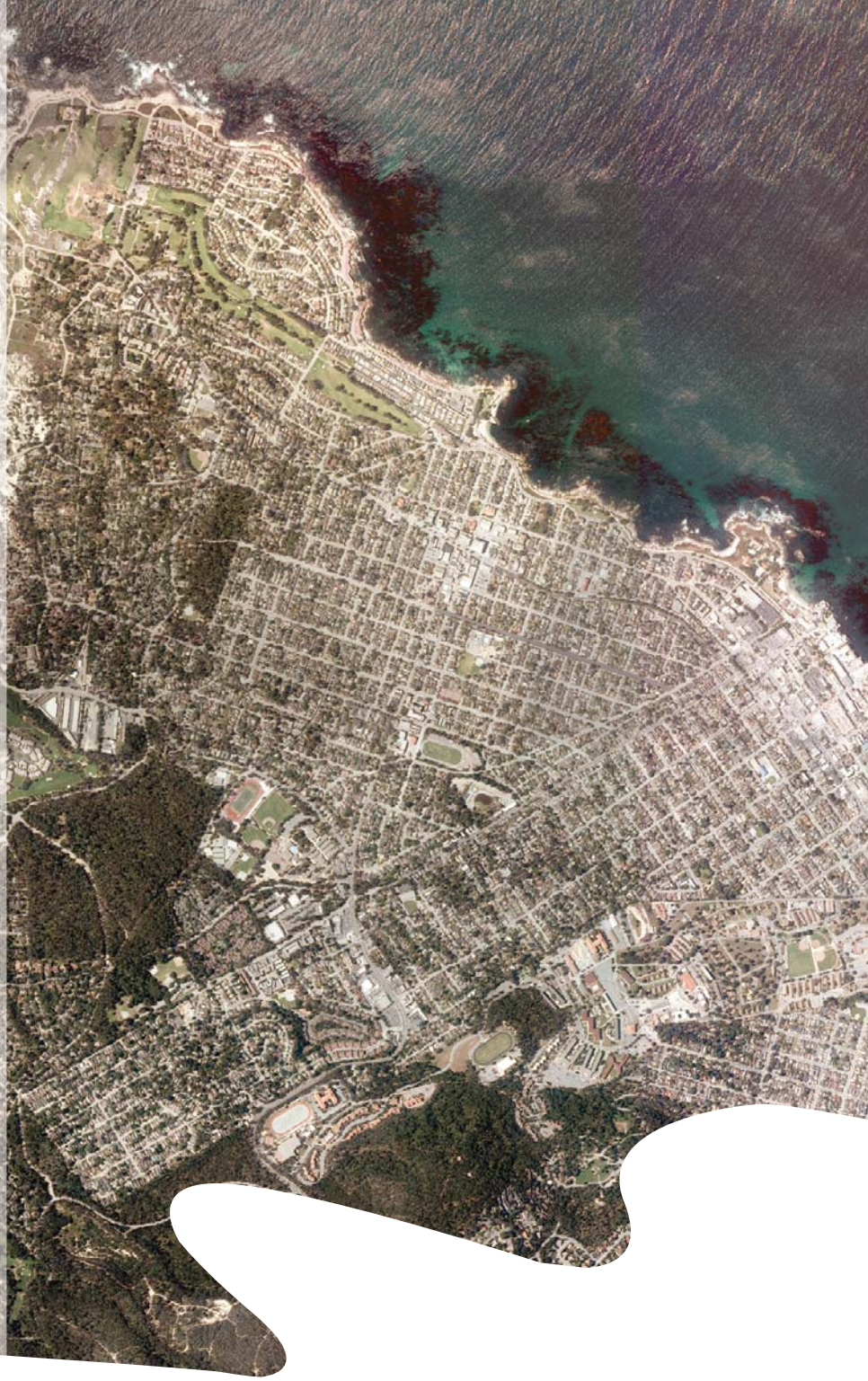
Sewer Collection System Master Plan



Prepared for

City of Pacific Grove
Public Works Department

May 2014

Prepared by

WALLACE GROUP®

612 CLARION COURT
SAN LUIS OBISPO
CALIFORNIA 93401
T 805 544-4011
F 805 544-4294
www.wallacegroup.us

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CITY OF PACIFIC GROVE

SEWER MASTER PLAN

MAY 2014

(City Council Approved – May 21, 2014)

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Mayor Protempore: Robert Huitt

Council Member: Alan Cohen

Council Member: Ken Cuneo

Council Member: Rudy Fischer

Council Member: Casey Lucius

Council Member: Daniel Miller

City Staff

City Manager: Thomas Frutchey

Community Development/Public Works Director: Michael Zimmer

Public Works Manager: Daniel Gho

Wastewater Field Supervisor: Vince Gentry

City Attorney: David Laredo

City Supporting Consultants

City Engineer: Sherman Low, P.E., Neill Engineers Corp.

GIS Specialist: Cary Stiebel, PIE Services

Approved By:

Daniel Gho
Public Works Manager

Prepared By:

Kari Wagner, P.E. 66026
Senior Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
KARI E. WAGNER
66026
CIVIL
STATE OF CALIFORNIA

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CHAPTER 1

INTRODUCTION

This report presents the Sewer Master Plan for the City of Pacific Grove (City). Pacific Grove is located in Monterey County on the Monterey Peninsula. The City was incorporated on July 16, 1889 and chartered as a city on April 22, 1927. The City is responsible for the maintenance and operation of the sewer collection system serving the residences and businesses in the City. The City is governed by a City Council, which is comprised of seven (7) elected members: a Mayor and six (6) Council Members.

Preparation of the Sewer Master Plan will assist the City in prioritizing both existing and future collection system needs through repair, rehabilitation, replacement, or new facilities. The master planning process will also tie the needs assessment, both existing and future, to the budgeting process. All figures for Chapter 1 are located at end of this chapter.

ENVIRONMENTAL REVIEW

In accordance with Title 14, California Code of Regulations, Chapter 3, Article 18 (Statutory Exemptions), this Sewer Master Plan is considered a planning study and therefore adoption of this document is exempt from the requirements to prepare Environmental Impact Reports (EIR) or Negative Declarations (ND). However, EMC Planning Group will be completing an environmental review of this document; more specifically the capital improvement projects identified, and will provide the City with an environmental determination.

AUTHORIZATION AND SCOPE OF WORK

On January 9, 2013, the City authorized Wallace Group to prepare a comprehensive Sewer Master Plan. The Sewer Master Plan study area boundary is depicted in Figure 1-1. The scope of work is as follows:

Sewer Flow Monitoring: Conduct sewer flow monitoring for a one-month period in four (4) to eight (8) different locations within the City's collection system. Depending on weather conditions, this monitoring will provide information on existing dry weather and wet weather conditions. Flows will be analyzed to determine the diurnal peaks, estimate inflow and infiltration, and prepare a memo summarizing the findings for the City.

Lift Station Pump Tests: Conduct pump tests at each lift station to confirm flow and head.

Land Use Evaluation and Wastewater Flow: Evaluate population and density information from the City General Plan, previous wastewater flow estimates, and data from the sewer flow monitoring, which will be used to determine the existing and future dry weather and wet weather flow characteristics for the City.

Sewer System Management Plan and Ordinance Review: Update the Sewer System Management Plan (SSMP). The City's SSMP Revision 1 was completed and adopted by the City on June 19, 2013. The City's updated SSMP includes the City's Operation and Maintenance Program and the City's ordinances and legal authority, which will be used to complete the projects recommended in this Sewer Master Plan. This Sewer Master Plan will also be incorporated into the City's SSMP by reference upon its completion.

Collection System Modeling: The Excel sewer model developed from the 2004 Sanitary Sewer Asset Management Plan will be converted to Innovyze® InfoSWMM sewer modeling program using the City's GIS database to re-evaluate the condition of the existing collection system. The collection system will be modeled under dry and wet weather conditions for the existing and future loadings. Only the 10-inch sewer mains and larger, with some exceptions will be modeled. The exceptions would be 6- or 8-inch trunk mains that collect or carry a reasonable amount of wastewater under existing or future conditions.

Sewer Master Plan: The information determined in the previous tasks will be used to prepare a Sewer Master Plan. The Sewer Master Plan will provide a summary of the existing facilities, wastewater flows, identified system capacity deficiencies for existing and future conditions, recommended capital improvement projects (CIP), recommended operation and maintenance practices, and recommended inspection programs. The CIPs will be grouped into two categories:

- Short Term - those projects that require immediate attention due to existing deficiencies.
- Long Term - those projects that are required due to future development (duration depending on future development).

The Short Term CIPs will be ranked based on a predetermined ranking matrix. A cost estimate will be determined for each of the CIPs and Operations and Maintenance (O&M) Activities, which will include construction and soft costs.

Rate Study: Based on the CIPs and O&M Activities identified in the Sewer Master Plan, a rate study will be prepared to identify the number and type of connections, current financial status of the City, and funding alternatives based on the needs of the City.

CEQA Environmental Review: The CIPs and O&M Activities identified in the Sewer Master Plan will be evaluated to determine the environmental impacts of the updated SSMP and Sewer Master Plan and the reasonable foreseeable impacts of identified CIPs planned for the future. The initial study will identify sensitive areas, impacts that could be reasonable expected by implementation of the updated plans

ACKNOWLEDGEMENTS

Wallace Group thanks and gratefully acknowledges the following City of Pacific Grove and Monterey Regional Water Pollution Control Agency staff for their efforts, involvement, input and assistance in preparing this Sewer Master Plan:

City of Pacific Grove City Council
Bill Kampe, Mayor
Robert Huitt, Mayor Protempore
Alan Cohen, Council Member
Ken Cuneo, Council Member
Rudy Fischer, Council Member
Casey Lucius, Council Member
Daniel Miller, Council Member

City of Pacific Grove Staff
Thomas Frutchey, City Manager
Michael Zimmer, Community Development/Public Works Director
Sarah Hardgrave, Environmental Programs Manager
Daniel Gho, Public Works Manager
Vince Gentry, Wastewater Field Supervisor

City of Pacific Grove Outside Consultants
City Engineer: Sherman Low, P.E., Neil Engineers Corp.
GIS Specialist: Cary Stiebel, PIE Services

Monterey Regional Water Pollution Control Agency
Tom Buell, Director of Finance
Lindsay Synsteby, Customer Service Supervisor
Bret Boatman, P.E., Maintenance Supervisor

This Sewer Master Plan was completed with the help of many team members. They include:

Wallace Group
Kari Wagner, P.E., Senior Civil Engineer
Valerie Huff, P.E., Senior Civil Engineer
Alma Gormley, GIS Specialist
Steven G. Tanaka, P.E., Director of Water Resources
Rob Miller, P.E., Principal Engineer

Utility Systems, Science and Software, Inc.
Mark Serres, Vice President – Operations
Tom Williams, Engineering Manager

Fluid Resource Management
Robbiy Ellison, Maintenance Manager
Michael Ellison, Maintenance Superintendent

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FIGURE 1-1: MASTER PLAN STUDY AREA

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CHAPTER 2

LAND USE AND POPULATION

This Chapter presents the land use and existing and future population forecasts for the City of Pacific Grove (City). The purpose of establishing the existing populations and land uses is to better understand the existing wastewater flow characteristics throughout the City, which would then help forecast the wastewater flows that will be contributed in the future by vacant or under-utilized land. All figures for Chapter 2 are located at end of this chapter.

LAND USE

The City provided land use information in geographic information system (GIS) format. For the purpose of this Sewer Master Plan, the land use will be used to evaluate wastewater flow contributions on a per parcel basis.

Existing Land Use

The City's existing land use is primarily residential with commercial facilities centered around Lighthouse Avenue (downtown), Central Avenue, and Forest Avenue. A summary of the existing land use is provided in Table 2-1. The existing land use is illustrated in Figure 2-1.

Table 2-1. Existing Land Use Summary

Description	Number of Parcels	Parcel Acreage	Building Square Footage
Commercial	375	104	800,385
Industrial	6	8	30,975
Institutional	38	205	9,119
Mixed Use	21	3	52,596
Multi-Family	803	120	---
Parking & Miscellaneous	89	61	---
Parks & Open Space	34	105	---
Residential	4,681	687	---
School	13	99	---
Vacant	108	22	---
Total	**6,168**	**1,414**	**893,075**

Future Land Use

Both the City's General Plan and Housing Element were referenced to evaluate future land use. The Housing Element is the most recent document, approved by the City Council in May 2011 and last updated August 2011. The Housing Element identifies potential future residential development for both vacant land and under-utilized sites. For underutilized sites, the development potential is described for each individual location. For vacant sites, overall development potential is listed by General Plan land use categories. The Housing Element also identifies a potential for 2,600 second units that could be constructed within existing residential lots. However, the historical rate of development for secondary units has been quite low, with an average of 3 new units constructed per year. Also, the potential for secondary units is spread throughout the City, and the wastewater flows from secondary units are typically less than that of a standard residential unit. Therefore, for the purpose of this Sewer Master Plan, future development will be based on build-out of only the vacant and underutilized lots as identified in the Housing Element. Table 2-2 provides a summary of this potential residential development per the Housing Element. The General Plan land use is illustrated in Figure 2-2.

Table 2-2. Potential Residential Development per Housing Element

Parcel Type	Future Development Capacity
Vacant	197 units
Underutilized	783 units
Total	**980 units**

In addition to the residential development described above, there are 37 parcels with commercial land use per the General Plan, which are currently vacant, a parking lot, or other miscellaneous uses. The majority of these parcels are adjacent to Lighthouse Avenue. The future development potential for these parcels will be based on an assumed Floor Area Ratio (FAR) of 1.5 for this Sewer Master Plan. FAR is the building floor area on a site, divided by the total area of the site. For example, on a site with 10,000 square feet of land area, a FAR of 1.5 would allow 15,000 square feet of floor area. Table 2-3 provides a summary of these parcels.

Table 2-3. Potential Commercial Development per General Plan

Existing Land Use	Parcels	Parcel Acreage
Vacant	15	3.6
Parking Lot	13	3.9
Miscellaneous	9	1.1
Total	**37**	**8.6**

The parcels with potential for future commercial or residential development are illustrated on Figure 2-3.

POPULATION

Per the 2010 Census, the existing population for the City of Pacific Grove is approximately 15,040 persons. The total number of housing units is estimated at 8,169 with a density of 1.84 persons per housing unit.

Per the Housing Element, the projected number of residential units is 9,149. Using the 2010 Census density of 1.84 persons per unit, the estimated future population for the City is approximately 16,830 persons.

The existing and future population for the City of Pacific Grove is summarized in Table 2-4.

Table 2-4. Population Summary

Condition	Population	Source
Existing	15,040	2010 Census
Future	16,830	2011 Housing Element + 2010 Census

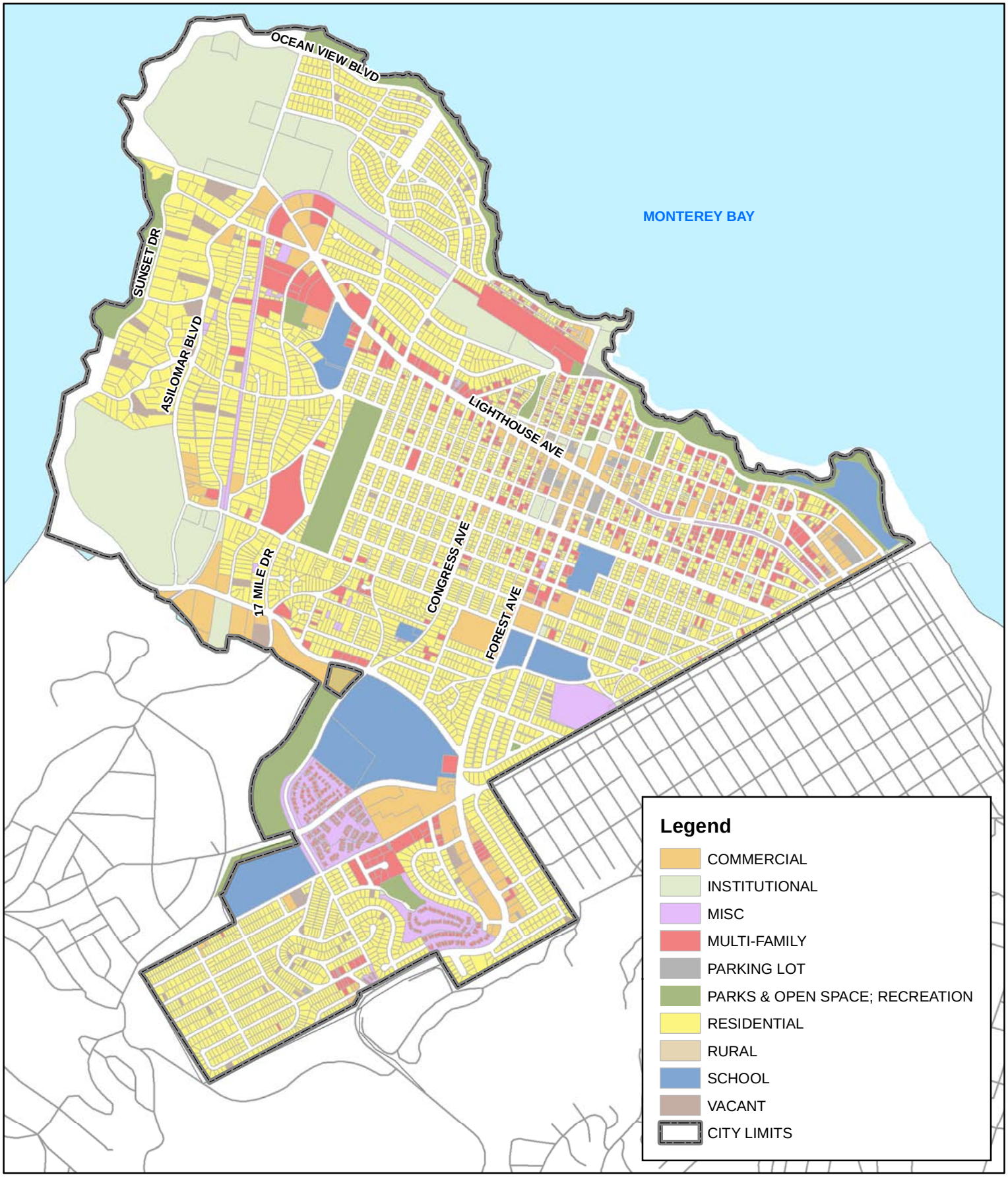

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FIGURE 2-1: EXISTING LAND USE MAP

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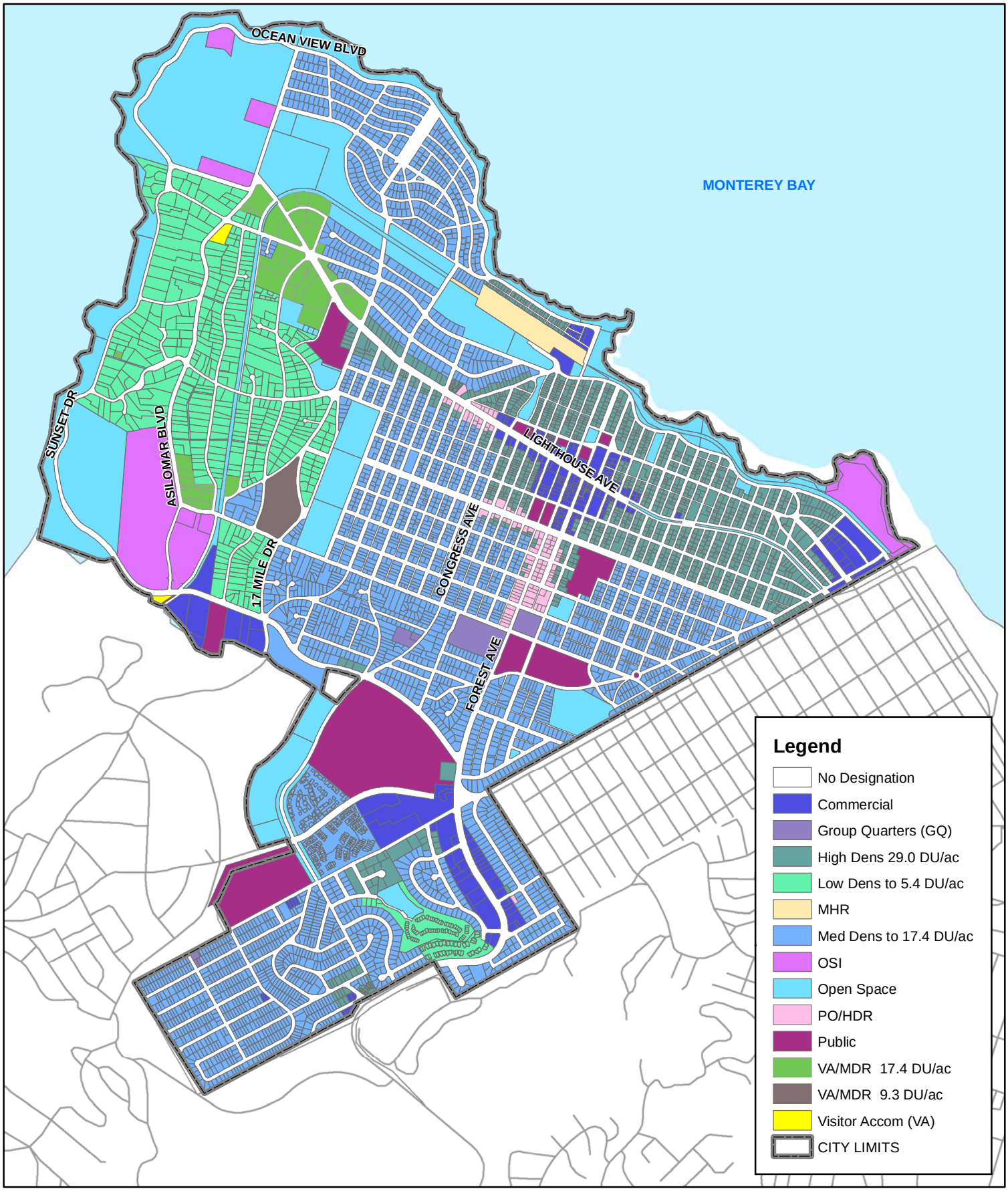

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FIGURE 2-2: GENERAL PLAN LAND USE MAP

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FIGURE 2-3: FUTURE DEVELOPMENT AREAS

CHAPTER 3

COLLECTION SYSTEM OVERVIEW

This Chapter provides an overview of the existing wastewater collection system for the City of Pacific Grove (City). The City provides sanitation services (collection system only) for the City of Pacific Grove. Monterey Regional Water Pollution Control Agency (MRWPCA) provides wastewater treatment. All figures for Chapter 3 are located at end of this chapter.

COLLECTION SYSTEM OVERVIEW

The City wastewater collection system consists of approximately fifty-eight miles of gravity sewer pipes ranging in size from 4-inch to 18-inch diameter. The City also owns seven lift stations and approximately one mile of corresponding force mains. MRWPCA owns two additional lift stations in the City's collection system, and operates and maintains all nine of the lift stations in the City's collection system.

Since the majority of the City's collection system was constructed in the early 1900's, the pipe material throughout the system consists primarily of Vitrified Clay Pipe (VCP). A small percentage of Polyvinyl Chloride (PVC) pipe has been installed in newer construction. An inventory of existing sewer pipe diameters and materials from the City's GIS are provided in Tables 3-1 and 3-2, and the sewer pipe diameters are shown on Figure 3-1.

Table 3-1. Existing Pipeline Inventory by Material

Material	Length	
	Feet	Miles
Cast Iron Pipe (CIP)	1,617	0.3
Ductile Iron Pipe (DIP)	1,394	0.3
High-density Polyethylene (HDPE)	1,699	0.3
Polyvinyl Chloride (PVC)	49,411	9.4
Vitrified Clay Pipe (VCP)	244,814	46.4
Unknown	14,784	2.8
Total	**313,719**	**59.4**

Table 3-2. Existing Pipeline Inventory by Diameter

Diameter (inches)	Length	
	Feet	Miles
4	1,971	0.4
6	212,086	40.2
8	64,954	12.3
10	1,758	0.3
12	14,856	2.8
15	9,256	1.8
16	5,187	1.0
18	101	0.0
Unknown	3,550	0.7
Total	**313,719**	**59.4**

Manholes

The collection system has approximately 900 manholes, which were primarily constructed in the early to mid-1900s. The collection system has both concrete and brick manholes, several of which are drop manholes. City Staff reported that the majority of these manholes are structurally sound, while some manholes in the system exhibit signs of corrosion from hydrogen sulfide attack. *It is recommended that the City's GIS be updated to include manhole type and condition, to assist with record keeping and prioritization of maintenance and future upgrades or replacement of manholes.*

Lift Stations

The City owns seven (7) lift stations located throughout the collection system, and MRWPCA owns two (2) lift stations at the downstream end of the City's collection system, which are illustrated in Figure 3-1. The City contracts with MRWPCA to maintain all nine (9) of the lift stations. The City's seven (7) lift stations and MRWPCA's two (2) lift stations are briefly summarized in this chapter. The City's seven (7) lift stations are described in further detail in the City's 2006 Pump Station Master Plan.

The 2006 Pump Station Master Plan did not conduct pumping capacity tests on the seven City lift stations. Therefore, lift station pumping capacity was reviewed as a part of this Sewer Master Plan. For each lift station, a timed test was performed to measure the volume pumped from the wet well over a known time period. This data was then used to estimate pump flow rate during the test. The pump test results are included in Table 3-3, and the full data sheets are included in Appendix A.

- Station #11 – Eardley Lift Station: Eardley Lift Station is a submersible wet well lift station located partially within Ocean View Boulevard near Eardley Avenue. The wet well is partially located within the sidewalk and in Ocean View Boulevard. This lift station receives flow from customers along Line Street and

between Eardley Avenue, 1st Street, and Ocean View Boulevard. The lift station discharges through a 6-inch diameter PVC force main to manhole #178 at the intersection of 1st Street, 2nd Street, and Ocean View Boulevard. This lift station is slated to be upgraded within the next year.

- Station #12 – 9th Street Lift Station: 9th Street Lift Station is a dry pit/wet pit lift station located next to Ocean View Boulevard near 9th Street. The lift station receives flow from customers along 2nd Street to Monterey Avenue. The lift station discharges through an 8-inch diameter cast iron force main to manhole #204 at the intersection of Ocean View Boulevard and Carmel Avenue. This lift station was recently upgraded.

- Station #13: Lift Station # 13 receives flow from the entire City's collection system and discharges through a 16-inch diameter force main to Monterey Regional Wastewater Treatment Plant. Lift Station #13 is owned and maintained by MRWPCA, therefore the evaluation of the physical and hydraulic condition of this lift station was not included in this Sewer Master Plan.

- Station #14 – Lovers Point Lift Station: Lovers Point Lift Station is a submersible wet well lift station located off of Ocean View Boulevard near 17th Street. The lift station receives flow from Lover's Point Park. The lift station discharges through a 4-inch diameter PVC force main to manhole #748 at the intersection of Ocean View Boulevard and Marine Street.

- Station #15 – Coral Street Lift Station: Coral Street Lift Station receives flow from Lift Stations #14, #15.5, #16, #17, and #17.5 and customers in the western and northwestern sections of the City's service area and discharges through a 12-inch diameter force main to Lift Station #13. Lift Station #15 is owned and maintained by MRWPCA, therefore the evaluation of the physical and hydraulic condition of this lift station was not included in this Sewer Master Plan.

- Station #15.5 – Crespi Pond Lift Station: Crespi Pond List Station is a submersible wet well lift station located off of Ocean View Boulevard. The lift station receives flow from a golf course bathroom off of the Pacific Grove golf course's 17th hole. The lift station discharges through a 4-inch diameter ductile iron force main to manhole #982 at the intersection of Ocean View Boulevard and Asilomar Avenue.

- Station #16 – Arena Lift Station: Arena Lift Station is a vertical-centrifugal lift station located off of Sunset Avenue near Arena Street and within the Asilomar State Park. This lift station receives flow from customers between Sunset Drive, Asilomar Avenue, and Lighthouse Avenue. The lift station discharges through an 8-inch diameter cast iron force main to manhole #810 at the intersection of Arena Avenue and Asilomar Avenue.

- Station #17 – Beachcomber Lift Station: Beachcomber Lift Station is a submersible wet well lift station located next to Sunset Avenue in front of the Beachcomber Hotel. This lift station receives flow from the businesses at the intersection of Sunset Drive and Crocker Avenue. The lift station discharges through a 4-inch diameter PVC force main to manhole #821 on Crocker Avenue.

- Station #17.5 – Russell Service Center Lift Station: Russell Service Center Lift Station, which is sometimes referred to as Station #18 by MRWPCA, is a submersible wet well lift station located within a parking lot at the Russell Service Center off of Sunset Avenue. This lift station receives flow from the Russell Service Center commercial center. The lift station discharges through a 4-inch diameter ductile iron force main to manhole #500 on Sunset Drive near the intersection of Sunset Drive and Grove Acre Avenue.

Table 3-3 below provides a summary of the City's lift station properties, per the 2006 Pump Station Master Plan. Data for lift stations 11 and 12 are based off the construction documents for the lift station upgrades.

Table 3-3. Lift Station Summary

Lift Station		**11**	**12**	**14**	**15.5**	**16**	**17**	**17.5**
Wet Well Length or Diameter (ft)		6	7	4.5	4.5	8	6	4
Wet Well Width (ft)		---	---	---	---	5.3	---	---
Wet Well Depth (ft)		16.75	17.1	15.9	15.9	15.5	12.5	10.0
Operating Depths (ft)	High (Pump On)	7.00	3.00	3.08	---	5.25	4.00	4.67
	Low (Pump Off)	2.00	1.50	2.08	---	2.50	3.00	3.00
Number of Pumps		2	2	2	2	2	2	2
Pump HP		10	50	N/A	---	20	7.5	3
Capacity from Master Plan[1] (gpm)		250	960	127	---	475	119	93
Tested Pump Capacity (gpm)		176	1,056	79	59	479	176	78
Force main Material		PVC	CI	PVC	PVC	CI	PVC	DI
Force main Diameter (in)		6	8	4	4	8	4	4
Force main Length (ft)		1,375	700	471	6,175	917	358	318

1. Pump Capacity for stations 11 and 12 based on construction documents.

Operation and Maintenance Problem Areas

Staff from the City operations department identified known problem areas throughout the collection system. Routine maintenance tasks performed by operations and contract staff consist of the following:

- Treating problem sewer pipes for root intrusion
- Cleaning problem sewer pipes on 2, 6, and 9 month intervals based on Staff's assessment of the internal condition of these lines
- Visual manhole inspections on 2 year intervals

The City's Sewer System Management Plan, Revision 1, Element 4 includes the City's Operation and Maintenance Program, which describes these activities in further detail.

O&M RELATED CAPITAL IMPROVEMENT PROGRAM RECOMMENDATIONS

Based on discussions with the City Operations and Maintenance Staff, the following segments of the collection system are recommended to be addressed. Details of the Capital Improvement Projects, such as pipe diameter, length, and project limits are included in Chapter 6 of this Master Plan.

Hwy 68: between Adobe Lane and Bishop Avenue (Drainfield A-1)
There is an exposed sewer main, which could benefit from a short wall to help prevent damage from a traffic accident.

Oceanview & Mermaid: Lover's Point to LS15 (Drainfield A-6)
This sewer main is recommended to be replaced based on age and deterioration. The City is currently planning for an urban stormwater diversion project that will use an abandoned force main within this project area. The City should consider coordinating this sewer pipe replacement project with the urban stormwater diversion project to combine financial resources, potentially reduce overall project costs for each project, and minimize the impact to the surrounding community.

14th Street: Sinex to Junipero (Drainfield A-9)
This is the highest priority area for the City based on operations and maintenance. This area has cross connection problems between stormwater drains and the collection system. In addition, some of the sewer mains currently run under private properties. The sewer mains in this area are recommended to be replaced and re-routed to the public right-of-way where possible. The City is planning to complete the improvements this fiscal year under a Proposition 84 grant.

14th Street: Lighthouse to Ocean View (Drainfield A-9)
This area of the collection system has three parallel sewer mains, due to the 54-inch storm drain that runs down the center of the street. It is recommended to replace the multiple sewer mains with a single sewer main. The sewer mains are in acceptable physical condition. This project would likely require simultaneous replacement or relocation of the storm drain.

Carmel Street: Junipero to Rickets (Drainfield A-9)
This area has sags in the sewer main due to trench settlement. It is recommended to replace the sewer main in this area to eliminate the sags.

Crocker & Asilomar: Sinex to Oceanview (Drainfield A-12)
These manholes are recommended for replacement or rehabilitation due to hydrogen sulfide (H_2S) deterioration. The existing manhole lids do not allow for venting, which can cause build-up of H_2S. It is recommended that the replacement manholes allow for venting.

Sunset Drive and Asilomar Blvd (Drainfield A-5)
The sewer mains in this area need to be replaced due to deterioration. The preferred method of construction is pipe bursting to avoid sensitive habitat. The City is currently underway with this project.

South of Hillcrest Avenue (Drainfield A-3)
Currently, the collection system south of Hillcrest Ave is a high priority for the City due to root intrusion. The sewer mains in this area are recommended to be replaced based on age and condition, to reduce the root intrusion and associated operations issues.

Beachcomber Lift Station (LS17)
This station has odor issues, because it does not cycle frequently. There is a potential to abandon LS17.5 and divert to LS17 to increase flow to LS17. The City will need to determine if LS17.5 is private before doing any work on this lift station. It is recommended that the City update the location of this lift station in the City's GIS.

Lift Station 15.5
Upgrades to LS15.5 may be recommended based on the need for a recycling project.

Del Monte Area (Drainfields A-1 and A-2)
The sewer mains in this area are recommended to be replaced based on condition and age. Inflow and infiltration (I/I) is an issue in this area during storm events. In addition, maintenance is difficult due to sewer mains being located on private property. It is recommended to pipe burst with seamless pipe in the same alignment to minimize root intrusion or to re-locate the sewer mains in the public right of way. Due to the significant length of sewer main in this area (over 10 miles), the replacement of these sewer mains is recommended to be incorporated into the City's long term replacement strategy, discussed in more detail below, rather than included in the CIP as a single project.

Long-Term Pipe Replacement Strategy
In addition to the specific locations above which are included in the Capital Improvement Program (CIP) in Chapter 6, it is recommended that the City follow a long-term pipe replacement strategy to upgrade the sewer collection system over time, specifically, the VCP pipes rated F by CCTV inspection. Approximately 24,500 LF of sewer main were identified as being rated F. The long term strategy is included in the recommended CIP, in order for the City's budget to account for on-going replacement of the collection system due to age and/or operating conditions. It is recommended that the City budget for the replacement of 3,000 linear feet of sewer main per year, in addition to the individual projects listed in the CIP. This will allow the City to have flexibility in prioritizing replacement projects based on field conditions year-by-year, ascertained by maintenance logs, video inspections, etc.

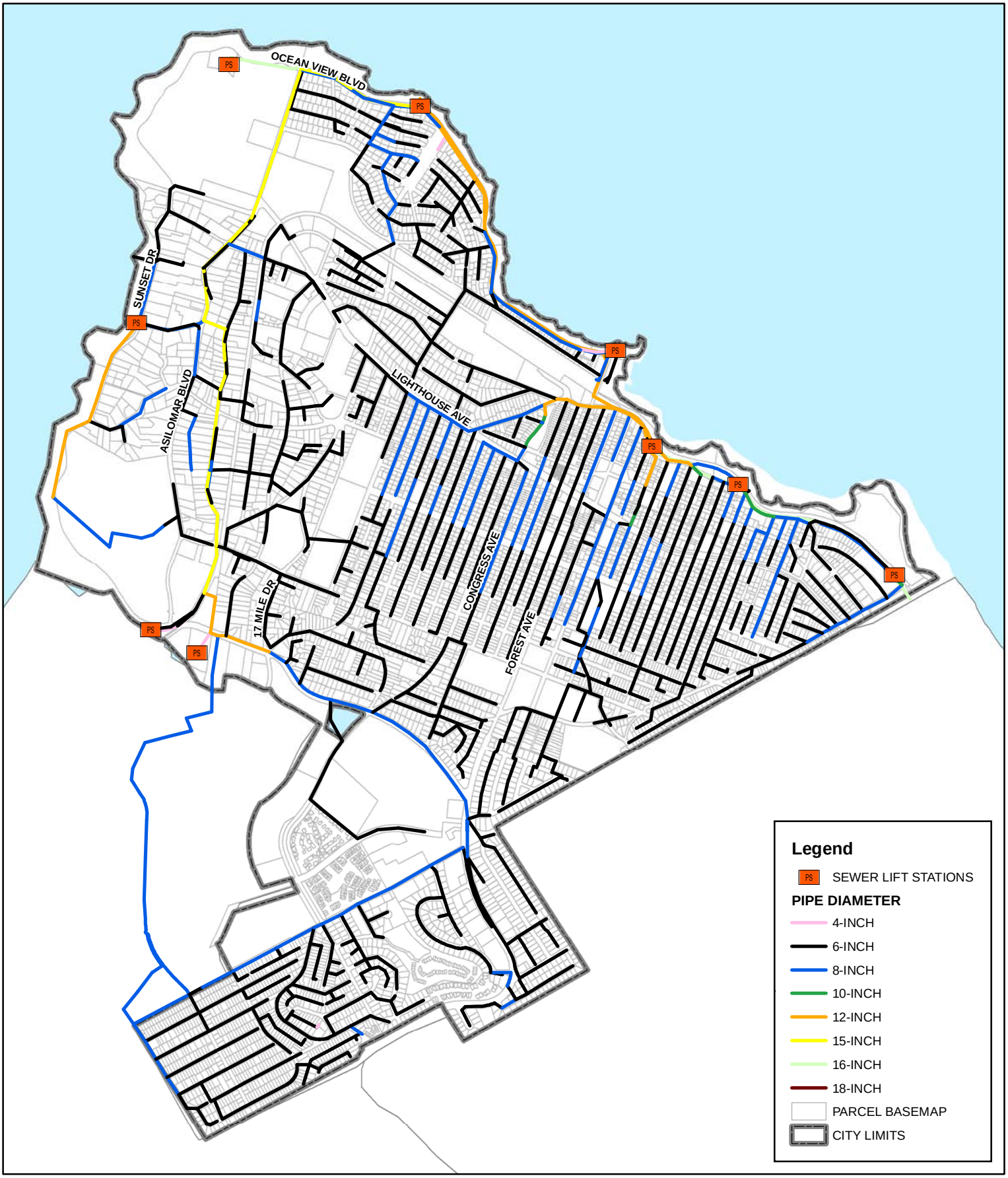

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FIGURE 3-1: COLLECTION SYSTEM OVERVIEW MAP

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CHAPTER 4

WASTEWATER FLOWS

This Chapter presents the results of the sewer flow monitoring and the development of the wastewater flow characteristics to be used for the analysis of the collection system for the City of Pacific Grove (City). All figures for Chapter 4 are located at end of this chapter.

INTRODUCTION

Wastewater flows were evaluated from three sources:

- Temporary flow meters installed in the City's collection system
- Wastewater flow records provided by Monterey Regional Water Pollution Control Agency (MRWPCA)
- Water use records provided by California American Water Company (Cal-Am)

Each source is described in the following sections.

WASTEWATER FLOW MONITORING

To develop a better understanding of the existing wastewater flows from the City, in-line flow monitoring was conducted at four different locations on main trunk lines throughout the City. The flow monitoring locations are as follows:

- **MH 303:** Located on Oceanview Blvd at Grand Avenue
- **MH 803:** Located on Asilomar Blvd at Lighthouse Avenue
- **MH 859:** Located on Jewell Avenue at Crocker Avenue
- **MH 1058:** Located on 14th Street at Central Avenue

The locations of the flow meters and their corresponding tributary areas are depicted on Figure 4-1. The flow meters were installed February 2, 2013 and removed April 10, 2013 for a total of 67 days. Summary sheets for the flow meters are included in Appendix C.

