sewer Flow (100 cf) and Bills, FY9–27

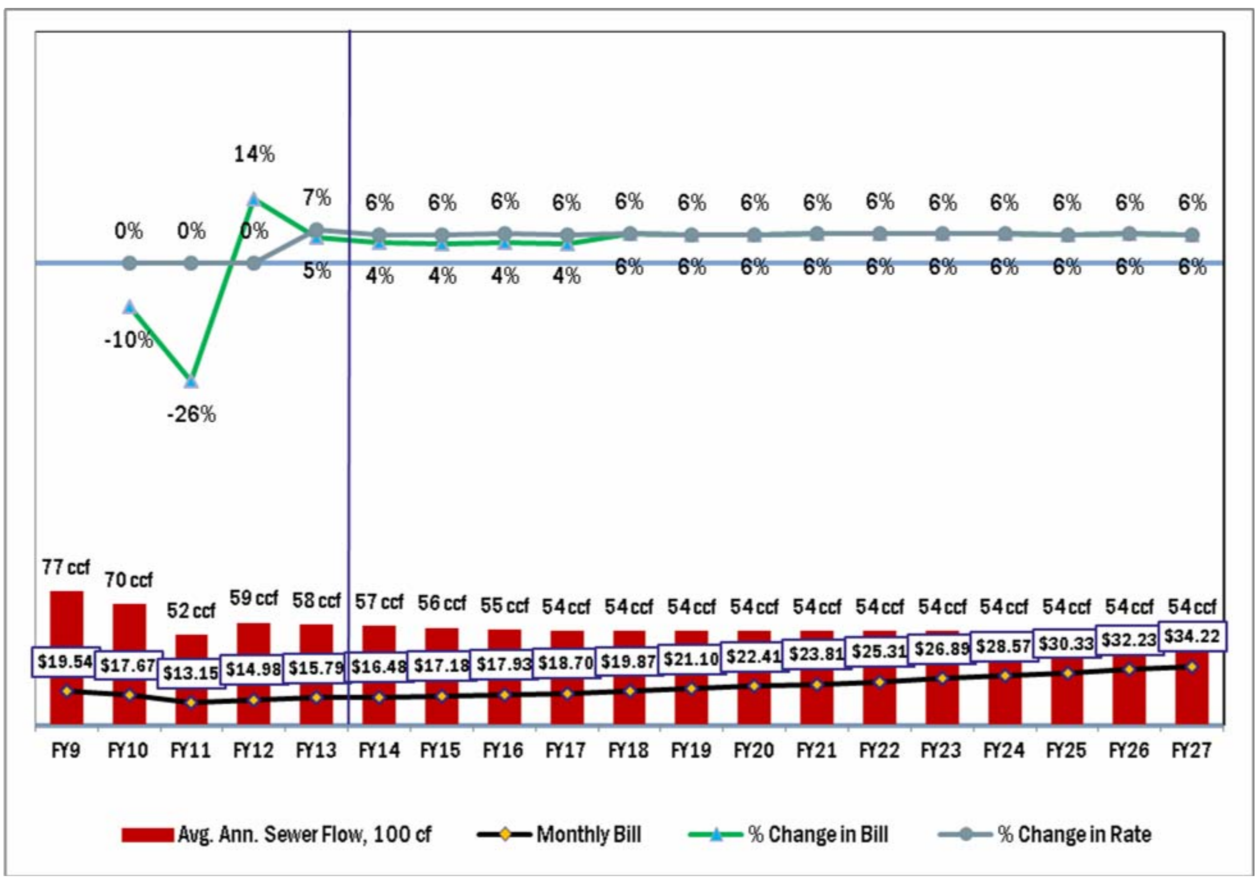


Figure 9-11. Condominium Average Sewer Flow (100 cf) and Bills, FY9–27

9.7 Adopted Rates and Rates Recommended in the 2005 Master Plan and 2012 Master Plan Update

Prior to completion of the 2005 Master Plan, the City began increasing sewer service charge rates in anticipation of large capital expenditure requirements. With the rate structure that was in place at the time, the increased sewer service charge rates raised single family monthly bills by $2.00 per month ($36 per year) for FY4, FY5 and FY6.

