Long Beach Water
Exceptional Water · Exceptional Service

1800 E. Wardlow Road, Long Beach, CA 90807-4931
562.570.2300 | lbwater.org

Board of Water Commissioners
October 10, 2019 Board Meeting

CHRISTOPHER J. GARNER, General Manager

Subject:

Approve the Long Beach Water Department's updated 2019-2024 Sewer System Management Plan (SSMP) and authorize the General Manager to submit the approved SSMP to the State Water Resources Control Board and to implement the SSMP.

Executive Summary:

The State Water Resources Control Board (SWRCB) requires public agencies in the State of California operating a sanitary sewer system to develop and implement a Sewer System Management Plan (SSMP). The overall objective of SSMP is to prevent and minimize sanitary sewer overflows (SSOs) and to mitigate SSOs that do occur. The SSMP establishes a detailed roadmap to effectively manage, operate, and maintain Long Beach Water Department's sewer collection system.

In accordance with SWRCB order No. 2006-003-DWQ, the SSMP shall be updated every 5 years. The Department has been working with HDR Engineering, Inc. to update the previous SSMP to include lessons learned internally and from other agencies. Approval and submission of the 2019-2024 SSMP will fulfill the SWRCB's order and will guide the Department over the next 5-years.

Staff Recommendation:

Approve the Long Beach Water Department's updated 2019-2024 Sewer System Management Plan (SSMP) and authorize the General Manager to submit the approved SSMP to the State Water Resources Control Board and to implement the SSMP.

Fiscal Impact: Funds associated with implementation of the SSMP are budgeted annually as part of the Sewer Fund Budget process.

10/2/19
Tai J. Tseng — Date
Assistant General Manager - Operations

10/2/19
Christopher J. Garner — Date
General Manager

APPROVED 10/10/2019
BOARD OF WATER COMMISSIONERS

Attachment

A COPY OF THE 2019-2024
SEWER SYSTEM
MANAGEMENT PLAN BOARD
LETTER ATTACHMENT
IS AVAILABLE AT THE LONG
BEACH WATER DEPARTMENT
ADMINISTRATION OFFICE

Long Beach Water Department Sewer System Management Plan

2019 Sewer System Management Plan Update

Long Beach, CA
September 2019

This page is intentionally left blank.

Contents

Tables

Figures

Attachments

Acronyms and Abbreviations

BMP	best management practice
Caltrans	California Department of Transportation
CCTV	closed-circuit television
CIP	capital improvement program
City	City of Long Beach
CIWQS	California Integrated Water Quality System
Department, Water Department, LBWD	Long Beach Water Department
FOG	fats, oils, and grease
FSE	food service establishments
GIS	Geographic Information System
LACSD	Sanitation Districts of Los Angeles County
LBDHHS	Long Beach Department of Health and Human Services
LBMC	City of Long Beach Municipal Code
LRO	Legally Responsible Official
NASSCO	National Association of Sewer Service Companies
O&M	operations and maintenance
SCADA	Supervisory Control and Data Acquisition
SSMP	Sewer System Management Plan
SSO	sanitary sewer overflow
SWRCB	State Water Resources Control Board
VCP	vitrified clay pipe

1 Goals and Overview

This section provides the goals and an overview of the Sewer System Management Plan (SSMP) for the City of Long Beach (City) Water Department (LBWD).

The purpose of this SSMP is to provide a plan and schedule to properly manage, operate, and maintain all parts of LBWD's sewer system. The overall objective of LBWD SSMP program implementation is to prevent and minimize sanitary sewer overflows (SSO) and to mitigate SSOs that do occur.

According to the State Water Resources Control Board's (SWRCB) Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ), the SSMP must be updated to incorporate changes every 5 years. This order is included as Attachment A1. This report is the updated version from the previous SSMP submitted in April 2014. A summary of changes to the SSMP is included as Attachment A2.

1.1 Structure

This SSMP is organized by 11 elements, as mandated in Order No. 2006-0003-DWQ:

1. Goal
2. Organization
3. Legal Authority
4. Operation and Maintenance (O&M) Program
5. Design and Performance Provisions
6. Overflow Emergency Response Plan
7. Fats, Oils, and Grease (FOG) Control Program
8. System Evaluation and Capacity Assurance Plan
9. Monitoring, Measurement, and Program Modifications
10. SSMP Program Audits
11. Communication Program

Each SSMP element is in full compliance with Order No. 2006-0003-DWQ, and Order No. WQ 2013-0058-EXEC and collectively, the SSMP elements meet the following objectives:

a) Properly fund, manage, operate, and maintain, with adequately trained staff, and/or contractors possessing adequate knowledge, skills, and abilities, all parts of the collection system owned and/or operated by LBWD

b) Provide adequate capacity to convey base flows and peak flows, including flows during wet weather events, to the minimum design criteria (as defined in Section 8), for all parts of the collection system owned and/or operated by LBWD

c) Take all feasible steps to stop and mitigate the impact of SSOs in the collection system owned and/or operated by LBWD

This SSMP integrates documentation of numerous collection system management programs into one formal document. These programs are described in greater detail in a variety of documents, which are referenced in this SSMP when appropriate.

1.2 System Overview

The LBWD is a commission-governed department of the City consisting of over 200 employees and operating with an annual budget of approximately $130 million. Established July 1, 1911, by the City Charter, LBWD's functions are to regulate and control the use, sale, and distribution of water owned or controlled by the City. In February 1988, LBWD assumed the responsibility of the various functions of the City's sanitary sewer system, including operations and maintenance.

LBWD's service area is located in Los Angeles County within Southern California, approximately 20 miles south of downtown Los Angeles and 105 miles north of San Diego. This coastal city is approximately bordered by the Pacific Ocean, the Los Angeles River, and the San Gabriel River, as shown on **Figure 1-1**.

Figure 1-1. City of Long Beach Map

With a population of approximately 469,450 the City is currently the second largest city in Los Angeles County and the seventh largest city in the state of California. The City is heavily developed, with a downtown at 4.2 million square feet of commercial office space. Major landmarks include the Long Beach Airport and the Port of Long Beach, one of the busiest container ports in the world. Tourism in the City continues to attract over 5.5 million visitors a year, as noted in *City of Long Beach Demographics* from the City website (City of Long Beach n.d.a):

http://www.longbeach.gov/globalassets/finance/media-library/documents/city-budget-and-finances/budget/budget-documents/fy-06-adopted-budget-webpage/understanding_the_city_s_budget

According to the 2018 SSMP Internal Audit (**Attachment J1**), the LBWD sanitary sewer system comprises of:

- 712 miles of gravity mains
- 7.6 miles of force mains (2-inch to 12-inch diameter)
- 28 sewer lift stations
- 115,133 lateral connections
- 16,158 sewer maintenance manholes

1.3 Sewer System Management Plan Goals

The overall goal of the SSMP is to achieve zero preventable SSOs, as encouraged by U.S. Environmental Protection Agency and State of California regulatory agencies. However, due to the sporadic and unexpected nature of the majority of SSO events, which can be caused by vandalism, contractor or property owner damage, excessive customer discharge of FOG, or extreme weather events, it is possible to minimize, not eliminate, SSO events.

LBWD has identified the following specific goals for the SSMP:

- Goal 1. To properly manage, operate and maintain all portions of LBWD's wastewater collection system.
- Goal 2. To provide adequate capacity to convey peak flows.
- Goal 3. To minimize the frequency of SSOs.
- Goal 4. To mitigate the impact of SSOs.
- Goal 5. To meet all applicable regulatory notification and reporting requirements.

1.4 Regulatory Goals

Federal and state regulatory agencies consider SSOs to be a violation of the Clean Water Act. Furthermore, federal and state regulatory agencies consider SSOs to be a potential indicator of improper management, operation, and maintenance of the wastewater system. Regulatory requirement is designed to accomplish the overall goal of “zero” SSOs.

Most regulatory officials recognize that it is extremely difficult to achieve zero SSOs on a consistent basis. This is especially true for “dry weather SSOs” that are caused by blockages, as opposed to “wet weather SSOs” that are caused by peak flows exceeding system capacity. Wet weather SSOs tend to occur at somewhat predictable, repeat overflow locations, unless a specific storm event is especially heavy in a particular section of the sewer system. Dry weather SSOs tend to occur at more random, isolated locations. Some dry weather SSOs can be prevented by recognizing sections of the sewer system that may be prone to certain types of dry weather overflows. Other dry weather SSOs, such as those caused by vandalism or by damage caused by external agencies or contractors, can seldom be prevented by collection system mangers or operators.

Consequently, SSMP elements are designed as a starting point in formalizing and institutionalizing an evaluation and continuous improvement process for the wastewater collection system. As the SSMP elements are implemented, the Monitoring, Measurement, and Program Modifications SSMP element will develop performance measurements to track success of each of the SSMP elements. If any of the SSMP elements are not contributing sufficiently to the overall goal of “zero” SSOs, then those SSMP elements should be re-evaluated and refined to facilitate further progress toward the goal and thus implement a philosophy of continual improvement for the collection system management and operations.

1.4.1 Regulatory Context

LBWD is required to comply with the SWRCB *Waste Discharge Requirements*, adopted May 2, 2006. Order No. 2006-0003-DWQ and associated *Monitoring and Reporting Program* requirements are included as **Attachment A1** and **Attachment A3,** respectively.

Additional information can be found at:
https://www.waterboards.ca.gov/water_issues/programs/sso

1.4.2 Summary of State Water Resources Control Board Waste Discharge Requirements

Table 1-1 summarizes the SWRCB *Waste Discharge Requirements* and associated monitoring and reporting requirements under which the collection system operates and that are addressed by this SSMP. All agencies that own and operate collection systems greater than 1 mile in length must comply with these requirements. In addition, Section C of the SWRCB *Waste Discharge Requirements* prohibits SSOs to waters of the United States, and SSOs that cause a nuisance, per the California Water Code Section 13050(m).

Table 1-1. Summary of State Water Resources Control Board Waste Discharge Requirements and Monitoring and Reporting Program Requirements

Provisions	Description	Applies to
D.3-5, 7	SSO prevention, response, and control	Element 4, Operation and Maintenance Program; Element 6, Overflow Emergency Response Plan; Element 7, FOG Control Program; Element 8, System Evaluation and Capacity Assurance Plan
D.8-9	System operations and maintenance, adequate resource allocation, appropriate training, knowledge, and abilities	Element 4, Operation and Maintenance Program
D.10	Adequate capacity for base, peak, and wet weather flows	Element 8, System Evaluation and Capacity Assurance Plan
D.11, 13-14	SSMP requirement, content, update and certification	All Elements of SSMP
D.12	Use of qualified professionals for engineering and geological evaluations and judgments	Element 5, Design and Performance Provisions
Monitoring and Reporting Requirements	SSO reporting and notification; water quality monitoring; change log	Element 6, Overflow Emergency Response Plan; Water Quality Monitoring Plan; SSMP Revision Log

Notes:
SSMP=Sewer System Management Plan; SSO=sanitary sewer overflows

1.4.3 Application for Coverage under the State Water Resources Control Board Waste Discharge Requirements

LBWD applied for coverage under the general *Waste Discharge Requirements* in 2006 for one collection system and was assigned a Wastewater Discharger Identification Number of **4SSO11423** in the California Integrated Water Quality System (CIWQS).

2 Organization

This section identifies the authorized representative to meet the SWRCB requirements for completing and certifying spill reports and the implementation and development of the SSMP. This section also includes the staff responsible for managing and maintenance of the wastewater collection system and the responders to SSO events.

2.1 Overview

In 1911, LBWD created its own water company by buying out its two private suppliers, the Long Beach Water Company and the Alamitos Water Company. In 1931, voters amended the LBWD charter to establish the Board of Water Commissioners, 5 citizens appointed for 5-year terms by the LBWD General Manager (now by the Mayor) with City Council approval. In 1988, LBWD assumed responsibility for O&M of LBWD's sanitary sewer system. In 1990, voters amended LBWD charter to allow greater autonomy for LBWD in administering LBWD's sanitary sewer operations.

2.2 Authorized Representative

LBWD has designated a primary Legally Responsible Official (LRO) pursuant to Section J., Report Declaration, of the Order No. 2006-0003.

Primary LRO

Mrs. Lourdes Vargas

Director of Field Operations

1800 East Wardlow Road

Long Beach, CA 90807

(562) 570-2393

Lourdes.Vargas@lbwater.org

Backup LRO

Mr. Tai Tseng

Assistant General Manager

1800 East Wardlow Road

Long Beach, CA 90807

(562) 570-2420

Tai.Tseng@lbwater.org

2.3 Positions Responsible for Implementing Sewer System Management Plan Program

A summary of key positions, including the personnel responsible for responding to and reporting SSOs, is presented in **Table 2-1** below.

Table 2-1. Responsible Position for Implementing SSMP

SSMP Element	Responsible Position
Goal, Organization & Legal Authority	• AGM of Operations (LRO) • Director of Field Operations (LRO) • Director of Engineering • Superintendent of Sewer Operations
O&M – Mapping	• Engineering Manager for Development Services • Business System Specialist VII • GIS Analyst
O&M – Preventive Maintenance	• Superintendent of Sewer Operations • Sewer Operations Water Utility Supervisor II's • Sewer Operations Water Utility Supervisor I's • Treatment Plant Superintendent • Water Treatment Supervisor I
O&M – System Rehabilitation	• Director of Engineering • Engineering Manager for Facilities • Engineer Manager for Development Services
Design and Performance Provisions	• Director of Engineering • Engineering Manager of Pipeline Infrastructure • Engineering Manager for Facilities • Construction Services Officer
Overflow Emergency Response – Response & Reporting	• Superintendent of Sewer Operations • Sewer Operations Water Utility Supervisor II's • Sewer Operations Water Utility Supervisor I's
Overflow Emergency Response – Water Quality Monitoring	• LBDHHS Environmental Health Operations Officer • LBDHHS Environmental Health Specialist IV's • LBDHHS Environmental Health Specialist III
FOG Control Program	• Engineering – Facilities – Associate Civil Engineer • Engineering – Development Services – Sr. Civil Engineer • LBDHHS Environmental Health Operations Officer • LBDHHS Environmental Health Specialist IV's • LBDHHS Environmental Health Specialist III
System Evaluation and Capacity Assurance	• Director of Engineering • Engineering - Senior Program Manager

Table 2-1. Responsible Position for Implementing SSMP (Continued)

SSMP Element	Responsible Position
Monitoring, Measurement, and Program Modifications	• Director of Field Operations (LRO) • Superintendent of Sewer Operations • Director of Engineering • Engineering - Senior Program Manager • Engineering Manager for Facilities
SSMP Program Audits	• Director of Field Operations • Superintendent of Sewer Operations
Communication Program	• Public Information Officer • Superintendent of Sewer Operations

Notes:
FOG=fats, oils, and grease; LBDHHS=Long Beach Department of Health and Human Services; LBWD=Long Beach Water Department; LRO=Legally Responsible Official; O&M=operations and maintenance; SSMP=Sewer System Management Plan

An organization chart showing the lines of authority for key positions responsible for implementing various elements of the SSMP program is included in **Attachment B1**. The contact information for each key position is included in **Attachment B2**.

2.4 Chain of Communication for Reporting Sanitary Sewer Overflows

The chain of communication for reporting and notification of sanitary sewer overflows is documented in the *Overflow Emergency Response Plan,* which is included in **Attachment F1**. Key positions described in the workflow include:

Water Communications Dispatch Control 1 (Normal Working Hours): The Water Communications Dispatch Control 1 receives complaint calls during Normal Working Hours and forwards these calls to Radio #530.

Radio #530: Radio #530 receives SSO complaints during Normal Working Hours and contacts the Water Utility Supervisor II to notify the potential SSO and also contacts a Cleaning Truck Crew to be dispatched and investigate.

Water Utility Supervisor II: The Water Utility Supervisor II receives notification of a potential SSO and sends out information to LBWD's SSO email list. After receiving SSO facts from Radio #530, the Water Utility Supervisor II will send out a confirmation of the SSO with additional information to the SSO email list. If there is no reportable SSO, the Water Utility Supervisor II will notify the SSO email list. The Water Utility Supervisor II is responsible for draft SSO reporting in CIWQS.

Cleaning Truck Crew: The cleaning truck crew will respond to all SSOs notified by Radio #530. If the SSO is confirmed, the cleaning truck crew will notify the Water Utility Supervisor II and begin leading spill response activities and documentation of the spill event. In addition, the Cleaning Truck Crew Lead is responsible for SSO notifications to the Office of Emergency Services, Regional Board, and other stakeholders.

Water Communications Dispatch Control 1 (After Hours 5:00 p.m. to 7:30 p.m.): The Water Communications Dispatch Control 1 receives complaint calls during After Hours, from 5:00 p.m. to 7:30 p.m., and contacts the Standby Sewer Lead of a potential SSO.

Water Communications Dispatch Control 2 (After Hours 7:30 p.m., Weekends and Holidays): The Water Communications Dispatch Control 2 receives complaint calls after 7:30 p.m. Monday through Friday, and on weekends and Holidays. Control 2 notifies the Standby Sewer Lead of a potential SSO.

Sewer Standby Lead: The Sewer Standby Lead receives notifications of a potential SSO and contacts a second standby crew person to pick up a cleaning truck at the Operations Service Center yard and meet at the spill location. The Sewer Standby Lead will call and inform the Standby Water Utility Supervisor II of a potential SSO.

Standby Water Utility Supervisor II: The Standby Water Utility Supervisor II will send out notification to the SSO email list and receive SSO facts from the Sewer Standby Lead. Once the facts of the potential SSO have been received and SSO has been verified, the Standby Water Utility Supervisor II will send additional information out to the SSO email list. The Standby Water Utility Supervisor II is responsible for draft SSO reporting in CIWQS.

Sewer Operations Superintendent: The Sewer Operations Superintendent is responsible for verifying that all Sewer Water Utility Supervisors follow the established SSO protocols pertaining to the SSMP.

Normal Working Hours are 6:30 a.m. to 5:00 p.m., Monday through Friday, except holidays. After Hours are 5:00 p.m. to 6:30 a.m., Monday through Friday, as well as weekends and holidays.

A detailed workflow for the sanitary sewer overflow response is shown on Figure 3-1 (Working Hours) and Figure 3-2 (After Hours) in **Attachment F1**.

3 Legal Authorities

The SWRCB *Waste Discharge Requirements* require LBWD to demonstrate, through sanitary sewer system use ordinances, service agreements, or other legally binding procedures, that it possesses the necessary legal authority to:

- Prevent illicit discharges into its sanitary sewer system (examples may include infiltration and inflow, stormwater, chemical dumping, unauthorized debris and cut roots, etc.)
- Require that sewers and connections be properly designed and constructed
- Ensure access for maintenance, inspection, or repairs for portions of the lateral owned or maintained by the Public Agency
- Limit the discharge of FOG and other debris that may cause blockages
- Enforce any violation of its sewer ordinances

Section 3 describes the sources of LBWD's legal authorities and the key legal authorities LBWD possesses to support proper management of the sewer system.

3.1 Sources of Long Beach Water Department Legal Authorities

3.1.1 City of Long Beach Charter

Article XIV of the City's Charter established LBWD and grants LBWD full and complete jurisdiction over all of the City's sewer system. According to Article XIV, LBWD is under the exclusive jurisdiction and control of the LBWD Board of Water Commissioners (Board) who have complete and exclusive power and duty to supervise, control, regulate, and manage the LBWD and to make and enforce all necessary rules and regulations.

The City Charter is available online at:
https://library.municode.com/ca/long_beach/codes/city_charter

3.1.2 Long Beach Water Department Rules and Regulations

LBWD's Board adopts Rules, Regulations and Charges Governing Potable Water, Reclaimed Water, Sewer Service, and the Water Conservation and Water Supply Shortage Plan (Rules and Regulations) to govern departmental operations. Key sewer terms and phrases are capitalized throughout the document and are defined in Part 10.

The Rules and Regulations are available on LBWD's website at:
https://lbwater.org/about-us/important-documents/rules-regulations/

3.1.3 City of Long Beach Municipal Code

LBWD's Rules and Regulations are codified into Chapter 15, *Public Utilities of the City of Long Beach Municipal Code* (LBMC), as approved and adopted by City Council. The LBMC 15.01.010, states in part:

> The current edition of the rules, regulations, and charges governing water and sewer service as approved by the Board of Water Commissioners is incorporated by this reference. A copy of the rules, regulations, and charges governing water and sewer service is available in the office of the General Manager.

The Board of Water Commissioners has further charged the General Manager of LBWD with administration of the Rules and Regulations as noted in the LBMC 15.01.020:

> The General Manager is charged by the Board of Water Commissioners with the responsibility to administer the rules, regulations and charges governing water and sewer service.

The LBMC is available online at:
https://library.municode.com/ca/long_beach/codes/municipal_code

Table 3-1 summarizes LBWD's legal authorities for each of the legal authorities required by the *Waste Discharge Requirements*. Refer to Attachment 1 for details.

Table 3-1. Summary of Legal Authorities

Requirement	Source of Authority
GENERAL	
Prevent illicit discharges into the wastewater collection system	• Rules and Regulations, Section 1401 – Discharges Prohibited
Limit the discharge of FOG and other debris that may cause blockages	• Rules and Regulations, Section 1301 – Standards for Discharge
Require that sewers and connection be properly designed and constructed	• Rules and Regulations, Section 1402 – Approval Required Prior to Occupancy • Rules and Regulations, Section 1408 – Existing Sewer Laterals • Rules and Regulations, Part 15 – Sewer Installation
Require proper installation, testing, and inspection of new and rehabilitated sewers	• Rules and Regulations, Section 1417 – Inspection • Rules and Regulations, Part 16 – Sewer Inspection and Enforcement
LATERALS	
Clearly define City lateral responsibility and policies	• Rules and Regulations, Section 1406 – Sewer Lateral Responsibility
Ensure access for maintenance, inspection, or repairs for portions of the service lateral owned or maintained by the City	• Rules and Regulations, Section 1406 – Sewer Lateral Responsibility, Subsection B.3

Table 3-1. Summary of Legal Authorities (Continued)

Requirement	Source of Authority
Control infiltration and inflow from private service laterals	• Rules and Regulations, Section 1401 – Discharges Prohibited, Subsection F • Rules and Regulations, Section 1412 – Disposal of Uncontaminated Water
FOG SOURCE CONTROL	
Installation of grease removal device	• Rules and Regulations, Section 1306 – Grease Trap Requirements • Rules and Regulations, Section 1308 – General Interceptor Requirements
Design standards for grease removal device	• Rules and Regulations, Section 1306 – Grease Trap Requirements • LBMC, Section 8.46.040 – Requirements for Grease Interceptors, Subsection A • LBMC, Section 8.46.050 – Requirements for Grease Traps, Subsections B and C
Maintenance and BMP requirements	• Rules and Regulations, Section 1307 – Operator's Responsibility • LBMC, Section 8.46.030 – Requirements for Food Facilities, Subsection A
Record keeping and reporting	• Rules and Regulations, Section 1307 – Operator's Responsibility, Subsection B • LBMC, Section 8.46.030 – Requirements for Food Facilities, Subsection E
Authority to inspect grease producing facilities	• LBMC, Section 8.46.030 – Requirements for Food Facilities Subsection G • LBMC, Section 8.46.060 - Enforcement
ENFORCEMENT	
Enforce any violations of sewer ordinances	• Rules and Regulations, Section 1101 – Conditions of Sewer Service • Rules and Regulations, Section 1301 – Permit Revocation • Rules and Regulations, Section 1503 – Notice of Noncompliance • LBMC, Section 8.46.060 – Enforcement

Notes:
BMP=best management practice; FOG=fats, oils, and grease; LBMC=City of Long Beach Municipal Code

3.2 Authority to Prevent Illicit Discharges

Section 1401 – *Discharges Prohibited* of LBWD's Rules and Regulations prohibit illicit discharges into its sanitary sewer system. Key discharge prohibitions related directly to reduction of sewer blockages and infiltration and inflow include prohibitions on the following discharges:

- Earth, sand, rocks, ashes, gravel, plaster, concrete, glass, metal filings, metal objects, other materials which will not be carried by the Sewer stream, anything which may obstruct the flow of Sewage in the Sewer, or any object which will cause clogging of a Sewage pump or a Sewage sludge pump. *(*Rules and Regulations: Section 1401.A*)*

- Any garbage which has not been first shredded so that each particle is not more than 3/8-inch in any dimension or any garbage containing broken glass. (Rules and Regulations: Section 1401.B)
- Any solid or semisolid material such as garbage, trimmings, cuttings, offal, or other waste produced in the processing of meats, fruits, vegetables, foodstuffs or similar materials except garbage produced which meets the requirements of Parts 10 through 18. (Rules and Regulations: Section 1401.C)
- Any storm water or runoff from any roof, yard, driveway, street or pump station, except where prior approval has been given by the Chief Engineer. (Rules and Regulations: Section 1401.F)
- Any materials which will cause damage to any part of the Sewer System, abnormal sulfide generation, abnormal maintenance or operation costs of any part of the Sewer System, or which may cause any part of the Sewer System to become a nuisance or a menace to public health or a hazard to workers or which will cause objectionable conditions at the final point of disposal of the Sewage. (Rules and Regulations: Section 1401.G)

Other discharge prohibitions include:

- Any volatile liquids or substances which can produce toxic or flammable atmospheres in the Sewer
- Any compounds which may produce strong odors in the Sewer or Sewage Treatment Plant
- Any liquid having a temperature in excess of one hundred twenty degrees Fahrenheit
- Unpolluted water from refrigeration systems, air conditioning systems, industrial cooling systems, swimming pools or other unpolluted water from any origin except as authorized by the LBWD
- Any radioactive waste which constitutes, or may constitute, a public health hazard or endanger workmen charged with the maintenance of Public Sewers

3.3 Authority to Require Proper Design and Construction of Sewers and Connections

LBWD has strong legal authorities to require proper design and construction of sewers and connection as well as proper installation, testing, and inspection of new and rehabilitated sewers.

3.3.1 Proper Design and Construction of Sewer and Connections

Section 1402 of LBWD's Rules and Regulations requires approval by an LBWD authorized inspector prior to use or occupancy of any building or structure for which a sewer has been constructed. This mainly applies to new sewer construction. For existing sewer laterals, Section 1408 of LBWD's Rules and Regulations requires any sewer lateral alterations or changes to conform to requirements applying to new construction.

Part 15 of the LBWD's Rules and Regulations includes requirements for proper design and construction of sewers and connections, including the following:

- Notice of Noncompliance

  If work performed on Sewers in a public street pursuant to a permit does not comply with the Rules, the LBWD shall notify the person to whom the permit was issued and specify the defect of the work. The person shall, without delay, take such steps as may be necessary to protect the public and within a period of five days after service of notice shall proceed with reasonable diligence to remedy the defect. If the person does not comply with the requirements of the notice, the LBWD shall not grant to the person a permit authorizing the installation of Sewers until the person has complied in full with the terms of the notice. (Rules and Regulations: Section 1503)

- Materials and Specifications Standards

  All materials used in any work shall be new, first-class materials and shall conform to and the manner of construction shall meet all the requirements of the Rules. LBWD, at the expense of the permittee, may order tests of any material to determine whether such material meets the specifications as defined in Section 1507. (Rules and Regulations: Section 1504)

- Main Line Sewer Size

  Main line Sewer pipe shall have an inside diameter of not less than eight inches and shall have sufficient capacity to carry Sewage from the area tributary when computed upon the basis developed in the Sewer master plan. (Rules and Regulations: Section 1505)

- Main Line Sewer Gradient

  A Main Line Sewer shall be designed so as to provide a minimum velocity of two feet per second for pipes up to a 15-inch diameter flowing one-half (1/2) full, and pipes with an 18-inch diameter flowing three-quarters (3/4) full except that LBWD may approve a gradient that will develop a lower velocity if it finds that the gradient required to develop the above-stated velocity of two feet per second is unfeasible. (Rules and Regulations: Section 1506)

- Pipe Specifications

  A. The pipe used shall be either vitrified clay pipe (VCP) or ductile iron pipe with fusion bond epoxy coating. All VCPs 6 inches or greater shall conform to the "Standard Specifications for Public Works Construction", latest edition, and the Long Beach, California Amendments thereto. All 4-inch diameter VCPs shall be first-class VCP, ceramic glazed on the inside. (Rules and Regulations: Section 1507.A)

  B. That portion of the pipe extending from the Public Sewer Main to the Property Line shall be not less than six inches in internal diameter. That portion extending from the Property Line to the house or building shall be not less than four inches in internal diameter provided, however, that the size of the pipe shall meet all of the requirements of the Uniform Plumbing Code. (Rules and Regulations: Section 1507.B)

- VCP Strength

  A. Standard strength for Sewers not more than ten feet in depth from the surface to invert. (Rules and Regulations: 1508.A)

  B. Extra strength for Sewers more than ten feet and not more than twenty feet in depth. (Rules and Regulations: 1508.B)

  C. Extra strength reinforced with concrete cradle or concrete encasement, for Sewers more than twenty feet in depth. (Rules and Regulations: Section 1508.C)

  D. Extra strength encased in concrete or placed inside of steel pipe back filled with sand for Sewers under railways, freeways, major highways and such other streets as may be designated by the LBWD. (Rules and Regulations: Section 1508.D)

  E. Reinforced as required by the LBWD for Sewers under large conduits or other Structures. (Rules and Regulations: Section 1508.E)

- **Pipe Laying Method**

  All pipe shall be laid up grade on an unyielding foundation true to line and grade and with a uniform bearing under the full length of the barrel of the pipe. Bell and spigot pipe shall be laid with sockets upgrade. Suitable excavations shall be made to receive the bells or collars of the pipe. All adjustments to bring the pipe to line and grade shall be made by scraping away or filling in under the body of the pipe, and not by wedging or blocking. (Rules and Regulations: Section 1509)

- **Main Line Sewer Slope**

  The grade or slope of Main Line Sewers shall be shown on the plans in feet of fall per foot of horizontal distance expressed as a decimal. Slopes shall be calculated to four decimal places. (Rules and Regulations: Section 1510)

- **Pipe Joint Materials**

  All joints in VCP or ductile iron pipe shall be made with approved joint materials to the satisfaction of the LBWD. (Rules and Regulations: Section 1511)

- **Pipe Disturbance after Joints Made**:

  No person shall walk upon or disturb the pipe in any manner after the joints have been made. (Rules and Regulations: Section 1512)

- **Depth Of Lines To Top Of Pipe:**
  - The minimum depth of Main Line Sewers to top of pipe in residential districts shall be 5 feet and, in business districts, shall be sufficient to provide a House Connection depth of ten and one-half feet for areas where no groundwater is present. Minimum depth for six-inch House Connection shall be four feet in residential districts and ten and one-half feet in business or apartment house districts, respectively, below the top of curb or ground elevation at Property Line. (Rules and Regulations: 1513)
  - Where the Lot to be served has a slope greater than one percent, the depth for residential Main Line Sewers shall be sufficient to provide for a Sewer

Lateral with a minimum depth of at least one foot below the surface at any part of the Lot and a grade of not less than two percent. (Rules and Regulations: Section 1513)

- Exceptions to the minimum depths set out in this Section may be made only on written approval by LBWD. (Rules and Regulations: Section 1513)

- **Sewer Structures**

  Manhole Structures shall be placed in the Main Line Sewer, except curved Sewers, at all changes of alignment or gradient; the maximum distance between such structures shall not be more than 350 feet. All Sewer Structures shall be designed and constructed in accordance with the standard drawings for such Structures on file in the offices of the LBWD. (Rules and Regulations: Section 1514)

- **End Structures**

  End Structures shall be located at least ten feet up grade from the point where the last lateral crosses the Property Line. (Rules and Regulations: Section 1515)

- **Sewer Requirement per Lot**

  Six-inch House Connection service shall be provided within the street right-of-way for each Lot. (Rules and Regulations: Section 1520)

- **Building Sewer Grade**

  All Building Sewers shall be laid on straight lines and uniform grades between Cleanouts shall be located as specified in Parts 10 through 18. Minimum grades of Building Sewer shall be one-quarter inch per foot except where otherwise permitted, in writing, by LBWD. (Rules and Regulations: Section 1521)

- **House Connection Grade**

  The alignment and grade of a House Connection shall be straight from the Public Sewer to the street Property Line and shall have a fall of not less than one foot in fifty feet towards the Public Sewer, except where otherwise permitted, in writing, by LBWD. (Rules and Regulations: Section 1522)

- **VCP Placement**

  VCP shall not be placed closer than two feet to the exterior wall of any building or Foundation or closer than twelve inches to the surface of the ground at any point in its course. (Rules and Regulations: Section 1523)

- **Reducers**

  A six-inch by four-inch reducer shall be inserted in the Sewer Lateral just inside the Property Line when the pipe size is changed from six-inch to four-inch. A six-inch by four-inch reducer TEE may be used at this location to serve as reducer, test TEE, and Cleanout. (Rules and Regulations: Section 1524)

- **Cleanouts**

  A. Cleanouts in a Sewer Lateral shall be made by inserting either a WYE branch or a two-way Cleanout fitting in the line, with the Cleanout hub placed vertically above the flow line of the pipe. A cap of the same material shall be tightly sealed in the bell of the access or vertical outlet. (Rules and Regulations: Section 1525)

  B. Cleanouts shall be accessible for maintenance and shall be placed in every Sewer Lateral at: 1. the junction with the Building Sewer at the building; 2. intervals of not more than fifty feet in straight runs. Cleanouts in straight runs longer than fifty feet shall be uniformly spaced; 3. the junction with the Main Line Sewer, or the junction of the House Connection and Building Sewer at the Property Line; 4. all significant changes in alignment or grade or when required by the LBWD. (Rules and Regulations: Section 1525)

  C. No rent or other charge will be paid by the LBWD for a Property Line Cleanout located on private property. (Rules and Regulations: Section 1525)

  D. A four inch or larger cleanout is required to receive any video inspection services from the LBWD. Installation is at the owner's expense. (Rules and Regulations: Section 1525)

3.3.2 Proper Installation, Testing, and Inspection of New and Rehabilitated Sewers

LBWD's Rules and Regulations have extensive requirements providing LBWD with authorities to require the proper installation, testing, and inspection of new and rehabilitated sewers, as shown below.

- **Inspection**

  LBWD may inspect as often as deemed necessary, every Sewer Pumping Plant, Private Sewage Disposal System, Sewer Lateral, dilution basin, neutralization basin, backwater Trap or valve, or other similar appurtenances, for the purpose of ascertaining whether such facilities are maintained and operated in accordance with the Rules. All persons shall permit LBWD to have access to all such facilities at all reasonable times. No object, whether a temporary or permanent Structure, nor any object which is difficult to remove, shall be placed in such a position so as to interfere with the ready and easy access to any such facility. Upon request by LBWD any such obstruction shall be immediately removed at no expense to LBWD and shall not be replaced. (Rules and Regulations: Section 1417)

- **Building Sewer Testing**
  - Upon completion, every House Connection and Building Sewer shall be subjected to a water pressure test by completely filling with water every portion of pipe from the lowest to the highest portion thereof. (Rules and Regulations: Section 1528)
  - No House Connections or Building Sewer shall be Approved if any portion thereof, including any fitting, material, work or construction, fails to withstand the test without leaking at any point or does not comply with the provisions of Parts 10 through 18. (Rules and Regulations: Section 1528)

- **Right of Entry**

LBWD shall have the right of entry into and upon any property, building, Structure, or site served by any public or Private Sewer, Cesspool, Septic Tank, or appurtenances thereon, for the purpose of examining and inspecting the construction or condition of the Sewer, Cesspool, Septic Tank or appurtenances, and every person owning, controlling, or otherwise occupying the property, Structure, or site shall permit the entrance and give such aid as may be necessary or required for the examination and inspection. (Rules and Regulations: Section 1601)

- **Inspection Requirements**

  All construction and installation made pursuant to the Rules shall be subject to: 1) a permit from LBWD for Sewer connections to the Main Line Sewers, 2) an encroachment permit issued by the City Department of Public Works for excavation in City streets, 3) a rider from the California Department of Transportation (Caltrans) for excavation in a Caltrans right-of-way and 4) inspection and approval by each of these agencies. Approval by LBWD shall not relieve any person from fully complying with all of the Rules. (Rules and Regulations: Section 1602)

- **Work To Be Observed**

  At the time of the inspection the permittee shall have all work uncovered and convenient for the LBWD's examination and shall give the LBWD every facility necessary to make a thorough examination and to apply the required water pressure test. The permittee shall furnish all labor, tools, and materials necessary for the test. No Sewer Lateral shall be inspected unless the required plug and water for tests are available on the job when the LBWD arrives. The permittee shall demonstrate to the LBWD that every Plumbing fixture requiring drainage has been connected to a Building Sewer and drains into a Public Sewer. (Rules and Regulations: Section 1603)

- **Defective Work Correction**

  If the LBWD notifies a permittee that the construction or installation of any part thereof is defective, the permittee shall, within ten days after notice from the LBWD, remove and reconstruct the construction or installation of any part thereof found to be defective. (Rules and Regulations: Section 1604)

- **Certificate of Final Inspection**

  Upon request, a certificate of final inspection may be issued to the person constructing the work if it appears that all work done under a permit issued pursuant to these rules has been constructed according to, and meets all the requirements of, the applicable provisions of these rules, and that all charges have been paid. (Rules and Regulations: Section 1605)

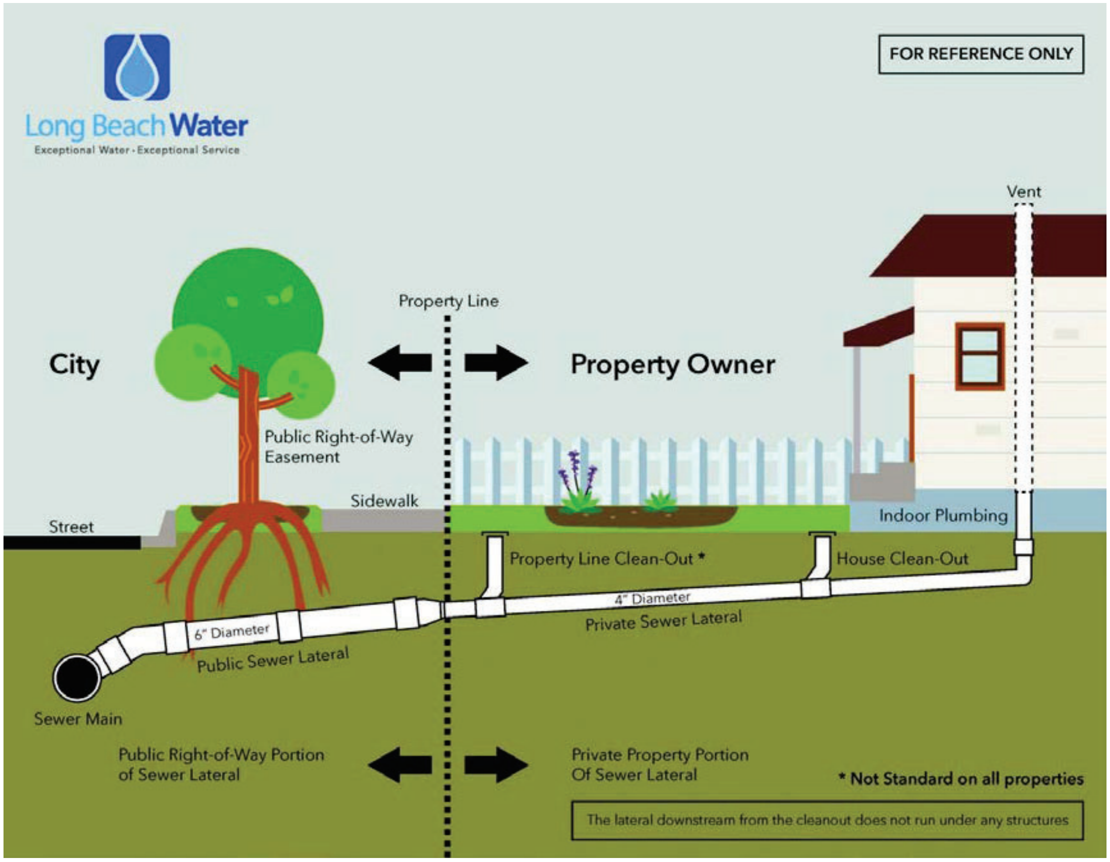
3.4 Authority to Ensure Access for Maintenance, Inspection or Repairs for Portions of Lateral Owned or Maintained by the City

Section 1406 of LBWD's Rules and Regulations documents the property owner's sewer lateral responsibility versus LBWD's responsibility, as follows:

> Owner's Responsibility
>
> 1. The property owner is responsible for ensuring sewage flow through the Building Sewer extending from the building to the property line, including the investigation and repair of the line. The responsibilities shall not be limited to root cutting, so as to ensure sewage flow.
>
> 2. The property owner shall ensure that all Building Sewers, Industrial Sewers, Private Sewage Disposal Systems and appurtenances thereto are in a safe and sanitary condition and, further shall maintain in good working order all devices or safeguards which are required by Parts 10 through 18 of these Rules.
>
> 3. A Force Main which discharges Sewage from a lift station or an ejector vacuum system to a public manhole in a Main Line Sewer shall be considered private and shall be operated and maintained by the private property owner.
>
> Long Beach LBWD Responsibility
>
> 1. The Department is responsible for ensuring sewage flow through the House Connection, extending from the property line to the sewer main within the public right-of-way, including repairs to the House Connection. The Department has the sole discretion in the House Connection repair process.
>
> 2. If the property owner believes that a problem in the House Connection is preventing sewage flow from the Building Sewer to the Main Line Sewer, the Department will not investigate until the property owner has performed an initial inspection, clearing, and draining of the Sewer Lateral. In order to expedite the process, the Department strongly encourages the property owner to secure and provide the Department with a video recording performed by a plumber of the Sewer Lateral.
>
> 3. The property owner shall provide an accessible 4-inch cleanout (see Section 1525) in order for the Department to inspect the House Connection. The Department will not investigate the failure of a House Connection unless an adequate and accessible Cleanout is present.
>
> 4. In conjunction with the repair or replacement of a House Connection by the Department, the Department retains the right to install a standard Cleanout at the Property Line, if needed. The Department will not pay rent or any other charge to the property owner for such cleanout.

Figure 3-1 illustrates the property owner's sewer lateral responsibilities versus LBWD's responsibilities (Long Beach Water n.d.a).

Figure 3-1: Property Owner versus Long Beach Water Department Sewer Lateral Responsibility



This graphic is also provided along with an explanation of these responsibilities on LBWD's website at: https://lbwater.org/customer-services/sewer/

In addition, LBWD has created a two-page *Sewer Systems Fact Sheet* that staff provides to property owners to clearly explain the division of responsibilities between property owners and LBWD regarding sewer system operation, maintenance, repair, and replacement. The *Sewer Systems Fact Sheet* is included as **Attachment C1**.

In summary, LBWD is responsible for performing repairs on house connections (i.e., the lower lateral) for portions of sewer laterals in the public right-of-way (e.g., streets and alleys). The City ensures access to house connections and sewer mainlines in the public right-of-way by not allowing any private construction in the public right-of-way.

As previously mentioned, Section 1525 in Rules and Regulations and on LBWD's website states that the property owner is responsible for providing a 4-inch cleanout on the private property side at the property line. LBWD is not responsible for a house connection sewer unless a cleanout is provided and accessible for LBWD to investigate and verify a failure in the house connection. The property owner is responsible for initial inspection, clearing, and draining of the entire Sewer Lateral before LBWD will respond to investigate.

Furthermore, LBWD is not responsible for any portion of the Sewer Lateral on private property or on an easement that is not a public right-of-way.

3.5 Authority to Limit Discharge of Fats, Oils and Grease or Other Debris

The LBWD's Rules and Regulations provide LBWD with the authority needed to limit the discharge of fats, oils, grease, or other debris. Section 1306 of the Rules and Regulations includes requirements for food service establishments (FSE) to install grease traps to capture grease prior to discharge into the sewer system. Section 1307 details the responsibilities of FSEs to operate grease traps properly.

- **Grease Trap Requirements**

  All restaurants, commercial kitchens, and facilities where food is prepared and served to the public, also known as FSEs, shall install and maintain an Approved Grease Trap so as to prevent excessive discharges of grease and oil which could result in sewer blockage. Three departments within the City have coordinated their efforts to establish a policy to detail the requirements for the design and installation of Grease Traps. These departments are the Long Beach Department of Health and Human Services (LBDHHS), the Planning and Building Department, and the LBWD.

  A Grease Trap could be a Grease Interceptor or a Grease Recovery Device. In most instances, the FSE shall install a Grease Interceptor in accordance with the Rules. In special circumstances, with the LBWD's prior written approval, the FSE may install a Grease Recovery Device. In either case, garbage disposals and dishwashers must be plumbed downstream of the Grease Trap. (Rules and Regulations: Section 1306)

- **Grease Interceptors**

  Grease Interceptors are designed and constructed to retain floating material such as grease and oils and are typically concrete box structures located outside, but usually adjacent to, the building containing the source of the grease (e.g., restaurant, cleaning room, vehicle wash, vehicle or equipment servicing and/or cleaning facility, etc.).

  The Grease interceptor shall be installed and connected so that it is easily accessible for inspection, cleaning, and removal of the grease. (Rules and Regulations: Section 1306)

- **Grease Recovery Devices**

  Grease Recovery Devices are generally located within the building and typically consist of a stainless steel chamber which traps the solid grease and a mechanism for separating the grease from the Wastewater stream and holding it in a separate chamber, or stand-alone container.

  A. General Information: A grease recovery device must be listed by the following agencies:

  1. International Association of Plumbing and Mechanical Officials
  2. National Safety Foundation by December 31, 1995
  3. Underwriters Laboratory

The LBDHHS must approve the location of the Grease Recovery Device, usually below or near the kitchen sink, and the Long Beach Planning and Building Department must approve the plumbing and installation. (Rules and Regulations: Section 1306)

- **Operator's Responsibility**

The operator of the food facility shall maintain, or cause to be maintained, proper operation of the grease trap by performing cleaning and preventive maintenance, as necessary. Failure to prevent grease from entering the Sewer System may result in the operator paying all costs associated with the response and cleaning of the Sewer System and liability for any private losses or damages incurred by the stoppage in the Sewer System. Failure to take the necessary corrective action to prevent future occurrences of grease discharge to the Sewer System will result in the shut-off of water services, per Rules Section 206.

A. If there is an existing grease trap, the operator must ensure that it is adequately and properly designed for the site. The operator may need to upgrade or make improvements if the grease trap is found by the LBWD to be deficient.

B. The operator must properly and regularly maintain the grease trap and keep records of registered haulers' manifests. These records shall be presented to the LBWD's authorized Inspector on request.

C. If an existing facility does not have a grease trap, the operator can call the LBWD for special programs or advice for installing grease traps in existing sites.

D. If an existing facility does not have, and fails to install, a grease trap, the operator shall make arrangements to clean the Sewer. If the operator still fails to take action after receiving a "Notice of Non-Compliance," the LBWD will make arrangement to have the Sewer cleaned by a private contractor. The LBWD will bill the operator for the cost plus a 35% administrative fee.

E. If the operator fails to prevent grease from entering the Public Sewer, the operator shall pay for all costs associated with the inspection, videotaping, and cleaning of the Public Sewer, as well as indemnify the LBWD for any losses or damages claimed by third parties and resulting from the stoppage in the Sewer System. (Rules and Regulations: Section 1307)

3.6 Authority to Enforce and Violations of Sewer Ordinances

Both the LBWD and the City have enforcement authorities related to the sewer system and the disposal of FOGs.

3.6.1 Long Beach Water Department Enforcement Authorities

As noted in City's Charter, the Board of Water Commissioners has complete and exclusive power and duty to supervise, control, regulate, and manage LBWD, and to make and enforce all necessary rules and regulations. The Board has charged the General Manager of the LBWD with the responsibility of administering these Rules and Regulations.

- **Conditions of Sewer Service**

  Sewer Service provided by the LBWD is subject to these Rules. All customers shall accept service subject to such Rules, City ordinances, and State laws. Any Customer not in compliance with these Rules may be subject to discontinuation of sewer service. Sewer Service is subject to shutdowns as required by the LBWD to make improvements or repairs to the Sewer System.

  The LBWD will enforce all of the provisions of Parts 10 through 18. Such powers shall not limit or otherwise affect the powers and duties of the City's Health Officer or other persons authorized by law to make inspections. (Rules and Regulations: Section 1101)

- **Permit Revocation**

  If the LBWD finds that the Applicant has not complied with the provisions of the permit, or has failed to comply with the provisions of Parts 10 through 18, or other applicable ordinances or statutes governing the discharge of Wastewater into a Public Sewer, or such person supplied false or misleading information in the application or if the discharge of Wastewater into a Main Line Sewer causes a nuisance in the operation of a Main Line Sewer, LBWD may give such person a thirty-day notice, in writing, specifying the manner in which such person has failed to comply with the provisions of the permit, or the manner in which the discharge constitutes an unreasonable burden in the operation of a Main Line Sewer. If the person within the time specified in the notice does not remedy the condition or conditions specified in the notice, LBWD may revoke the permit and cause to be capped the Wastewater outlet so that Wastewater will not be discharged into a Main Line Sewer. (Rules and Regulations: Section 1310)

- **Notice of Noncompliance**

  If work performed on Sewers in a public street, pursuant to a permit issued under Parts 10 through 18, does not comply with the provisions of Parts 10 through 18, LBWD shall notify the person to whom the permit was issued and specify the defect of the work. The person shall, without delay, take such steps as may be necessary to protect the public and within a period of five days after service of notice shall proceed with reasonable diligence to remedy the defect. If the person does not comply with the requirements of the notice, LBWD shall not grant to the person a permit authorizing the installation of Sewers until the person has complied in full with the terms of the notice. (Rules and Regulations: Section 1503)

3.6.2 City of Long Beach Enforcement Authorities

- **Municipal Code, Section 8.46.060 – Disposal of Fats, Oils and Grease**: Section 8.46 of the LBMC covers the Disposal of FOG. Section 8.46.060 provide the City and LBWD with authority to enforce this section of the Municipal Code and states that it "shall be enforced by the City Health Officer, or designee, or by the General Manager of the LBWD, or designee. These persons shall be known as enforcement officials and they are authorized to take any actions necessary to enforce this Chapter."

This page is intentionally left blank.

4 Operations and Maintenance Program

This section describes LBWD’s O&M program.

4.1 Sanitary Sewer System Mapping

LBWD implemented a Geographic Information System (GIS) in 1994. The GIS is SQL Server-based and consists of Environmental Systems Research Institute software programs. The GIS runs on Windows Server with networked computers over intranet and Internet.

The comprehensive GIS database contains detailed and up to date information on the sanitary sewer network. The key GIS information and uses are briefly summarized below:

Planning. The GIS database has information on existing sewer mains, planning and zoning information, census information, and parcel map information. The information is used to evaluate the capacity of existing sewer mains and to determine the size of proposed improvements.

Engineering. The LBWD has a sortable database of as-built drawings. Along with GIS attribute data for key sewer main elements (i.e., gravity sewer mains, laterals, manholes, pump stations, force mains), the GIS attribute data is populated with drawing reference numbers that enable Engineering staff to find as-built drawings. The GIS map also includes data on water, storm drain, street, county trunk sewer, and other underground utility data that is essential to sewer improvement design. In addition to the underground facility locations, the GIS map shows above ground building locations for things, such as pump stations, desalination facilities, and maintenance facilities.

Operation and Maintenance. The GIS map is compiled from LBWD’s historic Sewer Atlas Maps. Currently, updated Sewer Atlas Maps are used by sewer operations crews to locate and identify sewer facilities. With the implementation of GIS mapping capabilities, the Sewer Atlas Maps are now maintained within the GIS platform and hard copies are re-issued to Operations on an as-needed basis. Sewer investigators have laptop computers in their trucks with GIS maps. The GIS database capabilities have enhanced sewer operations activities beyond reliance on paper mapping sources by adding capabilities, such as developing repeat sewer cleaning route maps, locating FSEs and grease traps, and performing SSO analysis tracking.

Training. An introductory training session is provided to staff with an introduction guide to GIS to familiarize new employees with the sewer system GIS. The training also identifies GIS capabilities, such as zoom-in and zoom-out of the mapping system and how to extract sewer system information from GIS.

The sewer GIS is routinely updated with new and rehabilitated facilities and is corrected as needed when staff identify errors or inconsistencies with existing data. Staff complete a form and attach pictures to report problems with existing GIS data to the GIS group. GIS staff make updates based on a standard operating procedure. As part of these updates, the GIS group adds laterals to GIS based on closed-circuit television (CCTV) inspection videos.

4.2 Sewer System Preventive Maintenance

The LBWD's sewer system preventive maintenance program applies the following strategies to reduce sewer overflows:

- Aggressive system-wide sewer cleaning
- Targeted and frequent repeat cleaning of pipe segments with known maintenance issues
- Targeted chemical root control on pipe segments with known root issues
- Flow level monitoring at locations with an elevated risk of sewer overflow
- Regular CCTV inspection of sewer pipelines
- CCTV investigations to determine the root cause of sewer pipeline blockages and overflows to adjust maintenance approach

LBWD has the necessary staffing and equipment to accomplish each of these strategies. Major equipment includes: five jetter trucks, five CCTV inspection trucks and one high-pressure/low-volume lateral jetting truck.

4.2.1 Gravity Sewer Preventive Maintenance

System-wide Sewer Main Cleaning

LBWD cleans all sewer mains on a 2-year rotation. The system is divided into map grids that are divided into 5 Sewer Cleaning Groups. One sewer cleaning crew is assigned to each Sewer Cleaning Group. The map grids within each Sewer Cleaning Group are systematically assigned to sewer cleaning crews to accomplish the 2-year cleaning cycle. Once a cycle is complete, the sewer cleaning crews repeat the process. The grids are generally cleaned in the same order with each cycle. The Sewer Cleaning Water Utility Supervisor tracks the percentage of sewer map grids completed versus the percentage of the 2-year cycle expended and can easily see which crews are ahead of or behind schedule. Sewer cleaning crews ahead of schedule may be deployed to support crews that are behind schedule. Sewer cleaning crews document maintenance issues on the paper service rendered forms and will recommend potential additions to the targeted preventive maintenance program when significant maintenance issues (i.e., roots, grease, and debris) are found.

Targeted Sewer Main Cleaning

LBWD targets more frequent sewer cleaning on specific pipe segments with known maintenance issues. The Water Utility Supervisor responsible for sewer cleaning maintains a list identifying pipe segments cleaning on either a 60-day, 90-day,120-day, or 180-day cleaning cycle. Targeted sewer cleaning takes precedence over system-wide sewer cleaning.

Targeted Chemical Root Control

LBWD performs targeted chemical root control on pipe segments with known root intrusion issues. Chemical root control is performed on an ad hoc basis as a supplement to the sewer cleaning preventive maintenance program.

Sewer Manhole Visual Inspection and Flow Level Monitoring

LBWD currently performs manhole visual inspection during routine cleaning and CCTV inspection. LBWD performs more detailed inspection of manholes where warranted or when a significant number of manholes have been identified for potential rehabilitation. LBWD utilizes flow level sensors to monitor flow levels in some areas to identify potential stoppages, monitor locations with high flows, or monitor areas with a high consequence of failure, such as next to a water body.

Periodic Gravity Main Closed Circuit Television Inspection

LBWD is currently inspecting the gravity sewer system over a 5-year period using CCTV and the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program. Crew supervisors perform quality control reviews of CCTV data to maintain data quality and reliability of condition scoring. This quality control review is incorporated into staff training.

LBWD maintains CCTV inspection data in Pipelogix software, which provides easy access for review. The CCTV data can be mapped spatially through GIS to view problem sewer pipes on a map.

CCTV Investigation to Determine Root Cause of Maintenance Issues

LBWD performs investigative CCTV inspections when issues or needs are identified from customer calls, the Engineering Bureau, cleaning crews, or other sources. In some cases, these investigative CCTV inspections result in targeted adjustments to the preventive maintenance program. This type of investigative CCTV inspection is also performed after SSOs and blockages to determine the root cause of failure and to determine an appropriate corrective action, which in many cases is targeted and increased sewer cleaning.

Sewer Manhole Inspections

Manhole inspection records are documented on paper forms, and a photo is taken. The manhole inspection data is entered into a Microsoft Excel database. Manhole inspections and CCTV inspections are tracked and reported internally on a regular basis.

4.3 Pump Station Preventive Maintenance

LBWD owns and operates 28 pump stations as listed in **Table 4-1**. A flow schematic illustrating the relationship of the pump stations is shown on **Figure 4-1**.

The pump stations are monitored through a Supervisory Control and Data Acquisition (SCADA) system located at the Long Beach Groundwater Treatment Plant. Two staff are on duty 24 hours a day to monitor the SCADA system. Alarms are monitored for each pump station, including pump start, pump stop, high- and low- alarm levels, and wet well level. Newer pumps have extended run time alarms.

Pump station operators respond to SCADA alarms to ensure stations are operating properly. Each station has been evaluated to determine the required emergency response. Pump station failure is typically addressed through emergency bypass pumping. Larger bypassing needs, such as at pump station S-10 with force main length of 7,205.70 feet, may be addressed through an on-call contractor and coordination with LBWD Engineering Bureau. Tow-behind generators may also be used in the event of a power outage at a pump station. LBWD staff proactively prepare for a sustained high flow event, such as the Grand Prix, by mobilizing back-up generators and bypass pumps to the site prior to the event.

Two stations, S-27 and S-28, are currently not connected to SCADA. These stations are low flow and are checked weekly by LBWD staff and are also monitored by Airport personnel. The comfort stations along the beach and Marina are currently checked by Parks, Recreation, and Marine staff during cleaning. All pump stations have a sign with information for contacting LBWD in case of emergency.

Table 4-1. Pump Station Summary

Station No.	Station Name	Year Installed/Year Rehabilitated	No. of Pumps	Horsepower Per Pump	Pump Capacity (gpm)
1[7]	Hill & Atlantic	1920/2019	2	20	1,200
2	North Airport	1967	2	10	600
3	South Airport	1941	2	7.5	450
4	Los Altos	1964	2	7.5	800
5[1]	Westminster	2012/2014	2	5, 7.5	200
6	Ultimo	1981	3	7.5	680
7	Belmont Park	1929	2	14	1,000
8	Marina 2	1973	3	7.5	680
9[2]	Marina 1	1957	1[3]	5	Unknown
10	Naples	1952[4] /2002	2	24	900
11	Alamitos Bay	1926	2	7.5	580
12[7]	Belmont Shore	1991/2017	3	115	2240
13[2,5]	Belmont Pier	1965	2	2	180
14[2]	Coronado	1961	2	3	150
15[2]	Molino	1961	2	5, 3	100
16[2]	Cherry	1961	2	5, 10	220
17[2]	8th Place	1961	2	3, 5	Unknown
18[8]	Hart Place	1975/2020[6]	4	18 (2), 7.5 (2)	292
19	Harbor	Unknown/2003	2	7.5	Unknown

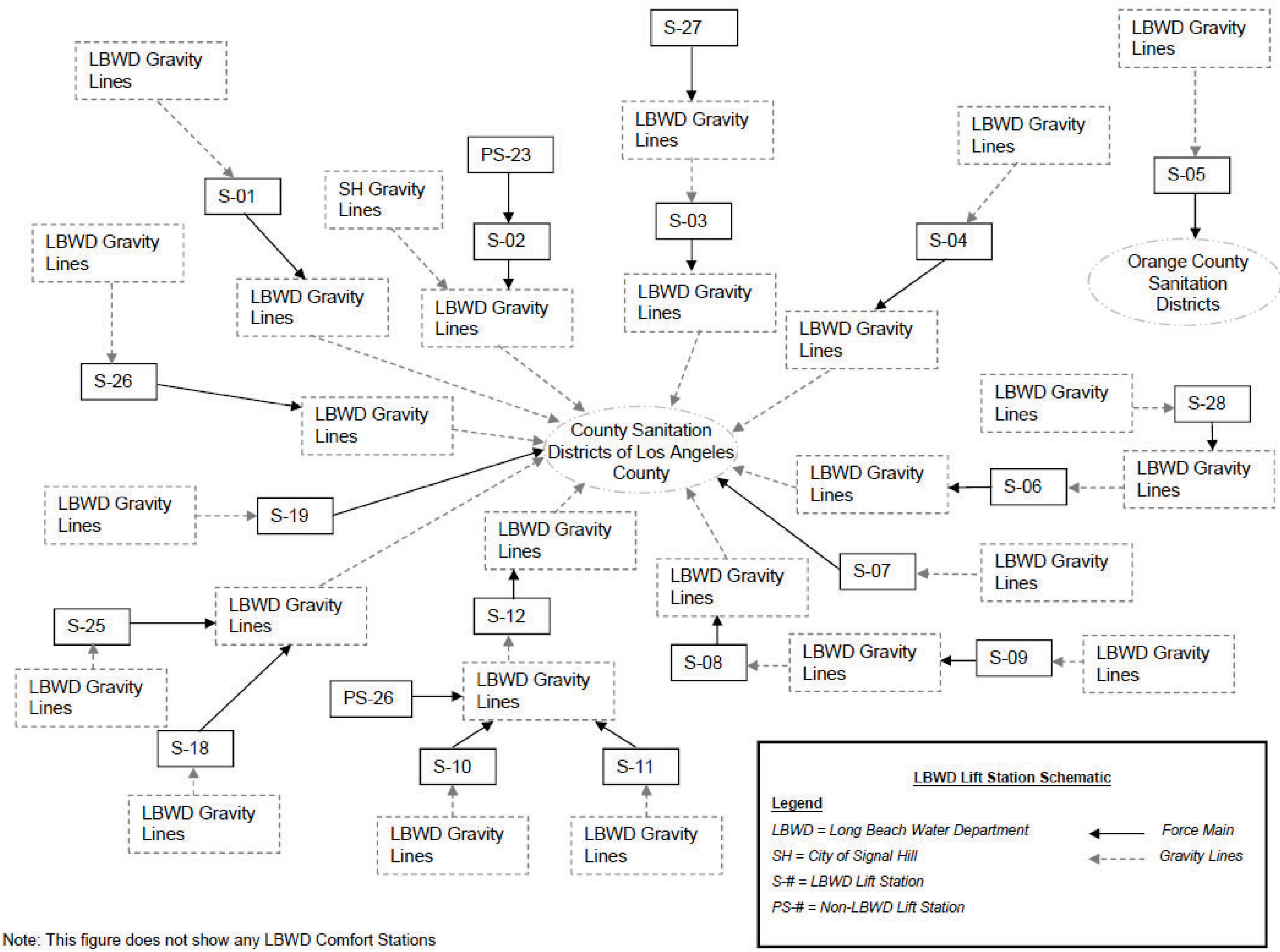
Table 4-1. Pump Station Summary (Continued)

Station No.	Station Name	Year Installed/Year Rehabilitated	No. of Pumps	Horsepower Per Pump	Pump Capacity (gpm)
20[2]	Shoreline Marina 1	1982	2	2	200
21[2]	Shoreline Marina 2	1982	2	2	200
22[2]	Shoreline Marina 3	1982	2	2	200
23[2]	Shoreline Marina 4	1982	2	2	200
24[2,5]	Shoreline Marina 5	1982	2	2	Unknown
25	Magnolia	1968/2021[6]	4	24.4 (2), 18,8, 10.4	500
26	Santa Fe	1980	3	30	820
27[2]	Airport Admin. Bldg.	Unknown	2	3	100
28	Marine Stadium	Unknown	1	Unknown	Unknown

Notes:

1 Serves approximately 20 acres that discharges flow to the County Sanitation Districts of Orange County.
2 Comfort station.
3 Ejector pump listed, but not used.
4 New pumps added in 1988.
5 No longer operated by the LBWD.
6 Estimated completion for rehabilitation.
7 Flow meter currently installed.
8 Flow meter to be installed once rehabilitation is completed.

Figure 4-1. Long Beach Water Department Pump Station Flow Schematic



Note: This figure does not show any LBWD Comfort Stations

Pump station inspection rounds begin with a visual inspection of the facility for items such as vandalism or damage to the site. The wet well is inspected for grease. Excessive grease can cause issues with sensors and is cleaned when identified. A contractor may be called in to clean grease if necessary. LBWD staff check the condition of each motor and pump, amps are checked to ensure they are within proper operating range, lug joints or connections are checked, the station is inspected for leaks, and fittings are greased where appropriate. Pumps are pulled for repairs or replacement when operators identify issues from rags or debris based on visual inspection and an audio assessment. All generators located on pump station sites are tested on a monthly basis. A log book is maintained at the pump station and also at LBWD Control 2. If a station is equipped with an odor control scrubber, the scrubbers are inspected regularly. Additionally, pump stations S-10, S-12, and S-18 receive weekly deliveries of BioMagic enzymes for grease control.

Force Main Inspection and Maintenance

LBWD visually inspects the alignment of each force main annually to detect any signs of leakage. LBWD monitors the performance of pump stations using SCADA and will investigate a force main if pump station performance issues indicate an issue with a force main.

4.4 Rehabilitation and Replacement Planning

This section describes LBWD's program for condition assessment and Capital Improvement Program (CIP) planning for pipelines, manholes, and pump stations. LBWD has historically performed rehabilitation and replacement planning on the collection system. In 1990, LBWD compiled a comprehensive sewer system master plan and management program. Detailed plans and studies were completed for 3 of the 14 service areas (Areas 1, 7 and 8), and special studies were conducted for the pump stations. In 2008, LBWD completed a sewer system master plan update to identify new improvement projects and reclassify the existing CIP list to address gravity sewer rehabilitation and replacement using geographic areas. Since 2008, LBWD has moved to utilizing NASSCO structural condition scores for gravity sewers to target rehabilitation and replacement. In 2013, a field assessment of fourteen sewer pump stations was completed and potential improvements were identified.

Gravity sewer main structural condition issues are currently identified through LBWD's CCTV inspection program and these condition issues are addressed based on risk. LBWD repair crews or emergency contractors address sewer main collapses or other major issues when identified. Less urgent gravity sewer main issues are compiled into a structural repair package and sent to LBWD Engineering Bureau for review and CIP project packaging. Sewer lateral defects are address by LBWD repair crews. LBWD has completed approximately 100 to 150 sewer lateral repairs per year over the prior few years.

LBWD's Engineering Bureau typically develops CIP projects once or twice per year. Gravity sewer main condition scores from CCTV data are used to identify approximately 20,000 linear feet of pipe per year with the highest risk of failure. These selected gravity mains are then packaged into CIP projects. LBWD typically utilizes pipe lining rehabilitation methods to address pipe condition, but point repairs and pipe replacement are also performed where appropriate. LBWD considers additional factors when packaging gravity sewers into projects including pavement moratoriums, coastal zoning permitting, Caltrans permitting, railroad permitting, and easements.

When inspecting and cleaning gravity sewer mains, LBWD crews will open manholes and perform initial inspections of manholes. LBWD will perform a more detailed inspection on the manholes when appropriate. Typical manhole rehabilitation work includes raising the manhole rings to grade, addressing missing bricks, addressing channel degradation, and replacing missing lids. LBWD crews perform manhole rehabilitation work where appropriate. Manholes identified for rehabilitation that will not be addressed by LBWD crews are referred to LBWD Engineering Bureau. The Engineering Bureau develops manhole rehabilitation projects based on referrals from the Operations Bureau on a regular basis.

Rehabilitation and replacement needs for pump stations and force mains are typically identified through regular planned maintenance activities at the pump stations and referred to the Engineering Bureau when appropriate.

4.4.1 Capital Improvement Plan

The CIP represents the City's strategic capital investment plan. The CIP identifies and provides two types of expenditures. The first covers strategic improvements to the City's existing infrastructure and the second type involves one-time projects designed to address important community needs.

The Sewer CIP is developed and managed by LBWD's Engineering Bureau.

Public Works, in conjunction with the Sewer Operations, review LBWD's capital needs and prioritize project submittals based on established criteria:

- The ability of the project to meet health, safety and legal concerns and mandates
- The value of the project to prolong the life of City assets or avoid/minimize future repair costs
- The benefit the project will provide the community in support of the goals articulated in the Strategic Plan
- The potential for the project to generate savings or increase productivity
- The extent to which the project will secure future funds through program planning or grant eligibility

Planned capital improvements to the LBWD's sewer system encompass a wide range of projects. The Sewer CIP budget covers a 5-year period for long-term needs and reflects a sustained level of investment in infrastructure. LBWD Engineering Bureau updates the CIP and project priorities annually through workshops with engineering and operations staff based on current operating conditions including recent data such as inspections or flow monitoring. The CIP includes rehabilitation and replacement projects, as well as repair projects developed by a collaboration of the Engineering Bureau and Sewer Operations.

The City's CIP covers a 3-year period and describes sources of funding and can be found on the Capital Improvement Plan webpage (City of Long Beach n.d.b.).

The LBWD develops a fiscal year CIP budget summary and presentation which is located on the LBWD website (Long Beach Water n.d.b).

4.5 Equipment and Replacement Part Inventories

The Sewer Operations maintains an inventory of 6-, 8-, 10- and 12-inch pipes and fittings for point repair and replacement activities. All spare parts are kept at the Operations Service Center in either the warehouse, the sewer storage areas, or on sewer construction vehicles.

The Pump Stations have been evaluated to identify spare parts. Typical spare parts include pumps and bypass pumps. An inventory of spare parts is maintained to ensure continued pump station operation. LBWD's goal is to have at least one spare pump per station.

LBWD has contracts in place with material vendor(s) to obtain parts or equipment during an emergency situation. These contracts have gone through the procurement process during initial set-up, and vendors are required to provide contact information for after-hours service.

This page is intentionally left blank.

5 Design and Performance Provisions

This section documents the design and performance provisions.

LBWD requires that all new sewer systems, pump stations and other appurtenances, as well as the rehabilitation and repair of existing sewer facilities, be designed and constructed in accordance with the following design requirements:

- LBMC, Section 15 (City of Long Beach 2019)
  - https://library.municode.com/ca/long_beach/codes/municipal_code
- LBWD Sewer System Design Guidelines (Long Beach Water n.d.c)
  - https://lbwater.org/customer-services/designing-and-planning/developers-agreement/
- Standard Drawings and Designs (Long Beach Water n.d.d)
  - https://lbwater.org/customer-services/designing-and-planning/standard-drawings-and-designs/
- The latest edition of the Standard Specifications for Public Works Construction (Green Book)

Where LBWD standards do not fully cover the design, the new sewer systems, pump stations, and rehabilitated sewer facilities are designed and constructed in accordance with the following design requirements:

- Los Angeles County Sanitation Districts, Standard Drawings for Construction (Sanitation Districts of Los Angeles County 2018)
  - https://www.lacsd.org/businesses/bidspur/amendments.asp
- City of Los Angeles Department of Public Works, Bureau of Engineering, Part F – *Sewer Design*, latest edition (City of Los Angeles Department of Public Works 2008)
  - http://eng2.lacity.org/techdocs/index.htm
- Los Angeles County, Department of Public Works, *Private Contract Sanitary Sewer Procedural Manual*, latest edition. (City of Los Angeles Department of Public Works 1987)
  - https://dpw.lacounty.gov/ldd/lib/fp/Sewer/Private%20Contract%20Sanitary%20Sewer%20Manual.pdf

Electronic files for sample sewer drawings and for construction specifications are available upon request.

5.1 Design and Construction Standards and Specifications

LBWD updates the design and construction standards and specifications on an as-needed basis. The Long Beach sewer service area is largely built out with limited new sewer extensions. Growth within the City is typically associated with redevelopment that may be more likely to utilize existing sewer infrastructure. If the proposed growth adds significantly to flows in the existing sewers and downstream facilities, LBWD will require upsizing or the addition of new pump stations to accommodate the additional flow.

5.1.1 Standards for Gravity Sewers

LBWD's *Sewer System Design Guidelines* includes design criteria applying to both new, repaired and rehabilitated assets (Long Beach Water n.d.c). The following are key design standards included in *LBWD's Sewer System Design Guidelines:*

- Sewer main depth, size, and location
- Sewer lateral depth, size, and location
- Pipeline material types
- Design parameters for gravity sewer main slope, flow, and demand
- Sewer laterals shall have a minimum diameter of 6 inches. Laterals shall have a minimum slope of 2 percent from the sanitary sewer main to the property line and shall have a minimum cover of 5 feet at the property line.
- Manholes shall be spaced at 350 foot maximum intervals. A manhole shall be constructed at the end of construction with 1-foot and 2-foot stub outs for future connection. Stub shall be plugged with brick and mortar.
- Cleanouts in a sewer lateral shall be made by inserting either a WYE branch or a two-way cleanout fitting in the line, with the cleanout hub placed vertically above the flow line of the pipe. Cleanouts shall be accessible for maintenance and shall be placed in every sewer lateral at specified areas, as outlined in *LBWD's Sewer System Design Guidelines.*
- LBWD refers to the *Standard Specifications for Public Works Construction (Green Book)* for gravity sewer rehabilitation and repairs.

5.1.2 General Guidelines for Sewer Force Mains

LBWD force mains are designed on a case-by-case basis for each force main. LBWD may refer to The City of Los Angeles Department of Public Works, Bureau of Engineering, Part F – Sewer Design and the Standard Specifications for Public Works Construction (Green Book) for sewer force main design.

5.1.3 General Guidelines for Sewer Lift Stations

LBWD pump stations are designed on a case-by-case basis for each unique situation. LBWD may refer to The City of Los Angeles Department of Public Works, Bureau of Engineering, Part F – Sewer Design and the Standard Specifications for Public Works Construction (Green Book) for sewer pump station design.

5.1.4 Standard Drawings

LBWD's *Standard Drawings and Designs* contains standard drawings for standard sewer improvements, including:

- WDS-501: Manhole Type “C”
- WDS-502: Manhole Type “D”
- WDS-503: Drop Manhole
- WDS-504: Inverted Siphon
- WDS-505: Sewer Manhole
- WDS-506: Sewer Cleanout
- WDS-507: Chimney
- WDS-508: Typical Grease and Grit Interceptor
- WDS-509: Rainwater Diversion System – Automatic
- WDS-403: Sewer Main Support
- WDS-404: House Sewer Connection

5.2 Procedures and Standards for Inspection and Testing

All work for LBWD is subject to inspection and gravity sewer construction must be warranted for a minimum of 1 year by the contractor. An internal CCTV inspection may be conducted prior to the end of the warranty period to ensure continued conformance to design standards.

The City’s Public Works Department assists LBWD with processing applications and issuing permits for new sewer connections on behalf of the LBWD. The LBWD inspector will inspect the installation of the lateral in the public right-of-way to insure compliance with the permit and LBWD standards. The LBWD inspector and the contractor will coordinate the construction schedule to insure sewer laterals are inspected during construction.

LBWD refers to Engineering Bureau Specifications and the *Standard Specifications for Public Works Construction (Green Book)* for gravity sewer rehabilitation and repair inspection standards and testing.

This page is intentionally left blank.

6 Overflow Emergency Response Plan

LBWD's Overflow Emergency Response Plan documents the protocols LBWD staff follow in the event of a sewer overflow and is included as **Attachment F1**. **Table 6-1** provides a summary of the Waste Discharge Requirements for an Overflow Emergency Response Plan and the relevant section of LBWD's Overflow Emergency Response Plan addressing the Waste Discharge Requirements.

Table 6-1. Linkage between Overflow Response Requirements and Overflow Emergency Response Plan

Overflow Emergency Response Program Requirement	Overflow Emergency Response Program Section
Prompt Initial Notification Procedures	Section 2 – SSO Detection Section 3.4 – Initial Response
Appropriate Response to SSOs	Section 2 – SSO Detection; Section 3 – SSO Response Procedures; Section 5 - Equipment
Prompt Notification of SSO Reaching Waters of the State	Section 3.5 – Water Quality Sampling and Testing Section 4 – SSO Documentation and Reporting
Procedures for Awareness and Training for Emergency Response Plan	Section 6 – SSO Response Training
Procedures to Address Emergency Operations	Section 3 – SSO Response Procedures
Program to Ensure Reasonable Steps Taken to Contain and Prevent Discharge	Section 3 – SSO Response Procedures; SSMP Chapter 4 - Operations and Maintenance Program

Notes:
SSMP=Sewer System Management Plan; SSO=sanitary sewer overflows

6.1 Summary of the Overflow Emergency Response Plan Sections

The City's Overflow Emergency Response Plan contains the following sections.

- **Section 1 - Purpose**

  This section states that the Sewer Overflow Response Plan has been developed to ensure an appropriate standardized response in the event of a sewer overflow. The Plan also ensures that the City is adequately prepared to respond to SSO events by:

  - Reducing or eliminating public health hazards
  - Preventing unnecessary property damage
  - Ensuring thorough recovery and cleanup efforts
  - Properly documenting, notifying, and reporting overflow spill events
  - Minimizing the inconvenience of service interruptions

  - Ensuring staff and contracted personnel are properly trained to respond to such events

- **Section 2 - Sanitary Sewer Overflow Detection**

  This section describes the methods in which overflows may be discovered or detected as well as the communication reception and response during working hours, afterhours, weekends, and holidays.

- **Section 3 – Sanitary Sewer Overflows Response Procedures**

  This section describes the responsibilities of LBWD personnel to respond to overflows, what a preliminary assessment and response might consist of, and how to respond to overflows in the collection system and on private property. Mitigation and spill containment measures describes the concept of reducing spill severity and the sensitivity of the coastal waters and the environment to SSOs.

  Water quality sampling is performed by the LBDHHS. **Attachment F2** describes the current water quality monitoring program sampling protocols, including for SSO events spilling greater than 50,000 gallons to a surface water.

  The Recovery and Cleanup section of the Overflow Emergency Response Plan describes procedures to be followed by LBWD's contractor for clean-up and disinfection on hard surfaces, into waterways, lawns or landscaped areas, storm drains, catch basins, and wet weather modifications. The procedures to estimate the volume of spills and recovery of spilled sewage ensures that overflow quantification is accurate and lists several means of quantifying overflow.

  SSO event investigation, traffic and crowd control, public notification, and follow up activities are also included in this section.

- **Section 4 – Sanitary Sewer Overflows Documentation and Reporting**

  The California SWRCB has established guidelines for classifying and reporting an SSO. These categories are described in detail in this section.

  In addition, all SSOs should be thoroughly investigated and documented for use in managing the wastewater collection system and meeting established reporting requirements. This section includes the procedures for investigating and documenting SSOs as well as the reporting protocol for various spill types.

- **Section 5 - Equipment**

  This section includes a description of vehicles and equipment to support the daily needs, routine maintenance, and emergency situations for sewer operations.

- **Section 6 – Sanitary Sewer Overflows Response Training**

  The Training section outlines various routine Overflow Emergency Response Plan related trainings, as well as record keeping.

6.2 Contractor Spill Prevention and Emergency Response Plans

LBWD requires all construction contractors performing work on the collection system to develop, submit and implement a Spill Prevention Plan in construction contracts. **Attachment F3** includes the Engineering Bureau's specification that includes description for the Spill Prevention, Control, and Countermeasure Plan.

This page is intentionally left blank.

7 Fats, Oils, and Grease Control Program

This section describes how FOG control is accomplished within LBWD.

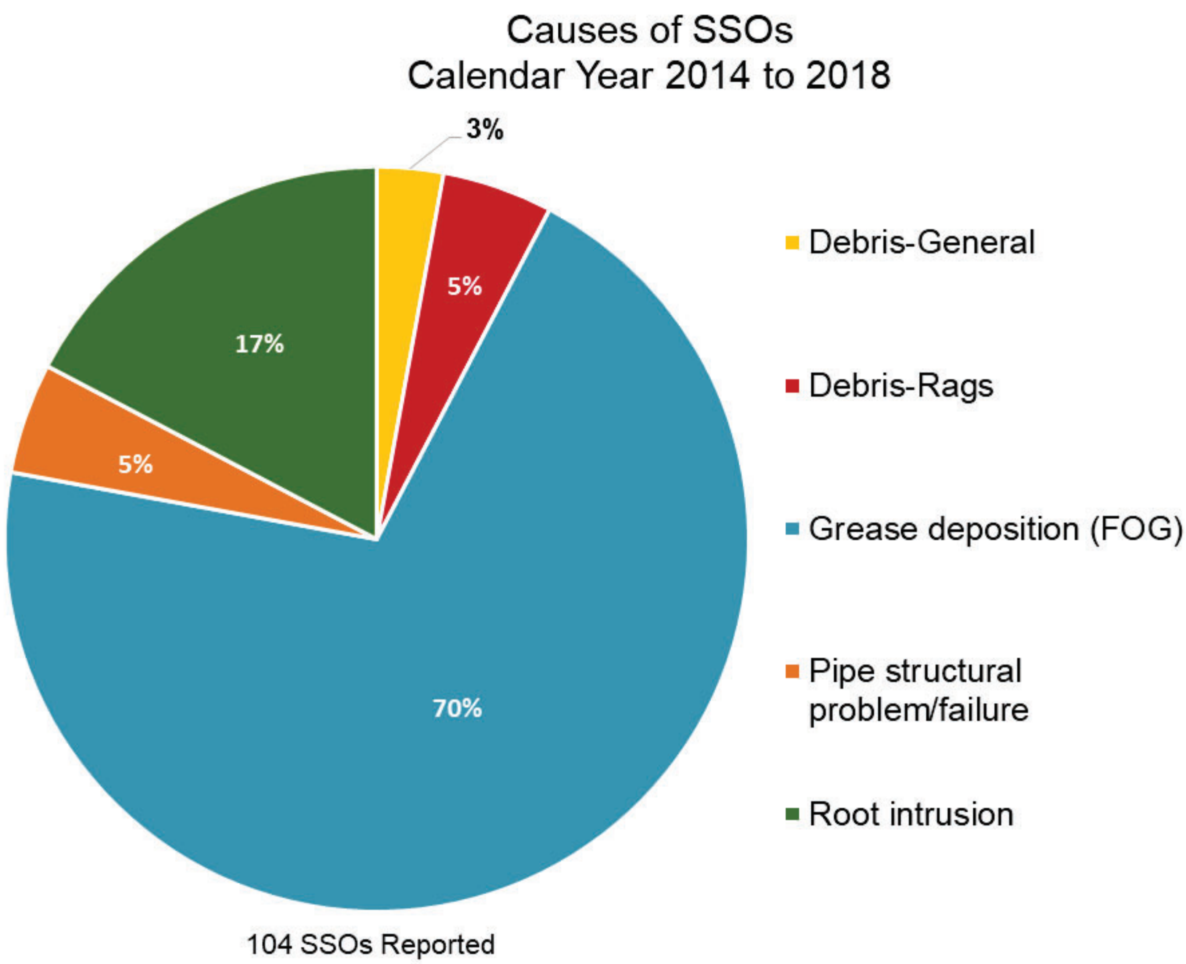
Under Order No. 2006-0003-DWQ, LBWD is responsible for evaluating the necessity of a FOG control program. If FOG is identified to be an issue, LBWD must prepare and enforce an implementation plan to reduce the amount of substance discharged into the sanitary sewer system. Otherwise, justification to the Board is required to validate that a FOG control program is not needed.

In 2003, LBWD determined that a formal FOG control program was necessary to meet the following objectives:

- Reduce the number of blockages in City sewer lines caused by FOG
- Reduce the number of sewer overflows onto City streets and storm drains due to FOG
- Reduce the frequency of cleaning needed to control FOG in “repeat” sewer lines

In 2005, the City Council implemented FOG Ordinance No. ORD-05-0003, which added regulations for the disposal of FOG into the LBMC under Chapter 8.46. In September 2016, a Memorandum of Understanding between the LBWD and the LBDHHS was reinstated to reduce blockages in City sewer lines due to FOG from FSEs and to reduce frequency of raw sewage backups in FSE and overflows into the streets and storm drains. Currently, the FOG control program remains active and enforced because FOG continues to be a major contributor to SSO events. **Figure 7-1** illustrates the percentage of FOG-related SSOs out of 104 reported SSOs from the past five calendar years (Year 2014 to 2018).

Figure 7-1. Percentage of Fats, Oils, and Grease-Related Sanitary Sewer Overflows



Source: CIWQS SSO Report

LBDHHS has more than 2,200 FSEs that are required to comply with the FOG regulations.

7.1 Public Education Outreach Program

LBWD and LBDHHS have developed the following public education outreach programs in an effort to reduce FOG:

- LBWD shared brochures to Long Beach students on Earth Day to highlight best management practices (BMP) that can be performed in households
- LBWD posted advertisements in local newspapers and bus tails
- LBWD displayed BMP posters in several languages (Spanish, English, Khmer, and Tagalog) in FSE kitchen
- LBWD distributed utility bill inserts and flyers
- LBWD and LBDHHS utilized social media to spread FOG messaging

- LBDHHS conducted FOG education and outreach during routine food inspections and provided FOG educational materials to FSEs
- LBDHHS posted FOG brochures and other educational materials on website and social media pages
- LBDHHS presented FOG information at several community events

In addition, during CCTV inspection, LBWD staff takes initiative to verbally educate homeowners on FOG reduction strategies when the homeowner's lateral is identified as a heavily greased line.

LBWD and LBDHHS are dedicated to improve and strengthen the community effort to reduce FOG-related SSOs. LBWD and LBDHHS plan to update and implement the following public outreach materials within the next 2-5 years:

- Develop an Informational Bulletin and other educational brochures or pamphlets for FOG to educate FSE owner
- Develop a robust training program for food inspectors on FOG regarding BMPs
- Present FOG information at the annual National Food Safety Month's Meet and Greet celebration, where food service facility owners are informed about upcoming legislative laws and food safety information

7.2 Disposal of Fats, Oils, and Grease

LBMC 8.46.030 – *Requirements for Food Facilities* outlines the process to adequately dispose of FOG generated within a sanitary sewer system area. A list of several acceptable disposal facilities needed to adequately dispose of FOG generated within a sanitary sewer system service area is included in **Attachment G1**. Note: this list is neither a referral nor a recommendation by the City.

7.3 Fats, Oils, and Grease Legal Authorities

The legal authority for LBWD's FOG control program are presented in Sections 3.5 and 3.6 of this SSMP.

7.3.1 Fats, Oils, and Grease Inspection

The LBDHHS is responsible for conducting FOG inspections annually at each FSE to ensure compliance to LBMC. Results are reported to LBWD to track how many inspections were in or out of compliance. If required documents are not prepared during the time of the FOG inspection, the FSE can submit at a later time via email. If a violation is determined, the FSE is given an allotted time by the health inspector to correct and sign a Certificate of Compliance Form. If the FSE exceeds the timeframe to correct an outstanding violation, it is up to the discretion of the health inspector whether or not to assess a reinspection fee. The health inspectors evaluate for:

- FOG BMP Compliance:
    - The owners and employees of an FSE shall be able to demonstrate that food facility complies with BMPs for handling FOG upon request from a LBDHHS representative, as noted in LBMC, 8.46.030.A.
- FOG Storage and Recycling:
    - A food facility shall have one or more drums or containers for the recycling and disposal of FOG, as noted in LBMC 8.46.030.B.
    - Drums and containers used for storage of FOG shall be leak proof and shall be secured with close fitting lids, as noted in LBMC 8.46.030.B.
    - The drums and containers shall be removed for recycling as frequently as necessary to avoid unsafe, hazardous, or untidy condition or an impediment to passage, as noted in LBMC 8.46.030.B.
- Clean and Maintain Facility:
    - The owner or operator of a FSE shall keep a written record of the maintenance, repair, and cleaning of grease traps and interceptors for one year, beginning the date a new business is open to the public or, in the case of a modification to the FSE which requires a building permit, on the date of final inspection, as shown on the building permit. A copy of the building permit is to be delivered to LBWD. The written record shall contain (but is not limited to) the following documentation:
        - Receipts showing the times, dates, nature of the maintenance, repair, and cleaning
        - Quantities of fats, oils, and grease removed
        - Name, address, and phone number of the person or entity cleaning the grease interceptor, grease trap, or alternative pretreatment technology (approved by City), as noted in LBMC 8.46.030.E
    - The owner or operator of a food facility shall install grease interceptors at a location easily accessible for inspection and for the cleaning and removal of grease, as noted in LBMC 8.46.040.C.
    - The grease interceptor shall not be installed near or in any part of a building where food is handled. The location of the grease interceptor must have a written approval by the LBDHHS, as noted in LBMC 8.46.040.C.
- Changes to Grease Interceptors
    - An FSE shall submit plans to LBWD for approval prior to installing, removing, or modifying a grease interceptor.
- Records:
    - The owner or operator of an FSE shall inspect the grease interceptor at least once per month. This frequency may be increased, as directed by an enforcement official, if the maintenance of the grease interceptor is found unsatisfactory, as noted in LBMC 8.46.040.E.

  - FSE operators are required to maintain 12 months of written records documenting maintenance, repairs or cleaning of grease traps and grease interceptors, as well as invoices or manifests for grease removal services, as noted in LBMC 8.46.030.E.
- Grease Interceptor Maintenance:
  - The owner or operator of an FSE shall empty grease interceptors of accumulated grease necessary to maintain the minimum capacity or volume of the grease interceptor, as noted in LBMC 8.46.040.D.
  - The owner or operator of a FSE shall keep the grease interceptor free from inorganic-solid materials that could settle into the sludge pocket and reduce the effective volume of the grease interceptor, as noted in LBMC 8.46.040.G.
  - The owner or operator of an FSE shall maintain the grease interceptor in clean, good repair, and proper operating condition at all times, in accordance with the manufacturer's directions. This includes proper spillage clean-up, storage of waste grease, frequent disposal of wastewater, food debris, and grease, and grease hauling. Grease shall not accumulate in any drain pipe or public or private sewer line as noted in LBMC 8.46.050.D.
  - A health inspector checks for maintenance invoices to ensure the grease interceptors are regularly cleaned.

7.4 Fats, Oils, and Grease Program Requirements

7.4.1 Grease Removal Device Requirements

Section 1306 – *Grease Trap Requirements* in LBWD's Rules and Regulations states the grease removal device requirements. A grease system can either be a grease interceptor or grease recovery device. LBWD's requirements to install and design grease removal devices are discussed in LBMC 8.46.040 – *Requirements for Grease Interceptors*.

7.4.2 Best Management Practice, Record-Keeping, and Reporting Requirements

The maintenance requirements, BMP requirements, record keeping, and reporting requirements are found in LBMC 8.46.030 – *Requirements for Food Facilities*. The majority of BMP materials are from County Sanitation District of Los Angeles County. Examples of BMP practices include:

- Dry clean-up, wiping cookware, utensils and work areas prior to washing; disposing of food waste directly into the trash; avoid use of garbage disposal
- Spill prevention
  - Immediately remove spilled FOG using absorbents
  - Empty grease collection containers before full
  - Properly operate and maintain grease trap/interceptor by having the equipment regularly and frequently cleaned and serviced

- Develop rotation system for multiple fryers
- Clean floor mats in a janitorial sink

7.5 Fats, Oils, and Grease Program Staffing

LBDHHS has an established Memorandum of Understanding with LBWD to perform FOG source control inspections. Currently, there are 10 FSE district areas throughout the City. Each district area is assigned a health inspector to conduct FOG inspections and to enforce the FOG ordinance for relevant FSEs.

7.6 Preventive Maintenance Program to Address Fats, Oils, and Grease Accumulation

LBWD has identified the pipe segments of the sewer system subject to higher levels of FOG. Heavily greased lines initially undergo hydro jet cleaning prior to being assigned to a repeat schedule. Maintenance for the grease interceptor depends upon operation, but it is typically quarterly.

7.7 Source Control Measures for All Sources of Fats, Oils, and Grease Discharged

LBWD and LBDHHS work together to address all known locations of FOG accumulation through either FOG source control inspections of food service facilities and/or preventive maintenance cleaning on pipe segments with known propensity for FOG accumulation. LBWD's Sewer Operations Division cleans pipe segments with excessive FOG accumulation.

8 System Evaluation and Capacity Assurance Plan

LBWD has implemented a program to assure system capacity to convey peak dry weather flows. The *Sewer Master Plan* was updated in 2013 and is included in **Attachment H1**. The plan includes wet weather monitoring, evaluation of peak flow including rainfall derived infiltration and inflow, projected future wastewater flows, and a hydraulic model of the entire collection system. The plan determined that the effects of infiltration and inflow were insignificant compared to the amount of sewer flow through the sewer system. The LBWD is in the process of updating the *2013 Sewer Master Plan*.

8.1 Evaluation to Identify Potential Hydraulic Deficiencies

In 2013, the LBWD updated its capacity analyses of the existing and future scenarios to determine if there are any potential capacity deficiencies. The plan aligned flow monitoring data with the InfoSWMM hydraulic model and updated flows for weekday and weekend demands. Weekend flows were higher than weekday flows which are attributed to tourism and increased commercial activity on weekends. Locations with potential surcharge identified through the analysis were evaluated to verify project needs through additional flow monitoring or other investigation such as CCTV inspection.

System flows have declined since the initial 2008 Sewer Master Plan and the 2013 update. This decline is primarily attributed to active and passive indoor water conservation measures. Previously identified potential surcharge locations were reevaluated through the *2013 Sewer Master Plan Update* and *Sewer Master Plan Supplement* work in 2014, and capacity improvements are not warranted.

8.1.1 Dynamic Hydraulic Model

A dynamic hydraulic model of the collection system was developed as part of the *2008 Sewer Master Plan*. The model was created using InfoSWMM software from Innovyze using the U.S. Environmental Protection Agency SWMM hydraulic engine which operates in the Environmental Systems Research Institute ArcGIS environment. InfoSWMM is an extension to Environmental Systems Research Institute ArcGIS, and this brings a powerful modeling system into a fully featured GIS, allowing all advanced GIS functions to be utilized. The hydraulic model is utilized to evaluate potential surcharge and SSO conditions in addition to pipe flows and capacity. The hydraulic model is also used to evaluate new development. The hydraulic model includes all gravity sewer mains 12-inch and greater and diameter and select smaller gravity mains. An all pipe model was developed for the Downtown Sewer Focus Study completed in 2019.

8.2 Evaluation and Design Criteria

The LBWD's sewer system evaluation criteria is located in Appendix F of the *2013 Sewer Master Plan Update*. Evaluation criteria for potential gravity sewer main upsizing is d/D of 0.90 or greater. Design criteria for new gravity sewer main infrastructure is d/D of less than or equal to 0.75 for gravity sewer mains greater than 18-inch diameter, and less than or equal to 0.50 for mains less than or equal to 18-inch diameter. Pump station and force main criteria includes a maximum velocity at 10 feet per second during peak dry weather flow at build out and a minimum of 3 feet per second at average dry weather flow for existing system conditions.

8.3 Capacity Enhancement Measures

The *2013 Sewer Master Plan Update* utilizes the results of the hydraulic model evaluation to recommend CIP projects for existing and future scenarios. Some potential deficiencies were identified for near-term monitoring and verification. Verification through flow monitoring and CCTV were performed as part of *2014 Sewer Master Plan Supplement* work, which identified the locations as having adequate capacity. The *2013 Sewer Master Plan Update* includes cost estimates and schedule for condition improvement of existing wastewater collection pump station facilities.

8.4 Schedule for Completion of Capital Program

The *2013 Sewer Master Plan Update* identifies targeted completion years for proposed projects. The LBWD updates the CIP and project priorities annually through workshops with the Engineering Bureau and Sewer Operations staff based on current operating conditions including recent data such as inspections or flow monitoring. The LBWD maintains a 5-year CIP budget internally and supports preparation of the City CIP plan which includes a 3-year CIP and identifies sources of funding. Current and historical CIP plans for the City are located on the City of Long Beach Website (City of Long Beach n.d.b): http://www.longbeach.gov/pw/resources/general/capital-improvement-plan/

The LBWD develops a fiscal year CIP budget summary and presentation which is located on the LBWD website (Long Beach Water n.d.b.): https://lbwater.org/about-us/important-documents/budget/

9 Monitoring, Measurement, and Program Modifications

Monitoring, measurement, and program modification is required to:

- Maintain relevant information to establish and prioritize appropriate SSMP activities
- Monitor the implementation and, where appropriate, measure the effectiveness of each element of the SSMP
- Assess the success of preventive maintenance activities
- Update program elements, as appropriate, based on monitoring of performance evaluations
- Identify and illustrate SSO trends, including frequency, location and volume

This section describes LBWD's monitoring, measurement, and program modification program.

9.1 Performance Measure Identification

Improved wastewater infrastructure performance is a core task of any properly run utility. LBWD is committed to fulfilling its Mission Statement through a program of continuous improvement that:

- Utilizes a formalized program for continuous improvement
- Institutionalizes continual evaluation of its performance
- Identifies opportunities for continuous improvement
- Rewards or recognizes staff when performance is improved

To accomplish the above goals, LBWD has established a number of performance measures and routinely monitors progress in meeting those performance measures. The performance measures relating to each SSMP program element are listed in Table 9-1.

Table 9-1. Performance Measures per Each Sewer System Management Plan Element

Element	Performance Measure	Source
Goal	<=2 SSOs/100 miles/year	CIWQS
Organization	Percentage of vacant sewer operations positions	Operations Bureau
Operation and Maintenance	Miles of sewer cleaned	Operations Bureau
	Miles of sewer inspected	Operations Bureau
	Number of sewer repairs (mainline and lateral)	Operations Bureau
	Miles of sewer rehabilitated/replaced	Engineering Bureau
	Number of wet wells cleaned	Operations Bureau
	Number of pump station inspections	Operations Bureau
	Number of air relief valves inspected	Operations Bureau
SSO Response	SSO response time	Operations Bureau
FOG Control Program	Number FSE inspections	LBDHHS
	Number of FSE enforcement actions initiated	LBDHHS
	Number of FSE enforcement actions resolved	LBDHHS
	Number of grease-related SSO events	Operations Bureau
	Number of FSE enforcement actions initiated	LBDHHS
Capacity Assurance	Number of capacity-related SSO events (including wet weather-related SSOs)	Engineering Bureau
	Number of recommended Capacity Enhancement CIP Projects completed	Engineering Bureau
Monitoring & Measurement	Monthly performance review at manager level with executives	Engineering and Operations Management
Communication Program	Number of sewer-related public information brochures or newsletters distributed	Public Information Officer
	Number of sewer-related public education activities (i.e., events, presentations)	Public Information Officer

Notes:

LBDHHS=Long Beach Department of Health and Human Services

CIP=capital improvement program; CIWQS=California Integrated Water Quality System; FSE=food service establishments; FOG=fats, oils, and grease; SSO=sanitary sewer overflow

9.2 Monitoring

Each operational unit responsible for SSMP program activities (i.e., Operations Bureau, Engineering Bureau, Public Information Officer, and LBDHHS) is responsible for collecting performance measurement data to track progress. Water Department management reviews performance data monthly to identify trends and progress towards achieving goals and, if performance issues are identified, will work with staff to identify corrective actions.

9.3 Program Modification Plan

The success of the SSMP program elements should lead to a reduction of SSOs within the collection system. If no reduction in SSOs is seen, the program elements should be critically reviewed to determine areas for improvement. Those program elements should be modified as needed to improve performance.

LBWD monitors and measures the effectiveness of the SSMP program to diagnose the root causes of issues impacting SSMP program effectiveness. This includes on-going data analysis and standing meetings with various work groups to discuss performance and best practices. A few examples are weekly Sewer Operations meetings, monthly Engineering/Field Ops meetings, quarterly General Manager meetings, and annual Budget review meetings.

Program modifications usually occur during the planning process for the following year's budget, but it can also occur at any time during the year if performance issues are identified through performance monitoring. Program modifications also occur as a result of the biennial SSMP program audit process. Planned changes or corrective actions to the SSMP program implementation are monitored and tracked by the Sewer Operations Superintendent.

This page is intentionally left blank.

10 Sewer System Management Plan Program Audit and Updates

The SSMP requires periodic internal audits to evaluate the effectiveness of the SSMP. This section details LBWD's plans to conduct such internal audits.

10.1 Sewer System Management Plan Program Audit Process

LBWD performs an SSMP Program Audit once every 2 years. The Sewer Operations Superintendent is responsible for initiating the SSMP Program Audit process, reviewing performance trends and the overall SSMP program implementation, and developing a set of audit findings and proposed corrective actions. The previous audit, input gathered throughout the term, and an assessment of current SSMP performance are all used to construct the initial draft of a new audit.

This initial set of audit findings and proposed corrective actions are provided to SSMP program implementation stakeholders for their review, comments, and additions. Stakeholders include Sewer Operations, LBWD Engineering, Pump Station Personnel, Health Department Environmental Services Bureau, and the Public Information Officer. Each SSMP element is evaluated for compliance with Waste Discharge Requirements, as well as effectiveness. Any deficiencies are identified, along with actions to correct each deficiency. The Sewer Operations Superintendent will collect and compile all of the input from the program stakeholders and will document the findings in the audit report.

The final audit report is reviewed by the Primary LRO (Director of Field Operations or the Assistant General Manager of Operations) before final acceptance. Audit reports and related materials are maintained in a hard copy and an electronic file is stored on the LBWD's server. The LBWD's most recent SSMP Program Audit Report from 2018 is included as **Attachment J1**.

Table 10-1 shows the timeline for SSMP audits and updates for the last 5 years and the anticipated schedule for the next 5 years.

Table 10-1. Sewer System Management Plan Audit and Update Schedule

Year	Audit
2014	5-year SSMP update completed in April 2014
2016	Biennial internal audit completed in early 2016
2018	Biennial internal audit completed in early 2018
2019	5-year SSMP update completed in August 2019
2020	Biennial internal audit planned in early 2020
2023	Biennial internal audit planned in early 2023

Table 10-2. Sewer System Management Plan Audit and Update Schedule (Continued)

Year	Audit
2024	5-year SSMP update planned in late 2024

Notes:
SSMP=Sewer System Management Plan

10.2 Audit Implementation and Tracking of Results

Once audit report findings and corrective actions are finalized, LBWD staff responsible for the various elements of the SSMP program implementation review the SSMP program audit findings to determine an appropriate course of action. The Sewer Operations Superintendent tracks implementation progress of SSMP program audit corrective actions. Any deficiencies in meeting the schedule are identified or anticipated and mitigation measures developed and implemented to ensure the corrective actions from the audit are addressed. Each subsequent audit update begins with a review of the previous audit to identify any corrective actions that have been or have not been addressed. Any updates necessary to enhance the SSMP performance are included as a part of the following year's budgeting process and/or the formal SSMP program audit.

10.3 Sewer System Management Plan Update Process

The Superintendent of Sewer Operations and the Director of Field Operations is responsible for ensuring the SSMP is updated when major changes occur to the SSMP program implementation or at a minimum of 5 years from the previous SSMP update, approval, and recertification. The results of the prior SSMP program audit reports are factored into the SSMP update process.

11 Communication Plan

LBWD communicates with the public and neighboring agencies on an on-going basis. The following sections describe the processes LBWD uses to communicate with the public and neighboring agencies.

11.1 Communication with the Public

LBWD communicates with the public on a continual basis through the LBWD website and Water Commission meetings, which are open to the public. LBWD's SSMP was reviewed and approved by the Board at the April 2, 2009, Board Meeting, providing the public with the opportunity to review the SSMP and, as part of the Water Commission meeting, to comment on the SSMP.

This 5-year SSMP update was approved at a public Water Commission meeting on October 3, 2019, providing the public with the opportunity to review and comment on the SSMP.

LBWD's website also provides a continual link for the public to download the Sewer System Management Plan (Long Beach Water n.d.a) at:
https://lbwater.org/customer-services/sewer/

The webpage also invites the public to send any comments on the SSMP to SewerService@longbeach.org or call (562) 570-2390. These modes of communication can occur at any time during development and implementation of the SSMP.

LBWD's goal is to educate the community about healthy sewers through campaigns, social and digital media, community events, engaging games and promotional products. LBWD seeks to utilize prominent events throughout the city and holidays to promote the healthy sewers campaign, for which we have already seen results of less sewer overflows when social media is used strategically

Within Long Beach, the LBWD publicizes wastewater issues through local newspapers, customer newsletters, and on the department's external website. Periodic press releases related to wastewater topics are also utilized. The LBWD website provides general information and publicizes sewer projects. If a significant project is planned that will impact a neighborhood, the LBWD will communicate with community leaders and specific informational meetings for residents and businesses in the neighborhood.

LBWD's Communications Dispatch Office has three operators who log all complaints and refer callers to the appropriate division for resolution. The Communications Dispatch Office tracks how long it takes to get each issue resolved. Customers are also asked to complete a survey to gage customer service satisfaction levels.

Specific to the sewer system, LBWD periodically receives unsolicited feedback from customers whom have had dealings with the department. Those unsolicited responses from customers are in the form of telephone calls or emails and are frequently complimentary of the work performed by LBWD crews. LBWD recognizes these employees at quarterly All Employees' Meetings, to reinforce this positive behavior.

11.2 Communication with Tributary or Satellite Systems

Satellite systems are those collection systems owned and maintained by others, but which transport flow into the LBWD's collection system. The following satellite systems have been identified as tributary to the LBWD:

- Long Beach Harbor Department
- City of Signal Hill (only one interconnection point, flow from which could be segregated with the installation of missing stop logs at the interconnection)

All of the above listed satellites transport flow through the LBWD collection system to the Sanitation Districts of Los Angeles County (LACSD) regional collection system and transported to LACSD's treatment facilities for treatment and disposal.

Additionally, LBWD's Pump Station S-05 serves a small private tract of homes of approximately 20 acres, known as the "Island Village," located south of 2nd Street and east of the San Gabriel River. Flow collected in this area is carried through a force main that extends eastwards to Seal Beach Boulevard to Orange County Sanitation District facilities. Consequently, the LBWD is a satellite system of both the LACSD and Orange County Sanitation District systems.

LBWD supervisors and crews currently provide technical and emergency response to its satellite systems on an as-needed basis. These communications, as well as similar communications with Orange County Sanitation District and LACSD supervisors and crews, occur as needed on an informal basis. Specifically related to SSMP communications, the Water Department sends each satellite agency a copy of the latest version of the SSMP document along with a brief cover letter and a current telephone, email contact list for key LBWD staff.

12 References

City of Long Beach. n.d.a. *City of Long Beach Demographics*. http://longbeach.gov/

________n.d.b. Capital Improvement Program (Current and Historical). http://www.longbeach.gov/pw/resources/general/capital-improvement-plan/

________2018. *Long Beach SSMP Final Report*. https://lbwater.org/wp-content/uploads/2018/09/Long-Beach-SSMP-Final-Report.pdf

________2019. Long Beach Municipal Code. Updated July 2019. https://library.municode.com/ca/long_beach/codes/municipal_code

City of Los Angeles, Department of Public Works. 1987. *Private Contract Sanitary Sewer Procedural Manual.* https://dpw.lacounty.gov/ldd/lib/fp/Sewer/Private%20Contract%20Sanitary%20Sewer%20Manual.pdf

________2008. *Sewer Design Manual* (Part F). http://eng2.lacity.org/techdocs/sewer-ma/index.htm

Long Beach Water. n.d.a. Sewer. https://lbwater.org/customer-services/sewer/

________n.d.b. Annual Budget Summary. https://lbwater.org/about-us/important-documents/budget/

________n.d.c. Sewer System Design Guidelines. https://lbwater.org/wp-content/uploads/2018/09/3.0-Sanitary-Sewer-Design-Criteria_v2.pdf

________n.d.d. Standard Drawings and Designs. https://lbwater.org/customer-services/designing-and-planning/developers-agreement/

________2011. Rules, Regulations, and Charges Governing Potable Water, Reclaimed Water, Sewer Service, and the Water Conservation and Water Supply Shortage Plan. https://lbwater.org/about-us/important-documents/rules-regulations/

________2014. *Long Beach SSMP Final Report*. https://lbwater.org/wp-content/uploads/2018/09/Long-Beach-SSMP-Final-Report.pdf

Sanitation Districts of Los Angeles County. 2018. Standard Drawings 2018 Edition. https://www.lacsd.org/businesses/bidspur/amendments.asp

This page is intentionally left blank.

13 Attachments

The following letter IDs are assigned to each SSMP element:

A – Goals

B – Organization

C – Legal Authorities

D – Operation and Maintenance Program

E – Design and Performance Provision Section

F – Overflow Emergency Response Plan

G – Fats, Oils, and Grease Program

H – System Evaluation and Capacity Assurance Plan

I – Monitoring, Measurement, and Program Modifications

J – SSMP Program Audit and Updates

K – Communication Plan

ID	Title	Owner	Last Updated
A1	Order No. 2006-0003-DWQ & Order No. 2013-0058 EXEC	LBWD	5/2/06
A2	Summary of Changes to the SSMP	HDR	8/22/2019
A3	Monitoring and Reporting Program	LBWD	9/9/2013
B1	Organization Chart for Key Positions Responsible for Implementing SSMP Elements	LBWD	8/26/2019
B2	Contact Information for Key Positions Responsible for Implementing SSMP Elements	LBWD	8/26/2019
C1	Sewer System Fact Sheet	LBWD	Unknown
F1	Overflow Emergency Response Plan	LBWD	August 2019
F2	Beach Water Quality Monitoring and Public Notification Program	LBWD	Unknown
F3	Spill Prevention, Control, and Countermeasure Plan Specification	LBWD	Unknown
G1	List of Disposal Facilities	LBDHHS	August 2019
H1	2013 Sewer System Master Plan Update	LBWD	August 2013
J1	SSMP Program Audit Report 2018	LBWD	2018

Notes:

LBDHHS=Long Beach Department of Health and Human Services; LBWD=Long Beach Water Department; SSMP=Sewer System Management Plan; SSO=sanitary sewer overflows

This page is intentionally left blank.

Attachment A1.
Order No. 2006-0003-DWQ

and

Order No. 2013-0058-EXEC

This page is intentionally left blank.

STATE WATER RESOURCES CONTROL BOARD
ORDER NO. 2006-0003

STATEWIDE GENERAL WASTE DISCHARGE REQUIREMENTS
FOR
SANITARY SEWER SYSTEMS

The State Water Resources Control Board, hereinafter referred to as "State Water Board", finds that:

1. All federal and state agencies, municipalities, counties, districts, and other public entities that own or operate sanitary sewer systems greater than one mile in length that collect and/or convey untreated or partially treated wastewater to a publicly owned treatment facility in the State of California are required to comply with the terms of this Order. Such entities are hereinafter referred to as "Enrollees".

2. Sanitary sewer overflows (SSOs) are overflows from sanitary sewer systems of domestic wastewater, as well as industrial and commercial wastewater, depending on the pattern of land uses in the area served by the sanitary sewer system. SSOs often contain high levels of suspended solids, pathogenic organisms, toxic pollutants, nutrients, oxygen-demanding organic compounds, oil and grease and other pollutants. SSOs may cause a public nuisance, particularly when raw untreated wastewater is discharged to areas with high public exposure, such as streets or surface waters used for drinking, fishing, or body contact recreation. SSOs may pollute surface or ground waters, threaten public health, adversely affect aquatic life, and impair the recreational use and aesthetic enjoyment of surface waters.

3. Sanitary sewer systems experience periodic failures resulting in discharges that may affect waters of the state. There are many factors (including factors related to geology, design, construction methods and materials, age of the system, population growth, and system operation and maintenance), which affect the likelihood of an SSO. A proactive approach that requires Enrollees to ensure a system-wide operation, maintenance, and management plan is in place will reduce the number and frequency of SSOs within the state. This approach will in turn decrease the risk to human health and the environment caused by SSOs.

4. Major causes of SSOs include: grease blockages, root blockages, sewer line flood damage, manhole structure failures, vandalism, pump station mechanical failures, power outages, excessive storm or ground water inflow/infiltration, debris blockages, sanitary sewer system age and construction material failures, lack of proper operation and maintenance, insufficient capacity and contractor-caused damages. Many SSOs are preventable with adequate and appropriate facilities, source control measures and operation and maintenance of the sanitary sewer system.

SEWER SYSTEM MANAGEMENT PLANS

5. To facilitate proper funding and management of sanitary sewer systems, each Enrollee must develop and implement a system-specific Sewer System Management Plan (SSMP). To be effective, SSMPs must include provisions to provide proper and efficient management, operation, and maintenance of sanitary sewer systems, while taking into consideration risk management and cost benefit analysis. Additionally, an SSMP must contain a spill response plan that establishes standard procedures for immediate response to an SSO in a manner designed to minimize water quality impacts and potential nuisance conditions.

6. Many local public agencies in California have already developed SSMPs and implemented measures to reduce SSOs. These entities can build upon their existing efforts to establish a comprehensive SSMP consistent with this Order. Others, however, still require technical assistance and, in some cases, funding to improve sanitary sewer system operation and maintenance in order to reduce SSOs.

7. SSMP certification by technically qualified and experienced persons can provide a useful and cost-effective means for ensuring that SSMPs are developed and implemented appropriately.

8. It is the State Water Board's intent to gather additional information on the causes and sources of SSOs to augment existing information and to determine the full extent of SSOs and consequent public health and/or environmental impacts occurring in the State.

9. Both uniform SSO reporting and a centralized statewide electronic database are needed to collect information to allow the State Water Board and Regional Water Quality Control Boards (Regional Water Boards) to effectively analyze the extent of SSOs statewide and their potential impacts on beneficial uses and public health. The monitoring and reporting program required by this Order and the attached **Monitoring and Reporting Program No. 2006-0003**, are necessary to assure compliance with these waste discharge requirements (WDRs).

10. Information regarding SSOs must be provided to Regional Water Boards and other regulatory agencies in a timely manner and be made available to the public in a complete, concise, and timely fashion.

11. Some Regional Water Boards have issued WDRs or WDRs that serve as National Pollution Discharge Elimination System (NPDES) permits to sanitary sewer system owners/operators within their jurisdictions. This Order establishes minimum requirements to prevent SSOs. Although it is the State Water Board's intent that this Order be the primary regulatory mechanism for sanitary sewer systems statewide, Regional Water Boards may issue more stringent or more

prescriptive WDRs for sanitary sewer systems. Upon issuance or reissuance of a Regional Water Board's WDRs for a system subject to this Order, the Regional Water Board shall coordinate its requirements with stated requirements within this Order, to identify requirements that are more stringent, to remove requirements that are less stringent than this Order, and to provide consistency in reporting.

REGULATORY CONSIDERATIONS

12. California Water Code section 13263 provides that the State Water Board may prescribe general WDRs for a category of discharges if the State Water Board finds or determines that:

- The discharges are produced by the same or similar operations;
- The discharges involve the same or similar types of waste;
- The discharges require the same or similar treatment standards; and
- The discharges are more appropriately regulated under general discharge requirements than individual discharge requirements.

This Order establishes requirements for a class of operations, facilities, and discharges that are similar throughout the state.

13. The issuance of general WDRs to the Enrollees will:
    a) Reduce the administrative burden of issuing individual WDRs to each Enrollee;
    b) Provide for a unified statewide approach for the reporting and database tracking of SSOs;
    c) Establish consistent and uniform requirements for SSMP development and implementation;
    d) Provide statewide consistency in reporting; and
    e) Facilitate consistent enforcement for violations.

14. The beneficial uses of surface waters that can be impaired by SSOs include, but are not limited to, aquatic life, drinking water supply, body contact and non-contact recreation, and aesthetics. The beneficial uses of ground water that can be impaired include, but are not limited to, drinking water and agricultural supply. Surface and ground waters throughout the state support these uses to varying degrees.

15. The implementation of requirements set forth in this Order will ensure the reasonable protection of past, present, and probable future beneficial uses of water and the prevention of nuisance. The requirements implement the water quality control plans (Basin Plans) for each region and take into account the environmental characteristics of hydrographic units within the state. Additionally, the State Water Board has considered water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect

water quality in the area, costs associated with compliance with these requirements, the need for developing housing within California, and the need to develop and use recycled water.

16. The Federal Clean Water Act largely prohibits any discharge of pollutants from a point source to waters of the United States except as authorized under an NPDES permit. In general, any point source discharge of sewage effluent to waters of the United States must comply with technology-based, secondary treatment standards, at a minimum, and any more stringent requirements necessary to meet applicable water quality standards and other requirements. Hence, the unpermitted discharge of wastewater from a sanitary sewer system to waters of the United States is illegal under the Clean Water Act. In addition, many Basin Plans adopted by the Regional Water Boards contain discharge prohibitions that apply to the discharge of untreated or partially treated wastewater. Finally, the California Water Code generally prohibits the discharge of waste to land prior to the filing of any required report of waste discharge and the subsequent issuance of either WDRs or a waiver of WDRs.

17. California Water Code section 13263 requires a water board to, after any necessary hearing, prescribe requirements as to the nature of any proposed discharge, existing discharge, or material change in an existing discharge. The requirements shall, among other things, take into consideration the need to prevent nuisance.

18. California Water Code section 13050, subdivision (m), defines nuisance as anything which meets all of the following requirements:
    a. Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.
    b. Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.
    c. Occurs during, or as a result of, the treatment or disposal of wastes.

19. This Order is consistent with State Water Board Resolution No. 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California) in that the Order imposes conditions to prevent impacts to water quality, does not allow the degradation of water quality, will not unreasonably affect beneficial uses of water, and will not result in water quality less than prescribed in State Water Board or Regional Water Board plans and policies.

20. The action to adopt this General Order is exempt from the California Environmental Quality Act (Public Resources Code §21000 et seq.) because it is an action taken by a regulatory agency to assure the protection of the environment and the regulatory process involves procedures for protection of the environment. (Cal. Code Regs., tit. 14, §15308). In addition, the action to adopt

this Order is exempt from CEQA pursuant to Cal.Code Regs., title 14, §15301 to the extent that it applies to existing sanitary sewer collection systems that constitute "existing facilities" as that term is used in Section 15301, and §15302, to the extent that it results in the repair or replacement of existing systems involving negligible or no expansion of capacity.

21. The Fact Sheet, which is incorporated by reference in the Order, contains supplemental information that was also considered in establishing these requirements.

22. The State Water Board has notified all affected public agencies and all known interested persons of the intent to prescribe general WDRs that require Enrollees to develop SSMPs and to report all SSOs.

23. The State Water Board conducted a public hearing on February 8, 2006, to receive oral and written comments on the draft order. The State Water Board received and considered, at its May 2, 2006, meeting, additional public comments on substantial changes made to the proposed general WDRs following the February 8, 2006, public hearing. The State Water Board has considered all comments pertaining to the proposed general WDRs.

IT IS HEREBY ORDERED, that pursuant to California Water Code section 13263, the Enrollees, their agents, successors, and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted hereunder, shall comply with the following:

A. DEFINITIONS

1. **Sanitary sewer overflow (SSO)** - Any overflow, spill, release, discharge or diversion of untreated or partially treated wastewater from a sanitary sewer system. SSOs include:
   (i) Overflows or releases of untreated or partially treated wastewater that reach waters of the United States;
   (ii) Overflows or releases of untreated or partially treated wastewater that do not reach waters of the United States; and
   (iii) Wastewater backups into buildings and on private property that are caused by blockages or flow conditions within the publicly owned portion of a sanitary sewer system.

2. **Sanitary sewer system** – Any system of pipes, pump stations, sewer lines, or other conveyances, upstream of a wastewater treatment plant headworks used to collect and convey wastewater to the publicly owned treatment facility. Temporary storage and conveyance facilities (such as vaults, temporary piping, construction trenches, wet wells, impoundments, tanks, etc.) are considered to be part of the sanitary sewer system, and discharges into these temporary storage facilities are not considered to be SSOs.

For purposes of this Order, sanitary sewer systems include only those systems owned by public agencies that are comprised of more than one mile of pipes or sewer lines.

3. **Enrollee** - A federal or state agency, municipality, county, district, and other public entity that owns or operates a sanitary sewer system, as defined in the general WDRs, and that has submitted a complete and approved application for coverage under this Order.

4. **SSO Reporting System** – Online spill reporting system that is hosted, controlled, and maintained by the State Water Board. The web address for this site is http://ciwqs.waterboards.ca.gov. This online database is maintained on a secure site and is controlled by unique usernames and passwords.

5. **Untreated or partially treated wastewater** – Any volume of waste discharged from the sanitary sewer system upstream of a wastewater treatment plant headworks.

6. **Satellite collection system** – The portion, if any, of a sanitary sewer system owned or operated by a different public agency than the agency that owns and operates the wastewater treatment facility to which the sanitary sewer system is tributary.

7. **Nuisance** - California Water Code section 13050, subdivision (m), defines nuisance as anything which meets all of the following requirements:
   a. Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.
   b. Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.
   c. Occurs during, or as a result of, the treatment or disposal of wastes.

B. APPLICATION REQUIREMENTS

1. Deadlines for Application – All public agencies that currently own or operate sanitary sewer systems within the State of California must apply for coverage under the general WDRs within six (6) months of the date of adoption of the general WDRs. Additionally, public agencies that acquire or assume responsibility for operating sanitary sewer systems after the date of adoption of this Order must apply for coverage under the general WDRs at least three (3) months prior to operation of those facilities.

2. Applications under the general WDRs – In order to apply for coverage pursuant to the general WDRs, a legally authorized representative for each agency must submit a complete application package. Within sixty (60) days of adoption of the general WDRs, State Water Board staff will send specific instructions on how to

apply for coverage under the general WDRs to all known public agencies that own sanitary sewer systems. Agencies that do not receive notice may obtain applications and instructions online on the Water Board's website.

3. Coverage under the general WDRs – Permit coverage will be in effect once a complete application package has been submitted and approved by the State Water Board's Division of Water Quality.

C. PROHIBITIONS

1. Any SSO that results in a discharge of untreated or partially treated wastewater to waters of the United States is prohibited.

2. Any SSO that results in a discharge of untreated or partially treated wastewater that creates a nuisance as defined in California Water Code Section 13050(m) is prohibited.

D. PROVISIONS

1. The Enrollee must comply with all conditions of this Order. Any noncompliance with this Order constitutes a violation of the California Water Code and is grounds for enforcement action.

2. It is the intent of the State Water Board that sanitary sewer systems be regulated in a manner consistent with the general WDRs. Nothing in the general WDRs shall be:

   (i) Interpreted or applied in a manner inconsistent with the Federal Clean Water Act, or supersede a more specific or more stringent state or federal requirement in an existing permit, regulation, or administrative/judicial order or Consent Decree;
   (ii) Interpreted or applied to authorize an SSO that is illegal under either the Clean Water Act, an applicable Basin Plan prohibition or water quality standard, or the California Water Code;
   (iii) Interpreted or applied to prohibit a Regional Water Board from issuing an individual NPDES permit or WDR, superseding this general WDR, for a sanitary sewer system, authorized under the Clean Water Act or California Water Code; or
   (iv) Interpreted or applied to supersede any more specific or more stringent WDRs or enforcement order issued by a Regional Water Board.

3. The Enrollee shall take all feasible steps to eliminate SSOs. In the event that an SSO does occur, the Enrollee shall take all feasible steps to contain and mitigate the impacts of an SSO.

4. In the event of an SSO, the Enrollee shall take all feasible steps to prevent untreated or partially treated wastewater from discharging from storm drains into

flood control channels or waters of the United States by blocking the storm drainage system and by removing the wastewater from the storm drains.

5. All SSOs must be reported in accordance with Section G of the general WDRs.

6. In any enforcement action, the State and/or Regional Water Boards will consider the appropriate factors under the duly adopted State Water Board Enforcement Policy. And, consistent with the Enforcement Policy, the State and/or Regional Water Boards must consider the Enrollee's efforts to contain, control, and mitigate SSOs when considering the California Water Code Section 13327 factors. In assessing these factors, the State and/or Regional Water Boards will also consider whether:

   (i) The Enrollee has complied with the requirements of this Order, including requirements for reporting and developing and implementing a SSMP;

   (ii) The Enrollee can identify the cause or likely cause of the discharge event;

   (iii) There were no feasible alternatives to the discharge, such as temporary storage or retention of untreated wastewater, reduction of inflow and infiltration, use of adequate backup equipment, collecting and hauling of untreated wastewater to a treatment facility, or an increase in the capacity of the system as necessary to contain the design storm event identified in the SSMP. It is inappropriate to consider the lack of feasible alternatives, if the Enrollee does not implement a periodic or continuing process to identify and correct problems.

   (iv) The discharge was exceptional, unintentional, temporary, and caused by factors beyond the reasonable control of the Enrollee;

   (v) The discharge could have been prevented by the exercise of reasonable control described in a certified SSMP for:
   - Proper management, operation and maintenance;
   - Adequate treatment facilities, sanitary sewer system facilities, and/or components with an appropriate design capacity, to reasonably prevent SSOs (e.g., adequately enlarging treatment or collection facilities to accommodate growth, infiltration and inflow (I/I), etc.);
   - Preventive maintenance (including cleaning and fats, oils, and grease (FOG) control);
   - Installation of adequate backup equipment; and
   - Inflow and infiltration prevention and control to the extent practicable.

   (vi) The sanitary sewer system design capacity is appropriate to reasonably prevent SSOs.

(vii) The Enrollee took all reasonable steps to stop and mitigate the impact of the discharge as soon as possible.

7. When a sanitary sewer overflow occurs, the Enrollee shall take all feasible steps and necessary remedial actions to 1) control or limit the volume of untreated or partially treated wastewater discharged, 2) terminate the discharge, and 3) recover as much of the wastewater discharged as possible for proper disposal, including any wash down water.

   The Enrollee shall implement all remedial actions to the extent they may be applicable to the discharge and not inconsistent with an emergency response plan, including the following:

   (i) Interception and rerouting of untreated or partially treated wastewater flows around the wastewater line failure;
   (ii) Vacuum truck recovery of sanitary sewer overflows and wash down water;
   (iii) Cleanup of debris at the overflow site;
   (iv) System modifications to prevent another SSO at the same location;
   (v) Adequate sampling to determine the nature and impact of the release; and
   (vi) Adequate public notification to protect the public from exposure to the SSO.

8. The Enrollee shall properly, manage, operate, and maintain all parts of the sanitary sewer system owned or operated by the Enrollee, and shall ensure that the system operators (including employees, contractors, or other agents) are adequately trained and possess adequate knowledge, skills, and abilities.

9. The Enrollee shall allocate adequate resources for the operation, maintenance, and repair of its sanitary sewer system, by establishing a proper rate structure, accounting mechanisms, and auditing procedures to ensure an adequate measure of revenues and expenditures. These procedures must be in compliance with applicable laws and regulations and comply with generally acceptable accounting practices.

10. The Enrollee shall provide adequate capacity to convey base flows and peak flows, including flows related to wet weather events. Capacity shall meet or exceed the design criteria as defined in the Enrollee's System Evaluation and Capacity Assurance Plan for all parts of the sanitary sewer system owned or operated by the Enrollee.

11. The Enrollee shall develop and implement a written Sewer System Management Plan (SSMP) and make it available to the State and/or Regional Water Board upon request. A copy of this document must be publicly available at the Enrollee's office and/or available on the Internet. This SSMP must be approved by the Enrollee's governing board at a public meeting.

12. In accordance with the California Business and Professions Code sections 6735, 7835, and 7835.1, all engineering and geologic evaluations and judgments shall be performed by or under the direction of registered professionals competent and proficient in the fields pertinent to the required activities. Specific elements of the SSMP that require professional evaluation and judgments shall be prepared by or under the direction of appropriately qualified professionals, and shall bear the professional(s)' signature and stamp.

13. The mandatory elements of the SSMP are specified below. However, if the Enrollee believes that any element of this section is not appropriate or applicable to the Enrollee's sanitary sewer system, the SSMP program does not need to address that element. The Enrollee must justify why that element is not applicable. The SSMP must be approved by the deadlines listed in the SSMP Time Schedule below.

Sewer System Management Plan (SSMP)

(i) **Goal**: The goal of the SSMP is to provide a plan and schedule to properly manage, operate, and maintain all parts of the sanitary sewer system. This will help reduce and prevent SSOs, as well as mitigate any SSOs that do occur.

(ii) **Organization**: The SSMP must identify:

(a) The name of the responsible or authorized representative as described in Section J of this Order.

(b) The names and telephone numbers for management, administrative, and maintenance positions responsible for implementing specific measures in the SSMP program. The SSMP must identify lines of authority through an organization chart or similar document with a narrative explanation; and

(c) The chain of communication for reporting SSOs, from receipt of a complaint or other information, including the person responsible for reporting SSOs to the State and Regional Water Board and other agencies if applicable (such as County Health Officer, County Environmental Health Agency, Regional Water Board, and/or State Office of Emergency Services (OES)).

(iii) **Legal Authority:** Each Enrollee must demonstrate, through sanitary sewer system use ordinances, service agreements, or other legally binding procedures, that it possesses the necessary legal authority to:

(a) Prevent illicit discharges into its sanitary sewer system (examples may include I/I, stormwater, chemical dumping, unauthorized debris and cut roots, etc.);

(b) Require that sewers and connections be properly designed and constructed;

(c) Ensure access for maintenance, inspection, or repairs for portions of the lateral owned or maintained by the Public Agency;

(d) Limit the discharge of fats, oils, and grease and other debris that may cause blockages, and

(e) Enforce any violation of its sewer ordinances.

(iv) **Operation and Maintenance Program**. The SSMP must include those elements listed below that are appropriate and applicable to the Enrollee's system:

(a) Maintain an up-to-date map of the sanitary sewer system, showing all gravity line segments and manholes, pumping facilities, pressure pipes and valves, and applicable stormwater conveyance facilities;

(b) Describe routine preventive operation and maintenance activities by staff and contractors, including a system for scheduling regular maintenance and cleaning of the sanitary sewer system with more frequent cleaning and maintenance targeted at known problem areas. The Preventative Maintenance (PM) program should have a system to document scheduled and conducted activities, such as work orders;

(c) Develop a rehabilitation and replacement plan to identify and prioritize system deficiencies and implement short-term and long-term rehabilitation actions to address each deficiency. The program should include regular visual and TV inspections of manholes and sewer pipes, and a system for ranking the condition of sewer pipes and scheduling rehabilitation. Rehabilitation and replacement should focus on sewer pipes that are at risk of collapse or prone to more frequent blockages due to pipe defects. Finally, the rehabilitation and replacement plan should include a capital improvement plan that addresses proper management and protection of the infrastructure assets. The plan shall include a time schedule for implementing the short- and long-term plans plus a schedule for developing the funds needed for the capital improvement plan;

(d) Provide training on a regular basis for staff in sanitary sewer system operations and maintenance, and require contractors to be appropriately trained; and

(e) Provide equipment and replacement part inventories, including identification of critical replacement parts.

(v) **Design and Performance Provisions**:

(a) Design and construction standards and specifications for the installation of new sanitary sewer systems, pump stations and other appurtenances; and for the rehabilitation and repair of existing sanitary sewer systems; and

(b) Procedures and standards for inspecting and testing the installation of new sewers, pumps, and other appurtenances and for rehabilitation and repair projects.

(vi) **Overflow Emergency Response Plan -** Each Enrollee shall develop and implement an overflow emergency response plan that identifies measures to protect public health and the environment. At a minimum, this plan must include the following:

(a) Proper notification procedures so that the primary responders and regulatory agencies are informed of all SSOs in a timely manner;

(b) A program to ensure an appropriate response to all overflows;

(c) Procedures to ensure prompt notification to appropriate regulatory agencies and other potentially affected entities (e.g. health agencies, Regional Water Boards, water suppliers, etc.) of all SSOs that potentially affect public health or reach the waters of the State in accordance with the MRP. All SSOs shall be reported in accordance with this MRP, the California Water Code, other State Law, and other applicable Regional Water Board WDRs or NPDES permit requirements. The SSMP should identify the officials who will receive immediate notification;

(d) Procedures to ensure that appropriate staff and contractor personnel are aware of and follow the Emergency Response Plan and are appropriately trained;

(e) Procedures to address emergency operations, such as traffic and crowd control and other necessary response activities; and

(f) A program to ensure that all reasonable steps are taken to contain and prevent the discharge of untreated and partially treated wastewater to waters of the United States and to minimize or correct any adverse impact on the environment resulting from the SSOs, including such accelerated or additional monitoring as may be necessary to determine the nature and impact of the discharge.

(vii) **FOG Control Program:** Each Enrollee shall evaluate its service area to determine whether a FOG control program is needed. If an Enrollee determines that a FOG program is not needed, the Enrollee must provide justification for why it is not needed. If FOG is found to be a problem, the Enrollee must prepare and implement a FOG source control program to reduce the amount of these substances discharged to the sanitary sewer system. This plan shall include the following as appropriate:

(a) An implementation plan and schedule for a public education outreach program that promotes proper disposal of FOG;

(b) A plan and schedule for the disposal of FOG generated within the sanitary sewer system service area. This may include a list of acceptable disposal facilities and/or additional facilities needed to adequately dispose of FOG generated within a sanitary sewer system service area;

(c) The legal authority to prohibit discharges to the system and identify measures to prevent SSOs and blockages caused by FOG;

(d) Requirements to install grease removal devices (such as traps or interceptors), design standards for the removal devices, maintenance requirements, BMP requirements, record keeping and reporting requirements;

(e) Authority to inspect grease producing facilities, enforcement authorities, and whether the Enrollee has sufficient staff to inspect and enforce the FOG ordinance;

(f) An identification of sanitary sewer system sections subject to FOG blockages and establishment of a cleaning maintenance schedule for each section; and

(g) Development and implementation of source control measures for all sources of FOG discharged to the sanitary sewer system for each section identified in (f) above.

(viii) **System Evaluation and Capacity Assurance Plan**: The Enrollee shall prepare and implement a capital improvement plan (CIP) that will provide hydraulic capacity of key sanitary sewer system elements for dry weather peak flow conditions, as well as the appropriate design storm or wet weather event. At a minimum, the plan must include:

(a) **Evaluation**: Actions needed to evaluate those portions of the sanitary sewer system that are experiencing or contributing to an SSO discharge caused by hydraulic deficiency. The evaluation must provide estimates of peak flows (including flows from SSOs that escape from the system) associated with conditions similar to those causing overflow events, estimates of the capacity of key system components, hydraulic deficiencies (including components of the system with limiting capacity) and the major sources that contribute to the peak flows associated with overflow events;

(b) **Design Criteria:** Where design criteria do not exist or are deficient, undertake the evaluation identified in (a) above to establish appropriate design criteria; and

(c) **Capacity Enhancement Measures:** The steps needed to establish a short- and long-term CIP to address identified hydraulic deficiencies, including prioritization, alternatives analysis, and schedules. The CIP may include increases in pipe size, I/I reduction programs, increases and redundancy in pumping capacity, and storage facilities. The CIP shall include an implementation schedule and shall identify sources of funding.

(d) **Schedule:** The Enrollee shall develop a schedule of completion dates for all portions of the capital improvement program developed in (a)-(c) above. This schedule shall be reviewed and updated consistent with the SSMP review and update requirements as described in Section D. 14.

(ix) **Monitoring, Measurement, and Program Modifications:** The Enrollee shall:

(a) Maintain relevant information that can be used to establish and prioritize appropriate SSMP activities;

(b) Monitor the implementation and, where appropriate, measure the effectiveness of each element of the SSMP;

(c) Assess the success of the preventative maintenance program;

(d) Update program elements, as appropriate, based on monitoring or performance evaluations; and

(e) Identify and illustrate SSO trends, including: frequency, location, and volume.

(x) **SSMP Program Audits** - As part of the SSMP, the Enrollee shall conduct periodic internal audits, appropriate to the size of the system and the number of SSOs. At a minimum, these audits must occur every two years and a report must be prepared and kept on file. This audit shall focus on evaluating the effectiveness of the SSMP and the

Enrollee's compliance with the SSMP requirements identified in this subsection (D.13), including identification of any deficiencies in the SSMP and steps to correct them.

(xi) **Communication Program** – The Enrollee shall communicate on a regular basis with the public on the development, implementation, and performance of its SSMP. The communication system shall provide the public the opportunity to provide input to the Enrollee as the program is developed and implemented.

The Enrollee shall also create a plan of communication with systems that are tributary and/or satellite to the Enrollee's sanitary sewer system.

14. Both the SSMP and the Enrollee's program to implement the SSMP must be certified by the Enrollee to be in compliance with the requirements set forth above and must be presented to the Enrollee's governing board for approval at a public meeting. The Enrollee shall certify that the SSMP, and subparts thereof, are in compliance with the general WDRs within the time frames identified in the time schedule provided in subsection D.15, below.

In order to complete this certification, the Enrollee's authorized representative must complete the certification portion in the Online SSO Database Questionnaire by checking the appropriate milestone box, printing and signing the automated form, and sending the form to:

State Water Resources Control Board
Division of Water Quality
Attn: SSO Program Manager
P.O. Box 100
Sacramento, CA 95812

The SSMP must be updated every five (5) years, and must include any significant program changes. Re-certification by the governing board of the Enrollee is required in accordance with D.14 when significant updates to the SSMP are made. To complete the re-certification process, the Enrollee shall enter the data in the Online SSO Database and mail the form to the State Water Board, as described above.

15. The Enrollee shall comply with these requirements according to the following schedule. This time schedule does not supersede existing requirements or time schedules associated with other permits or regulatory requirements.

Sewer System Management Plan Time Schedule

<u>Task and Associated Section</u>	**Completion Date**			
	Population > 100,000	Population between 100,000 and 10,000	Population between 10,000 and 2,500	Population < 2,500
Application for Permit Coverage ***Section C***	6 months after WDRs Adoption			
Reporting Program ***Section G***	6 months after WDRs Adoption[1]			
SSMP Development Plan and Schedule ***No specific Section***	9 months after WDRs Adoption[2]	12 months after WDRs Adoption[2]	15 months after WDRs Adoption[2]	18 months after WDRs Adoption[2]
Goals and Organization Structure ***Section D 13 (i) & (ii)***	12 months after WDRs Adoption[2]		18 months after WDRs Adoption[2]	
Overflow Emergency Response Program ***Section D 13 (vi)***	24 months after WDRs Adoption[2]	30 months after WDRs Adoption[2]	36 months after WDRs Adoption[2]	39 months after WDRs Adoption[2]
Legal Authority ***Section D 13 (iii)***				
Operation and Maintenance Program ***Section D 13 (iv)***				
Grease Control Program ***Section D 13 (vii)***				
Design and Performance ***Section D 13 (v)***	36 months after WDRs Adoption	39 months after WDRs Adoption	48 months after WDRs Adoption	51 months after WDRs Adoption
System Evaluation and Capacity Assurance Plan ***Section D 13 (viii)***				
Final SSMP, incorporating all of the SSMP requirements ***Section D 13***				

1. In the event that by July 1, 2006 the Executive Director is able to execute a memorandum of agreement (MOA) with the California Water Environment Association (CWEA) or discharger representatives outlining a strategy and time schedule for CWEA or another entity to provide statewide training on the adopted monitoring program, SSO database electronic reporting, and SSMP development, consistent with this Order, then the schedule of Reporting Program Section G shall be replaced with the following schedule:

Reporting Program ***Section G***	
Regional Boards 4, 8, and 9	8 months after WDRs Adoption
Regional Boards 1, 2, and 3	12 months after WDRs Adoption
Regional Boards 5, 6, and 7	16 months after WDRs Adoption

If this MOU is not executed by July 1, 2006, the reporting program time schedule will remain six (6) months for all regions and agency size categories.

2. In the event that the Executive Director executes the MOA identified in note 1 by July 1, 2006, then the deadline for this task shall be extended by six (6) months. The time schedule identified in the MOA must be consistent with the extended time schedule provided by this note. If the MOA is not executed by July 1, 2006, the six (6) month time extension will not be granted.

E. WDRs and SSMP AVAILABILITY

1. A copy of the general WDRs and the certified SSMP shall be maintained at appropriate locations (such as the Enrollee's offices, facilities, and/or Internet homepage) and shall be available to sanitary sewer system operating and maintenance personnel at all times.

F. ENTRY AND INSPECTION

1. The Enrollee shall allow the State or Regional Water Boards or their authorized representative, upon presentation of credentials and other documents as may be required by law, to:

    a. Enter upon the Enrollee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order;

    b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

d. Sample or monitor at reasonable times, for the purposes of assuring compliance with this Order or as otherwise authorized by the California Water Code, any substances or parameters at any location.

G. GENERAL MONITORING AND REPORTING REQUIREMENTS

1. The Enrollee shall furnish to the State or Regional Water Board, within a reasonable time, any information that the State or Regional Water Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order. The Enrollee shall also furnish to the Executive Director of the State Water Board or Executive Officer of the applicable Regional Water Board, upon request, copies of records required to be kept by this Order.

2. The Enrollee shall comply with the attached Monitoring and Reporting Program No. 2006-0003 and future revisions thereto, as specified by the Executive Director. Monitoring results shall be reported at the intervals specified in Monitoring and Reporting Program No. 2006-0003. Unless superseded by a specific enforcement Order for a specific Enrollee, these reporting requirements are intended to replace other mandatory routine written reports associated with SSOs.

3. All Enrollees must obtain SSO Database accounts and receive a “Username” and “Password” by registering through the California Integrated Water Quality System (CIWQS). These accounts will allow controlled and secure entry into the SSO Database. Additionally, within 30days of receiving an account and prior to recording spills into the SSO Database, all Enrollees must complete the “Collection System Questionnaire”, which collects pertinent information regarding a Enrollee’s collection system. The “Collection System Questionnaire” must be updated at least every 12 months.

4. Pursuant to Health and Safety Code section 5411.5, any person who, without regard to intent or negligence, causes or permits any untreated wastewater or other waste to be discharged in or on any waters of the State, or discharged in or deposited where it is, or probably will be, discharged in or on any surface waters of the State, as soon as that person has knowledge of the discharge, shall immediately notify the local health officer of the discharge. Discharges of untreated or partially treated wastewater to storm drains and drainage channels, whether man-made or natural or concrete-lined, shall be reported as required above.

   Any SSO greater than 1,000 gallons discharged in or on any waters of the State, or discharged in or deposited where it is, or probably will be, discharged in or on any surface waters of the State shall also be reported to the Office of Emergency Services pursuant to California Water Code section 13271.

H. CHANGE IN OWNERSHIP

1. This Order is not transferable to any person or party, except after notice to the Executive Director. The Enrollee shall submit this notice in writing at least 30 days in advance of any proposed transfer. The notice must include a written agreement between the existing and new Enrollee containing a specific date for the transfer of this Order's responsibility and coverage between the existing Enrollee and the new Enrollee. This agreement shall include an acknowledgement that the existing Enrollee is liable for violations up to the transfer date and that the new Enrollee is liable from the transfer date forward.

I. INCOMPLETE REPORTS

1. If an Enrollee becomes aware that it failed to submit any relevant facts in any report required under this Order, the Enrollee shall promptly submit such facts or information by formally amending the report in the Online SSO Database.

J. REPORT DECLARATION

1. All applications, reports, or information shall be signed and certified as follows:

   (i) All reports required by this Order and other information required by the State or Regional Water Board shall be signed and certified by a person designated, for a municipality, state, federal or other public agency, as either a principal executive officer or ranking elected official, or by a duly authorized representative of that person, as described in paragraph (ii) of this provision. (For purposes of electronic reporting, an electronic signature and accompanying certification, which is in compliance with the Online SSO database procedures, meet this certification requirement.)

   (ii) An individual is a duly authorized representative only if:

      (a) The authorization is made in writing by a person described in paragraph (i) of this provision; and

      (b) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity.

K. CIVIL MONETARY REMEDIES FOR DISCHARGE VIOLATIONS

1. The California Water Code provides various enforcement options, including civil monetary remedies, for violations of this Order.

2. The California Water Code also provides that any person failing or refusing to furnish technical or monitoring program reports, as required under this Order, or

falsifying any information provided in the technical or monitoring reports is subject to civil monetary penalties.

L. SEVERABILITY

1. The provisions of this Order are severable, and if any provision of this Order, or the application of any provision of this Order to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this Order, shall not be affected thereby.

2. This order does not convey any property rights of any sort or any exclusive privileges. The requirements prescribed herein do not authorize the commission of any act causing injury to persons or property, nor protect the Enrollee from liability under federal, state or local laws, nor create a vested right for the Enrollee to continue the waste discharge.

CERTIFICATION

The undersigned Clerk to the State Water Board does hereby certify that the foregoing is a full, true, and correct copy of general WDRs duly and regularly adopted at a meeting of the State Water Resources Control Board held on May 2, 2006.

AYE: Tam M. Doduc
Gerald D. Secundy

NO: Arthur G. Baggett

ABSENT: None

ABSTAIN: None

Song Her
Clerk to the Board

STATE OF CALIFORNIA
WATER RESOURCES CONTROL BOARD
ORDER NO. WQ 2013-0058-EXEC

AMENDING MONITORING AND REPORTING PROGRAM
FOR
STATEWIDE GENERAL WASTE DISCHARGE REQUIREMENTS FOR
SANITARY SEWER SYSTEMS

The State of California, Water Resources Control Board (hereafter State Water Board) finds:

1. The State Water Board is authorized to prescribe statewide general Waste Discharge Requirements (WDRs) for categories of discharges that involve the same or similar operations and the same or similar types of waste pursuant to Water Code section 13263(i).

2. Water Code section 13193 *et seq.* requires the Regional Water Quality Control Boards (Regional Water Boards) and the State Water Board (collectively, the Water Boards) to gather Sanitary Sewer Overflow (SSO) information and make this information available to the public, including but not limited to, SSO cause, estimated volume, location, date, time, duration, whether or not the SSO reached or may have reached waters of the state, response and corrective action taken, and an enrollee's contact information for each SSO event. An enrollee is defined as the public entity having legal authority over the operation and maintenance of, or capital improvements to, a sanitary sewer system greater than one mile in length.

3. Water Code section 13271, *et seq.* requires notification to the California Office of Emergency Services (Cal OES), formerly the California Emergency Management Agency, for certain unauthorized discharges, including SSOs.

4. On May 2, 2006, the State Water Board adopted Order 2006-0003-DWQ, "Statewide Waste Discharge Requirements for Sanitary Sewer Systems"[1] (hereafter SSS WDRs) to comply with Water Code section 13193 and to establish the framework for the statewide SSO Reduction Program.

5. Subsection G.2 of the SSS WDRs and the Monitoring and Reporting Program (MRP) provide that the Executive Director may modify the terms of the MRP at any time.

6. On February 20, 2008, the State Water Board Executive Director adopted a revised MRP for the SSS WDRs to rectify early notification deficiencies and ensure that first responders are notified in a timely manner of SSOs discharged into waters of the state.

7. When notified of an SSO that reaches a drainage channel or surface water of the state, Cal OES, pursuant to Water Code section 13271(a)(3), forwards the SSO notification information[2] to local government agencies and first responders including local public health officials and the applicable Regional Water Board. Receipt of notifications for a single SSO event from both the SSO reporter

---

[1] Available for download at:
http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2006/wqo/wqo2006_0003.pdf

[2] Cal OES Hazardous Materials Spill Reports available Online at:
http://w3.calema.ca.gov/operational/malhaz.nsf/$defaultview and http://w3.calema.ca.gov/operational/malhaz.nsf

and Cal OES is duplicative. To address this, the SSO notification requirements added by the February 20, 2008 MRP revision are being removed in this MRP revision.

8. In the February 28, 2008 Memorandum of Agreement between the State Water Board and the California Water and Environment Association (CWEA), the State Water Board committed to re-designing the CIWQS[3] Online SSO Database to allow "event" based SSO reporting versus the original "location" based reporting. Revisions to this MRP and accompanying changes to the CIWQS Online SSO Database will implement this change by allowing for multiple SSO appearance points to be associated with each SSO event caused by a single asset failure.