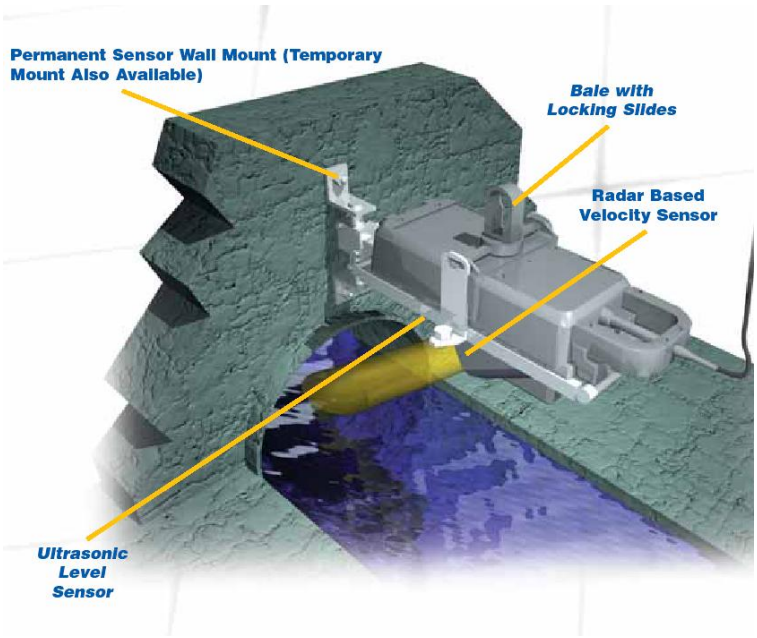
In addition to the four meters listed above, the City provided data for a flow meter located in manhole 502, at the City corporation yard on Sunset Drive. This meter was installed by the Pebble Beach Community Services District in coordination with the City to obtain flow data for potential wastewater recycling projects.

The sites chosen to install the flow meters were based on the proposed sewer model development. The flow meters were set to monitor and characterize large tributary areas that would provide information about the characteristics of the collection system.

Flow Meters

Flow meters utilized for this study were Flo-Dar® brand non-contact measuring devices. Flo-Dar® measuring devices consist of a Doppler radar based velocity measurement system and an ultrasonic pulse echo depth measurement system, which mounts to the interior of the manholes above the sewer flow-line. This equipment has a reported accuracy of +/- 5%. In this configuration, velocity measurements are obtained in a manner similar to that of a radar gun measuring the velocity of a baseball or an automobile. Site-specific pipe characteristics (pipe diameter, pipe shape, velocity profile) were inputted to each device allowing for automated flow based conversion according to respective velocity/depth profiles. Mounting the metering devices above the flow line eliminates the potential for fouling of the metering sensors by suspended debris typically found within municipal wastewater.

Typical flow meter installation into a manhole utilizing Flo-Dar® measuring devices is shown in the following sketch.



Typical Flo-Dar® Flow Meter Installation

Flow data was recorded by the meters at 15-minute recurring intervals. Since sewer flow monitoring does not record continuous flow, it only provides an estimate of the amount of wastewater flow generated by various areas of the community. It provides useful information about the diurnal patterns of the community and can show the impacts of inflow and infiltration. The following provides a summary of the benefits and potential drawbacks with sewer flow monitoring:

<u>Benefits</u>

- Allows for calculation of hourly and daily wastewater flow averages for various tributaries within the community. This can help differentiate between the amount of wastewater flow coming from residential versus commercial development.

- Evaluates diurnal trends within the community, which will help estimate the peaking factors that are required to size the collection system and evaluate the remaining capacity within the existing collection system.
- Evaluates the impacts of inflow and infiltration, and can help to isolate where the problem areas may be.

Potential Problems

- The flow meters provide readings every 15 minutes. These readings are then averaged to estimate total daily flows. Therefore, there are possibilities that the flow meter could miss higher instantaneous peaks that may come through the collection system in between readings.
- Since wastewater is not a clean liquid, debris travels through the collection system, which can cause blockages in the sewer mains, thereby changing the levels and velocities in the sewer main and producing inaccurate readings.

Flow Meter Locations

The following provides a summary of the locations and tributary areas for each of the flow monitoring stations.

MH 303: 12-inch

The MH 303 flow meter was installed just upstream of Lift Station 13. The flow meter was installed on the 12-inch sewer main in Oceanview Boulevard that receives flow from downtown Pacific Grove and from the residential and commercial areas between 17 Mile Drive, 11th Street, and Briggs Avenue. It covers drain fields A7, A8, and A9 as shown on Figure 4-2.

MH 803: 15-inch

The MH 803 flow meter was installed upstream of the Lift Station 15 tributary area. The flow meter was installed on a 15-inch sewer main in Asilomar Avenue that receives flow from the residential and commercial area in western Pacific Grove. This meter also receives flow from the MH 502 flow meter and MH 859 flow meter tributary areas. It covers drain fields A1 through A5 as shown on Figure 4-2.

MH 859: 8-inch

The MH 859 flow meter was installed upstream of the MH 803 tributary area. The flow meter was installed on an 8-inch sewer main in Jewell Avenue that receives flow from a small tributary area west of Asilomar Avenue. The tributary area for this meter is primarily multi-family residential, with some single family residential a few small motels. It covers a portion of drain field A5 as shown on Figure 4-2.

MH 1058: 6-inch

The MH 1058 was installed on a 6-inch sewer main in 14th Street that receives flow from a portion of downtown, and residential and commercial areas between Oceanview Boulevard and Sinex Avenue, including Robert Down Elementary School. It covers a portion of drain field A9 as shown on Figure 4-2.

MH 1052: 8-inch (City Meter)

The MH 1052 meter is installed on an 8-inch sewer main in the City's corporation yard on Sunset Drive. The City provided flow records for this meter for the same time period as the flow monitoring. This meter receives flow from the residential and commercial areas south of Sunset Drive and west of Forest Avenue. It covers drain fields A-1 and A-2 as shown on Figure 4-2.

Flow Meter Results

The flow meters were used to evaluate wastewater flow contributions from the individual tributary areas in the City. There were no significant rain events during the flow monitoring period to evaluate the rainfall dependent infiltration and inflow. Therefore, flow data collected for the entire monitoring period was used to calculate a daily average, representative of dry weather flow. Infiltration and inflow are discussed in more detail in a subsequent section of this chapter.

A summary of the average daily flow results from each of the flow monitoring stations is provided in Table 4-1 below. A graph of the average day flow versus daily rain totals are provided on Figures 4-3 through 4-7. The rain data was obtained through a weather station in Pacific Grove maintained by the California Irrigation Management Information System (CIMIS).

Table 4-1. Flow Meter Results Summary

	Average Daily Flow[1] (gpd)
MH 1058	133,000
MH 303	271,000
MH 502 (City Meter)	149,800
MH 859	100,000
MH 803[2]	606,000
Total	**1,010,000**

1. This table represents flow from the metered areas only, and does not include flow for the entire City of Pacific Grove.
2. MH 859 and MH 502 are tributary to MH 803

LIFT STATION FLOW RECORDS

Monterey Regional Water Pollution Control Agency (MRWPCA) provided flow data for two lift stations: Lift Station 15 and Lift Station 13. Lift Station 15 collects flow from the western half of the City, and pumps directly to Lift Station 13. Lift Station 13 collects all the flow from the City and pumps to the City of Monterey, which ultimately then goes to MRWPCA's Regional Wastewater Treatment Plant. There are no regional lift stations upstream of Lift Station 15.

Both of these lift stations have been recently upgraded and the pumps operate on variable frequency drives. Flow is recorded through a magmeter flow meter installed on the forcemain downstream from the pumps. According to MRWPCA staff, a data recording device at each station receives continuous flow data from the magmeters. MRWPCA extracted hourly average flow values for each station, and provided data for

the same time period as the flow monitoring. In addition, MRWPCA provided daily average flow values for both stations for years 2008 through 2012. The lift station flow data is summarized in Table 4-2.

Table 4-2. MRWPCA Lift Station Flow Summary

Year	Average Flow (mgd)	
	Lift Station 15	Lift Station 13
2008	0.59	1.16
2009	0.59	1.15
2010	0.64	1.42
2011	0.63	1.07
2012	0.54	0.94

WATER USE DATA

Another source of evaluating wastewater flows is to compare the estimated wastewater flow to water use records. Cal-Am provided water use records for the City for the purpose of comparing indoor water use to the wastewater flow data, and to review water use by service type (ie residential and commercial). Cal-Am provided water use records for the City for years 2008 through 2012.

In order to compare water use records to wastewater flow it is important to identify indoor water use that would contribute flow to the wastewater system. Due to the mild climate on the peninsula and smaller lot sizes, the majority of water used in the City of Pacific Grove is for indoor uses, with the exception of the Municipal golf links, schools, and parks. These irrigation accounts were identified and indoor water use was calculated excluding these irrigation flow volumes. Also, average residential water use increased between the months of June and September, presumably due to outdoor water use. Therefore, the water use for October through May was used to calculate the average indoor residential water use. Table 4-3 provides a summary of average indoor water use for the City of Pacific Grove.

Table 4-3. Indoor Water Use Summary

Year	Average Indoor Water Use (mgd)
2008	1.01
2009	0.97
2010	1.05
2011	1.04
2012	1.06

EXISTING WASTEWATER FLOWS

The following terms are used to describe average flows in the City's collection system:

> *Wastewater Base Flow* is the anticipated average flow rate of only wastewater in the collection system.
>
> *Average Daily Flow* is the average daily dry weather flow in a collection system and includes both wastewater base flow and groundwater infiltration.

Based on our review of the data outlined in this Chapter, the water use records were found to be the most reliable source of estimating the average wastewater base flow for the City. The flow monitoring provided valuable data for estimating peaking factors, and dry weather infiltration due to groundwater.

The water use records were used for estimating wastewater flow in lieu of lift station flow records for two reasons. First, the flow monitoring conducted estimated a much higher average daily flow than the flow recorded through the lift stations during the same time period. Second, the lift station records appear to underestimate average daily flow when compared to water use records. In general, the lift station flows are expected to be greater than indoor water use, due to known groundwater infiltration in the City's collection system. With the exception of year 2010, the lift station flows are lower than or equivalent to indoor water use.

Based on the information from the sewer flow monitoring, MRWPCA's record information, water usage data from Cal-Am, and reliable wastewater resources such as Metcalf & Eddy, *Wastewater Engineering Treatment and Reuse, fourth addition*, the wastewater generation characteristics of various existing development types within the City were developed and are presented in Table 4-4.

Table 4-4. Summary of Wastewater Flow Factors

	Quantity	Unit	Flow Factor (gal/day/unit)	Total Wastewater Base Flow (gpd)
Residential	15,041	persons	60	902,500
Hotel Rooms	743	rooms	60	44,600
Commercial	888,816	square feet	0.15	133,300
School	2,252	students	20	45,000
			Existing Wastewater Base Flow	**1,125,400**

The quantity of persons or buildings for the various land uses in Table 4-4 is based on multiple sources, as follows. The residential population is based on census data as discussed in Chapter 2. The commercial square footage is based on the City's GIS database. The number of hotel rooms and students were obtained from contacting the schools and hotels located within the City.

Inflow and Infiltration

Inflow and infiltration (I/I) can cause significant issues in collection systems and wastewater treatment plants. The I/I of surface and ground water into a sewer system can result in peak flows that far exceed dry weather flow conditions. For the purposes of this report, these terms are defined as follows:

> *Infiltration* is the water entering a sewer system and service connections from groundwater, through such means as defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include inflow and is relatively constant over a period of days, weeks, or even months as high groundwater conditions persist.
>
> *Inflow* is the water discharged into a sewer system and service connections from such sources as roof drains, cellar, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers, catch basins, storm water, surface runoff, or drainage. Inflow does not include infiltration. Inflow occurs and varies rapidly with rainfall conditions, with flows rising and falling within minutes or hours of a severe storm event.

As stated previously, there were no significant rain events that occurred during the flow monitoring period and thus rainfall dependent I/I could not be determined as a part of this study. However, based on our review of daily flow fluctuations for the flow meters there does appear to be a significant flow contribution due to groundwater infiltration at two locations in the City: MH1058 and MH803. The tributary area for MH1058 is known to have infiltration due to high groundwater. The tributary area for MH803 is characterized by mature trees and dense vegetation, which can lead to infiltration through root intrusion. In addition, the flow monitoring and field investigation conducted as part of the City's 2004 Sewer System Asset Management Plan also indicated groundwater infiltration in these areas. Therefore, these results appear reasonable based on known system conditions.

Estimated groundwater infiltration was determined for each tributary area by subtracting the estimated Base Wastewater Flow from the Average Daily Flow recorded through the meter. For the purpose of this study, it was assumed that groundwater infiltration is negligible for the portion of the City that was not within a flow meter tributary area. Table 4-5 provides a summary of the estimated dry weather infiltration due to groundwater in the City.

Existing Wastewater Flow Summary

Table 4-5 provides a summary of the average daily flows from each tributary area, based on the wastewater flow factors listed in Table 4-4 and estimated dry weather infiltration. The estimated average daily flow for the City is approximately 1,327,000 gpd. Table 4-6, located at the end of this chapter, breaks down the flow characteristics of the individual tributary areas based on the wastewater generation factors.

Table 4-5: Average Daily Flow by Tributary Area

Tributary Area	Wastewater Base Flow (gpd)	Estimated Groundwater Infiltration (gpd)	Average Daily Flow (gpd)
MH 1058	46,800	86,400	133,200
MH 303	257,000	0	257,000
MH 502 (City Meter)	150,800	0	150,800
MH 859	85,100	14,400	99,500
MH 803	491,300	115,200	606,500
Remainder (not monitored)	330,300	N/A	330,300
City Total	**1,125,400**	**201,600**	**1,327,000**

*NOTE: MH803 includes flow for MH502 and MH859

Peaking Factor Analysis

When discussing wastewater flows, it is important to define some of the terminology commonly used to describe and analyze wastewater flows.

Average Daily Flow (ADF) is the average daily wastewater flow in a collection system and includes wastewater base flow and infiltration. ADF is generally obtained by averaging the mean monthly flows conveyed to a WWTP through the course of a year. In the case of this report the ADF is based on flow records from the Cal-Am water use records for years 2008-2012, and estimated dry weather ground water infiltration from the flow monitoring.

Maximum Day Dry Weather Flow (MDDWF) reflects the maximum day flow rate typically seen during the peak summer months. This condition reflects the seasonal variation in dry weather flow. For the purposes of this study, the MDDWF peaking factor was estimated based on peaking factor requirements per California Title 22.

Peak Hour Dry Weather Flow (PHDWF). In order to appropriately design wastewater collection system facilities, peak flow conditions must be quantified. Peak flow was determined based on flow monitoring that was conducted from February 2, 2103 and April 10, 2013. Figure 4-8 provides the residential and commercial diurnal curves for the collection system, based on flow monitoring. The PHDWF factor is equal to the diurnal factor multiplied by the MDDWF factor. The peaking factor for the diurnal peak does not apply to inflow/infiltration (I/I) flow contributions to the collection system.

Peak Hour Wet Weather Flow (PHWWF) is the maximum flow rate that occurs in a single hour during wet weather (a significant rain storm event). This factor is derived from standard engineering methodology and judgment combined with actual flow monitoring data. This flow condition may govern the design of the sewage collection system as it may represent the maximum flow rate that the system must convey. The flow monitoring conducted for this study did not provide data for calculation of PHWWF, as the rainfall that occurred during the flow monitoring period was minimal. Therefore, wet weather peaking factors

derived as a part of the City's 2004 Sewer System Asset Management Plan will be used.

Table 4-7 provides a summary of the existing average daily wastewater flow and the peaking factors used for this report. It is important to note that the diurnal peaking factors do not apply to the estimated dry weather groundwater infiltration.

Table 4-7. Summary of Peaking Factor Analysis

Flow Condition	Flow (gpd)	Peaking Factor	Notes
Wastewater Base Flow	1,125,400	--	Based on water use records
Average Daily Flow (ADF)	1,327,000	--	Based on water use records and dry weather infiltration
Maximum Day Dry Weather Flow (MDDWF)	1,889,700	1.5	Based on Title 22 peaking factor requirements
Peak Hour Dry Weather Flow (PHDWF)	3,969,900	3.4 - Residential 3.2 - Commercial	Based on flow monitoring conducted between February 2, 2013 and April 10, 2013.
Peak Hour Wet Weather Flow (PHWWF)	Varies for Each Tributary Area		Per the City's 2004 Sewer System Asset Management Plan

Table 4-8 provides a summary of the PHWWF factors, per the City's 2004 Sewer System Asset Management Plan (SSAMP). In most tributary areas the peak hour dry weather flow is estimated to be greater than the peak hour wet weather flow.

Table 4-8: Peak Hour Wet Weather Flow Factors

Tributary Area	PHWWF Factor from 2004 SSAMP	2004 Flow Monitor
MH 1058	4.0	Basin 4
MH 303	2.6	Basin 3
MH 502	2.7	Basin 1
MH 859	2.7	Basin 1
MH 803	2.7	Basin 1
Remainder (not monitored)	4.0	Basin 4

FUTURE WASTEWATER FLOWS

Projection of wastewater flow is tied closely to population projections and anticipated development. As noted in Chapter 2 of this report, the future wastewater flows for this collection system are anticipated to be comprised of infill and redevelopment.

Although it is assumed that water conservation measures will be taken, such as low flow plumbing fixtures for all future development, to determine the future flows, the existing flow factors noted in Table 4-4 will be used. In addition, the existing peaking factors noted in Table 4-7 and Table 4-8 will also be used for estimating future development maximum day and peak flows. Tables 4-9 and 4-10 provide a breakdown of the land uses and the estimated future wastewater flows for the City.

Table 4-9. Future Wastewater Base Flows By Land Use

Source of Flow	Quantity	Unit	Flow Factor (gal/day/unit)	Total Wastewater Base Flow (gpd)
Residential	1,793	persons	60	107,600
Commercial	565,300	square feet	0.15	84,800
Future Wastewater Base Flow				**192,400**

Table 4-10. Summary of Future Average Daily Flows

Tributary Area	Existing Average Daily Flow (gpd)	Future Wastewater Base Flow Addition (gpd)	Future Average Daily Flow (gpd)
MH 1058	133,200	15,800	149,000
MH 303	257,000	27,300	284,300
MH 502	150,800	19,700	170,500
MH 859	99,500	19,300	118,800
MH 803	606,500	88,300	694,800
Remainder (not monitored)	330,300	61,000	391,300
Totals	**1,327,000**	**192,400**	**1,519,400**

NOTE: MH803 includes flow for MH502 and MH859

Table 4-6: Breakdown of Average Daily Flow by Land Use and Flow Monitoring Tributary Area

Tributary Area	Number of Residential Housing Units	Estimated Residential Population Density*	Estimated Residential Population	gpd	Estimated # of Hotel Rooms	gpd	Estimated # of Students	gpd	Commercial and Public Facilities (minus schools & hotels) (sq. ft)	gpd	SubTotal Estimated Wastewater Base Flow (gpd)	Estimated Infiltration (gpd)	Estimated Average Daily Flow** (gpd)	Flow Monitoring (gpd)	Percent Difference
MH1058	278	1.70	473	28,356	0	0	500	10,000	55,817	8,373	46,800	86,400	133,200	133,000	100%
MH303	2,210	1.60	3,536	212,160	85	5,100	75	1,500	254,352	38,153	257,000	0	257,000	271,000	95%
MH502 (City meter)	1,385	1.70	2,355	141,270	0	0	38	760	58,229	8,734	150,800	0	150,800	149,800	101%
MH859	404	3.00	1,212	72,720	186	11,160	60	1,200	0	0	85,100	14,400	99,500	100,000	100%
MH803***	1,273	2.50	3,183	190,950	286	17,160	1,064	21,280	173,107	25,966	491,300	115,200	606,500	606,000	100%
Total Monitored	5,550	1.94	10,758	645,456	557	33,420	1,737	34,740	541,505	81,226	795,100	216,000	996,700		
Not Monitored	2,619	1.64	4,283	257,044	186	11,160	515	10,300	347,311	52,074	330,300	0	330,300		
System Total	8,169	1.84	15,041	902,500	743	44,600	2,252	45,000	888,816	133,300	**1,125,400**	216,000	**1,327,000**		

*The population density was estimated for the various tributary areas based on results of the flow monitoring and the type of residential uses (single-family, multi-family) predominant in the tributary area.

** Average Daily Flow = Wastewater Base Flow + Dry Weather Infiltration

**Total includes MH502 and MH859 Tributary Area

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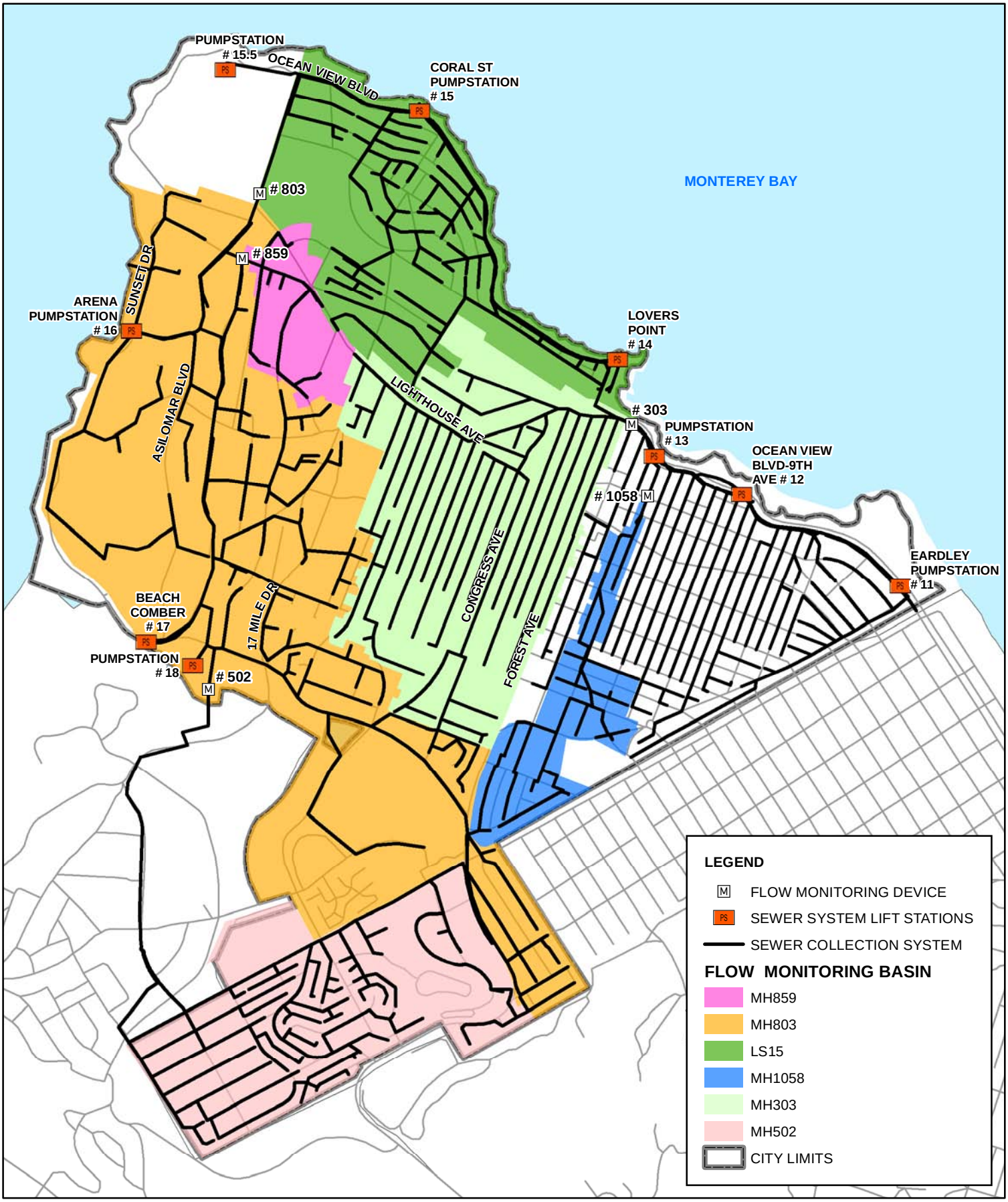

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FIGURE 4-1: FLOW MONITORING BASIN MAP

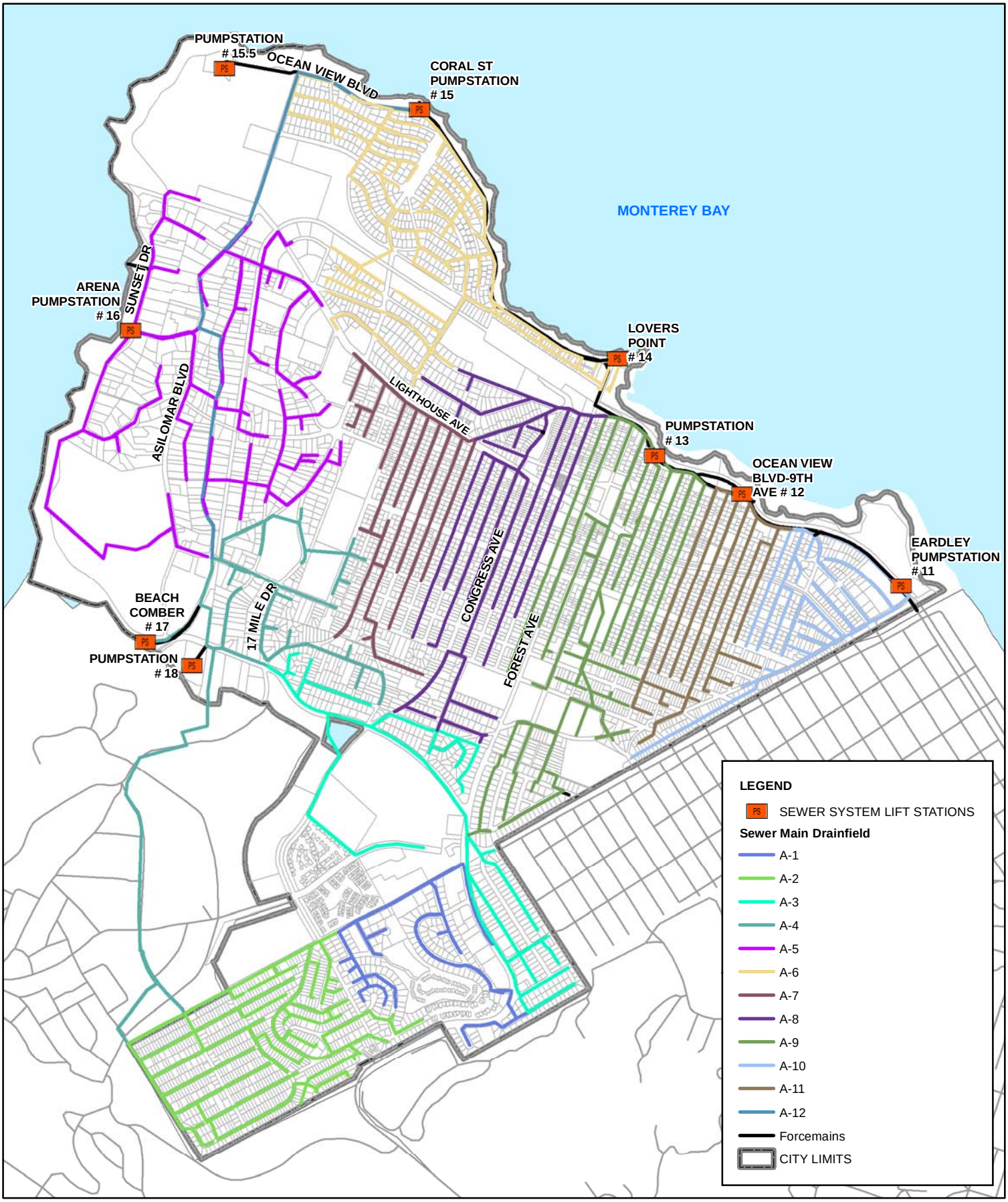

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FIGURE 4-2: CITY WASTEWATER DRAIN FIELDS