The Master Plan completed in 2005 recommended increases in sewer service charge rates that would raise single family monthly bills from $23.76 in FY7 to $37.50 in FY12. Decreases in sewer flow (which became manifest after completion of the 2005 Master Plan) and changes in the annual budgets have enabled the City to keep the sewer service charge rate at its FY9 level and has lowered sewer bills for most customers. The cumulative difference in single family monthly bills from FY7–12 between increases recommended in the 2005 Master Plan and those based on sewer service charge rates actually adopted are shown in Table 9-1.

Table 9-1. Actual and Projected Single Family Monthly Bills, FY4–12

Item	FY4	FY5	FY6	FY7	FY8	FY9	FY10	FY11	FY12	Difference FY7-12
Single Family Monthly Bills										
Actual Prior to 2005 Maser Plan	$17.00	$19.00	$21.00							
2005 Master Plan Projected				$23.75	$26.50	$29.25	$32.50	$34.75	$37.50	$13.75
Actual After 2005 Master Plan				$23.75	$23.75	$37.96	$35.29	$31.51	$27.51	$3.76
Annual % Difference										
Actual Prior to 2005 Master Plan		12%	11%							
2005 Master Plan Projected				13%	12%	10%	9%	9%	8%	58%
Actual After 2005 Master Plan				13%	0%	60%	-7%	-11%	-13%	16%

Sewer service charge rates recommended in this Master Plan Update are projected to increase and will require a vote. The increased charges will result in increased sewer bills for most customers as the projected rate of reduction in sewer flow is expected to decrease and finally stop.

Single Family Monthly Bills based on adopted sewer service charge rates and sewer service charge rates recommended in the 2005 Master Plan and 2012 Master Plan Update for FY4–27 are shown in Figure 9-12. As observed in the figure, actual rate increases since 2005 have fallen below the Master Plan projections. This is likely due to a number of reasons:

- There has been a favorable bidding climate for capital projects since 2008-2009 due to the economic downturn.
- Several capital projects recommended in the 2005 Master Plan were either eliminated or downsized based on changed conditions or new data. This included the North Replacement Sewer, the Pine Lane Pump Station, the trunk sewer corrosion rehabilitation and the permanent flow monitoring project which was partially funded by the Town.