9. Based on stakeholder input and Water Board staff experience implementing the SSO Reduction Program, SSO categories have been revised in this MRP. In the prior version of the MRP, SSOs have been categorized as Category 1 or Category 2. This MRP implements changes to SSO categories by adding a Category 3 SSO type. This change will improve data management to further assist Water Board staff with evaluation of high threat and low threat SSOs by placing them in unique categories (i.e., Category 1 and Category 3, respectively). This change will also assist enrollees in identifying SSOs that require Cal OES notification.

10. Based on over six years of implementation of the SSS WDRs, the State Water Board concludes that the February 20, 2008 MRP must be updated to better advance the SSO Reduction Program[4] objectives, assess compliance, and enforce the requirements of the SSS WDRs.

IT IS HEREBY ORDERED THAT:

Pursuant to the authority delegated by Water Code section 13267(f), Resolution 2002-0104, and Order 2006-0003-DWQ, the MRP for the SSS WDRs (Order 2006-0003-DWQ) is hereby amended as shown in Attachment A and shall be effective on September 9, 2013.

8/6/13
Date

Thomas Howard
Executive Director

[3] California Integrated Water Quality System (CIWQS) publicly available at http://www.waterboards.ca.gov/ciwqs/publicreports.shtml

[4] Statewide Sanitary Sewer Overflow Reduction Program information is available at: http://www.waterboards.ca.gov/water_issues/programs/sso/

ATTACHMENT A

STATE WATER RESOURCES CONTROL BOARD
ORDER NO. WQ 2013-0058-EXEC

AMENDING MONITORING AND REPORTING PROGRAM
FOR
STATEWIDE GENERAL WASTE DISCHARGE REQUIREMENTS FOR
SANITARY SEWER SYSTEMS

This Monitoring and Reporting Program (MRP) establishes monitoring, record keeping, reporting and public notification requirements for Order 2006-0003-DWQ, "Statewide General Waste Discharge Requirements for Sanitary Sewer Systems" (SSS WDRs). This MRP shall be effective from September 9, 2013 until it is rescinded. The Executive Director may make revisions to this MRP at any time. These revisions may include a reduction or increase in the monitoring and reporting requirements. All site specific records and data developed pursuant to the SSS WDRs and this MRP shall be complete, accurate, and justified by evidence maintained by the enrollee. Failure to comply with this MRP may subject an enrollee to civil liabilities of up to $5,000 a day per violation pursuant to Water Code section 13350; up to $1,000 a day per violation pursuant to Water Code section 13268; or referral to the Attorney General for judicial civil enforcement. The State Water Resources Control Board (State Water Board) reserves the right to take any further enforcement action authorized by law.

A. SUMMARY OF MRP REQUIREMENTS

Table 1 – Spill Categories and Definitions

CATEGORIES	DEFINITIONS [see Section A on page 5 of Order 2006-0003-DWQ, for Sanitary Sewer Overflow (SSO) definition]
CATEGORY 1	Discharges of untreated or partially treated wastewater of **any volume** resulting from an enrollee's sanitary sewer system failure or flow condition that: • Reach surface water and/or reach a drainage channel tributary to a surface water; or • Reach a Municipal Separate Storm Sewer System (MS4) and are not fully captured and returned to the sanitary sewer system or not otherwise captured and disposed of properly. Any volume of wastewater not recovered from the MS4 is considered to have reached surface water unless the storm drain system discharges to a dedicated storm water or groundwater infiltration basin (e.g., infiltration pit, percolation pond).
CATEGORY 2	Discharges of untreated or partially treated wastewater of **1,000 gallons or greater** resulting from an enrollee's sanitary sewer system failure or flow condition that **do not** reach surface water, a drainage channel, or a MS4 unless the entire SSO discharged to the storm drain system is fully recovered and disposed of properly.
CATEGORY 3	All other discharges of untreated or partially treated wastewater resulting from an enrollee's sanitary sewer system failure or flow condition.
PRIVATE LATERAL SEWAGE DISCHARGE (PLSD)	Discharges of untreated or partially treated wastewater resulting from blockages or other problems **within a privately owned sewer lateral** connected to the enrollee's sanitary sewer system or from other private sewer assets. PLSDs that the enrollee becomes aware of may be voluntarily reported to the California Integrated Water Quality System (CIWQS) Online SSO Database.

Table 2 – Notification, Reporting, Monitoring, and Record Keeping Requirements

ELEMENT	REQUIREMENT	METHOD
NOTIFICATION (see section B of MRP)	• Within two hours of becoming aware of any Category 1 SSO **greater than or equal to 1,000 gallons discharged to surface water or spilled in a location where it probably will be discharged to surface water**, notify the California Office of Emergency Services (Cal OES) and obtain a notification control number.	Call Cal OES at: **(800) 852-7550**
REPORTING (see section C of MRP)	• Category 1 SSO: Submit draft report within three business days of becoming aware of the SSO and certify within 15 calendar days of SSO end date. • Category 2 SSO: Submit draft report within 3 business days of becoming aware of the SSO and certify within 15 calendar days of the SSO end date. • Category 3 SSO: Submit certified report within 30 calendar days of the end of month in which SSO the occurred. • SSO Technical Report: Submit within 45 calendar days after the end date of any Category 1 SSO in which 50,000 gallons or greater are spilled to surface waters. • "No Spill" Certification: Certify that no SSOs occurred within 30 calendar days of the end of the month or, if reporting quarterly, the quarter in which no SSOs occurred. • Collection System Questionnaire: Update and certify every 12 months.	Enter data into the CIWQS Online SSO Database (http://ciwqs.waterboards.ca.gov/), certified by enrollee's Legally Responsible Official(s).
WATER QUALITY MONITORING (see section D of MRP)	• Conduct water quality sampling **within 48 hours** after initial SSO notification for Category 1 SSOs in which 50,000 gallons or greater are spilled to surface waters.	Water quality results are required to be uploaded into CIWQS for Category 1 SSOs in which 50,000 gallons or greater are spilled to surface waters.
RECORD KEEPING (see section E of MRP)	• SSO event records. • Records documenting Sanitary Sewer Management Plan (SSMP) implementation and changes/updates to the SSMP. • Records to document Water Quality Monitoring for SSOs of 50,000 gallons or greater spilled to surface waters. • Collection system telemetry records if relied upon to document and/or estimate SSO Volume.	Self-maintained records shall be available during inspections or upon request.

B. NOTIFICATION REQUIREMENTS

Although Regional Water Quality Control Boards (Regional Water Boards) and the State Water Board (collectively, the Water Boards) staff do not have duties as first responders, this MRP is an appropriate mechanism to ensure that the agencies that have first responder duties are notified in a timely manner in order to protect public health and beneficial uses.

1. For any Category 1 SSO greater than or equal to 1,000 gallons that results in a discharge to a surface water or spilled in a location where it probably will be discharged to surface water, either directly or by way of a drainage channel or MS4, the enrollee shall, as soon as possible, but not later than two (2) hours after (A) the enrollee has knowledge of the discharge, (B) notification is possible, and (C) notification can be provided without substantially impeding cleanup or other emergency measures, notify the Cal OES and obtain a notification control number.

2. To satisfy notification requirements for each applicable SSO, the enrollee shall provide the information requested by Cal OES before receiving a control number. Spill information requested by Cal OES may include:

   i. Name of person notifying Cal OES and direct return phone number.
   ii. Estimated SSO volume discharged (gallons).
   iii. If ongoing, estimated SSO discharge rate (gallons per minute).
   iv. SSO Incident Description:
      a. Brief narrative.
      b. On-scene point of contact for additional information (name and cell phone number).
      c. Date and time enrollee became aware of the SSO.
      d. Name of sanitary sewer system agency causing the SSO.
      e. SSO cause (if known).
   v. Indication of whether the SSO has been contained.
   vi. Indication of whether surface water is impacted.
   vii. Name of surface water impacted by the SSO, if applicable.
   viii. Indication of whether a drinking water supply is or may be impacted by the SSO.
   ix. Any other known SSO impacts.
   x. SSO incident location (address, city, state, and zip code).

3. Following the initial notification to Cal OES and until such time that an enrollee certifies the SSO report in the CIWQS Online SSO Database, the enrollee shall provide updates to Cal OES regarding substantial changes to the estimated volume of untreated or partially treated sewage discharged and any substantial change(s) to known impact(s).

4. PLSDs: The enrollee is strongly encouraged to notify Cal OES of discharges greater than or equal to 1,000 gallons of untreated or partially treated wastewater that result or may result in a discharge to surface water resulting from failures or flow conditions within a privately owned sewer lateral or from other private sewer asset(s) if the enrollee becomes aware of the PLSD.

C. REPORTING REQUIREMENTS

1. **CIWQS Online SSO Database Account:** All enrollees shall obtain a CIWQS Online SSO Database account and receive a "Username" and "Password" by registering through CIWQS. These accounts allow controlled and secure entry into the CIWQS Online SSO Database.

2. **SSO Mandatory Reporting Information:** For reporting purposes, if one SSO event results in multiple appearance points in a sewer system asset, the enrollee shall complete one SSO report in the CIWQS Online SSO Database which includes the GPS coordinates for the location of the SSO appearance point closest to the failure point, blockage or location of the flow condition that caused the SSO, and provide descriptions of the locations of all other discharge points associated with the SSO event.

3. **SSO Categories**

   i. **Category 1** – Discharges of untreated or partially treated wastewater of any volume resulting from an enrollee's sanitary sewer system failure or flow condition that:

      a. Reach surface water and/or reach a drainage channel tributary to a surface water; or

      b. Reach a MS4 and are not fully captured and returned to the sanitary sewer system or not otherwise captured and disposed of properly. Any volume of wastewater not recovered from the MS4 is considered to have reached surface water unless the storm drain system discharges to a dedicated storm water or groundwater infiltration basin (e.g., infiltration pit, percolation pond).

   ii. **Category 2** – Discharges of untreated or partially treated wastewater greater than or equal to 1,000 gallons resulting from an enrollee's sanitary sewer system failure or flow condition that does not reach a surface water, a drainage channel, or the MS4 unless the entire SSO volume discharged to the storm drain system is fully recovered and disposed of properly.

   iii. **Category 3** – All other discharges of untreated or partially treated wastewater resulting from an enrollee's sanitary sewer system failure or flow condition.

4. **Sanitary Sewer Overflow Reporting to CIWQS - Timeframes**

   i. **Category 1 and Category 2 SSOs** – All SSOs that meet the above criteria for Category 1 or Category 2 SSOs shall be reported to the CIWQS Online SSO Database:

      a. Draft reports for Category 1 and Category 2 SSOs shall be submitted to the CIWQS Online SSO Database within three (3) business days of the enrollee becoming aware of the SSO. Minimum information that shall be reported in a draft Category 1 SSO report shall include all information identified in section 8.i.a. below. Minimum information that shall be reported in a Category 2 SSO draft report shall include all information identified in section 8.i.c below.

      b. A final Category 1 or Category 2 SSO report shall be certified through the CIWQS Online SSO Database within 15 calendar days of the end date of the SSO. Minimum information that shall be certified in the final Category 1 SSO report shall include all information identified in section 8.i.b below. Minimum information that shall be certified in a final Category 2 SSO report shall include all information identified in section 8.i.d below.

ii. **Category 3 SSOs** – All SSOs that meet the above criteria for Category 3 SSOs shall be reported to the CIWQS Online SSO Database and certified within 30 calendar days after the end of the calendar month in which the SSO occurs (e.g., all Category 3 SSOs occurring in the month of February shall be entered into the database and certified by March 30). Minimum information that shall be certified in a final Category 3 SSO report shall include all information identified in section 8.i.e below.

iii. **"No Spill" Certification** – If there are no SSOs during the calendar month, the enrollee shall either 1) certify, within 30 calendar days after the end of each calendar month, a "No Spill" certification statement in the CIWQS Online SSO Database certifying that there were no SSOs for the designated month, or 2) certify, quarterly within 30 calendar days after the end of each quarter, "No Spill" certification statements in the CIWQS Online SSO Database certifying that there were no SSOs for each month in the quarter being reported on. For quarterly reporting, the quarters are Q1 - January/ February/ March, Q2 - April/May/June, Q3 - July/August/September, and Q4 - October/November/December.

If there are no SSOs during a calendar month but the enrollee reported a PLSD, the enrollee shall still certify a "No Spill" certification statement for that month.

iv. **Amended SSO Reports** – The enrollee may update or add additional information to a certified SSO report within 120 calendar days after the SSO end date by amending the report or by adding an attachment to the SSO report in the CIWQS Online SSO Database. SSO reports certified in the CIWQS Online SSO Database prior to the adoption date of this MRP may only be amended up to 120 days after the effective date of this MRP. After 120 days, the enrollee may contact the SSO Program Manager to request to amend an SSO report if the enrollee also submits justification for why the additional information was not available prior to the end of the 120 days.

5. **SSO Technical Report**

The enrollee shall submit an SSO Technical Report in the CIWQS Online SSO Database within 45 calendar days of the SSO end date for any SSO in which 50,000 gallons or greater are spilled to surface waters. This report, which does not preclude the Water Boards from requiring more detailed analyses if requested, shall include at a minimum, the following:

i. **Causes and Circumstances of the SSO:**

a. Complete and detailed explanation of how and when the SSO was discovered.

b. Diagram showing the SSO failure point, appearance point(s), and final destination(s).

c. Detailed description of the methodology employed and available data used to calculate the volume of the SSO and, if applicable, the SSO volume recovered.

d. Detailed description of the cause(s) of the SSO.

e. Copies of original field crew records used to document the SSO.

f. Historical maintenance records for the failure location.

ii. **Enrollee's Response to SSO:**

a. Chronological narrative description of all actions taken by enrollee to terminate the spill.

b. Explanation of how the SSMP Overflow Emergency Response plan was implemented to respond to and mitigate the SSO.

c. Final corrective action(s) completed and/or planned to be completed, including a schedule for actions not yet completed.

iii. **Water Quality Monitoring:**

a. Description of all water quality sampling activities conducted including analytical results and evaluation of the results.

b. Detailed location map illustrating all water quality sampling points.

6. **PLSDs**

Discharges of untreated or partially treated wastewater resulting from blockages or other problems within a privately owned sewer lateral connected to the enrollee's sanitary sewer system or from other private sanitary sewer system assets may be voluntarily reported to the CIWQS Online SSO Database.

i. The enrollee is also encouraged to provide notification to Cal OES per section B above when a PLSD greater than or equal to 1,000 gallons has or may result in a discharge to surface water. For any PLSD greater than or equal to 1,000 gallons regardless of the spill destination, the enrollee is also encouraged to file a spill report as required by Health and Safety Code section 5410 et. seq. and Water Code section 13271, or notify the responsible party that notification and reporting should be completed as specified above and required by State law.

ii. If a PLSD is recorded in the CIWQS Online SSO Database, the enrollee must identify the sewage discharge as occurring and caused by a private sanitary sewer system asset and should identify a responsible party (other than the enrollee), if known. Certification of PLSD reports by enrollees is not required.

7. **CIWQS Online SSO Database Unavailability**

In the event that the CIWQS Online SSO Database is not available, the enrollee must fax or e-mail all required information to the appropriate Regional Water Board office in accordance with the time schedules identified herein. In such event, the enrollee must also enter all required information into the CIWQS Online SSO Database when the database becomes available.

8. **Mandatory Information to be Included in CIWQS Online SSO Reporting**

All enrollees shall obtain a CIWQS Online SSO Database account and receive a "Username" and "Password" by registering through CIWQS which can be reached at CIWQS@waterboards.ca.gov or by calling (866) 792-4977, M-F, 8 A.M. to 5 P.M. These accounts will allow controlled and secure entry into the CIWQS Online SSO Database. Additionally, within thirty (30) days of initial enrollment and prior to recording SSOs into the CIWQS Online SSO Database, all enrollees must complete a Collection System Questionnaire (Questionnaire). The Questionnaire shall be updated at least once every 12 months.

i. **SSO Reports**

At a minimum, the following mandatory information shall be reported prior to finalizing and certifying an SSO report for each category of SSO:

a. **Draft Category 1 SSOs**: At a minimum, the following mandatory information shall be reported for a draft Category 1 SSO report:

1. SSO Contact Information: Name and telephone number of enrollee contact person who can answer specific questions about the SSO being reported.
2. SSO Location Name.
3. Location of the overflow event (SSO) by entering GPS coordinates. If a single overflow event results in multiple appearance points, provide GPS coordinates for the appearance point closest to the failure point and describe each additional appearance point in the SSO appearance point explanation field.
4. Whether or not the SSO reached surface water, a drainage channel, or entered and was discharged from a drainage structure.
5. Whether or not the SSO reached a municipal separate storm drain system.
6. Whether or not the total SSO volume that reached a municipal separate storm drain system was fully recovered.
7. Estimate of the SSO volume, inclusive of all discharge point(s).
8. Estimate of the SSO volume that reached surface water, a drainage channel, or was not recovered from a storm drain.
9. Estimate of the SSO volume recovered (if applicable).
10. Number of SSO appearance point(s).
11. Description and location of SSO appearance point(s). If a single sanitary sewer system failure results in multiple SSO appearance points, each appearance point must be described.
12. SSO start date and time.
13. Date and time the enrollee was notified of, or self-discovered, the SSO.
14. Estimated operator arrival time.
15. For spills greater than or equal to 1,000 gallons, the date and time Cal OES was called.
16. For spills greater than or equal to 1,000 gallons, the Cal OES control number.

b. **Certified Category 1 SSOs**: At a minimum, the following mandatory information shall be reported for a certified Category 1 SSO report, in addition to all fields in section 8.i.a :

1. Description of SSO destination(s).
2. SSO end date and time.
3. SSO causes (mainline blockage, roots, etc.).
4. SSO failure point (main, lateral, etc.).
5. Whether or not the spill was associated with a storm event.
6. Description of spill corrective action, including steps planned or taken to reduce, eliminate, and prevent reoccurrence of the overflow; and a schedule of major milestones for those steps.
7. Description of spill response activities.
8. Spill response completion date.
9. Whether or not there is an ongoing investigation, the reasons for the investigation and the expected date of completion.

10. Whether or not a beach closure occurred or may have occurred as a result of the SSO.
11. Whether or not health warnings were posted as a result of the SSO.
12. Name of beach(es) closed and/or impacted. If no beach was impacted, NA shall be selected.
13. Name of surface water(s) impacted.
14. If water quality samples were collected, identify parameters the water quality samples were analyzed for. If no samples were taken, NA shall be selected.
15. If water quality samples were taken, identify which regulatory agencies received sample results (if applicable). If no samples were taken, NA shall be selected.
16. Description of methodology(ies) and type of data relied upon for estimations of the SSO volume discharged and recovered.
17. SSO Certification: Upon SSO Certification, the CIWQS Online SSO Database will issue a final SSO identification (ID) number.

c. **Draft Category 2 SSOs**: At a minimum, the following mandatory information shall be reported for a draft Category 2 SSO report:

   1. Items 1-14 in section 8.i.a above for Draft Category 1 SSO.

d. **Certified Category 2 SSOs**: At a minimum, the following mandatory information shall be reported for a certified Category 2 SSO report:

   1. Items 1-14 in section 8.i.a above for Draft Category 1 SSO and Items 1-9, and 17 in section 8.i.b above for Certified Category 1 SSO.

e. **Certified Category 3 SSOs**: At a minimum, the following mandatory information shall be reported for a certified Category 3 SSO report:

   1. Items 1-14 in section 8.i.a above for Draft Category 1 SSO and Items 1-5, and 17 in section 8.i.b above for Certified Category 1 SSO.

ii. **Reporting SSOs to Other Regulatory Agencies**

These reporting requirements do not preclude an enrollee from reporting SSOs to other regulatory agencies pursuant to state law. In addition, these reporting requirements do not replace other Regional Water Board notification and reporting requirements for SSOs.

iii. **Collection System Questionnaire**

The required Questionnaire (see subsection G of the SSS WDRs) provides the Water Boards with site-specific information related to the enrollee's sanitary sewer system. The enrollee shall complete and certify the Questionnaire at least every 12 months to facilitate program implementation, compliance assessment, and enforcement response.

iv. **SSMP Availability**

The enrollee shall provide the publicly available internet web site address to the CIWQS Online SSO Database where a downloadable copy of the enrollee's approved SSMP, critical supporting documents referenced in the SSMP, and proof of local governing board approval of the SSMP is posted. If all of the SSMP documentation listed in this subsection is not publicly available on the Internet, the enrollee shall comply with the following procedure:

a. Submit an **electronic** copy of the enrollee's approved SSMP, critical supporting documents referenced in the SSMP, and proof of local governing board approval of the SSMP to the State Water Board, within 30 days of that approval and within 30 days of any subsequent SSMP re-certifications, to the following mailing address:

State Water Resources Control Board
Division of Water Quality
Attn: SSO Program Manager
1001 I Street, 15th Floor, Sacramento, CA 95814

D. WATER QUALITY MONITORING REQUIREMENTS:

To comply with subsection D.7(v) of the SSS WDRs, the enrollee shall develop and implement an SSO Water Quality Monitoring Program to assess impacts from SSOs to surface waters in which 50,000 gallons or greater are spilled to surface waters. The SSO Water Quality Monitoring Program, shall, at a minimum:

1. Contain protocols for water quality monitoring.

2. Account for spill travel time in the surface water and scenarios where monitoring may not be possible (e.g. safety, access restrictions, etc.).

3. Require water quality analyses for ammonia and bacterial indicators to be performed by an accredited or certified laboratory.

4. Require monitoring instruments and devices used to implement the SSO Water Quality Monitoring Program to be properly maintained and calibrated, including any records to document maintenance and calibration, as necessary, to ensure their continued accuracy.

5. Within 48 hours of the enrollee becoming aware of the SSO, require water quality sampling for, at a minimum, the following constituents:

   i. Ammonia

   ii. Appropriate Bacterial indicator(s) per the applicable Basin Plan water quality objective or Regional Board direction which may include total and fecal coliform, enterococcus, and e-coli.

E. RECORD KEEPING REQUIREMENTS:

The following records shall be maintained by the enrollee for a minimum of five (5) years and shall be made available for review by the Water Boards during an onsite inspection or through an information request:

1. General Records: The enrollee shall maintain records to document compliance with all provisions of the SSS WDRs and this MRP for each sanitary sewer system owned including any required records generated by an enrollee's sanitary sewer system contractor(s).

2. SSO Records: The enrollee shall maintain records for each SSO event, including but not limited to:

   i. Complaint records documenting how the enrollee responded to all notifications of possible or actual SSOs, both during and after business hours, including complaints that do not result in SSOs. Each complaint record shall, at a minimum, include the following information:

a. Date, time, and method of notification.

b. Date and time the complainant or informant first noticed the SSO.

c. Narrative description of the complaint, including any information the caller can provide regarding whether or not the complainant or informant reporting the potential SSO knows if the SSO has reached surface waters, drainage channels or storm drains.

d. Follow-up return contact information for complainant or informant for each complaint received, if not reported anonymously.

e. Final resolution of the complaint.

ii. Records documenting steps and/or remedial actions undertaken by enrollee, using all available information, to comply with section D.7 of the SSS WDRs.

iii. Records documenting how all estimate(s) of volume(s) discharged and, if applicable, volume(s) recovered were calculated.

3. Records documenting all changes made to the SSMP since its last certification indicating when a subsection(s) of the SSMP was changed and/or updated and who authorized the change or update. These records shall be attached to the SSMP.

4. Electronic monitoring records relied upon for documenting SSO events and/or estimating the SSO volume discharged, including, but not limited to records from:

i. Supervisory Control and Data Acquisition (SCADA) systems

ii. Alarm system(s)

iii. Flow monitoring device(s) or other instrument(s) used to estimate wastewater levels, flow rates and/or volumes.

F. CERTIFICATION

1. All information required to be reported into the CIWQS Online SSO Database shall be certified by a person designated as described in subsection J of the SSS WDRs. This designated person is also known as a Legally Responsible Official (LRO). An enrollee may have more than one LRO.

2. Any designated person (i.e. an LRO) shall be registered with the State Water Board to certify reports in accordance with the CIWQS protocols for reporting.

3. Data Submitter (DS): Any enrollee employee or contractor may enter draft data into the CIWQS Online SSO Database on behalf of the enrollee if authorized by the LRO and registered with the State Water Board. However, only LROs may certify reports in CIWQS.

4. The enrollee shall maintain continuous coverage by an LRO. Any change of a registered LRO or DS (e.g., retired staff), including deactivation or a change to the LRO's or DS's contact information, shall be submitted by the enrollee to the State Water Board within 30 days of the change by calling (866) 792-4977 or e-mailing help@ciwqs.waterboards.ca.gov.

5. A registered designated person (i.e., an LRO) shall certify all required reports under penalty of perjury laws of the state as stated in the CIWQS Online SSO Database at the time of certification.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of an order amended by the Executive Director of the State Water Resources Control Board.

7/30/13
Date

Jeanine Townsend
Clerk to the Board

This page is intentionally left blank.

Attachment A2. Summary of Changes to the Sewer System Management Plan

This page is intentionally left blank.

Summary of Changes to the Sewer System Management Plan

SSMP Section	Description of Changes	Date	Authorized
1 – Goal	Update the SSMP program implementation goals. Incorporated regulatory context and summary of Order requirements.		
2 – Organization	Added Primary and Backup LROs. Identified specific positions responsible for implementation of various SSMP program elements. Updated the Chain of Communication for SSOs.		
3 – Legal Authorities	Created summary table of legal authorities. Incorporated excerpts of LBWD Rules and Long Beach Municipal Code showing basis of authorities and providing fast reference to authorities		
4 – Sanitary Sewer System Mapping	Minor updates to document current practices. Removed tables of infrastructure information. Removed planned future activities.		
4 – Preventive Maintenance	Update Pump Station Preventative Maintenance with Minor updates to document current practices. Removed Typical Sewer Pump Station Control Strategy Added Sewer Manhole and Flow Level Monitoring section Added Information Management section Updated Rehabilitation and Replacement Planning section to document current practices Minor updates to spare parts inventory to document current practices.		
5 – Design and Performance Provisions	Updates to document current practices and include additional detail such as links to documents.		
6 – Overflow Emergency Response Plan	Updates and reorganization of entire section to summarize and describe the location of various sections of a new attachment document. This new attached document is LBWD's current SSO Response Plan.		
7 – Fats, Oils and Grease Control Program	Updated to document the transfer of FOG program inspection and enforcement activities to the City of Long Beach Department of Health and Human Services (LBDHHS). Updated the description of FOG program activities to align with current processes and practices.		

SSMP Section	Description of Changes	Date	Authorized
8 – SECAP	Updated to provide summaries of existing programs and reference the detailed 2013 Sewer Master Plan document. Updated to document existing practices. Removed table of identified projects from 2008 Master Plan. Removed table of potentially surcharged pipes from 2013 Master Plan (LBWD identified that these pipes have adequate capacity deficient).		
9 – Monitoring, Measurement and Program Modifications	Updated the list of performance measures to focus on the primary measures LBWD uses to track SSMP program implementation. Updated performance tracking and program modification process description.		
10 – SSMP Program Audits	Updated the SSMP Program audit process description to align with current processes.		
11 – Communication Program	Updated the description of Communication Program processes to align with current processes.		

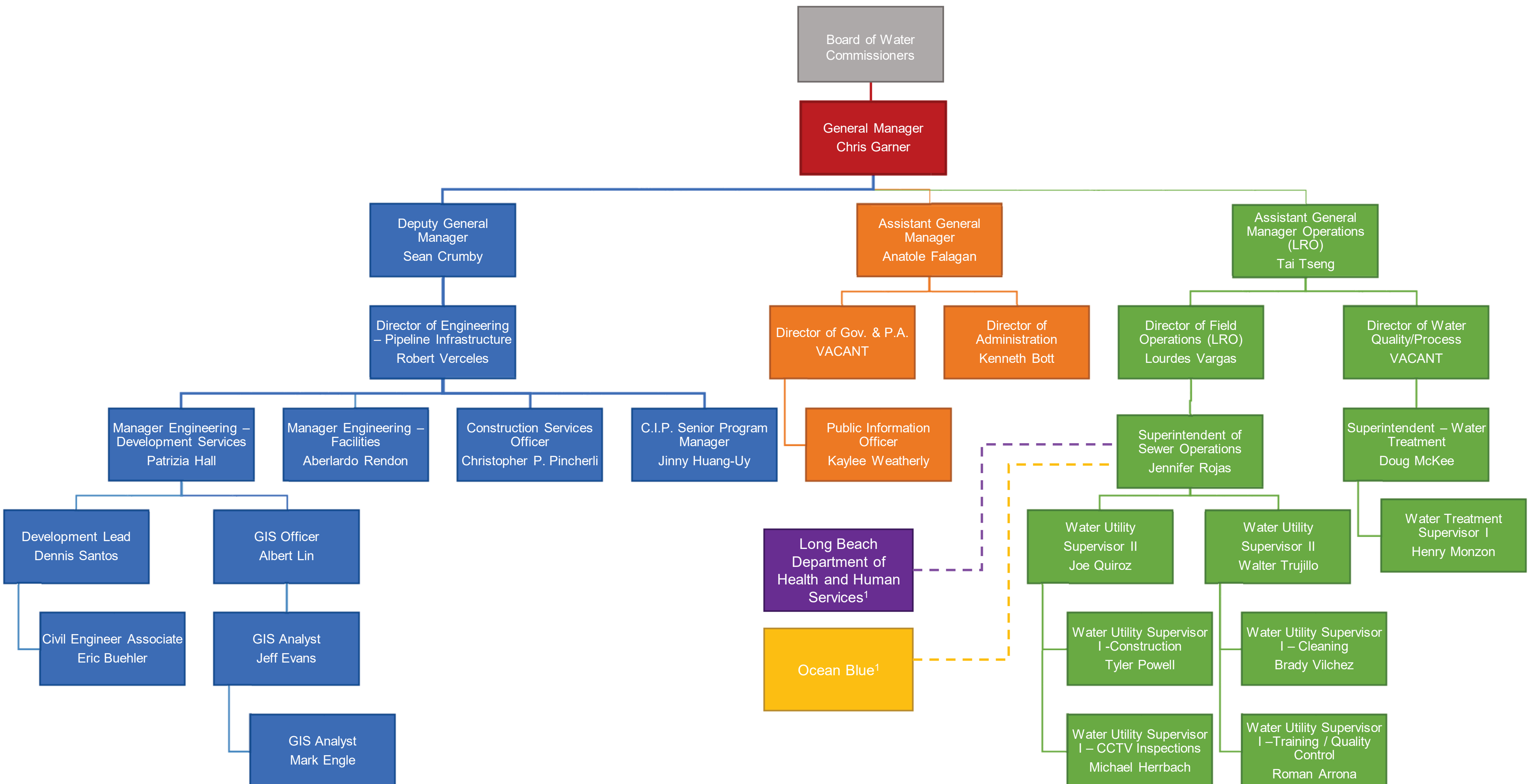
Attachment A3.
Monitoring and Reporting Program

This page is intentionally left blank.

Attachment B1. Organization Chart for Key Positions Responsible for Implementing Sewer System Management Plan Elements

This page is intentionally left blank.

Attachment B1. Organization Chart for Key Positions Responsible for Implementing Sewer System Management Plan Elements



Long Beach Water Department

NOTES:
[1]Separate entity from Long Beach Water Department that reports to Superintendent of Sewer Operations.
CCTV=closed-circuit television; C.I.P.=capital improvement project; GIS= Geographic Information System; Gov.=Government; LRO=Legally Responsible Official; P.A.=Public Affairs

Last Updated: 9/13/2019

This page is intentionally left blank.

Attachment B2. Contact Information for Key Positions Responsible for Implementing Sewer System Management Plan Elements

This page is intentionally left blank.

Long Beach Water
Exceptional Water · Exceptional Service

1800 E. Wardlow Road, Long Beach, CA 90807-4931
562.570.2300 | lbwater.org

Attachment B2. Contact Information for Key Positions Responsible for Implementing Sewer System Management Plan Elements[1]

Position	Name	Telephone Number	SSMP Element
Assistant General Manager	Anatole Falagan	(562) 570-2317	• Goals • Organization • Legal Authority • Communication Program
Assistant General Manager, Operations (LRO)	Tai Tseng	(562) 570-2420	• Goals • Organization • Legal Authority • Program Audits • O&M • FOG
C.I.P. Senior Program Manager	Jinny Huang-Uy	(562) 570-2346	• O&M – Rehabilitation Planning • Design and Performance Provisions • SECAP • Monitoring, Measurement, and Program Modifications • Program Audits
Civil Engineering Associate	Eric Buehler	(562) 570-2328	• FOG
Construction Services Officer	Christopher P. Pincherli	(562) 570-2327	• Design and Performance Provisions
Deputy General Manager	Sean Crumby	(562) 570-2347	• O&M • Design and Performance Provisions • SECAP • Monitoring, Measurement, and Program Modifications • Program Audits

Position	Name	Telephone Number	SSMP Element
Development Lead	Dennis Santos	(562) 570-2381	• FOG
Director of Administration	Kenneth Bott	(562) 570-2364	• Organization
Director of Engineering – Pipeline Infrastructure	Robert Verceles	(562) 570-2337	• O&M – Rehabilitation Planning • Design and Performance Provisions • SECAP • Monitoring, Measurement, and Program Modifications • Program Audits
Director of Field Operations (LRO)	Lourdes Vargas	(562) 570-2393	• Goals • Organization • Legal Authority • Program Audits • O&M • FOG
Director of Government and Public Affairs	VACANT	(562) 570-XXXX	• Communication Program
Director of Water Quality/Process	VACANT	(562) 570-XXXX	• O&M – Lift stations • OERP • Design and Performance Provisions
Environmental Health Operations Officer	Judeth Luong[2]	(562) 570-4104	• FOG
Environmental Health Specialist III	Vanna Kho[2]	(562) 570–4306	• FOG
Environmental Health Specialist IV	Craig Wong[2]	(562) 570-6747	• FOG
Environmental Health Specialist IV	Leila Judd[2]	(562) 570-4152	• FOG
General Manager	Chris Garner	(562) 570-2318	• Goals • Organization • Legal Authority

Position	Name	Telephone Number	SSMP Element
GIS Analyst	Jeff Evans	(562) 570-2359	• O&M - Mapping
GIS Analyst	Mark Engle	(562) 570-2360	• O&M - Mapping
GIS Officer	Albert Lin	(562) 570-2356	• O&M - Mapping
Manager Engineering – Development Services	Patrizia Hall	(562) 570-2332	• O&M - Mapping • SECAP • Monitoring, Measurement, and Program Modifications • Program Audits
Manager Engineering – Facilities	Aberlardo Rendon	(562) 570-2341	• Design and Performance Provisions
Public Information Officer	Kaylee Weatherly	(562) 570-2314	• Communication Program
Water Utility Supervisor I – Construction	Tyler Powell	(562) 570-2451	• O&M • OERP
Superintendent – Water Treatment	Doug McKee	(562) 570-2464	• O&M – Lift stations • OERP • Design and Performance Provisions
Superintendent of Sewer Operations	Jennifer Rojas	(562) 570-2441	• O&M • OERP • Monitoring, Measurement, and Program Modifications • Program Audits • FOG
Water Treatment Supervisor I	Henry Monzon	(562) 570-2462	• O&M – Lift stations • OERP • Design and Performance Provisions
Water Utility Supervisor I – CCTV Inspections	Michael Herrbach	(562) 570-2390	• O&M • OERP
Water Utility Supervisor I – Cleaning	Brady Vilchez	(562) 570-2443	• O&M • OERP

Position	Name	Telephone Number	SSMP Element
Water Utility Supervisor I – Training/Quality Control	Roman Arrona	(562) 570-2442	• O&M • OERP
Water Utility Supervisor II	Joe Quiroz	(562) 570-2440	• O&M • OERP
Water Utility Supervisor II	Walter Trujillo	(562) 570-2442	• O&M • OERP

NOTES:
[1]Last updated 8/22/2019.
[2]LBDHHS, Bureau of Environmental Health
CCTV = closed-circuit television
C.I.P. = Capital Improvements Project;
FOG= fats, oils, and grease
GIS= Geographic Information System
LBDHHS = Long Beach Department of Health and Human Services;
LRO = Legally Responsible Official; O&M = Operation and Maintenance
OERP = Overflow Emergency Response Plan
O&M = Operations and Maintenance
SECAP = System Evaluation and Capacity Assurance Plan

Attachment C1.
Sewer System Fact Sheet

This page is intentionally left blank.

Sewer Systems Fact Sheet

Long Beach Water
Exceptional Water · Exceptional Service

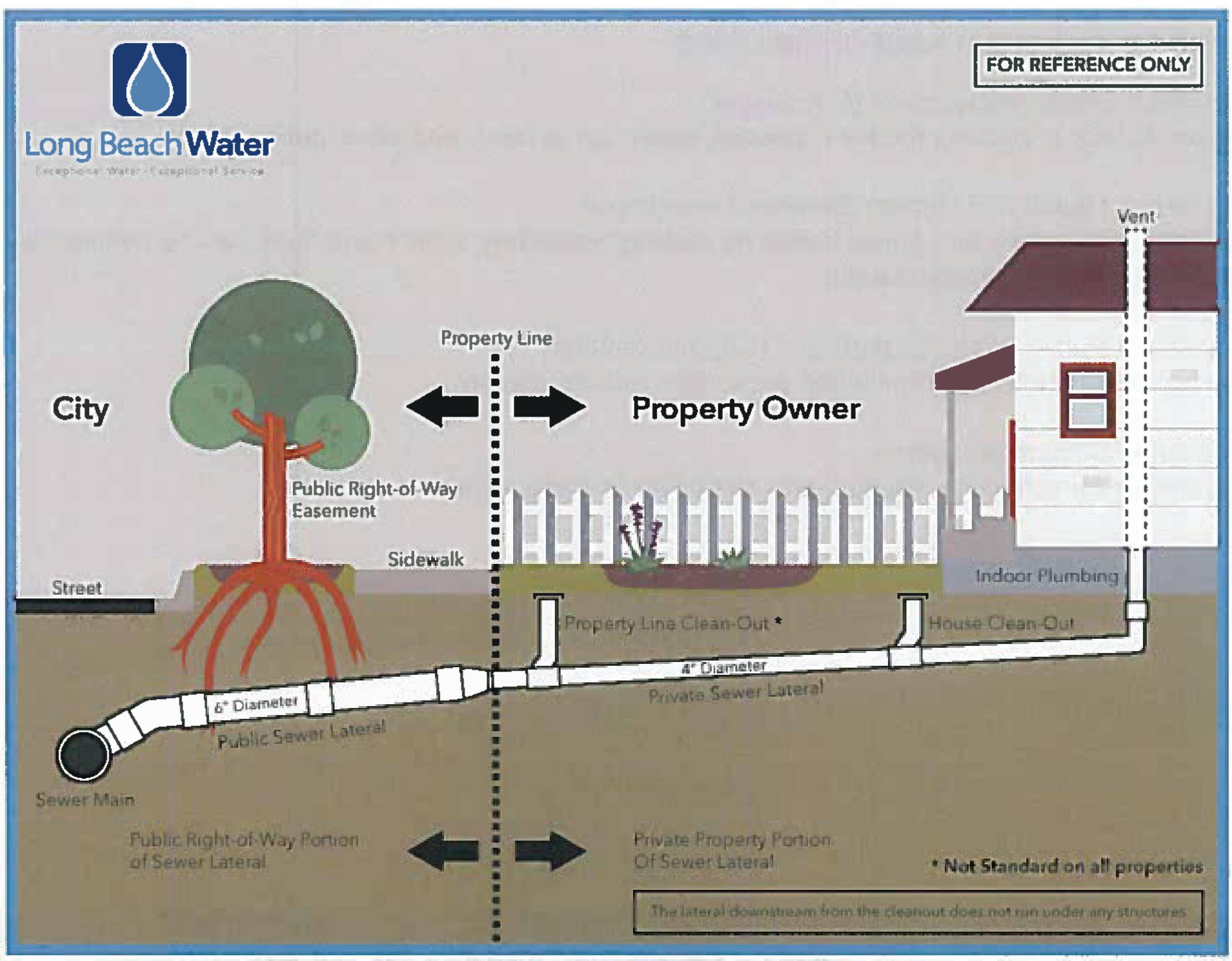
The City of Long Beach owns, operates and maintains the sanitary sewer system that carries water from toilets, showers, sinks, and dish and clothes washers away from homes and businesses. In fact, most of the water used by customers ultimately makes its way to and through the sanitary sewer system.

Long Beach Water operates and maintains over 700 miles of sanitary sewer lines, safely collecting and delivering over 40 million gallons of wastewater per day to the Sanitation Districts of Los Angeles County for treatment for disinfected tertiary recycled water.

THE SANITARY SEWER SYSTEM: WHO'S RESPONSIBLE FOR WHAT?

The pipe that conveys wastewater from your property to the City sewer main is called the sewer lateral. There are two sections to a lateral:

- The first section runs from the building to the sidewalk/property line, commonly 4" in diameter (on private property) is the property owner's responsibility.
- The second section runs from sidewalk/property line, to the center of the street/alley commonly 6" in diameter (on City property) is a shared responsibility between the property owner and the City.
- The property owner is responsible for the routine maintenance of both sections of the sewer lateral.



I HAVE A BACKUP. WHAT SHOULD I DO?

1. Get an initial inspection, clearing, and draining of the sewer lateral performed, ideally by a professional. For ease of inspection, clearing and draining of sewer laterals, we strongly recommend that property owners ensure that a proper cleanout is installed:

- 4" in diameter
- Off Structure, ground level (not located in/on wall of structure)
- On the downstream side of structure (no longer runs under any buildings)

2. Get the lateral to drain by means of snake or hydrojet (by homeowner or private plumber)
3. If the video shows an issue on City property, please submit that video to Long Beach Water Department, Attention Sewer Superintendent, 1800 E Wardlow Rd, Long Beach, CA 90807 or call (562) 570-2300 for more information.

If the property owner believes that there is problem on the city property's line preventing wastewater from draining to the sewer main, Long Beach Water will investigate after the property owner performs the initial inspection, clearing, and draining of the sewer lateral.
For any sewer related questions, emergencies or after hours please call our 24/7 dispatch line at (562) 570-2390.

AGENCIES AND THEIR RESPONSIBILITIES

Long Beach Water Department (City Sewer)
Responsible for protecting the local sewage collection system, and other public areas.

Long Beach Health and Human Services Department
Responsible for protecting public health by closing ocean/bay waters and food service businesses if a spill poses a threat to public health.

Long Beach Public Works Department (City Stormwater)
Responsible for stormwater pollution prevention and education.

L.A. County Sanitation Districts
Responsible for collecting, treating and disposing of wastewater.

Attachment D.
Reserved for Operation and Maintenance Program Attachments

This page is intentionally left blank.

Attachment E. Reserved for Design and Performance Provision Section Attachments

This page is intentionally left blank.

Attachment F1.
Overflow Emergency Response Plan

This page is intentionally left blank.

Sanitary Sewer Overflow Emergency Response Plan

Long Beach Water Department

Protocols for Sanitary Sewer Overflow Response, Notification and Reporting

Long Beach, California
September 2019

Contents

Tables

Figures

1 Purpose

The purpose of the Overflow Emergency Response Plan (OERP) is to support an orderly and effective response to Sanitary Sewer Overflows (SSOs). This plan provides guidelines for Long Beach Water Department (LBWD) personnel to follow in responding to, cleaning up, and reporting SSOs that may occur within LBWD's service area.

1.1 Regulatory Requirements

LBWD shall develop and implement an overflow emergency response plan that identifies measures to protect public health and the environment. At a minimum, this plan must include the following:

(a) Proper notification procedures so that the primary responders and regulatory agencies are informed of all SSOs in a timely manner;

(b) A program to ensure appropriate response to all overflows;

(c) Procedures to ensure prompt notification to appropriate regulatory agencies and other potentially affected entities (e.g. health agencies, regional water boards, water suppliers, etc.) of all SSOs that potentially affect public health or reach the waters of the State in accordance with the Monitoring and Reporting Program. All SSOs shall be reported in accordance with this MRP, the California Water Code, other State Law, and other applicable Regional Water Board Waste Discharge Requirements or National Pollutant Discharge Elimination System (NPDES) permit requirements. The SSMP should identify the officials who will receive immediate notification;

(d) Procedures to ensure that appropriate staff and contractor personnel are aware of and follow the Emergency Response Plan and are appropriately trained;

(e) Procedures to address emergency operations, such as traffic and crowd control and other necessary response activities; and

(f) A program to ensure that all reasonable steps are taken to contain untreated wastewater and prevent discharge of untreated wastewater to waters of the United States and minimize or correct any adverse impact on the environment resulting from the SSOs, including such accelerated or additional monitoring as may be necessary to determine the nature and impact of the discharge.

This page is intentionally left blank.

2 Sanitary Sewer Overflow Detection

The processes that are employed to notify LBWD of the occurrence of an SSO include: observation by the public, calls from outside agencies such as the Long Beach City Police Department, Long Beach Fire Department or Public Works, receipt of an alarm (SCADA, SmartCover® Monitoring Systems or US3 Cricket technologies), or observation by LBWD staff during the normal course of their work.

2.1 Public Observation and Emergency Communications

Public observation is the most common way that LBWD is notified of possible spills. Contact information for reporting sewer spills is located on LBWD's website at http://www.lbwater.org/contact-lbwd.

2.1.1 Normal Work Hours

The normal working hours for LBWD's Administration Building are 8:00 a.m. to 4:30 p.m., Monday through Friday. The Communication's office (Control 1) staff responsible for answering emergency calls, is from 6:30 a.m. to 7:30 p.m. Monday through Friday. The normal working hours for LBWD's Collection System Maintenance field crews are Monday through Friday from 6:30 a.m. to 5:00 p.m. When a report of a possible sewer spill is made, the Control 1 representative receives the call, takes the information from the caller and communicates this information to Radio #530, who then dispatches the closest available cleaning truck to the site and notifies the Water Utility Supervisor II (WUS II). The WUS II will proceed to email all relevant information regarding the SSO to the SSO Notification List which is presented in **Table 2-1** below. Emergency calls received by the City of Long Beach's Police or Fire Department are routed to the Control 1, and follow the process listed above.

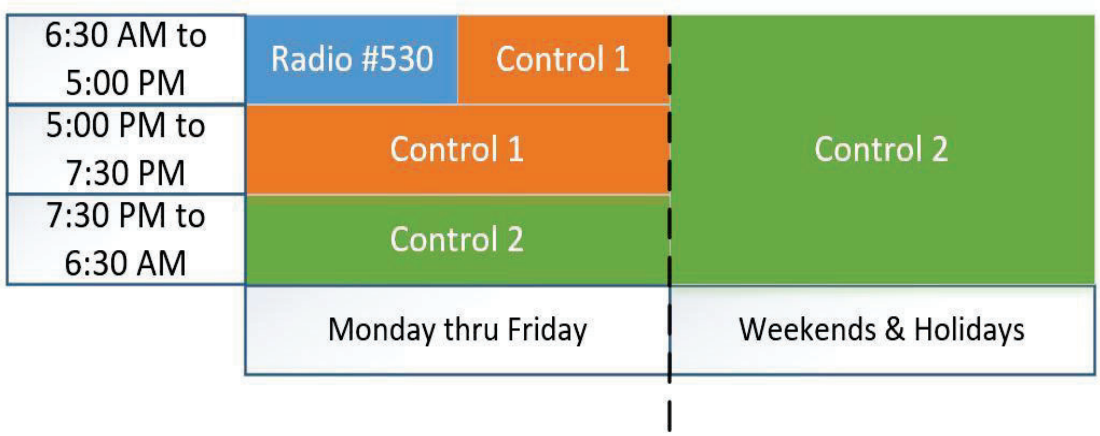
2.1.2 After Hours

After hours emergency calls between the hours of 5:00 p.m. to 7:30 pm, Monday through Friday, go to LBWD's Water Communications Dispatch Control 1. Control 1 gathers basic information regarding a customer complaint and relays this information to the Standby Sewer Lead who will notify the WUS II of a potential SSO. The Sewer Standby Lead will call the second standby crew person to pick up the cleaning truck at the OSC yard and meet at the spill location. The standby lead will call and inform the Sewer Standby Supervisor of the potential SSO, who will then proceed to email all relevant information regarding the SSO to the SSO Notification List which is represented in **Table 2-1** below**.** From 7:30 p.m. to 6:30 a.m., Monday through Friday and on weekends and holidays, all calls are answered by LBWD's Water Communications Dispatch Control 2. Control 2 gathers information regarding the potential spill and notifies the Sewer Standby Lead who will notify the WUS II of a potential SSO. The Sewer Standby Lead will call the second standby crew person to pick up the cleaning truck at the OSC yard and meet at the spill location. The standby lead will call and inform the Sewer Standby Supervisor of the potential SSO, who will then proceed to email all relevant information regarding the SSO to the SSO Notification List which is presented in **Table 2-1** below. **Figure 2-1** below documents the reception of calls received and by whom during normal working, after hours, weekends, and holidays.

Table 2-1: SSO Notification List

Water Department
General Manager
Assistant General Manager - Business
Assistant General Manager - Operations
Deputy General Manager - Engineering
Director of Engineering
Director of Field Operations
Public Information Officer
Superintendent – Sewer Operations
Chief Construction Inspector
Construction Services Officer
Senior Program Manager
All Sewer Supervisors (WUS II = 2, WUS I = 4)
Department of Public Works
City Engineer
Public Service Bureau Manager
Storm Water/Environmental Compliance Officer
Department of Health & Human Services
Program Supervisor
Environmental Health Specialist IV
Environmental Health Specialist III

Figure 2-1: SSO Communication Reception



2.1.3 Routing of Calls

Any calls answered by the City of Long Beach's Police or Fire Department are routed through Control 1, Monday thru Friday from 6:30 a.m. to 7:30 p.m. or Control 2 from 7:30 p.m. to 6:30 a.m. and on weekends and holidays. Additionally, calls made to LBWD's main line or any calls from Customers are routed to Control 1, Monday thru Friday from 6:30 a.m. to 7:30 p.m. and Control 2 from 7:30 p.m. to 6:30 a.m. and on weekends.

This page is intentionally left blank.

3 Sanitary Sewer Overflow Response Procedures

Sewer service calls are high priority events that demand a prompt response to the location of the problem. Upon notification of a potential sewer overflow, a LBWD Cleaning Truck Crew shall be dispatched onsite within 30 minutes during normal working hours and during standby. During normal working hours, LBWD's Primary Responder will be Radio #530 and a LBWD Cleaning Truck Crew. During after hours, the LBWD's Primary Responder will be the Sewer Standby Lead and a LBWD Cleaning Truck Crew who will investigate the service call to determine the appropriate response.

The response procedures for SSOs caused by LBWD sewers, private laterals within LBWD's service area, and surrounding Agency sewers during working hours and after hours, weekends, and holidays are depicted in **Figure 3-1** and **Figure 3-2**.

Figure 3-1: Sanitary Sewer Overflow Response During Working Hours

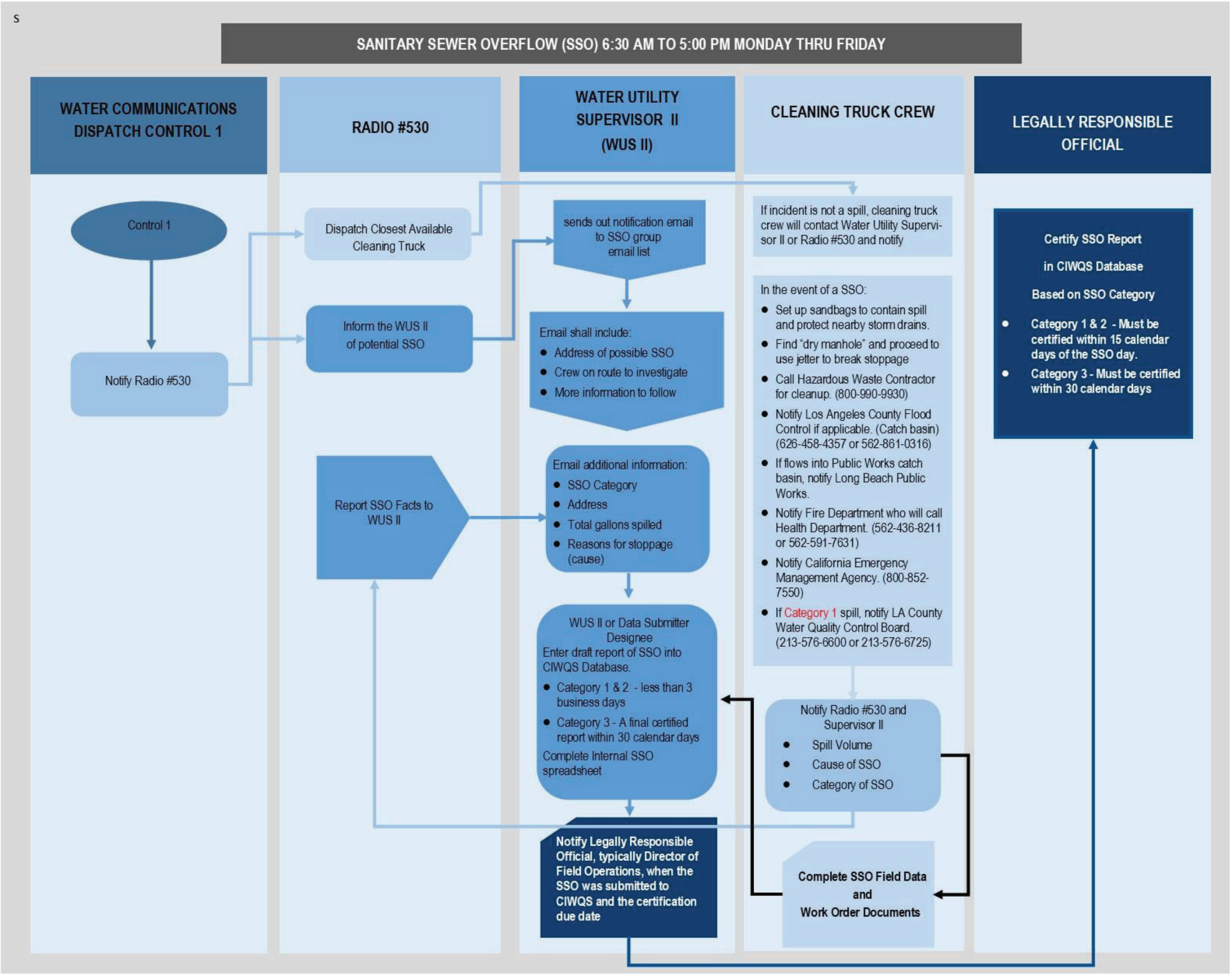
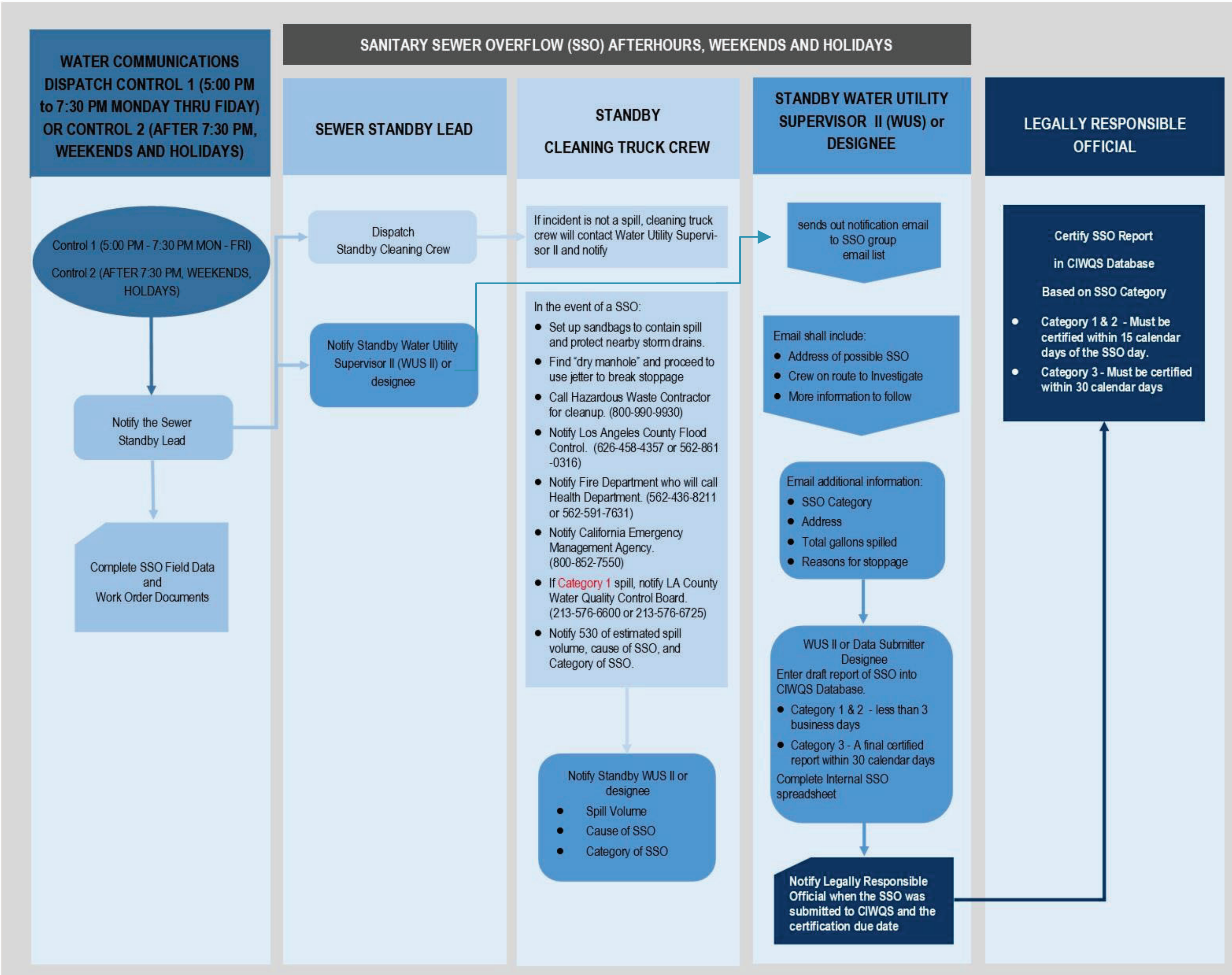


Figure 3-2: Sanitary Sewer Overflow Response During After-Hours, Weekends and Holidays



3.1 Safety

All responding Sewer Operations personnel are responsible for following LBWD safety procedures at all times.

3.2 Traffic and Crowd Control

Traffic control requirements vary depending on the location and the risk to operating personnel and the public. LBWD uses the following traffic control devices, as appropriate:

- Warning signs (signs with the symbol for person working are preferred);
- Directional arrow signs on rear of the truck;
- Traffic cones clearly delineating traffic lanes and directions; and
- One or more flaggers utilized to control and direct traffic where visibility is limited or the possibility of collision exits.

Place warning signs, cones, barricades and caution tape as needed to keep vehicles and pedestrians away from contact with spilled sewage.

3.3 Primary Responder Priorities

The Primary Responder's priorities, as the first person to respond to the call, are:

- To follow safe work practices;
- To respond promptly with appropriate equipment;
- To contain the spill wherever feasible;
- To restore the flow as soon as practicable;
- To minimize public access to and/or contact with the spilled sewage;
- To ensure proper cleanup has occurred with contractor; and
- To restore the area to its original condition (or as close as possible).

3.4 Initial Response

Upon notification of a possible SSO to LBWD's 24-hour Emergency phone number, the operator receiving the call gathers as much information as available through the caller. Information typically available includes the time the SSO was noticed, address of the SSO, general location of the SSO (street, alley, easement, parking lot, private property, etc.) as well as a call back telephone number of the calling party in case additional information is needed.

The receiving operator will call, by telephone during off-hours or by radio during normal working hours, Radio #530 (or the Sewer Standby Lead during off-hours). All known information about the SSO will be provided to the Radio #530. Radio #530 will notify the

Water Utility Supervisor II. The WUS II will send out a notification to the SSO email list in **Table 2-1** with the following information:

- Address of possible SSO
- Crew en route to investigate
- More information to follow

Radio #530 will dispatch a cleaning crew during regular working hours. During off-hours, the Sewer Standby Lead will respond from home directly to reported SSO location and will call the second standby person on the crew to pick up the cleaning truck at the Operations Service Center (OSC) yard to meet at the SSO location. Upon arrival, the cleaning truck crew will:

- Field verify the address and nearest cross street to determine whether the spill or backup is located in LBWD's service area.
  - Note arrival time at spill site.
- The crew will then proceed to contact Hazardous Waste Contractor for cleanup (Current contractor is Ocean Blue Environmental Services)
- Use best judgment to determine whether to proceed immediately with blockage removal versus containment.
- If the spill/backup is caused by a private lateral, the responding crew should contain/mitigate the spilled sewage to prevent sewage from entering the public right of way without LBWD staff going on private property.
- Set up sandbags to prevent flow from entering any nearby storm drain or catch basin. The cleaning truck crew will also locate the dry sewer manhole for the jetter truck to clear the upstream stoppage.
- Set up traffic and pedestrian control as necessary for safety of the public and the response crew.

3.4.1 Restore Flow

Using the appropriate cleaning tools, the LBWD's jetter truck will set up downstream of the blockage and hydro clean upstream from a clear manhole. The crew will attempt to remove the blockage from the system and observe the flows to ensure that the blockage does not recur downstream.

- If the blockage cannot be cleared within a reasonable time, or the sewer requires construction repairs to restore flow, then initiate additional containment measures and/or bypass pumping.
- If the blockage is too large for the sewer operations crew to bypass, LBWD's engineering division will be asked to mobilize one of three emergency contractors to assist with a larger bypass.

3.4.2 Initiate Spill Containment Measures

The responding crew should attempt to contain as much of the spilled sewage as possible using the following steps:

- Determine the immediate destination of the overflowing sewage.
- Implement immediate containment measures consisting of plugging catch basins using straw wattles, and/or other dam construction material to contain the spill, whenever appropriate.
- Additional containment measures include containing/directing the spilled sewage by digging a dike/dam or using sandbags.
- If the spill is caused by a sewer lateral, LBWD will check the mainline and ensure this is clear. If this is not, LBWD will proceed to unblock the line to restore flow. If the mainline is clear of any blockages, LBWD will contact the owner of the lateral, who will be responsible to contact a plumber to clear the blockage and restore flow. General precautions for sewage contamination on residential property and details on a private lateral's ownership responsibility is detailed below:

General Precautions for Sewage Contamination of Residential Property

If a sewer backup caused flooding in a home, the property owner should:

- Keep people and pets away from the affected area(s).
- Do not attempt to clean it themselves.
- Turn off central heat and air-conditioning systems and prevent flow from reaching floor vents by using towels or blankets as a berm. Remove the vent cover and stuff a towel in the opening to help prevent the flow from entering.
- Leave items in the affected area for the experts to handle.

Homeowner Responsibilities:

The homeowner is responsible for clearing any blockage in the home's plumbing system or private lateral and for any resulting flood damage to the structure. The homeowner is also responsible for damage that happens because a lateral was not properly installed. If the sewage flooding was caused by blockage in the private lateral:

- Call an experienced restoration company for cleanup and removal of affected surfaces.
- Report a claim to the homeowner's insurance carrier.
- If there was recent plumbing work performed, contact the plumber or contractor.

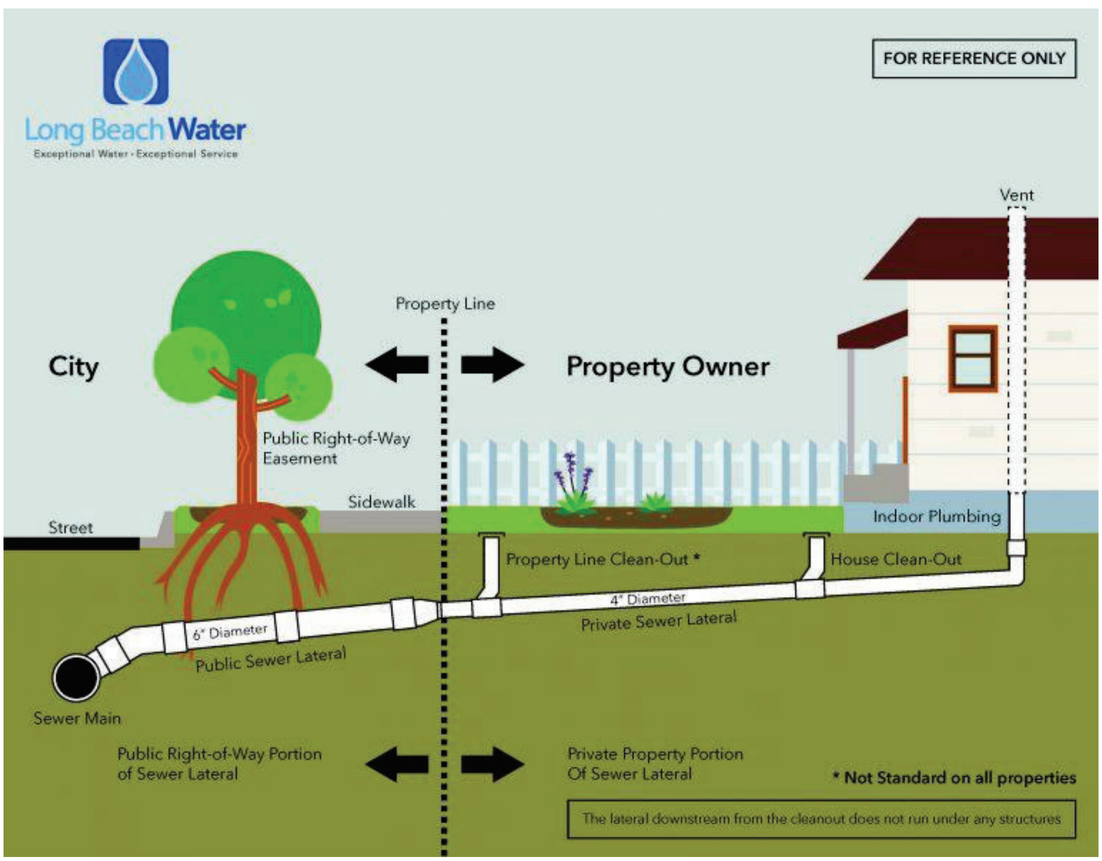
If the sewage flooding was caused by a blockage in the public sewer main, shown in **Figure 3-3** below, LBWD may be responsible for the damages. If this occurs, the property owner will file a claim as soon as possible, and LBWD will respond accordingly. Appropriate reporting of an SSO described in section 1.9 due to the sewer main blockage would be documented. If a blockage occurs in the Public Sewer Lateral and is not caused by a structural failure, it is the homeowner's responsibility to clear the blockage. If the blockage in the Public Sewer Lateral is caused by a structural failure and cannot be cleared, it is LBWD's responsibility to clear and take appropriate means to address the failure. All blockages occurring in the Private Sewer Lateral, shown in **Figure 3-3**, are the responsibility of the homeowner. Illustrated below, are further details on how to determine a private sewer lateral's ownership and responsibility.

Private Lateral Ownership Responsibility

The pipe that conveys wastewater from a property to the city sewer main is called the sewer lateral. There are two sections to a lateral as shown in **Figure 3-3**:

- The first section runs from the building to the sidewalk/property line, commonly 4-inches in diameter (on private property) is the <u>property owner's</u> responsibility.
- The second section runs from sidewalk/property line, to the center of the street/alley commonly 6-inches in diameter (on city property) is a <u>shared responsibility between the property owner and the City.</u>
- The property owner is responsible for the <u>routine</u> maintenance of <u>both sections</u> of the sewer lateral. (LBWD Policy Section 1406: Sewer Lateral Responsibility, Appendix 1)

Figure 3-3: Private Lateral Responsibility



3.5 Water Quality Sampling and Testing

All water quality sampling and testing is performed and handled at the direction of the Long Beach Health Department.

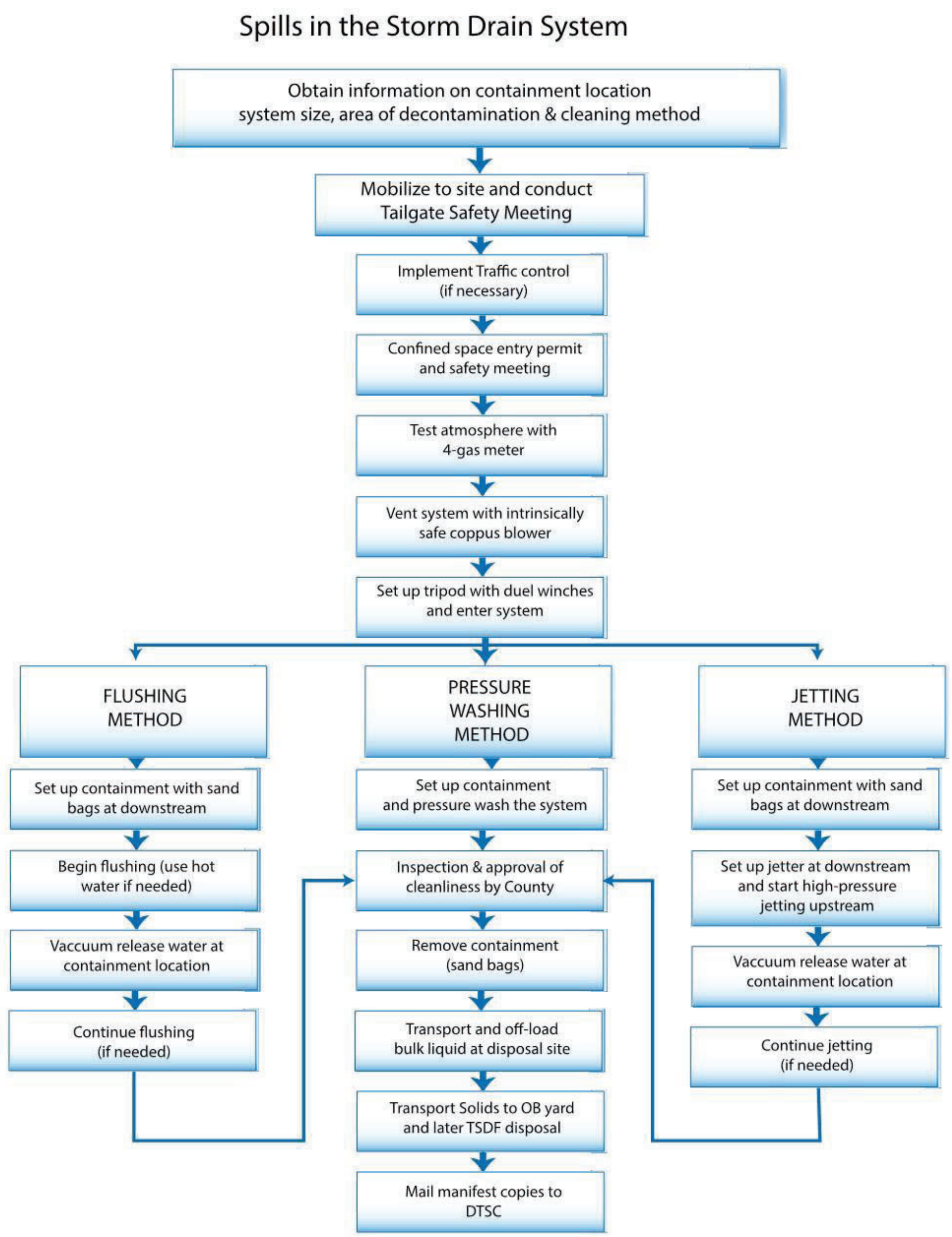
3.6 Recovery and Clean Up

The recovery and clean up phase begins when the flow has been restored and the spilled sewage has been contained to the extent possible. The current contractor on call for the City is Ocean Blue Environmental Services, Inc. The following details the contractor's responsibilities relating to SSOs:

1. Upon receiving the initial telephone call from LBWD, a representative from Ocean Blue Environmental Services, Inc., will respond to the SSO address.
2. While in route, the Ocean Blue Representative will attempt to determine what type of cleaning equipment will be needed to expedite the cleanup.
3. Upon arrival, the Ocean Blue Representative will confer with LBWD staff and/or Health Department Inspector at the site to assess the appropriate cleaning needed, and to further determine personnel and equipment needed to complete the cleaning and disinfection process.
4. When Ocean Blue staff and equipment arrive on site, a vacuum truck will start vacuuming at the designated lowest point downstream of the SSO per LBWD staff, Health Department Inspector and, when required, the LACSD Supervisor.
5. A second vehicle, equipped with a high pressure sprayer, will start pressure washing all areas on city property at the highest point affected by the SSO. Concurrently, the vacuum truck will collect the flushing water and excess sewage.
6. Upon completion of the cleanup, as instructed by LBWD staff, the Health Department Inspector and, when required, the LACSD Supervisor, the Ocean Blue Representative will fill out a Personnel Work Ticket. The highest-ranking LBWD staff member at the site will approve the time, work and equipment utilized during the cleanup by placing his or her signature at the bottom left of the Personnel Work Ticket.

Figure 3-4 provides a process workflow chart for Ocean Blue SSO response support activities. Additional information of the SSO recovery and clean up procedures include the steps detailed in Section 3.6.1 and 3.6.2.

Figure 3-4: Ocean Blue SSO Response Plan



3.6.1 Recovery of Spilled Sewage

Contractor will use a vacuum truck to vacuum up all spilled sewage and any water used to flush the area. All contents collected into the vacuum truck will be taken to Liquid Waste Southwest Treatment, an offsite dump location.

3.6.2 Clean Up and Disinfection

Contractor will implement clean up and disinfection procedures to reduce the potential for human health issues and adverse environmental impacts that are associated with an SSO event. The procedures described are for dry weather conditions and should be modified as required for wet weather conditions.

Hard Surface Areas

Take reasonable steps to contain and vacuum up the wastewater. Collect all signs of sewage solids and sewage-related material either by hand or with the use of rakes and brooms. Wash down the affected area with high pressure water using nozzles on provided on the hydro/combo unit and vacuum the wash water utilizing the hydro/combo unit. Allow area to dry. Repeat the process if additional cleaning is required. Use disinfection.

Landscaped and Unimproved Natural Vegetation

If SSO occurs in landscape, take off the top inch or the amount that has been affected. Either LBWD or contractor will replace soil. This will be determined by the WUS II onsite.

Wet Weather Modifications

Omit flushing and sampling during heavy storm events with heavy runoff where flushing is not required and sampling would not provide meaningful results.

3.6.3 Follow Up Activities

If sewage has reached the storm drain system, the contractor will use the hydro/combo unit to vacuum/pump out the catch basin. The contractor will flush the storm drain system with wash water and capture all residual wash water at a point of containment downstream. LA County and/or Long Beach Public Works will request the amount/quantity of storm drain to clean/flush.

If LBWD sewer causes an overflow on a private property, a Hazardous Waste Disposal Contractor will be called to clean and sanitize the affect areas of the home. If the blockage occurs in the main, LBWD will report this as an SSO and restore flow and notify the WUS II. The WUS II will notify the Sewer Operations Superintendent to determine if any immediate steps to rectify the issue are required. Provide the customer with the contact information of LBWD to make a claim, pending investigation. This can be found here: http://www.longbeach.gov/attorney/about-our-office/claim-form/.

3.7 Public Notification

If an SSO enters the ocean or a waterway requiring posting of signage, contact Long Beach Health Department. Long Beach Health Department will post and remove signage for waterways and beach closures as required and will not remove the signs until the effects of the SSO have been mitigated. A public press release will be made of the temporary closure due to an SSO.

3.8 Sanitary Sewer Overflow Event Investigation

The objective of the SSO event investigation is to determine the cause of the SSO and to identify corrective action(s) needed that will reduce or eliminate potential for the SSO to recur.

The investigation includes reviewing all relevant data to determine appropriate corrective action(s) for the line segment. The investigation will be conducted by the Supervisor II and/or and reported to the Superintendent or his/her designee. The investigation should include:

- A review of and verification of the information reported on the Sanitary Sewer Overflow Report Form;
- A review of available photographs;
- A review of historical maintenance activities;
- Completion of a post-SSO CCTV inspection to determine the condition of the line segment immediately upstream and downstream of the SSO and review the results.
- A review of the results of a FOG source control investigation, if the SSO is FOG-related (request Long Beach Health Department to perform this investigation); and
- Debrief with staff who responded to the SSO.

The goal of the SSO event investigation is to determine the cause of the SSO event and to identify appropriate corrective actions. LBWD's standard practice is, at a minimum, to perform a CCTV inspection of the pipe containing the blockage that caused the SSO event along with the pipes immediately upstream and downstream to find a resolution on how to decrease the chance this will happen again.

LBWD has a book of hot spots of high grease areas that are cleaned more often and are considered repeat lines. These are put on a more regular cleaning schedule to reduce the potential of another SSO if one had occurred previously. Additionally, LBWD installs SmartCovers® in certain locations if there have been multiple SSOs on a particular line.

4 Sanitary Sewer Overflow Documentation and Reporting

All SSOs should be thoroughly investigated and documented for use in managing the wastewater collection system and meeting established reporting requirements. The procedures for investigating and documenting SSOs are:

4.1 Sanitary Sewer Overflow Categories

The California State Water Resources Control Board (SRWCB) has established guidelines for classifying and reporting SSOs. Reporting and documentation requirements vary based on the type of SSO.

Currently, there are three categories of SSOs as defined by the SWRCB and shown in **Table 4-1**[1].

Table 4-1: Spill Categories and Definitions

CATEGORIES	DEFINITIONS [see Section A on page 5 of Order 2006-0003-DWQ, for Sanitary Sewer Overflow definition]
CATEGORY 1	Discharges of untreated or partially treated wastewater of any volume resulting from an enrollee's sanitary sewer system failure or flow condition that: • Reach surface water and/or reach a drainage channel tributary to a surface water; or • Reach a Municipal Separate Storm Sewer System (MS4) and are not fully captured and returned to the sanitary sewer system or not otherwise captured and disposed of properly. Any volume of wastewater not recovered from the MS4 is considered to have reached surface water unless the storm drain system discharges to a dedicated storm water or groundwater infiltration basin (e.g., infiltration pit, percolation pond).
CATEGORY 2	Discharges of untreated or partially treated wastewater of 1,000 gallons or greater resulting from an enrollee's sanitary sewer system failure or flow condition that do not reach surface water, a drainage channel, or a MS4 unless the entire SSO discharged to the storm drain system is fully recovered and disposed of properly.
CATEGORY 3	All other discharges of untreated or partially treated wastewater resulting from an enrollee's sanitary sewer system failure or flow condition.
PRIVATE LATERAL SEWAGE DISCHARGE (PLSD)	Discharges of untreated or partially treated wastewater resulting from blockages or other problems within a privately owned sewer lateral connected to the enrollee's sanitary sewer system or from other private sewer assets. PLSDs that the enrollee becomes aware of may be voluntarily reported to the California Integrated Water Quality System (CIWQS) Online SSO Database.

[1] State Water Resources Control Board Monitoring and Reporting Program No. 2006·0003-DWQ (as revised by Order No. WQ 2013-0058-EXEC) Statewide General Waste Discharge Requirements for Sanitary Sewer Systems

4.2 Internal Sanitary Sewer Overflow Reporting Procedures

The Cleaning Truck Lead will fill out the Sanitary Sewer Overflow Field Data Form and turn it in to the WUS II. The WUS II reviews and completes a draft of the report and is required to enter all necessary information into the State Water Resources Control Board (SWRCB) California Integrated Water Quality System (CIWQS) Online SSO Reporting System. The Legally Responsible Official certifies the SSO Report in CIWQS.

4.3 External Sanitary Sewer Overflow Reporting Procedures[2]

CIWQS is used for reporting SSO information to the SWRCB whenever possible. A summary of external reporting requirements and contact information is included as **Table 4-2**.

4.3.1 Category 1 Sanitary Sewer Overflows

If a Category 1 SSO results in a discharge to a drainage channel or surface waters, the following notification/reporting requirements apply:

- Within two hours of notification of the spill event the WUS II or Sewer Operations Superintendent will:
  - Notify California Office of Emergency Services (Cal OES) and obtain a notification control number;
  - Notify the appropriate Regional Water Quality Control Board by phone:
  - Los Angeles RWQCB (Region 4)
  - Notify Long Beach Department of Health and Human Services (Health Department)
  - Notify Long Beach Public Works Department
- Within 3 business days of becoming aware of an SSO, a draft report must be entered into the CIWQS Online SSO Reporting System. This is usually completed by the WUS II.
- Within 15 calendar days of the conclusion of SSO response and remediation, the Legally Responsible Official or his/her designee will certify the final report using the CIWQS Online SSO Reporting System.
- The Legally Responsible Official or his/her designee will update CIWQS and re-certify the SSO report as new or changed information becomes available. The updates should be submitted as soon as new information is verified. The LRO must certify all SSO report updates.

[2] State Water Resources Control Board Monitoring and Reporting Program No. 2006·0003-DWQ (as revised by Order No. WQ 2008-0002.EXEC) Statewide General Waste Discharge Requirements for Sanitary Sewer Systems

4.3.2 Category 2 Sanitary Sewer Overflows

- Within 3 business days of becoming aware of an SSO, a draft report must be entered into the CIWQS Online SSO Reporting System. This is usually completed by the WUS II.
- **Within 15 calendar days** of the conclusion of SSO response and remediation, the Legally Responsible Official or his/her designee will certify the final report using the CIWQS Online SSO Reporting System.

4.3.3 Category 3 Sanitary Sewer Overflows

- **Within 30 calendar days** after the end of the calendar month in which the SSO occurs, the Legally Responsible Official or his/her designee will submit a certified report using the Online SSO Reporting System.

4.3.4 Private Lateral Sewage Discharges

The Legally Responsible Official or his/her designee may report private lateral sewage discharges using the CIWQS Online SSO Reporting System **at LBWD's discretion**, specifying that the sewage discharge occurred and was caused by a private lateral and identifying the responsible party (other than LBWD), if known.

4.3.5 No Spill Certification (Monthly)

If there are no SSOs during the calendar month, the Supervisor II will notify the Legally Responsible Official (Director of Field Ops) who will submit and certify an electronic report that LBWD did not have any SSOs, **within 30 days after the end of each calendar month**.

4.3.6 Online Sanitary Sewer Overflow Reporting System (California Integrated Water Quality System) Not Available

In the event that the CIWQS Online SSO Reporting System is not available, LBWD would call and request guidance from CIWQS on how to proceed with reporting. General procedures in the case a representative could not be reached, would be for the Legally Responsible Official or his/her designee to fax all required information to the appropriate RWQCB office in accordance with the time schedules identified above. In such event, LBWD will submit the appropriate reports using the CIWQS Online SSO Reporting System as soon as practical.

Table 4-2. External Reporting Requirement Checklist and Contact Information

Reporting & Certification Checklist

Category 1 SSO that reach Drainage Channel or Surface Waters

2-Hour Notification:

Regulatory Agencies (Cal OES, Los Angeles County Water Quality Control Board, RWQCB) must be notified within two hours of ANY discharge of sewage (untreated/partially treated) to a surface water or drainage channel (that is not fully captured and returned to sewer).

Within 3 Business Days of Notification:

Enter draft report in CIWQS.

Within 15 Calendar Days of Conclusion of Response/Remediation:

Must be certified by LRO using CIWQS.

Category 2 SSO (>1,000, Did not reach Surface Waters)

Within 3 Business Days of Notification:

Enter draft report in CIWQS.

Within 15 Calendar Days of Conclusion of Response/Remediation:

Must be certified by LRO using CIWQS.

Category 3 SSO

Within 30-Days After End of Calendar Month with SSO Event:

Must be reported to SWRCB using CIWQS; Must be certified by LRO using CIWQS.

Negative Reporting (No SSOs in Month)

Within 30 days past the end of the month
The LRO or designee must report using CIWQS.

Private Lateral Sewage Discharge (Reporting is Optional)

If reporting, enter into CIWQS as a "Private Lateral Sewage Discharge" and identify responsible party, if known (not LBWD). Must be certified by LRO using CIWQS.

California Integrated Water Quality Systems (CIWQS)

SWRCB Reporting Timeframes Depend on the Size and Final Destination of the SSO.

- CIWQS must be used for reporting if the website is available (http://ciwqs.waterboards.ca.gov)
  - User Name: xxxx Password: xxxx
  - Waste Discharge Identification Number (WDID): 4SSO11423
  - The SSO database will automatically generate an email notification with customized information about the SSO upon initial reporting and final certification for all Category I SSOs.
  - Emails will be sent to the appropriate RWQCB staff
  - Fax RWQCB (only if website is down)

Two-Hour Notification / 24-Hour Certification

1. **California Emergency Management Agency**
   Phone: (800) 852-7550 Make sure you ask for an "OES Control Number" (for RWQCB)
2. **City of Long Beach Fire Department**
   24-Hour Phone: (562) 436-8211 and (562) 591-7631
3. **RWQCB (Region 4 – Los Angeles)**
   Option of phoning in the 2-hour notification and follow up within 24 hours using the online certification or utilize the online feature for both.

RWQCB, Region 4
Region 4, Main Number (213) 576-6600
Region 4, Fax (213) 576-6640
Region 4: xxx@waterboards.ca.gov

Table 4-2. External Reporting Requirement Checklist and Contact Information

Sanitary Sewer Overflow
Any overflow, spill, release, discharge or diversion of untreated or partially treated wastewater from a sanitary sewer system that: (i) Reach waters of the United States (including storm drains, unless fully captured and returned to sewer); (ii) Do not reach waters of the United States; and (iii) Backs up into buildings and on private property that are caused by LBWD owned lines.

4.4 Internal Sanitary Sewer Overflow Documentation

4.4.1 Category 1, 2, and 3 SSOs

The Cleaning Crew Lead will complete the SSO Field Data Form and provide a draft report to the WUS II or his/her designee. The WUS II will assemble all available documentation and review, complete, and submit an internal report of all available information to appropriate LBWD staff via e-mail.

The WUS II or his/her designee will prepare a file for each individual SSO. The electronic file should include the following information, as available:

- Initial service call information (Dispatch has an access database of the history of all calls made to this office);
- SSO Field Data Form;
- Online SSO Reporting System form;
- Volume estimate;
- Map showing the spill location;
- Photographs of spill location, if available;
- CCTV inspection data, if applicable;
- Water quality sampling and test results, if applicable;
- SSO event investigation results; and
- Any other forms related to the SSO.
- Hazardous Waste Disposal Contractor delivers two items to LBWD
    - Non-hazardous waste manifest and personnel work ticket.
- LBWD has added additional fields along with the standard CIWQS data fields for internal record keeping.

4.4.2 Private Lateral Sewage Discharges

Service rendered are documented and filed in the Supervisor's office. Communications Dispatch Office also has an extra copy of this. Data from Service Rendered forms is entered in the Access database also commonly referred to as "Work Order System."

4.5 External Sanitary Sewer Overflow Record Keeping Requirements[3]

The WDR requires that individual SSO records be maintained for a minimum of **five years** from the date of the SSO. This period may be extended when requested by a Regional Water Quality Control Board Executive Officer.

All records shall be made available for review upon State or Regional Water Board staff's request.

Records shall be retained for all SSOs, including but not limited to the following when applicable:

- Records from Hazardous Waste Disposal Contractor;
- GIS map of SSO;
- SSO Field Data Form;
- Services rendered form;
- Email notification or notice of SSO;
- CIWQS report once this is input online;
- Notice of certification from CIWQS;
- Copy of Certified Online SSO Reporting System report(s);
- Any photos (if taken); and
- Steps that have been and will be taken to prevent the SSO from recurring and a schedule to implement those steps.

If water quality samples are required by an environmental or health regulatory agency, or if voluntary monitoring is conducted by the Long Beach Health Department, as a result of any SSO, records of monitoring information are kept by the Health Department. This information includes:

- The date, exact place, and time of sampling or measurements;
- The individual(s) who performed the sampling or measurements;
- The date(s) analyses were performed;
- The individual(s) who performed the analyses;
- The analytical technique or method used; and
- The results of such analyses.

[3] State Water Resources Control Board Monitoring and Reporting Program No. 2006·0003-DWQ (as revised by Order No. WQ 2008-0002.EXEC) Statewide General Waste Discharge Requirements for Sanitary Sewer Systems

4.5.1 Post Sanitary Sewer Overflow Event Debriefing

As soon as possible after major SSO events, all of the participants, from the person who received the call to the last person to leave the site, should meet to review the procedures used and to discuss what worked and where improvements could be made in responding to and mitigating future SSO events. This usually takes place at the weekly tailgate meetings of field staff.

This page is intentionally left blank.

5 Equipment

This section provides a list of specialized equipment that should be used to support this Sanitary Sewer Overflow Emergency Response Plan.

- By-pass pumps:
  - Collections: 2 – 3” Honda GX240 gas-powered pumps; 1 – 2 1/2 “ Honda 5.5 pump
  - Pump Stations: 2 – 6” Sewer Transfer Pumps; Diesel 74HP
- Generators:
  - Collections: 2 Honda portable 3000 watt generators
  - Pump Stations: 3 general use generators
- Piping or hoses (length or length x number of reels):
  - Collections: 3” hose = 50’ per reel x 10 reels. Total is 500’ of 3” hoses; 2 ½” hose = 50’ per reel x 1 reel. Total is 50’ of 2 ½ “ hose.
  - Pump Stations: 6” hose = 10’ per section x 8 sections. Total is 80’ of 6” hose.
- Flood lights:
  - Collections: 1 trailer-mounted Light Plant, plus flood lights on all trucks
  - Pump Stations: No Flood Lights.
- Traffic control items:
  - Collections: Barricades, Delineators, Cones, Various Signs, Arrow Boards, etc.
  - Pump Stations: No additional traffic control items. (Sewer Collections performs traffic control if needed)

This page is intentionally left blank.

6 Sanitary Sewer Overflow Response Training

This section provides information on the training that is required to support this Overflow Emergency Response Plan.

6.1 Initial and Annual Refresher Training

The Sewer Operations Superintendent manages field operations and maintenance activities and is responsible for making sure all Sewer employees receive training in emergency response, SSO investigation, and SSO reporting duties. All new employees receive standard “new hire” training before they are placed in a position where they may have to respond. New hires are evaluated for reaching training milestones with a 6-month training checklist, and all employees attend standard safety meetings or training tailgates on a weekly basis.

The following routine OERP-related training occurs:

- As needed after each SSO event and when changes have been made to the report form or reporting requirement changes, the Sewer Operations Superintendent ensures that the necessary LBWD staff receives additional training required by the SSO event need or by the changed requirement(s).
- The weekly tailgate meetings in the Sewer Operations meeting area include a discussion of SSO events and lessons learned from each event.
- Whenever the SSO report form or telephone numbers change, updated forms are distributed and posted in the sewer offices.
- Emergency response and investigation is discussed as needed and after each SSO event.
- Supervisors and leads took part in an OCSD Sewer Overflow Training Class on January 10, 2019, covering response, notification, SSO volume estimation, and reporting.
- Supervisors are registered for an upcoming SSO Documentation Workshop on November 6, 2019.

6.2 Sanitary Sewer Overflow Training Record Keeping

LBWD maintains records for all OERP training provided in support of this plan. The records for all scheduled training courses and for each overflow emergency response training event include date, time, place, content, name of trainer(s), and names of attendees. This is stored in excel spreadsheets. This includes meeting minutes, training checklists, and annual employee evaluations.

6.3 Contractors Working on Long Beach Water Department Sewer Facilities

LBWD requires all contractors working on LBWD sewer facilities to develop a spill response plan, which identifies who the contractor will contact at LBWD and any actions a contractor is required to perform in the event of an SSO.

Attachment F2.
Beach Water Quality Monitoring and Public Notification Program

This page is intentionally left blank.

BEACH WATER QUALITY MONITORING AND PUBLIC NOTIFICATION PROGRAM

CITY OF LONG BEACH WORKPLAN Revision No. 1

California Water Board Program Manager	Date	Long Beach Bureau of Environmental Health Quality Assurance Officer	Date
Long Beach Bureau of Environmental Health Project Manager	Date	Long Beach Bureau of Environmental Health Contract Manager	Date

California Water Board Quality Assurance Officer	Date

A2. Table of Contents

Group A. Project Management **Page**

A3. Distribution List

AGENCY	TITLE	NAME	E-MAIL ADDRESS
SWRCB	Program Coordinator	Karen Black	Karen.Black@waterboards.ca.gov
City of Long Beach	Health Director	Kelly Colopy	Kelly.Colopy@longbeach.gov
City of Long Beach	EH Manager	Nelson Kerr	Nelson.Kerr@longbeach.gov
City of Long Beach	EH Operations Officer	Judeth Luong	Judeth.Luong@longbeach.gov
City of Long Beach	Administrative Analyst II	Carl Vos	Carl.Vos@longbeach.gov
City of Long Beach	Program Supervisor	Craig Wong	Craig.Wong@longbeach.gov
City of Long Beach	Program Clerk	Claudia McGee	Claudia.Mcgee@longbeach.gov
City of Long Beach	Public Health Lab Director	Mimi Lachica	Mimi.Lachica@longbeach.gov
City of Long Beach	Public Health Microbiologist	Patricia Tritz	Patricia.Tritz@longbeach.gov
City of Long Beach	Health Officer	Anissa Davis	Anissa.Davis@longbeach.gov
City of Long Beach	EH Specialist	Keith Allen	Keith.Allen@longbeach.gov

*Annual distribution of updated QAPP will be sent by the program supervisor via e-mail.

A4. Project Organization

The Program Coordinator is a part of the State Water Control Resources Board. Represents for water safety monitoring program.

Health Director is responsible for signing off on the project

EH Manager is responsible for overseeing the project and approves the budget, as well as working with staff to complete the project. Also, responsible for press release and beach closures.

EH Operations Officer is responsible for reviewing and approving the QAPP. They are also responsible for sample design and data review, not data generation.

Administrative Analyst II is responsible for reviewing and collecting surveys.

Program Supervisor (Environmental Health Specialist IV) is responsible for assigning tasks to appropriate personnel. This position ensures that the project budget is followed and works through any problems that needs to be resolved.

Program Clerk is responsible for data entry and emails.

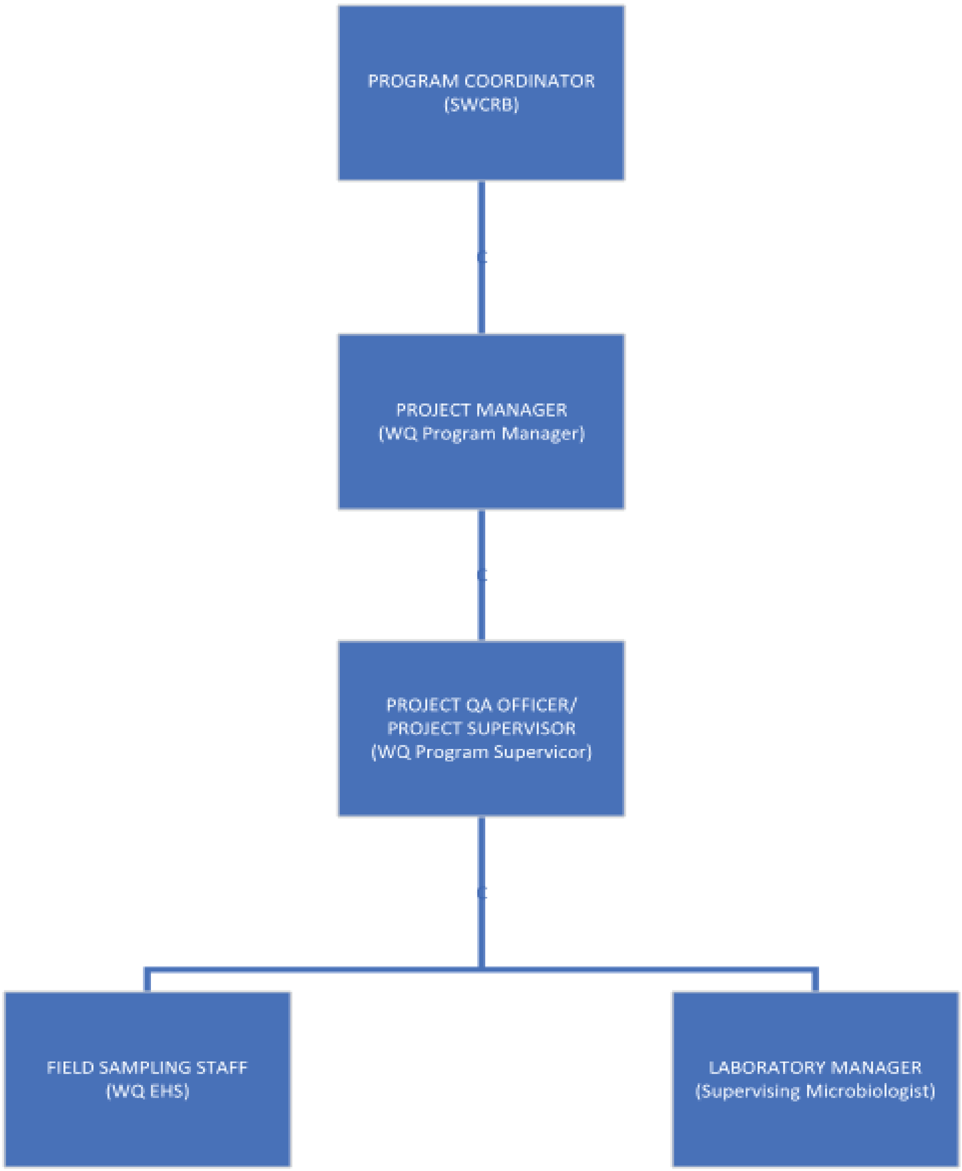
Public Health Lab Director (Laboratory Services Officer) is the supervising microbiologist and is responsible for assigning laboratory staff to perform bacteriological analysis and duties laid out in this plan.

Public Health Microbiologist is responsible for performing the bacteriological analysis.

Health Officer is responsible for notification of advisory, beach closures and beach openings to the public.

EH Specialist is responsible for water sampling and public information.

Organizational Chart



A5. Project Definition and Background

The City of Long Beach is pleased to submit a workplan to detail current levels of effort and proposed enhanced efforts to monitor beach water quality and notify the public of the results within the city. Established and incorporated in 1888, Long Beach is a coastal city situated in the southeast portion of Los Angeles County. With a population of 469,450 residents, it is the fifth largest city in California and the 34^{th} largest in the United States (U.S. Census, 2017).

Long Beach borders the Pacific Ocean with over 7 miles of beaches frequented by 50,000 or more persons per year. As such, Health and Safety Code §115880 [Assembly Bill (AB 411), Statutes of 1997, Chapter 765] requires all waters adjacent to beaches be tested weekly for microbiological contaminants, including, but not limited to, total coliform, fecal coliform, and enterococci bacteria. Also, the Los Angeles and San Gabriel rivers, two major urban watersheds in Southern California, form the northwestern and southeastern boundaries of the city. Besides storm water, the runoff from these rivers consists of trash and debris, occasional sewage spills, chemicals, microbiological matter, and other pollution associated with urban watersheds.

Because of these factors, the city is susceptible to water polluted by bacterial matter that could be harmful to individuals who use local recreational water. Residents of the city and tourists use city coastal waters to swim, fish, sail, and for other recreational uses. The City of Long Beach's Department of Health and Human Services (DHHS), Bureau of Environmental Health (DHHS EH) currently conducts regular beach water quality sampling for bacterial indicators (fecal coliform, total coliform, and enterococcus) at 15 sites throughout the city frequented by recreational usage of at least 50,000 individuals per year (See Appendix 1), and located adjacent to a storm drain that flows in the summer.

The purpose of this plan is to establish a uniform procedure for DHHS EH personnel to follow bacteriological sampling and the environmental inspection program for water contact sports areas including the harbor, bays, marinas and river in the City of Long Beach.

A6. Project Task/Description

This program is in place to protect the public from exposure of recreational water that may cause illness. For work performed and time constraints, see Section B2 "Field Sampling Methods". All the data collected and measured to ensure the quality of ocean waters for use and enjoyment by the public.

Beach Identification: According to the California Health and Safety Code, "public beach" means any beach area used by the public for recreational purposes that is owned, operated, or controlled by the state, any state agency, any local agency, or any private person in this state, and is located in the coastal zone as defined in Section 30103 of the Public Resources Code.

A list of 15 recreational water areas have been identified as priority beach locations in the City of Long Beach. Nine locations (numbers 1-9) are AB411 beaches (see Appendix 1). Five AB411 beaches (1-5) are sampled three times a week year-round as part of the City's NPDES Permit requirement. The other locations (10-15) are water locations chosen based on health risks of recreational use and historical data. Sites 10-15 are tested weekly following Title 17's standards. The following areas are the water locations accessible by the public:

1. 5th Place off Beach
2. 10th Place
3. Molino Ave.
4. Coronado

5. West Side of Belmont Pier
6. Prospect Ave
7. Granada
8. 55th Place
9. 72nd Place
10. 56th Place
11. Alamitos Bay Bayshore
12. 2nd St Bridge &Bayshore Ave
13. Mother's Beach
14. Colorado Lagoon- West
15. Colorado Lagoon- East

Samples are taken at these sites due to the estimated number of people who use the beach on an annual basis (over 50,000) and their proximity to a storm drain. During storm events, a rain advisory notice is issued to the local newspaper, posted on the Health & Human Services website, and on the "Beach Advisory and Closure Hotline" if the precipitation is in excess of 0.10 inches in a 24-hour period. This notice communicates to the public, "It is recommended to avoid all ocean water contact for at least 72 hours after rainfall, especially at storm drain outlets, river mouths, streams, and lagoons."

In general, the public uses recreational waters year-round in the City of Long Beach; however, usage is more frequent during spring and summer months (April and October), due to the warmer weather, which can be seen by the number of beach goers frequenting the beach on a daily basis. Typical beach usage in the areas tested is for swimming, windsurfing, sailing, boating and fishing. Known point and non-point sources of pollution include storm drains at 9th Place, Molino Avenue, Redondo Avenue, 36th Place, West Side of Belmont Pier, and the Los Angeles and San Gabriel Rivers. Weekly testing takes place at sites near each of these sources.

A7. Quality Objectives and Criteria

The protective minimum standards for total coliform, fecal coliform, and enterococci bacteria set forth by the California Environmental Protection Agency are as follows:

30- day Geometric Mean – The following standards are based on the geometric mean of the five most recent samples from each site:

i. Total coliform density shall not exceed 1,000 per 100 ml;
ii. Fecal coliform density shall not exceed 200 per 100 ml; and
iii. Enterococcus density shall not exceed 35 per 100 ml.

Single Sample Maximum:

i. Total coliform density shall not exceed 10,000 per 100 ml;
ii. Fecal coliform density shall not exceed 400 per 100 ml;
iii. Enterococcus density shall not exceed 104 per 100 ml; and

iv. Total coliform density shall not exceed 1,000 per 100 ml when the fecal coliform/total coliform ratio exceeds 0.1.

Currently, the DHHS is going through all lab reports and entering the data into an electronic format. Any errors in the reports are compared with the Public Health Lab's physical records.

For the lab quality assurance manual, see Appendix 4.

Note: The 30-day Geometric Mean is not conducted by the Long Beach DHHS. Only the single sample maximum is taken.

A8. Special Training/Certifications

All project personnel should have the required and appropriate training before performing any of the tasks. A Registered Environmental Health Specialist (REHS) collects water samples and a program clerk must be familiar with different proprietary applications. Currently, all project personnel have the required training to perform their duties. If there is a need for more specialized training or certification, then it is the duty of the project supervisor to provide the appropriate training/certification or assign qualified personnel to provide the training/certification. All project personnel, who receive the specialized training/ certification, should keep and store all documentation of the specialized training/certification on file (physically or electronically) and the program supervisor should have a copy of the specialized training/certification on file (physically or electronically) as well. An annual review of the required training will be conducted by the program supervisor one month before then end of every fiscal year.

A9. Documentation and Records

All sample data reports generated by the DHHS Public Health Laboratory (DHHS PHL) will be manually entered into an Excel spreadsheet by the program clerk. Once the spreadsheet is finished, the data will be reviewed for accuracy by the EH specialist and uploaded onto Beachwatch. Then the website (www.longbeach.gov/beachwaterquality*)* will be updated accordingly. At the end of each month, all the spreadsheets from that month will be compiled into one PDF document and uploaded into the historical section of the website. All the spreadsheets will be indefinitely stored electronically on the DHHS EH server. If all electronic reports are lost or cannot be accessed, sample data reports are also stored physically in a secure room for 4 years, in the DHHS PHL.

B1. Sampling Process Design (Sampling Design and Logistics)

The DHHS Water Program is fortunate to partner with the DHHS Public Health Laboratory. Both programs are located in the same building, making communication, sample delivery, and problem solving much more efficient. For recreational water quality, the Public Health Laboratory has in place detailed procedures to receive and process samples, enter data, perform testing, and report results. These procedures are discussed in greater detail below (see Appendix

4). Discussed below are water quality testing methods currently in use that will be used in the Beach Safety Monitoring Program grant:

Test	**Method of Analysis**	**Bacteria**
Colilert-18	**SM 9221F**	**Fecal Coliform** **Total Coliform**
Enterolert™	**SM 9230D (using multi-well procedure)**	**Enterococcus**

Under normal circumstances, a REHS will sample all 15 sites (see section A6's "Beach Notification") on the first work day of the week, which is usually Monday. On Tuesday and Wednesdays, a REHS will only sample the first 5 sites listed.
The DHHS Water Program will re-sample any recreational waters where the previous sample exceeded state standards for total, fecal, or enterococcus bacteria. Re-sampling will continue daily until samples no longer exceed state standards.

Communication: The DHHS communicates results of recreational water monitoring and testing in a variety of methods detailed in section A6's "Policies / Procedures for Monitoring and Notification." When test results confirm that state water quality standards are not being met, advisories (signage) are posted at the site; the hotline and website are updated; and the Marine Safety Division and Long Beach Lifeguards are notified. An e-mail update is also sent to department heads and other City Officials on a daily basis.

The decision to close a beach is made by the City Health Officer, in consultation with DHHS Environmental Health Bureau Manager and Water Program staff. Generally, a beach is closed due to a known contaminant, such as a sewage spill; however, unacceptable test results at a certain location results in an advisory of the beach until test results show that bacterial levels do not exceed state standards. When a beach is closed, closure signs are immediately posted at the site(s); additionally, closure signs (See Appendix 2) are posted up and down the affected beach area every 50 feet to ensure all beach access points clearly indicate the status of the beach; a press release is coordinated through the City of Long Beach Public Information Officer, posted to the website, and submitted to the local newspaper (the Long Beach Press Telegram) for inclusion in the next day's newspaper; the Marine Safety Division of the Fire Department (lifeguards) and the Department of Parks, Recreation and Marine are notified of the closure; and the hotline is updated. For beach closures, sampling is continued on a daily basis until the affected recreational waters return to below state standards for two consecutive samples and the known source of the contaminant is contained.

Posting and/or Closure: Recreational water sites in the city are posted with advisories when test results indicate that state standards for microbacterial content have been exceeded. An advisory sign (see Appendix 3) is posted at the main beach access point(s) to inform the public of the status of the recreational waters. The telephone hotline and website are updated as soon as test results are available. If a beach is closed, the same procedures are followed above in the section B1's "Communication".

During storm events, a rain advisory notice is issued to the local newspaper and on the "Beach Advisory and Closure Hotline" if the precipitation is in excess of 0.10 inches in a 24-hour period. This notice communicates to the public to "stay out of recreational waters for at least 72 hours after the rain stops." Furthermore, the website states a warning

CONSUMER PROTECTION PROGRAM RECREATIONAL WATER MONITORING

Long Beach has approximately 7 miles of public beach and is visited by over 50,000 people during the summer months. In order to protect the safety of the public, weekly water samples are collected and tested routinely to monitor bacterial levels. If you would like more information on beach water quality, please call our office between 8 a.m. and 5 p.m. Monday through Friday at (562)570-4129.

Important Note: After any significant rainfall (0.10" or more) high levels of bacteria from storm drains, rivers, and polluted runoff enter our ocean. It is recommended to avoid all ocean water contact for at least 72 hours after rainfall, especially at storm drain outlets, river mouths, streams, and lagoons. People should always pay particular attention to any warning signs posted at the beach for their safety.

THERE ARE 4 POSSIBLE BEACH WATCH CONDITIONS:

"**OPEN**": (Bacterial levels are within State standards. There are no restrictions to water contact activity.)

"**ADVISORY**": (Bacterial levels are outside of State Standards. Contact with water may cause illness and should be avoided.)

"**RAIN ADVISORY**": (Bacterial levels rise significantly during and after rainstorms. Contact with water should be avoided for a period of 72 hours after rainfall ends.)

"**CLOSED**": (Significant risk to health. Avoid any contact with the water until further notice.

Risk Communication: To inform the public of potential risks of contact with recreational water that exceeds applicable water quality standards, advisory signs have a brief statement in English and Spanish (see Appendix 3).

If the beach is closed, see Appendix 2.

The DHHS website has a "Frequently Asked Questions" section at www.longbeach.gov/beachwaterquality, which provides excellent detail to the public on recreational water quality and potential risks associated with using these waters when they exceed applicable water quality standards.

The DHHS Water Program has also developed a brochure on "Water Quality Program: Recreational Water Safety" (see Appendix 5) in both English and Spanish. DHHS distributes these brochures to the community at meetings, conferences, and other local events. The brochure is specific regarding the risk to public health of water contaminated with bacterial levels exceeding standards, and highlights the risks common during and after rainstorms and water risks near storm drains.

Water Quality Data and Beach Status Information: The City of Long Beach DHHS Environmental Health Water Program will comply with water quality data and information on beach status and/or posting requirements as provided by the State of California.

Enhancement of Quality Assurance / Quality Control Measures: The DHHS Water Program and Public Health Laboratory have implemented Quality Assurance / Quality Control (QA/QC) measures for recreational water sampling. These measures are outlined in detail in Appendix 4 and will be used and enhanced if necessary under the Beach Safety Monitoring Program grant.

In anticipation of EPA's guidelines for enterococci testing we are interested in expanding our public health laboratory's ability to define this organism by other methods for source tracking. Overall, the QA/QC activities for beach water quality have been well addressed but will be continually revised as new federal, state, and / or local requirements develop.

B2. Field Sampling Methods (sample collection)

Location of sampling: Samples will be collected at established sampling points, as approved by the program supervisor or bureau manager. The information on the sterile sample bottle and/or bag will include the sample number and the date/time collected (see Appendix 5).

Time of sampling: All beach, bay, and marina samples will be submitted to the laboratory for analysis no later than 10:00 AM on the day samples are collected, except when collected on Saturday or Sunday. Samples may be taken, as needed, when favorable conditions are noted.

Frequency of sampling: All AB411 samples shall be collected weekly. The five most Westerly beach sites are done three times a week. In accordance with the sampling schedule, Alamitos Bay bacteriological samples will be collected once a week. The frequency and location of monitoring and assessment of coastal waters is based on:

- The periods of recreational use of waters;
- The nature and extent of use during certain periods;
- The proximity of the waters to known point sources and nonpoint sources of pollution;
- Any effect of storm events on the water

Recheck samples will be taken as soon as the results come back from the sampling taken the previous day. A resample will consist of only one bag, no D.O Bottle. Recheck samples will continue to be taken until the coliform level is below states standards and regulations.

Procedure for Collection of Water Sample: A REHS in the Water Program collects water samples in sterile "whirl pak" 100 -millimeter bags containing sodium thiosulfate (See Appendix 5). Each bag is marked with the location, time, and date of the sample taken. Samples are taken in ankle-knee deep water approximately 4-24 inches below the water using a plastic scooper. This depth was selected because studies have shown this is where bacteriological concentrations are typically at the highest as well as most exposed to the public. The bag is then twisted closed and placed in an ice chest with a thermometer and ice to keep samples cool until returning them to the lab.

B3. Sampling Handling and Custody

See Appendix 4's sections Colilert-18 and Enterococci Detection by Enterolert™'s subsection titled "Specimens".

For every test request, there is a water test request form that needs to be filled out. A water test-request form can be found in Appendix 6.

B4. Laboratory Analytical Methods

B5. Quality Control

B6. Instrument/Equipment Testing, Inspection, and Maintenance

B7. Instrument/Equipment Calibration and Frequency

B8. Inspection/Acceptance for Supplies and Consumables

For sections B4-B8, reference the appropriate sections in Appendix 4.

B9. Data Management

As the results are obtained in the DHHS PHL, they store a physical copy of these records. They then prepare a physical report of all samples collected the previous day for a REHS to pick up. After the report is picked up, the data is then entered by the program clerk into an Excel worksheet. The worksheet will be stored onto a secure drive in the DHHS server and uploaded to any appropriate agencies (e.g. California BeachWatch). Before the data is uploaded, a REHS III (EH specialist) oversees quality control and making sure the data was inputted correctly and in the correct format. For an example of the format uploaded to BeachWatch, see Appendix 7. Since basic applications are being used to generate the data, hardware and software configurations are very basic. The computer being used must have access to the Internet and the DHHS's server and it must be able to run Microsoft Excel.

C1. Assessments and Response Actions

The program supervisor will annually assess the water program and the laboratory services officer will assess the laboratory's functions. The following are some of the areas assessed: Standard operating procedures in collecting samples, data-entry and submission, data verification, and compliance with different state and city standards. The program supervisor will meet with the EH manager and EH operations officer at the end of each fiscal year to report on any major developments and changes that have occurred or are needed. If there are any changes needed, the EH manager and EH operations officer will set a deadline and the program supervisor and/or laboratory services officer will oversee their respective area. Any documentation of change will be documented by the EH specialist and/or public health microbiologist, submitted to the program supervisor and/or laboratory services officer, reviewed by the program supervisor and/or laboratory services officer, and then submitted to the EH manager and EH operations officer. The documentation will be stored on a secure hard drive and be brought up for review at the end of the fiscal year.

C2. Reports to Management and State Water Board

The Quality Assurance Project Plan (QAPP) will be written by the program supervisor and submitted to the State Water Board. On the 15th day of each month, the health officer will submit a survey that documents all beach postings and closures that occurred during the preceding month.

See C1 for annual report at the end of the fiscal year. The annual assessment report will be distributed to the following members: Health officer, EH manager, EH operations officer, program supervisor, and EH specialist. The program clerk will distribute the annual assessment reports along with any corrective actions taken.

D1. Data Review, Verification, Validation

Each section is responsible for the review, verifying, and validating the data generated.

The public health laboratory follows strict standard operating procedures to ensure that the data collected for each sample is accurate and precise. Since the methods used (see section B1) are time-sensitive, public health microbiologists strictly adhere to standard operating procedures in maintaining equipment and culturing. Any review of the standard operating procedures is conducted by a public health microbiologist under the supervision of the laboratory services officer.

The water program's EH specialist will verify any data inputted by a program clerk. The data will be checked before submission and/or posting. The EH specialist will ensure the data is in a valid format by giving a pre-set template (see Appendix 7) to the program clerk. The EH specialist will conduct a quality control check on the data and sign off after completing the check. The signed-off report will be stored at the DHHS.

The program supervisor (see section A8) will be responsible for any further training needed to ensure that data reviews, verifications, and validations go smoothly.

D2. Data Verification and Validation Methods

All data generated by the public health laboratory have multiple checkpoints for verification and validation before it is submitted and/or posted. EH specialists will complete a chain-of-custody forms, which will be verified and time-stamped by a public health microbiologist. Laboratory equipment checks will be overseen by a public health microbiologist. Before any data is posted on the website or submitted another agency, multiple EH specialists will perform a quality control check on the data entered by the program clerks. After entering a specific amount of data (e.g. one month's worth), the program clerk will sign off on their entered reports and submit their work the EH specialist. The EH specialist must verify the data's accuracy and the validity of the format. After performing the quality control check, the EH specialist will sign off on the work, submit the work to the respective agency and post the data to the DHHS's website. Any invalid formats rejected by the receiving agency will be corrected by the EH specialist and resubmitted accordingly.

See Appendix 7 for example Excel sheet.

D3. Reconciliation with User Requirements

For the evaluation of the uncertainty of validated data, see sections B9, C1, and D2. All data posted on the website is public information and there are no limitations of how data can be used.

Appendices

Appendix 1

Appendix 2


KEEP OUT
BEACH CLOSED
SEWAGE CONTAMINATED WATER
OCEAN WATER MAY CAUSE ILLNESS
BY ORDER OF THE HEALTH OFFICER
City of Long Beach Department of Health & Human Services
For further information, call: (562)570-4134
PLAYA CERRADA
MANTENGASE AFUERA
AGUA CONTAMINADA DE DESAGÜE
EL AGUA DEL OCÉANO PUEDE
CAUSAR ENFERMEDADES
POR ORDEN DEL OFICIAL DE
SALUD DE LONG BEACH
Departmento de Salud & Servicios
Humanos de la Ciudad de Long Beach
Para más información, llame al: (562) 570-4134
www.longbeach.gov

Appendix 3


WARNING
OCEAN WATER CONTACT MAY CAUSE ILLNESS
BACTERIA LEVELS EXCEED HEALTH STANDARDS
¡AVISO!
EL CONTACTO CON AGUA DEL OCEANO PUEDE CAUSAR ENFERMEDADES
LOS NIVELES DE BACTERIAS EXCEDEN LOS ESTANDARES DE SALUD
City of Long Beach Department of Health & Human Services
For further information call:
Para más información llame al:
(562) 570-4199
www.longbeach.gov

Appendix 4

City of Long Beach I Department of Health & Human Services I
Public Health Laboratory

QUALITY ASSURANCE MANUAL FOR WATER MICROBIOLOGY

ALL PRINTED COPIES ARE UNCONTROLLED DOCUMENTS

Section: Water I Date Created: 03/18/2011

Purpose

A quality assurance plan ensures reliable, timely, and accurate results. Maintaining a quality assurance management system is essential in making sure that the entire testing process from receipt of samples, testing of samples, to reporting of results are accurately performed.

Responsibility

All laboratory staff share responsibilities and contribute towards the goal of obtaining reliable and accurate results.

Laboratory Director

- Responsible for the overall laboratory operation, quality assurance, and administration of the laboratory
- Provides consultation and acts as a liaison between appropriate parties and agencies
- Defines goals, reviews procedures, procures and allocates resources

Supervisor

- Oversees the different sections under their supervision
- Responsible for maintaining quality assurance and standard operation procedures
- Acts as technical advisor

Public Health Microbiologist (PHMs)/ Clinical Laboratory Scientist {CLS)

- Performs microbiological testing in Bacteriology, Parasitology, Virology, Serology, Molecular, Dairy, and Water sections
- May function as a back-up chemist, once approved by AIHA
- Reviews and verifies lab results performed by other testing personnel, when applicable

Environmental Chemist

- Principal analyst for environmental lead testing
- Provides back-up help in processing environmental lead samples
- Back-up analyst for toxicology testing

Laboratory Assistant

- Processes and accessions all specimens received in the lab
- Performs data entry in the laboratory's information management system
- Sends lab reports to clients
- Sterilizes re-usable instruments and glassware
- Acts as a back-up to perform water and dairy testing
- As a California certified phlebotomist, draws blood from patients

Laboratory Clerk Typist

- Performs assigned clerical duties
- Performs data entry when needed
- Sends lab reports to clients

Specimens

Custody, Holding, And Disposal

1. Samples are collected by a Registered Environmental Health Specialist (REHS) of Environmental Health's Water Program. The REHS is responsible for completing the water request form with the following information: their name, date and time collected, and the time brought into the laboratory.
2. The Accession staff is responsible for accepting the samples and the accompanying water test request form and making sure that all required information is provided.
3. Adequately iced cooler with samples will be processed as soon as possible, taking into account the availability of personnel to read the test within the parameters of incubation, but within 2 hours for non-potable water and within 1 hour for potable water. If there is going to be a delay in processing beyond the times described but within regulatory acceptance (<6 hrs of collection), samples must be placed in the refrigerator (2-8°().
4. Record holding temperature on field sample form.
5. Minimum volume collected is 100 ml.
6. Note time of sample processing/incubation. All routine samples are held until samples have been processed, assuring that repeat setups are poss,ble.
7. Chain of custody samples must have a declaration of retention time written on the form.
8. All samples and dilution bottles must be autoclaved before discarding.

9. Disposal of all reagents and materials are in accordance with local, state, and federal environmental guidelines.

Sample Processing

1. Performed at room temperature.
2. Laboratory bench must be disinfected before and after use.
3. Room air quality must be monitored monthly (see SOP for QC Air Monitor).

Materials

All materials and reagents used are tested for sterility to ensure its veracity on receipt and before they are put into the assay.

Quality Control

Sterility Check Procedure on Empty Vessels

1. Depending on the size of the vessel, pour into the container, Trypticase Soy Broth (TSB) or similar non-selective medium, to about one-third the volume and swirl contents around the container.
2. Incubate at 35°C for 48 hours.
3. Examine for growth (cloudy). If growth is present, verify by setting up another set before discarding the batch of containers. If growth is still present, contact the manufacturer for advice and vessel replacement.
4. Log results into the QC book.

Sterility Check on IDEXX trays

1. Make up Idexx reagents in diluent and pour into trays. Seal and incubate under respective temperature requirements for 24 hours.
2. Examine for any yellow color and/or blue fluorescence greater than the comparator. If neither is present, it is assumed the system does not contain any bacteria that will interfere with the assay.
3. Log results into the QC book.
4. IDEXX™ Colilert, Colilert-18, and Enterolert media should be tested for sterility and autofluorescence by incubating at the required time and temperature and checking for presence or absence of growth and placing under the UV lamp to check for autofluorescence.

Performance Check/Sterility on Reagents and Prepared Media

1. Tested on receipt, monthly, and on each new lot number with results maintained in the designated logbook.
2. Colilert, Colilert 18, and Enterolert reagents are tested with positive and negative control organisms (refer to Colilert, Colilert 18, and Enterolert SOPs).
3. Perform sterility check on each lot of autoclaved DI water in dilution bottles by adding to a tube of TSB. Check the volume in the dilution bottles by taking a bottle and pouring into a graduated cylinder.
4. Perform sterility on reagents for each new lot number.
5. For in-house prepared media, refer to quality control sheets for positive and negative control organisms.
6. Quality control logs are maintained to demonstrate the receipt and reactions of the materials and reagents.
7. Note the lot numbers/expiration dates of materials/reagents used for that day's assay on the sample fog sheet.
8. All attendant material (trays, media, diluents, sample bottles) are checked for sterility and ability to measure the desired outcome before use.
9. Check the pH on all new lots of TSB broth. Using the digital pH meter, test the pH of the broth. The pH should be 7.3 $\pm$ 0.2. Document the results on the TSB pH QC sheet.

Calibration

1. Thermometers - see Calibration of Thermometers
2. pH Meters -addressed under Preventive Maintenance
3. Autoclaves -performed by contracted vendor (currently Technical Safety Services)

Preventive Maintenance and Quality Assurance

1. Autoclaves - maintenance, temperature, pressure, timing
    - Quarterly maintenance by the vendor.
    - Monitor for temperature and pressure during use. Maintain temperature recorder so it does not overlap cycles. Autoclave temperature must be verified weekly using a maximum registering thermometer (MRT) to confirm that **121°C** has been reached.
    - Sterilization cycle time check is performed quarterly.
    - Any carbohydrate media should not be in the sterilizing cycle longer than 12-15 minutes and not left in the autoclave longer than 45 minutes total. This means removing the media from the autoclave at the end of the cycle.
    - To test interval: Time the entire cycle from the start until the autoclave shuts off, then open the door. Note the cycle time. It should be 45 minutes or less when you open the door to remove the media.

- With a second timer, monitor the actual sterilizing time and compare it to the autoclave set time.
- Document all of the above actions in their appropriate forms.
- Corrective actions
    i. If the total autoclave functioning time is reached and the door doesn't release for opening within the designated time, autoclave vendor should be contacted.
    ii. If sterilization time is too long and it exceeds the maximum time limit of 15 minutes, set the timer to compensate for the time overrun, e.g., actual time is 18 minutes when set to 15 minutes. For use, set time to 11 or 12 minutes so the total time does not exceed the mandated maximum which is 15 minutes.
    iii. Out of range times must be noted in red ink.
- Temperature range (high-low) checks are performed twice a year.
- Spore checks are performed weekly. Check autoclave performance monthly with a bioindicator.
- Supervisor/Analyst performs an annual quality assurance audits and document findings on Annual Quality Assurance Audit form.

2. Analytical Balances - accuracy, calibration, service maintenance
    - Annual preventive maintenance and calibration (currently by Transcat)
    - Before use, check the accuracy with a 5 gram or 500 mg standard weight depending on the balance used (log) with at least 2 working weights that bracket the normal usage range.
    - Working weights are checked monthly against a set of reference weights of known tolerance for accuracy, precision and linearity. (certification of reference weights).
    - Keep the balances and surrounding area clean of spilled solids/liquids.

3. pH Meter - calibrate each use, monthly slope determination
    - Calibrate with at least 2 of the standard buffers 7.0, 4.0, and 10.0 that bracket the target pH for the unknown solution.
    - Date the buffers upon opening by writing the date on the buffer itself. Check pH against another meter if possible or if not available, have a secondary buffer to check the primary buffer's viability, on a monthly basis.
    - Corrective actions
        i. No reading- clogged interface (refer to manual)
        ii. Erratic reading- check if stopper on electrode is open
        iii. Check KCl/AgCl solution level of electrode. Electrodes have a finite life.

4. Water deionization unit (Aries ultra-high purifying system) - check conductivity each day of use, water quality check annually, bacterial contamination check as necessary
   - Monitor daily with conductivity meter (should be 18.0 mOhms or greater). Record on Aries Pure Water Purification System and Deionized Water Check form.
   - Replace cartridge filters per manufacturer's recommendation.
   - Test for lead annually.
   - Corrective action
     i. If conductivity is out of range (<18.0 mohms), check filters and replace if necessary.
     ii. If flow through the filter is less than ll/min., replace filter.
     iii. If not able to resolve, call South Coast Water, the vendor rep for Aries.

5. Media dispensing Units
   - Check accuracy of volume delivery by dispensing into the appropriate sized graduated cylinders before use, e.g., using a 10 ml syringe, 5 shots should equal 50 ml ± 1 ml. Adjust with tool if necessary (see manual).
   - To clean between different media, use a large volume of hot deionized water, to pump through the dispenser.
   - At the end of use, break down into parts. Wash, dry, and autoclave to store.

6. Hot-Air drying or sterilizing ovens
   - Monitor internal temperature using a calibrated thermometer with an accuracy of 160 - 180 °C. Log results on chart.
   - Test performance monthly by use of spore strips or suspensions.
   - Use heat-indicating strips to label and identify wrapped contents.

7. Refrigerator and Freezer
   - Check and record temperatures daily
   - Clean refrigerators monthly, discarding outdated materials.
   - Clean and defrost freezers semi-annually, discarding outdated materials.

8. Water Baths
   - Keep an appropriate type of thermometer immersed and record temperature daily or during period of use.
   - Clean water baths as needed

- Use only non-corrosive racks. Do not use rusted racks!

9. Incubators
   - Check and record temperatures twice daily, in the morning and afternoon.
   - Place glass thermometers in water or mineral oil for consistency. The liquid level should be up to the indicated mark on the thermometer.
   - Thermometers should be placed on each shelf to measure the variability with the chamber.

10. Tray Sealer and Holders
    - Holders - disinfect after use by soaking in 2% Lysol. Rinse well. Air dry.
    - Sealer - wipe up any spills/leaks immediately. On a monthly basis, check for leaks in trays by adding methylene blue stain to 100 ml DI water and adding to the tray. Seal the tray and check for any bleeding outside of the wells.

11. Automatic Pipettors
    - Reconnect to recharge when not in use.
    - Pipettors are calibrated annually by an outside vendor (currently Calibrate Inc.)

12. Turbidity Meter
    - Calibrate at time of use. Select 0-20.0 range. Standards to use are O NTU (dark stain), 100 NTU (DI water). Check calibration curve with the 40.0 NTU standard.
    - To obtain a 0.5 MacFarland standard of the water QC organisms (grown overnight on BAP at 35°C) for the Inhibitory test or membrane filtration QC testing, use a 15 NTU setting. This concentration will give you a countable plate count after making 100-fold dilutions and selecting the 10^{-6} dilution. Add 1 ml. of the dilution into S mis. of melted but cooled plate counting media. Incubate overnight at 35°C and count the colonies.
    - Refer to the Orbeco-Hellige Digital, Direct-Reading Turbidimeter instruction manual for operating and maintaining this instrument.

13. Thermometers
    - Check twice a year.
    - Laboratory thermometers must be checked against a NIST-certified thermometer. The testing date and results are logged in the QC and discrepancy noted on the thermometer and daily logs. Example: If the thermometer is off by -2°C, label the thermometer with the discrepancy. When logging the daily temperature, subtract the discrepancy from the actual reading.

14. Laboratory Supplies

- Glassware: use proper Miele washer program (see Manual by washer)
    i. Excessive "beading" - Rewash. Check level of detergent and neutralizer.
    ii. pH spot check - Add a few drops of 0.04% Bromthymol blue (BTB) or other pH indicator and observe the color reaction. BTB should be blue-green at pH 7 (neutral).
    <u>BIB formula:</u>
    Add 16 ml 0.01 N NaOH (sodium hydroxide) to 0.1 gm BTB q.s. to 250 ml with distilled water
    iii. Inhibitory Residue Test (see Std. Method Micro Exam 9000) - Use Miele's documentation for the detergent.

- Reagent Grade Water
    i. For bacteriological quality, perform in house. Refer to Standard Methods Micro exam 9000) or use a purveyor that performs this quality check, like Arrowhead Water. Obtain certification from company.

- Membrane filters and pads
    i. Purchase individually wrapped, sterile units.
    ii. Specifications - 47 mm diameter., 0.45 Lm pore size; pads absorb about 2 ml.

- Membrane Filter System
    i. Check assembly system for leaks; discard chipped funnels
    ii. Coat units with silicone to improve drainage. Discard units if inside surfa,ces are scratched.
    iii. Wash and rinse filtration assemblies well, wrap in non-toxic paper or foit and autoclave to sterilize.

- Culture Media
    i. Purchase in quarter pound packaging, if possible, for 1 year's usage.
    ii. Shelf life should be no more than 2 years, unopened, even if the expiration date on package is longer than 2 years.
    iii. For unopened media passed 1 year, a comparative recovery study must be done between old lot and previously tested lot using control organisms.
    iv. Media that have been opened are only good for 6 months but if stored with a desiccator, are good for 1 year.

v. Discard all expired media immediately.

vi. Media Preparation:

b) Use a container 2 times the volume of medium that is being made.

c) Record medium name, lot number, exp. date on media log.

d) Use a magnetic stir/hot plate. Avoid scorching or boiling-over by continuous tending during healing process.

e) For small batches, heat in a boiling water bath.

f) If necessary, dispense into tubes or autoclave the entire batch. Total time in the autoclave should not exceed 45 minutes.

g) Check the pH on a cooled aliquot of the sterile medium by pouring a small amount into a small beaker. Record results. Do not pour the medium back into the flask. Depending on the results, adjust the pH by using acids and bases. Read the recipe carefully. Rinse the electrode well.

h) Store prepared media at room temperature first with loose caps for 2 weeks, then screw capped for 3 months.

i) Label each rack of tubed media with type of media, preparation date, and expiration date.

- Pipette Raw Measurement Verification

i. Each lot of 10 ml pipettes received must have the dispensing volume verified by weight.

ii. Place a small beaker onto an analytical balance and zero.

iii. Pipette 10 ml of DI water into the beaker to register a weight (10 ml= 10 grams).

iv. Record the weight on the Pipette Raw Measurement Log.

v. Repeat 9 more times.

vi. The final inaccuracy should be 5 2.0%.

Proficiency Testing

The laboratory subscribes to ERA for microbiological testing on recreational and potable waters and for toxicity from lead.

Procedure

1. All marine recreational samples are analyzed using Idexx Colilert-18 and Enterolert.
2. Potable truck and boat waters are analyzed using Idexx's Colilert 24-hour test.
3. Details of both analytical procedures are outlined in the Water Lab SOP.

Resulting, Verification, Reporting of Lab Reports

1. Read results according to the Result Interpretation table outlined in the package insert.
2. Count the number of positive wells and refer to the MPN (Most Probable Number) table provided with the trays to obtain a MPN.
3. Look for fluorescence with a 6-watt, 365-nm UV light with 5 inches of the sample in a dark environment. Face light away from your eyes and towards the sample. Fluorescence is used for fecal coliform and enterococcus enumeration.
4. Data is reported using Most Probable Number calculation.

Performance and System Audits

1. Personnel audits are performed annually by the Supervisor or designee.
2. System audits (see form) are performed annually by Supervisor or designee

Corrective Action and Alerts

1. In the event of a laboratory accident, immediately notify the lab supervisor and REHS supervisor. A resample may be taken depending on when the notification was made.
2. For reporting errors, make the necessary corrections and generate an amended report.
3. Alerts - Potable water from catering trucks that are positive for total coliforms and/or *E. coli* must be called to the attention of the REHS supervisor. Write the date, time, and initial of the analyst on the lab report copy and to whom the notification was made.

General Policies

1. AH complaints from client(s) must be documented in the complaint log and brought to the immediate attention of the supervisor or laboratory director.
2. For problems affecting the assay: consult with the lab supervisor.
3. Samples that do not meet the standards of acceptabitity:
   - Report by phone to the appropriate REHS supervisor.
   - Report to the principal analyst.
   - Document the action into the Communications Log, which should contain all complaints, corrections, and alert notifications..
4. All analysts must participate in the proficiency evaluation program subscribed to by the laboratory for ELAP accreditation.
5. Proficiiency testing program currently subscribed to are Environmental Resource Association (ERA) and RTC for lead.
6. Potable water and waste water samples are tested for presence/absence of coliforms using the Defined Substrate Technology™ by Idexx.
7. For lead in water, potable and recreational waters are tested on the Varian AA graphite furnace.
8. ELAP requires one acceptable proficiency result for every field of testing performed per year.

Procedure Title: COLILERT-18

ALL PRINTED COPIES ARE UNCONTROLLED DOCUMENTS

Section: Water Microbiology I Date Created: 02/16/2011

Purpose

Recreational and marine waters are monitored weekly by this methodology. Fifteen stations along The City of Long Beach beaches and Colorado Lagoon are monitored. The advantage of Colilert-18 is the results are ready to read after 18 hours of incubation, which helps facilitate the reporting to Environmental Health Water Program under the guidelines of California AB411 guidelines.

Enterolert™ test for enterococcus is set up for the fifteen AB411 stations as well (see Standard Operating Procedure for Enterolert).

Responsibility

Microbiologists

- **Designated as principal analyst for water microbiology**
- **Maintains the standard operating procedures and quality assurance manuals.**
- **Also designated to setup, read and report results.**

Lab Assistants

- **Designated to setup, read, and report results as a back up to the microbiologist when the latter is out. The principal analyst reviews all lab assistant work.**
- **A lab assistant who has passed the proficiency tests can perform AB411 testing.**

Specimens

- **Samples are collected by Registered Environmental Health Specialists (REHS) of the Environmental Health Water Program. They are responsible for initiating the chain of custody by logging on the field sample sheet: their name, date and time collected, and the time brought into the laboratory.**
- **The lab assistant receiving the samples needs to acknowledge receipt of specimens by signing and dating the field sample sheet.**

- If it is necessary for secure chain of custody (COC), a special form will be filled out and must have a laboratory staff sign its receipt. These samples will be placed into the lockable refrigerator pending assay.
- Adequately iced cooler (<10°() with samples will be processed as soon as possible, taking into account the availability of personnel to read the test within the parameters of incubation for AB411's. For delays in processing beyond above times but within regulatory acceptance (<6 hrs), place all samples into the refrigerator (<10°(). Note holding temperature on field sample form. Minimum volume collected: 100 ml.
- Note time of sample processing/incubation on the field sample sheet. All routine samples are held until samples have been processed, assuring that repeat setups are possible. COC samples must be returned to secured storage. (Supervisor has key). Be sure to log sample in/out.
- Secure chain of custody samples must have a declaration of retention time written on the form.
- Disposal of samples: all samples and dilution bottles must be autoclaved before discarding.
- Disposal of all reagents and materials are in accordance with local state and federal environmental guidelines.

Specimen Rejection Criteria

<u>Acceptable:</u> Samples maintained in the dark and kept cold with ice or blue ice at <8 C.
<u>Reiection;</u> Samples with chlorine residual, frozen or leaking samples

Materials

A. *Equipment*

- Incubator 35 ± O.SC.
- Quanti-Tray™ Sealer
- Tray Holders
- 365 nm UV fluorescent lamp
- UV protection goggles
- Refrigerator 5°C + 5

B. *Materials & Reagents*

- Colilert-18r'" (IDEXX #WP200-18) 200-pack for 100-mL water sample
- Quanti-Tray™ IDEXX (97 wells) for total/fecal coliforms
- 90 ml Sterilized DI water, Nalgene reusable dilution bottles
- Test tubes, screw-capped, sterile, capacity about 15-mL
- ATCC Stock Cultures: Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa
- Color/fluorescence Comparator (IDEXX #WP104)
- Whirl-Pak ThioBag™ (Nasca 100-mL BO1040WA)

- Pipettes 1a-mL
- Pipette discard container - la% bleach or equivalent disinfectant for reusable pipettes
- Bio-hazard bags for disposable/autoclavables

Quality Control

For new lot Numbers:

1. Remove required frozen control organisms from freezer #11 that is located in the Bacteriology freezer.
2. Subculture organisms onto labeled blood agar plate and incubate for 18-24 hours.
3. Label 3 test tubes: TC+, FC+, TC/FC-
4. Reconstitute 1 Colilert-18™ reagent pack in 90-ml DI Water. Aliquot about 10-ml per tube
5. Very lightly inoculate with the following organisms:

		Expected Reaction
TC+	*K. pneumoniae*	yellow, no fluorescence
TC/FC-	*Ps. aeruginosa*	colorless or slight tinge, no fluorescence
FC+	*E.coli*	yellow, blue fluorescence

6. Incubate tubes in 35 ± a.s°C incubator for 18 hours.
7. Reagent control (to test for auto reactivity/fluorescence): Add 1 Colilert-18™reagent to a bottle of DI water into a tray and seal. Incubate at 35 ± a.5°C 18 hours. For new lots of trays and reagents, set up a QC test as outlined in OA/QC SOP.

Proficiency Testing

Once a year, the principal analyst orders proficiency sample from ERA (Environmental Resource Associates). Use the yellow card in the black order box. Samples are analyzed using the same methods in the procedures section of this SOP.

Procedure

Assign sample numbers - (see Accessioning SOP)

1. Label each Nalgene dilution bottle (filled with 90 ml of DI water) with each sample point & label the trays to correspond to the sample points.
2. Aseptically add 1 reagent pack to dilution bottles. Shake to dissolve.
3. These can be prepared up to 6 hours before sample inoculation.
4. Shake the sample 25 times and aseptically add 10-mL to each dilution bottle.
5. Shake the dilution bottles and carefully pour into the labeled trays.

6. Seal trays according to directions in Colilert SOP.
7. Incubate at 35 ± 0.5C for 18 ± 4 hours.
8. Negative weUs: slight tinge *or* colorless.
9. Count number of yellow {total coliforms) wells >= comparator. Keep a separate count of large and small wells when using the 97-well tray.
10. Count number of blue fluorescing (fecal coliforms) wells ::: comparator when exposed UV lamp held 5" away. Keep separate count of large and small wells when using the 97-well tray.
11. Any well(s) that appear indeterminate in reaction, i.e.- not quite up to the color/fluorescence intensity of the comparator, but not negative, must be further incubated for up to 4 more hours. If the intensity increases to the comparator or greater, it is considered positive.
12. Any coliform must be ONPG positive {yellow). Any fluorescent well(s) that is ONPG negative is not counted.

Resulting, Verification, Reporting of lab Reports

1. Use the appropriate MPN table for the trays used. Quanti-tray/2000 refers to the 97-well tray.
2. Locate on the left side, the positive large well count and on the top horizontal, small well count and note the number at the intersect.
3. Multiply that value by 10 (dilution) to determine MPN/100-ml.
4. Report separately, total coliforms and ***E. coli*** MPNs.
5. All negative wells are reported as <10, not "O.
6. Data entry of results:
   - Laboratory Technicians: Enter the fecal coliform #/total coliform#
     Print out the reports Give the original paperwork and printed results to supervisor for verification/review.
   - Microbiologists: Enter fecal coliform#/total coliform #.
     Print out the reports.
     Review print out resuhs against the original, checking off as you go. Initial check form for documentation. Originals back to water lab.
     Signature, date and stamp with laboratory name and address on form sent to environmental health.

7. Resamples are taken when the CaHfornia State standard is exceeded (EH 8/18/04):
8. If the Fecal Coliform/Total Coliform ratio is greater than 0.1 and the Total Coliform is 1000 MPN/100 ml or greater. (Fecal Coliform= E.coli count x 1.3)

9. If the Total Coliform is 10,000 MPN/100 ml or greater
10. If Fecal Coliform is 400 MPN/100 ml or greater

References

IDEXX product insert: Colilert™ 18 06-02027-10. IDEXX Laboratories, Inc. One IDEXX Drive, Westbrook, ME 04092

Standard Methods for the Examination of Water and Wastewater, 18th ed. APHA, 015 Fifteenth St, NW, Washington DC 20005

California Department of Health Services. Regulations for Ocean Beaches and Ocean Water-Contact Sports Areas Pursuant to AB 411.
http://cdpinternet/HealthInfo/environhealth/water/Pages/Beaches.aspx.

ApolloLIMS (Common Cents)

City of Long Beach | Department of Health & Human Services |
Public Health Laboratory

Procedure Title: ENTEROCOCCI DETECTION BY ENTEROLERT™

ALL PRINTED COPIES ARE UNCONTROLLED DOCUMENTS

Section: Water Microbiology | Date Created: 02/28/2011

Purpose

Recreational and marine waters are monitored weekly by this methodology. Fifteen stations along The City of Long Beach beaches and Colorado Lagoon are monitored. Enterolert™ detects enterococci such as *E.faecium* and *E.faecalis* in fresh and marine water. It is based on IDEXX's patented Defined Substrate Technology® (DST®). When Enterococci utilize the P-D glucosidase enzyme to metabolize Enterolert's nutrient indicator, 4-methyl-umbelliferyl P-D glucosidase, the sample fluoresces. Enterolert detects enterococci at 1 colony-forming unit (du) per 100 ml sample within 24 hours, which helps facilitate the reporting to Environmental Health Water Program under the guidelines of California AB411.

Responsibility

Microbiologists:

1. Designated as principal analyst for water microbiology.
2. Responsible for oversight of the laboratory technicians that set up and report the water testing.
3. Maintains the standard operating procedures and quality assurance manuals.
4. Also designated to setup, read, and report results.

Lab Assistants:

1. Designated to setup, read, and report results as a substitute when the microbiologist is out.
2. The principal analyst reviews all of the lab assistant work.
3. A lab assistant who has passed the proficiency tests can perform AB411 testing.

Specimens

1. Samples are collected by a Registered Environmental Health Specialist (REHS). They are responsible for completing the Water Requisition form (field sample form).

2. If it is necessary to secure a chain of custody (COC), a special form will be filled out and must have a laboratory staff sign its receipt. These samples will be placed into the lockable refrigerator pending assay.
3. Field samples are placed in an iced cooler with a thermometer. REHS picks up the cooler and ice packs from the lab either in the morning or the night before. (Thermometers in these coolers are also calibrated by the lab).
4. Adequately iced cooler with samples will be processed as soon as possible, taking into account the availability of personnel to read the test within the parameters of incubation for A8411's, but within 2 hours for non-potable water and within 1 hour for potable water. If there is going to be a delay in processing beyond the above times but within regulatory acceptance (<6 hrs), place all samples into the refrigerator (2-4°C)
5. Minimum volume collected should be 100 ml.
6. Record the holding temperature in the cooler on the field sample form.
7. Note time of sample processing/incubation. All routine samples are held until samples have been processed, assuring that repeat setups are possible. COC samples must be returned to secured storage. (Supervisor has the key). Be sure to log the sample in/out.
8. Secure chain of custody samples must have a declaration of retention time written on the form.
9. Disposal of samples: all samples and dilution bottles must be autoclaved before discarding.
10. Disposal of all reagents and materials are in accordance with the local, state, and federal environmental guidelines.

Materials

A. Equipment
   1. Incubator 41 ± 0.5°C
   2. Incubator 41 ± 0.5°C
   3. Quanti-Tray™ Sealer
   4. Tray Holders
   5. 365 nm UV fluorescent lamp
   6. UV protection goggles
   7. Refrigerator (2-8°C)

B. Materials & Reagents
   1. Enterolert™ reagent snap packs (IDEXX #WENT200) 200 packs
   2. Quanti-Tray™ IDEXX #WQTI00 (51 wells) 100 trays
   3. 90 ml DI Water used as diluent.
   4. Test tubes, screw-capped, sterile, capacity about 15-ml
   5. 1-ul inoculating loop
   6. ATCC Stock cultures: *Enterococcusfaecium, Serratia marcescens and Aerococcus viridans*
   7. Color/fluorescence Comparator (IDEXX #WP104)
   8. Whirl-Pak ThioBag™' (Nasco 100-ml BO1040WA)

9. Pipettes 10-mL
10. Pipette discard container
11. Specific use bio-hazard bags for autoclaving and disposables

Quality Control

For new lot numbers:

1. Label 3 tubes: E. faecium,S. marcescens and A. viridans.
2. Place 10-mL sterile, deionized water each into four sterile screw-capped tubes.
3. Touch a 1-ul loop to a colony of£. *faecium* and inoculate the corresponding tube. Recap tightly, shake thoroughly. Repeat the procedure, using *Serratia marcescens* and A. *viridans.*
4. Prepare 4 bottles: Add Enterolert™ reagent powder to 90-mL DI Water.

    - Label one sterility, one £. *faecium,* one *S. marcescens* and the last A. *viridans.*
    - From the bacterial dilutions prepared in step 3 above, inoculate 1-ul loop from each of the dilutions.Shake inoculated bottles and incubate at 41 ± 0.5 C for 24 hours.
    - Place UV lamp 5" away from bottles. Blue fluorescence indicates the presence of enterococci.
    - Reagent control (to test for auto reactivity/fluorescence):
        a) Add Enterolert™reagent to a bottle of DI water into a tray and seal.
        b) Incubate at 41 ± 0.5C 24 hours.
        c) For new lots of trays and reagents, set up a QC test as outlined in the OA/QCSOP.

Proficiency Testing

Once a year, the principal analyst orders the proficiency sample from ERA (Environmental Resource Associates). Use the yellow card in the black order box.Samples are analyzed using the same methods in the procedures section of thisSOP.