Figure 4-3. MH 502 Average Daily Flow Readings

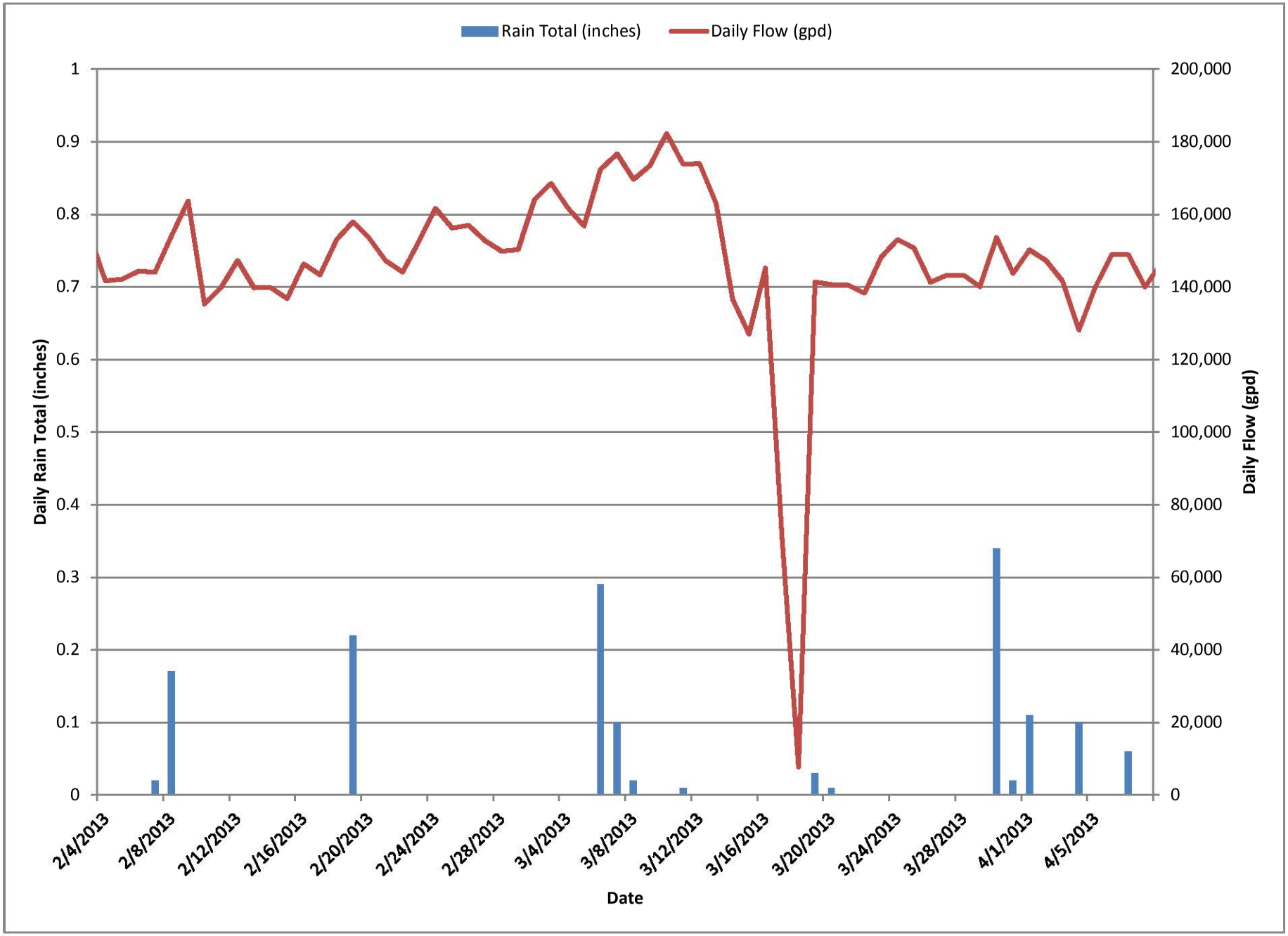


Figure 4-4. MH 303 Average Daily Flow Readings

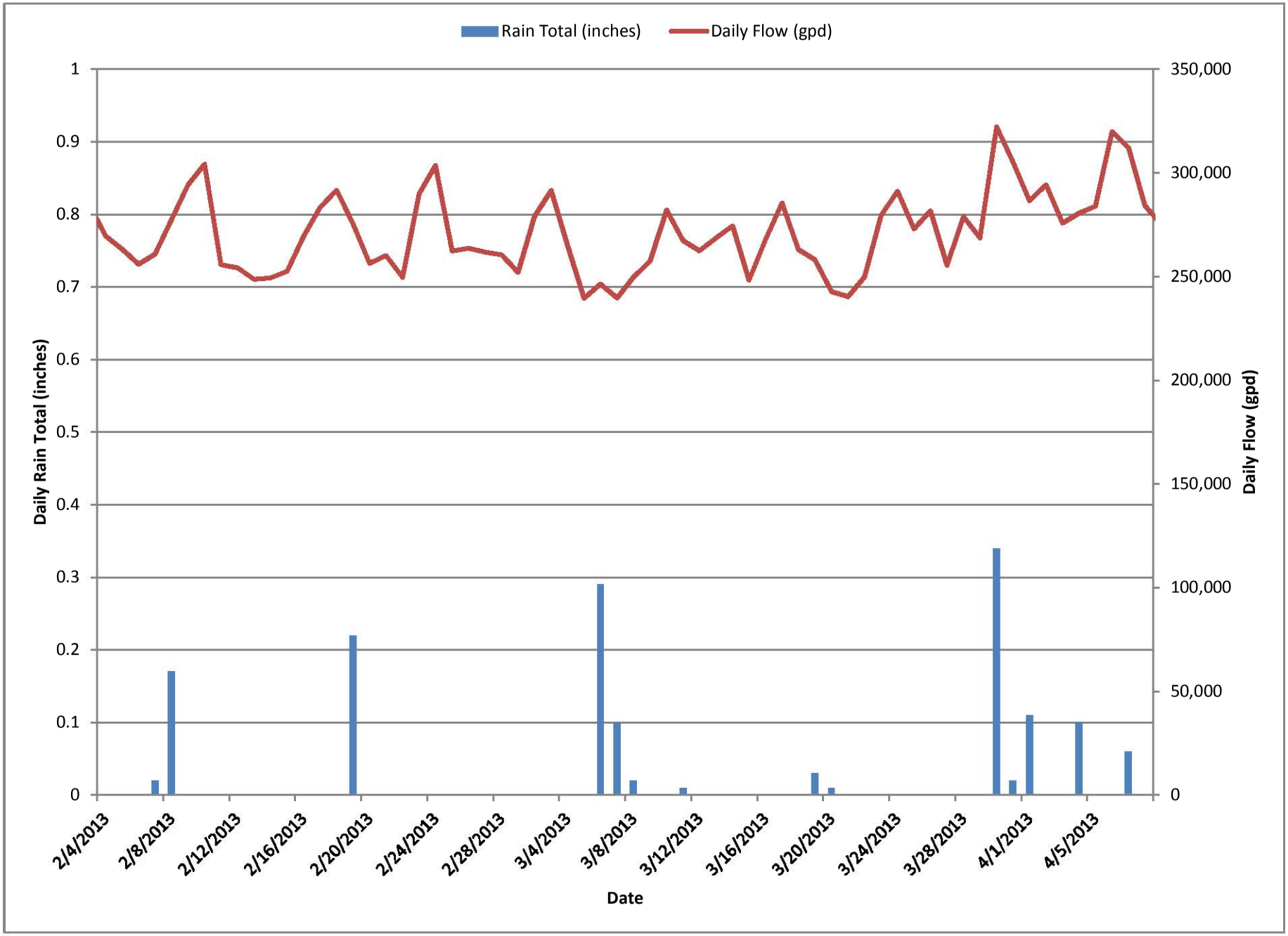


Figure 4-5. MH 803 Average Daily Flow Readings

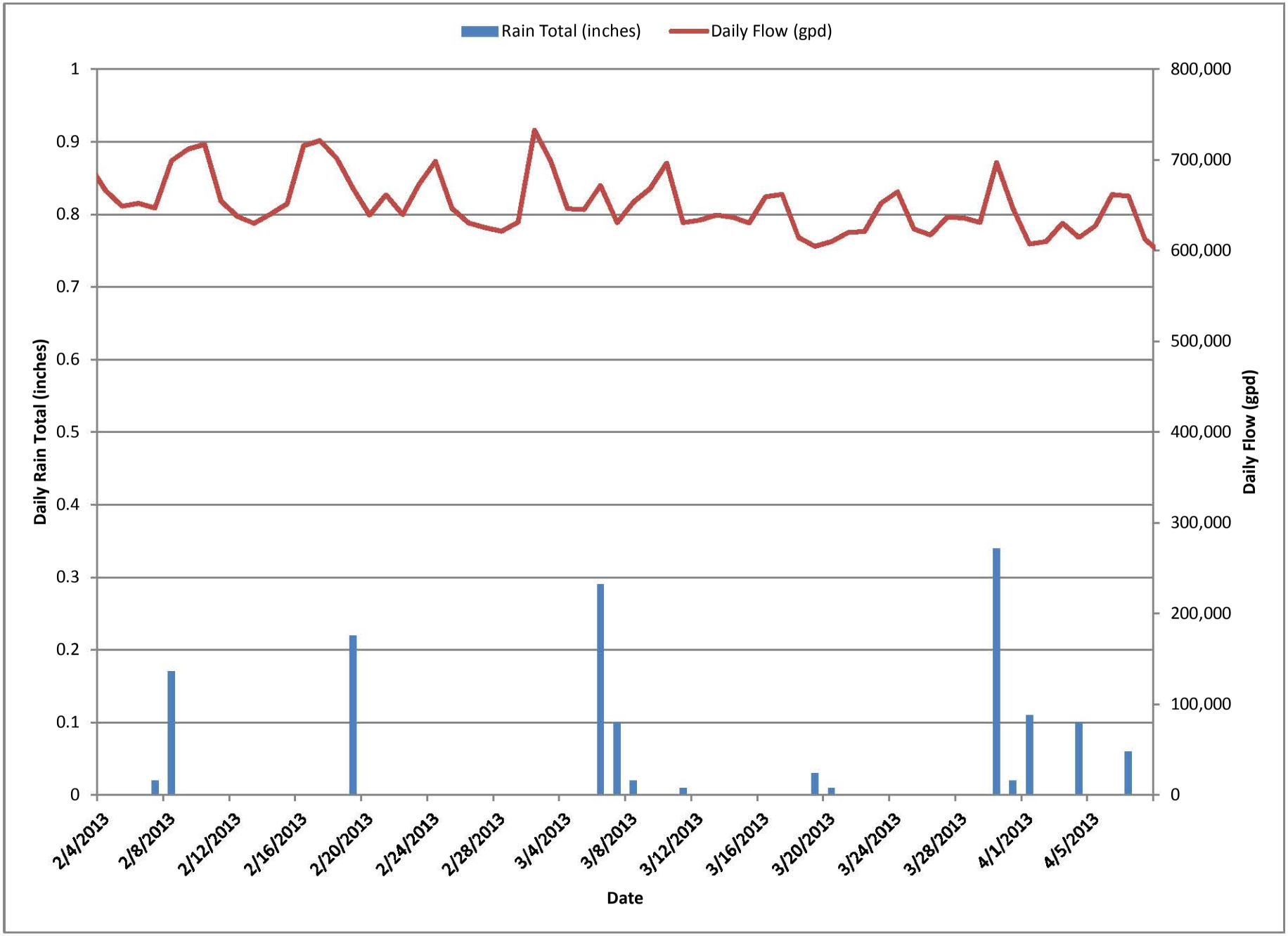


Figure 4-6. MH 859 Average Daily Flow Readings

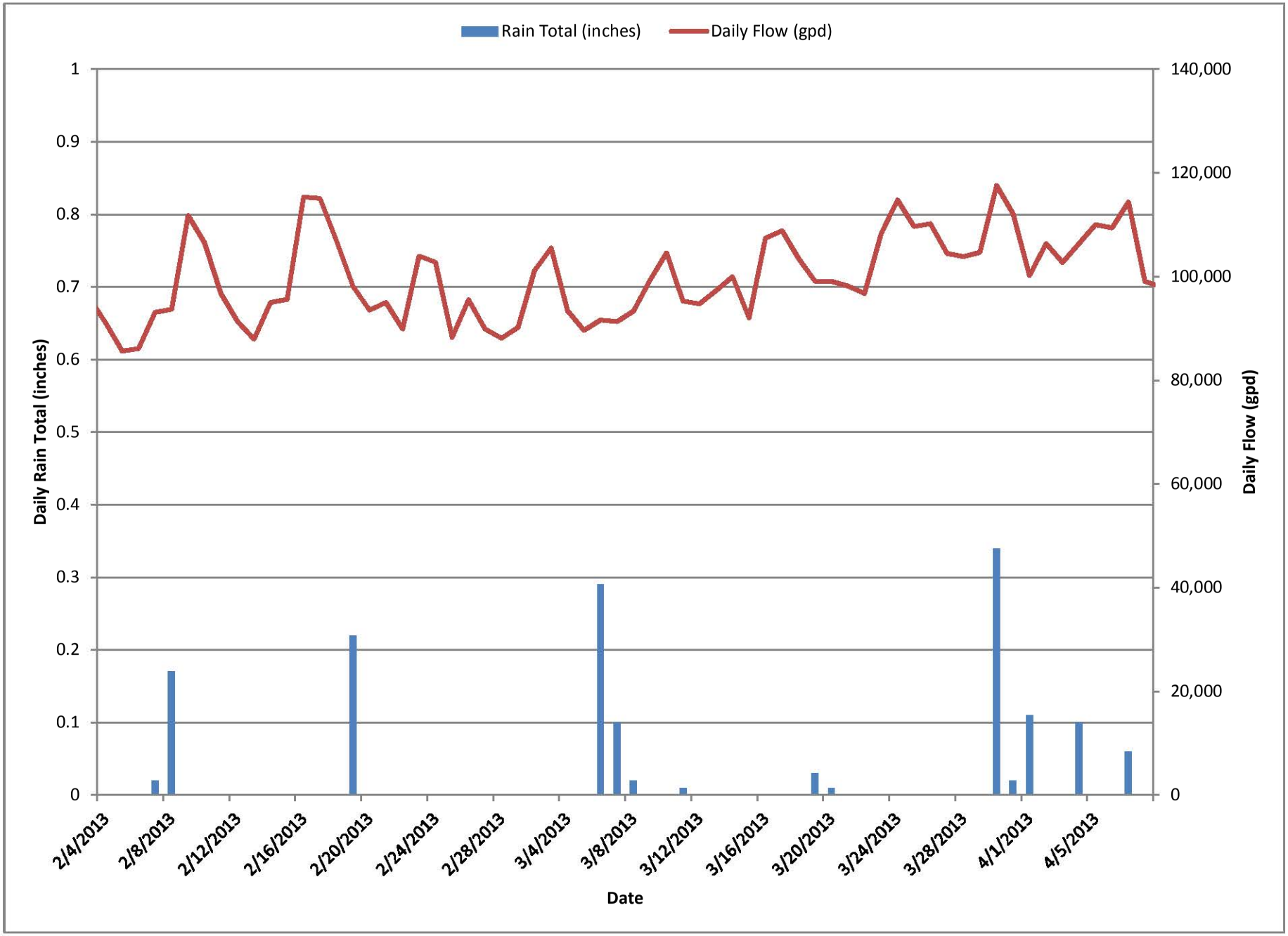


Figure 4-7. MH 1058 Average Daily Flow Readings

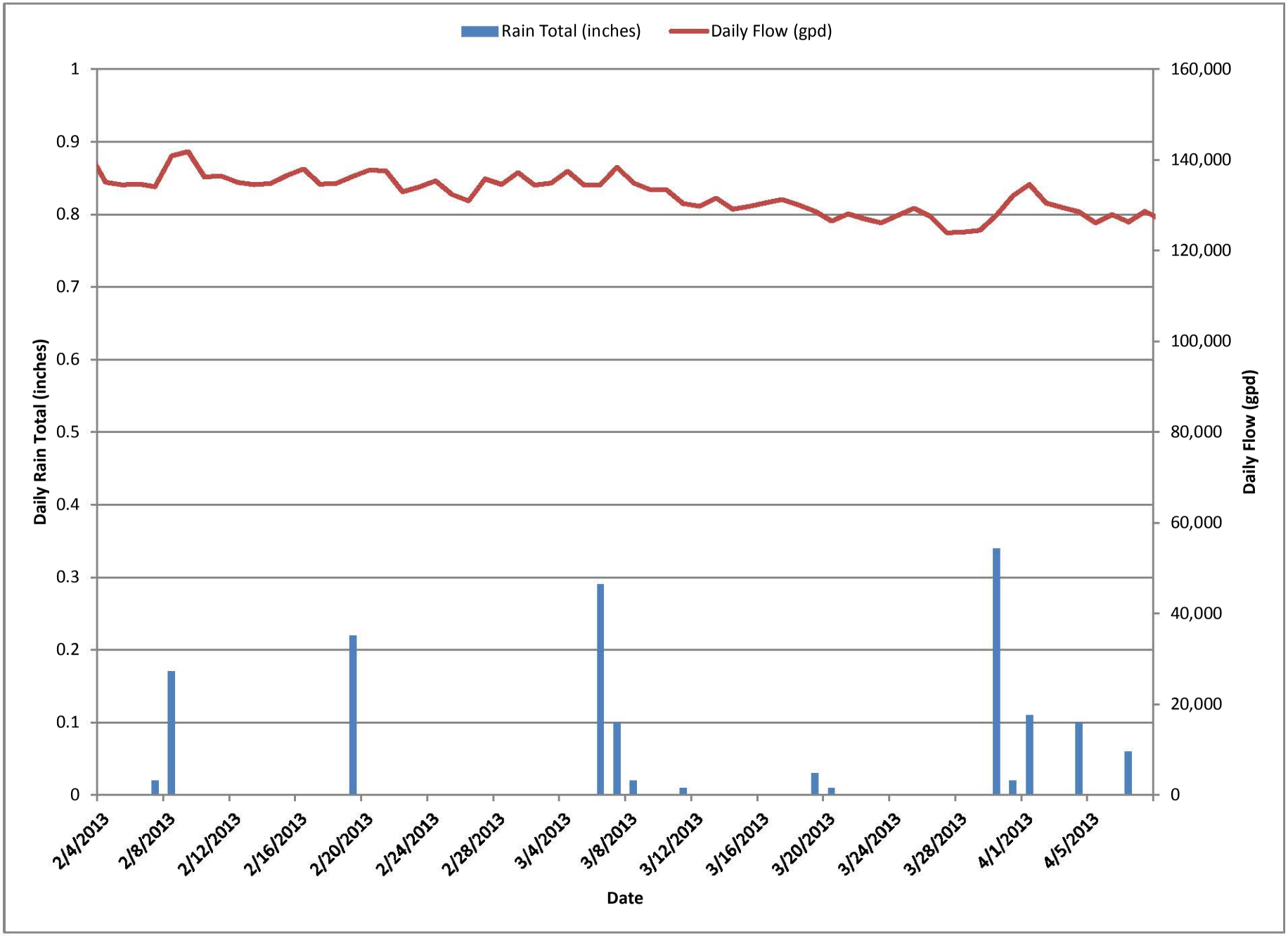
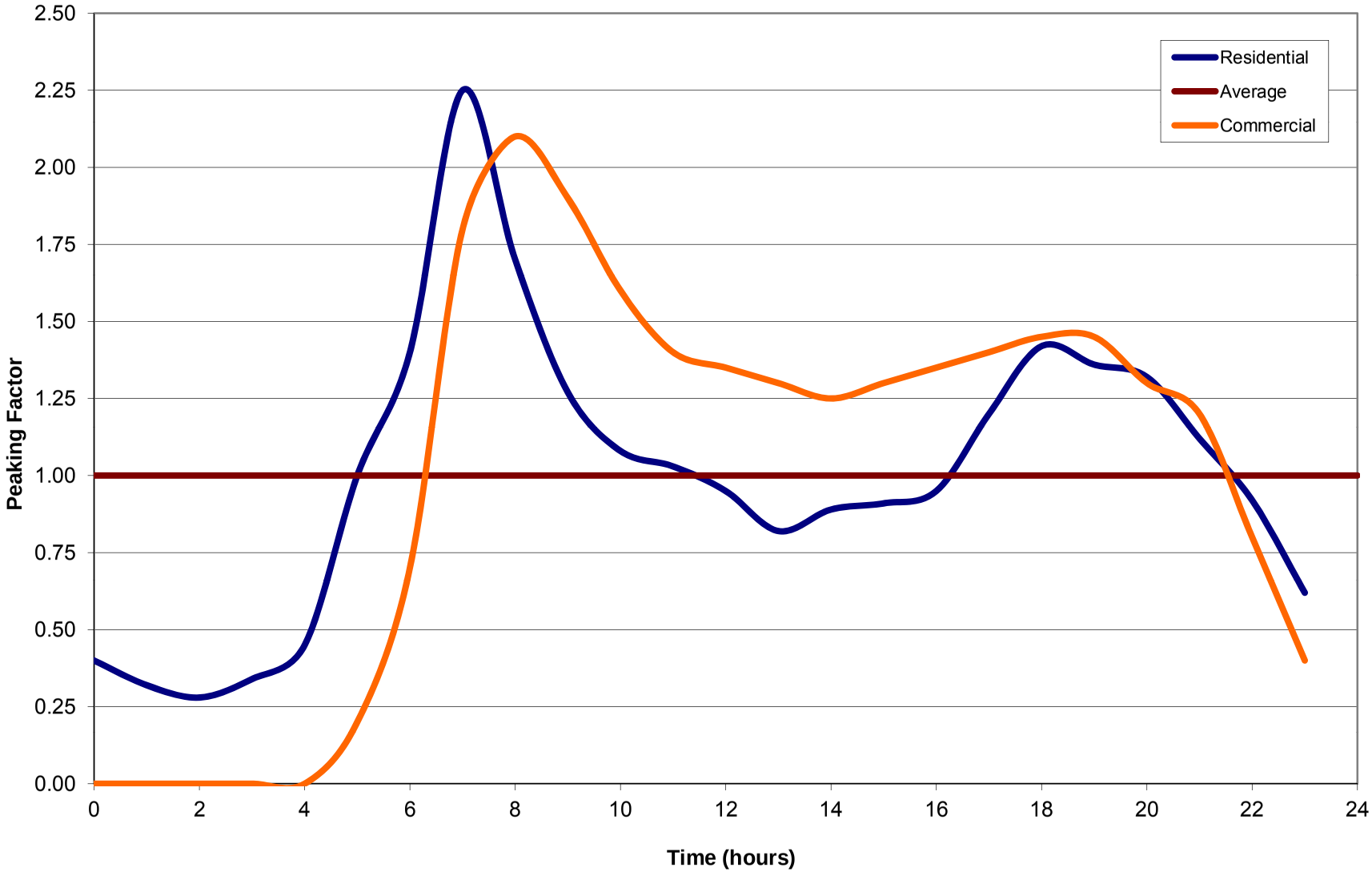


Figure 4-8. Diurnal Curves



CHAPTER 5

COLLECTION SYSTEM ANALYSIS

This Chapter presents the analysis of the gravity wastewater collection system for the City of Pacific Grove. Refer to Chapter 3 for an overview of the City's wastewater collection system. Refer to Chapter 6 for the proposed capital improvements based on the analysis presented in this Chapter. All figures for Chapter 5 are located at end of this chapter.

INTRODUCTION

The City's wastewater collection system consists of a network of 4-inch to 18-inch gravity sewer mains, and nine (9) lift stations, seven (7) of which are owned by the City and maintained by Monterey Regional Water Pollution Control Agency (MRWPCA), providing service to the City of Pacific Grove. The main trunk sewer system was analyzed using a computer based hydraulic model as part of this Sewer Master Plan project, to evaluate performance of the wastewater collection system under both existing and future conditions. Figure 5-1 provides an overview of the sewer mains, lift stations, and force mains that were included in the hydraulic model. All gravity sewer mains that were analyzed in the City's 2004 Sewer System Asset Management Plan (SSMP) were modeled for this Master Plan. In addition, the model was extended upstream of pipe segments identified for upgrades in the City's 2004 Master Plan. The City's lift stations and corresponding force mains were included in the sewer model.

The analysis of the wastewater collection system is based on a sewer Geographic Information System (GIS) for the entire City collection system, which was provided by the City. The manhole rim and invert elevation for the manholes included in the hydraulic model are based off a field survey conducted as part of this Master Plan. Additional information regarding the survey data is included in Appendix D.

COLLECTION SYSTEM ANALYSIS CRITERIA

As described in the City's Sanitary Sewer Management Plan Revision 1, Element 5: Design and Performance Provisions, design criteria is typically developed for each City project, and the City does not currently have a standardized design standard for the wastewater collection system. For this reason, design criteria for neighboring agencies were reviewed to develop a set of recommended design criteria for the analysis of the City's trunk sewer collection system. The recommended design criteria are summarized in Table 5-1. These criteria provide capacity buffer for surcharge conditions, for fluctuations in flows due to diurnal variations, and anticipated peak wet weather flows. Gravity pipe performance was analyzed based on maximum percent full (d/D ratio), defined as the depth of flow in a pipe divided by the diameter of the pipe. A summary of the various criteria reviewed is included in Appendix B.

Table 5-1. City Design and Performance Standards

Gravity Pipe Percent Full Criteria	
Pipe Diameter	**Maximum Allowed d/D**
10-inch and smaller	0.67
12-inch to 24-inch	0.80
Other Design Criteria	
Minimum Diameter	8-inch
Minimum Velocity	2.0 fps
Maximum Velocity	8.0 fps
Manning's Coefficient, n	0.013 for VCP, CIP & DIP; 0.011 for PVC & HDPE

COLLECTION SYSTEM FLOWS

Existing and future flows were analyzed in the sewer model for both dry weather and wet weather conditions. Flow rates were derived as described in Chapter 4 of this report. Flow parameters as utilized in this analysis are defined as follows.

- **ADF**: Average daily dry weather system flow
- **MDDWF**: Maximum daily dry weather system flow
- **PHDWF**: Peak hour dry weather system flow
- **I/I**: Flow due to wet weather infiltration and inflow
- **WWF**: Wet weather system flow, equal to ADF plus the added flow contribution from I/I

COLLECTION SYSTEM MODEL DEVELOPMENT

A hydraulic model of the sewer collection system was developed with the Innovyze® InfoSWMM sewer modeling program. InfoSWMM utilizes Manning's Equation for open channel flow (gravity pipes), Dynamic Wave analysis for flow routing through the collection system, and the Hazen-Williams Equation for pressurized flow conditions (force mains or surcharged pipes). Model results were evaluated for pipeline capacity, flow velocity, and maximum d/D ratio under various flow conditions.

Flow Allocation

Wastewater flows were assigned to the sewer model utilizing estimated flows as described in Chapter 4. Flows were allocated to individual sewer manholes based on the actual location of City customers. Tributary areas for each modeled manhole were developed and shown on Figure B-1, included in Appendix B. Each tributary area represents the total residential, commercial, and institutional customers contained within the tributary boundary.

Future wastewater flows were allocated to the sewer model based on the location of the parcels in relation to the tributary areas for the modeled manholes; refer to Figure B-2 included in Appendix B for the future flow locations. **The impact to the collection system from future flows may need to be re-evaluated for the portions of the collection system not included in the sewer model, and may also need to be re-evaluated if proposed development infrastructure connects to the existing City collection system in a location different then what was modeled.**

Diurnal curves were then applied to the allocated wastewater flows, to represent both dry weather and wet weather conditions. A separate diurnal curve was applied to residential and commercial connections, with hotels and schools included in the residential curve. A discussion of the diurnal curves for the City system is included in Chapter 4.

Model Calibration

Approximately ten weeks of sewer flow data was collected in support of the hydraulic model development, as described in Chapters 4 of this report. Representative data for each flow monitoring location was compared to model results for both wet and dry weather days. Through this process the diurnal curves applied to the model were adjusted to accurately represent the system flows as recorded through the flow monitoring. Model results for existing conditions were also compared to the City maintenance records to confirm locations where the model exhibited existing collection system deficiencies. Graphs comparing model results and flow monitoring data are included in Appendix B.

System Conditions Analyzed

The hydraulic model was utilized to analyze dry and wet weather system flow for both existing and future flow conditions. Within the model, multiple scenarios were developed that represent these various conditions. Existing and Future scenarios were utilized to identify system upgrades required in order to meet performance criteria as specified, and to identify areas recommended for high priority maintenance operations. Scenarios developed consist of the following:

- *Existing MDDWF Scenario:* This scenario represents the trunk sewer system under existing maximum dry weather flow conditions. This scenario includes estimated flow contributions from groundwater infiltration.

- *Existing WWF Scenario:* This scenario represents the trunk sewer system under existing average daily flow (ADF) with contributions from rainfall dependent I/I. In some tributary areas, anticipated peaking factors for contributions from I/I are higher than diurnal curve peaking factors for dry weather.

- *Future MDDWF Scenario:* This scenario represents the trunk sewer system under future maximum dry weather flow conditions, with all potential development as described in Chapter 2 contributing to the existing collection system. This scenario includes estimated flow contributions from groundwater infiltration.

- *Future WWF Scenario:* This scenario represents the trunk sewer system under future average daily flow (ADF) conditions with contributions from rainfall dependent I/I, and all potential future connections to the collection system in place. Within the model it was assumed that future connections to the existing system *would not* create additional inflow from I/I. This is because the future connections will occur within the existing collection system. This is conservative in that I/I is anticipated to be reduced as pipe upgrades occur over time.

COLLECTION SYSTEM MODEL RESULTS – EXISTING FLOW CONDITIONS

This section provides a summary of model results for the existing flow conditions modeled.

Deficient System Capacity

The following locations were identified through the analysis as having insufficient capacity to meet City performance standards while conveying existing system flows. Pipe upgrades identified for existing conditions may increase in diameter for future conditions, as described later in this chapter. Refer to Figures 5-2 and 5-3 for a system-wide map of maximum d/D under existing flow conditions. Figures 5-4 and 5-5 illustrate maximum d/D under existing flow conditions, with recommended improvements in place. Refer to Figure 5-6 for an overall map of the location of recommended system upgrades for existing conditions. Within the sewer model all system upgrades were designated as PVC.

Where improvements are recommended to the collection system, worst case d/D values are provided for reference. These d/D values represent a snapshot of the system under either: a) existing conditions, or b) proposed conditions with all improvements in place. In many cases, recommended upgrades would increase downstream maximum d/D, exceeding City standards, if the downstream recommended improvements were not constructed. Through the digital sewer model, maximum d/D was analyzed for the system as a whole, ensuring that recommended upgrades do not trigger additional downstream improvements.

<u>17 Mile</u>

- Location Extents: Manhole 510 to Manhole 501

17 Mile is currently an 8-inch VCP sewer main that has a d/D up to 1.00 under MDDWF, with peak flow up to 349 gpm. Upgrade to 12-inch PVC reduces maximum d/D to 0.68. This upgrade requires 2,900 lineal feet of 12-inch PVC.

<u>Asilomar</u>

- Location Extents: Manhole 801 to Manhole 806

Asilomar is currently a 15-inch VCP sewer main that has a d/D up to 0.98 under MDDWF with peak flow up to 1,169 gpm. The hydraulic capacity of the existing sewer mains is limited by the very flat slope of the pipes. Increasing the sewer main slopes, and thereby increasing the manhole depths, reduces the maximum d/D to 0.76 under

MDDWF. The required manholes depths are summarized in Table 5-2. Total affected pipe length is 2,150 lineal feet.

Table 5-2. Recommended Changes in Manhole Depth

Manhole Number	802	803	804	805
Existing Depth (ft)	5.26	14.58	15.11	13.40
Recommended Depth (ft)	8.83	17.58	16.49	14.26
Depth Increase (ft)	3.57	3.00	1.38	0.86

It is recommended that the City increase the manhole depths in order to increase the slope of the sewer main instead of upsizing the sewer mains, because there is a significant length of 15-inch sewer main downstream from this project area that has adequate capacity. The 15-inch sewer main continues from manhole 806 to Lift Station 15, for a total length of 4,720 lineal feet downstream from the recommended project.

Marginal System Capacity

Locations where pipes flow close to design standards as included in Table 5-1 were identified within the hydraulic model, as follows. The d/D values provided represent system performance with all improvements recommended for existing conditions in place. It is recommended that these locations are flushed on a regular basis to maintain optimum pipe capacity. These locations are depicted on Figure B-3, included in Appendix B.

<u>Sunset & Crocker</u>

- Location Extents: Manhole 501 to Manhole 821

The sewer main on Sunset and Crocker Avenue is three pipe segments of existing 12-inch VCP with MDDWF maximum d/D up to 0.82. Although a d/D of 0.82 is high, it occurs at peak flow times only. Therefore, these three sewer mains do not warrant upgrade at this time.

Low Pipe Velocity

Low pipe velocity results in the increased likelihood for solids to settle out of wastewater flow, leading to pipe backups and blockages. It is recommended to maintain a minimum pipe velocity of 2.0 feet per second (fps) to maintain solids in suspension. A total of 36 modeled pipes were identified with a velocity below 2.0 fps under existing average day conditions. It is recommended that pipes identified with a maximum velocity of less than 2.0 fps be flushed and/or vacuumed on a regular basis. Total length of pipe is 2.2 miles. These pipes are depicted in Figure B-3, included in Appendix B.

Pipe Travel Time

Excessive pipe travel time is a result of low velocity and/or long pipe runs, and can lead to problems with hydrogen sulfide attack and odor at downstream manholes. Typically

wastewater is oxygenated as it flows through a manhole, decreasing likelihood of hydrogen sulfide generation. Travel time exceeding thirty minutes through a single pipe (manhole to manhole) is undesirable. All pipes included in the hydraulic model have an existing average day travel time of 19 minutes or less; therefore pipe travel time is not anticipated to cause maintenance issues for the City's system.

COLLECTION SYSTEM MODEL RESULTS – FUTURE FLOW CONDITIONS

This section provides a summary of model results for the future flow conditions modeled.

Deficient System Capacity

The following locations were identified through the analysis as having insufficient capacity to meet City performance standards while conveying future system flows. Refer to Figures 5-7 and 5-8 for a system-wide map of maximum d/D under future flow conditions. Figures 5-9 and 5-10 illustrate maximum d/D under future flow conditions, with all recommended improvements in place. Refer to Figure 5-11 for an overall map of recommended system upgrades for future conditions.

Recommendations for future upgrades to the City sewer collection system are based on the assumptions that the all of the upgrades recommended for existing conditions have been completed.

<u>Asilomar</u>

- Location Extents: Manhole 806 to Manhole 801

The sewer main on Asilomar is currently 15-inch VCP that has a d/D up to 0.87 under MDDWF with peak flow up to 1,417 gpm. Increasing the depths of manholes 802 through 805, as shown in Table 5-2 above, increases the sewer main pipe segment slopes and reduces maximum d/D to 0.79 under MDDWF. Total affected pipe length is 2,150 lineal feet.

<u>Sunset & Crocker</u>

- Location Extents: Manhole 501 to Manhole 821

The sewer main on Sunset and Crocker Avenue is three pipe segments of existing 12-inch VCP with MDDWF maximum d/D of 0.92, 0.93, 0.97 with peak flow up to 803 gpm. Upgrade to 15-inch PVC reduces maximum d/D to 0.68. This upgrade requires 740 lineal feet of 15-inch PVC.

The majority of the existing 12-inch sewer main is located in an easement that parallels Crocker Avenue through the Hayward Lumber yard. According to the City's GIS basemap, there is a sewer manhole located in the lumber yard. This manhole was not found during the field survey and may have been paved over. In addition, based on the surveyed locations of the upstream and downstream manhole, the sewer main may be located underneath an existing building. Additional field survey and record drawing research is recommended to confirm the location of the existing sewer main.

Marginal System Capacity

Crocker & Pico

- Location Extents: Manhole 814 to Manhole 813

The sewer main on Crocker and Pico is a single pipe segment of existing 15-inch VCP, with MDDWF maximum d/D of 0.76. Although a d/D of 0.76 is high, it occurs at peak flows only, and upgrading this pipe segment would require the upgrade of the downstream sewer main. Therefore, this sewer main does not warrant upgrade at this time. Rather, it is recommended that this location is flushed on a regular basis to maintain optimum pipe capacity.

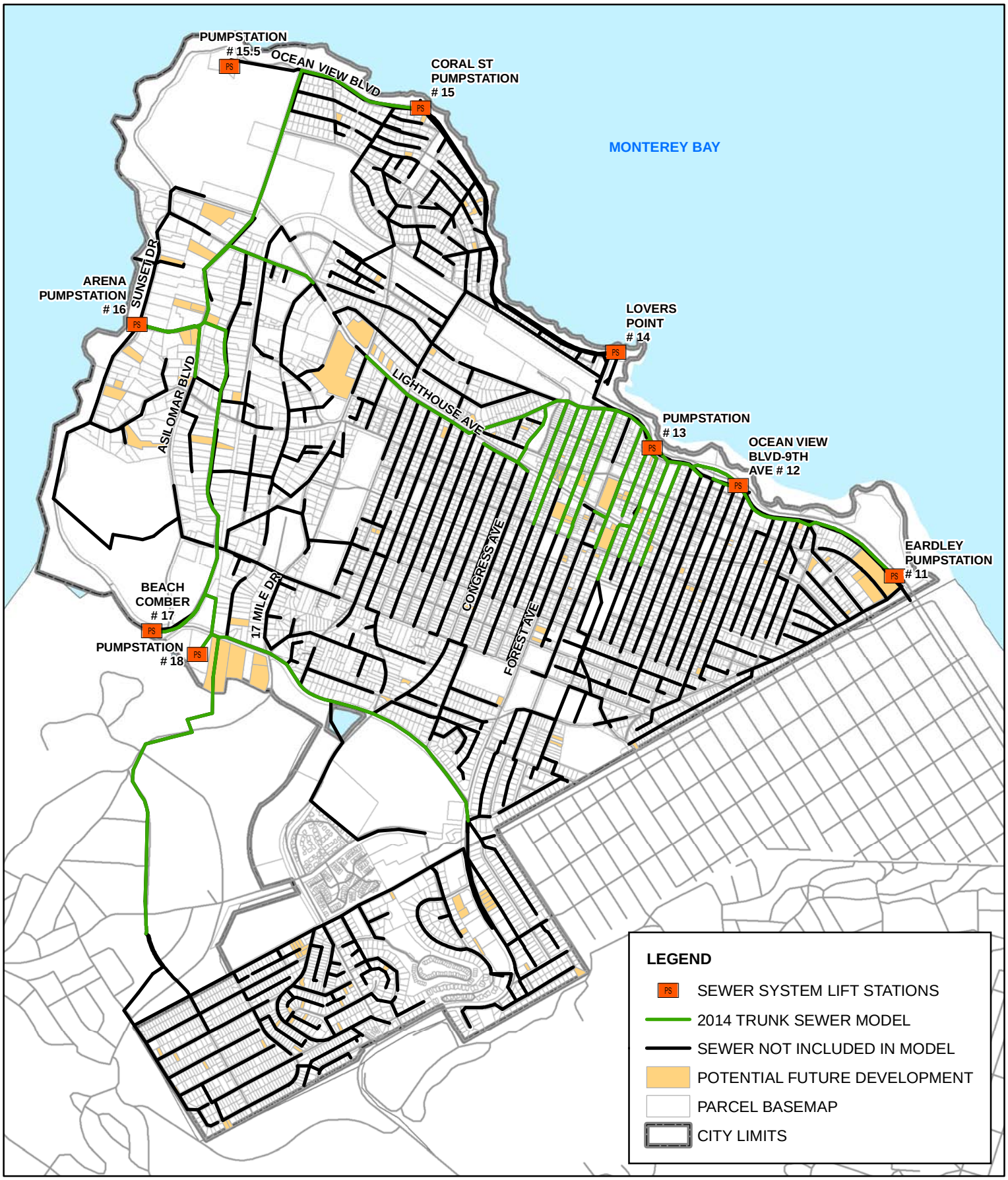


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FIGURE 5-1: TRUNK SEWER MODEL OVERVIEW MAP

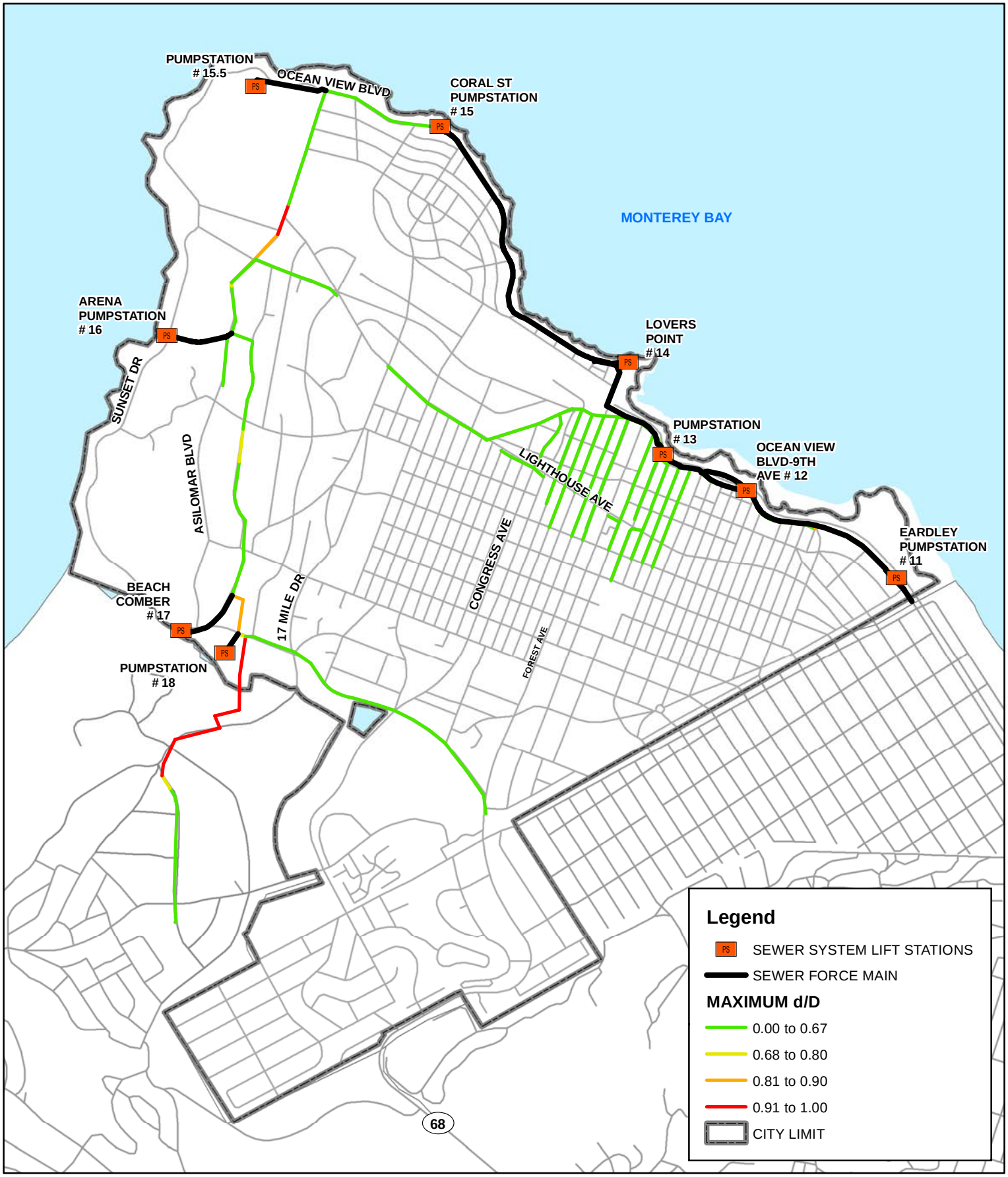

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FIGURE 5-2: TRUNK SEWER d/D DURING EXISTING MDDWF CONDITIONS

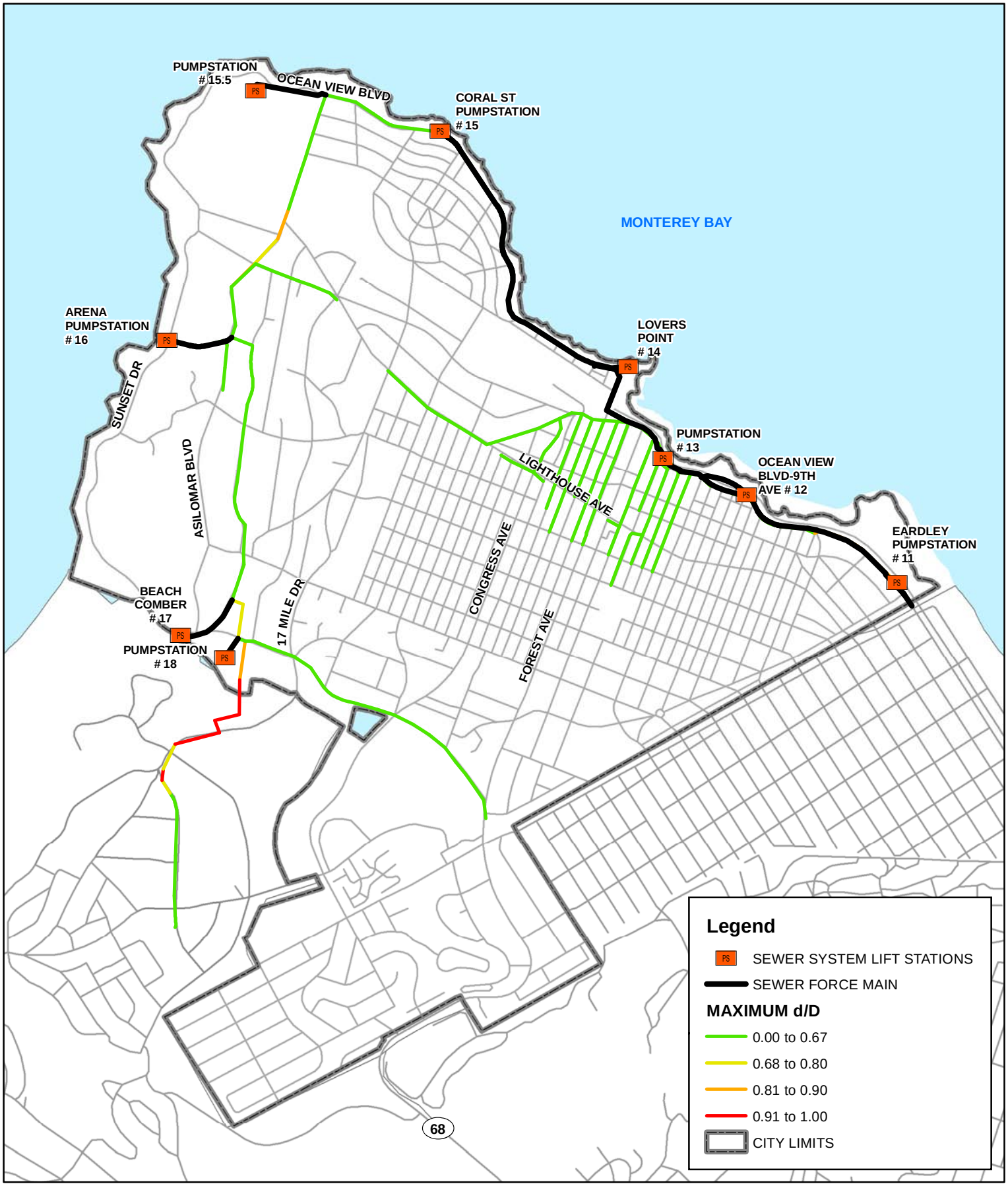

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FIGURE 5-3: TRUNK SEWER d/D DURING EXISTING PHWWF CONDITIONS

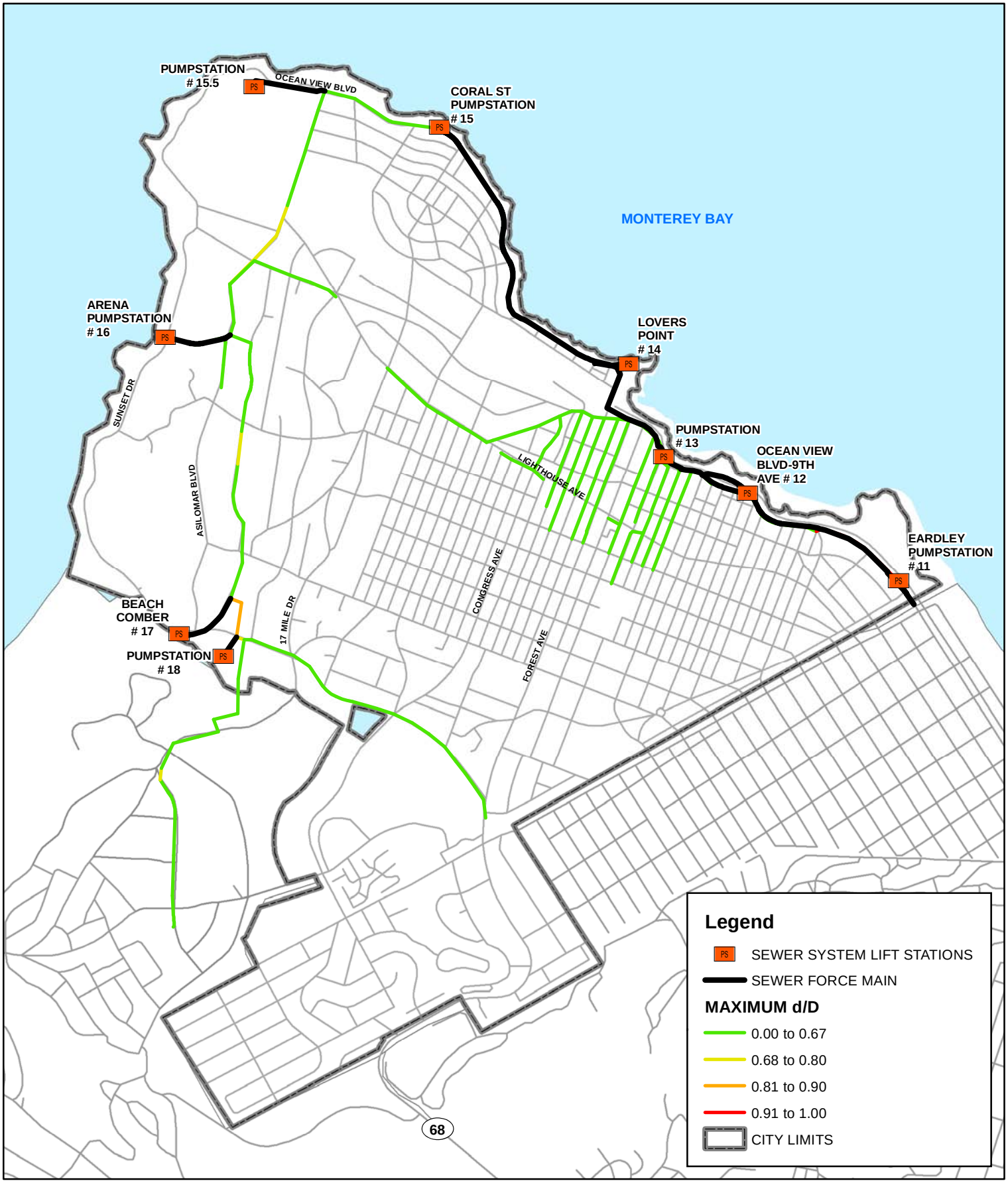

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FIGURE 5-4: TRUNK SEWER d/D WITH UPGRADES DURING EXISTING MDDWF CONDITIONS