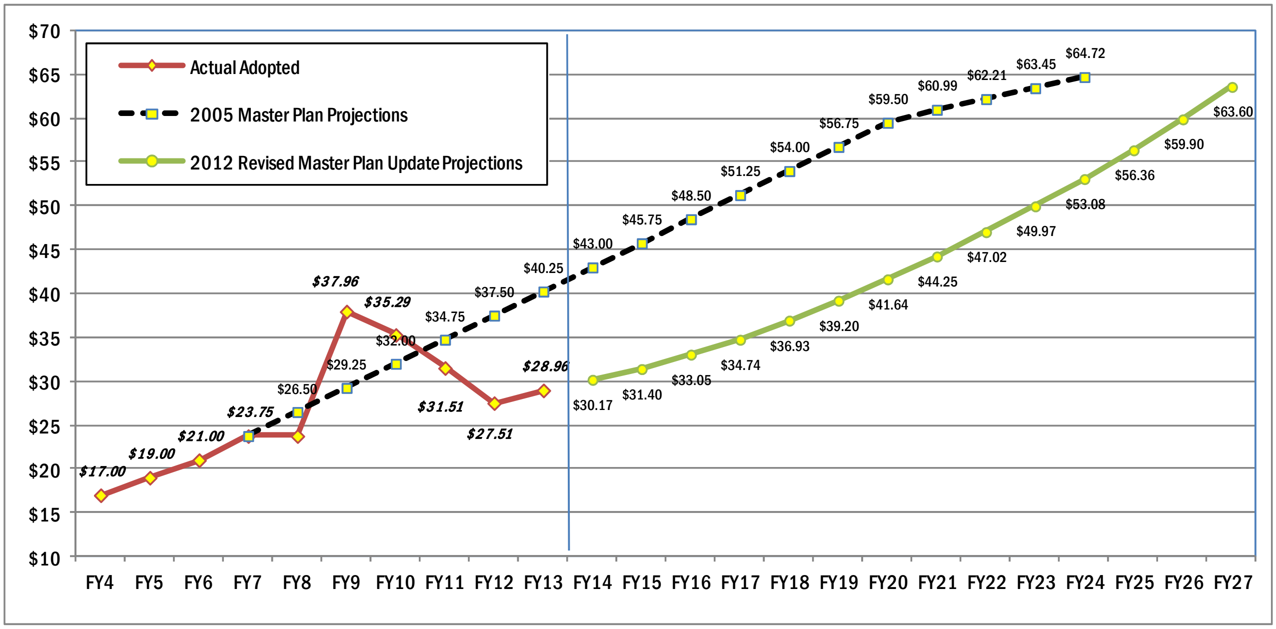


Figure 9-12. Single Family Monthly Bills Based on Adopted Charges and Charges Recommended in the 2005 Master Plan and 2012 Master Plan Update, FY4–27

9.8 Survey of Single Family Monthly Bills

Single family monthly bills based on the proposed sewer service charges for the City were compared with single family monthly bills for five other nearby cities. Although the City's single family monthly bills are low compared to those for some other municipalities in the Bay Area and the State, they are similar to those for the communities closest to the City (except for the City of Milpitas). Comparison of single family monthly bills is shown in Figure 9-13.

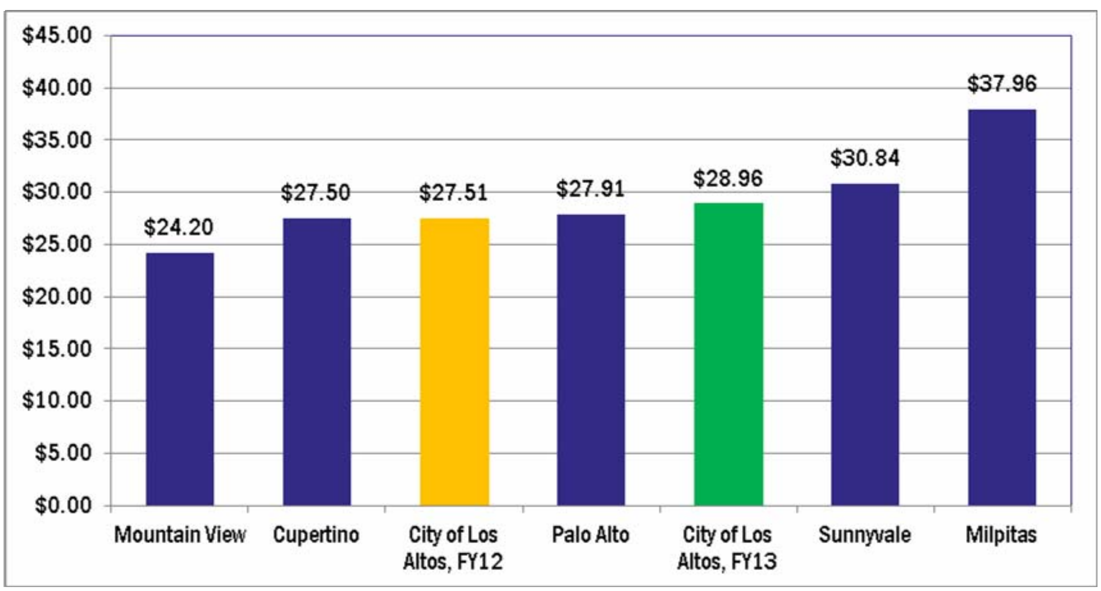


Figure 9-13. Survey of Single-Family Monthly Bills

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