Procedure

1. Assign sample numbers (see Accessioning)
2. Marine waters are to be diluted 1:10 for this assay.
3. Label 90-ml dilution bottles and trays to correspond to the AB411 weekly samples.
4. Tap Enterolert™ reagent pack to ensure powder is on the bottom part. Aseptically, snap back top and add to dilution bottles. Shake to dissolve. These can be prepared up to 6 hours before sample inoculation.
5. Shake water sample 25 times and aseptically add 10-mL to designated bottles.
6. Shake the dilution bottles and carefully pour into the labeled trays. Seal trays according to directions in ColilertSOP.

7. Incubate, sealed-side up, at 41 ± 0.5°C for 24 hours.
8. Immediately after use, rinse all dilution bottles by flooding the bottles with running DI water. Rinse 5 more times and allow to air dry.
9. Fill the dilution bottles with 90-ml DI water using a large bottle with attached 50-ml dispenser pump. Make sure the pump is set to 45 ml. Pump twice into each dilution bottle. Cap and autoclave to sterilize. Allow to cool before use.
10. Expose Enterolert tray to UV fluorescent lamp held 5" away (keep light away from eyes). Count number of fluorescing wells that is ≥ comparator fluorescence. You may see grayish-blue wells with a very weak, but slight fluorescence. Do not count these as positive wells.
11. Record the number of positive wells on the worksheet for each sample.
12. Reincubate for additional 4 hours those wells that are not considered negative but show less fluorescence than the comparator. They may become positive within the additional four-hour incubation.
13. Determine MPN, using the Table for the 51-well tray.

Resulting, Verification, Reporting of Lab Reports

1. Use the appropriate MPN table for the type of tray used.
2. locate the MPN value for the number of positive wells counted.
3. Multiply that number by 10 (dilution made) to determine MPN/100-ml.
4. Record this number on the Enterolert worksheet.
5. Enter this value into the computer.
6. If tray is inadvertently incubated longer than 28 hrs, a negative test is valid. Fluorescence after 28 hours is not reportable and is an invalid result.
7. Data entry of results:
    a) Enter MPN results.
    b) Print out the reports.
    c) Review printed results against original worksheet, checking as you go. Initial and date the worksheets where required.

(Refer to Appendix A: ApolloLIMS)

References

IDEXX product insert: EIT 06-02150-03

Gary Budnick, Robert T. Howard and Donald R. Mayo, "Evaluation of Enterolert for Enumeration of Enterococci in Recreational Waters", Appl. & Environ. Micro. Oct. 1996 p.3881-3884

American Public Health Association et al, "Standard Methods For the Examination of Water and Wastewater. 22nd Edition.

Water Quality Program

The City of Long Beach has approximately seven miles of public beach along its shoreline. To ensure that beaches and other recreational waters such as marina, bay, and harbor waters in the City maintain a high level of water quality, the Department of Health and Human Services' Water Quality Program routinely samples and tests recreational water to ensure that bacteria levels meet the State of California standards for cleanliness and safety.

Beach Advisory

A Beach Advisory is in effect during and after rainstorms. During rainstorms, water discharging into the ocean may contain excessive amounts of bacteria from a variety of sources, such as animal waste and decomposing vegetation.

Generally, the levels of bacteria can rise significantly in the ocean and bay waters close to storm drains and the outlets of creeks and rivers during and after rain. High levels of bacteria may continue for at least three days, depending upon the intensity of the rain. ***Swimmers are advised to avoid all recreational water contact for at least 72 hours after a rainstorm.*** During the non-rainy season, it is recommended that swimmers avoid water contact near all discharging storm drains or tributaries.

Storm Drains

The storm drain system was designed to prevent flooding by safely carrying rain water to our lakes, rivers and ocean. If any trash or hazardous chemicals are dumped into the storm drain system, they can pollute our recreational water. To help ensure the safety and enjoyment of our recreational water, residents may assist the Health Department by keeping the storm drain free from pollutants such as:

- fuel and motor oil from leaking cars
- household cleaning products and paints
- paper and plastic items
- pesticide and fertilizer

Waterborne Illnesses

Waterborne diseases are the result of drinking contaminated water. These contaminants can cause symptoms and illnesses which may last for several days. If you suspect that your symptoms are due to contaminated water, visit your physician and mention any exposure to contaminated water.

Common symptoms associated with exposure to contaminated water include:

- vomiting, diarrhea, nausea
- fever, chills
- skin rash
- ear, nose, throat infections

Warning Signs

If you see this sign at any beach water site in the City of Long Beach, maintain a distance of at least 25 yards from all four sides of the sign.

Signs will be removed when water resample results are below the state bacteriological standards.

Programa de Calidad del Agua

La Ciudad de Long Beach tiene apróximadamente siete millas de playa pública a lo largo de su orilla. Para aseguramos que las playas y otras aguas recreacionales como los puertos deportivos, bahías, y puertos de carga en la Ciudad mantengan un nivel alto de calidad, el Programa de Calidad del Agua del Departamento de Salud y Servicios Humanos rutinariamente toma muestras y examina el agua recreacional para asegurarse que los niveles de bacteria conforman con las normas Estatales de California en cuanto a la limpieza y seguridad.

Notificación de Alerta

Una Notificación de Alerta está en efecto durante y después de las tormentas de lluvia. Durante las tormentas de lluvia, el agua que se descarga en el océano puede contener cantidades excesivas de bacterias de una variedad de fuentes, como del desperdicio de los animales y la vegetación en descomposición.

Generalmente, los niveles de bacteria pueden subir significativamente en el océano y aguas de bahías cerca de los desagües y de las tomas de corriente de riachuelos y ríos durante y después de las tormentas de lluvia. Los niveles altos de bacteria pueden continuar por lo menos tres días, dependiendo de la intensidad de la lluvia. **A los nadadores se les aconseja que eviten todo contacto con el agua al menos 72 horas despúes de una tormenta de lluvia.** Durante la estación no lluviosa, se recomienda que los nadadores eviten el contacto con el agua cerca de todos los desagües o afluentes.

Desagües de Tormentas

El sistema de desagües de tormentas fue diseñado para prevenir inundaciones al llevar agua de éstas lluvias a nuestros lagos, ríos y océano. Si alguna basura o químicos peligrosos se dejan caer dentro del sistema de desagüe de tormentas, puede contaminar nuestra agua recreativa. Para asegurarse de que el agua esté sana y disfrutar de nuestra agua recreacional, los habitantes pueden asistir al Departamento de Salud al mantener estos desagües alejados de contaminantes como:

- Gasolina y aceite de motor que gotea de los automóviles
- Productos domésticos de limpieza y pinturas
- Artículos de papel y plástico
- Pesticidas y fertilizantes

Enfermedades por Contaminación del Agua

Estas enfermedades son el resultado de tomar agua contaminada. Los contaminantes pueden causar síntomas y enfermedades que pueden durar varios días. Si usted sospecha que sus síntomas son debidos a agua contaminada, visite su doctor y mencione alguna exposición con agua contaminada.

Los Síntomas Comunes Asociados con la Exposición al Agua Contaminada incluyen:

- Vómitos, diarrea, nausea
- Fiebre, escalofríos
- Ronchas en la piel
- Infecciones de oído, nariz y garganta

Señales de Advertencia

Si usted vé este letrero en cualquier playa/sitio de agua en la Ciudad de Long Beach mantenga una distancia de por lo menos 25 yardas de todos los cuatro lados del letrero.

Estos letreros se quitarán cuando los resultados de las muestras del agua estén más bajas que las normas bacteriológicas estatales.

Appendix 6

WATER TEST REQUEST FORM Date/Time Received: ________________

Long Beach Public Health Laboratory
Department of Health & Human Services
2525 Grand Avenue, Room 260
Long Beach, California 90815
Ph: (562) 570-4077 Fax: (562) 570-4070

Miriam L. Lachica, M.A.
Laboratory Services Officer

CA ELAP Certificate No.: 2368
AIHA ELLAP ID No.: 102620

PLEASE PRINT

Type of Water: ☐ Potable ☐ Marine
Type of Sample: ☐ Routine ☐ Resample / Make-up
Test Requested: ☐ Colilert 18 ☐ Enterolert ☐ P/A ☐ Other: ________________
Submitter: ☐ EH ☐ Other: ________________________________
Sampling Point: ☐ AB411 ☐ Pump Out ☐ Mobile Food Inspection ☐ Miscellaneous
Date Collected: ________________________________
Collected by: ________________________________

Time Set-up: __________
Sample Temp: __________
Analyst: __________

	Lab No.	Sampling Points	Time Collected
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

RELINQUISHED BY (Please Print) Signature Date Time

RECEIVED BY (Please Print) Signature Date Time

Revised: 10/08/2012

StationCode	SampleDate	CollectionTime	LabBatch	AnalysisDate	MethodName	AnalyteName	UnitName	Result	QualC	MDL	RL	tionFac	SampleID	LabSampleID	LabResultComments
B-5				1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10		0	
B-5	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	0	0	0
B-5	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	0	0	0
B-7	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	1	1	0
B-7	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	1	1	0
B-7	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	1	1	0
B-8	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	2	2	0
B-8	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	2	2	0
B-8	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	2	2	0
B-9	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	3	3	0
B-9	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	3	3	0
B-9	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	3	3	0
B-10	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	4	4	0
B-10	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	4	4	0
B-10	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	4	4	0
B-11	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	5	5	0
B-11	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	5	5	0
B-11	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	5	5	0
B-14	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	6	6	0
B-14	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	6	6	0
B-14	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	6	6	0
B-22	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	7	7	0
B-22	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	7	7	0
B-22	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	7	7	0
B-24	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	8	8	0
B-24	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	8	8	0
B-24	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	8	8	0
B-25	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	9	9	0
B-25	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	9	9	0
B-25	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	9	9	0
B-31	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	10	10	0
B-31	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	10	10	0
B-31	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	10	10	0
B-56	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	11	11	0
B-56	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	11	11	0
B-56	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	11	11	0
B-60	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	12	12	0
B-60	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	12	12	0
B-60	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	12	12	0
B-64	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	13	13	0
B-64	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	13	13	0
B-64	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	13	13	0
B-67	0-Jan-00		0	1/0/00 12:00 AM	SM 9221 F	Coliform, Fecal	MPN/100 mL		=	10	10	10	14	14	0
B-67	0-Jan-00	0:00	0	1/0/00 12:00 AM	SM 9221 F	Coliform, Total	MPN/100 mL		=	10	10	10	14	14	0
B-67	0-Jan-00	0:00	1	1/0/00 12:00 AM	SM 9230 D v21online	Enterococcus	MPN/100 mL		=	10	10	10	14	14	0

Attachment F3.
Spill Prevention, Control, and Countermeasure Plan Specification

This page is intentionally left blank.

SECTION 33 01 30
SEWAGE BYPASSING

PART 1 - GENERAL

1.1 Work Included

A. Temporary bypassing of wastewater flows around cleaning, video inspection, rehabilitation and construction Work.

B. Convey sewage flows in closed conduits and dispose of in sanitary sewers downstream.
   1. Do not allow sewage to enter trenches or be covered by backfill.

C. Minimum flow depths in sewers during bypassing shall be:

OPERATION	MINIMUM (UPSTREAM) DEPTH
Heavy-Duty Mechanical Cleaning	2 inches
Video Inspection – Post Cleaning	0 inches (dry)
Liner Installation	0 inches (dry)
Manhole Rehabilitation, Sewer Construction, Lift Station Rehabilitation	0 inches (dry)
Video Inspection – Post Lining	0 inches (dry)

D. Existing sewage flow quantities are estimated as follows:

FLOW CONDITION	FLOW RATE	
Minimum Flow	XXX mgd	XXX gpm
Minimum Average Day Flow	XXX mgd	XXX gpm
Average Flow	XXX mgd	XXX gpm
Peak Dry Weather Flow	XXX mgd	XXX gpm
Peak Wet Weather Flow	XXX mgd	XXX gpm

E. Equipment furnished shall be capable of bypassing sewage flows at flow rates above.

1.2 Related Work

A. Section 01 22 00: Unit Prices
B. Section 01 33 00: Submittal Procedures
C. Section 01 40 00: Quality Requirements
D. Section 01 50 00: Temporary Facilities and Controls
E. Section 01 55 26: Traffic Control and Restriping
F. Section 01 61 00: Common Product Requirements
G. Section 01 65 00: Product Delivery Requirements
H. Section 01 66 00: Product Storage and Handling Requirements
I. Section 01 73 00: Execution

1.3 System Description

A. Provide labor, materials and supervision to temporarily bypass flow around Work.

B. Bypassing may be achieved by any of the following means at Contractor's option
   1. By providing inflatable plugs at appropriate locations and pumping from upstream of new Work to location downstream from new Work.
   2. By providing inflatable plugs at appropriate locations and pumping from upstream of new Work to location downstream from new Work, while using fiberglass manhole base liners to allow pumping to be discontinued after 24 hours and prior to full curing of concrete.
   3. By constructing inflatable plugs at appropriate locations and providing flexible gravity piping or hoses to divert wastewater flow from upstream of new Work to location downstream from new Work.

C. Do not begin bypassing Work until applicable submittals have been accepted by Owner.

D. Notify Owner's Representative before bypassing sewage flow.

E. Notify customers whose service will be disrupted in writing before bypassing sewer service.

F. Entire bypassing system shall be in place and tested before bypassing sewage.

G. Notify Owner's Representative immediately in event of sewage spill.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Provide temporary pumps, conduits, and other equipment to bypass sewage flow. Furnish necessary labor and supervision to set up, maintain and operate pumping and bypass system.

C. Engine-driven pumps may be used only for bypassing 8" and larger mains and shall be equipped with mufflers or enclosed to keep noise level below 60db or 10db above ambient noise levels when measured at property lines closest to noise source.

D. Sewer lateral bypass pumps shall be electric-driven and comply with same noise requirements as engine-driven pumps. Pumps and bypass lines shall be of adequate capacity and size to handle flows.

E. Maintain on-site sufficient equipment and materials to ensure continuous and successful operation of bypass and dewatering systems.
   1. Standby pumps shall be fueled and operational at all times.
   2. Maintain sufficient valves, tees, elbows, connections, tools, sewer plugs, piping, and other parts or system hardware on site to ensure immediate repair or modification of any part of system.

F. Design piping, joints and accessories to withstand at least twice maximum system pressure, or 50 psi, whichever is greater.

G. Where flows are bypassed, bypass flow shall be discharged as accepted by Owner's Representative.
   1. Do not discharge to ground surface, receiving waters, storm drains, or locations which may result in groundwater contamination or potential health hazards.

H. Do not shut down bypassing system between shifts, on holidays or weekends, or during Work stoppages without written permission from Owner's Representative.
   1. Notify parties whose service laterals will be out of service and advise against water usage until main line is back in service.
   2. Do not remove bypass without informing Owner's Representative.

1.5 References

A. Reference publications below form part of this specification to extent referenced and are referred to within text by basic designation only.
   1. California Building Code (CBC)
   2. California Electrical Code (CEC)
   3. California Fire Code (CFC)
   4. California Plumbing Code (CPC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION	
Working Drawings	Submit per Working Drawing requirements.	.
	Show location of temporary sewer plugs diversion points and bypass discharge lines.	
	Show expected high water level behind plugs and diversions.	
	Show capacities of pumps, prime movers and standby equipment.	
	Show standby power source.	
	Show materials proposed for temporary surfacing over bypass pipes.	
	Show materials proposed for permanent surface replacement over bypass	

SUBMITTAL	DESCRIPTION	
	pipe trenches.	
	Show methods for security and protection of bypass system.	
Spill Prevention, Control, and Countermeasure Plan (SPCCP)	Submit listing of precautions to be implemented to prevent sewage spills, including specific responses and control measures to follow during overflow resulting from breakage or blockage and maintenance and inspection schedules to detect potential problems and mitigate potential release resulting from overflows, bypass pipe ruptures, pipe ruptures, blockages and backups.	
Description of Proposed Equipment	Show suction and discharge pipe diameters, materials and bury depths	
	Show size and model of pumps including pump curve, horsepower, speed, voltage and phase or fuel type and fuel consumption as applicable.	
	Show make, model, horsepower, kW and kVA ratings, speed, voltage, phase, fuel type and fuel consumption of standby generator if used.	
	Show standby equipment provided on-site in case of emergency.	
Staffing Plan and Schedule	Submit staffing plan for maintaining equipment for 24-hour continuous reliable operation including weekends and holidays.	
	Show anticipated times of flow interruption and/or flow diversion	
Engineering Calculations	Provide design calculations, including system head curve analysis showing adequacy of system and selected equipment.	
Noise Control Plan	Refer to Section 01 50 00. Include noise rating for equipment.	
Traffic Control Plan	Refer to Section 01 55 26.	
Warranty	If water levels are raised more than 18” above sewer soffit at points in upstream sewer, provide statement accepting full responsibility and liability for damage to upstream properties due to backflow during bypassing.	

B. Refer to Section 01 33 00 for definition of requirements for Working Drawings.

1.7 Project Site Conditions

A. Anticipated handled fluids and their properties are:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

1.8 Unit Prices

A. Refer to Section 01 22 00 for measurement and payment clauses for sewage bypassing.

PART 2 – PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Inflatable Plugs	Cherne Industries, Inc.	Minneapolis, MN (952) 933-5501
	Petersen Products	Fredonia, WI (800) 827-5275
	Accepted equal	
Gravity Bypass Piping	Cherne Industries, Inc.	Minneapolis, MN (952) 933-5501
	Petersen Products	Fredonia, WI (800) 827-5275
	Accepted equal	
Prefabricated FRP Manhole Base Liners	Geneva Polymer Products “Armorock”	Boulder City, NV (702) 824-9702 Orange County, CA (949) 371-3606
	Predl Liner Systems	Burnaby, BC (855) 773-3562
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install sewage bypass equipment before submitting shop drawings or ordering.
   1. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Examine areas and conditions under which work of this section will be performed.
   1. Correct conditions detrimental to timely and proper completion of Work.

C. Bypass pumps shall be self-priming, designed, for raw sewage applications, resistant to ragging and capable of passing minimum 3” solid sphere.
   1. Pumping system shall be equipped with sound attenuation to limit noise to meet local noise ordinances (See Appendices).
   2. Back-up pumps providing 100% redundancy shall be on-site and connected at all times.

D. In multi-pump applications, back-up pump shall be equal in capacity under same pumping conditions as largest duty pump. Provide pumps capable of pumping over full range of flows for each set-up.

E. Temporary piping may be placed above ground only if it will be in service no more than 1 Calendar Day or is within areas protected by accepted traffic control plans.
   1. Place other temporary piping in recessed trench.
   2. At street crossings, temporary resurfacing over recessed trenches shall be flush with existing grade.
   3. When temporary pipelines cross wheelchair ramps or sidewalks, install pipeline within recessed trench or provide asphalt mound ramped at slope ≤ 1:12.

F. Fully test bypass system (all equipment) prior to commencing bypass operation including:
   1. Pressure testing piping at test pressure specified above with potable water prior to introducing sewage to line.
   2. Inspecting piping for leaks and repair or replace leaking sections and joints.
   3. Testing pumping system, including back-up pumps.

G. Material and equipment identified in spill contingency plan, including control measures in event of spill shall be on-site prior to commencing bypass operation.

3.2 Bypass Pumping Procedures

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. The following installation standards shall be followed:
   1. Applicable OSHA and Cal OSHA regulations
   2. Applicable Regional Water Quality Control Standards.
   3. Other applicable building, fire, and plumbing code requirements.

C. Refer variances between above documents and Contract Documents to Owner’s Representative.

D. Bypass sewage as follows:
   1. Where appropriate, keep rehabilitated Work free from water during rehabilitation. Disposal of water shall not damage property nor create public nuisance.
      a. Maintain pumping equipment and machinery in good working condition on hand for emergencies.
      b. Have workmen available for operation of said equipment.
   2. During bypass pumping.
      a. When bypass pumping operations are complete, drain piping into sanitary sewer prior to disassembly.
   3. If sewage accidentally spills into storm drainage system or street, immediately stop overflow, notify Owner and Owner’s Representative, and take necessary action to clean up and disinfect spillage to Owner’s satisfaction.

4. If sewage spills onto public or private property, wash down, clean up, and disinfect spillage to satisfaction of Owner, property owner, Owner's Representative, and applicable Regional Water Quality Control Boards.
5. Bypass system shall only be operated when weather forecasts indicate no rain is predicted for at least 5 days.
   a. Immediately remove pipes and equipment within manholes when rain is predicted within 24 hours.
6. Take necessary precautions, including constant monitoring of bypass pumping to prevent sewage spills due to back-up and/or overflow resulting from breakage or blockage of bypass system.
   a. Provide experienced personnel knowledgeable in bypass equipment operation to monitor each bypass when installed and operating.
   b. At no time shall bypass system be left unattended during operation by designated personnel.
   c. Contractor shall be liable for cleanup, damages, and resultant fines in event of a spill.
7. Protect pumps and piping from damage, vandalism, and/or theft to maximum extent possible and as shown on Plans.
8. After Work is completed, remove temporary bypass system.
   a. Return surrounding area, including hardscape and landscape to pre-construction condition.
9. Contractor shall be responsible for labor, materials, equipment, and incidentals associated with temporary controls and diversions required to maintain uninterrupted flow in existing sewer lines associated with this project.

E. Contractor shall repair, without cost to Owner, damage resulting from Contractor's negligence, carelessness, mechanical failures, electrical failures, or inadequate or improper installation, maintenance or operation of Contractor's bypassing and dewatering system.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Bypass System	No Spills	Comply with NPDES Permit Requirements	1 inspection	Contractor	Contractor

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

Attachment G1.
List of Disposal Facilities

This page is intentionally left blank.

CITY OF LONG BEACH

DEPARTMENT OF HEALTH AND HUMAN SERVICES
BUREAU OF ENVIRONMENTAL HEALTH

2525 GRAND AVENUE ROOM 220 • LONG BEACH, CALIFORNIA 90815 • (562) 570-4132
WWW.LONGBEACH.GOV/HEALTH/EH

Grease Interceptor and Grease Trap Waste Pumping and Transportation Companies As of August 2019

Baker Commodities, Inc.
(323) 268-2801

Darling International, Inc
(323) 583-6311

JR Grease Trap Corp.
(562) 551-8727

Nottingham M C Co of So California
(323) 283-8821
(626) 799-4122
(626) 442-4660

Roberts Liquid Disposal
(562) 864-2953

Southwest Processors, Inc.
(323) 269-9876

United Pumping Service
(626) 961-9326

This list is not a referral or a recommendation by the City of Long Beach.
Additionally, this is not a complete list of all films available for service. Further names can be obtained by contacting appropriate associations or by referring to telephone directories or other resources.

This page is intentionally left blank.

Attachment H1.
Sewer System Master Plan Update 2013

This page is intentionally left blank.

PREPARED FOR
LONG BEACH WATER DEPARTMENT

2013 Sewer Master Plan Update

August 2013

FINAL

MWH®

BUILDING A BETTER WORLD

TABLE OF CONTENTS

TABLE OF CONTENTS

Executive Summary

Section 1 - Introduction

Section 2 - Service Area Description and Population

Section 3 - Existing Sewer System

Section 4 – Facility Assessment

Figures

Appendices

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The 2013 Sewer Master Plan Update provides the Long Beach Water Department (LBWD) with an overview of the sewer service area, the conditions in existing sewer system lift stations, and an evaluation of the sewer system capacity under existing conditions. This report presents Long Beach Water Department's (LBWD's) near-term capital improvement program (CIP) and planning level cost estimates for the recommended projects.

Objectives of the SMPU

The primary focus of the 2013 SMPU is to develop a near-term CIP for the LBWD with a focus on the rehabilitation of LBWD's existing lift stations. The key goals of the SMPU are listed below:

- Perform a condition assessment of LBWD's lift stations
- Validate the calibration performed for the 2008 SMP
- Identify hydraulic deficiencies in the system
- Develop a near-term CIP for LBWD to address existing deficiencies in the system

Key Findings of the 2013 Sewer Master Plan Update

Key findings of the SMPU are summarized in the following paragraphs:

Condition Assessment of Sewer Lift Stations

One of the main focus areas of this Sewer Master Plan Update (SMPU) was to perform a visual condition assessment of lift stations that are critical to LBWD's systems. Twenty six (26) LBWD lift stations were reviewed and fourteen (14) lift stations were selected to conduct a condition assessment based on factors such as age, pump inflows, location relative to the collection system, maintenance logs, and input from LBWD staff. Based on the information gathered during the field visits and input from LBWD Staff, a methodology was developed to assess the condition of the sewer lift stations. The stations are ranked based on their relative condition as good, fair, poor, or very poor. The remaining useful life of pumps and electrical gear is also considered. The replacement of the lift stations is prioritized based on a ranking system where a rank of 1 indicates a candidate considered to be the highest priority for replacement and a rank of 14 indicates a candidate considered to be the lowest priority for replacement. Besides the physical condition assessed based on visual inspection, factors such as the amount of flow conveyed via the lift station are also considered for the prioritization. Based on the condition assessment of the Sewer Lift Stations, three lift stations (S-8, S-12, and S-26) are identified as candidates for rehabilitation. **Figure ES-1** depicts the location of the lift stations and their recommended prioritization for replacement.

Hydraulic Model Validation and Recalibration

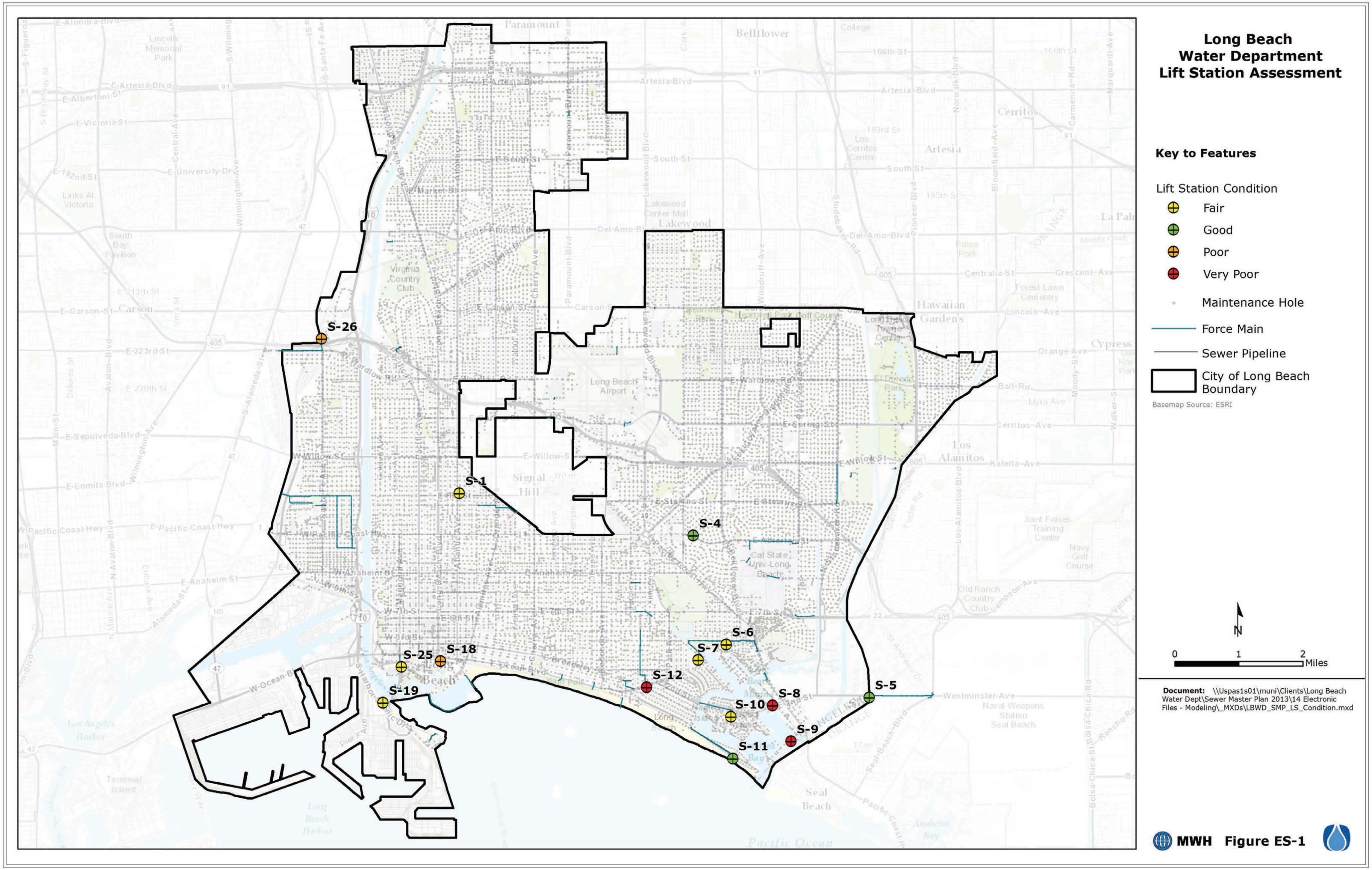
A flow monitoring plan was implemented during the early stages of the project to compare actual sewer system flows with the simulated flows in the hydraulic model. Twelve (12) flow monitoring locations were selected throughout the system to conduct the following:

1. Collect representative sewer flows in the collection system to validate the updated 2008 SMP hydraulic model to dry weather flow conditions. Collect sewer flows in areas of potential or known high infiltration/inflow (I/I).
2. Eight of the 12 locations are selected as potential areas of high I/I based on the 2008 Flow Monitoring report and input from LBWD staff.

Flow monitoring was conducted for a consecutive two-week period from January 5, 2013 through January 18, 2013. From the two weeks of flow monitoring data, the model validation process was performed by selecting flows for two weekdays and two weekend days within the monitored period. Two days are selected so that one can be used for validation (or recalibration) and another for verification. Once the validation and verification days are selected for each weekday and weekend condition, actual flow data was matched against the modeled flow results to determine how well the hydraulic model results compares against new flow monitoring data. The modeled results were validated to check that modeled peak flow values and flow volumes match measured values within acceptable tolerances. Five locations were identified for recalibration.

Hydraulic Deficiencies in the Existing System

One of the goals of the SMPU is to identify and eliminate hydraulic deficiencies in the existing system. LBWD has implemented projects recommended in the 2008 Sewer Master Plan (SMP). The effectiveness of these projects was validated using the calibrated hydraulic model as part of this SMPU. Once the implementation of the projects was validated, the hydraulic model was used to identify bottlenecks in the system. Five locations were identified to be surcharged under existing conditions. Each of these five locations was further inspected by conducting field investigations for the evidence of surcharge. If there was no evidence of surcharge (e.g., water level above the bench) during the field inspection, then a recommendation was not provided, although further investigation in the form of frequent inspections and flow monitoring are recommended. These locations are presented in **Table ES-1** and depicted on **Figure ES-2**.


Long Beach
Water Department
Lift Station Assessment
Key to Features
Lift Station Condition
Fair
Good
Poor
Very Poor
Maintenance Hole
Force Main
Sewer Pipeline
City of Long Beach Boundary
Basemap Source: ESRI
0 1 2 Miles
N
S-1
S-4
S-5
S-6
S-7
S-8
S-9
S-10
S-11
S-12
S-18
S-19
S-25
S-26
Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMP_LS_Condition.mxd
MWH
Figure ES-1

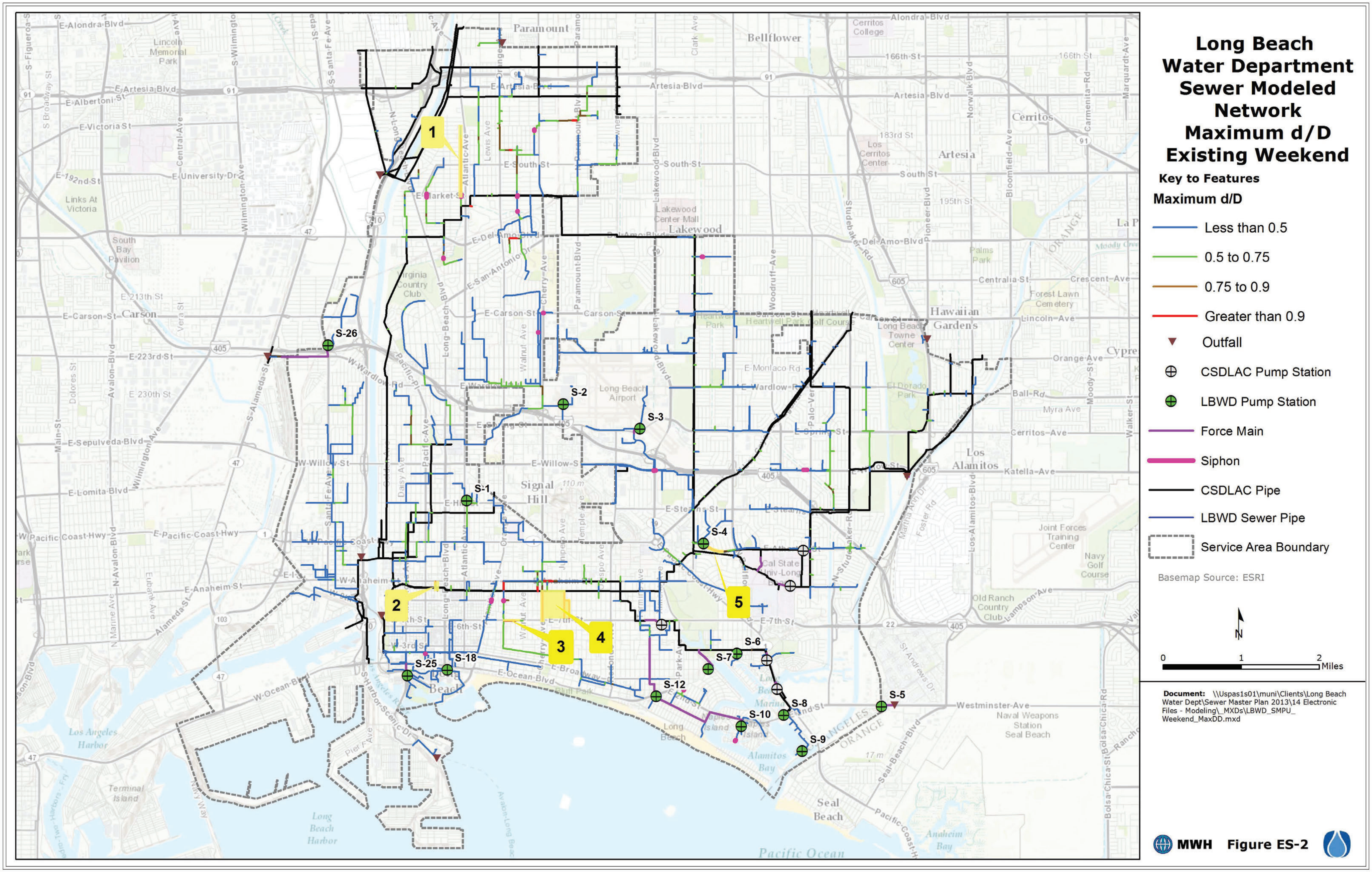

Long Beach Water Department Sewer Modeled Network Maximum d/D Existing Weekend
Key to Features
Maximum d/D
Less than 0.5
0.5 to 0.75
0.75 to 0.9
Greater than 0.9
Outfall
CSDLAC Pump Station
LBWD Pump Station
Force Main
Siphon
CSDLAC Pipe
LBWD Sewer Pipe
Service Area Boundary
Basemap Source: ESRI
0 1 2 Miles
Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMPU_Weekend_MaxDD.mxd
MWH
Figure ES-2

Table ES-1
Surcharged Locations

Location No.	Location	Surcharged Under Existing Conditions	Evidence of Surcharge during Field Inspection(1)	Infrastructure Recommendations
1	Linden Avenue north of Market Street	Yes	Yes, 1 foot above bench	No. Perform additional investigations and flow monitoring.
2	Locust Avenue and 12th Street	Yes	No	No
3	7th Street east of Orange Avenue	Yes	N/A	No
4	Cherry Avenue south of 11th Street; alley west of Stanley Avenue and 10th Street	Yes	Yes, 2 feet above bench	No. Perform additional investigations and flow monitoring.
5	Atherton Street and Daggett Street	Yes	No	No

N/A = Location not field inspected for evidence of surcharge
1 Field inspection was conducted by LBWD staff on March 27, 2013. Location 4 was inspected at 11:15 AM and Location 10 was inspected at 10:30 AM.

After evaluation of the surcharged locations, no locations are identified for CIP recommendations and Locations 1 and 4 have been identified as candidates for further investigation. It is recommended that regular monitoring be performed by LBWD's operations staff to identify any evidence of surcharge. Flow monitoring is also recommended along these pipelines to further refine and recalibrate the model at these locations.

Near-Term CIP Summary

The near-term CIP developed in this SMPU identifies three lift stations for rehabilitation. **Table ES-2** presents a summary of LBWD's near-term CIP. It is recommended that S-12 be rehabilitated in fiscal year 2013, S-8 be rehabilitated in fiscal year 2014, and S-26 be rehabilitated in fiscal year 2015. The total cost of rehabilitating these lift stations is estimated to be $7.8 million. Best engineering judgment was used for the prioritization of these lift stations for rehabilitation. Although S-8, S-12, and S-26 are in poor condition relative to the other lift stations in the sewer system, Lift Station S-12 is ranked as number "1" based on the following rationale:

- S-12 is in very poor condition
- S-12 has the largest design flow of all stations. S-12 has high risk and consequence of failure because of large flows and its location
- S-12 has significant safety concerns (documented in **Appendix A, Exhibit 10**)
- LBWD Operations staff concurs with these findings for the immediate rehabilitation of S-12

S-8 and S-26 have minimal remaining useful life and have not been rehabilitated in over 40 years. However, S-8 is assigned a higher priority than S-26 because it has a lower remaining useful life when compared to S-26.

Table ES-2
Summary of Near-Term CIP Costs

Lift Station	Priority	Rehabilitation Cost
FY 2013		
S-12	1	$ 2,400,000
Total Cost for FY 2013		**$ 2,400,000**
FY 2014		
S-8	2	$ 1,600,000
Total Cost for FY 2014		**$ 1,600,000**
FY 2015		
S-26	3	$ 3,800,000
Total Cost for FY 2015		**$ 3,800,000**
Total Rehabilitation Cost		**$ 7,800,000**

SECTION 1

INTRODUCTION

SECTION 1 INTRODUCTION

This section provides an overview of the Sewer Master Plan Update (SMPU) for the Long Beach Water Department (LBWD). A brief description of the SMPU project background, the scope of work, a description of the report sections to follow, and a listing of abbreviations and definitions used in this report are included.

1.1 Authorization

This SMPU has been developed in accordance with a contract between Long Beach Water Department (LBWD) and MWH Americas, Inc. (MWH) dated October 15, 2012.

1.2 Project Background

The LBWD took over administrative responsibility for operation, maintenance and management of the City of Long Beach (City) sanitary sewer system from the City's Public Works Department in 1988. Upon assuming responsibilities of the sewer system, the LBWD quickly developed a comprehensive deficiency study on which to base its sewer capital improvement program (CIP), a major part of which was extensive replacement of deteriorating concrete pipe. In 1990, the LBWD developed its first strategic plan, which established new priorities for sewer system management:

- To identify and eliminate major inadequacies
- To insure the system remains self-supporting
- To insure the system meets the City's growing development needs

In 1990, the LBWD compiled a comprehensive sewer system master plan and management program covering the entire City. Detailed plans and studies were completed for three of the 14 service areas (Areas 1, 7 and 8) and special studies were conducted for the pump stations. The 1990 plan included a 20-year CIP list prioritized from A to E. Priority A, B, and C projects from that list have been completed by LBWD.

In 1999, the sewer master plan was updated and detailed reports were generated for four additional service areas (Areas 2, 3, 4 and 6). The CIP list was amended with new A through E priority projects. Most Priority A and B projects from that list have been completed. In 2004, a Focused Master Plan of Area 8 was completed. The focused study recommended rehabilitation of the California Bowl Sewer System which was completed in May 2011.

In 2008, a comprehensive sewer master plan was developed to evaluate sewer system needs through the year 2030. This evaluation covered the entire City of Long Beach sewer service area and includes over 700 miles of sewer pipes collecting flow from over 460,000 City residents. A sewer hydraulic model was also developed from LBWD's Geographical Information System (GIS) database to evaluate system capacity. A CIP schedule was developed based on hydraulically deficient pipes identified by the hydraulic model, and the condition assessment of LBWD lift station.

1.3 Objectives of the SMPU

The primary focus of the 2013 SMPU is to develop a near-term CIP for the LBWD with a focus on the rehabilitation of LBWD's existing lift stations. The key goals of the SMPU are listed below:

- Perform a condition assessment of LBWD's lift stations
- Validate the calibration performed for the 2008 SMP
- Identify hydraulic deficiencies in the system
- Develop a near-term CIP for LBWD to address existing deficiencies in the system

Development of a replacement schedule for structurally deficient pipelines is expected to be documented in a separate study that will serve as a supplement to this SMPU.

1.4 Data Sources

In preparation of this SMPU, LBWD staff provided many reports, maps, electronic files, and other sources of information. In addition, material was obtained from other sources such as United States Census and the Environmental Systems Research Institute, Inc. (ESRI). Pertinent materials included sewer system maps, design drawings, sewer system GIS files, flow monitoring data, planning and development information, land use information, historical water billing data and information gathered from field inspections. Monthly progress meetings were held with LBWD staff. In addition, extended interactions were held with the LBWD's staff during the development of the CIP for this SMPU.

1.5 Acknowledgements

MWH wishes to acknowledge and thank all LBWD staff for their support and assistance in completing this project. Special thanks to Eric Leung (P.E., Director of Engineering), Robert Verceles (P.E., Division Engineer), Justin Pennington (EIT, Civil Engineering Assistant), and Richard Robillard (P.E., Civil Engineer).

1.6 Project Staff

The following MWH personnel were involved in the preparation of this SMPU:

Principal-in-Charge:	Ajit Bhamrah, P.E.
Project Manager:	Ganesh Krishnamurthy, P.E., PMP
Project Engineer:	Jinny Huang, P.E., LEED AP
Staff Engineers:	Parag Kalaria, EIT, PMP Tony Hancock, EIT Jeffrey Morris, EIT, LEED AP Mehrshad Ketabdar, P.E. Christopher Mote, P.E.
Technical Review:	Shannon Conway, P.E. George Tey, P.E. Jeff Mohr, P.E.

1.7 Report Structure

This SMPU is divided into seven sections. **Section 2** discusses the LBWD service area, existing population, climate, land use, future land use, and population projections. **Section 3** discusses the existing gravity sewers, force mains, pump stations, and LBWD sewer connections with other agencies. **Section 4** summarizes the facility assessment of lift stations conducted during the project, including the condition of the lift stations. **Section 5** gives an overview of the development of the hydraulic model and allocation of wastewater flows performed in the 2008 SMP and discusses the model validation and calibration of select areas performed for this SMPU. The hydraulic capacity evaluation criteria and recommended capacity improvements are reported in **Section 6**. A list of recommended capital improvement projects and the associated expenditures are discussed in **Section 7**.

1.8 Acronyms and Abbreviations

To conserve space and improve readability, abbreviations have been used in this report. Each abbreviation has been spelled out in the text the first time it is used. Subsequent usage of the term is usually identified by its abbreviation. The abbreviations used are shown in **Table 1-1**.

Table 1-1
Acronyms and Abbreviations

Abbreviation	Explanation
°F	Degree Fahrenheit
%	Percent
AACEI	Association for the Advancement of Cost Engineering International
AC	Asbestos Cement Pipe
Ave	Avenue
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program
City	City of Long Beach
CP	Cement Pipe
CSDLAC	County Sanitation District of Los Angeles County
d/D	Depth To Diameter Ratio
DSI	Downstream Services, Incorporated
ESRI	Environmental Systems Research Institute
FM	Flow Monitoring
FOG	Fats, oil, and grease
Ft	Feet
Gal	Gallon
GIS	Geographic Information Systems
GPM	Gallons Per Minute
Hp	Horsepower
HVAC	Heating, ventilation, and air conditioning

Table 1-1 (continued)
Acronyms and Abbreviations

Abbreviation	Explanation
I	Interstate (e.g. I-405, I-605)
I/I	Infiltration/Inflow
In	Inch
JWPCP	Joint Water Pollution Control Plant
LACSD	Los Angeles County Sanitation Districts (see also CSDLAC)
LBWD	Long Beach Water Department
Ln	Lane
MGD	Million Gallons Per Day
Mi	Mile
MWD	Metropolitan Water District of Southern California
MWH	MWH Americas, Inc.
NRCP	Non-Reinforced Concrete Pipe
OCSD	Orange County Sanitation District
O&M	Operations and Maintenance
OPCC	Opinion of Probable Construction Cost
PCH	Pacific Coast Highway
PE	Polyethylene Pipe
PVC	Polyvinyl Chloride Pipe
RCP	Reinforced Concrete Pipe
Rd	Road
SCAG	Southern California Association of Governments
SMP	Sewer Master Plan
SMPU	Sewer Master Plan Update
Sq Ft	Square Feet
St	Street
TM	Technical Memorandum
VCP	Vitrified Clay Pipe

SECTION 2

SERVICE AREA DESCRIPTION AND POPULATION

SECTION 2 SERVICE AREA DESCRIPTION AND POPULATION

This section describes the Long Beach Water Department's (LBWD) wastewater service area under existing conditions. A discussion on population, land use, and the potential for development within the service area is also presented.

2.1 Service Area

LBWD was established in 1911 to provide clean water to the residents of the City of Long Beach (City). In 1931, LBWD was under the direction of an independent, five-member Board of Water Commissioners and also became one of the founding member agencies of the Metropolitan Water District of Southern California (MWD). It was not until February 1988 that the responsibility of administering, operating, and maintaining the City's sanitary sewer system was transferred from the City of Long Beach Public Works Department to LBWD. In April 1990, the citizens of Long Beach ratified a charter amendment giving the Board of Water Commissioners full responsibility for the operation, maintenance, repair, and improvement of the sewer system.

LBWD's wastewater is primarily generated from customers within the City of Long Beach. LBWD operates and maintains over 710 miles of sanitary sewer lines, approximately 15,000 maintenance holes, and delivers over 40 million gallons per day of wastewater to Los Angeles County Sanitation District (LACSD) facilities. LBWD provides sewer services for a 46 square mile area within the City of Long Beach; included in 46 square miles are portions of the cities of Signal Hill and Lakewood. LBWD's service area is divided into 14 main service trunk sewer areas. LBWD does not provide sewer service to the Port of Long Beach.

The majority of the City's wastewater is sent to the Joint Water Pollution Control Plant (JWPCP), located in the City of Carson, east of the Harbor Freeway (I-110). The JWPCP is the largest LACSD wastewater treatment plant, providing advanced primary and partial secondary treatment for 350 million gallons of wastewater per day. The remaining portion of the City's wastewater is delivered to the Long Beach Water Reclamation Plant, located in the City, west of the San Gabriel River Freeway (I-605). The Long Beach Water Reclamation Plant provides primary, secondary, and tertiary treatment for 25 million gallons of wastewater per day. Approximately 5 million gallons per day (mgd) of the purified water is reused at over 40 reuse sites.

A figure showing the boundaries of the LBWD service area is shown on **Figure 2-1**..

2.2 Existing Geographical Description

The City of Long Beach is located on the south coast of Los Angeles County, approximately 25 miles south of downtown Los Angeles, and borders Orange County on its southeast edge. The size of the City is approximately 50.3 square miles of land and about 1.4 square miles of water. Long Beach is bounded on the east by the cities of Seal Beach, Los Alamitos, and Hawaiian Gardens, the north by the City of Lakewood, and the west by the cities of Carson and Wilmington. Long Beach includes one of the busiest ports on the West Coast and holds the largest municipally owned and operated marina systems in the country, comprising of 3,200 acres of land and handling over 6 million containers in 2011.

2.2.1 Climate

The City of Long Beach is located in a semi-arid region where temperatures typically range between about 50 to 80 degrees Fahrenheit (°F). The warmest month of the year is August with an average maximum temperature of about 84 °F, and the coldest month of the year is December with an average minimum temperature of 45 °F. Long Beach's climate is moderately affected by the Pacific Ocean and its topography with the highest elevation point at Signal Hill, a city independent of Long Beach, but located in the center of the City. The temperature differences between night and day are quite narrow during the summer and winter months. Maximum, average, and minimum monthly temperatures over a 30 year period of 1981-2010 for the City is shown in **Table 2-1**.

Table 2-1
Average Monthly Temperatures

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max °F	67.4	67.2	68.6	71.7	73.6	76.7	81.9	83.8	82.1	77.2	72.1	66.8	74.1
Mean °F	56.7	57.6	59.6	62.4	65.6	68.9	73.2	74.3	72.7	67.7	61.4	56.3	64.7
Min °F	46.1	48	50.5	53.2	57.6	61.0	64.5	64.9	63.2	58.3	50.8	45.8	55.3

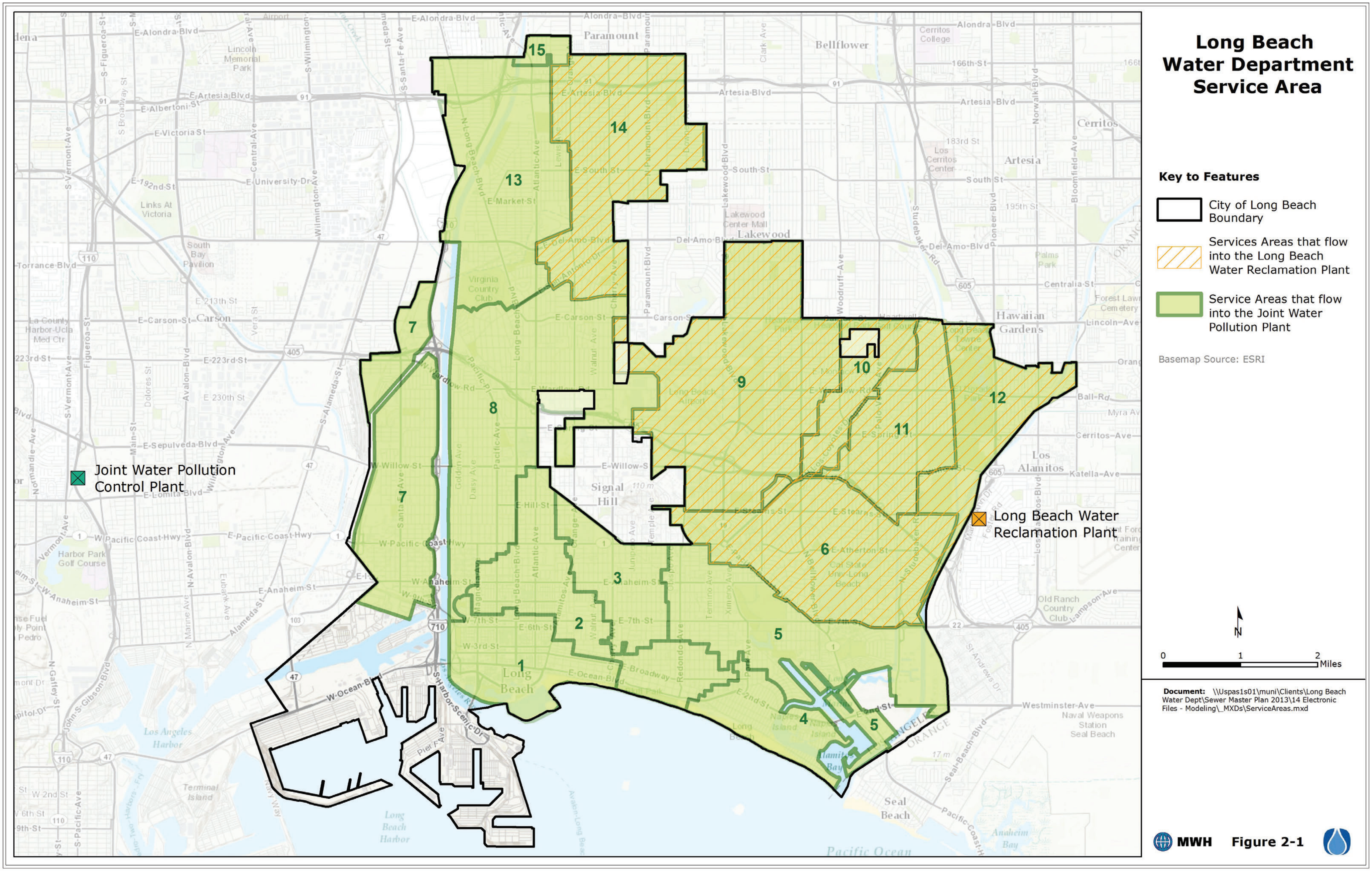
Source: National Oceanic and Atmospheric Administration. National Climatic Data Center. Summary of Monthly Normals at Long Beach Daughtery Field, CA US.

Long Beach experiences on average approximately 12.26 inches of rainfall each year. Precipitation is sparse between the months of April and October. The greatest rainfall occurs during the winter months. On average, February is the wettest month of the year with an average rainfall of approximately 3.09 inches. The 30 year average monthly precipitation between years 1981 and 2010 for the City is shown in **Table 2-2**.

Table 2-2
30-Year Average Monthly Precipitation

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Monthly Precipitation (inch)	2.60	3.09	1.87	0.60	0.21	0.07	0.03	0.03	0.18	0.63	1.00	1.95	12.26

Source: National Oceanic and Atmospheric Administration. National Climatic Data Center. Summary of Monthly Normals at Long Beach Daughtery Field, CA US.


Long Beach Water Department Service Area
Key to Features
City of Long Beach Boundary
Services Areas that flow into the Long Beach Water Reclamation Plant
Service Areas that flow into the Joint Water Pollution Plant
Basemap Source: ESRI
Joint Water Pollution Control Plant
Long Beach Water Reclamation Plant
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
N
0
1
2
Miles
Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\ServiceAreas.mxd
MWH
Figure 2-1
Long Beach
Signal Hill
Lakewood
Bellflower
Paramount
Carson
Cerritos
Artesia
Hawaiian Gardens
Los Alamitos
Seal Beach
Pacific Ocean

The annual amount of precipitation from the last 10 years of available data is shown in **Table 2-3**, which shows an average of approximately 12.2 inches of rainfall. The City received as little as 4.3 inches of rainfall in 2007 and as much as 25.24 inches of rainfall in 2010.

Table 2-3
Annual Precipitation

Year	Rainfall (inch)
2012	8.21
2011	9.29
2010	25.24
2009	7.73
2008	13.08
2007	4.30
2006	7.84
2005	21.56
2004	14.92
2003	9.69
Average	**12.19**

Source: National Oceanic and Atmospheric Administration. National Climatic Data Center. Local Climatological Data Annual Summary.

2.2.2 Existing Land Use

The City of Long Beach is largely residential encompassing over 46 percent of the land based on the Zoning Geographic Information System (GIS) information from the City's website. Zoning information is verified for this SMPU by overlaying the zoning data with aerial imagery, and adjusting any areas within the City to the appropriate land use category. Existing land use categories and their relative coverage within the City is shown in **Table 2-4**. A figure of the City's land use is shown on **Figure 2-2**.

Based on the land use update, about 35 percent of the City is low-density residential homes (i.e. single-family homes), 9 percent medium-density residential (e.g., townhomes, multi-family homes, condominiums, mobile homes), and 2 percent high-density residential (e.g., apartments, high-rise buildings). The second largest land use category is industrial which comprises approximately 17 percent of the City, and encompasses general industry areas, harbors, airport, and restricted industry. The third largest land use is mixed use areas, which comprises about 13 percent of the City. Mixed areas include mixed retail and residential areas, mixed office space and residential areas, and other areas of mixed land uses.

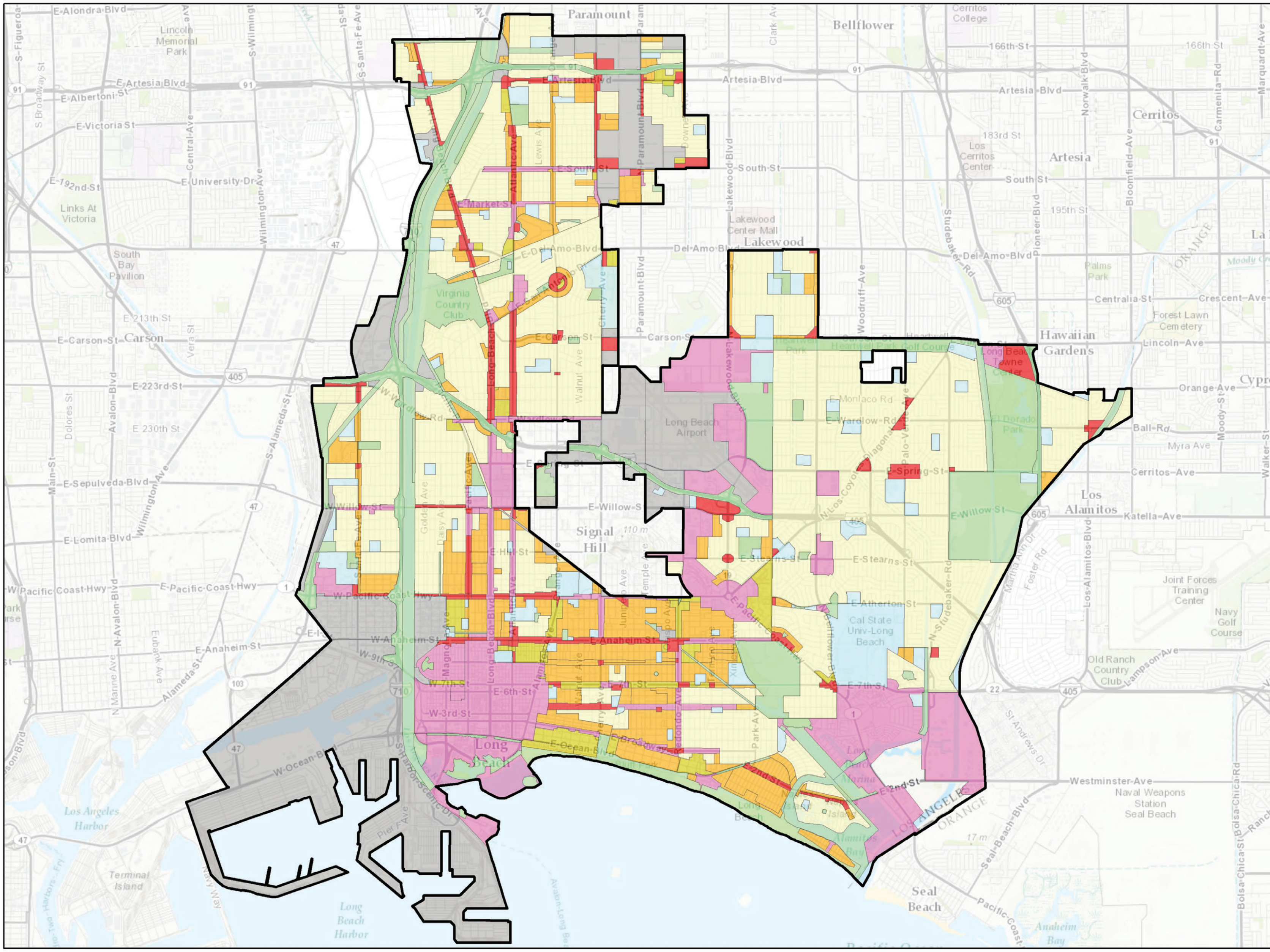
Other land uses within the City include public land uses, which cover about 5 percent of the City, and include institutions and schools. Commercial land use includes shopping centers, restaurants, malls, and offices, and comprises about 3 percent of the City. Open areas such as parks and recreational areas cover approximately 11 percent of the City. Undevelopable land takes up about 4 percent, and includes right-of-way, channels, and roadways.

Table 2-4
Existing Land Use

Land Use	Area (acre)	Total Percentage
Low-Density Residential	11,867	35.4%
Medium-Density Residential	3,060	9.1%
High-Density Residential	678	2.0%
Industrial	5,739	17.1%
Mixed Use	4,470	13.3%
Open	3,765	11.2%
Public	1,713	5.1%
Commercial	1,089	3.3%
Undevelopable Land	1,189	3.5%
Total	33,559	100.0%

2.2.3 Existing Population

According to the 2010 Census Bureau, the City of Long Beach has a population of 462,257, the seventh largest city in the state of California. Due to the number of tourist attractions, large events, and its central location within Southern California, Long Beach attracts approximately 5 million visitors each year. The Census Bureau in 2000 reported a population of 461,522. Based on the 2010 census records, a 735 person or 0.2 percent increase between years 2000 and 2010 is observed. The average number of persons per household reported in the 2010 Census data is 2.80, which is similar to 2.77 persons per household reported in the 2000 Census data.



Long Beach Water Department General Plan Land Use

Key to Features

- City of Long Beach Boundary
- Low Density Residential
- Moderate Density Residential
- High Density Residential
- Mixed Use
- Commercial
- Industry
- Public
- Open

Basemap Source: ESRI

N

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LandUse.mxd

MWH

Figure 2-2

2.3 Projected Future Conditions

Future conditions consider anticipated future developments and population projections. Data from the Southern California Association of Governments (SCAG) and the U.S. Census Bureau are used to develop future population projections within LBWD's service area. Sewer flows predicted based on land use and population are input into the sewer hydraulic model to assess the needs of LBWD's sewer system to meet growth-related increases.

2.3.1 Future Land Use

The City of Long Beach is currently built out with minimal vacant land. Future development within LBWD's service area is expected to be redevelopment of existing developed areas. It is likely that such redevelopment may result in a change in the land use category. For example, certain areas in the downtown area have been converted to mixed-use residential land use types. No new developments were identified as part of this SMPU. Based on a review of LBWD's most recent land use data, it is also determined that there are no significant changes in the land use classification since the completion of the 2008 Sewer Master Plan (SMP).

2.3.2 Population Projections

Population projections for this SMPU are developed using SCAG data to evaluate growth trends within the City of Long Beach. The most recent SCAG population forecast was adopted in 2012 and provides the City's forecast for years 2020 and 2035. The average annual percentage change from the SCAG forecasts is applied to the 2010 Census population and projected through year 2013. This information is presented in **Table 2-5**. Population forecasts for the City have decreased since the 2008 SMP. According to the 2008 SMP, the population for year 2030 was estimated to be 561,700; this is greater than the population forecasted for years 2030 and 2035 in this SMPU (shown in **Table 2-5**).

Table 2-5
Projected Population for the City of Long Beach

Year	Population Projection	Percent Growth
2010	462,257	-
2015	474,384	2.6%
2020	486,829	2.6%
2025	501,241	3.0%
2030	516,080	3.0%
2035	531,358	3.0%

Population numbers are estimates based on SCAG growth trends.

The minor change in population and land use over the last decade indicates that the sewer flows developed in the hydraulic model as part of the 2008 SMP to represent existing conditions are valid for this SMPU. A discussion on the development and validation of sewer flows (via flow monitoring) used in this SMPU is presented in **Section 5**.

This Page Intentionally Left Blank

SECTION 3

EXISTING SEWER SYSTEM

SECTION 3
EXISTING SEWER SYSTEM

The existing sewer system currently consists of 26 sewer lift stations and over 700 miles of pipeline, which covers approximately 46 square miles of the City of Long Beach (City). The sewer system consists primarily of vitrified clay pipes and some concrete pipes. The oldest sewers that are still in operation were installed in the downtown area in 1903. The majority of the City's sewers were built between the 1920s and 1950s. The location of the existing sewer system is shown on **Figure 3-1**.

The Long Beach Water Department (LBWD) operates all 26 sewer lift stations. Eight of the 26 LBWD lift stations are known as comfort stations that lift small quantities of flow to the gravity system. These comfort stations are located in recreational areas such as marinas, piers, or beaches, and typically include a toilet and wash facility. The following paragraphs describe the LBWD's sewer infrastructure.

3.1 Gravity System

Information described in this section for the gravity system is based upon LBWD's GIS database received in December 2012 and the database used for the 2008 Sewer Master Plan (SMP). The attributes of the gravity pipelines used from the GIS data include the diameter, depths, invert elevations, conduit material, and year of installation for the gravity pipes.

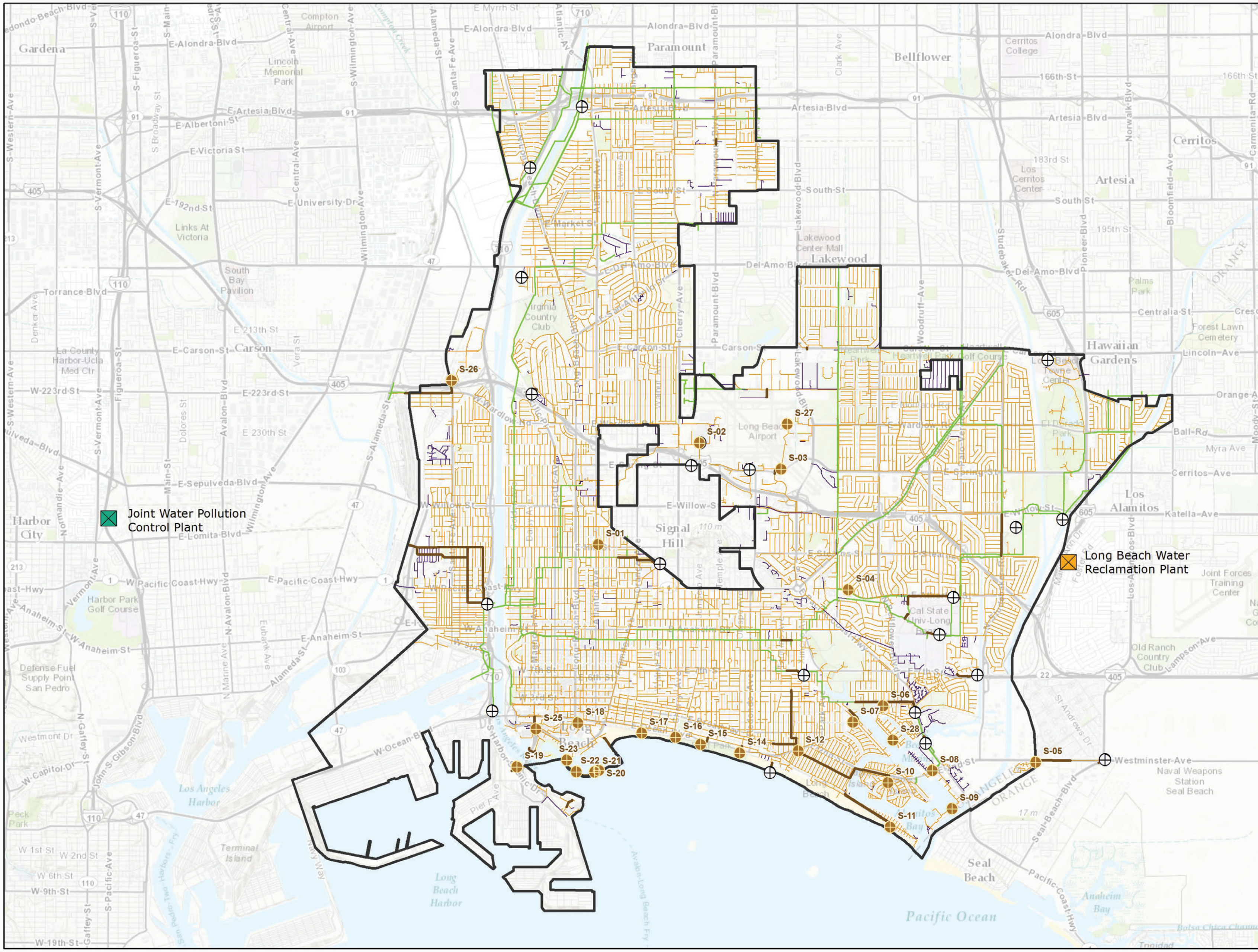
The sewer hydraulic model used for the Sewer Master Plan Update (SMPU) was originally based on the GIS database provided in 2008. Improvements made to LBWD's system that are captured in LBWD's GIS database (received in December 2012) are reflected in the sewer model. Model updates performed in this SMPU include changes to the pipe size, pipe material, installation year, and invert elevations based on record and/or design drawings for new pipeline projects since the 2008 SMP, as well as any additional drawings requested during the model update process. The gravity pipe GIS database received in December 2012 is used to update information on pipes that have been cast-in-place since the 2008 SMP. More information on the model update process is discussed in **Section 5** of this SMPU.

3.1.1 Pipelines

The collection system consists of over 710 miles of pipelines, with pipe sizes up to 48-inches in diameter. LBWD primarily has 8-inch diameter pipelines, which make up over 80 percent of the gravity sewer system. Most of the large pipelines (i.e., 15-inches or larger) and some small pipelines are intercepted by CSDLAC's sewer trunk mains that run through the City. Small pipelines are generally near the lift stations or at the top of the collection system. **Table 3-1** presents the distribution of pipeline sizes in the LBWD's existing gravity system. The entire gravity system, colored by the size of the gravity main, is shown on **Figure 3-2**. **Figure 3-3** graphically illustrates the cumulative length distribution of LBWD sewers by size.

Table 3-1
Pipeline by Diameter Summary

Diameter (inch)	Total Length (feet)	Total Length (mile)	Percentage of Total Length (%)	Year of Installation (Range)
≤ 8	3,198,923	606.0	85%	1903 – 2012
10	211,458	40.0	6%	1903 – 2010
12	141,672	26.8	4%	1903 – 2008
14	968	0.2	< 1%	1903 – 1999
15	68,948	13.1	2%	1903 – 2009
16	1,131	0.2	< 1%	1933 - 2000
18	56,368	10.7	1%	1903 – 2009
21	31,973	6.1	1%	1927 – 2012
24	22,769	4.3	1%	1923 – 2000
27	6,684	1.3	< 1%	1927 – 1984
30	8,564	1.6	< 1%	1903 – 1961
33	8,016	1.5	< 1%	1927 – 1927
36	9,473	1.8	< 1%	1939 – 2001
48	2,227	0.4	< 1%	Unknown
Unknown	1,529	0.3	< 1%	Unknown
Total	**3,770,704**	**714.1**	**100%**	**1903 - 2012**



Long Beach Water Department Sewer System

Key to Features

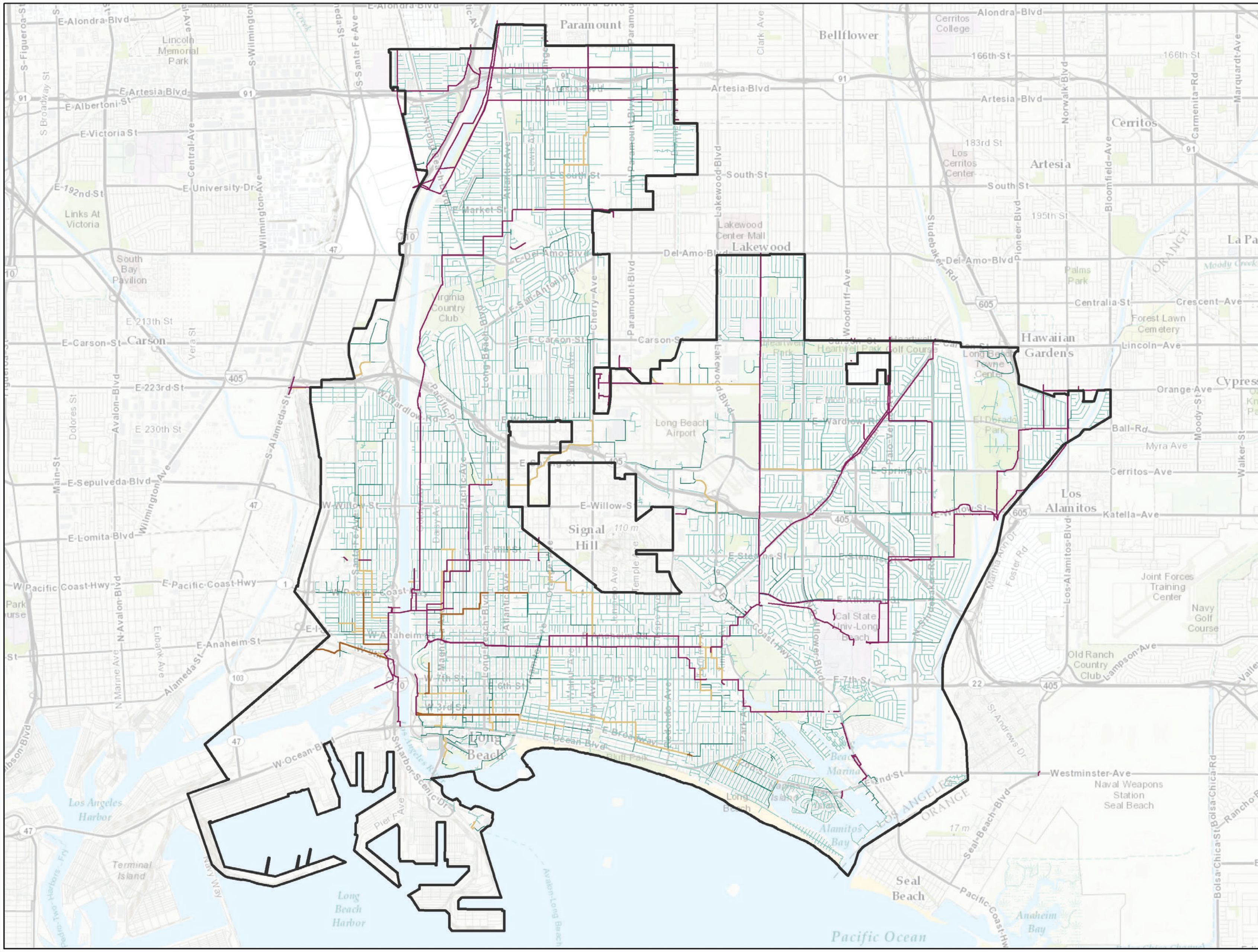
- LBWD Pump Station
- Non-LBWD Pump Station
- Pressure Main
- LBWD Gravity Main
- CSDLAC Gravity Main
- Other Gravity Main
- City of Long Beach Boundary

Basemap Source: ESRI

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\SewerSystem.mxd

MWH **Figure 3-1**



Long Beach Water Department Gravity Sewer by Diameter

Key to Features

- CSDLAC Gravity Main
- Greater than 24 inches
- 16 - 24 inches
- 10 - 15 inches
- Less than 8 inches
- City of Long Beach Boundary

Basemap Source: ESRI

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\GravitySewer Diameter.mxd

MWH **Figure 3-2**

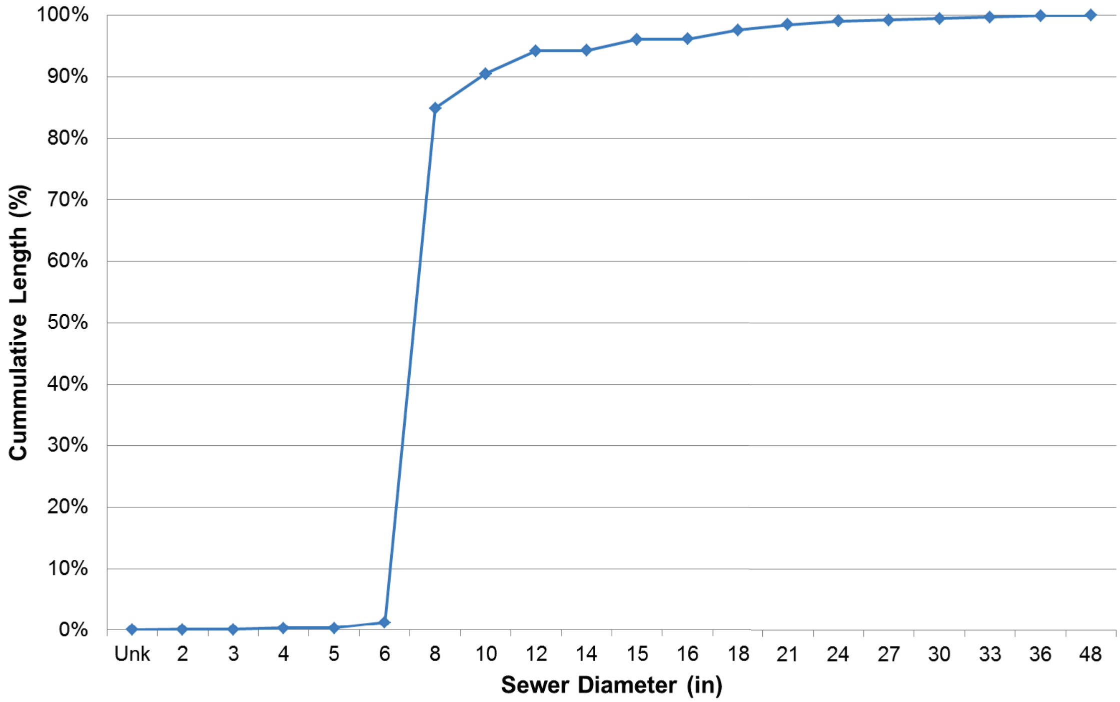


Figure 3-3
Cumulative Pipeline Length

Table 3-2 shows that the majority of LBWD's pipelines were installed before the early-1960s. Approximately 70 percent of the sewer system is at least 53 years or older.

Table 3-2
Pipeline by Installation Period

Period (years)	Length (ft)	Length (mi)	Percentage of Total Length (%)
1903 - 1909	108,447	20.5	2.9%
1910 - 1919	252,970	47.9	6.7%
1920 - 1929	617,784	117.0	16.4%
1930 - 1939	588,126	111.4	15.6%
1940 - 1949	806,073	152.7	21.4%
1950 - 1959	797,657	151.1	21.2%
1960 - 1969	175,113	33.2	4.6%
1970 - 1979	105,242	19.9	2.8%
1980 - 1989	72,933	13.8	1.9%
1990 - 1999	51,327	9.7	1.4%
2000 - 2009	47,759	9.0	1.3%
2010 - 2012	4,608	0.9	0.1%
Unknown	142,664	27.0	3.8%
Total	**3,770,704**	**714.1**	**100.0%**

Figure 3-4 shows the number of pipe segments installed by year. Only those sewer pipelines that have an installation date recorded in LBWD's pipeline geodatabase are shown on the figure.

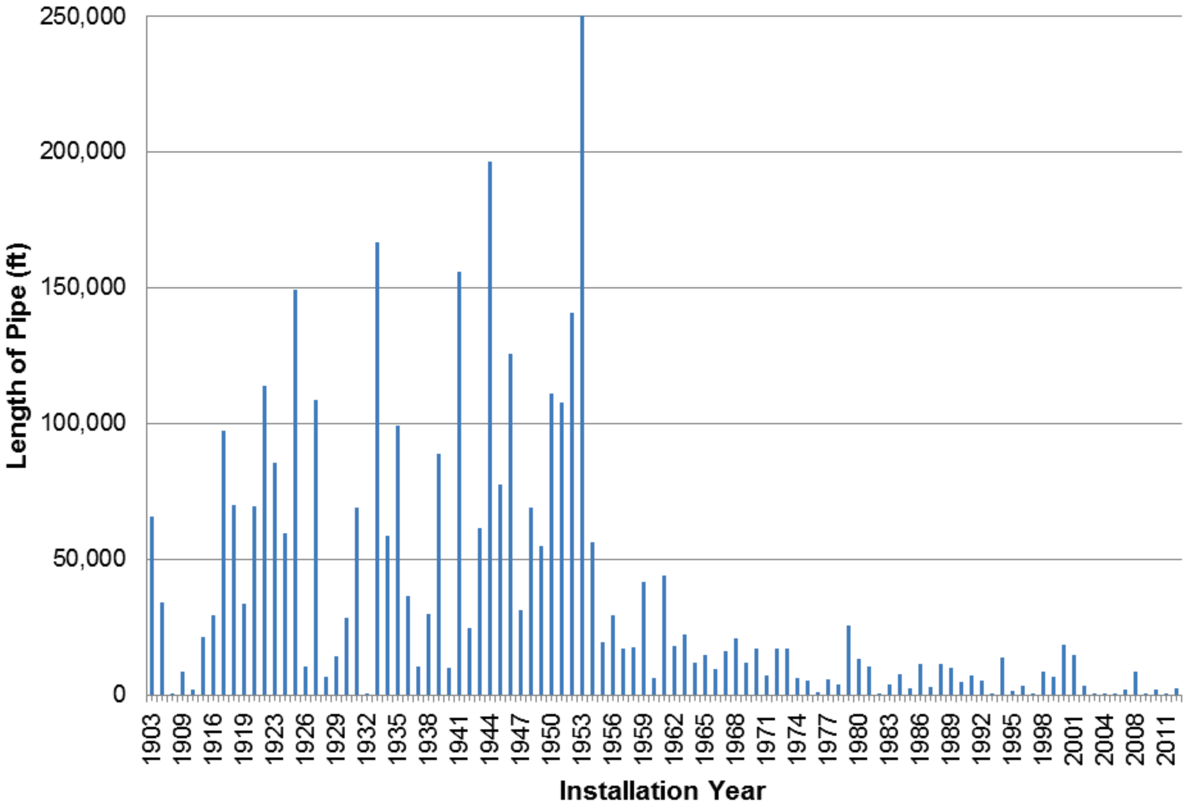


Figure 3-4
LBWD Sewers by Installation Date

Figure 3-5 shows the gravity sewer breakdown by age range and installation years. Approximately 4 percent of the pipes in the GIS have an unknown age and 70 percent of the pipes have an age greater than 53 years. In many utilities in Southern California, a large predominance of the pipes with an unknown age are the older pipes, therefore, it is assumed that the group of unknown pipes are at least 53 years of age.

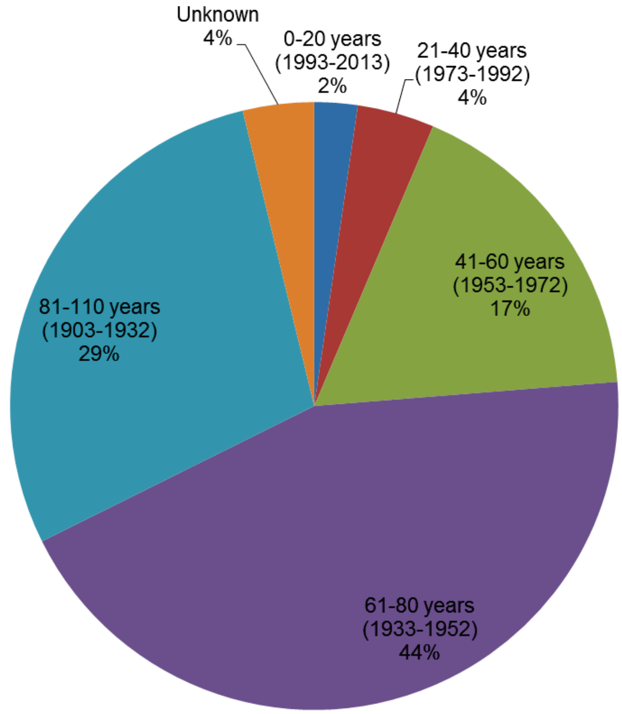


Figure 3-5
LBWD Sewer Distribution by Age

Concrete pipes cover approximately 10 percent of the sewer system and were installed as early as the 1910's. LBWD is aware of the aging concrete pipes and has been conducting closed-circuit television inspections (CCTV) of these pipes to assess their condition prior to the 2008 SMP. The distribution of pipe material for the existing gravity system is shown in **Table 3-3**.

Table 3-3
Pipelines by Material Summary

Material	Total Length (ft)	Total Length (mi)	Percentage of Total Length (%)
Asbestos Concrete	26	< 0.1	< 0.01
Cast Iron	5,635	1.1	0.15
Concrete (Unknown Type)	271,739	51.5	7.21
Ductile Iron	118	< 0.1	< 0.01
Non-Reinforced Concrete	76,482	14.5	2.03
Polyethylene	104	< 0.1	< 0.01
Polyvinylchloride	3,387	0.6	0.09
Reinforced Concrete	17,573	3.3	0.47
Steel	2,349	0.4	0.06
Vitrified Clay	3,378,899	639.9	89.61
Unknown	14,392	2.7	0.38
Total	**3,770,704**	**714.1**	**100.00**

Historically, sewer pipe materials have included clay, concrete, and polyvinylchloride (PVC). Clay pipe is susceptible to root intrusion at the joints and tends to crack when subjected to improperly installed "hammer taps" commonly used by untrained or unlicensed plumbers. Clay, however, is resistant to corrosive environments and high temperature industrial wastewater streams. PVC pipes are light and easier to install, but are potentially subject to ultraviolet light deterioration prior to installation, to cracking from improperly installed "hammer taps", and to deformation when subject to high vertical loads when buried too deep. Concrete pipes can be quite durable, but can also be subject to corrosion at the top of the pipes under certain conditions. Many of LBWD's concrete pipes are the oldest pipes in the sewer system, especially the non-reinforced concrete pipes. LBWD has been proactively inspecting all concrete pipes through CCTV activities and replacing or rehabilitating these pipes.

3.1.2 Siphons

The LBWD collection system has a number of inverted siphons. Inverted siphons are essentially gravity pipes that transport flow under a river or other interfering structures. Gravity flow is maintained by the upstream head that "pushes" flow through the structure. Inverted siphons can be either single barrel or multiple barrel pipes. Siphons in the LBWD system cross storm drains, railroad crossings, storm drains, or channel.

LBWD's inverted siphons are identified by querying out segments of pipe labeled as a 60-, 90-, 120-, 180-day siphon under the remarks column of the gravity main GIS database. These remarks indicate the frequency of field inspection for LBWD's maintenance crew. Siphons are also identified through visual inspection of the LBWD GIS database and review of design drawings. Based on the GIS database, there are 99 pipeline segments that are indicated as siphons that cover approximately 9,800 feet or 1.86 miles.

During the development of the hydraulic sewer model, a list of siphons that would be modeled in the network was compiled, and the structures of the inverted siphons were verified with referenced design drawings associated with the pipe segment. During the review of siphons that are modeled, a number of entries could not be identified on the existing GIS system map or the as-built map. **Table 3-4** lists the siphons that were checked by inspecting the referenced as-built and atlas maps. Additional siphons have been included since the 2008 SMP based on new information received during the SMPU. The listed siphons are included in the hydraulic model and a profile picture can be seen in **Section 5.1.2**.

Figure 3-6 shows the identified inverted siphon locations.

Table 3-4
LBWD Siphons Verified in the Model

No.	Siphon ID	Diameter (in.)	No. of Barrels	Location	Upstream Manhole ID	Downstream Manhole ID
1	G13378	10	1	Gardenia Ave. and Roosevelt Rd.	K26-SMH-017	K25-SMH-001
2	G16181	15	1	Arbor Rd. between Clark Ave. and Charlemagne Ave.	Q30-SMH-003	Q29-SMH-008
3	G7159, G9287	10, 8	2	Willow St. and Los Cerritos Channel	S18-SMH-010	S18-SMH-011
4	G5150	10	1	Pacific Ave. and Broadway	H09-SMH-036	G09-SMH-020
5	G11176, G14848	10, 10	2	Cherry Ave. and Carson St.	L27-SMH-004	L27-SMH-006
6	G8038	6	1	N/S Alley of E/O St Joseph Ave. between 2nd and Livingston	P07-SMH-047	P07-SMH-048
7	G18978	10	1	Elm Ave. between 46th St. and 47th St.	H29-SMH-018	H29-SMH-016
8	G6174, G5599	10, 10	2	N/S Alley of E/O Neapolitan Ln. and Naples Canal	R04-SMH-054	R04-SMH-048
9	CDT-87	12	2	Alamitos Ave. and 10th St.	J11-SMH-062	J12-SMH-076
10	G20024	12	2	Walnut Ave, and Market St.	N/A	N/A
11	G6991, G10436	15, 10	2	Gardenia Ave. and Curry St.	K36-SMH-071	K36-SMH-070
12	G10005, G9808	10	2	Willow St. and Lakewood Blvd.	N18-SMH-043	N18-SMH-042
13	G17010	10	1	Walnut Ave. and Jackson St.	K32-SMH-023	K32-SMH-022
14	G18955	8	1	Cedar Ave. and Market St.	H33-SMH-054	H32-SMH-074
15	G19076	8	1	Linden Ave. and Market St.	H33-SMH-056	H32-SMH-076
16	G519, G20004	18, 21	2	Orange Ave. and 10th St.	K11-SMH-033	K12-SMH-029

3.1.3 Flow Diversion

The LBWD collection system includes several parallel interceptors. Parallel pipes are typically constructed to relieve the original sewer pipeline when it can no longer carry peak flows. Flow is split between the parallel sewers at interconnection points that may occur either at a common manhole or at a connecting section of sewer line constructed between the parallel sewers. In addition, several flow diversion structures and flow splitting manhole structures are located at various points within the collection system.

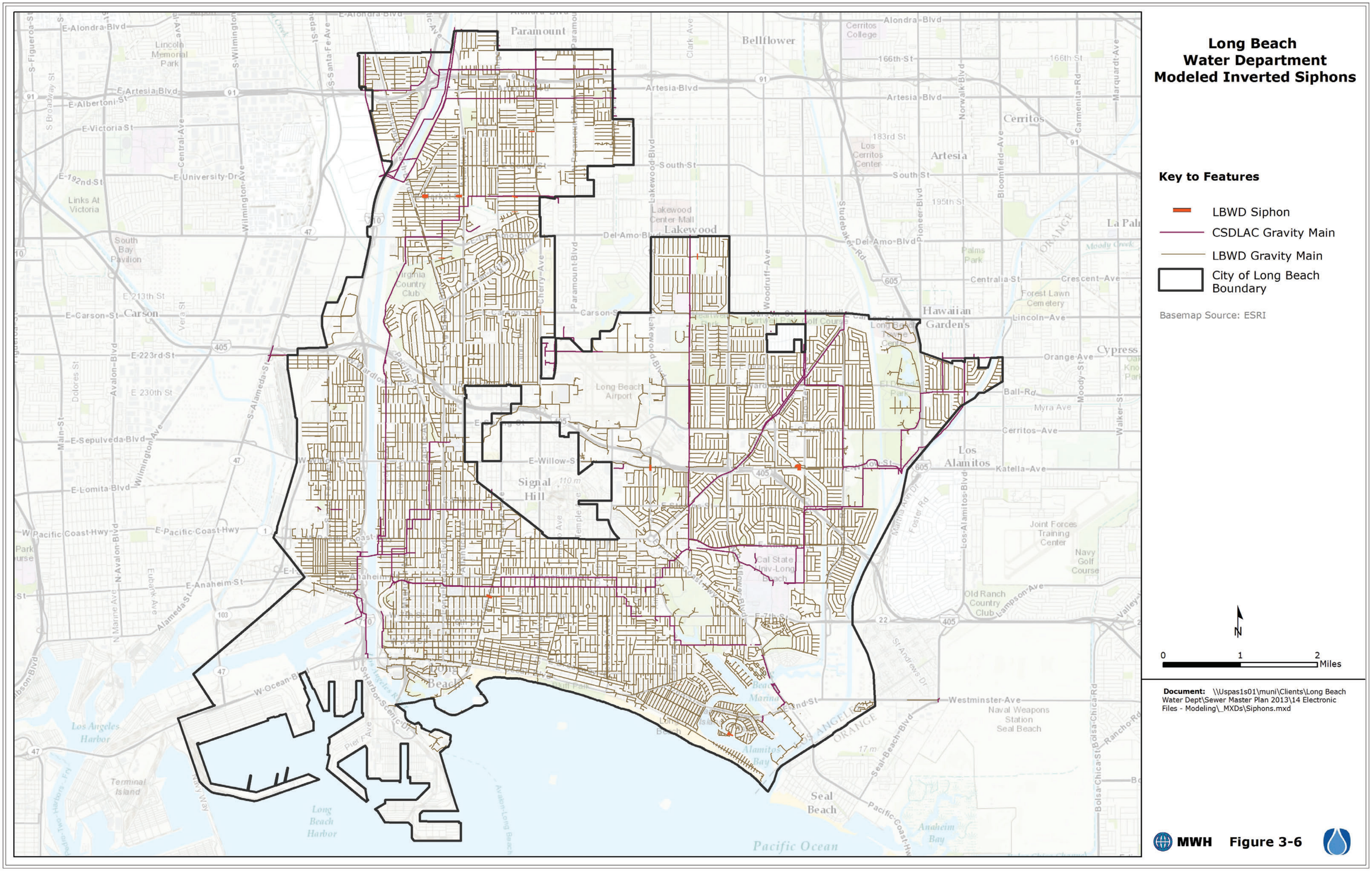
Flow diversion areas were identified through a manual review of the geodatabase during hydraulic model development for the 2008 SMP. These flow diversions were reviewed during the update of the hydraulic model for the 2013 SMPU. Based on record drawings received for the Broadway Trunk Sewer Replacement/Rehabilitation Project (Phase III), it was determined that the flow split near Alamitos Avenue and Broadway Avenue is no longer present. Also, during a field investigation of the LBWD sewer system conducted on May 20, 2013 it was observed that the flow diversion at Olive Avenue and Market Street was no longer present. The remaining flow diversion location is located at the intersection of Willow Street and Redondo Avenue at the LBWD manhole M18-SMH-015, as listed in **Table 3-5** and shown on **Figure 3-7**. It was confirmed during a field visit conducted on June 19, 2013 that flows along two City of Signal Hill 12-inch sewer pipelines split at manhole M18-SMH-015 to a 12-inch LBWD pipe and an 18-inch Signal Hill pipe. **Figure 3-7** shows a flow split in an area where Signal Hill and LBWD pipelines interconnect. A bulkhead slot was designed to be placed at M18-SMH-015, but the field investigation determined that the boards are missing and therefore, wastewater is free to flow in either direction. The split pipes eventually meet at a 48-inch CSDLAC trunk line on Clark Avenue just south of Stearns Street (not shown on **Figure 3-7**).

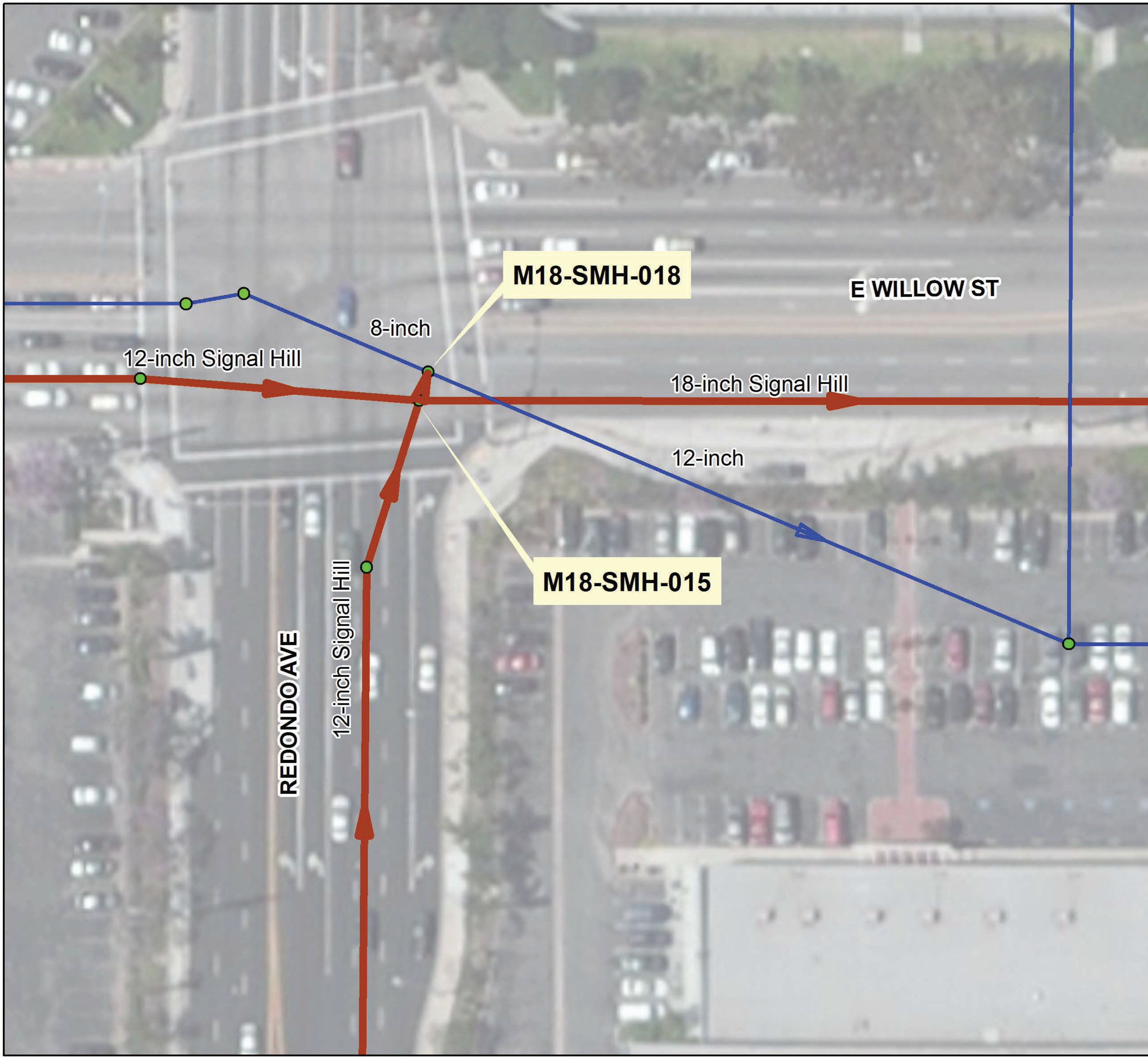
During the field visit it was observed that the connection to the LBWD sewer pipeline from the Signal Hill sewer pipeline is an overflow connection. It appeared that the overflow only functions when the Signal Hill sewer pipeline is flowing full. During the field visit, the sewer was only flowing at a small fraction of the total capacity. In addition, significant amount of solids deposition in the overflow pipeline was not observed. LBWD can monitor the overflow by installing a parshall flume and a level sensor at this location. A plug could also be installed on the over flow line as solid deposition appears to be minimal in the pipeline. It is recommended that LBWD coordinate with the City of Signal Hill while developing a solution for this issue.

No other diversion structures were found in the LBWD sewer system.

Table 3-5
Flow Split Locations

No.	Street	Manhole ID
1	Willow St. and Redondo Ave.	M18-SMH-015


Long Beach
Water Department
Modeled Inverted Siphons
Key to Features
LBWD Siphon
CSDLAC Gravity Main
LBWD Gravity Main
City of Long Beach Boundary
Basemap Source: ESRI
N
0
1
2
Miles
Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\Siphons.mxd
MWH
Figure 3-6



Long Beach Water Department LBWD Diversion: Willow St. and Redondo Ave.

Key to Features

Maintenance Hole

LBWD Sewer Pipe

City of Signal Hill Sewer Pipe

Basemap Source: ESRI

N

0 25 50 Feet

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDS\LBWD_SMPU_FLOWSPLITS.mxd

MWH **Figure 3-7**

3.2 Collection Lift stations

Collection lift stations help carry flow from one pipeline to another pipeline at a higher elevation. There are LBWD and CSDLAC lift stations within the City. The LBWD lift stations help carry flow from one LBWD pipeline to another LBWD pipeline, whereas the CSDLAC lift stations help carry flow to and from CSDLAC trunk mains.

3.2.1 Lift Stations

LBWD operates 26 lift stations within its sewer system. The location of each of the collection system lift stations are shown on **Figure 3-1**. The number of pump units at each station ranges from one to four pumps, which vary in capacity from 1 horsepower (hp) to 115 hp, and from about 200 gallons per minute (gpm) to approximately 2,240 gpm. Most lift stations utilize electric driven constant speed pumps, with the majority of the pump stations having emergency backup diesel/electric generators. All lift stations are on telemetry.

Pumping units that have been upgraded in the last decade (i.e., Lift Station 12, Lift Station 18, Lift Station 25) utilize variable frequency driven pumps.

Information about the lift stations was gathered from the 2008 SMP, available operation and maintenance manuals for each station, LBWD one-page lift station summary print outs from SCADA, and notes from the field inspection for the lift station assessment. A summary of each lift station's characteristics can be found in **Table 3-6**. Further information on the condition assessment performed at select lift stations is discussed in **Section 4** of this report and **Appendix A**.

Table 3-6
Summary of Lift Stations

Station No.	Station Name	Year Installed	No. of Pumps	Horsepower Per Pump	Pump Capacity (gpm)	Modeled (Y/N)
S-1	Hill & Atlantic	1920	2	20	1200	Y
S-2	North Airport	1967	2	10	580	Y
S-3	South Airport	1941	2	7.5	450	Y
S-4	Los Altos	1964	2	7.5	450	Y
S-5	Westminster	Unknown	2	5, 7.5	200	Y
S-6	Ultimo	1981	3	7.5	340	Y
S-7	Belmont Park	1929	2	14	1000	Y
S-8	Marina 2	1973	3	7.5	340	Y

Table 3-6 (continued)
Summary of Lift Stations

Station No.	Station Name	Year Installed	No. of Pumps	Horsepower Per Pump	Pump Capacity (gpm)	Modeled (Y/N)
S-10	Naples	1952	2	24	900	Y
S-11	Alamitos Bay	1926	2	7.5	600	N
S-12	Belmont Shore	1991	3	115	2,240	Y
S-14[b]	Coronado	1961	2	3	60	N
S-15[b]	Molino	1961	2	10	100	N
S-16[b]	Cherry	1961	2	3	60	N
S-17[b]	8th Place	1961	2	3	60	N
S-18	Hart Place	1975	4	18 (2), 7.5 (2)	290	Y
S-19	Harbor	Unknown[c]	2	7.5	Unknown	N
S-20[b]	Shoreline Marina 1	1982	2	5	200	N
S-21[b]	Shoreline Marina 2	1982	2	5	200	N
S-22[b]	Shoreline Marina 3	1982	2	5	200	N
S-23[b]	Shoreline Marina 4	1982	2	5	200	N
S-25	Magnolia	1968	4	24.4 (2), 18.8, 10.4	500	Y
S-26	Santa Fe	1980	3	30	820	Y
S-27	Airport Admin. Bldg.	Unknown	1	Unknown	100	N
S-28	Marine Stadium	Unknown	1	Unknown	Unknown	N

[a] Includes two 7.5 air compressor pumps
[b] Comfort station
[c] Lift Station 19 was rehabilitated in 2001

Figure 3-8 shows a schematic of the LBWD lift stations.

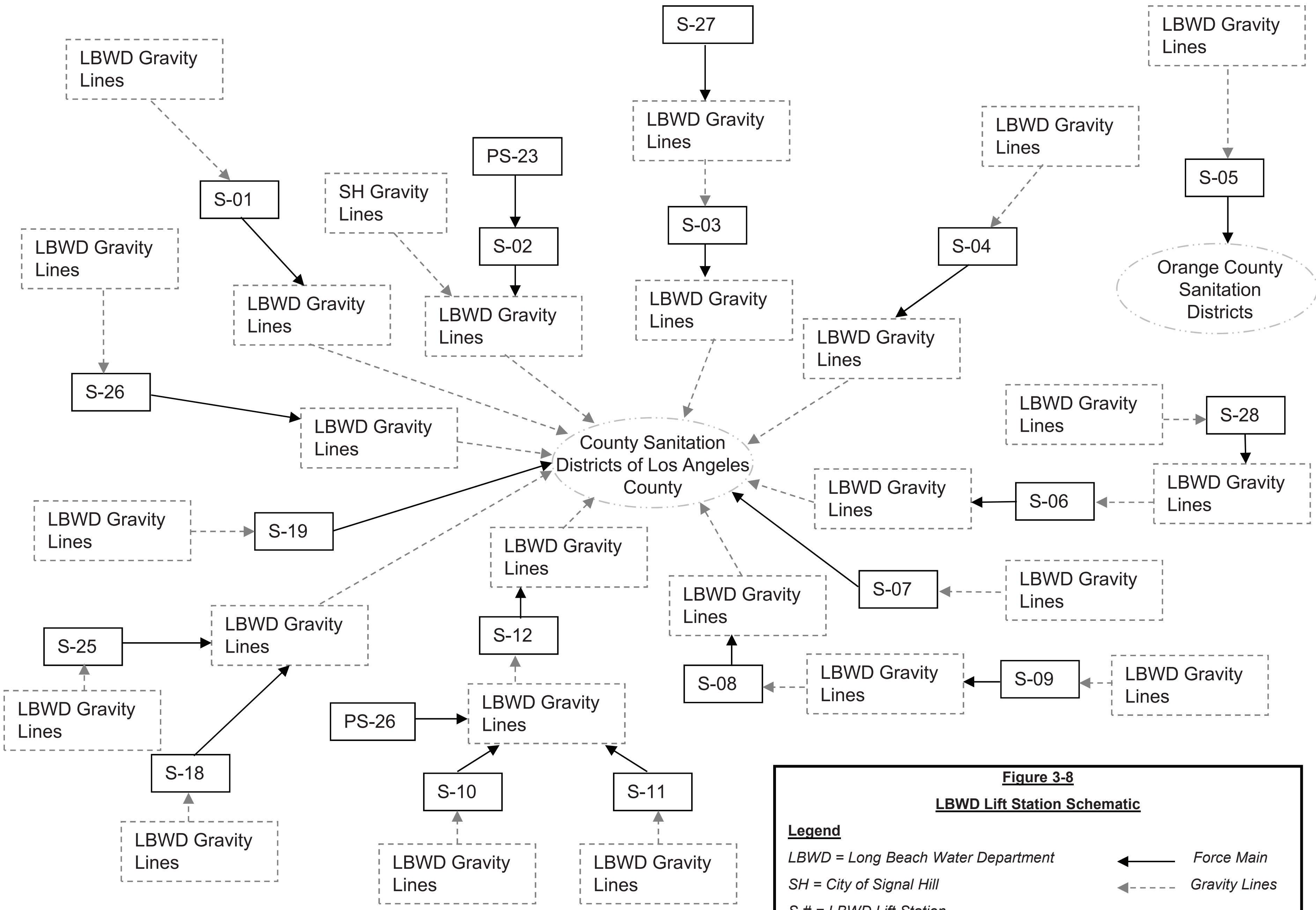


Figure 3-8

LBWD Lift Station Schematic

Legend

LBWD = Long Beach Water Department — *Force Main*

SH = City of Signal Hill — *Gravity Lines*

S-# = LBWD Lift Station

PS-# = Non-LBWD Lift Station

Note: This figure does not show any LBWD Comfort Stations

3.2.2 Force Mains

Force mains are pressurized pipes that carry flow from a pump station to a discharge point, usually a gravity sewer manhole. Based on the GIS database, the LBWD collection system contains approximately 31,100 feet, or approximately 7.5 miles, of force main ranging from 4- to 12-inches in diameter. As noted in **Table 3-7**, the force mains are mainly made of PVC. These force mains serve the 26 sewer system lift stations noted above. There are several lift stations that carry a small amount of flow and discharge to a local gravity line.

Table 3-7
LBWD Collection System Force Main Listing

Serves Lift Station	Size (inches)	Length (feet)[a]	Pipe Material	Installation Date
S-01	8	20	Unknown	Unknown
S-02	6	137	Asbestos Cement	1967
S-03	8	626	Polyethylene	Unknown
S-04	8	526	Asbestos Cement	1963
S-05	4	2,343	Polyvinyl Chloride	1973
S-06	6	46	Cast Iron	1980
S-07	8	1,898	Asbestos Cement	1948
S-08	6	95	Unknown	Unknown
S-10	12	7,029	Cast Iron, Ductile Iron	1993, 2007
S-11	10	3,798	Polyethylene	2000
S-12	12	4,353	Ductile Iron	2002
S-14[b]	4	484	Cast Iron	1917
S-15	6	533	Cast Iron	Unknown
S-16	4	141	Steel	1954
S-17	4	176	Polyvinyl Chloride	Unknown
S-18	6	305	Polyvinyl Chloride	1976
S-19	6	384	Polyvinyl Chloride	1970
S-20	4	302	Polyvinyl Chloride	Unknown
S-21	4	1,282	Polyvinyl Chloride	Unknown
S-22	4	1,083	Polyvinyl Chloride	Unknown
S-23	4	178	Polyvinyl Chloride	Unknown
S-25	4	873	Polyvinyl Chloride	1967
S-26	12	3,938	Asbestos Cement	1980
S-27	Unknown	Unknown	Unknown	Unknown
S-28	4	497	Unknown	Unknown
Totals		**31,097**		

(a) Length values is determined by force main length in the LBWD GIS database (2008), except for S-01, which is length reported in record drawing or 1999 Sewer Master Plan report
(b) 4-inch diameter force main in S-14 is encased in a 6-inch diameter cast iron pipe

3.3 Interconnection to Other Agencies

The collection system interconnection locations are situated throughout the sewer system. From **Figure 3-1** the interconnections are essentially the areas where the LBWD and the CSDLAC pipelines intersect. There are roughly 130 connections between the LBWD and CSDLAC sewer mains in the modeled network. The larger CSDLAC trunk mains convey flow that is collected from LBWD pipelines to the treatment plant. Those LBWD subcatchments that contribute to the CSDLAC trunk mains vary in size.

The City of Signal Hill is completely surrounded by the City of Long Beach and has a population of over 11,000 people (U.S. Census 2010). Wastewater flows generated from Signal Hill are collected by the City of Signal Hill pipelines and carried to CSDLAC trunk mains. Based on the GIS database, the only area where LBWD and Signal Hill pipelines intersect is at the intersection of Willow Street and Redondo Avenue as shown in **Figure 3-7**. Section 3.1.3 discusses this interconnection in detail and offers potential solutions.

Other pipelines not owned or operated by LBWD that interact with the LBWD sewer system include privately owned property such as the Lakewood Douglas Park and Lloyns Mobile Homes. Flow from these properties flow through LBWD pipeline to reach the CSDLAC trunk mains. Lift Station S-05 serves a small private tract of homes of approximately 20 acres, known as the “Island Village”, located south of 2nd Street and east of the San Gabriel River. Flow collected in this area is carried through a force main that extends eastward to Seal Beach Boulevard to Orange County Sanitation District (OCSD) facilities.

There are two wastewater treatment plants that treat flow collected from LBWD pipelines. The wastewater treatment plants are the Long Beach Water Reclamation Plant in Long Beach, and the Joint Water Pollution Control Plant (JWPCP) in Carson. Both plants are owned and operated by the CSDLAC. Wastewater flow that is carried through the CSDLAC trunk mains end up at one of the two wastewater treatment plants.

SECTION 4

FACILITY ASSESSMENT

SECTION 4
FACILITY ASSESSMENT

This section summarizes the condition assessment of selected Long Beach Water Department (LBWD) sewer lift stations. MWH reviewed all twenty six (26) LBWD lift stations and selected fourteen (14) lift stations to conduct a condition assessment based on factors such as age, pump inflows, location relative to the collection system, maintenance logs, and input from LBWD staff. Recommendations developed from this assessment will be used to support the development of the 2013 Sewer Master Plan Update (SMPU) Capital Improvement Plan (CIP).

4.1 Lift Station Condition Assessment

As part of the condition assessment for LBWD's lift stations, MWH's technical experts visited the following lift stations over a 2-day field visit on January 15-16, 2013:

- S-1 (Hill & Atlantic)
- S-4 (Los Altos)
- S-5 (Westminster)
- S-6 (Ultimo)
- S-7 (Belmont Park)
- S-8 (Marina 2)
- S-10 (Naples)
- S-11 (Alamitos Bay)
- S-12 (Belmont)
- S-18 (Hart Place)
- S-19 (Harbor)
- S-25 (Magnolia)
- S-26 (Santa Fe)

During the field visit, MWH staff visually inspected the lift stations for the following issues:

- Condition of the wet well lining
- Greasing at the lift station
- Inlet and outlet pipe configuration
- Electrical system
- Telemetry system
- Condition of pumps, including remaining useful life
- Structural integrity
- General lift station condition

Figure 4-1 depicts the location and condition of each station relative to one another. Based on the information gathered during the field visits and input from LBWD Staff, a methodology was developed to assess the condition of the sewer lift stations. The stations are ranked based on their relative condition as good, fair, poor, or very poor. A brief description of the parameters considered to assess the condition of the lift stations is provided below. The remaining useful life of pumps and electrical gear is also considered and described by the parameters below. The replacement of the lift stations is prioritized based on a ranking system where a rank of 1 indicates a candidate considered to be the highest priority for replacement and a rank of 14 indicates a candidate considered to be the lowest priority for replacement. Besides the physical condition assessed based on visual inspection, factors such as the amount of flow conveyed via the lift station are also considered for the prioritization.

Good Condition – The facility is considered to be in good condition if the facility is able to perform its intended function(s) with a desirable degree of efficiency without requiring additional repair or refurbishment other than routine maintenance. In addition, the facility does not have any visible exterior damage.

Fair Condition – The facility is considered to be in fair condition if the facility is able to perform its intended function(s) at a lower than desired efficiency while requiring minor repair or refurbishment in addition to routine maintenance. In addition, the facility has minor visible exterior damage.

Poor Condition – The facility is considered to be in poor condition if the facility is able to perform its intended function(s), however requires repair or refurbishment to operate at a lower than desired efficiency which may not be cost-effective for LBWD. In addition, the facility has severe visible damage on its exterior.

Very Poor Condition – The facility is considered to be in very poor condition if the facility is unable to perform its intended function(s) and requires replacement to operate at a desired efficiency. In addition, the facility has severe visible damage on its exterior.

Table 4-1 provides a summary of the LBWD sewer lift stations, remaining useful life of pumps, overall condition and key issues based on visual inspection. Information presented in **Table 4-1** is obtained from LBWD staff. These key issues are described in detail in **Appendix A**.

Table 4-1
Overall Condition of Selected LBWD Lift Stations

Priority	Lift Station ID	Station Name	Location	Year of Construction	No. of Pumps	Horsepower (No. of pumps)	Design Flow (gallons per minute)	Design Head (feet)	Wet Well Volume (gallons)	Force Main Diameter (inch)	Overall Condition	Remaining useful life of pump	Key Observations
1	S-12	Belmont	Division Street & Bennett Avenue	1991	3	115 (3)	2,244	36	3,400	10,12	Very Poor	10 to 15 years (i.e., 2023-2028)	VFDs have passive harmonic filters (one each on line side); unknown if load reactors are employed or what sort of cabling is used from VFD to terminal junction boxes for pumps. There are odor and corrosion at the wet well. This station has a grease problem, which may to false readings by the level sensor. SAFETY: Gas fumes are sucked back down into the dry pit when the ventilator is on, making it difficult (and potential hazardous) for staff working in the pit. LBWD follows protocols associated with confined space entry while accessing this lift station. Fans are turned ON and operators carry a sniffer. Wet well lining is peeling off the wall inside of the wet well, potentially causing damage and clogging the pumps.
2	S-8	Marina 2	6391 Marina Drive	1973	3	7.5 (3)	337	30	1,900	6	Very Poor	0 to 3 years (i.e. 2013-2016)	Pumps appear to be of the original installation and all three pumps have reached the end of their useful life.
3	S-26	Santa Fe	3816 N. Santa Fe	1980	3	30 (3)	821	44	5800	12	Poor	0 to 5 years (i.e., 2013-2018)	Pumps have reached the end of their useful life.
4	S-1	Hill & Atlantic	Hill St. & Atlantic Ave.	1920	2	20 (2)	1,212	40	800 to 2,000	6	Poor	0 to 5 years (i.e., 2013-2018)	The electrical gear has reached the end of its useful life. Disconnect switch marked for transformer is rated for 60 Amps (A), but transformer full load current is 62A. SAFETY: Emergency lighting is inadequate/inoperable, per OSHA 29 CFR 1910, Subpart E.
5	S-18	Hart Place	Hart Place & Seaside Way	1975/ 1999 Rehab	4	18 (2), 7.5 (2)	292	100	814	6	Poor	10 to 15 year on newer pumps (i.e., 2023-2028) 5 to 10 years on the older pumps (i.e., 2018-2023)	This station is located in the parking garage of the Long Beach Convention Center and difficult to access. The staff can only bring in one small truck to access the site. The main issues at this site are the power concerns (e.g. power outage). The electrical gears are not owned by Long Beach, and the generator does not run.
6	S-6	Ultimo	339 Ultimo Avenue	1981	3	7.5 (3)	341	31	2,000	6	Fair	5 to 15 years (i.e., 2018-2028)	The electrical gear has reached the end of its useful life. SAFETY: This station has structural concerns including termite damage, wall cracks, and inadequate pump supports.
7	S-7	Belmont Park	349 Lakeview Avenue	1929/ 2000 Rehab	2	14 (2)	996	42	2,600	8	Fair	5 to 15 years (i.e., 2018-2028)	Noise complaints are the main issues at this lift station. Noise is as high as 50 decibels during the day and 45 decibels at night.
8	S-25	Magnolia	200 S. Magnolia Avenue	1968/ 2004 Rehab	4	10.4 (1), 18.8 (1), 24.4 (2)	498	48.5	2020	8	Fair	10 to 15 years (i.e., 2023-2028) on newer pumps 0 to 5 years on the pump with cooling issue (i.e., 2013-2018)	Safety: A large homeless population on site may present security and safety issues. Pump #3 (10.4 HP) has a cooling problem and overheats frequently.
9	S-10	Naples	91 Rivo Alto Canal	1952/ 2002 Rehab	2	24 (2)	898	30	8	10	Fair	15 to 20 years (i.e., 2028-2032)	Access for maintenance of the lift station is difficult. Staff must shut down one side of the bridge when conducting any maintenance work at this site.

Table 4-1 (continued)
Overall Condition of Selected LBWD Lift Stations

Priority	Lift Station ID	Station Name	Location	Year of Construction	No. of Pumps	Horsepower (No. of pumps)	Design Flow (gallons per minute)	Design Head (feet)	Wet Well Volume (gallons)	Force Main Diameter (inch)	Overall Condition	Remaining useful life of pump	Key Observations
10	S-19	Harbor	Harbor Queensway Drive	2001 Rehab	2	7.5 (2)		53	814	4,6	Fair	10 to 15 years (i.e., 2023-2028)	Cracked wet well lid is located on the street.
11	S-4	Los Altos	5155 Atherton Street	1964/ 2000 Rehab	2	7.5 (2)	449	15	4,000	8	Good	10 to 15 years (i.e., 2023-2028)	Problems were recently encountered at this lift station. Levels in the wet wells are reduced to five feet within a few minutes of pump operation. Thereafter, the flow rates drop significantly and it takes a long time before the pumps reach the shutoff level.
12	S-11	Alamitos Bay	62nd Place & Ocean Boulevard	1926/ 2011 Rehab	2	7.5 (2)	597	30	2,550	10	Good	15 to 20 years (i.e. 2028-2033)	A potential power outage compromises the reliability of this site. Recommend adding generator receptacle to accommodate the connection of a portable generator.
13	S-5	Westminster	7171 Seawind Drive	N/A	2	5 (1), 7.5 (1)	200	97	814	4	Good	15 to 20 years (i.e. 2028-2033)	The lift station is currently going through renovation. The condition of the lift station is subject to change.

Remaining useful life

Pumps: The useful life of a pump or pumping component is a forecast of the time remaining during which it will be economic and reliably usable in the current operating conditions. This can be a shorter period than its physical life, as it may reach a point where the cost of repair or pumping reliability may pose a challenge to the pumping operation and safety.

Electrical Gear: The expected useful service life for circuit breakers, dry type transformers, motor control equipment, and other industrial electrical gear is typically 20-30 years. This is due to deterioration from infiltration of dust and moisture over time. The fact that the electrical gear equipment is in wastewater conveyance facilities adds a greater exposure to corrosive gasses, which accelerate the deterioration of wire insulation and other protective coverings. As electrical equipment ages, it can become less reliable due to these factors, at worst becoming a fire hazard from an arcing short circuit. Additionally, maintenance can become a challenge as the availability of spare parts is increasingly difficult after 15-20 years. Electrical gear older than 20 years is noted in the exhibits.

Safety: The term “SAFETY” used in this section represents a potential hazard to personnel in or around the lift station. Safety issues noted in this section will be address by LBWD Operations.

4.2 Lift Station Condition

A brief description of each lift station is presented in the following pages. Detailed discussions of findings and recommendations during the field visits are provided in **Appendix A**.

4.2.1 S-1 (Hill & Atlantic)

Lift station S-1 is determined to be in “poor” condition. The station is located in an alley east of Atlantic Avenue and north of Hill Street. The electrical gear in this lift station has reached the end of its useful life. The pumps have an estimated remaining useful life of 0 to 5 years. Additional information on this lift station is provided in **Appendix A, Exhibit 1**.

4.2.2 S-4 (Los Altos)

Lift station S-4 is determined to be in “good” condition. The station is located at 5155 Atherton Street. This station reports excessive run times on pumps. The pumps have an estimated remaining useful life of 10 to 15 years. Additional information on this lift station is provided in **Appendix E, Exhibit 2**.

4.2.3 S-5 (Westminster)

Lift station S-5 is determined to be in “good” condition. The station is located at 7171 Seawind Drive. This station is currently going through renovation, so the condition of the station is subject to change. The pumps have an estimated remaining useful life of 15 to 20 years. Additional information on this lift station is provided in **Appendix A, Exhibit 3**.

4.2.4 S-6 (Ultimo)

Lift station S-6 is determined to be in “fair” condition. The station is located at 339 Ultimo Avenue. The electrical gear in this lift station has reached the end of its useful life. The pumps have an estimated remaining useful life of 5 to 15 years. Additional information on this lift station is provided in **Appendix A, Exhibit 4**.

4.2.5 S-7 (Belmont Park)

Lift station S-7 is determined to be in “fair” condition. The station is located at 349 Lakeview Avenue. Noise complaints are the main issues at this lift station. The noise is as high as 50 decibels during the day and 45 decibels at night. The pumps have an estimated remaining useful life of 5 to 15 years. Additional information on this lift station is provided in **Appendix A, Exhibit 5**.

4.2.6 S-8 (Marina 2)

Lift station S-8 is determined to be in “very poor” condition. The station is located at 6391 Marina Drive. The pumps in this station appear to be of the original installation in 1973. The pumps have an estimated remaining useful life of 0 to 3 years. Additional information on this lift station is provided in **Appendix A, Exhibit 6**.

4.2.7 S-10 (Naples)

Lift station S-10 is determined to be in “fair” condition. The station is located at 91 Rio Alto Canal. Access to this station is difficult. Staff must shut down one side of a bridge to perform maintenance work. The pumps have an estimated remaining useful life of 15 to 20 years. Additional information on this lift station is provided in **Appendix A, Exhibit 8**.

4.2.8 S-11 (Alamitos Bay)

Lift station S-11 is determined to be in “good” condition. The station is located between 62nd Place and Ocean Boulevard. Potential power outages compromise the reliability of the lift station. There is no on-site standby power and no receptacle for connection of portable generator. The pumps have an estimated remaining useful life of 15 to 20 years. Additional information on this lift station is provided in **Appendix A, Exhibit 9**.

4.2.9 S-12 (Belmont)

Lift station S-12 is determined to be in “very poor” condition. The station is located between Division Street and Bennett Avenue. This station has issues with the VFDs, odor, grease, and corrosion. The grease problem causes false readings from level sensor, leading to inefficient operation of pumps. Gas fumes from the wet well are sucked back down into the dry pit when the ventilator is on, making it difficult, and potentially hazardous, for staff working in the pit. Additionally, the wet well lining is peeling off of the wall in the wet well, potentially clogging the pumps. The pumps have an estimated remaining useful life of 10 to 15 years. Additional information on this lift station is provided in **Appendix A, Exhibit 10**.

4.2.10 S-18 (Hart Place)

Lift station S-18 is determined to be in “poor” condition. The station is located between Hart Place and Seaside Way. This station is located in the parking garage of the Long Beach Convention Center.

Access to the station is difficult. The main issue at this station is power concerns. The electrical gears are not owned by Long Beach and the backup generator does not run. The pumps have an estimated remaining useful life of 10 to 15 years on newer pumps and 5 to 10 years on the older pumps. Additional information on this lift station is provided in **Appendix A, Exhibit 11**.

4.2.11 S-19 (Harbor)

Lift station S-19 is determined to be in “fair” condition. The station is located at Harbor Queensway Drive. The wet well lid is located in the street and is cracked. The pumps have an estimated remaining useful life of 10 to 15 years. Additional information on this lift station is provided in **Appendix A, Exhibit 12**.

4.2.12 S-25 (Magnolia)

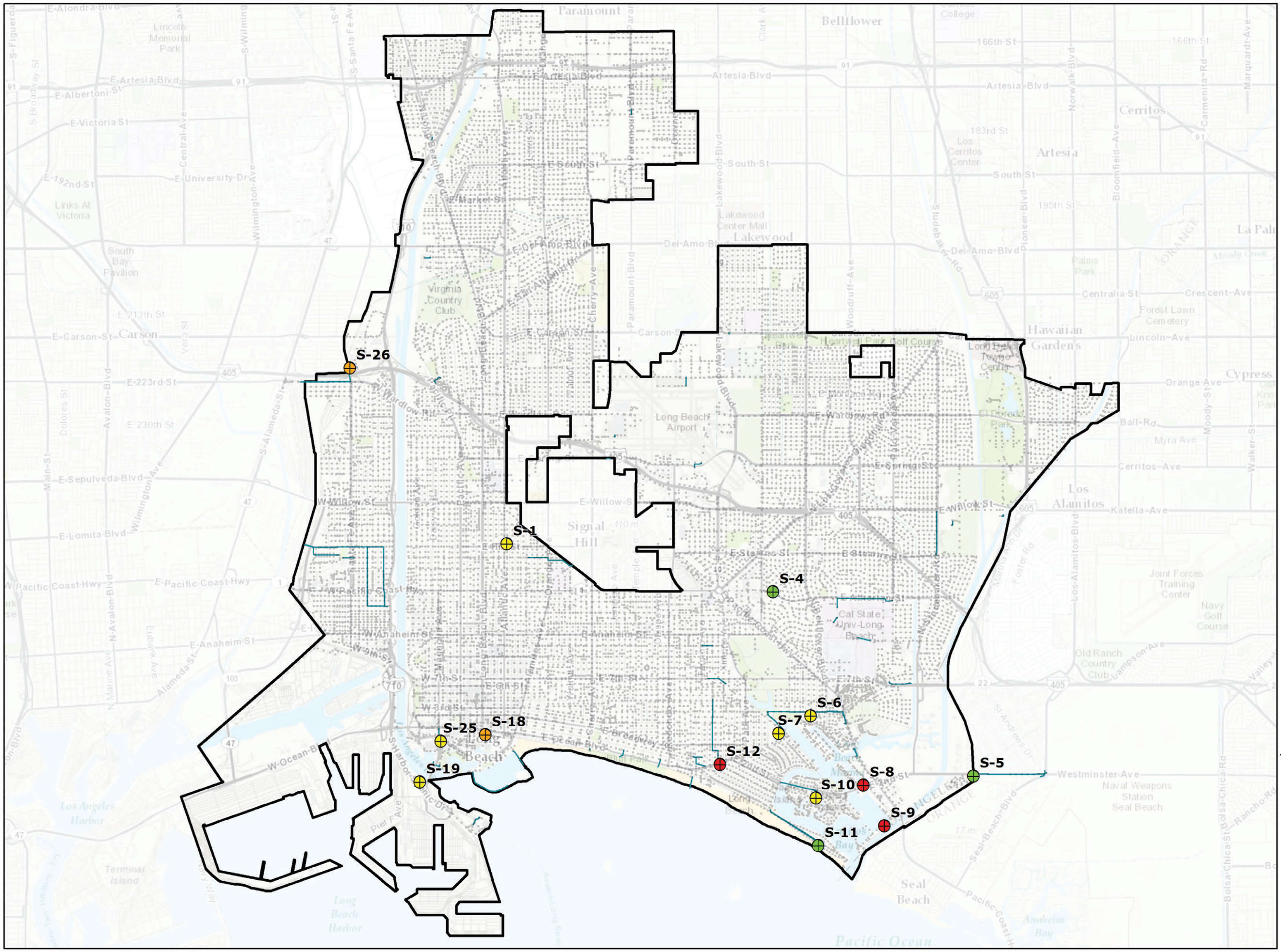
Lift station S-25 is determined to be in “fair” condition. The station is located at 200 South Magnolia Avenue. The large homeless population around the site presents a potential security and safety issue. Pump #3 in this station has a cooling problem and overheats frequently. The pumps have an estimated remaining useful life of 10 to 15 years on newer pumps and 0 to 5 years on Pump #3. Additional information on this lift station is provided in **Appendix A, Exhibit 13**.

4.2.13 S-26 (Santa Fe)

Lift station S-26 is determined to be in “poor” condition. The station is located at 3816 North Sante Fe Avenue. The pumps, piping, and valves in this station have reached the end of their useful life. The pumps have an estimated remaining useful life of 0 to 5 years. Additional information on this lift station is provided in **Appendix A, Exhibit 14**.

\This Page Intentionally Left Blank

Long Beach
Water Department
Lift Station Assessment



Key to Features

Lift Station Condition

- Fair
- Good
- Poor
- Very Poor

Maintenance Hole

Force Main

Sewer Pipeline

City of Long Beach Boundary

Basemap Source: ESRI

N

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMP_LS_Condition.mxd

MWH **Figure 4-1**

SECTION 5

HYDRAULIC MODEL: UPDATE, VALIDATION, & RECALIBRATION

SECTION 5
HYDRAULIC MODEL: UPDATE, VALIDATION, & RECALIBRATION

This section summarizes the updates made to the sewer hydraulic model for the Long Beach Water Department's (LBWD) 2013 Sewer Master Plan Update (SMPU). Pipes constructed since the completion of the 2008 Sewer Master Plan (SMP) (MWH, 2008) are added to the model including pipes that have been cured-in-place. In addition, pipes that either in their planning, design, or construction phases are also added to the model. This section also includes a discussion on flow monitoring performed during dry weather conditions and the subsequent hydraulic model validation and recalibration process.

5.1 Hydraulic Model Update

The LBWD sewer hydraulic model was created for the 2008 SMP using Innovyze® InfoSWMM (Version 6.0, Update No. 6) software. The updated sewer hydraulic model also uses the same software with the latest version and update, InfoSWMM (Version 11.0, Update No. 9). InfoSWMM is a fully dynamic model based on the EPA SWMM 5 engine, and utilizes the explicit solution of the Saint Venant equations, which permits accurate analysis of reverse flows and backwater conditions. InfoSWMM is an extension to ESRI ArcGIS (Version 10.0), and this brings a powerful modeling system into a fully featured GIS, allowing all advanced GIS functions to be utilized.

5.1.1 Data Collection

Information required for updating the sewer hydraulic model was provided by LBWD, obtained from the City of Long Beach website, or information from the 2008 SMP. Key information for this SMPU included:

- Design drawings of sewer projects (including projects under construction and in design)
- Record drawings of sewers (select drawings as requested to verify areas in the model)
- GIS file of gravity sewers
- GIS file of sewer maintenance holes including rim and invert elevations
- GIS file of street centerlines
- General Plan and land use information
- 2008 LBWD SMP hydraulic model

5.1.2 Model Development Overview

The LBWD digitized sewer network contains approximately 19,500 pipe segments, which extend approximately 714 miles. The modeled database includes all sewer pipes with a diameter of 12-inches or larger and select pipelines smaller than 12-inches that capture flow from a large network of small pipes. The model includes approximately 54 miles of the 646 miles of pipelines smaller than 12-inches in diameter in the sewer system. Select City of Signal Hill and privately owned pipelines are also included in the modeled system because of their flow contribution to the LBWD sewer system. County Sanitation Districts of Los Angeles (CSDLAC) pipes that collect and send flows from the LBWD system to the CSDLAC outfalls are also added to the modeled network. These CSDLAC pipes, which act as a trunk system to the LBWD sewers, are not being evaluated as part of the SMPU project. In total, the modeled database includes approximately 200 miles of the digitized pipeline, which is slightly less than 30 percent of the entire network. **Figure 5-1** shows the modeled sewer network.

Detailed information on the process of constructing the LBWD sewer hydraulic model is discussed in **Section 5** of the 2008 SMP.

5.1.2.1 Lift Stations

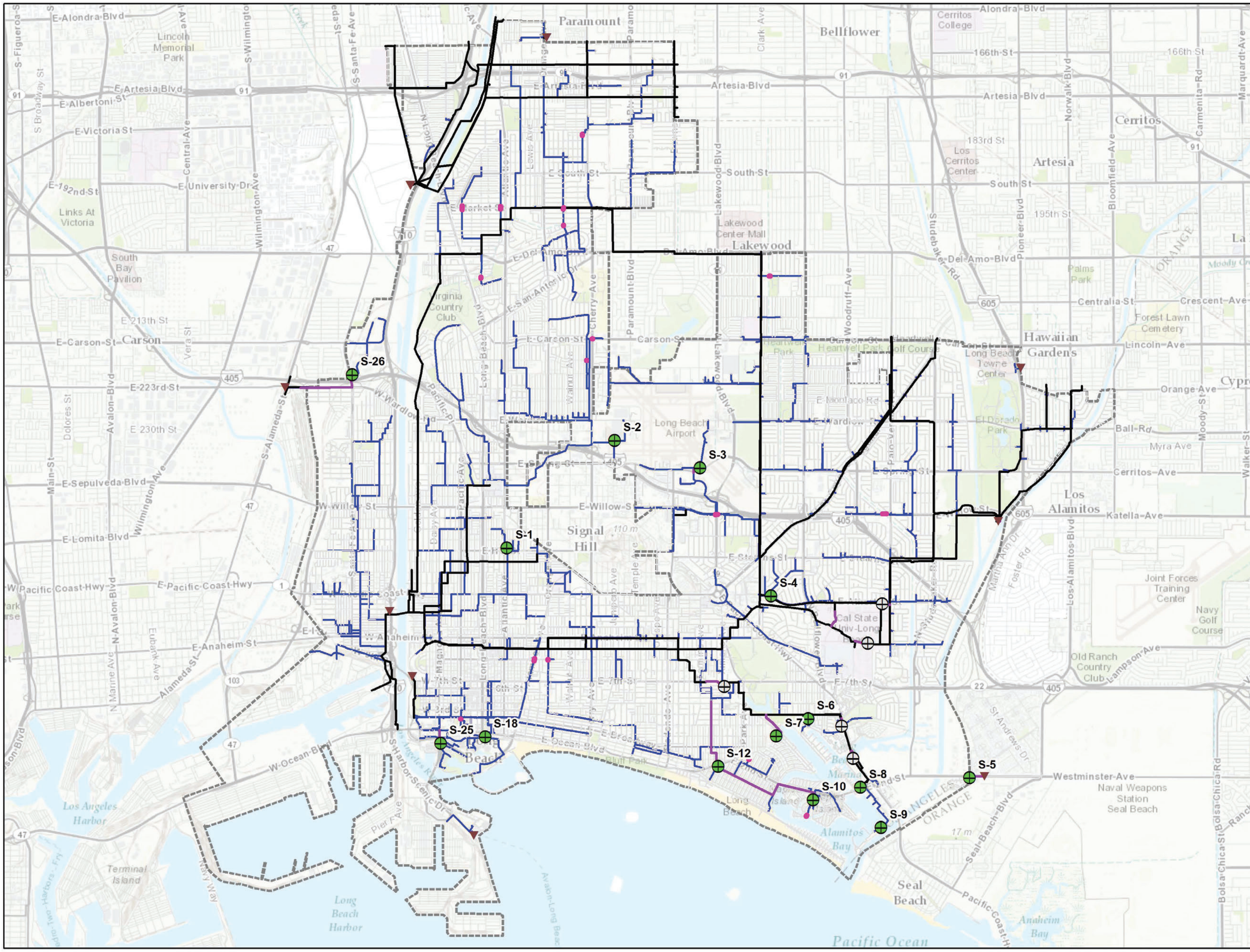
The existing LBWD sewer system contains 26 lift stations, of which 19 pump stations with a total of 44 pumping units are included in the hydraulic model. Fourteen of the 19 modeled lift stations are operated by LBWD, and the remaining five are CSDLAC pump stations. These CSDLAC pump stations are included in the modeled network, but flows through the CSDLAC sewer mains and pump stations are not expressly evaluated in this SMPU.

Each lift station is modeled with a wet well, a number of pumps, discharge node, and a force main, all of which are modeled based on data contained in as-built drawings and pump curves provided by LBWD. Details on the modeled wet wells are presented in **Figure 5-6**. CSDLAC pump stations are included in the model but not analyzed in the SMPU.

Attached to the wet well are a number of pump units. Each pump unit in the model includes the pump's start and stop levels based on information obtained from LBWD's SCADA system. The operating characteristics of the pumps are reflected by adding pump curves to the model which are developed from the manufacturer's curve and pump test data obtained from LBWD.

Table 5-1
Modeled LBWD Wet Wells

Model ID	Description	Invert Elevation (ft)	Maximum Depth (ft)	Wet Well Area (sq ft)
W-LS1	LBWD Station 01 Wet Well	-8.00	27.00	192.00
W-LS2	LBWD Station 02 Wet Well	25.50	26.50	84.00
W-LS3	LBWD Station 03 Wet Well	17.00	14.00	70.00
W-LS4	LBWD Station 04 Wet Well	-6.16	20.66	77.00
W-LS5	LBWD Station 05 Wet Well	-8.03	16.65	58.00
W-LS6	LBWD Station 06 Wet Well	-9.83	22.33	97.00
W-LS7	LBWD Station 07 Wet Well	-18.50	23.83	70.00
W-LS8	LBWD Station 08 Wet Well	-9.83	22.33	84.00
W-LS9	LBWD Station 09 Wet Well	-5.18	19.68	19.00
W-LS10	LBWD Station 10 Wet Well	-13.08	17.96	183.78
W-LS12	LBWD Station 12 Wet Well	-18.00	23.00	146.48
W-LS18	LBWD Station 18 Wet Well	-10.10	17.90	174.00
W-LS25	LBWD Station 25 Wet Well	-11.17	21.50	108.00
W-LS26	LBWD Station 06 Wet Well	-9.83	22.33	97.00



Long Beach Water Department Sewer Model Network

Key to Features

- Outfall
- CSDLAC Pump Station
- LBWD Pump Station
- Force Main
- Siphon
- CSDLAC Pipe
- LBWD Sewer Pipe
- Service Area Boundary

Basemap Source: ESRI

N

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMPU_ModelNetwork.mxd

MWH **Figure 5-1**

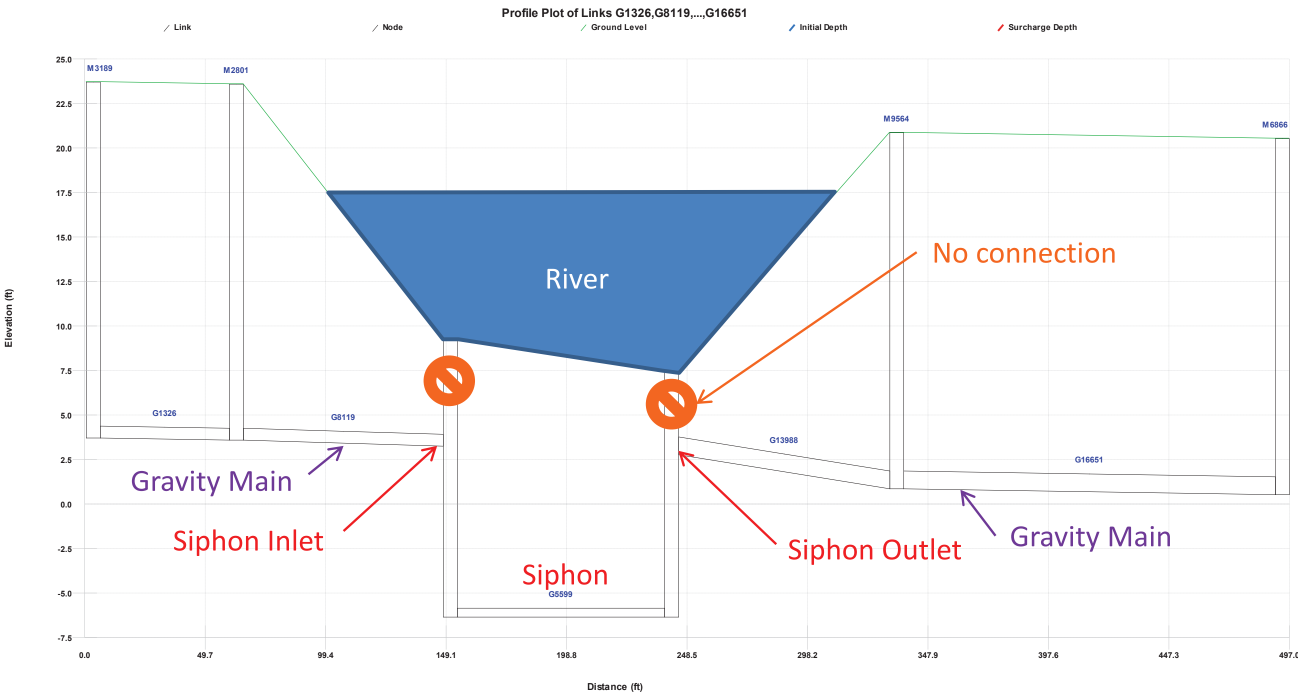
5.1.2.2 Siphons

Sixteen siphons are modeled in the hydraulic model as discussed in Section 3.1.2. These siphons are identified by the LBWD GIS as either a 60-day, 90-day, or 180-day siphon under its "Remarks" field, discovered through manual inspection of the GIS based sewer system, or indicated in design drawings and record drawings received for this SMPU. Depth and elevation information of the siphons are verified using design drawings. A summary of the modeled siphons are shown in **Table 5-2**. Depending on the configuration of the pipes in the GIS database, siphons are shown as one pipe to represent a single barrel siphon or two pipes to represent a double barrel siphon. In cases where there are discrepancies between the GIS database and the record drawings, information contained in the record drawings are considered to be take precedence.

For example, there are some cases where one pipe segment in the GIS database to represent a single barrel siphon; however, the record drawing for that same pipeline indicates the presence of a double barrel siphon. A profile of a typical siphon represented in the model is shown in **Figure 5-2**.

Table 5-2
Summary of Modeled Siphons

Model Siphon ID	Diameter (in)	No. of Barrels	Location
G13378	10	1	Gardenia Ave. and Roosevelt Rd.
G16181	15	1	Arbor Rd. between Clark Ave. and Charlemagne Ave.
G7159, G9287	10, 8	2	Willow St. and Los Cerritos Channel
G5150	10	1	Pacific Ave. and Broadway
G11176, G14848	10, 10	2	Cherry Ave. and Carson St.
G8038	6	1	N/S Alley of E/O St Joseph Ave. between 2nd and Livingston
G18978	10	1	Elm Ave. between 46th St. and 47th St.
G6174, G5599	10, 10	2	N/S Alley of E/O Neapolitan Ln. and Naples Canal
CDT-87	12	2	Alamitos Ave. and 10th St.
G20024	12	2	Walnut Ave, and Market St.
G6991, G10436	15, 10	2	Gardenia Ave. and Curry St.
G10005, G9808	10	2	Willow St. and Lakewood Blvd.
G17010	10	1	Walnut Ave. and Jackson St.
G18955	8	1	Cedar Ave. and Market St.
G19076	8	1	Linden Ave. and Market St.
G519, G20004	18, 21	2	Orange Ave. and 10th St.



Note: This is a representation of a siphon in the hydraulic model. There is no physical connection to the siphon and the channel.

Figure 5-2
Profile of Modeled Siphon

5.1.2.3 Outfalls

A model must have at least one outfall to discharge all flows that have been input into the system. Typically, this point would be at a hydraulic cut off, such as a treatment facility. For the LBWD sewer system, outfall points are typically locations where flows leave the LBWD system and enter the CSDLAC system. The CSDLAC system is not analyzed as part of the SMPU. Based on discussion with LBWD staff during the development of the 2008 SMP, downstream effects of flows through the CSDLAC do not significantly impact the LBWD sewer system.

Thirteen outfalls are modeled in the hydraulic sewer system. These outfalls lie at the end of a network of pipes where flow would either discharge to the Joint Water Pollution Control Plant (JWPCP) in the City of Carson or the Long Beach Water Reclamation Plant. A few outfalls have been modeled for a small network of pipes outside of the main collection system. The outfall that represents the flow leaving LBWD pipelines and Lift Station S-05, and entering OCSD pipelines where flow is to be treated at an OCSD treatment plant. Information needed to model an outfall in the InfoSWMM software is its invert elevation, which has been assumed to be the lowest point of the pipe network.

5.1.3 Update Hydraulic Model for Projects Completed Since 2008

The hydraulic model is updated to reflect new sewer pipeline improvement projects since the completion of the 2008 SMP. LBWD provided drawings for several completed construction projects, as well as projects in the design and construction phase during the SMPU. These drawings were used to update information in the hydraulic model, such as changes in pipe size, changes to pipe alignment or connections, and changes to the invert elevations or ground elevations of a maintenance hole. Some of the updates performed in the model do not affect the hydraulics of the system, such as updates to the installation year, project identification number, and material. Model updates that affect the hydraulics of the system include modifications to the invert elevations and pipe sizes.

The projects that are incorporated in the updated model are shown in **Table 5-3**. A more detailed description and information of the model update process is provided in the LBWD Sewer Model Update Technical Memorandum (MWH, 2013), and shown in **Appendix B**. During the model update period, it was found that the pipeline configuration for certain areas near projects being designed or constructed also needed to be reviewed. Drawings for these areas were not provided during the model development for the 2008 SMP, however these drawings were received during the model develop process for this SMPU, and the latest pipeline configuration has been incorporated into the updated model.

Table 5-3
Sewer Pipeline Projects for Hydraulic Model Update

Project Name	Name	Year	Model Update
SC-0120a	Broadway Trunk Sewer Placement/Rehabilitation Project (Phase 1: Microtunneling)	2004	Verified pipeline alignment and updated laterals that tie into the 36" pipeline along Broadway Ave. between Alamitos Ave. and Shoreline Dr.
SC-0143	California Bowl Sewer Lining Rehabilitation Project	2011	Modified pipeline attributes (material, year of installation, and project number).
SC-0147	Broadway Trunk Sewer Replacement/Rehabilitation Project	2007	Realigned pipeline alignments and added new 21" pipeline along Magnolia Ave., between Ocean Blvd. and Broadway Ave. Added new connection of a 21" pipeline on Broadway Ave. to the 36" pipeline.
SC-0171	Broadway Trunk Sewer Replacement/Rehabilitation Project Phase III	2009	Removed abandoned pipeline and increased pipe size along Broadway Ave., between Magnolia Ave. and Atlantic Ave, from 14" to 18". Modified pipeline attributes associated with the pipeline.
SC-0190	Pacific Avenue Trunk Sewer Rehabilitation	2011	Modified pipeline attributes (material, year of installation, and project number).
SC-0191	Orange Avenue/7th Street Sewer Upgrade Project (Location 13 in 2008 SMP CIP)	2012	Increased pipeline size from 8" to 12" on 7th St. between Orange Ave. and Walnut Ave. Increased pipeline size from 24" to 30" on Orange Ave., between 7th St. and 11th St. Modified pipeline attributes (material, year of installation, and project number). Modeled the double-barrel siphon along Walnut Ave.
SC-0193	Sanitary Sewer Pipeline Replacement Project – Phase 1	2012	Modified pipeline attributes (material, year of installation, and project number).
SC-0212	28th Street Sanitary Sewer Pipeline Improvements Project (Location 11 in 2008 SPM CIP)	2012	Increased pipeline size from 12" to 15" on W. 28th St., between Eucalyptus Ave and Pine Ave. Modified pipeline attributes (material, year of installation, and project number).
SC-136	Broadway Golden Elementary School	2002	Removed pipe segment on Oro Way.
SC-0225	Orange Ave/Del Amo Blvd/walnut Ave Sewer Upgrade Project (Location 13 in 2008 SMP CIP)	2013	Modified pipe size from 12" to 15" on Walnut Ave., between Jackson St. and Market St. Rerouted new 12" double-barrel siphon to connect to 33" CSDLAC line at Market St. and Walnut Ave. Updated changes to material, year of installation, and project number.
SC-0228	15th Street and Cherry Avenue Sewer Upgrade Project (Location 9 in 2008 SMP CIP)	2012	Modified pipe size from 8" to 12" on 15th Street between Cherry Ave. and Dawson Ave. Updated changes to material, year of installation, and project number
MC-5056	Pacific Coast Highway Sanitary Sewer Project (Location 12 in 2008 SMP CIP)	2013	Modified pipe size from 8" to 12" on PCH from alley east of Pine Ave. and alley west of Pine Ave. Update pipe size from 12" to 15" on PCH from alley west of Pine Ave. to alley west of Cedar Ave., and going south of 17th St. to the CSDLAC connection. Updated changes to material, year of installation, and project number.
N/A	Market Street Drain (CSDLAC Project)	1995	Modified pipe size and invert elevations to model an 8-inch siphon near Cedar Ave. and Market St., and an 8-inch siphon near Linden Ave. and Market St.