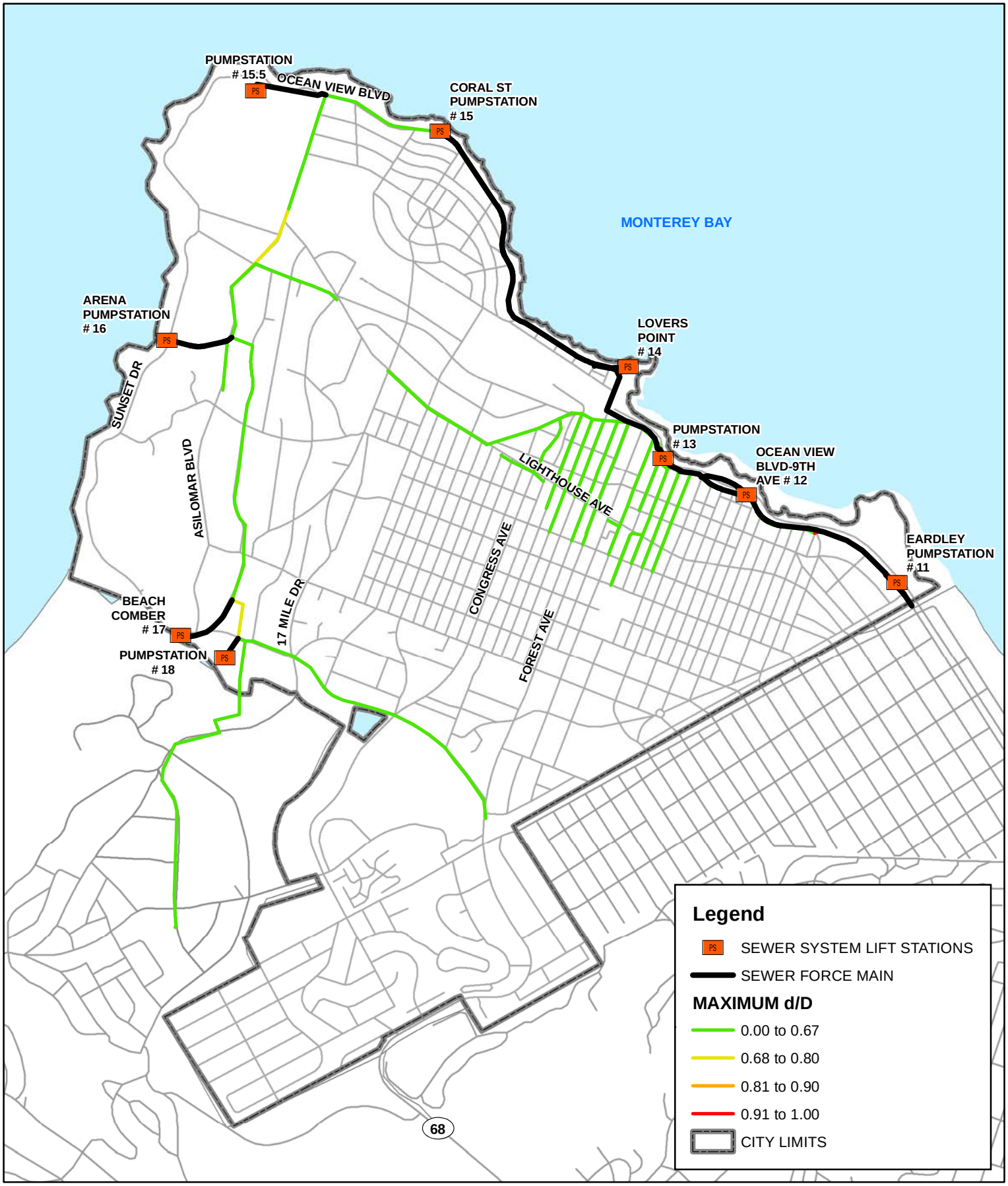

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FIGURE 5-5: TRUNK SEWER d/D WITH UPGRADES DURING EXISTING PHWWF CONDITIONS

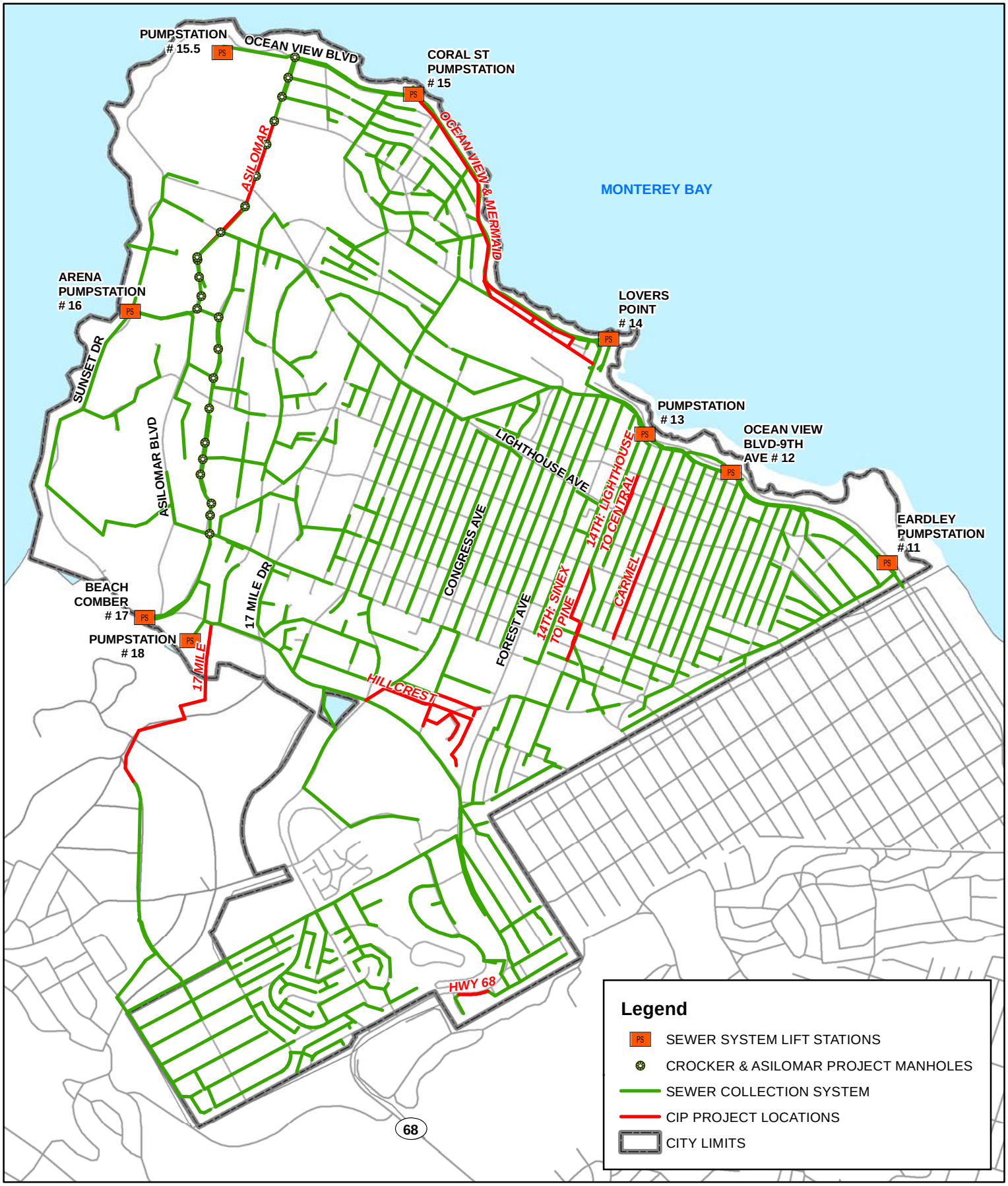

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FIGURE 5-6: RECOMMENDED SYSTEM UPGRADES FOR EXISTING CONDITIONS

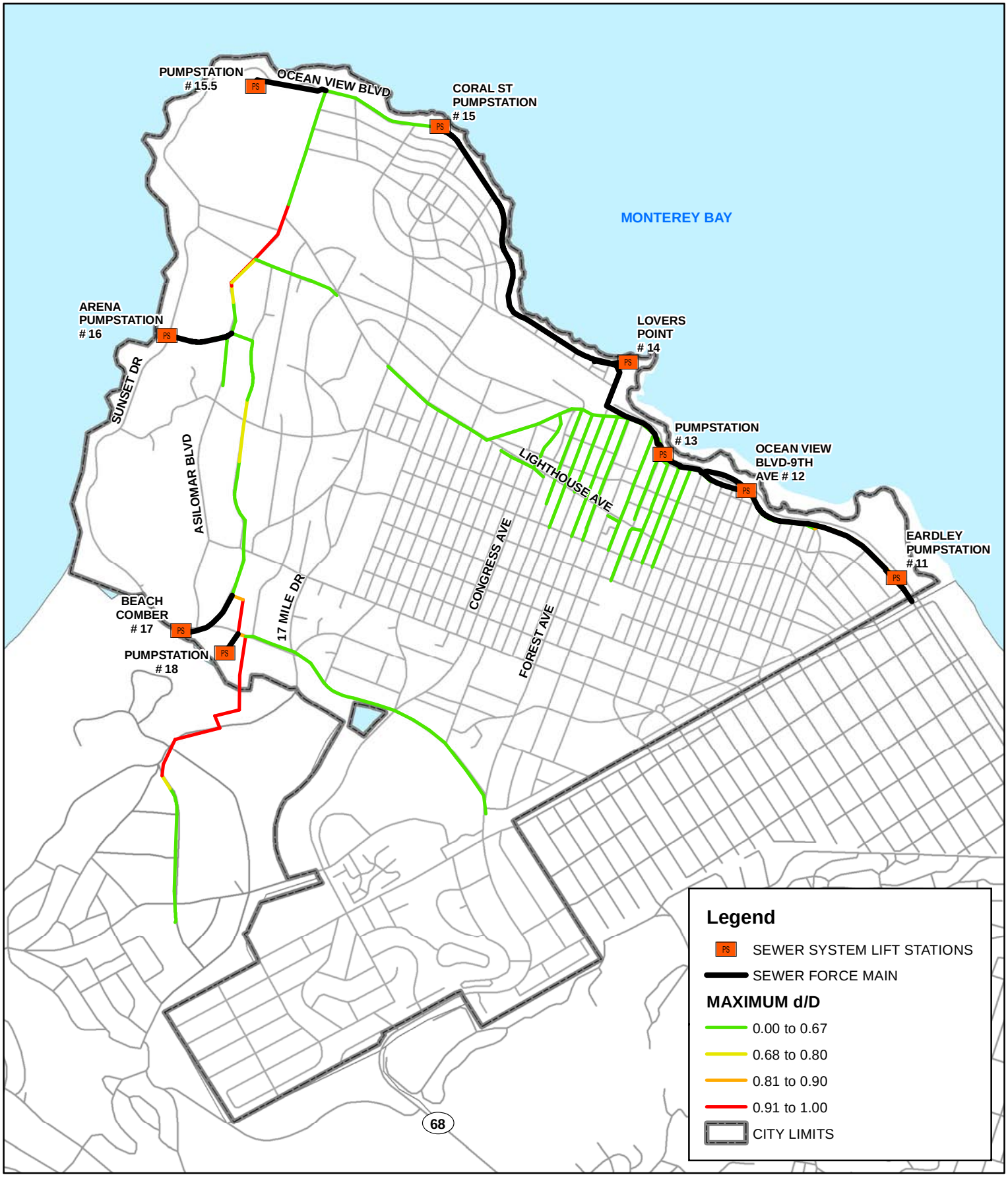

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FIGURE 5-7: TRUNK SEWER d/D
DURING FUTURE MDDWF CONDITIONS

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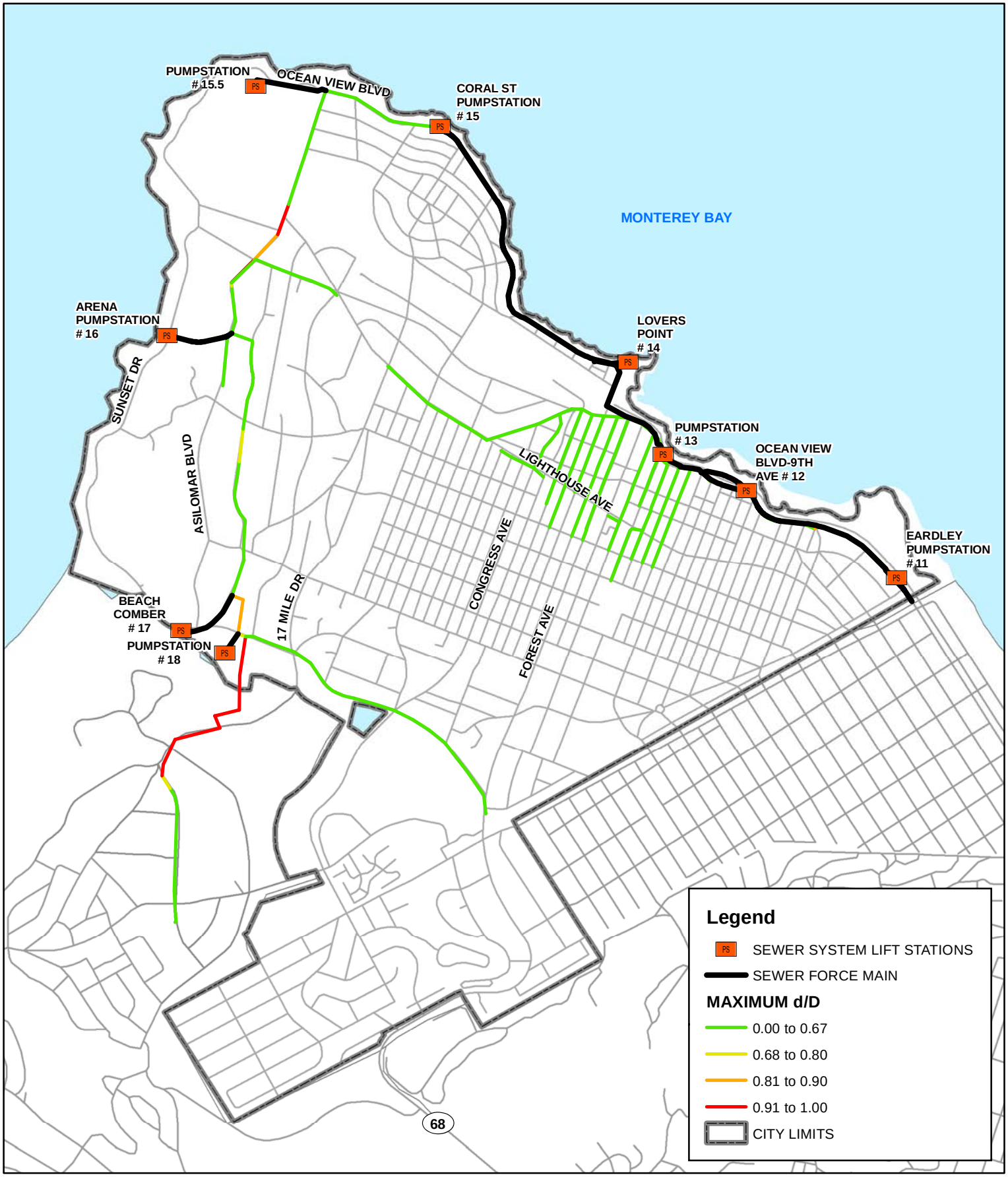

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FIGURE 5-8: TRUNK SEWER d/D DURING FUTURE PHWWF CONDITIONS

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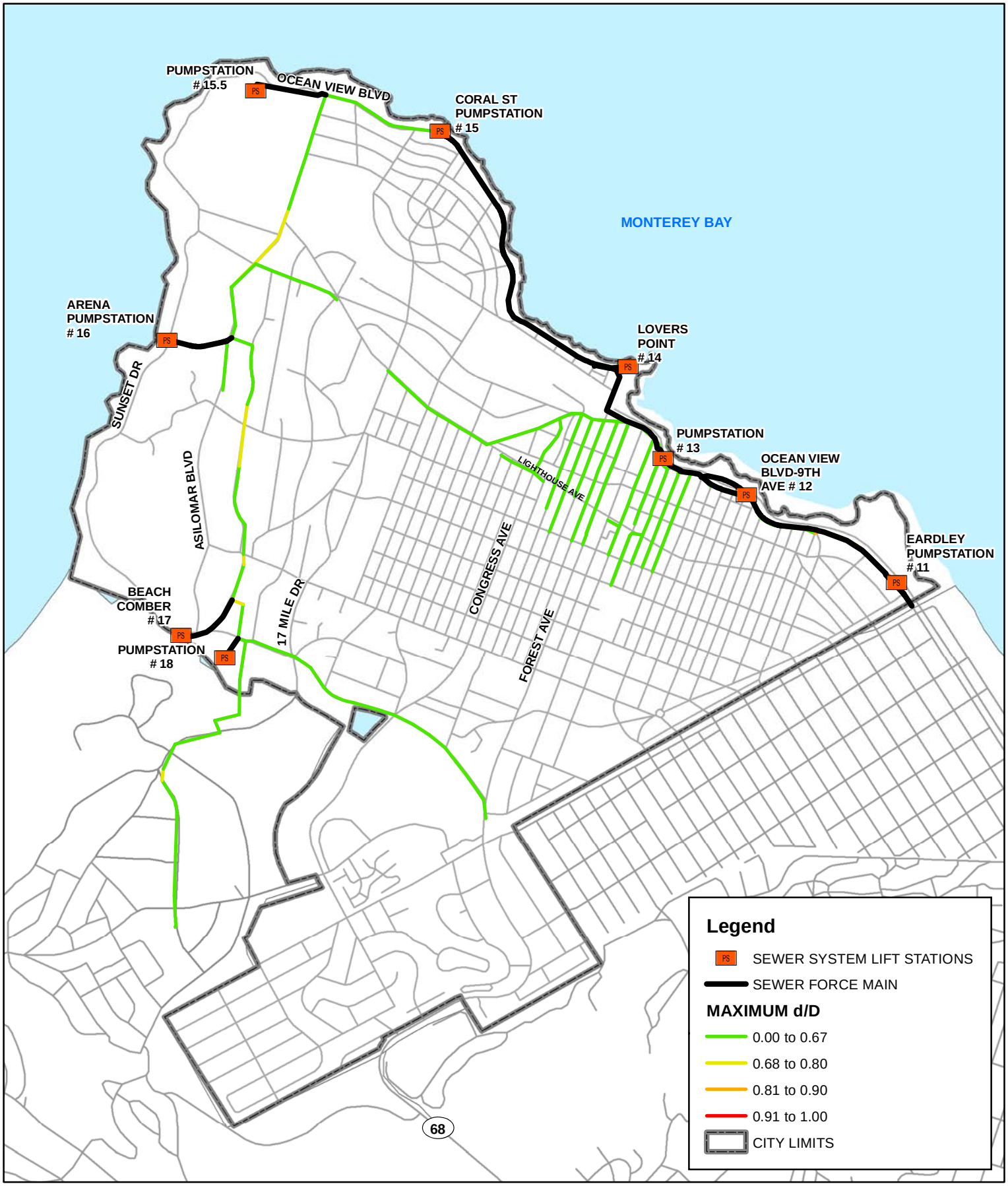

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FIGURE 5-9: TRUNK SEWER d/D WITH UPGRADES DURING FUTURE MDDWF CONDITIONS

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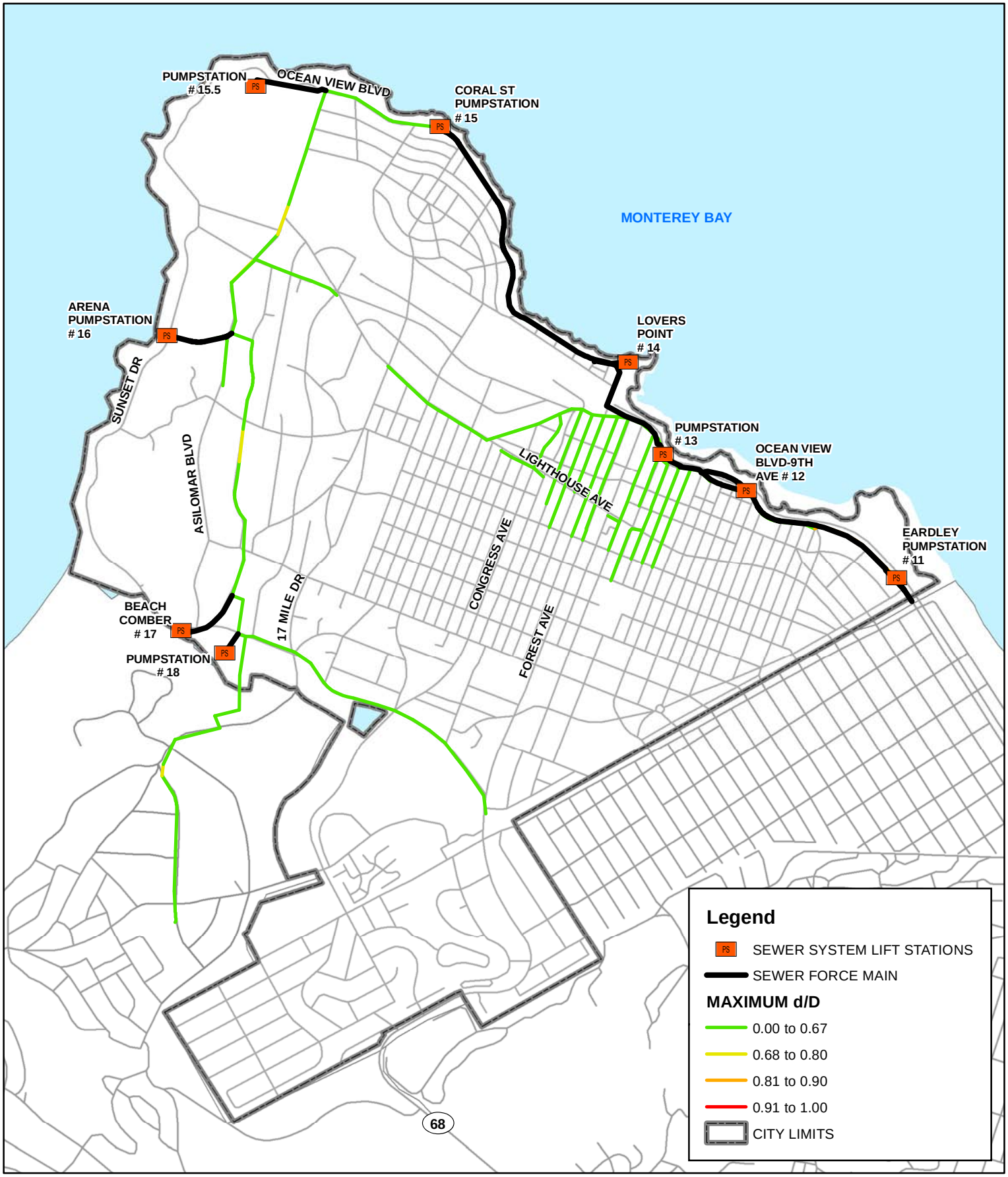

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FIGURE 5-10: TRUNK SEWER d/D WITH UPGRADES DURING FUTURE PHWWF CONDITIONS

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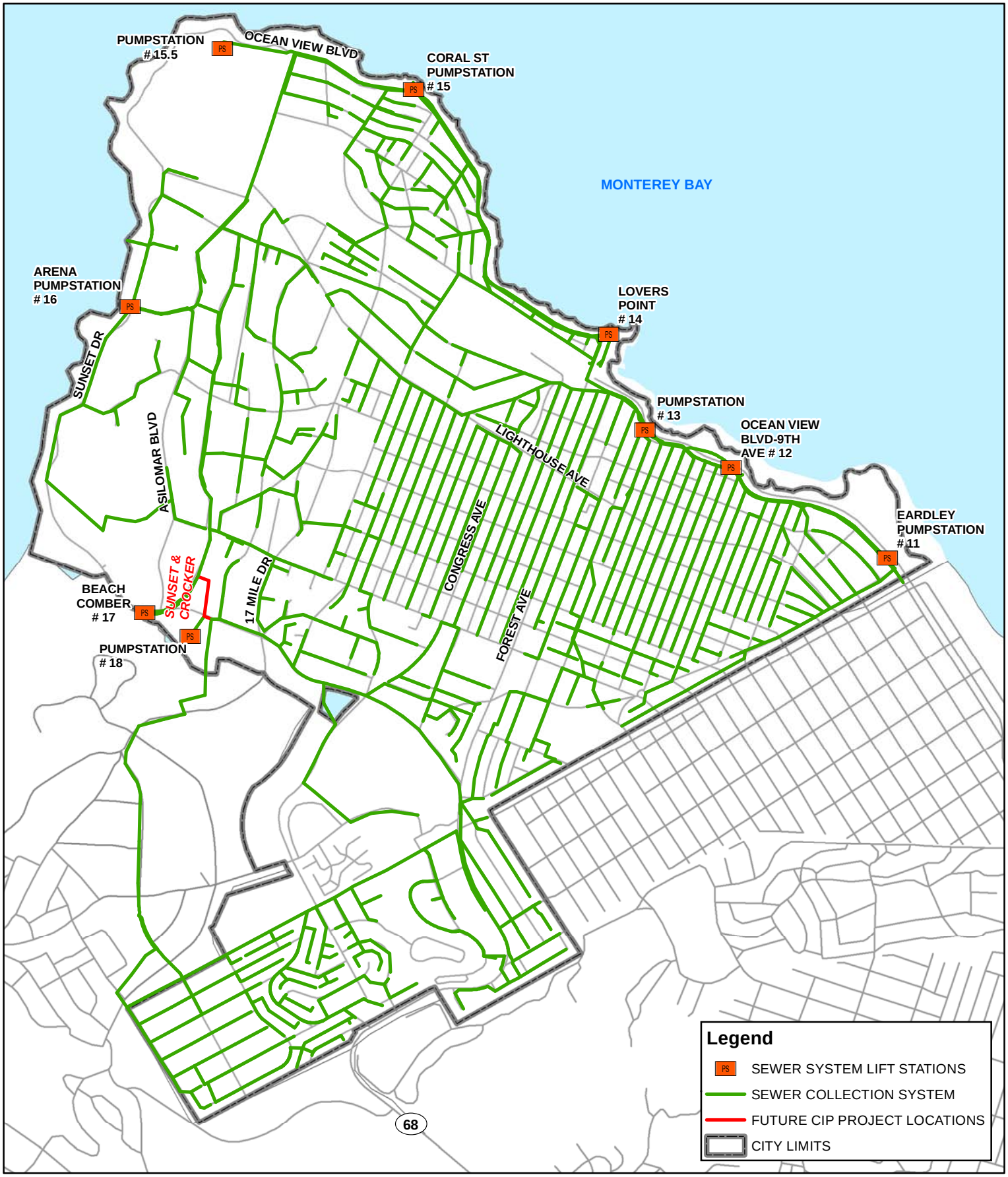

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FIGURE 5-11: RECOMMENDED SYSTEM UPGRADES FOR FUTURE CONDITIONS

CHAPTER 6

CAPITAL IMPROVEMENT PROJECTS

This Chapter presents the proposed Capital Improvement Projects (CIP), with a brief description of the proposed projects and a preliminary cost estimate for each proposed improvement for the City of Pacific Grove (City). Also included in the CIP recommendations are general timelines and scheduling for the needed improvements, and general guidelines for cost allocations relative to existing and future developments.

BASIS OF CAPITAL IMPROVEMENT PROGRAM COSTS

The CIP costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources. Hard construction costs are typically escalated by a factor of 1.4, to allow budget for "soft costs" that include preliminary engineering, engineering, administration, construction management and inspection costs. Some projects may have factors other then 1.4 depending on project type. All CIP costs are expressed in January 2014 dollars, using McGraw-Hill ENR Construction Cost Index of **9664**, and will need to be escalated to the year or years scheduled for the work. The unit cost for new gravity sewers includes the proposed pipelines, manholes, lateral re-connections, sewer bypassing, traffic control, etc., and all other aspects of sewer system construction.

TIMING OF RECOMMENDED IMPROVEMENTS

There are some projects triggered by existing deficiencies and some projects triggered by future development. The projects that address existing deficiencies are ranked in order of importance, which is discussed in greater detail within this Chapter. These existing deficiencies are considered near-term projects, and are recommended to be completed within the next 15 years.

There are also projects that are triggered by potential future development, for which timing is difficult to ascertain. These long-term projects are grouped by the City's sewer drainfields, to address potential impacts and future upgrades.

CIP RANKING

The near term capital improvement projects were ranked to determine what priority the existing recommended projects should be constructed. Table 6-1 evaluates each of the projects in five categories: overflow to a water body of the state, hydraulic capacity (d/D), community impact, condition assessment, and cost. Each category was provided a weighted importance factor based on what factors are more important than others. The importance factor is multiplied by the score the project received and then summed together to determine its final score.

Table 6-1. City of Pacific Grove CIP Ranking Matrix

Importance Factor	5	4	3	2	1		
	Overflow to Water Body of the State	Design Standard	Community Impact	Pipe and/or Manhole Condition	Cost		
Project Name	Yes - 10 Via Storm Drain - 5 No - 0	Meets Design Standard - 0 Doesn't Meet Design Standards - 2 Surcharging - 5 Overflowing - 10	< 1,000 - 0 1,001 to 5,000 - 5 >5,000 - 10	Good - 0 Acceptable - 5 Poor - 10	<$50,000 - 10 $50,000 to $250,000 - 5 >$250,000 - 2	Score	Ranking
						= Importance Factor X Points	
17 Mile	10	5	5	5	2	97	1
Oceanview & Mermaid	10	2	5	10	2	95	2
Asilomar	5	5	10	5	2	87	3
Crocker & Asilomar	5	0	10	10	5	80	4
14th: Sinex to Pine	5	2	5	10	2	70	5
Hillcrest	5	2	0	10	2	55	6
14th: Lighthouse to Central	5	0	5	0	5	45	7
Carmel	0	2	0	10	2	30	8
Hwy 68	0	2	0	5	10	28	9

*Although the projects are ranked as described above, it should be noted that **all** projects identified in the Near-Term CIPs are a result of deficiencies in the existing collection system due to existing needs and are therefore all important to be constructed within the next 10 years. It is also recommended that the City review these projects periodically to determine if any substantial changes have occurred that may re-prioritize a project to a higher ranking.*

Table 6-2 provides a summary of all the existing recommended CIPs, or Near Term Projects, in order of ranking from Table 6-1. Table 6-2 also provides an estimate of the construction and "soft" costs for each project. The costs are based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources. A draft bid estimate was prepared for each project and is provided in Appendix E. The cost estimates are approximate and should be used for planning purposes only. Actual project costs will vary depending upon economic conditions at the time of construction. As noted previously, these costs are based on January 2014 dollars (McGraw-Hill ENR Construction Cost Index of **9664)** and need to be escalated to the year or years scheduled for the work.

Table 6-3 provides a summary of the future recommended CIPs, or Long Term Projects, and their estimated costs. These projects are not ranked, as timing for these projects is dependent on future development. The costs are based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources. A draft bid estimate was prepared for each project and is provided in Appendix E. The cost estimates are approximate and should be used for planning purposes only. Actual project costs will vary depending upon economic conditions at the time of construction. As noted previously, these costs are based on January 2014 dollars (McGraw-Hill ENR Construction Cost Index of **9664)** and need to be escalated to the year or years scheduled for the work.

Following the tables, project description sheets are provided for each project noted. The project description sheets provide the following information:

- Project name
- Project trigger
- Project benefit
- Project need
- Project cost
- Project schedule
- Project description
- Project map

These description sheets can be used by the City in the planning for each project, and for inclusion in fiscal year budget requests.

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Table 6-2. City of Pacific Grove Near Term Capital Improvement Program

Project #	Title	Description	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Upstream Manhole Number	Downstream Manhole Number	Upgrade to Meet Future Needs*	Traffic Control	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
1	**17 Mile**	Upgrade sewer main due to capacity deficiency	2,900	8	12	17 Mile Drive	Majella Road from Treasure Road to 17-Mile Drive, and 17-Mile Drive from Majella Road to Sunset Drive	510	501	No	Heavy	$400	LF	$1,160,000	**$1,624,000**
2	**Oceanview & Mermaid**	Replace sewer mains due to age & condition	1,850	6	8	Mermaid	Oceanview Blvd to Sea Palm Ave	E749	744	No	Moderate	$490	LF	$906,000	$1,269,000
			150	6	8	Marine	Mermaid to Oceanview Blvd	749	748	No	Moderate	$553	LF	$83,000	$116,000
			100	6	8	Clyte	Mermaid to Oceanview Blvd	750	T747	No	Moderate	$720	LF	$72,000	$101,000
			2,250	8	8	Oceanview	Marine Street to Balboa Ave	748	741	No	Heavy	$505	LF	$1,137,000	$1,592,000
			1,950	12	12	Oceanview	Balboa Ave to Lift Station 15	741	LS 15	No	Heavy	$500	LF	$975,000	$1,365,000
		Total Length	6,300											**Total**	**$4,443,000**
3	**Asilomar**	Upgrade sewer main due to capacity deficiency (Increase Slope)	2,150	15	15	Asilomar Avenue	Lighthouse Ave to Del Monte Blvd	806	801	Yes	Heavy	$498	LF	$1,071,000	**$1,500,000**
4	**Crocker & Asilomar**	Replace or rehabilitate manholes due to hydrogen sulfide deterioration	10 Manholes	---	---	Crocker	Sinex to easement to Asilomar	819	811	No	Moderate	$37,480	EA	$374,800	$525,000
			13 Manholes	---	---	Asilomar	Arena Ave to Oceanview	810	982	No	Heavy	$37,485	EA	$487,300	$682,000
		Total Manholes	23											**Total**	**$1,207,000**
5	**14th: Sinex to Pine**	Consolidate multiple sewer mains	850	6 & 8	8	14th	Sinex Street to Junipero Ave	264	253	No	Moderate	$441	LF	$375,000	$525,000
		Consolidate multiple sewer mains	750	6	8	Easement	Junipero Ave to Pine Ave	253	251	No	Moderate	$437	LF	$328,000	$460,000
		Abandon existing sewer main and tie-over to new sewer main	350	8	---	14th	Gibson Street to Junipero Ave	256	242	No	Moderate	---	LS	$30,000	$42,000
		Total Length	1,950											**Total**	**$1,027,000**
6	**Hillcrest**	Replace sewer mains due to root intrusion	2,950	6	8	Multiple	Hillcrest Avenue to Sunset Avenue, from Forest Ave to Congress Ave	377 & S365	642	No	Moderate	$412	LF	$1,216,000	$1,703,000
			1,300	6	8	Easement	Sunset & Forest Ave to 19th Street & Marino Pines Road	372	366	No	Moderate	$452	LF	$587,000	$822,000
		Total Length	4,250											**Total**	**$2,525,000**
7	**14th: Lighthouse to Central**	Consolidate multiple sewer mains	600	6 & 10	12	14th	Lighthouse Ave to Central Ave	239	1,058	No	Heavy	$533	LF	$320,000	**$448,000**
8	**Carmel**	Replace sewer main to eliminate sags	1,900	6 & 8	8	Carmel	Junipero Ave to Ricketts Row	E219	214	No	Heavy	$415	LF	$788,000	**$1,104,000**
9	**Hwy 68**	Protect exposed pipe from damage	400	6	---	Hwy 68	Between Adobe Lane & Bishop Ave	I630	629	No	Heavy	---	LS	$42,000	**$59,000**
														TOTAL NEAR TERM PROJECT COSTS	**$13,937,000**

*** If noted "Yes", then the proposed project has existing deficiencies. In addition, upgrades are necessary for future development. The proposed pipe diameter noted in this Table is to meet the capacity needs of future development.**

****Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs. Construction costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources.**

Table 6-3. City of Pacific Grove Long Term Capital Improvement Program

Project #	Title	Description	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Upstream Manhole Number	Downstream Manhole Number	Traffic Control	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
1	**Sunset & Crocker**	Upgrade sewer main due to capacity deficiency	750	12	15	Easement	Sunset Drive to Crocker Avenue	501	821	Moderate	$492	LF	$369,000	**$517,000**
													TOTAL LONG TERM PROJECT COSTS	**$517,000**

****Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs. Construction costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources.**

OPERATION AND MAINTENANCE PROGRAM

In addition to the projects required to meet the hydraulic needs of the collection system, the City has additional projects or programs that are related to the day-to-day operations and maintenance of the collection system. Table 6-4 provides a summary of the costs for the proposed operation and maintenance budget. This information will be used to assist in the preparation of the sewer rate study.