5.1.4 Allocation of Wastewater Flows

Wastewater flows for existing conditions are based on the flow pattern for the different land uses, per capita flow generation by land use, and the population within LBWD's service area.

To allocate the flows of the existing sewer system within the hydraulic model, the land use within the subbasins are required. Subcatchments are hydraulic units of land whose drainage system elements direct flow to a single discharge point. The subcatchments are created to define a sewershed area encapsulating a network of pipelines. The hydraulic model is divided into 675 polygon subbasins of roughly 30 to 50 acres with 675 receiving nodes (discharge points) associated with each subcatchment. This subbasin size provides a sufficient level of resolution to uniformly apply the wastewater flow components (diurnal curve, population, etc.). The downstream node of each subcatchment, known as the receiving node, is selected to receive the flows collected within the subbasin. Within the GIS, the land use and population data is combined and its information is used to allocate flows into the sewer system model.

The LBWD hydraulic model uses seven different land use categories: low-density residential, medium-density residential, high-density residential, commercial, industrial, open, and undeveloped. The open category includes areas such as the parks and recreational areas that contribute little flow to the sewer system. The undeveloped land use category includes areas that that do not contribute any flow to the sewer system, such as freeways, the Los Angeles River and Los Coyote Flood Channel. Therefore, the flow generation for undeveloped land is zero. A summary of each base dry weather flow allocation criteria are described below.

A flow generation profile is associated with each land use. Seven different profiles are created and input into the model to simulate flow generation variations over a 24-hour period. As described in Section 2, land use changes between 2008 and 2012 are not significant enough to warrant the development of new flow generation profiles for this SMPU. Therefore, profiles generated as part of the 2008 SMP are used in this SMPU. The flow monitoring period during the 2008 SMP occurred between December 2007 and January 2008, thus representing a typical winter day. The flow patterns are described below for each land use category.

5.1.4.1 Residential Flows

Within the hydraulic model, the flows for residential areas are entered into each subbasin. In order to generate base flows for these subbasins, unit flow rate factors are applied to the residential flows in the model. These unit rate factors, typically expressed in per capita units of gallons per person per day (gpcd), can vary significantly for different areas and are influenced by such factors as socio-economics, potable water availability, water use restrictions, land use type (e.g., residential, commercial, industrial, etc.) and development density.

As part of the 2008 SMP, the unit flow rate factor in the calibrated model was 95.1 gpcd for all residential type flows. Given that land use and population for LBWD's service area have not changed significantly since 2008, it is recommended that a unit flow rate factor of 95.1 gpcd be used for this SMPU.

In addition to unit rate flow generation values, diurnal patterns are also developed specific to different land use types. Weekend and weekday diurnal patterns are developed. The flow pattern exhibited in residential homes varies between a typical weekday and weekend. Typical weekday residential profile characteristics include a low and steady flow between the hours of 12:00 A.M. and 4:00 A.M and a morning peak generally between 6:00 A.M. and 9:00 A.M. For this model, there are two residential profiles during the weekday and one residential profile during the weekend as shown on **Figure 5-3**. One weekday profile is designated for low-density residential homes, and the other weekday profile is designated for medium and high-residential homes.

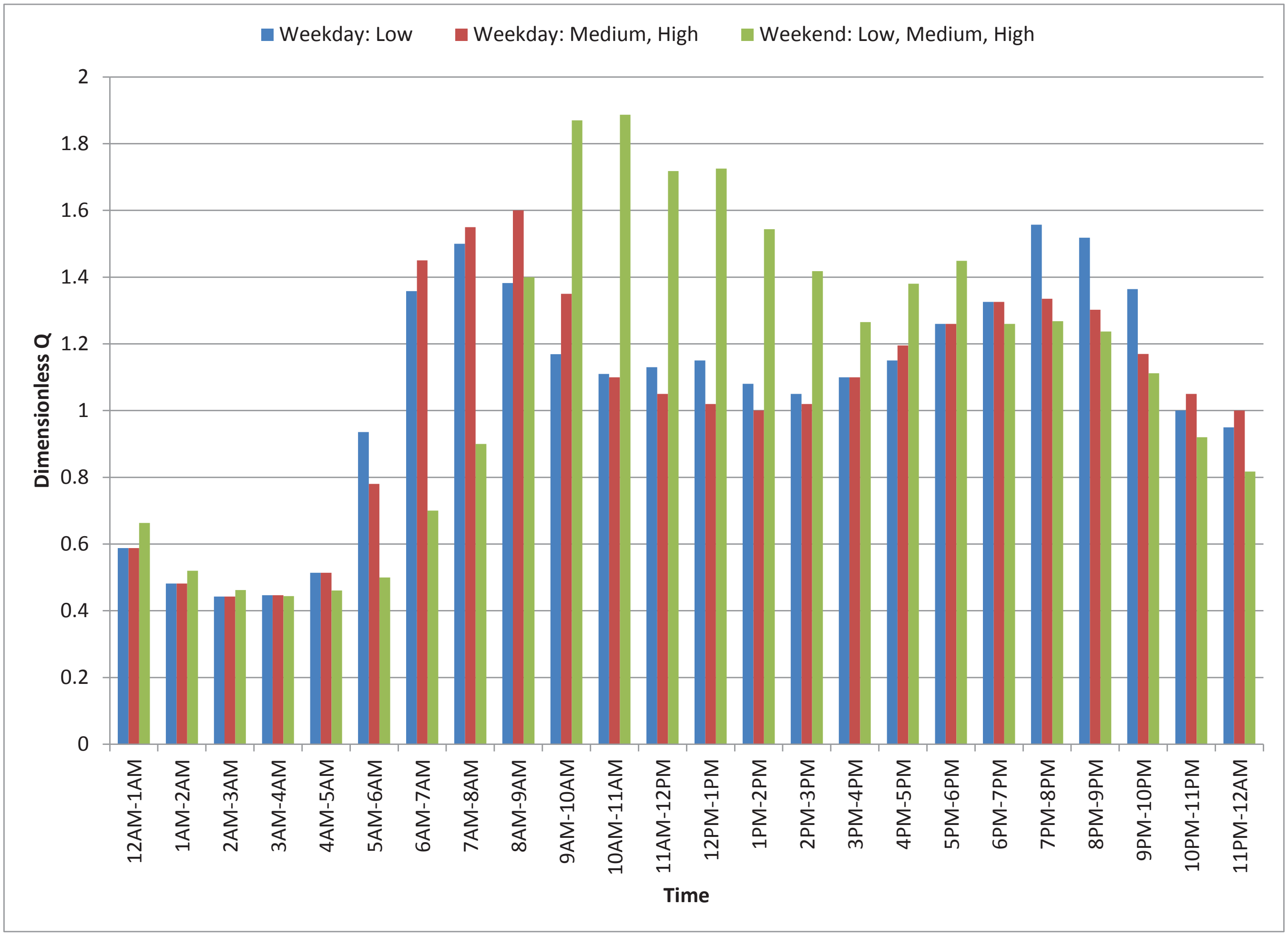


Figure 5-3
Diurnal Pattern for Residential Land Use

5.1.4.2 Commercial and Industrial Flows

Diurnal patterns similar to the residential diurnal patterns described above are developed for industrial and commercial sources. Land use codes based on LBWD Land Development Department's zones are used to classify properties as industrial, commercial, open, or undeveloped. These classifications are used to assign representative diurnal flow distribution patterns. For example, property identified as industrial factories might operate 24 hours per day whereas many commercial properties operate only during normal business hours.

Commercial areas are scattered throughout the City, therefore, a distinct commercial profile pattern cannot be distinguished through the flow monitoring data as it is achieved for the residential profiles. For areas receiving flow that are not exclusively from a commercial land use type, the commercial profile is incorporated into a mixed used profile, which also includes open land use types. The mixed use profile is determined by using the flow monitoring pattern of areas with a large percentage of non-residential land use type and a variety of open, commercial, and small industrial use types. Open areas include parks and recreational areas. Multiple mixed use patterns for weekday and weekend conditions are shown on **Figure 5-4** and **Figure 5-5**.

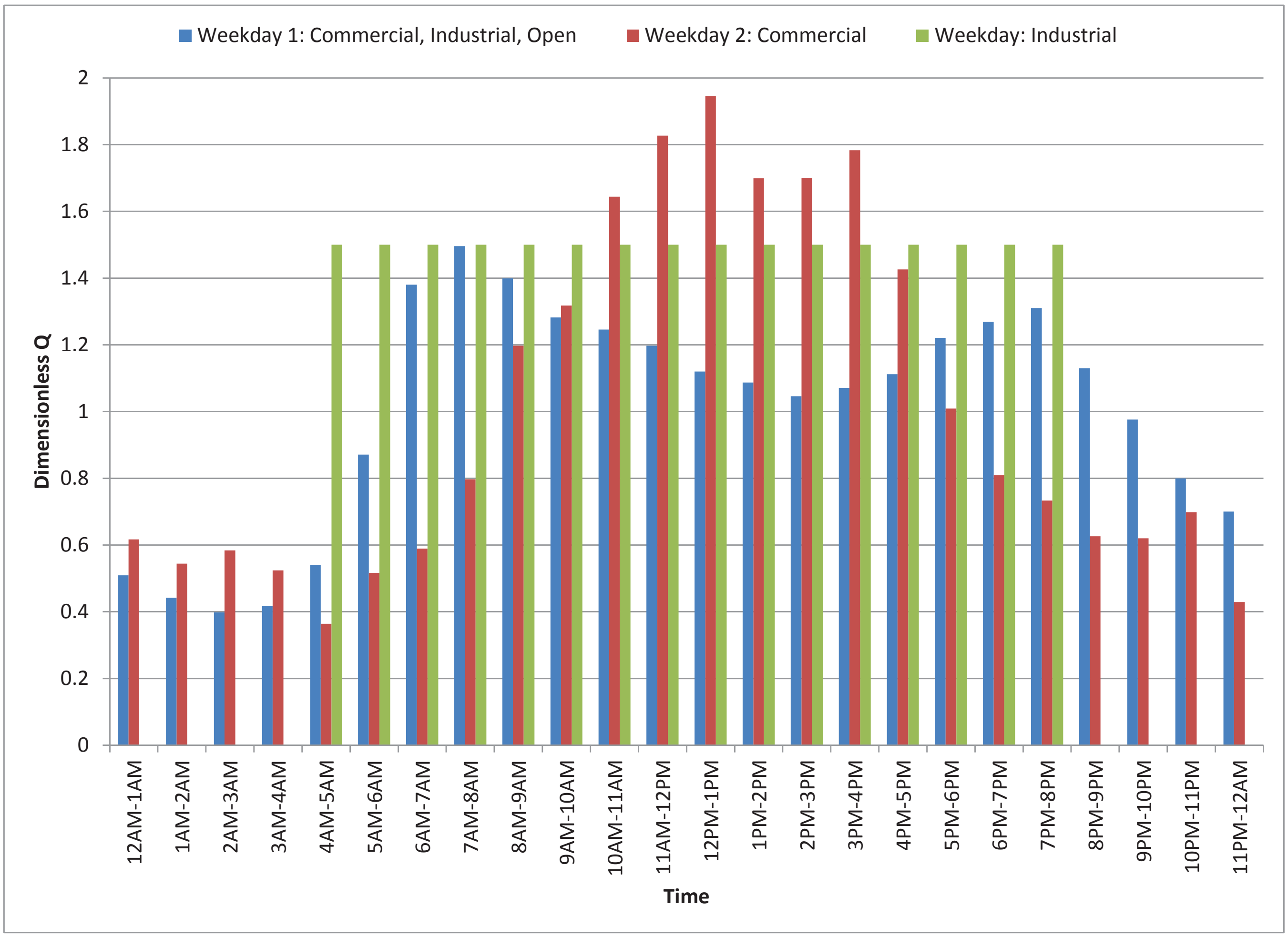


Figure 5-4
Diurnal Pattern for Commercial and Open Land Use during Weekday Conditions

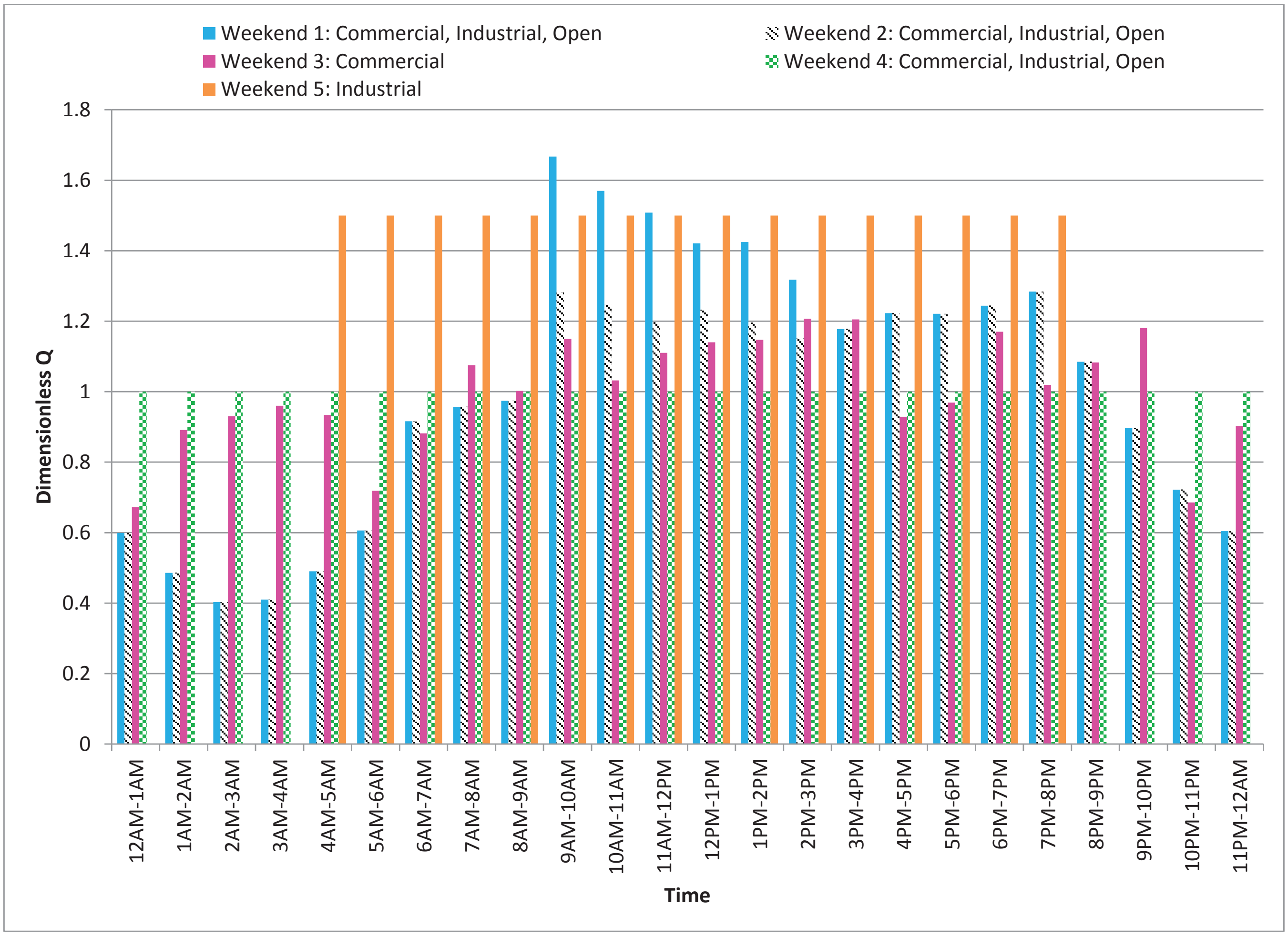


Figure 5-5
Diurnal Pattern for Commercial and Open Land Use during Weekend Conditions

In addition to defining industrial and commercial flows by land use codes, it is recognized that there are a number of large industrial customers that contribute significant wastewater flow to the system. To account for these large flows, permits for Industrial Wastewater Discharge issued by the Sanitation Districts of Los Angeles were reviewed during the 2008 SMP project. Based on discussions with LBWD staff, no new large industrial users were added to the system since the completion of the 2008 SMP. The updated model includes the large industrial users included in the 2008 hydraulic model. Industrial users with an average flow rate recorded on their permit that are greater than about 100 gallons per minute are added to the a receiving node in the model. The receiving node for each large industrial user is selected as the nearest node to the discharge address of the permit. The diurnal profile of each user is based on the days and times of operation indicated in the permit (i.e., the discharge pattern throughout a 24-hour period). The large industrial customers that are included in the model have a total flow of about 2.8 MGD and are listed in **Table 5-4**.

Table 5-4
Large Industrial Customer Pattern of Discharge[(1)]

No.	Model Node ID	Customer	Address	Average Flow (gpd)	Average Instantaneous Flow (MGD)	Hours of Operation	Days of Operation
1	JCT-2268	Water Replenishment District of Southern California	7380 E. Willow Street	760,000	0.76	12AM-12AM	Sunday-Saturday
2	M14087	Republic Master Chefs	1340 Orizaba Avenue	750,000	0.75	4AM-9PM	Monday-Friday
3	M6582	BreitBurn Energy Company, Inc..	6433 Westminster Avenue	360,440	0.36	12AM-12AM	Sunday-Saturday
4	M1192	International Garment Finish Corporation	2144 Gaylord Street	250,000	0.25	6AM-6PM	Monday-Friday
5	M9226	Department of Veterans Affairs Medical Center	5901 E. 7th Street	182,986	0.183[(2)]	12AM-12AM	Sunday-Saturday
6	M13197	Edginton Oil Company, Inc.	2400 E. Artesia Boulevard	180,000	0.18	12AM-12AM	Sunday-Saturday
7	M16184	TABC, Inc.	6375 Paramount Boulevard	152,000	0.152	12AM-12AM	Monday-Friday
8	M1109	Long Beach Water Department	3610 E. Spring Street	118,003	0.118	12AM-12AM	Sunday-Saturday
9	M2744	Crosby & Overton, Inc.	1630 W. 17th Street	31,900	0.032	6AM-12AM	Monday-Friday
10	M16301	Robertshaw Control Co.	100 W. Victoria Street	14,710	0.015	12AM-12AM	Monday-Friday
11	M8453	G&M Oil Company, Inc.	5790 E. 2nd Street	7,200	0.007	12AM-12AM	Sunday-Saturday
			Total	**2,807,239**	**2.807**		

1. Large industrial customers based on information from Industrial Water Discharge Permits received January 2008.
2. Flows reduced during recalibration on of Flow Monitor 12 subcatchment area as discussed in Section 5.1.2.

5.1.4.3 Total Base Flows

In summary, base flows within the LBWD hydraulic model are computed in the following manner for each subbasin. The groundwater and seawater infiltration factor is already implicitly included in the diurnal profile and thus the factor is not explicitly stated in the following equation.

The residential flows for each catchment are calculated using the following formula:

Total Residential Flow = Catchment Population x Unit Flow Rate Factor (95.1 gal/p/d) x Diurnal Multiplier

The industrial and commercial flows for each catchment are calculated using the following formula:

Total Industrial & Commercial Flow = [Catchment Population x Unit Flow Rate Factor (95.1 gal/p/d) x Diurnal Multiplier] + Average Flow Rate Derived from CSDLAC Permit

As base flows are computed for each modeled catchment the flow is routed to the modeled network via the assigned load points (i.e., receiving node of the subbasin). These load points are nodes in the model where the catchments are connected to the collection system.

Flows that are generated by land use and population, in addition to the large industrial flows, for existing and future conditions are summarized in **Table 5-5**. Flows that will be generated in the year 2035 are approximately 20 percent greater than existing 2013 flows, with an increase of about 9.5 MGD from 45.9 MGD to 55.4 MGD. This increase is attributed to an increase in the projected population within LBWD's service area between year 2008 and year 2035. Population projections developed in the 2008 SMP indicated a 20 percent increase for LBWD's service area between year 2008 and year 2035. However, based on the 2010 population data from the United States Census Bureau, the population is expected to increase 16 percent between year 2010 and year 2035 within LBWD's service area. Future flows in the model are not adjusted to account for the projected decline in year 2035 population based on the 2010 census data. Future flows in the model are based on the flows developed for the 2008 SMP which make the hydraulic model conservative for the purposes of planning.

Table 5-5
Existing and Future Flows by Land Use Type

Land Use Type	2013 Existing Flows (MGD)	2035 Future Flows (MGD)
Low-Density Residential	27.1	33.2
Medium-Density Residential	2.4	2.9
High-Density Residential	5.1	6.4
Commercial	7.6	9.1
Open	0.5	0.6
Industrial(1)	3.2	3.1
Total	**45.9**	**55.4**

Industrial flows include the 2.8 MGD of large industrial customers.

5.2 Model Validation

Dry weather flows are assumed to be representative of the base flows for LBWD's system. These are flows that occur normally in a sewer system without the influence of wet weather conditions. Allocation of wastewater base flows for existing conditions is based on the flow pattern for the different land uses within LBWD's service area and population. The flow patterns are dimensionless diurnal patterns that are developed based on flow monitoring data of actual flows within the LBWD system. Details on the flow allocation within the hydraulic model are provided in Section 4.2 of the 2008 SMP.

As discussed in **Section 2** of the SMPU, the minor change in population over the last decade for the City of Long Beach indicates that the sewer flows developed in the hydraulic model as part of the 2008 SMP to represent existing conditions are valid for this SMPU. Based on a review of land use and population data with LBWD, it was agreed that new sewer flows will not be developed as part of this SMPU to model existing sewer flows. Rather the flows in the model will be validated by conducting flow monitoring at selected locations.

A flow monitoring plan was implemented during the early stages of the project to compare actual sewer system flows with the simulated flows in the hydraulic model. Twelve flow monitoring locations were selected throughout the system to conduct the following:

1. Collect representative sewer flows in the collection system to validate the updated 2008 SMP hydraulic model to dry weather flow conditions. Collect sewer flows in areas of potential or known high infiltration/inflow (I/I).
2. Eight of the 12 locations are selected as potential areas of high I/I based on the 2008 Flow Monitoring report and input from LBWD staff.

The locations of the twelve flow monitors and their sewer catchment areas are shown on **Figure 5-6**. Details on each monitored location and further information on the flow monitoring plan is presented in **Appendix B**. Flow monitoring was conducted for a consecutive two-week period from January 5, 2013 through January 18, 2013. Flow monitoring data collected from all twelve locations are shown in a report provided by Downstream Services, Inc. (DSI) and shown in **Appendix C**.

5.2.1 Dry Weather Flow Recalibration

Dry weather flow follows different diurnal patterns and flow volumes during the weekdays as compared to weekends. Therefore, The LBWD sewer system is analyzed for both typical weekday and weekend conditions. For example, a typical residential weekday diurnal displays an early morning peak followed by a sharp decline in the afternoon and another peak during the evening. The weekend pattern does not display the same sharp peak, but rather the peaks are spread out over a longer period of time.

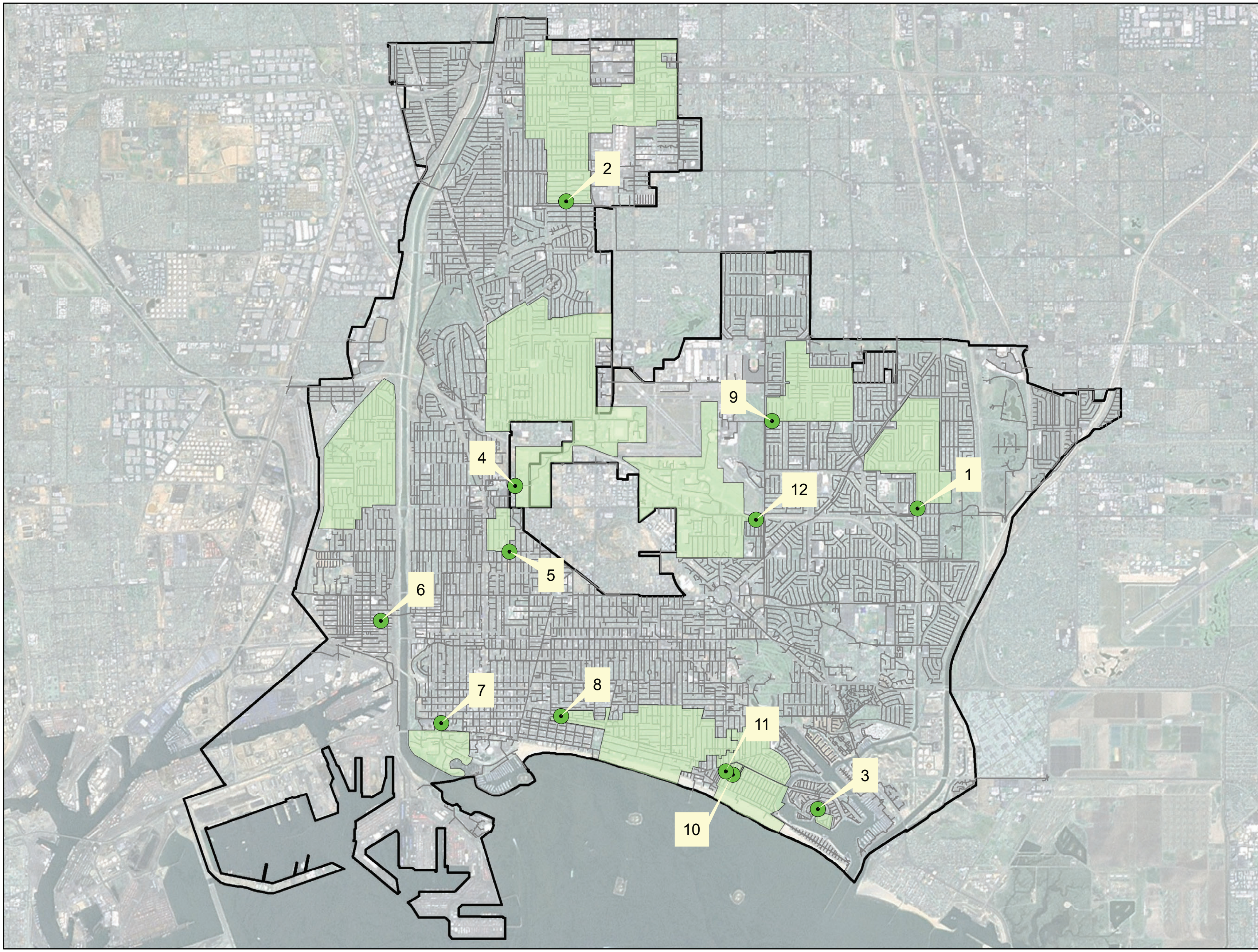
From the two weeks of flow monitoring data, the model validation process was performed by selecting flows for two weekdays and two weekend days within the monitored period. Two days are selected so that one can be used for validation (or recalibration) and another for verification. Flow monitoring data from January 9, 2013 was used for the weekday dry weather flow validation. Flow from January 15, 2013 was selected as another weekday to verify flows. Therefore, the model output for weekday conditions was validated against two 24-hour period weekdays. Flow monitoring data from January 12, 2013 was used for the weekend dry weather flow validation. Flow from January 5, 2013 was selected as another weekend day to verify flows. Adjustments to the model are not made under a verification run; the verification day is used to test whether results from the simulation match the field data.

Once the validation and verification days are selected for each weekday and weekend condition, actual flow data was matched against the modeled flow results to determine how well the hydraulic model results compares against new flow monitoring data. The modeled results were validated to check that modeled peak flow values and flow volumes match measured values within acceptable tolerances.

There are several locations where the flows upstream of a monitor have changed significantly compared to flows monitored in January 2008. Flow Monitor Sites 4, 10, and 12 were identified as areas that needed to be recalibrated because of a large decrease in flows since 2008. Other flow monitoring locations that needed to be calibrated are areas that were not monitored for the 2008 SMP. Flow Monitor Sites 5 and 7 were identified as new areas and needed to be calibration. Flow Monitor Site 3 was also a new location; however, the model results at this location correlate well with actual 2013 field data, therefore calibration at this new location was not needed. Once the five locations (i.e., Flow Monitoring Sites 4, 5, 7, 10, and 12) were identified for recalibration/calibration, comparison graphs for each location were reviewed again to confirm the model is ready for hydraulic analysis.

The comparison graphs showing the model calibration results, flow monitoring results from January 2013, and also flow monitoring results from January 2008 for any repeated location from the 2008 SMP are shown in **Figure 5-7** through **Figure 5-30**.

Additional comparison graphs for the model validation results, and a table comparing measured and modeled values is included as a summary page in **Appendix D**.



Long Beach Water Department Flow Monitoring Locations

Key to Features

Flow Monitoring Locations

Sewer Pipes

Flow Monitoring Sewer Shed Areas

City of Long Beach Boundary

Basemap Source: ESRI

0 1 2 Miles

N

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMPU_Flow MonitorAreas.mxd

MWH

Figure 5-6

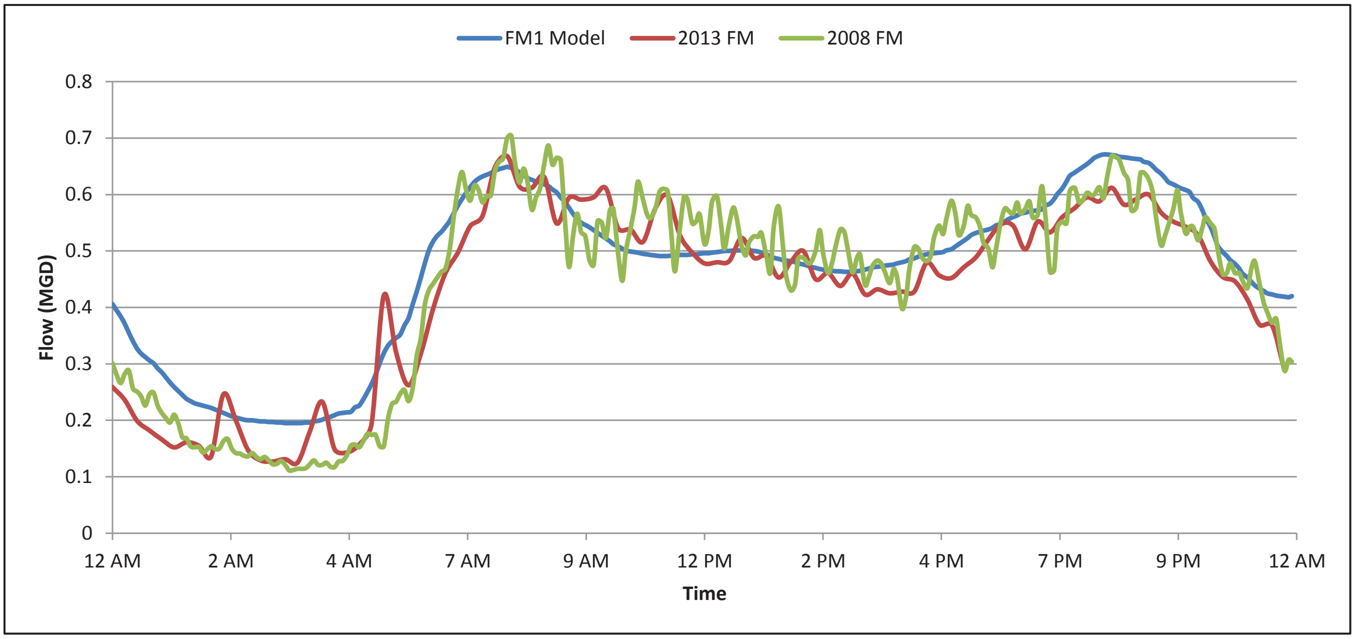


Figure 5-7
Weekday Calibration (Flow Monitoring Site 1)

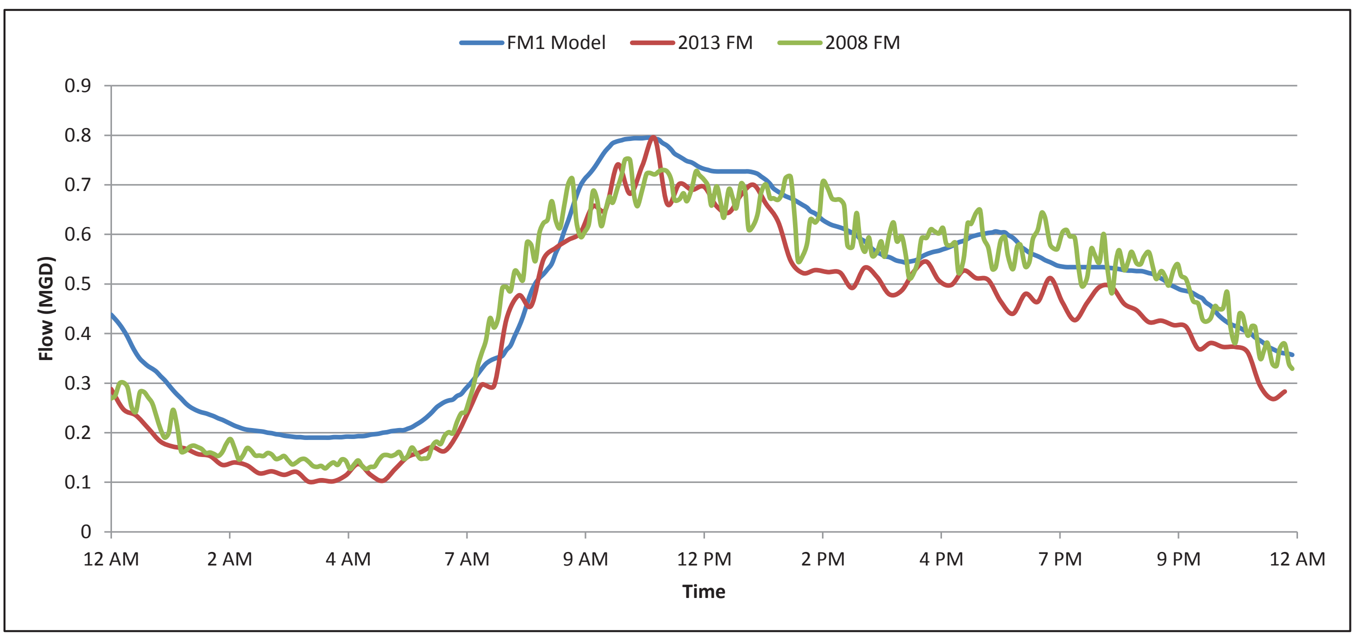


Figure 5-8
Weekend Calibration (Flow Monitoring Site 1)

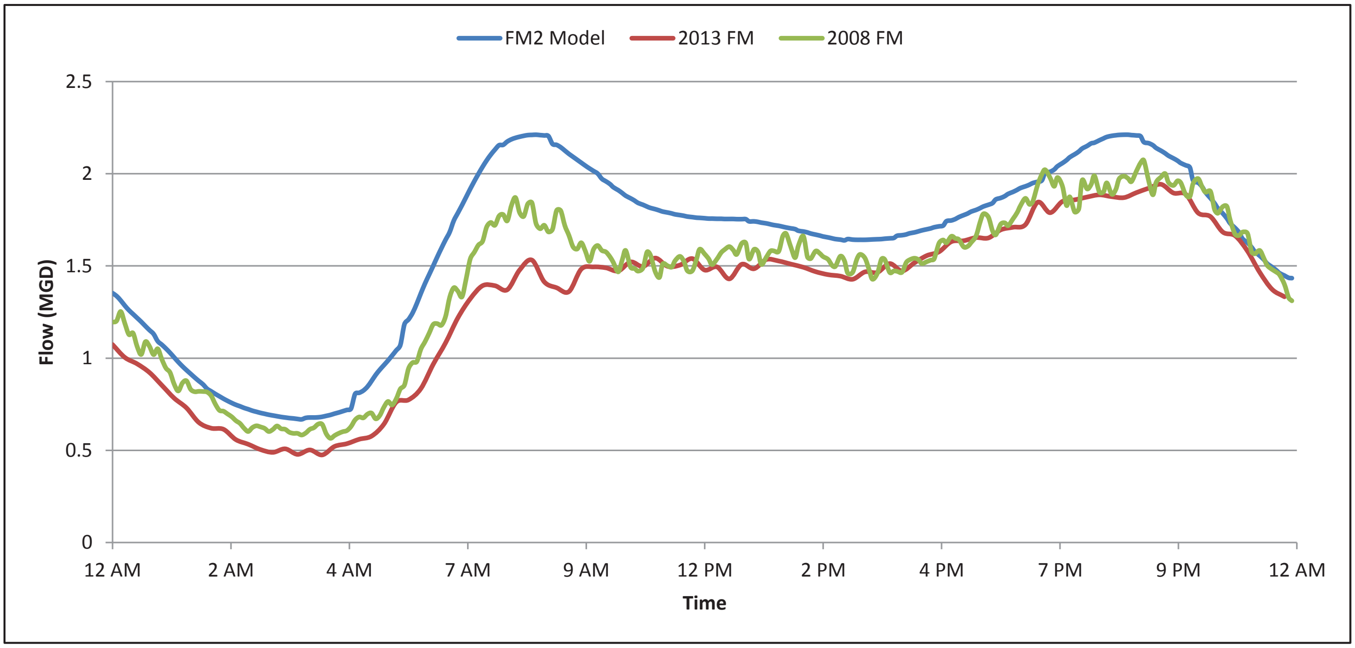


Figure 5-9
Weekday Calibration (Flow Monitoring Site 2)

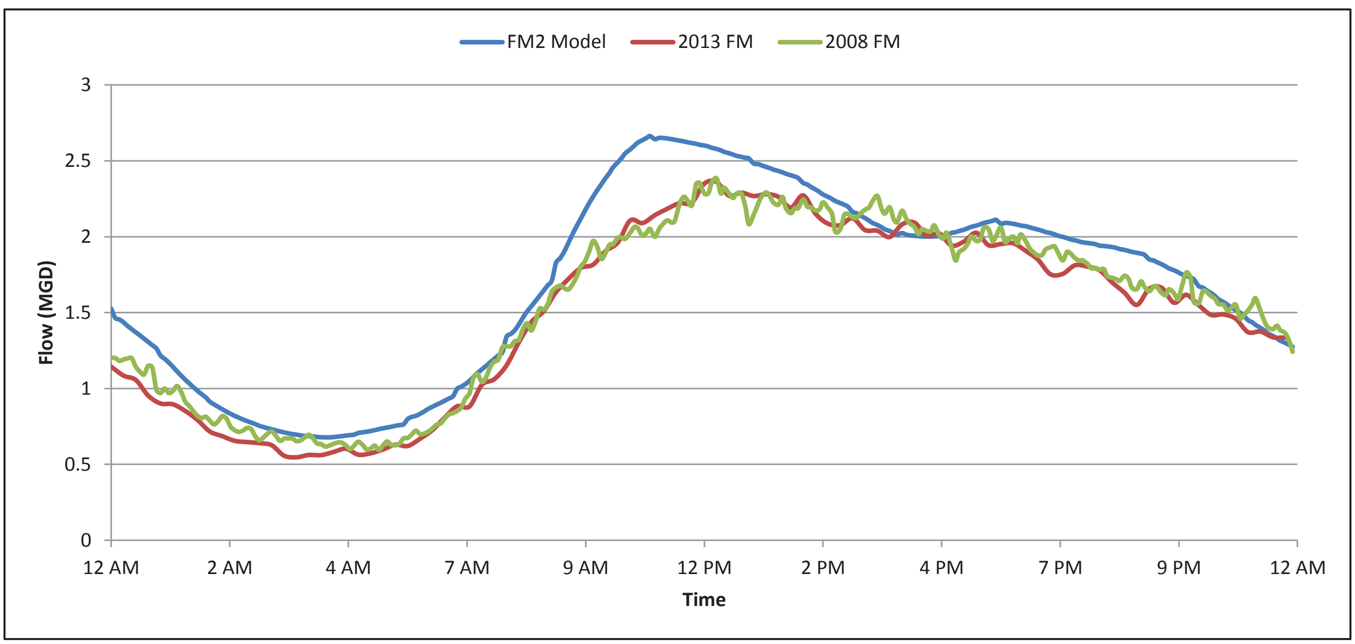


Figure 5-10
Weekend Calibration (Flow Monitoring Site 2)

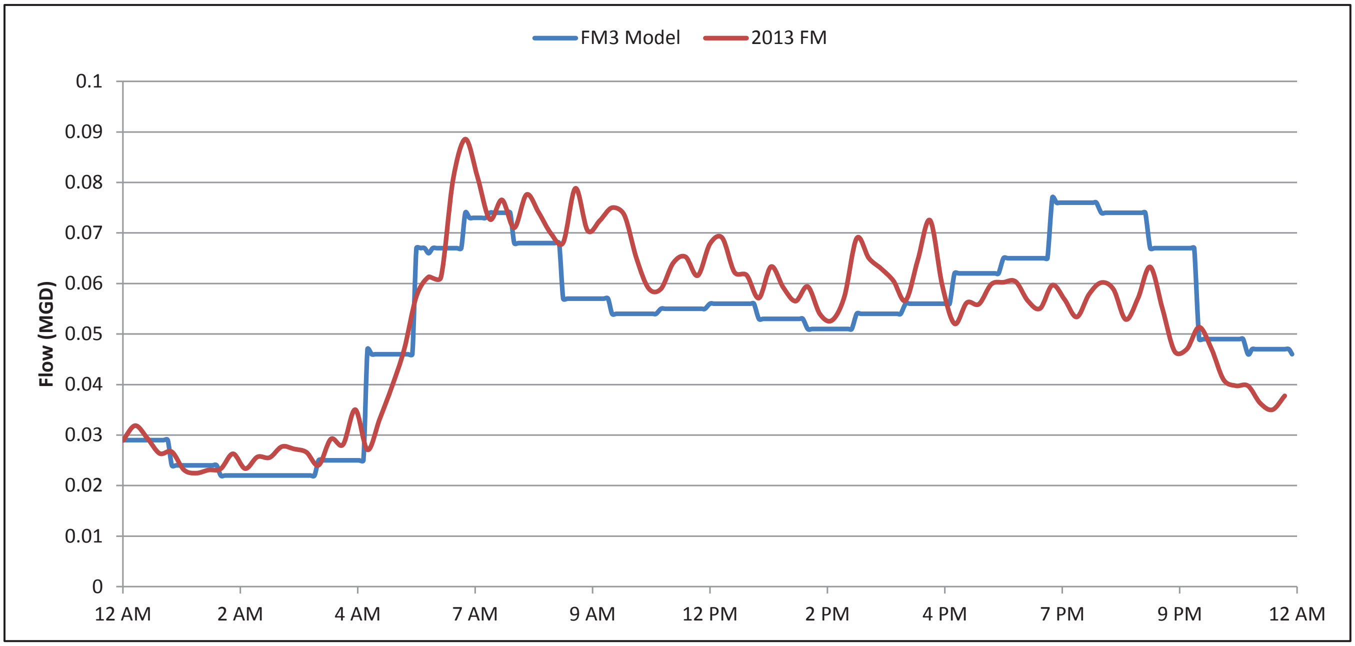


Figure 5-11
Weekday Calibration (Flow Monitoring Site 3)

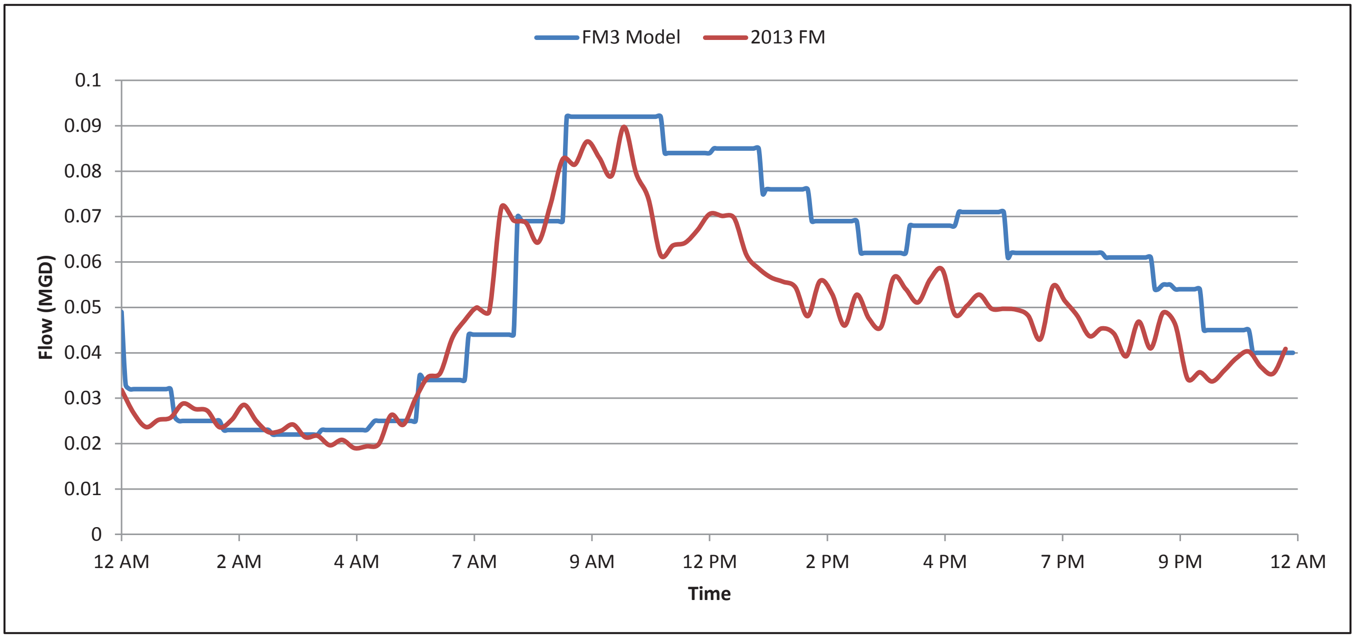


Figure 5-12
Weekend Calibration (Flow Monitoring Site 3)

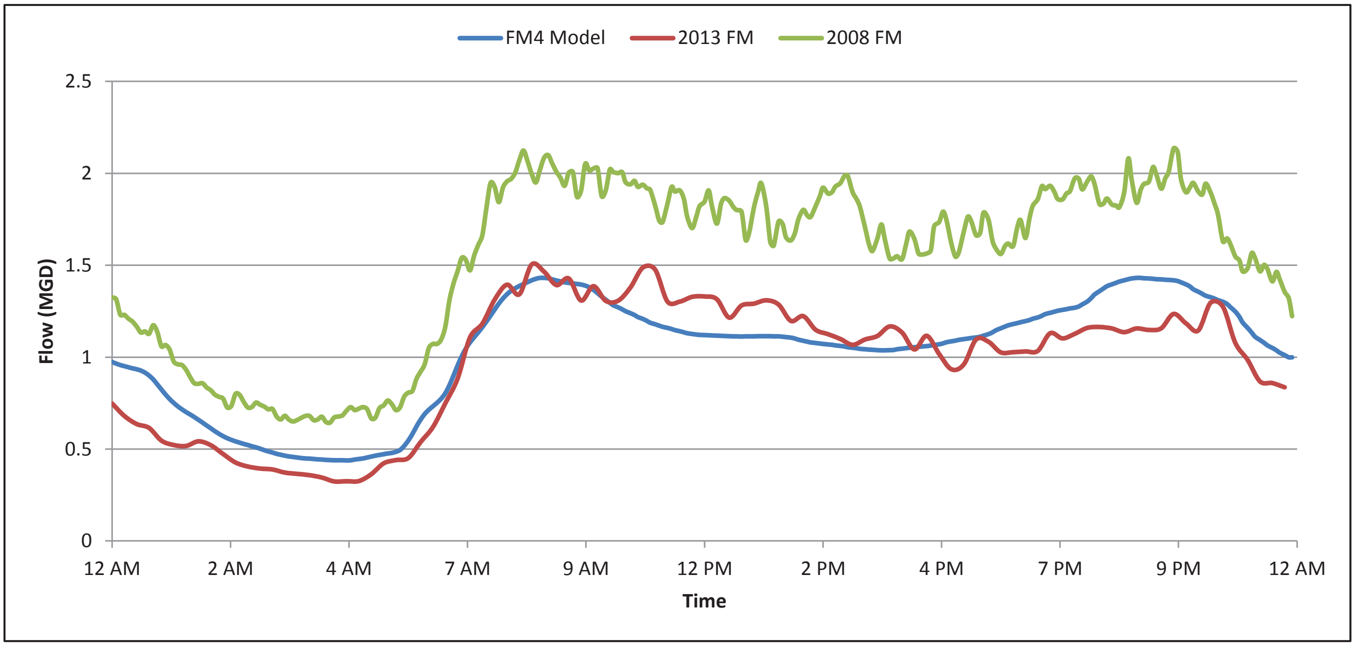


Figure 5-13
Weekday Calibration (Flow Monitoring Site 4)

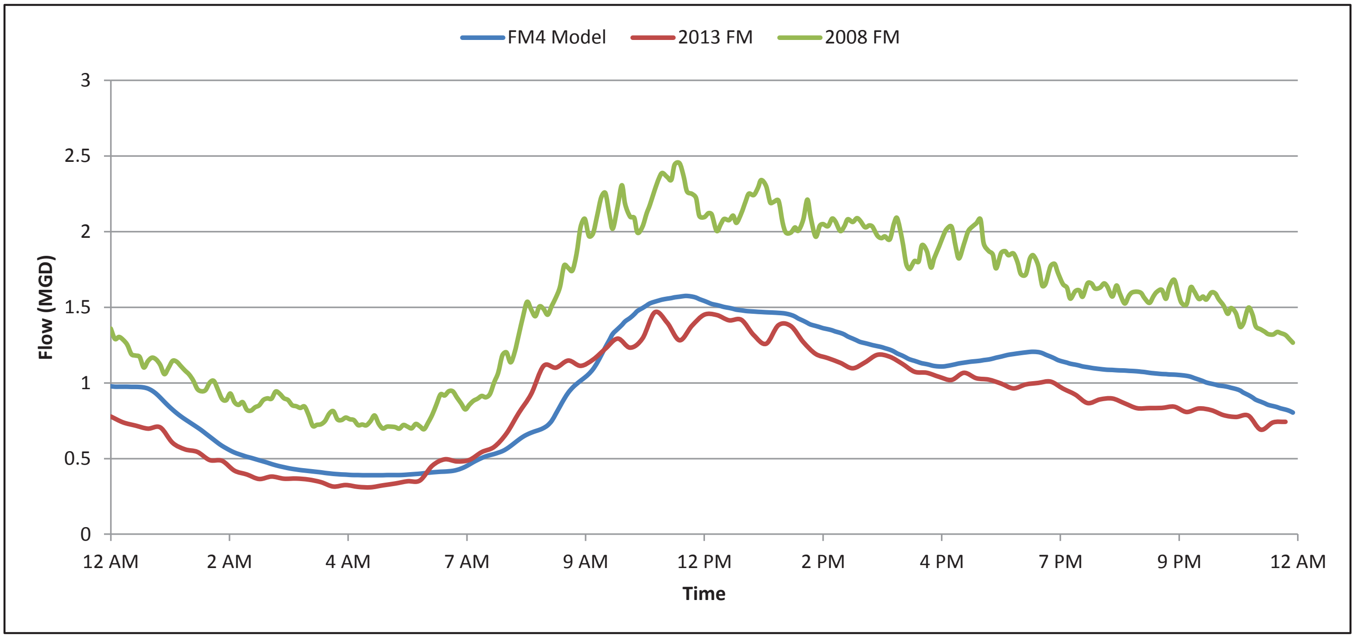


Figure 5-14
Weekend Calibration (Flow Monitoring Site 4)

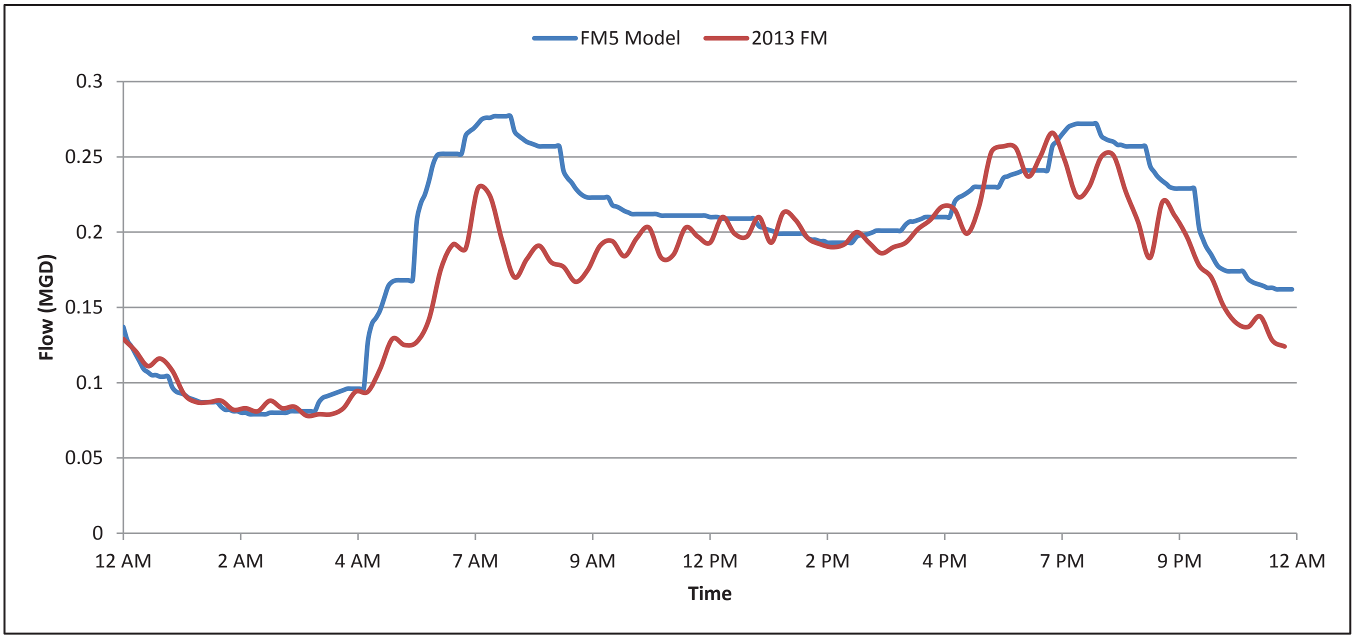


Figure 5-15
Weekday Calibration (Flow Monitoring Site 5)

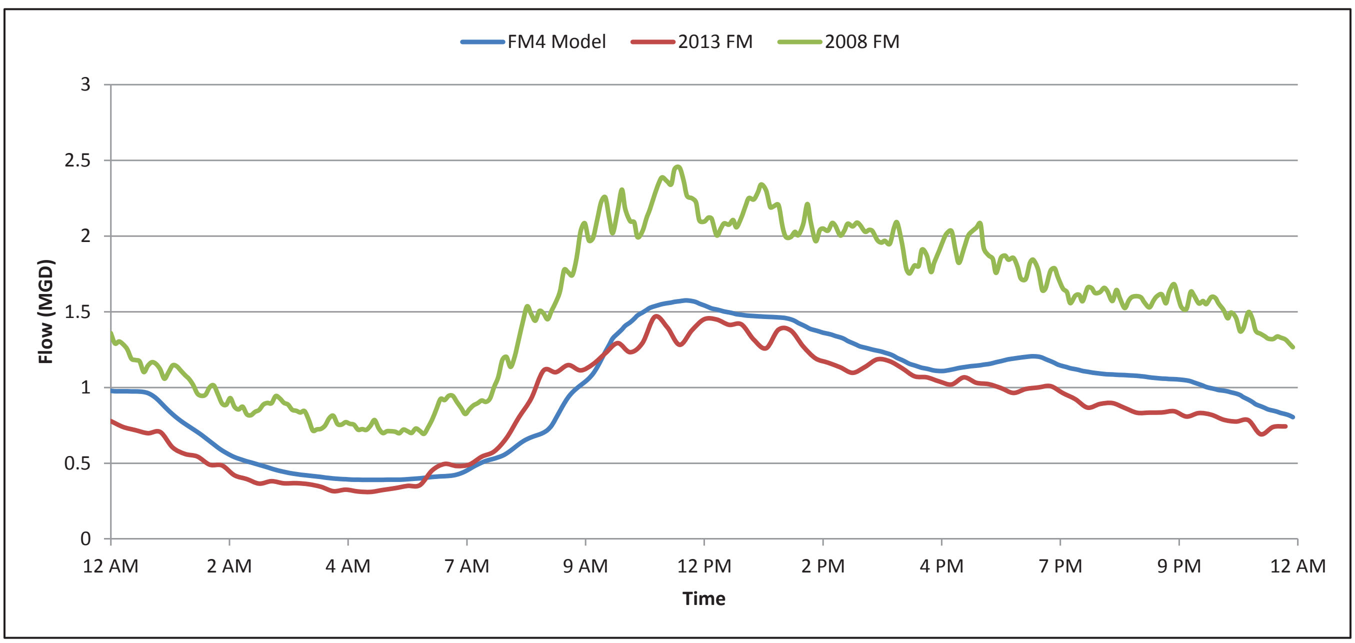


Figure 5-16
Weekend Calibration (Flow Monitoring Site 5)

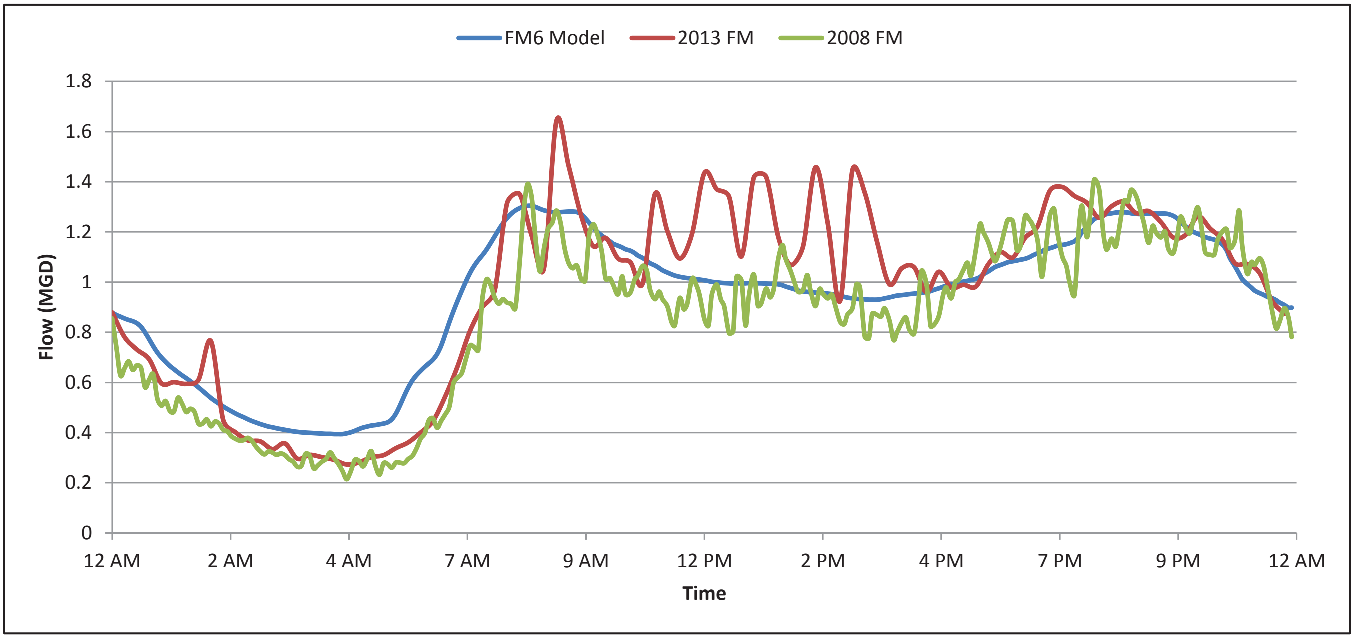


Figure 5-17
Weekday Calibration (Flow Monitoring Site 6)

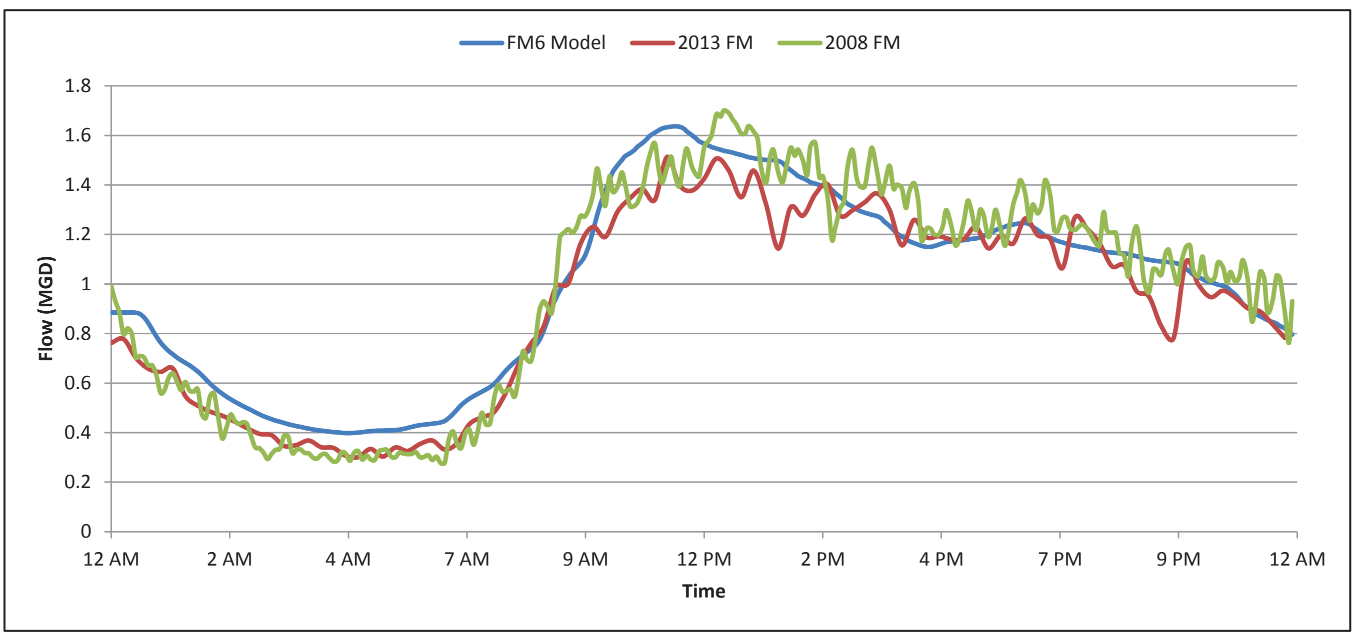


Figure 5-18
Weekend Calibration (Flow Monitoring Site 6)

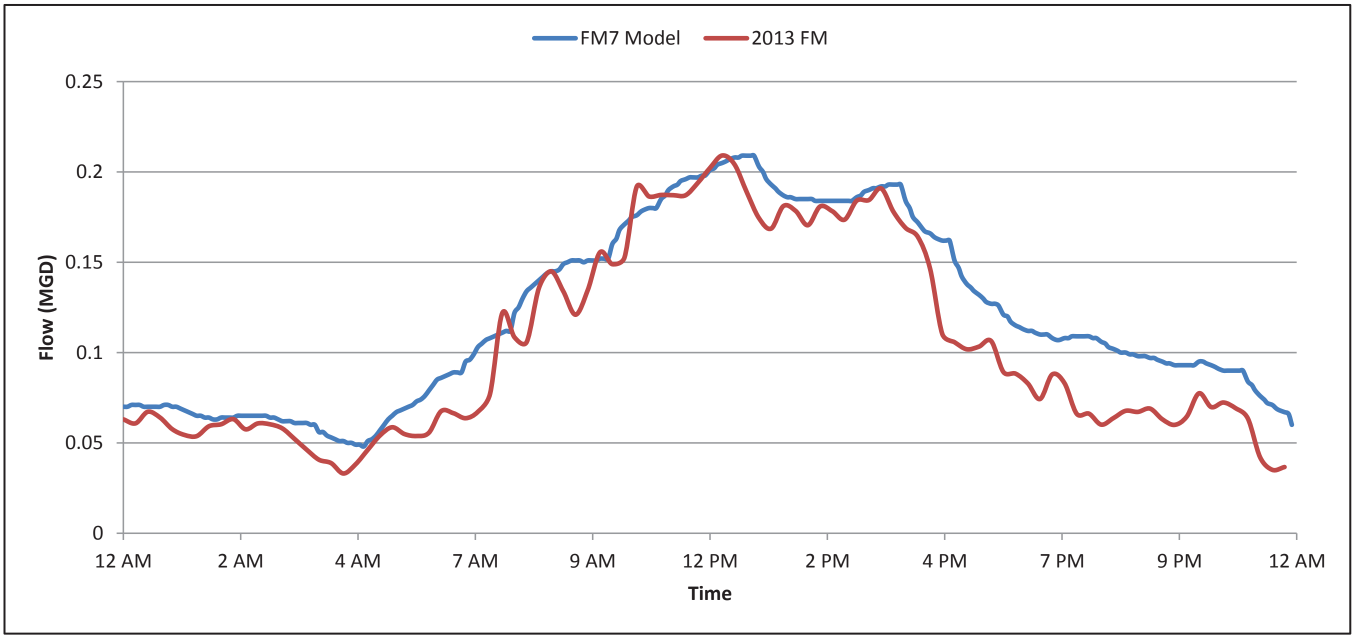


Figure 5-19
Weekday Calibration (Flow Monitoring Site 7)

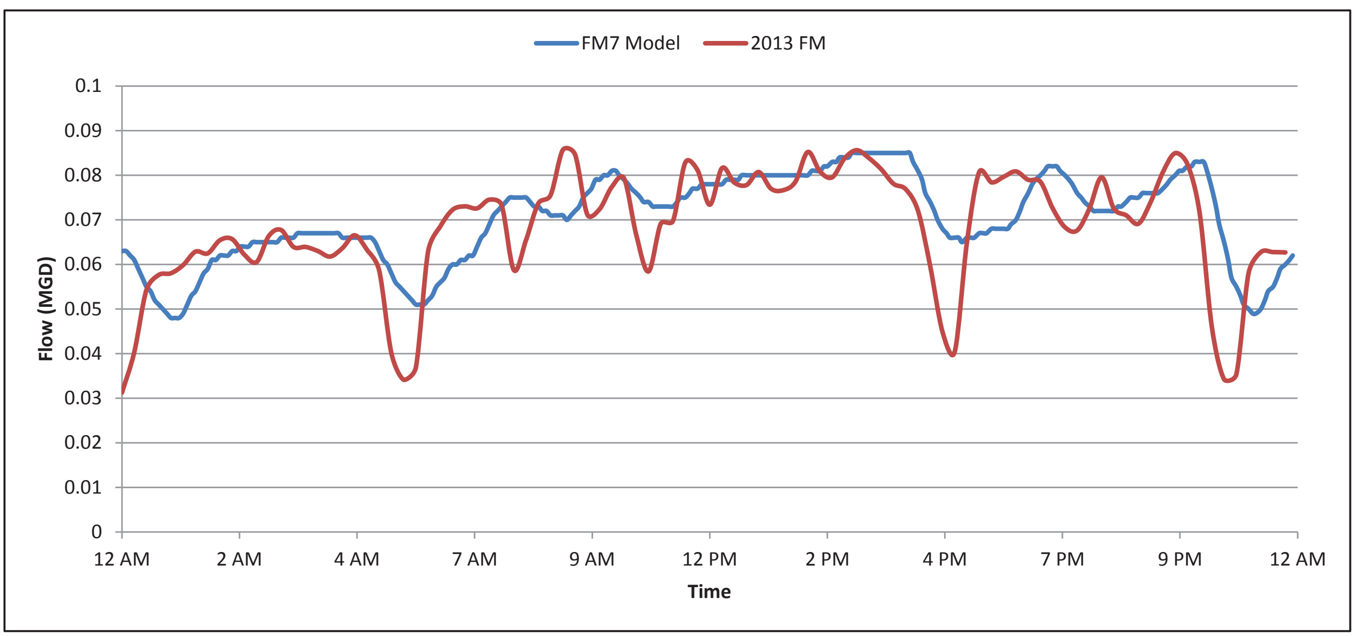


Figure 5-20
Weekend Calibration (Flow Monitoring Site 7)

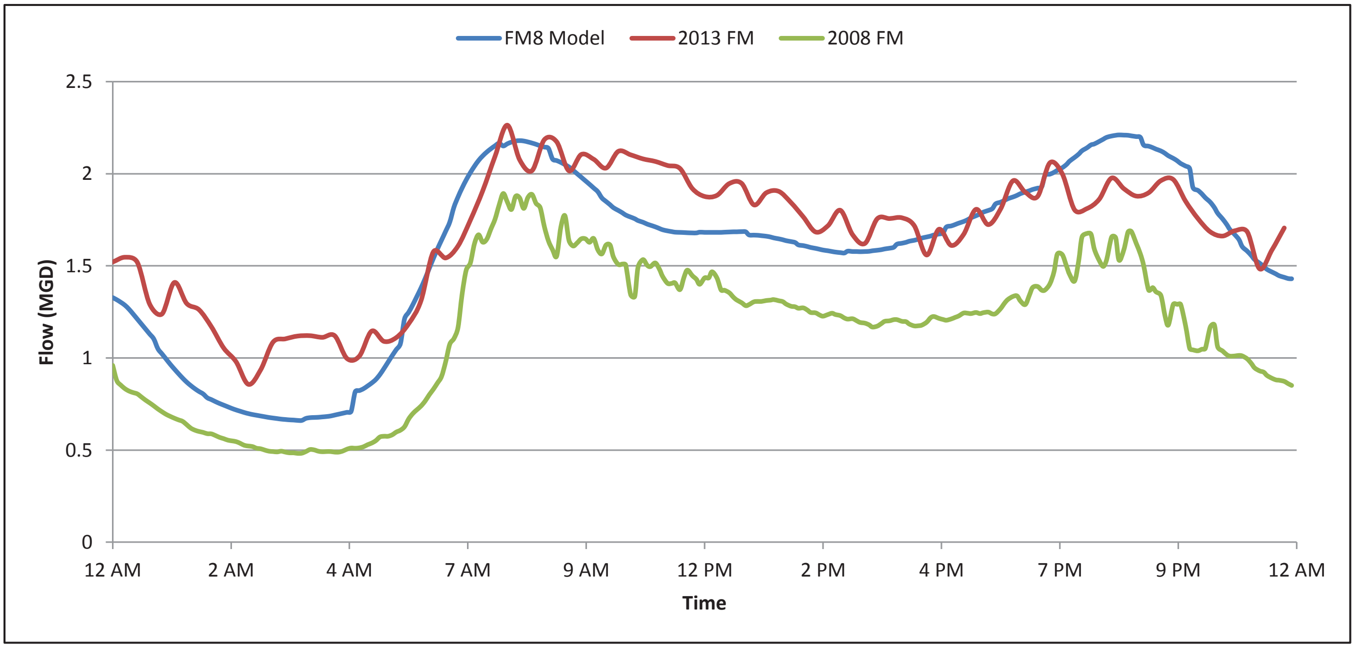


Figure 5-21
Weekday Calibration (Flow Monitoring Site 8)

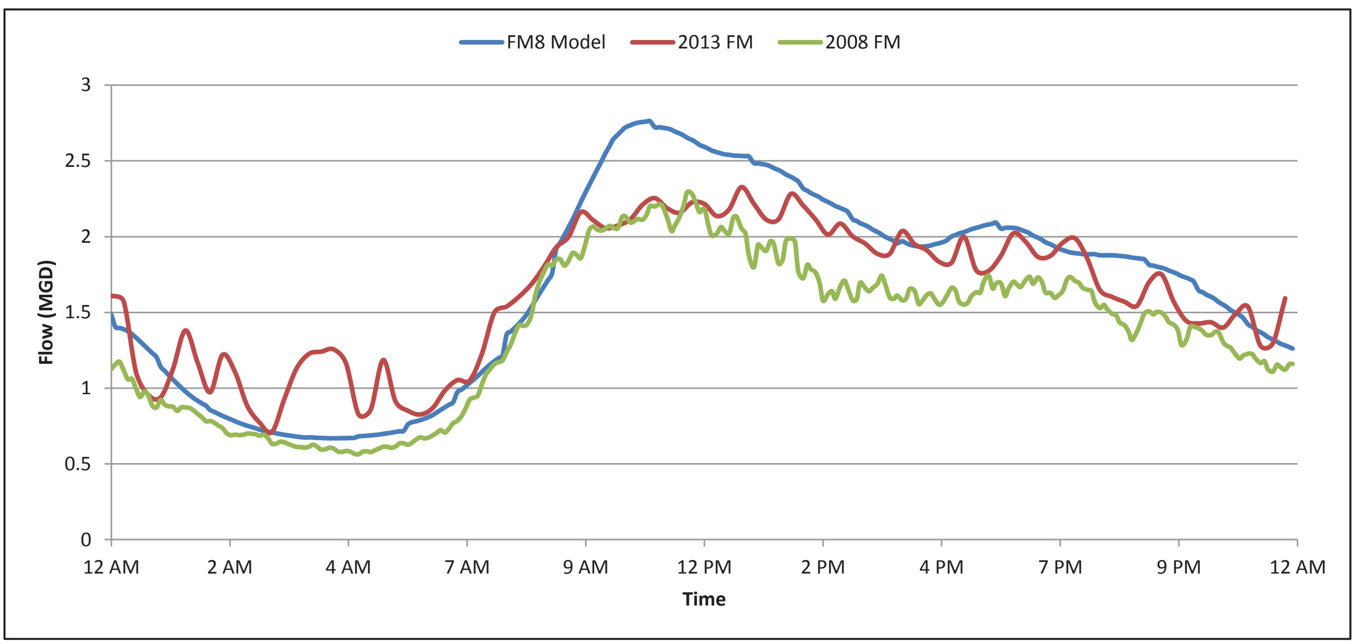


Figure 5-22
Weekend Calibration (Flow Monitoring Site 8)

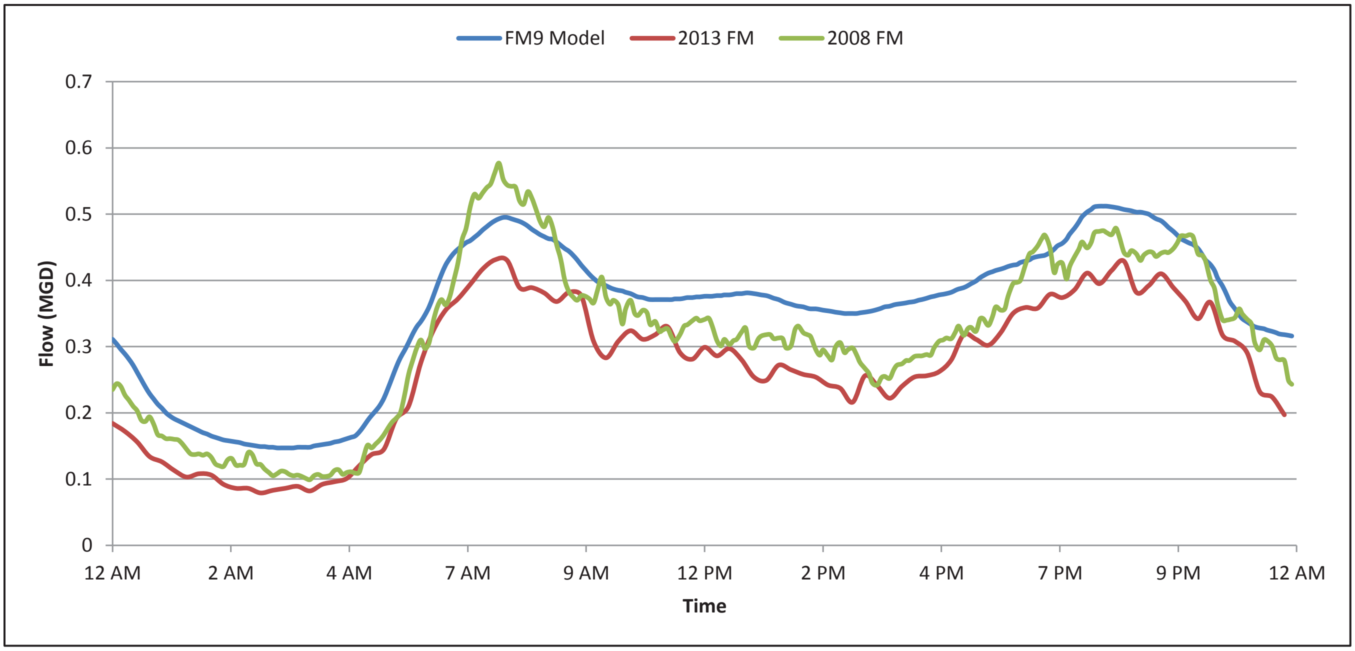


Figure 5-23
Weekday Calibration (Flow Monitoring Site 9)

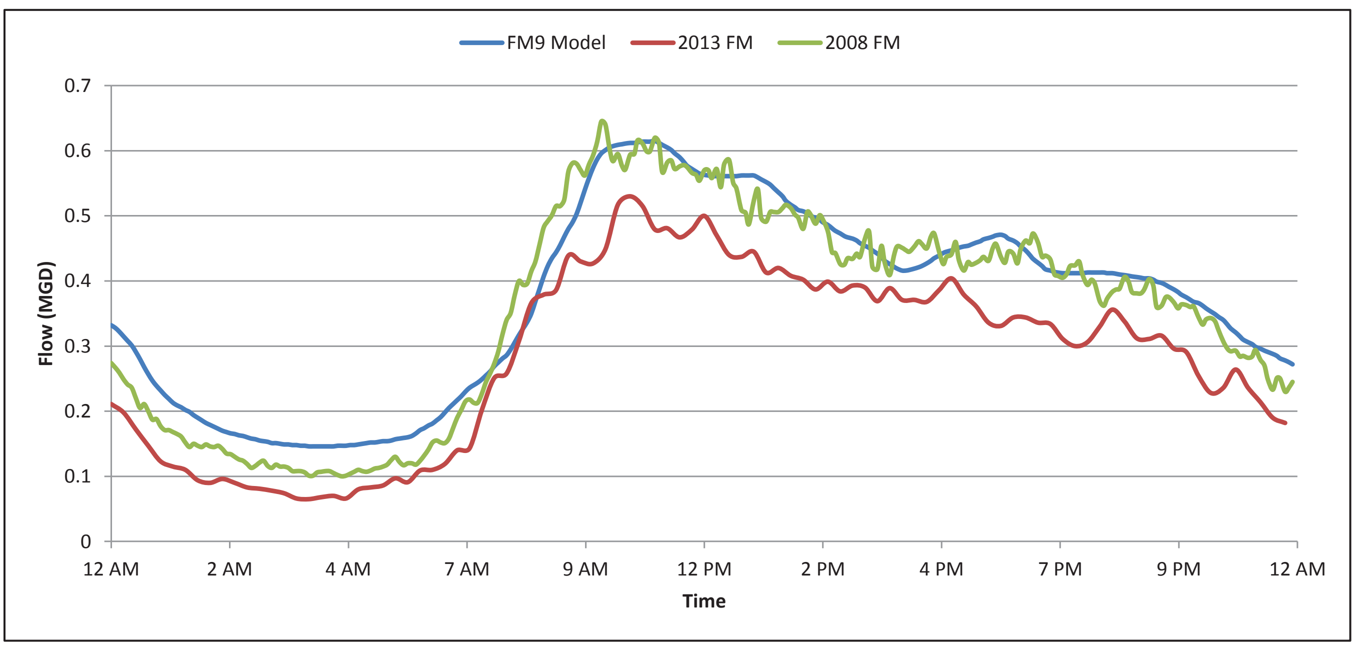


Figure 5-24
Weekend Calibration (Flow Monitoring Site 9)

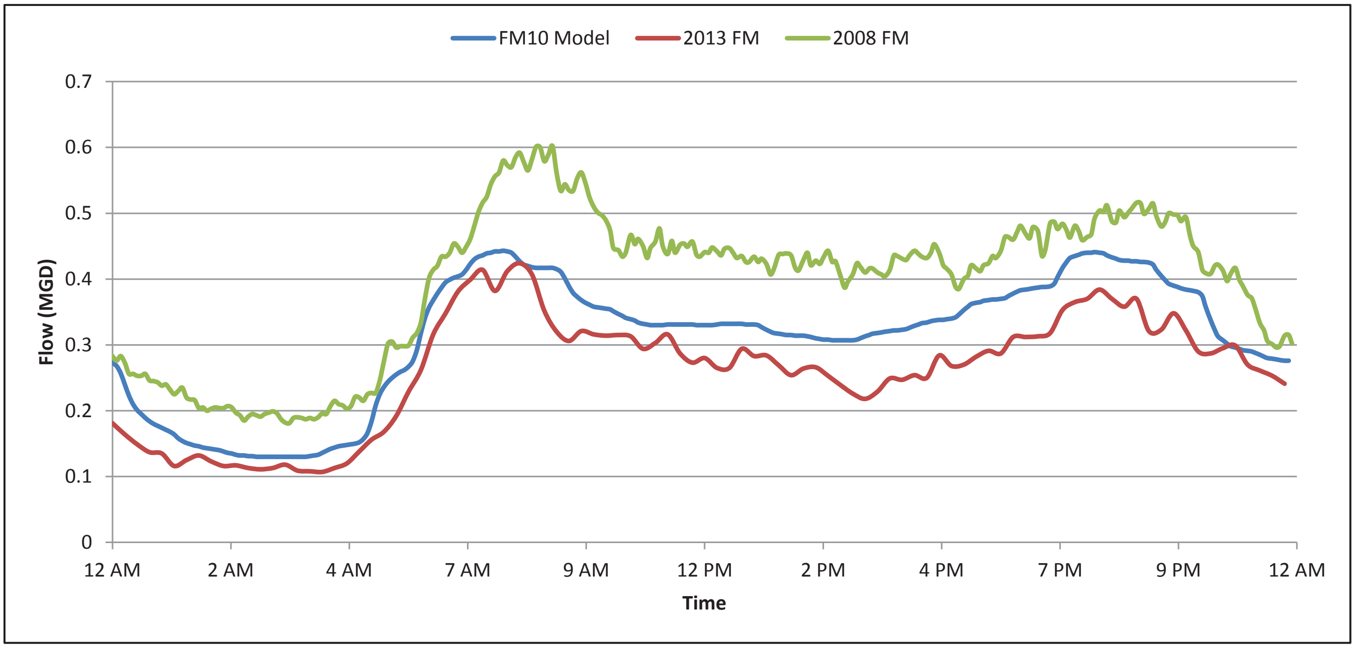


Figure 5-25
Weekday Calibration (Flow Monitoring Site 10)

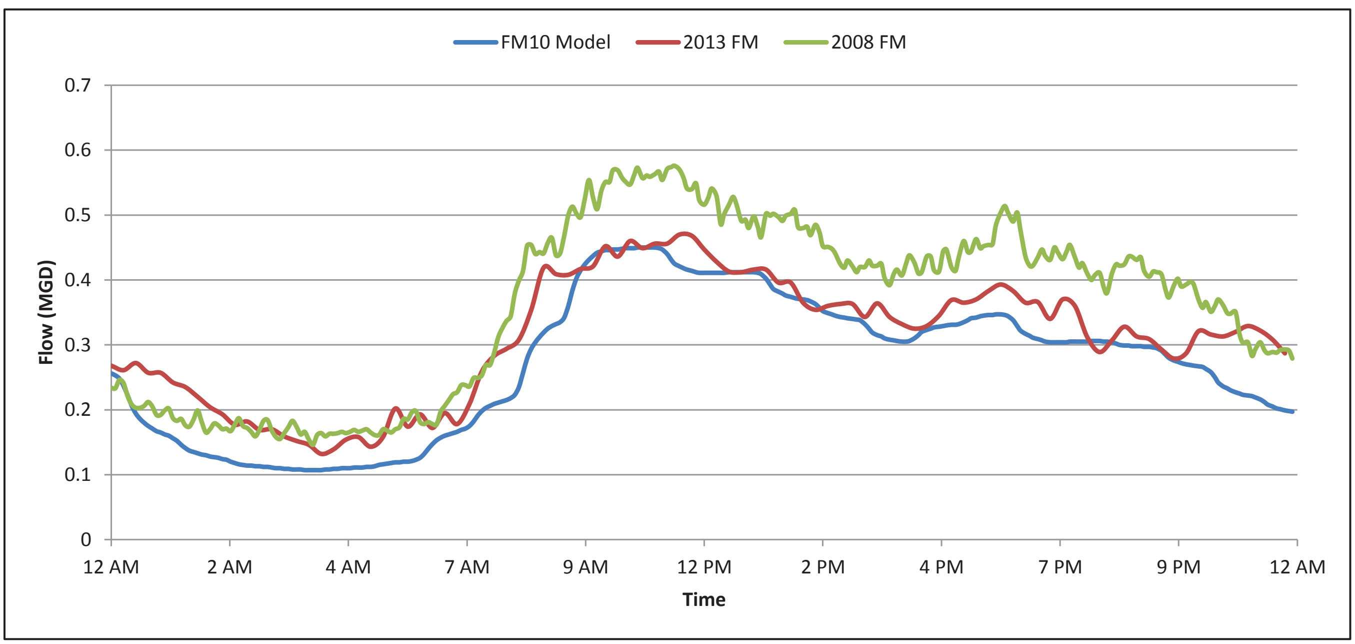


Figure 5-26
Weekend Calibration (Flow Monitoring Site 10)

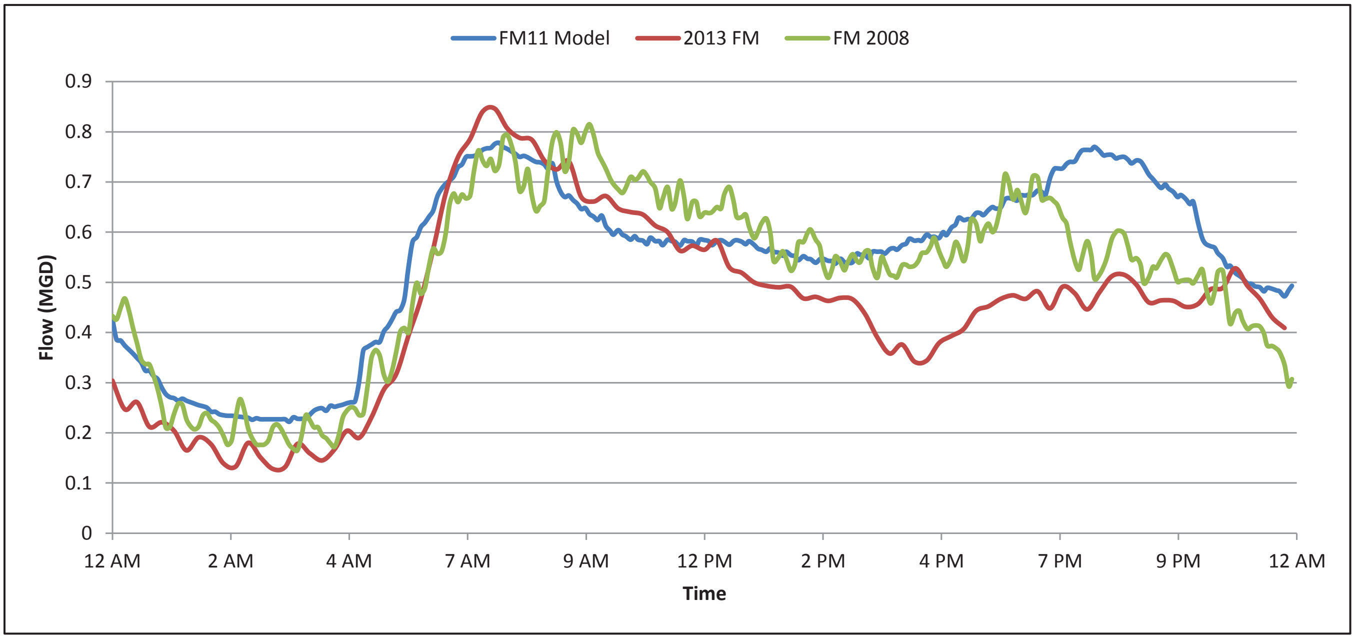


Figure 5-27
Weekday Calibration (Flow Monitoring Site 11)

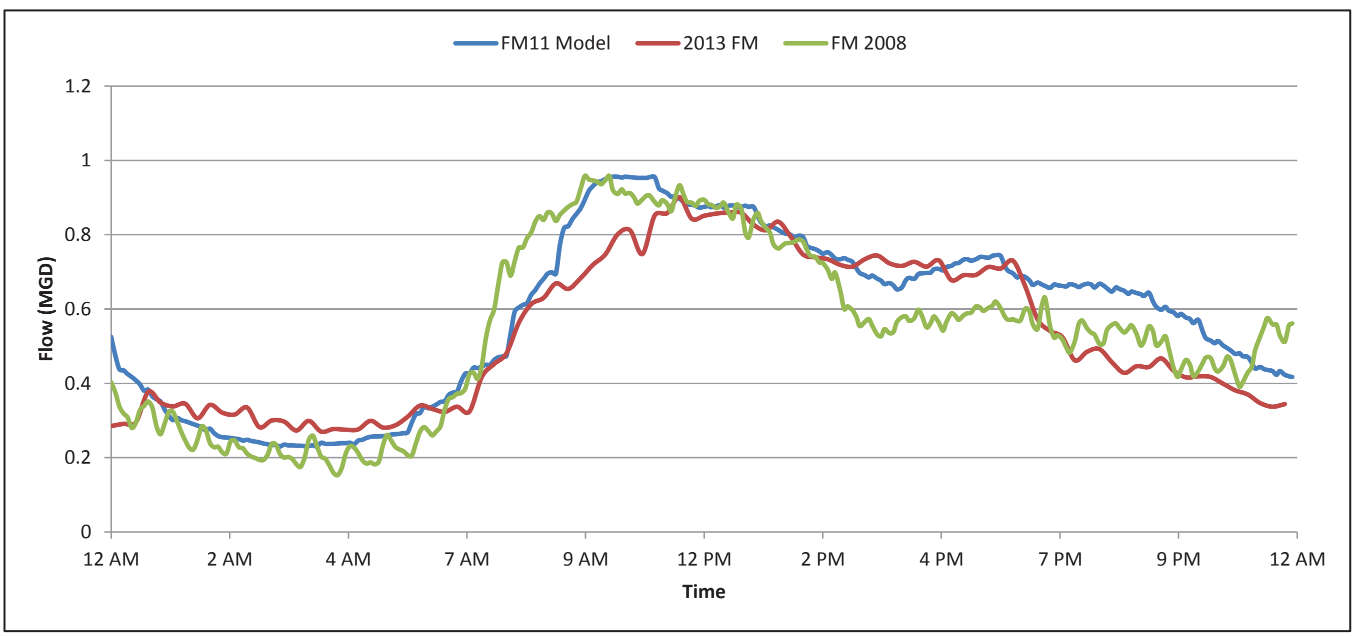


Figure 5-28
Weekend Calibration (Flow Monitoring Site 11)

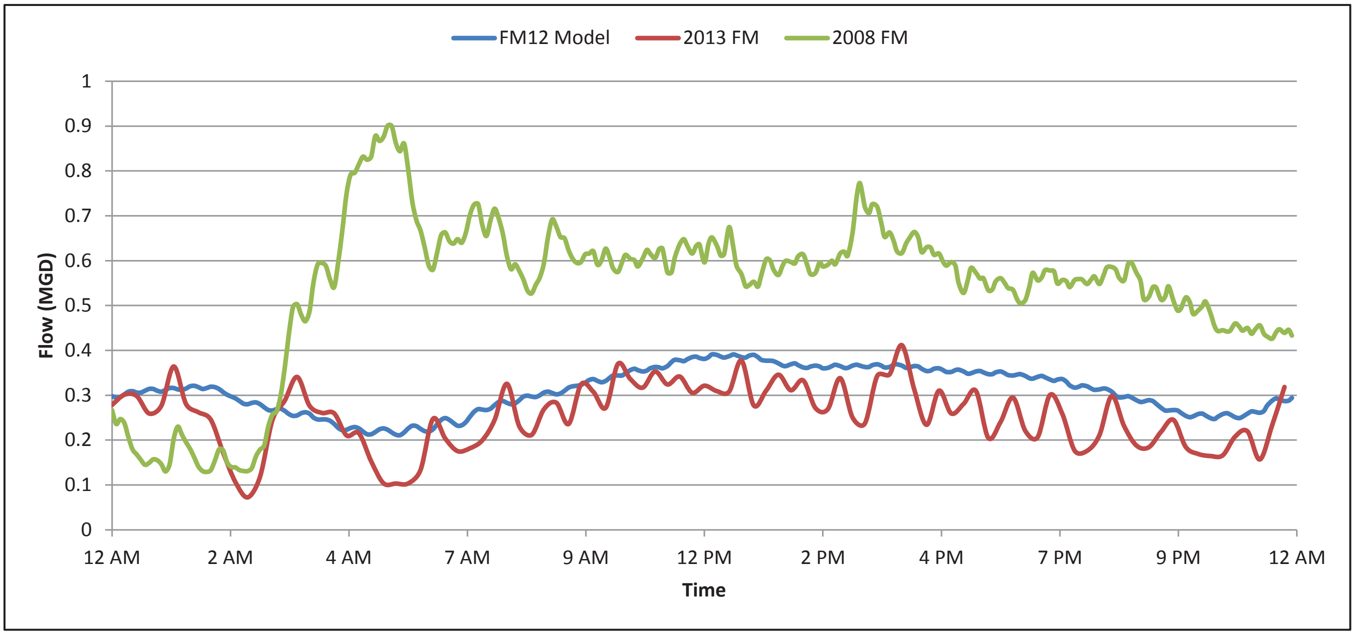


Figure 5-29
Weekday Calibration (Flow Monitoring Site 12)

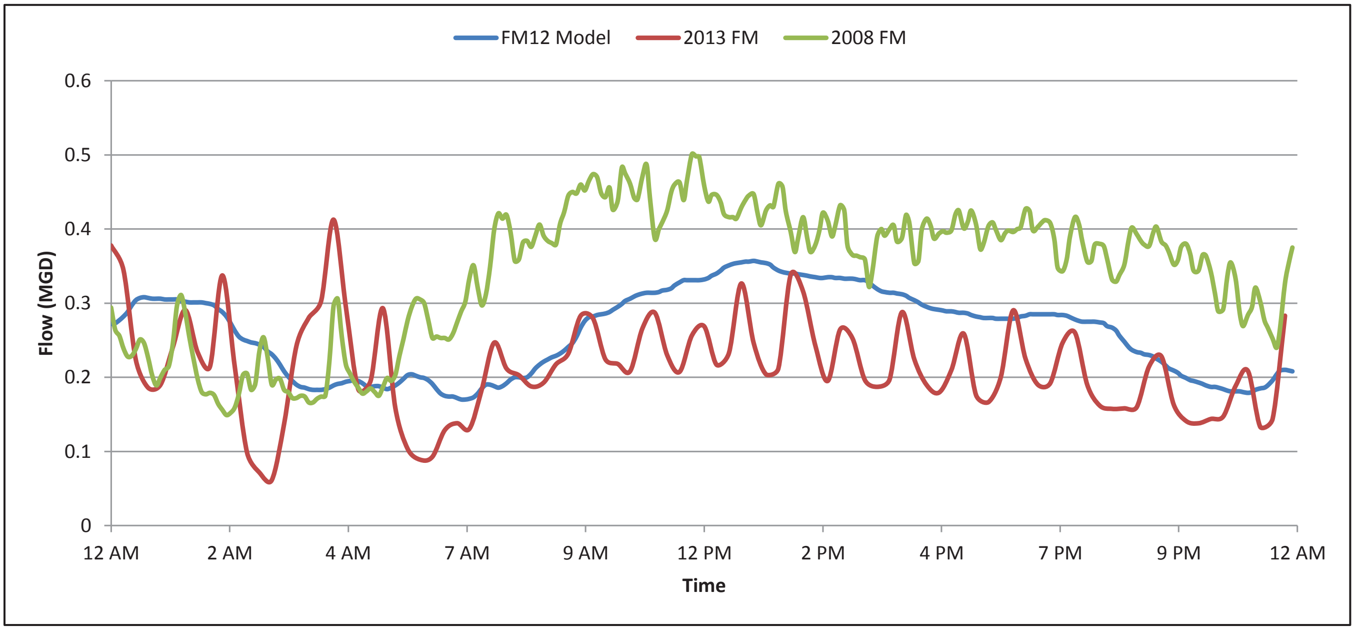


Figure 5-30
Weekend Calibration (Flow Monitoring Site 12)

5.2.2 Infiltration and Inflows

Flow monitoring for the SMPU was conducted during January 5 – 18, 2013. No significant rainfall occurred during the flow monitoring period. Based on a review of historical data and input from LBWD staff, the effects of infiltration and inflow (I/I) are insignificant compared to the amount of sewer flow through the LBWD sewer system. It is likely that I/I may be more pronounced in areas close to the seawater barrier; however the difference in flows between areas near coastal and inland areas showed to be insignificant from the 2008 SMP (Section 4, page 4-17). It is recommended that pipelines near the seawater barrier and areas with known infiltration be monitored on a regular basis to check that conditions have not worsened over time. LBWD sewer system historically has not had wet-weather related capacity problems. The results of the flow monitoring are presented in **Appendix E.**

This Page Intentionally Left Blank

SECTION 6

SEWER SYSTEM CAPACITY EVALUATION

SECTION 6
EXISTING SEWER SYSTEM CAPACITY EVALUATION

This section summarizes the known (reported) hydraulic condition of the LBWD sewer collection system and the model (predicted) performance of the system. Results from the model assessment are presented as system performance during dry weather flow conditions. The section concludes with an overall characterization of the performance of the system based on the results of the reported condition, the predicted condition and other available data.

6.1 System Modeling Evaluation

The sewer system hydraulic model is used for assessing the existing system performance. Wet weather conditions were not observed during the flow monitoring period associated with this Sewer Master Plan Update (SMPU); therefore, the model is primarily based on dry weather assessment criteria.

6.1.1 Dry Weather Assessment Criteria

Evaluation of a collection system during dry weather involves evaluation of both the capacity and general operational issues. The flow into the system is primarily derived from population within the service area and significant industrial dischargers. Operational issues that might lead to dry weather problems include blockages due to roots, fats, oils and grease. These problems can be exacerbated by the lack of sufficient flushing velocity in the pipe. Due to the random nature of these problems, it is impossible to accurately simulate their effects in a hydraulic model without site specific information. However, there is general information from the model that can assist with the identification of potential problem areas due to these causes. While there are many reasons for line blockages, one major component is that solids and debris will settle out in sewers that experience low velocities during dry weather. The hydraulic model can be used to identify the potential problem areas within the sewer system.

System capacity evaluation criteria were established for the LBWD system to determine the level of service the collection system must meet. Criteria are shown in the Sewer System Hydraulic Evaluation and Planning Criteria TM in **Appendix F**. These evaluation criteria are termed “trigger criteria” which are used to evaluate the hydraulic model results. The hydraulic model includes all LBWD gravity mains 12-inch or greater in diameter and some smaller gravity mains. The model is used to evaluate three different conditions: existing weekday conditions and existing weekend conditions. For the LBWD model, the existing weekend flow is slightly greater than the existing weekday flow and is therefore considered the worst case scenario. The trigger criteria used to evaluate dry weather flow for all the flow conditions include:

- All modeled pipes with a d/D ratio (depth of flow in pipe divided by the pipe diameter) equal to or greater than 0.5 are documented

- All modeled pipes with a d/D ratio equal to or greater than 0.9 are reviewed for potential improvement

6.1.2 Hydraulic Evaluation

The sewer hydraulic model was utilized to identify areas with surcharged pipes for existing weekday and existing weekend conditions. These conditions are represented in the model as separate scenarios. **Table 6-1** shows the number of pipe segments in the model that are reported as surcharged (i.e., d/D ratio at or above 0.9) compared to the total number of LBWD pipes evaluated in the hydraulic model. Flows under weekend conditions are greater than weekday conditions; therefore the number of pipes that are surcharged during weekend conditions exceeds those during the weekday.

Table 6-1
Summary of Surcharged Pipes

	Existing Weekday Scenario	Existing Weekend Scenario
Number of Surcharged Pipes	56	81
Total Number of LBWD Modeled Pipes	2812	2812
% of Surcharged Pipes	2.0%	2.9%

Surcharged areas are investigated to determine the significance of the surcharge. Modeled reports of surcharge need to be investigated by reviewing hydraulic profiles. Some surcharged areas reported in the model may be artificial due to insufficient data in an area or assumptions made during the model development process. Some examples are presented below.

(1) Missing data for pipe inverts often results in interpolation of incorrect invert elevations which may cause surcharge in pipelines during a model simulation.

(2) Other pipes reported as surcharged in the model may be due to flows from an upstream tributary area being loaded onto a single manhole that marks the start of the downstream modeled pipe network. While all the flow from such a tributary area may be modeled, the sewers in this area may not be modeled due to the pipes being less than 12-inches in diameter. Under this configuration, the model includes no natural attenuation of peak flows that would normally occur as flow is routed through the upstream pipe network. If the model predicts surcharge in a single pipe located at the very upstream reach of the modeled network and is immediately downstream of an upstream catchment's load point, this surcharge can most often be ignored.

Areas that are reported to be surcharged during simulations of existing conditions are further investigated through field inspection of manholes by LBWD staff. A list of manholes that are reported as surcharged in the model are visually inspected for evidence of surcharge. This visual inspection is conducted by opening the manhole lid and checking if there is any evidence that the water level has reached beyond the top of the sewer main. Evidence of surcharge may include debris found at the edges of the manhole or on top of the bench or on the manhole rungs.

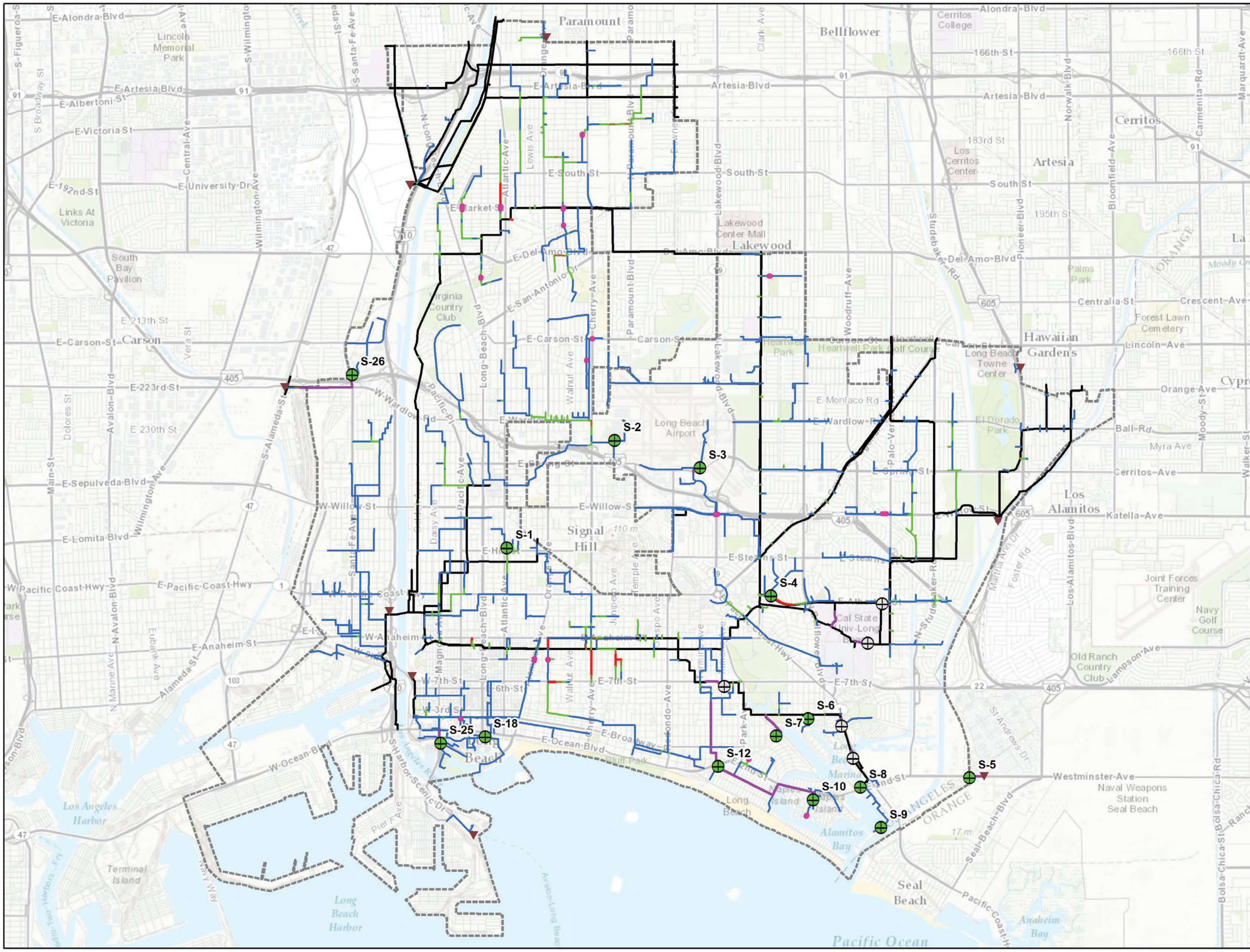
After a review of the pipeline capacity of the system using the trigger criteria previous discussed, five areas were found to potentially cause surcharge problems in the LBWD sewer system. These surcharged locations are shown on **Figure 6-3**. Each location is reviewed to determine if a CIP recommendation is made and discussed in the following subsection.

6.1.3 Reported Surcharged Areas

The focus of this SMPU is to provide guidance to LBWD staff in identifying and implementing a near-term CIP. As stated previously, five surcharged locations were identified using the sewer hydraulic model based on existing weekend flow conditions (i.e., worst-case existing flow condition). To understand the hydraulic conditions, hydraulic profiles of the surcharged pipe reaches under all modeled flow conditions were reviewed. The model includes a feature that allows the user to replay results from a simulation which shows the variation in the hydraulic gradeline of the pipelines over a 24-hour simulation. The change in the hydraulic grade line at each time step over a 24-hour simulation was observed at each location to understand the cause of the surcharge and the duration for which the pipes remain surcharged. This allows for a comprehensive assessment of the problem and selection of the appropriate infrastructure improvement to address the issue.

The following pages present profile plots for all surcharged areas identified in the model. For each surcharged location, the maximum water levels for the existing weekend condition are provided. These findings coupled with the visual inspection of the manholes were used to determine whether an infrastructure improvement was warranted at these locations.

This Page Intentionally Left Blank



Long Beach Water Department Sewer Modeled Network Maximum d/D Existing Weekday

Key to Features

Maximum d/D

- Less than 0.5
- 0.5 to 0.75
- 0.75 to 0.9
- Greater than 0.9
- Outfall
- CSDLAC Pump Station
- LBWD Pump Station
- Force Main
- Siphon
- CSDLAC Pipe
- LBWD Sewer Pipe
- Service Area Boundary

Basemap Source: ESRI

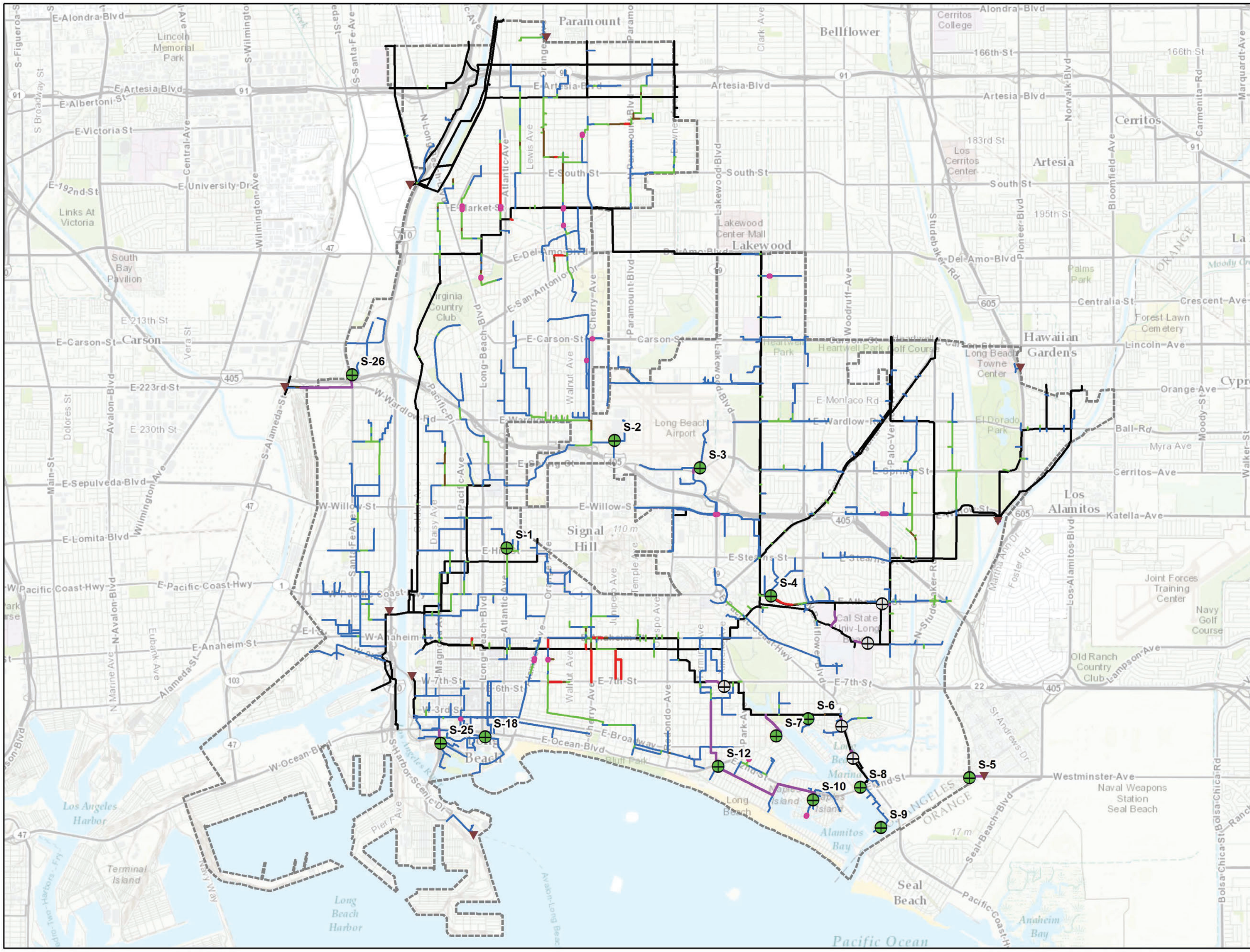
N

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMPU_ExistingWeekday_MaxDD.mxd

MWH

Figure 6-1



Long Beach Water Department Sewer Modeled Network Maximum d/D Existing Weekend

Key to Features

Maximum d/D

- Less than 0.5
- 0.5 to 0.75
- 0.75 to 0.9
- Greater than 0.9
- Outfall
- CSDLAC Pump Station
- LBWD Pump Station
- Force Main
- Siphon
- CSDLAC Pipe
- LBWD Sewer Pipe
- Service Area Boundary

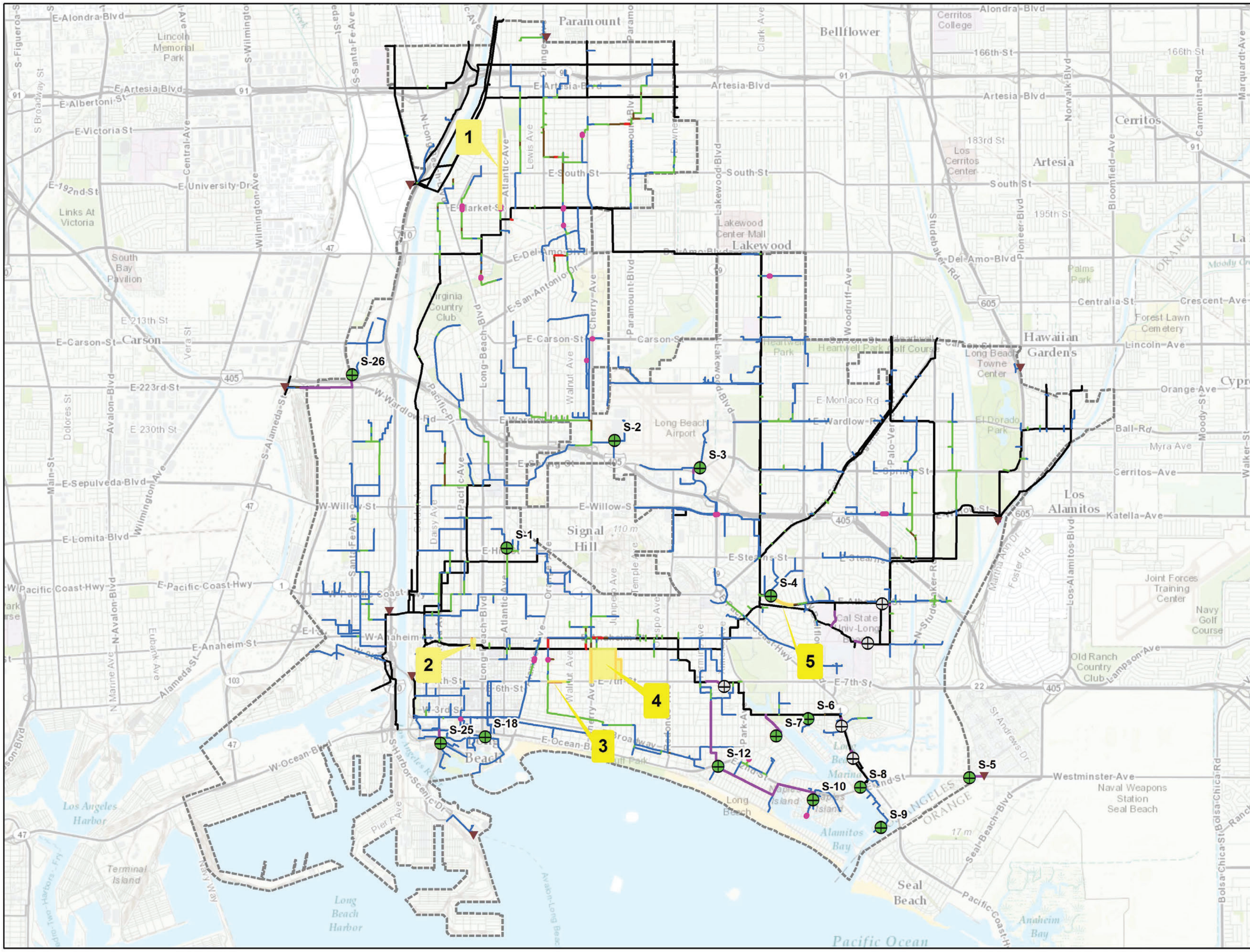
Basemap Source: ESRI

N

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMPU_Weekend_MaxDD.mxd

MWH **Figure 6-2**



Long Beach Water Department Sewer Modeled Network Surcharged Locations

Key to Features

Surcharged Locations

Maximum d/D

- Less than 0.5
- 0.5 to 0.75
- 0.75 to 0.9
- Greater than 0.9
- Outfall
- CSDLAC Pump Station
- LBWD Pump Station
- Force Main
- Siphon
- CSDLAC Pipe
- LBWD Sewer Pipe
- Service Area Boundary

Basemap Source: ESRI

N

0 1 2 Miles

Document: \\Uspas1s01\muni\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modeling_MXDs\LBWD_SMPU_Weekend_MaxDD.mxd

MWH **Figure 6-3**

Location 1 is along Linden Avenue from Harding Street to Market Street on a 10-inch pipe. The surcharge shown during the peak weekend flows (**Figure 6-4**) is exacerbated due to limited conveyance capacity at the existing 8-inch single-barrel siphon located on Linden Avenue and Market Street. This causes wastewater to back-up resulting in the surcharge along the 10-inch pipe. Field investigation indicated evidence of surcharge about 1 foot above the bench upstream of the siphon. It is recommended that flow monitoring be conducted along this reach to confirm whether surcharge occurs at other manholes along the reach. It is also recommended that this location be calibrated in the hydraulic model in the future. No infrastructure improvements are recommended at this time.

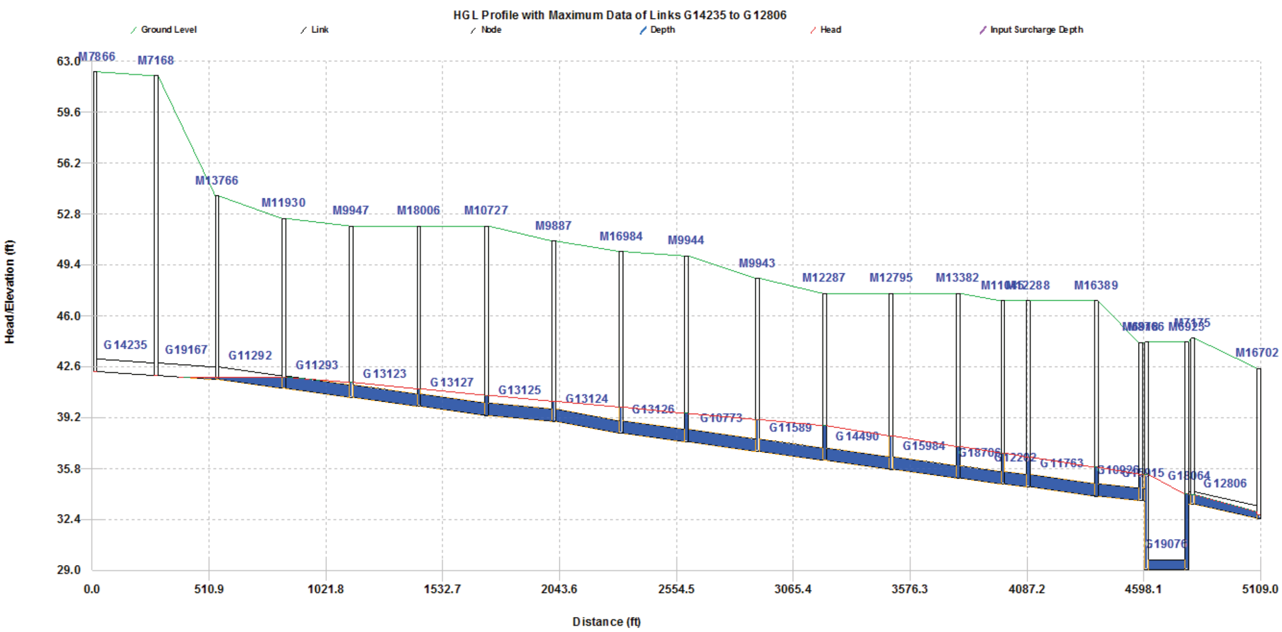


Figure 6-4
Location No. 1 Under Existing Weekend Conditions

Location 2 begins at an alley east of Locust Street at Lily Way, runs north to 12th Street, then west on 12th Street to Locust Avenue, runs north on Locust Street to Anaheim Street, and makes a U-turn to the right back down south on Locust Avenue until it reaches the CSDLAC pipe, along 8-inch pipe. Surcharge predicted during existing flow conditions could be an artifact of the procedure adopted to model the subcatchment area at Locust Avenue and Lily Way. A field investigation was conducted at a manhole near the intersection of Locust Street and Regal Way, and no evidence of surcharge was reported. However, given the flat terrain along the downstream reaches of this pipeline, it is recommended that this location be monitored regularly for indications of surcharge. No infrastructure improvements are recommended at this time.

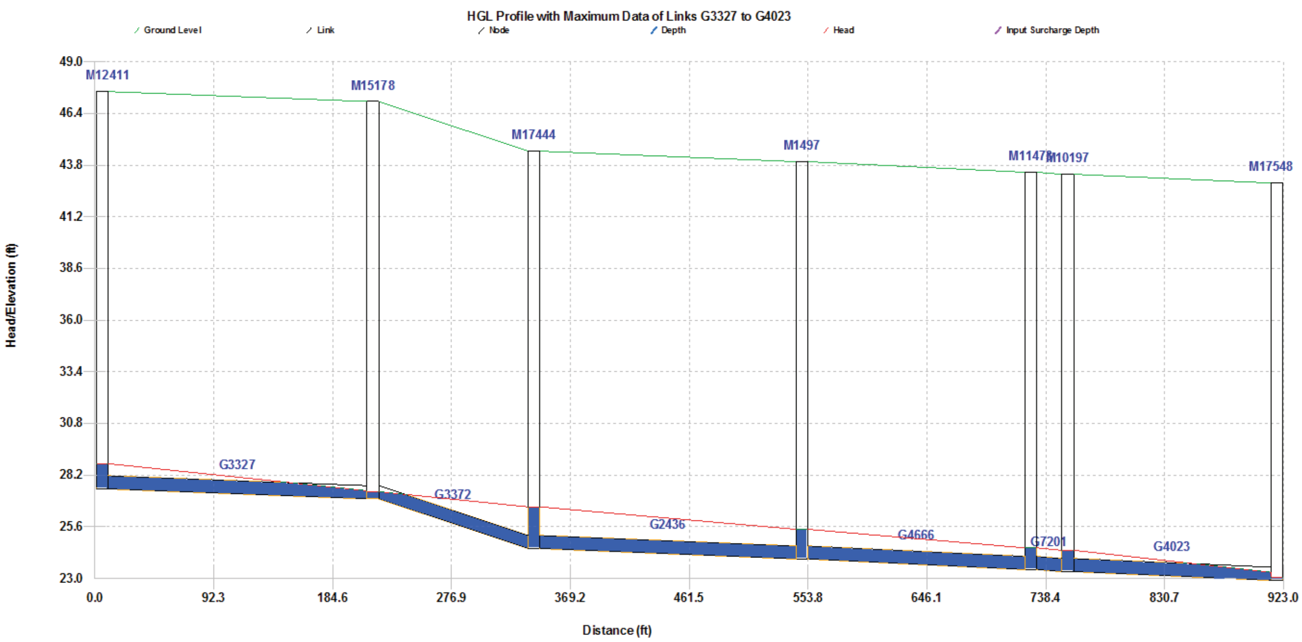


Figure 6-5
Location 2 Under Existing Weekend Conditions

Location 3 begins on 7th Street west of Walnut Avenue, and runs west to Orange Avenue, along 12-inch pipe. This location has been upsized already from 8-inch to 12-inch since the 2008 SMP (i.e., Location 13 in the 2008 SMP). Surcharge predicted during existing flow conditions is an artifact of the procedure adopted to model the subcatchment area. Therefore, no infrastructure upgrades are recommended for this location.

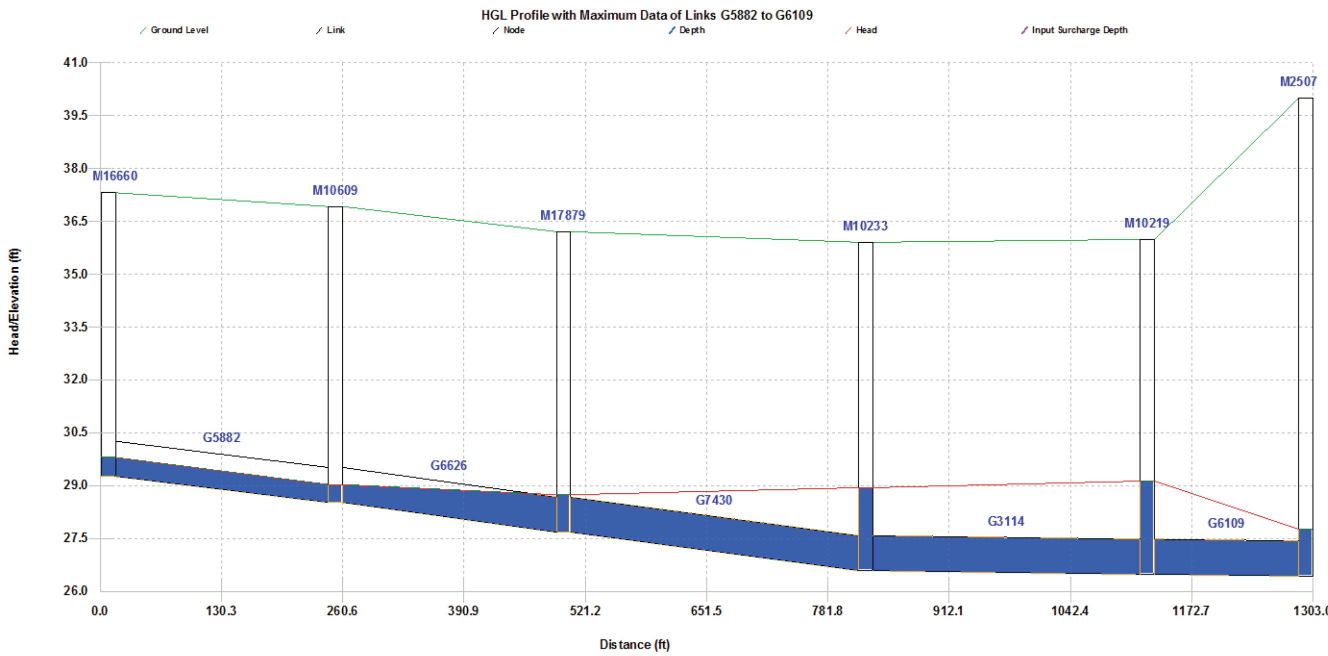


Figure 6-6
Location 3 Under Existing Weekend Conditions

Location 4 (Segment 1) is on Cherry Avenue from 7th Street and runs north to 11th Street, along 8-inch pipe. This location is surcharged during existing flow conditions, and has also been identified in the 2008 SMP CIP as Location 10. Field investigations at this location were not conclusive with surcharge being reported only during some of the investigations. Therefore, it is recommended that flow monitoring be conducted along this reach to confirm whether surcharge occurs at other manholes along the reach. It is also recommended that this location be calibrated in the hydraulic model in the future. No infrastructure improvements are recommended at this time.

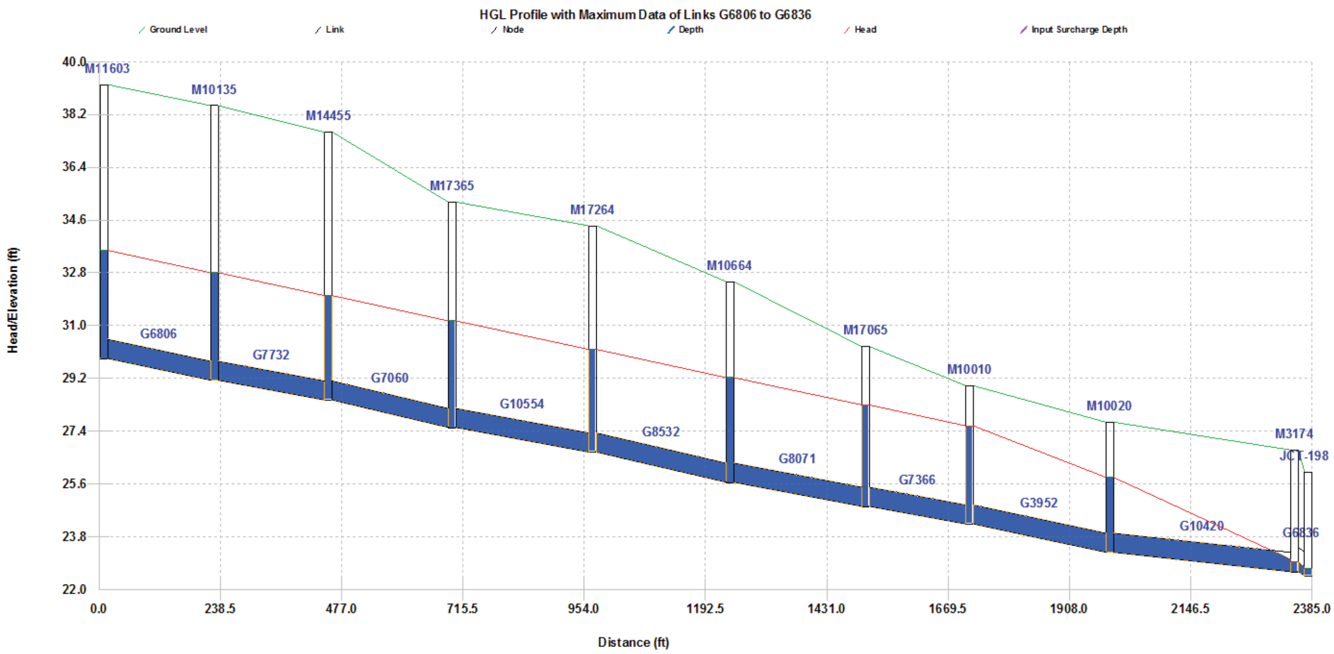


Figure 6-7
Location 4 (Segment 1) Under Existing Weekend Conditions

Location 4 (Segment 2) is on an alley between Junipero Avenue and Stanley Avenue at a manhole north of 7th Street and runs north to 11th Street, along 10-inch pipe. This location is surcharged during existing flow conditions, and has also been identified in the 2008 SMP CIP as Location 10. Field investigations at this location were not conclusive with surcharge being reported only during some of the investigations. It is recommended that flow monitoring be conducted along this reach to confirm whether surcharge occurs at other manholes along the reach. It is also recommended that this location be calibrated in the hydraulic model in the future. No infrastructure improvements are recommended at this time.

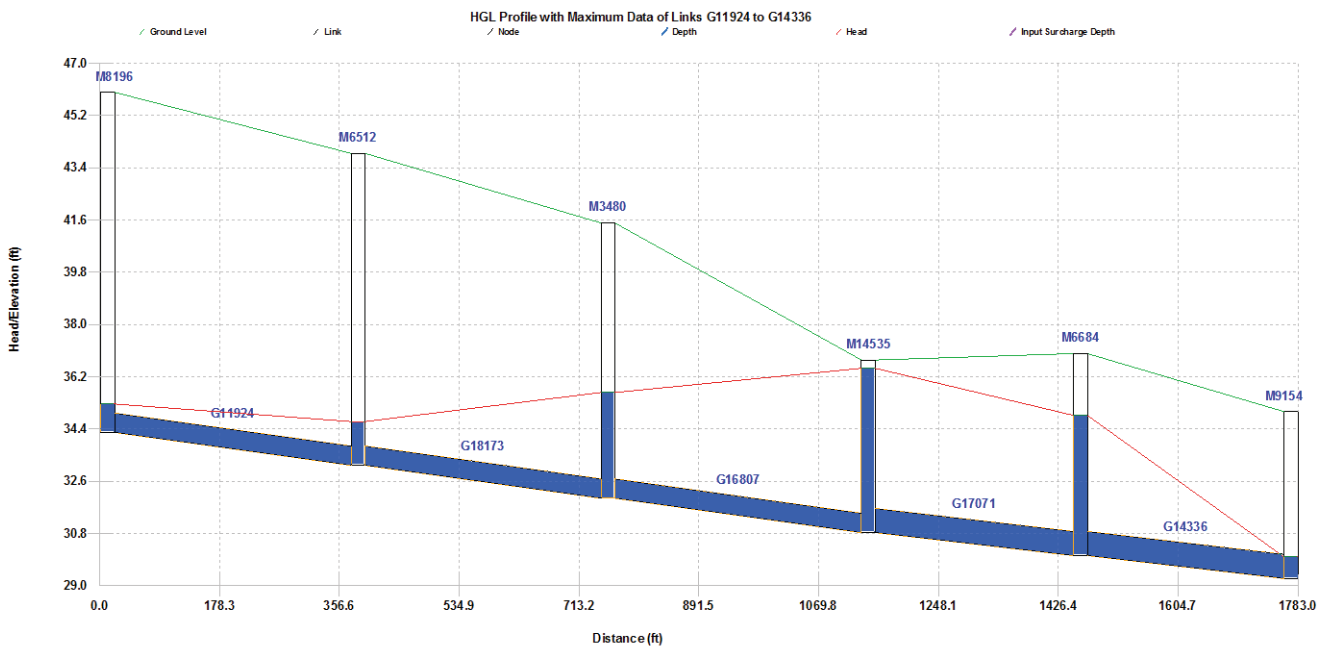


Figure 6-8
Location 4 (Segment 2) Under Existing Weekend Conditions

Location 4 (Segment 3) begins on an alley between Stanley Avenue and Molina Avenue at a manhole north of 7th Street and runs north to 10th Street, then runs west on 10th Street to an alley west of Stanley Avenue, along 10-inch pipe. This location is surcharged during existing flow conditions, and has also been identified in the 2008 SMP CIP as Location 10. Field investigations at this location were not conclusive with surcharge being reported only during some of the investigations. It is recommended that flow monitoring be conducted along this reach to confirm whether surcharge occurs at other manholes along the reach. It is also recommended that this location be calibrated in the hydraulic model in the future. No infrastructure improvements are recommended at this time.

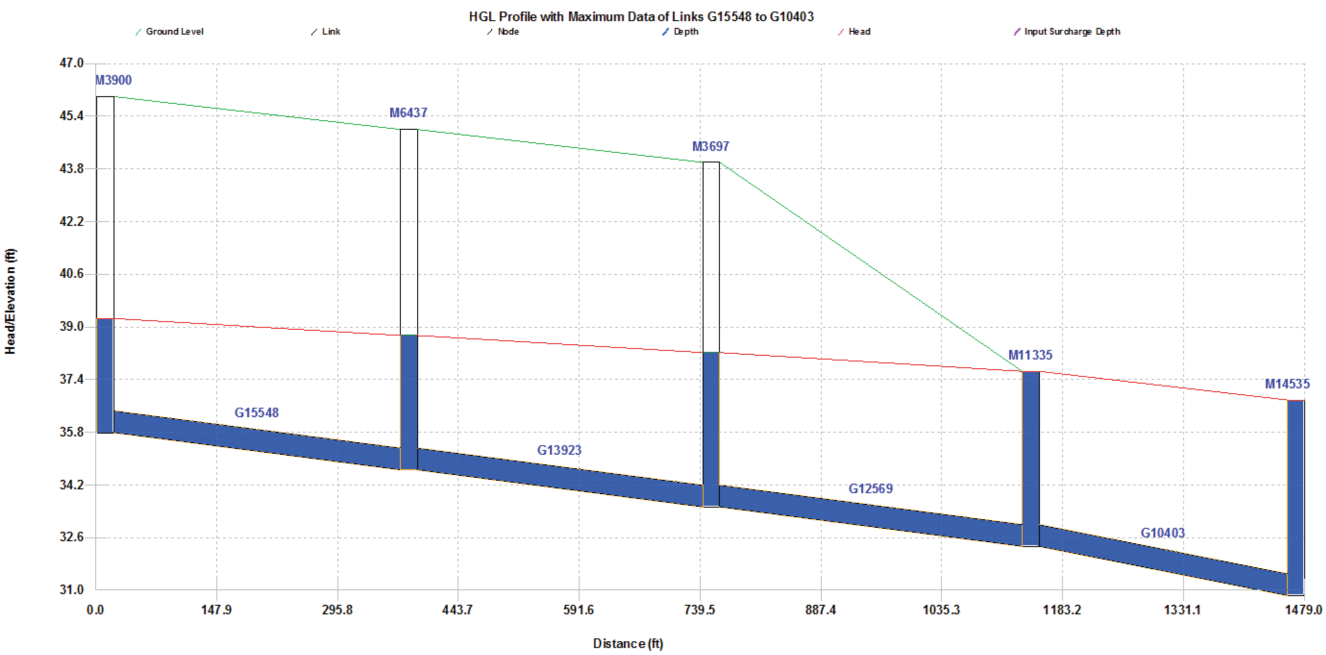


Figure 6-9
Location 4 (Segment 3) Under Existing Weekend Conditions

Location 5 is along Atherton Street from Tulane Avenue and runs northwest to Lift Station No. 4 (S-4). The surcharge reported along this segment is an artifact of the way lift station operations are modeled. A field investigation was conducted near Atherton Street and Ashbrook Avenue and no evidence of surcharge was reported. Therefore, no infrastructure upgrades are recommended for this location.

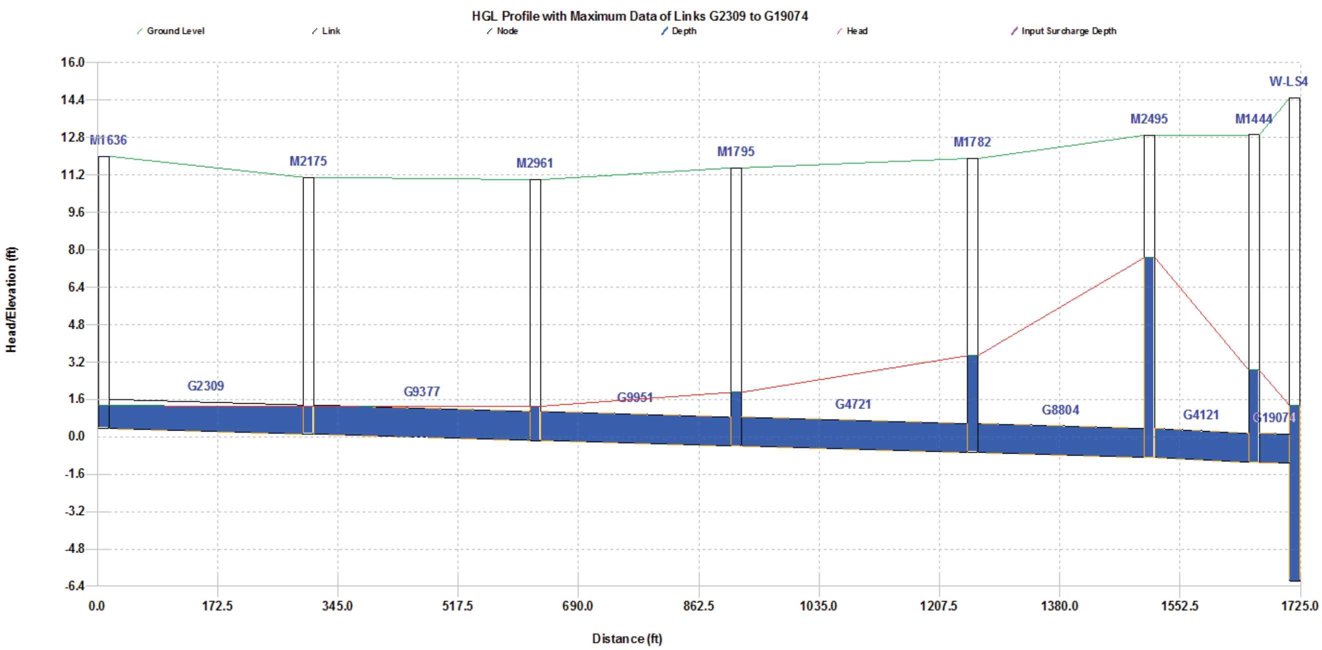


Figure 6-10
Location 5 Under Existing Weekend Conditions

A summary of the five reported surcharged locations is shown in **Table 6-2**. Each location was evaluated for the existing conditions, and select locations were also field inspected by LBWD staff for evidence of surcharge. If there was no evidence of surcharge (e.g., water level above the bench) during the field inspection, then a recommendation was not provided, although further investigation in the form of frequent inspections and flow monitoring are recommended.

Table 6-2
Surcharged Locations

Location No.	Location	Surcharged Under Existing Conditions	Evidence of Surcharge during Field Inspection(1)	Infrastructure Recommendations
1	Linden Avenue north of Market Street	Yes	Yes, 1 foot above bench	No. Perform additional investigations and flow monitoring.
2	Locust Avenue and 12th Street	Yes	No	No
3	7th Street east of Orange Avenue	Yes	N/A	No
4	Cherry Avenue south of 11th Street; alley west of Stanley Avenue and 10th Street	Yes	Yes, 2 feet above bench	No. Perform additional investigations and flow monitoring.
5	Atherton Street and Daggett Street	Yes	No	No

N/A = Location not field inspected for evidence of surcharge
1 Field inspection was conducted by LBWD staff on March 27, 2013. Location 4 was inspected at 11:15 AM and Location 10 was inspected at 10:30 AM.

After evaluation of the surcharged locations, no locations are identified for CIP recommendations and Locations 1 and 4 have been identified as candidates for further investigation. It is recommended that regular monitoring be performed by LBWD's operations staff to identify any evidence of surcharge. Flow monitoring is also recommended along these pipelines to further refine and recalibrate the model at these locations.

SECTION 7

CAPITAL IMPROVEMENT PROGRAM

SECTION 7 NEAR-TERM CAPITAL IMPROVEMENT PROGRAM

This section presents a summary of Long Beach Water Department's (LBWD's) near-term capital improvement program (CIP) and planning level cost estimates for the recommended projects. While infrastructure deficiencies are identified for LBWD's system for existing flow conditions, given the uncertainty related with the timing of future growth within LBWD's service area, only near-term improvements are recommended to be included in the CIP. One of the main focus areas of this Sewer Master Plan Update (SMPU) was to perform a visual condition assessment of lift stations that are critical to LBWD's systems. The near-term CIP developed in this SMPU identifies three lift stations for rehabilitation.

7.1 Cost Estimating Basis

The CIP project cost estimates in this section are planning level cost estimates. The appropriate use of this estimate is for planning and may not be an actual representation of design to construction activities and costs. Expected accuracy ranges are from –20 percent to +100 percent, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.

The estimate was prepared using a combination of parametric estimating factors and local experience in delivering projects similar to those that constitute LBWD's near-term CIP. Costs for unique facilities are developed on a case-by-case basis. Project cost allowances are then added to the baseline costs, as a percentage of the baseline cost, to account for unlisted items allowance and engineering costs.

The following assumptions were made:

- The cost estimates are based on April 2013 dollars.
- Construction management was assumed at 12 percent of the total construction cost.
- Design engineering was assumed at 12 percent of the total construction cost.
- Installation component was assumed at 50 percent of material subtotal.
- Unlisted item allowance was assumed at 20 percent of material subtotal.
- Sales tax was assumed at 8.75 percent.

7.2 Near-Term CIP

Based on the recommendations from the 2008 SMP, a visual condition assessment was conducted for lift stations that are critical to LBWD's systems. The near-term CIP developed in this SMPU identifies three lift stations for rehabilitation.

7.2.1 Lift Stations

As discussed in **Section 4**, MWH conducted a facility assessment of fourteen (14) lift stations, evaluated the condition of each of the 14 lift stations, and ranked each lift station in terms of priority and condition. As a result of the facility assessment, rehabilitation of lift stations S-8, S-12, S-26 is recommended. Each of these lift stations was determined to be in “very poor” condition relative to one another. The condition of each lift station is discussed in further detail in **Section 4** and **Appendix A**. The rehabilitation of lift stations S-8, S-12, and S-26 is expected to occur in the near-term over the next three fiscal years. The following paragraphs summarize the condition, rehabilitation assumptions, and planning level cost estimates for lift stations S-8, S-12, and S-26.

7.2.1.1 Lift Station S-8

Lift station S-8 is determined to be in “very poor” condition. The station is located at 6391 Marina Drive. The pumps in this station appear to be of the original installation in 1973. The pumps have an estimated remaining useful life of 0 to 3 years. Additional information on this lift station is provided in **Appendix A, Exhibit 6**.

Rehabilitation of lift station S-8 is anticipated to consist of:

- Saw cutting of the concrete slab to allow for installation of new hatches
- Demolition of the existing pumps and installation of new pumps.
- Replacement of HVAC
- Replacement of the existing MCC and SWG
- Addition of wet well level indicator near local pump controls, addition of a flow meter, addition of a wet well level indicator, and addition of a discharge piping pressure indicating transmitter.
- Removal of existing float switches
- Demolition of existing conduits and wires and installation of new conduits and wires.
- Addition of generator receptacle and manual transfer switch
- Addition of emergency lighting
- Addition of ladder safety cage
- Demolition of pump supports and installation of new pump supports
- Modification of wet well vent piping and accessories
- Demolition of building roof and installation of a new roof.

Table 7-1
S-8 (Marina 2) Lift Station Improvement Costs

Item	Costs
Mobilization, site setup, fencing and sound attenuation.	$ 65,000
Demolition	$ 65,000
Structural Work	$ 175,000
Piping	-
Pumps	$ 75,000
Electrical	$ 115,000
Instrumentation and Telemetry	$ 50,000
HVAC	$ 65,000
Sitework	$ 30,000
Bypass Pumping	$ 35,000
Startup	$ 30,000
Material Subtotal	**$ 705,000**
Installation component	$ 352,500
Unlisted Item Allowance	$ 141,000
Sales Tax	$ 61,688
Escalation to Construction Year	$ 28,482
Total Construction Cost	**$ 1,288,670**
Anticipated Construction Year	2015
Years Remaining	2
Design Engineering	$ 155,000
Construction Management	$ 155,000
Total Project Cost	**$ 1,600,000**

7.2.1.2 Lift Station S-12

Lift station S-12 is determined to be in "very poor" condition. The station is located between Division Street and Bennett Avenue. This station has issues with the VFDs, odor, grease, and corrosion. The grease problem causes false readings from level sensor, leading to inefficient operation of pumps. Gas fumes from the wet well are sucked back down into the dry pit when the ventilator is on, making it difficult, and potentially hazardous, for staff working in the pit. Additionally, the wet well lining is peeling off of the wall in the wet well, potentially clogging the pumps. The pumps have an estimated remaining useful life of 10 to 15 years. Additional information on this lift station is provided in **Appendix A, Exhibit 10**.

Rehabilitation of lift station S-12 is anticipated to consist of:

- Demolition and replacement of wet pit, including self-cleaning and smooth flow transition features

- Rehabilitation of dry pit walls and floor
- Addition of wet well level indicator near local pump controls, flow meter, sump level signal, PIT on discharge pipes, sump high-high sensor, and VFD signals
- Installation of bypass piping
- Replacement of chemical system with Bioxide system or Calcium-nitrate feed system
- Removal of old MCC sections
- Addition of hand rail to stairs
- Removal and replacement of concrete pads for pumps, pump supports, and pipe supports
- Addition of lateral bracing for cabinets
- Grating improvements
- Removal and replacement of existing HVAC system
- Recoating of piping and valves

Table 7-2
S-12 (Belmont) Lift Station Improvement Costs (Final)

Item	Costs
Mobilization, site setup, fencing and sound barrier	$ 100,000
Demolition	$ 120,000
Structural Work	$ 430,000
Piping	$ 100,000
Pumps	-
Electrical	$ 50,000
Instrumentation and Telemetry	$ 50,000
HVAC	$ 40,000
Sitework	$ 65,000
Bypass Pumping	$ 95,000
Startup	$ 30,000
Material Subtotal	**$ 1,080,000**
Installation component	$ 540,000
Unlisted Item Allowance	$ 216,000
Sales Tax	$ 94,500
Escalation to Construction Year	$ 21,600
Total Construction Cost	**$ 1,952,100**
Anticipated Construction Year	2014
Years Remaining	1
Design Engineering	$ 234,000
Construction Management	$ 234,000
Total Project Cost	**$ 2,400,000**

7.2.1.3 Lift Station S-26

Lift station S-26 is determined to be in “poor” condition. The pumps and piping in this lift station have reached the end of their useful life. The pumps have an estimated remaining useful life of 0 to 5 years. Additional information on this lift station is provided in **Appendix A, Exhibit 14**.

Rehabilitation of lift station S-26 is anticipated to consist of:

- Installation of a wet well level indicator near the existing hand/off/automatic switch
- Installation of new generator receptacles
- Installation of a new manual transfer switch
- Installation of a new flow meter
- Installation of pressure indicating transmitters on the discharge piping
- Installation of a new wet well level indicator
- Installation of a level switch in the sump to indicate a high-high level
- Installation of cables, conduits, and programmable logic controller upgrades to accommodate VFD signals
- Removal of abandoned conduit, addition of new conduit for level probe, and addition of bracket for cable retention inside access manhole
- Removal of the air compressor and addition of a new air handling device
- Removal and replacement of the existing manhole lid, collar, and riser rings
- Removal and replacement of existing pipe supports
- Removal and replacement of the existing concrete pad
- Removal and replacement of the existing door
- Structural rehabilitation of the existing roof beam
- Removal and replacement of the existing pumps and piping. It is recommended at least two new pumps be installed.

Table 7-3
S-26 (Marina 1) Lift Station Improvement Costs

Item	Costs
Mobilization, site setup, fencing and sound attenuation	$170,000
Demolition	$50,000
Structural Work	$20,000
Piping	$80,000
Pumps	$375,000
Electrical	$550,000
Instrumentation and Telemetry	$200,000
HVAC	$25,000
Sitework	$75,000
Bypass Pumping	$60,000
Startup	$50,000
Material Subtotal	**$1,655,000**

Table 7-3
S-26 (Marina 1) Lift Station Improvement Costs

Item	Costs
Installation component	$827,500
Unlisted Item Allowance	$331,000
Sales Tax	$144,813
Escalation to Construction Year	$136,425
Total Construction Cost	**$3,094,738**
Anticipated Construction Year	2017
Years Remaining	4
Design Engineering	$371,000
Construction Management	$371,000
Total Project Cost	**$3,800,000**

7.2.2 Hydraulic Deficiencies

Hydraulic deficient areas during the evaluation of the sewer are documented in **Section 6**. At this time, no infrastructure recommendation is recommended for the LBWD sewer system, since the existing surcharge locations in the hydraulic model were not apparent during the field investigation. It is recommended that these deficiencies identified for the existing system be further investigated. It is also recommended that flow monitoring be conducted in areas that may have potential surcharge issues, also calibrated in the hydraulic model in the future.

7.2.3 Near-Term CIP Summary

Table 7-4 presents a summary of LBWD's near-term CIP. It is recommended that S-12 be rehabilitated in fiscal year 2013, S-8 be rehabilitated in fiscal year 2014, and S-26 be rehabilitated in fiscal year 2015. The total cost of rehabilitating these lift stations is estimated to be $7.8 million. Best engineering judgment was used for the prioritization of these lift stations for rehabilitation. Although S-8, S-12, and S-26 are in poor condition relative to the other lift stations in the sewer system, Lift Station S-12 is ranked as number "1" based on the following rationale:

- S-12 is in very poor condition
- S-12 has the largest design flow of all stations. S-12 has high risk and consequence of failure because of large flows and its location
- S-12 has significant safety concerns (documented in **Appendix A, Exhibit 10**)
- LBWD Operations staff concurs with these findings for the immediate rehabilitation of S-12

S-8 and S-26 have minimal remaining useful life and have not been rehabilitated in over 40 years. However, S-8 is assigned a higher priority than S-26 because it has a lower remaining useful life when compared to S-26.

Table 7-4
Summary of Near-Term CIP Costs

Lift Station	Priority	Rehabilitation Cost
FY 2013		
S-12	1	$ 2,400,000
Total Cost for FY 2013		**$ 2,400,000**
FY 2014		
S-8	2	$ 1,600,000
Total Cost for FY 2014		**$ 1,600,000**
FY 2015		
S-26	3	$ 3,800,000
Total Cost for FY 2015		**$ 3,800,000**
Total Rehabilitation Cost		**$ 7,800,000**

This Page Intentionally Left Blank

APPENDICES

APPENDIX A:

SEWER LIFT STATION ASSESSMENT TM

TECHNICAL MEMORANDUM

To:	Long Beach Water Department (LBWD)	**Date:**	August 1, 2013
From:	Jinny Huang, P.E., MWH Tony Hancock, MWH	**Reference:**	10501555/5.1
Subject:	Lift Station Assessment Technical Memorandum FINAL		

Introduction

The purpose of this Technical Memorandum (TM) is to summarize the condition assessment of selected Long Beach Water Department (LBWD) sewer lift stations. Recommendations developed from this assessment will be used to support the development of the 2013 Sewer Master Plan Update (SMPU) Capital Improvement Plan (CIP). MWH reviewed all twenty six (26) LBWD lift stations and selected fourteen (14) lift stations for to conduct a condition assessment based on factors such as age, pump inflows, location relative to the collection system, maintenance logs, and input from LBWD staff. The stations visited over a 2-day field visit on January 15-16, 2013 include:

- S-1 (Hill & Atlantic)
- S-4 (Los Altos)
- S-5 (Westminster)
- S-6 (Ultimo)
- S-7 (Belmont Park)
- S-8 (Marina 2)
- S-10 (Naples)
- S-11 (Alamitos Bay)
- S-12 (Belmont)
- S-18 (Hart Place)
- S-19 (Harbor)
- S-25 (Magnolia)
- S-26 (Santa Fe)

LBWD's system has several lift stations that serve a single customer or a serve a single restroom, such as the comfort stations along the beach. The flows pumped via these lift stations is relatively small compared to wastewater flows conveyed through the pump stations listed above. These small lift stations include: S-02 (North Airport), S-03 (South Airport), S-14 (Coronado), S-15 (Molino), S-16 (Cherry), S-17 (8th Place), S-20 (Shoreline #1), S-21 (Shoreline #2), S-22 (Shoreline #3), S-23 (Shoreline #4), S-27 (Airport Administration), and S-28 (Marine Stadium). The physical condition of these lift stations is not evaluated as part of this task.

During the field visit, MWH staff visually inspected the lift stations for the following issues:

- Condition of the wet well lining
- Greasing at the lift station
- Inlet and outlet pipe configuration

- Electrical system
- Telemetry system
- Condition of pumps, including remaining useful life
- Structural integrity
- General lift station condition

Detailed discussions of findings and recommendations during the field visits are provided in **Exhibits 1 - 14**. Representative photographs of each facility are also included in each exhibit. Based on the information gathered during the field visits and input from LBWD Staff, a methodology was developed to assess the condition of the sewer lift stations. The stations are ranked based on their relative condition as good, fair, poor, or very poor. A brief description of the parameters considered to assess the condition of the lift stations is provided below. The remaining useful life of pumps and electrical gear is also considered and described by the parameters below. The replacement of the lift stations is prioritized based on a ranking system where a rank of 1 indicates a candidate considered to be the highest priority for replacement and a rank of 14 indicates a candidate considered to be the lowest priority for replacement. Besides the physical condition assessed based on visual inspection, factors such as the amount of flow conveyed via the lift station are considered for the prioritization.

Good Condition – The facility is considered to be in good condition if the facility is able to perform its intended function(s) with a desirable degree of efficiency without requiring additional repair or refurbishment other than routine maintenance. In addition, the facility does not have any visible exterior damage.

Fair Condition – The facility is considered to be in fair condition if the facility is able to perform its intended function(s) at a lower than desired efficiency while requiring minor repair or refurbishment in addition to routine maintenance. In addition, the facility has minor visible exterior damage.

Poor Condition – The facility is considered to be in poor condition if the facility is able to perform its intended function(s) but requires major repair or refurbishment to operate at a lower than desired efficiency which may not be cost-effective for LBWD. In addition, the facility has severe visible damage on its exterior.

Very Poor Condition – The facility is considered to be in very poor condition if the facility is unable to perform its intended function(s) and requires replacement to operate at a desired efficiency. In addition, the facility has severe visible damage on its exterior.

The sewer lift station improvements and repairs are prioritized and numerically ranked using the following information:

- Visual condition assessment
- Safety of personnel in and around the lift station
- Remaining useful life of pumps and electrical gear
- The lift station pumping capacity
- Year of construction
- Year of most recent rehabilitation of the station
- System criticality (this is based on the total flow passing through the lift station)
- Input from LBWD's Operations staff

The lift stations are ranked in ascending order of priority (i.e. “2” refers to the second highest priority to be rehabilitated after number “1”).

In the case of multiple lift stations with similar physical condition, best engineering judgment was used for prioritization. For example, S-8 and S-12 are in very poor condition. However, Lift Station S-12 is ranked as number “1” based on the following rationale:

- S-12 is in very poor condition
- S-12 has the largest design flow of all stations
- LBWD Operations staff recommend immediate rehabilitation of S-12
- S-12 has significant safety concerns (documented in Exhibit 10)

S-8 has minimal remaining useful life and have not been rehabilitated in over 40 years.

Remaining useful life –

- **Pumps:** The useful life of a pump or pumping component is a forecast of the time remaining during which it will be economic and reliably usable in the current operating conditions. This can be a shorter period than its physical life, as it may reach a point where the cost of repair or pumping reliability may pose a challenge to the pumping operation and safety.

- **Electrical Gear:** The expected useful service life for circuit breakers, dry type transformers, motor control equipment, and other industrial electrical gear is typically 20-30 years. This is due to deterioration from infiltration of dust and moisture over time. The fact that the electrical gear equipment is in wastewater conveyance facilities adds a greater exposure to corrosive gasses, which accelerate the deterioration of wire insulation and other protective coverings. As electrical equipment ages, it can become less reliable due to these factors, at worst becoming a fire hazard from an arcing short circuit. Additionally, maintenance can become a challenge as the availability of spare parts is increasingly difficult after 15-20 years. Electrical gear older than 20 years is noted in the exhibits.

Safety – The term “SAFETY” used in this memo for Exhibits 1 through 14 represents a potential hazard to personnel in or around the lift station. Safety issues noted in this memo will be address by LBWD Operations.

Codes – The following codes are referenced throughout the memo:

- **CBC (2010)** – The 2010 California Building Code.
- **ASCE7** – The American Society of Civil Engineers (ASCE) *Minimum Design Loads for Buildings and Other Structures* (2010).
- **ACI 318-08** – The American Concrete Institute (ACI) *318-08: Building Code Requirements for Structural Concrete and Commentary* (2008).
- **NFPA 820** – The National Fire Protection Association (NFPA) *NFPA 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities* (2012).
- **OSHA 29 CFR 1910, Subpart E** – The Occupational Safety and Health Administration (OSHA) Code of Federal Regulations (CFR) Standard Number 1910 Subpart E.

- **OSHA 29 CFR 1910, Subpart D** – The Occupational Safety and Health Administration (OSHA) Code of Federal Regulations (CFR) Standard Number 1910 Subpart D.

Electrical Installation Requirements –

The National Fire Protection Agency's (NFPA's) "NFPA 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities" provides requirements for electrical installations in wastewater treatment and collection facilities. Per the standard, if a wet well hatch is located in a control building, there is a possibility of wet well off-gasses entering the building and accumulating. Therefore, the area is classified as a "hazardous area," per NFPA, requiring certain electrical installation requirements to prevent an electrical spark from igniting the gasses in the building. To determine what level of NFPA requirements the electrical installation has to meet (i.e. Division I or Division II), a ventilation analysis must be performed. The measure of air changes per hour (i.e. turnover time for control volume of air in the building) is used to estimate how much gas can build up over a period, and thus, how hazardous the area is. Depending on the results of this analysis, the NFPA will require either Division I or Division II electrical installation requirements. Currently, installations at the noted facilities do not meet the current National Electrical Code (NEC) or NFPA requirements for a hazardous location. In order to conform to this standard and ensure the safety of personnel near the lift stations, it is recommended that LBWD upgrade the noted facilities to conform to these applicable codes.

Table 1 provides a summary of the LBWD sewer lift stations, remaining useful life of pumps, overall condition and key issues based on visual inspection. Information presented in **Table 1** is obtained from LBWD staff. These key issues are described in detail in **Exhibits 1 - 14**.

Table 1: Overall Condition of Selected LBWD Lift Stations

Lift Station ID	Station Name	Location	Year of Construction	No. of Pumps	Horsepower (No. of pumps)	Design Flow (gallons per minute)	Design Head (feet)	Wet Well Volume (gallons)	Force Main Diameter (inch)	Overall Condition	Priority	Remaining useful life of pump	Key Observations
S-12	Belmont	Division Street & Bennett Avenue	1991	3	115 (3)	2,244	36	3,400	10,12	Very Poor	1	10 to 15 years (i.e., 2023-2028)	VFDs have passive harmonic filters (one each on line side); unknown if load reactors are employed or what sort of cabling is used from VFD to terminal junction boxes for pumps. There are odor and corrosion at the wet well. This station has a grease problem, which may to false readings by the level sensor. SAFETY: Gas fumes are sucked back down into the dry pit when the ventilator is on, making it difficult (and potential hazardous) for staff working in the pit. Wet well lining is peeling off the wall inside of the wet well, potentially causing damage and clogging the pumps.
S-8	Marina 2	6391 Marina Drive	1973	3	7.5 (3)	337	30	1,900	6	Very Poor	3	0 to 3 years (i.e. 2013-2016)	Pumps appear to be of the original installation and all three pumps have reached the end of their useful life.
S-26	Santa Fe	3816 N. Santa Fe	1980	3	30 (3)	821	44	5800	12	Poor	4	0 to 5 years (i.e., 2013-2018)	Pumps have reached the end of their useful life.
S-1	Hill & Atlantic	Hill St. & Atlantic Ave.	1920	2	20 (2)	1,212	40	800 to 2,000	6	Poor	5	0 to 5 years (2013-2018)	The electrical gear has reached the end of its useful life. Disconnect switch marked for transformer is rated for 60 Amps (A), but transformer full load current is 62A. SAFETY: Emergency lighting is inadequate/inoperable, per OSHA 29 CFR 1910, Subpart E.
S-18	Hart Place	Hart Place & Seaside Way	1975/ 1999 Rehab	4	18 (2), 7.5 (2)	292	100	814	6	Poor	6	10 to 15 year on newer pumps (i.e., 2023-2028) 5 to 10 years on the older pumps (i.e., 2018-2023)	This station is located in the parking garage of the Long Beach Convention Center and difficult to access. The staff can only bring in one small truck to access the site. The main issues at this site are the power concerns (e.g. power outage). The electrical gears are not owned by Long Beach, and the generator does not run.
S-6	Ultimo	339 Ultimo Avenue	1981	3	7.5 (3)	341	31	2,000	6	Fair	7	5 to 15 years (i.e., 2018-2028)	The electrical gear has reached the end of its useful life. SAFETY: This station has structural concerns including termite damage, wall cracks, and inadequate pump supports.
S-7	Belmont Park	349 Lakeview Avenue	1929/ 2000 Rehab	2	14 (2)	996	42	2,600	8	Fair	8	5 to 15 years (i.e., 2018-2028)	Noise complaints are the main issues at this lift station. Noise is as high as 50 decibels during the day and 45 decibels at night.
S-25	Magnolia	200 S. Magnolia Avenue	1968/ 2004 Rehab	4	10.4 (1), 18.8 (1), 24.4 (2)	498	48.5	2020	8	Fair	9	10 to 15 years (i.e., 2023-2028) on newer pumps 0 to 5 years (2013-2018) on the pump with cooling issue	Safety: A large homeless population on site may present security and safety issues. Pump #3 (10.4 HP) has a cooling problem and overheats frequently.
S-10	Naples	91 Rivo Alto Canal	1952/ 2002 Rehab	2	24 (2)	898	30	8	10	Fair	10	15 to 20 years (i.e., 2028-2032)	Access for maintenance of the lift station is difficult. Staff must shut down one side of the bridge when conducting any maintenance work at this site.
S-19	Harbor	Harbor Queensway Drive	2001 Rehab	2	7.5 (2)		53	814	4,6	Fair	11	10 to 15 years (i.e., 2023-2028)	Cracked wet well lid is located on the street.
S-4	Los Altos	5155 Atherton Street	1964/ 2000 Rehab	2	7.5 (2)	449	15	4,000	8	Good	12	10 to 15 years (i.e., 2023-2028)	Problems were recently encountered at this lift station. Levels in the wet wells are reduced to five feet within a few minutes of pump operation. Thereafter, the flow rates drop significantly and it takes a

Lift Station ID	Station Name	Location	Year of Construction	No. of Pumps	Horsepower (No. of pumps)	Design Flow (gallons per minute)	Design Head (feet)	Wet Well Volume (gallons)	Force Main Diameter (inch)	Overall Condition	Priority	Remaining useful life of pump	Key Observations
													long time before the pumps reach the shutoff level.
S-11	Alamitos Bay	62nd Place & Ocean Boulevard	1926/ 2011 Rehab	2	7.5 (2)	597	30	2,550	10	Good	13	15 to 20 years (i.e. 2028-2033)	A potential power outage compromises the reliability of this site. Recommend adding generator receptacle to accommodate the connection of a portable generator.
S-5	Westminster	7171 Seawind Drive	N/A	2	5 (1), 7.5 (1)	200	97	814	4	Good	14	15 to 20 years (i.e. 2028-2033)	The lift station is currently going through renovation. The condition of the lift station is subject to change.

Exhibit 1: Lift Station S-1

Facility Name: S-1 Hill & Atlantic

Date / Time: January 15, 2013; 8:00 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Poor

General Comments:

- Graffiti is observed on the lift station entry door.
- Electrical service is 240 Volt (V)/3-phase, which is not commonly used. However, it may be the only option in residential areas.
- 60 kilowatt (kW) on-site standby generator is adequately sized.
- Water seepage is observed on the walls.
- New corrosion-resistant wet well lid installed recently.

Key Issues:

- Electrical gear has reached the end of its useful life.

Pump Condition:

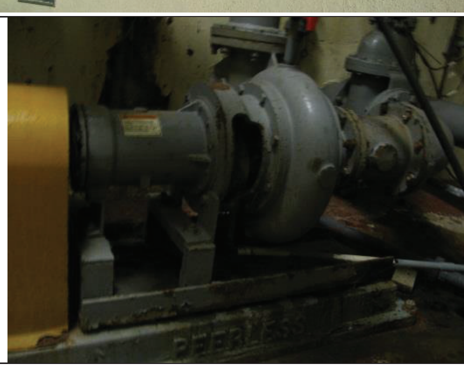
- Pump design capacity: Total of 2 pumps, each 1,200 gallons per minute (gpm) @ 40-feet total dynamic head (TDH) with 20 brake horsepower (Bhp) motor.
- Lift station pumping capacity: 2,200 gpm based on 10 feet per second (ft/s) on 10-inch discharge header.
- Estimated remaining economic useful life of pumps: 0 to 5 years (i.e., 2013-2018).
- 2 Fairbanks Morse horizontal centrifugal non-clog pumps in dry pit, Pump #1 is newer and replaced couple years ago, Pump #2 has served long time and appears to have reached the end of its useful life.

Piping and Valve Condition:

- Piping and valves appear to be in usable condition, but need rust cleaning and coating repair. The 10-inch discharge header isolation gate valve takes 86 quarter turns to open or close the valve during the wet well cleaning cycle. This operation is time consuming and labor intensive. Pipe material is ductile iron (DI).

Lift Station S-1 Observations	Lift Station S-1 Recommendations	
Telemetry cabinet impedes full swing of entry door (**FIGURE 1-1).**	1-1	Relocate telemetry cabinet so that entry/egress is not impeded.
Electrical gear has reached the end of its useful life. Disconnect switch marked for transformer is rated for 60 Amps (A), but transformer full load current is 62A.	1-2	Consider replacing all electrical gear with similar equipment to what has been used at other recently-upgraded sites, such as S-5 (use 208V/3-phase service if available).
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	1-3	Add wet well level indicator near local pump control switches.

Lift Station S-1 Observations	Lift Station S-1 Recommendations	
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	1-4	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
Wet well lining is deteriorated; pieces of the lining fall into the wet well and flow into the pumps.	1-5	Repair wet well lining.
Observed minor cracks at wall (**FIGURE 1-2 and FIGURE 1-3).**	1-6	Recommend reevaluating the cracks again after 5 years.
Observed mild corrosion in some steel pads for pumps. Also, minimum edge distances for steel pads have not been met, per ACI 318-2008 requirements.	1-7	Recommend reevaluation of the steel pad.
A crack around window frame occurs. Lack of additional rebar such as diagonal rebar could be the reason.	1-8	Recommend investigating the reason and designing appropriate remedy plan.
SAFETY: Some cabinets are not laterally supported per CBC (2010) standards. They are not stable during seismic event.	1-9	Cabinets should be properly braced.
Discharge isolation valve takes 86 quarter turns to close the valve, which can be a strenuous and time consuming activity for staff.	1-10	Recommend installing an automated discharge isolation valve.
SAFETY: Emergency lighting is inadequate/inoperable.	1-11	Recommend adding emergency lighting per OSHA 29 CFR 1910, Subpart E.
Additional Recommendations.	1-12	Replace pump #2 and suction, discharge valve and piping as needed.
Additional Recommendations.	1-13	Rehabilitate pump room dry pit wall and floor. Provide slope drain to sump.
Additional Recommendations.	1-14	Replace all utility and draining piping to sump and sump pump.
Additional Recommendations.	1-15	Piping and valves need cleaning and recoating.

Lift Station S-1 Photo Record	
	**FIGURE 1-1:** Telemetry cabinet accessibility issue behind entrance door
	**FIGURE 1-2:** Back wall Cracks
	**FIGURE 1-3:** Evidence of wall cracks at exterior wall
	**FIGURE 1-4:** Pump in dry well

Lift Station S-1 Photo Record	
	**FIGURE 1-5:** Dry Well Arrangement

Exhibit 2: Lift Station S-4

Facility Name: S-4 Los Altos

Date / Time: January 16, 2013; 7:50 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Good

General Comments:

- Carbon filter for odor control is not in service. Ventilation is at low elevation.
- Flow meter does not connect to SCADA system.
- SAFETY: Termite damage was observed on timber beams (**FIGURE 4-1 and FIGURE 4-3)**.
- Electrical service is 240V/3-phase, which is not commonly used - may be the only option in residential areas, however.
- Circuit breaker marked "spare" is turned on - not sure if the odor control system has been changed over to this breaker.
- Unable to determine true age of electrical gear, but it appears less than 10 years old and is still in good condition.

Key Issues:

- Problems were recently encountered at this lift station. Levels in the wet wells are reduced to five feet within a few minutes of pump operation. Thereafter, the flow rates drop significantly and it takes a long time before the pumps reach the shutoff level. This problem leads to excessive run times of pumps. A flow meter is currently in use at the discharge, to ensure it is generating flow. This is not typical of the operation of these stations and is apparently a temporary condition.

Pump Condition:

- Pump designed capacity: Total of 2 pumps, each 700 gpm @ 2-feet TDH with 7.5 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 60-inch discharge header.
- Estimate remaining useful life of each pump: 10 to 15 years (i.e., 2023-2028).

Piping and Valve Condition:

- Piping and valves appear to be in good condition.

Lift Station S-4 Observations:	Lift Station S-4 Recommendations:	
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	4-1	Add wet well level indicator near local pump control switches.
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	4-2	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.

Lift Station S-4 Observations:	Lift Station S-4 Recommendations:	
SAFETY: Emergency lighting is unavailable.	4-3	Recommend adding emergency lighting per OSHA 29 CFR 1910, Subpart E.
No on-site standby power; no receptacle to easily connect a portable generator.	4-4	Add generator receptacle.
Communications antenna lead appears to enter top of outdoor motor control center (MCC) enclosure - this could provide a point of entry for water.	4-5	Ensure that any penetrations through top of MCC cabinet are properly sealed.
SAFETY: Tree branches are falling on electrical service drop.	4-6	Recommend landscape maintenance/tree trimming.

Lift Station S-4 Photo Record	
	**FIGURE 4-1:** SAFETY: Possible termite damage at the base of structure
	**FIGURE 4-2:** SAFETY: Inadequate lighting and clearance in wet well
	**FIGURE 4-3:** SAFETY: Possible termite damage to timber beams shown inside structure

<table>
<tr><th colspan="2">Lift Station S-4 Photo Record</th></tr>
<tr><td></td><td>FIGURE 4-4: Dry well arrangement</td></tr>
</table>

Exhibit 3: Lift Station S-5

Facility Name: S-5 Westminster

Date / Time: January 16, 2013; 10:30 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Good

General Comments:

- Station is currently going through renovation; condition of station is subject to change.
- Station has some operational interaction with LADWP Haynes power plant, so it does not necessarily bear a "standard" resemblance to other LBWD lift stations for electrical equipment used.
- No on-site standby power, but does have a receptacle for connection of a portable generator.
- Some cable is improperly routed through cabinet penetrations and may be temporary.
- Some pull boxes do not appear to have proper clearances and accessibility due to ventilation fan location. Relocation may not be feasible due to site constraints.
- Electrical service is 240V/3-phase, which is not commonly used, but may be the only option in residential areas, however.
- Building is close to the slope of the channel; recommend reviewing the setback requirement by geotechnical engineer.

Key Issues:

- Station is currently going through renovation; condition of station is subject to change.

Pump Condition:

- Pump designed capacity: Total of 2 pumps, each 200 gpm @ 100-feet TDH with 18 to 22 kW motor.
- Lift station pumping capacity: 400 gpm based on 10 ft/s on 4-inch discharge header.
- Estimate remaining useful life of each pump: New pumps, 15 to 20 years (i.e. 2028-2033).

Piping and Valve Condition:

- Piping and valves are in new condition. Piping is of ductile iron (DI) pipe.

Lift Station S-5 Observations:	Lift Station S-5 Recommendations:	
Inconsistent conduit and fitting type and size; some boxes may not be properly rated, per NFPA 820, for use in a classified hazardous area.	5-1	Correct problems with inconsistent conduit fittings.
Poor wire routing inside control panels - this may be cleaned up prior to completion.	5-2	Ensure that wiring issues are cleaned up prior to final sign-off.
SAFETY: No fall prevention for ladders (**FIGURE 5-1).**	5-3	Recommend providing ladder cages for fall prevention.

Lift Station S-5 Photo Record	
	**FIGURE 5-1:** SAFETY: No fall prevention for ladder
	**FIGURE 5-2:** Dry well arrangement

Exhibit 4: Lift Station S-6

Facility Name: S-6 Ultimo

Date / Time: January 16, 2013; 8:30 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Fair

General Comments:

- This lift station uses submersible type motors and previously used line-in shaft pumps.
- Existing wet well lid is in need of repair; LBWD staff has scheduled for new wet well installation soon.
- Past issues with dry pit flooding were reported by staff.
- LBWD staff notes the wet well is in decent condition. Wet well does not have lining.
- SAFETY: LBWD staff noted that the ladder in the wet well was badly corroded. However ,the ladder is not being used by staff.
- The back wall is connected to a residential wall.

Key Issues:

- Electrical gear has reached the end of its useful life.
- SAFETY: This station has structural concerns including termite damage, wall cracks, and inadequate pump supports.

Pump Condition:

- Pump designed capacity: Total of 3 pumps, each 340 gpm @ 31-feet TDH with 7.5 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of each pump: 5 to 15 years (i.e. 2018-2028).
- The newer vertical centrifugal non-clog Pump #2 is newer replaced couple years ago, Pump #1 and #3 are of submersible type and have served long time for about 10 years.

Piping and Valve Condition:

- Piping and valves appear to be in usable condition, but need rust cleaning and coating repair.

Lift Station S-6 Observations:	**Lift Station S-6 Recommendations:**	
Odor control discharge line located outside of the lift station wall is leaking condensate, creating a puddle outside of the building.	6-1	Recommend adding a drain line/hose.
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	6-2	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
Electrical gear has reached the end of its useful life.	6-3	Consider replacing all electrical gear with similar equipment to what has been used at other recently-upgraded sites, such as S-5.

Lift Station S-6 Observations:	Lift Station S-6 Recommendations:	
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	6-4	Add wet well level indicator near local pump control switches.
There is no on-site standby power, nor does there appear to be a receptacle to easily connect a portable generator.	6-5	Add generator receptacle and transfer switch.
SAFETY: Emergency lighting is unavailable.	6-6	Recommend adding emergency lighting per OSHA 29 CFR 1910, Subpart E.
SAFETY: Timber beam has mild termite problem (**FIGURE 6-3).**	6-7	Recommend termite treatment.
SAFETY: No Fall prevention.	6-8	Recommend adding ladder safety cage to the ladders.
An anchor bolt is missing and we observe mild to average corrosion in the steel plate (**FIGURE 6-1).**	6-9	Pump support needs to be repaired.
Minor vertical and diagonal cracks on the wall have been observed.	6-10	Recommend reevaluating them within five years.
External wall is connected to the building (**FIGURE 6-2).**	6-11	Recommend a gap between wall and structure and using filler between.
Additional Recommendations.	6-12	Replace pump #1 and #3 as needed.
Additional Recommendations.	6-13	Rehabilitate pump room dry pit wall and floor. Provide slope drain to sump.
Additional Recommendations.	6-14	Provide pump seal water drain piping to sump.
Additional Recommendations.	6-15	Piping and valves need cleaning and recoating.
Additional Recommendations.	6-16	Provide well wet vent pipe condensate drain line, clean and recoat vent pipe flange and raise vent pipe support pad higher than the surrounding floor.

Lift Station S-6 Photo Record	
	**FIGURE 6-1:** Missing anchor bolt and corroded pump support

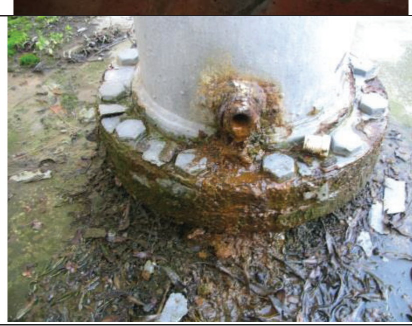
Lift Station S-6 Photo Record	
	**FIGURE 6-2:** External wall connected to building
	**FIGURE 6-3:** SAFETY: Termite damage at wood beam
	**FIGURE 6-4:** Dry well arrangement
	**FIGURE 6-5:** Plan view of pumps
	**FIGURE 6-6:** Corroded pipe and leaking condensate outside of building

Exhibit 5: Lift Station S-7

Facility Name: S-7 Belmont Park

Date / Time: January 15, 2012; 2:05 PM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Fair

General Comments:

- Built in 1929 and rehabilitated in 2000.
- Similar configuration to S-11.
- Peeling of paint along wall and at the base of the dry well. Concrete condition appears fine.
- Minimal clearance in dry well.
- Electrical gear is less than 10 years old and appears adequately sized.
- Electrical service is 240V/3-phase, which is not commonly used, but may be the only option in residential areas.

Key Issues:

- Noise complaints are the main issues at this lift station. Noise is as high as 50 decibels during the day and 45 decibels at night.

Pump Condition:

- Pump designed capacity: Total of 2 pumps, each 990 gpm @ 42-feet TDH with 14 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of each pump: 5 to 15 years (i.e., 2018-2028).
- The submersible pumps were replaced 10 years ago.

Piping and Valve Condition:

- Piping and valves appear to be in a usable condition, but need rust cleaning and coating repair.

Lift Station S-7 Observations:	Lift Station S-7 Recommendations:	
No on-site standby power, and there does not appear to be a receptacle to connect a portable generator.	7-1	Add a generator receptacle.
SAFETY: Emergency lighting is unavailable.	7-2	Recommend adding emergency lighting per OSHA 29 CFR 1910, Subpart E.
Pump motors are rated at 208V, which requires the electrical gear to be run at 208V after being transformed down from 240. This transformer is located outside and produces a considerable hum (may be source of noise complaints).	7-3	Change motors to 240V or change electrical service to 208V (if available) so that outdoor transformer may be removed (most, if not all, of the existing gear should still be compatible).

Lift Station S-7 Observations:	Lift Station S-7 Recommendations:	
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	7-4	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
There appears to be conduit penetrations through the top of the outdoor motor control center (MCC) enclosure - this could provide a point of entry for water.	7-5	Ensure that any penetrations through top of MCC cabinet are sealed sufficiently.
Concrete spalling along the dry well wall mid-way down along the spiral staircase.	7-6	Recommend repairing spalling concrete.
Pump support edge distance is not adequate.	7-7	Recommend reevaluating anchor bolts for pump support, per ACI 318-08 requirements.
SAFETY: Stair beam has minor corrosion.	7-8	Recommend reevaluating them within three years.
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	7-9	Add wet well level indicator near local pump control switches.
Dry pit wall and floor is poor condition **(FIGURE 7-1).**	7-10	Rehabilitating pump room dry pit wall and floor. Provide slope drain to sump.

Lift Station S-7 Photo Record	
	**FIGURE 7-1:** Dry pit wall and floor
	**FIGURE 7-2:** Piping arrangement

Lift Station S-7 Photo Record	
	**FIGURE 7-3:** Interior wall cracks

Exhibit 6: Lift Station S-8

Facility Name: S-8 Marina 2

Date / Time: January 16, 2013; 9:05 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Very Poor

General Comments:

- Building structure is similar to S-6.
- Lift station has line-in shafts configuration for 3 pumps.
- Existing wet well lid is in need of repair; LBWD staff has scheduled for the installation of a new wet well at this site.
- Dry well used to flood every couple of months. Staff would have to pull the sump pump lever to draw down water in the dry well. Flooding could be due to sump pump not working or the result of a leaking pump. Staff indicates this issue has been alleviated in the last year.
- Local bus stop lighting is fed from the lighting panel at this station.

Key Issues:

- Pumps appear to be of the original installation, in 1973. All three pumps have reached the end of their useful life.

Pump Condition:

- Pump designed capacity: Total of 3 pumps, each 337 gpm @ 30-feet TDH with 7.5 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of each pump: 0 to 3 years (i.e. 2013-2016).
- The pumps have served a very long time and appear to have reached its useful life.

Piping and Valve Condition:

- Piping and valves are corroded and appear to have reached the end of their useful life.

Lift Station S-8 Observations:	Lift Station S-8 Recommendations:	
Pumps appear to be of the original installation, in 1973. All three pumps have reached the end of their useful life.	8-1	Recommend replacement of pumps.
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	8-2	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.

Lift Station S-8 Observations:		Lift Station S-8 Recommendations:
Electrical gear is greater than 20 years old. Electrical service is 208V/3-phase, but most equipment at this site is rated for 480V/3-phase; a transformer is used to increase the voltage to 480 to supply the pumps and ventilation fans.	8-3	Consider replacing all electrical gear with similar equipment to what has been used at other recently-upgraded sites. Use 480V/3-phase service if available; otherwise, use existing 208V/3-phase and replace motors and gear at the same time to eliminate the transformer.
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	8-4	Add wet well level indicator near local pump control switches.
Site has had problems with the dry well flooding - probably a float switch issue.	8-5	Troubleshoot/replace faulty float switch in dry well.
Communication antenna cable is improperly routed through a window.	8-6	Correct any improperly routed wires and remove abandoned conduit.
No on-site standby power and no receptacle to connect a portable generator.	8-7	Add generator receptacle and transfer switch.
SAFETY: Emergency lighting is unavailable.	8-8	Recommend adding emergency lighting per OSHA 29 CFR 1910, Subpart E.
SAFETY: Observed significant humidity damage in timber beam.	8-9	Those beams should be investigated and remedy and treatment plan should be provided. Termite treatment is recommended if determined to be the source of damage.
SAFETY: Corrosion on hatches and ladder (**FIGURE 8-1).**	8-10	Recommend adding ladder safety cage to the ladders and reevaluating corrosion within five years.
Minor concrete damage is observed in wet well.	8-11	Recommend reevaluating it within 5 years (i.e., 2018).
Corrosion in pump support is observed. Edge distance for anchor bolt seems less than min requirement. (**FIGURE 8-2)**	8-12	Recommend reevaluating pump supports, per ACI 318-08 requirements.
Observed very minor cracks in wall.	8-13	Recommend reevaluating them within five years again.
Additional Recommendations.	8-14	Provide well wet vent pipe condensate drain line, clean and recoat vent pipe flange and raise vent pipe support pad higher than the surrounding floor.

Lift Station S-8 Photo Record	
	**FIGURE 8-1:** Ladder and hatch corrosion inside wet well
	**FIGURE 8-2:** Corroded pump support
	**FIGURE 8-3:** Corroded pipe support
	**FIGURE 8-4:** Wet well and ladder condition

Lift Station S-8 Photo Record	
	**FIGURE 8-5:** Corroded pump and support
	**FIGURE 8-6:** Pump arrangement

Exhibit 8: Lift Station S-10

Facility Name: S-10 Naples

Date / Time: January 15, 2012; 1:30 PM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Fair
General Comments:

- Built in 1952 and rehabilitated in 2002.
- During high tides, water comes out of the mains and seeps out of cracks on sidewalk, stairs down to the station. Water from the canal flows through grating outside of the pump station entry door and into the wet well.
- The lift station foundation is sinking (evidence at the public side walk outside of the station).
- Gas transmitters are not in operation.
- Electrical service is 480V/3-phase; gear is less than 10 years old and appears to be in good condition.
- Transfer switch and receptacle for portable standby generator are located outside of control room.

Key Issues:

- Access to the lift station is difficult. Staff must shut down one side of the bridge when conducting any maintenance work at this site. Lift station is located under the road.

Pump Condition:

- Pump designed capacity: Duplex submersible pumps, each 900 gpm @ 30-feet TDH with 24 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of each pump: New Pumps, 15 to 20 years (i.e., 2028-2032).

Piping and Valve Condition:

- Piping and valves appear to be in good condition, but need minor rust cleaning and coating repair.

Lift Station S-10 Observations:	Lift Station S-10 Recommendations:	
Noise complaints.	10-1	Recommend sound proofing door.
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	10-2	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
Infiltration of water during high tides.	10-3	Take steps to ensure that flooding problem does not reach electrical junction boxes or equipment in control room.

Lift Station S-10 Observations:	Lift Station S-10 Recommendations:
Concrete spalling around stair and wet wells and steel corrosion have been observed.	10-4 Recommend reevaluating them within three years (i.e., 2016).
SAFETY: Odor control system is not laterally supported.	10-5 Seismic lateral braces shall be added.

Lift Station S-10 Photo Record	
	**FIGURE 10-1:** Deterioration of concrete handrail support
	**FIGURE 10-2:** Dry well pump discharge piping configuration
	**FIGURE 10-3:** Duplex submersible pumps in wet well condition
	**FIGURE 10-4:** Corrosion on entrance grating, poor drainage with stagnant water below gating.

Exhibit 9: Lift Station S-11

Facility Name: S-11 Alamitos Bay

Date / Time: January 15, 2012; 1:01 PM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Good

General Comments:

- New wet well lid to be installed soon.
- Staff comments suggest station is quite reliable and not problematic.
- S-11 takes care of domestic discharge for homes along peninsula. Station has had offset with joints due to sand and infiltration. Lines have been slip lined about 10 years ago. No grease issues, mostly sand.
- Electrical service is 240V/3-phase, which is not commonly used - may be the only option in residential areas, however.
- Electrical gear is less than 10 years old and appears to be in good condition.

Key Issues:

- Potential power outages compromise the reliability of the lift station. There is no on-site standby power and no receptacle for connection of portable generator.

Pump Condition:

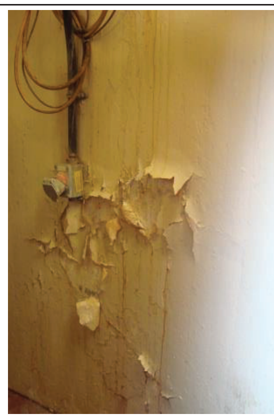
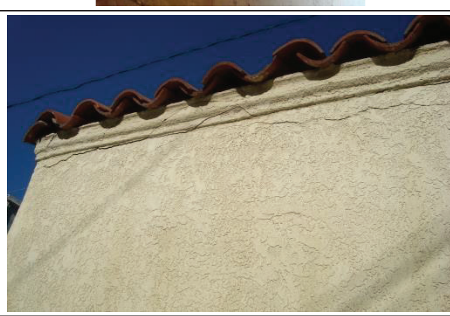
- Pump designed capacity: Total of 2 pumps, each 550 gpm @ 25-feet TDH with 7.5 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of each pump: Newer pumps, 15 to 20 years (i.e., 2028-2032).

Piping and Valve Condition:

- Piping and valves appear to be in good condition, but need minor rust cleaning and coating repair.

Lift Station S-11 Observations:	**Lift Station S-11 Recommendations:**	
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	11-1	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	11-2	Add wet well level indicator near local pump control switches.
No on-site standby power and no receptacle for connection of portable generator.	11-3	Add generator receptacle to accommodate the connection of a portable generator.

Lift Station S-11 Observations:	Lift Station S-11 Recommendations:	
There appears to be conduit penetrations through the top of the outdoor motor control center (MCC) enclosure - this could provide a point of entry for water.	11-4	Ensure that any penetrations through top of MCC cabinet are sealed sufficiently.
Possible water infiltration along the wall or corrosion causing peeling along the wall. (**FIGURE 11-1)**	11-5	Recommend repairing wall lining.
SAFETY: Minor corrosion in stair beam.	11-6	Recommend reevaluating it within three years.
Minor cracks on wall (**FIGURE 11-2).**	11-7	Recommend reevaluating within three years.
Additional Recommendations.	11-8	Provide new sump pump.

Lift Station S-11 Photo Record	
	**FIGURE 11-1:** Peeling along wall
	**FIGURE 11-2:** Minor wall cracks
	**FIGURE 11-3:** Dry well configuration

Lift Station S-11 Photo Record	
	**FIGURE 11-4:** Condition of sump
	**FIGURE 11-5:** Piping and valves

Exhibit 10: Lift Station S-12

Facility Name: S-12 Belmont

Date / Time: January 15, 2012; 10:50 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Very Poor

General Comments:

- Air conditioning unit is expected to be replaced soon.
- Corrosion caused by hydrogen sulfide is observed outside of the station above the wet well.
- S-12 experiences a lot of flow and grease. The station receives flow from restaurants along 2nd Street, areas south of Ocean Blvd, and S-10 and S-11.
- Within the last three years, there has been two new pumps installed (#1 & #2), new impeller pump and volute for Pump #3 (all Dezurik pumps).
- By pass is conducted when cleaning up the wet well. Bypass set up for this station is difficult; switch gear needs to be brought in, and pump needs to be set up.
- Appears that groundwater infiltrates through dry well walls and rusts the supports, in the area near the discharge line. The dry pit floor is constantly wet due to infiltration.
- Electrical service is 480V/3-phase with 800A switchboard and MCC for power distribution.
- Service feed electrical gear is approximately 20 years old and appears in good shape; VFDs added less than 5 years ago - one recently replaced due to a fire; power feed to VFDs is from original MCC which has had some sections partially abandoned.
- 300kW on-site generator appears in good condition with 152 hours on elapsed time meter; may be just slightly undersized for operation of all three pumps plus HVAC and other loads.
- 14-inch wall pipe suction thimble from wet well with plug isolation valve, 14-inch X 10-inch reducer to 10-inch pump suction flange. 8-inch pump discharge to 8-inch check valve and 8-inch isolation plug valve and connect to 12-inch discharge header. All ductile Iron (DI) piping.
- Three (3) submersible pumps in dry well, all appear in good and clean condition. Two pumps were newer installed couple years ago (#1 & #2), and new impeller pump and volute for pump #3 (All ABS pumps).
- Well wet fume is ventilated with a 4-inch suction duct to an odor control tank connected to an exhaust fan discharges high above building roof level. The building is served by an air conditioner unit.
- Corrosion of metal on HVAC equipment, ducting and supports.
- Poor fume exhaust pipe termination location, the vent pipe terminate point appears lower than the adjacent or close by residential window opening about 10 to 15 feet away.
- Poor ventilation, as indicated by odor in the dry pit near pump area.
- Poor drainage, wet floor or water accumulation on dry pit floor due to poor floor slope to sump.
- Pumps and piping supports not adequate provided, the pumps are supported on a narrow 2-inch wide grout strip with grout cracks found along the grout strip.

Key Issues:

- Issues with VFD, odor, grease and corrosion described in the table below.
- Grease problem causes false readings from level sensor, leading to inefficient operation of pumps.

- SAFETY: Gas fumes are sucked back down into the dry pit when the ventilator is on, making it difficult (and potential hazardous) for staff working in the pit.
- Wet well lining is peeling off the wall inside of the wet well, potentially clogging the pumps.

Pump Condition:

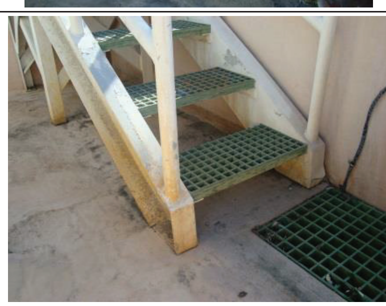
- Pump designed capacity: Total of 3 pumps, each 2,244 gpm @ 100-feet TDH with 115 Bhp motor.
- Lift station pumping capacity: 3,500 gpm based on 10 ft/s on 12-inch discharge header.
- Estimate remaining useful life of each pump: 10 to 15 years (i.e., 2023-2028).
- 3 submersible pumps (by ABS pump) in dry pit, the pumps appear in good and clean condition. Two pumps were newer installed couple years ago (#1 & #2), and new impeller for pump #3.

Piping and Valve Condition:

- Piping and valves appear to be in good condition, but need some coating repair.

Lift Station S-12 Observations:	**Lift Station S-12 Recommendations:**	
Manhole to the wet well needs to be resealed each time it is opened. (**FIGURE 12-5)**	12-1	Recommend Rehabilitating wet well roof (courtyard area) and provide easier manhole access and sealing.
Exposed rebar inside wet well.	12-2	Recommend rehabilitating wet well.
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	12-3	Add wet well level indicator near local pump control switches.
Clearance issues.	12-4	Consider removing unused sections of original MCC for ease of maintenance and increase working clearances.
VFDs have passive harmonic filters (one each on line side); unknown if load reactors are employed or what sort of cabling is used from VFD to terminal junction boxes for pumps.	12-5	Analyze VFD installation to ensure proper methods are employed to mitigate harmonics and comply with manufacturer recommendations.
SAFETY: Access stair does not have hand rail.	12-6	Recommend adding hand rail.
Concrete pad for pumps are cracked and damaged.	12-7	Suggest replacing the concrete pad.
SAFETY: Observed mild corrosion in stair beams. (**FIGURE 12-2)**	12-8	Recommend reevaluating them within three years again.
Wet well lining is in poor condition.	12-9	Wet well lining needs to be repaired.
SAFETY: Some cabinets do not have lateral bracing.	12-10	Seismic lateral brace shall be added.
SAFETY: Gratings are not laterally supported. During seismic event they can slip off. **(FIGURE 12-3 and FIGURE 12-4)**	12-11	Recommend pursuing remedy design.
Pump Support edge distance is not adequate. Pipe supports not adequate.	12-12	Repair pump and pipe supports.

Lift Station S-12 Observations:	**Lift Station S-12 Recommendations:**	
Corrosive fume (H_2S) is observed in the courtyard above the wet well, major concrete floor and metal corrosion. (**FIGURE 12-1)**	12-13	Rehabilitating wet well wall and floor need further assessment on method of wet well rehabilitations, repair or replace rebar reinforcement, wet well wall concrete and lining replacement.
Wet well maintenance/cleaning isolation with by pass is difficult, needs major switch gear and pump setup. The wet well receives discharge from nearby restaurants and has grease accumulation issues on wet well wall, and needs grease cleaning.	12-14	Provide wet well grease cleaning design.
SAFETY: Poor dry well ventilation, gas fume on dry pit when the ventilator is on, potential hazardous for operating staffs in the dry pit.	12-15	Replace the existing ventilation system and air conditioner system, with a new redesign system.
Strong odor near wet well hatch area in the courtyard above wet well.	12-16	Evaluate the existing odor control system and treatment capacity and vent discharge location.
Poor drainage, continue wet floor or water accumulation on dry pit floor, potential odor and corrosion issues.	12-17	Rehabilitating pump room dry pit wall and floor. Provide slope drain to sump.
Minor corrosion and rust on piping, valves and supports.	12-18	Piping and valves cleaning and recoating.

Lift Station S-12 Photo Record	
	**FIGURE 12-1:** H_2S Corrosion
	**FIGURE 12-2:** Stair beam corrosion

Lift Station S-12 Photo Record	
	**FIGURE 12-3:** Grating corrosion at dry pit
	**FIGURE 12-4:** Grating support issue at dry pit
	**FIGURE 12-5:** Wet well manhole needs to be sealed each time wet well needs to be accessed
	**FIGURE 12-6:** H2S corrosion on AC unit

Lift Station S-12 Photo Record	
	**FIGURE 12-7:** Corrosion on flange
	**FIGURE 12-8:** Piping and valve
	**FIGURE 12-9:** SAFETY: Cracking at structural support
	**FIGURE 12-10:** Wet well condition
	**FIGURE 12-11:** Corroded support

Exhibit 11: Lift Station S-18

Facility Name: S-18 Hart Place

Date / Time: January 15, 2012; 10:10 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Poor

General Comments:

- Station rehabilitated in 1999.
- Pumps #2 and #3 have been replaced within the last 3 years
- Wet well rehabilitated and relined about 5 years ago.
- S-18 takes care of Shoreline Village, Marina Green, condos, restaurants, convention center, and special events in the area such as the Grand Prix.
- Staff would like the check valve located at the top (instead of bottom by the pump).
- Staff mentioned pipe configuration is not operator-friendly.
- Visible crack along wall at odor scrubber area and along wall in pump/generator room.
- Electrical service is 480V/3-phase, fed via a switchboard on the top of the parking structure - no meter on site; power has been unreliable during times of high demand.
- 15 kW on-site standby generator is undersized; necessary to use portable generator connected via receptacle.
- Infiltration at this site; lot of sand and grit. Sediment clogs check valves for pumps 2, 3, and 4.
- Restricted to 4-inch suction line (instead of 6-inches); causing the pumps to continuously run during high flows.

Key Issues:

- Station located in the parking garage of the Long Beach Convention Center. Access to the station is difficult. Staff can only bring in one of the small trucks to access the site due to clearance in the garage.
- Main issue at this site is the power concerns (e.g. power outage). Gears are not owned by Long Beach, and the generator doesn't run.

Pump Condition:

- Pump designed capacity: Total of 4 pumps, 2 pumps each at 290 gpm @ 52-feet TDH with 7.5 Bhp motor. 2 pumps each at 450 gpm @ 41-feet TDH @ 18 Bhp.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of pumps: 10 to 15 year on newer pumps (i.e., 2023-2028), and 5 to 10 years on the other pumps (i.e., 2018-2023).
- Two newer pumps were replaced couple years ago; the other two pumps have served for about 10 years.

Piping and Valve Condition:

- Piping and valves appear to be in usable condition, but need rust cleaning and coating repair.

Lift Station S-18 Observations:	Lift Station S-18 Recommendations:	
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	18-1	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
125A service size prohibits the installation of larger pumps.	18-2	Consider upgrading the electrical service to allow for larger pumps.
Electrical gear is approximately 15 years old, but VFDs are outdated and consequently not used - they are left in bypass mode to operate the pumps at full speed.	18-3	Consider replacing all electrical gear with similar equipment to what has been used at other recently-upgraded sites; VFDs may be removed.
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	18-4	Add wet well level indicator near local pump control switches.
Vertical wall cracks were observed. It seems they were repaired and occurred again. Also minor diagonal cracks occur. (**FIGURE 18-2)**	18-5	Recommend reevaluating them within 5 years again.
SAFETY: Height of stair riser is 11 inch and it is not compliant with OSHA 29 CFR 1910, Subpart D requirements. Maximum height of riser shall be per OSHA requirements.	18-6	Recommend removing the stair and installing new aluminum stair.
SAFETY: Some small pipes do not have seismic lateral support. (**FIGURE 18-1)**	18-7	Seismic lateral brace should be added.
Additional Recommendations.	18-8	Piping and valves need cleaning and recoating.
Additional Recommendations.	18-9	Upsize the existing 4-inch suction to 6-inch.
Additional Recommendations.	18-10	Rearrange discharge piping and locate check valve in riser pipe.
Additional Recommendations.	18-11	Replace emergency generator.

Lift Station S-18 Photo Record

FIGURE 18-1: No lateral pipe support

Lift Station S-18 Photo Record	
	**FIGURE 18-2:** Vertical wall cracks
	**FIGURE 18-3:** Dry well configuration
	**FIGURE 18-4:** Piping and valve arrangement

Exhibit 12: Lift Station S-19

Facility Name: S-19 Harbor

Date / Time: January 15, 2012; 10:00 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Fair

General Comments:

- 208V/3-phase electrical service.
- Telemetry cabinet with motor control equipment appears to be less than 10 years old and is in good shape.
- A new pump was recently installed a couple months ago.

Key Issues:

- Wet well lid is located in the street and is cracked.

Pump Condition:

- Pump designed capacity: Duplex submersible pumps, each unknown gpm and TDH with 7.5 Bhp motor.
- Lift station pumping capacity: 400 gpm based on 10 ft/s on 4-inch discharge header.
- Estimate remaining useful life of each pump: 10 to 15 years (i.e. 2023-2028)

Piping and Valve Condition:

- Valve vault floods, causing corrosion of piping and valves.

Lift Station S-19 Observations:	Lift Station S-19 Recommendations:	
No on-site standby power and no receptacle for connection to portable generator.	19-1	Add generator receptacle.
Wet well lid and aluminum hatch has cracks (**FIGURE 19-1).**	19-2	Wet well lid needs to be designed for heavy traffic loads and replaced.
SAFETY: No fall prevention for access ladder.	19-3	Recommend adding ladder safety cage to the ladder.
Additional Recommendations.	19-4	Provide sump and sump pump in valve vault discharge back to wet well.
Additional Recommendations.	19-5	Replace corroded hardware inside valve vault.
Additional Recommendations.	19-6	Replace corroded air valve and air piping.
Additional Recommendations.	19-7	Clean and recoat piping and valve.
Additional Recommendations.	19-8	Rearrange discharge piping and locate check valve in riser pipe.

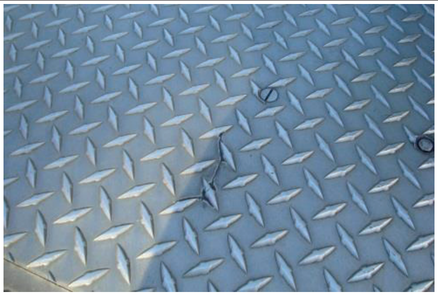
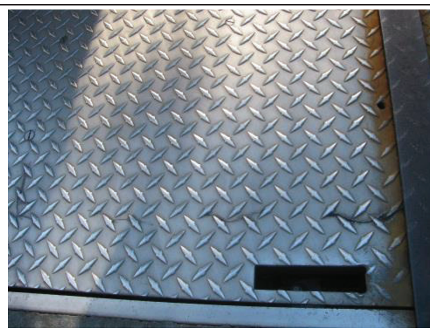
Lift Station S-19 Photo Record	
	**FIGURE 19-1:** Cracks in aluminum hatch
	**FIGURE 19-2:** Cracks at edge of hatch
	**FIGURE 19-3:** Piping and valve configuration
	**FIGURE 19-4:** Piping and valve configuration
	**FIGURE 19-5:** Wet well condition

Exhibit 13: Lift Station S-25

Facility Name: S-25 Magnolia

Date / Time: January 15, 2013; 9:15 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Fair

General Comments:

- Lift station includes generator/ generator room.
- Infiltration, rocks, and sand occur at this site.
- SAFETY: Wet well is in good shape, but does not have an access ladder.
- The station bypass does not work.
- Electrical service is 480V/3-phase.
- 130kW on-site standby generator is adequately sized and in good condition.
- Electrical gear is approximately 15 years old, but VFDs are outdated and consequently not used - they are left in bypass mode to operate the pumps at full speed.
- Lift Station S-25 experiences sewer flow backup upstream of the station where two incoming pipelines converge, and also grease problems that require constant cleaning by LBWD maintenance staff.

Key Issues:

- Large homeless population around the site presents a potential security and safety issue.
- Pump #3 has a cooling problem and frequently overheats.

Pump Condition:

- Pump designed capacity: Total of 4 pumps.
- Pump#1, 500 gpm @ 49-feet TDH with 14 Bhp motor.
- Pump#2, 500 gpm @ 49-feet TDH with 13 Bhp motor.
- Pump#3, 224 gpm @ 55-feet TDH with 10 Bhp motor.
- Pump#4, 500 gpm @ 49-feet TDH with 14 Bhp motor.
- Lift station pumping capacity: 900 gpm based on 10 ft/s on 6-inch discharge header.
- Estimate remaining useful life of pump: 10 to 15 year (i.e. 2023-2028) on newer pumps, and 0 to 5 years (i.e. 2013-2018) on the pump with cooling issue.

Piping and Valve Condition:

- Piping and valves appear to be in usable condition, but need rust cleaning and coating repair.

Lift Station S-25 Observations:	Lift Station S-25 Recommendations:	
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	25-1	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.

Lift Station S-25 Observations:	Lift Station S-25 Recommendations:	
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	25-2	Add wet well level indicator near local pump control switches.
SAFETY: Some equipment is not laterally supported.(**FIGURE 25-2)**	25-3	Seismic brace shall be designed to support equipment per CBC (2010) requirements.
It seems the edge distance for anchors are less than minimum edge distance. (**FIGURE 25-3)**	25-4	Suggest reevaluating the anchor bolts for pumps per ACI 318-08 requirements.
Pump station is located on sloped area.(**FIGURE 25-1)**	25-5	Recommend evaluating the slope stability by geotechnical engineer.
SAFETY: No access ladder.	25-6	Recommend adding access ladder with safety cage.
Additional Recommendations.	25-7	Piping and valves cleaning and recoating.
Additional Recommendations.	25-8	Replace Pump#3.
Additional Recommendations.	25-9	Provide bypass pipe for lift station.

Lift Station S-25 Photo Record	
	**FIGURE 25-1:** Lift station on sloped area
	**FIGURE 25-2:** SAFETY: Equipment not properly braced
	**FIGURE 25-3:** Inadequate pump support

Lift Station S-25 Photo Record	
	**FIGURE 25-4:** Dry well configuration
	**FIGURE 25-5:** Dry well configuration
	**FIGURE 25-6:** Pump with cooling issue
	**FIGURE 25-7:** Corrosion on pump flange
	**FIGURE 25-8:** Corrosion on pump flange

Lift Station S-25 Photo Record	
	**FIGURE 25-9:** Evidence of overheating

Exhibit 14: Lift Station S-26

Facility Name: S-26 Santa Fe

Date / Time: January 15, 2013; 8:40 AM

Reviewer: G. Tey, J. Morris, M. Ketabdar, J. Huang, T. Hancock

Overall Condition: Poor

General Comments:

- Wet well appears to be in good condition and ladders are usable.
- SAFETY: Exhaust pipe from diesel generator is not laterally supported.
- Electrical service is 480V/3-phase.
- 125kW on-site standby generator is adequately sized and in good condition.

Key Issues:

- Pumps have reached the end of their useful life.

Pump Condition:

- Pump designed capacity: Total of 3 pumps, each 820 gpm @ 44-foot TDH with 205 Bhp motor.
- Lift station pumping capacity: 1,600 gpm based on 10 ft/s on 8-inch discharge forced main on yard.
- Estimate remaining useful life of each pump: 0 to 5 years (i.e., 2013-2018).

Piping and Valve Condition:

- Piping and valves are corroded and appear to have reached the end of their economic life.

Lift Station S-26 Observations:	Lift Station S-26 Recommendations:	
SAFETY: Emergency lighting is unavailable.	26-1	Recommend adding emergency lighting per OSHA 29 CFR 1910, Subpart E.
Local H-O-A switches at pumps should also have level indicator visible nearby to avoid running the pumps dry when in Hand mode.	26-2	Add wet well level indicator near local pump control switches.
SAFETY: Electrical installation does not appear to be suitable to meet the needs of a classified hazardous area, as defined in NFPA 820, which may be applicable due to the wet well hatch opening into the control building.	26-3	Perform ventilation system analysis to determine the current number of air changes per hour (ACH). The results of this analysis will determine whether the electrical installation shall meet Division I or Division II explosion proof requirements as defined in NFPA 820.
Electrical gear appears in good condition, but reaching the end of its useful life.	26-4	If this station is scheduled for a pump upgrade, consider replacing the electrical gear at the same time due to its age.
SAFETY: No fall prevention in wet well. (**FIGURE 26-1)**	26-5	Recommend adding ladder safety cage to the ladders.
Pumps have reached the end of their useful life.	26-6	Recommend replacement of pumps.

Lift Station S-26 Photo Record	
	**FIGURE 26-1:** SAFETY: No fall prevention for ladder in wet well
	**FIGURE 26-2:** Dry well configuration
	**FIGURE 26-3:** Line shaft motors

APPENDIX B:

SEWER MODEL UPDATE TM

TECHNICAL MEMORANDUM

To:	Justin Pennington, Long Beach Water Department	**Date:**	June 2013
From:	Jinny Huang, P.E., MWH	**Reference:**	10501555/6.2
Subject:	LBWD Sewer Model Update - FINAL		

Introduction

A hydraulic model of the Long Beach Water Department's (LBWD) sewer collection system was developed for the 2008 Sewer Master Plan (SMP) (MWH, 2008). The 24-hour simulation model of the sewer system was created and calibrated to include all 12-inch diameter and larger sewers, as well as some 8-inch and 10-inch sewers. Pipelines less than 12-inch in diameter are included in the model since large portions of the system would be left unmodeled if only pipelines 12-inch in diameter or larger are modeled.

As part of the 2013 Sewer Master Plan Update (SMPU) project, the hydraulic model has been updated to reflect new pipeline improvements constructed since the completion of the 2008 SMP. For the 2008 SMP, MWH had developed separate hydraulic models to simulate weekday and weekend flow conditions due to the significant variation observed in wastewater flows during those days. As part of this model update, MWH is updating the Existing Weekday model and the Future Weekend model developed for the 2008 SMP. This technical memorandum (TM) summarizes and documents the model update process and includes recommendations for future model improvements.

New Pipeline Projects

The focus of the 2013 hydraulic model update is to incorporate sewer improvements constructed by LBWD since the last model development. LBWD provided MWH with record drawings for pipeline projects constructed since 2008. Two of these projects [Location 11 (SC-0212) and Location 13 (SC-0191)] are projects recommended in the 2008 SMP Capital Improvement Plan (CIP) to address hydraulic deficiencies (MWH, 2008). Other projects completed since 2008 include the California Bowl Sewer Lining Rehabilitation (SC-0143), the replacement/rehabilitation of various cement pipelines in the southeast area of Long Beach near Naples Island (SC-0193), and the Broadway Trunk Sewer Lining Rehabilitation (SC-0143).

While updating the model for Project SC-0143 along Broadway Avenue, additional record drawings (i.e., SC-0120a, SC-0147, SC-0171, and SC-136) were requested to update pipeline alignments along Broadway Avenue that were not captured during the development of the 2008 SMP hydraulic model. The Sewer Gravity Main GIS shapefile provided in 2008 had not incorporated these improvements.

A summary of the projects and modifications made to the 2013 hydraulic model is provided in **Table 1** and shown on **Figure 1**. Changes reflected in the model include changes in pipe sizing, invert elevations, material, and project information. Only changes made to the invert elevations of a maintenance hole and the size of the pipelines affect the hydraulics of the model. Others changes such as material, year of installation, and project number does not affect the hydraulics of the model.

Pipeline Projects Currently Under Design or Planning

Record drawings for pipeline projects that are currently in design or in the planning phase are also incorporated into the 2013 hydraulic model update for existing and future conditions.

LBWD provided design drawings from Tetra Tech for the Orange Avenue/Del Amo Blvd/Walnut Ave Sewer Upgrade Project (SC-0225), an area reported to have hydraulic deficiencies and recommended for improvement in the 2008 SMP CIP (Location 3). The pipeline alignment recommended in the 2008 SMP includes a pipe size increase from 12-inch to 15-inch along Walnut Avenue between Hardwick and Market Street, and a new 12-inch relief pipeline along Orange Avenue between Del Amo Boulevard and Market Street, and along Del Amo Boulevard between Falcon Avenue and Orange Avenue (page 5-34, 2008 SMP). The pipeline alignment under Project SC-0225 includes the recommended 12-inch to 15-inch pipe upsize along Walnut Avenue, and a new relief pipeline heading east on Del Amo Blvd. and north along Rose Ave. Under Project SC-0225, flows in this catchment area are now being diverted to a 33-inch County Sanitation District of Los Angeles County (CSDLAC) trunk sewer flowing east on Market St., instead of to the 24-inch CSDLAC trunk sewer flowing west on Market St. Modifications made to model required adjustments in flows to adjusted subcatchments.

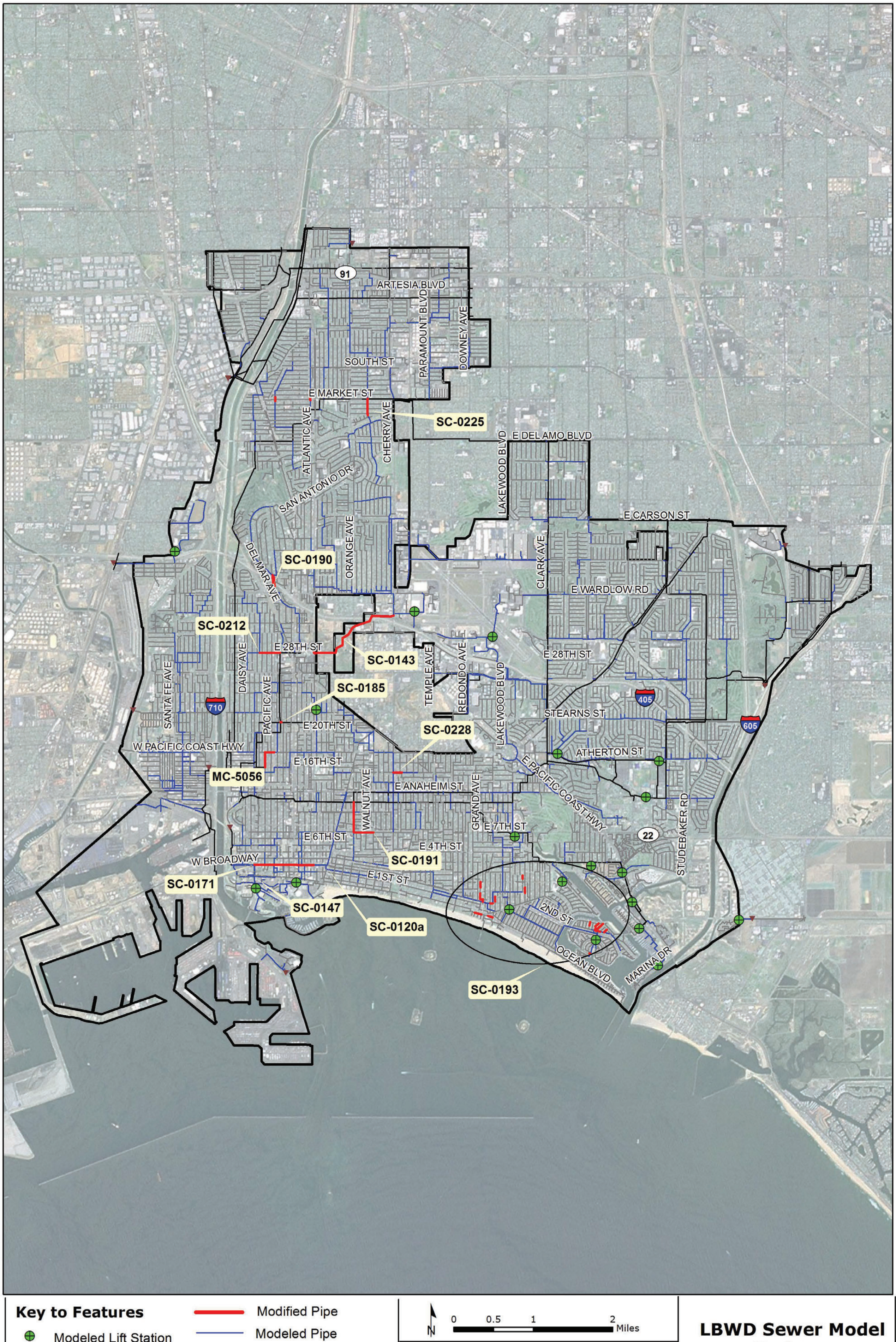
Other design drawings incorporated into the model include the 15th Street and Cherry Avenue Sewer Upgrade Project (SC-0228) and the Pacific Coast Highway Sanitary Sewer Project (MC-5056).

Table 1
New Pipeline Projects Included in the 2013 Sewer Model Update

Project Name	Name	Year	Model Update
SC-0120a	Broadway Trunk Sewer Placement/Rehabilitation Project (Phase 1: Microtunneling)	2004	Verified pipeline alignment and updated laterals that tie into the 36” pipeline along Broadway Ave. between Alamitos Ave. and Shoreline Dr.
SC-0143	California Bowl Sewer Lining Rehabilitation Project	2011	Modified pipeline attributes (material, year of installation, and project number).
SC-0147	Broadway Trunk Sewer Replacement/Rehabilitation Project	2007	Realigned any pipeline alignments and added new 21” pipeline along Magnolia Ave., between Ocean Blvd. and Broadway Ave. Added new connection of a 21” pipeline on Broadway Ave. to the 36” pipeline.
SC-0171	Broadway Trunk Sewer Replacement/Rehabilitation Project Phase III	2009	Removed abandoned pipeline and increased pipe size along Broadway Ave., between Magnolia Ave. and Atlantic Ave, from 14” to 18”. Modified pipeline attributes associated with the pipeline.
SC-0190	Pacific Avenue Trunk Sewer Rehabilitation	2011	Modified pipeline attributes (material, year of installation, and project number).
SC-0191	Orange Avenue/7th Street Sewer Upgrade Project (Location 13 in 2008 SMP CIP)	2012	Increased pipeline size from 8” to 12” on 7th St. between Orange Ave. and Walnut Ave. Increased pipeline size from 24” to 30” on Orange Ave., between 7th St. and 11th St. Modified pipeline attributes (material, year of installation, and project number). Modeled the double-barrel siphon along Walnut Ave.
SC-0193	Sanitary Sewer Pipeline Replacement Project – Phase 1	2012	Modified pipeline attributes (material, year of installation, and project number).
SC-0212	28th Street Sanitary Sewer Pipeline Improvements Project (Location 11 in 2008 SPM CIP)	2012	Increased pipeline size from 12” to 15” on W. 28th St., between Eucalyptus Ave and Pine Ave. Modified pipeline attributes (material, year of installation, and project number).
SC-136	Broadway Golden Elementary School	2002	Removed pipe segment on Oro Way.
SC-0225	Orange Ave/Del Amo Blvd/walnut Ave Sewer Upgrade Project (Location 13 in 2008 SMP CIP)	2013	Modified pipe size from 12” to 15” on Walnut Ave., between Jackson St. and Market St. Rerouted new 12” double-barrel siphon to connect to 33” CSDLAC line at Market St. and Walnut Ave. Updated changes to material, year of installation, and project number.

Table 2 (continued)
New Pipeline Projects Included in the 2013 Sewer Model Update

Project Name	Name	Year	Model Update
SC-0228	15th Street and Cherry Avenue Sewer Upgrade Project (Location 9 in 2008 SMP CIP)	2012	Modify pipe size from 8" to 12" on 15th Street between Cherry Ave. and Dawson Ave. Update changes to material, year of installation, and project number
MC-5056	Pacific Coast Highway Sanitary Sewer Project (Location 12 in 2008 SMP CIP)	2013	Modify pipe size from 8" to 12" on PCH from alley east of Pine Ave. and alley west of Pine Ave. Update pipe size from 12" to 15" on PCH from alley west of Pine Ave. to alley west of Cedar Ave., and going south past 17th St. to the CSDLAC connection. Update changes to material, year of installation, and project number.
N/A	Market Street Drain (CSDLAC Project)	1995	Modified pipe size and invert elevations to model an 8-inch siphon near Cedar Ave. and Market St., and an 8-inch siphon near Linden Ave. and Market St.
SC-0185	Long Beach Family Projects	2011	Add new 8” pipe to connect to the CSDLAC line. Delete abandoned segment of pipe according to as-built drawing. Update changes to material, year of installation, and project number.



Key to Features

- Modeled Lift Station
- Modeled Outfall
- LBWD Boundary
- Modified Pipe
- Modeled Pipe
- CSDLAC Pipe

Note: Hydraulic analysis of CSDLAC pipe is not included for this project.

Imagery Source: Bing Maps/ESRI

Document: \\Uspas1s01\MUNI\Clients\Long Beach Water Dept\Sewer Master Plan 2013\ 14 Electronic Files - Modeling_MXDs\LBWD_SMP_Model Updates_v2

Date: June 5, 2013

LBWD Sewer Model Updates

Figure 1

MWH

This map has been designed to print size 11'' by 17''.

Pipeline Update

The LBWD hydraulic model for the 2008 SMP was developing using LBWD's Sewer Gravity Main GIS shapefile available at that time; but updates to the Sewer Gravity Main shapefile have been made since 2008. MWH requested the most up-to-date LBWD Sewer Gravity Main GIS shapefile for the 2013 Sewer Master Plan Update in order to update select pipeline attributes in the model. These pipeline attributes include installation year, pipeline material, job number, hyperlink, user identification, rehabilitation date, rehabilitation category, and the rehabilitation job number, as shown in **Table 3**.

Pipeline attributes are only updated for pipelines that were modeled in the 2008 SMP hydraulic model. This update is performed using a Spatial Join tool in GIS between pipelines in the 2008 hydraulic model and the updated LBWD Sewer Gravity Main GIS shapefile. Using the Spatial Join tool in GIS, updated information for pipelines in the sewer pipeline GIS shapefile can be added to any of the modeled pipelines that the shapefile overlays. Only pipeline attributes are updated using this methodology. In some cases, there are several segments of small pipelines where the alignment in the updated GIS shapefile does not overlay with the existing modeled pipelines. This could be due to a variety of reasons such as inaccurate, or change to, digitization of a pipeline. Since the offset in the overlay is minor (less than a few feet), the locations of the pipelines in the model are not spatially adjusted to match with the GIS shapefile. It is recommended that LBWD perform annual updates to the hydraulic model using the latest manhole and sewer pipeline GIS shapefiles.

Table 3
Updated Pipeline Attributes

Model Field Name (InfoSWMM)	Field Description
Year of Installation	Year of original pipeline installation
MATERIAL	Material of pipeline
REPEAT	Days representative of the maintenance history on the pipeline (e.g., 30, 60, 90)
REMARKS	Comments about the pipeline
JOBN	Job number of the pipeline project
HYPERLINK	Hyperlink of pipeline LBWD project files
USER_ID	User identification of pipeline (i.e., upstream and downstream manhole ID)
REHAB_DATE	Date of pipeline rehabilitation project
REHABMATER	Type of rehabilitation project (e.g., CIPP)
REHAB_JOBN	Job number of rehabilitation project

Recommendations

Pipeline Attribute Information

Additional information is necessary to complete a comprehensive update to the 2013 hydraulic model. Missing information in the model includes rehabilitation dates for pipelines that have been rehabilitated since 2008, as well as year of installation and material for existing pipeline. A thorough review of each pipeline with missing information is necessary to provide for a comprehensive model update. These data, while useful to the purposes of asset management, do not affect system hydraulics. It is recommended that LBWD staff update the model for the missing information when the data becomes available.

Missing material or year of installation information for select pipelines will be required for developing the Pipeline Replacement Program at the later stages of this SMP. This information will be utilized for the CapPlan software to develop the risk-based prioritization for pipeline repairs and replacements. The age and material of a sewer can serve a surrogate indicator for pipe condition. MWH will coordinate with LBWD staff to acquire these data.

Pipelines with Missing Rehabilitation Dates

Rehabilitation dates for the cast-in-place pipes (CIPP) (i.e., REHAB_DATE field with REHABMATER = CIPP) are missing for 131 out of 405 pipeline segments. It is recommended that LBWD provide the installation date (MM/DD/YYYY) for the missing pipelines listed in Appendix B.

Pipelines with Missing Material

Information on pipeline material is missing for 151 LBWD sewer pipeline segments in the updated hydraulic model. It is recommended that LBWD provide this information for all missing pipelines listed in Appendix C.

Pipelines with Missing Installation Year

The year of installation is missing for 950 LBWD sewer pipeline segments in the updated hydraulic model, which comprises about 16,680 pipelines.

It is recognized that some of the missing information may not be readily available, such as older areas of the system where records may be missing. In such cases, MWH will work with LBWD to develop assumptions for the missing information based on the attributes of other pipelines in the system.

APPENDIX A: Updates to Sewer Model from New Pipeline Projects

Project Number	Model ID	Element Type	Model Update
SC-0143	G11820	Conduit	Updated pipe information attribute
SC-0143	G14032	Conduit	Updated pipe information attribute
SC-0143	G15759	Conduit	Updated pipe information attribute
SC-0143	G17878	Conduit	Updated pipe information attribute
SC-0143	G17925	Conduit	Updated pipe information attribute
SC-0143	G18480	Conduit	Updated pipe information attribute
SC-0143	G18607	Conduit	Updated pipe information attribute
SC-0143	G18770	Conduit	Updated pipe information attribute
SC-0143	M10290	Junction	Updated pipe information attribute
SC-0143	M10455	Junction	Updated pipe information attribute
SC-0143	M11276	Junction	Updated pipe information attribute
SC-0143	M11872	Junction	Updated pipe information attribute
SC-0143	M13395	Junction	Updated pipe information attribute
SC-0143	M13675	Junction	Updated pipe information attribute
SC-0143	M14408	Junction	Updated pipe information attribute
SC-0143	M14701	Junction	Updated pipe information attribute
SC-0143	M16589	Junction	Updated pipe information attribute
SC-0143	M17179	Junction	Updated pipe information attribute
SC-0143	M6577	Junction	Updated pipe information attribute
SC-0143	M7937	Junction	Updated pipe information attribute
SC-0147	M20020 (NEW)	Junction	Added new manhole
SC-0147	M20022 (NEW)	Junction	Added new manhole
SC-0147	M20018 (NEW)	Junction	Added new manhole
SC-0147	M20024 (NEW)	Junction	Added new manhole
SC-0147	M20026 (NEW)	Junction	Added new manhole
SC-0147	M20028 (NEW)	Junction	Added new manhole
SC-0147	M2481	Junction	Updated manhole information
SC-0147	M20016 (NEW)	Junction	Added new manhole
SC-0147	G20018 (NEW)	Conduit	Added new pipeline
SC-0147	G20016 (NEW)	Conduit	Added new pipeline
SC-0147	G20014 (NEW)	Conduit	Added new pipeline
SC-0147	G20012 (NEW)	Conduit	Added new pipeline
SC-0147	G20008 (NEW)	Conduit	Added new pipeline
SC-0147	G20006 (NEW)	Conduit	Added new pipeline
SC-0147	G20010 (NEW)	Conduit	Added new pipeline
SC-0171	G536	Conduit	Updated pipe size per as-built drawing
SC-0171	G9210	Conduit	Updated pipe information attribute
SC-0171	G5029	Conduit	Deleted in model and redrawing to new pipe G20000
SC-0171	G5036	Conduit	Deleted in model and redrawing to new pipe G20000
SC-0171	G20000 (NEW)	Conduit	Added new pipeline since the manhole between old modeled pipe G5029 and G5036 is deleted
SC-0171	G10667	Conduit	Updated pipe information attribute
SC-0171	G1586	Conduit	Updated pipe information attribute
SC-0171	G4733	Conduit	Updated pipe information attribute
SC-0171	G2747	Conduit	Updated pipe information attribute
SC-0171	G2750	Conduit	Updated pipe information attribute
SC-0171	G5151	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G12005	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G3969	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G834	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G8776	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G2748	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G20002 (NEW)	Conduit	Added new pipeline
SC-0171	G8403	Conduit	Updated pipe information attribute
SC-0171	G4041	Conduit	Updated pipe information attribute
SC-0171	G2585	Conduit	Updated pipe information attribute
SC-0171	M2481	Junction	Updated manhole information
SC-0171	M437	Junction	Updated pipe information attribute
SC-0171	M5174	Junction	Updated manhole information
SC-0171	M2355	Junction	Updated pipe information attribute
SC-0171	M2483	Junction	Updated pipe information attribute
SC-0171	M2326	Junction	Updated pipe information attribute
SC-0171	M2556	Junction	Deleted in model (abandoned manhole)
SC-0171	M805	Junction	Deleted in model (abandoned manhole)
SC-0171	M3441	Junction	Deleted in model (abandoned manhole)
SC-0171	M2007	Junction	Deleted in model (abandoned manhole)
SC-0171	M20000 (new)	Junction	Added new manhole
SC-0171	M2905	Junction	Updated manhole information
SC-0171	M988	Junction	Updated manhole information

APPENDIX A: Updates to Sewer Model from New Pipeline Projects

Project Number	Model ID	Element Type	Model Update
SC-0171	M2054	Junction	Updated manhole information
SC-0171	M1012	Junction	Updated manhole information
SC-0171	M619	Junction	Updated manhole information
SC-0171	M6615	Junction	Updated manhole information
SC-0171	M2056	Junction	Updated manhole information
SC-0171	M1547	Junction	Deleted in model (abandoned manhole)
SC-0171	M2352	Junction	Updated manhole information
SC-0171	G16597	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G19031	Conduit	Deleted in model (abandoned pipeline)
SC-0171	G3969	Conduit	Deleted in model (abandoned pipeline)
SC-0171	M4566	Junction	Deleted in model (Abandoned manhole)
SC-0171	M9106	Junction	Deleted in model (Abandoned manhole)
SC-0171	JCT-504	Junction	Deleted in model (Abandoned manhole)
SC-0190	G18914	Conduit	Updated pipe information attribute
SC-0190	G15326	Conduit	Updated pipe information attribute
SC-0190	G11841	Conduit	Updated pipe information attribute
SC-0190	G14309	Conduit	Updated pipe information attribute
SC-0190	G15689	Conduit	Updated pipe information attribute
SC-0190	G13443	Conduit	Updated pipe information attribute
SC-0190	G1881	Conduit	Updated pipe information attribute
SC-0190	M13138	Junction	Updated manhole information
SC-0190	M15824	Junction	Updated manhole information
SC-0190	M15932	Junction	Updated manhole information
SC-0190	M14810	Junction	Updated manhole information
SC-0190	M10625	Junction	Updated manhole information
SC-0190	M13182	Junction	Updated manhole information
SC-0190	M6362	Junction	Updated manhole information
SC-0190	M17227	Junction	Updated manhole information
SC-0190	M17336	Junction	Updated manhole information
SC-0191	G1507	Conduit	Updated pipe size and attribute
SC-0191	G3114	Conduit	Updated pipe size and attribute
SC-0191	G3776	Conduit	Updated pipe size and attribute
SC-0191	G3787	Conduit	Updated pipe size and attribute
SC-0191	G519	Conduit	Updated pipe size and attribute; new siphon
SC-0191	G5860	Conduit	Updated pipe size and attribute
SC-0191	G5882	Conduit	Updated pipe size and attribute
SC-0191	G6109	Conduit	Updated pipe size and attribute
SC-0191	G6391	Conduit	Updated pipe size and attribute
SC-0191	G6626	Conduit	Updated pipe size and attribute
SC-0191	G6997	Conduit	Updated pipe size and attribute
SC-0191	G7105	Conduit	Updated pipe size and attribute
SC-0191	G7430	Conduit	Updated pipe size and attribute
SC-0191	G8497	Conduit	Updated pipe size and attribute
SC-0191	M10219	Junction	Updated manhole information
SC-0191	M10233	Junction	Updated manhole information
SC-0191	M10609	Junction	Updated manhole information
SC-0191	M10643	Junction	Updated manhole information; new elevation for modeled siphon
SC-0191	M16660	Junction	Updated manhole information
SC-0191	M1675	Junction	Updated manhole information
SC-0191	M17879	Junction	Updated manhole information
SC-0191	M1809	Junction	Updated manhole information
SC-0191	M1877	Junction	Updated manhole information; new elevation for modeled siphon
SC-0191	M1891	Junction	Updated manhole information
SC-0191	M2507	Junction	Updated manhole information
SC-0191	M2532	Junction	Updated manhole information
SC-0191	M2533	Junction	Updated manhole information
SC-0191	M2562	Junction	Updated manhole information
SC-0191	M440	Junction	Updated manhole information
SC-0191	G20004 (NEW)	Conduit	Added new pipeline; new siphon parallel to G519
SC-0193	G10291	Conduit	Updated pipe information attribute
SC-0193	G11732	Conduit	Updated pipe information attribute
SC-0193	G11829	Conduit	Updated pipe information attribute
SC-0193	G12512	Conduit	Updated pipe information attribute
SC-0193	G13520	Conduit	Updated pipe information attribute
SC-0193	G15042	Conduit	Updated pipe information attribute
SC-0193	G15182	Conduit	Updated pipe information attribute
SC-0193	G15343	Conduit	Updated pipe information attribute
SC-0193	G15993	Conduit	Updated pipe information attribute

APPENDIX A: Updates to Sewer Model from New Pipeline Projects

Project Number	Model ID	Element Type	Model Update
SC-0193	G17298	Conduit	Updated pipe information attribute
SC-0193	G17728	Conduit	Updated pipe information attribute
SC-0193	G18097	Conduit	Updated pipe information attribute
SC-0193	G18759	Conduit	Updated pipe information attribute
SC-0193	G18856	Conduit	Updated pipe information attribute
SC-0193	G3145	Conduit	Updated pipe information attribute
SC-0193	G3423	Conduit	Updated pipe information attribute
SC-0193	G381	Conduit	Updated pipe information attribute
SC-0193	G4027	Conduit	Updated pipe information attribute
SC-0193	G541	Conduit	Updated pipe information attribute
SC-0193	G7872	Conduit	Updated pipe information attribute
SC-0193	G9609	Conduit	Updated pipe information attribute
SC-0193	M10531	Junction	Updated manhole information
SC-0193	M10662	Junction	Updated manhole information
SC-0193	M13071	Junction	Updated manhole information
SC-0193	M14114	Junction	Updated manhole information
SC-0193	M15257	Junction	Updated manhole information
SC-0193	M16104	Junction	Updated manhole information
SC-0193	M16493	Junction	Updated manhole information
SC-0193	M1734	Junction	Updated manhole information
SC-0193	M2112	Junction	Updated manhole information
SC-0193	M2295	Junction	Updated manhole information
SC-0193	M2452	Junction	Updated manhole information
SC-0193	M3616	Junction	Updated manhole information
SC-0193	M3706	Junction	Updated manhole information
SC-0193	M4262	Junction	Updated manhole information
SC-0193	M4389	Junction	Updated manhole information
SC-0193	M4468	Junction	Updated manhole information
SC-0193	M4536	Junction	Updated manhole information
SC-0193	M4547	Junction	Updated manhole information
SC-0193	M4841	Junction	Updated manhole information
SC-0193	M4893	Junction	Updated manhole information
SC-0193	M4902	Junction	Updated manhole information
SC-0193	M5066	Junction	Updated manhole information
SC-0193	M5296	Junction	Updated manhole information
SC-0193	M6537	Junction	Updated manhole information
SC-0193	M69	Junction	Updated manhole information
SC-0193	M7050	Junction	Updated manhole information
SC-0193	M7075	Junction	Updated manhole information
SC-0193	M7255	Junction	Updated manhole information
SC-0193	M7563	Junction	Updated manhole information
SC-0193	M7627	Junction	Updated manhole information
SC-0193	M7677	Junction	Updated manhole information
SC-0193	M7822	Junction	Updated manhole information
SC-0193	M8013	Junction	Updated manhole information
SC-0193	M8721	Junction	Updated manhole information
SC-0193	M8729	Junction	Updated manhole information
SC-0193	M9461	Junction	Updated manhole information
SC-0193	M11719	Junction	Updated manhole information
SC-0193	M9490	Junction	Updated manhole information
SC-0212	G14304	Conduit	Updated pipe size and attribute
SC-0212	G12199	Conduit	Updated pipe size and attribute
SC-0212	G12958	Conduit	Updated pipe size and attribute
SC-0212	G14405	Conduit	Updated pipe size and attribute
SC-0212	G11464	Conduit	Updated pipe size and attribute
SC-0212	M9824	Junction	Added new manhole
SC-0212	M16796	Junction	Updated manhole information
SC-0212	M14687	Junction	Updated manhole information
SC-0212	M14616	Junction	Updated manhole information
SC-0212	M16712	Junction	Updated manhole information
SC-0212	M7132	Junction	Updated manhole information
SC-136	JCT-2674	Junction	Deleted in model (removed manhole)
SC-136	G16871	Conduit	Deleted in model (abandoned pipeline)
WD-10-01	M791	Junction	Updated manhole information
WD-10-01	M854	Junction	Updated manhole information
WD-10-01	M853	Junction	Updated manhole information
WD-10-01	M873	Junction	Updated manhole information
WD-10-01	M296	Junction	Updated manhole information

APPENDIX A: Updates to Sewer Model from New Pipeline Projects

Project Number	Model ID	Element Type	Model Update
WD-10-01	M872	Junction	Updated manhole information
WD-10-01	M20006 (NEW)	Junction	Added new manhole
WD-10-01	M20008 (NEW)	Junction	Added new manhole
WD-10-01	M20012 (NEW)	Junction	Added new manhole
WD-10-01	JCT-512	Junction	Updated manhole information
WD-10-01	M2272	Junction	Updated manhole information
WD-10-01	JCT-860	Junction	Relocated manhole and updated manhole information.
WD-10-01	M20014 (NEW)	Junction	Added new manhole
SC-0225	M20032 (NEW)	Junction	Added new manhole
SC-0225	G20022 (NEW)	Conduit	Added new pipeline
SC-0225	G20024 (NEW)	Conduit	Added new pipeline (double-barrel siphon)
SC-0225	G20020 (NEW)	Conduit	Added new pipeline
SC-0225	M20030 (NEW)	Junction	Added new manhole
SC-0225	G19585	Conduit	Deleted in model (abandoned pipeline)
SC-0225	M7180	Junction	Deleted in model (abandoned manhole)
SC-0225	G19587	Conduit	Deleted in model (abandoned double-barrel siphon)
SC-0225	M12062	Junction	Updated manhole information
SC-0225	M7189	Junction	Updated manhole information
SC-0225	G17010	Conduit	Updated pipe information attribute
SC-0225	G13611	Conduit	Updated pipe information attribute
SC-0225	G15912	Conduit	Updated pipe size and attribute
SC-0225	M6322	Junction	Updated manhole information
SC-0225	G10761	Conduit	Updated pipe size and attribute
SC-0225	M16508	Junction	Updated manhole information
SC-0225	G13930	Conduit	Updated pipe size and attribute
SC-0225	M13887	Junction	Updated manhole information
SC-0225	G14830	Conduit	Updated pipe size and attribute
SC-0225	M12135	Junction	Updated manhole information
SC-0225	G10758	Conduit	Updated pipe size and attribute
SC-0225	M15056	Junction	Updated manhole information
SC-0225	M3747	Junction	Updated manhole information
SC-0228	G5216	Conduit	Updated pipe size and attribute
SC-0228	G5239	Conduit	Updated pipe size and attribute
SC-0228	G7053	Conduit	Updated pipe size and attribute
SC-0228	M10015	Junction	Updated manhole information
SC-0228	M10814	Junction	Updated manhole information
SC-0228	M12561	Junction	Updated manhole information
MC-5056	M14407	Junction	Updated manhole information and transferred flow to junction
MC-5056	G43	Conduit	Updated pipe size attribute and added downstream offset
MC-5056	M2668	Junction	Updated manhole information and invert elevation
MC-5056	G42	Conduit	Updated pipe size and attribute
MC-5056	M14356	Junction	Updated manhole information and invert elevation
MC-5056	G2514	Conduit	Updated pipe size and attribute
MC-5056	M14578	Junction	Updated manhole information and invert elevation
MC-5056	G8366	Conduit	Updated pipe size and attribute
MC-5056	M1533	Junction	Updated manhole information and invert elevation
MC-5056	G2803	Conduit	Updated pipe size and attribute
MC-5056	M2309	Junction	Updated manhole information and invert elevation
MC-5056	G9761	Conduit	Updated pipe size and attribute
MC-5056	M14326	Junction	Updated manhole information and invert elevation
MC-5056	G482	Conduit	Updated pipe size and attribute
MC-5056	M11328	Junction	Updated manhole information and invert elevation
MC-5056	G490	Conduit	Updated pipe size and attribute
MC-5056	M2086	Junction	Updated manhole information and invert elevation
CSDLAC	M8766	Junction	Updated invert elevation and depth
CSDLAC	G19076	Conduit	Modeled siphon
CSDLAC	G15915	Conduit	Updated pipe size and attribute, added downstream offset
CSDLAC	M6923	Junction	Updated invert elevation and depth
CSDLAC	G18064	Conduit	Updated pipe size and attribute, added upstream offset
CSDLAC	G17616	Conduit	Updated pipe size and attribute, added downstream offset
CSDLAC	G16408	Conduit	Updated pipe size and attribute, added upstream offset
CSDLAC	M9431	Junction	Updated invert elevation and depth
CSDLAC	M8513	Junction	Updated invert elevation and depth
N/A	M12894	Junction	Updated invert elevation and depth based on as-built information
N/A	M17809	Junction	Updated invert elevation and depth based on as-built information
N/A	G6492	Conduit	Confirmed pipe size
N/A	G7911	Conduit	Updated pipe size
N/A	M3900	Junction	Updated depth based on rim elevation from GIS

APPENDIX A: Updates to Sewer Model from New Pipeline Projects

Project Number	Model ID	Element Type	Model Update
N/A	M6437	Junction	Updated depth based on rim elevation from GIS
N/A	M3697	Junction	Updated depth based on rim elevation from GIS
N/A	M8196	Junction	Updated depth based on rim elevation from GIS
N/A	M6512	Junction	Updated depth based on rim elevation from GIS
N/A	M3480	Junction	Updated depth based on rim elevation from GIS
N/A	M6684	Junction	Updated depth based on rim elevation from GIS
N/A	M9154	Junction	Updated depth based on rim elevation from GIS
N/A	M6671	Junction	Updated depth based on rim elevation from GIS
N/A	M6672	Junction	Updated depth based on rim elevation from GIS
N/A	M4826	Junction	Updated depth based on rim elevation from GIS
N/A	M5905	Junction	Updated depth based on rim elevation from GIS
N/A	M5904	Junction	Updated depth based on rim elevation from GIS
N/A	M9264	Junction	Updated depth based on rim elevation from GIS
N/A	M2303	Junction	Updated depth based on rim elevation from GIS
N/A	M3033	Junction	Updated depth based on rim elevation from GIS
N/A	M2467	Junction	Updated invert elevation based on as-built information, and depth based on rim elevation from GIS
SC-0185	M20034 (NEW)	Junction	Added new manhole
SC-0185	G20026 (NEW)	Conduit	Added new pipeline
SC-0185	G7341	Conduit	Split pipeline due to added manhole and pipeline for project, and deleted abandoned pipe segment

This Page Intentionally Left Blank

Appendix B: Cast-in-Place Pipelines with Missing Rehabilitation Dates

OBJECTID	USERID	TILENAME	OWNER	STREETNAME	INSTALLYEA	RECORDEDLE	MATERIAL	DISTTOCENT	JOBNUMBER	SHEETNUMBE	MAINSIZE	UPSTREAMID	DWNSTREAMI	UPINVERTEL	DOWNINVERT	REHABDATE	REHABMATER	REHABJOBNU
5181	L08-SMH-011L08-SMH-012	3626	LBWD	DODGE WAY	1917	355.00000000	CP	0	D-267	3	8	L08-SMH-011	L08-SMH-012	39.30000000	38.24000000	1/1/9999	CIPP	
3552	M08-SMH-016M08-SMH-017	4026	LBWD		1917	295.00000000	CP		D-267	20	8	M08-SMH-016	M08-SMH-017	40.66000000	39.78000000	1/1/9999	CIPP	
3672	G15-SMH-034G15-SMH-035	2835	LBWD	PACIFIC COAST HWY	1922	187.00000000	CP	0	D-76	4	8	G15-SMH-034	G15-SMH-035	-2.93000000	-3.68000000	1/1/9999	CIPP	
123	L08-SMH-010L08-SMH-011	3626	LBWD	DODGE WAY	1917	394.00000000	CP	0	D-267	4	8	L08-SMH-010	L08-SMH-011	40.49000000	39.31000000	1/1/9999	CIPP	
1871	L07-SMH-007L07-SMH-008	3626	LBWD		1917	300.00000000	CP	0	D-267	6	8	L07-SMH-007	L07-SMH-008	37.72000000	36.82000000	1/1/9999	CIPP	
2024	L08-SMH-013L08-SMH-014	3626	LBWD	DODGE WAY	1917	350.00000000	CP	0	D-267	3	8	L08-SMH-013	L08-SMH-014	37.17000000	36.12000000	1/1/9999	CIPP	
5948	L13-SMH-040L13-SMH-041	3632	LBWD	N/S AL E/O DAWSON AVE	1923	217.50000000	CP		D-208	9	8	L13-SMH-040	L13-SMH-041	17.36000000	16.27000000	1/1/9999	CIPP	
293	M08-SMH-025M08-SMH-026	4026	LBWD	E/W AL E/O ORIZABA AVE	1917	275.00000000	CP		D-267	20	8	M08-SMH-025	M08-SMH-026	40.61000000	39.98000000	1/1/9999	CIPP	
347	L07-SMH-010L07-SMH-011	3626	LBWD		1917	127.00000000	CP	0	D-267	6	8	L07-SMH-010	L07-SMH-011	35.77000000	35.39000000	1/1/9999	CIPP	
399	M08-SMH-030M08-SMH-029	4026	LBWD	E/W AL E/O ORIZABA AVE	1917	330.00000000	CP		D-267	15	8	M08-SMH-030	M08-SMH-029	42.13000000	41.14000000	1/1/9999	CIPP	
423	Q06-SMH-076Q06-SUK-000	4823	LBWD	ALLEY NORTH 2ND ST	1945	212.00000000	VCP	0	A-655	1	8	Q06-SMH-076	Q06-SUK-000	1.46000000	1.14000000	1/1/9999	CIPP	
6104	L13-SMH-057L13-SMH-058	3632	LBWD	N/S AL E/O CHERRY AVE	1923	217.50000000	CP		D-208	9	8	L13-SMH-057	L13-SMH-058	16.21000000	15.12000000	1/1/9999	CIPP	
2409	L13-SMH-013L13-SMH-016	3632	LBWD	14TH ST	1923	197.19999695	CP	5'N CL	D-208	9	8	L13-SMH-013	L13-SMH-016	21.02000000	18.65000000	1/1/9999	CIPP	
4279	L13-SMH-041L13-SMH-051	3632	LBWD	14TH ST	1923	330.00000000	CP	5'N CL	D-208	9	8	L13-SMH-041	L13-SMH-051	13.37000000	12.05000000	1/1/9999	CIPP	
812	L07-SMH-006L07-SMH-007	3626	LBWD		1917	282.50000000	CP	0	D-267	6	8	L07-SMH-006	L07-SMH-007	38.56000000	37.72000000	1/1/9999	CIPP	
2784	L13-SMH-037L13-SMH-038	3632	LBWD	N/S AL E/O RAYMOND AVE	1923	217.50000000	CP		D-208	12	8	L13-SMH-037	L13-SMH-038	17.43000000	16.56000000	1/1/9999	CIPP	
2808	L13-SMH-022L13-SMH-035	3632	LBWD	14TH ST	1923	160.00000000	CP	5'N CL	D-208	9	8	L13-SMH-022	L13-SMH-035	16.65000000	16.01000000	1/1/9999	CIPP	
1083	M08-SMH-017M08-SMH-018	4026	LBWD		1917	300.00000000	CP		D-267	20	8	M08-SMH-017	M08-SMH-018	39.78000000	38.88000000	1/1/9999	CIPP	
6754	M07-SMH-010M07-SMH-011	4023	LBWD		1917	363.00000000	CP	0	D-267	21	8	M07-SMH-010	M07-SMH-011	37.03000000	36.31000000	1/1/9999	CIPP	SC-0175
4882	L08-SMH-009L08-SMH-010	3626	LBWD	JUNIPERO AVE	1917	120.00000000	CP	33.5'E CL	D-267	4	8	L08-SMH-009	L08-SMH-010	43.19000000	40.79000000	1/1/9999	CIPP	
3170	Q06-SMH-008Q06-SMH-009	4423	LBWD	ALLEY NORTH 2ND ST	1945	212.00000000	VCP	0	A-655	1	10	Q06-SMH-008	Q06-SMH-009	-0.37000000	-0.68000000	1/1/9999	CIPP	
6989	Q06-SMH-075Q06-SMH-076	4823	LBWD	E/W AL E/O POMONA AVE	1945	212.00000000	VCP	0	A-655	1	8	Q06-SMH-075	Q06-SMH-076	2.32000000	1.46000000	1/1/9999	CIPP	
9135	L13-SMH-038L13-SMH-041	3632	LBWD	14TH ST	1923	330.00000000	CP	5'N CL	D-208	9	8	L13-SMH-038	L13-SMH-041	14.69000000	13.37000000	1/1/9999	CIPP	
9145	L07-SMH-005L07-SMH-006	3626	LBWD	KENNEBEC AVE	1917	185.00000000	CP	5'E CL	D-267	3	8	L07-SMH-005	L07-SMH-006	40.72000000	38.70000000	1/1/9999	CIPP	
11168	M14-SMH-040M14-SMH-041	4032	LBWD	15TH ST	1920	334.00000000	CP	0	D-71	19	8	M14-SMH-040	M14-SMH-041	41.07000000	35.63000000	1/1/9999	CIPP	
11174	M14-SMH-002M14-SMH-014	4035	LBWD	N/S AL E/O ORIZABA AVE	1920	300.00000000	CP		D-71	21	8	M14-SMH-002	M14-SMH-014	76.81000000	60.81000000	1/1/9999	CIPP	
11195	N06-SCO-014N06-SMH-016	4023	LBWD	39TH PL	1966	180.00000000	CP	2.5'E CL	D-518	22	8	N06-SCO-014	N06-SMH-016	13.90000000	12.20000000	1/1/9999	CIPP	
9415	M07-SMH-011M07-SMH-012	4023	LBWD		1917	366.00000000	CP	0	D-267	21	8	M07-SMH-011	M07-SMH-012	36.31000000	35.57000000	1/1/9999	CIPP	SC-0175
11299	M11-SMH-032M11-SMH-033	4029	LBWD	7TH ST	1920	157.00000000	CP	29'N CL	D-71	5	8	M11-SMH-032	M11-SMH-033	46.62000000	45.90000000	1/1/9999	CIPP	
11391	M10-SMH-039M10-SMH-057	4029	LBWD	CORONADO AVE	1920	320.00000000	CP	5'E CL	D-71	10	8	M10-SMH-039	M10-SMH-057	45.39000000	44.12000000	1/1/9999	CIPP	
11393	L14-SMH-035L14-SMH-036	3635	LBWD	17TH ST	1924	324.00000000	NRCP	0	E-4	13	8	L14-SMH-035	L14-SMH-036	21.28000000	18.46000000	1/1/9999	CIPP	
11401	L14-SMH-013L14-SMH-014	3632	LBWD	15TH ST	1924	217.00000000	NRCP		E-4	11	8	L14-SMH-013	L14-SMH-014	13.63000000	12.11000000	1/1/9999	CIPP	
13222	L07-SMH-011L07-SMH-012	3626	LBWD		1917	223.00000000	CP	0	D-267	6	8	L07-SMH-011	L07-SMH-012	35.39000000	34.72000000	1/1/9999	CIPP	
9579	Q06-SMH-072Q06-SMH-007	4823	LBWD	ALLEY NORTH 2ND ST	1945	212.00000000	VCP	0	A-655	1	8	Q06-SMH-072	Q06-SMH-007	0.69000000	0.11000000	1/1/9999	CIPP	
11410	M14-SMH-010M14-SMH-011	4035	LBWD	17TH ST	1920	172.00000000	CP	10'S CL	D-71	17	8	M14-SMH-010	M14-SMH-011	49.09000000	45.90000000	1/1/9999	CIPP	
11415	M12-SMH-034M12-SMH-062	4032	LBWD	N/S AL E/O FREEMAN AVE	1920	330.00000000	CP	1.5W CL	D-71	4	10	M12-SMH-034	M12-SMH-062	30.48000000	9.00000000	1/1/9999	CIPP	
11419	L14-SMH-007L14-SMH-009	3632	LBWD	15TH ST	1924	376.00000000	NRCP		E-4	11	8	L14-SMH-007	L14-SMH-009	22.45000000	19.44000000	1/1/9999	CIPP	
11494	M14-SMH-039M14-SMH-040	4032	LBWD	N/S AL E/O ORIZABA AVE	1920	320.00000000	CP	0	D-71	23	8	M14-SMH-039	M14-SMH-040	50.91000000	41.37000000	1/1/9999	CIPP	
11514	M11-SMH-030M11-SMH-029	4029	LBWD	CORONADO AVE	1920	320.00000000	CP	5'E CL	D-71	5	8	M11-SMH-030	M11-SMH-029	43.21000000	41.93000000	1/1/9999	CIPP	
13376	L14-SMH-055L14-SMH-056	3635	LBWD	SHERMAN PL	1924	270.00000000	NRCP	0	E-4	11	8	L14-SMH-055	L14-SMH-056	12.19000000	11.38000000	1/1/9999	CIPP	
11623	M08-SMH-033M08-SMH-034	4026	LBWD	OBISPO AVE	1920	285.00000000	CP		B-217	5	8	M08-SMH-033	M08-SMH-034	41.44000000	40.16000000	1/1/9999	CIPP	
13495	M07-SMH-018M07-SMH-019	4026	LBWD	BRONCE WAY	1917	306.00000000	CP		D-267	12	8	M07-SMH-018	M07-SMH-019	36.39000000	35.48000000	1/1/9999	CIPP	
9772	M14-SMH-013M14-SMH-011	4035	LBWD	17TH ST	1920	158.00000000	CP	10'S CL	D-71	19	8	M14-SMH-013	M14-SMH-011	56.34000000	52.64000000	1/1/9999	CIPP	
11684	M11-SMH-019M11-SMH-018	4029	LBWD	NEWPORT AVE	1920	329.00000000	CP	5'E CL	D-71	15	8	M11-SMH-019	M11-SMH-018	45.02000000	42.40000000	1/1/9999	CIPP	
11693	M08-SMH-034M08-SMH-035	4026	LBWD	OBISPO AVE	1920	268.00000000	CP		B-217	6	8	M08-SMH-034	M08-SMH-035	40.16000000	38.89000000	1/1/9999	CIPP	
11697	L14-SMH-011L14-SMH-013	3632	LBWD	15TH ST	1924	323.00000000	NRCP		E-4	11	8	L14-SMH-011	L14-SMH-013	15.89000000	13.63000000	1/1/9999	CIPP	
11724	M11-SMH-037M11-SMH-036	4029	LBWD	OBISPO AVE	1920	305.00000000	CP	0	D-71	4	8	M11-SMH-037	M11-SMH-036	41.38000000	40.46000000	1/1/9999	CIPP	
11737	L13-SMH-027L13-SMH-029	3632	LBWD	TEMPLE AVE	1924	90.00000000	CP	20'W CL	E-4	12	8	L13-SMH-027	L13-SMH-029	25.45000000	24.91000000	1/1/9999	CIPP	
11743	M14-SMH-009M14-SMH-013	4035	LBWD	N/S AL E/O GLADYS AVE	1920	300.00000000	CP		D-71	23	8	M14-SMH-009	M14-SMH-013	64.64000000	56.44000000	1/1/9999	CIPP	
13622	M13-SMH-024M13-SMH-023	4032	LBWD	SPAULDING ST	1920	220.00000000	CP	0	D-71	34	8	M13-SMH-024	M13-SMH-023	35.37000000	32.73000000	1/1/9999	CIPP	
11753	M11-SMH-035M11-SMH-034	4029	LBWD	OBISPO AVE	1920	305.00000000	CP	0	D-71	3	8	M11-SMH-035	M11-SMH-034	38.94000000	37.72000000	1/1/9999	CIPP	
11754	M11-SMH-017M11-SMH-016	4029	LBWD	N/S AL E/O NEWPORT AVE	1920	330.39999390	CP	0	D-71	15	8	M11-SMH-017	M11-SMH-016	40.95000000	39.48000000	1/1/9999	CIPP	
11800	M14-SMH-014M14-SMH-039	4035	LBWD	N/S AL E/O ORIZABA AVE	1920	330.00000000	CP		D-71	23	8	M14-SMH-014	M14-SMH-039	60.81000000	50.91000000	1/1/9999	CIPP	
11801	L14-SMH-009L14-SMH-011	3632	LBWD	15TH ST	1924	307.00000000	NRCP		E-4	11	8	L14-SMH-009	L14-SMH-011	19.44000000	16.97000000	1/1/9999	CIPP	
11804	M14-SMH-005M14-SMH-003	4035	LBWD	N/S AL E/O FREEMAN AVE	1920	300.00000000	CP		D-71	20	8	M14-SMH-005	M14-SMH-003	82.01000000	73.01000000	1/1/9999	CIPP	
11826	M10-SMH-036M10-SMH-037	4029	LBWD	CORONADO AVE	1920	331.50000000	CP	5'E CL	D-71	10	8	M10-SMH-036	M10-SMH-037	49.14000000	47.81000000	1/1/9999	CIPP	
8027	M11-SMH-016M11-SMH-006	4029	LBWD	N/S AL E/O NEWPORT AVE	1920	330.00000000	CP	0	D-71	15	8	M11-SMH-016	M11-SMH-006	39.48000000	38.00000000	1/1/9999	CIPP	
10029	L13-SMH-051L13-SMH-055	3632	LBWD	14TH ST	1923	160.00000000	CP	5'N CL	D-208	9	8	L13-SMH-051	L13-SMH-055	12.05000000	11.41000000	1/1/9999	CIPP	
11865	N06-SMH-017N06-SMH-018	4023	LBWD	MID WY	1923	286.00000000	CP	0	F-1	0	8	N06-SMH-017	N06-SMH-018	0.00000000	0.00000000	1/1/9999	CIPP	
11874	N06-SMH-015N06-SMH-016	4023	LBWD	39TH PL	1923	140.00000000	CP	2.5'E CL	B-536	2	8	N06-SMH-015	N06-SMH-016	17.18000000	12.20000000	1/1/9999	CIPP	
11875	M11-SMH-020M11-SMH-007	4029	LBWD		1920	330.00000000	CP	0	D-71	13	8	M11-SMH-020	M11-SMH-007	40.84000000	39.52000000	1/1/9999	CIPP	
11910	M13-SMH-022M13-SMH-020	4032	LBWD	SPAULDING ST	1920	387.50000000	CP	0	D-71	34	8	M13-SMH-022	M13-SMH-020	29.85000000	27.93000000	1/1/9999	CIPP	
11928	L13-SMH-033L13-SMH-034	3632	LBWD	SPAULDING ST	1924	343.00000000	CP	5'N CL	E-4	12	8	L13-SMH-033	L13-SMH-034	21.08000000	19.02000000	1/1/9999	CIPP	
11942	L14-SMH-018L14-SMH-019	3632	LBWD	SHERMAN PL	1924	330.00000000	NRCP		E-4	11	8	L14-SMH-018	L14-SMH-019	10.39000000	9.40000000	1/1/9999	CIPP	
11944	L14-SMH-019L14-SMH-020	3632	LBWD	15TH ST	1924	223.00000000	NRCP		E-4	11	8	L14-SMH-019	L14-SMH-020	8.77000000	7.88000000	1/1/9999	CIPP	
11952	L13-SMH-043L13-SMH-044	3632	LBWD	SPAULDING ST	1924	363.00000000	CP	5'N CL	E-4	12	8	L13-SMH-043	L13-SMH-044	16.80000000	15.71000000	1/1/9999	CIPP	
8092	M11-SMH-021M11-SMH-020	4029	LBWD		1920	330.00000000	CP	0	D-71	14	8	M11-SMH-021	M11-SMH-020	42.16000000	40.94000000	1/1/9999	CIPP	
8095	L13-SMH-046L14-SMH-017	3632	LBWD	DAWSON AVE	1924	325.00000000	CP		E-4	12	8	L13-SMH-046	L14-SMH-017	14.48000000	13.50000000	1/1/9999	CIPP	
12074	P10-SMH-019P10-SMH-020	4429	LBWD	QUINCY AVE	1925	328.00000000	CP	5'E CL	B-439	16	8	P10-SMH-019	P10-SMH-020	-2.30000000	-3.28000000	1/1/9999	CIPP	
13968	Q06-SMH-009P06-SMH-016	4423	LBWD	ALLEY NORTH 2ND ST	1945	222.00000000	VCP	0	A-655	1	10	Q06-SMH-009	P06-SMH-016	-0.68000000	-0.90000000	1/1/9999	CIPP	
13991	L08-SMH-017L08-SMH-018	3626	LBWD	BROADWAY	1917	347.00000000	CP	31.5'S CL	D-267	10	8	L08-SMH-017	L08-SMH-018	38.95000000	37.92000000	1/1/9999	CIPP	
8227	M12-SMH-035M12-SMH-034	4032	LBWD	N/S AL E/O FREEMAN AVE	1920	335.00000000	CP	1.5W CL	D-71	3	10	M12-SMH-035	M12-SMH-034	31.97000000	30.48000000	1/1/9999	CIPP	
8229	M14-SMH-044M14-SMH-046	4032	LBWD	16TH ST	1920	170.00000000	CP	10'S CL	D-71	18	8	M14-SMH-044	M14-SMH-046	39.51000000	36.36000000	1/1/9999	CIPP	
8273	M10-SMH-050M10-SMH-051	4029	LBWD	NEWPORT AVE	1920	326.00000000	CP	5'E CL	D-71	16	8	M10-SMH-050	M10-SMH-051	50.57000000	49.10000000	1/1/9999	CIPP	
12103	M10-SMH-037M10-SMH-038	4029	LBWD	CORONADO AVE	1920	290.00000000	CP	5'E CL	D-71	10	8	M10-SMH-037	M10-SMH-038	47.81000000	46.65000000	1/1/9999	CIPP	

Appendix B: Cast-in-Place Pipelines with Missing Rehabilitation Dates

OBJECTID	USERID	TILENAME	OWNER	STREETNAME	INSTALLYEA	RECORDEDLE	MATERIAL	DISTTOCENT	JOBNUMBER	SHEETNUMBE	MAINSIZE	UPSTREAMID	DWNSTREAMI	UPINVERTEL	DOWNINVERT	REHABDATE	REHABMATER	REHABJOBNU
12117	M10-SMH-048M10-SMH-049	4029	LBWD	NEWPORT AVE	1920	336.50000000	CP	5'E CL	D-71	16	8	M10-SMH-048	M10-SMH-049	53.41000000	51.90000000	1/1/9999	CIPP	
14089	L14-SMH-024L14-SMH-004	3635	LBWD	HILE AVE	1924	330.00000000	NRCP	0	E-4	11	8	L14-SMH-024	L14-SMH-004	40.90000000	31.00000000	1/1/9999	CIPP	
14092	M14-SMH-046M14-SMH-045	4032	LBWD	N/S AL E/O TEMPLE AVE	1920	320.00000000	CP	5'W CL	D-71	17	8	M14-SMH-046	M14-SMH-045	36.26000000	30.26000000	1/1/9999	CIPP	
10333	L14-SMH-004L14-SMH-005	3632	LBWD	HILLE AVE	1924	330.00000000	NRCP	3'E CL	E-4	11	8	L14-SMH-004	L14-SMH-005	26.28000000	23.64000000	1/1/9999	CIPP	
10395	L14-SMH-034L14-SMH-035	3635	LBWD	MOLINO AVE	1924	300.00000000	NRCP	11E CL	E-4	10	8	L14-SMH-034	L14-SMH-035	32.50000000	23.50000000	1/1/9999	CIPP	
10405	M09-SMH-047M08-SMH-032	4026	LBWD	OBISPO AVE	1920	315.00000000	CP		B-217	6	8	M09-SMH-047	M08-SMH-032	44.10000000	42.69000000	1/1/9999	CIPP	
10443	D15-SMH-026D14-SMH-019	2035	LBWD	N/O W PACIFIC COAST HWY	1948	112.00000000	VCP		D-20	0	8	D15-SMH-026	D14-SMH-019	0.00000000	0.00000000	1/1/9999	CIPP	
12221	P10-SMH-020P10-SMH-045	4429	LBWD	QUINCY AVE	1925	308.00000000	CP	5'E CL	B-439	16	8	P10-SMH-020	P10-SMH-045	-3.28000000	-7.79000000	1/1/9999	CIPP	
8505	K13-SMH-009K13-SMH-001	3232	LBWD	14TH ST	1923	170.00000000	CP	5'N CL	D-208	11	8	K13-SMH-009	K13-SMH-001	14.28000000	13.60000000	1/1/9999	CIPP	SC-0167
10519	M13-SMH-023M13-SMH-022	4032	LBWD	SPAULDING ST	1920	225.00000000	CP	0	D-71	34	8	M13-SMH-023	M13-SMH-022	32.73000000	30.05000000	1/1/9999	CIPP	
10571	G15-SMH-023G15-SMH-018	2435	LBWD	PACIFIC COAST HWY.	1925	314.00000000	VCP	15'N CL	D-91	12	10	G15-SMH-023	G15-SMH-018	-2.50000000	-3.11000000	1/1/9999	CIPP	
10574	L14-SMH-029L14-SMH-030	3635	LBWD	17TH ST	1924	179.39999390	NRCP	0	E-4	13	8	L14-SMH-029	L14-SMH-030	36.63000000	31.25000000	1/1/9999	CIPP	
14357	G08-SMH-060G08-SMH-023	2826	LBWD	W SHORELINE DR	1996	225.00000000	VCP		SC-0070	3	18	G08-SMH-060	G08-SMH-023	-2.39000000	-2.62000000	1/1/9999	CIPP	
10587	L14-SMH-015L14-SMH-016	3632	LBWD	STANTON PL	1924	330.00000000	NRCP		E-4	13	8	L14-SMH-015	L14-SMH-016	11.61000000	10.62000000	1/1/9999	CIPP	
10597	M11-SMH-033M11-SMH-031	4029	LBWD	CORONADO AVE	1920	329.00000000	CP	5'E CL	D-71	5	8	M11-SMH-033	M11-SMH-031	45.80000000	44.49000000	1/1/9999	CIPP	
10606	M14-SMH-003M14-SMH-015	4035	LBWD	N/S AL E/O FREEMAN AVE	1920	300.00000000	CP		D-71	19	8	M14-SMH-003	M14-SMH-015	73.01000000	64.01000000	1/1/9999	CIPP	
12536	H09-SMH-052H09-SMH-053	2826	LBWD	TRIBUNE CT	1924	40.00000000	NRCP	4'W CL	B-340	1	10	H09-SMH-052	H09-SMH-053	7.50000000	7.38000000	1/1/9999	CIPP	
12566	N06-SMH-016N06-SMH-017	4023	LBWD	MID WY	1923	286.00000000	CP	0	F-1	0	8	N06-SMH-016	N06-SMH-017	0.00000000	0.00000000	1/1/9999	CIPP	
10810	M08-SMH-018M08-SMH-019	4026	LBWD	ORIZABA AVE	1917	146.60000610	CP	5'W CL	D-267	20	8	M08-SMH-018	M08-SMH-019	38.68000000	38.29000000	1/1/9999	CIPP	
12657	M08-SMH-032M08-SMH-033	4026	LBWD	OBISPO AVE	1920	276.00000000	CP		B-217	5	8	M08-SMH-032	M08-SMH-033	42.69000000	41.44000000	1/1/9999	CIPP	
14574	L14-SMH-016L14-SMH-017	3632	LBWD	15TH ST	1924	336.00000000	NRCP		E-4	11	8	L14-SMH-016	L14-SMH-017	10.55000000	9.22000000	1/1/9999	CIPP	
14653	M10-SMH-056M11-SMH-019	4029	LBWD	NEWPORT AVE	1920	326.00000000	CP	5'E CL	D-71	15	8	M10-SMH-056	M11-SMH-019	47.62000000	45.02000000	1/1/9999	CIPP	
10923	M13-SMH-020M13-SMH-019	4032	LBWD	SPAULDING ST	1920	126.90000153	CP	0	D-71	34	8	M13-SMH-020	M13-SMH-019	27.83000000	27.22000000	1/1/9999	CIPP	
14665	M14-SMH-037M14-SMH-040	4032	LBWD	15TH ST	1920	330.00000000	CP	0	D-71	19	8	M14-SMH-037	M14-SMH-040	47.01000000	41.07000000	1/1/9999	CIPP	
14689	M14-SMH-015M14-SMH-038	4035	LBWD	N/S AL E/O FREEMAN AVE	1920	330.00000000	CP		D-71	19	8	M14-SMH-015	M14-SMH-038	64.01000000	54.11000000	1/1/9999	CIPP	
14691	M14-SMH-004M14-SMH-002	4035	LBWD	N/S AL E/O ORIZABA AVE	1920	300.00000000	CP		D-71	21	8	M14-SMH-004	M14-SMH-002	78.81000000	76.81000000	1/1/9999	CIPP	
14695	Q06-SMH-074Q06-SMH-075	4823	LBWD	E/W AL E/O SANTA ANA AVE	1926	208.00000000	VCP		G-262	0	8	Q06-SMH-074	Q06-SMH-075	0.00000000	0.00000000	1/1/9999	CIPP	
14707	M08-SMH-037M07-SMH-052	4026	LBWD	OBISPO AVE	1920	354.00000000	CP		B-217	6	8	M08-SMH-037	M07-SMH-052	37.35000000	35.74000000	1/1/9999	CIPP	
14721	M10-SMH-034M10-SMH-059	4029	LBWD	OBISPO AVE	1920	305.00000000	CP	0	D-71	3	8	M10-SMH-034	M10-SMH-059	43.89000000	42.68000000	1/1/9999	CIPP	
11014	L14-SMH-023L14-SMH-024	3635	LBWD	17TH ST	1924	157.19999695	NRCP	0	E-4	11	8	L14-SMH-023	L14-SMH-024	47.00000000	42.53000000	1/1/9999	CIPP	
18873	F12-SMH-007F12-SMH-008	2432	LBWD		1922	395.00000000	CP		B-231	2	10	F12-SMH-007	F12-SMH-008	-9.06000000	-10.25000000	1/1/9999	CIPP	
18920	L07-SMH-008L07-SMH-009	3626	LBWD		1917	221.19999695	CP	0	D-267	3	8	L07-SMH-008	L07-SMH-009	36.82000000	36.15000000	1/1/9999	CIPP	
17023	M14-SMH-041M14-SMH-045	4032	LBWD	15TH ST	1920	324.00000000	CP	0	D-71	20	8	M14-SMH-041	M14-SMH-045	35.63000000	30.16000000	1/1/9999	CIPP	
19083	L08-SMH-019L08-SMH-020	3626	LBWD	BROADWAY	1917	361.50000000	CP	31.5'S CL	D-267	9	8	L08-SMH-019	L08-SMH-020	36.92000000	35.83000000	1/1/9999	CIPP	
17156	L13-SMH-048L13-SMH-046	3632	LBWD	SPAULDING ST	1924	93.00000000	CP	5'S CL	E-4	12	8	L13-SMH-048	L13-SMH-046	14.76000000	14.48000000	1/1/9999	CIPP	
17198	L13-SMH-044L13-SMH-048	3632	LBWD	SPAULDING ST	1924	317.00000000	CP	5'N CL	E-4	12	8	L13-SMH-044	L13-SMH-048	15.71000000	14.76000000	1/1/9999	CIPP	
19141	L08-SMH-012L08-SMH-013	3626	LBWD	DODGE WAY	1917	355.00000000	CP	0	D-267	3	8	L08-SMH-012	L08-SMH-013	38.23000000	37.17000000	1/1/9999	CIPP	
17290	M10-SMH-059M11-SMH-037	4029	LBWD	OBISPO AVE	1920	305.00000000	CP	0	D-71	4	8	M10-SMH-059	M11-SMH-037	42.58000000	41.38000000	1/1/9999	CIPP	
17464	M08-SMH-031M08-SMH-030	4026	LBWD	E/W AL E/O ORIZABA AVE	1917	290.00000000	CP		D-267	15	8	M08-SMH-031	M08-SMH-030	43.00000000	42.13000000	1/1/9999	CIPP	
17493	L07-SMH-009L07-SMH-010	3626	LBWD		1917	126.80000305	CP	0	D-267	3	8	L07-SMH-009	L07-SMH-010	36.15000000	35.77000000	1/1/9999	CIPP	
4105	K13-SMH-064K13-SMH-065	3632	LBWD	14TH ST	2008	165.64000000	VCP	5'N CL	SC-0153	0	12	K13-SMH-064	K13-SMH-065	5.69000000	5.27000000	1/1/9999	CIPP	
15541	L13-SMH-055L13-SMH-058	3632	LBWD	14TH ST	1923	170.00000000	CP	5'N CL	D-208	9	8	L13-SMH-055	L13-SMH-058	11.41000000	10.73000000	1/1/9999	CIPP	
19496	M10-SMH-038M10-SMH-039	4029	LBWD	CORONADO AVE	1920	315.00000000	CP	5'E CL	D-71	10	8	M10-SMH-038	M10-SMH-039	46.65000000	45.39000000	1/1/9999	CIPP	
19531	M10-SMH-031M10-SMH-032	4029	LBWD	OBISPO AVE	1920	341.50000000	CP	0	D-71	6	8	M10-SMH-031	M10-SMH-032	47.70000000	46.33000000	1/1/9999	CIPP	
19557	L14-SMH-028L14-SMH-029	3635	LBWD	OHIO AVE	1924	290.00000000	NRCP	5'E CL	E-4	13	8	L14-SMH-028	L14-SMH-029	46.20000000	37.50000000	1/1/9999	CIPP	
19561	M14-SMH-038M14-SMH-037	4032	LBWD	N/S AL E/O FREEMAN AVE	1920	320.00000000	CP	0	D-71	20	8	M14-SMH-038	M14-SMH-037	54.11000000	47.11000000	1/1/9999	CIPP	
19597	L13-SMH-016L13-SMH-019	3632	LBWD	14TH ST	1923	159.00000000	CP	5'N CL	D-208	9	8	L13-SMH-016	L13-SMH-019	18.65000000	17.99000000	1/1/9999	CIPP	
15833	M07-SMH-021L07-SMH-013	4026	LBWD	BRONCE WAY	1917	306.00000000	CP		D-267	12	8	M07-SMH-021	L07-SMH-013	34.56000000	33.64000000	1/1/9999	CIPP	
17987	Q06-SMH-007Q06-SMH-008	4423	LBWD	ALLEY NORTH 2ND ST	1945	212.00000000	VCP	0	A-655	1	8	Q06-SMH-007	Q06-SMH-008	0.11000000	-0.37000000	1/1/9999	CIPP	
17988	M10-SMH-049M10-SMH-050	4029	LBWD	NEWPORT AVE	1920	295.00000000	CP	5'E CL	D-71	16	8	M10-SMH-049	M10-SMH-050	51.90000000	50.57000000	1/1/9999	CIPP	
18190	M11-SMH-029M11-SMH-010	4029	LBWD	CORONADO AVE	1920	317.00000000	CP	5'E CL	D-71	6	8	M11-SMH-029	M11-SMH-010	41.93000000	40.67000000	1/1/9999	CIPP	
18228	P06-SMH-016P07-SMH-050	4423	LBWD	ALLEY NORTH 2ND ST	1945	232.00000000	VCP	0	A-655	1	10	P06-SMH-016	P07-SMH-050	-0.90000000	-1.13000000	1/1/9999	CIPP	
18428	M08-SMH-035M08-SMH-036	4026	LBWD	OBISPO AVE	1920	283.00000000	CP		B-217	6	8	M08-SMH-035	M08-SMH-036	38.89000000	37.62000000	1/1/9999	CIPP	
18436	L07-SMH-012L07-SMH-013	3626	LBWD		1917	357.50000000	CP	0	D-267	5	8	L07-SMH-012	L07-SMH-013	34.72000000	33.65000000	1/1/9999	CIPP	
18472	L13-SMH-034L13-SMH-043	3632	LBWD	SPAULDING ST	1924	322.00000000	CP	5'N CL	E-4	12	8	L13-SMH-034	L13-SMH-043	19.02000000	18.05000000	1/1/9999	CIPP	
16726	L08-SMH-018L08-SMH-019	3626	LBWD	BROADWAY	1917	332.50000000	CP	31.5'S CL	D-267	10	8	L08-SMH-018	L08-SMH-019	37.92000000	36.92000000	1/1/9999	CIPP	

Appendix C: Pipelines with Missing Material

No.	InfoSWMM Model ID	Owner	LBWD User Identification
1	G10061	LBWD	H08-SMH-047H08-SMH-048
2	G10096	LBWD	H09-SMH-051H09-SMH-023
3	G10233	LBWD	M21-SMH-003M21-SUK-000
4	G10244	LBWD	H09-SMH-020H09-SMH-021
5	G10416	LBWD	H08-SMH-016H08-SMH-017
6	G10822	LBWD	R23-SUK-000R23-SMH-025
7	G10944	LBWD	E15-SMH-054E15-SMH-055
8	G11032	LBWD	L40-SCO-035
9	G11039	LBWD	G09-SUK-000G09-SUK-000
10	G11040	LBWD	G09-SUK-000G09-SUK-000
11	G11207	LBWD	G09-SUK-000G09-SUK-000
12	G11315	LBWD	F08-SUK-000F08-SMH-016
13	G11329	LBWD	R09-SMH-059R09-SMH-062
14	G11826	LBWD	H28-SCO-008H28-SUK-000
15	G11906	LBWD	H08-SMH-028H08-SMH-027
16	G11953	LBWD	Q08-SCO-013Q08-SUK-000
17	G12161	LBWD	J23-SUK-000J23-SUK-000
18	G12181	LBWD	P23-SUK-000P23-SUK-000
19	G12182	LBWD	P23-SUK-000P23-SUK-000
20	G12260	LBWD	L40-SCO-036L40-SCO-035
21	G12263	LBWD	J42-SMH-001J41-SMH-005
22	G12446	LBWD	H28-SCO-007H28-SUK-000
23	G12578	LBWD	G09-SCP-002G09-SMH-032
24	G12791	LBWD	Q07-SUK-000Q07-SMH-025
25	G12858	LBWD	P23-SUK-000P23-SUK-000
26	G13270	LBWD	L38-SMH-026L38-SMH-025
27	G13517	LBWD	H08-SUK-000H08-SMH-016
28	G13555	LBWD	P12-SMH-011N12-SMH-055
29	G13599	LBWD	K23-SUK-000K22-SUK-000
30	G13665	LBWD	H08-SUK-000H08-SMH-017
31	G13668	LBWD	J15-SMH-023J15-SUK-000
32	G13871	LBWD	F15-SCP-001F15-SMH-030
33	G13898	LBWD	J23-SUK-000J23-SUK-000
34	G14132	LBWD	N14-SCO-042N14-SCO-041
35	G14242	LBWD	G09-SUK-000G09-SUK-000
36	G14263	LBWD	H06-SUK-000H06-SMH-008
37	G14602	LBWD	H06-SUK-000H06-SMH-012
38	G14645	LBWD	D15-SMH-038D15-SMH-039
39	G1477	LBWD	K12-SUK-000K12-SMH-057
40	G14861	LBWD	K23-SUK-000K22-SUK-000
41	G15345	LBWD	Q08-SMH-040Q08-SPS-001
42	G1539	LBWD	H09-SMH-029H09-SMH-013
43	G1541	LBWD	H09-SMH-095H09-SMH-009
44	G15441	LBWD	R25-SUK-000R25-SMH-023
45	G15503	LBWD	H06-SUK-000H06-SPS-023
46	G15534	LBWD	H09-SUK-000H09-SMH-024
47	G15571	LBWD	N14-SMH-040N14-SMH-039
48	G15625	LBWD	H08-SMH-029H08-SMH-028
49	G15641	LBWD	S10-SMH-111S10-SMH-112
50	G15838	LBWD	L23-SMH-014L23-SMH-013
51	G15915	LBWD	H33-SMH-057H33-SMH-056
52	G16257	LBWD	H06-SMH-011H06-SMH-010
53	G16277	LBWD	J14-SCO-030J13-SUK-000
54	G16565	LBWD	R23-SUK-000R23-SMH-021
55	G16574	LBWD	Q08-SUK-000Q08-SMH-054
56	G16587	LBWD	K13-SMH-048K13-SMH-049
57	G16607	LBWD	N14-SCO-041N14-SUK-000
58	G16676	LBWD	K14-SCO-059K14-SMH-041
59	G16724	LBWD	C24-SMH-002C24-SMH-010
60	G16727	LBWD	Q08-SCS-002Q08-SUK-000
61	G17051	LBWD	R09-SMH-032R09-SMH-033
62	G17070	LBWD	H06-SUK-000H06-SPS-022
63	G17101	LBWD	M11-SMH-005M12-SMH-009
64	G17334	LBWD	M22-SUK-000M22-SUK-000
65	G17630	LBWD	E15-SMH-057E15-SMH-058
66	G17721	LBWD	R09-SMH-062R09-SMH-063
67	G17826	LBWD	H09-SMH-081H09-SMH-080
68	G17834	LBWD	Q07-SCO-013Q07-SUK-000
69	G17850	LBWD	F15-SUK-000F15-SMH-034
70	G17865	LBWD	H08-SUK-000H08-SMH-018
71	G17962	LBWD	Q09-SMH-048Q09-SMH-047
72	G17994	LBWD	H08-SCO-003H08-SMH-061
73	G18023	LBWD	N11-SMH-005N12-SMH-040
74	G18064	LBWD	H32-SMH-076H32-SMH-075
75	G18081	LBWD	P23-SUK-000P23-SMH-006
76	G18083	LBWD	H06-SUK-000H06-SPS-021
77	G18086	LBWD	G09-SCP-001G09-SMH-044
78	G18103	LBWD	R09-SMH-063R09-SMH-064

Appendix C: Pipelines with Missing Material

No.	InfoSWMM Model ID	Owner	LBWD User Identification
79	G18169	LBWD	L14-SCO-059L14-SUK-000
80	G18180	LBWD	Q06-SGT-001Q06-SUK-000
81	G18320	LBWD	G08-SUK-000G08-SMH-015
82	G18413	LBWD	G31-SCO-048000-000-000
83	G18419	LBWD	R09-SMH-049R09-SMH-048
84	G18431	LBWD	H08-SCP-003H08-SMH-027
85	G18471	LBWD	H06-SMH-008H06-SMH-007
86	G18472	LBWD	H06-SUK-000H06-SMH-008
87	G18481	LBWD	E15-SMH-048E15-SMH-071
88	G18554	LBWD	R07-SPS-001R07-SMH-008
89	G18560	LBWD	Q07-SCS-001Q07-SUK-000
90	G18649	LBWD	P23-SUK-000P23-SUK-000
91	G18879	LBWD	S10-SCO-005S10-SMH-041
92	G19024	LBWD	H09-SCO-004H09-SMH-032
93	G19034	LBWD	P06-SMH-030P06-SMH-060
94	G19076	LBWD	H33-SMH-056H32-SMH-076
95	G19168	LBWD	Q24-SMH-015
96	G19264	LBWD	J15-SMH-057J15-SUK-000
97	G19303	LBWD	R23-SUK-000R23-SMH-025
98	G19366	LBWD	G09-SUK-000G09-SMH-022
99	G19410	LBWD	Q06-SUK-000Q06-SGT-001
100	G2647	LBWD	V22-SMH-002V22-SMH-001
101	G2824	LBWD	J15-SMH-012J15-SMH-013
102	G2922	LBWD	N16-SMH-002N16-SMH-030
103	G3030	LBWD	H08-SMH-037H08-SMH-042
104	G3151	LBWD	Q08-SMH-041Q08-SPS-001
105	G3474	LBWD	R20-SMH-025R20-SMH-024
106	G3526	LBWD	H09-SMH-013H09-SMH-017
107	G3893	LBWD	H09-SMH-011H09-SMH-013
108	G3979	LBWD	R11-SMH-010Q11-SMH-035
109	G4392	LBWD	H08-SMH-022H08-SMH-004
110	G4452	LBWD	K12-SMH-039K12-SMH-058
111	G4479	LBWD	H14-SMH-056H14-SMH-057
112	G4593	LBWD	H08-SMH-061H09-SMH-021
113	G4753	LBWD	H08-SMH-046H08-SMH-047
114	G4817	LBWD	H09-SMH-027H09-SMH-011
115	G4824	LBWD	H08-SMH-051H08-SMH-052
116	G5032	LBWD	H09-SCP-002H09-SMH-069
117	G514	LBWD	H10-SMH-049H10-SUK-001
118	G5355	LBWD	E12-SMH-033E12-SMH-036
119	G5382	LBWD	H08-SMH-059H09-SMH-016
120	G5422	LBWD	H11-SMH-034H11-SMH-035
121	G5474	LBWD	H08-SMH-036H08-SMH-037
122	G5599	LBWD	R04-SMH-054R04-SMH-048
123	G5689	LBWD	R10-SMH-013R10-SMH-014
124	G5712	LBWD	H10-SUK-000H10-SMH-014
125	G6396	LBWD	H08-SMH-060H08-SMH-061
126	G6685	LBWD	H14-SMH-058H14-SMH-059
127	G6731	LBWD	H08-SMH-039H09-SMH-013
128	G6758	LBWD	H09-SMH-067H09-SMH-068
129	G6964	LBWD	H08-SMH-006H08-SMH-048
130	G7284	LBWD	H08-SMH-062H09-SMH-022
131	G7410	LBWD	H08-SMH-014H08-SMH-015
132	G7437	LBWD	J20-SUK-000J20-SMH-013
133	G7442	LBWD	H09-SMH-094H09-SMH-095
134	G7470	LBWD	H08-SMH-035H08-SMH-036
135	G8125	LBWD	H09-SUK-000H09-SMH-075
136	G8143	LBWD	H09-SMH-012H09-SMH-014
137	G8207	LBWD	Q08-SMH-048Q08-SMH-041
138	G8280	LBWD	Q12-SMH-014Q12-SMH-015
139	G8937	LBWD	R14-SMH-011R14-SMH-012
140	G9106	LBWD	N19-SMH-005N19-SMH-019
141	G9222	LBWD	H08-SCO-002H08-SMH-054
142	G9240	LBWD	H09-SMH-016H09-SMH-018
143	G9304	LBWD	R08-SMH-106R08-SMH-103
144	G9398	LBWD	H08-SMH-054H09-SMH-011
145	G9402	LBWD	H09-SMH-017H09-SMH-031
146	G9494	LBWD	J13-SMH-030J13-SMH-031
147	G9526	LBWD	H08-SMH-045H08-SMH-044
148	G97	LBWD	H09-SMH-019H09-SMH-017
149	G9718	LBWD	H09-SCP-001H09-SMH-068
150	G9770	LBWD	H09-SMH-008H09-SMH-023
151	G9901	LBWD	H09-SMH-021H09-SMH-008

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
1	G10208	LBWD	NO	R16-SMH-040R16-SMH-013	No
2	G10277	LBWD	NO	S26-SUK-000S26-SUK-000	No
3	G10752	LBWD	YES	P14-SMH-040P14-SMH-039	Yes
4	G10756	LBWD	NO	R08-SCO-066R08-SMH-065	No
5	G10785	LBWD	NO	U25-SUK-000U25-SUK-000	No
6	G10787	LBWD	YES	X23-SMH-037X23-SMH-036	Yes
7	G10822	LBWD	NO	R23-SUK-000R23-SMH-025	No
8	G10939	LBWD	NO	R07-SMH-009R07-SMH-014	No
9	G10944	LBWD	NO	E15-SMH-054E15-SMH-055	No
10	G10964	LBWD	NO	R08-SMH-013R08-SMH-014	No
11	G11032	LBWD	NO	L40-SCO-035	No
12	G11039	LBWD	NO	G09-SUK-000G09-SUK-000	No
13	G11040	LBWD	NO	G09-SUK-000G09-SUK-000	No
14	G11045	LBWD	YES	Q29-SMH-027P29-SMH-003	Yes
15	G11049	LBWD	NO	R07-SCP-001R07-SPS-001	No
16	G11060	LBWD	NO	Q09-SMH-038Q09-SMH-039	No
17	G11073	LBWD	YES	J15-SMH-065J15-SUK-000	Yes
18	G11081	LBWD	NO	R23-SMH-020R23-SMH-015	No
19	G11087	LBWD	NO	R08-SMH-053R08-SMH-054	No
20	G11093	LBWD	YES	N10-SMH-058N10-SMH-056	Yes
21	G11094	LBWD	YES	N10-SMH-050N10-SMH-022	Yes
22	G11099	LBWD	NO	R04-SMH-032R04-SMH-034	No
23	G11100	LBWD	NO	R04-SMH-031R04-SMH-032	No
24	G11109	LBWD	NO	G21-SMH-031G21-SMH-034	No
25	G11110	LBWD	NO	T15-SMH-044T15-SMH-043	No
26	G11111	LBWD	NO	R11-SUK-000R11-SMH-014	No
27	G11122	LBWD	NO	N14-SMH-071N14-SMH-034	No
28	G11125	LBWD	NO	E13-SCO-005E13-SCO-006	No
29	G11135	LBWD	NO	Q26-SCO-004Q26-SUK-000	No
30	G11144	LBWD	NO	M23-SMH-002M23-SMH-001	No
31	G11146	LBWD	NO	R08-SCO-005R08-SMH-052	No
32	G11163	LBWD	NO	F38-SUK-000F38-SMH-007	No
33	G11201	LBWD	NO	X24-SMH-004X23-SMH-013	No
34	G11207	LBWD	NO	G09-SUK-000G09-SUK-000	No
35	G11223	LBWD	YES	G14-SMH-023G14-SMH-022	Yes
36	G11240	LBWD	NO	X24-SMH-024X24-SMH-023	No
37	G11279	LBWD	YES	E12-SMH-010E12-SMH-053	Yes
38	G11289	LBWD	NO	E21-SUK-000E21-SUK-000	No
39	G11314	LBWD	NO	N06-SCO-033N06-SUK-000	No
40	G11320	LBWD	YES	N09-SMH-049N09-SMH-032	Yes
41	G11326	LBWD	NO	G06-SMH-007G06-SMH-008	No
42	G11329	LBWD	NO	R09-SMH-059R09-SMH-062	No
43	G11349	LBWD	NO	H40-SMH-009H40-SMH-008	No
44	G11355	LBWD	NO	N06-SCO-035N06-SUK-000	No
45	G11374	LBWD	YES	M18-SMH-018M18-SMH-019	Yes
46	G11410	LBWD	NO	H28-SMH-005H28-SMH-004	No
47	G11436	LBWD	YES	T19-SMH-034T19-SMH-035	Yes
48	G11452	LBWD	NO	P05-SMH-039P05-SCO-040	No
49	G11461	LBWD	NO	R09-SMH-040R09-SUK-000	No
50	G11489	LBWD	NO	G21-SMH-021G21-SMH-022	No
51	G11512	LBWD	NO	R05-SMH-092R05-SMH-032	No
52	G11573	LBWD	YES	X23-SMH-020X23-SMH-031	Yes
53	G11574	LBWD	YES	S06-SMH-027S06-SMH-028	Yes
54	G11603	LBWD	NO	G37-SUK-000G37-SMH-044	No
55	G11609	LBWD	NO	K12-SMH-002K12-SMH-001	No
56	G11624	LBWD	NO	R08-SMH-064R08-SMH-068	No
57	G11630	LBWD	NO	R07-SUK-000R07-SPS-001	No
58	G11644	LBWD	NO	R16-SMH-042R16-SMH-041	No
59	G11668	LBWD	NO	P21-SUK-000P21-SMH-001	No
60	G11671	LBWD	YES	F34-SMH-008F34-SMH-007	Yes
61	G11676	LBWD	NO	L34-SMH-014L34-SMH-015	No
62	G11710	LBWD	NO	Q04-SMH-031Q04-SMH-039	No
63	G11726	LBWD	NO	V25-SCO-031V25-SUK-000	No
64	G11733	LBWD	NO	J12-SMH-001J12-SMH-024	No
65	G11743	LBWD	NO	L34-SUK-000L34-SCO-002	No
66	G11746	LBWD	NO	R07-SMH-028	No
67	G11747	LBWD	NO	R07-SMH-017	No
68	G11770	LBWD	YES	N08-SMH-023N08-SMH-037	Yes
69	G11797	LBWD	NO	R08-SMH-014R08-SMH-015	No
70	G11822	LBWD	NO	H22-SMH-015H22-SMH-014	No
71	G11826	LBWD	NO	H28-SCO-008H28-SUK-000	No
72	G11831	LBWD	NO	H20-SMH-014H20-SMH-015	No
73	G11851	LBWD	NO	F10-SMH-024F10-SMH-025	No
74	G11855	LBWD	NO	R07-SCO-002R07-SMH-010	No
75	G11872	LBWD	NO	R04-SMH-028R04-SMH-029	No
76	G11873	LBWD	YES	N10-SMH-051N10-SMH-050	Yes
77	G11888	LBWD	YES	N10-SMH-035N10-SMH-034	Yes
78	G11907	LBWD	NO	G09-SUK-000G09-SUK-000	No
79	G11941	LBWD	NO	R10-SCO-041R10-SMH-071	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
80	G11948	LBWD	NO	R08-SMH-012R08-SMH-013	No
81	G11949	LBWD	NO	R08-SMH-010R08-SMH-012	No
82	G11951	LBWD	NO	R08-SMH-068Q08-SMH-017	No
83	G11954	LBWD	NO	R08-SMH-060R08-SMH-061	No
84	G11955	LBWD	NO	R08-SMH-051R08-SMH-055	No
85	G11979	LBWD	NO	R07-SUK-000R07-SUK-000	No
86	G12012	LBWD	YES	P18-SMH-002P18-SMH-003	Yes
87	G12014	LBWD	NO	Q14-SMH-019Q14-SMH-017	No
88	G12018	LBWD	NO	R26-SCO-011R26-SCO-008	No
89	G12021	LBWD	NO	K21-SMH-004K21-SMH-003	No
90	G12027	LBWD	NO	T12-SMH-037T12-SMH-036	No
91	G12033	LBWD	YES	N18-SMH-047N18-SMH-048	Yes
92	G12046	LBWD	NO	H06-SMH-012H06-SMH-011	No
93	G12054	LBWD	NO	E13-SCO-003E13-SUK-000	No
94	G12080	LBWD	YES	J15-SMH-016J15-SMH-019	Yes
95	G12081	LBWD	NO	K35-SMH-046K35-SMH-047	No
96	G12085	LBWD	NO	K32-SMH-052K32-SMH-054	No
97	G12101	LBWD	NO	N06-SCO-034N06-SCO-035	No
98	G12107	LBWD	YES	E14-SMH-051E14-SMH-052	Yes
99	G12108	LBWD	NO	R19-SMH-035R19-SMH-036	No
100	G12127	LBWD	NO	H28-SUK-000H28-SMH-043	No
101	G12144	LBWD	NO	V25-SUK-000V25-SCO-031	No
102	G12148	LBWD	YES	J16-SMH-061J16-SUK-000	Yes
103	G12149	LBWD	YES	J16-SUK-000J15-SMH-065	Yes
104	G12159	LBWD	NO	K21-SMH-003K21-SUK-000	No
105	G12162	LBWD	NO	F35-SMH-004F35-SMH-003	No
106	G12164	LBWD	YES	N09-SMH-033N10-SMH-033	Yes
107	G12168	LBWD	NO	X24-SUK-000X24-SMH-022	No
108	G12169	LBWD	NO	X24-SUK-000X24-SMH-027	No
109	G12171	LBWD	NO	X23-SMH-012X23-SMH-016	No
110	G12177	LBWD	NO	K32-SMH-027K32-SMH-025	No
111	G12178	LBWD	NO	K31-SMH-003K32-SMH-027	No
112	G12181	LBWD	NO	P23-SUK-000P23-SUK-000	No
113	G12182	LBWD	NO	P23-SUK-000P23-SUK-000	No
114	G12183	LBWD	NO	K32-SMH-034K32-SMH-035	No
115	G12195	LBWD	NO	R11-SMH-012R11-SMH-011	No
116	G12222	LBWD	NO	J19-SMH-004J19-SMH-005	No
117	G12260	LBWD	NO	L40-SCO-036L40-SCO-035	No
118	G12286	LBWD	NO	N18-SMH-006N18-SMH-005	No
119	G12287	LBWD	NO	K32-SMH-024K32-SMH-025	No
120	G12290	LBWD	YES	P18-SMH-024P18-SMH-026	Yes
121	G12294	LBWD	NO	H22-SMH-014H22-SMH-010	No
122	G12343	LBWD	NO	R05-SMH-098R05-SMH-092	No
123	G12345	LBWD	NO	G12-SMH-050G12-SMH-057	No
124	G12351	LBWD	NO	R26-SCO-040R26-SCO-039	No
125	G12354	LBWD	YES	G13-SMH-033G12-SMH-073	Yes
126	G12375	LBWD	NO	U19-SUK-000U19-SMH-011	No
127	G12376	LBWD	NO	U19-SMH-014U19-SUK-000	No
128	G12409	LBWD	NO	P26-SUK-000P26-SMH-001	No
129	G12429	LBWD	NO	R07-SUK-000R07-SUK-000	No
130	G12436	LBWD	YES	N18-SMH-053N18-SMH-052	Yes
131	G12443	LBWD	NO	H38-SCO-013H38-SMH-012	No
132	G12446	LBWD	NO	H28-SCO-007H28-SUK-000	No
133	G12462	LBWD	NO	R07-SUK-000R07-SUK-000	No
134	G12476	LBWD	NO	F40-SUK-000F40-SMH-042	No
135	G12481	LBWD	NO	K21-SMH-005K21-SMH-004	No
136	G12494	LBWD	YES	J16-SUK-000J16-SMH-061	Yes
137	G12538	LBWD	YES	N08-SMH-037N08-SMH-024	Yes
138	G12541	LBWD	NO	F40-SUK-000F40-SMH-026	No
139	G12543	LBWD	NO	J40-SCO-001J40-SMH-011	No
140	G12548	LBWD	YES	C24-SMH-004C24-SMH-007	Yes
141	G12557	LBWD	NO	J29-SMH-029J29-SMH-031	No
142	G12571	LBWD	NO	K32-SMH-061K32-SMH-062	No
143	G12584	LBWD	YES	G36-SMH-009G36-SMH-011	Yes
144	G12587	LBWD	YES	K13-SMH-044K13-SMH-043	Yes
145	G12588	LBWD	NO	K12-SMH-071K12-SMH-072	No
146	G12590	LBWD	NO	H17-SMH-040H17-SMH-038	No
147	G12607	LBWD	NO	E21-SUK-000E21-SMH-049	No
148	G12645	LBWD	NO	J32-SMH-050J32-SMH-044	No
149	G12654	LBWD	NO	X24-SMH-023X24-SMH-021	No
150	G12686	LBWD	NO	H28-SCO-010H28-SMH-003	No
151	G12689	LBWD	YES	G33-SMH-038G32-SMH-052	Yes
152	G12702	LBWD	NO	E12-SUK-000E12-SMH-021	No
153	G12718	LBWD	NO	K32-SMH-056K32-SMH-060	No
154	G12727	LBWD	NO	U19-SUK-000U19-SUK-000	No
155	G12739	LBWD	NO	H28-SUK-000H28-SMH-017	No
156	G12741	LBWD	YES	R05-SMH-052R05-SMH-051	Yes
157	G12760	LBWD	NO	X23-SMH-021X23-SMH-020	No
158	G12765	LBWD	YES	P30-SMH-033P30-SMH-034	Yes