Table 6-4. City of Pacific Grove Operation & Maintenance Annual Costs[1]

Title	Description	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19
Video Inspection	Conduct video inspection of critical sewer mains	$29,251	$32,176	$33,785	$35,474	$37,248
Sewer System Management Plan	Updates to the Sewer System Management Plan (SSMP), including biennial audits	$10,000	$25,000	$10,000	$25,000	$100,000
Public Outreach	Public outreach to customers for SSMP	$997	$1,447	$1,099	$1,154	$1,211
Sewer Operation & Maintenance	Annual cleaning of all sewer lines, weekly hot spots, root intrusion, broken main repairs, reporting, etc	$385,703	$404,988	$425,238	$446,499	$468,824
Long-Term Pipe Replacement[2]	Upgrade or replace approximately ----- linear feet of sewer collection system per year. Cost is based on an estimated average cost of $500 per linear foot, with a 3% escalation factor per year.	$1,500,000	$1,545,000	$1,591,350	$1,639,091	$1,688,263
FOG Program	Develop and implement FOG program, including inspections	$10,589	$11,119	$11,675	$12,259	$12,872
GIS Maintenance & Mapping	Update GIS database and maps on a semi-annual basis	$32,136	$33,743	$35,430	$37,201	$39,062
LS Maintenance	Contract with MRWPCA for lift station maintenance	$36,111	$37,917	$39,813	$41,803	$43,893
PG&E	Electricity bill for operating lift stations	$2,700	$2,835	$2,977	$3,126	$3,282
		$2,007,487	**$2,094,224**	**$2,151,365**	**$2,241,607**	**$2,394,655**

1. Budgets provided by City of Pacific Grove staff, with the exception of the long-term pipe replacement strategy.
2. Pipe replacement strategy to be evaluated as a part of the Rate Study

Near Term Project No. 1: 17 Mile Sewer Line Upgrade

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

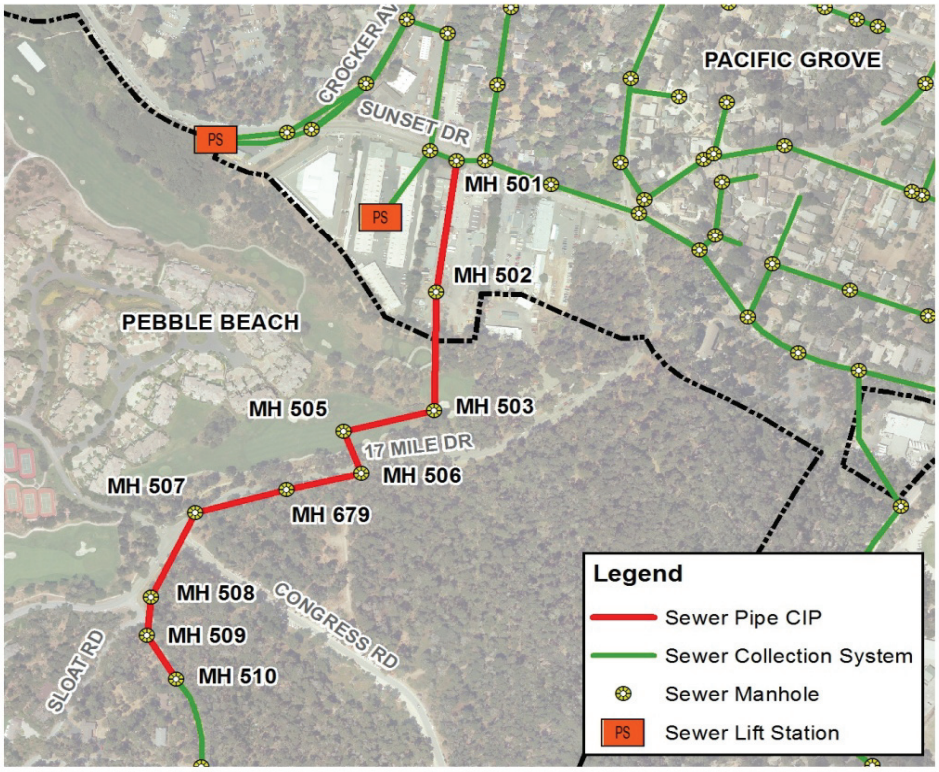
Existing Customers	88%
New Development	12%

Project Components

- [x] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [ ] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 12 weeks



Project Need

- [x] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [x] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$1,160,000
Planning, Engineering, CM, Legal/Admin (40%)	$464,000
Total Project Cost	**$1,624,000**

Project Description

This project proposes to upgrade approximately 2,900 linear feet of existing 8-inch and 10-inch sewer main with new 12-inch sewer main. The existing sewer main is located in Majella Road and 17-Mile Drive, crosses the Spanish Bay golf course, spans across a creek and is routed through the City Corporation yard to Sunset Drive. The infrastructure is over 100 years old and has numerous structural defects i.e., offset joints, sags, roots and infiltration seepage through joints. There is a hydraulic deficiency in the main due to very flat slopes, which limits capacity and cannot maintain self-cleaning velocities. This project will increase pipe slope, and where practical, segments of the main would be re-aligned to locate manholes in more serviceable locations. The location of the main where it crosses the creek is anticipated to remain at its present alignment, except at higher elevations. New pipe support structures would need to be constructed. However, alternate routes to avoid crossing the creek channel, as well as the Spanish Bay golf course, will be evaluated for feasibility.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-1:
17 MILE SEWER LINE UPGRADE

NOTES:
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Near Term Project No. 2: Oceanview & Mermaid Sewer Line Replacement

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

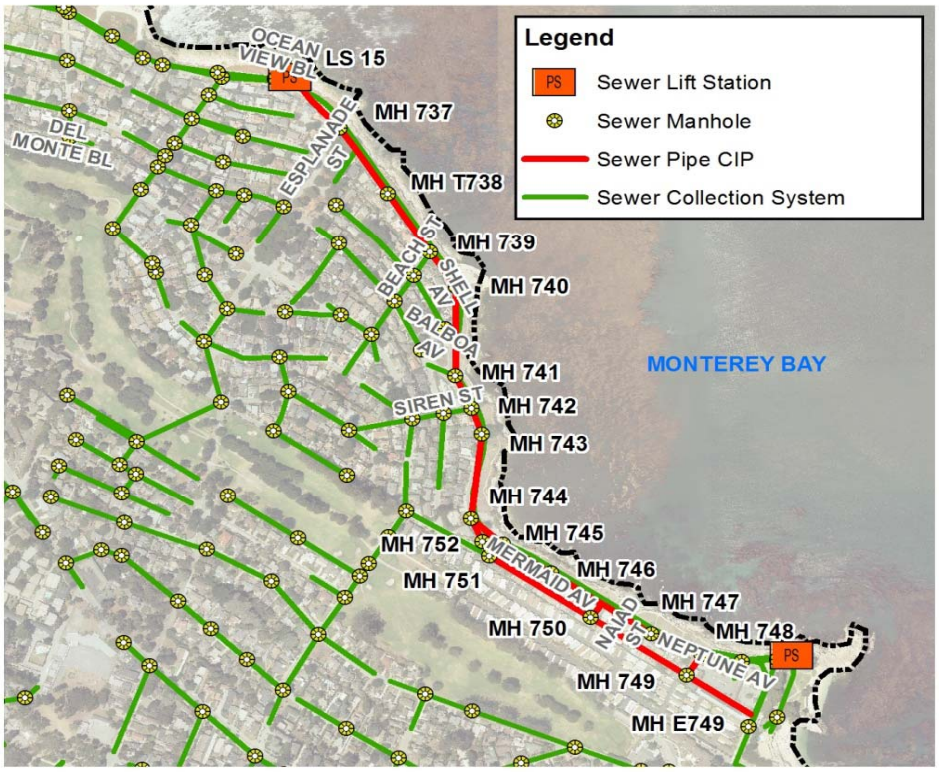
Existing Customers	87%
New Development	13%

Project Components

- [x] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [ ] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 45 weeks



Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [x] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$3,173,000
Planning, Engineering, CM, Legal/Admin (40%)	$1,270,000
Total Project Cost	**$4,443,000**

Project Description

This project proposes to upgrade approximately 6,300 linear feet of existing sewer main, along Mermaid Avenue, Oceanview Boulevard, Marine Street, and Clyte Street. This project was identified by the City due to the age and condition of the sewer mains. The existing sewer main ranges in size from 6-inch to 12-inch diameter. This project proposes to upsize the 6-inch main to 8-inch sewer main, and replace the existing 8-inch and 12-inch sewer main with the same diameter pipe.

The City is currently planning for an urban stormwater diversion project that may use an abandoned force main within this project area. If possible, this sewer upgrade project could be coordinated with the urban stormwater diversion project to combine financial resources, potentially reduce overall project costs for each project, and minimize impacts to the surrounding community.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-2:
OCEANVIEW & MERMAID SEWER LINE REPLACEMENT

NOTES:
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Near Term Project No. 3: Asilomar Sewer Line Upgrade

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [x] Future Condition

Project Benefit

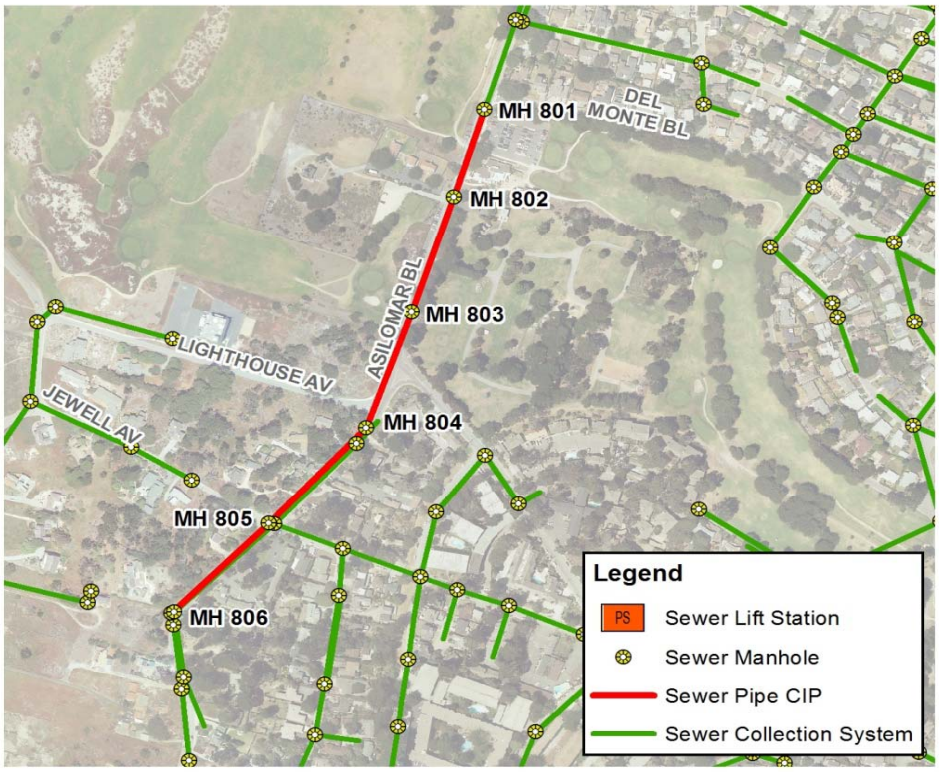
Existing Customers	84%
New Development	16%

Project Components

- [x] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [ ] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 10 weeks



Project Need

- [x] Insufficient capacity for existing flow
- [x] Insufficient capacity for future flow
- [ ] Existing condition limits O&M
- [ ] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$1,071,000
Planning, Engineering, CM, Legal/Admin (40%)	$429,000
Total Project Cost	**$1,500,000**

Project Description

This project proposes to replace approximately 2,150 linear feet of 15-inch sewer main in Asilomar Avenue from Lighthouse Avenue to Del Monte Boulevard. There is a hydraulic deficiency in this stretch of sewer main due to very flat slopes. Rather than upsize the diameter of the sewer main, this project proposes to increase slope by increasing depth of manholes, thereby increasing hydraulic capacity. Depth of the existing manholes needs to be increased between 1 and 4-feet to obtain an adequate slope for hydraulic capacity. The approach of increasing slope rather than upsizing the main was selected because there is a significant length of existing 15-inch sewer main downstream from this project that has sufficient capacity to convey peak flows. In general, it is not recommended to decrease sewer main diameter in the direction of flow.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-3:
ASILOMAR SEWER LINE UPGRADE

NOTES:
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Near Term Project No. 4: Crocker & Asilomar Manhole Replacement

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

Existing Customers	84%
New Development	16%

Project Components

- [ ] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [x] Rehabilitation/Repair
- [x] Replace Manhole

Project Scheduling

Est. Construction Duration: 13 weeks

Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [ ] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$862,000
Planning, Engineering, CM, Legal/Admin (40%)	$345,000
Total Project Cost	**$1,207,000**

Project Description

This project proposes to replace or rehabilitate multiple manholes due to hydrogen sulfide deterioration. This project was identified by the City due to operations and maintenance concerns with the structural integrity of the manholes. The existing manhole lids do not allow for venting, which may also be contributing to the build-up of hydrogen sulfide. It is recommended that the manhole lids are replaced with lids that allow for venting.

The preliminary cost estimate prepared for this project assumes full replacement of all manholes. However, it may be possible to rehabilitate some manholes dependent on condition. It is recommended as a cost savings measure that the potential for rehabilitation is evaluated at the time of the project, and that manholes are rehabilitated where possible rather than replaced.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-4:
CROCKER & ASILOMAR MANHOLE REPLACEMENT

NOTES:
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Near Term Project No. 5: 14th Street, Sinex to Pine Sewer Line Consolidation

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

Existing Customers	98%
New Development	2%

Project Components

- [x] Upgrade Gravity Pipeline
- [x] New Gravity Pipeline
- [x] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 15 weeks

Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [x] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$733,000
Planning, Engineering, CM, Legal/Admin (40%)	$294,000
Total Project Cost	**$1,027,000**

Project Description

This project proposed to upgrade approximately 1,950 linear feet of sewer main in 14th Street from Sinex Street to Junipero Avenue and in an easement between Junipero Avenue and Pine Avenue. This project was identified by the City due to operations and maintenance concerns. This location is a high priority for the City for maintenance, due to cross connection problems between stormwater drains and the sewer collection system.

This project proposes to consolidate dual sewer mains in 14th Street between Gibson Avenue and Junipero Avenue to a single upsized sewer main. This consolidation would minimize the wastewater flow to the existing sewer main that is located underneath Robert Down Elementary School. Approximatley 350 linear feet of sewer main will be abandoned as a part of the consolidation.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-5:
14TH ST, SINEX TO JUNIPERO SEWER LINE CONSOLIDATION

NOTES:
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Near Term Project No. 6: Hillcrest Sewer Line Replacement

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

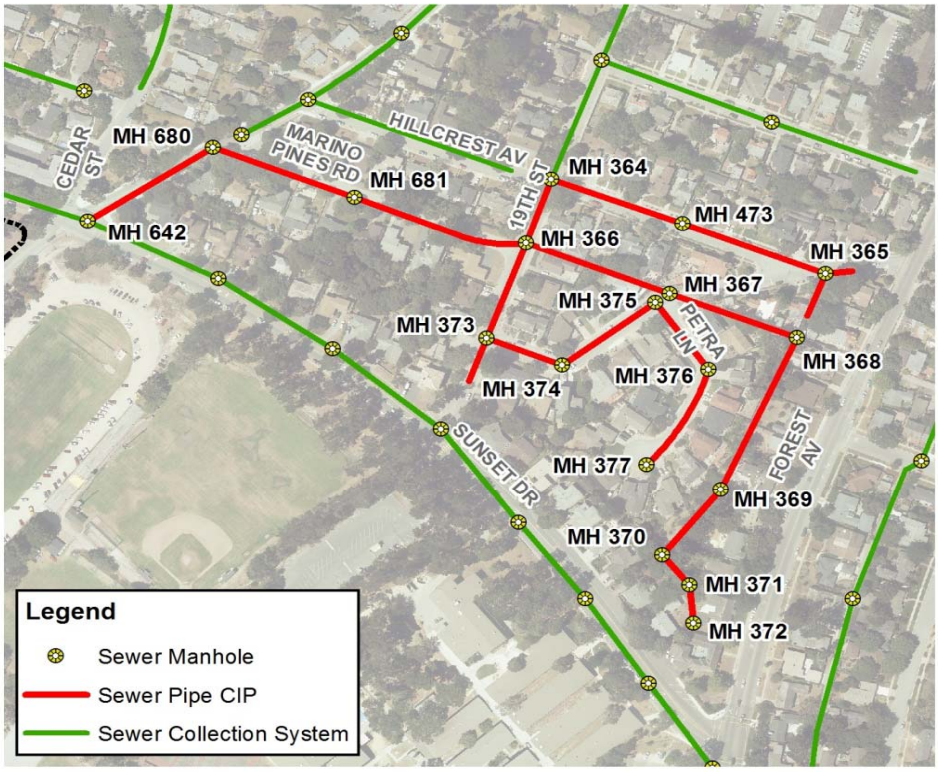
Existing Customers	100%
New Development	0%

Project Components

- [x] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [x] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 21 weeks



Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [x] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$1,803,000
Planning, Engineering, CM, Legal/Admin (40%)	$722,000
Total Project Cost	**$2,525,000**

Project Description

This project proposes to replace approximately 4,250 linear feet of 6-inch sewer main with new 8-inch sewer main in the residential neighborhood adjacent to Hillcrest Avenue between Forest Avenue and Congress Avenue. This project was identified by the City due to root intrusion that results in operations and maintenance concerns. Approximately 1,300 linear feet of existing sewer main is located in backyard easements, and therefore this project will require coordination with multiple property owners. Relocation of the sewer to the public righ-of-way may not be possible without significant upgrades to individual homes. For this reason the preliminary cost estimate and project description assumes that the existing sewer mains will be replaced in their current location.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-6:
HILLCREST SEWER LINE REPLACEMENT

NOTES:
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Near Term Project No. 7: 14th Street, Lighthouse to Central Sewer Consolidation

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

Existing Customers	74%
New Development	26%

Project Components

- [x] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [ ] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 9 weeks

Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [ ] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$320,000
Planning, Engineering, CM, Legal/Admin (40%)	$128,000
Total Project Cost	**$448,000**

Project Description

This project proposes to consolidate multiple sewer mains to a single main in 14th Street from Lighthouse Avenue to Central Avenue. The existing 6-inch and 10-inch sewer mains would be replaced with a single 12-inch sewer main. This project was identified by the City due to operations and maintenance concerns with the multiple sewer mains. According to the City the sewer mains are in acceptable physical condition, however the number of mains increases the effort required for operations and maintenance.

The existing multiple sewer mains were constructed over time to avoid a 54-inch storm drain that is also located in 14th Street. This project may require the simultaneous relocation or replacement of the existing 54-inch storm drain. The preliminary cost estimate prepared for this project does not include additional work that may be required for the storm drain.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

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FIGURE 6-7:
14TH ST, LIGHTHOUSE TO CENTRAL SEWER LINE CONSOLIDATION

NOTES:
Wallace Group did not perform boundary survey services for this map. Not a legal document.

Near Term Project No. 8: Carmel Sewer Line Replacement

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

Existing Customers	100%
New Development	0%

Project Components

- [x] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [x] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 10 weeks

Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [ ] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$788,000
Planning, Engineering, CM, Legal/Admin (40%)	$316,000
Total Project Cost	**$1,104,000**

Project Description

This project proposes to replace approximately 1,900 linear feet of existing 6-inch and 8-inch sewer with a new 8-inch sewer main in Carmel Avenue, from Junipero Avenue to Ricketts Row. This project was identified by the City due to existing sags in the sewer main that create operations and maintenance concerns.

The existing sewer is located within the paved area of Carmel Street, and crosses underneath a vegetated median on Lighthouse Avenue. The proposed sewer main replacement under the median will be trenchless (ie pipe bursting or jack and bore) to minimize disturbance to the existing vegetated median. The remainder of the project will be either conventional open trench or trenchless, dependent on which type of construction is appropriate to eliminate the sags in the sewer main.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

PREPARED BY:
Wallace Group
www.wallacegroup.us
San Luis Obispo, CA

FIGURE 6-8:
CARMEL SEWER LINE REPLACEMENT

NOTES:
Wallace Group did not perform boundary survey services for this map. Not a legal document.

Near Term Project No. 9: Hwy 68 Sewer Line Repair

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- [x] Existing Condition
- [ ] Future Condition

Project Benefit

Existing Customers	100%
New Development	0%

Project Components

- [ ] Upgrade Gravity Pipeline
- [ ] New Gravity Pipeline
- [x] Rehabilitation/Repair
- [ ] Replace Manhole

Project Scheduling

Est. Construction Duration: 6 weeks

Project Need

- [ ] Insufficient capacity for existing flow
- [ ] Insufficient capacity for future flow
- [x] Existing condition limits O&M
- [ ] Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$42,000
Planning, Engineering, CM, Legal/Admin (40%)	$17,000
Total Project Cost	**$59,000**

Project Description

This project proposes to construct a short wall to provide protection for approximately 400 linear feet of exposed sewer main on Highway 68 (Forest Avenue) between Adobe Lane and Bishop Avenue. The sewer main is located adjacent to a steep slope and was originally constructed along the ground surface. The City is concerned with the potential for damage to the sewer main from traffic on Highway 68.

This project is located within Caltrans right-of-way and will require coordination and permitting through Caltrans. It is recommended that the project concept is discussed with Caltrans prior to beginning the engineering design for this project.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

PREPARED BY:
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San Luis Obispo, CA

FIGURE 6-9:
HWY 68 SEWER LINE REPAIR

NOTES:
Wallace Group did not perform boundary survey services for this map. Not a legal document.

Long Term Project No. 1: Sunset & Crocker Sewer Line Upgrade

City of Pacific Grove Capital Improvement Project Information Sheet

2014 Sewer Collection System Master Plan

Project Trigger

- ☐ Existing Condition
- ☑ Future Condition

Project Benefit

Existing Customers	0%
New Development	100%

Project Components

- ☑ Upgrade Gravity Pipeline
- ☐ New Gravity Pipeline
- ☐ Rehabilitation/Repair
- ☐ Replace Manhole

Project Scheduling

Est. Construction Duration: 9 weeks

Project Need

- ☐ Insufficient capacity for existing flow
- ☑ Insufficient capacity for future flow
- ☐ Existing condition limits O&M
- ☐ Reduction of I/I

Project Cost Breakdown

Construction Cost[1]	$369,000
Planning, Engineering, CM, Legal/Admin (40%)	$148,000
Total Project Cost	**$517,000**

Project Description

This project proposes to upgrade approximately 740 linear feet of sewer main between Sunset Drive and Crocker Avenue. This project will upsize the existing 12-inch sewer main to 15-inch, to accommodate additional wastewater flow from future development. Future development that may contribute additional flow to this sewer main includes residential and commercial infill in the Del Monte area, and commercial development and redevelopment on Sunset Drive.

The majority of the existing 12-inch sewer main is located in an easement through the Hayward Lumber yard. According to the City's GIS basemap, there is a sewer manhole located in the lumber yard (MH 822). In addition, based on the surveyed locations of the upstream and downstream manholes (MH 500 and MH 821), the sewer main may be located underneath an existing building. Additional field survey and/or record drawing research is recommended to confirm the location of the existing sewer main.

1. Construction costs are expressed in January 2014 dollars, using an ENR construction Cost Index of 9664, and will need to be escalated to the year or years scheduled for the work.

PREPARED BY:
Wallace Group
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San Luis Obispo, CA

FIGURE 6-10:
SUNSET & CROCKER SEWER LINE UPGRADE

NOTES:
Wallace Group did not perform boundary survey services for this map. Not a legal document.

APPENDIX A

LIFT STATION DATA

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LS 11											
Wet Well	72"										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	13.8	13.6	13.9	2kmΩ	2kmΩ	2kmΩ	Start	124"	Stop	129"	**30sec**
					1000vac						
Pump 2	12.8	13.1	12.9	2kmΩ	2kmΩ	2kmΩ	Start	129"	Stop	132"	**30sec**
					1000vac						
P1&P2							Start	123"	Stop	129.25"	**30sec**
Notes:	LS is Slated for reconstruction later this year. Pump 2 creates turbulence while running.										
WG Flow Calcs											
Wet Well Dia.		72	inches								
		6	feet								
Volume per inch		2.36	cubic feet, per inch of depth								
		17.62	gallons, per inch of depth								
Pump 1 Test											
	Start	124	inches								
	Stop	129	inches								
	Duration	30	seconds								
Volume Pumped		88.12	gallons								
	Flowrate	**176**	**gpm**								
Pump 2 Test											
	Start	129	inches								
	Stop	132	inches								
	Duration	30	seconds								
Volume Pumped		52.87	gallons								
	Flowrate	**106**	**gpm**								
Pump 1 & 2											
	Start	123	inches								
	Stop	129.25	inches								
	Duration	30	seconds								
Volume Pumped		110.15	gallons								
	Flowrate	**220**	**gpm**								

LS 12											
Wet Well	84"										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	61	60.9	61	Pumps on VFD's			Start	100"	Stop	122"	**30sec**
Pump 2	12.8	13.1	12.9	Pumps on VFD's			Start	122"	Stop	144"	**30sec**
P1&P2							Start	144"	Stop	182"	**30sec**
Notes:	Newer LS, Pumps are operated off of VFD's, Timing interval started after pumps ramped up to 100% approx. 3seconds										
WG Flow Calcs											
	Wet Well Dia	84	inches								
		7	feet								
	Volume per inch	3.21	cubic feet, per inch of depth								
		23.99	gallons, per inch of depth								
	Pump 1 Test										
	Start	100	inches								
	Stop	122	inches								
	Duration	30	seconds								
	Volume Pumped	527.75	gallons								
	Flowrate	**1056**	**gpm**								
	Pump 2 Test										
	Start	122	inches								
	Stop	144	inches								
	Duration	30	seconds								
	Volume Pumped	527.75	gallons								
	Flowrate	**1056**	**gpm**								
	Pump 1 & 2										
	Start	144	inches								
	Stop	182	inches								
	Duration	30	seconds								
	Volume Pumped	911.57	gallons								
	Flowrate	**1823**	**gpm**								

LS 14											
Wet Well	54"										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	6.6	6.5	6.6	560mΩ	560mΩ	560mΩ	Start	100"	Stop	104"	**30sec**
					980volts						
Pump 2	6.5	6.4	6.5	54mΩ	56mΩ	54mΩ	Start	104"	Stop	108"	**30sec**
					950vac						
P1&P2							Start	108"	Stop	114"	**30sec**
Notes:	None										
WG Flow Calcs											
Wet Well Dia.		54	inches								
		4.5	feet								
Volume per inch		1.33	cubic feet, per inch of depth								
		9.91	gallons, per inch of depth								
Pump 1 Test											
	Start	100	inches								
	Stop	104	inches								
	Duration	30	seconds								
Volume Pumped		39.65	gallons								
	Flowrate	**79**	**gpm**								
Pump 2 Test											
	Start	104	inches								
	Stop	108	inches								
	Duration	30	seconds								
Volume Pumped		39.65	gallons								
	Flowrate	**79**	**gpm**								
Pump 1 & 2											
	Start	108	inches								
	Stop	114	inches								
	Duration	30	seconds								
Volume Pumped		59.48	gallons								
	Flowrate	**119**	**gpm**								

LS 15.5											
Wet Well	54"										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	12.1	12.2	12.1	820mΩ	820mΩ	820mΩ	Start	48"	Stop	51"	**30sec**
					980volts						
Pump 2	10.8	10.2	10.7	524mΩ	522mΩ	522mΩ	Start	51"	Stop	54"	**30sec**
					950vac						
P1&P2							Start	48"	Stop	52.5"	**30sec**
Notes:	Discharge Piping bad. Serves park Bathroom										
WG Flow Calcs											
Wet Well Dia.		54	inches								
		4.5	feet								
Volume per inch		1.33	cubic feet, per inch of depth								
		9.91	gallons, per inch of depth								
Pump 1 Test											
	Start	48	inches								
	Stop	51	inches								
	Duration	30	seconds								
Volume Pumped		29.74	gallons								
	Flowrate	**59**	**gpm**								
Pump 2 Test											
	Start	51	inches								
	Stop	54	inches								
	Duration	30	seconds								
Volume Pumped		29.74	gallons								
	Flowrate	**59**	**gpm**								
Pump 1 & 2											
	Start	48	inches								
	Stop	52.5	inches								
	Duration	30	seconds								
Volume Pumped		44.61	gallons								
	Flowrate	**89**	**gpm**								

LS 16											
Wet Well	8'x6'										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	35.1	35	35.3	2kmΩ	2kmΩ	2kmΩ	Start	134"	Stop	142"	**30sec**
					1000volts						
Pump 2	34.3	34.8	34.2	2kmΩ	2kmΩ	2kmΩ	Start	134"	Stop	141"	**30sec**
					1000vac						
P1&P2							Start	134"	Stop	146"	**30sec**
Notes:	Rectangular Wet Well										
WG Flow Calcs											
Wet Well Dim.		8	feet wide								
		6	feet long								
Volume per inch		4.00	cubic feet, per inch of depth								
		29.92	gallons, per inch of depth								
Pump 1 Test											
	Start	134	inches								
	Stop	142	inches								
	Duration	30	seconds								
Volume Pumped		239.36	gallons								
	Flowrate	**479**	**gpm**								
Pump 2 Test											
	Start	134	inches								
	Stop	141	inches								
	Duration	30	seconds								
Volume Pumped		209.44	gallons								
	Flowrate	**419**	**gpm**								
Pump 1 & 2											
	Start	134	inches								
	Stop	146	inches								
	Duration	30	seconds								
Volume Pumped		359.04	gallons								
	Flowrate	**718**	**gpm**								

LS17											
Wet Well	72"										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	13.9	13.8	13.9	2kmΩ	2kmΩ	2kmΩ	Start	104"	Stop	108"	**30sec**
					1000volts						
Pump 2	14	13.9	14.1	2kmΩ	2kmΩ	2kmΩ	Start	108"	Stop	113"	**30sec**
					1000vac						
P1&P2							Start	113"	Stop	119.5"	**30sec**
Notes:	None										
WG Flow Calcs											
Wet Well Dia.		72	inches								
		6	feet								
Volume per inch		2.36	cubic feet, per inch of depth								
		17.62	gallons, per inch of depth								
Pump 1 Test											
	Start	104	inches								
	Stop	108	inches								
	Duration	30	seconds								
Volume Pumped		70.50	gallons								
	Flowrate	**141**	**gpm**								
Pump 2 Test											
	Start	108	inches								
	Stop	113	inches								
	Duration	30	seconds								
Volume Pumped		88.12	gallons								
	Flowrate	**176**	**gpm**								
Pump 1 & 2											
	Start	113	inches								
	Stop	119.5	inches								
	Duration	30	seconds								
Volume Pumped		114.56	gallons								
	Flowrate	**229**	**gpm**								

LS 17.5											
Wet Well	48"										
	FLA			**MegΩ**			**Drawn Down Measurement**				**Duration**
	L1	L2	L3	L1	L2	L3					
Pump 1	7.4	7.4	7.3	520mΩ	522mΩ	553mΩ	Start	71"	Stop	72.5"	**15sec**
					980v						
Pump 2	6.8	6.5	6.7	254mΩ	252mΩ	254mΩ	Start	72.5"	Stop	75"	**15sec**
					470v						
P1&P2							Start	76"	Stop	81"	**30sec**
Notes:	LS serves a commercial complex.										
WG Flow Calcs											
Wet Well Dia.		48	inches								
		4	feet								
Volume per inch		1.05	cubic feet, per inch of depth								
		7.83	gallons, per inch of depth								
Pump 1 Test											
	Start	71	inches								
	Stop	72.5	inches								
	Duration	15	seconds								
Volume Pumped		11.75	gallons								
	Flowrate	**47**	**gpm**								
Pump 2 Test											
	Start	72.5	inches								
	Stop	75	inches								
	Duration	15	seconds								
Volume Pumped		19.58	gallons								
	Flowrate	**78**	**gpm**								
Pump 1 & 2											
	Start	76	inches								
	Stop	81	inches								
	Duration	30	seconds								
Volume Pumped		39.17	gallons								
	Flowrate	**78**	**gpm**								

	Description	Pump Station Requirement
1.	Number of pumps	2
2.	Location	Wet Well
3.	Service	Raw Wastewater
4.	Operation (hours per day)	Continuous
5.	Drive	Constant Speed

C. Operating Conditions. Pump performance shall conform to the following requirements:

	Description	Pump Station Requirement
1.	Design Point (DP)	250 gpm @ 30 feet
2.	NPSH available @ DP	10 feet
3.	Liquid to be pumped	Raw Wastewater
4.	Minimum size solid to pass (in)	3
5.	Specific gravity of liquid	1.01
6.	Liquid temperature (degrees Fahrenheit)	60-85
7.	Min. overall efficiency @ DP	36%
8.	Min. pump efficiency @ BEP (full speed)	55%
9.	Second operating point	600 gpm @ 20 feet
10.	Min. overall efficiency @ second operating point	55%
11.	NPSH available @ second operating point	21
12.	Third operating point	800 gpm @ 13 feet
13.	Min. overall efficiency @ third operating point	48%
14.	Min. shutoff head	51
15.	Max. Pump speed (rpm)	1755
16.	Max. motor speed (rpm)	1755
17.	Min. motor size (Hp)	5
18.	Discharge diameter (in)	4
19.	Minimum suction diameter (in)	4
20.	Voltage/cycle/phase	230/60/3
21.	Service factor	1.15
22.	Insulation rating	Class H
23.	Enclosure	Submersible/Explosion proof
24.	FLA, (Amps)	14
25.	LRA, (Amps)	79
36.	Power Factor	0.81

2.04 SUBMERSIBLE PUMP DESIGN AND MATERIALS OF CONSTRUCTION

A. The manufacturer of the pump shall have unit responsibility for the complete motor and pump.

PART 2 -- PRODUCTS

2.01 SUPPLIER

A. Submersible pumps shall be Flygt Model NP-3171, type HT. No exceptions allowed.

B. The manufacturers' model number listed above is for general product. Any modifications required to meet these specifications shall be made to the manufacturer's standard product.

2.02 PUMP SCHEDULE

A. Each pump shall be of the heavy duty, submersible, centrifugal non-clog type.

B. Pump performance shall conform to the following requirements:

	Description	Pump Station Requirement
1.	Number of pumps	2 total (1 standby)
2.	Location	Wet Well
3.	Service	Raw Wastewater
4.	Operation (hours per day)	Continuous
5.	Drive	Adjustable

C. Operating Conditions. Pump performance shall conform to the following requirements:

	Description	Pump Station Requirement
1.	Design Point (DP) @ maximum pump speed	960 gpm @ 53 feet
2.	NPSH available @ DP	18 feet
3.	Liquid to be pumped	Raw Wastewater
4.	Minimum size solid to pass (in)	3
5.	Specific gravity of liquid	1.01
6.	Liquid temperature (degrees Fahrenheit)	60-85
7.	Min. overall efficiency @ DP	64%
8.	Min. pump efficiency @ BEP (full speed)	70%
9.	Second operating point @ maximum	1160 gpm @ 47 feet (max.

	Description	Pump Station Requirement
	pump speed	head)
10.	Min. overall efficiency @ second operating point	60%
11.	NPSH available @ second operating point	21
12.	Third operating point	640 gpm @ 38 feet
13.	Third operating point speed (% of max. speed)	75
14.	Min. pump efficiency @ third operating point	64%
15.	Fourth operating point	225 gpm @ 32 ft
16.	Fourth operating point speed (% of max. speed)	58
17.	Min. pump efficiency @ fourth operating point	50%
18.	Min. shutoff head @ max. speed (ft)	120
19.	Max. Pump speed (rpm)	1755
20.	Max. motor speed (rpm)	1755
21.	Min. motor size (Hp)	25
22.	Minimum discharge diameter (in)	4
23.	Minimum suction diameter (in)	4
24.	Voltage/cycle/phase	230/60/3
25.	Service factor	1.15
26.	Insulation rating	Class H
27.	Enclosure	Submersible/Explosion proof
28.	FLA, (Amps)	61
29.	LRA, (Amps)	360
30.	Power Factor	0.86

2.03 SUBMERSIBLE PUMP DESIGN AND MATERIALS OF CONSTRUCTION

A. The pump shall be capable of handling wastewater. Pumps shall be provided with discharge elbows for permanent installation in the wet well. All pumps shall be identical. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. Pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for the purpose and no need for personnel to enter the wet well. Sealing of the pumping unit to the discharge elbow shall be accomplished by a simple linear downward motion of the pumps with the entire weight of the pumping units guided to and pressed tightly against the discharge elbow with a metal-to-metal watertight contact. Sealing of the discharge interface by means of a diaphragm, O-ring, or other device will not be acceptable. No portion of the pump shall bear

APPENDIX B

SEWER MODEL CALIBRATION AND SUPPORTING DATA

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APPENDIX B

SEWER MODEL CALIBRATION AND SUPPORTING DATA

SEWER MODEL RECOMMENDED DESIGN STANDARDS

Table B-1 provides a comprehensive summary of the design standards referenced in order to develop the recommended design standards used to analyze the City's collection system, as discussed in Chapter 5 of this report.

Table B-1. Design and Performance Standards Comparison

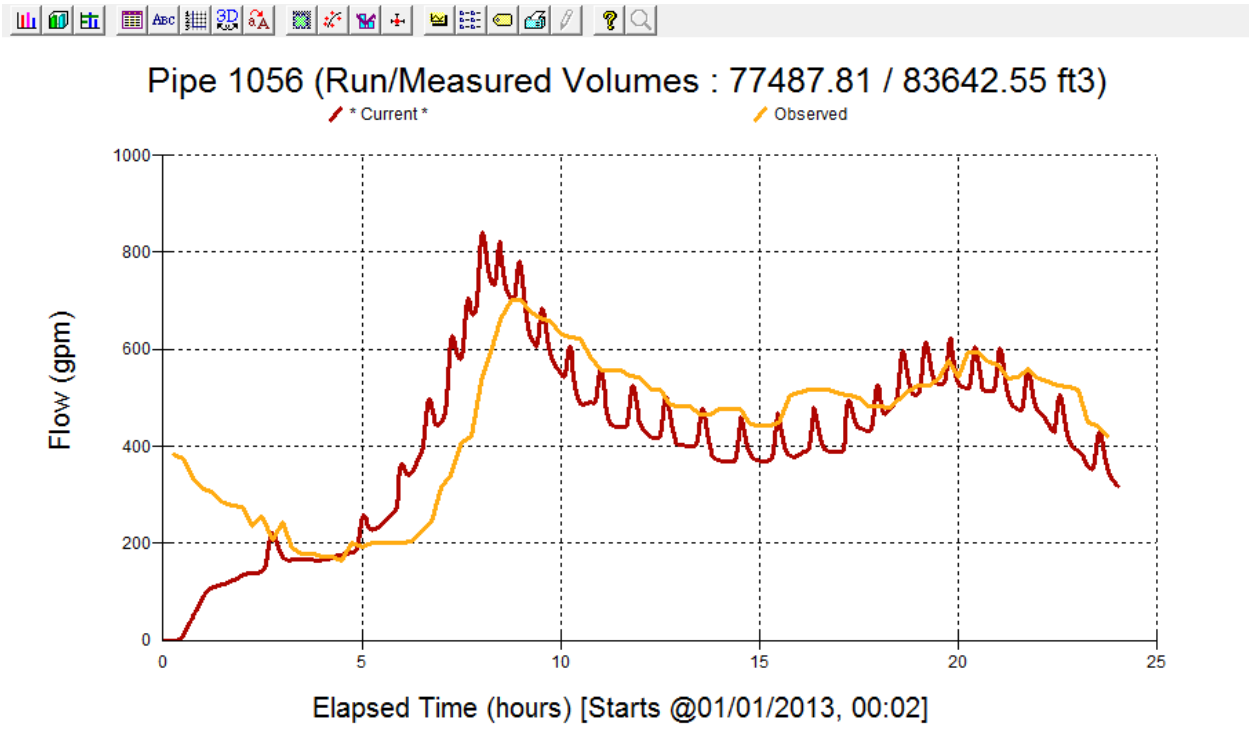
Agency	Min. Diameter (inches)	d/D by Pipe Diameter	Min. Vel. (fps)	Max. Vel. (fps)	Manning's Coefficient, n
Pacific Grove (Recommended)	8[1]	10-inch and smaller: 0.67 12-inch to 24-inch: 0.80 27-inch and larger: 0.90	2.0	8.0	0.11 for PVC & HPDE; 0.013 for VCP, CIP, & DIP
Seaside County Sanitation District	---	10-inch and smaller: 0.67 12-inch to 24-inch: 0.80 27-inch and larger: 0.90	2.0	8.0	0.11 for PVC; 0.013 for VCP & RCP
Marina Coast Water District	6	12-inch and smaller: 0.67 15-inch to 24-inch: 0.80 27-inch and larger: 0.90	2.0	8.0	0.013
City of Salinas	8	Future Pipes: 0.75 Existing Pipes: 0.9	2.0	8.0	0.013
Carmel Area Water District	6	12-inch and smaller: 0.5	2.0	---	0.013
Pebble Beach CSD	---	---	---	---	---
Moss Landing County Sanitation District[2]	6	---	---	---	---
Monterey County[3]	---	---	---	---	---
MRWPCA[3]	---	---	---	---	---
San Luis Obispo County	8	15-inch and smaller: 0.50 Larger than 15-inch: 0.75	2.0	---	---

[1] This standard is the City Municipal Code Section 9.20.010: Definitions in the definition for "sewer" or "sewer main".
[2] MLCSD uses the Standard Specifications for Use in Monterey County Sanitation Districts and Service Areas (1995).
[3] MRWPCA and Monterey County specify to use the design standards and details fo the agency in which the work is being completed. [MRWPCA Ordinance 2008-01 Section 2.11: Sewerage Design Requirements, and Monterey County Standard Property Development Specification Section M(5) (Revised 1981).].