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
159	G12776	LBWD	NO	N06-SMH-048N06-SMH-050	No
160	G12823	LBWD	NO	H24-SCO-002H24-SMH-032	No
161	G12842	LBWD	YES	U20-SMH-009U20-SMH-010	Yes
162	G12858	LBWD	NO	P23-SUK-000P23-SUK-000	No
163	G12881	LBWD	NO	U16-SUK-000U16-SCO-029	No
164	G12910	LBWD	NO	G12-SMH-049G12-SMH-050	No
165	G12912	LBWD	YES	N10-SMH-022N10-SMH-023	Yes
166	G12915	LBWD	YES	H15-SMH-053H15-SMH-051	Yes
167	G12950	LBWD	NO	H06-SUK-000H06-SMH-005	No
168	G12951	LBWD	NO	G12-SMH-057G12-SMH-054	No
169	G12954	LBWD	YES	G13-SMH-041G13-SMH-040	Yes
170	G12975	LBWD	NO	F10-SUK-000F10-SUK-000	No
171	G12982	LBWD	NO	F35-SMH-005F35-SMH-004	No
172	G12985	LBWD	NO	G22-SMH-009G22-SMH-010	No
173	G12989	LBWD	NO	J32-SMH-012K31-SMH-005	No
174	G12990	LBWD	NO	H12-SCO-001H12-SUK-000	No
175	G12992	LBWD	NO	J33-SMH-061J33-SMH-062	No
176	G12993	LBWD	NO	J32-SMH-052J32-SMH-053	No
177	G12995	LBWD	NO	F38-SUK-000F38-SMH-007	No
178	G12996	LBWD	NO	E13-SCO-004E13-SCO-003	No
179	G12998	LBWD	NO	R08-SMH-065R08-SMH-068	No
180	G13004	LBWD	NO	G09-SUK-000G09-SUK-000	No
181	G13009	LBWD	NO	R03-SCO-009R03-SMH-010	No
182	G13014	LBWD	NO	#N/A	No
183	G13025	LBWD	NO	G25-SCO-020G25-SMH-028	No
184	G13038	LBWD	NO	H21-SMH-054G21-SMH-025	No
185	G13040	LBWD	NO	X23-SMH-033X23-SMH-032	No
186	G13042	LBWD	YES	X23-SMH-016X23-SMH-020	Yes
187	G13043	LBWD	NO	X23-SMH-023X23-SMH-022	No
188	G13044	LBWD	NO	G11-SMH-016G11-SMH-010	No
189	G13051	LBWD	NO	J08-SUK-000J08-SMH-019	No
190	G13052	LBWD	YES	H14-SMH-036H14-SMH-035	Yes
191	G13054	LBWD	NO	X23-SMH-019X23-SMH-018	No
192	G13094	LBWD	YES	H14-SMH-008H14-SMH-005	Yes
193	G13097	LBWD	NO	V25-SUK-000V25-SMH-030	No
194	G13151	LBWD	NO	U16-SCS-002U16-SUK-000	No
195	G13154	LBWD	NO	U15-SMH-014U15-SMH-013	No
196	G13192	LBWD	NO	Q08-SCO-016R08-SMH-069	No
197	G13198	LBWD	YES	#N/A	Yes
198	G13201	LBWD	NO	R03-SCO-012R03-SCO-024	No
199	G13222	LBWD	NO	H28-SMH-044H28-SMH-045	No
200	G13232	LBWD	NO	K32-SMH-057K32-SMH-059	No
201	G13235	LBWD	NO	J33-SMH-051J33-SMH-052	No
202	G13236	LBWD	NO	J33-SMH-060J33-SMH-061	No
203	G13237	LBWD	YES	J33-SMH-056J33-SMH-055	Yes
204	G13238	LBWD	YES	J33-SMH-057J33-SMH-056	Yes
205	G13242	LBWD	YES	P18-SMH-049P18-SMH-050	Yes
206	G13245	LBWD	NO	J19-SMH-002J19-SMH-003	No
207	G13267	LBWD	YES	N08-SMH-032N08-SMH-025	Yes
208	G13268	LBWD	YES	P08-SMH-043N08-SMH-040	Yes
209	G13275	LBWD	NO	H38-SMH-012H38-SMH-014	No
210	G13332	LBWD	YES	P09-SMH-053P09-SMH-055	Yes
211	G13340	LBWD	NO	P26-SMH-002P26-SUK-000	No
212	G13351	LBWD	NO	#N/A	No
213	G13355	LBWD	NO	L35-SMH-024L35-SMH-025	No
214	G13362	LBWD	NO	E21-SCO-005E21-SCO-006	No
215	G13367	LBWD	NO	H28-SMH-004H28-SMH-016	No
216	G13375	LBWD	NO	L30-SMH-006L30-SMH-005	No
217	G13383	LBWD	NO	P11-SCO-002P11-SUK-000	No
218	G13406	LBWD	YES	N08-SMH-024N08-SMH-032	Yes
219	G13409	LBWD	NO	M40-SMH-032M40-SMH-021	No
220	G13413	LBWD	YES	G13-SMH-043G13-SMH-042	Yes
221	G13414	LBWD	NO	R10-SMH-067R10-SMH-073	No
222	G13423	LBWD	NO	R05-SMH-033R05-SMH-034	No
223	G13424	LBWD	NO	L30-SMH-001L30-SMH-002	No
224	G13427	LBWD	NO	K12-SMH-005K12-SMH-004	No
225	G13428	LBWD	NO	K12-SMH-004K12-SMH-035	No
226	G13435	LBWD	NO	P24-SCO-013P24-SCO-012	No
227	G13458	LBWD	NO	N06-SCO-025N06-SUK-000	No
228	G13494	LBWD	NO	P13-SMH-039P13-SMH-040	No
229	G13499	LBWD	NO	H31-SCO-060H31-SMH-007	No
230	G13503	LBWD	NO	N21-SUK-000N21-SUK-000	No
231	G13517	LBWD	NO	H08-SUK-000H08-SMH-016	No
232	G13542	LBWD	YES	R05-SMH-058R05-SMH-052	Yes
233	G13543	LBWD	NO	R07-SMH-012R07-SMH-013	No
234	G13555	LBWD	NO	P12-SMH-011N12-SMH-055	No
235	G13568	LBWD	NO	M22-SUK-000L22-SMH-013	No
236	G13580	LBWD	NO	H20-SUK-000	No
237	G13599	LBWD	NO	K23-SUK-000K22-SUK-000	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
238	G13612	LBWD	NO	E21-SMH-049E22-SMH-026	No
239	G13616	LBWD	YES	Q25-SMH-055Q24-SMH-019	Yes
240	G13617	LBWD	NO	R23-SMH-029R23-SMH-020	No
241	G13638	LBWD	YES	G09-SMH-008F09-SMH-018	Yes
242	G13641	LBWD	NO	R08-SCO-004R08-SMH-051	No
243	G13650	LBWD	NO	R05-SMH-071R05-SMH-072	No
244	G13653	LBWD	NO	#N/A	No
245	G13665	LBWD	NO	H08-SUK-000H08-SMH-017	No
246	G13666	LBWD	NO	U19-SUK-000U19-SUK-000	No
247	G13668	LBWD	NO	J15-SMH-023J15-SUK-000	No
248	G13678	LBWD	NO	K32-SMH-028K31-SMH-003	No
249	G13679	LBWD	NO	K32-SMH-029K31-SMH-004	No
250	G13693	LBWD	YES	H14-SMH-005H14-SMH-004	Yes
251	G13699	LBWD	NO	L12-SMH-006L12-SMH-007	No
252	G13704	LBWD	NO	K32-SMH-058L33-SMH-025	No
253	G13705	LBWD	NO	K32-SMH-060K32-SMH-061	No
254	G13712	LBWD	NO	G16-SMH-029G15-SMH-059	No
255	G13719	LBWD	NO	R07-SCO-004R07-SMH-017	No
256	G13720	LBWD	NO	R26-SCO-042R26-SCO-041	No
257	G13721	LBWD	NO	R08-SCO-002R08-SMH-050	No
258	G13722	LBWD	NO	R08-SCO-001R08-SMH-050	No
259	G13743	LBWD	NO	H09-SMH-032H09-SMH-031	No
260	G13744	LBWD	NO	N06-SCO-003N06-SCO-004	No
261	G13750	LBWD	NO	H28-SMH-006H28-SMH-005	No
262	G13762	LBWD	NO	R04-SMH-037R04-SMH-038	No
263	G13825	LBWD	NO	R02-SCO-004R02-SMH-012	No
264	G13844	LBWD	NO	P11-SMH-006P11-SMH-001	No
265	G13871	LBWD	NO	F15-SCP-001F15-SMH-030	No
266	G13885	LBWD	YES	X22-SMH-015X22-SMH-014	Yes
267	G13886	LBWD	NO	U19-SCO-003U19-SCO-004	No
268	G13901	LBWD	NO	K32-SMH-035K32-SMH-040	No
269	G13916	LBWD	NO	G21-SMH-030G21-SMH-035	No
270	G13931	LBWD	NO	K32-SMH-026K32-SMH-027	No
271	G13939	LBWD	NO	H12-SUK-000H12-SMH-053	No
272	G13958	LBWD	NO	R04-SMH-045R05-SMH-101	No
273	G13981	LBWD	YES	P29-SMH-001P29-SMH-002	Yes
274	G13988	LBWD	YES	R04-SMH-048R04-SMH-046	Yes
275	G13996	LBWD	NO	G21-SMH-034G21-SMH-033	No
276	G14003	LBWD	NO	H21-SUK-000H21-SMH-054	No
277	G14005	LBWD	NO	G21-SMH-035G21-SMH-034	No
278	G14020	LBWD	YES	G36-SMH-010G36-SMH-009	Yes
279	G14024	LBWD	NO	S20-SUK-000S20-SMH-037	No
280	G14054	LBWD	NO	X23-SMH-017X23-SMH-016	No
281	G14061	LBWD	YES	P18-SMH-023P18-SMH-024	Yes
282	G14071	LBWD	YES	#N/A	Yes
283	G14104	LBWD	NO	M18-SMH-016M18-SMH-017	No
284	G14109	LBWD	YES	N09-SMH-032N09-SMH-033	Yes
285	G14118	LBWD	NO	X24-SMH-020X23-SMH-012	No
286	G14130	LBWD	NO	N18-SMH-054N18-SMH-047	No
287	G14131	LBWD	YES	P22-SMH-009P22-SMH-008	Yes
288	G14132	LBWD	NO	N14-SCO-042N14-SCO-041	No
289	G14151	LBWD	NO	H28-SCO-009H28-SCO-010	No
290	G14174	LBWD	NO	K39-SMH-019K39-SMH-018	No
291	G14177	LBWD	NO	F40-SUK-000F40-SMH-034	No
292	G14217	LBWD	NO	U19-SCO-002U19-SCO-003	No
293	G14221	LBWD	NO	R04-SMH-035R04-SMH-034	No
294	G14242	LBWD	NO	G09-SUK-000G09-SUK-000	No
295	G14258	LBWD	NO	R02-SCO-003R02-SCO-013	No
296	G14263	LBWD	NO	H06-SUK-000H06-SMH-008	No
297	G14264	LBWD	YES	#N/A	Yes
298	G14269	LBWD	NO	S05-SMH-013S06-SMH-012	No
299	G14270	LBWD	NO	S05-SMH-014S05-SMH-015	No
300	G14276	LBWD	NO	R19-SMH-047R19-SMH-034	No
301	G14292	LBWD	NO	J07-SUK-000J07-SUK-000	No
302	G14295	LBWD	NO	L12-SMH-042L13-SMH-004	No
303	G14299	LBWD	NO	R20-SMH-055R20-SMH-054	No
304	G14313	LBWD	YES	N10-SMH-034N10-SMH-062	Yes
305	G14323	LBWD	NO	Q04-SCO-007Q04-SCO-012	No
306	G14334	LBWD	NO	Q26-SCO-006Q26-SUK-000	No
307	G14341	LBWD	NO	S26-SCS-001S26-SUK-000	No
308	G14343	LBWD	YES	R05-SMH-101R05-SMH-013	Yes
309	G14348	LBWD	NO	V25-SMH-025V25-SMH-026	No
310	G14355	LBWD	NO	R03-SCO-013R03-SCO-023	No
311	G14374	LBWD	NO	N06-SMH-050N06-SMH-051	No
312	G14376	LBWD	NO	Q05-SMH-071Q05-SMH-026	No
313	G14378	LBWD	NO	Q05-SMH-070R04-SMH-051	No
314	G14380	LBWD	YES	R05-SMH-091R05-SMH-003	Yes
315	G14383	LBWD	NO	Q17-SMH-046Q17-SMH-045	No
316	G14395	LBWD	YES	K40-SMH-003K40-SMH-002	Yes

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
317	G14403	LBWD	NO	G11-SMH-010G11-SMH-007	No
318	G14411	LBWD	NO	R04-SMH-044R04-SCO-001	No
319	G14427	LBWD	NO	J07-SCO-001J07-SUK-000	No
320	G14466	LBWD	YES	G14-SMH-052G14-SMH-051	Yes
321	G14487	LBWD	NO	V25-SUK-000V25-SUK-000	No
322	G14488	LBWD	NO	V25-SUK-000V25-SUK-000	No
323	G14491	LBWD	NO	X24-SMH-005X24-SMH-004	No
324	G14495	LBWD	NO	R09-SMH-044R09-SMH-045	No
325	G14547	LBWD	NO	P11-SMH-004P11-SMH-006	No
326	G14551	LBWD	NO	L30-SMH-004L31-SUK-000	No
327	G14562	LBWD	NO	T18-SUK-000T18-SMH-059	No
328	G14568	LBWD	NO	J08-SMH-019J08-SMH-020	No
329	G14570	LBWD	NO	F37-SUK-000F37-SMH-013	No
330	G14575	LBWD	YES	X22-SMH-016X22-SMH-015	Yes
331	G14596	LBWD	NO	N19-SMH-001N18-SMH-054	No
332	G14597	LBWD	NO	G10-SMH-047F10-SMH-024	No
333	G14602	LBWD	NO	H06-SUK-000H06-SMH-012	No
334	G14620	LBWD	NO	H20-SCO-004H20-SMH-019	No
335	G14627	LBWD	NO	L30-SMH-002L30-SMH-006	No
336	G14629	LBWD	NO	K34-SUK-000K34-SCO-001	No
337	G14637	LBWD	NO	E21-SCO-007E21-SCO-008	No
338	G14638	LBWD	YES	H14-SMH-004H14-SMH-002	Yes
339	G14645	LBWD	NO	D15-SMH-038D15-SMH-039	No
340	G14655	LBWD	YES	J16-SMH-024J16-SUK-000	Yes
341	G14663	LBWD	YES	N08-SMH-018N07-SMH-026	Yes
342	G14725	LBWD	NO	U16-SUK-000U16-SUK-000	No
343	G14727	LBWD	YES	H08-SMH-005H08-SMH-040	Yes
344	G14729	LBWD	YES	G35-SMH-005F34-SMH-001	Yes
345	G14730	LBWD	NO	N18-SMH-005N18-SMH-008	No
346	G14735	LBWD	NO	J33-SMH-058J32-SMH-047	No
347	G14747	LBWD	NO	#N/A	No
348	G14765	LBWD	NO	E21-SCO-006E21-SCO-007	No
349	G14771	LBWD	NO	L30-SMH-003	No
350	G14772	LBWD	NO	M23-SMH-001L23-SMH-005	No
351	G14776	LBWD	NO	L21-SCO-001L20-SMH-001	No
352	G14788	LBWD	YES	R05-SMH-051R05-SMH-050	Yes
353	G14789	LBWD	YES	R05-SMH-039R05-SMH-050	Yes
354	G14798	LBWD	NO	G08-SMH-044G08-SCO-022	No
355	G14816	LBWD	NO	N06-SCO-001N06-SCO-002	No
356	G14819	LBWD	NO	R10-SMH-069R10-SMH-070	No
357	G14832	LBWD	NO	#N/A	No
358	G14861	LBWD	NO	K23-SUK-000K22-SUK-000	No
359	G14878	LBWD	NO	R04-SMH-039R04-SMH-040	No
360	G14886	LBWD	NO	J31-SCO-001K31-SMH-006	No
361	G14890	LBWD	NO	R08-SCO-009R08-SMH-059	No
362	G14913	LBWD	YES	K13-SMH-043K13-SMH-042	Yes
363	G14920	LBWD	NO	R07-SMH-010R07-SMH-009	No
364	G14966	LBWD	NO	P28-SCO-041P28-SMH-053	No
365	G14987	LBWD	NO	J07-SUK-000J07-SMH-007	No
366	G14988	LBWD	NO	H31-SMH-007H31-SMH-006	No
367	G15004	LBWD	NO	J32-SMH-049J32-SMH-051	No
368	G15005	LBWD	NO	J32-SMH-047J32-SMH-048	No
369	G15026	LBWD	NO	K31-SMH-005K31-SMH-004	No
370	G15035	LBWD	NO	R10-SMH-089R10-SMH-088	No
371	G15057	LBWD	NO	X24-SMH-021X24-SMH-020	No
372	G15061	LBWD	NO	K07-SUK-000K07-SUK-000	No
373	G15070	LBWD	NO	R04-SMH-041R04-SMH-042	No
374	G15072	LBWD	YES	H08-SMH-058H08-SMH-059	Yes
375	G15077	LBWD	YES	P29-SMH-005P29-SMH-006	Yes
376	G15083	LBWD	NO	H12-SMH-053H12-SMH-054	No
377	G15084	LBWD	NO	H12-SMH-054H12-SMH-055	No
378	G15085	LBWD	NO	R10-SMH-090R10-SMH-089	No
379	G15086	LBWD	NO	H28-SMH-043H28-SMH-044	No
380	G15155	LBWD	NO	L34-SMH-015L34-SMH-016	No
381	G15167	LBWD	NO	L30-SMH-003L30-SMH-006	No
382	G15173	LBWD	NO	R19-SMH-034R19-SMH-035	No
383	G15177	LBWD	NO	X23-SMH-024X23-SMH-023	No
384	G15189	LBWD	YES	G14-SMH-033G14-SMH-032	Yes
385	G15224	LBWD	NO	R07-SMH-018R07-SMH-014	No
386	G15226	LBWD	NO	H22-SCO-001H22-SCO-002	No
387	G15229	LBWD	YES	R05-SMH-060R05-SMH-059	Yes
388	G15234	LBWD	NO	G06-SMH-006G06-SMH-007	No
389	G15239	LBWD	NO	P21-SMH-001Q21-SMH-001	No
390	G15259	LBWD	NO	K40-SCO-022K39-SMH-006	No
391	G15276	LBWD	YES	P22-SMH-012P22-SMH-011	Yes
392	G15282	LBWD	NO	H21-SCO-023H21-SMH-035	No
393	G15303	LBWD	NO	K12-SMH-070K12-SMH-071	No
394	G15311	LBWD	NO	R08-SMH-055R07-SMH-019	No
395	G15314	LBWD	YES	N10-SMH-033N10-SMH-035	Yes

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
396	G15316	LBWD	YES	N08-SMH-040N08-SMH-023	Yes
397	G15320	LBWD	NO	V25-SUK-000V25-SMH-029	No
398	G15349	LBWD	NO	E16-SCO-071E16-SCO-070	No
399	G15377	LBWD	NO	K31-SMH-006K31-SMH-005	No
400	G15389	LBWD	NO	R26-SCO-044R26-SCO-043	No
401	G15390	LBWD	NO	R26-SCO-038R26-SUK-000	No
402	G15419	LBWD	NO	P14-SMH-042P14-SMH-040	No
403	G15434	LBWD	NO	X24-SMH-027X24-SMH-026	No
404	G15438	LBWD	NO	V25-SMH-024V25-SMH-023	No
405	G15440	LBWD	NO	U25-SUK-000U25-SUK-000	No
406	G15454	LBWD	YES	R06-SMH-035R05-SMH-060	Yes
407	G15456	LBWD	NO	R04-SMH-050R04-SMH-049	No
408	G15457	LBWD	NO	N14-SUK-000N14-SUK-000	No
409	G15460	LBWD	YES	N18-SMH-048N18-SMH-014	Yes
410	G15473	LBWD	NO	F35-SUK-000F35-SMH-006	No
411	G15490	LBWD	NO	G30-SMH-038G30-SMH-030	No
412	G15496	LBWD	NO	P12-SUK-000P12-SMH-011	No
413	G15503	LBWD	NO	H06-SUK-000H06-SPS-023	No
414	G15504	LBWD	NO	H06-SPS-022H06-SMH-001	No
415	G15510	LBWD	NO	N06-SMH-042N06-SMH-048	No
416	G15583	LBWD	NO	U16-SCO-030U16-SUK-000	No
417	G15586	LBWD	NO	K32-SMH-032K32-SMH-033	No
418	G15595	LBWD	NO	X23-SMH-027X23-SMH-028	No
419	G15600	LBWD	NO	R16-SMH-015R16-SMH-014	No
420	G15607	LBWD	NO	H29-SCO-056H29-SMH-055	No
421	G15626	LBWD	YES	G10-SMH-019G10-SMH-007	Yes
422	G15643	LBWD	YES	V25-SMH-051V25-SMH-001	Yes
423	G15654	LBWD	NO	P11-SMH-005P11-SMH-006	No
424	G15665	LBWD	NO	J32-SMH-048J33-SMH-059	No
425	G15709	LBWD	NO	E13-SCO-001E13-SUK-000	No
426	G15726	LBWD	NO	U19-SUK-000U19-SUK-000	No
427	G15734	LBWD	NO	X24-SMH-028X24-SMH-025	No
428	G15784	LBWD	NO	K21-SUK-000K21-SMH-002	No
429	G15786	LBWD	NO	G30-SMH-040G30-SMH-039	No
430	G15797	LBWD	NO	N06-SMH-049N06-SUK-000	No
431	G15803	LBWD	NO	G21-SMH-025G21-SMH-029	No
432	G15824	LBWD	NO	Q25-SMH-023Q25-SUK-000	No
433	G15825	LBWD	NO	X24-SMH-006X24-SMH-004	No
434	G15830	LBWD	NO	H27-SMH-021H28-SMH-006	No
435	G15832	LBWD	NO	N10-SCO-028N10-SMH-045	No
436	G15844	LBWD	NO	R23-SUK-000R23-SMH-021	No
437	G15845	LBWD	NO	U17-SUK-000U16-SUK-000	No
438	G15847	LBWD	NO	L12-SMH-048L13-SMH-005	No
439	G15851	LBWD	NO	L12-SMH-039L13-SMH-003	No
440	G15856	LBWD	NO	R10-SMH-070R10-SMH-071	No
441	G15858	LBWD	NO	S10-SMH-099S10-SMH-116	No
442	G15870	LBWD	NO	G22-SMH-012G22-SMH-011	No
443	G15893	LBWD	NO	P26-SCO-014P26-SUK-000	No
444	G15895	LBWD	NO	R26-SCO-041R26-SCO-040	No
445	G15897	LBWD	NO	F12-SCO-001F12-SMH-025	No
446	G15905	LBWD	NO	K21-SMH-002K21-SMH-001	No
447	G15912	LBWD	YES	K32-SMH-022K32-SMH-020	Yes
448	G15915	LBWD	YES	H33-SMH-057H33-SMH-056	Yes
449	G15925	LBWD	YES	G13-SMH-040G13-SMH-033	Yes
450	G15926	LBWD	NO	R11-SMH-022R11-SMH-027	No
451	G15932	LBWD	NO	R04-SMH-040R04-SMH-041	No
452	G15939	LBWD	NO	V21-SMH-001V20-SMH-009	No
453	G15940	LBWD	NO	U18-SCO-009U18-SCO-010	No
454	G15942	LBWD	NO	V25-SMH-028V25-SMH-024	No
455	G15944	LBWD	NO	V25-SMH-029V25-SMH-028	No
456	G15945	LBWD	NO	U25-SCO-001V25-SCO-031	No
457	G15946	LBWD	NO	X23-SMH-013X23-SMH-012	No
458	G15947	LBWD	NO	X23-SMH-022X23-SMH-021	No
459	G15963	LBWD	NO	Q17-SMH-047Q17-SMH-046	No
460	G15972	LBWD	NO	L40-SMH-001M40-SMH-032	No
461	G15979	LBWD	NO	L30-SMH-005L30-SMH-004	No
462	G15980	LBWD	YES	L12-SMH-062L12-SMH-063	Yes
463	G15991	LBWD	NO	G36-SUK-000G36-SCO-014	No
464	G16001	LBWD	NO	X23-SMH-034X23-SMH-033	No
465	G16010	LBWD	NO	V25-SUK-000V25-SUK-000	No
466	G16011	LBWD	NO	V25-SMH-030V25-SUK-000	No
467	G16033	LBWD	NO	G21-SMH-022G21-SMH-035	No
468	G16037	LBWD	YES	H14-SUK-000H14-SMH-036	Yes
469	G16039	LBWD	YES	N10-SMH-023N10-SMH-024	Yes
470	G16049	LBWD	NO	L34-SCO-002L34-SCO-001	No
471	G16051	LBWD	NO	R04-SMH-043R04-SMH-044	No
472	G16055	LBWD	NO	N06-SCO-002N06-SCO-003	No
473	G16065	LBWD	NO	G36-SCO-014G36-SCO-013	No
474	G16066	LBWD	NO	M18-SMH-017M19-SMH-024	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
475	G16068	LBWD	NO	N10-SMH-045N10-SMH-046	No
476	G16084	LBWD	NO	H38-SMH-014H38-SMH-015	No
477	G16108	LBWD	NO	R08-SCO-006R08-SMH-052	No
478	G16113	LBWD	YES	C24-SMH-003C24-SMH-004	Yes
479	G16135	LBWD	NO	J31-SMH-020K31-SMH-005	No
480	G16157	LBWD	NO	Q25-SMH-042Q25-SMH-054	No
481	G16167	LBWD	NO	F35-SUK-000F35-SMH-006	No
482	G16187	LBWD	YES	G14-SMH-029G14-SMH-026	Yes
483	G16196	LBWD	NO	R04-SMH-029R04-SMH-032	No
484	G16206	LBWD	NO	#N/A	No
485	G16209	LBWD	NO	P24-SCO-012P24-SUK-000	No
486	G16222	LBWD	NO	L22-SMH-008L22-SVC-001	No
487	G16225	LBWD	NO	L23-SMH-005L23-SMH-006	No
488	G16236	LBWD	NO	G36-SUK-000G36-SCO-012	No
489	G16239	LBWD	NO	R08-SCO-007R08-SMH-057	No
490	G16245	LBWD	YES	G11-SMH-007G10-SMH-019	Yes
491	G16250	LBWD	NO	G08-SUK-000G08-SMH-016	No
492	G16260	LBWD	NO	P24-SUK-000P24-SCO-013	No
493	G16271	LBWD	NO	N22-SUK-000N22-SMH-003	No
494	G16277	LBWD	NO	J14-SCO-030J13-SUK-000	No
495	G16281	LBWD	YES	G14-SMH-026G14-SMH-023	Yes
496	G16287	LBWD	YES	F09-SMH-013F09-SMH-012	Yes
497	G16306	LBWD	YES	G14-SMH-022G13-SMH-043	Yes
498	G16308	LBWD	YES	G13-SMH-042G13-SMH-041	Yes
499	G16311	LBWD	NO	H20-SUK-000H20-SMH-016	No
500	G16337	LBWD	NO	E16-SCO-073E16-SCO-072	No
501	G16340	LBWD	NO	K08-SUK-000K08-SUK-000	No
502	G16341	LBWD	NO	K07-SUK-000K08-SUK-000	No
503	G16343	LBWD	NO	E21-SCO-004E21-SUK-000	No
504	G16344	LBWD	NO	E21-SUK-000E21-SMH-049	No
505	G16348	LBWD	NO	Q09-SUK-000Q09-SMH-037	No
506	G16354	LBWD	NO	R08-SMH-015R08-SMH-016	No
507	G16358	LBWD	NO	K32-SCO-009K32-SMH-024	No
508	G16361	LBWD	NO	K31-SMH-004K31-SMH-003	No
509	G16387	LBWD	YES	X23-SMH-031X23-SMH-037	Yes
510	G16388	LBWD	NO	L30-SMH-001	No
511	G16394	LBWD	NO	U19-SUK-000U19-SMH-014	No
512	G16407	LBWD	NO	H20-SMH-016H20-SCO-004	No
513	G16408	LBWD	YES	H32-SMH-074H32-SMH-073	Yes
514	G16411	LBWD	NO	G06-SMH-008G07-SMH-045	No
515	G16423	LBWD	YES	P29-SMH-006P29-SMH-007	Yes
516	G16424	LBWD	NO	Q26-SCO-003Q26-SUK-000	No
517	G16427	LBWD	NO	K35-SUK-000K35-SMH-047	No
518	G16444	LBWD	NO	H33-SMH-058H33-SMH-057	No
519	G16449	LBWD	YES	G10-SMH-007G10-SMH-055	Yes
520	G16475	LBWD	YES	G10-SMH-049F10-SMH-025	Yes
521	G16478	LBWD	NO	K15-SMH-040K15-SMH-042	No
522	G16479	LBWD	NO	K15-SMH-042K15-SMH-044	No
523	G16505	LBWD	YES	H08-SMH-040H08-SMH-057	Yes
524	G16518	LBWD	NO	P12-SUK-000P12-SUK-000	No
525	G16522	LBWD	NO	N06-SUK-000N06-SCO-034	No
526	G16531	LBWD	YES	P14-SMH-039P14-SMH-043	Yes
527	G16535	LBWD	NO	K12-SMH-010K12-SMH-033	No
528	G16536	LBWD	NO	N18-SMH-009N18-SMH-010	No
529	G16540	LBWD	NO	N18-SMH-003N18-SMH-002	No
530	G16559	LBWD	YES	P25-SMH-020P25-SMH-021	Yes
531	G16560	LBWD	NO	Q06-SMH-060Q06-SMH-064	No
532	G16565	LBWD	NO	R23-SUK-000R23-SMH-021	No
533	G16567	LBWD	NO	N20-SUK-000N20-SMH-011	No
534	G16575	LBWD	NO	R08-SMH-054R08-SMH-058	No
535	G16576	LBWD	NO	R08-SMH-050R07-SMH-011	No
536	G16577	LBWD	NO	R07-SCO-005R07-SMH-017	No
537	G16578	LBWD	NO	R26-SCO-013R26-SCO-012	No
538	G16579	LBWD	YES	E12-SMH-010E12-SMH-053	Yes
539	G16587	LBWD	YES	K13-SMH-048K13-SMH-049	Yes
540	G16607	LBWD	NO	N14-SCO-041N14-SUK-000	No
541	G16614	LBWD	NO	R08-SMH-056R08-SMH-057	No
542	G16624	LBWD	NO	P12-SUK-000P12-SUK-000	No
543	G16630	LBWD	NO	J08-SCO-002J08-SMH-022	No
544	G16635	LBWD	NO	R26-SCO-015R26-SCO-014	No
545	G16643	LBWD	NO	H21-SCO-018H22-SMH-030	No
546	G16648	LBWD	NO	Q29-SUK-000Q28-SMH-047	No
547	G16650	LBWD	NO	R05-SMH-090R04-SMH-051	No
548	G16651	LBWD	YES	R04-SMH-046R05-SMH-091	Yes
549	G16665	LBWD	NO	L39-SMH-022L39-SMH-019	No
550	G16671	LBWD	YES	R05-SMH-059R05-SMH-058	Yes
551	G16675	LBWD	NO	H09-SCO-001H09-SUK-000	No
552	G16678	LBWD	NO	R23-SMH-025R23-SMH-028	No
553	G16680	LBWD	NO	R26-SCO-014R26-SCO-013	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
554	G16695	LBWD	NO	U16-SUK-000U16-SUK-000	No
555	G16698	LBWD	YES	G35-SMH-027G35-SMH-025	Yes
556	G16699	LBWD	NO	R05-SCO-061R05-SMH-071	No
557	G16721	LBWD	NO	E21-SUK-000E21-SMH-049	No
558	G16722	LBWD	NO	R16-SMH-010R16-SMH-011	No
559	G16727	LBWD	NO	Q08-SCS-002Q08-SUK-000	No
560	G16733	LBWD	NO	H22-SMH-030H22-SMH-039	No
561	G16738	LBWD	NO	M40-SMH-022M40-SMH-023	No
562	G16739	LBWD	NO	U19-SUK-000U19-SUK-000	No
563	G16746	LBWD	NO	S05-SUK-000S06-SUK-000	No
564	G16748	LBWD	NO	H30-SMH-024H30-SMH-025	No
565	G16755	LBWD	NO	G09-SMH-058G09-SMH-045	No
566	G16792	LBWD	NO	H16-SMH-054H16-SMH-053	No
567	G16803	LBWD	NO	E16-SCO-072E16-SMH-006	No
568	G16805	LBWD	NO	G21-SMH-008G21-SMH-031	No
569	G16816	LBWD	YES	G31-SMH-026G30-SMH-032	Yes
570	G16823	LBWD	NO	R16-SMH-008R16-SMH-010	No
571	G16826	LBWD	YES	N18-SMH-052N18-SMH-047	Yes
572	G16831	LBWD	NO	U16-SCO-029U16-SUK-000	No
573	G16853	LBWD	YES	J17-SMH-002J16-SMH-023	Yes
574	G16867	LBWD	NO	Q04-SCO-009Q04-SCO-011	No
575	G16876	LBWD	NO	T23-SCO-048T23-SMH-042	No
576	G16880	LBWD	NO	L12-SMH-041L12-SMH-042	No
577	G16882	LBWD	NO	Q14-SMH-026Q14-SUK-000	No
578	G16885	LBWD	NO	R03-SMH-023R03-SMH-019	No
579	G16887	LBWD	YES	J32-SMH-045J33-SMH-054	Yes
580	G16891	LBWD	NO	N12-SCO-017N12-SMH-042	No
581	G16902	LBWD	NO	Q18-SMH-058P18-SMH-054	No
582	G16910	LBWD	NO	#N/A	No
583	G16912	LBWD	NO	K32-SMH-062K32-SMH-057	No
584	G16915	LBWD	YES	F10-SMH-028F10-SMH-029	Yes
585	G16923	LBWD	NO	N06-SUK-000N06-SMH-050	No
586	G16932	LBWD	NO	R16-SMH-013R16-SMH-014	No
587	G16947	LBWD	YES	P18-SMH-003P18-SMH-023	Yes
588	G16949	LBWD	YES	P18-SMH-026P18-SMH-025	Yes
589	G16958	LBWD	YES	H15-SMH-050H15-SMH-048	Yes
590	G16960	LBWD	NO	P17-SUK-000P17-SMH-018	No
591	G16961	LBWD	NO	P17-SMH-018P17-SMH-015	No
592	G16962	LBWD	NO	N18-SMH-010N18-SMH-011	No
593	G16963	LBWD	NO	N18-SMH-007N18-SMH-006	No
594	G16964	LBWD	NO	N17-SMH-016N17-SMH-015	No
595	G16974	LBWD	NO	K12-SMH-009K12-SMH-010	No
596	G16975	LBWD	NO	R10-SMH-071R10-SMH-075	No
597	G16978	LBWD	YES	F34-SMH-001F34-SMH-006	Yes
598	G16990	LBWD	NO	H30-SCO-001H30-SMH-024	No
599	G16992	LBWD	NO	H17-SMH-044H17-SMH-045	No
600	G17006	LBWD	NO	H10-SUK-000H10-SUK-000	No
601	G17009	LBWD	NO	G29-SMH-018G29-SMH-019	No
602	G17010	LBWD	YES	K32-SMH-023K32-SMH-022	Yes
603	G17014	LBWD	NO	N20-SUK-000N20-SMH-011	No
604	G17021	LBWD	NO	G09-SUK-000G09-SUK-000	No
605	G17031	LBWD	YES	N10-SMH-053N10-SMH-051	Yes
606	G17033	LBWD	NO	R04-SMH-038R04-SMH-039	No
607	G17041	LBWD	YES	H14-SMH-035H14-SMH-008	Yes
608	G17051	LBWD	YES	R09-SMH-032R09-SMH-033	Yes
609	G17058	LBWD	NO	V25-SMH-023V25-SMH-025	No
610	G17060	LBWD	NO	X24-SMH-007X24-SMH-006	No
611	G17064	LBWD	NO	R08-SMH-059R08-SMH-060	No
612	G17065	LBWD	NO	T15-SCO-058T15-SMH-045	No
613	G17069	LBWD	NO	U19-SUK-000U18-SCO-007	No
614	G17070	LBWD	NO	H06-SUK-000H06-SPS-022	No
615	G17077	LBWD	NO	K32-SMH-031K32-SMH-032	No
616	G17078	LBWD	NO	K32-SMH-033K32-SMH-034	No
617	G17080	LBWD	YES	G14-SMH-031G14-SMH-029	Yes
618	G17083	LBWD	NO	G21-SMH-019G21-SMH-020	No
619	G17091	LBWD	NO	L34-SCO-001K34-SUK-000	No
620	G17094	LBWD	YES	K40-SMH-003	Yes
621	G17098	LBWD	YES	P22-SMH-010P22-SMH-009	Yes
622	G17101	LBWD	YES	M11-SMH-005M12-SMH-009	Yes
623	G17108	LBWD	YES	N22-SMH-006N22-SMH-005	Yes
624	G17109	LBWD	NO	Q08-SMH-017Q08-SMH-019	No
625	G17111	LBWD	NO	R07-SMH-019R08-SMH-056	No
626	G17112	LBWD	NO	R07-SMH-013R07-SMH-019	No
627	G17119	LBWD	NO	P14-SMH-046P14-SMH-047	No
628	G17124	LBWD	NO	R10-SMH-068R10-SMH-069	No
629	G17128	LBWD	NO	U17-SUK-000U17-SUK-000	No
630	G17136	LBWD	NO	D24-SUK-000D24-SUK-000	No
631	G17137	LBWD	NO	R26-SCO-043R26-SCO-042	No
632	G17146	LBWD	YES	N10-SMH-062N10-SMH-064	Yes

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
633	G17157	LBWD	NO	U18-SCO-008U18-SCO-009	No
634	G17159	LBWD	NO	R08-SMH-063R08-SMH-064	No
635	G17167	LBWD	YES	L12-SMH-063L13-SMH-008	Yes
636	G17179	LBWD	NO	L35-SUK-000L35-SMH-024	No
637	G17187	LBWD	NO	R26-SCO-012R26-SCO-011	No
638	G17205	LBWD	NO	E16-SCO-070E16-SCO-073	No
639	G17209	LBWD	NO	H08-SCP-001H08-SMH-006	No
640	G17215	LBWD	NO	R07-SCO-022R07-SUK-000	No
641	G17216	LBWD	NO	R08-SMH-070Q08-SMH-017	No
642	G17218	LBWD	NO	R08-SCO-003R08-SMH-051	No
643	G17219	LBWD	NO	R05-SMH-032R05-SMH-033	No
644	G17220	LBWD	NO	R07-SCO-023R07-SMH-028	No
645	G17229	LBWD	NO	R08-SMH-057R08-SMH-058	No
646	G17243	LBWD	YES	H14-SMH-002G14-SMH-033	Yes
647	G17250	LBWD	YES	Q14-SMH-006Q14-SMH-007	Yes
648	G17254	LBWD	NO	R07-SMH-027R07-SMH-007	No
649	G17257	LBWD	NO	R07-SMH-016R07-SMH-018	No
650	G17260	LBWD	NO	R04-SMH-051R04-SMH-050	No
651	G17263	LBWD	NO	R07-SMH-011R07-SMH-013	No
652	G17267	LBWD	NO	#N/A	No
653	G17269	LBWD	NO	K12-SMH-006K12-SMH-005	No
654	G17278	LBWD	NO	R04-SMH-042R04-SMH-045	No
655	G17285	LBWD	NO	X24-SMH-025X23-SMH-019	No
656	G17292	LBWD	NO	Q09-SUK-000Q09-SMH-022	No
657	G17295	LBWD	NO	R08-SCO-067R08-SMH-065	No
658	G17297	LBWD	NO	R16-SMH-041R16-SMH-040	No
659	G17306	LBWD	NO	J33-SMH-063J32-SMH-052	No
660	G17324	LBWD	YES	P14-SMH-032P13-SMH-040	Yes
661	G17331	LBWD	NO	M19-SMH-024M18-SMH-018	No
662	G17334	LBWD	NO	M22-SUK-000M22-SUK-000	No
663	G17335	LBWD	YES	N12-SUK-000N12-SUK-000	Yes
664	G17341	LBWD	YES	P09-SMH-061N09-SMH-049	Yes
665	G17342	LBWD	YES	P09-SMH-055P09-SMH-061	Yes
666	G17348	LBWD	NO	R08-SCO-008R08-SMH-059	No
667	G17366	LBWD	NO	U19-SCO-004U19-SUK-000	No
668	G17369	LBWD	NO	N17-SMH-015N18-SMH-007	No
669	G17375	LBWD	NO	N20-SUK-000N20-SMH-011	No
670	G17384	LBWD	NO	R07-SUK-000R07-SMH-027	No
671	G17409	LBWD	YES	K33-SMH-057K33-SMH-058	Yes
672	G17411	LBWD	NO	K34-SUK-000K34-SUK-000	No
673	G17437	LBWD	NO	K39-SMH-018K39-SMH-014	No
674	G17439	LBWD	YES	L12-SMH-061L12-SMH-062	Yes
675	G17443	LBWD	YES	J32-SMH-046J32-SMH-045	Yes
676	G17451	LBWD	NO	H27-SUK-000H27-SMH-020	No
677	G17461	LBWD	NO	M18-SMH-022M18-SMH-016	No
678	G17463	LBWD	NO	S06-SMH-012S06-SMH-038	No
679	G17466	LBWD	NO	R08-SMH-011R08-SMH-010	No
680	G17467	LBWD	NO	S22-SMH-039S22-SMH-038	No
681	G17470	LBWD	NO	R07-SCO-001R07-SMH-010	No
682	G17471	LBWD	YES	G14-SMH-032G14-SMH-031	Yes
683	G17476	LBWD	NO	K12-SMH-001K12-SMH-037	No
684	G17478	LBWD	NO	R26-SCO-039R26-SCO-038	No
685	G17488	LBWD	NO	X23-SMH-028X23-SMH-034	No
686	G17494	LBWD	NO	K32-SMH-025K32-SMH-023	No
687	G17501	LBWD	NO	G08-SCO-021G09-SMH-025	No
688	G17541	LBWD	YES	G35-SMH-025G35-SMH-001	Yes
689	G17552	LBWD	NO	L22-SMH-023L22-SMH-024	No
690	G17565	LBWD	NO	H22-SCO-003H22-SUK-000	No
691	G17566	LBWD	NO	H22-SCO-002H22-SCO-003	No
692	G17572	LBWD	NO	K12-SMH-003K12-SMH-002	No
693	G17576	LBWD	NO	N22-SUK-000N22-SMH-004	No
694	G17577	LBWD	NO	N22-SUK-000N22-SUK-000	No
695	G17585	LBWD	NO	G21-SMH-007G21-SMH-030	No
696	G17587	LBWD	NO	U18-SCO-004U18-SCO-003	No
697	G17592	LBWD	NO	K15-SMH-044K15-SMH-045	No
698	G17616	LBWD	YES	H33-SMH-053H33-SMH-054	Yes
699	G17617	LBWD	NO	J33-SMH-050J33-SMH-051	No
700	G17618	LBWD	NO	J32-SMH-043J32-SMH-044	No
701	G17620	LBWD	NO	J33-SMH-062J32-SMH-049	No
702	G17621	LBWD	NO	G08-SMH-087G08-SCO-023	No
703	G17622	LBWD	NO	J33-SMH-067J33-SMH-064	No
704	G17623	LBWD	NO	J32-SMH-051J33-SMH-014	No
705	G17624	LBWD	NO	J33-SMH-064J33-SMH-063	No
706	G17630	LBWD	NO	E15-SMH-057E15-SMH-058	No
707	G17645	LBWD	NO	M22-SMH-001M22-SUK-000	No
708	G17650	LBWD	YES	J15-SMH-019J15-SMH-025	Yes
709	G17659	LBWD	NO	N18-SMH-001N18-SMH-004	No
710	G17680	LBWD	NO	J19-SMH-005J19-SMH-006	No
711	G17700	LBWD	NO	R04-SMH-033R04-SMH-035	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
712	G17701	LBWD	NO	R04-SMH-036R04-SMH-010	No
713	G17704	LBWD	NO	J31-SUK-000J31-SMH-020	No
714	G17709	LBWD	NO	R03-SCO-015R03-SMH-019	No
715	G17715	LBWD	NO	K34-SCO-002K34-SUK-000	No
716	G17719	LBWD	NO	N06-SCO-004N06-SUK-000	No
717	G17721	LBWD	NO	R09-SMH-062R09-SMH-063	No
718	G17727	LBWD	YES	#N/A	Yes
719	G17763	LBWD	NO	G09-SUK-000F08-SUK-000	No
720	G17789	LBWD	NO	F12-SMH-020F12-SMH-025	No
721	G17792	LBWD	NO	S20-SUK-000S20-SMH-037	No
722	G17806	LBWD	YES	G35-SMH-001G35-SMH-005	Yes
723	G17812	LBWD	NO	R07-SMH-015R07-SMH-016	No
724	G17813	LBWD	YES	H15-SMH-048H14-SUK-000	Yes
725	G17835	LBWD	NO	#N/A	No
726	G17841	LBWD	NO	S10-SMH-099R10-SMH-067	No
727	G17844	LBWD	NO	S23-SMH-052S23-SMH-027	No
728	G17845	LBWD	YES	F10-SMH-029F10-SMH-030	Yes
729	G17850	LBWD	NO	F15-SUK-000F15-SMH-034	No
730	G17853	LBWD	NO	#N/A	No
731	G17855	LBWD	NO	Q29-SUK-000Q28-SMH-049	No
732	G17860	LBWD	YES	P30-SMH-030P29-SMH-001	Yes
733	G17880	LBWD	NO	J07-SUK-000J07-SUK-000	No
734	G17884	LBWD	NO	S05-SMH-015S05-SMH-013	No
735	G17887	LBWD	NO	R04-SMH-027R04-SMH-028	No
736	G17891	LBWD	NO	H20-SMH-015H20-SMH-016	No
737	G17894	LBWD	YES	J15-SUK-000J15-SMH-059	Yes
738	G17926	LBWD	YES	N07-SMH-021N07-SMH-020	Yes
739	G17931	LBWD	NO	T15-SMH-045T15-SMH-044	No
740	G17936	LBWD	NO	R09-SMH-039R09-SMH-040	No
741	G17941	LBWD	NO	J08-SMH-022J08-SMH-023	No
742	G17942	LBWD	NO	J08-SCO-001J08-SMH-022	No
743	G17953	LBWD	NO	R02-SCO-013R02-SMH-008	No
744	G17959	LBWD	NO	P30-SUK-000P30-SMH-013	No
745	G17962	LBWD	NO	Q09-SMH-048Q09-SMH-047	No
746	G17963	LBWD	NO	R09-SMH-058R09-SMH-059	No
747	G17966	LBWD	NO	U18-SCO-010U18-SCO-005	No
748	G17969	LBWD	NO	#N/A	No
749	G18022	LBWD	YES	J15-SUK-000J15-SMH-025	Yes
750	G18023	LBWD	NO	N11-SMH-005N12-SMH-040	No
751	G18024	LBWD	NO	#N/A	No
752	G18033	LBWD	NO	M40-SMH-021M40-SMH-022	No
753	G18052	LBWD	NO	J33-SMH-052J32-SMH-043	No
754	G18056	LBWD	NO	X23-SMH-032X23-SMH-031	No
755	G18064	LBWD	YES	H32-SMH-076H32-SMH-075	Yes
756	G18071	LBWD	NO	H16-SMH-053H16-SMH-010	No
757	G18073	LBWD	NO	E13-SCO-006E13-SCO-001	No
758	G18076	LBWD	NO	R04-SMH-034R04-SMH-037	No
759	G18081	LBWD	NO	P23-SUK-000P23-SMH-006	No
760	G18083	LBWD	NO	H06-SUK-000H06-SPS-021	No
761	G18095	LBWD	YES	N07-SMH-010N07-SMH-013	Yes
762	G18097	LBWD	YES	N07-SMH-013N07-SMH-012	Yes
763	G18103	LBWD	NO	R09-SMH-063R09-SMH-064	No
764	G18121	LBWD	NO	S05-SUK-000S05-SMH-009	No
765	G18123	LBWD	NO	R04-SMH-010R04-SMH-039	No
766	G18125	LBWD	YES	G14-SMH-019G14-SMH-020	Yes
767	G18127	LBWD	NO	R23-SMH-028R23-SMH-029	No
768	G18142	LBWD	NO	H09-SUK-000H09-SUK-000	No
769	G18143	LBWD	NO	#N/A	No
770	G18157	LBWD	NO	H20-SUK-000H20-SMH-014	No
771	G18169	LBWD	NO	L14-SCO-059L14-SUK-000	No
772	G18179	LBWD	NO	P05-SMH-016P05-SMH-039	No
773	G18180	LBWD	NO	Q06-SGT-001Q06-SUK-000	No
774	G18190	LBWD	NO	R06-SMH-022R05-SMH-059	No
775	G18195	LBWD	NO	Q09-SMH-037Q09-SMH-038	No
776	G18196	LBWD	NO	R08-SMH-061R08-SMH-063	No
777	G18203	LBWD	NO	Q14-SMH-028Q14-SMH-027	No
778	G18204	LBWD	NO	Q14-SMH-026Q14-SMH-028	No
779	G18208	LBWD	NO	R16-SMH-011R15-SMH-059	No
780	G18223	LBWD	NO	#N/A	No
781	G18240	LBWD	NO	V25-SMH-027V24-SMH-001	No
782	G18253	LBWD	NO	R07-SMH-014R07-SMH-012	No
783	G18255	LBWD	NO	R16-SCO-055R16-SMH-008	No
784	G18261	LBWD	NO	#N/A	No
785	G18270	LBWD	NO	Q26-SCO-005P26-SMH-005	No
786	G18275	LBWD	YES	N20-SMH-012N20-SMH-013	Yes
787	G18297	LBWD	NO	G09-SUK-000G09-SUK-000	No
788	G18305	LBWD	YES	N08-SMH-025N08-SMH-026	Yes
789	G18309	LBWD	NO	#N/A	No
790	G18323	LBWD	NO	R08-SMH-062R08-SMH-063	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
791	G18330	LBWD	NO	N18-SMH-015N18-SMH-001	No
792	G18334	LBWD	YES	#N/A	Yes
793	G18336	LBWD	NO	R20-SMH-054R19-SMH-047	No
794	G18357	LBWD	NO	R10-SMH-088R10-SMH-086	No
795	G18358	LBWD	NO	G21-SMH-029G21-SMH-035	No
796	G18359	LBWD	YES	G35-SMH-026G35-SMH-027	Yes
797	G18366	LBWD	YES	F10-SMH-030F10-SMH-017	Yes
798	G18371	LBWD	NO	H19-SMH-011H19-SMH-010	No
799	G18388	LBWD	YES	V20-SMH-009V20-SMH-003	Yes
800	G18392	LBWD	NO	G22-SMH-010G22-SMH-012	No
801	G18413	LBWD	NO	G31-SCO-048000-000-000	No
802	G18419	LBWD	YES	R09-SMH-049R09-SMH-048	Yes
803	G18422	LBWD	YES	N20-SMH-014N20-SMH-011	Yes
804	G18423	LBWD	YES	N20-SUK-000N20-SMH-012	Yes
805	G18425	LBWD	NO	E21-SUK-000E21-SUK-000	No
806	G18449	LBWD	YES	N10-SMH-060N10-SMH-058	Yes
807	G18453	LBWD	NO	R03-SMH-005R03-SMH-021	No
808	G18459	LBWD	NO	R23-SMH-015R22-SMH-030	No
809	G18462	LBWD	NO	Q14-SCO-001Q14-SMH-007	No
810	G18470	LBWD	NO	U16-SCS-001U16-SUK-000	No
811	G18472	LBWD	NO	H06-SUK-000H06-SMH-008	No
812	G18477	LBWD	NO	X23-SMH-026X23-SMH-027	No
813	G18478	LBWD	NO	X23-SMH-025X23-SMH-024	No
814	G18481	LBWD	NO	E15-SMH-048E15-SMH-071	No
815	G18482	LBWD	NO	G06-SMH-005G06-SMH-006	No
816	G18490	LBWD	NO	Q25-SMH-014Q25-SMH-023	No
817	G18492	LBWD	YES	N12-SUK-000N11-SMH-049	Yes
818	G18496	LBWD	NO	N10-SMH-046N10-SMH-025	No
819	G18499	LBWD	NO	R20-SMH-056R20-SMH-055	No
820	G18505	LBWD	NO	N10-SMH-048N10-SMH-023	No
821	G18518	LBWD	NO	U17-SUK-000U17-SUK-000	No
822	G18552	LBWD	NO	V21-SUK-000V21-SUK-000	No
823	G18554	LBWD	NO	R07-SPS-001R07-SMH-008	No
824	G18559	LBWD	YES	N07-SMH-010N07-SMH-021	Yes
825	G18563	LBWD	NO	K39-SUK-000K39-SMH-004	No
826	G18571	LBWD	NO	L35-SMH-025L35-SMH-026	No
827	G18586	LBWD	YES	H08-SMH-015H08-SPS-002	Yes
828	G18594	LBWD	NO	E21-SUK-000E21-SMH-048	No
829	G18633	LBWD	NO	Q26-SCO-030Q26-SCO-003	No
830	G18649	LBWD	NO	P23-SUK-000P23-SUK-000	No
831	G18654	LBWD	NO	L12-SMH-038L12-SMH-039	No
832	G18677	LBWD	YES	M18-SMH-019N18-SMH-053	Yes
833	G18687	LBWD	NO	X23-SMH-018X23-SMH-017	No
834	G18691	LBWD	NO	U18-SCO-005U18-SCO-004	No
835	G18696	LBWD	NO	V25-SMH-026V25-SMH-027	No
836	G18699	LBWD	NO	G21-SMH-020G21-SMH-034	No
837	G18705	LBWD	NO	U20-SUK-000U20-SUK-000	No
838	G18718	LBWD	NO	G30-SMH-039G30-SMH-028	No
839	G18722	LBWD	NO	R07-SMH-008R08-SMH-049	No
840	G18727	LBWD	NO	N18-SCO-057N18-SMH-054	No
841	G18742	LBWD	NO	X24-SMH-022X24-SMH-021	No
842	G18746	LBWD	NO	X24-SMH-029X24-SMH-028	No
843	G18748	LBWD	NO	K15-SMH-041K15-SMH-042	No
844	G18758	LBWD	YES	N08-SMH-026N08-SMH-018	Yes
845	G18759	LBWD	NO	R04-SMH-049R04-SMH-048	No
846	G18761	LBWD	NO	S22-SMH-040S22-SMH-039	No
847	G18764	LBWD	YES	J15-SMH-025H15-SMH-053	Yes
848	G18800	LBWD	NO	Q25-SMH-072Q25-SMH-014	No
849	G18803	LBWD	NO	Q26-SUK-000Q26-SCO-005	No
850	G18813	LBWD	YES	H08-SMH-057H08-SMH-058	Yes
851	G18815	LBWD	YES	X23-SMH-036X22-SMH-016	Yes
852	G18824	LBWD	NO	N18-SMH-008N18-SMH-009	No
853	G18828	LBWD	NO	Q14-SMH-059R14-SMH-039	No
854	G18837	LBWD	NO	N10-SCO-049N10-SMH-048	No
855	G18843	LBWD	NO	T26-SUK-000U26-SUK-000	No
856	G18857	LBWD	NO	Q25-SUK-000Q25-SMH-042	No
857	G18858	LBWD	YES	N07-SMH-012N07-SMH-026	Yes
858	G18866	LBWD	YES	N10-SMH-056N10-SMH-053	Yes
859	G18868	LBWD	YES	F10-SMH-025F10-SMH-026	Yes
860	G18869	LBWD	YES	F10-SMH-026F10-SMH-028	Yes
861	G18874	LBWD	NO	E21-SMH-048E21-SUK-000	No
862	G18880	LBWD	YES	J15-SMH-059J15-SUK-000	Yes
863	G18893	LBWD	NO	U18-SCO-007U18-SCO-008	No
864	G18900	LBWD	NO	L35-SMH-026K35-SMH-046	No
865	G18911	LBWD	YES	Q24-SMH-019Q24-SMH-020	Yes
866	G18919	LBWD	YES	G36-SMH-011G35-SMH-026	Yes
867	G18929	LBWD	YES	J33-SMH-055J32-SMH-046	Yes
868	G18933	LBWD	YES	Q25-SMH-054Q25-SMH-053	Yes
869	G18937	LBWD	NO	K34-SCO-001K34-SCO-002	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
870	G18940	LBWD	NO	R23-SMH-021R23-SMH-020	No
871	G18942	LBWD	YES	R06-SMH-034R05-SMH-058	Yes
872	G18943	LBWD	NO	R08-SMH-052R08-SMH-053	No
873	G18944	LBWD	NO	R08-SMH-058R08-SMH-062	No
874	G18954	LBWD	YES	G15-SMH-054G15-SMH-055	Yes
875	G18955	LBWD	YES	H33-SMH-054H32-SMH-074	Yes
876	G18956	LBWD	NO	Q04-SMH-046Q04-SMH-044	No
877	G18957	LBWD	NO	Q04-SMH-005Q04-SMH-044	No
878	G18958	LBWD	NO	R03-SMH-021R03-SPS-001	No
879	G18959	LBWD	NO	L12-SMH-007L12-SMH-015	No
880	G18960	LBWD	NO	G10-SMH-048F10-SMH-024	No
881	G18966	LBWD	YES	N10-SMH-025N10-SMH-024	Yes
882	G18967	LBWD	NO	K32-SMH-053J32-SMH-054	No
883	G18995	LBWD	NO	J19-SMH-003J18-SMH-005	No
884	G19006	LBWD	NO	J07-SUK-000J07-SUK-000	No
885	G19020	LBWD	NO	N14-SUK-000N14-SUK-000	No
886	G19024	LBWD	NO	H09-SCO-004H09-SMH-032	No
887	G19029	LBWD	NO	H09-SCO-002H09-SUK-000	No
888	G19030	LBWD	NO	H09-SCO-003H09-SUK-000	No
889	G19032	LBWD	YES	H15-SMH-051H15-SMH-049	Yes
890	G19033	LBWD	NO	H06-SPS-023H06-SMH-002	No
891	G19034	LBWD	YES	P06-SMH-030P06-SMH-060	Yes
892	G19040	LBWD	YES	S06-SMH-040S06-SMH-041	Yes
893	G19062	LBWD	YES	P22-SMH-011P22-SMH-010	Yes
894	G19067	LBWD	NO	K32-SMH-059K32-SMH-058	No
895	G19089	LBWD	NO	L40-SMH-023	No
896	G19097	LBWD	NO	S23-SMH-027T23-SMH-025	No
897	G19102	LBWD	NO	X24-SMH-026X24-SMH-025	No
898	G19111	LBWD	NO	K32-SMH-054K32-SMH-053	No
899	G19115	LBWD	NO	H19-SMH-043H19-SMH-045	No
900	G19116	LBWD	YES	F34-SMH-006F34-SMH-008	Yes
901	G19127	LBWD	NO	R07-SCO-006R08-SMH-056	No
902	G19134	LBWD	NO	H06-SPS-021H06-SMH-003	No
903	G19138	LBWD	YES	P30-SMH-002P30-SMH-033	Yes
904	G19139	LBWD	NO	R07-SMH-028R07-SMH-018	No
905	G19141	LBWD	NO	N18-SMH-004N18-SMH-005	No
906	G19153	LBWD	NO	F10-SMH-027F10-SMH-028	No
907	G19164	LBWD	NO	G36-SCO-013G36-SUK-000	No
908	G19168	LBWD	NO	Q24-SMH-015	No
909	G19171	LBWD	YES	K40-SMH-002K40-SUK-000	Yes
910	G19172	LBWD	NO	R03-SCO-006R03-SMH-018	No
911	G19199	LBWD	NO	G09-SMH-064G10-SMH-047	No
912	G19238	LBWD	NO	R05-SMH-031R05-SMH-032	No
913	G19246	LBWD	NO	U18-SCO-003U18-SUK-000	No
914	G19263	LBWD	NO	E21-SCO-008E22-SUK-000	No
915	G19264	LBWD	NO	J15-SMH-057J15-SUK-000	No
916	G19283	LBWD	NO	N18-SMH-002N18-SMH-001	No
917	G19285	LBWD	NO	U19-SCO-001U19-SCO-002	No
918	G19297	LBWD	NO	H17-SMH-045H17-SMH-040	No
919	G19300	LBWD	NO	H22-SCO-004H22-SMH-015	No
920	G19303	LBWD	NO	R23-SUK-000R23-SMH-025	No
921	G19310	LBWD	NO	V25-SCO-032V25-SUK-000	No
922	G19321	LBWD	YES	Q29-SMH-028Q29-SMH-027	Yes
923	G19355	LBWD	NO	H09-SUK-000H09-SUK-000	No
924	G19366	LBWD	NO	G09-SUK-000G09-SMH-022	No
925	G19371	LBWD	NO	L09-SMH-039L09-SMH-040	No
926	G19380	LBWD	NO	H40-SMH-008H40-SMH-007	No
927	G19399	LBWD	YES	N10-SMH-064N10-SMH-060	Yes
928	G19403	LBWD	YES	P14-SMH-047P14-SMH-045	Yes
929	G19404	LBWD	YES	P14-SMH-045P14-SMH-032	Yes
930	G19406	LBWD	NO	R07-SMH-007R07-SPS-001	No
931	G19410	LBWD	NO	Q06-SUK-000Q06-SGT-001	No
932	G19430	LBWD	NO	F14-SMH-056F14-SMH-027	No
933	G19443	LBWD	NO	Q26-SUK-000Q26-SUK-000	No
934	G19464	LBWD	YES	P08-SMH-041P08-SMH-042	Yes
935	G19467	LBWD	NO	N06-SCP-001N06-SMH-042	No
936	G19471	LBWD	NO	G09-SUK-000G09-SUK-000	No
937	G19488	LBWD	NO	U20-SUK-000U20-SUK-000	No
938	G19491	LBWD	YES	N20-SMH-013N20-SMH-014	Yes
939	G19493	LBWD	YES	N07-SMH-011N07-SMH-012	Yes
940	G19499	LBWD	NO	H17-SMH-038H16-SMH-054	No
941	G19525	LBWD	NO	G39-SCO-002G39-SMH-030	No
942	G19535	LBWD	NO	R10-SUK-000R10-SMH-089	No
943	G19554	LBWD	NO	R04-SCO-001R04-SMH-045	No
944	G19557	LBWD	NO	R08-SMH-069R08-SMH-070	No
945	G19568	LBWD	NO	X24-SMH-030X24-SMH-029	No
946	G19569	LBWD	NO	R07-SCO-003R07-SMH-015	No
947	G19577	LBWD	NO	L21-SMH-020L21-SMH-019	No
948	G9255	LBWD	NO	F35-SMH-006F35-SMH-005	No

Appendix D: Pipelines with Missing Installation Year

No.	InfoSWMM Model ID	Owner	Analyzed in Model (Y/N)	LBWD User Identification	Update Priority (Y/N)
949	G9260	LBWD	NO	V20-SUK-000V20-SMH-009	No
950	G9709	LBWD	NO	Q09-SUK-000Q09-SMH-025	No

This Page Intentionally Left Blank

APPENDIX C:

FLOW MONITORING PLAN TM

TECHNICAL MEMORANDUM

MWH

BUILDING A BETTER WORLD

To: LBWD

From: Jinny Huang, MWH

Subject: Flow Monitoring Plan - FINAL

Date: December 14, 2012

Reference: 10501555/6.2

Introduction

As part of the sewer master plan update model validation effort, a flow monitoring plan will be implemented in order to correlate the actual sewer system flows with the estimated flows in the hydraulic model. This flow monitoring plan focuses on the field work and data collection. In addition, the plan shows the proposed locations of the monitoring sites.

The objectives of this flow monitoring plan are:

1. To collect representative sewer flows in the collection system to validate the hydraulic model to the dry weather flow conditions with the hydraulic model developed for the 2008 Sewer Master Plan (SMP). At least six (6) of the flow monitoring locations will be consistent with the flow monitoring locations selected from the 2008 SMP.
2. To collect sewer flows in areas of potential or known high infiltration/inflow (I/I) based on input from LBWD staff and areas showing evidence of infiltration from the 2008 SMP Flow Monitoring report.

The plan has been developed in accordance with Task 4: Flow Monitoring and Sewer Model Validation. MWH will utilize the same subconsultant as the 2008 SMP, Downstream Services, Inc. (DSI), to perform flow monitoring in the field. MWH's engineer will supervise the DSI crew on the day of installation of the meters. DSI will be responsible for flow monitoring, data collection, data processing, and transmission of the data to MWH. DSI will also be responsible for preparing any required traffic control plans in accordance with Manual on Uniform Traffic Control Devices (MUTCD) standards.

Implementation of Flow Monitoring Plan

To achieve maximum benefit from the LBWD flow monitoring plan, certain guidelines should be considered when selecting manholes for meter installation:

- Avoid manholes with junctions of large pipes or drops: turbulent "mixing" of flows will likely result in inaccurate level and velocity readings. These manholes can also experience high levels of hydrogen sulfide (H_2S) gas, which can damage electrical equipment over time and preclude personnel entry for maintenance, cleaning and periodic accuracy checks;
- Avoid manholes near curves or sharp alignment bends: velocity variations between the inside and outside walls of a pipeline around a curve or sharp alignment bend will likely result in inaccurate velocity readings. Most manufacturers recommend a straight, constantly sloped length of 5 to 10 times the pipe diameter upstream and downstream from the meter location;

Flow Monitoring Plan

MWH has selected twelve (12) sites for the installation of temporary flow monitoring meters.

MWH is recommending that nine (9) of the 12 locations be consistent with flow monitoring locations from the 2008 SMP. Eight (8) of the 12 locations are selected as potential areas of high I/I based the 2008 Flow Monitoring and input from LBWD staff. **Table 1** lists the flow monitoring locations. The following paragraphs discuss the rationale behind the selection of these locations.

Table 1
Flow Monitoring Locations

Monitor No.	Purpose	Location	Monitored in 2008 (Y/N)	Potential I/I (Y/N)	Manhole ID	Pipe Diameter (in.)
1	Single-Family	Ladoga Ave., north of E. Willow St.	Y	Y	T19-SMH-035	15
2	Single-Family	E. Washington St. and Walnut Ave.	Y	N	K33-SMH-039	21
3	Single-Family	N. Ravenna Dr.	N	Y	R05-SMH-014	8
4	Single-Family, Cal Bowl, 21 to 18-in	E. 28th St., East of Atlantic Ave.	Y	N	J20-SMH-012	21 to 18
5	Mixed Use	E. Hill St., east of Atlantic Ave.	N	N	J16-SMH-025	10 to 12
6	Single-Family, Industrial	W. 15th St. and Harbor Ave.	Y	Y	F13-SMH-037	21
7	Mixed Use	Magnolia Ave., south of W. Broadway	N	Y	G09-SMH-026	18
8	Multi-Family, Monitored 1999	E. 3rd St. and Esperanza Ave.	Y	N	K09-SMH-016	24
9	Single-Family	E. Wardlow Rd., between N. Greenbrier Rd. and Fidler Ave.	Y	Y	Q22-SMH-068	15
10	Single-Family	E. Division St., between Quincy Ave. and Roycroft Ave.	Y	Y	P06-SMH-022	18
11	Single-Family	E. Division St., between Ximeno Ave. and Prospect Ave.	Y	Y	N06-SMH-061	16
12	Industrial-Airport	E. Vernon St., between Argonne Ave. and Granada Ave.	Y	Y	P18-SMH-028	15

Flow Monitoring Site 1

Flow Monitoring Site 1 (**No. 1**) is located on Ladoga Avenue along a 15-inch pipeline, approximately 350 feet north of Willow Street, as shown on **Figure 2**. **No. 1** primarily captures sewer flow from single-family residential homes, as well as commercial companies, schools, and a park. The manhole (T19-SMH-035) is about 11 to 12 feet in depth and is located on a two-way street with street parking on both sides. Traffic is expected to be light during non-peak morning hours. This area was monitored for the 2008 SMP (Site No. 13) and evidence of infiltration was detected during flow monitoring (Downstream Services, Inc., 2008).

Flow Monitoring Site 2

Flow Monitoring Site 2 (**No. 2**) is located on the Walnut Avenue and Washington Street intersection along a 21-inch pipeline, as shown on **Figure 3**. **No. 2** primarily captures sewer flow from single-family homes and industrial companies. The manhole (K33-SMH-039) is about 11 to 12 feet in depth and located at the intersection of a two-way street, surrounded by single-family residential homes. Light to medium traffic is expected during non-peak morning and afternoon hours. This area was monitored for the 2008 SMP (Site No. 2).

Flow Monitoring Site 3

Flow Monitoring Site 3 (**No. 3**) is located on North Ravenna Drive adjacent to the Naples Fountain along an 8-inch pipeline, as shown on **Figure 4**. **No. 3** primarily captures sewer flow from single-family homes. The manhole (R05-SMH-014) is expected to be about 3 to 6 feet in depth and located at the intersection of a two-way street, surrounded by single-family residential homes. Light to medium traffic is expected during non-peak morning and afternoon hours. This site is being monitored for potential I/I due to its area of low elevation.

Flow Monitoring Site 4

Flow Monitoring Site 4 (**No. 4**) is located on East 28th Street between Atlantic Avenue and Olive Avenue along a 21-inch influent pipeline to an 18-inch effluent pipeline, as shown on **Figure 5**. **No. 4** primarily captures sewer flow from single-family homes and a few businesses. The manhole (J20-SMH-012) is about 18 to 20 feet in depth and located at the end of a cul-de-sac on a two-way street with street parking on both sides. The traffic is expected to occur from visitors going in and out of the medical building, which is not part of the main Long Beach Memorial Medical Center. This area was monitored for the 2008 SMP (Site No. 4), where evidence of stains and deposits were observed at the barrel, bench, and deterioration at the rungs. Improved conditions of this site should be observed since structural issues along and upstream of this area have been addressed since the 2008 SMP (Site No. 4), under the California Bowl Trunk Sewer Rehabilitation Project.

Flow Monitoring Site 5

Flow Monitor No. 5 (**No. 5**) is located on East Hill Street approximately 140 feet east of Atlantic Avenue, along a 10-inch influent pipeline to a 12-inch effluent pipeline, as shown on **Figure 6**. **No. 5** primarily captures sewer flow from single-family homes, as well as businesses and a school. The depth of manhole (J16-SMH-025) is currently unknown and located at a two-way street at a residential neighborhood next to a major street, and across from Burnett Elementary

School. Medium traffic is expected to occur during non-peak morning and afternoon hours. This site has been selected to monitor for influent flows to Lift Station No. 1.

Flow Monitoring Site 6

Flow Monitoring Site 6 (**No. 6**) is located on West 15th Street, between Harbor Avenue and Fashion Avenue along a 21-inch pipeline, as shown on **Figure 7**. **No. 6** captures sewer flow from single-family residential homes and small industrial businesses. The manhole (F13-SMH-037) is about 17 to 19 feet in depth and located on a two-way street, surrounded by large manufacturing buildings. Light traffic from employees coming to and from work is expected throughout the day. This area was monitored for the 2008 SMP (Site No. 6) and is also being monitored for I/I due to its area of low elevation.

Flow Monitoring Site 7

Flow Monitoring Site 7 (**No. 7**) is located on Magnolia Avenue, south of West Broadway along a 15-inch pipeline, as shown on **Figure 8**. **No. 7** captures sewer flows from a variety of commercial businesses, offices, restaurants, Shoreline Aquatic Park, and Aquarium of the Pacific. The depth of manhole (G09-SMH-026) is currently unknown and the manhole is located on a two-way, four lane street between office buildings. Medium traffic is expected throughout the day. This site is selected for potential I/I due to its low elevation, and its ability to capture flows in the downtown area.

Flow Monitoring Site 8

Flow Monitoring Site 8 (**No. 8**) is located on East 3rd Street, approximately 120 feet east of Esperanza Avenue, along a 24-inch pipeline, as shown on **Figure 9**. **No. 8** primarily captures sewer flow from multi-family residential homes that reside near the beach. The manhole (K09-SMH-016) is about 18 to 19 feet in depth and located at the west-bound lane of a four-lane street with street parking on both sides, surrounded by residential homes. Light to medium traffic is expected throughout the day. This area was monitored for the 1999 and 2008 SMP (Site No. 8).

Flow Monitoring Site 9

Flow Monitoring Site 9 (**No. 9**) is located on Wardlow Road, between Clark Avenue and Fidler Avenue along a 15-inch pipeline, as shown on **Figure 10**. No. 9 primarily captures sewer flow from single-family residential homes and Wardlow Park. The manhole (Q22-SMH-068) is about 12 to 13 feet in depth and located at the east-bound fast lane of a four-lane road with an island divider, with parking on both sides. Light to medium traffic is expected during non-peak morning and afternoon hours. This area was monitored for the 2008 SMP (Site No. 9) and evidence of stains and deposits and potential I/I was detected during flow monitoring (Downstream Services, Inc., 2008).

Flow Monitoring Site 10

Flow Monitoring Site 10 (**No. 10**) is located on Division Street, between Quincy Avenue and Roycroft Avenue along an 18-inch pipeline, as shown on **Figure 11**. **No. 10** primarily captures sewer flow from upper-class, single, two-family residential homes and the beach, located about a half-mile away. The manhole (P06-SMH-022) is about 10 to 11 feet in depth and located at the left side of the one-way street with parking on both sides of the street. Light residential traffic is expected during non-peak morning and afternoon hours. This area was monitored for the 2008 SMP (Site No. 10) and is also being monitored for potential I/I. LBWD maintenance crew indicated concerns with grease build-up, silting, and mineral deposits from seeping infiltration at this location during the 2008 SMP study.

Flow Monitoring Site 11

Flow Monitoring Site 11 (**No. 11**) is located on Division Street, between Ximeno Avenue and Prospect Avenue along a 16-inch pipeline, as shown on **Figure 11**. **No. 11** primarily captures sewer flow from upper-class, single and two-family residential homes near the beach, located about a half-mile away. The manhole (N06-SMH-061) is about 10 to 11 feet in depth and located at the right side of the one-way street with parking on both sides of the street. Light residential traffic is expected during non-peak morning and afternoon hours. This area was monitored for the 2008 SMP (Site No. 11) and is being monitored for potential I/I. The 2008 Flow Monitoring report indicated potential back-up flow due to the inside-drop lateral spilling into the channel (Downstream Service, Inc., 2008).

Flow Monitoring Site 12

Flow Monitoring Site 12 (**No. 12**) is located on Vernon Street, between Granada Avenue and Clark Avenue along a 15-inch pipeline, as shown on **Figure 12**. **No. 12** primarily captures sewer flow from the Long Beach Airport, nearby hotels, business, and industrial companies. The manhole (P18-SMH-028) is about 6 to 8 feet in depth and located on the west-bound lane of a two-way street with street parking on both sides, at a residential neighborhood south of the 405 Freeway. Light to medium residential traffic is expected during non-peak morning and afternoon hours. This area was monitored for the 2008 SMP (Site No. 12) and evidence of infiltration was detected during flow monitoring (Downstream Services, Inc., 2008).

Flow Monitoring

Once the flow monitors are installed and confirmed, Downstream Service, Inc. (DSI) will monitor flows for one-week (i.e., 7 days) to capture dry weather conditions and one-week to capture wet weather conditions. The monitoring period may be extended if necessary. To record data over the longer term, pressure-sensitive taps will be used.

During the course of the project and as part of DSI quality control program, the field crews will visit each location and reconfirm that the monitor is in proper working condition. This includes cleaning depth and velocity sensors, confirmations as needed, and checking an installation to make sure that the ring is secure in the pipe. A DSI data analyst will also review the data on a regular basis throughout the monitoring period.

DSI will provide all necessary services for the flow monitors that involve troubleshooting the common faults that are repairable in the field. Common service problems are sensor scrubs, battery changes, and internal board replacements.

Once activated and confirmed to be working properly, DSI field crews will visit the monitored locations. Depth and velocity data will be collected and reviewed onsite to reduce the potential for data loss.

Once authorized, crews will remove the flow monitors and deliver final data to the data analyst.

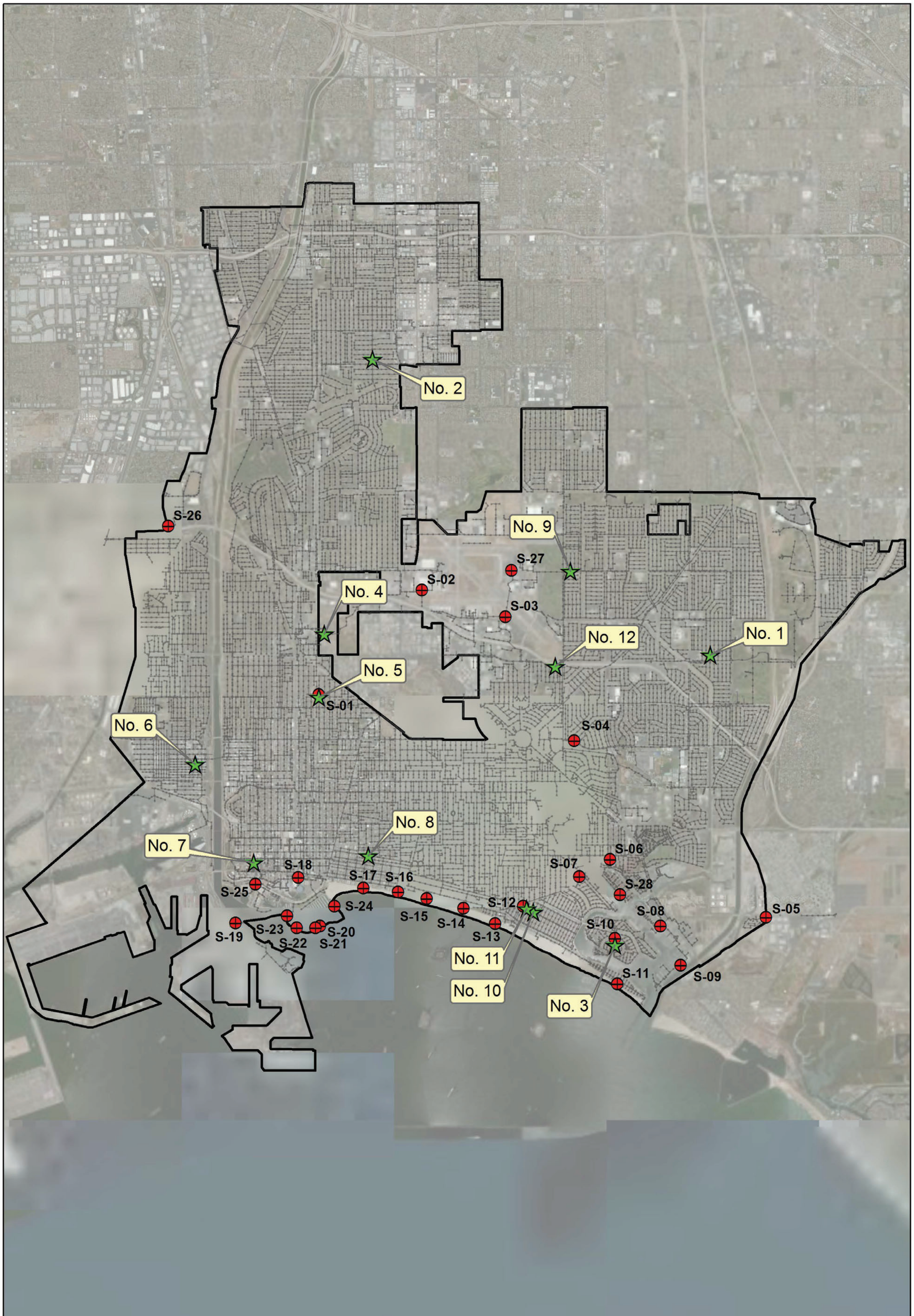
Flow Data

During and upon completion of each monitoring period, DSI will analyze the data. The data analyst will directly calculate flow using the continuity equation from recorded depth and average velocity data. Flow quantities as determined by the continuity equation will be plotted. The analyst will also utilize scattergraphs (depth vs. velocity readings) to verify monitor accuracy. Once the data is transmitted to MWH, the data will be used for validation of the hydraulic model.

Public Notification

LBWD is responsible for notifying the City of Long Beach, LBWD operations crew, emergency services, and residential watch groups that there will be a field crew working in their area during the period approved for flow monitoring.

This Page Intentionally Left Blank



Key to Features

- Sewer Lift Station
- Maintenance Hole
- Flow Monitoring Locations
- Sewer Pipeline
- LBWD Boundary

Imagery Source: Bing Maps/ESRI

N

0 3,400 6,800 13,600 Feet

Document: \\Uspas1s01\MUNI\Clients\Long Beach Water Dept\Sewer Master Plan 2013\ 14 Electronic Files - Modeling_MXDs\LBWD_SMP_FM_OVERALL

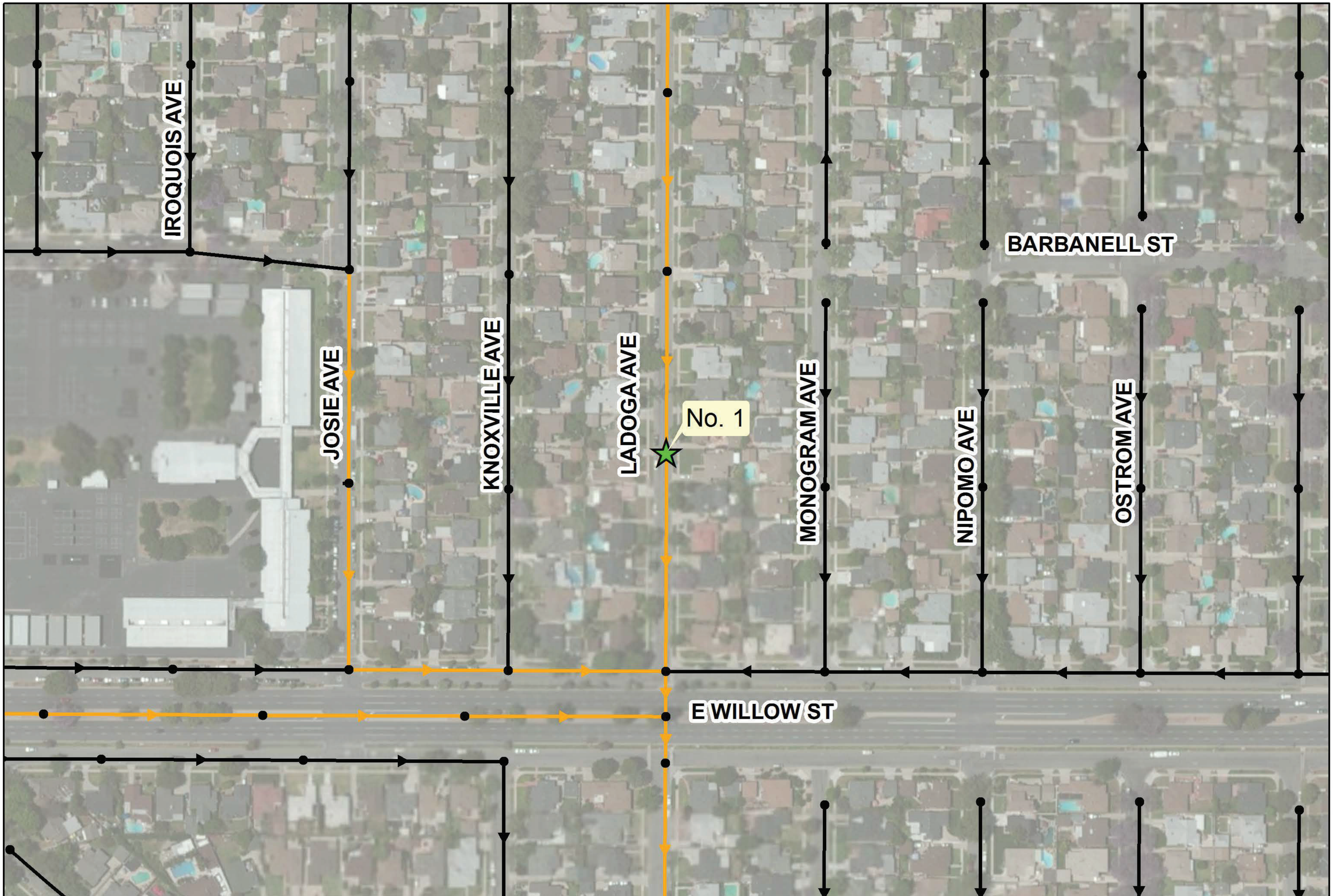
Date: February 12, 2013

Flow Monitoring Sites - Overall

Figure 1

MWH

This map has been designed to print size 11'' by 17''.



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

N 0 150 300 Feet

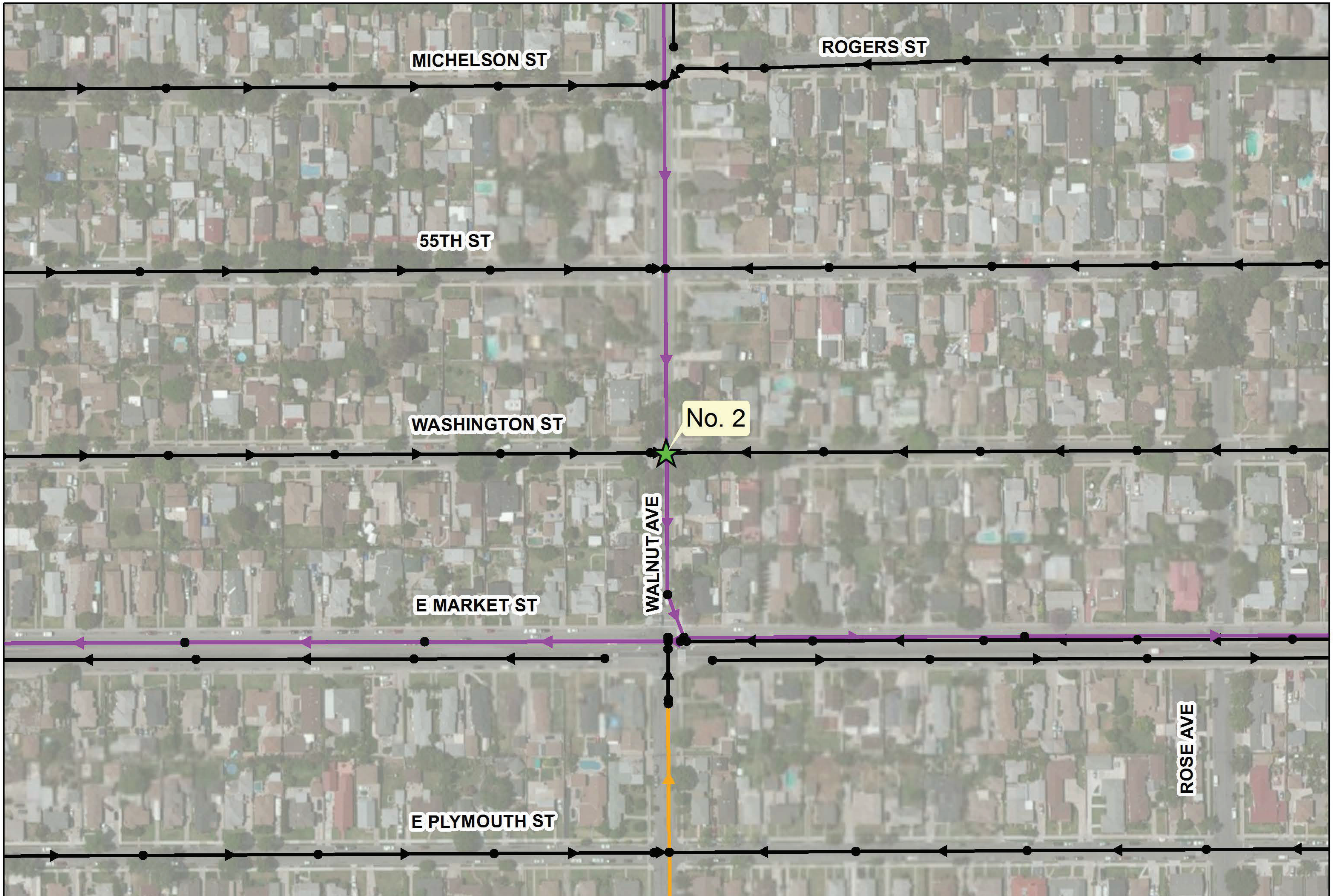
Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #1

Figure 2

MWH



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

0 150 300 Feet

N

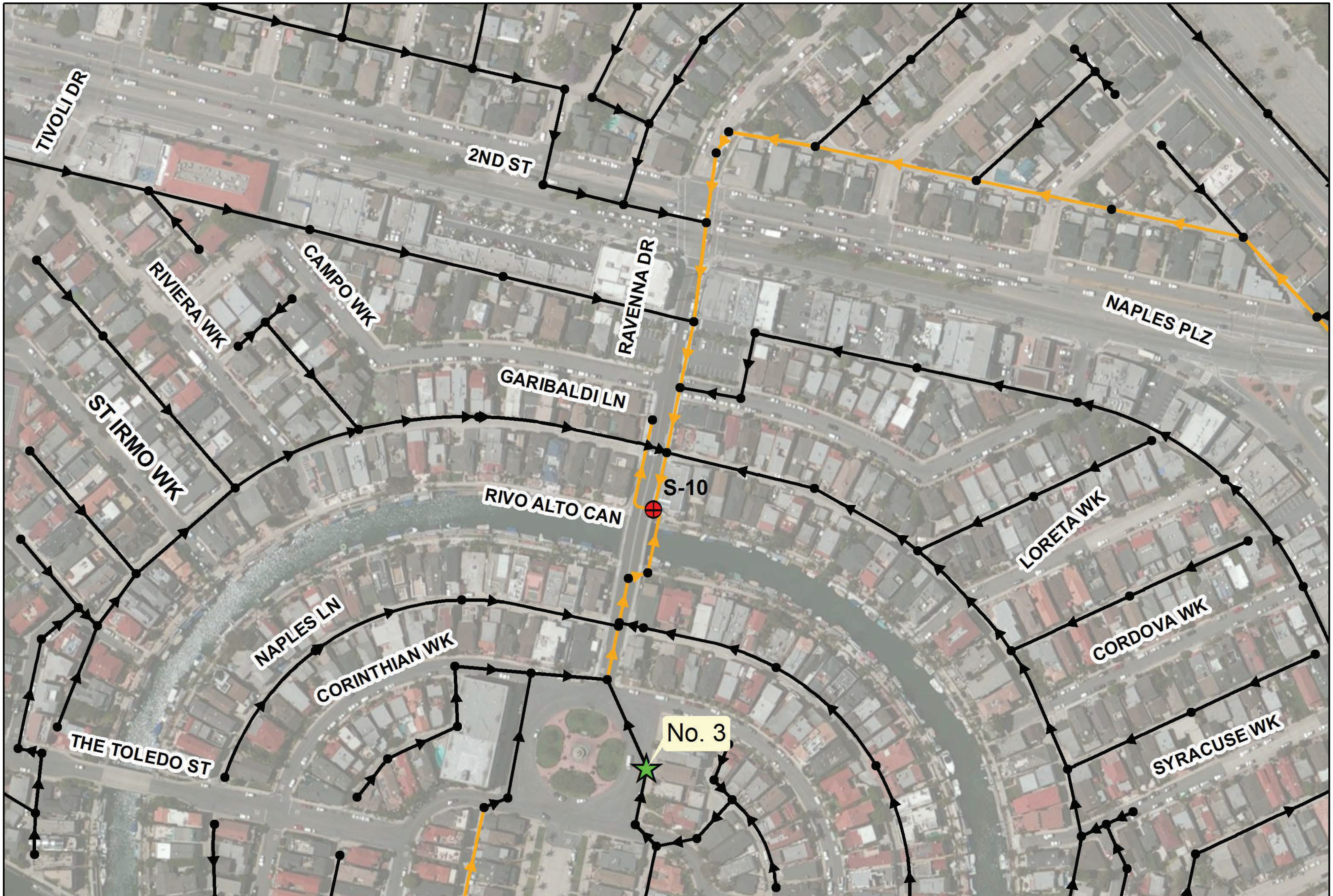
Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #2

Figure 3

MWH.



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

0 150 300 Feet

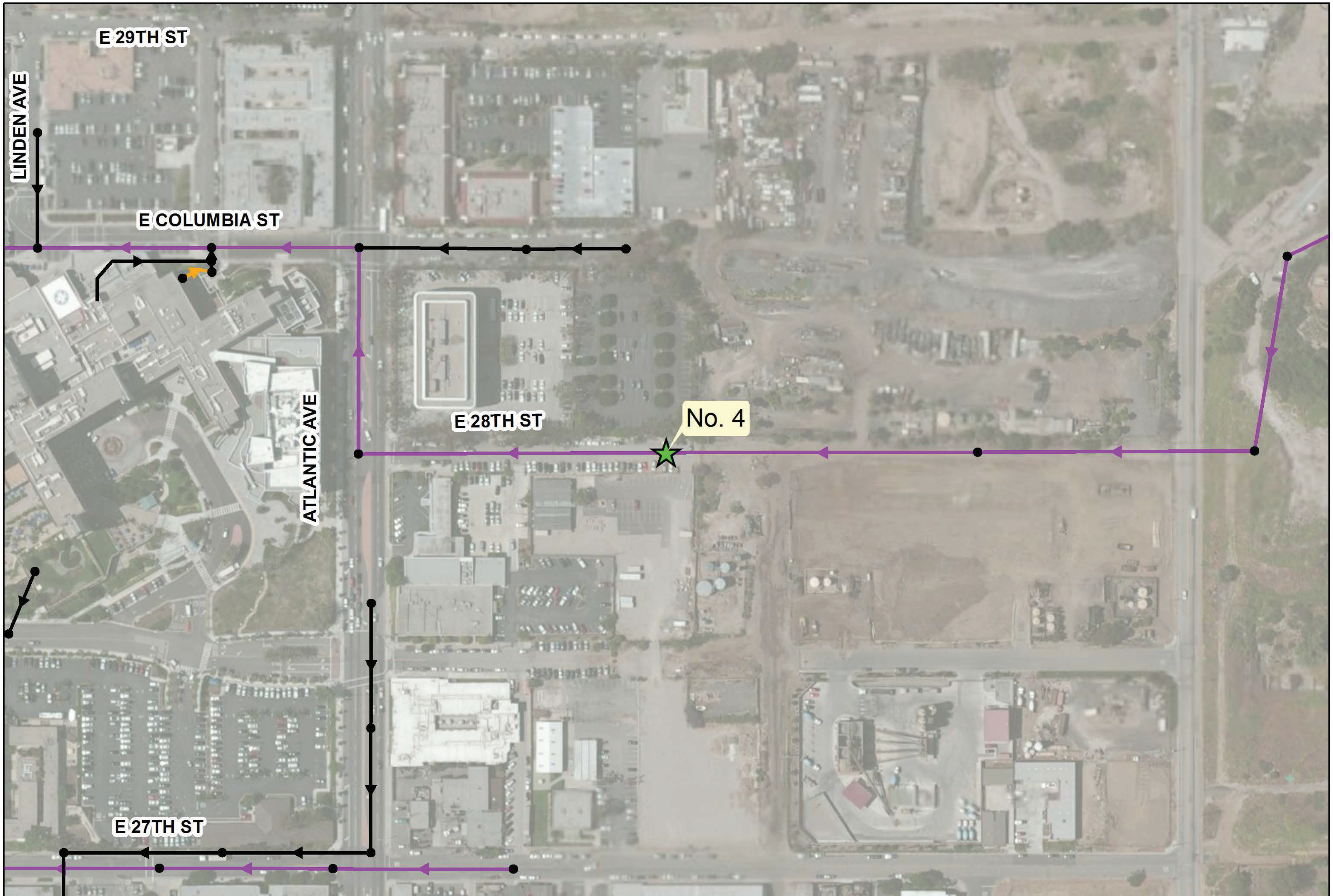
Document: \\Uspas1s01\MUNI\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modelin_MXD\LBWD_SMP_FM_INDIVIDUAL

Date: Februaryy 12, 2013

Flow Monitoring Site #3

Figure 4

MWH



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

N 0 150 300 Feet

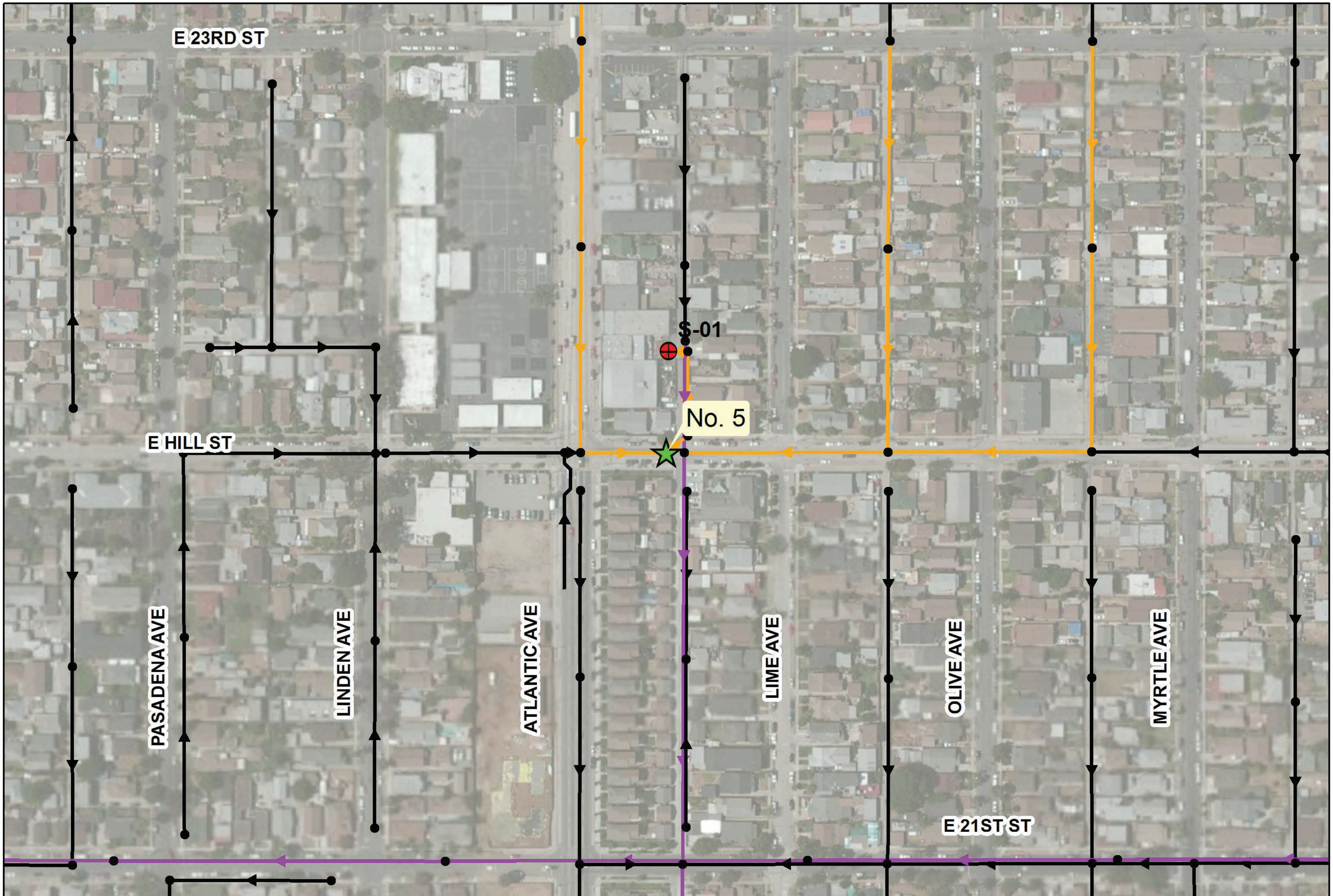
Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date:December 12, 2012

Flow Monitoring Site #4

Figure 5

MWH.



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

N 0 150 300 Feet

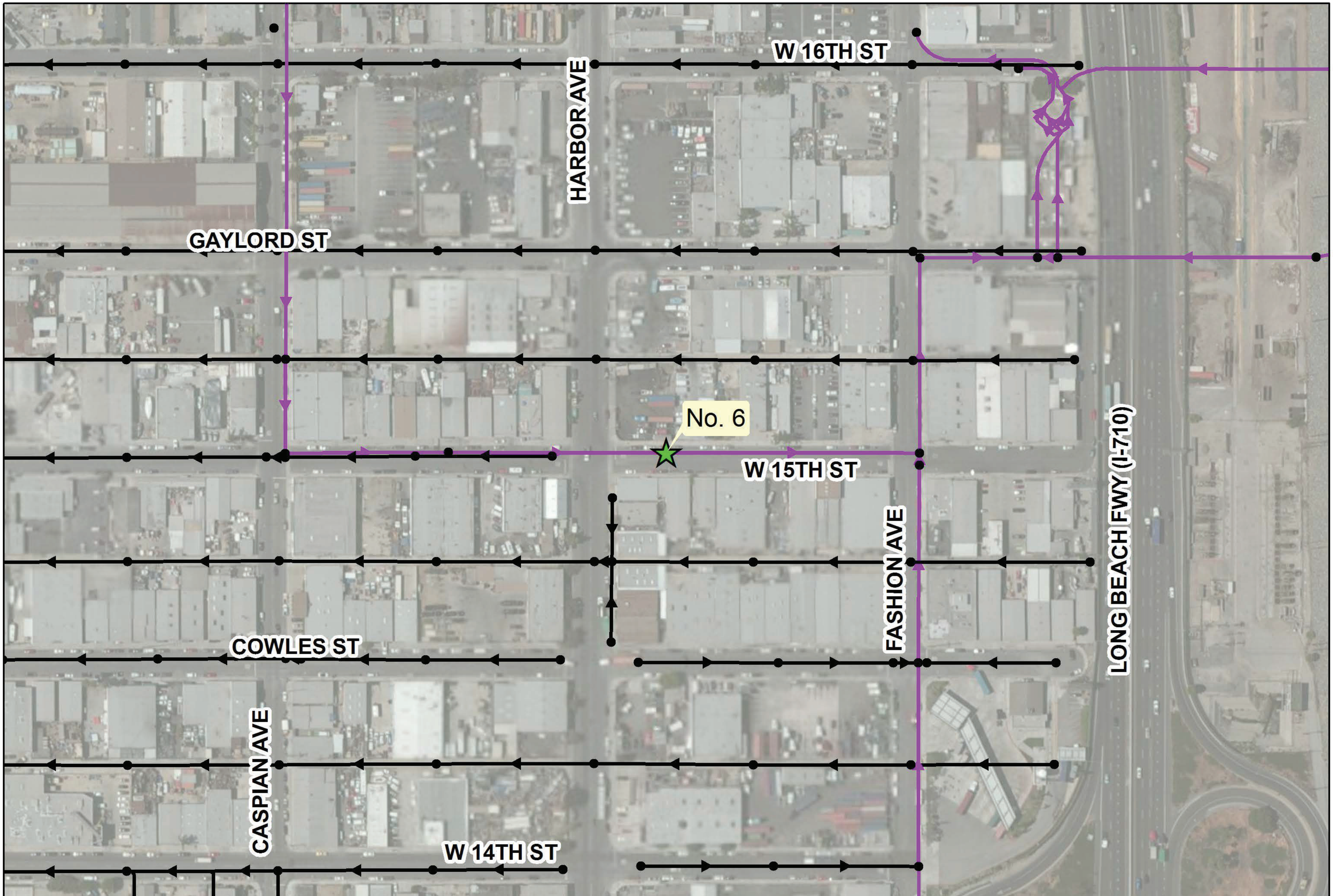
Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #5

Figure 6

MWH.



Legend

Sewer Pipelines

<=8" | 10-16" | >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

0 150 300 Feet

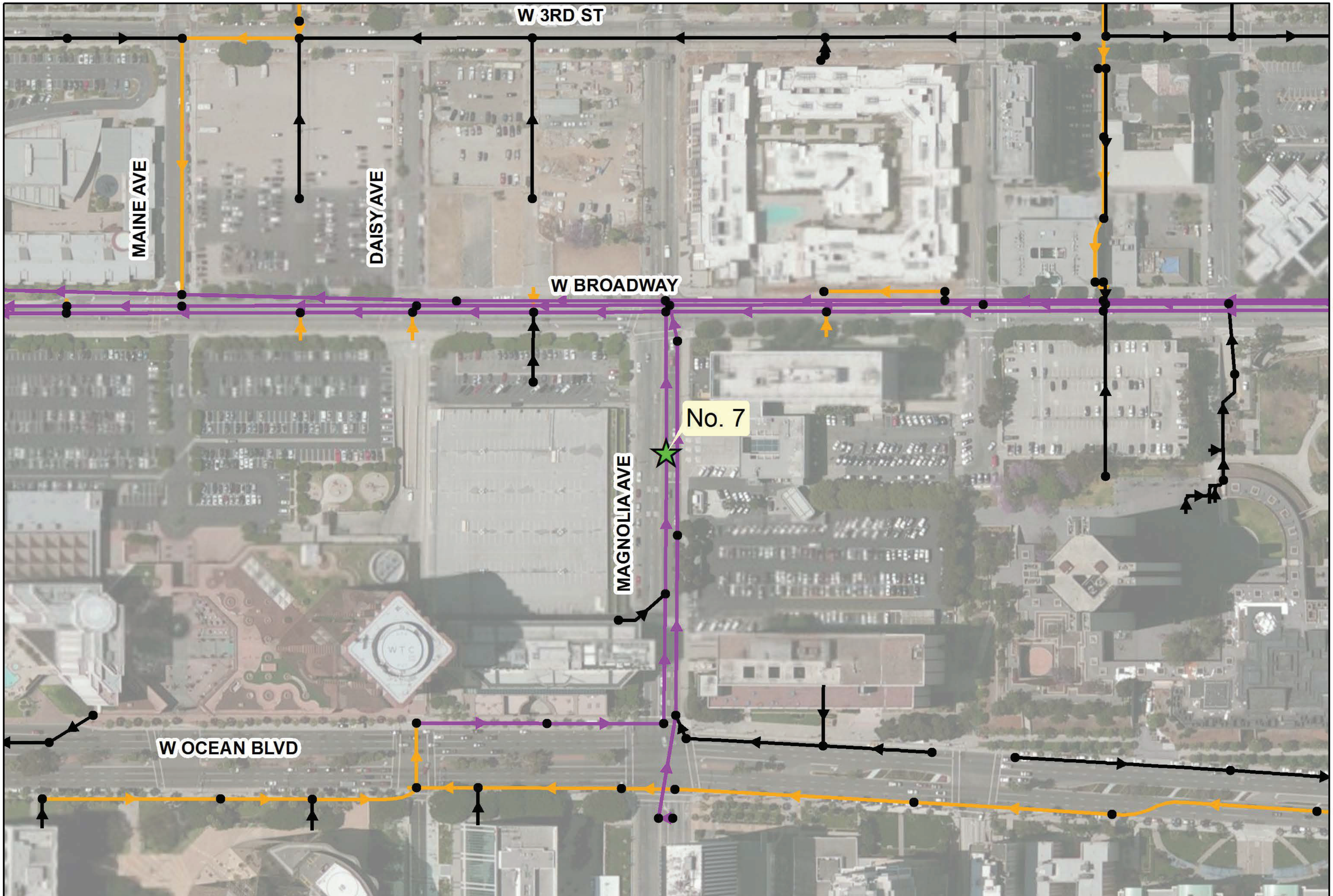
Document: \\Uspas1s01\MUNI\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modelin_MXD\LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #6

Figure 7

MWH.



Legend

Sewer Pipelines

<=8"   10-16"   >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

0 150 300 Feet

N

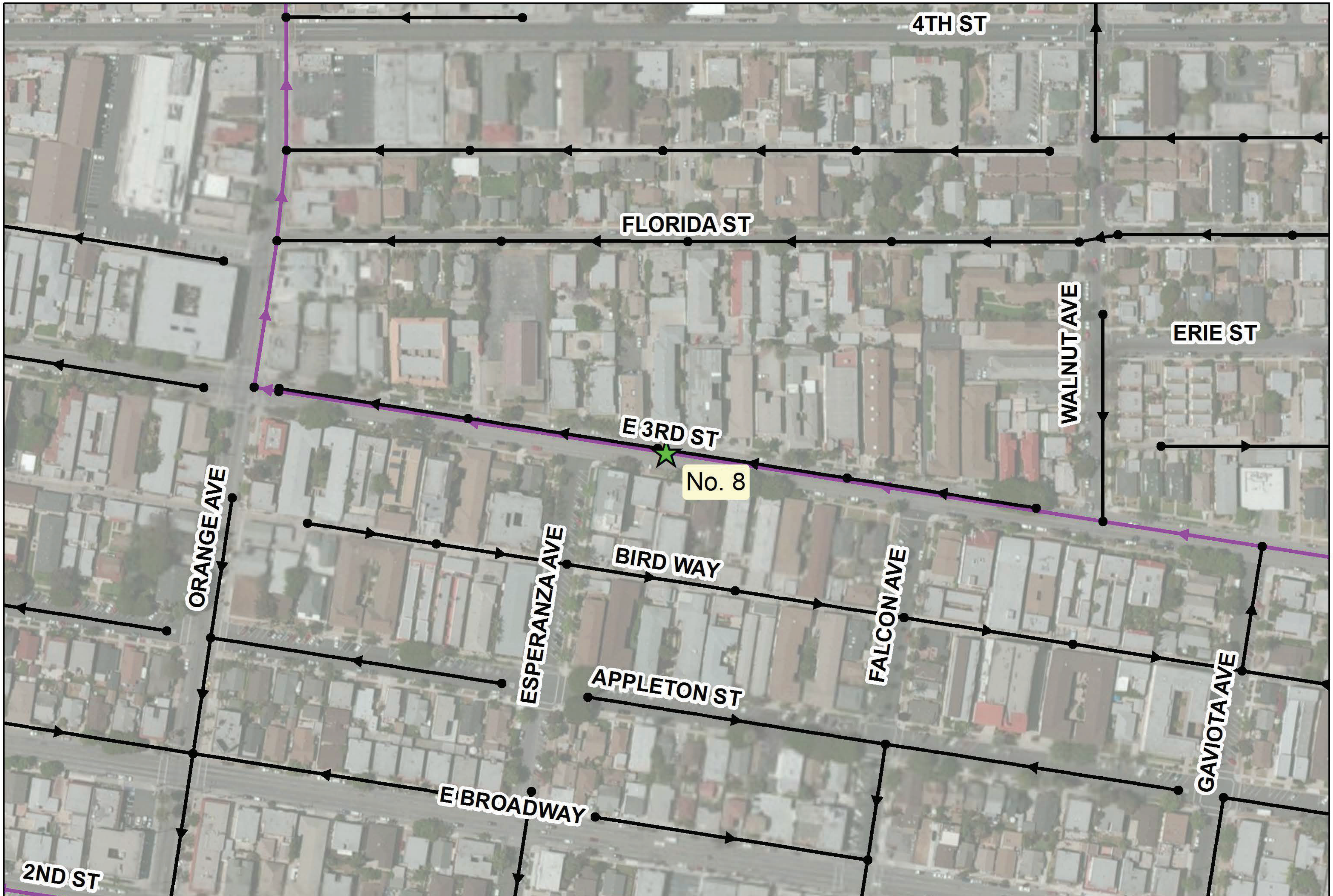
Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #7

Figure 8

MWH.



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

0 150 300 Feet

N

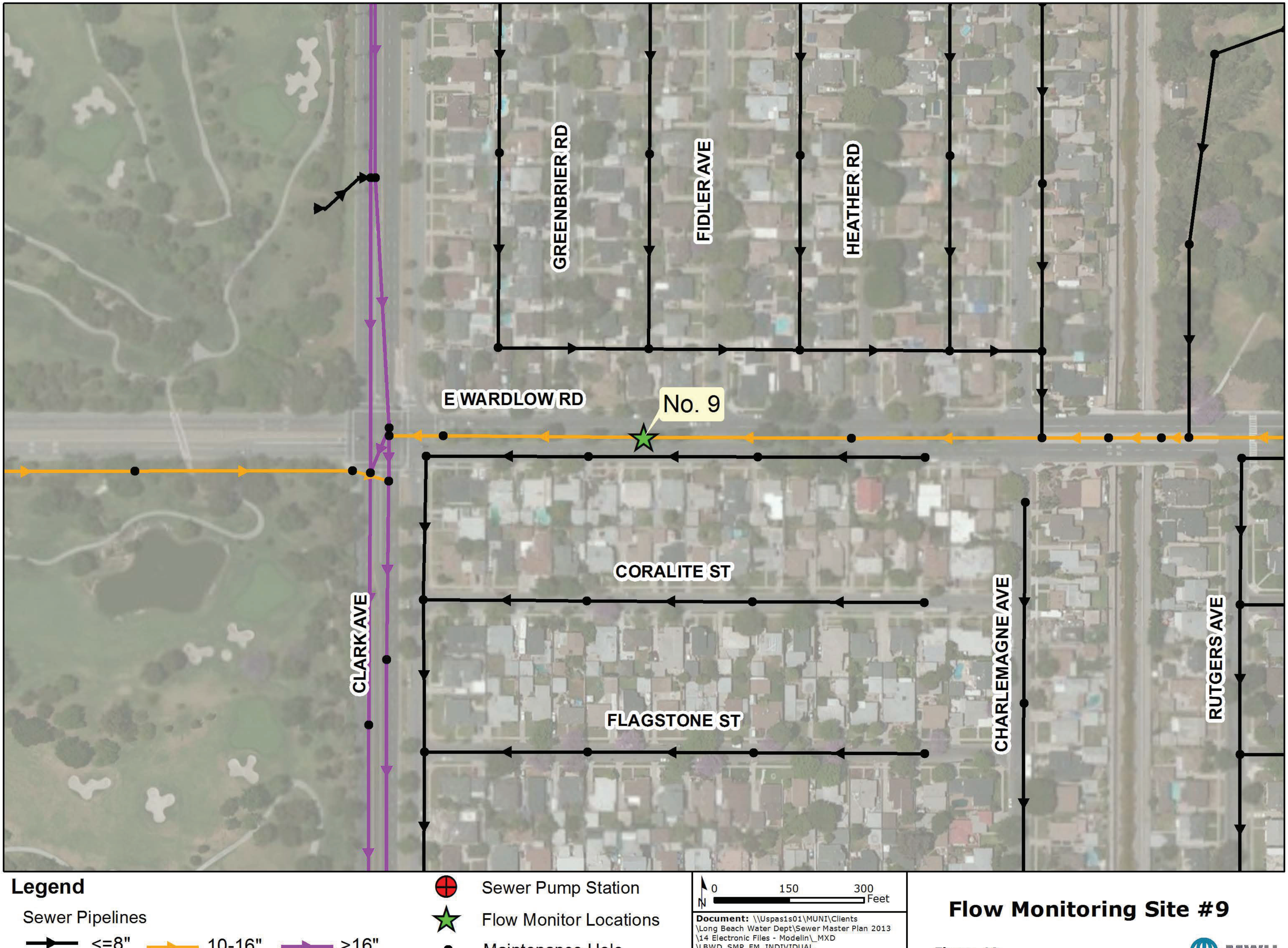
Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date:December 12, 2012

Flow Monitoring Site #8

Figure 9

MWH.



Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #9

Figure 10

MWH.

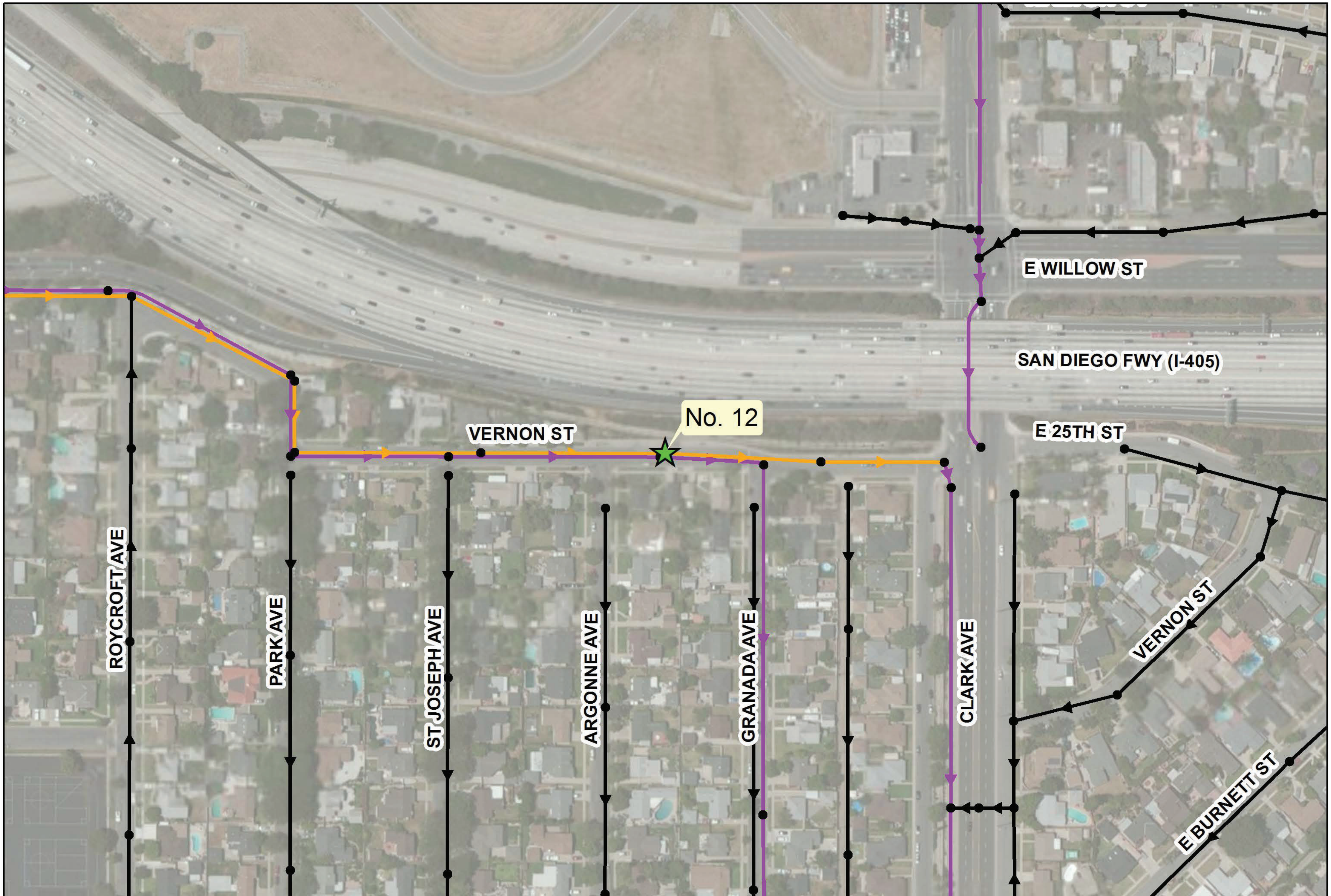
Document: \\Uspas1s01\MUNI\Clients\Long Beach Water Dept\Sewer Master Plan 2013\14 Electronic Files - Modelin_MXD\LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #10 and #11

Figure 11

MWH.



Legend

Sewer Pipelines

<=8" 10-16" >16"

Sewer Pump Station

Flow Monitor Locations

Maintenance Hole

0 150 300 Feet

N

Document: \\Uspas1s01\MUNI\Clients \Long Beach Water Dept\Sewer Master Plan 2013 \14 Electronic Files - Modelin_MXD \LBWD_SMP_FM_INDIVIDUAL

Date: December 12, 2012

Flow Monitoring Site #12

Figure 12

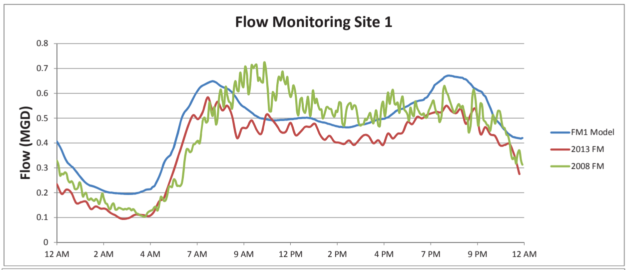
MWH.

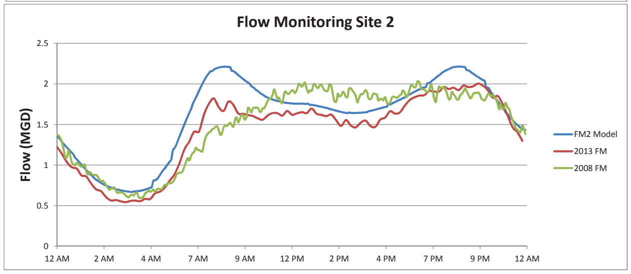
This Page Intentionally Left Blank

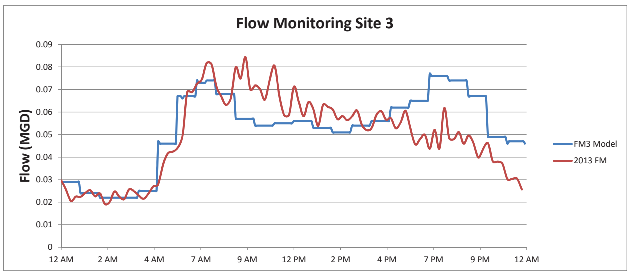
APPENDIX D:

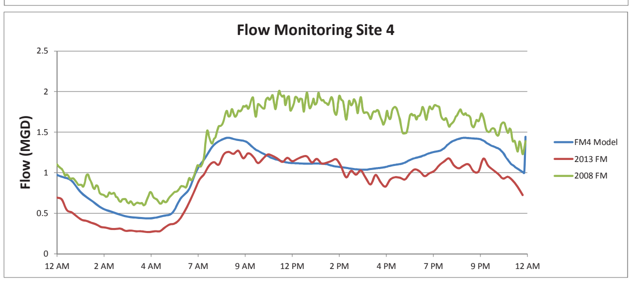
MODEL VALIDATION AND CALIBRATION COMPARISON GRAPHS AND SUMMARY

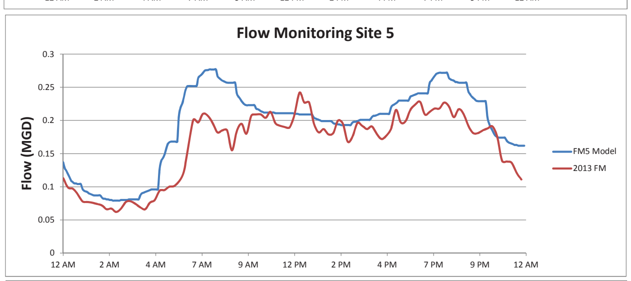
2013 Sewer Model Validation - Weekday, Validation

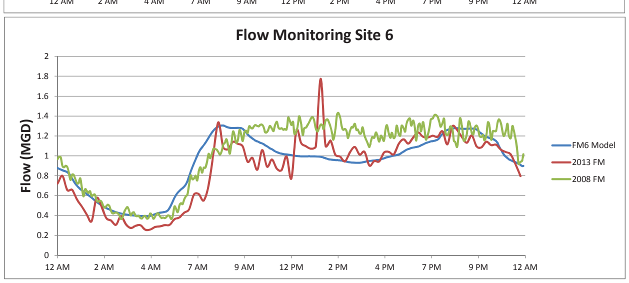


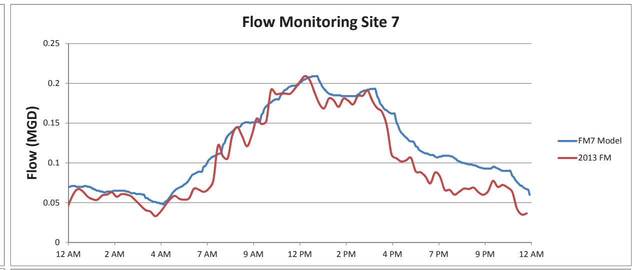


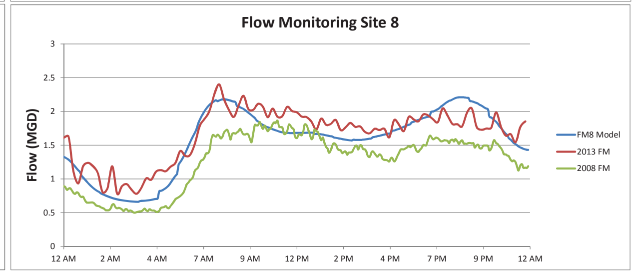


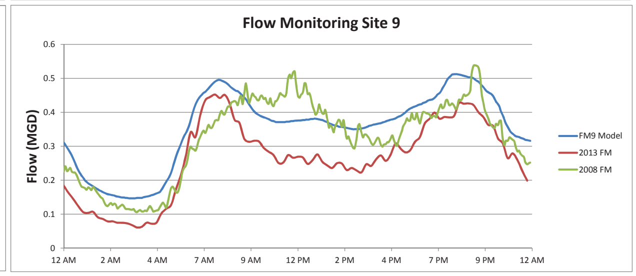


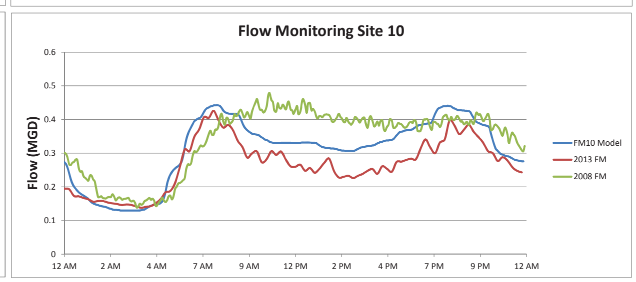


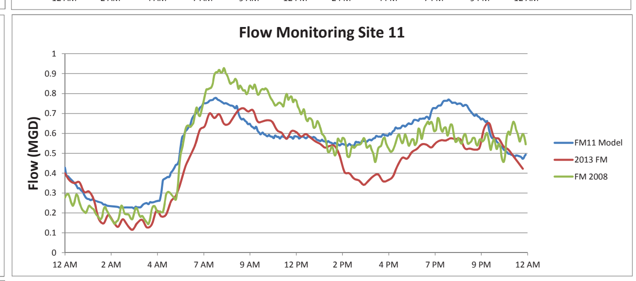


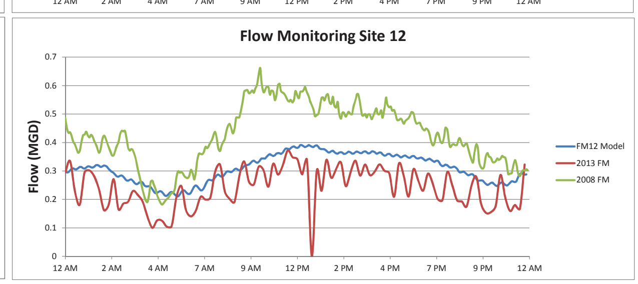








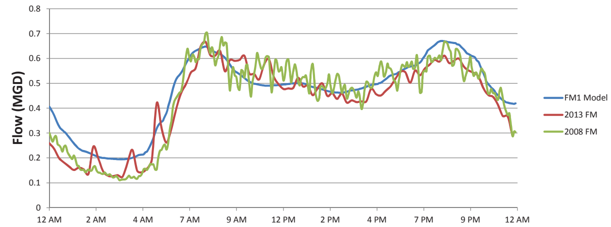




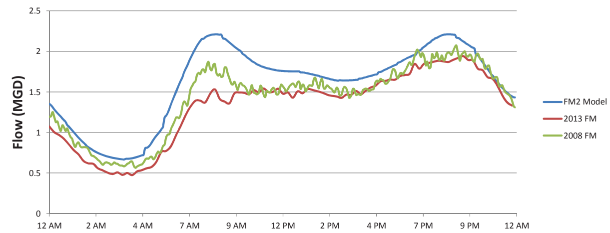
1. Model Date: January 9, 2008
2. 2013 Flow Monitoring Date: January 16, 2013
3. 2008 Flow Monitoring Date: January 2, 2008
4. Recalibrated the updated hydraulic model at Flow Monitoring Sites 4, 5, 7, 10, 12 for the 2013 Sewer Master Plan Update based on 2013 flow meter data

2013 Sewer Model Validation - Weekday, Calibration

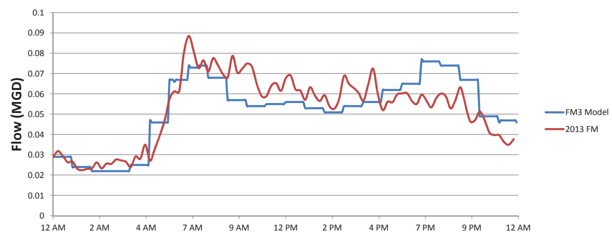
Flow Monitoring Site 1



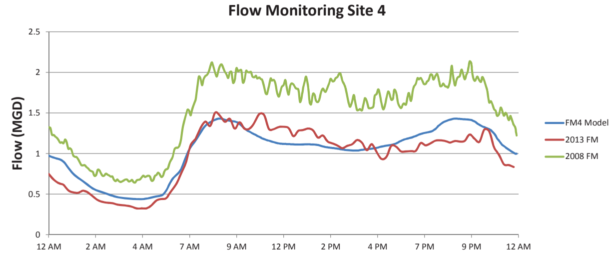
Flow Monitoring Site 2



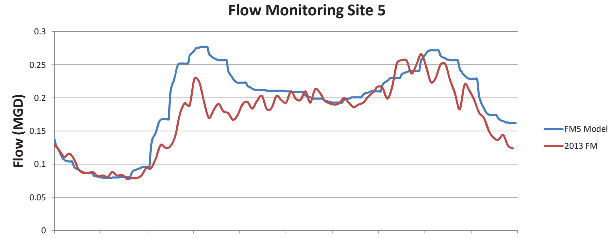
Flow Monitoring Site 3



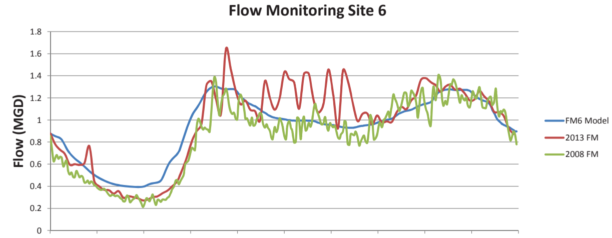
Flow Monitoring Site 4



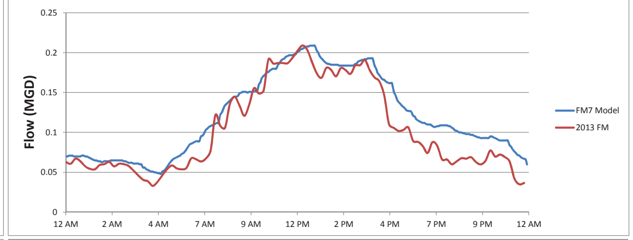
Flow Monitoring Site 5



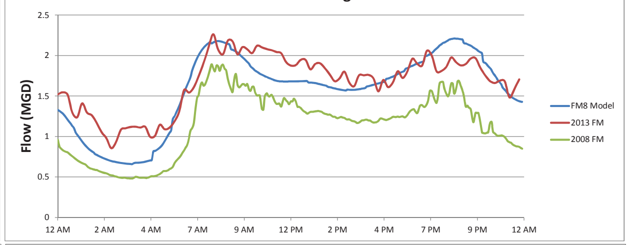
Flow Monitoring Site 6



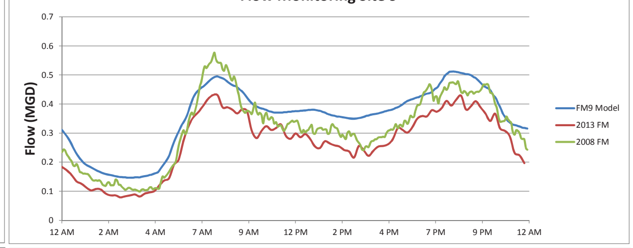
Flow Monitoring Site 7



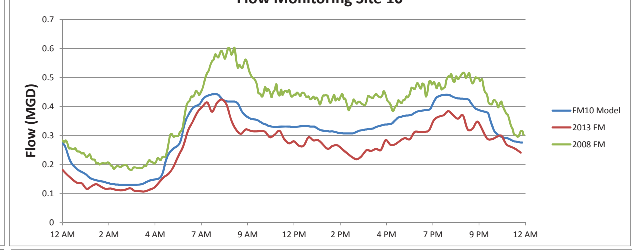
Flow Monitoring Site 8



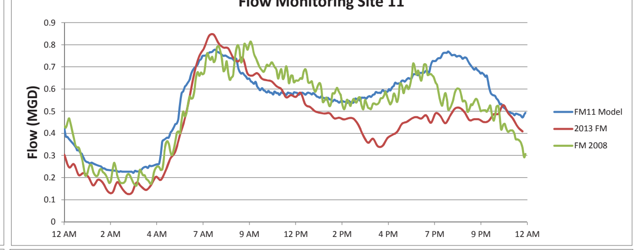
Flow Monitoring Site 9



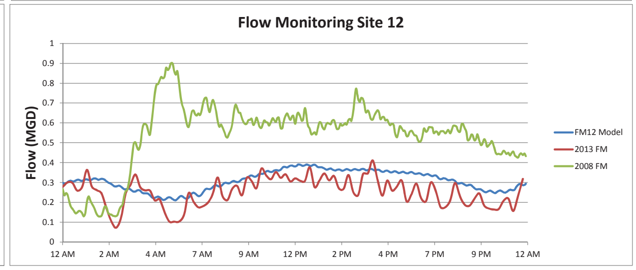
Flow Monitoring Site 10



Flow Monitoring Site 11

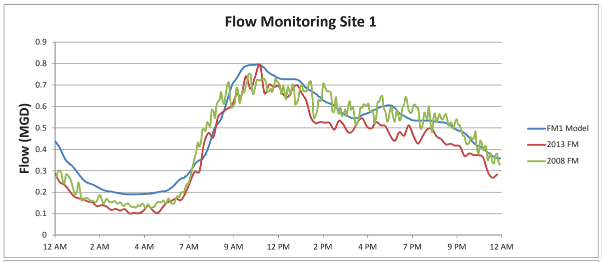


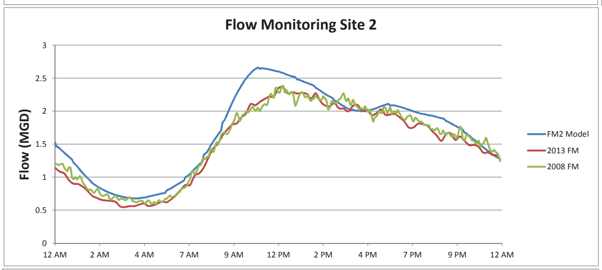
Flow Monitoring Site 12

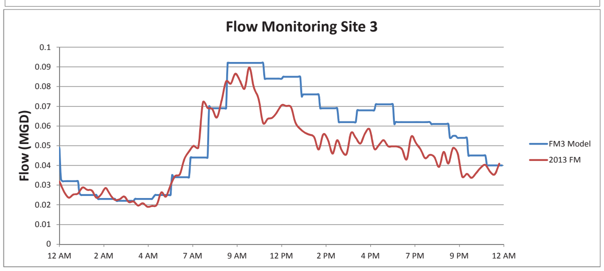


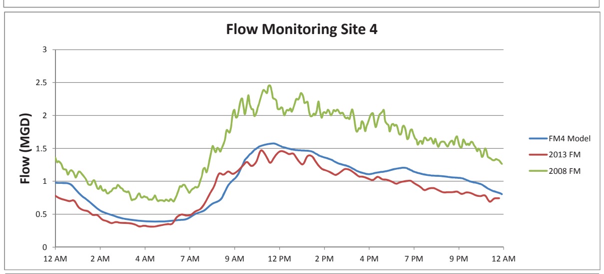
1. Model Date: January 9, 2008
2. 2013 Flow Monitoring Date: January 9, 2013
3. 2008 Flow Monitoring Date: January 9, 2008
4. Recalibrated the updated hydraulic model at Flow Monitoring Sites 4, 5, 7, 10, 12 for the 2013 Sewer Master Plan Update based on 2013 flow meter data

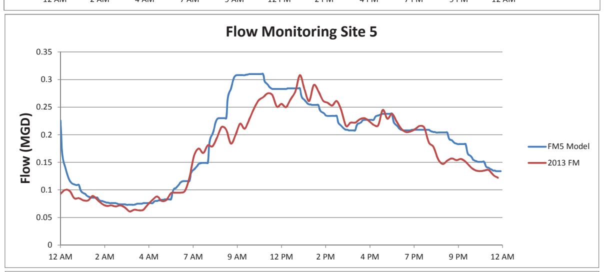
2013 Sewer Model Validation - Weekend, Calibration

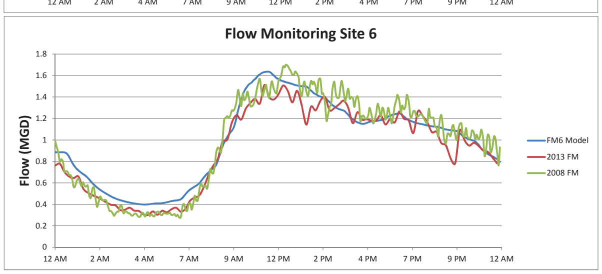


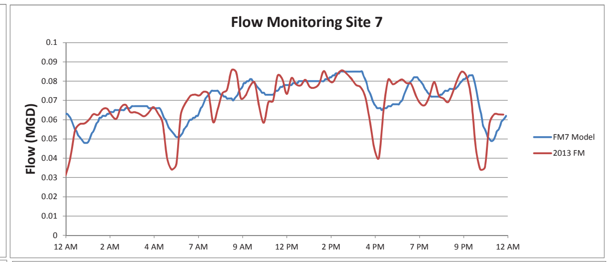


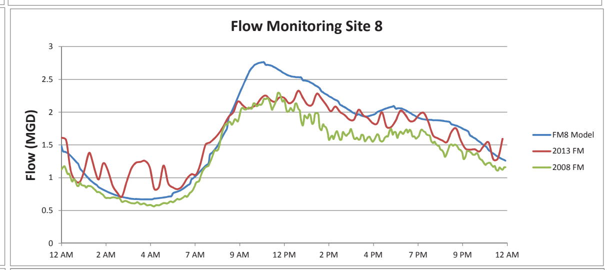


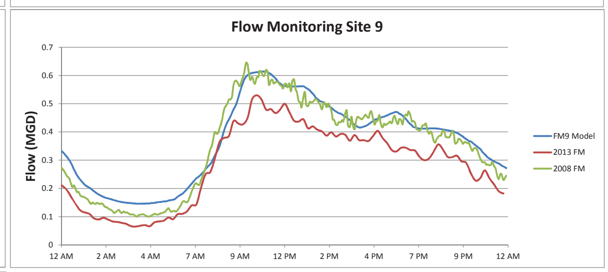


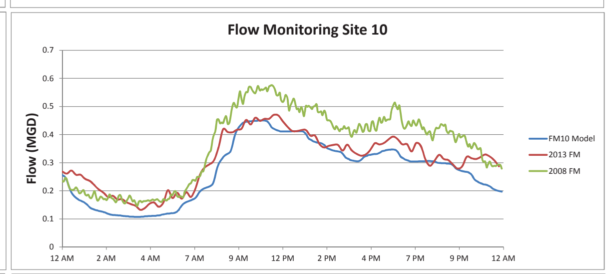


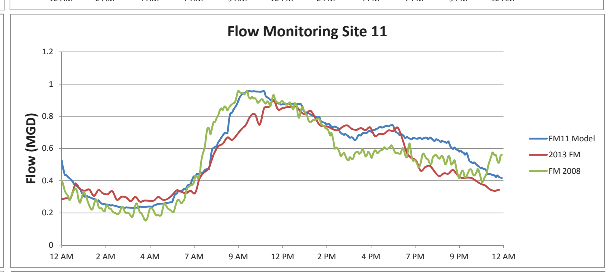


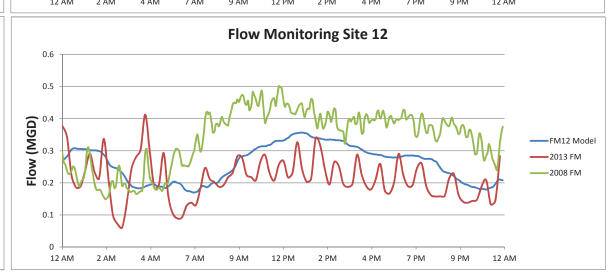






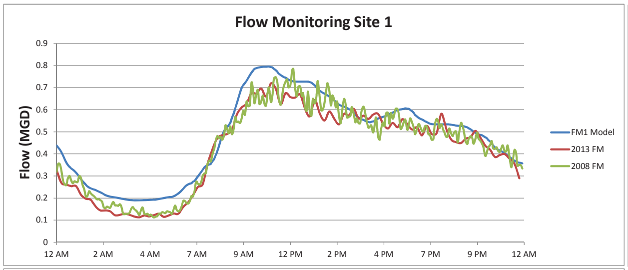


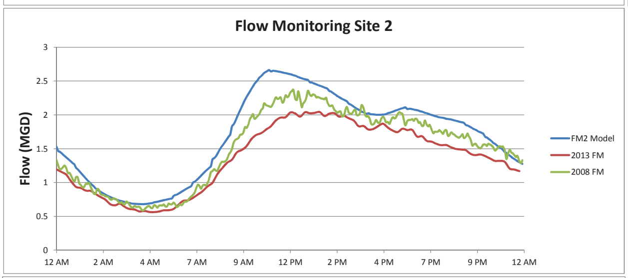


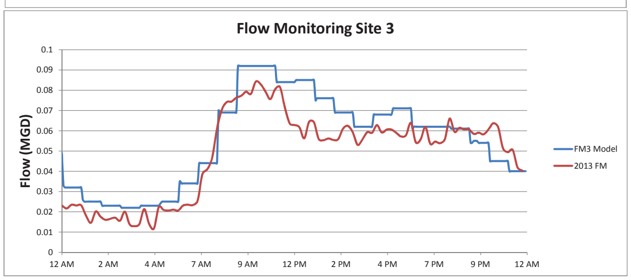


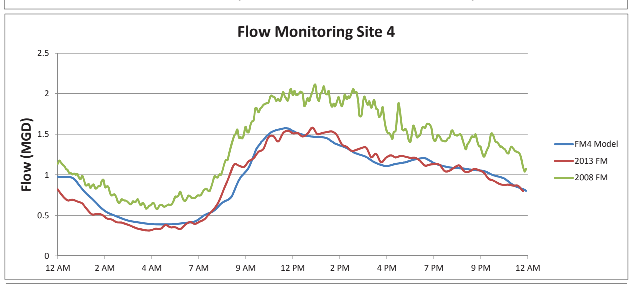
1. Model Date: January 12, 2008
2. 2013 Flow Monitoring Date: January 12, 2013
3. 2008 Flow Monitoring Date: January 12, 2008
4. Recalibrated the updated hydraulic model at Flow Monitoring Sites 4, 5, 7, 10, 12 for the 2013 Sewer Master Plan Update based on 2013 flow meter data

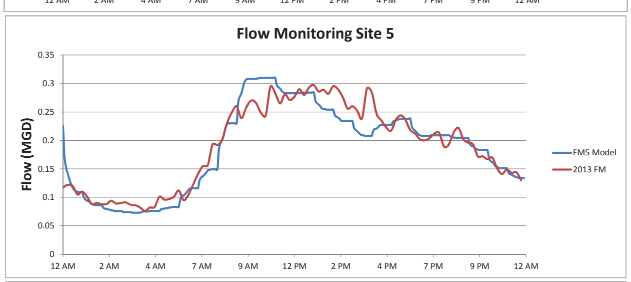
2013 Sewer Model Validation - Weekend, Validation

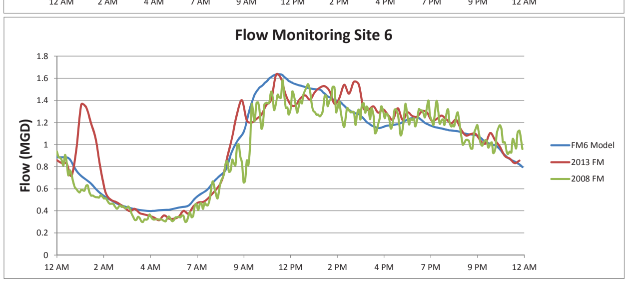


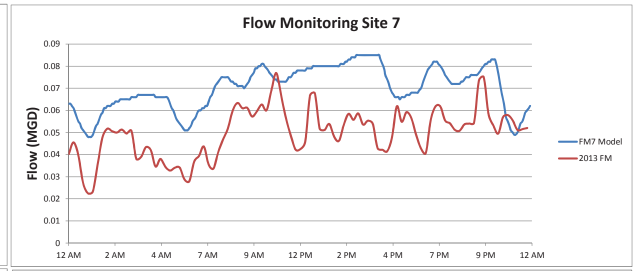


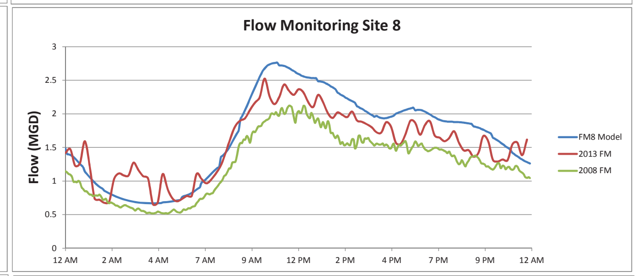


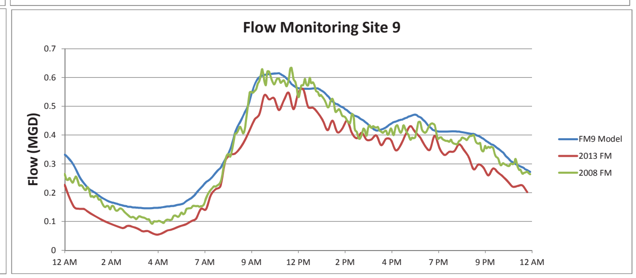


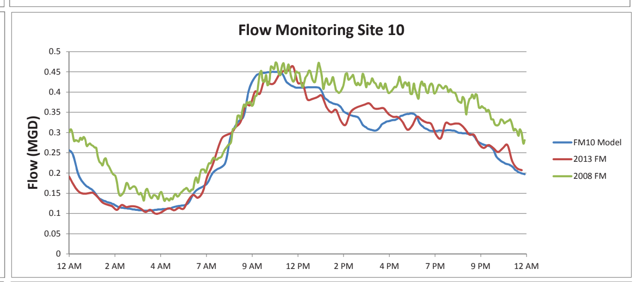


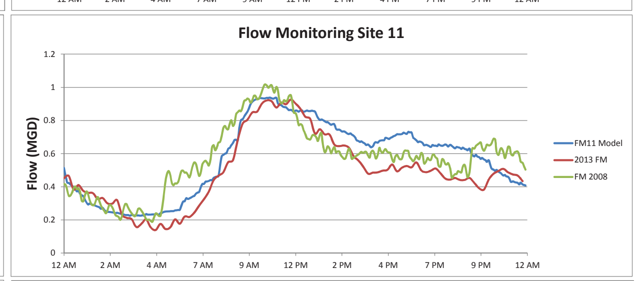


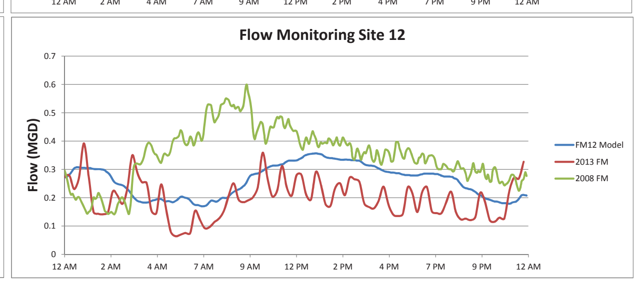












1. Model Date: January 12, 2008
2. 2013 Flow Monitoring Date: January 5, 2013
3. 2008 Flow Monitoring Date: December 29, 2007
4. Recalibrated the updated hydraulic model at Flow Monitoring Sites 4, 5, 7, 10, 12 for the 2013 Sewer Master Plan Update based on 2013 flow meter data

Model Calibration and Validation Summary Results

			Model Results			2013 Flow Monitor Results			Difference	% Difference	Difference	% Difference	Difference	% Difference
FM	Day	Type	Ave. Flow (mgd)	Max. Flow (mgd)	Total Flow Volume (ft^3)	Ave. Flow (mgd)	Max. Flow (mgd)	Total Flow Volume (ft^3)	Ave. Flow (mgd)	Ave. Flow	Max. Flow (mgd)	Max. Flow	Total Volume (ft^3)	Total Volume
FM-01	Weekday	Calibration	0.466	0.671	89,625,000	0.428	0.668	82,381,684	0.038	8%	0.003	0%	7,243,316	8%
FM-01	Weekday	Validation				0.380	0.584	73,175,134	0.085	18%	0.087	13%	16,449,866	18%
FM-01	Weekend	Calibration	0.476	0.795	91,590,241	0.403	0.794	77,608,957	0.073	15%	0.001	0%	13,981,283	15%
FM-01	Weekend	Validation				0.419	0.719	80,612,968	0.057	12%	0.076	10%	10,977,273	12%
FM-02	Weekday	Calibration	1.608	2.212	309,510,027	1.323	1.943	254,719,251	0.285	18%	0.269	12%	54,790,775	18%
FM-02	Weekday	Validation				1.425	2.004	274,317,513	0.183	11%	0.208	9%	35,192,513	11%
FM-02	Weekend	Calibration	1.680	2.663	323,424,465	1.498	2.360	288,368,984	0.182	11%	0.303	11%	35,055,481	11%
FM-02	Weekend	Validation				1.363	2.042	262,351,604	0.317	19%	0.621	23%	61,072,861	19%
FM-03	Weekday	Calibration	0.052	0.077	10,046,791	0.053	0.089	10,125,572	0.000	1%	0.012	15%	78,781	1%
FM-03	Weekday	Validation				0.049	0.084	9,506,643	0.003	5%	0.007	10%	540,149	5%
FM-03	Weekend	Calibration	0.055	0.092	10,596,925	0.047	0.090	8,994,104	0.008	15%	0.002	2%	1,602,821	15%
FM-03	Weekend	Validation				0.049	0.084	9,357,730	0.006	12%	0.008	8%	1,239,196	12%
FM-04	Weekday	Calibration	1.033	1.431	198,772,727	0.979	1.504	188,436,497	0.054	5%	0.073	5%	10,336,230	5%
FM-04	Weekday	Validation				0.864	1.271	166,315,508	0.169	16%	0.160	11%	32,457,219	16%
FM-04	Weekend	Calibration	0.967	1.575	186,072,861	0.866	1.467	166,716,578	0.101	10%	0.108	7%	19,356,283	10%
FM-04	Weekend	Validation				0.951	1.581	183,018,048	0.016	2%	0.006	0%	3,054,813	2%
FM-05	Weekday	Calibration	0.193	0.277	37,096,257	0.172	0.266	33,114,305	0.021	11%	0.011	4%	3,981,952	11%
FM-05	Weekday	Validation				0.163	0.242	31,353,610	0.030	15%	0.035	13%	5,742,647	15%
FM-05	Weekend	Calibration	0.186	0.310	35,713,904	0.173	0.308	33,238,636	0.013	7%	0.002	1%	2,475,267	7%
FM-05	Weekend	Validation				0.190	0.297	36,495,321	0.004	2%	0.013	4%	781,417	2%
FM-06	Weekday	Calibration	0.933	1.304	179,683,824	0.966	1.641	186,058,155	0.033	4%	0.337	26%	6,374,332	4%
FM-06	Weekday	Validation				0.868	1.774	167,027,406	0.066	7%	0.470	36%	12,656,417	7%
FM-06	Weekend	Calibration	0.991	1.637	190,686,497	0.919	1.513	176,955,882	0.071	7%	0.124	8%	13,730,615	7%
FM-06	Weekend	Validation				1.022	1.631	196,774,733	0.032	3%	0.006	0%	6,088,235	3%
FM-07	Weekday	Calibration	0.120	0.209	23,082,219	0.103	0.209	19,903,520	0.017	14%	0.000	0%	3,178,699	14%
FM-07	Weekday	Validation				0.103	0.209	19,871,594	0.017	14%	0.000	0%	3,210,625	14%
FM-07	Weekend	Calibration	0.070	0.085	13,515,374	0.068	0.086	13,129,921	0.002	3%	0.001	1%	385,454	3%
FM-07	Weekend	Validation				0.050	0.077	9,580,848	0.020	29%	0.008	10%	3,934,526	29%
FM-08	Weekday	Calibration	1.574	2.211	302,974,599	1.673	2.264	322,137,032	0.100	6%	0.053	2%	19,162,433	6%
FM-08	Weekday	Validation				1.660	2.400	319,612,299	0.086	5%	0.189	9%	16,637,701	5%
FM-08	Weekend	Calibration	1.664	2.762	320,393,717	1.617	2.327	311,352,273	0.047	3%	0.435	16%	9,041,444	3%
FM-08	Weekend	Validation				1.552	2.524	298,770,722	0.112	7%	0.238	9%	21,622,995	7%
FM-09	Weekday	Calibration	0.353	0.512	67,992,647	0.268	0.431	51,661,765	0.085	24%	0.081	16%	16,330,882	24%
FM-09	Weekday	Validation				0.262	0.452	50,370,321	0.092	26%	0.060	12%	17,622,326	26%
FM-09	Weekend	Calibration	0.367	0.615	70,711,230	0.282	0.530	54,344,920	0.085	23%	0.085	14%	16,366,310	23%
FM-09	Weekend	Validation				0.292	0.559	56,161,765	0.076	21%	0.056	9%	14,549,465	21%
FM-10	Weekday	Calibration	0.311	0.443	59,590,909	0.261	0.424	50,276,070	0.049	16%	0.019	4%	9,314,840	16%
FM-10	Weekday	Validation				0.266	0.426	51,132,353	0.045	14%	0.017	4%	8,458,556	14%
FM-10	Weekend	Calibration	0.270	0.450	52,012,032	0.310	0.470	59,753,342	0.040	15%	0.020	4%	7,741,310	15%
FM-10	Weekend	Validation				0.271	0.463	52,239,305	0.001	0%	0.013	3%	227,273	0%
FM-11	Weekday	Calibration	0.544	0.778	104,647,727	0.449	0.846	86,408,422	0.095	17%	0.068	9%	18,239,305	17%
FM-11	Weekday	Validation				0.462	0.726	88,933,155	0.082	15%	0.052	7%	15,714,572	15%
FM-11	Weekend	Calibration	0.580	0.956	111,566,176	0.534	0.901	102,705,882	0.046	8%	0.055	6%	8,860,294	8%
FM-11	Weekend	Validation				0.494	0.926	95,189,840	0.085	15%	0.030	3%	16,376,337	15%
FM-12	Weekday	Calibration	0.310	0.391	59,688,503	0.253	0.412	48,788,260	0.057	18%	0.021	5%	10,900,242	18%
FM-12	Weekday	Validation				0.242	0.372	46,537,495	0.068	22%	0.019	5%	13,151,007	22%
FM-12	Weekend	Calibration	0.261	0.357	50,223,930	0.214	0.413	41,217,464	0.047	18%	0.056	16%	9,006,466	18%
FM-12	Weekend	Validation				0.197	0.392	37,979,134	0.064	24%	0.035	10%	12,244,797	24%

Corresponding Dates:

Weekday Calibration - 1/9/13; Weekday Validation - 1/16/13

Weekend Calibration - 1/12/13; Weekend Validation - 1/5/13

APPENDIX E:

FLOW MONITORING RESULTS

(DOWNSTREAM SERVICE, INC.)

DownStream Services, Inc.

MWH-City of Long Beach
TFM-Master Plan Results

January - 2013

www.downstreamservices.com

January 31, 2013

Jinny C. Huang,
MWH Global, Inc.
618 Machillinda Avenue Suite 200
Arcadia, CA 91007
626-568-6536
Jinny.C.Huang@us.mwhglobal.com

Subject: Fourteen day Results of Temporary Flow Metering Study for Master Plan, City of Long Beach

This report presents the flow monitoring results for January 5, 2013 through January 18, 20113 from the twelve (12) temporary flow monitoring sites located in the City of Long Beach.

Included in this report are the fourteen (14) day results presented in multiple formats including hydrographs, scattergraphs, tabular data, and CSV files. The entire report is also included on CD for your convenience.

Nine of the twelve sites were previously metered in December 2007 through January 2008. The twelve locations metered in January 2013 are:

FM01: The 15" PVC, located at 2631 Ladoga Avenue, was previously metered as "Site FM13."

FM02: The 21" VCP, located at 5404 Walnut, was previously metered as "Site FM02."

FM03: The 8" VCP, located on Ravenna Street, south of Corinthian Walk, is a new location. The line is silted and reaches 50% capacity during diurnal peak.
.
FM04: The 21" VCP, located near 701 E. 28th Street, was previously metered as "Site FM04." The manhole lid was found locked, and was opened for the study period.

FM05: The 12" VCP, located in the alley north of E. Hill Street, is a new location. It discharges downstream to a pumping station.

FM06: The 21" VCP, located at 1346 W. 15th Street, was previously metered as "Site FM06."

FM07: The 18" VCP, located on Magnolia Avenue south of Broadway, is a new location. This is a commercial area with numerous government buildings which are closed on weekends. A distinct commercial pattern is seen in the data from this site.

FM08: The 24" VCP, located at 1347 E. 3rd Street, was previously metered as "Site FM08." Since then, the manhole has been rehabilitated.

FM09: The 15" VCP, located on the landscaped center divider at Wardlow Road and Clark Avenue, was previously metered as "Site FM14." During installation on January 04, 2013, and again during the interim visit of January 08, 2013, the flow here was seen running dark red for a period of about five minutes.

FM10: The 18" VCP, located on Division Street northwest of Roycroft Avenue, was previously metered as "Site FM10."

FM11: The 15.63" lined pipe, located on Division Street southeast of Ximeno Avenue, was previously metered as "Site FM11."

FM12: The 15” VCP, located on Vernon Street west of Clark Avenue, was previously metered as “Site FM12.” This line has above-average turbidity with rags in the flow. During previous metering in 2007 and during the recent 2013 study, syringes and other debris were found deposited on the manhole bench.

A minimal rainfall occurred during the study, on Sunday, January 6, 2013. Private weather stations (PWS) located within study area recorded 0.07” total rainfall, occurring in the early morning hours. This produced a slight inflow spike at some sites, which is noticeable in the data during the minimum diurnal low. There was insufficient rainfall to produce noticeable infiltration results.

Calibration of the meters was conducted during installation. Additional line calibrations were conducted at the interim site visits on January 08, 2013 and January 15, 2013. Final calibration was performed at removal January 21, 2013

If you have any questions concerning this report, please feel free to contact me.

Regards,

Deena Ramos, Field Supervisor
Flow Metering services

Field Calibrations & Depth of Flow Measurements

Downstream Services, Inc. obtains depth of flow measurements by manned entry. The entrant remains clear of flow at time of measurement, taken at invert to surface of flow line.

MWH Long Beach

INSTALLATION 01/03-04/2013

Site Name	Pipe Dia.	DOF Time	Field DOF (in.)	Air DOF (in.)	Date	Meter Depth (in.)	Field Vel. (fps)	Meter Vel. (fps)	Comments
FM01	15	9:26	6.38		1/3/2013	6.36	1.79	1.77	
FM02	21	14:24	9.75		1/3/2013	9.66	3.01	2.65	
FM03	8	17:37	4.13		1/3/2013	4.1	0.66	0.86	
FM04	21	14:00	6.88		1/4/2013	7.01	3.57	3.34	
FM05	12	12:50	3.13		1/3/2013	3.16	2.23	2.19	
FM06	21	15:39	12		1/3/2013	11.98	1.85	1.79	
FM07	18	11:28	2.63		1/3/2013	2.62	1.49	1.21	
FM08	24	11:55	10.38		1/4/2013	10.38	2.38	2.49	
FM09	15	13:08	4.88		1/4/2013	4.93	1.58	1.5	
FM10	18	8:29	5		1/4/2013	5	1.69	1.75	
FM11	15.63	9:50	7.13		1/4/2013	7.06	2.39	2.34	
FM12	15	20:29	3.38		1/3/2013	3.3	2.57	2.49	

MAINTENANCE 1/8/2013

Site Name	Pipe Dia.	DOF Time	Field DOF (in.)	Air DOF (in.)	Date	Meter Depth (in.)	Field Vel. (fps)	Meter Vel. (fps)	Comments
FM01	15	12:00	5.38		1/8/2013	5.39	1.77	1.67	
FM02	21	10:50	8.5		1/8/2013	8.41	2.43	2.29	
FM03	8	7:30	3.88		1/8/2013	3.91	0.65	0.83	
FM04	21	5:33	3.75		1/8/2013	3.84	2.25	2	
FM05	12	10:15	2.75		1/8/2013	2.83	2.11	2.01	
FM06	21	6:55	9.5		1/8/2013	9.49	1.1	1.03	
FM07	18	9:46	2.75		1/8/2013	2.78	1.44	1.31	
FM08	24	9:05	10.5		1/8/2013	10.59	2.15	2.28	
FM09	15	11:25	4.5		1/8/2013	4.56	1.3	1.36	
FM10	18	8:15	4.75		1/8/2013	4.73	1.72	1.8	
FM11	15.63	7:59	7.38		1/8/2013	7.33	2.22	2.19	
FM12	15	6:16	3.25		1/8/2013	3.19	2.37	2.49	

DownStream Services, Inc.

MAINTENANCE **1/15/2013**

Site Name	Pipe Dia.	DOF Time	Field DOF (in.)	Air DOF (in.)	Date	Meter Depth (in.)	Field Vel. (fps)	Meter Vel. (fps)	Comments
FM01	15	14:20	5.25		1/15/2013	5.13	1.79	1.9	
FM02	21	13:04	9.13		1/15/2013	9.06	2.65	2.42	
FM03	8	8:37	4		1/15/2013	4.07	0.65	0.78	
FM04	21	5:48	4		1/15/2013	3.89	2.33	2.25	
FM05	12	12:30	3.63		1/15/2013	3.05	2.25	2.21	
FM06	21	7:25	10		1/15/2013	10.35	1.31	1.27	
FM07	18	11:16	3.38		1/15/2013	3.31	1.33	1.32	
FM08	24	10:36	9.88		1/15/2013	9.98	2.13	2.08	
FM09	15	13:41	4.5		1/15/2013	4.59	1.31	1.34	
FM10	18	9:34	4.25		1/15/2013	4.01	1.76	1.48	
FM11	15.63	9:18	6.63		1/15/2013	6.65	2.34	2.17	
FM12	15	6:35	2.13		1/15/2013	2.21	2.25	2.32	

REMOVAL **1/21/2013**

Site Name	Pipe Dia.	DOF Time	Field DOF (in.)	Air DOF (in.)	Date	Meter Depth (in.)	Field Vel. (fps)	Meter Vel. (fps)
FM01	15	16:56	5.75		1/21/2013	5.65	1.95	2.01
FM02	21	15:57	9.88		1/21/2013	9.78	3.01	2.66
FM03	8	9:19	4.25		1/21/2013	4.34	0.86	0.76
FM04	21	6:20	4.38		1/21/2013	4.2	2.3	2.09
FM05	12	17:54	4		1/21/2013	3.35	2.28	2.18
FM06	21	8:14	10.5		1/21/2013	11.24	1.44	1.37
FM07	18	14:00	3.25		1/21/2013	3.26	1.12	0.86
FM08	24	12:56	10.75		1/21/2013	10.86	2.25	2.21
FM09	15	14:01	4.75		1/21/2013	4.84	1.61	1.6
FM10	18	10:48	5.38		1/21/2013	5.17	2.09	1.72
FM11	15.63	9:59	6.75		1/21/2013	6.79	2.47	2.19
FM12	15	7:05	1.88		1/21/2013	1.92	2.08	2.15

Services, Inc.

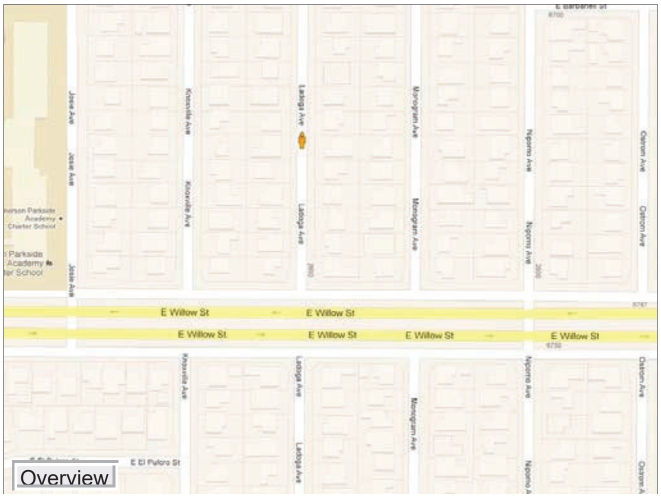
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

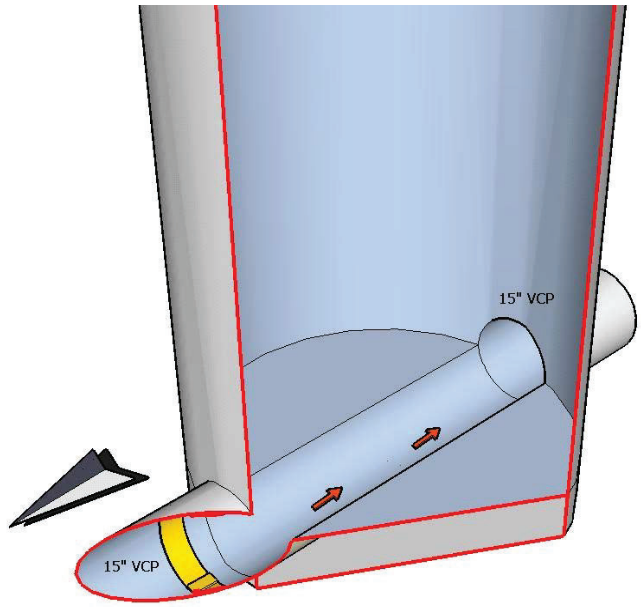
Site #: FM01 **Date:** 12/27/201

Address: 2631 Ladoga Ave.

Traffic: Light, residential **Job #** 2012.5.166



Profile



MH Condition: Poor

Laterals: No

Rungs: Yes

Silt/Sediment: No

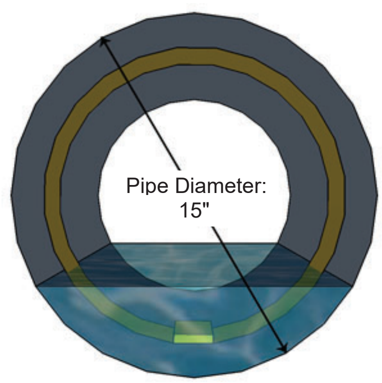
Infiltration: Yes

Surcharge Evidence: No

Level: N/A

Manhole Depth: 11.1'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 1.79 fps

Flow Depth: 6.25"

Pipe Material: PVC

Comments: Good hydraulics; straight-through, moderate velocity

Services, Inc.

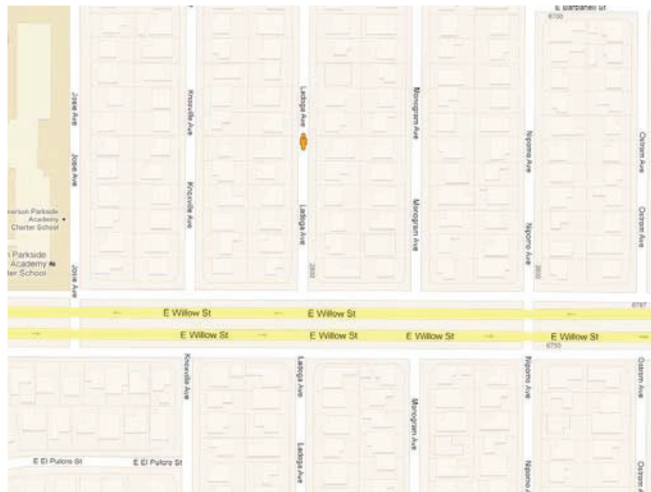
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM01
Map Page: T19-SMH-035
Location: 2631 Ladoga Ave
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 9:20:00 AM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Light, residential
Manhole Depth: 11.1'

Overview



Facility Inspection

Cover

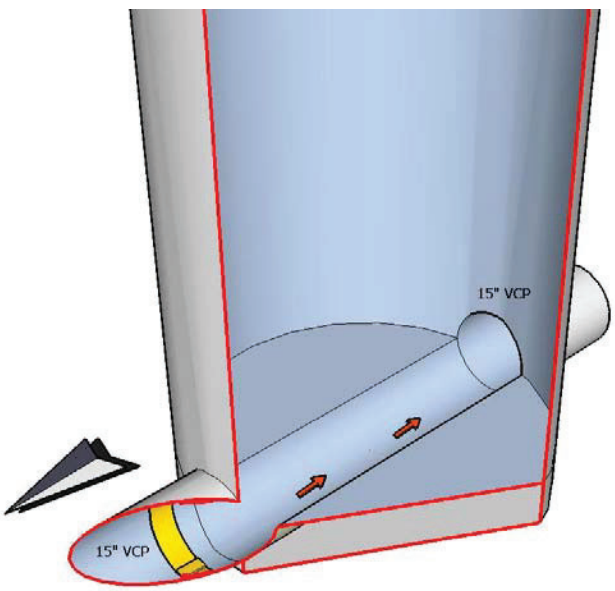
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: Light

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Concentric
Material: Brick
Condition: Fair
Infiltration: None



Barrel

Material: Brick
Condition: Fair
Infiltration: stains

Rungs

Rungs: Yes
Material: Cast Iron
Condition: Corroded

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: Light
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

Observations and Comments

Flow Velocity: 1.79 fps
Flow Depth: 6.25"
Observation Location: Influent Pipe

Comments: Older brick manhole

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM01

Area Reference

Down Manhole

Effluent

Influent

Site Data Summary

Project #	2012.5.166	
Location ID	FM01	
Pipe Diameter	15	Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	5.12
Maximum	7.44
Minimum	3.05
Max d/D	49.6%

Velocity - Feet per Second

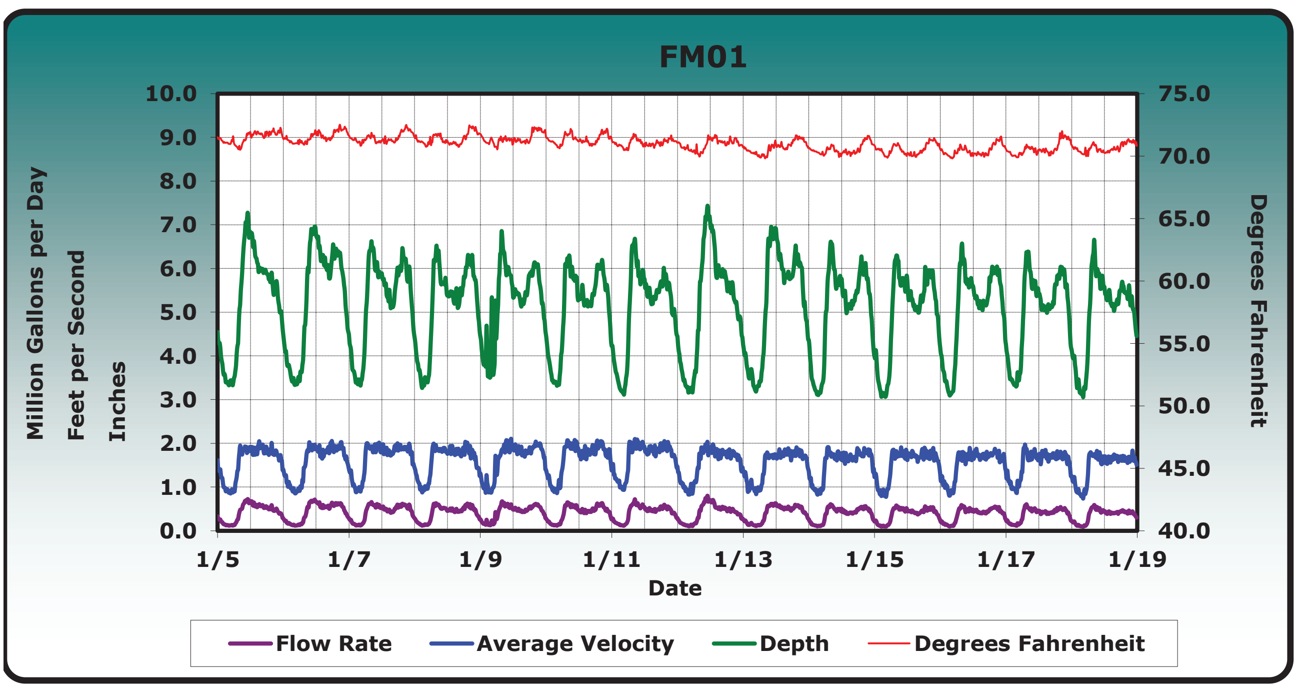
Average	1.58
Maximum	2.10
Minimum	0.74

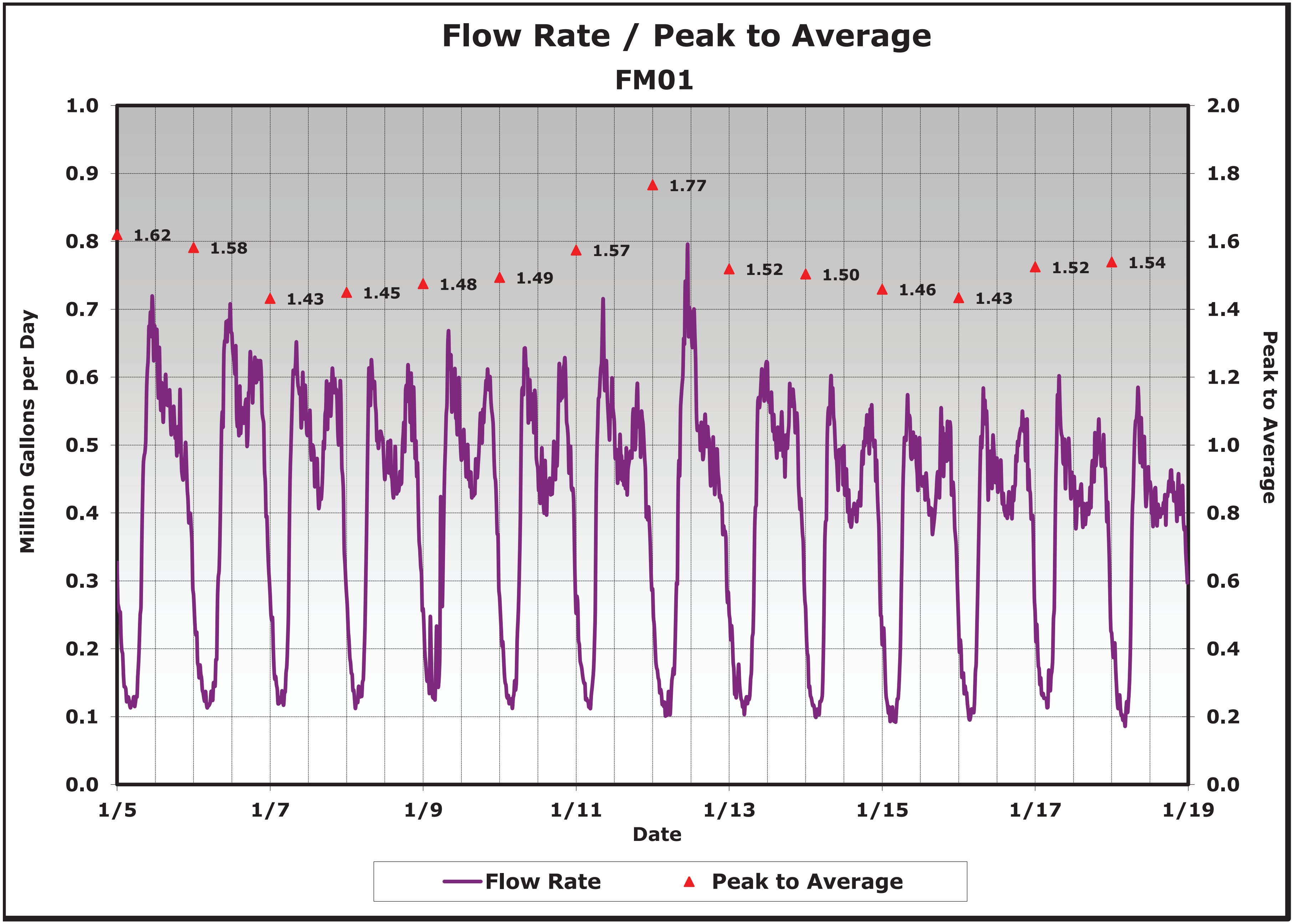
Flow - Million Gallons per Day

Average	0.40
Maximum	0.79
Minimum	0.09
Peak Factor	1.98

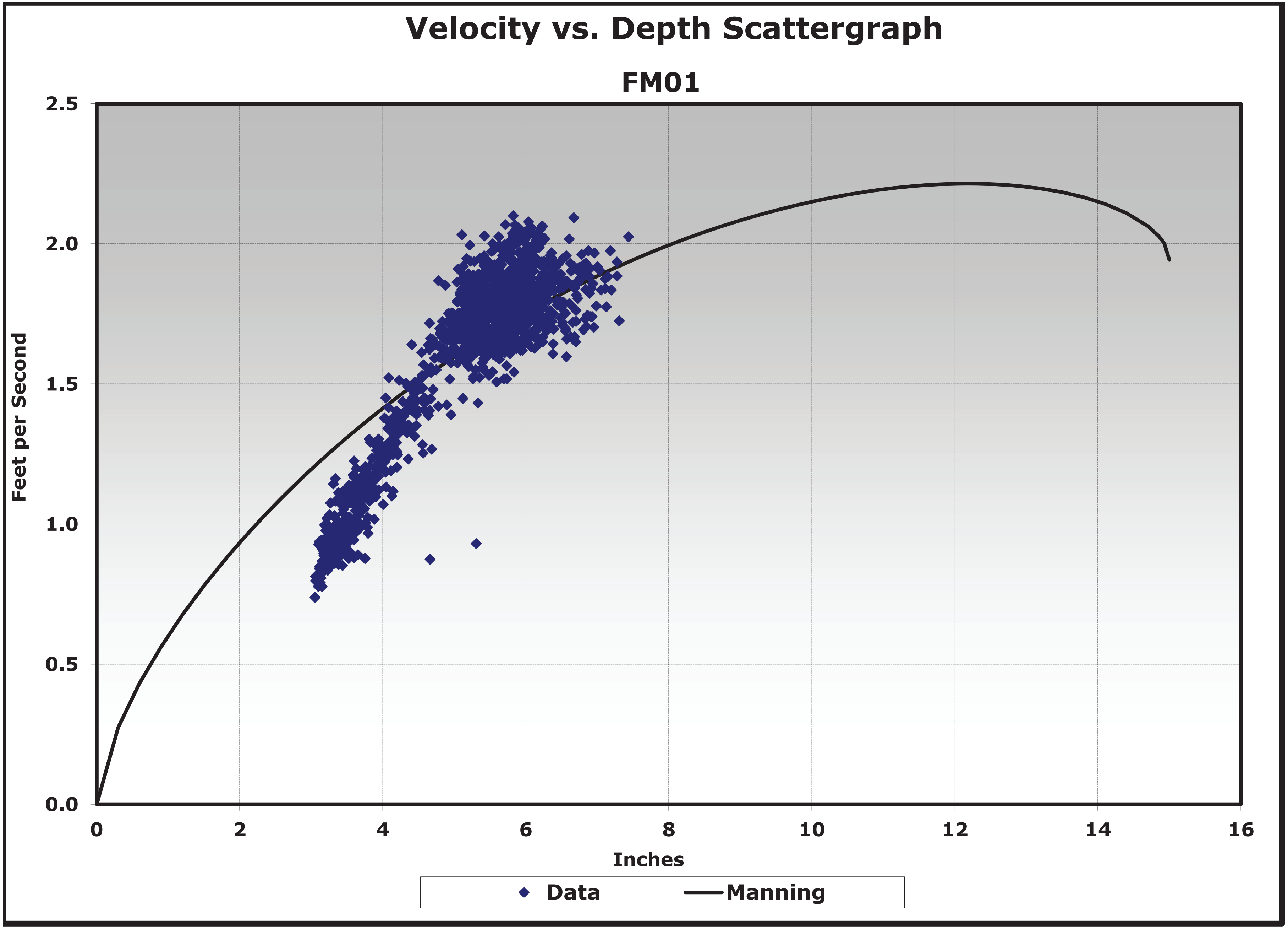
Temperature - Deg. F

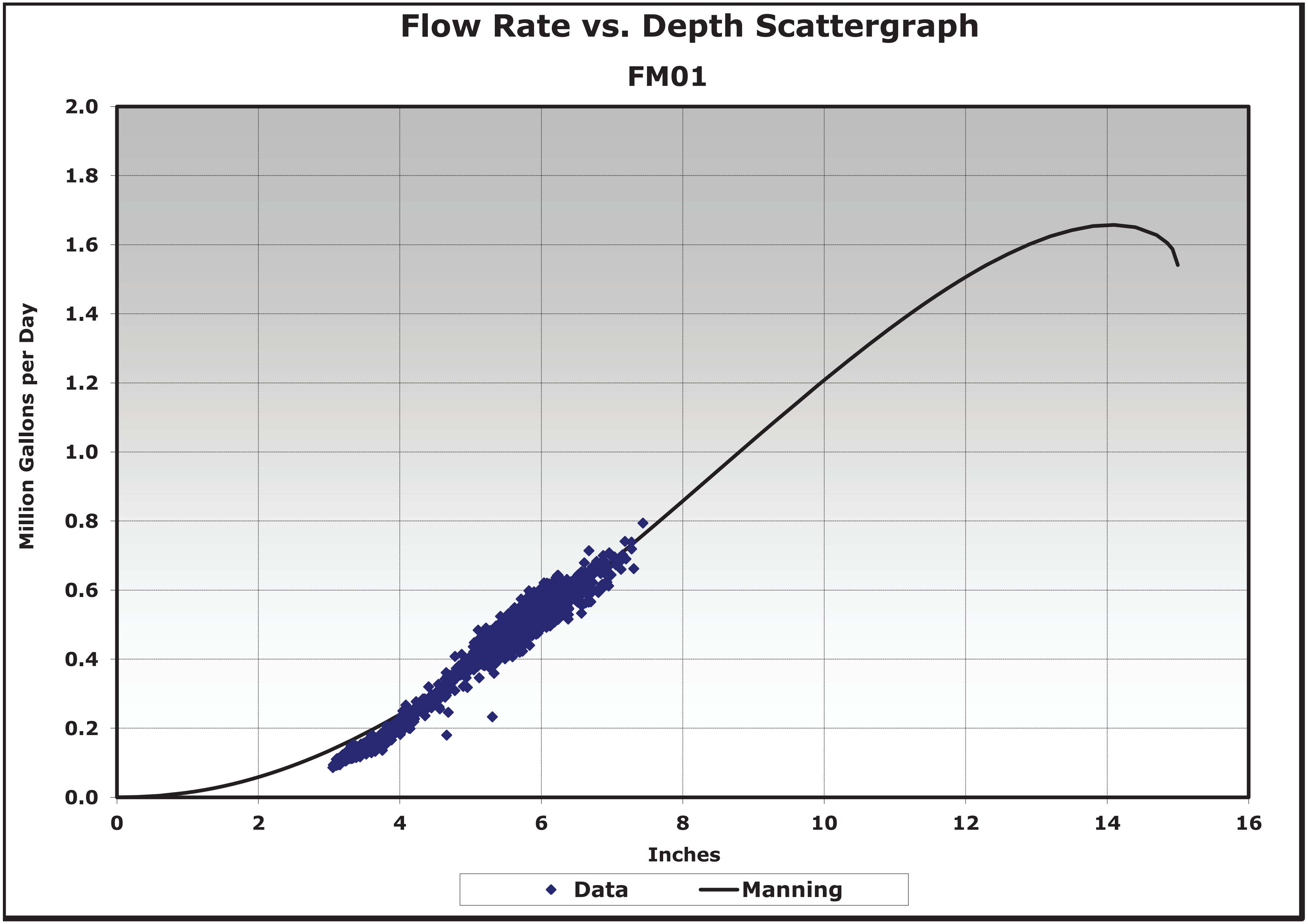
Average	71.00
Maximum	72.50
Minimum	69.81





Flow Rate / Peak to Average
FM01
Million Gallons per Day
Peak to Average
Date
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.62
1.58
1.43
1.45
1.48
1.49
1.57
1.77
1.52
1.50
1.46
1.43
1.52
1.54
Flow Rate
Peak to Average


Velocity vs. Depth Scattergraph
FM01
Feet per Second
Inches
0.0
0.5
1.0
1.5
2.0
2.5
0
2
4
6
8
10
12
14
16
Data
Manning



Flow Rate vs. Depth Scattergraph
FM01
Million Gallons per Day
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
16
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM01 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.28	0.25	0.26	0.24	0.22	0.24	0.25	0.24	0.24	0.22	0.21	0.21	0.23	0.20
1:00	0.21	0.18	0.17	0.17	0.16	0.18	0.18	0.17	0.17	0.14	0.13	0.15	0.16	0.16
2:00	0.15	0.16	0.13	0.13	0.18	0.13	0.15	0.14	0.14	0.12	0.10	0.13	0.13	0.12
3:00	0.12	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.15	0.11	0.10	0.10	0.12	0.10
4:00	0.12	0.12	0.13	0.13	0.18	0.13	0.12	0.11	0.12	0.11	0.11	0.11	0.14	0.10
5:00	0.12	0.13	0.20	0.18	0.27	0.19	0.17	0.12	0.12	0.17	0.16	0.18	0.19	0.14
6:00	0.15	0.14	0.46	0.42	0.36	0.37	0.42	0.16	0.14	0.41	0.38	0.38	0.40	0.35
7:00	0.27	0.24	0.60	0.59	0.56	0.60	0.59	0.26	0.22	0.55	0.52	0.53	0.57	0.52
8:00	0.47	0.41	0.62	0.59	0.63	0.62	0.66	0.48	0.42	0.57	0.55	0.55	0.51	0.55
9:00	0.58	0.59	0.57	0.53	0.58	0.56	0.60	0.61	0.56	0.50	0.49	0.46	0.47	0.50
10:00	0.68	0.67	0.56	0.51	0.55	0.55	0.54	0.70	0.60	0.47	0.49	0.47	0.49	0.47
11:00	0.68	0.68	0.54	0.50	0.55	0.53	0.56	0.71	0.60	0.48	0.48	0.47	0.44	0.44
12:00	0.65	0.64	0.52	0.46	0.49	0.44	0.50	0.67	0.58	0.45	0.45	0.46	0.42	0.42
13:00	0.59	0.58	0.49	0.48	0.48	0.45	0.47	0.63	0.55	0.41	0.44	0.45	0.41	0.42
14:00	0.57	0.54	0.45	0.44	0.46	0.43	0.47	0.52	0.52	0.39	0.42	0.41	0.42	0.40
15:00	0.58	0.54	0.42	0.46	0.44	0.45	0.46	0.50	0.50	0.41	0.40	0.41	0.39	0.40
16:00	0.56	0.54	0.46	0.45	0.45	0.44	0.46	0.52	0.52	0.41	0.39	0.41	0.40	0.41
17:00	0.53	0.58	0.55	0.47	0.48	0.49	0.50	0.51	0.49	0.45	0.44	0.43	0.43	0.42
18:00	0.51	0.60	0.56	0.55	0.54	0.55	0.52	0.46	0.51	0.50	0.50	0.49	0.47	0.45
19:00	0.52	0.61	0.58	0.59	0.57	0.57	0.56	0.47	0.57	0.52	0.50	0.52	0.49	0.43
20:00	0.47	0.61	0.58	0.54	0.59	0.61	0.53	0.47	0.56	0.53	0.49	0.53	0.50	0.42
21:00	0.48	0.58	0.53	0.53	0.57	0.51	0.49	0.42	0.52	0.50	0.50	0.49	0.49	0.42
22:00	0.41	0.46	0.52	0.42	0.48	0.46	0.40	0.37	0.41	0.44	0.42	0.43	0.43	0.41
23:00	0.36	0.34	0.35	0.31	0.36	0.37	0.34	0.30	0.33	0.29	0.32	0.35	0.30	0.33

Average	0.42	0.43	0.43	0.41	0.43	0.42	0.42	0.40	0.40	0.38	0.37	0.38	0.38	0.36
Median	0.48	0.53	0.50	0.46	0.48	0.45	0.48	0.45	0.49	0.43	0.43	0.43	0.42	0.41
Max Hr. Mean	0.68	0.68	0.62	0.59	0.63	0.62	0.66	0.71	0.60	0.57	0.55	0.55	0.57	0.55
Min Hr. Mean	0.12	0.12	0.13	0.13	0.13	0.12	0.12	0.11	0.12	0.11	0.10	0.10	0.12	0.10
Inst. Max	0.72	0.71	0.65	0.62	0.67	0.64	0.71	0.79	0.62	0.60	0.57	0.58	0.60	0.59
Inst. Min	0.11	0.11	0.12	0.11	0.13	0.11	0.11	0.10	0.10	0.10	0.09	0.10	0.11	0.09
Peak To Avg.	1.62	1.58	1.43	1.45	1.48	1.49	1.57	1.77	1.52	1.50	1.46	1.43	1.52	1.54

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM01 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.44	1.31	1.36	1.34	1.18	1.29	1.42	1.34	1.32	1.23	1.25	1.23	1.29	1.19
1:00	1.27	1.12	1.11	1.12	1.00	1.13	1.21	1.09	1.10	1.00	0.94	1.06	1.11	1.05
2:00	1.01	1.05	0.94	0.95	1.07	0.97	1.13	1.02	1.01	0.93	0.84	1.01	0.97	0.89
3:00	0.93	0.95	0.94	0.95	0.89	0.92	1.00	0.92	1.03	0.88	0.85	0.83	0.94	0.81
4:00	0.87	0.87	0.95	0.97	0.94	1.00	0.96	0.85	0.92	0.90	0.86	0.90	1.02	0.83
5:00	0.91	0.93	1.23	1.16	1.38	1.14	1.17	0.95	0.95	1.15	1.11	1.12	1.20	0.95
6:00	1.01	0.98	1.91	1.75	1.49	1.66	1.83	1.11	0.97	1.72	1.70	1.65	1.68	1.61
7:00	1.41	1.29	1.92	1.91	1.75	1.96	1.87	1.36	1.27	1.83	1.74	1.73	1.87	1.75
8:00	1.84	1.66	1.88	1.85	1.90	2.00	1.98	1.76	1.72	1.73	1.76	1.72	1.63	1.72
9:00	1.83	1.91	1.85	1.85	1.97	1.92	2.00	1.87	1.70	1.71	1.78	1.63	1.71	1.70
10:00	1.86	1.91	1.92	1.86	1.88	1.96	1.90	1.89	1.72	1.73	1.74	1.73	1.78	1.68
11:00	1.87	1.90	1.89	1.83	1.97	1.95	1.95	1.87	1.71	1.71	1.74	1.69	1.67	1.60
12:00	1.86	1.86	1.84	1.79	1.90	1.73	1.83	1.86	1.69	1.71	1.71	1.75	1.65	1.63
13:00	1.79	1.80	1.83	1.86	1.85	1.74	1.82	1.86	1.74	1.66	1.74	1.79	1.73	1.63
14:00	1.84	1.73	1.78	1.77	1.84	1.74	1.89	1.82	1.75	1.63	1.75	1.68	1.79	1.63
15:00	1.96	1.80	1.74	1.81	1.78	1.83	1.84	1.72	1.79	1.69	1.68	1.72	1.65	1.67
16:00	1.92	1.85	1.84	1.78	1.76	1.79	1.78	1.79	1.82	1.65	1.66	1.68	1.69	1.68
17:00	1.83	1.95	1.93	1.80	1.79	1.88	1.88	1.79	1.72	1.73	1.76	1.72	1.73	1.63
18:00	1.79	1.88	1.91	1.90	1.86	1.91	1.90	1.73	1.75	1.79	1.78	1.74	1.71	1.67
19:00	1.86	1.89	1.87	1.90	1.91	1.93	1.94	1.74	1.81	1.73	1.75	1.76	1.71	1.63
20:00	1.77	1.92	1.88	1.77	1.97	2.02	1.94	1.80	1.80	1.80	1.70	1.81	1.69	1.62
21:00	1.80	1.95	1.86	1.78	1.98	1.83	1.89	1.72	1.76	1.80	1.76	1.71	1.73	1.65
22:00	1.68	1.73	1.86	1.56	1.88	1.73	1.72	1.67	1.69	1.77	1.72	1.65	1.64	1.68
23:00	1.59	1.58	1.58	1.39	1.62	1.71	1.57	1.46	1.55	1.49	1.54	1.62	1.45	1.59
Average	1.58	1.58	1.66	1.61	1.65	1.66	1.68	1.54	1.51	1.54	1.54	1.54	1.54	1.48
Median	1.76	1.77	1.82	1.77	1.79	1.80	1.84	1.71	1.70	1.68	1.69	1.68	1.66	1.63
Max Hr. Mean	1.96	1.95	1.93	1.91	1.98	2.02	2.00	1.89	1.82	1.83	1.78	1.81	1.87	1.75
Min Hr. Mean	0.87	0.87	0.94	0.95	0.89	0.92	0.96	0.85	0.92	0.88	0.84	0.83	0.94	0.81
Inst. Max	2.04	2.05	2.01	2.03	2.10	2.07	2.09	2.03	1.90	1.91	1.91	1.89	1.97	1.83
Inst. Min	0.85	0.86	0.88	0.88	0.87	0.86	0.94	0.83	0.84	0.83	0.78	0.80	0.87	0.74

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM01 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	4.37	4.28	4.28	4.20	4.24	4.25	4.12	4.20	4.13	4.06	3.99	4.02	4.08	4.03
1:00	3.98	3.89	3.74	3.75	3.81	3.79	3.70	3.75	3.80	3.42	3.46	3.58	3.58	3.73
2:00	3.59	3.68	3.47	3.42	4.02	3.46	3.42	3.45	3.53	3.23	3.14	3.35	3.42	3.33
3:00	3.39	3.45	3.42	3.39	3.54	3.39	3.21	3.29	3.52	3.13	3.12	3.13	3.33	3.15
4:00	3.37	3.36	3.39	3.42	4.29	3.34	3.17	3.19	3.23	3.22	3.17	3.16	3.48	3.19
5:00	3.39	3.44	3.85	3.75	4.31	3.83	3.56	3.25	3.30	3.61	3.57	3.73	3.77	3.52
6:00	3.61	3.58	5.12	5.06	5.10	4.86	4.88	3.58	3.47	5.07	4.87	4.96	5.01	4.74
7:00	4.33	4.16	6.26	6.22	6.36	6.12	6.27	4.32	4.04	6.08	6.03	6.15	6.15	6.00
8:00	5.35	5.19	6.50	6.37	6.48	6.22	6.57	5.62	5.22	6.52	6.23	6.32	6.22	6.35
9:00	6.32	6.19	6.15	5.85	5.99	5.94	6.06	6.43	6.54	5.94	5.69	5.80	5.70	5.91
10:00	7.00	6.81	5.97	5.67	5.96	5.78	5.79	7.12	6.83	5.61	5.77	5.65	5.67	5.70
11:00	6.99	6.91	5.87	5.62	5.73	5.57	5.88	7.27	6.82	5.73	5.63	5.68	5.48	5.70
12:00	6.77	6.72	5.79	5.39	5.42	5.35	5.63	6.94	6.70	5.53	5.46	5.46	5.36	5.43
13:00	6.48	6.39	5.57	5.44	5.43	5.44	5.42	6.65	6.27	5.28	5.37	5.28	5.11	5.37
14:00	6.17	6.23	5.37	5.26	5.32	5.21	5.27	5.89	6.01	5.12	5.15	5.18	5.09	5.23
15:00	5.97	6.09	5.18	5.34	5.21	5.19	5.30	5.96	5.78	5.13	5.07	5.12	5.09	5.12
16:00	5.96	5.96	5.24	5.29	5.36	5.21	5.43	5.89	5.84	5.22	5.08	5.17	5.11	5.22
17:00	5.94	5.97	5.80	5.50	5.60	5.44	5.53	5.84	5.79	5.44	5.32	5.32	5.27	5.36
18:00	5.83	6.34	5.94	5.87	5.88	5.82	5.65	5.57	5.98	5.77	5.73	5.79	5.69	5.60
19:00	5.77	6.37	6.21	6.18	5.99	6.02	5.89	5.56	6.30	6.07	5.81	5.99	5.84	5.48
20:00	5.53	6.37	6.22	6.14	6.08	6.11	5.65	5.49	6.18	5.99	5.90	5.97	5.98	5.39
21:00	5.55	6.01	5.79	6.01	5.85	5.71	5.46	5.20	5.95	5.75	5.77	5.86	5.81	5.36
22:00	5.19	5.50	5.72	5.60	5.34	5.51	4.99	4.89	5.17	5.27	5.24	5.46	5.44	5.15
23:00	4.87	4.76	4.82	4.84	4.83	4.72	4.70	4.60	4.64	4.42	4.66	4.77	4.59	4.66
Average	5.24	5.32	5.24	5.15	5.26	5.09	5.06	5.16	5.21	5.03	4.97	5.04	5.01	4.95
Median	5.58	5.89	5.60	5.42	5.42	5.35	5.42	5.46	5.79	5.38	5.29	5.30	5.19	5.28
Max Hr. Mean	7.00	6.91	6.50	6.37	6.48	6.22	6.57	7.27	6.83	6.52	6.23	6.32	6.22	6.35
Min Hr. Mean	3.37	3.36	3.39	3.39	3.54	3.34	3.17	3.19	3.23	3.13	3.12	3.13	3.33	3.15
Inst. Max	7.28	6.96	6.62	6.52	6.84	6.30	6.67	7.44	6.95	6.61	6.30	6.57	6.38	6.66
Inst. Min	3.33	3.33	3.32	3.26	3.50	3.31	3.11	3.16	3.18	3.10	3.06	3.09	3.30	3.05

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM01 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	71.43	71.40	71.52	71.50	71.65	71.44	71.16	71.06	70.67	70.59	70.65	70.49	70.43	70.72
1:00	71.33	71.41	71.32	71.19	71.27	71.20	71.00	70.77	70.48	70.46	70.55	70.21	70.29	70.64
2:00	71.10	71.18	71.33	71.14	71.06	71.15	70.84	70.63	70.38	70.37	70.47	70.14	70.03	70.44
3:00	71.07	71.05	71.12	71.03	71.11	70.97	70.83	70.69	70.23	70.27	70.14	69.95	70.01	70.27
4:00	70.97	71.01	70.95	70.79	71.29	70.73	70.58	70.45	70.24	70.15	69.92	69.86	69.97	70.16
5:00	71.28	71.06	71.23	71.19	70.79	70.80	70.54	70.39	70.06	70.14	70.17	70.22	70.18	70.31
6:00	70.92	71.19	71.40	71.16	70.87	71.30	70.81	70.33	69.93	70.43	70.56	70.40	70.30	70.43
7:00	70.65	70.97	71.59	71.70	71.39	71.77	71.39	70.39	70.07	70.56	70.91	70.72	70.74	70.86
8:00	70.63	71.06	71.64	71.68	71.27	71.74	71.67	70.15	69.90	70.82	70.90	70.50	70.67	70.93
9:00	71.11	71.32	71.39	71.63	71.38	71.92	71.33	70.39	70.55	70.53	70.64	70.63	70.64	70.49
10:00	71.42	71.61	71.08	71.21	71.33	71.42	71.19	70.82	70.71	70.38	70.32	70.33	70.50	70.49
11:00	71.78	71.84	71.16	71.13	71.24	71.27	70.90	71.40	70.92	70.04	70.11	70.14	70.26	70.34
12:00	71.66	71.76	71.25	71.05	71.28	71.24	70.94	71.36	70.83	70.28	70.17	70.15	70.48	70.27
13:00	71.84	71.92	71.20	70.99	71.23	71.14	70.87	71.51	70.80	70.36	70.11	70.18	70.45	70.33
14:00	71.86	71.53	71.25	71.05	71.24	71.28	70.88	71.36	70.81	70.25	70.11	70.15	70.41	70.51
15:00	71.78	71.38	71.28	70.94	71.10	71.11	70.85	71.18	70.57	70.17	70.03	70.17	70.24	70.57
16:00	71.69	71.38	71.13	70.84	71.15	70.89	71.08	71.11	70.77	70.30	70.26	70.10	70.24	70.61
17:00	71.62	71.35	71.30	71.15	71.15	70.95	70.96	70.98	70.91	70.31	70.36	70.15	70.34	70.52
18:00	71.81	71.80	71.59	71.49	71.40	71.12	70.98	71.00	71.22	70.45	70.64	70.56	70.55	70.99
19:00	71.83	72.01	72.00	71.80	72.12	71.52	71.25	71.32	71.55	70.97	71.03	70.97	71.25	71.02
20:00	72.02	72.23	72.15	72.35	72.16	71.90	71.22	71.09	71.43	71.32	71.31	71.13	71.62	71.22
21:00	71.75	72.12	72.26	72.26	72.15	71.87	71.46	71.35	71.42	71.49	71.29	71.26	71.55	71.17
22:00	71.92	72.21	72.06	72.10	72.04	71.98	71.26	70.97	71.22	71.38	71.17	71.27	71.46	71.14
23:00	71.93	71.93	71.80	71.77	71.97	71.47	71.17	70.86	70.84	70.92	70.85	70.76	71.23	71.02

Average	71.48	71.53	71.46	71.38	71.40	71.34	71.05	70.90	70.69	70.54	70.53	70.44	70.58	70.64
Median	71.58	71.45	71.35	71.20	71.32	71.25	71.06	70.97	70.71	70.39	70.46	70.30	70.46	70.57
Max Hr. Mean	72.02	72.23	72.26	72.35	72.16	71.98	71.67	71.51	71.55	71.49	71.31	71.27	71.62	71.22
Min Hr. Mean	70.63	70.97	70.95	70.79	70.79	70.73	70.54	70.15	69.90	70.04	69.92	69.86	69.97	70.16
Inst. Max	72.25	72.50	72.48	72.44	72.30	72.18	71.77	71.69	71.64	71.61	71.44	71.55	71.99	71.35
Inst. Min	70.51	70.92	70.83	70.74	70.53	70.62	70.46	69.96	69.81	69.93	69.87	69.82	69.89	69.99

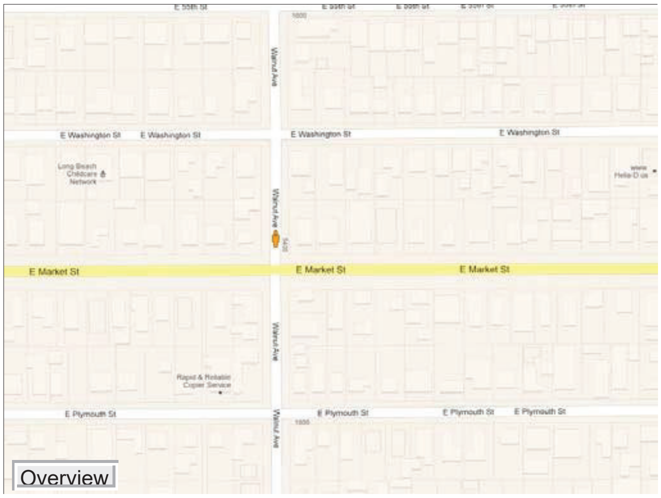
Site Investigation Summary

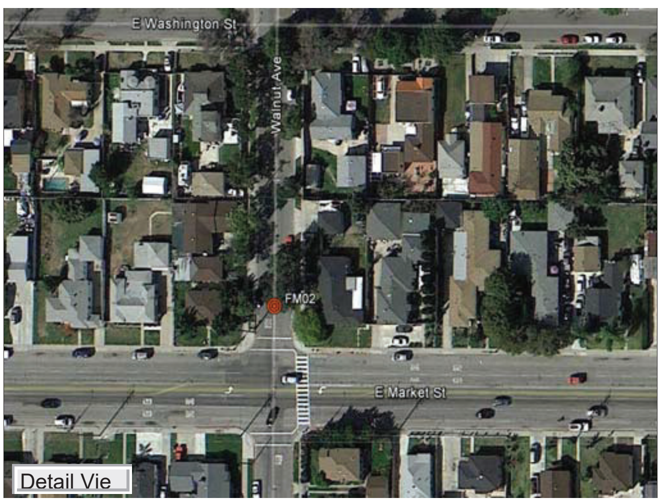
MWH Global - City of Long Beach Master Plan

Site #: FM02 **Date:** 12/27/201

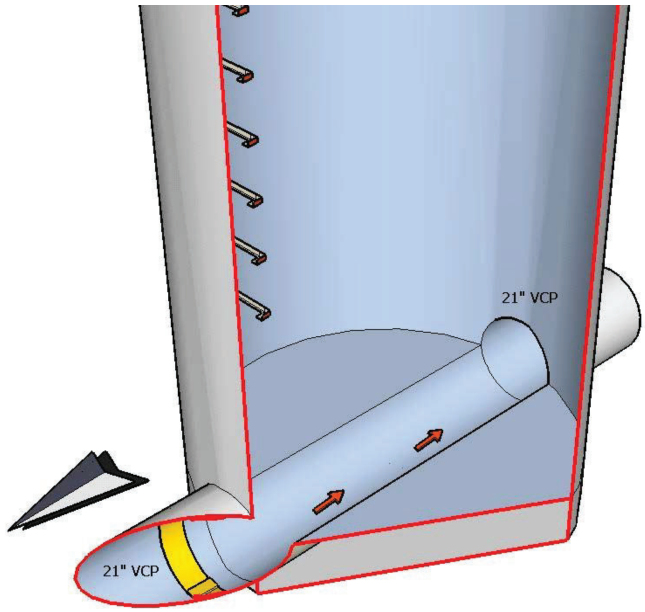
Address: 5404 Walnut Ave

Traffic: Moderate, residential **Job #** 2012.5.166



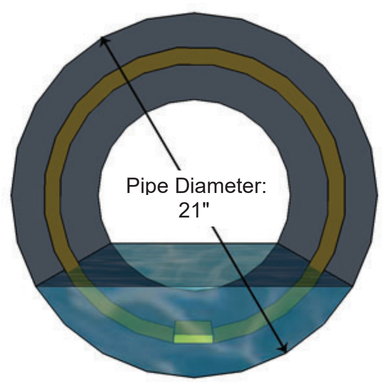


Profile



MH Condition:	Fair	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	11.5'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 3.01 fps

Flow Depth: 9.75"

Pipe Material: VCP

Comments: Excellent hydraulics, straight-through,scouring velocity

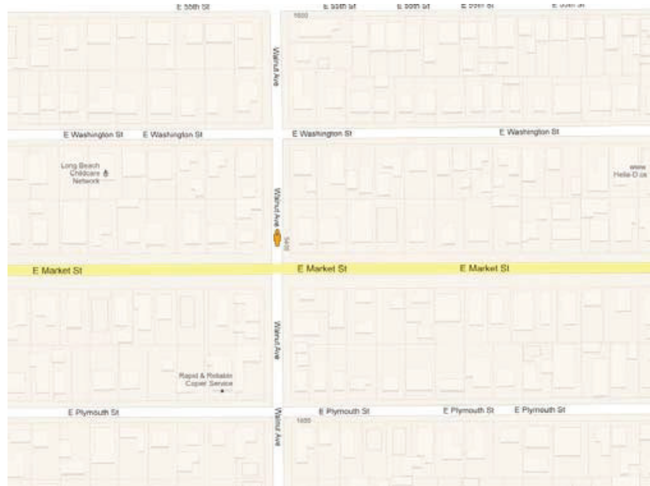
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM02
Map Page: K33-SMH-039
Location: 5404 Walnut Ave
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 12:30:00 PM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Moderate, residential
Manhole Depth: 11.5'

Overview



Facility Inspection

Cover

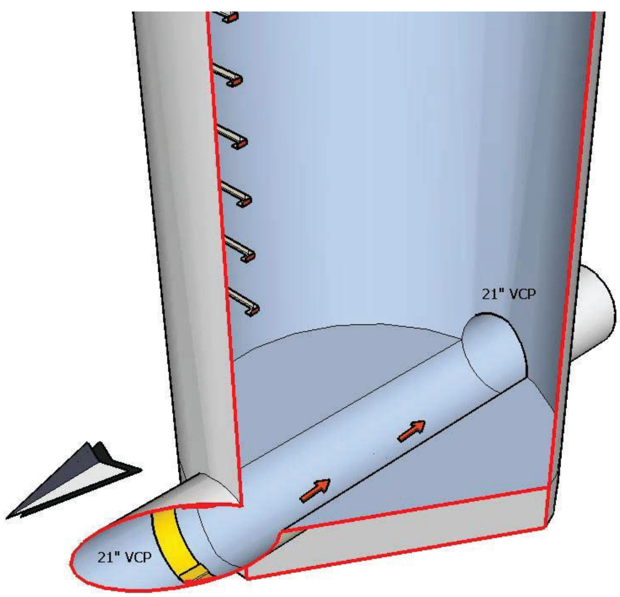
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: Light

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Eccentric
Material: Precast Concrete
Condition: Fair
Infiltration: None



Barrel

Material: Precast Concrete
Condition: Fair
Infiltration: stains

Rungs

Rungs: Yes
Material: Plastic-coated
Condition: Fair

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: None
Vermin: Few - Roaches
Odor: Yes - H2S
Vandalism: None

Observations and Comments

Flow Velocity: 3.01 fps
Flow Depth: 9.75"
Observation Location: Influent Pipe

Comments: Older manhole has sulphur powder buildup

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM02

Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project #	2012.5.166	
Location ID	FM02	
Pipe Diameter	21	Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	....	8.40
Maximum	....	11.62
Minimum	....	5.61
Max d/D	....	55.3%

Velocity - Feet per Second

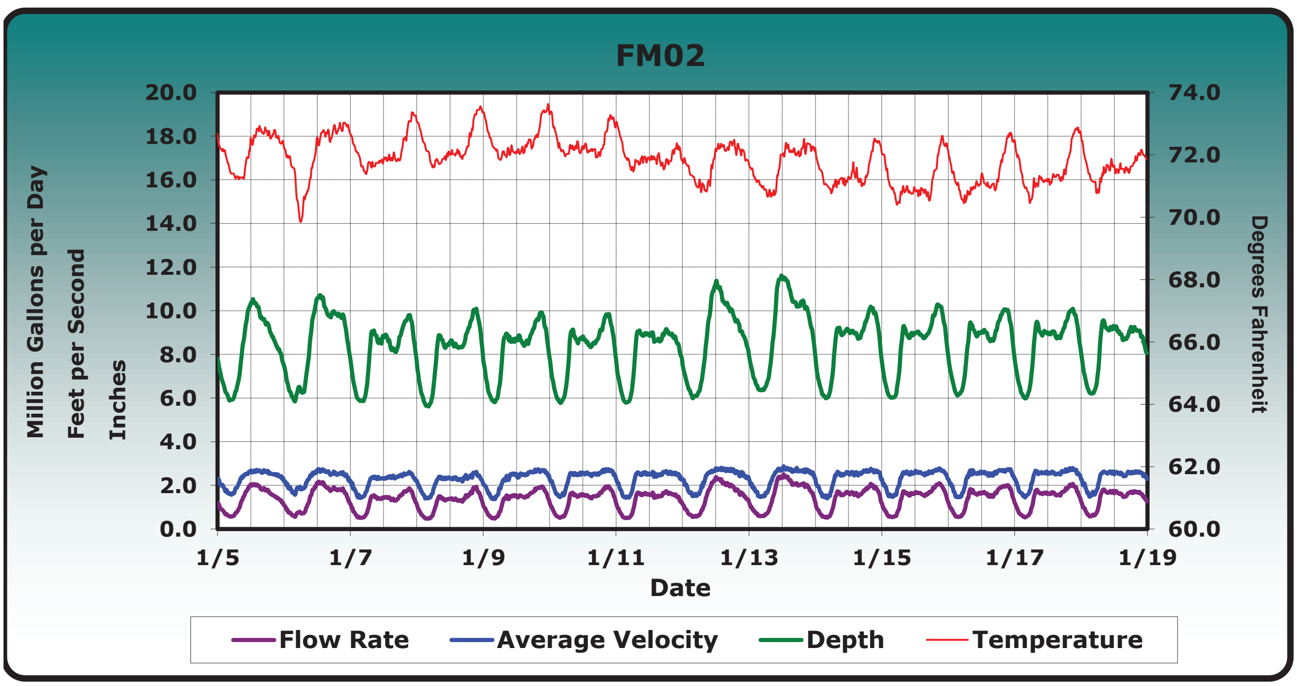
Average	....	2.30
Maximum	....	2.87
Minimum	....	1.35

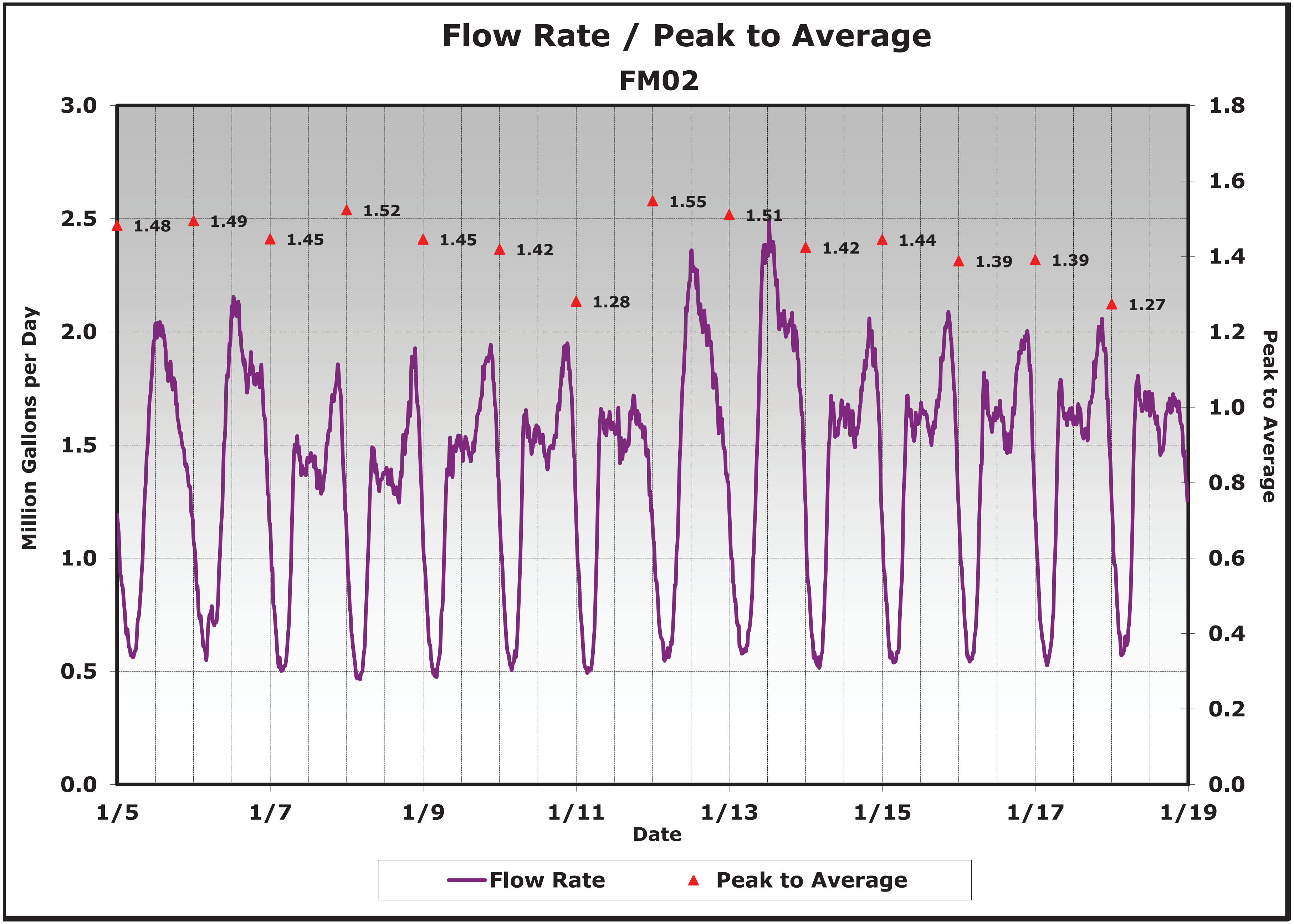
Flow - Million Gallons per Day

Average	....	1.38
Maximum	....	2.49
Minimum	....	0.47
Peak Factor	....	1.80

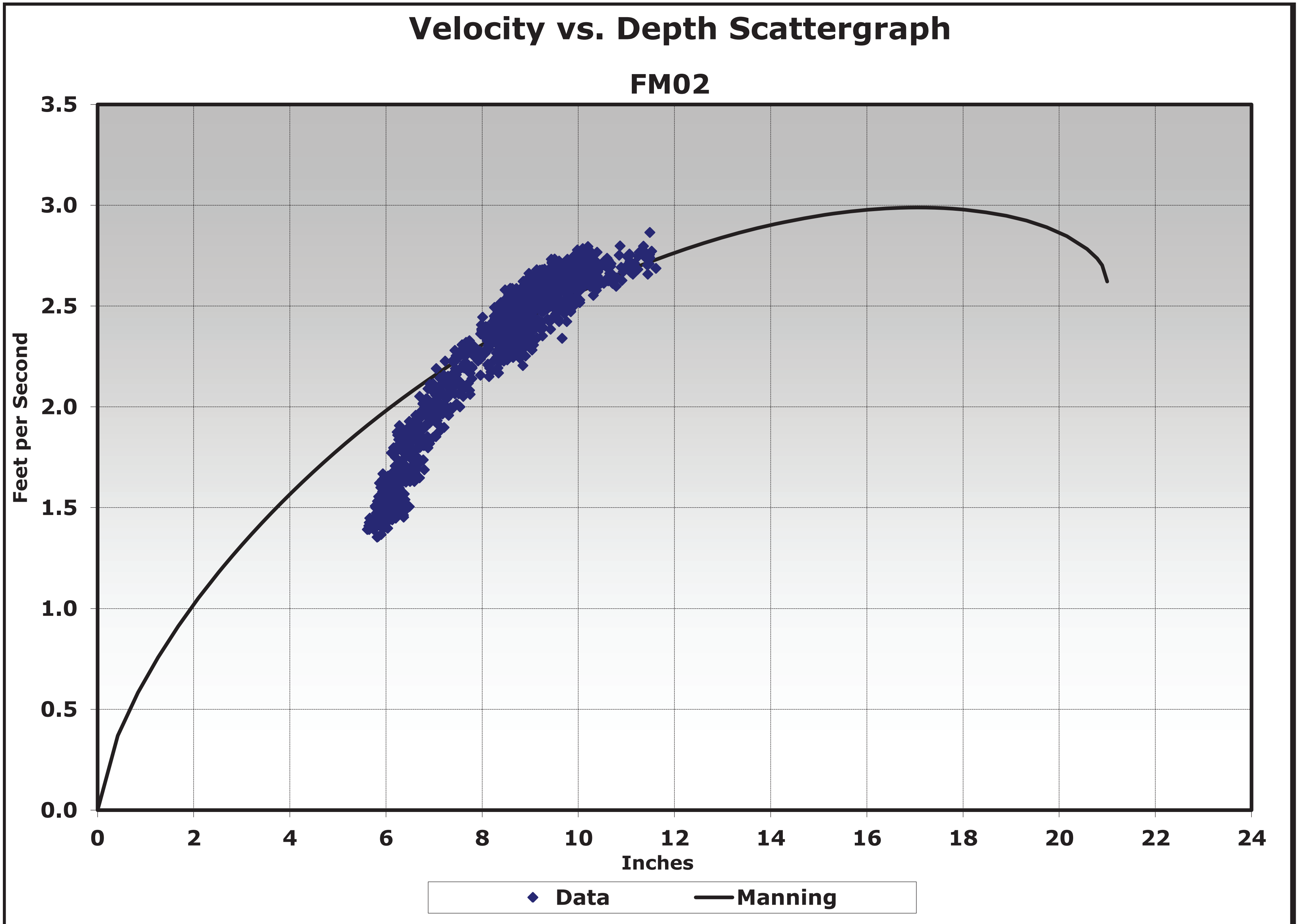
Temperature - Deg. F

Average	....	71.85
Maximum	....	73.63
Minimum	....	69.84

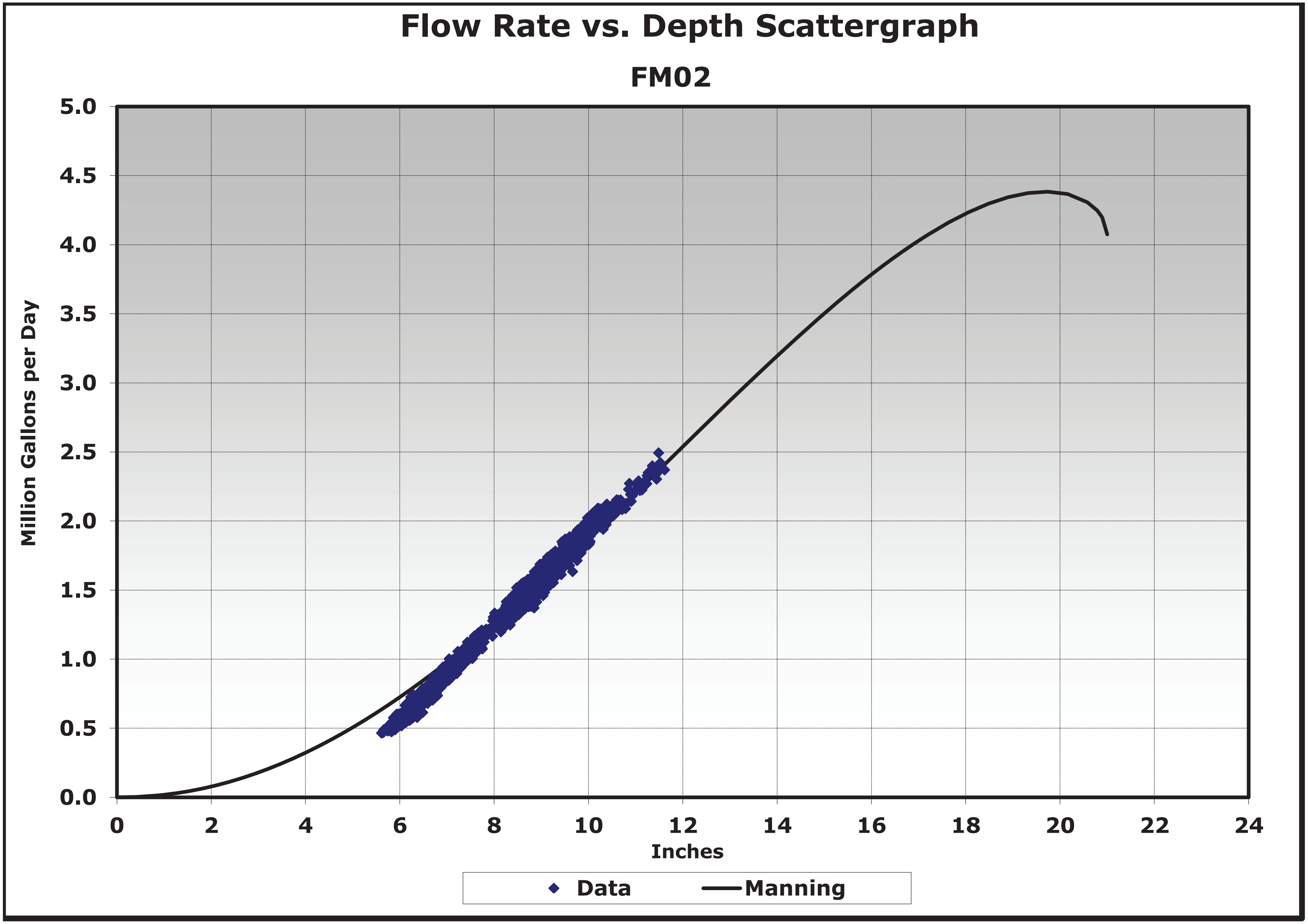




Flow Rate / Peak to Average
FM02
Million Gallons per Day
Peak to Average
Date
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.48
1.49
1.45
1.52
1.45
1.42
1.28
1.55
1.51
1.42
1.44
1.39
1.39
1.27
Flow Rate
Peak to Average



Velocity vs. Depth Scattergraph
FM02
Feet per Second
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM02
Million Gallons per Day
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM02 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.12	1.03	1.03	0.98	0.99	1.08	1.05	1.06	1.10	1.03	1.04	1.09	1.09	1.12
1:00	0.90	0.82	0.76	0.72	0.75	0.82	0.78	0.86	0.90	0.79	0.80	0.86	0.79	0.90
2:00	0.76	0.71	0.57	0.57	0.58	0.61	0.58	0.68	0.75	0.61	0.60	0.64	0.64	0.67
3:00	0.65	0.60	0.52	0.48	0.49	0.53	0.51	0.59	0.63	0.54	0.56	0.56	0.55	0.58
4:00	0.58	0.64	0.52	0.48	0.51	0.55	0.51	0.58	0.59	0.54	0.56	0.57	0.57	0.62
5:00	0.58	0.76	0.61	0.57	0.64	0.63	0.61	0.59	0.60	0.64	0.68	0.71	0.69	0.70
6:00	0.69	0.71	0.91	0.88	0.91	0.96	1.00	0.71	0.70	1.01	1.04	1.10	1.10	1.08
7:00	0.85	0.76	1.39	1.28	1.33	1.50	1.54	0.96	0.92	1.50	1.54	1.55	1.64	1.65
8:00	1.16	1.06	1.50	1.47	1.45	1.61	1.62	1.35	1.31	1.68	1.66	1.75	1.73	1.76
9:00	1.45	1.40	1.44	1.37	1.43	1.55	1.57	1.74	1.76	1.56	1.59	1.66	1.63	1.67
10:00	1.71	1.74	1.39	1.33	1.50	1.49	1.61	2.02	2.26	1.58	1.57	1.59	1.62	1.70
11:00	1.92	1.94	1.40	1.36	1.52	1.55	1.58	2.19	2.36	1.67	1.61	1.64	1.64	1.69
12:00	2.02	2.12	1.44	1.38	1.48	1.55	1.57	2.32	2.41	1.62	1.66	1.64	1.61	1.69
13:00	2.02	2.10	1.43	1.34	1.51	1.53	1.55	2.25	2.38	1.66	1.64	1.64	1.64	1.64
14:00	2.00	2.06	1.39	1.33	1.47	1.45	1.48	2.15	2.28	1.60	1.59	1.55	1.61	1.59
15:00	1.88	1.89	1.35	1.30	1.47	1.44	1.49	2.05	2.11	1.53	1.54	1.50	1.55	1.48
16:00	1.82	1.80	1.30	1.28	1.53	1.49	1.52	2.05	2.05	1.58	1.59	1.52	1.56	1.52
17:00	1.78	1.81	1.43	1.44	1.64	1.53	1.65	1.97	2.04	1.71	1.68	1.67	1.69	1.65
18:00	1.73	1.85	1.55	1.51	1.74	1.66	1.67	1.92	2.00	1.83	1.81	1.84	1.79	1.67
19:00	1.59	1.78	1.69	1.63	1.84	1.79	1.62	1.78	2.05	1.92	1.95	1.92	1.91	1.69
20:00	1.51	1.79	1.74	1.80	1.88	1.91	1.58	1.66	1.96	2.00	2.05	1.95	1.99	1.67
21:00	1.43	1.79	1.81	1.87	1.91	1.91	1.54	1.63	1.93	1.90	2.01	1.98	1.97	1.64
22:00	1.35	1.58	1.63	1.66	1.73	1.75	1.45	1.50	1.71	1.78	1.80	1.84	1.80	1.52
23:00	1.22	1.29	1.29	1.34	1.44	1.44	1.25	1.35	1.47	1.44	1.46	1.44	1.49	1.34

Average	1.36	1.42	1.25	1.22	1.32	1.35	1.31	1.50	1.59	1.41	1.42	1.42	1.43	1.39
Median	1.43	1.63	1.38	1.34	1.48	1.50	1.52	1.63	1.88	1.58	1.60	1.61	1.61	1.59
Max Hr. Mean	2.02	2.12	1.81	1.87	1.91	1.91	1.67	2.32	2.41	2.00	2.05	1.98	1.99	1.76
Min Hr. Mean	0.58	0.60	0.52	0.48	0.49	0.53	0.51	0.58	0.59	0.54	0.56	0.56	0.55	0.58
Inst. Max	2.04	2.15	1.86	1.93	1.94	1.95	1.72	2.36	2.49	2.06	2.09	2.00	2.06	1.81
Inst. Min	0.56	0.55	0.50	0.47	0.48	0.51	0.49	0.55	0.58	0.52	0.54	0.54	0.53	0.57
Peak To Avg.	1.48	1.49	1.45	1.52	1.45	1.42	1.28	1.55	1.51	1.42	1.44	1.39	1.39	1.27

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM02 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	2.22	2.15	2.10	2.07	2.00	2.20	2.17	2.20	2.13	2.07	2.13	2.16	2.20	2.15
1:00	2.00	1.94	1.81	1.79	1.78	1.94	1.87	1.97	1.93	1.84	1.89	1.94	1.83	1.98
2:00	1.85	1.83	1.54	1.56	1.54	1.63	1.55	1.69	1.74	1.57	1.56	1.59	1.64	1.66
3:00	1.70	1.65	1.46	1.40	1.39	1.50	1.45	1.58	1.55	1.45	1.51	1.47	1.49	1.50
4:00	1.61	1.72	1.46	1.42	1.43	1.55	1.44	1.54	1.48	1.46	1.52	1.48	1.53	1.60
5:00	1.60	1.88	1.61	1.56	1.65	1.64	1.60	1.55	1.51	1.60	1.69	1.71	1.70	1.70
6:00	1.78	1.83	1.95	1.95	1.94	2.08	2.09	1.72	1.65	2.07	2.11	2.16	2.19	2.11
7:00	1.99	1.89	2.29	2.24	2.23	2.49	2.52	2.04	1.94	2.45	2.47	2.49	2.58	2.53
8:00	2.28	2.19	2.35	2.38	2.31	2.51	2.53	2.36	2.29	2.56	2.55	2.60	2.58	2.60
9:00	2.41	2.37	2.32	2.30	2.34	2.53	2.50	2.56	2.54	2.48	2.56	2.57	2.57	2.55
10:00	2.51	2.51	2.33	2.31	2.50	2.48	2.56	2.62	2.70	2.49	2.52	2.54	2.56	2.60
11:00	2.59	2.58	2.31	2.33	2.51	2.54	2.51	2.66	2.71	2.57	2.55	2.58	2.58	2.58
12:00	2.62	2.69	2.31	2.31	2.41	2.54	2.50	2.74	2.77	2.53	2.61	2.56	2.55	2.57
13:00	2.64	2.65	2.34	2.30	2.48	2.55	2.49	2.73	2.76	2.58	2.58	2.55	2.58	2.54
14:00	2.67	2.68	2.38	2.29	2.49	2.50	2.46	2.73	2.72	2.53	2.55	2.51	2.54	2.54
15:00	2.64	2.60	2.38	2.26	2.48	2.47	2.47	2.69	2.67	2.49	2.50	2.49	2.52	2.43
16:00	2.62	2.55	2.34	2.22	2.56	2.51	2.49	2.72	2.67	2.53	2.53	2.50	2.53	2.48
17:00	2.62	2.52	2.41	2.38	2.60	2.51	2.60	2.69	2.71	2.62	2.59	2.58	2.62	2.59
18:00	2.59	2.56	2.44	2.34	2.64	2.57	2.59	2.69	2.65	2.65	2.60	2.67	2.65	2.57
19:00	2.52	2.49	2.51	2.41	2.67	2.66	2.58	2.59	2.66	2.64	2.68	2.68	2.69	2.59
20:00	2.49	2.54	2.51	2.50	2.65	2.69	2.53	2.49	2.64	2.70	2.72	2.65	2.73	2.59
21:00	2.47	2.53	2.56	2.55	2.68	2.69	2.53	2.55	2.67	2.63	2.70	2.71	2.71	2.59
22:00	2.41	2.44	2.46	2.42	2.62	2.66	2.48	2.43	2.56	2.62	2.62	2.69	2.62	2.49
23:00	2.33	2.26	2.27	2.23	2.48	2.46	2.31	2.35	2.45	2.45	2.43	2.45	2.47	2.38

Average	2.30	2.29	2.18	2.15	2.27	2.33	2.28	2.33	2.34	2.32	2.34	2.35	2.36	2.33
Median	2.45	2.47	2.32	2.28	2.46	2.50	2.48	2.52	2.60	2.52	2.54	2.54	2.54	2.53
Max Hr. Mean	2.67	2.69	2.56	2.55	2.68	2.69	2.60	2.74	2.77	2.70	2.72	2.71	2.73	2.60
Min Hr. Mean	1.60	1.65	1.46	1.40	1.39	1.50	1.44	1.54	1.48	1.45	1.51	1.47	1.49	1.50
Inst. Max	2.70	2.74	2.61	2.61	2.72	2.73	2.64	2.80	2.87	2.76	2.77	2.73	2.79	2.64
Inst. Min	1.56	1.56	1.41	1.39	1.35	1.45	1.42	1.50	1.45	1.40	1.47	1.44	1.43	1.47

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM02 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	7.56	7.27	7.41	7.21	7.46	7.43	7.33	7.32	7.70	7.44	7.35	7.57	7.47	7.73
1:00	6.96	6.62	6.58	6.41	6.65	6.64	6.61	6.80	7.12	6.70	6.63	6.89	6.76	6.98
2:00	6.51	6.24	6.06	5.94	6.13	6.11	6.06	6.40	6.72	6.25	6.18	6.38	6.29	6.47
3:00	6.18	5.97	5.89	5.68	5.89	5.87	5.82	6.09	6.44	6.06	6.03	6.15	6.04	6.23
4:00	5.92	6.05	5.88	5.66	5.86	5.85	5.83	6.08	6.37	6.04	6.05	6.24	6.06	6.25
5:00	5.94	6.47	6.14	5.97	6.21	6.15	6.16	6.17	6.41	6.40	6.38	6.59	6.46	6.56
6:00	6.22	6.28	7.13	6.95	7.18	7.04	7.23	6.49	6.65	7.36	7.42	7.58	7.50	7.62
7:00	6.70	6.43	8.66	8.32	8.56	8.62	8.72	7.21	7.18	8.74	8.83	8.82	8.97	9.15
8:00	7.57	7.33	9.00	8.83	8.91	9.04	9.05	8.30	8.29	9.20	9.15	9.37	9.36	9.44
9:00	8.61	8.49	8.80	8.58	8.71	8.74	8.89	9.48	9.62	8.94	8.85	9.08	8.98	9.18
10:00	9.49	9.60	8.59	8.35	8.60	8.61	8.93	10.44	11.15	9.00	8.86	8.87	8.98	9.17
11:00	10.12	10.23	8.66	8.46	8.68	8.73	8.94	11.02	11.49	9.14	8.94	8.99	9.01	9.22
12:00	10.41	10.61	8.84	8.61	8.74	8.73	8.89	11.24	11.48	9.03	8.99	9.03	8.95	9.23
13:00	10.38	10.64	8.73	8.43	8.73	8.58	8.85	11.01	11.42	9.06	8.98	9.05	8.99	9.08
14:00	10.22	10.38	8.43	8.40	8.49	8.39	8.63	10.60	11.13	8.96	8.87	8.81	8.98	8.91
15:00	9.83	9.98	8.24	8.32	8.53	8.43	8.66	10.33	10.63	8.78	8.77	8.65	8.78	8.69
16:00	9.62	9.76	8.14	8.35	8.59	8.54	8.71	10.25	10.40	8.85	8.91	8.71	8.79	8.75
17:00	9.45	9.87	8.52	8.65	8.95	8.71	8.97	10.04	10.25	9.17	9.14	9.12	9.08	9.02
18:00	9.33	9.90	8.99	9.09	9.27	9.08	9.10	9.82	10.27	9.56	9.63	9.55	9.42	9.13
19:00	8.93	9.83	9.40	9.45	9.57	9.38	8.93	9.54	10.42	9.98	9.95	9.87	9.78	9.17
20:00	8.68	9.75	9.60	9.90	9.79	9.78	8.87	9.34	10.15	10.10	10.25	10.05	10.00	9.09
21:00	8.38	9.75	9.75	10.00	9.84	9.77	8.73	9.02	9.92	9.90	10.13	10.00	9.95	8.97
22:00	8.17	9.12	9.25	9.52	9.25	9.25	8.46	8.76	9.32	9.47	9.54	9.50	9.54	8.69
23:00	7.76	8.27	8.26	8.60	8.39	8.44	7.97	8.35	8.59	8.46	8.61	8.50	8.64	8.20

Average	8.29	8.53	8.12	8.07	8.21	8.16	8.10	8.75	9.13	8.44	8.44	8.47	8.45	8.37
Median	8.44	9.32	8.53	8.43	8.63	8.58	8.66	9.07	9.83	8.95	8.89	8.94	8.95	8.89
Max Hr. Mean	10.41	10.64	9.75	10.00	9.84	9.78	9.10	11.24	11.49	10.10	10.25	10.05	10.00	9.44
Min Hr. Mean	5.92	5.97	5.88	5.66	5.86	5.85	5.82	6.08	6.37	6.04	6.03	6.15	6.04	6.23
Inst. Max	10.53	10.72	9.80	10.09	9.93	9.84	9.15	11.38	11.62	10.19	10.28	10.07	10.09	9.56
Inst. Min	5.89	5.85	5.86	5.61	5.81	5.78	5.79	5.99	6.36	5.99	6.01	6.12	5.98	6.20

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM02 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	72.45	72.17	72.61	73.04	73.30	73.36	72.97	71.83	71.63	71.98	72.03	71.95	72.25	72.46
1:00	72.18	71.93	72.31	72.77	72.91	72.98	72.66	71.72	71.47	71.61	71.72	71.52	71.92	71.94
2:00	72.15	71.82	72.09	72.44	72.60	72.65	72.30	71.54	71.22	71.43	71.28	71.26	71.50	71.57
3:00	71.86	71.59	71.90	72.20	72.32	72.31	71.95	71.34	71.15	71.09	70.95	71.07	71.05	71.28
4:00	71.56	70.98	71.61	72.04	72.18	72.15	71.85	71.20	71.00	71.01	70.84	70.76	70.90	71.14
5:00	71.40	70.23	71.43	71.69	72.01	72.03	71.59	70.97	70.93	70.88	70.49	70.53	70.60	70.96
6:00	71.30	69.93	71.63	71.68	71.87	72.03	71.55	71.03	70.79	70.91	70.53	70.59	70.69	70.89
7:00	71.27	70.55	71.68	71.82	72.08	72.21	71.80	71.00	70.77	71.10	70.85	70.78	71.09	71.26
8:00	71.27	70.79	71.67	71.72	72.00	72.23	71.73	70.85	70.71	71.14	70.84	70.87	71.07	71.45
9:00	71.28	71.14	71.71	71.84	72.10	72.23	71.86	71.10	70.78	71.24	70.90	70.95	71.27	71.62
10:00	71.76	71.67	71.76	71.90	72.18	72.30	71.91	71.39	71.29	71.11	70.79	71.07	71.16	71.57
11:00	72.02	72.07	71.79	72.04	72.07	72.12	71.85	71.86	71.82	71.15	70.82	71.04	71.18	71.72
12:00	72.43	72.43	71.86	72.05	72.12	72.25	71.89	72.18	72.00	71.25	70.84	71.32	71.14	71.53
13:00	72.56	72.61	71.85	72.02	72.07	72.23	71.91	72.26	72.24	71.50	70.80	71.06	71.16	71.49
14:00	72.80	72.75	71.91	72.08	72.15	72.13	71.81	72.29	72.20	71.38	70.85	71.02	71.33	71.60
15:00	72.83	72.67	71.93	72.04	72.24	72.15	71.96	72.18	72.12	71.29	70.84	70.98	71.34	71.51
16:00	72.71	72.61	71.86	71.93	72.43	72.11	71.72	72.20	72.13	71.16	70.75	71.03	71.24	71.55
17:00	72.79	72.61	71.84	72.03	72.35	71.98	71.60	72.39	72.02	71.06	70.61	70.99	71.28	71.49
18:00	72.71	72.88	72.01	72.25	72.43	72.06	71.81	72.40	72.02	71.27	71.16	71.35	71.49	71.64
19:00	72.57	72.75	72.47	72.64	72.60	72.26	71.76	72.15	72.25	71.62	71.52	71.81	71.85	71.81
20:00	72.73	72.91	72.65	72.99	72.88	72.73	72.02	72.26	72.22	72.05	71.97	72.10	72.28	71.92
21:00	72.60	72.90	73.06	73.33	73.35	73.08	72.16	72.10	72.36	72.44	72.42	72.53	72.68	72.06
22:00	72.48	72.98	73.29	73.45	73.39	73.21	72.25	72.01	72.23	72.42	72.43	72.66	72.83	72.05
23:00	72.40	72.86	73.26	73.47	73.52	73.05	72.03	71.83	72.21	72.36	72.31	72.47	72.76	71.91
Average	72.17	71.99	72.09	72.31	72.46	72.41	71.96	71.75	71.65	71.44	71.19	71.32	71.50	71.60
Median	72.35	72.31	71.88	72.08	72.26	72.22	71.87	71.85	71.97	71.26	70.89	71.08	71.28	71.57
Max Hr. Mean	72.83	72.98	73.29	73.47	73.52	73.36	72.97	72.40	72.36	72.44	72.43	72.66	72.83	72.46
Min Hr. Mean	71.27	69.93	71.43	71.68	71.87	71.98	71.55	70.85	70.71	70.88	70.49	70.53	70.60	70.89
Inst. Max	72.93	73.03	73.36	73.56	73.63	73.39	73.06	72.48	72.51	72.52	72.60	72.70	72.88	72.64
Inst. Min	71.21	69.84	71.38	71.59	71.84	71.92	71.47	70.80	70.65	70.77	70.40	70.45	70.45	70.77

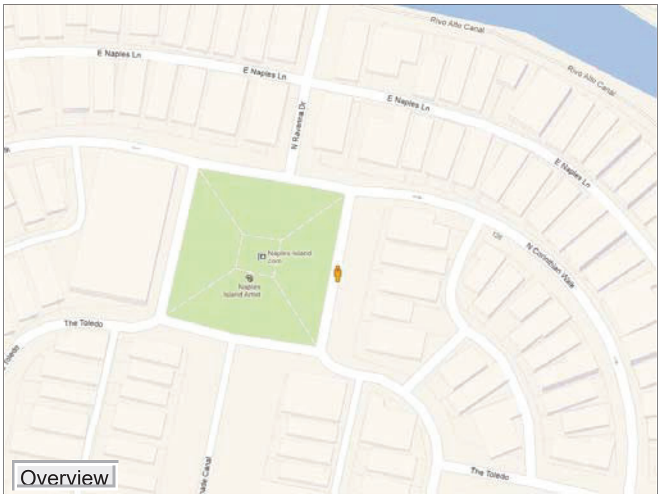
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

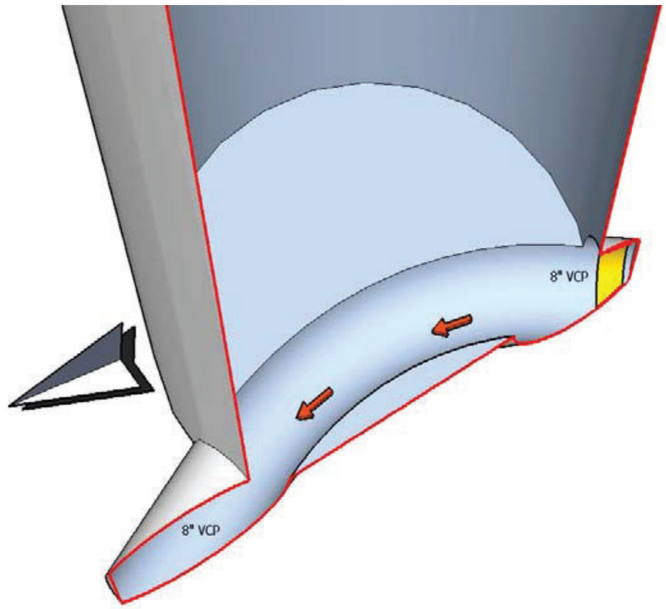
Site #: FM03 **Date:** 12/27/201

Address: Ravenna St. S/of Corinthian Walk

Traffic: Light, residential **Job #** 2012.5.166

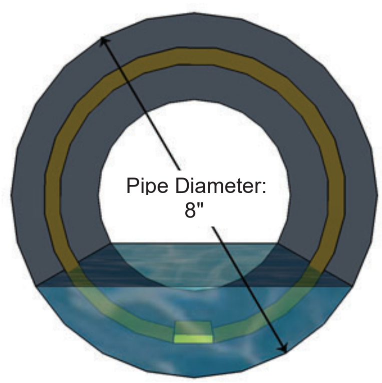


Profile



MH Condition:	Good	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	Yes	**Manhole Depth:**	5.5'

Cross Section



Monitor SN:	ISCO
SensorType:	Pressure transducer, Doppler Velocity
Velocity:	0.65 fps
Flow Depth:	4.00"
Pipe Material:	VCP
Comments:	Pipe full to 50% capacity, slow flow, silted

DownStream Services, Inc.

Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166

Site Identifier: FM03

Map Page:

Location: Ravenna St. S/of Corinthian Walk

Weather: Sunny

Team: D. Ramos & J. White

Date/Time: 12/27/2012 5:30:00 PM

Site Status: New Site

Surroundings: Asphalt

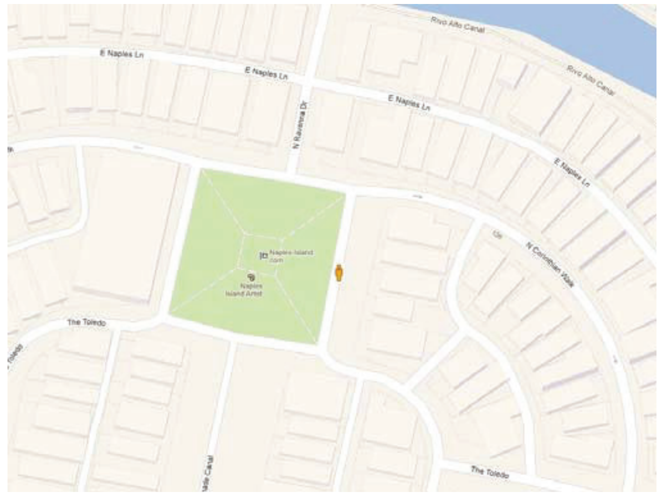
Surface Condition: Roadway

Traffic Setup: Roadway

Traffic Volume: Light, residential

Manhole Depth: 5.5'

Overview



Facility Inspection

Cover

Status: Normal

Shape: Round

Size: 24" diameter

Material: Cast iron

Corrosion: Light

Grade Ring / Frame

Condition: Fair

Corrosion: Moderate

Lid/Frame Seal: None

Frame/Ring Seal: Good

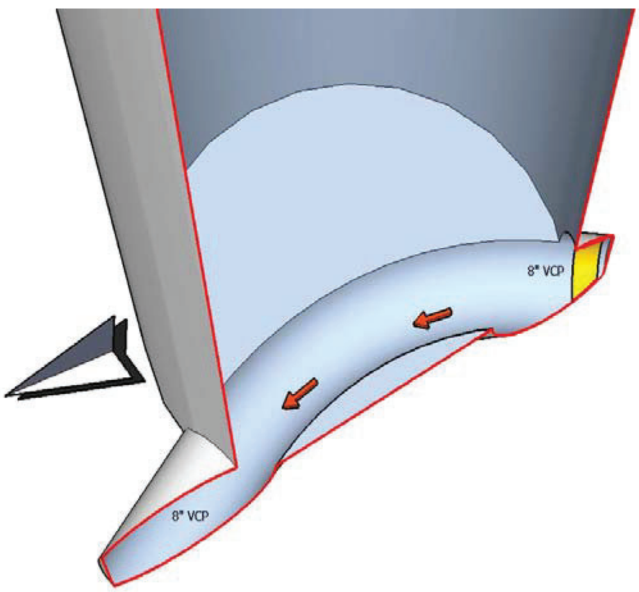
Cone

Shape: Concentric

Material: Brick

Condition: Fair

Infiltration: None



Barrel

Material: Brick

Condition: good

Infiltration: stains

Rungs

Rungs: Yes

Material: Cast Iron

Condition: Offset

Bench

Material: Brick

Condition: Good

Infiltration: Stains

Channel

Material: Brick

Condition: Good

Infiltration: None

Defect Observation

Surcharge

Active: None

Evidence: Old

Level: to 10"

Silt

Present: Yes

Depth: 1.50"

Debris

Present: No

Desc.: N/A

Other

Grease: None

Vermin: Few - Roaches

Odor: No - N/A

Vandalism: None

Observations and Comments

Flow Velocity: 0.65 fps

Flow Depth: 4.00"

Observation Location: Influent Pipe

Comments: Older brick manhole; 50% pipe capacity

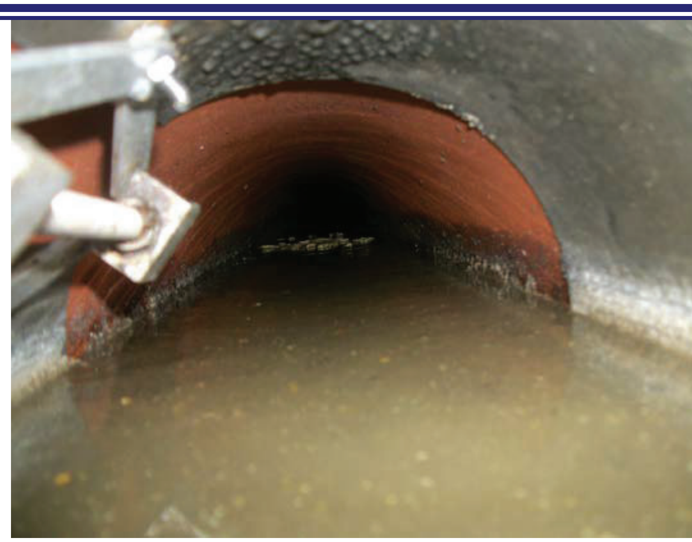
DownStream Services, Inc.

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM03


Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project #	2012.5.166
Location	FM03
Pipe Diameter	8 Inches

Report Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	3.91
Maximum	4.57
Minimum	3.10
Max d/D	57.1%

Velocity - Feet per Second

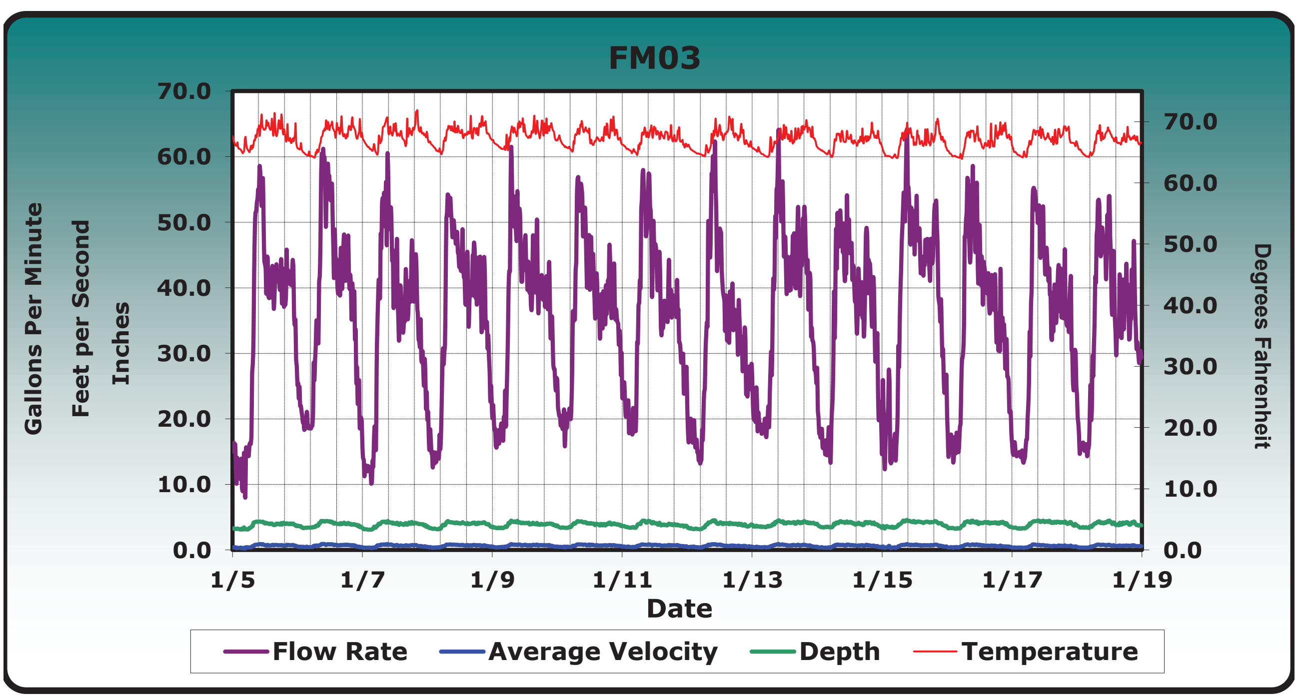
Average	0.61
Maximum	0.91
Minimum	0.22

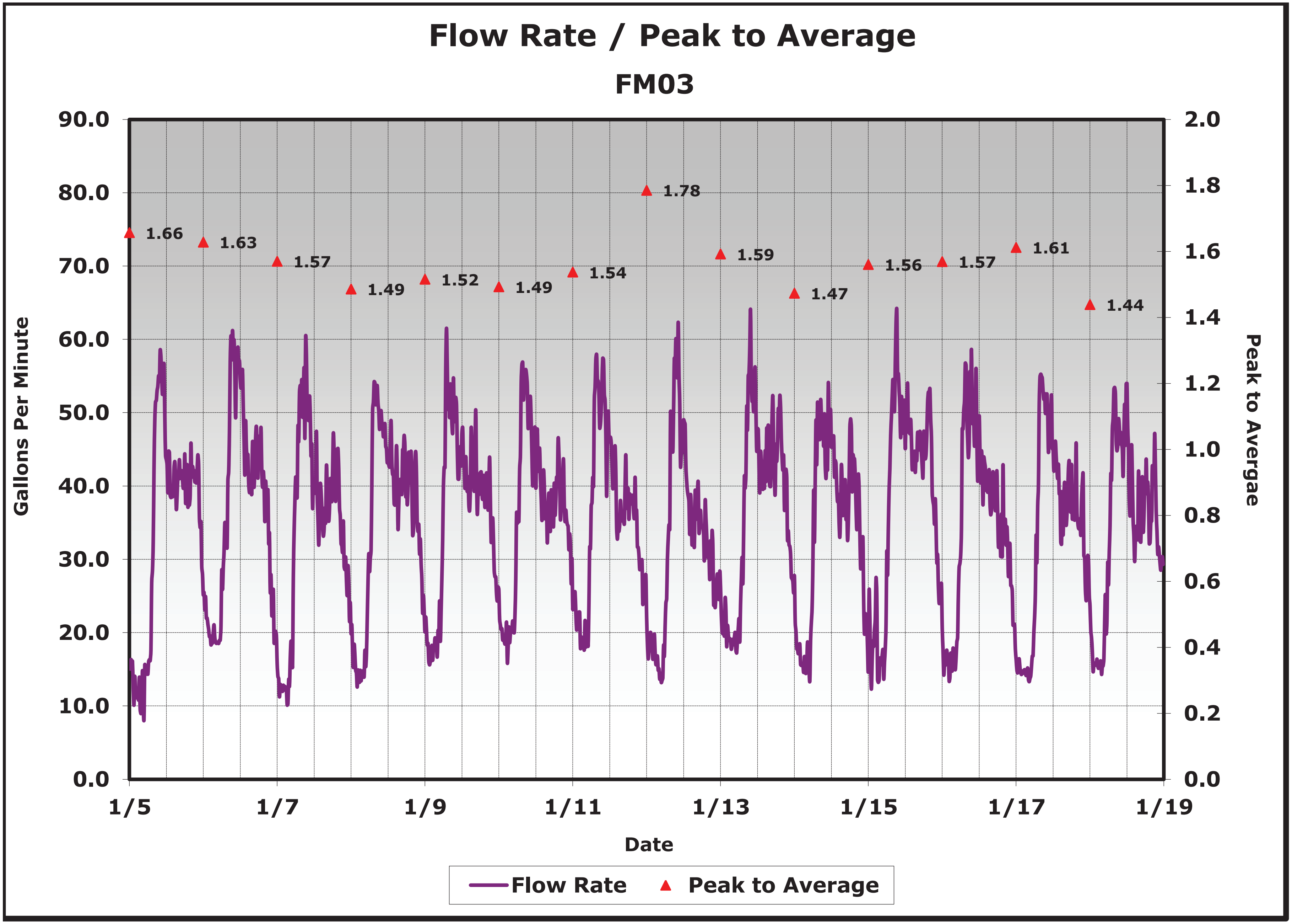
Flow - Gallons per Minute

Average	35.18
Maximum	64.02
Minimum	8.16
Peak Factor	1.82

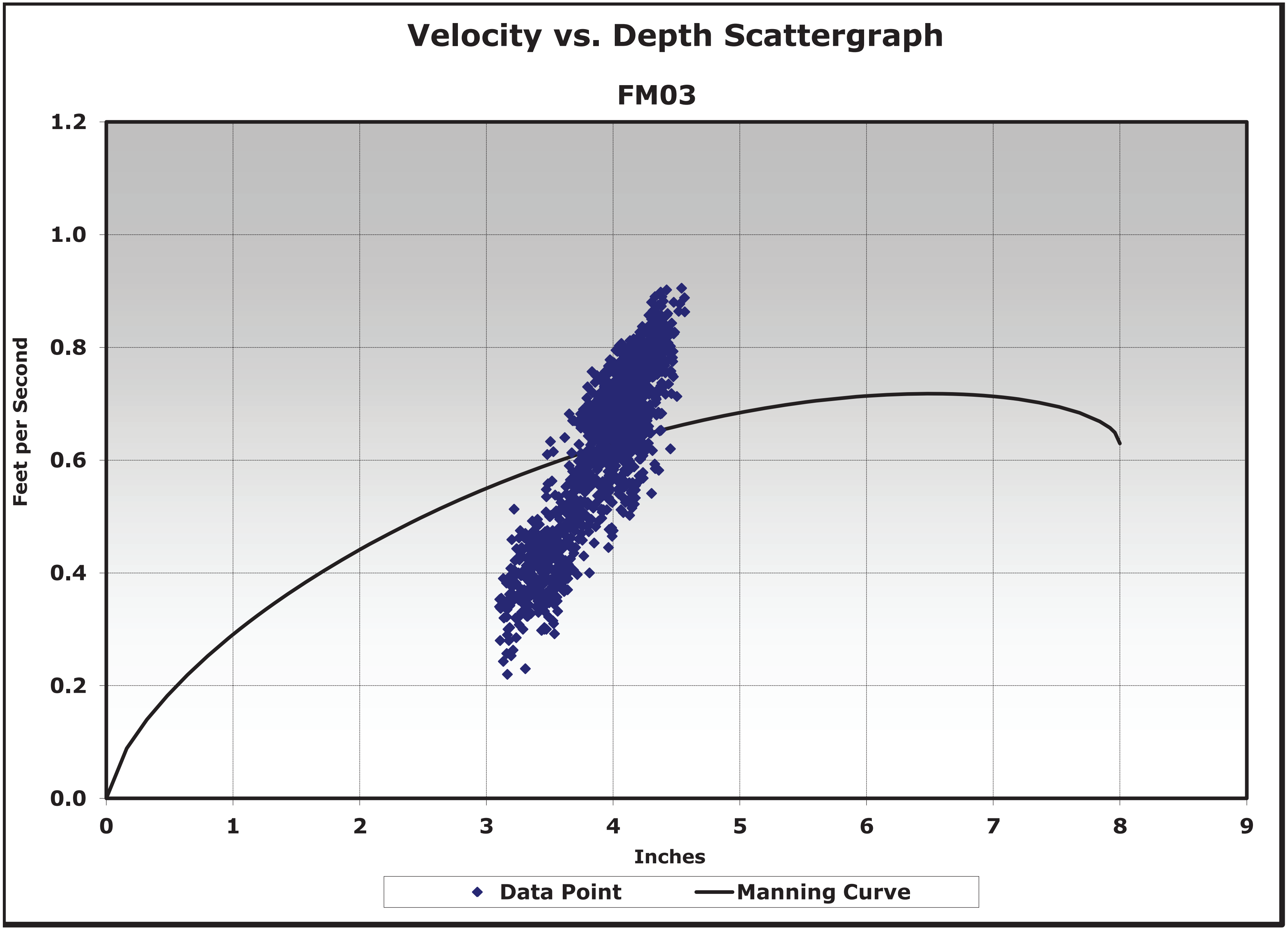
Temperature - Deg. F

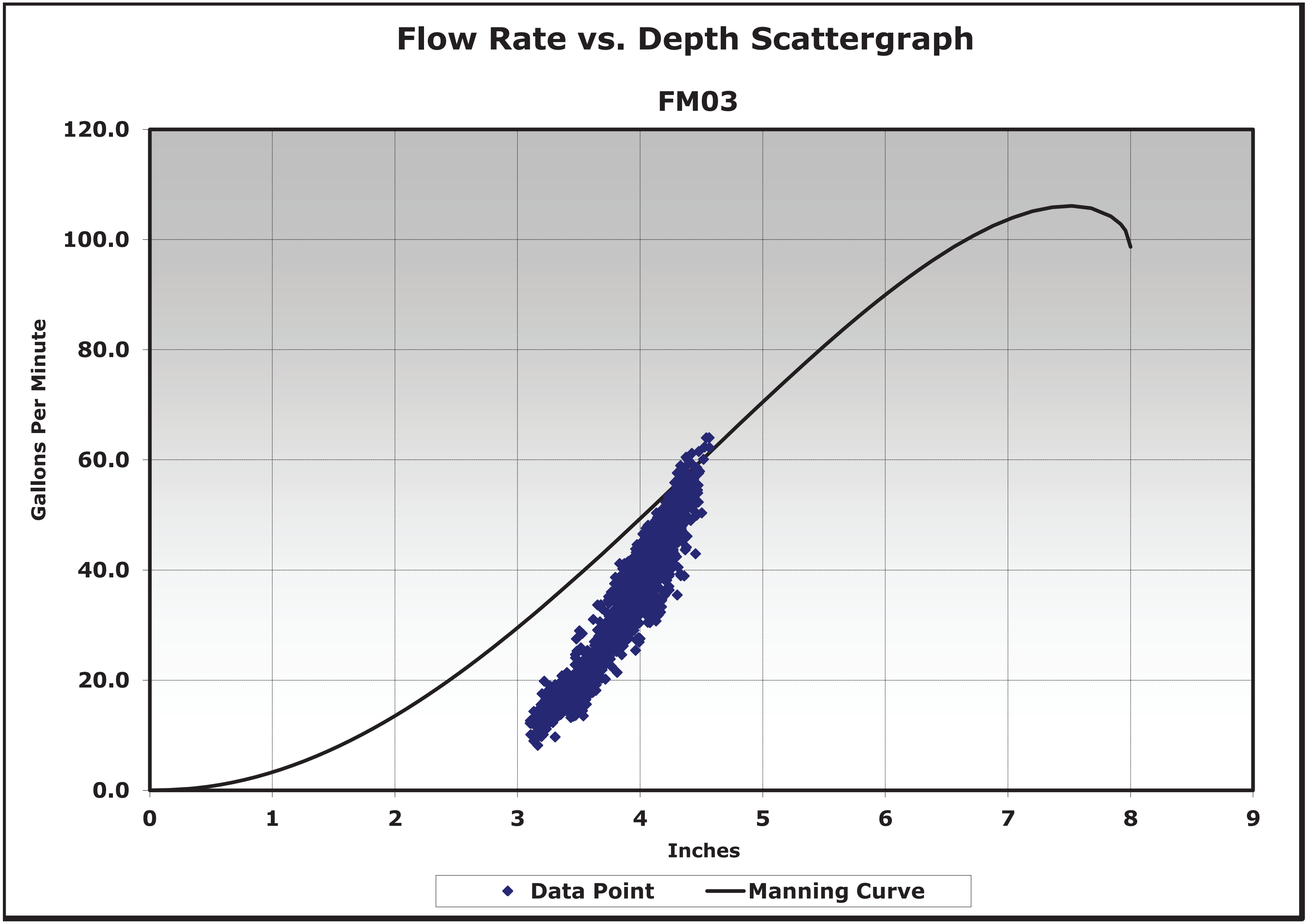
Average	67.17
Maximum	71.85
Minimum	63.88





Flow Rate / Peak to Average
FM03
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Gallons Per Minute
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Peak to Avergae
1.66
1.63
1.57
1.49
1.52
1.49
1.54
1.78
1.59
1.47
1.56
1.57
1.61
1.44
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
Date
Flow Rate
Peak to Average


Velocity vs. Depth Scattergraph
FM03
Feet per Second
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
4
5
6
7
8
9
Inches
Data Point
Manning Curve


Flow Rate vs. Depth Scattergraph
FM03
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Gallons Per Minute
0
1
2
3
4
5
6
7
8
9
Inches
Data Point
Manning Curve

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM03 Tabular - Flow Rate in GPM

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	15.85	24.66	13.68	18.40	20.23	22.28	24.74	18.64	22.17	21.76	19.43	17.05	15.50	20.18
1:00	13.18	21.39	12.54	16.16	16.55	19.52	21.26	18.99	21.93	17.91	16.40	16.40	15.11	15.46
2:00	11.67	18.97	12.54	13.70	17.13	18.65	20.72	17.78	19.48	15.64	23.76	15.27	14.73	15.65
3:00	10.82	19.75	11.54	14.24	18.60	19.24	18.44	15.79	18.57	15.08	14.20	16.37	14.59	15.41
4:00	10.61	18.64	16.24	15.44	20.21	20.56	19.70	14.09	19.19	16.47	16.47	16.55	13.69	17.15
5:00	14.75	19.33	28.62	24.10	25.49	26.59	26.25	15.59	18.62	19.34	17.16	25.78	17.26	24.06
6:00	15.71	28.58	42.27	32.50	45.25	36.98	39.05	24.89	22.92	35.55	33.18	40.08	27.57	33.44
7:00	26.30	33.31	50.99	52.52	55.36	52.92	55.10	37.88	32.92	47.41	47.77	53.81	45.86	47.75
8:00	48.57	46.72	53.02	52.15	50.79	54.38	52.38	47.69	44.94	49.23	53.06	46.49	54.46	49.25
9:00	54.00	59.46	53.85	49.43	50.32	51.21	52.62	57.91	58.36	48.21	59.25	53.68	51.17	47.14
10:00	55.93	55.15	50.24	47.98	47.30	49.18	52.06	55.94	52.02	42.43	50.63	48.90	49.02	44.86
11:00	51.60	57.18	41.94	45.56	43.38	44.84	45.15	44.51	51.34	50.67	49.54	46.00	48.08	49.34
12:00	42.57	54.68	41.56	43.70	45.28	43.60	45.45	47.22	44.31	45.88	49.63	44.86	44.27	46.32
13:00	40.20	46.82	35.46	43.80	41.00	42.19	42.22	39.10	42.72	41.86	47.96	41.77	42.61	40.74
14:00	40.74	43.46	37.86	40.26	38.80	38.88	35.87	35.21	41.75	36.19	43.82	40.36	35.66	32.79
15:00	39.46	39.62	34.84	38.51	44.69	35.46	35.66	35.17	45.50	39.07	43.67	39.08	37.76	35.70
16:00	41.93	42.73	38.61	40.91	44.00	36.49	35.13	38.13	43.52	39.01	46.34	39.68	36.67	34.73
17:00	40.70	45.10	39.13	43.95	38.89	37.65	39.72	34.97	44.22	36.39	43.39	39.24	40.33	37.64
18:00	40.91	45.67	43.61	40.89	40.32	38.92	37.87	33.06	46.28	46.05	45.65	34.08	38.87	40.60
19:00	37.82	41.05	42.90	41.70	39.54	43.03	38.10	34.34	49.48	43.23	51.02	34.98	39.10	34.30
20:00	42.97	37.29	36.86	37.34	39.75	38.97	37.38	30.50	41.68	37.19	47.01	33.58	34.77	40.33
21:00	41.02	32.69	31.79	38.72	36.78	38.23	30.63	29.56	38.96	33.48	37.04	31.13	38.38	39.96
22:00	41.22	24.75	27.78	31.91	31.11	33.97	28.10	25.06	32.10	26.69	30.19	27.64	27.74	30.65
23:00	31.62	19.62	25.35	24.45	25.84	30.57	26.71	26.64	26.80	20.84	24.93	20.25	27.77	29.61
Average	33.76	36.53	34.30	35.35	36.53	36.43	35.85	32.44	36.66	34.40	37.98	34.29	33.79	34.29
Median	38.78	39.29	36.98	39.41	39.65	37.37	36.04	32.86	39.94	37.61	43.63	36.13	36.21	35.17
Max Hr. Mean	55.93	59.46	53.85	52.52	55.36	54.38	55.10	57.91	58.36	50.67	59.25	53.81	54.46	49.34
Min Hr. Mean	10.61	18.64	11.54	13.70	16.55	18.65	18.44	14.09	18.57	15.08	14.20	15.27	13.69	15.41
Inst. Max	58.49	61.19	60.22	54.22	61.52	56.87	57.93	62.33	64.00	53.97	64.02	58.60	55.25	53.99
Inst. Min	8.16	18.34	10.11	12.57	15.60	15.93	17.69	13.21	17.24	13.46	12.30	13.38	13.30	14.30
Peak To Avg.	1.66	1.63	1.57	1.49	1.52	1.49	1.54	1.78	1.59	1.47	1.56	1.57	1.61	1.44

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM03 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.39	0.49	0.35	0.41	0.45	0.46	0.50	0.43	0.44	0.41	0.42	0.39	0.35	0.41
1:00	0.33	0.46	0.33	0.39	0.39	0.45	0.46	0.47	0.44	0.39	0.35	0.39	0.35	0.36
2:00	0.30	0.45	0.35	0.35	0.40	0.43	0.47	0.46	0.41	0.35	0.52	0.37	0.36	0.35
3:00	0.29	0.46	0.31	0.37	0.44	0.45	0.42	0.40	0.39	0.33	0.31	0.41	0.36	0.35
4:00	0.26	0.43	0.37	0.39	0.45	0.46	0.44	0.37	0.42	0.36	0.37	0.41	0.33	0.38
5:00	0.39	0.44	0.57	0.50	0.51	0.52	0.52	0.39	0.39	0.42	0.36	0.53	0.38	0.49
6:00	0.38	0.61	0.73	0.60	0.73	0.62	0.68	0.54	0.46	0.63	0.59	0.69	0.51	0.58
7:00	0.50	0.65	0.79	0.80	0.83	0.80	0.82	0.66	0.61	0.77	0.74	0.81	0.72	0.76
8:00	0.75	0.75	0.81	0.81	0.78	0.82	0.78	0.75	0.75	0.75	0.78	0.73	0.81	0.77
9:00	0.81	0.88	0.82	0.79	0.78	0.79	0.80	0.85	0.86	0.75	0.84	0.80	0.74	0.77
10:00	0.85	0.81	0.80	0.78	0.76	0.78	0.80	0.84	0.78	0.67	0.75	0.77	0.73	0.72
11:00	0.81	0.85	0.70	0.75	0.71	0.75	0.73	0.77	0.79	0.80	0.75	0.76	0.71	0.74
12:00	0.70	0.84	0.70	0.73	0.75	0.74	0.76	0.76	0.73	0.72	0.78	0.73	0.67	0.70
13:00	0.70	0.77	0.63	0.71	0.69	0.73	0.73	0.67	0.68	0.70	0.73	0.67	0.64	0.66
14:00	0.71	0.74	0.65	0.69	0.68	0.69	0.66	0.60	0.67	0.64	0.68	0.64	0.56	0.60
15:00	0.73	0.69	0.63	0.67	0.76	0.66	0.66	0.59	0.73	0.66	0.70	0.63	0.60	0.63
16:00	0.74	0.73	0.68	0.69	0.76	0.66	0.66	0.65	0.71	0.69	0.71	0.65	0.57	0.61
17:00	0.71	0.75	0.66	0.73	0.71	0.69	0.70	0.61	0.70	0.64	0.68	0.63	0.63	0.62
18:00	0.70	0.78	0.72	0.70	0.72	0.68	0.69	0.59	0.73	0.73	0.71	0.56	0.61	0.65
19:00	0.64	0.72	0.71	0.69	0.71	0.72	0.69	0.61	0.75	0.68	0.77	0.58	0.61	0.61
20:00	0.74	0.68	0.62	0.61	0.68	0.69	0.70	0.57	0.67	0.62	0.74	0.54	0.58	0.66
21:00	0.72	0.60	0.56	0.64	0.63	0.67	0.60	0.56	0.64	0.58	0.62	0.52	0.61	0.65
22:00	0.72	0.48	0.51	0.57	0.56	0.62	0.56	0.52	0.53	0.50	0.55	0.51	0.50	0.58
23:00	0.61	0.43	0.50	0.51	0.50	0.58	0.54	0.50	0.47	0.44	0.50	0.44	0.51	0.56
Average	0.60	0.65	0.60	0.62	0.64	0.64	0.64	0.59	0.61	0.59	0.62	0.59	0.56	0.59
Median	0.68	0.69	0.65	0.67	0.70	0.67	0.66	0.59	0.66	0.65	0.69	0.60	0.58	0.62
Max Hr. Mean	0.85	0.88	0.82	0.81	0.83	0.82	0.82	0.85	0.86	0.80	0.84	0.81	0.81	0.77
Min Hr. Mean	0.26	0.43	0.31	0.35	0.39	0.43	0.42	0.37	0.39	0.33	0.31	0.37	0.33	0.35
Inst. Max	0.88	0.90	0.89	0.83	0.88	0.85	0.84	0.88	0.91	0.81	0.89	0.84	0.84	0.82
Inst. Min	0.22	0.41	0.28	0.32	0.37	0.37	0.40	0.35	0.38	0.30	0.29	0.32	0.32	0.33

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM03 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	3.30	3.68	3.25	3.47	3.48	3.59	3.64	3.41	3.70	3.78	3.49	3.41	3.42	3.64
1:00	3.24	3.54	3.17	3.32	3.38	3.41	3.53	3.30	3.65	3.52	3.51	3.36	3.40	3.42
2:00	3.20	3.37	3.11	3.26	3.38	3.43	3.44	3.22	3.58	3.47	3.52	3.33	3.31	3.45
3:00	3.18	3.41	3.15	3.20	3.38	3.39	3.43	3.25	3.57	3.53	3.50	3.29	3.29	3.44
4:00	3.28	3.42	3.44	3.23	3.46	3.48	3.44	3.19	3.53	3.50	3.44	3.30	3.33	3.44
5:00	3.18	3.44	3.65	3.59	3.66	3.70	3.66	3.26	3.56	3.50	3.55	3.61	3.47	3.63
6:00	3.35	3.54	4.00	3.83	4.15	4.05	3.97	3.53	3.65	3.93	3.90	3.98	3.83	3.95
7:00	3.77	3.72	4.27	4.31	4.36	4.32	4.38	3.96	3.83	4.13	4.25	4.34	4.22	4.18
8:00	4.25	4.19	4.28	4.24	4.28	4.34	4.37	4.21	4.07	4.31	4.40	4.21	4.38	4.24
9:00	4.32	4.38	4.29	4.19	4.27	4.26	4.32	4.43	4.40	4.26	4.50	4.36	4.46	4.12
10:00	4.31	4.39	4.18	4.15	4.17	4.21	4.29	4.36	4.34	4.20	4.38	4.22	4.36	4.17
11:00	4.22	4.37	4.08	4.10	4.12	4.07	4.14	4.01	4.26	4.22	4.33	4.10	4.39	4.34
12:00	4.09	4.31	4.05	4.07	4.10	4.04	4.06	4.15	4.11	4.22	4.24	4.14	4.34	4.31
13:00	4.00	4.11	3.93	4.13	4.08	3.98	4.00	4.02	4.19	4.07	4.32	4.17	4.35	4.12
14:00	4.02	4.04	4.00	4.02	3.95	3.92	3.83	4.05	4.14	3.91	4.26	4.20	4.24	3.87
15:00	3.84	3.96	3.90	3.99	4.03	3.84	3.86	4.04	4.17	4.04	4.18	4.16	4.21	3.93
16:00	3.95	4.02	3.96	4.06	3.99	3.88	3.79	4.03	4.12	3.93	4.31	4.12	4.23	3.94
17:00	3.94	4.08	4.06	4.09	3.88	3.87	3.95	3.97	4.21	3.97	4.22	4.16	4.23	4.09
18:00	4.01	4.03	4.11	4.02	3.93	3.96	3.87	3.93	4.21	4.19	4.24	4.11	4.23	4.17
19:00	4.04	3.97	4.09	4.09	3.90	4.07	3.88	3.94	4.32	4.20	4.34	4.10	4.25	3.91
20:00	4.01	3.88	4.04	4.14	4.00	3.95	3.81	3.82	4.17	4.08	4.21	4.18	4.08	4.13
21:00	3.98	3.85	3.96	4.08	4.02	3.97	3.72	3.78	4.10	4.00	4.08	4.05	4.19	4.14
22:00	3.98	3.73	3.87	3.92	3.88	3.89	3.69	3.61	4.12	3.80	3.86	3.83	3.89	3.79
23:00	3.75	3.50	3.71	3.60	3.74	3.78	3.67	3.80	3.98	3.57	3.67	3.54	3.83	3.79
Average	3.80	3.87	3.86	3.88	3.90	3.89	3.86	3.80	4.00	3.93	4.03	3.93	4.00	3.93
Median	3.94	3.93	3.97	4.02	3.96	3.94	3.83	3.91	4.09	3.98	4.20	4.10	4.17	3.96
Max Hr. Mean	4.32	4.39	4.29	4.31	4.36	4.34	4.38	4.43	4.40	4.31	4.50	4.36	4.46	4.34
Min Hr. Mean	3.18	3.37	3.11	3.20	3.38	3.39	3.43	3.19	3.53	3.47	3.44	3.29	3.29	3.42
Inst. Max	4.36	4.43	4.39	4.40	4.48	4.41	4.49	4.53	4.54	4.38	4.57	4.46	4.50	4.47
Inst. Min	3.13	3.35	3.10	3.16	3.33	3.36	3.40	3.17	3.47	3.41	3.29	3.23	3.24	3.39

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM03 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	66.98	65.54	67.01	66.94	66.77	67.32	66.14	66.05	65.63	65.68	65.33	65.22	65.64	65.98
1:00	66.21	65.69	66.23	66.37	66.29	66.78	65.70	65.49	65.29	65.36	64.46	64.69	64.94	65.29
2:00	65.60	64.87	65.72	65.84	65.92	66.08	65.43	65.14	65.41	65.08	64.35	64.34	64.54	64.72
3:00	65.10	64.52	65.34	65.30	65.59	65.81	65.05	64.85	64.80	64.75	64.16	64.28	64.27	64.37
4:00	66.20	64.57	65.73	65.22	65.59	65.71	65.24	64.73	64.52	64.97	64.37	64.13	64.60	64.33
5:00	65.71	64.30	64.86	64.97	66.37	65.24	64.79	64.56	64.27	64.37	64.14	64.26	64.65	64.70
6:00	65.40	64.39	67.06	66.98	67.04	67.17	66.09	64.50	65.36	66.21	65.62	65.70	66.32	65.73
7:00	65.93	65.08	68.23	68.64	68.70	68.34	67.69	65.57	65.79	67.73	67.58	67.71	67.06	67.73
8:00	67.28	66.54	69.77	68.92	68.53	68.76	68.43	65.57	66.42	67.40	67.91	68.01	68.35	68.35
9:00	68.70	68.09	69.38	68.74	68.63	69.13	67.80	67.52	67.13	67.83	68.55	68.45	68.42	67.51
10:00	69.49	69.35	68.53	68.98	69.66	68.71	68.63	69.00	68.37	66.76	68.41	67.45	68.00	67.71
11:00	68.87	69.13	68.69	68.69	69.51	68.47	68.20	68.12	67.93	67.69	67.12	68.00	68.16	68.60
12:00	69.30	69.54	68.58	68.30	68.05	66.76	68.36	68.56	68.11	67.31	66.43	66.76	67.22	68.14
13:00	69.36	68.60	67.88	67.65	67.48	66.38	67.99	67.37	67.52	66.66	67.68	65.78	67.70	67.20
14:00	69.28	68.44	67.92	67.92	67.95	67.11	67.87	68.14	67.36	66.42	66.60	66.28	66.94	67.05
15:00	69.31	68.48	66.79	68.28	69.34	67.01	67.54	69.70	66.89	66.69	66.29	66.31	67.00	66.50
16:00	68.08	69.19	67.72	68.38	68.88	67.12	68.26	69.62	67.76	67.54	67.62	67.34	67.05	66.66
17:00	69.48	67.64	68.42	68.78	67.87	68.31	67.40	67.85	68.14	66.93	66.80	66.36	68.38	67.35
18:00	69.45	67.92	68.47	68.20	69.24	68.68	67.66	67.53	68.59	67.25	67.37	68.01	67.67	67.52
19:00	67.80	68.95	69.75	69.36	68.45	68.34	67.21	67.82	69.04	67.35	67.32	68.69	68.95	67.43
20:00	67.76	69.78	70.48	70.11	69.21	69.77	67.62	68.69	69.31	68.72	70.02	68.49	68.67	67.30
21:00	66.83	68.19	68.58	69.46	69.15	68.37	67.40	66.61	68.47	67.60	68.11	69.00	67.48	67.30
22:00	67.07	67.74	68.01	68.02	68.68	67.58	66.56	66.30	67.87	67.66	67.13	67.54	66.52	66.97
23:00	67.50	68.65	67.86	67.27	67.13	66.92	66.03	66.27	66.73	66.57	66.36	67.38	66.34	66.41

Average	67.61	67.30	67.79	67.81	67.92	67.49	67.05	66.90	66.95	66.69	66.66	66.67	66.87	66.70
Median	67.55	67.83	67.91	68.05	68.11	67.34	67.21	66.85	67.13	66.85	66.68	66.86	67.09	66.87
Max Hr. Mean	69.49	69.78	70.48	70.11	69.66	69.77	68.63	69.70	69.31	68.72	70.02	69.00	68.95	68.60
Min Hr. Mean	65.10	64.30	64.86	64.97	65.59	65.24	64.79	64.50	64.27	64.37	64.14	64.13	64.27	64.33
Inst. Max	71.43	70.89	71.85	70.97	70.96	70.82	69.44	70.79	70.25	69.86	70.46	69.89	69.23	69.44
Inst. Min	64.81	64.08	64.59	64.68	65.31	65.06	64.52	64.31	64.21	64.19	64.03	63.88	64.15	64.22

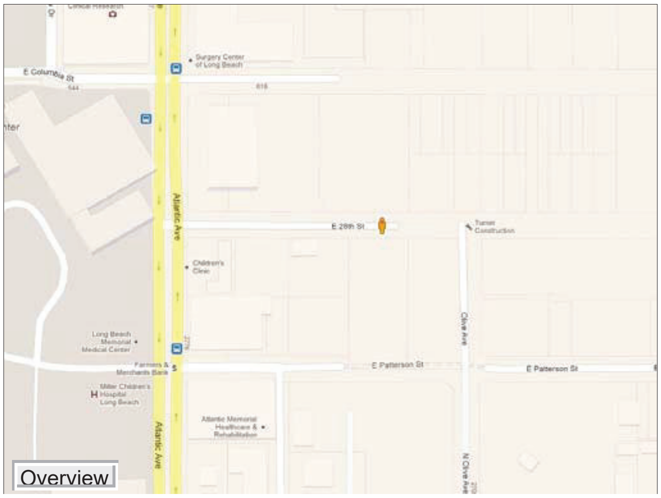
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

Site #: FM04 **Date:** 12/27/201

Address: 701 E. 28th St

Traffic: Moderate, commercial **Job #** 2012.5.166

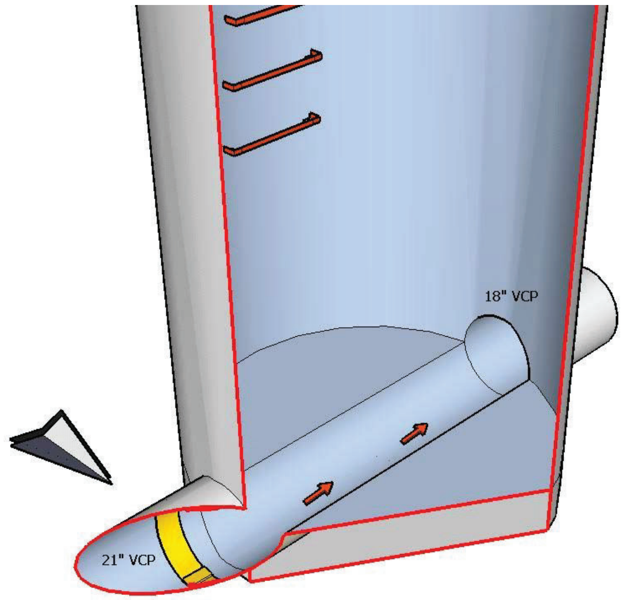


Overview

Detail Vie

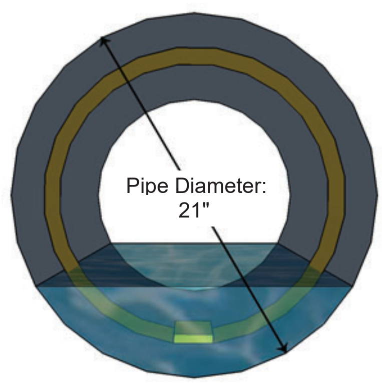

Planar Vie

Profile



MH Condition:	Fair	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	18.3'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 3.57 fps

Flow Depth: 6.88"

Pipe Material: VCP

Comments: Good hydraulics; straight-through, moderate velocity

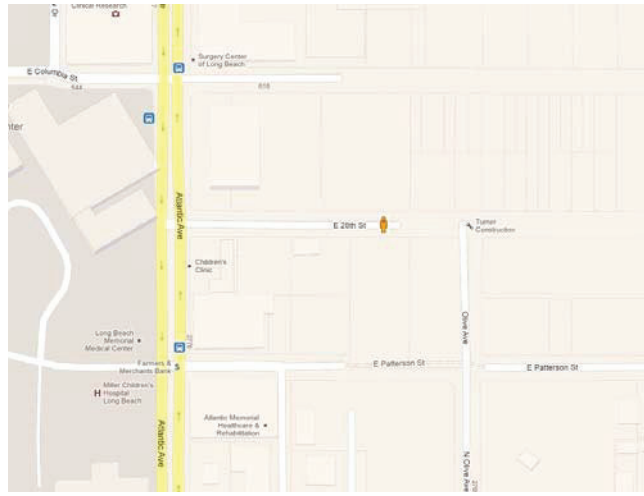
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM04
Map Page: J20-SMH-012
Location: 701 E. 28th St
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 2:00:00 PM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Moderate, commercial
Manhole Depth: 18.3'