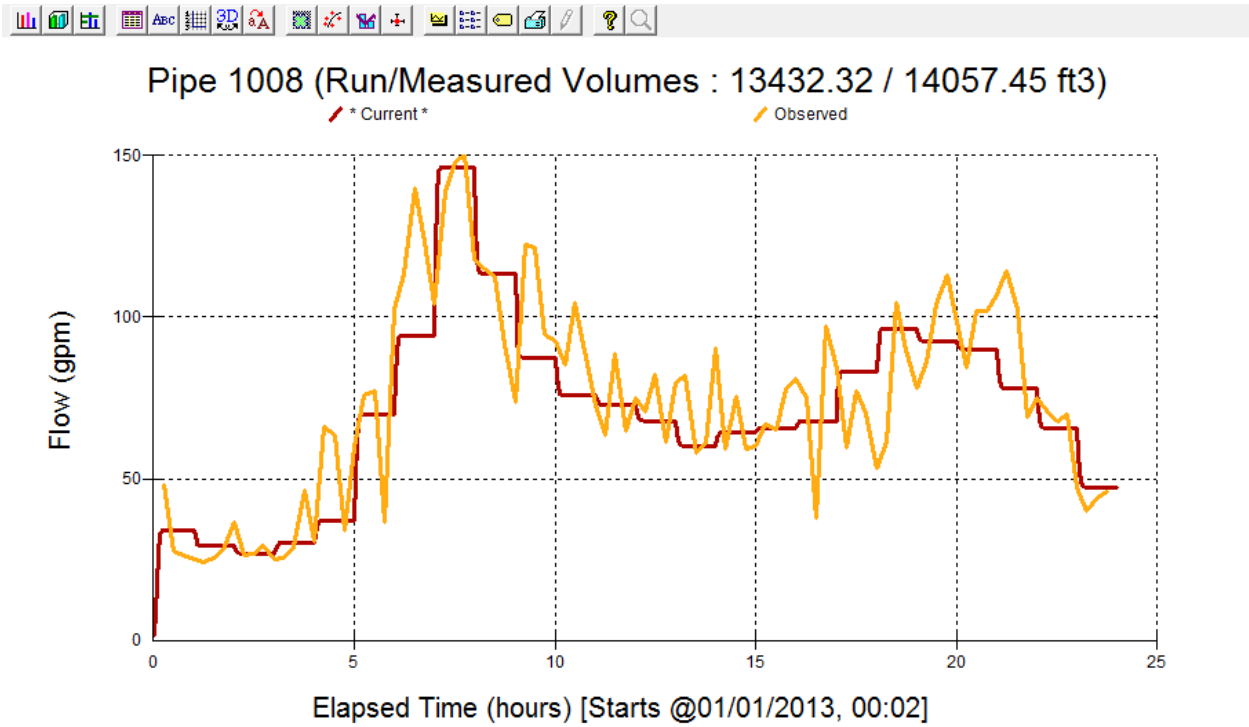
SEWER MODEL CALIBRATION GRAPHS

The following graphs illustrate results from the sewer model calibration. These graphs compare the modeled average day flows to the flow meter readings obtained through the flow monitoring conducted in support of this Master Plan. Model results may differ from metered flow for a variety of reasons: the metered flows represent a single day of flow monitoring and may not represent average day flows, anomalies in meter data, system deficiencies not included in the model such as cracked pipes, existing blockages, or other unforeseen conditions.

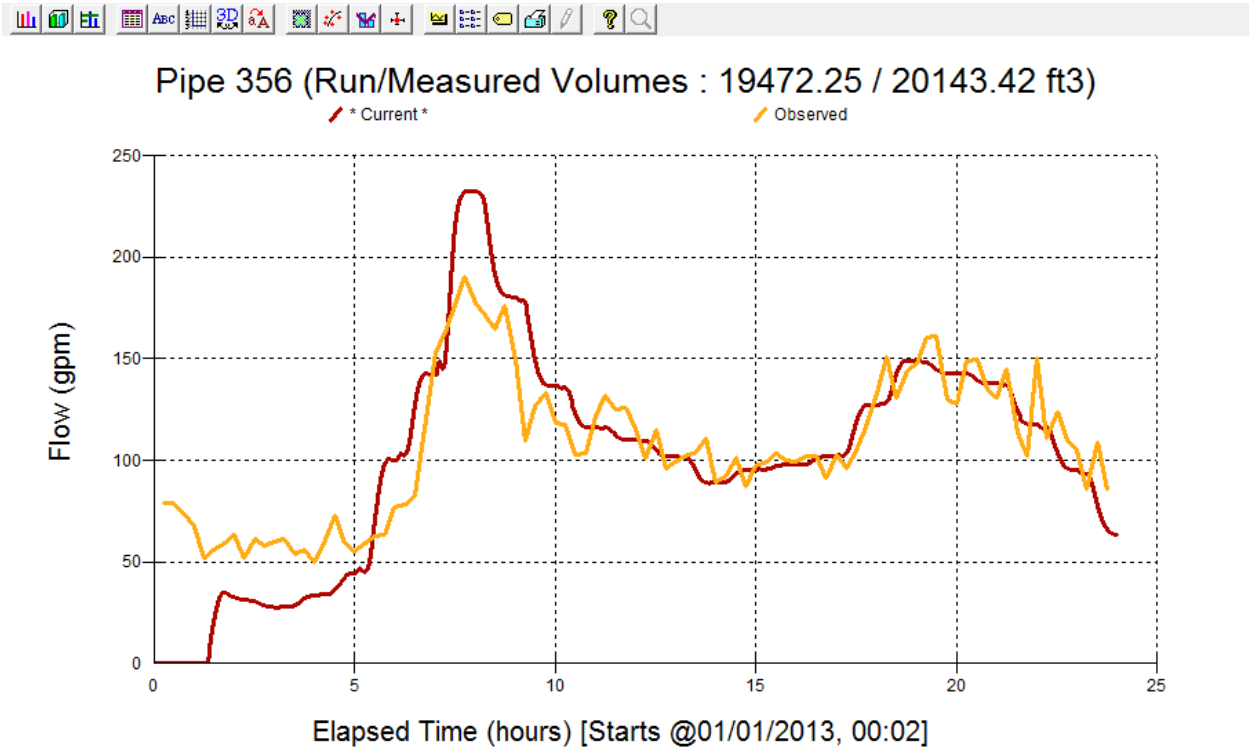
Manhole 803



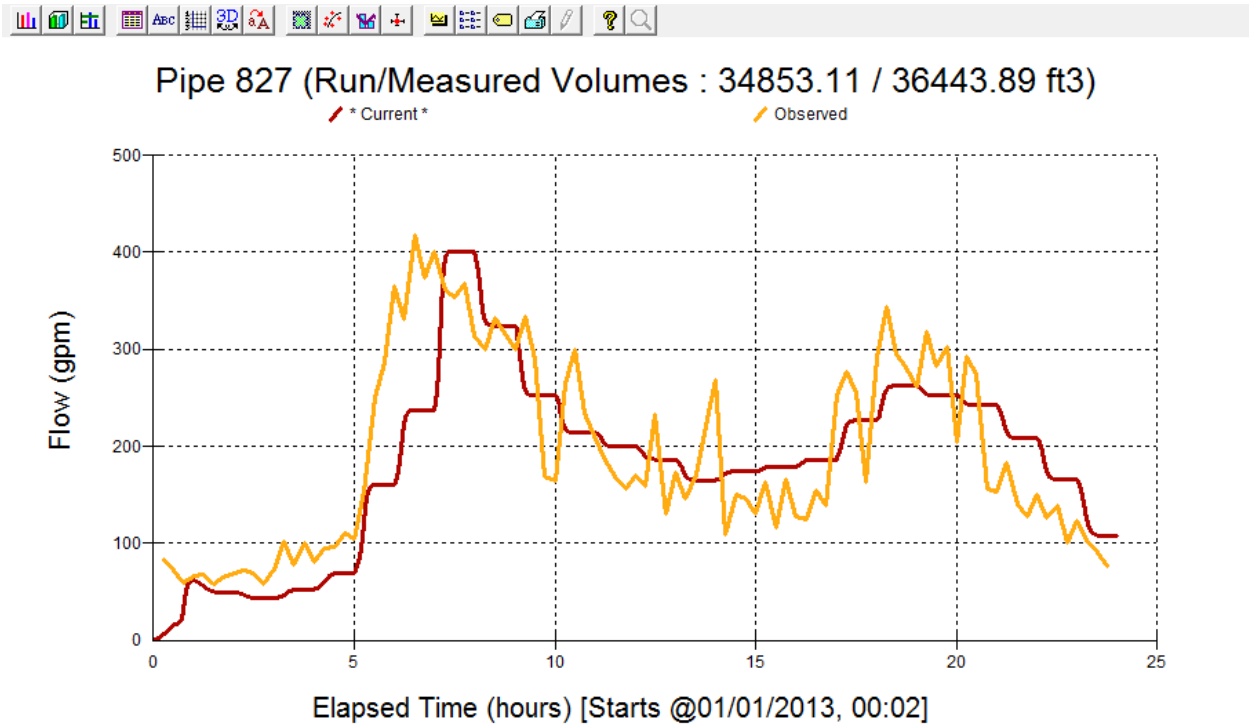
Manhole 859



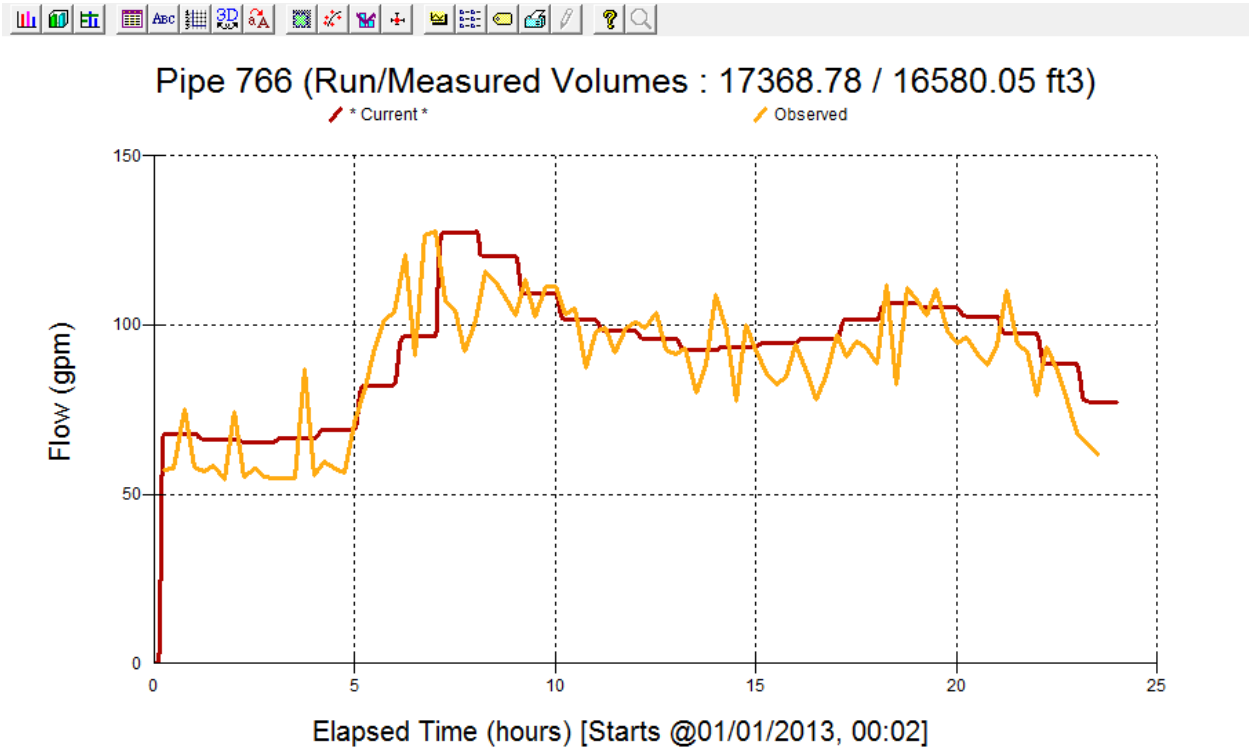
Manhole 502



Manhole 303



Manhole 1058



Sewer Model Results: Existing Maximum Day Dry Weather Flow (MDDWF)

Model ID	Upstream MH	Downstrem MH	Material	Length (feet)	Diameter (inches)	Slope	Max Flow (gpm)	Max Velocity (fps)	Max Depth/Dia	Reserve Capacity (gpm)
16	350	985	SDR 26	225	10	2.7%	159	4.2	0.21	1,454
17	985	349	SDR 26	170	10	2.7%	161	4.1	0.22	1,444
20	P1055	821	PVC	929	4	3.5%	182	5.2	0.83	71
23	P1040	810	CIP	917	8	4.0%	552	4.2	1.00	709
24	806	805	PVC	449	15	0.1%	1,230	2.4	0.90	-275
25	1003	1004	VCP	285	15	1.9%	1,166	4.5	0.47	2,789
26	1002	1003	VCP	301	15	0.6%	1,167	4.7	0.46	1,085
205	514	513	VCP	431	8	5.9%	349	6.6	0.40	964
724	333	332	SDR 26	587	8	4.0%	17	2.1	0.10	1,068
725	308	307	PVC	309	8	6.7%	23	2.7	0.10	1,383
726	122	991	VCP	55	6	11.7%	76	3.4	0.41	784
729	228	227	PVC	442	6	4.6%	27	3.2	0.15	511
735	816	815	VCP	211	15	0.3%	751	2.8	0.49	841
736	114	122	VCP	154	8	2.8%	58	3.5	0.16	851
737	325	324	VCP	303	6	6.0%	20	2.9	0.14	597
739	991	LS 12	PVC	18	6	5.7%	414	7.3	0.61	186
741	101	114	UNK	159	8	3.5%	30	2.2	0.15	988
224	513	512	VCP	550	8	2.5%	349	5.2	0.45	509
233	512	511	VCP	503	8	2.5%	349	5.7	0.42	515
244	649	677	VCP	245	8	6.3%	63	4.5	0.15	1,297
246	511	510	VCP	371	8	4.9%	349	6.6	0.37	851
250	677	648	VCP	219	8	5.4%	63	4.2	0.15	1,198
253	510	509	PVC	152	8	4.6%	349	3.5	0.69	810
254	648	647	VCP	218	8	5.7%	63	4.4	0.15	1,232
263	647	646	VCP	209	8	7.4%	63	4.6	0.14	1,411
270	646	645	VCP	251	8	6.2%	63	4.1	0.16	1,290
277	645	644	VCP	272	8	3.7%	63	3.5	0.17	977
288	644	643	VCP	269	8	2.6%	63	3.2	0.18	813
299	643	642	VCP	283	8	2.3%	63	3.0	0.20	757
313	642	641	VCP	242	8	3.2%	87	3.9	0.20	880
321	641	640	VCP	338	8	3.7%	87	2.9	0.25	954
325	640	639	VCP	233	8	5.8%	246	6.5	0.29	1,064
332	639	638	VCP	236	8	6.8%	246	6.5	0.29	1,167
346	638	637	VCP	322	8	6.0%	264	5.9	0.33	1,063
356	502	501	PVC	534	8	0.2%	350	2.3	0.93	-107
375	637	636	VCP	269	8	3.9%	271	6.0	0.33	800
398	636	635	VCP	341	12	4.0%	271	6.0	0.19	2,946
418	635	634	VCP	261	12	7.3%	273	6.9	0.17	4,062
433	501	500	PVC	106	12	0.4%	632	2.6	0.70	382
434	634	501	VCP	105	12	8.6%	282	2.7	0.37	4,399
448	500	822	PVC	472	12	0.2%	676	2.2	0.81	-1
506	822	821	PVC	159	12	0.2%	661	2.2	0.82	13
CDT-19	509	508	PVC	152	8	2.5%	349	2.5	1.00	510
CDT-21	131	991	PVC	136	10	0.5%	339	3.2	0.44	360
CDT-23	508	507	PVC	376	8	1.1%	350	2.8	1.00	218
CDT-25	507	679	PVC	348	8	0.3%	351	2.5	1.00	-75
CDT-27	506	505	PVC	179	8	0.0%	351	2.3	1.00	-338
CDT-29	505	503	PVC	342	8	0.2%	351	2.3	1.00	-106
CDT-31	503	502	PVC	472	8	0.2%	350	2.3	1.00	-124
285	679	506	PVC	281	8	0.4%	351	2.2	1.00	-11
513	821	820	VCP	509	15	0.1%	697	2.2	0.56	279
547	251	250	PVC	376	8	8.7%	136	6.6	0.21	1,463
575	223	222	SDR 26	386	8	10.0%	7	2.1	0.05	1,708
583	231	230	VCP	369	6	10.7%	0	0.0	0.05	825
591	820	819	VCP	139	15	0.3%	679	2.0	0.60	1,018
595	240	239	VCP	422	8	10.2%	3	0.6	0.14	1,729
602	250	249	VCP	352	8	5.9%	141	5.1	0.24	1,177
616	819	818	VCP	245	15	0.0%	752	2.4	0.55	-218
618	292	290	SDR 26	413	8	4.8%	71	4.0	0.18	1,120
634	222	221	PVC	320	6	5.7%	9	2.2	0.09	592
636	310	I310	SDR 35	150	6	5.3%	18	3.1	0.12	565
646	230	229	VCP	336	6	6.5%	15	2.1	0.14	627
648	317	316	VCP	528	6	4.7%	18	2.7	0.13	529

Sewer Model Results: Existing Maximum Day Dry Weather Flow (MDDWF)

Model ID	Upstream MH	Downstrem MH	Material	Length (feet)	Diameter (inches)	Slope	Max Flow (gpm)	Max Velocity (fps)	Max Depth/Dia	Reserve Capacity (gpm)
656	249	248	VCP	45	8	3.8%	143	4.4	0.26	910
657	818	817	VCP	159	15	1.3%	752	5.3	0.31	2,566
665	248	239	VCP	144	6	3.8%	143	4.8	0.37	351
666	239	237	SDR 26	282	10	3.5%	149	3.6	0.24	1,694
667	I310	034	SDR 35	25	6	5.3%	18	2.9	0.13	565
669	178	171	SDR 26	155	8	1.3%	263	3.4	0.49	362
670	P1022	178	PVC	1375	6	0.6%	495	10.0	0.80	-237
677	171	165	VCP	161	8	0.9%	280	3.1	0.56	226
679	165	150	VCP	162	8	0.7%	286	3.2	0.55	176
683	291	290	VCP	184	6	5.2%	0	0.0	0.13	576
684	290	289	SDR 26	295	8	3.9%	88	3.9	0.20	980
685	150	139	SDR 26	317	10	0.8%	310	3.4	0.40	551
687	817	816	VCP	416	15	2.8%	752	4.0	0.37	4,124
690	221	220	PVC	254	6	5.4%	12	2.6	0.10	575
698	229	228	VCP	254	6	1.4%	19	2.0	0.16	284
703	139	131	PVC	203	10	1.1%	325	3.1	0.45	706
704	237	1059	VCP	56	6	1.7%	157	3.5	0.51	171
713	034	308	SDR 35	411	6	4.1%	19	3.0	0.13	492
714	1059	1058	VCP	223	6	1.8%	159	4.4	0.43	178
715	962	343	SDR 26	337	8	4.8%	17	2.7	0.09	1,176
717	289	288	SDR 26	276	8	3.1%	92	3.9	0.21	867
719	220	203	SDR 26	478	8	3.6%	15	0.9	0.31	1,015
723	316	315	PVC	354	6	6.1%	25	3.2	0.15	594
744	332	331	VCP	297	6	5.7%	27	2.8	0.17	573
747	288	287	SDR 26	365	8	4.1%	100	4.7	0.19	1,001
751	205	204	SDR 26	175	10	2.9%	25	2.2	0.30	1,637
1015	858	805	VCP	19	6	1.0%	128	2.9	0.50	128
1017	805	804	PVC	465	15	0.2%	1,261	2.7	0.88	-2
1033	804	803	PVC	434	15	0.2%	1,170	2.2	0.99	210
752	343	342	VCP	256	8	4.8%	21	2.4	0.11	1,170
756	307	306	VCP	367	8	3.7%	30	3.1	0.11	1,006
758	815	814	VCP	213	15	0.3%	801	2.7	0.53	853
761	353	352	VCP	180	6	1.7%	71	2.9	0.33	258
764	204	1019	SDR 26	49	12	4.4%	1,219	8.6	0.47	2,126
765	324	323	VCP	380	6	3.7%	26	2.8	0.16	458
766	1058	235	SDR 26	397	12	3.5%	161	4.0	0.17	2,815
767	1019	203	SDR 26	108	12	2.4%	1,032	7.5	0.42	1,431
769	203	227	SDR 26	167	12	2.4%	631	6.2	0.33	1,832
770	388	352	SDR 26	166	8	4.5%	61	2.6	0.21	1,086
771	352	350	VCP	206	8	3.3%	151	4.6	0.26	842
773	227	1018	VCP	277	12	2.4%	572	4.9	0.37	1,920
774	315	1009	SDR 35	382	6	4.1%	27	3.0	0.16	485
775	331	1008	PVC	379	6	3.6%	39	3.3	0.19	437
778	285	JCT-10	VCP	263	6	4.7%	9	2.5	0.08	540
780	235	284	PVC	163	12	1.9%	166	3.6	0.19	2,063
781	342	1007	VCP	384	6	3.1%	25	2.5	0.17	417
782	396	388	SDR 26	172	8	4.6%	36	2.7	0.14	1,128
785	814	813	VCP	451	15	0.2%	800	2.0	0.69	476
791	287	1017	SDR 26	318	8	8.4%	102	4.3	0.21	1,471
793	401	396	VCP	165	8	5.4%	23	2.7	0.11	1,241
794	284	1014	VCP	125	6	5.0%	181	5.3	0.41	381
797	1018	P1015	VCP	28	12	6.5%	1,444	10.6	0.41	2,647
798	306	305	SDR 26	520	8	6.3%	34	3.6	0.11	1,324
800	986	1018	VCP	101	18	1.8%	898	5.8	0.26	5,510
806	1014	986	VCP	42	6	3.6%	182	5.1	0.43	296
809	1015	986	SDR 35	174	12	0.4%	707	3.3	0.58	317
811	323	322	VCP	426	6	4.7%	33	1.2	0.36	511
814	1008	330	PVC	389	6	4.6%	43	1.5	0.42	500
818	035	410	SDR 26	97	8	1.2%	148	3.6	0.31	442
819	410	984	SDR 35	308	8	4.5%	162	5.1	0.26	987
820	1009	314	SDR 35	484	6	5.5%	33	1.1	0.37	560
821	1007	339	SDR 35	407	6	3.1%	33	1.7	0.42	407
822	1017	1015	SDR 26	41	6	3.3%	105	4.2	0.33	350

Sewer Model Results: Existing Maximum Day Dry Weather Flow (MDDWF)

Model ID	Upstream MH	Downstrem MH	Material	Length (feet)	Diameter (inches)	Slope	Max Flow (gpm)	Max Velocity (fps)	Max Depth/Dia	Reserve Capacity (gpm)
823	424	416	SDR 26	171	8	1.2%	127	2.8	0.33	467
827	303	1015	SDR 35	230	12	1.0%	601	3.2	0.53	976
829	349	1044	SDR 26	114	10	2.3%	163	3.9	0.23	1,338
830	984	409	SDR 35	326	8	4.3%	166	5.2	0.26	956
832	430	424	SDR 26	172	8	1.1%	116	2.8	0.31	461
833	813	812	VCP	402	15	0.1%	798	2.2	0.63	-98
840	409	351	SDR 35	333	8	4.9%	174	5.4	0.26	1,023
841	305	303	PVC	201	12	1.5%	588	4.4	0.40	1,339
842	444	430	SDR 26	172	8	1.2%	67	2.0	0.27	530
843	1044	351	SDR 26	137	12	1.7%	163	3.3	0.20	1,898
849	314	305	PVC	154	12	3.5%	547	5.3	0.33	2,456
851	322	314	PVC	184	12	3.5%	505	6.1	0.28	2,484
852	447	444	SDR 26	173	8	3.5%	58	2.7	0.19	956
853	330	322	PVC	160	12	1.9%	469	5.2	0.30	1,708
854	351	348	SDR 26	176	12	4.2%	339	1.5	0.61	2,958
860	339	330	PVC	162	12	1.2%	409	4.0	0.33	1,330
866	348	339	SDR 35	141	12	0.6%	371	1.5	0.67	856
867	457	447	SDR 26	178	8	3.2%	47	3.0	0.16	924
873	460	457	VCP	364	6	3.1%	31	2.7	0.19	412
878	812	881	VCP	402	15	0.4%	819	3.0	0.50	1,121
890	899	898	VCP	306	8	0.5%	11	0.9	0.13	364
894	464	460	VCP	370	6	5.1%	13	1.7	0.14	557
903	881	811	VCP	417	15	0.3%	820	2.9	0.50	696
918	898	897	VCP	308	8	0.4%	14	1.2	0.12	323
926	895	1074	VCP	334	6	4.8%	16	3.2	0.11	537
927	896	895	VCP	351	6	2.2%	14	2.1	0.13	363
928	811	810	VCP	304	15	0.4%	821	3.3	0.52	1,075
935	897	896	VCP	99	6	2.2%	14	2.0	0.13	363
937	825	LS 16	VCP	24	15	27.8%	76	7.1	0.53	15,218
940	810	809	VCP	174	15	0.5%	1,329	4.2	0.55	769
952	809	808	VCP	254	15	0.7%	1,275	4.0	0.57	1,104
970	808	807	VCP	227	15	0.4%	1,208	4.5	0.49	713
975	864	863	VCP	137	6	3.4%	85	4.3	0.28	377
984	863	862	VCP	266	6	4.4%	85	4.5	0.27	446
986	807	806	VCP	43	15	2.3%	1,202	3.2	0.67	3,178
989	857	806	VCP	9	6	14.6%	109	4.0	0.61	853
990	858	857	VCP	452	6	1.1%	105	3.6	0.36	158
991	862	861	VCP	176	6	4.4%	84	4.3	0.28	443
997	861	860	VCP	130	6	3.9%	88	3.5	0.34	411
1003	860	859	PVC	273	8	4.0%	209	5.3	0.30	877
1008	859	858	PVC	239	8	3.9%	214	4.6	0.34	861
1056	803	802	PVC	433	15	0.1%	1,170	3.2	0.63	-411
1067	802	801	PVC	326	15	7.0%	1,169	8.9	0.29	6,510
1082	801	980	VCP	332	15	3.6%	1,169	5.4	0.42	4,313
1095	980	981	VCP	266	15	0.6%	1,169	4.5	0.48	1,159
1096	1005	P1024	VCP	79	15	1.1%	1,166	5.6	0.40	1,904
1098	1004	1005	VCP	295	15	0.4%	1,166	3.8	0.54	762
1102	1001	1002	VCP	294	15	0.5%	1,167	3.8	0.55	820
1103	981	982	VCP	283	15	1.1%	1,168	4.4	0.48	1,871
1105	982	1001	VCP	423	15	0.5%	1,168	3.8	0.54	905
1107	1074	825	SDR 26	69	6	16.8%	16	3.5	0.11	1,018
1112	286	E286	SDR 26	195	8	2.1%	0	0.0	0.02	785
1113	285	286	SDR 26	262	8	1.8%	3	0.8	0.06	725
1123	416	035	SDR 26	90	8	1.1%	148	2.9	0.36	421
1131	JCT-10	284	VCP	197	6	8.4%	9	0.6	0.23	719
CDT-11	JCT-12	500	DIP	317	4	6.8%	90	2.3	1.00	189
CDT-17	p1020	204	CIP	700	8	3.0%	1,072	7.4	0.89	116

Sewer Model Results: Existing Peak Hour Wet Weather Flow (PHWWF)

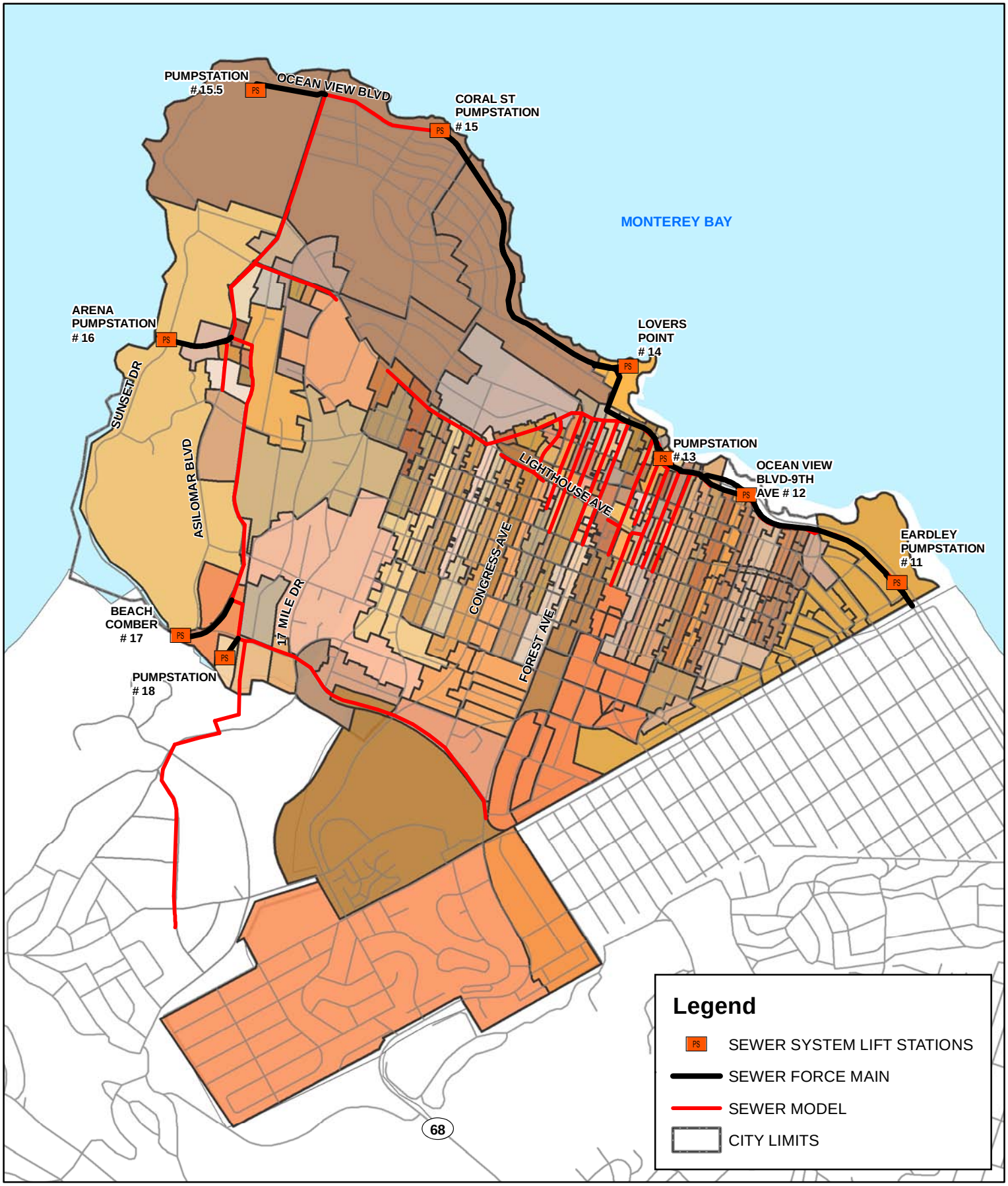
Model ID	Upstream MH	Downstrem MH	Material	Length (feet)	Diameter (inches)	Slope	Max Flow (gpm)	Max Velocity (fps)	Max Depth/Dia	Reserve Capacity (gpm)
16	350	985	SDR 26	225	10	2.7%	131	4.0	0.19	1,481
17	985	349	SDR 26	170	10	2.7%	133	3.9	0.20	1,472
20	P1055	821	PVC	929	4	3.5%	173	5.1	0.80	80
23	P1040	810	CIP	917	8	4.0%	553	4.2	1.00	709
24	806	805	PVC	449	15	0.1%	1,084	2.3	0.80	-129
25	1003	1004	VCP	285	15	1.9%	1,038	4.4	0.44	2,917
26	1002	1003	VCP	301	15	0.6%	1,039	4.6	0.43	1,212
205	514	513	VCP	431	8	5.9%	300	6.6	0.37	1,013
724	333	332	SDR 26	587	8	4.0%	14	2.1	0.09	1,071
725	308	307	PVC	309	8	6.7%	19	2.5	0.10	1,387
726	122	991	VCP	55	6	11.7%	92	4.0	0.45	769
729	228	227	PVC	442	6	4.6%	33	3.4	0.17	505
735	816	815	VCP	211	15	0.3%	648	2.7	0.45	945
736	114	122	VCP	154	8	2.8%	70	3.7	0.18	840
737	325	324	VCP	303	6	6.0%	16	2.8	0.13	601
739	991	LS 12	PVC	18	6	5.7%	474	7.5	0.67	126
741	101	114	NA	159	8	3.5%	36	2.4	0.16	982
224	513	512	VCP	550	8	2.5%	300	5.1	0.42	557
233	512	511	VCP	503	8	2.5%	300	5.5	0.38	564
244	649	677	VCP	245	8	6.3%	55	4.4	0.14	1,306
246	511	510	VCP	371	8	4.9%	300	6.3	0.34	900
250	677	648	VCP	219	8	5.4%	54	4.1	0.14	1,207
253	510	509	PVC	152	8	4.6%	300	3.2	0.67	859
254	648	647	VCP	218	8	5.7%	54	4.3	0.14	1,240
263	647	646	VCP	209	8	7.4%	54	4.4	0.13	1,420
270	646	645	VCP	251	8	6.2%	54	4.0	0.15	1,298
277	645	644	VCP	272	8	3.7%	54	3.4	0.16	986
288	644	643	VCP	269	8	2.6%	54	3.1	0.17	821
299	643	642	VCP	283	8	2.3%	54	2.8	0.18	766
313	642	641	VCP	242	8	3.2%	75	3.7	0.19	892
321	641	640	VCP	338	8	3.7%	75	2.8	0.23	966
325	640	639	VCP	233	8	5.8%	212	6.3	0.27	1,098
332	639	638	VCP	236	8	6.8%	212	6.2	0.27	1,202
346	638	637	VCP	322	8	6.0%	227	5.7	0.30	1,100
356	502	501	PVC	534	8	0.2%	304	2.1	0.89	-61
375	637	636	VCP	269	8	3.9%	233	5.8	0.30	838
398	636	635	VCP	341	12	4.0%	233	5.7	0.17	2,984
418	635	634	VCP	261	12	7.3%	235	6.6	0.16	4,100
433	501	500	PVC	106	12	0.4%	543	2.5	0.63	471
434	634	501	VCP	105	12	8.6%	243	2.8	0.34	4,438
448	500	822	PVC	472	12	0.2%	590	2.2	0.72	84
506	822	821	PVC	159	12	0.2%	574	2.1	0.73	101
CDT-19	509	508	PVC	152	8	2.5%	304	2.0	1.00	556
CDT-21	131	991	PVC	136	10	0.5%	384	3.3	0.48	315
CDT-23	508	507	PVC	376	8	1.1%	300	2.7	0.76	268
CDT-25	507	679	PVC	348	8	0.3%	302	2.1	1.00	-26
CDT-27	506	505	PVC	179	8	0.0%	305	2.0	1.00	-293
CDT-29	505	503	PVC	342	8	0.2%	307	2.0	1.00	-61
CDT-31	503	502	PVC	472	8	0.2%	307	2.0	1.00	-82
285	679	506	PVC	281	8	0.4%	304	1.9	1.00	35
513	821	820	VCP	509	15	0.1%	580	2.1	0.51	396
547	251	250	PVC	376	8	8.7%	123	6.4	0.20	1,476
575	223	222	SDR 26	386	8	10.0%	8	2.4	0.06	1,707
583	231	230	VCP	369	6	10.7%	0	0.0	0.06	825
591	820	819	VCP	139	15	0.3%	563	1.8	0.55	1,134
595	240	239	VCP	422	8	10.2%	3	0.2	0.13	1,729
602	250	249	VCP	352	8	5.9%	127	4.9	0.22	1,191
616	819	818	VCP	245	15	0.0%	650	2.3	0.51	-116
618	292	290	SDR 26	413	8	4.8%	58	3.9	0.16	1,132
634	222	221	PVC	320	6	5.7%	10	2.4	0.10	590
636	310	I310	SDR 35	150	6	5.3%	15	2.9	0.11	568
646	230	229	VCP	336	6	6.5%	18	2.4	0.15	624
648	317	316	VCP	528	6	4.7%	15	2.6	0.12	532
656	249	248	VCP	45	8	3.8%	128	4.2	0.25	924
657	818	817	VCP	159	15	1.3%	650	5.1	0.28	2,667
665	248	239	VCP	144	6	3.8%	128	4.7	0.35	366

Sewer Model Results: Existing Peak Hour Wet Weather Flow (PHWWF)

Model ID	Upstream MH	Downstrem MH	Material	Length (feet)	Diameter (inches)	Slope	Max Flow (gpm)	Max Velocity (fps)	Max Depth/Dia	Reserve Capacity (gpm)
666	239	237	SDR 26	282	10	3.5%	134	3.5	0.23	1,709
667	I310	034	SDR 35	25	6	5.3%	15	2.8	0.12	568
669	178	171	SDR 26	155	8	1.3%	273	3.4	0.51	352
670	P1022	178	PVC	1,375	6	0.6%	495	10.0	0.81	-237
677	171	165	VCP	161	8	0.9%	298	3.2	0.58	208
679	165	150	VCP	162	8	0.7%	308	3.3	0.58	154
683	291	290	VCP	184	6	5.2%	0	0.0	0.12	576
684	290	289	SDR 26	295	8	3.9%	73	3.8	0.18	996
685	150	139	SDR 26	317	10	0.8%	341	3.4	0.43	519
687	817	816	VCP	416	15	2.8%	650	3.9	0.35	4,226
690	221	220	PVC	254	6	5.4%	14	2.7	0.11	573
698	229	228	VCP	254	6	1.4%	23	2.2	0.18	279
703	139	131	PVC	203	10	1.1%	364	3.2	0.48	667
704	237	1059	VCP	56	6	1.7%	140	3.4	0.48	188
713	034	308	SDR 35	411	6	4.1%	16	2.9	0.12	495
714	1059	1058	VCP	223	6	1.8%	141	4.3	0.40	195
715	962	343	SDR 26	337	8	4.8%	14	2.6	0.08	1,179
717	289	288	SDR 26	276	8	3.1%	76	3.6	0.19	883
719	220	203	SDR 26	478	8	3.6%	17	0.9	0.33	1,012
723	316	315	PVC	354	6	6.1%	21	3.1	0.13	599
744	332	331	VCP	297	6	5.7%	23	2.6	0.15	578
747	288	287	SDR 26	365	8	4.1%	82	4.5	0.17	1,018
751	205	204	SDR 26	175	10	2.9%	29	2.3	0.30	1,632
1015	858	805	VCP	19	6	1.0%	111	2.8	0.46	145
1017	805	804	PVC	465	15	0.2%	1,118	2.7	0.70	141
1033	804	803	PVC	434	15	0.2%	1,081	2.2	0.84	300
752	343	342	VCP	256	8	4.8%	17	2.3	0.10	1,173
756	307	306	VCP	367	8	3.7%	25	2.9	0.10	1,012
758	815	814	VCP	213	15	0.3%	686	2.6	0.49	967
761	353	352	VCP	180	6	1.7%	59	2.8	0.30	270
764	204	1019	SDR 26	49	12	4.4%	1,225	8.6	0.47	2,120
765	324	323	VCP	380	6	3.7%	21	2.7	0.15	462
766	1058	235	SDR 26	397	12	3.5%	144	3.9	0.16	2,833
767	1019	203	SDR 26	108	12	2.4%	1,089	7.5	0.44	1,375
769	203	227	SDR 26	167	12	2.4%	720	6.3	0.36	1,744
770	388	352	SDR 26	166	8	4.5%	51	2.4	0.19	1,097
771	352	350	VCP	206	8	3.3%	125	4.3	0.24	868
773	227	1018	VCP	277	12	2.4%	658	5.5	0.37	1,834
774	315	1009	SDR 35	382	6	4.1%	22	2.9	0.14	489
775	331	1008	PVC	379	6	3.6%	32	3.1	0.18	444
778	285	JCT-10	VCP	263	6	4.7%	7	2.3	0.08	541
780	235	284	PVC	163	12	1.9%	147	3.5	0.18	2,081
781	342	1007	VCP	384	6	3.1%	21	2.3	0.16	421
782	396	388	SDR 26	172	8	4.6%	30	2.6	0.13	1,134
785	814	813	VCP	451	15	0.2%	682	1.9	0.63	594
791	287	1017	SDR 26	318	8	8.4%	84	4.1	0.19	1,489
793	401	396	VCP	165	8	5.4%	19	2.5	0.10	1,245
794	284	1014	VCP	125	6	5.0%	160	5.2	0.38	402
797	1018	P1015	VCP	28	12	6.5%	1,381	10.4	0.40	2,710
798	306	305	SDR 26	520	8	6.3%	28	3.4	0.10	1,330
800	986	1018	VCP	101	18	1.8%	745	5.4	0.25	5,663
806	1014	986	VCP	42	6	3.6%	161	4.9	0.40	317
809	1015	986	SDR 35	174	12	0.4%	584	3.2	0.52	440
811	323	322	VCP	426	6	4.7%	27	1.2	0.33	517
814	1008	330	PVC	389	6	4.6%	35	1.2	0.38	507
818	035	410	SDR 26	97	8	1.2%	123	3.4	0.28	468
819	410	984	SDR 35	308	8	4.5%	134	4.8	0.23	1,015
820	1009	314	SDR 35	484	6	5.5%	27	1.1	0.34	566
821	1007	339	SDR 35	407	6	3.1%	27	1.4	0.38	413
822	1017	1015	SDR 26	41	6	3.3%	87	4.0	0.30	368
823	424	416	SDR 26	171	8	1.2%	105	2.7	0.30	489
827	303	1015	SDR 35	230	12	1.0%	497	3.0	0.47	1,081
829	349	1044	SDR 26	114	10	2.3%	135	3.7	0.21	1,367
830	984	409	SDR 35	326	8	4.3%	138	4.9	0.24	985
832	430	424	SDR 26	172	8	1.1%	96	2.7	0.28	481
833	813	812	VCP	402	15	0.1%	680	2.1	0.58	20

Sewer Model Results: Existing Peak Hour Wet Weather Flow (PHWWF)

Model ID	Upstream MH	Downstrem MH	Material	Length (feet)	Diameter (inches)	Slope	Max Flow (gpm)	Max Velocity (fps)	Max Depth/Dia	Reserve Capacity (gpm)
840	409	351	SDR 35	333	8	4.9%	144	5.1	0.24	1,053
841	305	303	PVC	201	12	1.5%	486	4.2	0.36	1,441
842	444	430	SDR 26	172	8	1.2%	55	1.9	0.24	542
843	1044	351	SDR 26	137	12	1.7%	135	3.1	0.19	1,926
849	314	305	PVC	154	12	3.5%	452	5.0	0.30	2,551
851	322	314	PVC	184	12	3.5%	418	5.8	0.26	2,572
852	447	444	SDR 26	173	8	3.5%	48	2.6	0.18	966
853	330	322	PVC	160	12	1.9%	387	4.9	0.27	1,789
854	351	348	SDR 26	176	12	4.2%	280	1.3	0.60	3,016
860	339	330	PVC	162	12	1.2%	338	3.8	0.30	1,400
866	348	339	SDR 35	141	12	0.6%	307	1.3	0.65	920
867	457	447	SDR 26	178	8	3.2%	39	2.8	0.14	932
873	460	457	VCP	364	6	3.1%	26	2.5	0.17	417
878	812	881	VCP	402	15	0.4%	694	2.8	0.46	1,246
890	899	898	VCP	306	8	0.5%	9	0.9	0.12	366
894	464	460	VCP	370	6	5.1%	10	1.6	0.13	560
903	881	811	VCP	417	15	0.3%	694	2.8	0.46	822
918	898	897	VCP	308	8	0.4%	12	1.2	0.12	325
926	895	1074	VCP	334	6	4.8%	14	3.1	0.10	539
927	896	895	VCP	351	6	2.2%	12	2.0	0.12	365
928	811	810	VCP	304	15	0.4%	695	3.1	0.49	1,201
935	897	896	VCP	99	6	2.2%	12	1.9	0.12	365
937	825	LS 16	VCP	24	15	27.8%	65	6.8	0.52	15,228
940	810	809	VCP	174	15	0.5%	1,196	4.2	0.52	902
952	809	808	VCP	254	15	0.7%	1,135	3.9	0.53	1,245
970	808	807	VCP	227	15	0.4%	1,064	4.3	0.46	857
975	864	863	VCP	137	6	3.4%	75	4.2	0.26	387
984	863	862	VCP	266	6	4.4%	74	4.3	0.25	456
986	807	806	VCP	43	15	2.3%	1,058	3.2	0.60	3,322
989	857	806	VCP	9	6	14.6%	95	1.7	0.61	867
990	858	857	VCP	452	6	1.1%	91	3.5	0.34	172
991	862	861	VCP	176	6	4.4%	74	4.1	0.26	454
997	861	860	VCP	130	6	3.9%	77	3.3	0.32	422
1003	860	859	PVC	273	8	4.0%	181	5.1	0.28	905
1008	859	858	PVC	239	8	3.9%	186	4.5	0.31	889
1056	803	802	PVC	433	15	0.1%	1,060	2.9	0.63	-301
1067	802	801	PVC	326	15	7.0%	1,051	8.7	0.27	6,628
1082	801	980	VCP	332	15	3.6%	1,050	5.3	0.39	4,432
1095	980	981	VCP	266	15	0.6%	1,048	4.4	0.45	1,279
1096	1005	P1024	VCP	79	15	1.1%	1,035	5.4	0.38	2,035
1098	1004	1005	VCP	295	15	0.4%	1,035	3.7	0.50	892
1102	1001	1002	VCP	294	15	0.5%	1,041	3.7	0.51	946
1103	981	982	VCP	283	15	1.1%	1,047	4.3	0.45	1,992
1105	982	1001	VCP	423	15	0.5%	1,043	3.7	0.51	1,030
1107	1074	825	SDR 26	69	6	16.8%	14	3.3	0.10	1,020
1112	286	E286	SDR 26	195	8	2.1%	0	0.0	0.02	785
1113	285	286	SDR 26	262	8	1.8%	2	0.7	0.05	726
1123	416	035	SDR 26	90	8	1.1%	123	2.8	0.33	447
1131	JCT-10	284	VCP	197	6	8.4%	7	0.5	0.22	721
CDT-11	JCT-12	500	DIP	317	4	6.8%	97	2.5	1.00	181
CDT-17	p1020	204	CIP	700	8	3.0%	1,069	7.4	1.00	118



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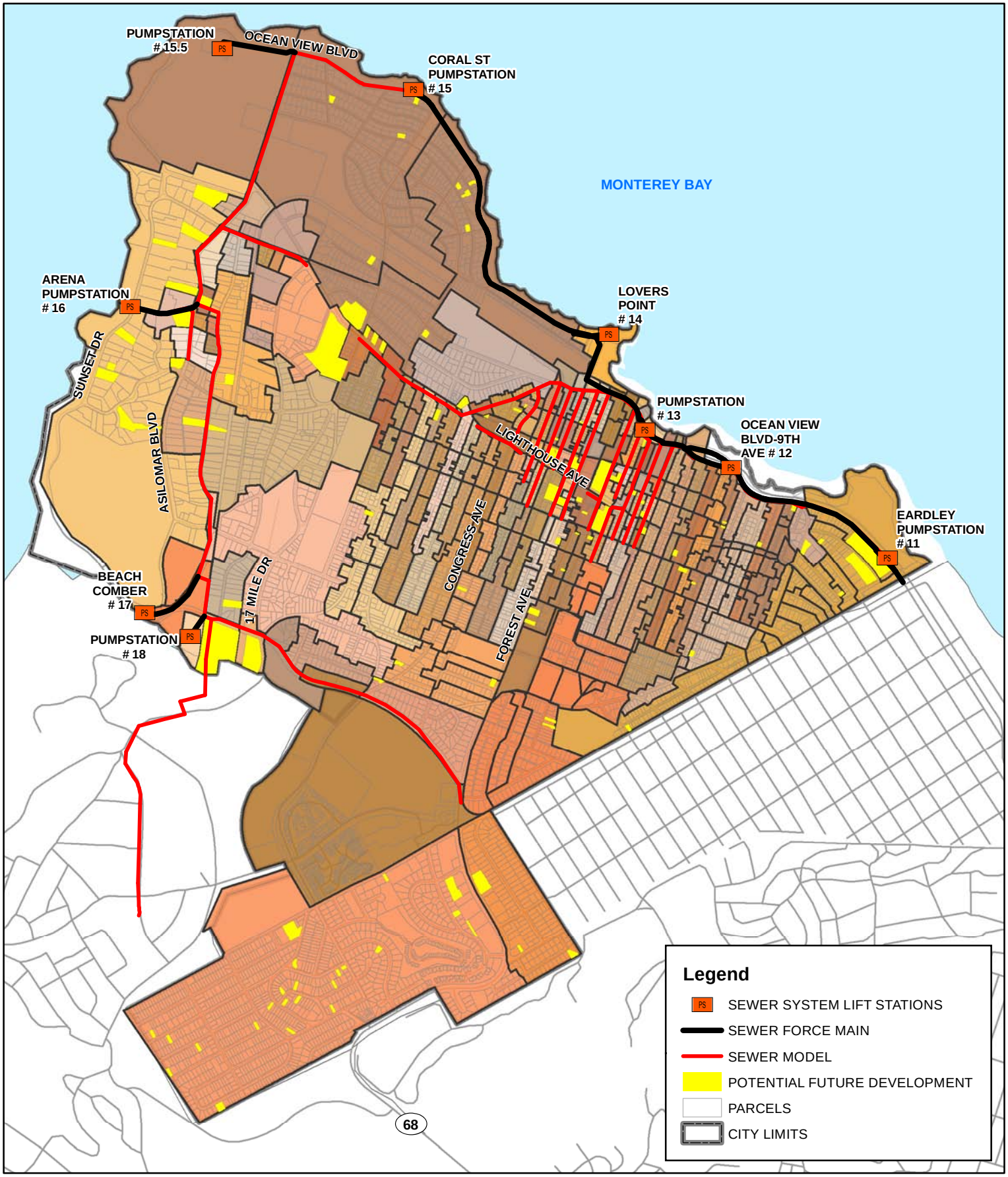
CITY OF PACIFIC GROVE
2014 SEWER MASTER PLAN

NOTES:BASEMAP PROVIDED BY CITY OF PACIFIC GROVE. WALLACE GROUP DID NOT PERFORM BOUNDARY SURVEY SERVICES FOR THIS MAP. NOT A LEGAL DOCUMENT. MAP PRODUCED FEBRUARY 2014.

CITY OF PACIFIC GROVE CA INC. 1889

FIGURE B-1: SEWER FLOW TRIBUTARY BASIN MAP



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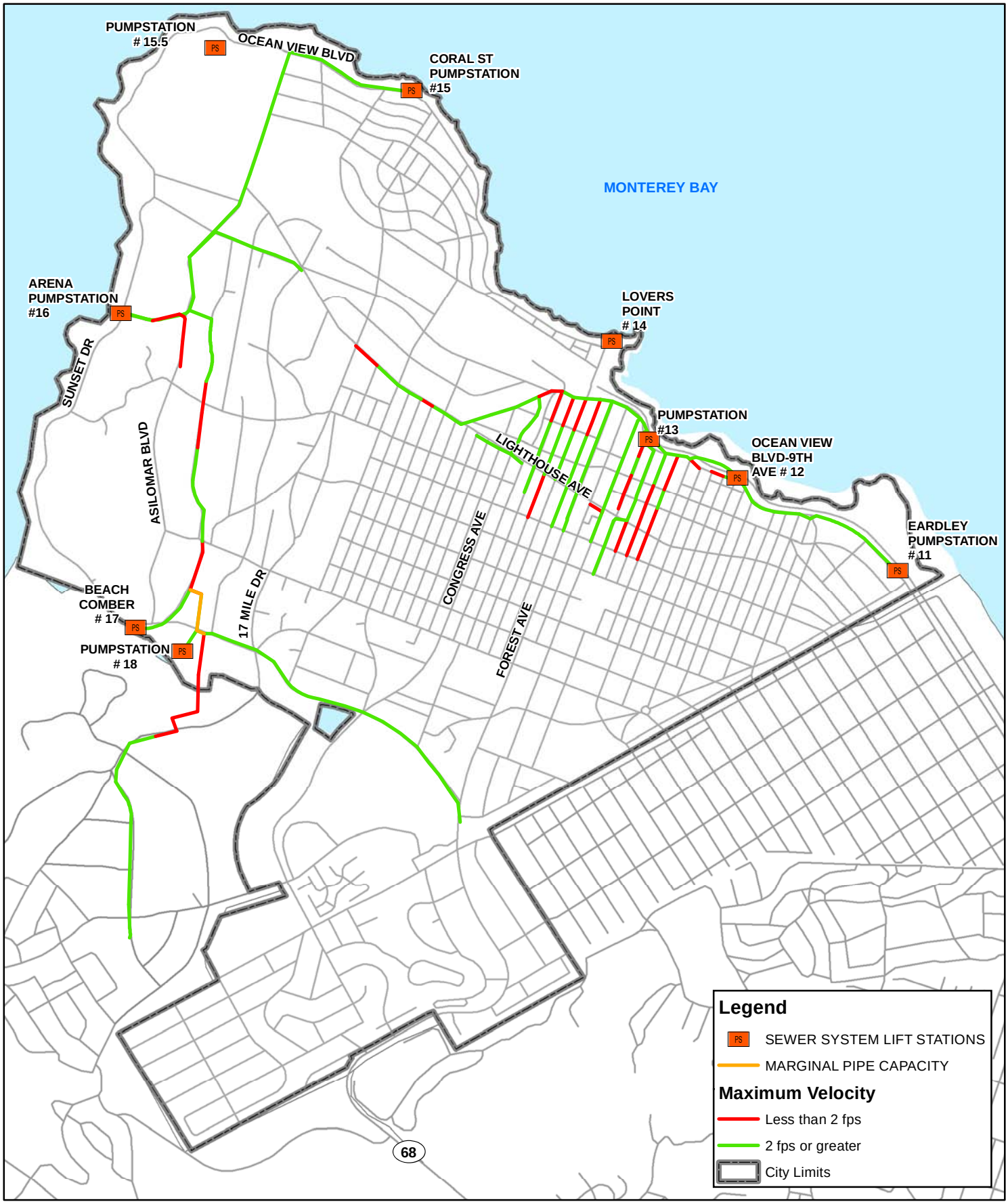
CITY OF PACIFIC GROVE, CA INC. 1889

FIGURE B-2 FUTURE SEWER FLOWS FLOW ALLOCATION MAP



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CITY OF PACIFIC GROVE
2014 SEWER MASTER PLAN

NOTES:BASEMAP PROVIDED BY CITY OF PACIFIC GROVE. WALLACE GROUP DID NOT PERFORM BOUNDARY SURVEY SERVICES FOR THIS MAP. NOT A LEGAL DOCUMENT. MAP PRODUCED FEBRUARY 2014.

FIGURE B-3 EXISTING FLOW CONDITIONS AVERAGE DAY VELOCITIES & MARGINAL PIPE CAPACITY

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APPENDIX C

FLOW METER DATA SUMMARY

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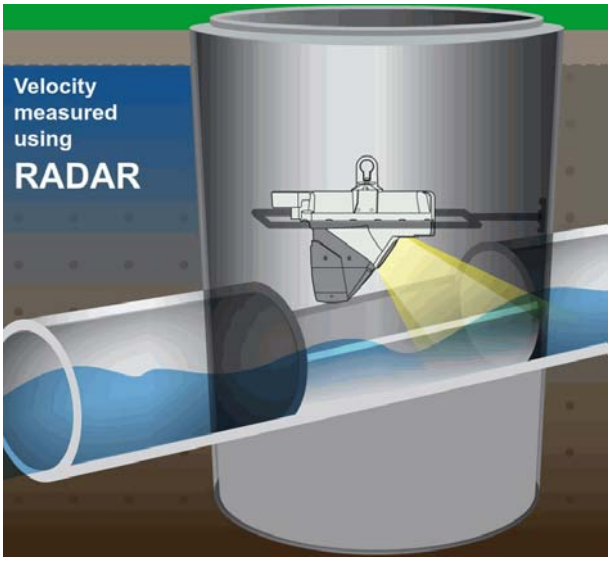
Site Installation Report

Customer:	Wallace Group
Site Name:	MH 303
Site Location	Ocean View and Grand

Access:	System Type:	
street access	Sanitary [X] Storm [ ]	Install Date: 2/2/2013



Manhole Depth (feet)	5.5 feet
Pipe Size (inches)	12 inch
Pipe Condition	good
Manhole Material	concrete
Silt (inches)	0

Hydraulics

Avg Velocity	Avg Measured Level	Multiplier
3.7 fps	2.05 inches	1X

Gas

O2	H2S	CO	LEL
20.5%	0%	0%	0%

Notes

Traffic Safety

Land Use

Residential	Commercial	Industrial	Trunk
X	X		

Meter Site Document

City	Wallace Group
Site Name	MH 303
Site Location	Ocean View and Grand
Access	street access

Temporary Flow Study

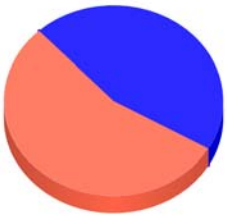
Wallace Group

MH 303

Meter Start Date		From	2/2/2013 12:00:00 AM
Meter Stop Date		To	4/10/2013 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	4.202	2.130	0.271
Maximum	7.753	4.469	1.005
Minimum	2.464	1.081	0.069
Pipe Size		12.000	
Estimated Capacity (mgd)		1.834	
Capacity Used		54.78 %	
Sensor Type		Hach - Flodar	

Estimated Capacity Usage

% Capacity Used Estimated Capacity Available



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6190 Fairmount Ave. Suite E
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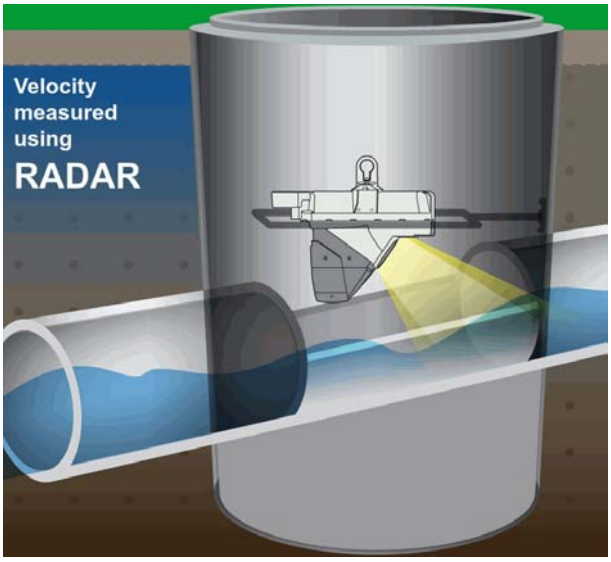
601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705

Site Installation Report

Customer:	Wallace Group
Site Name:	MH 803
Site Location	Lighthouse

Access:	System Type:	
street access	Sanitary [X] Storm [ ]	Install Date: 2/2/2013



Manhole Depth (feet)	13 feet
Pipe Size (inches)	15 inches
Pipe Condition	good
Manhole Material	concrete
Silt (inches)	0

Hydraulics

Avg Velocity	Avg Measured Level	Multiplier
1.22 fps	9.5 inches	1X

Gas

O2	H2S	CO	LEL
20.5%	0%	0%	0%

Notes

Traffic Safety

Land Use

Residential	Commercial	Industrial	Trunk
X	X		

Meter Site Document

City	Wallace Group
Site Name	MH 803
Site Location	Lighthouse
Access	street access

Temporary Flow Study

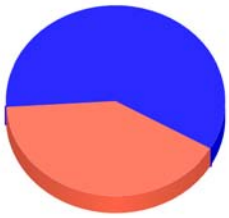
Wallace Group

MH 803

Meter Start Date		From	2/2/2013 12:00:00 AM
Meter Stop Date		To	4/10/2013 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	1.218	8.789	0.606
Maximum	1.840	11.950	1.065
Minimum	0.630	5.660	0.173
Pipe Size		15.000	
Estimated Capacity (mgd)		2.620	
Capacity Used		40.66 %	
Sensor Type		Hach - Flodar	

Estimated Capacity Usage

% Capacity Used Estimated Capacity Available



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Site Report

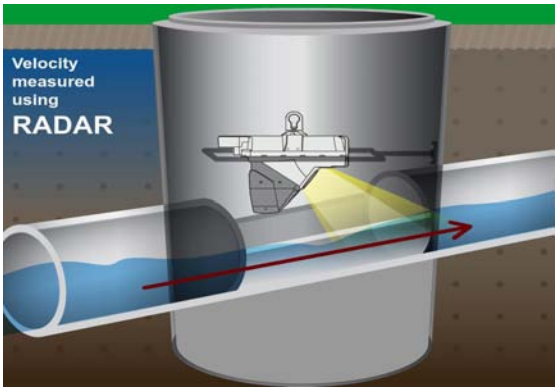
01-20-2014

Wallace Group	Jewell and Asilomar
MH 859	Manhole No.

Access:	System Type:	Install Date: 2/2/2013
Manhole	Sanitary [X] Storm [ ]	

Map

Technology



Traffic Plan

Flow Meter			
Meter Depth ":			
Meter SN ":			
Avg Velocity	Avg Measured Level		Multiplier
4.27 fps	1.4 inches		1X
Gas			
O2	H2S	CO	LEL
20.5%	0%	0%	0%
Notes			
Traffic Safety			
Low Traffic Site			
Land Use			
Residential	Commercial	Industrial	Trunk
X			

Manhole Depth "	3.5 feet
Pipe Size "	8 inches
Inner Pipe Size " (In/Out)	8/8
Pipe Shape	
Pipe Condition	good
Manhole Material	concrete
Silt (inches)	0
Velocity Profile Data	
Velocity Profile Taken	
Sensor Offset	
Sensor Dist. to Crown	
Flow Direction	Downstream
Flow Heading	North

Meter Site Document

Wallace Group

MH 859

Jewell and Asilomar

Site

Manhole Before Install

Installation Process

Installed

Upstream

Downstream

Temporary Flow Study

Wallace Group

MH 859

Meter Start Date		From	2/4/2013 12:00:00 AM
Meter Stop Date		To	4/11/2013 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	4.026	1.438	0.100
Maximum	6.639	2.261	0.284
Minimum	1.935	0.595	0.024
Pipe Size		8.000	
Estimated Capacity (mgd)		1.081	
Capacity Used		26.31 %	
Sensor Type		Hach - Flodar	

Estimated Capacity Usage

% Capacity Used Estimated Capacity Available

Utility Systems, Science and Software

6190 Fairmount Ave. Suite E
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601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705

Meter Site Document

Wallace Group

MH 859

Jewell and Asilomar

Site

Manhole Before Install

Installation Process

Installed

Upstream

Downstream

Temporary Flow Study

Wallace Group

MH 859

Meter Start Date		From	2/4/2013 12:00:00 AM
Meter Stop Date		To	4/11/2013 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	4.026	1.438	0.100
Maximum	6.639	2.261	0.284
Minimum	1.935	0.595	0.024
Pipe Size		8.000	
Estimated Capacity (mgd)		1.081	
Capacity Used		26.31 %	
Sensor Type		Hach - Flodar	

Estimated Capacity Usage

% Capacity Used Estimated Capacity Available

Utility Systems, Science and Software

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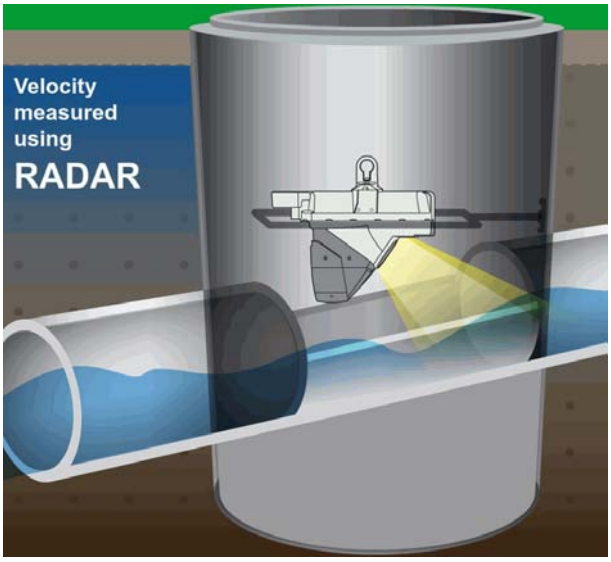
601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705

Site Installation Report

Customer:	Wallace Group
Site Name:	MH 1058
Site Location	14th and Central

Access:	System Type:	
street access	Sanitary [X] Storm [ ]	Install Date: 2/2/2013



Manhole Depth (feet)	8 feet
Pipe Size (inches)	6 inches
Pipe Condition	okay
Manhole Material	concrete
Silt (inches)	0

Hydraulics

Avg Velocity	Avg Measured Level	Multiplier
3.91 fps	1.92 inches	1X

Gas

O2	H2S	CO	LEL
20.5%	0%	0%	0%

Notes

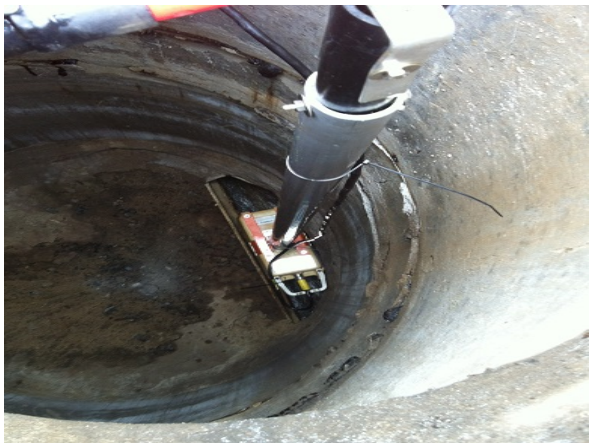
Traffic Safety

Land Use

Residential	Commercial	Industrial	Trunk
X	X		

Meter Site Document

City	Wallace Group
Site Name	MH 1058
Site Location	14th and Central
Access	street access



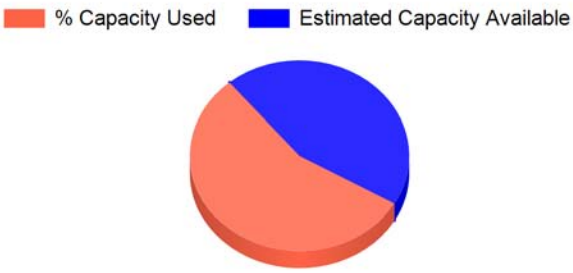
Temporary Flow Study

Wallace Group

MH 1058

Meter Start Date		From	2/2/2013 12:00:00 AM
Meter Stop Date		To	4/10/2013 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	3.686	1.945	0.133
Maximum	5.484	2.622	0.292
Minimum	2.316	1.623	0.067
Pipe Size		6.000	
Estimated Capacity (mgd)		0.524	
Capacity Used		55.63 %	
Sensor Type		Hach - Flodar	

Estimated Capacity Usage



Utility Systems, Science and Software

6190 Fairmount Ave. Suite E
San Diego, CA 92021

601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705

APPENDIX D

SURVEYOR'S REPORT

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Sanitary Sewer Manhole Survey
Surveyor's Report

City of Pacific Grove

August, 2013

Pacific Grove and Pebble Beach, California

Prepared by:

Wallace Group
612 Clarion Court
San Luis Obispo, Ca.
93401

Job No. 1153-0001-0031
Project Manager, George Marchenko, PLS 6964

11/1/2013

PURPOSE OF REPORT

This report is prepared to document the instruments, procedure, and results of a survey of existing sanitary sewer manhole rim and inverts.

LOCATION

The survey was within a portion of the City along with a handful of manholes along Majella Road within Pebble Beach (aka Del Monte Forest).

BACKGROUND

Wallace Group engineering team prepared a map of the City's sewer manholes showing manhole identification numbers, known pipe alignments, and which manholes were priorities for this survey.

SURVEY METHODS

The field survey was performed on August 12 thru 14, 2013. The survey was performed using a Trimble GNSSR8 real time kinematic GPS system. A base station was set at the City Fire Station on Pine Avenue. Static observations were post-processed using the National Geodetic Survey OPUS site to obtain CCS83 coordinates, epoch 2010.0000 (California State Plane Zone 4 Coordinates, epoch 2010.0000).

The benchmark for the survey is Tidal 9. Tidal 9 is a Vertical Order – First Class I benchmark located near the northerly end of the Del Monte Avenue-Lighthouse Avenue tunnel in Monterey, CA. The elevation of Tidal 9 is 25.16 feet NAVD 88 (North American Vertical Datum of 1988).

At each manhole the survey crew painted the City's manhole identification number and the Wallace Group survey point number adjacent to the rim, using white paint. Photographs of the manhole were taken showing the painted numbers, the rim, and photographs down into the manhole to show pipes, pipe directions, and approximate pipe sizes. All photographs were taken 'looking south'. At each manhole both rim and invert measurements were recorded. Where there were laterals or other lines intersecting at a higher invert, those measurements were recorded also.

SURVEY PROCEDURE AND ANALYSIS OF SURVEY RESULTS

The rim and invert elevations were measured using a 24 foot telescopic rod with the RTK antenna (real time kinematic GPS survey) mounted on top. RTK

measurement accuracies are: ± 10mm + 1ppm horizontal and ± 20mm + 1ppm vertical, root mean square. The accuracy will vary according to field conditions and anomalies due to multi path, obstructions (tree canopy and buildings), satellite geometry and atmospheric conditions. By utilizing the telescopic rod we were able to lift the antenna high enough to obtain suitable data from satellites through areas of heavier street trees and amongst downtown buildings. Based on field comparisons, we estimate that this technique resulted in accuracy at the GPS antenna of within the range of ±0.07 feet to ± 0.10 feet RMS depending on field conditions.

Conclusion

With trained personnel RTK is acceptable for performing a survey in a wooded and hilly environment, for a sanitary sewer master plan.

APPENDIX

Table 1: Local Survey Control List

Diagram 1: Sketch of Local Survey Control

Table 2: Survey manhole coordinate list

TABLE 1: Local Survey Control Points, CCS 83, Zone 4, 2010.0000, NAVD 88

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION	LOCATION
1	2121673.20	5705113.92	143.72	SET PK WGWSH	FIRE STATION PARKING LOT
8	2121060.80	5708478.64	114.74	SET 5RBR WG	NEAR LIGHT HOUSE & FIRST
10	2120129.70	5700726.54	97.78	SET PK WGWSH	PUBLIC WORKS YARD

See Diagram 1.

Units are US Survey Feet.

SCALE

0 1500 3000

1 INCH = 1500 FEET

DIAGRAM 1
SANITARY SEWER
MANHOLE SURVEY
LOCAL CONTROL
PACIFIC GROVE,CA

WALLACE GROUP
612 Clarion Court
SAN LUIS OBISPO, CA 93401
T 805 544-4011
F 805 544-4294
www.wallacegroup.us

JOB No. :	1153-01
DRAWING :	1553mh
DRAWN BY:	GM
DATE :	11/1/2013
Sheet 1 of 1	

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2001	2121880.58	5705051.93	128.70	RIM 326
2002	2121880.58	5705052.15	124.09	MH INV
2003	2121936.60	5704907.48	124.05	MH 333
2004	2121936.82	5704907.36	121.25	MH INV
2005	2122483.23	5705119.11	102.03	MH 332
2006	2122483.50	5705118.89	97.78	MH INV
2007	2122760.14	5705224.89	83.54	MH 331
2008	2122759.96	5705225.30	80.93	MH INV
2009	2123113.69	5705360.61	71.13	MH 1008
2010	2123113.72	5705361.09	67.43	MH INV
2011	2123476.57	5705500.98	55.80	MH 330
2012	2123476.81	5705501.34	49.40	MH INV
2013	2123552.45	5705358.40	54.50	MH 339
2014	2123552.37	5705358.40	51.31	MH INV
2015	2123552.98	5705236.57	56.70	MH 348
2016	2123552.30	5705236.66	50.48	MH INV ABAN
2017	2123556.34	5705218.64	57.43	MH 348
2018	2123556.07	5705218.50	53.89	MH INV
2019	2123349.17	5704759.46	81.32	MH 409
2020	2123349.69	5704759.68	75.56	MH INV
2021	2123249.79	5704444.05	93.11	MH 984
2022	2123249.99	5704443.81	89.49	MH INV
2023	2122259.24	5704866.69	108.32	MH 962
2024	2122259.82	5704866.52	104.13	MH INV
2025	2122416.73	5705258.08	104.00	MH 325
2026	2122416.48	5705257.77	98.44	MH INV
2027	2122703.73	5705368.50	84.49	MH 324
2028	2122703.72	5705368.74	80.29	MH INV
2029	2123058.30	5705505.67	70.76	MH 323
2030	2123058.25	5705506.00	66.27	MH INV
2031	2123171.68	5705212.25	67.80	MH 1007
2032	2123171.87	5705211.79	63.74	MH INV
2033	2122573.99	5704985.80	94.26	MH 343
2034	2122574.41	5704986.22	87.85	MH INV
2035	2122310.08	5705404.57	108.55	MH 316
2036	2122309.72	5705404.97	103.92	MH INV
2037	2122640.42	5705531.98	85.01	MH 315
2038	2122640.60	5705532.43	82.52	MH INV
2039	2122942.63	5705808.16	71.03	MH 306
2040	2122943.33	5705808.12	70.95	MH 306
2041	2122942.28	5705808.18	67.53	MH INV
2042	2122599.53	5705673.84	83.41	MH 307
2043	2122599.43	5705673.96	80.93	MH INV

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2044	2122301.78	5705560.00	107.94	MH 308 .14V
2045	2122301.68	5705560.30	107.78	MH 308 .14V
2046	2122300.99	5705559.59	101.65	MH INV .13V
2047	2121625.01	5705718.16	123.79	MH 292
2048	2121624.42	5705718.23	115.42	MH INV
2049	2122011.06	5705867.58	100.84	MH 290
2050	2122011.13	5705867.49	95.54	MH INV
2051	2122279.90	5705971.57	88.69	MH 289
2052	2122280.14	5705971.60	84.09	MH INV
2053	2122541.02	5706071.44	79.13	MH 288
2054	2122540.49	5706071.87	75.49	MH INV
2055	2122876.51	5706202.16	63.27	MH 287
2056	2122876.82	5706202.27	60.48	MH INV
2057	2123177.20	5706320.93	38.00	MH 1017
2058	2123176.97	5706321.35	33.87	MH INV
2059	2122901.22	5706405.48	47.20	MH 1014
2060	2122901.76	5706404.94	41.76	MH INV
2061	2122716.56	5706332.97	62.55	MH 284
2062	2122716.67	5706332.75	58.15	MH INV
2063	2122470.90	5706238.03	75.66	MH 285
2064	2122471.04	5706237.66	70.63	MH INV
2065	2122210.87	5706307.86	69.54	MH 1059
2066	2122210.96	5706307.32	62.65	MH INV
2067	2122157.78	5706293.58	70.17	MH 237
2068	2122157.48	5706293.56	63.61	MH INV
2069	2122157.16	5706293.73	65.55	MH INV2
2070	2121899.11	5706183.13	82.84	MH 239
2071	2121898.64	5706182.84	73.52	MH INV
2072	2121899.32	5706183.03	76.47	MH INV2 WEST
2073	2121504.77	5706031.38	120.89	MH 240
2074	2121504.97	5706030.89	116.29	MH INV
2075	2121559.29	5705885.89	111.48	MH 250
2076	2121559.20	5705885.88	104.46	MH INV
2077	2121886.29	5706012.28	88.74	MH 249
2078	2121886.29	5706012.82	83.72	MH INV
2079	2121918.94	5706043.44	88.51	MH ?
2080	2121918.92	5706044.00	82.02	MH INV
2081	2121919.76	5706043.32	82.87	MH INV2 NWEST
2082	2122045.18	5706074.10	85.54	MH E286
2083	2122045.65	5706073.66	79.41	MH INV
2084	2122227.20	5706142.74	81.38	MH 286
2085	2122226.83	5706143.15	75.34	MH INV
2086	2122416.79	5706385.67	67.69	MH 1058

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2087	2122417.09	5706385.85	58.66	MH INV
2088	2122792.85	5706525.20	49.53	MH 235
2089	2122792.96	5706525.19	44.91	MH INV
2090	2122345.83	5706517.11	60.81	MH 228
2091	2122345.75	5706517.57	57.03	MH INV
2092	2122052.05	5706571.12	72.82	MH 221
2093	2122052.44	5706571.06	67.93	MH INV
2094	2121753.09	5706454.36	91.20	MH 222
2095	2121753.59	5706454.57	86.12	MH INV
2096	2121791.34	5706308.53	89.13	MH 230
2097	2121791.20	5706308.65	82.50	MH INV
2098	2121394.04	5706314.76	130.02	MH 223
2099	2121394.32	5706314.91	124.45	MH INV
2100	2121448.51	5706175.66	126.75	MH 231
2101	2121448.99	5706174.95	121.83	MH INV
2102	2122293.03	5706671.09	59.19	MH 220
2103	2122293.46	5706671.08	51.70	MH INV
2104	2122293.22	5706671.09	54.16	MH INV2 SOUTH
2105	2123636.74	5703244.59	129.62	MH 457
2106	2123636.56	5703244.74	123.29	MH INV
2107	2123538.70	5703393.20	123.11	MH 447
2108	2123538.63	5703393.69	117.59	MH INV
2109	2123450.31	5703542.17	117.38	MH 444
2110	2123450.42	5703542.64	111.54	MH INV
2111	2123355.88	5703686.14	115.77	MH 430
2112	2123356.03	5703686.42	109.45	MH INV
2113	2123266.15	5703835.44	114.41	MH 424
2114	2123266.45	5703835.30	107.51	MH INV
2115	2123176.66	5703981.88	113.36	MH 416
2116	2123176.83	5703981.94	113.33	MH 416 .11V
2117	2123176.25	5703982.27	105.45	MH INV
2118	2123129.09	5704058.16	112.28	MH 035
2119	2123128.86	5704058.81	104.46	MH INV
2120	2122986.85	5704252.43	108.37	MH 401
2121	2122986.34	5704252.77	104.56	MH INV
2122	2122986.38	5704253.26	104.54	MH INV
2123	2122901.74	5704390.43	100.31	MH 396
2124	2122821.96	5704547.99	90.80	MH 388
2125	2122822.07	5704547.59	87.71	MH INV
2126	2122901.70	5704390.73	95.61	MH INV
2127	2122747.74	5704694.08	88.57	MH 352
2128	2122747.37	5704694.96	80.31	MH INV
2129	2122629.90	5704830.56	87.54	MH 353

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2130	2122629.71	5704830.84	83.37	MH INV
2131	2122629.81	5704830.77	84.32	MH INV2 SWEST
2132	2122924.45	5704800.39	78.80	MH 350
2133	2122924.56	5704799.92	73.43	MH INV
2134	2122924.39	5704799.89	74.75	MH INV2 EAST
2135	2123157.74	5704151.67	110.32	MH 410
2136	2123157.78	5704151.63	103.31	MH INV
2137	2123448.32	5705843.10	46.09	MH 314
2138	2123448.91	5705842.84	40.01	MH INV
2139	2123426.61	5705994.57	40.45	MH 305
2140	2123426.78	5705994.70	34.60	MH INV
2141	2123426.57	5705994.30	35.01	MH INV2 SOUTH
2142	2123428.66	5706004.45	40.08	MH RIM
2143	2123428.84	5706003.87	31.23	MH INV
2144	2123349.01	5706179.66	37.77	MH 303
2145	2123349.48	5706180.16	31.68	MH INV
2146	2122708.67	5706946.07	43.45	MH 1019
2147	2122708.96	5706946.65	37.08	MH INV
2148	2122675.93	5706983.92	44.67	MH 204A
2149	2122676.01	5706983.65	39.22	MH INV
2150	2122667.47	5706994.34	44.94	MH 204B
2151	2122667.76	5706994.41	39.78	MH INV
2152	2122667.62	5706994.13	41.59	MH INV NE
2153	2122562.81	5707110.26	47.79	MH 205
2154	2122562.67	5707109.88	44.21	MH INV
2155	2122456.95	5707412.48	35.78	MH 122
2156	2122457.17	5707413.01	28.79	MH INV
2157	2122417.14	5707562.54	31.96	MH 114
2158	2122417.41	5707562.88	24.47	MH INV
2159	2122321.19	5707693.14	27.27	MH 131
2160	2122321.22	5707693.37	18.72	MH INV
2161	2122143.81	5707789.59	28.46	MH 139
2162	2122143.33	5707789.20	20.95	MH INV
2163	2122007.05	5708068.50	29.96	MH 150
2164	2122007.15	5708068.26	23.38	MH INV
2165	2121974.17	5708389.35	33.06	MH 171
2166	2121974.27	5708389.22	25.95	MH INV
2167	2121917.00	5708532.14	32.53	MH 178
2168	2121917.05	5708532.84	28.00	MH INV
2181	2121924.24	5705419.79	123.39	MH 034
2182	2121924.42	5705420.51	118.59	MH INV
2183	2121760.96	5705365.16	133.46	MH 310
2184	2121761.18	5705365.19	127.95	MH INV

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2185	2121209.22	5705751.13	145.48	MH 251
2186	2121209.07	5705750.96	136.96	MH INV
2187	2121817.81	5705215.70	133.75	MH 317
2188	2121817.70	5705215.31	128.83	MH INV
2189	2122097.59	5705710.83	108.07	MH 291
2190	2122097.25	5705710.83	105.12	MH INV
2192	2121990.86	5708229.85	30.31	MH 165
2193	2121991.07	5708230.35	24.55	MH INV
2194	2122429.25	5707612.61	29.30	MH 991
2195	2122429.51	5707612.07	18.04	MH INV
2196	2122526.00	5707267.87	38.76	MH 101
2197	2122526.08	5707268.52	34.40	MH INV
2198	2122759.09	5706674.76	42.28	MH 227
2199	2122759.13	5706674.46	30.55	MH INV
2200	2122759.35	5706674.01	36.93	MH INV2 SOUTH
2201	2122960.82	5706487.33	36.71	MH 1018
2202	2122961.21	5706486.91	23.83	MH INV
2203	2122961.21	5706486.91	23.83	WELL BOT
2204	2123048.27	5706436.52	37.81	MH 986
2205	2123048.27	5706436.52	25.70	MH INV
2206	2123048.27	5706436.52	29.73	MH INV2 WEST
2207	2123048.27	5706436.52	34.03	MH INV2 SOUTH
2209	2123030.33	5706398.28	41.76	MH 1014
2210	2123030.07	5706398.15	35.53	MH INV
2211	2123197.64	5706357.28	36.65	MH 1015
2212	2123197.53	5706357.25	29.44	MH INV
2213	2123197.40	5706356.94	32.53	MH INV2 SOUTH
2214	2123228.42	5706349.11	35.65	LID
2215	2123455.91	5705659.33	54.11	MH 322
2216	2123455.76	5705659.07	46.44	MH INV
2218	2127401.02	5703347.95	17.70	MH 1005
2219	2127400.82	5703347.10	7.89	MH INV
2220	2127437.70	5703055.17	16.93	MH 1004
2221	2127438.10	5703055.76	9.19	MH INV
2222	2127482.26	5702771.16	23.24	MH 1003
2223	2127482.84	5702770.98	14.50	MH INV
2224	2127639.81	5702515.40	25.76	MH 1002
2225	2127640.42	5702515.65	16.32	MH INV
2226	2127800.47	5702268.15	24.30	MH 1001
2227	2127800.23	5702268.40	17.70	MH INV
2228	2127902.75	5701859.02	24.26	MH 982
2229	2127903.23	5701859.50	19.86	MH INV
2230	2127633.01	5701771.70	28.06	MH 981

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2232	2127633.04	5701771.59	22.96	MH INV
2233	2127380.79	5701690.48	29.83	MH 980
2234	2127380.98	5701690.17	24.68	MH INV
2235	2127065.01	5701588.80	41.35	MH 801
2236	2127065.30	5701588.39	36.55	MH INV
2237	2126754.53	5701487.05	64.66	MH 802
2238	2126754.55	5701487.13	59.40	MH INV
2239	2126343.52	5701352.77	74.27	MH 803
2240	2126342.95	5701352.50	59.69	MH INV
2241	2125940.03	5701205.14	75.79	MH 804
2242	2125939.69	5701204.77	60.68	MH INV
2244	2125596.68	5700895.19	74.95	MH 805
2245	2125596.16	5700894.43	61.56	MH INV
2246	2125596.47	5700895.01	68.06	MH INV2 SEAST
2247	2125594.23	5700912.07	74.77	MH 858
2248	2125594.16	5700912.20	68.25	MH INV
2249	2125507.43	5701136.73	81.70	MH 859
2250	2125507.61	5701136.12	77.63	MH INV
2251	2125235.06	5700576.57	68.55	MH 807
2252	2125235.12	5700576.31	63.02	MH INV
2253	2125279.70	5700579.60	67.63	MH RIM
2254	2125278.50	5700579.66	63.35	MH INV
2255	2125274.75	5700572.05	67.77	MH RIM
2256	2125275.09	5700572.13	62.04	MH INV
2257	2125284.61	5700554.10	64.88	MH RIM SD
2258	2125010.58	5700608.50	76.44	MH 808
2259	2125010.08	5700607.98	64.01	MH INV
2260	2124757.14	5700626.25	80.68	MH 809
2261	2124756.34	5700626.81	65.72	MH INV
2262	2124588.06	5700576.05	73.27	MH 810
2263	2124588.09	5700576.09	66.64	MH INV
2265	2124478.90	5700860.07	82.24	MH 811 .2V
2266	2124485.95	5700892.67	83.24	FL GUT
2267	2124479.76	5700859.65	67.94	MH INV .2V
2268	2124063.50	5700853.21	76.68	MH 881
2269	2124063.48	5700853.08	69.08	MH INV
2270	2123673.97	5700796.10	75.87	MH 812
2271	2123673.84	5700795.87	70.88	MH INV
2272	2123676.14	5700790.28	76.10	MH 883
2273	2123676.32	5700789.81	70.05	MH INV
2274	2123278.33	5700734.70	82.38	MH 813
2275	2123278.83	5700734.14	71.04	MH INV .14V
2276	2123279.00	5700733.83	71.11	MH INV

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2277	2122830.00	5700693.42	78.67	AC OPENSKY
2278	2122833.90	5700672.18	78.22	MH 814
2279	2122834.13	5700672.05	71.98	MH INV
2280	2122638.25	5700645.95	77.82	AC OPENSKY
2281	2122623.14	5700642.05	77.97	MH 815
2282	2122623.02	5700641.82	72.68	MH INV
2283	2122418.31	5700614.19	78.22	MH 816
2284	2122418.18	5700614.22	73.31	MH INV
2285	2122033.25	5700759.01	91.22	MH 817
2286	2122032.62	5700758.58	85.07	MH INV
2287	2122032.60	5700758.74	85.07	MH INV
2288	2121873.95	5700747.16	93.77	MH 818
2289	2121874.15	5700747.43	87.16	MH INV
2290	2121627.23	5700741.31	97.24	MH 819
2291	2121627.17	5700740.95	87.24	MH INV
2292	2121489.66	5700742.92	99.10	MH 820
2293	2121489.56	5700742.85	87.72	MH INV
2294	2121016.26	5700553.00	92.65	TC
2295	2120949.07	5700728.49	97.29	AC SNF MH
2296	2120489.52	5700664.57	95.25	MH 500
2297	2120489.43	5700664.66	89.42	MH INV
2298	2120451.50	5700765.71	99.74	MH 501
2299	2120451.06	5700765.91	89.84	MH INV
2300	2120438.23	5700867.70	105.10	MH 634
2301	2120438.15	5700867.93	98.81	MH INV
2302	2120237.66	5701431.03	136.45	MH 636
2303	2120237.74	5701431.00	131.71	MH INV
2304	2123001.55	5705672.81	70.00	MH 1009
2305	2123001.22	5705672.63	66.81	MH INV
2306	2122106.69	5706430.73	68.34	MH 229
2307	2122105.20	5706426.95	60.69	MH INV
2308	2122814.98	5705072.75	80.04	MH 342 .10V
2309	2122814.98	5705073.21	75.55	MH INV
2310	2122815.13	5705073.03	80.21	MH 342
2314	2123108.18	5704923.08	71.92	MH 985
2315	2123107.80	5704923.89	67.39	MH INV
2316	2123244.20	5705022.09	67.94	MH RIM 349
2317	2123244.23	5705022.26	62.86	MH INV
2318	2123346.44	5705070.92	64.50	MH RIM 1044
2319	2123346.79	5705070.45	60.21	MH INV
2320	2123483.26	5705059.06	63.01	MH RIM 351
2321	2123483.13	5705059.74	57.93	MH INV
2322	2123483.88	5705060.74	59.36	MH INV W

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2325	2119442.58	5702795.73	214.81	MH NOT654 642
2326	2119443.19	5702795.98	211.16	MH INV
2327	2119523.00	5702563.16	207.91	MH 641
2328	2119522.75	5702563.42	203.47	MH INV
2329	2119604.38	5702242.38	195.21	MH 640
2330	2119604.80	5702242.93	191.00	MH INV
2331	2119673.64	5702020.46	182.62	MH 639
2332	2119673.69	5702020.78	177.43	MH INV
2333	2119816.14	5701835.19	167.62	MH 638
2334	2119816.52	5701835.33	161.44	MH INV
2335	2120085.14	5701657.81	147.14	MH 637
2336	2120085.26	5701658.07	142.19	MH INV .1V
2337	2120085.24	5701658.07	142.16	MH INV
2338	2118546.97	5699627.74	103.74	MH 509
2339	2118546.81	5699628.12	98.56	MH INV
2340	2118372.15	5699735.22	111.01	MH 510
2341	2118372.10	5699734.79	105.51	MH INV
2342	2118022.90	5699826.93	128.86	MH 511 .13V
2343	2118022.87	5699826.89	128.98	MH 511 .07V
2344	2118022.57	5699827.35	123.63	MH INV
2345	2117520.26	5699811.56	142.70	MH 512 .13V
2346	2117520.19	5699811.51	142.79	MH 512 .08V
2347	2117520.16	5699811.68	136.38	MH INV
2348	2116970.91	5699794.44	156.42	MH 513
2349	2116970.79	5699794.82	150.07	MH INV .13V
2350	2116970.84	5699794.63	150.11	MH INV
2351	2116542.10	5699807.56	180.95	MH 514 .08V
2352	2116542.21	5699807.12	175.42	MH INV .15V
2353	2116542.30	5699807.12	175.36	MH INV .09V
2354	2119200.58	5700286.29	109.71	MH ?
2355	2119130.86	5699990.82	105.02	MH RIM 679?
2356	2125410.36	5701384.67	94.33	MH RIM .3V
2357	2125410.39	5701384.71	94.33	MH RIM .1V 860
2358	2125409.99	5701385.30	88.58	MH INV .1V
2359	2125409.91	5701385.35	88.54	MH INV .1V
2360	2125364.92	5701503.95	98.12	MH 861
2361	2125364.77	5701503.63	93.63	MH INV
2362	2125300.64	5701668.95	106.26	MH 862
2363	2125300.35	5701668.76	101.32	MH INV
2364	2125204.54	5701915.47	118.18	MH 863
2365	2125204.15	5701915.40	113.09	MH INV
2366	2125101.79	5702011.16	125.20	MH 864
2367	2125101.92	5702010.98	117.70	MH INV

		TABLE 2		
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
2368	2125101.92	5702010.98	118.70	MH INV2 +1.0
2369	2124137.30	5702707.58	160.10	MH 464
2370	2124137.17	5702707.51	153.47	MH INV
2371	2124137.14	5702707.83	155.86	MH INV2 SOUTH
2372	2123886.91	5702976.51	140.55	MH 460
2373	2123887.05	5702976.05	134.54	MH INV
2374	2124555.04	5699715.73	30.59	MH 825
2375	2124555.12	5699715.62	17.91	MH INV
2376	2124555.18	5699715.64	17.89	MH INV
2377	2124555.42	5699715.59	25.30	MH INV2 EAST
2378	2124542.00	5699782.71	32.02	MH 1074
2379	2124542.06	5699783.11	29.30	MH INV
2380	2124456.72	5700102.70	51.55	MH 895
2381	2124456.68	5700102.93	45.39	MH INV
2382	2124480.68	5700516.69	70.28	MH 897
2383	2124480.99	5700517.05	55.46	MH INV
2385	2124173.80	5700485.57	63.61	MH 898
2386	2124173.81	5700485.80	56.64	MH INV
2387	2123869.25	5700455.07	61.80	MH 899
2388	2123869.49	5700455.05	58.11	MH INV
2389	2120567.39	5700233.68	74.37	MH SSCO
2390	2120570.04	5700231.59	74.41	MH 1054
2391	2120570.23	5700231.64	69.65	MH INV
2392	2118798.21	5703640.13	254.72	MH 646
2393	2118798.06	5703639.66	250.21	MH INV
2394	2118634.16	5703770.80	270.06	MH 647
2395	2118634.13	5703770.70	265.60	MH INV
2396	2118454.12	5703894.82	282.59	MH 648
2397	2118454.07	5703894.54	278.02	MH INV
2398	2118274.59	5704019.05	294.77	MH 677
2399	2118274.48	5704019.08	289.83	MH INV
2400	2118031.33	5704043.97	308.54	MH 649
2401	2118031.34	5704043.82	305.23	MH INV
2402	2118995.32	5703492.89	238.40	MH 645
2403	2118994.71	5703492.86	234.49	MH INV
2404	2118995.31	5703492.74	234.62	MH INV
2405	2119165.14	5703284.05	229.12	MH 644
2406	2119164.99	5703283.86	224.63	MH INV
2407	2119316.55	5703051.01	222.00	MH 643
2408	2119316.22	5703051.06	217.63	MH INV
2409	2119916.43	5700689.20	95.14	MH 502?
2410	2119915.89	5700689.54	90.92	MH INV
2411	2119916.14	5700689.07	91.95	MH INV2 EAST

		TABLE 2		
POINT	**NORTHING**	**EASTING**	**ELEVATION**	**DESCRIPTION**
2412	2120167.39	5700727.35	98.22	CKPT11
2413	2120352.93	5701114.06	122.17	MH 635
2414	2120352.78	5701114.04	117.94	MH INV
2416	2121005.58	5700580.89	93.29	MH 821
2417	2121005.78	5700580.99	88.29	MH INV
2418	2121006.24	5700580.56	89.91	MH INV2 SWEST
2424	2121082.25	5709745.19	27.41	MH RIM
2425	2121088.64	5709743.05	27.13	MH RIM
2426	2121097.12	5709737.89	26.97	MH RIM
2427	2121113.04	5709729.70	26.51	MH RIM
2428	2121110.31	5709751.10	26.31	MH RIM
2429	2120927.72	5709863.85	35.12	SNF MH
2430	2120676.37	5709056.98	79.07	MH RIM
2431	2120589.56	5708904.42	93.13	MH RIM 015

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APPENDIX E

PRELIMINARY COST ESTIMATES

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NEAR TERM PROJECT NO. 1: 17 MILE SEWER LINE UPGRADE PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates	Length (Ft)	2,900		
LABOR					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	29	**$387,000**
MATERIALS					
12" SDR 35		$15/LF			$43,500
Manholes		(10) MH's R&R			$50,000
Misc Sand Backfill		Estimated Import			$15,000
Cold Mix		Temporary Asphalt			$12,500
RESTORATION					
Paving		Tons*Cost			$66,000
Class II Base		Cubic Yards*Cost			$11,000
Grinding		Estimated $2000/Day Min.			$6,000
Misc. Striping		Estimated Cost			$5,000
SUBTOTAL (B)					**$209,000**
		BASELINE CONSTRUCTION COST (A+B)			$805,000
	Add	10%	TRAFFIC CONTROL		$80,500
	Add	10%	REMOVE EXISTING PIPE		$80,500
	Add	10%	MOB/DEMOB COST		$80,500
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$966,000
	Add	20%	CONTINGENCY		$194,000
		ESTIMATED CONSTRUCTION COST			**$1,160,000**
	Add	40%	ENGINEERING, CM, LEGAL		$464,000
			PROJECT TOTAL		**$1,624,000**

NEAR TERM PROJECT NO. 2: OCEANVIEW & MERMAID SEWER LINE REPLACEMENT PRELIMINARY OPINION OF PROBABLE COST PART 1 OF 5: OCEANVIEW BLVD TO SEA PALM AVE					
	Hourly Rates	Length (Ft)	1,850		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	19	**$247,000**
MATERIALS					
8" SDR 35		$8/LF			$14,800
Manholes		(6) MH's R&R @ $5,000/Ea			$30,000
Misc Sand Backfill		Estimated Import	1644	Tons @ $25/Ton	$41,100
Cold Mix		Temporary Asphalt	137	Tons @ $100/Ton	$13,700
RESTORATION					
Paving		Tons*Cost	343	Tons @ $125/Ton	$42,875
Class II Base		Cubic Yards*Cost	171	$40/Cubic Yard	$6,840
Grinding		Estimated $2000/Day Min.			$4,000
Misc. Striping		Estimated Cost			$2,500
SUBTOTAL (B)					**$156,000**
		BASELINE CONSTRUCTION COST (A+B)			$559,000
	Add	10%	TRAFFIC CONTROL		$55,900
	Add	10%	REMOVE EXISTING PIPE		$55,900
	Add	10%	MOB/DEMOB COST		$55,900
	Add	$15/LF	ADDITIONAL DEWATERING		$27,750
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$754,450
	Add	20%	CONTINGENCY		$151,000
		ESTIMATED CONSTRUCTION COST			**$906,000**
	Add	40%	ENGINEERING, CM, LEGAL		$363,000
			PROJECT TOTAL		**$1,269,000**

NEAR TERM PROJECT NO. 2: OCEANVIEW & MERMAID SEWER LINE REPLACEMENT PRELIMINARY OPINION OF PROBABLE COST PART 2 OF 5: MERMAID TO OCEANVIEW BLVD					
	Hourly Rates	Length (Ft)	150		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	2	**$25,000**
MATERIALS					
8" SDR 35		$8/LF			$1,200
Manholes		(0) MH's R&R @ $5,000/Ea			$0
Misc Sand Backfill		Estimated Import	133	Tons @ $25/Ton	$3,325
Cold Mix		Temporary Asphalt	11	Tons @ $100/Ton	$1,100
RESTORATION					
Paving		Tons*Cost	28	Tons @ $125/Ton	$3,500
Class II Base		Cubic Yards*Cost	14	$40/Cubic Yard	$560
Grinding		Estimated $2000/Day Min.			$2,000
Misc. Striping		Estimated Cost			$500
SUBTOTAL (B)					**$13,000**
		BASELINE CONSTRUCTION COST (A+B)			$51,000
	Add	10%	TRAFFIC CONTROL		$5,100
	Add	10%	REMOVE EXISTING PIPE		$5,100
	Add	10%	MOB/DEMOB COST		$5,100
	Add	$15/LF	ADDITIONAL DEWATERING		$2,250
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$68,550
	Add	20%	CONTINGENCY		$14,000
		ESTIMATED CONSTRUCTION COST			**$83,000**
	Add	40%	ENGINEERING, CM, LEGAL		$33,000
			PROJECT TOTAL		**$116,000**

NEAR TERM PROJECT NO. 2: OCEANVIEW & MERMAID SEWER LINE REPLACEMENT PRELIMINARY OPINION OF PROBABLE COST PART 3 OF 5: MERMAID TO OCEANVIEW BLVD					
	Hourly Rates	Length (Ft)	100		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	2	**$23,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		$8/LF			$800
Manholes			0	$ 5,000.00	$0
Misc Sand Backfill		Estimated Import	89	$ 25.00	$2,222
Cold Mix		Temporary Asphalt	11	$ 100.00	$1,100
RESTORATION					
Paving		Tons*Cost	28	$ 125.00	$3,472
Class II Base		Cubic Yards*Cost	14	$ 40.00	$556
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$500
SUBTOTAL (B)					**$11,000**
		BASELINE CONSTRUCTION COST (A+B)			$45,000
	Add	10%	TRAFFIC CONTROL		$4,500
	Add	10%	REMOVE EXISTING PIPE		$4,500
	Add	10%	MOB/DEMOB COST		$4,500
	Add	$15/LF	ADDITIONAL DEWATERING		$1,500
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$60,000
	Add	10%	CONTINGENCY		$12,000
		ESTIMATED CONSTRUCTION COST			**$72,000**
	Add	30%	ENGINEERING, CM, LEGAL		$29,000
			PROJECT TOTAL		**$101,000**

NEAR TERM PROJECT NO. 2: OCEANVIEW & MERMAID SEWER LINE REPLACEMENT PRELIMINARY OPINION OF PROBABLE COST PART 4 OF 5: MARINE STREET TO BALBOA AVENUE					
	Hourly Rates	Length (Ft)	2,250		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	23	**$300,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)	2250	$ 8.00	$18,000
Manholes			10	$ 5,000.00	$50,000
Misc Sand Backfill		Estimated Import	2000	$ 25.00	$50,000
Cold Mix		Temporary Asphalt	167	$ 100.00	$16,667
RESTORATION					
Paving		Tons*Cost	417	$ 125.00	$52,083
Class II Base		Cubic Yards*Cost	208	$ 40.00	$8,333
Grinding		Estimated $2000/Day Min.	2	$ 2,000.00	$4,000
Misc. Striping		Estimated Cost			$1,500
SUBTOTAL (B)					**$201,000**
		BASELINE CONSTRUCTION COST (A+B)			$702,000
	Add	10%	TRAFFIC CONTROL		$70,200
	Add	10%	REMOVE EXISTING PIPE		$70,200
	Add	10%	MOB/DEMOB COST		$70,200
	Add	$15/LF	ADDITIONAL DEWATERING		$33,750
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$946,350
	Add	10%	CONTINGENCY		$190,000
		ESTIMATED CONSTRUCTION COST			**$1,137,000**
	Add	40%	ENGINEERING, CM, LEGAL		$455,000
			PROJECT TOTAL		**$1,592,000**

NEAR TERM PROJECT NO. 2: OCEANVIEW & MERMAID SEWER LINE REPLACEMENT PRELIMINARY OPINION OF PROBABLE COST PART 5 OF 5: BALBOA AVE TO LIFT STATION 15					
	Hourly Rates	Length (Ft)	1,950		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	20	**$260,000**
MATERIALS					
12" SDR 35		$15/LF			$29,250
Manholes		(10) MH's R&R @ $5,000/Ea			$25,000
Misc Sand Backfill		Estimated Import	1733	Tons @ $25/Ton	$43,325
Cold Mix		Temporary Asphalt	144	Tons @ $100/Ton	$14,400
RESTORATION					
Paving		Tons*Cost	361	Tons @ $125/Ton	$45,125
Class II Base		Cubic Yards*Cost	181	$40/Cubic Yard	$7,240
Grinding		Estimated $2000/Day Min.			$4,000
Misc. Striping		Estimated Cost			$2,500
SUBTOTAL (B)					**$171,000**
		BASELINE CONSTRUCTION COST (A+B)			$602,000
	Add	10%	TRAFFIC CONTROL		$60,200
	Add	10%	REMOVE EXISTING PIPE		$60,200
	Add	10%	MOB/DEMOB COST		$60,200
	Add	$15/LF	ADDITIONAL DEWATERING		$29,250
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$811,850
	Add	20%	CONTINGENCY		$163,000
		ESTIMATED CONSTRUCTION COST			**$975,000**
	Add	40%	ENGINEERING, CM, LEGAL		$390,000
			PROJECT TOTAL		**$1,365,000**

NEAR TERM PROJECT NO. 3: ASILOMAR SEWER LINE UPGRADE PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates	Length (Ft)	2,150		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	22	**$287,000**
MATERIALS			Unit	Unit Cost	
15" SDR 35		Length (Ft)	2150	$ 19.00	$40,850
Manholes			7	$ 5,000.00	$35,000
Misc Sand Backfill		Estimated Import	1593	$ 25.00	$39,815
Cold Mix		Temporary Asphalt	80	$ 100.00	$7,963
RESTORATION					
Paving		Tons*Cost	398	$ 125.00	$49,769
Class II Base		Cubic Yards*Cost	199	$ 40.00	$7,963
Grinding		Estimated $2000/Day Min.	2	$ 2,000.00	$4,000
Misc. Striping		Estimated Cost			$1,500
SUBTOTAL (B)					**$187,000**
		BASELINE CONSTRUCTION COST (A+B)			$661,000
	Add	10%	TRAFFIC CONTROL		$66,100
	Add	10%	REMOVE EXISTING PIPE		$66,100
	Add	10%	MOB/DEMOB COST		$66,100
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$32,250
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$891,550
	Add	10%	CONTINGENCY		$179,000
		ESTIMATED CONSTRUCTION COST			**$1,071,000**
	Add	40%	ENGINEERING, CM, LEGAL		$429,000
			PROJECT TOTAL		**$1,500,000**

NEAR TERM PROJECT NO. 4: CROCKER & ASILOMAR MANHOLE REPLACEMENT PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates	Length (Ft)	23	Manholes	
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	0 hours per day	$0	0	**$0**
MATERIALS			Unit	Unit Cost	
15" SDR 35		Length (Ft)	0	$ 19.00	$0
Manholes			23	$ 12,000.00	$276,000
Misc Sand Backfill		Estimated Import	0	$ 25.00	$0
Cold Mix		Temporary Asphalt	0	$ 100.00	$0
RESTORATION					
Paving		Tons*Cost	0	$ 125.00	$0
Class II Base		Cubic Yards*Cost	0	$ 40.00	$0
Grinding		Estimated $2000/Day Min.	0	$ 2,000.00	$0
Misc. Striping		Estimated Cost			$0
SUBTOTAL (B)					**$276,000**
		BASELINE CONSTRUCTION COST (A+B)			$552,000
	Add	10%	TRAFFIC CONTROL		$55,200
	Add	10%	REMOVE EXISTING PIPE		$55,200
	Add	10%	MOB/DEMOB COST		$55,200
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$717,600
	Add	10%	CONTINGENCY		$144,000
		ESTIMATED CONSTRUCTION COST			**$862,000**
	Add	40%	ENGINEERING, CM, LEGAL		$345,000
			PROJECT TOTAL		**$1,207,000**

NEAR TERM PROJECT NO. 5: 14TH STREET, SINEX TO PINE SEWER LINE CONSOLIDATION PRELIMINARY OPINION OF PROBABLE COST PART 1 OF 3: SINEX STREET TO JUNIPERO AVENUE					
	Hourly Rates	Length (Ft)	850		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	9	**$114,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)	850	$ 8.00	$6,800
Manholes			3	$ 5,000.00	$15,000
Misc Sand Backfill		Estimated Import	378	$ 25.00	$9,444
Cold Mix		Temporary Asphalt	19	$ 100.00	$1,889
RESTORATION					
Paving		Tons*Cost	157	$ 125.00	$19,676
Class II Base		Cubic Yards*Cost	79	$ 40.00	$6,296
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$1,000
SUBTOTAL (B)					**$63,000**
		BASELINE CONSTRUCTION COST (A+B)			$240,000
	Add	10%	TRAFFIC CONTROL		$24,000
	Add	10%	REMOVE EXISTING PIPE		$24,000
	Add	10%	MOB/DEMOB COST		$24,000
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$312,000
	Add	10%	CONTINGENCY		$63,000
		ESTIMATED CONSTRUCTION COST			**$375,000**
	Add	40%	ENGINEERING, CM, LEGAL		$150,000
			PROJECT TOTAL		**$525,000**

NEAR TERM PROJECT NO. 5: 14TH STREET, SINEX TO PINE SEWER LINE CONSOLIDATION PRELIMINARY OPINION OF PROBABLE COST PART 2 OF 3: JUNIPERO AVE TO PINE AVE					
	Hourly Rates	Length (Ft)	750		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	8	**$100,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)	750	$ 8.00	$6,000
Manholes			3	$ 5,000.00	$15,000
Misc Sand Backfill		Estimated Import	333	$ 25.00	$8,333
Cold Mix		Temporary Asphalt	17	$ 100.00	$1,667
RESTORATION					
Paving		Tons*Cost	139	$ 125.00	$17,361
Class II Base		Cubic Yards*Cost	69	$ 40.00	$2,778
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$1,000
SUBTOTAL (B)					**$55,000**
		BASELINE CONSTRUCTION COST (A+B)			$210,000
	Add	10%	TRAFFIC CONTROL		$21,000
	Add	10%	REMOVE EXISTING PIPE		$21,000
	Add	10%	MOB/DEMOB COST		$21,000
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$273,000
	Add	10%	CONTINGENCY		$55,000
		ESTIMATED CONSTRUCTION COST			**$328,000**
	Add	30%	ENGINEERING, CM, LEGAL		$132,000
			PROJECT TOTAL		**$460,000**

NEAR TERM PROJECT NO. 5: 14TH STREET, SINEX TO PINE SEWER LINE CONSOLIDATION PRELIMINARY OPINION OF PROBABLE COST PART 3 OF 3: GIBSON STREET TO JUNIPERO AVENUE					
	Hourly Rates		Abandon and Tie-Over to new sewermain		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	0 hours per day	$0	n/a	n/a
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)		$ 8.00	$0
Manholes				$ 5,000.00	$0
Misc Sand Backfill		Estimated Import		$ 25.00	$0
Cold Mix		Temporary Asphalt		$ 100.00	$0
RESTORATION					
Paving		Tons*Cost		$ 125.00	$0
Class II Base		Cubic Yards*Cost		$ 40.00	$0
Grinding		Estimated $2000/Day Min.		$ 2,000.00	$0
Misc. Striping		Estimated Cost			
SUBTOTAL (B)					**$0**
		BASELINE CONSTRUCTION COST (A+B)			$0
	Add	10%	TRAFFIC CONTROL		$0
	Add	10%	REMOVE EXISTING PIPE		$0
	Add	10%	MOB/DEMOB COST		$0
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$25,000
	Add	10%	CONTINGENCY		$5,000
		ESTIMATED CONSTRUCTION COST			**$30,000**
	Add	40%	ENGINEERING, CM, LEGAL		$12,000
			PROJECT TOTAL		**$42,000**

NEAR TERM PROJECT NO 6: HILLCREST PRELIMINARY OPINION OF PROBABLE COST PART 1 OF 2: HILLCREST AVENUE TO SUNSET AVENUE					
	Hourly Rates	Length (Ft)	2,950		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	30	**$393,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)	2950	$ 8.00	$23,600
Manholes			9	$ 5,000.00	$45,000
Misc Sand Backfill		Estimated Import	1311	$ 25.00	$32,778
Cold Mix		Temporary Asphalt	66	$ 100.00	$6,556
RESTORATION					
Paving		Tons*Cost	546	$ 125.00	$68,287
Class II Base		Cubic Yards*Cost	273	$ 40.00	$10,926
Grinding		Estimated $2000/Day Min.	2	$ 2,000.00	$4,000
Misc. Striping		Estimated Cost			$1,500
SUBTOTAL (B)					**$193,000**
		BASELINE CONSTRUCTION COST (A+B)			$779,000
	Add	10%	TRAFFIC CONTROL		$77,900
	Add	10%	REMOVE EXISTING PIPE		$77,900
	Add	10%	MOB/DEMOB COST		$77,900
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$1,012,700
	Add	10%	CONTINGENCY		$203,000
		ESTIMATED CONSTRUCTION COST			**$1,216,000**
	Add	40%	ENGINEERING, CM, LEGAL		$487,000
			PROJECT TOTAL		**$1,703,000**

NEAR TERM PROJECT NO 6: HILLCREST PRELIMINARY OPINION OF PROBABLE COST PART 2 OF 2: SUNSET & FOREST AVENUE TO 19TH STREET & MARINO PINES ROAD					
	Hourly Rates	Length (Ft)	1,300		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	13	**$174,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)	1300	$ 8.00	$10,400
Manholes			7	$ 5,000.00	$35,000
Misc Sand Backfill		Estimated Import	578	$ 25.00	$14,444
Cold Mix		Temporary Asphalt	29	$ 100.00	$2,889
RESTORATION					
Paving		Tons*Cost	241	$ 125.00	$30,093
Class II Base		Cubic Yards*Cost	120	$ 40.00	$4,815
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$1,000
SUBTOTAL (B)					**$101,000**
		BASELINE CONSTRUCTION COST (A+B)			$376,000
	Add	10%	TRAFFIC CONTROL		$37,600
	Add	10%	REMOVE EXISTING PIPE		$37,600
	Add	10%	MOB/DEMOB COST		$37,600
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$488,800
	Add	10%	CONTINGENCY		$98,000
		ESTIMATED CONSTRUCTION COST			**$587,000**
	Add	40%	ENGINEERING, CM, LEGAL		$235,000
			PROJECT TOTAL		**$822,000**

NEAR TERM PROJECT NO. 7: 14TH STREET, LIGHTHOUSE TO CENTRAL PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates	Length (Ft)	600		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	6	**$80,000**
MATERIALS			Unit	Unit Cost	
12" SDR 35		Length (Ft)	600	$ 15.00	$9,000
Manholes			5	$ 5,000.00	$25,000
Misc Sand Backfill		Estimated Import	267	$ 25.00	$6,667
Cold Mix		Temporary Asphalt	13	$ 100.00	$1,333
RESTORATION					
Paving		Tons*Cost	111	$ 125.00	$13,889
Class II Base		Cubic Yards*Cost	56	$ 40.00	$2,222
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$1,000
SUBTOTAL (B)					**$62,000**
		BASELINE CONSTRUCTION COST (A+B)			$204,000
	Add	10%	TRAFFIC CONTROL		$20,400
	Add	10%	REMOVE EXISTING PIPE		$20,400
	Add	10%	MOB/DEMOB COST		$20,400
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$265,200
	Add	10%	CONTINGENCY		$54,000
		ESTIMATED CONSTRUCTION COST			**$320,000**
	Add	40%	ENGINEERING, CM, LEGAL		$128,000
			PROJECT TOTAL		**$448,000**

NEAR TERM PROJECT NO 8: CARMEL PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates	Length (Ft)	1,900		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	19	**$254,000**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)	1900	$ 8.00	$15,200
Manholes			6	$ 5,000.00	$30,000
Misc Sand Backfill		Estimated Import	844	$ 25.00	$21,111
Cold Mix		Temporary Asphalt	42	$ 100.00	$4,222
RESTORATION					
Paving		Tons*Cost	352	$ 125.00	$43,981
Class II Base		Cubic Yards*Cost	176	$ 40.00	$7,037
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$1,000
SUBTOTAL (B)					**$125,000**
		BASELINE CONSTRUCTION COST (A+B)			$504,000
	Add	10%	TRAFFIC CONTROL		$50,400
	Add	10%	REMOVE EXISTING PIPE		$50,400
	Add	10%	MOB/DEMOB COST		$50,400
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$655,200
	Add	10%	CONTINGENCY		$132,000
		ESTIMATED CONSTRUCTION COST			**$788,000**
	Add	40%	ENGINEERING, CM, LEGAL		$316,000
			PROJECT TOTAL		**$1,104,000**

NEAR TERM PROJECT NO. 9: HIGHWAY 68 PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates		Protect exposed pipe from damage		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	0 hours per day	$0	0	**$0**
MATERIALS			Unit	Unit Cost	
8" SDR 35		Length (Ft)		$ 8.00	$0
Manholes				$ 5,000.00	$0
Misc Sand Backfill		Estimated Import		$ 25.00	$0
Cold Mix		Temporary Asphalt		$ 100.00	$0
RESTORATION					
Paving		Tons*Cost		$ 125.00	$0
Class II Base		Cubic Yards*Cost		$ 40.00	$0
Grinding		Estimated $2000/Day Min.		$ 2,000.00	$0
Misc. Striping		Estimated Cost			
SUBTOTAL (B)					**$0**
		BASELINE CONSTRUCTION COST (A+B)			$0
	Add	10%	TRAFFIC CONTROL		$0
	Add	10%	REMOVE EXISTING PIPE		$0
	Add	10%	MOB/DEMOB COST		$0
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$35,000
	Add	10%	CONTINGENCY		$7,000
		ESTIMATED CONSTRUCTION COST			**$42,000**
	Add	40%	ENGINEERING, CM, LEGAL		$17,000
			PROJECT TOTAL		**$59,000**

LONG TERM PROJECT NO. 1: SUNSET DRIVE AND CROCKER AVE PRELIMINARY OPINION OF PROBABLE COST					
	Hourly Rates	Length (Ft)	750		
LABOR, EQUIP, RENTALS					
Foreman	$60				
Operator (350 Ex)	$58				
Operator (330Ex)	$58				
Operator (Loader)	$58				
Operator (BH)	$58				
Labor	$43				
Labor	$43				
Labor	$43				
Labor	$43				
Teamster (Water Truck)	$46				
EQUIPMENT					
Cat 350 Excavator	$195	Mainline			
Cat 330 Excavator/compactor	$100	Backfill and compact			
Cat 936 Loader	$80	Backfill and compact			
Cat 466 Backhoe	$65	Pothole utilities			
Water Truck	$65	Backfill and compact			
Pick-up	$25	Tools			
Pick-up	$25	Tools			
RENTALS					
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off			
Dumptruck	$100	Haul-off	Daily Cost for	Est. Number of Days to	
Trench Boxes	$200	Shoring	Pipeline Installation	Install Pipeline	
SUBTOTAL (A)	$1,665	8 hours per day	$13,320	8	**$100,000**
MATERIALS			Unit	Unit Cost	
15" SDR 35		Length (Ft)	750	$ 19.00	$14,250
Manholes			4	$ 5,000.00	$20,000
Misc Sand Backfill		Estimated Import	333	$ 25.00	$8,333
Cold Mix		Temporary Asphalt	17	$ 100.00	$1,667
RESTORATION					
Paving		Tons*Cost	139	$ 125.00	$17,361
Class II Base		Cubic Yards*Cost	69	$ 40.00	$2,778
Grinding		Estimated $2000/Day Min.	1	$ 2,000.00	$2,000
Misc. Striping		Estimated Cost			$1,000
SUBTOTAL (B)					**$68,000**
		BASELINE CONSTRUCTION COST (A+B)			$236,000
	Add	10%	TRAFFIC CONTROL		$23,600
	Add	10%	REMOVE EXISTING PIPE		$23,600
	Add	10%	MOB/DEMOB COST		$23,600
	Add	$15/LF	ADDITIONAL DEWATERING	(OPTIONAL)	$0
		ESTIMATED CONSTRUCTION COST SUBTOTAL			$306,800
	Add	10%	CONTINGENCY		$62,000
		ESTIMATED CONSTRUCTION COST			**$369,000**
	Add	30%	ENGINEERING, CM, LEGAL		$148,000
			PROJECT TOTAL		**$517,000**