Overview



Facility Inspection

Cover

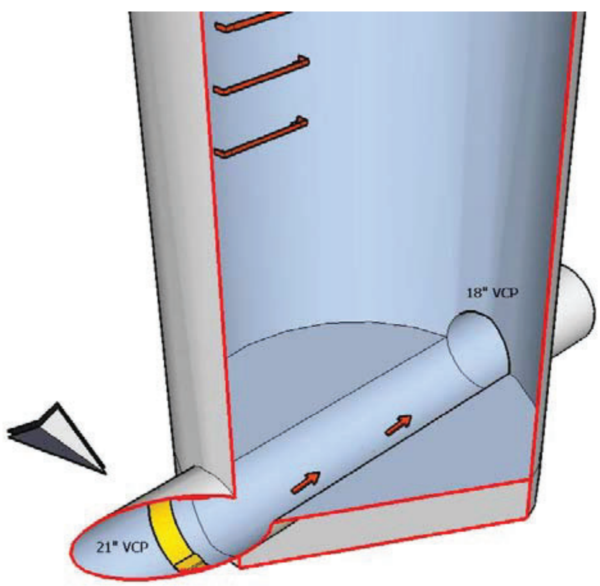
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: moderate

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: None

Cone

Shape: Concentric
Material: Brick
Condition: Fair
Infiltration: None



Barrel

Material: Brick
Condition: good
Infiltration: stains

Rungs

Rungs: Yes
Material: Cast Iron
Condition: Corroded

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: Light
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

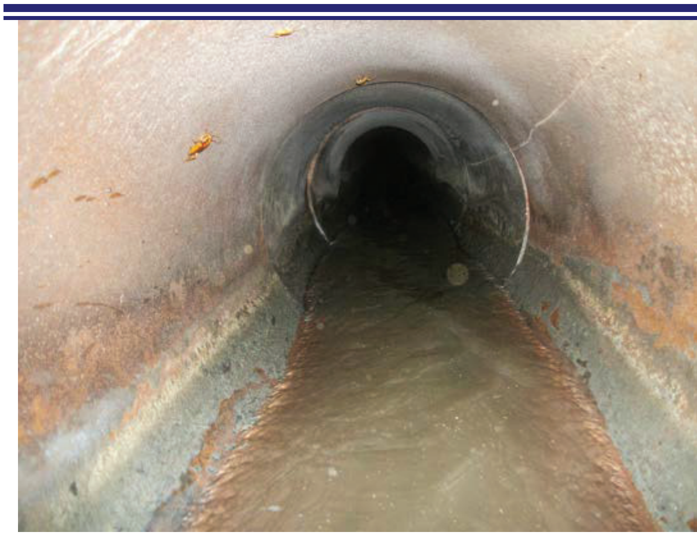
Observations and Comments

Flow Velocity: 3.57 fps
Flow Depth: 6.88"
Observation Location: Influent Pipe

Comments: Manhole lid had been locked


Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project #	2012.5.166
Location ID	FM04
Pipe Diameter	21 Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	5.39
Maximum	7.02
Minimum	3.06
Max d/D	33.4%

Velocity - Feet per Second

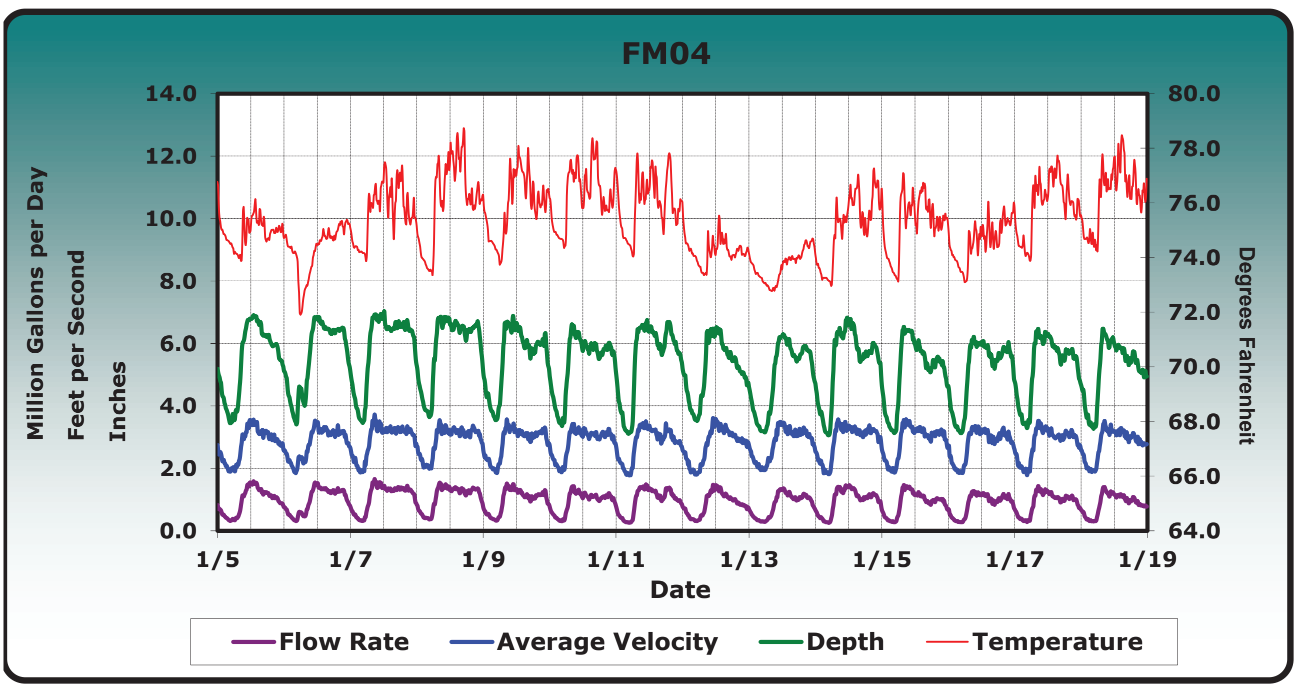
Average	2.84
Maximum	3.72
Minimum	1.77

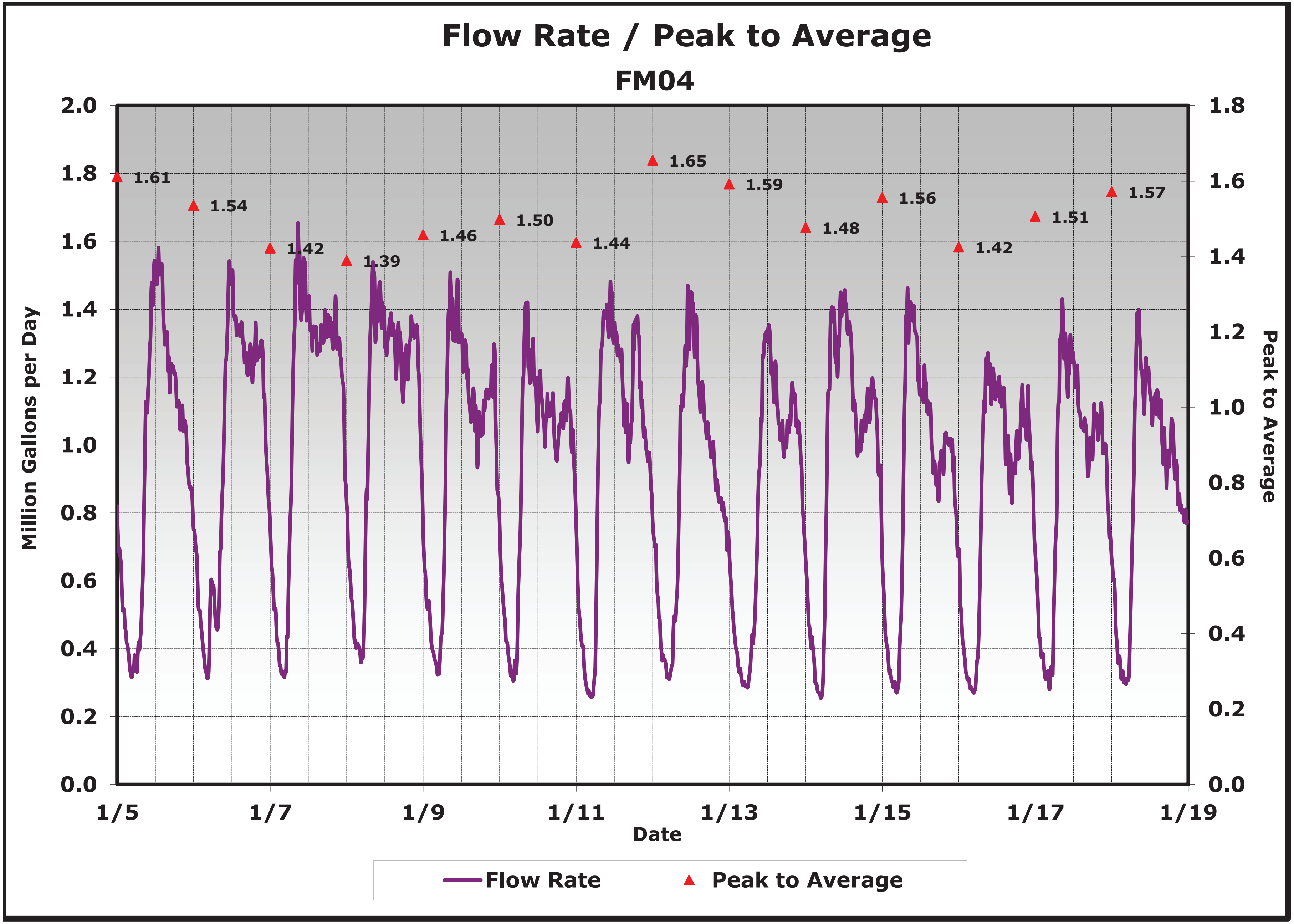
Flow - Million Gallons per Day

Average	0.94
Maximum	1.65
Minimum	0.25
Peak Factor	1.75

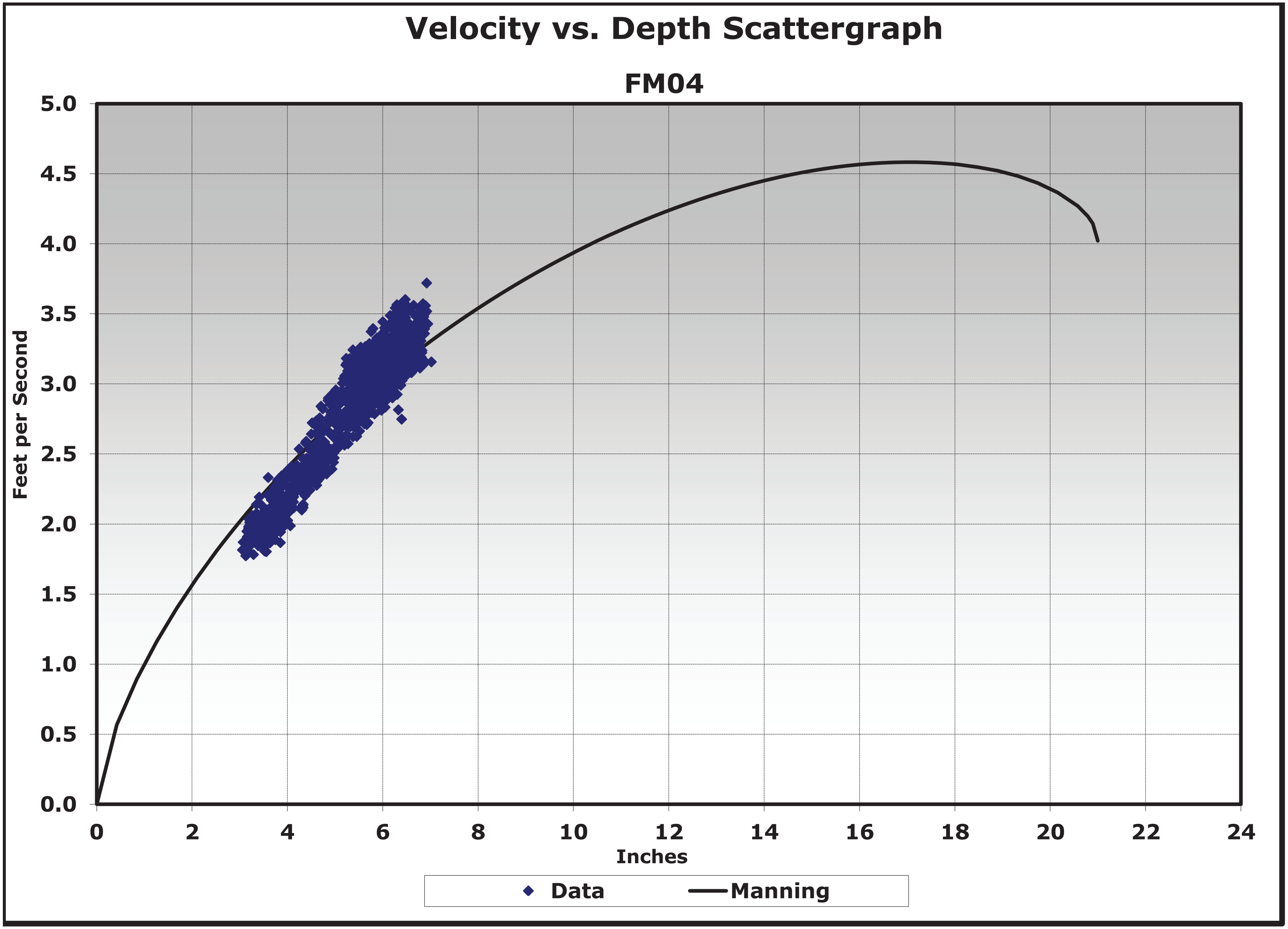
Temperature - Deg. F

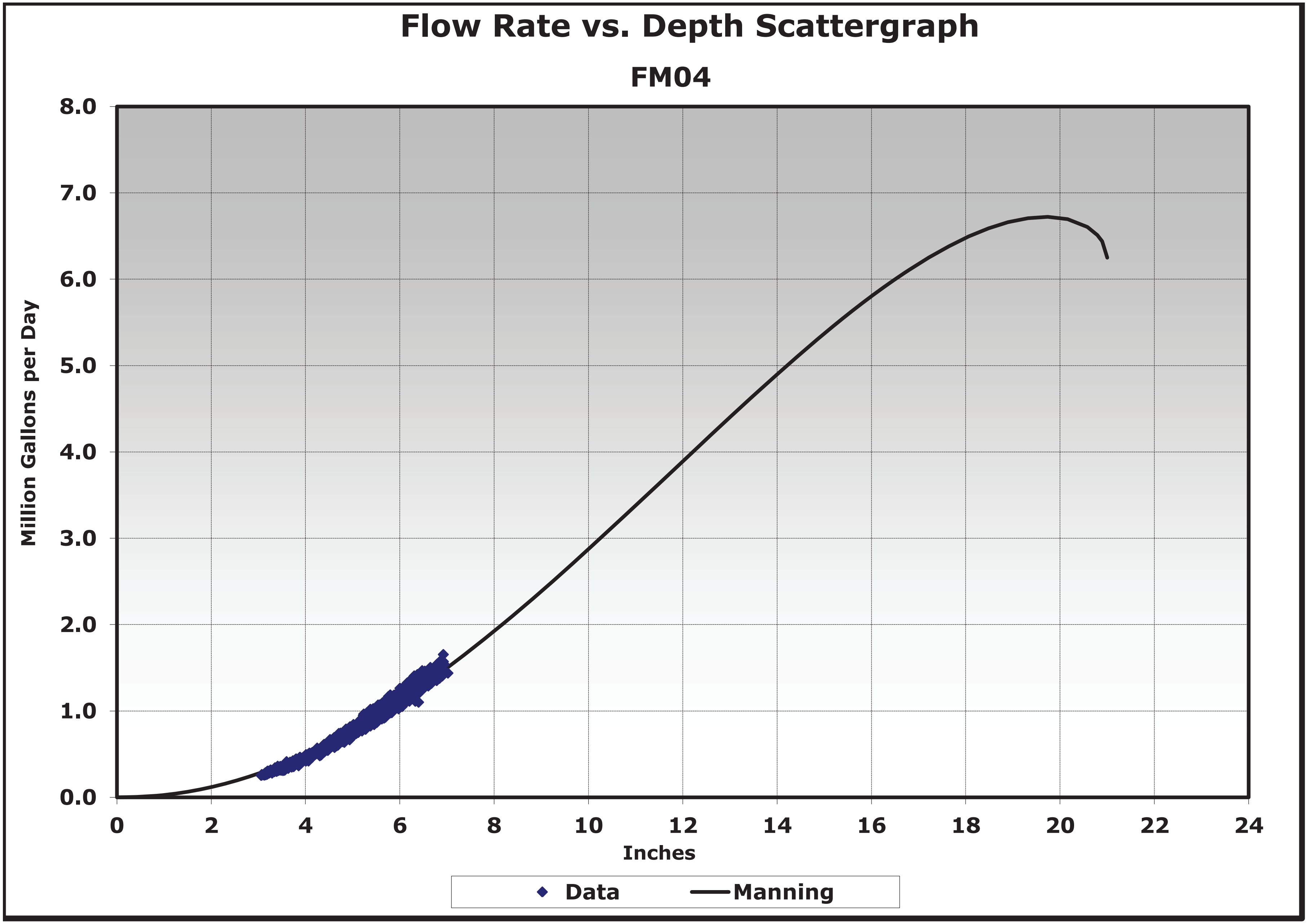
Average	75.32
Maximum	78.73
Minimum	71.91





Flow Rate / Peak to Average
FM04
Million Gallons per Day
Peak to Average
Date
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.61
1.54
1.42
1.39
1.46
1.50
1.44
1.65
1.59
1.48
1.56
1.42
1.51
1.57
Flow Rate
Peak to Average


Velocity vs. Depth Scattergraph
FM04
Feet per Second
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM04
Million Gallons per Day
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM04 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.74	0.73	0.68	0.74	0.67	0.67	0.65	0.73	0.63	0.60	0.59	0.60	0.63	0.63
1:00	0.60	0.58	0.53	0.58	0.53	0.51	0.46	0.60	0.48	0.44	0.42	0.42	0.44	0.47
2:00	0.49	0.47	0.42	0.45	0.46	0.41	0.37	0.45	0.39	0.39	0.34	0.33	0.37	0.36
3:00	0.40	0.37	0.34	0.41	0.38	0.34	0.28	0.37	0.33	0.29	0.30	0.30	0.32	0.32
4:00	0.33	0.32	0.33	0.38	0.34	0.32	0.26	0.34	0.30	0.26	0.28	0.28	0.30	0.30
5:00	0.35	0.54	0.44	0.45	0.39	0.40	0.28	0.32	0.29	0.32	0.36	0.31	0.37	0.35
6:00	0.37	0.55	0.80	0.87	0.59	0.73	0.59	0.41	0.33	0.74	0.71	0.49	0.69	0.68
7:00	0.45	0.46	1.25	1.28	1.12	1.19	1.13	0.52	0.43	1.21	1.27	0.94	1.15	1.13
8:00	0.77	0.68	1.56	1.51	1.43	1.40	1.34	0.88	0.58	1.39	1.40	1.18	1.36	1.37
9:00	1.13	0.98	1.48	1.34	1.38	1.22	1.39	1.13	0.90	1.30	1.40	1.23	1.28	1.23
10:00	1.32	1.30	1.45	1.44	1.37	1.27	1.37	1.26	1.17	1.29	1.35	1.18	1.19	1.17
11:00	1.49	1.50	1.43	1.38	1.35	1.14	1.37	1.38	1.32	1.41	1.22	1.17	1.28	1.20
12:00	1.50	1.45	1.38	1.29	1.29	1.16	1.33	1.43	1.33	1.43	1.15	1.18	1.22	1.12
13:00	1.53	1.35	1.33	1.35	1.27	1.12	1.27	1.33	1.23	1.35	1.18	1.13	1.17	1.14
14:00	1.44	1.34	1.32	1.35	1.15	1.05	1.22	1.19	1.20	1.27	1.11	1.08	1.07	1.13
15:00	1.32	1.33	1.29	1.26	1.11	1.11	1.08	1.15	1.09	1.11	1.05	0.99	1.06	1.09
16:00	1.21	1.24	1.33	1.34	1.08	1.12	1.01	1.08	1.03	1.00	0.93	0.89	0.97	0.98
17:00	1.23	1.25	1.36	1.19	1.02	1.01	1.08	1.04	0.99	1.02	0.87	0.93	0.98	0.95
18:00	1.18	1.24	1.35	1.25	1.03	1.01	1.34	0.99	1.04	1.06	0.96	1.00	1.05	1.00
19:00	1.11	1.29	1.32	1.25	1.13	1.08	1.34	0.94	1.12	1.13	0.97	1.06	1.06	1.00
20:00	1.08	1.27	1.35	1.35	1.15	1.10	1.15	0.87	1.14	1.12	1.02	1.10	1.08	0.90
21:00	1.05	1.29	1.31	1.33	1.18	1.15	1.04	0.83	1.06	1.16	1.00	1.08	1.01	0.83
22:00	0.91	1.08	1.23	1.28	1.20	1.04	0.97	0.80	0.99	1.05	0.94	1.01	0.94	0.80
23:00	0.85	0.87	1.01	0.97	0.89	0.94	0.91	0.74	0.77	0.89	0.75	0.85	0.74	0.78
Average	0.95	0.98	1.09	1.08	0.98	0.94	0.97	0.87	0.84	0.97	0.90	0.86	0.91	0.87
Median	1.05	1.17	1.30	1.27	1.10	1.07	1.07	0.87	0.99	1.08	0.98	0.98	1.03	0.95
Max Hr. Mean	1.53	1.50	1.56	1.51	1.43	1.40	1.39	1.43	1.33	1.43	1.40	1.23	1.36	1.37
Min Hr. Mean	0.33	0.32	0.33	0.38	0.34	0.32	0.26	0.32	0.29	0.26	0.28	0.28	0.30	0.30
Inst. Max	1.58	1.54	1.65	1.54	1.50	1.42	1.48	1.47	1.35	1.46	1.46	1.27	1.43	1.40
Inst. Min	0.32	0.31	0.32	0.36	0.32	0.31	0.26	0.31	0.29	0.25	0.27	0.27	0.28	0.30
Peak To Avg.	1.61	1.54	1.42	1.39	1.46	1.50	1.44	1.65	1.59	1.48	1.56	1.42	1.51	1.57

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM04 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	2.57	2.54	2.50	2.58	2.46	2.54	2.48	2.53	2.62	2.47	2.50	2.56	2.49	2.52
1:00	2.39	2.32	2.28	2.36	2.29	2.30	2.22	2.35	2.34	2.22	2.24	2.20	2.14	2.23
2:00	2.21	2.18	2.09	2.13	2.16	2.11	2.07	2.08	2.17	2.14	2.02	2.00	2.04	2.01
3:00	2.04	1.98	1.91	2.08	2.00	1.98	1.87	1.93	2.06	1.90	1.94	1.93	1.92	1.93
4:00	1.90	1.91	1.92	2.05	1.92	1.94	1.82	1.88	1.99	1.85	1.91	1.88	1.89	1.92
5:00	2.00	2.30	2.15	2.13	2.03	2.07	1.88	1.83	1.95	1.94	2.11	1.96	2.01	2.00
6:00	2.01	2.31	2.59	2.67	2.37	2.58	2.42	2.01	2.07	2.62	2.60	2.27	2.52	2.53
7:00	2.14	2.19	3.14	3.13	3.04	3.13	3.00	2.19	2.30	3.23	3.30	2.99	3.08	3.06
8:00	2.58	2.52	3.54	3.44	3.39	3.37	3.30	2.64	2.51	3.48	3.48	3.21	3.41	3.44
9:00	3.01	2.85	3.38	3.21	3.29	3.15	3.37	2.93	2.91	3.34	3.47	3.29	3.35	3.23
10:00	3.19	3.19	3.33	3.29	3.29	3.23	3.34	3.20	3.28	3.29	3.37	3.24	3.21	3.22
11:00	3.44	3.44	3.26	3.18	3.27	3.11	3.31	3.51	3.45	3.29	3.22	3.20	3.29	3.19
12:00	3.44	3.31	3.18	3.13	3.12	3.19	3.28	3.52	3.43	3.32	3.24	3.20	3.15	3.14
13:00	3.47	3.19	3.25	3.27	3.18	3.12	3.21	3.34	3.27	3.23	3.25	3.18	3.16	3.18
14:00	3.32	3.23	3.25	3.20	3.10	3.01	3.15	3.25	3.25	3.25	3.22	3.08	2.99	3.20
15:00	3.13	3.26	3.17	3.10	3.08	3.11	2.99	3.27	3.15	3.16	3.16	2.98	3.03	3.14
16:00	3.10	3.09	3.19	3.25	3.01	3.09	2.92	3.21	3.11	3.12	3.04	2.86	2.98	3.03
17:00	3.17	3.14	3.26	3.04	2.98	2.98	3.01	3.09	3.07	3.08	2.94	2.92	2.98	2.96
18:00	3.06	3.12	3.24	3.13	3.01	3.02	3.26	3.06	3.15	3.16	3.10	3.03	3.11	3.04
19:00	3.02	3.18	3.20	3.12	3.09	3.12	3.20	2.97	3.20	3.30	3.12	3.15	3.09	3.01
20:00	2.98	3.15	3.22	3.30	3.16	3.10	2.98	2.91	3.20	3.20	3.13	3.13	3.15	2.90
21:00	2.91	3.18	3.23	3.18	3.17	3.17	2.85	2.88	3.05	3.21	3.18	3.05	3.04	2.87
22:00	2.78	2.95	3.11	3.13	3.17	3.01	2.83	2.86	2.98	3.06	3.08	2.94	2.91	2.77
23:00	2.72	2.75	2.88	2.86	2.81	2.87	2.76	2.81	2.74	2.91	2.81	2.77	2.72	2.77
Average	2.77	2.80	2.93	2.92	2.85	2.85	2.81	2.76	2.80	2.91	2.89	2.79	2.82	2.80
Median	2.92	3.03	3.16	3.12	3.08	3.04	2.96	2.88	3.01	3.15	3.10	2.97	3.00	2.97
Max Hr. Mean	3.47	3.44	3.54	3.44	3.39	3.37	3.37	3.52	3.45	3.48	3.48	3.29	3.41	3.44
Min Hr. Mean	1.90	1.91	1.91	2.05	1.92	1.94	1.82	1.83	1.95	1.85	1.91	1.88	1.89	1.92
Inst. Max	3.56	3.53	3.72	3.54	3.56	3.42	3.50	3.60	3.49	3.56	3.57	3.36	3.52	3.52
Inst. Min	1.90	1.85	1.87	1.99	1.86	1.87	1.77	1.80	1.94	1.82	1.87	1.86	1.78	1.89

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM04 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	5.03	5.04	4.87	5.00	4.86	4.72	4.70	5.07	4.43	4.46	4.39	4.38	4.59	4.56
1:00	4.58	4.55	4.34	4.49	4.34	4.22	3.98	4.65	3.96	3.89	3.72	3.78	3.98	4.03
2:00	4.17	4.10	3.91	4.07	4.05	3.82	3.62	4.12	3.62	3.69	3.43	3.43	3.67	3.62
3:00	3.84	3.71	3.59	3.85	3.77	3.52	3.24	3.80	3.37	3.26	3.25	3.28	3.42	3.41
4:00	3.51	3.47	3.49	3.71	3.58	3.46	3.14	3.62	3.21	3.10	3.16	3.16	3.37	3.33
5:00	3.58	4.38	3.97	4.04	3.78	3.76	3.20	3.56	3.18	3.36	3.51	3.32	3.63	3.53
6:00	3.70	4.41	5.27	5.49	4.53	4.97	4.40	3.97	3.30	4.94	4.81	4.09	4.88	4.79
7:00	4.04	4.08	6.36	6.49	6.00	6.15	6.11	4.43	3.73	6.08	6.20	5.35	6.05	6.00
8:00	5.15	4.80	6.85	6.82	6.62	6.57	6.46	5.55	4.30	6.38	6.40	6.01	6.38	6.36
9:00	6.09	5.70	6.82	6.60	6.61	6.24	6.54	6.23	5.30	6.27	6.42	6.09	6.19	6.14
10:00	6.54	6.46	6.78	6.82	6.57	6.30	6.50	6.32	5.86	6.31	6.39	5.97	6.04	5.96
11:00	6.76	6.80	6.83	6.78	6.55	6.01	6.56	6.31	6.19	6.72	6.15	6.00	6.27	6.13
12:00	6.81	6.81	6.78	6.54	6.53	5.96	6.47	6.47	6.26	6.74	5.86	6.01	6.25	5.88
13:00	6.86	6.67	6.49	6.53	6.39	5.90	6.34	6.38	6.10	6.58	5.95	5.88	6.05	5.91
14:00	6.75	6.54	6.45	6.65	6.05	5.78	6.23	5.99	6.02	6.27	5.73	5.81	5.90	5.85
15:00	6.63	6.47	6.46	6.45	5.93	5.87	5.93	5.81	5.75	5.80	5.60	5.59	5.81	5.76
16:00	6.28	6.42	6.58	6.52	5.90	5.94	5.76	5.63	5.59	5.46	5.26	5.31	5.50	5.50
17:00	6.25	6.35	6.59	6.29	5.70	5.66	5.92	5.62	5.47	5.56	5.12	5.42	5.56	5.44
18:00	6.21	6.38	6.58	6.36	5.71	5.62	6.52	5.47	5.58	5.65	5.34	5.57	5.64	5.54
19:00	6.00	6.44	6.55	6.40	5.99	5.75	6.62	5.39	5.79	5.71	5.34	5.66	5.72	5.60
20:00	5.94	6.43	6.62	6.51	5.98	5.86	6.22	5.20	5.90	5.82	5.52	5.84	5.73	5.34
21:00	5.93	6.46	6.44	6.59	6.07	5.95	5.99	5.06	5.76	5.95	5.38	5.84	5.59	5.09
22:00	5.54	5.99	6.34	6.48	6.12	5.76	5.72	4.97	5.57	5.70	5.25	5.72	5.46	5.04
23:00	5.36	5.40	5.78	5.67	5.39	5.55	5.54	4.74	4.95	5.27	4.77	5.28	4.87	4.99
Average	5.48	5.58	5.86	5.88	5.54	5.39	5.49	5.18	4.97	5.37	5.12	5.12	5.27	5.16
Median	5.93	6.23	6.45	6.44	5.91	5.80	5.97	5.23	5.49	5.72	5.38	5.56	5.64	5.44
Max Hr. Mean	6.86	6.81	6.85	6.82	6.62	6.57	6.62	6.47	6.26	6.74	6.42	6.09	6.38	6.36
Min Hr. Mean	3.51	3.47	3.49	3.71	3.58	3.46	3.14	3.56	3.18	3.10	3.16	3.16	3.37	3.33
Inst. Max	6.90	6.85	7.02	6.85	6.88	6.61	6.74	6.52	6.29	6.82	6.53	6.21	6.47	6.47
Inst. Min	3.45	3.41	3.46	3.64	3.54	3.36	3.11	3.52	3.15	3.06	3.13	3.13	3.29	3.27

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM04 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	76.18	74.77	74.87	74.87	75.88	75.92	76.87	75.40	74.00	73.91	75.66	74.72	75.30	75.36
1:00	75.13	74.50	74.42	74.28	75.28	75.08	75.58	74.58	73.76	73.64	74.28	74.17	74.56	74.71
2:00	74.87	74.38	74.37	73.94	74.60	74.89	74.92	74.34	73.47	73.31	73.94	73.97	74.38	74.65
3:00	74.67	74.20	74.23	73.73	74.55	74.73	74.69	74.22	73.38	73.26	73.68	73.80	74.51	74.75
4:00	74.55	74.13	74.19	73.55	74.36	74.67	74.52	74.06	73.27	73.21	73.42	73.55	74.13	74.61
5:00	74.42	72.92	74.05	73.48	74.15	74.45	74.35	73.86	73.09	73.08	73.26	73.39	73.98	74.48
6:00	74.17	72.03	75.29	75.26	73.83	76.23	74.37	73.64	73.01	73.81	74.48	73.13	75.57	75.55
7:00	74.07	72.69	75.96	77.19	74.88	77.34	76.98	73.42	72.87	75.37	76.57	74.31	76.51	76.94
8:00	73.97	72.99	76.09	76.75	75.09	77.07	76.56	73.40	72.81	75.42	76.03	74.37	76.49	76.92
9:00	75.32	73.41	76.37	75.88	76.65	77.15	76.70	74.40	72.88	75.06	75.68	74.87	76.72	76.75
10:00	74.82	73.86	75.94	77.02	76.56	77.41	76.18	74.17	73.06	75.38	75.81	74.68	76.03	76.52
11:00	75.15	74.34	76.68	77.42	77.10	76.38	76.56	74.47	73.50	75.51	76.15	74.77	76.29	77.10
12:00	75.37	74.49	77.23	77.81	77.41	76.19	76.93	74.30	73.76	76.28	75.22	75.02	76.75	77.15
13:00	75.85	74.64	76.27	77.39	77.58	76.80	77.12	75.14	73.87	76.04	75.98	74.51	77.22	77.41
14:00	75.38	74.88	76.33	77.83	77.12	76.25	76.86	74.71	73.96	76.30	76.46	75.43	76.92	77.78
15:00	75.52	74.72	75.73	77.65	76.53	77.97	75.98	74.67	73.98	76.74	76.64	74.71	77.36	78.10
16:00	75.26	74.91	76.10	78.00	77.45	77.68	75.70	74.29	73.94	75.48	75.78	74.72	77.12	76.68
17:00	74.82	74.72	76.90	77.73	76.12	77.54	75.37	74.00	73.94	75.28	75.71	74.73	76.44	76.61
18:00	74.68	74.72	77.09	76.08	76.29	76.36	76.97	74.08	74.02	75.07	75.67	74.65	75.80	76.38
19:00	74.95	75.01	76.00	76.16	75.71	75.91	77.69	74.15	74.19	75.42	75.03	75.22	76.65	77.26
20:00	74.96	75.24	75.77	75.99	76.07	75.79	76.15	74.34	74.56	75.79	75.26	75.58	76.01	76.28
21:00	74.98	75.11	75.45	76.06	76.21	75.83	75.59	74.26	74.43	76.97	75.23	75.32	75.79	76.04
22:00	75.07	75.27	75.53	76.47	75.93	76.13	75.48	74.09	74.56	76.70	75.39	75.27	75.66	76.36
23:00	75.04	75.27	75.62	76.14	76.44	76.73	76.01	74.28	74.56	75.92	75.49	75.73	75.85	76.37
Average	74.97	74.30	75.69	76.11	75.91	76.27	76.01	74.26	73.70	75.12	75.28	74.61	75.92	76.28
Median	74.94	74.61	75.82	76.21	75.97	76.23	76.07	74.24	73.82	75.38	75.46	74.68	76.08	76.48
Max Hr. Mean	76.18	75.27	77.23	78.00	77.58	77.97	77.69	75.40	74.56	76.97	76.64	75.73	77.36	78.10
Min Hr. Mean	73.97	72.03	74.05	73.48	73.83	74.45	74.35	73.40	72.81	73.08	73.26	73.13	73.98	74.48
Inst. Max	76.77	75.38	77.49	78.73	78.08	78.37	77.82	76.03	74.70	77.26	77.09	76.04	77.73	78.47
Inst. Min	73.88	71.91	73.87	73.36	73.75	74.36	74.04	73.36	72.78	72.97	73.13	73.10	73.89	74.24

DownStream Services, Inc.

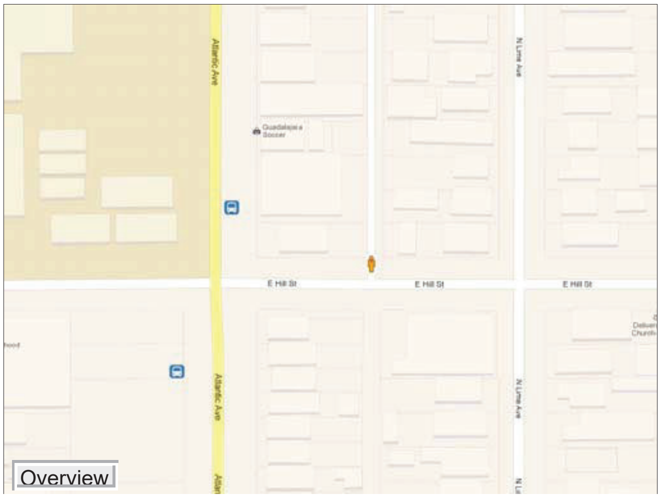
Site Investigation Summary

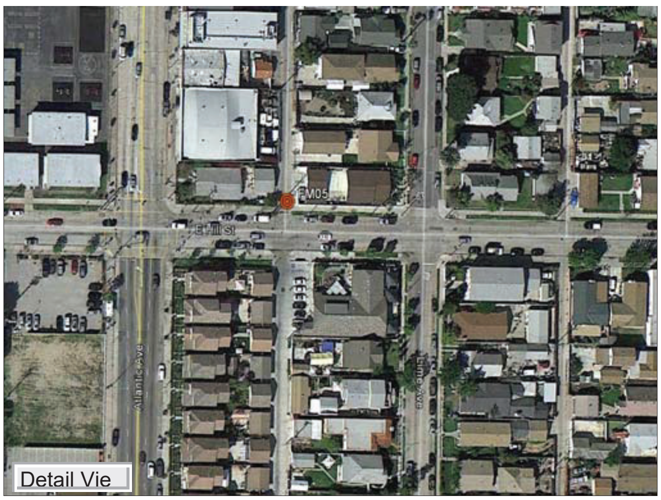
MWH Global - City of Long Beach Master Plan

Site #: FM05 **Date:** 12/27/201

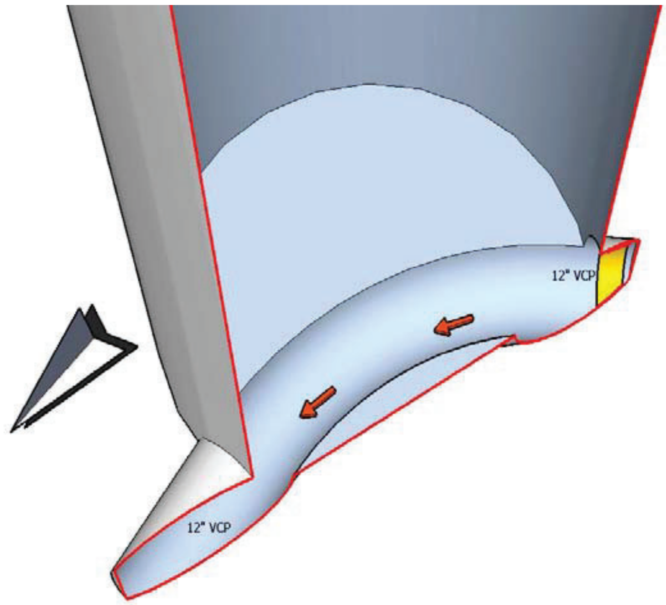
Address: alley N/of E. Hill St.

Traffic: Light, residential **Job #** 2012.5.166



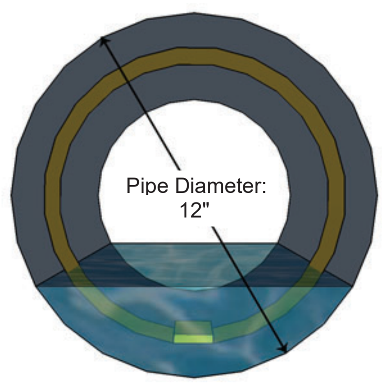


Profile



MH Condition:	Good	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	20.6'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 2.23 fps

Flow Depth: 3.88"

Pipe Material: VCP

Comments: Hydraulics acceptable for metering: slight bend, moderate velocity

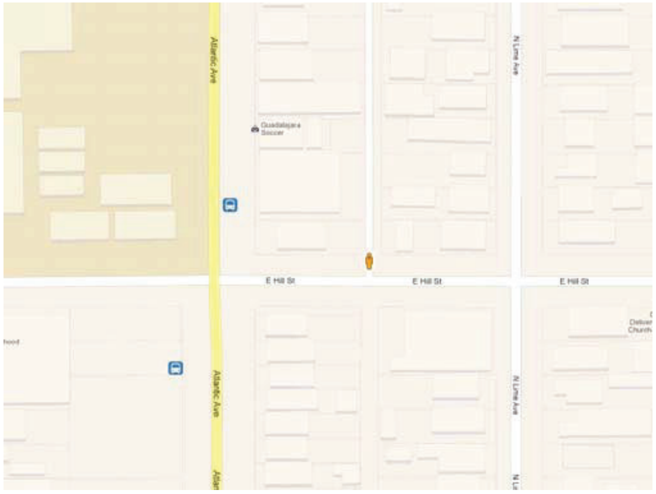
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number:	2012.5.166
Site Identifier:	FM05
Map Page:	
Location:	alley N/of E. Hill St.
Weather:	Sunny
Team:	D. Ramos & J. White
Date/Time:	12/27/2012 12:50:00 PM
Site Status:	New Site
Surroundings:	Concrete
Surface Condition:	Alley
Traffic Setup:	Roadway
Traffic Volume:	Light, residential
Manhole Depth:	20.6'

Overview



Facility Inspection

Cover

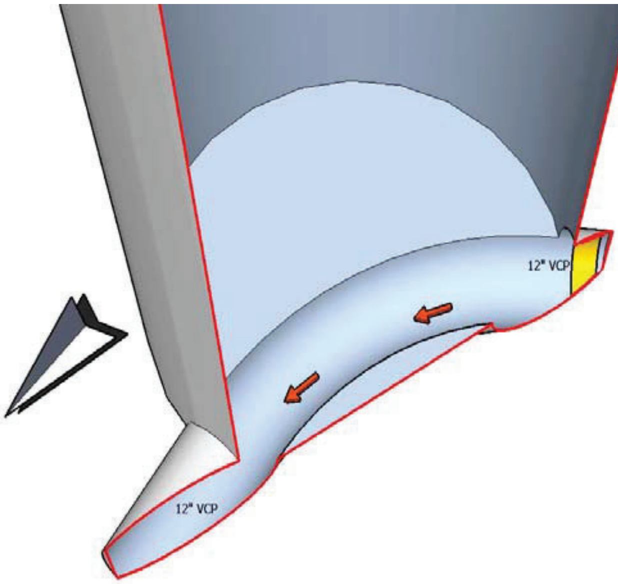
Status:	Normal
Shape:	Round
Size:	24" diameter
Material:	Cast iron
Corrosion:	Light

Grade Ring / Frame

Condition:	Good
Corrosion:	Light
Lid/Frame Seal:	None
Frame/Ring Seal:	Good

Cone

Shape:	Concentric
Material:	Brick
Condition:	Good
Infiltration:	None



Barrel

Material:	Brick
Condition:	good
Infiltration:	none

Rungs

Rungs:	Yes
Material:	Cast Iron
Condition:	Fair

Bench

Material:	Cast in place Concrete
Condition:	Good
Infiltration:	Stains

Channel

Material:	Cast in place Concrete
Condition:	Good
Infiltration:	None

Defect Observation

Surcharge

Active:	None
Evidence:	N/A
Level:	N/A

Silt

Present:	No
Depth:	N/A

Debris

Present:	No
Desc.:	N/A

Other

Grease:	None
Vermin:	Few - Roaches
Odor:	No - N/A
Vandalism:	None

Observations and Comments

Flow Velocity: 2.23 fps **Flow Depth:** 3.88" **Observation Location:** Influent Pipe

Comments: Manhole is upstream of pumping station

DownStream Services, Inc.

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM05

Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project # 2012.5.166
Location ID FM05
Pipe Diameter 12 Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	2.73
Maximum	3.74
Minimum	1.65
Max d/D	31.2%

Velocity - Feet per Second

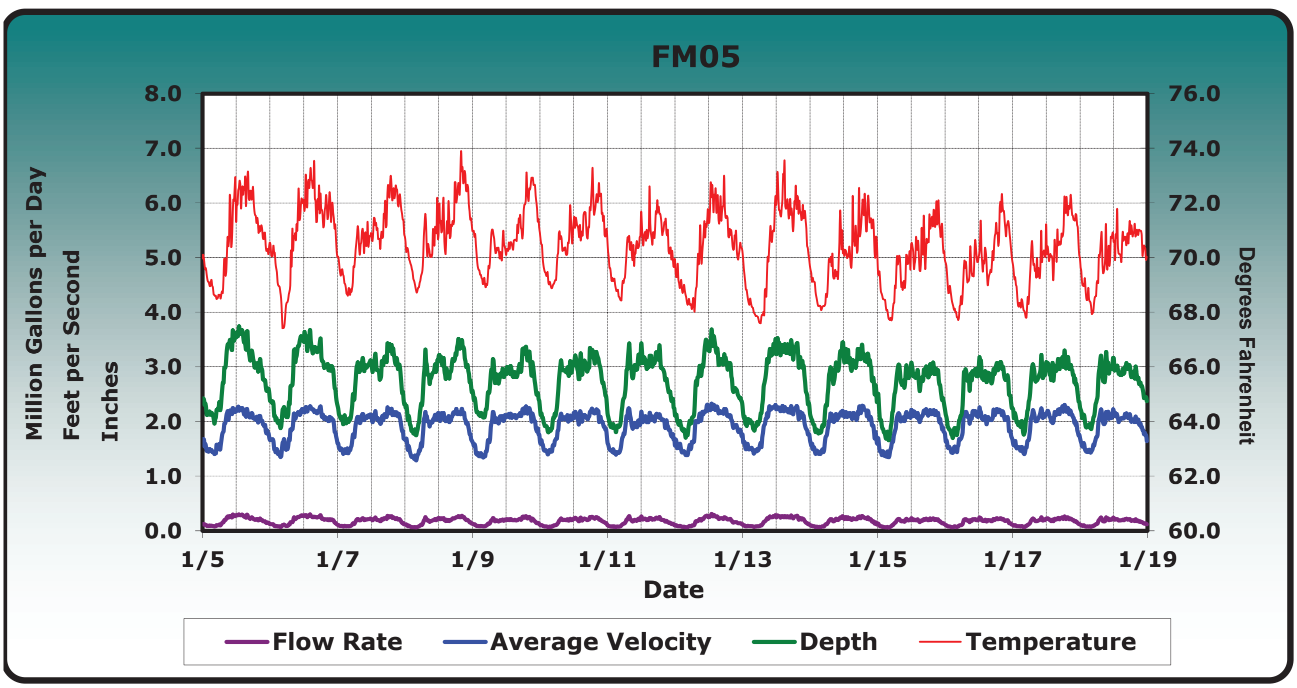
Average	1.92
Maximum	2.32
Minimum	1.28

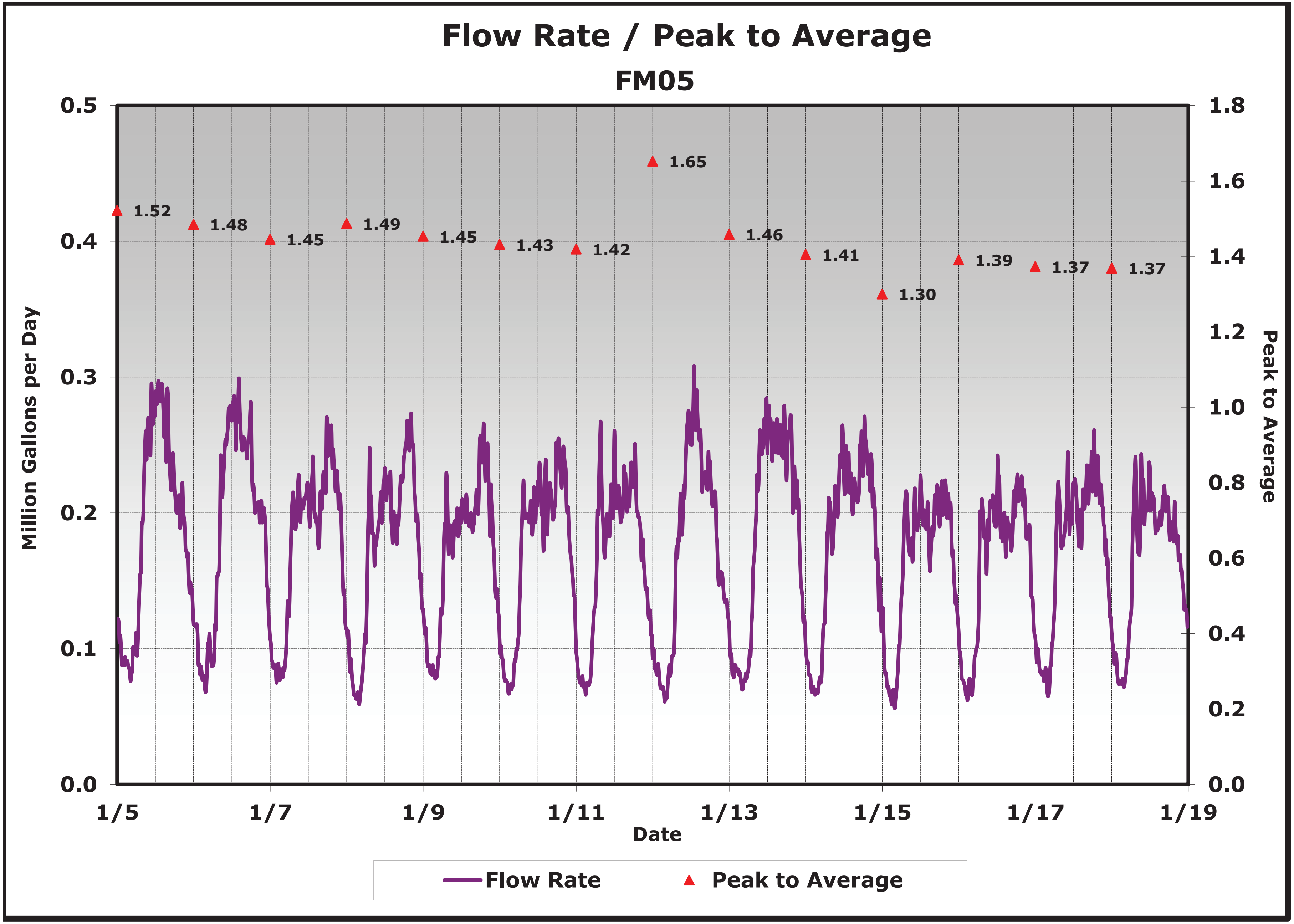
Flow - Million Gallons per Day

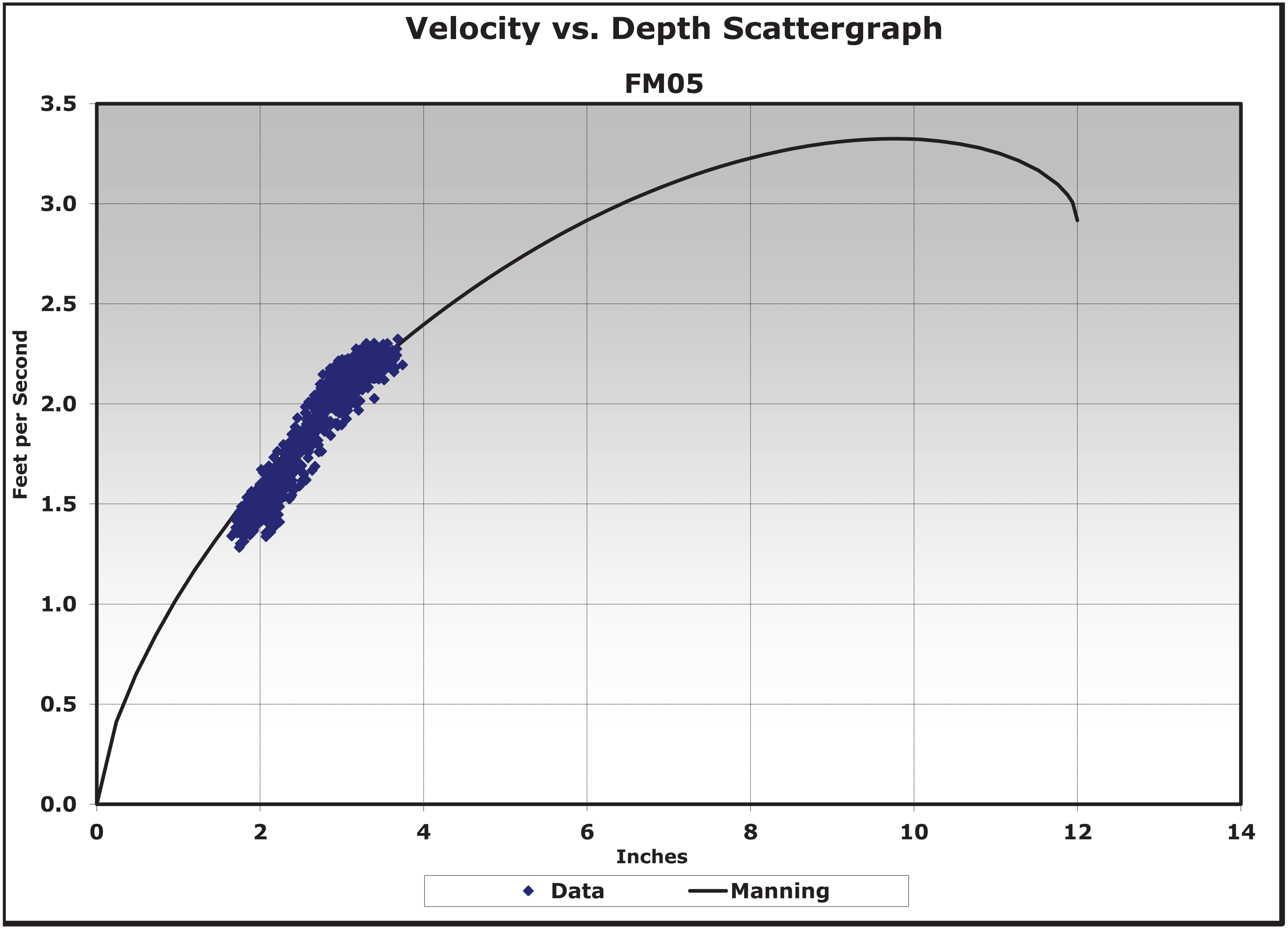
Average	0.17
Maximum	0.31
Minimum	0.06
Peak Factor	1.77

Temperature - Deg. F

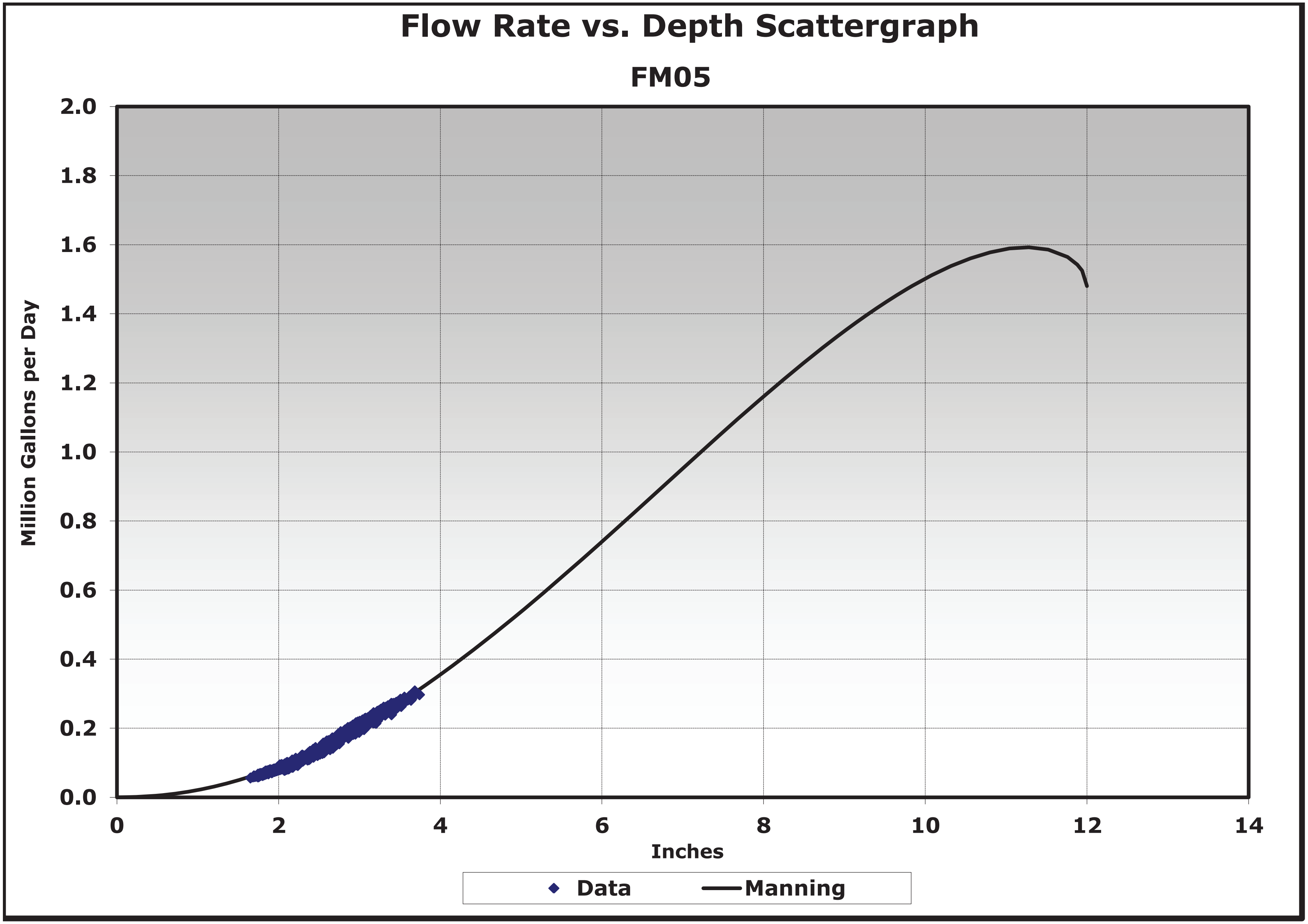
Average	70.41
Maximum	73.89
Minimum	67.41




Flow Rate / Peak to Average
FM05
Million Gallons per Day
Peak to Average
Date
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.52
1.48
1.45
1.49
1.45
1.43
1.42
1.65
1.46
1.41
1.30
1.39
1.37
1.37
Flow Rate
Peak to Average



Velocity vs. Depth Scattergraph
FM05
Feet per Second
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM05
Million Gallons per Day
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM05 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.12	0.12	0.10	0.11	0.12	0.10	0.09	0.09	0.10	0.09	0.11	0.10	0.10	0.10
1:00	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09
2:00	0.09	0.08	0.08	0.07	0.08	0.07	0.07	0.08	0.09	0.07	0.07	0.07	0.08	0.08
3:00	0.09	0.07	0.08	0.06	0.08	0.07	0.07	0.07	0.08	0.07	0.06	0.07	0.08	0.08
4:00	0.08	0.09	0.08	0.07	0.08	0.08	0.08	0.07	0.07	0.08	0.07	0.07	0.07	0.08
5:00	0.10	0.10	0.12	0.10	0.11	0.10	0.12	0.08	0.08	0.10	0.10	0.10	0.10	0.11
6:00	0.11	0.10	0.16	0.14	0.16	0.14	0.16	0.10	0.09	0.15	0.15	0.15	0.16	0.16
7:00	0.16	0.14	0.20	0.22	0.21	0.21	0.24	0.16	0.14	0.20	0.21	0.20	0.21	0.22
8:00	0.22	0.21	0.20	0.18	0.18	0.20	0.20	0.19	0.20	0.18	0.18	0.18	0.18	0.17
9:00	0.26	0.23	0.21	0.18	0.18	0.20	0.18	0.20	0.24	0.21	0.17	0.19	0.19	0.22
10:00	0.26	0.26	0.21	0.20	0.19	0.20	0.19	0.24	0.25	0.22	0.20	0.21	0.22	0.21
11:00	0.28	0.28	0.22	0.21	0.19	0.20	0.21	0.27	0.27	0.25	0.19	0.19	0.20	0.21
12:00	0.29	0.28	0.20	0.22	0.20	0.23	0.23	0.26	0.26	0.23	0.21	0.23	0.22	0.21
13:00	0.29	0.27	0.22	0.22	0.21	0.20	0.21	0.29	0.25	0.22	0.20	0.19	0.19	0.20
14:00	0.28	0.28	0.20	0.19	0.19	0.21	0.20	0.26	0.26	0.22	0.19	0.19	0.19	0.19
15:00	0.26	0.25	0.19	0.19	0.19	0.21	0.23	0.24	0.25	0.22	0.17	0.19	0.21	0.20
16:00	0.25	0.25	0.22	0.20	0.21	0.21	0.21	0.23	0.25	0.21	0.20	0.18	0.22	0.21
17:00	0.23	0.26	0.24	0.23	0.22	0.21	0.23	0.23	0.26	0.25	0.21	0.20	0.23	0.21
18:00	0.21	0.24	0.26	0.25	0.25	0.25	0.23	0.22	0.25	0.25	0.21	0.22	0.24	0.19
19:00	0.20	0.21	0.25	0.25	0.24	0.23	0.20	0.21	0.26	0.24	0.21	0.22	0.23	0.19
20:00	0.21	0.20	0.23	0.26	0.23	0.24	0.18	0.17	0.22	0.23	0.21	0.21	0.22	0.18
21:00	0.18	0.20	0.22	0.22	0.20	0.20	0.16	0.16	0.21	0.21	0.20	0.18	0.20	0.16
22:00	0.16	0.19	0.19	0.19	0.16	0.17	0.14	0.14	0.16	0.17	0.16	0.17	0.17	0.14
23:00	0.14	0.13	0.13	0.14	0.13	0.14	0.12	0.13	0.12	0.13	0.13	0.13	0.13	0.13
Average	0.19	0.19	0.18	0.17	0.17	0.17	0.17	0.17	0.19	0.18	0.16	0.16	0.17	0.16
Median	0.20	0.20	0.20	0.19	0.19	0.20	0.19	0.18	0.21	0.21	0.18	0.19	0.19	0.18
Max Hr. Mean	0.29	0.28	0.26	0.26	0.25	0.25	0.24	0.29	0.27	0.25	0.21	0.23	0.24	0.22
Min Hr. Mean	0.08	0.07	0.08	0.06	0.08	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.08
Inst. Max	0.30	0.30	0.27	0.27	0.27	0.26	0.27	0.31	0.28	0.27	0.23	0.24	0.26	0.24
Inst. Min	0.08	0.07	0.08	0.06	0.08	0.07	0.07	0.06	0.07	0.07	0.06	0.06	0.07	0.07
Peak To Avg.	1.52	1.48	1.45	1.49	1.45	1.43	1.42	1.65	1.46	1.41	1.30	1.39	1.37	1.37

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM05 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.62	1.66	1.55	1.65	1.58	1.61	1.54	1.59	1.65	1.59	1.58	1.66	1.60	1.61
1:00	1.51	1.56	1.48	1.49	1.43	1.50	1.46	1.54	1.52	1.49	1.42	1.52	1.55	1.55
2:00	1.46	1.45	1.44	1.36	1.38	1.44	1.45	1.47	1.50	1.43	1.39	1.45	1.51	1.45
3:00	1.45	1.39	1.45	1.33	1.38	1.45	1.42	1.42	1.49	1.42	1.38	1.50	1.49	1.45
4:00	1.42	1.52	1.48	1.35	1.38	1.51	1.46	1.40	1.44	1.46	1.42	1.50	1.45	1.50
5:00	1.52	1.55	1.67	1.51	1.56	1.63	1.70	1.52	1.47	1.63	1.64	1.67	1.61	1.63
6:00	1.58	1.56	1.88	1.78	1.79	1.84	1.92	1.62	1.56	1.88	1.88	1.92	1.92	1.87
7:00	1.83	1.80	2.05	2.10	2.11	2.08	2.17	1.95	1.83	2.10	2.12	2.16	2.15	2.16
8:00	2.06	2.01	2.04	1.97	2.01	2.05	2.00	2.04	2.05	2.01	2.03	2.06	2.02	1.98
9:00	2.14	2.10	2.08	1.98	2.01	2.06	1.93	2.10	2.19	2.07	2.04	2.09	2.08	2.10
10:00	2.17	2.13	2.08	2.07	2.07	2.04	1.92	2.16	2.23	2.10	2.13	2.18	2.17	2.11
11:00	2.19	2.20	2.10	2.09	2.06	2.05	1.98	2.24	2.28	2.16	2.09	2.10	2.11	2.11
12:00	2.23	2.21	2.04	2.08	2.09	2.16	2.07	2.22	2.24	2.12	2.15	2.18	2.17	2.13
13:00	2.21	2.22	2.12	2.14	2.12	2.03	2.05	2.28	2.22	2.10	2.13	2.04	2.06	2.07
14:00	2.20	2.25	2.03	2.03	2.09	2.10	2.00	2.25	2.23	2.12	2.08	2.03	2.02	2.04
15:00	2.14	2.20	2.00	2.02	2.09	2.08	2.11	2.20	2.23	2.10	2.04	2.04	2.15	2.06
16:00	2.12	2.16	2.09	2.05	2.11	2.08	2.04	2.16	2.19	2.06	2.15	2.03	2.17	2.13
17:00	2.12	2.21	2.15	2.15	2.15	2.10	2.11	2.17	2.22	2.20	2.18	2.13	2.23	2.09
18:00	2.05	2.16	2.20	2.17	2.21	2.20	2.09	2.16	2.20	2.23	2.16	2.20	2.23	2.02
19:00	2.04	2.07	2.17	2.14	2.21	2.15	2.03	2.10	2.23	2.22	2.15	2.19	2.21	2.03
20:00	2.05	2.03	2.14	2.18	2.19	2.20	1.97	1.96	2.11	2.16	2.17	2.15	2.16	2.01
21:00	1.97	2.04	2.13	2.05	2.07	2.02	1.92	1.92	2.10	2.06	2.11	2.05	2.09	1.93
22:00	1.86	2.01	2.00	1.92	1.93	1.95	1.79	1.84	1.91	1.89	1.98	1.99	1.97	1.83
23:00	1.77	1.75	1.75	1.71	1.80	1.83	1.71	1.80	1.78	1.71	1.84	1.77	1.78	1.73
Average	1.90	1.93	1.92	1.89	1.91	1.92	1.87	1.92	1.95	1.93	1.93	1.94	1.95	1.90
Median	2.02	2.05	2.05	2.01	2.05	2.04	1.97	2.01	2.10	2.05	2.07	2.05	2.06	2.00
Max Hr. Mean	2.23	2.25	2.20	2.18	2.21	2.20	2.17	2.28	2.28	2.23	2.18	2.20	2.23	2.16
Min Hr. Mean	1.42	1.39	1.44	1.33	1.38	1.44	1.42	1.40	1.44	1.42	1.38	1.45	1.45	1.45
Inst. Max	2.27	2.28	2.25	2.23	2.27	2.23	2.24	2.32	2.30	2.28	2.22	2.25	2.30	2.22
Inst. Min	1.40	1.35	1.41	1.28	1.34	1.39	1.39	1.38	1.41	1.40	1.34	1.42	1.40	1.43

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM05 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	2.38	2.36	2.19	2.26	2.47	2.14	2.06	2.09	2.14	2.07	2.32	2.10	2.16	2.17
1:00	2.22	2.22	2.06	2.03	2.24	1.98	1.90	1.97	1.96	1.92	1.96	1.87	2.04	2.08
2:00	2.14	2.02	2.02	1.85	2.12	1.89	1.90	1.89	2.02	1.83	1.80	1.75	1.94	1.91
3:00	2.13	1.95	2.00	1.80	2.12	1.83	1.88	1.79	1.95	1.80	1.73	1.83	1.92	1.91
4:00	2.03	2.11	2.04	1.84	2.13	1.95	1.94	1.78	1.87	1.89	1.77	1.81	1.86	1.96
5:00	2.23	2.17	2.35	2.17	2.41	2.12	2.31	1.97	1.96	2.16	2.17	2.06	2.20	2.23
6:00	2.31	2.16	2.70	2.56	2.76	2.50	2.64	2.09	2.09	2.56	2.61	2.49	2.63	2.64
7:00	2.75	2.56	3.00	3.11	3.00	3.02	3.21	2.57	2.51	2.95	2.99	2.89	2.99	3.10
8:00	3.14	3.05	3.00	2.81	2.79	2.94	2.97	2.88	2.93	2.76	2.74	2.70	2.75	2.75
9:00	3.43	3.20	3.04	2.82	2.76	2.93	2.92	2.94	3.18	3.01	2.69	2.83	2.83	3.07
10:00	3.45	3.43	3.00	2.96	2.89	2.94	2.99	3.22	3.24	3.09	2.92	2.92	3.00	2.97
11:00	3.55	3.54	3.08	3.02	2.86	2.96	3.16	3.41	3.41	3.35	2.86	2.83	2.90	3.03
12:00	3.59	3.56	2.99	3.18	2.92	3.14	3.22	3.39	3.39	3.23	2.96	3.10	3.05	3.02
13:00	3.64	3.42	3.13	3.08	2.96	2.93	3.11	3.54	3.32	3.16	2.85	2.82	2.86	2.96
14:00	3.57	3.52	2.93	2.89	2.85	3.03	3.03	3.37	3.33	3.05	2.82	2.83	2.89	2.85
15:00	3.46	3.31	2.87	2.84	2.84	3.00	3.16	3.16	3.31	3.07	2.69	2.84	2.98	2.91
16:00	3.36	3.31	3.11	2.96	2.96	3.01	3.06	3.11	3.31	3.07	2.84	2.76	3.04	3.02
17:00	3.23	3.37	3.22	3.13	3.07	3.06	3.21	3.12	3.36	3.27	2.93	2.88	3.12	3.01
18:00	3.05	3.23	3.38	3.31	3.29	3.27	3.23	3.05	3.27	3.27	2.92	3.01	3.14	2.85
19:00	3.01	3.02	3.32	3.39	3.22	3.16	2.97	3.05	3.37	3.16	2.97	3.01	3.10	2.88
20:00	3.04	3.00	3.13	3.41	3.15	3.21	2.83	2.69	3.09	3.17	2.93	3.00	3.02	2.82
21:00	2.86	2.96	3.06	3.14	2.96	2.98	2.65	2.59	3.03	3.04	2.87	2.80	2.90	2.69
22:00	2.67	2.92	2.87	2.96	2.64	2.70	2.48	2.50	2.66	2.74	2.59	2.73	2.71	2.55
23:00	2.57	2.50	2.44	2.66	2.44	2.46	2.32	2.40	2.35	2.52	2.37	2.38	2.44	2.42

Average	2.91	2.87	2.79	2.76	2.74	2.71	2.72	2.69	2.79	2.76	2.60	2.59	2.69	2.66
Median	2.99	3.01	2.97	2.90	2.83	2.91	2.95	2.81	3.07	2.98	2.77	2.79	2.85	2.82
Max Hr. Mean	3.64	3.56	3.38	3.41	3.29	3.27	3.23	3.54	3.41	3.35	2.99	3.10	3.14	3.10
Min Hr. Mean	2.03	1.95	2.00	1.80	2.12	1.83	1.88	1.78	1.87	1.80	1.73	1.75	1.86	1.91
Inst. Max	3.74	3.67	3.43	3.51	3.37	3.34	3.43	3.69	3.53	3.45	3.08	3.18	3.30	3.27
Inst. Min	1.96	1.88	1.95	1.75	2.07	1.80	1.80	1.70	1.83	1.78	1.65	1.70	1.76	1.86

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM05 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	69.96	70.28	69.90	70.47	70.91	70.63	70.12	69.50	69.80	69.44	69.57	69.72	69.55	69.56
1:00	69.45	70.22	69.47	70.08	70.32	69.69	69.35	69.23	68.85	69.15	68.78	68.85	68.94	69.05
2:00	69.04	69.49	69.20	69.63	69.52	69.39	69.15	68.94	68.40	68.53	68.46	68.53	68.28	68.59
3:00	69.04	68.89	68.71	69.09	69.21	69.06	68.82	68.82	68.24	68.23	68.07	68.10	68.32	68.53
4:00	68.62	67.84	68.80	68.80	69.07	68.93	68.51	68.39	67.94	68.16	67.75	67.83	67.97	68.03
5:00	68.53	67.80	69.10	69.11	69.25	69.13	68.89	68.34	67.81	68.36	67.97	68.22	68.23	68.49
6:00	68.60	68.46	70.09	69.92	70.18	70.19	69.54	68.29	67.66	69.15	68.94	68.87	69.54	69.34
7:00	69.15	69.42	70.80	71.14	70.88	70.77	70.66	68.59	67.93	69.88	69.95	69.69	70.05	70.47
8:00	69.74	70.70	70.52	70.28	70.27	70.29	70.30	69.93	68.90	69.49	69.36	69.19	69.58	69.60
9:00	71.04	70.93	70.70	70.08	70.19	70.18	70.05	70.34	70.23	69.43	68.98	69.80	69.40	70.18
10:00	71.07	71.78	70.78	70.84	70.17	70.98	70.38	70.87	70.84	70.35	69.79	69.85	70.21	70.03
11:00	72.41	72.03	70.63	71.18	70.53	70.96	70.58	71.37	71.47	70.65	69.90	70.05	70.12	70.80
12:00	71.91	72.17	70.79	71.37	70.24	71.33	71.01	71.77	72.46	70.22	70.40	70.53	70.50	70.48
13:00	72.45	72.47	71.33	71.46	70.49	71.15	70.79	72.20	71.63	70.07	70.01	69.87	70.01	70.78
14:00	72.44	72.89	70.86	70.51	70.44	70.84	70.90	72.16	72.49	69.98	70.33	70.08	69.68	70.03
15:00	72.49	72.87	70.68	71.45	70.64	71.23	71.36	71.71	72.27	70.92	70.00	69.22	70.30	70.70
16:00	72.58	71.71	71.13	70.96	71.20	71.28	70.73	71.72	71.78	70.63	70.59	69.56	70.63	70.67
17:00	72.30	72.04	71.65	71.66	71.09	71.19	71.63	72.16	71.73	71.22	70.21	70.33	70.65	70.93
18:00	71.98	71.85	72.53	72.33	71.62	72.45	71.68	71.46	71.57	71.47	70.94	70.99	71.51	70.95
19:00	71.38	71.47	72.49	72.69	72.49	71.81	71.12	70.85	72.22	71.85	71.30	71.23	71.79	70.96
20:00	71.03	71.79	72.41	73.27	72.44	72.16	71.24	70.62	71.76	71.53	71.49	71.90	71.97	70.89
21:00	70.91	71.93	72.20	72.85	72.85	72.39	70.75	70.71	71.54	71.46	71.79	71.22	71.59	70.99
22:00	70.63	71.71	72.07	72.39	72.40	71.52	70.20	70.09	71.43	71.19	71.03	71.23	71.47	70.39
23:00	70.27	70.80	71.30	71.44	71.40	70.90	69.89	70.39	70.21	70.42	70.55	70.48	70.73	70.16

Average	70.71	70.90	70.76	70.96	70.74	70.77	70.32	70.35	70.38	70.07	69.84	69.80	70.04	70.03
Median	70.74	71.31	70.78	70.89	70.58	70.85	70.45	70.41	70.96	70.13	70.01	69.84	70.05	70.20
Max Hr. Mean	72.58	72.89	72.53	73.27	72.85	72.45	71.68	72.20	72.49	71.85	71.79	71.90	71.97	70.99
Min Hr. Mean	68.53	67.80	68.71	68.80	69.07	68.93	68.51	68.29	67.66	68.16	67.75	67.83	67.97	68.03
Inst. Max	73.12	73.53	72.99	73.89	73.11	73.27	72.60	72.99	73.53	72.54	72.07	72.32	72.29	71.78
Inst. Min	68.49	67.41	68.61	68.71	68.91	68.87	68.43	68.02	67.59	68.08	67.70	67.71	67.80	67.94

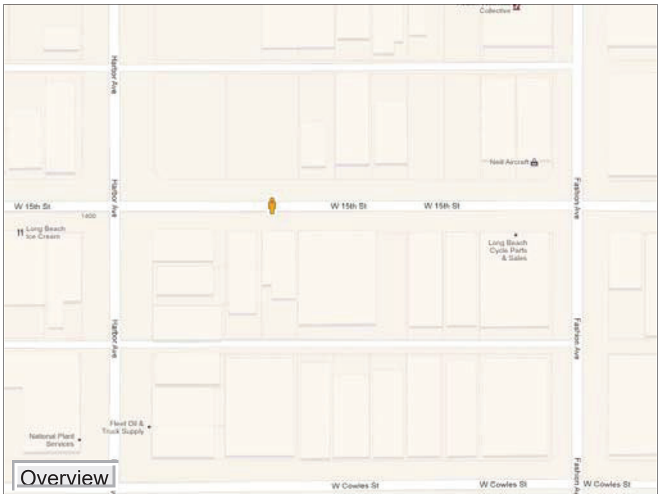
Site Investigation Summary

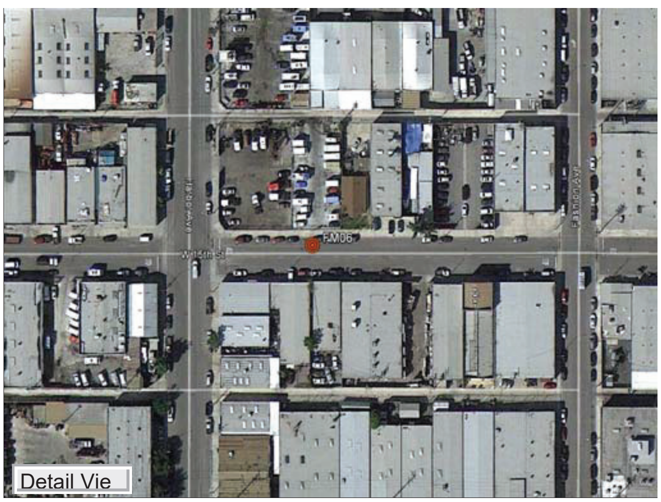
MWH Global - City of Long Beach Master Plan

Site #: FM06 **Date:** 12/27/201

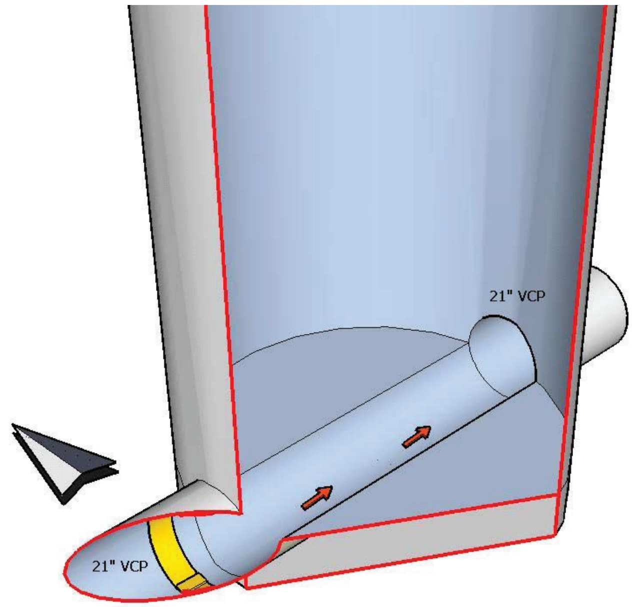
Address: 1346 W. 15h St.

Traffic: Light, commercial **Job #** 2012.5.166



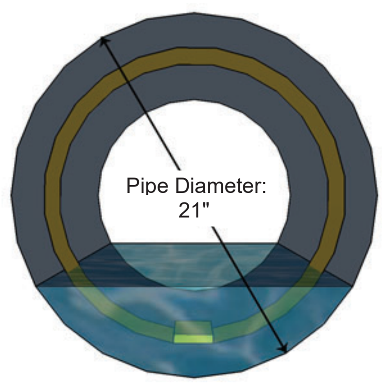


Profile



MH Condition:	Fair	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	18.7'

Cross Section



Monitor SN:	ISCO
SensorType:	Pressure transducer, Doppler Velocity
Velocity:	1.85 fps
Flow Depth:	13.13"
Pipe Material:	VCP
Comments:	Almost 50% capacity, moderate-slow flow

DownStream Services, Inc.

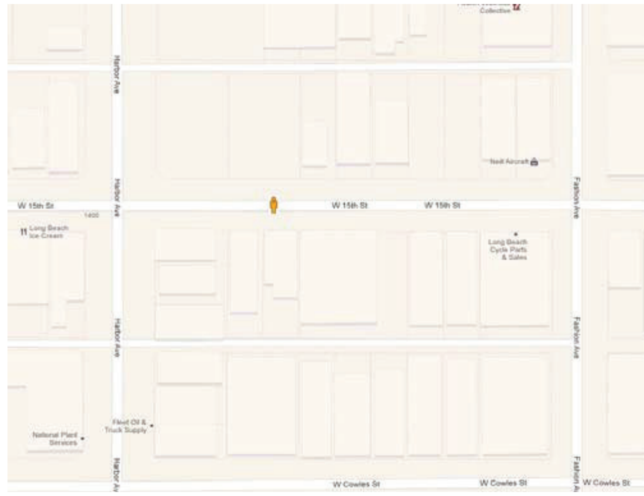
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM06
Map Page: F13-SMH-037
Location: 1346 W. 15h St.
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 3:20:00 PM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Light, commercial
Manhole Depth: 18.7'

Overview



Facility Inspection

Cover

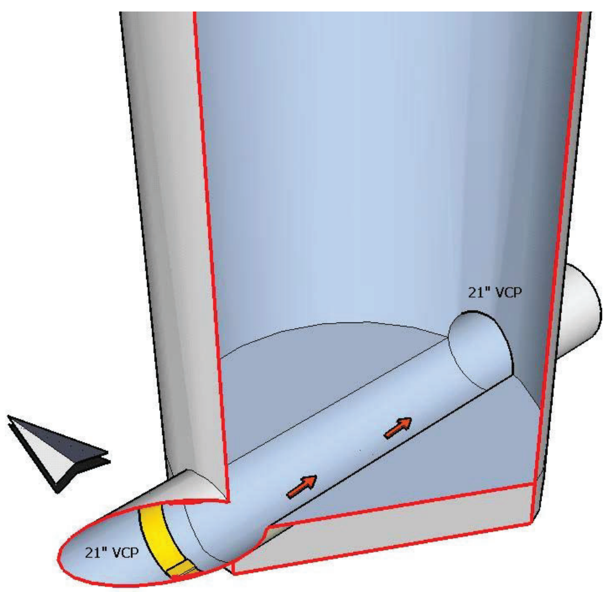
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: Light

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Eccentric
Material: Precast Concrete
Condition: Good
Infiltration: None



Barrel

Material: Precast Concrete
Condition: good
Infiltration: stains

Rungs

Rungs: Yes
Material: Plastic-coated
Condition: good

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: Old
Level: to 2'

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

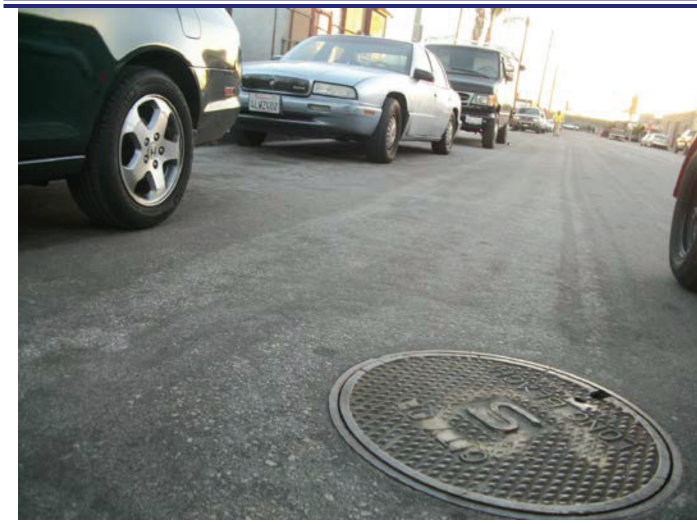
Grease: Light
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

Observations and Comments

Flow Velocity: 1.85 fps
Flow Depth: 13.13"
Observation Location: Influent Pipe

Comments: 50% pipe capacity; moderate-slow velocity

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM06


Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project #	2012.5.166	
Location ID	FM06	
Pipe Diameter	21	Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	11.75
Maximum	20.17
Minimum	8.05
Max d/D	96.0%

Velocity - Feet per Second

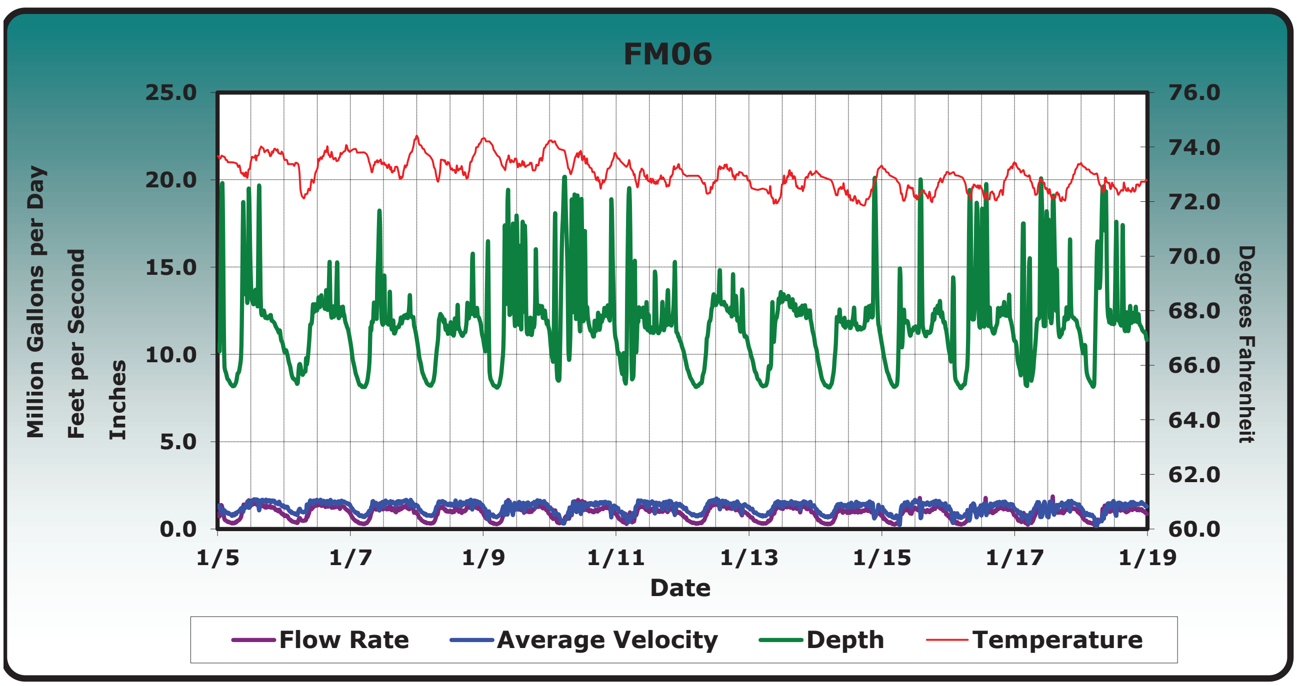
Average	1.22
Maximum	1.74
Minimum	0.17

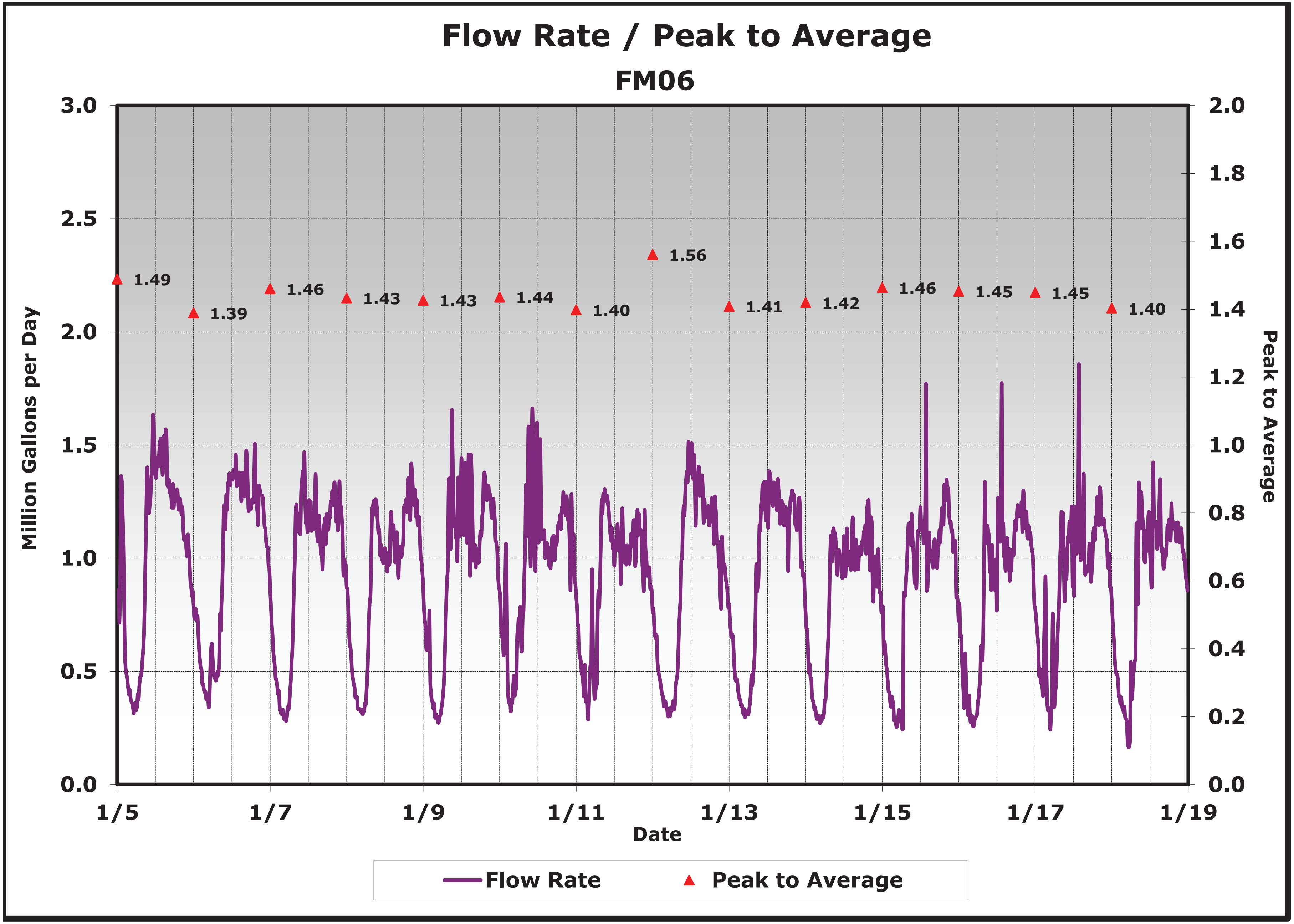
Flow - Million Gallons per Day

Average	0.93
Maximum	1.86
Minimum	0.17
Peak Factor	2.01

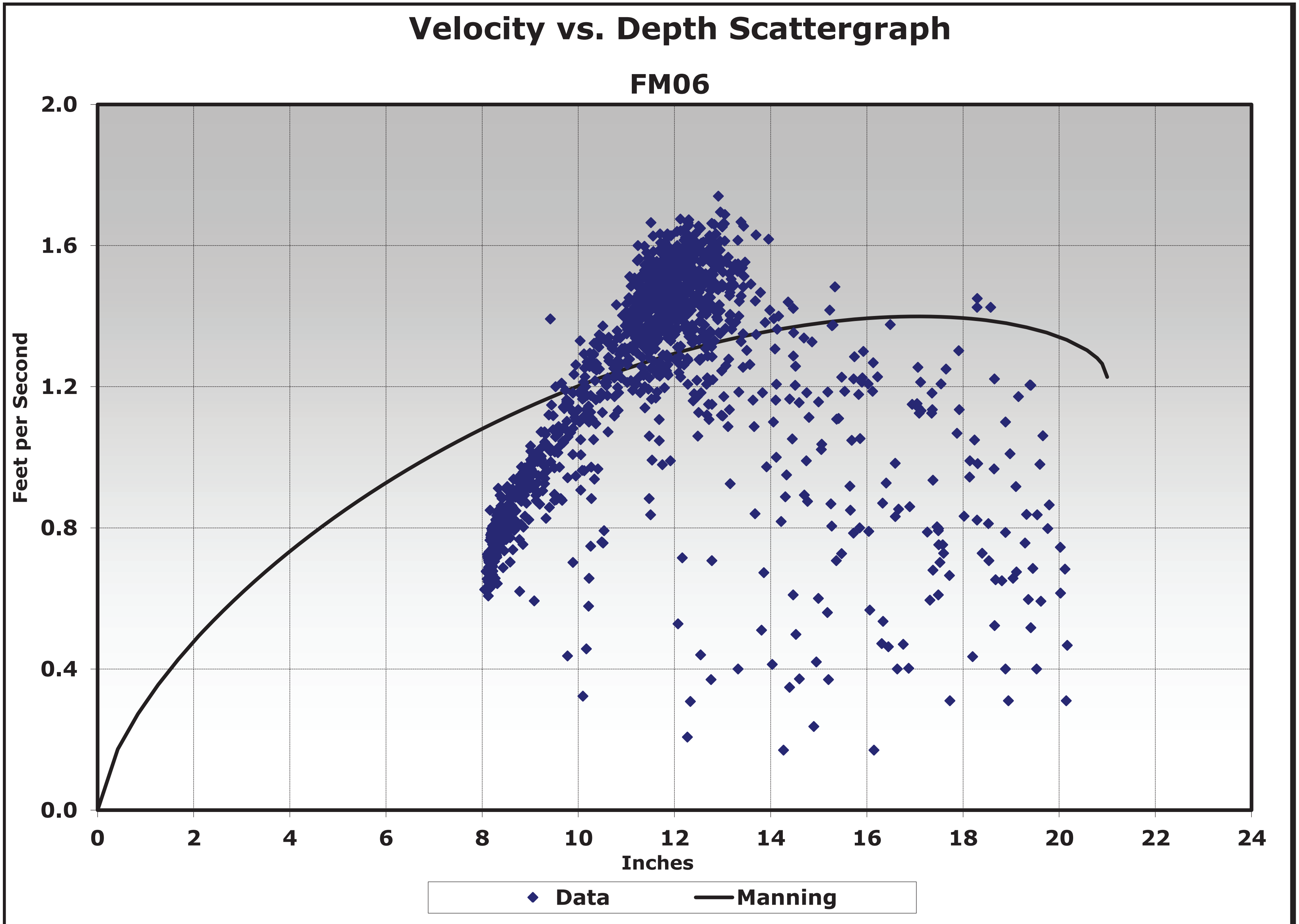
Temperature - Deg. F

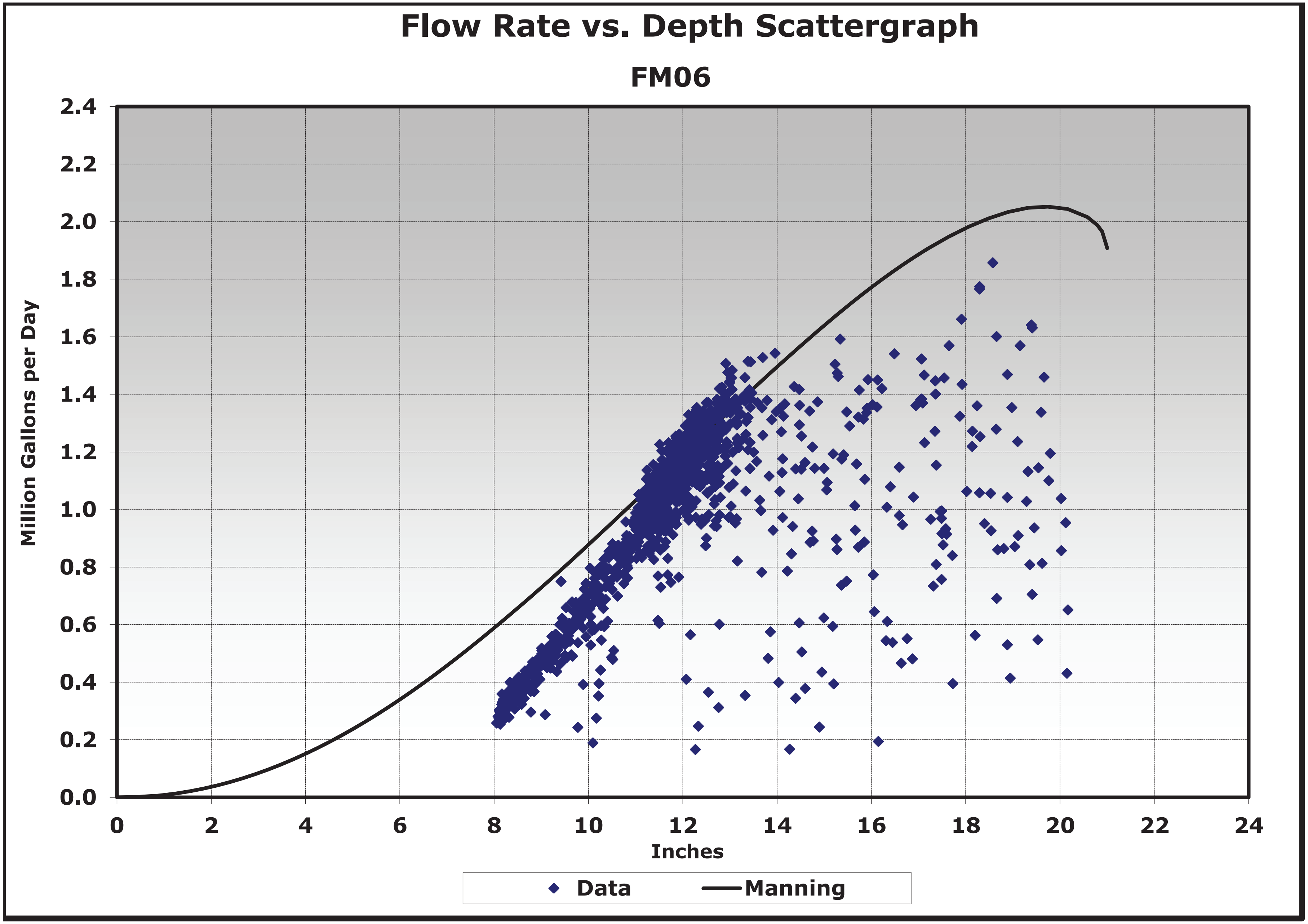
Average	73.04
Maximum	74.42
Minimum	71.86





Flow Rate / Peak to Average
FM06
Million Gallons per Day
Peak to Average
Date
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.49
1.39
1.46
1.43
1.43
1.44
1.40
1.56
1.41
1.42
1.46
1.45
1.45
1.40
Flow Rate
Peak to Average


Velocity vs. Depth Scattergraph
FM06
Feet per Second
2.0
1.6
1.2
0.8
0.4
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM06
Million Gallons per Day
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM06 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.81	0.77	0.76	0.80	0.77	0.75	0.76	0.73	0.71	0.68	0.69	0.71	0.72	0.72
1:00	1.21	0.68	0.53	0.56	0.60	0.67	0.54	0.59	0.59	0.49	0.52	0.45	0.51	0.51
2:00	0.72	0.50	0.43	0.43	0.50	0.68	0.46	0.45	0.45	0.36	0.38	0.45	0.48	0.40
3:00	0.44	0.42	0.33	0.36	0.34	0.35	0.35	0.37	0.37	0.31	0.35	0.32	0.65	0.35
4:00	0.38	0.38	0.31	0.33	0.29	0.42	0.47	0.34	0.33	0.29	0.27	0.28	0.31	0.30
5:00	0.34	0.53	0.31	0.33	0.31	0.55	0.61	0.32	0.31	0.30	0.31	0.30	0.51	0.18
6:00	0.36	0.50	0.44	0.46	0.44	0.69	0.50	0.35	0.35	0.43	0.40	0.41	0.43	0.45
7:00	0.48	0.48	0.80	0.85	0.83	0.76	0.90	0.43	0.48	0.81	0.89	0.62	0.79	0.69
8:00	0.69	0.69	1.20	1.22	1.23	1.19	1.25	0.71	0.79	1.08	1.13	1.13	1.14	1.08
9:00	1.24	1.08	1.17	1.22	1.38	1.28	1.27	1.10	1.01	1.05	1.10	1.07	0.93	1.20
10:00	1.26	1.24	1.39	1.08	1.09	1.40	1.18	1.30	1.25	1.00	0.92	0.95	1.07	1.06
11:00	1.52	1.35	1.17	1.00	1.21	1.25	1.07	1.41	1.26	0.96	1.10	0.92	1.08	1.13
12:00	1.39	1.37	1.23	1.01	1.31	1.27	1.04	1.44	1.31	1.00	1.17	1.06	1.04	0.95
13:00	1.48	1.37	1.15	1.03	1.27	1.14	1.08	1.31	1.29	1.03	1.29	1.26	1.31	1.23
14:00	1.45	1.34	1.23	1.14	1.19	1.06	1.08	1.33	1.30	1.06	0.97	1.03	1.09	1.09
15:00	1.47	1.33	1.12	1.05	1.24	1.01	1.01	1.32	1.28	1.03	1.01	1.04	1.07	1.18
16:00	1.32	1.38	1.03	0.99	1.03	1.03	1.01	1.20	1.22	0.99	1.03	0.96	0.95	0.99
17:00	1.26	1.26	1.14	1.03	1.00	1.06	1.07	1.18	1.20	1.05	1.02	1.08	0.98	1.08
18:00	1.28	1.25	1.17	1.24	1.15	1.13	1.07	1.20	1.10	1.10	1.14	1.18	1.08	1.16
19:00	1.25	1.36	1.26	1.28	1.35	1.19	1.16	1.18	1.26	1.18	1.22	1.21	1.20	1.15
20:00	1.20	1.25	1.26	1.32	1.29	1.23	1.08	1.07	1.23	1.08	1.30	1.21	1.23	1.12
21:00	1.08	1.27	1.22	1.25	1.22	1.20	1.01	0.91	1.16	0.90	1.16	1.13	1.16	1.09
22:00	1.03	1.14	1.19	1.18	1.18	1.08	0.96	0.97	1.11	0.97	1.07	1.11	1.06	1.04
23:00	0.86	1.01	0.97	1.00	0.98	0.99	0.89	0.85	0.91	0.85	0.89	0.94	0.93	0.92
Average	1.02	1.00	0.95	0.92	0.97	0.97	0.91	0.92	0.93	0.83	0.89	0.87	0.91	0.88
Median	1.19	1.17	1.12	1.01	1.07	1.06	1.00	0.99	1.13	0.95	1.03	1.00	0.97	1.03
Max Hr. Mean	1.52	1.38	1.39	1.32	1.38	1.40	1.27	1.44	1.31	1.18	1.30	1.26	1.31	1.23
Min Hr. Mean	0.34	0.38	0.31	0.33	0.29	0.35	0.35	0.32	0.31	0.29	0.27	0.28	0.31	0.18
Inst. Max	1.63	1.51	1.47	1.42	1.64	1.66	1.30	1.51	1.38	1.26	1.77	1.77	1.86	1.42
Inst. Min	0.32	0.34	0.28	0.31	0.27	0.32	0.29	0.30	0.30	0.27	0.24	0.26	0.24	0.17
Peak To Avg.	1.49	1.39	1.46	1.43	1.43	1.44	1.40	1.56	1.41	1.42	1.46	1.45	1.45	1.40

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM06 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.29	1.25	1.22	1.25	1.20	1.16	1.20	1.19	1.17	1.10	1.12	1.17	1.10	1.14
1:00	1.04	1.17	1.00	1.03	0.69	0.94	0.95	1.09	1.06	0.92	0.97	0.69	0.94	0.83
2:00	0.99	0.98	0.91	0.89	0.88	0.86	0.87	0.93	0.91	0.78	0.79	0.78	0.78	0.83
3:00	0.93	0.90	0.75	0.80	0.77	0.73	0.77	0.81	0.81	0.72	0.79	0.74	0.71	0.78
4:00	0.85	0.84	0.73	0.77	0.70	0.39	0.40	0.79	0.77	0.69	0.64	0.67	0.68	0.71
5:00	0.79	1.04	0.73	0.76	0.73	0.40	0.73	0.75	0.74	0.70	0.70	0.70	0.60	0.22
6:00	0.83	0.99	0.91	0.93	0.90	0.74	0.81	0.79	0.79	0.89	0.47	0.86	0.88	0.44
7:00	0.97	0.96	1.13	1.32	1.09	1.05	1.30	0.90	0.93	1.20	1.28	0.74	1.24	0.56
8:00	1.14	1.22	1.48	1.54	1.23	1.16	1.56	1.19	1.10	1.36	1.44	1.16	1.47	0.87
9:00	1.08	1.51	1.38	1.56	1.39	1.32	1.57	1.49	1.38	1.36	1.44	1.29	0.83	1.22
10:00	1.38	1.53	1.16	1.44	0.99	1.26	1.51	1.60	1.50	1.32	1.30	0.80	1.27	1.35
11:00	1.31	1.61	1.45	1.39	1.34	1.20	1.38	1.56	1.42	1.27	1.51	1.21	1.08	1.47
12:00	1.53	1.60	1.48	1.39	1.28	1.31	1.44	1.63	1.46	1.33	1.59	1.08	1.02	1.00
13:00	1.66	1.57	1.50	1.40	1.42	1.37	1.50	1.41	1.45	1.33	1.52	1.26	1.44	1.47
14:00	1.57	1.58	1.52	1.48	1.21	1.43	1.26	1.54	1.47	1.36	0.95	1.17	0.96	1.43
15:00	1.39	1.53	1.50	1.43	1.29	1.43	1.42	1.54	1.49	1.40	1.42	1.37	1.24	1.32
16:00	1.62	1.48	1.43	1.41	1.44	1.43	1.29	1.44	1.44	1.34	1.46	1.35	1.37	1.31
17:00	1.58	1.53	1.54	1.44	1.38	1.41	1.40	1.44	1.46	1.41	1.43	1.45	1.36	1.39
18:00	1.61	1.54	1.52	1.52	1.47	1.49	1.32	1.39	1.35	1.38	1.47	1.46	1.36	1.47
19:00	1.58	1.49	1.58	1.56	1.48	1.48	1.51	1.43	1.51	1.46	1.50	1.47	1.49	1.45
20:00	1.56	1.53	1.58	1.40	1.56	1.51	1.36	1.40	1.51	1.33	1.56	1.46	1.35	1.42
21:00	1.47	1.56	1.46	1.53	1.49	1.50	1.17	1.13	1.43	0.71	1.40	1.39	1.47	1.46
22:00	1.45	1.49	1.49	1.50	1.48	0.96	1.38	1.37	1.42	1.08	1.38	1.36	1.39	1.44
23:00	1.32	1.42	1.33	1.38	1.30	1.24	1.35	1.27	1.31	1.20	1.25	1.32	1.30	1.32

Average	1.29	1.35	1.28	1.30	1.20	1.16	1.23	1.25	1.24	1.15	1.22	1.12	1.14	1.12
Median	1.33	1.45	1.39	1.40	1.23	1.28	1.34	1.34	1.36	1.25	1.37	1.22	1.23	1.30
Max Hr. Mean	1.66	1.61	1.58	1.56	1.56	1.51	1.57	1.63	1.51	1.46	1.59	1.47	1.49	1.47
Min Hr. Mean	0.79	0.84	0.73	0.76	0.69	0.39	0.40	0.75	0.74	0.69	0.47	0.67	0.60	0.22
Inst. Max	1.70	1.66	1.66	1.67	1.63	1.56	1.63	1.74	1.59	1.57	1.67	1.56	1.61	1.59
Inst. Min	0.74	0.78	0.67	0.73	0.54	0.31	0.40	0.71	0.70	0.60	0.24	0.35	0.37	0.17

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM06 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	10.36	10.20	10.27	10.45	10.49	10.54	10.41	10.14	10.18	10.23	10.25	10.15	10.61	10.36
1:00	17.26	9.84	9.31	9.48	13.64	11.68	9.73	9.43	9.58	9.35	9.41	11.43	9.46	10.21
2:00	11.74	9.16	8.68	8.81	9.57	12.30	9.46	8.88	8.96	8.63	8.82	10.14	10.63	8.77
3:00	8.74	8.63	8.27	8.44	8.33	8.95	8.60	8.51	8.56	8.28	8.39	8.33	14.00	8.40
4:00	8.41	8.43	8.15	8.24	8.16	15.52	17.09	8.23	8.29	8.15	8.16	8.10	8.61	8.21
5:00	8.20	9.06	8.19	8.28	8.16	19.48	13.12	8.18	8.18	8.18	8.37	8.21	13.44	13.19
6:00	8.30	9.02	8.80	8.91	8.81	14.50	10.75	8.31	8.36	8.80	12.92	8.74	8.79	14.72
7:00	8.87	8.97	11.20	10.49	12.46	11.74	11.05	8.76	9.19	10.81	11.09	14.33	10.41	17.14
8:00	10.06	9.72	12.34	12.15	15.07	15.72	12.26	10.01	11.28	12.12	12.03	14.89	11.97	18.52
9:00	16.45	11.25	12.78	12.02	14.81	14.50	12.31	11.48	11.48	11.91	11.77	12.75	17.20	14.99
10:00	13.49	12.33	16.98	11.66	15.77	16.20	11.96	12.36	12.56	11.74	11.21	17.08	13.38	12.06
11:00	16.92	12.65	12.32	11.32	13.78	15.57	12.02	13.31	13.24	11.76	11.44	11.80	15.45	11.82
12:00	13.49	12.85	12.68	11.39	15.17	14.48	11.36	13.05	13.20	11.64	11.48	15.11	15.71	14.55
13:00	13.22	12.99	11.83	11.50	13.34	12.56	11.35	13.77	13.17	11.97	13.16	15.48	13.70	12.65
14:00	13.85	12.75	12.31	11.91	14.94	11.59	13.23	12.90	13.13	11.99	16.31	13.44	16.51	11.79
15:00	15.92	12.94	11.58	11.45	14.33	11.20	11.28	12.85	12.84	11.47	11.24	11.85	12.93	13.78
16:00	12.36	13.75	11.35	11.11	11.30	11.41	12.08	12.55	12.67	11.49	11.21	11.24	11.08	11.76
17:00	12.17	12.41	11.61	11.33	11.44	11.70	11.84	12.41	12.42	11.54	11.27	11.64	11.37	11.94
18:00	12.11	12.30	11.90	12.38	12.08	11.78	12.62	13.04	12.37	12.22	11.93	12.35	12.18	12.07
19:00	12.09	13.51	12.14	12.46	13.66	12.22	11.83	12.59	12.56	12.33	12.36	12.45	12.30	12.16
20:00	11.81	12.34	12.17	14.13	12.48	12.35	12.16	11.82	12.40	12.38	12.56	12.54	13.74	12.05
21:00	11.50	12.41	12.68	12.38	12.42	12.23	13.32	12.43	12.34	18.32	12.49	12.33	12.07	11.67
22:00	11.24	11.78	12.13	12.09	12.16	16.57	11.09	11.16	11.98	13.67	11.91	12.35	11.83	11.34
23:00	10.65	11.22	11.39	11.39	11.68	12.23	10.65	10.81	11.06	11.19	11.22	11.25	11.29	11.07

Average	12.05	11.27	11.29	10.99	12.25	13.21	11.73	11.12	11.25	11.26	11.29	12.00	12.44	12.30
Median	11.93	11.91	11.75	11.31	12.09	12.17	11.48	11.56	12.16	11.57	11.38	11.84	11.98	11.84
Max Hr. Mean	17.26	13.75	16.98	14.13	15.77	19.48	17.09	13.77	13.24	18.32	16.31	17.08	17.20	18.52
Min Hr. Mean	8.20	8.43	8.15	8.24	8.16	8.95	8.60	8.18	8.18	8.15	8.16	8.10	8.61	8.21
Inst. Max	19.79	15.28	18.24	15.74	19.39	20.17	19.53	14.80	13.57	20.12	20.03	19.76	20.02	19.62
Inst. Min	8.17	8.30	8.12	8.20	8.08	8.49	8.33	8.13	8.16	8.09	8.13	8.05	8.18	8.14

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM06 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	73.64	73.55	73.87	74.33	74.32	74.24	73.66	73.04	72.71	73.09	73.26	73.04	73.38	73.36
1:00	73.64	73.45	73.93	74.07	74.22	74.19	73.53	72.95	72.48	73.01	73.15	73.05	73.22	73.26
2:00	73.64	73.38	73.85	73.94	74.19	74.11	73.41	72.95	72.45	72.92	73.05	73.02	73.10	73.18
3:00	73.51	73.36	73.80	73.79	74.04	73.96	73.31	72.95	72.44	72.88	72.94	72.96	73.09	73.11
4:00	73.45	73.41	73.81	73.70	73.82	73.91	73.40	72.95	72.46	72.84	72.89	72.92	72.95	73.03
5:00	73.44	73.23	73.78	73.58	73.68	73.84	73.26	72.95	72.47	72.80	72.80	72.85	72.90	73.02
6:00	73.42	72.29	73.62	73.26	73.48	73.43	73.04	72.88	72.42	72.63	72.63	72.56	72.63	72.78
7:00	73.32	72.17	73.25	72.84	73.25	73.10	72.67	72.70	72.38	72.32	72.21	72.27	72.36	72.50
8:00	73.16	72.32	73.26	73.13	73.38	73.23	72.85	72.52	72.17	72.38	72.10	72.27	72.45	72.53
9:00	73.01	72.49	73.47	73.53	73.58	73.63	73.17	72.31	71.98	72.50	72.50	72.59	72.79	72.75
10:00	72.98	72.77	73.47	73.44	73.48	73.72	72.98	72.45	71.97	72.52	72.51	72.56	72.71	72.58
11:00	73.14	72.99	73.44	73.41	73.52	73.73	72.84	72.68	72.20	72.34	72.37	72.53	72.48	72.61
12:00	73.56	73.38	73.38	73.23	73.39	73.60	72.76	72.78	72.73	72.16	72.16	72.41	72.39	72.50
13:00	73.64	73.59	73.29	73.16	73.35	73.45	72.76	73.23	72.73	72.06	72.20	72.22	72.19	72.32
14:00	73.65	73.72	73.27	73.16	73.42	73.30	72.70	73.24	73.02	72.14	72.36	72.12	72.15	72.39
15:00	73.91	73.90	73.10	73.18	73.31	73.15	72.76	73.30	72.98	71.99	72.36	72.28	72.30	72.52
16:00	73.97	73.71	73.24	73.18	73.35	72.98	72.87	73.24	72.89	71.93	72.20	72.27	72.13	72.43
17:00	73.85	73.71	73.10	73.02	73.37	72.83	72.82	73.20	72.58	71.86	72.23	72.08	72.09	72.43
18:00	73.85	73.58	72.87	72.92	73.15	72.63	72.61	72.95	72.48	72.02	72.07	72.25	72.16	72.43
19:00	73.73	73.51	73.15	73.36	73.31	72.72	72.72	72.93	72.48	72.14	72.31	72.36	72.54	72.41
20:00	73.87	73.69	73.34	73.63	73.48	72.92	73.02	73.04	72.76	72.40	72.62	72.70	72.71	72.62
21:00	73.90	73.80	73.67	73.89	73.62	73.22	73.23	73.06	72.95	72.72	72.79	72.99	72.97	72.63
22:00	73.77	73.97	73.89	74.07	74.00	73.40	73.31	72.95	73.05	73.02	72.84	73.22	73.23	72.73
23:00	73.78	73.89	74.26	74.24	74.14	73.69	73.20	72.87	73.02	73.26	73.04	73.33	73.37	72.76

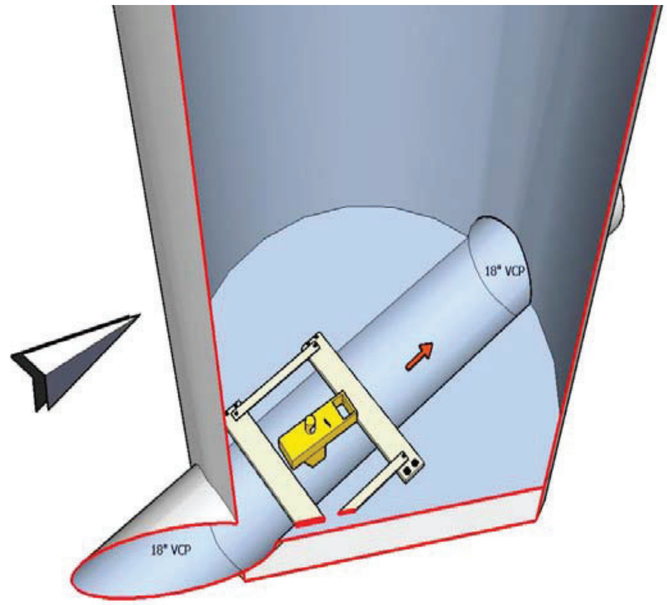
Average	73.58	73.33	73.51	73.50	73.62	73.46	73.04	72.92	72.58	72.50	72.57	72.62	72.68	72.70
Median	73.64	73.50	73.46	73.46	73.50	73.48	72.98	72.95	72.49	72.47	72.51	72.54	72.67	72.63
Max Hr. Mean	73.97	73.97	74.26	74.33	74.32	74.24	73.66	73.30	73.05	73.26	73.26	73.33	73.38	73.36
Min Hr. Mean	72.98	72.17	72.87	72.84	73.15	72.63	72.61	72.31	71.97	71.86	72.07	72.08	72.09	72.32
Inst. Max	74.02	74.07	74.36	74.42	74.34	74.24	73.73	73.37	73.15	73.30	73.32	73.42	73.44	73.42
Inst. Min	72.87	72.12	72.83	72.73	73.15	72.48	72.53	72.29	71.93	71.86	71.99	72.05	72.02	72.25

Site Investigation Summary

MWH Global - City of Long Beach Master Plan

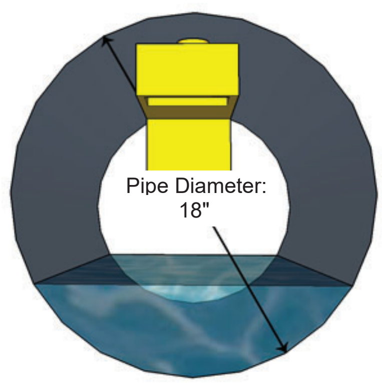
Site #: FM07 **Date:** 12/27/201
Address: Magnolia, S/of Broadway
Traffic: Heavy, business **Job #** 2012.5.166

Profile



MH Condition:	Good	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	No	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	17'

Cross Section



Monitor SN:	FloDar
SensorType:	Ultrasonic, radar-Doppler velocity
Velocity:	1.55 fps
Flow Depth:	2.75"
Pipe Material:	VCP
Comments:	Low flow shows commercial pattern

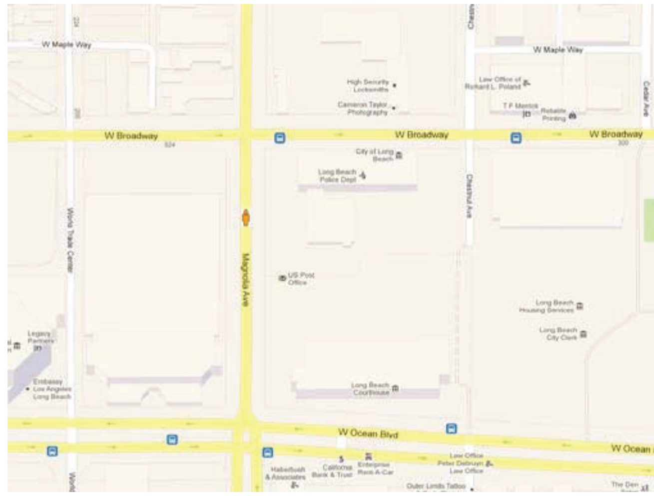
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

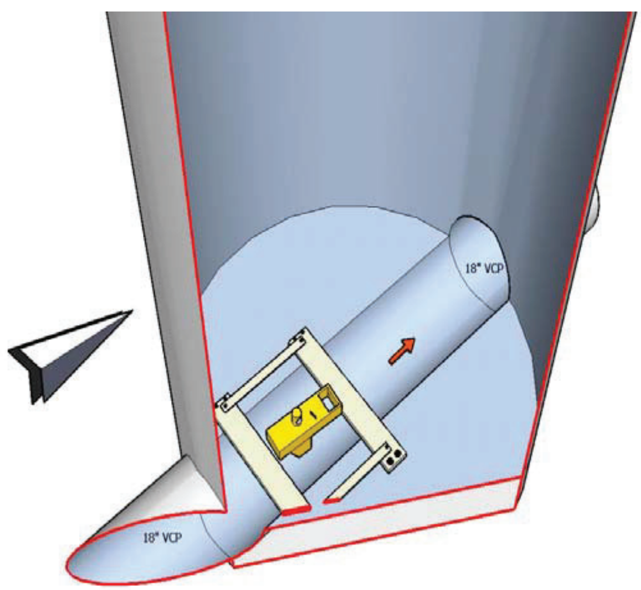
Site Details

Job Number: 2012.5.166
Site Identifier: FM07
Map Page: G09-SMH-026
Location: Magnolia, S/of Broadway
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 11:10:00 AM
Site Status: New Site
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Heavy, business
Manhole Depth: 17'

Overview



Facility Inspection



Cover

Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: Light

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Eccentric
Material: Precast Concrete
Condition: Good
Infiltration: None

Barrel

Material: Precast Concrete
Condition: good
Infiltration: none

Rungs

Rungs: No
Material: Cast Iron
Condition: good

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: None
Vermin: None - N/A
Odor: No - N/A
Vandalism: None

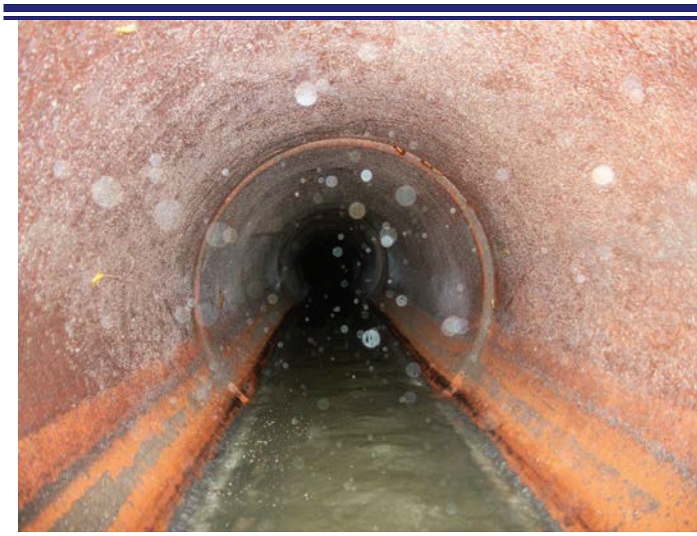
Observations and Comments

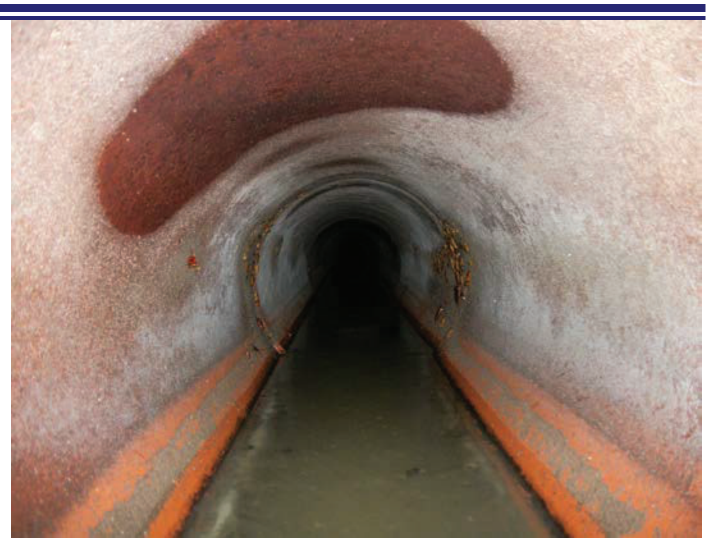
Flow Velocity: 1.55 fps
Flow Depth: 2.75"
Observation Location: Influent Pipe

Comments: Government offices: commercial flow pattern


Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project # 2012.5.166
Location FM07
Pipe Diameter 18 Inches

Report Date 1/5/2013 to 1/18/2013

Depth - Inches

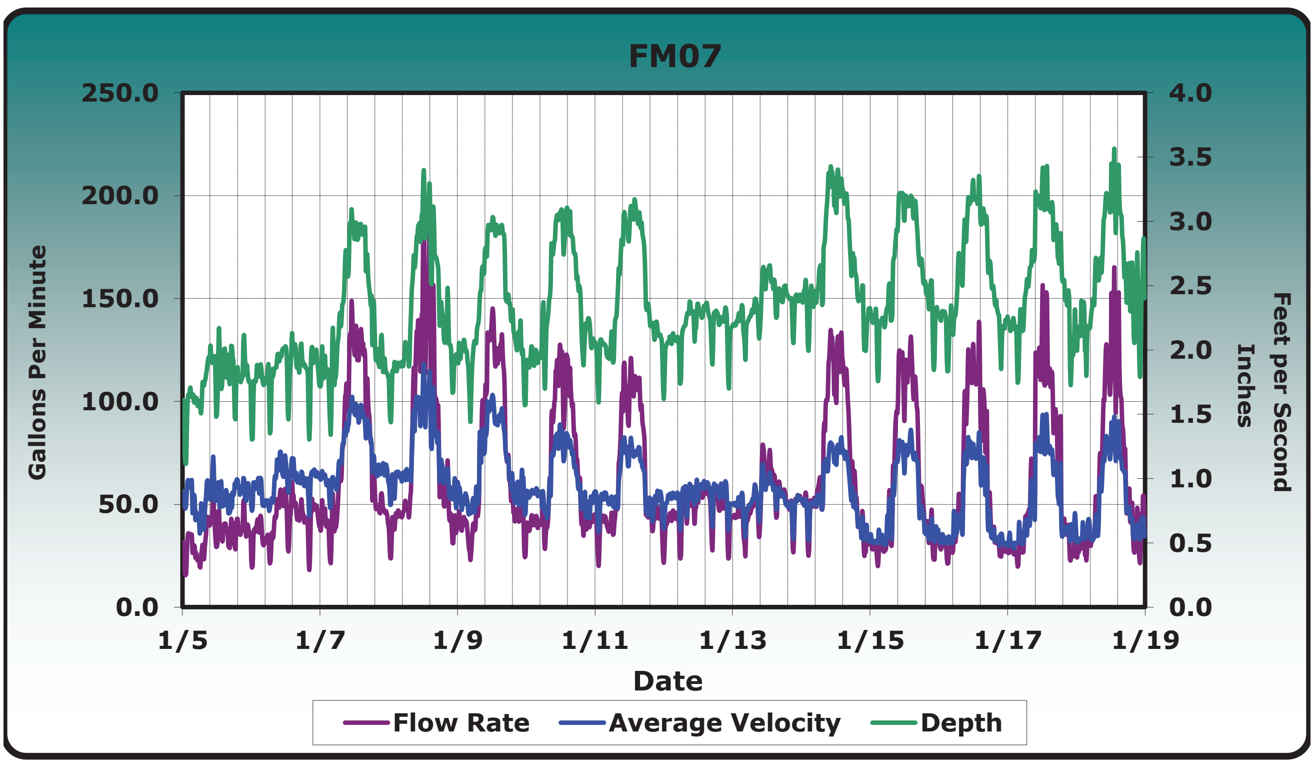
Average	2.36
Maximum	3.56
Minimum	1.11
Max d/D	19.8%

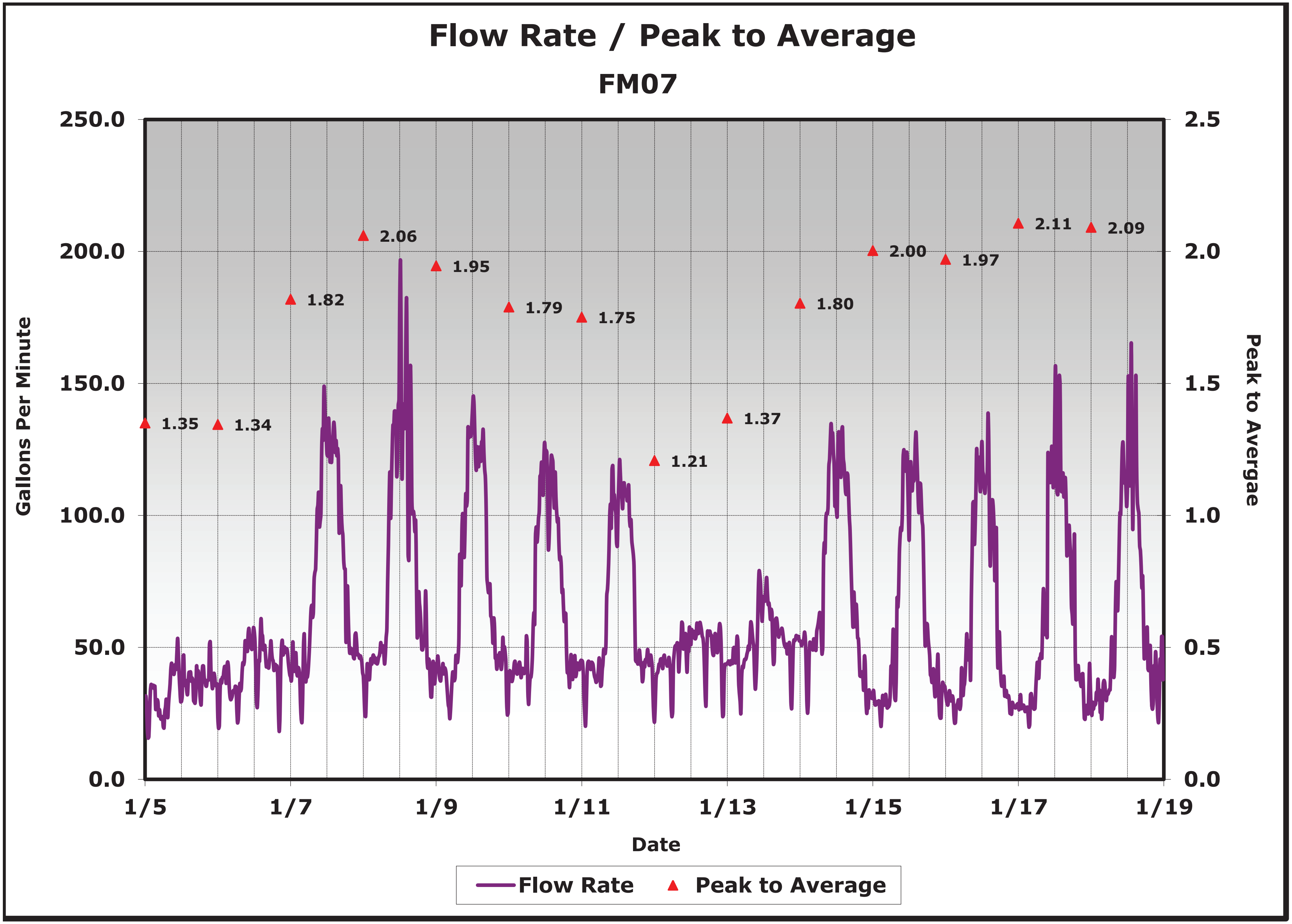
Velocity - Feet per Second

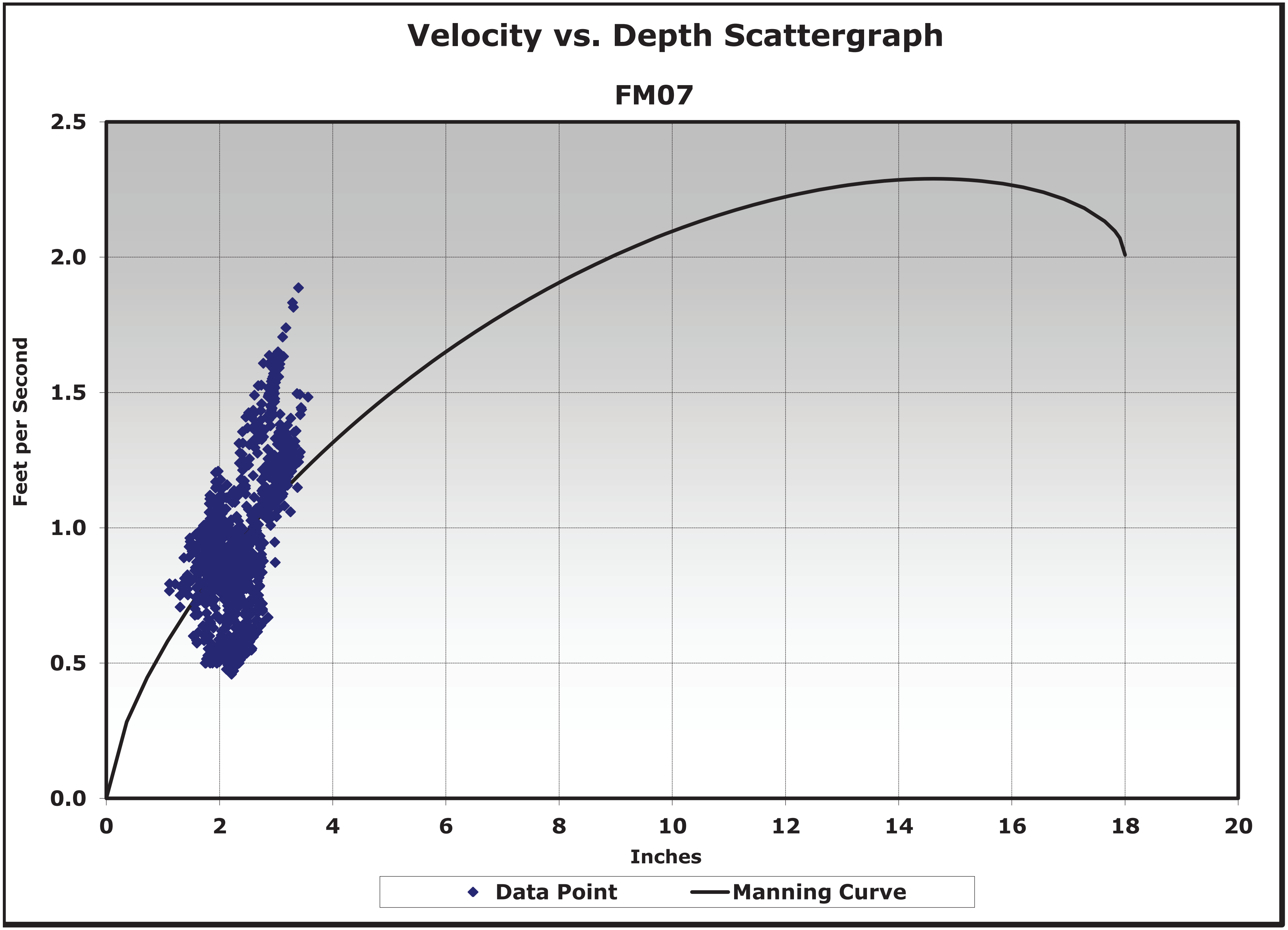
Average	0.94
Maximum	1.89
Minimum	0.46

Flow - Gallons per Minute

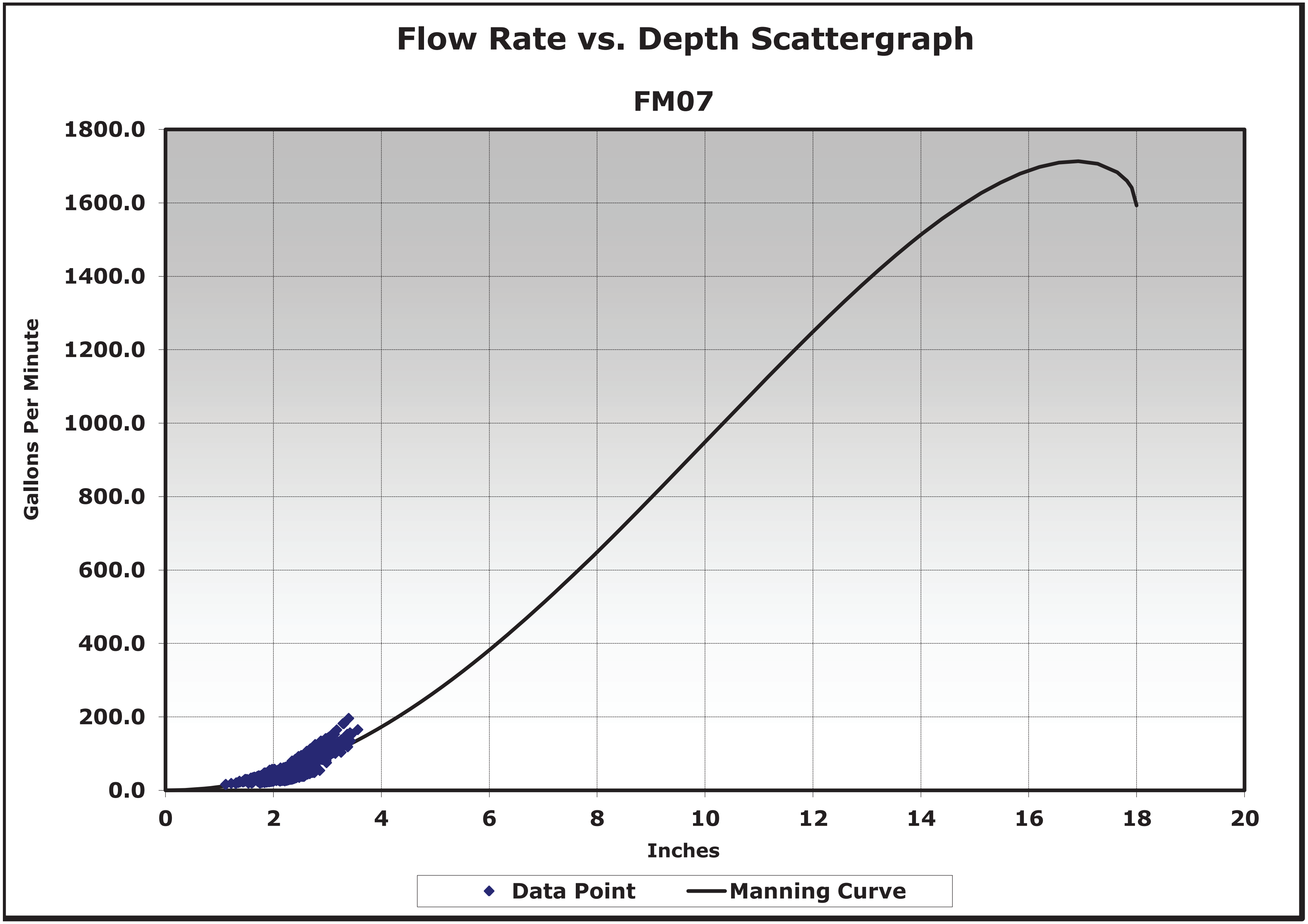
Average	61.05
Maximum	195.92
Minimum	15.60
Peak Factor	3.21




Flow Rate / Peak to Average
FM07
Gallons Per Minute
Peak to Avergae
250.0
200.0
150.0
100.0
50.0
0.0
2.5
2.0
1.5
1.0
0.5
0.0
1.35
1.34
1.82
2.06
1.95
1.79
1.75
1.21
1.37
1.80
2.00
1.97
2.11
2.09
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
Date
Flow Rate
Peak to Average



Velocity vs. Depth Scattergraph
FM07
Feet per Second
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
Inches
Data Point
Manning Curve



Flow Rate vs. Depth Scattergraph
FM07
Gallons Per Minute
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
0
2
4
6
8
10
12
14
16
18
20
Inches
Data Point
Manning Curve

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM07 Tabular - Flow Rate in GPM

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	26.46	24.27	42.64	29.66	44.28	39.45	40.42	31.86	44.24	51.77	31.11	29.97	29.39	26.68
1:00	22.44	37.83	44.33	38.99	39.04	39.88	27.99	42.23	44.29	53.65	28.75	31.43	27.56	29.53
2:00	35.35	40.49	40.97	42.40	41.96	41.85	43.95	44.07	47.27	32.04	24.80	29.06	26.72	33.88
3:00	30.80	41.24	28.21	46.25	37.63	42.82	43.36	45.49	48.20	49.62	28.60	24.48	22.91	25.98
4:00	27.46	30.96	44.76	44.50	26.15	40.72	38.63	44.27	31.42	51.12	29.55	28.49	30.71	35.62
5:00	23.54	33.87	38.93	48.35	37.12	44.09	40.84	34.06	43.64	52.84	28.95	35.06	28.71	31.74
6:00	23.09	26.47	54.71	49.18	42.25	36.93	38.84	41.79	46.86	61.33	46.17	40.13	40.84	41.20
7:00	26.75	33.66	66.53	50.48	57.24	41.38	47.27	50.95	53.31	58.61	34.73	50.17	46.40	43.55
8:00	38.59	43.27	87.61	96.47	85.95	68.00	67.63	47.49	53.95	93.70	72.31	60.06	66.08	68.68
9:00	41.48	50.38	101.50	117.67	94.62	94.34	96.59	54.50	39.47	110.94	95.73	98.71	73.30	91.37
10:00	46.65	54.01	121.72	137.25	118.01	112.96	112.86	48.91	71.37	131.06	120.80	116.64	115.56	120.92
11:00	37.28	52.11	137.54	130.21	131.15	118.44	95.27	52.60	66.13	114.16	115.02	116.36	117.91	110.50
12:00	38.65	44.85	128.33	161.01	139.66	119.84	113.05	54.03	69.63	114.99	108.89	117.58	133.37	123.86
13:00	35.57	37.68	122.12	136.99	121.99	99.12	107.86	54.33	69.98	122.28	113.09	112.44	131.67	130.09
14:00	37.14	56.13	130.37	143.12	122.09	118.39	109.01	57.19	62.96	122.29	124.28	110.20	113.81	133.83
15:00	38.46	48.94	124.32	126.50	128.03	106.87	106.26	57.10	49.31	112.04	107.55	102.30	109.67	106.67
16:00	30.31	43.00	102.32	101.67	102.41	92.02	93.17	44.00	59.04	96.24	95.18	89.91	90.31	82.06
17:00	40.35	48.38	87.48	80.37	72.44	77.00	68.49	45.92	55.37	66.60	57.23	51.81	75.74	58.05
18:00	32.62	43.56	66.79	64.15	58.11	62.61	44.56	55.22	54.58	62.52	52.30	38.47	67.34	49.49
19:00	40.47	41.64	53.12	51.56	52.65	42.38	45.31	48.80	49.78	48.24	38.21	35.11	40.28	44.52
20:00	36.41	27.61	47.87	59.29	44.91	41.12	40.56	50.73	48.57	39.64	35.14	31.92	37.07	31.84
21:00	45.33	49.57	51.96	44.49	44.54	42.60	46.42	55.94	35.81	38.54	38.99	26.49	33.71	39.63
22:00	37.76	49.01	46.86	34.82	50.14	41.34	45.43	32.48	53.19	28.33	25.96	28.08	25.83	30.45
23:00	36.49	43.32	44.28	40.39	30.77	43.42	36.09	42.76	53.43	31.63	35.73	27.78	34.51	45.90

Average	34.56	41.76	75.64	78.16	71.80	66.98	64.58	47.36	52.16	72.67	62.04	59.69	63.31	64.00
Median	35.53	42.87	61.54	53.69	52.56	47.12	45.97	49.38	51.63	57.77	42.52	38.60	45.07	47.45
Max Hr. Mean	46.65	56.13	137.54	161.01	139.66	119.84	113.05	57.19	71.37	131.06	124.28	117.58	133.37	133.83
Min Hr. Mean	22.44	24.27	28.21	29.66	26.15	36.93	27.99	31.86	31.42	28.33	24.80	24.48	22.91	25.98
Inst. Max	53.41	60.89	148.42	195.92	145.23	127.56	121.12	59.51	78.88	134.77	131.52	138.55	156.56	165.16
Inst. Min	15.60	18.12	21.60	23.82	22.94	28.36	20.16	21.70	25.05	24.99	20.12	21.24	19.76	21.65
Peak To Avg.	1.35	1.34	1.82	2.06	1.95	1.79	1.75	1.21	1.37	1.80	2.00	1.97	2.11	2.09

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM07 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.84	0.82	1.02	0.87	0.94	0.88	0.84	0.72	0.80	0.83	0.53	0.52	0.53	0.52
1:00	0.86	0.94	1.02	0.96	0.81	0.87	0.67	0.84	0.79	0.81	0.51	0.53	0.50	0.53
2:00	0.96	0.95	0.98	0.97	0.85	0.90	0.87	0.87	0.82	0.60	0.50	0.52	0.48	0.57
3:00	0.85	0.96	0.85	1.05	0.81	0.91	0.88	0.88	0.82	0.79	0.55	0.52	0.50	0.55
4:00	0.79	0.79	0.99	1.00	0.75	0.88	0.83	0.87	0.62	0.81	0.52	0.50	0.56	0.65
5:00	0.69	0.83	0.95	1.04	0.80	0.85	0.83	0.73	0.77	0.83	0.51	0.62	0.52	0.53
6:00	0.69	0.78	1.04	1.03	0.83	0.77	0.80	0.83	0.81	0.86	0.72	0.61	0.62	0.61
7:00	0.68	0.83	1.15	1.00	0.98	0.73	0.81	0.92	0.88	0.85	0.59	0.69	0.67	0.61
8:00	0.91	1.00	1.32	1.37	1.25	0.98	0.96	0.81	0.88	1.11	0.96	0.80	0.88	0.95
9:00	0.89	1.10	1.39	1.53	1.27	1.20	1.21	0.90	0.73	1.13	1.14	1.16	0.88	1.11
10:00	1.02	1.15	1.50	1.61	1.46	1.31	1.28	0.87	1.04	1.27	1.26	1.25	1.24	1.28
11:00	0.91	1.07	1.59	1.51	1.55	1.33	1.14	0.92	0.97	1.18	1.22	1.22	1.27	1.20
12:00	0.91	1.04	1.54	1.68	1.61	1.35	1.27	0.91	0.97	1.18	1.18	1.22	1.35	1.29
13:00	0.88	0.97	1.47	1.57	1.45	1.21	1.20	0.93	1.00	1.24	1.22	1.20	1.34	1.32
14:00	0.81	1.14	1.53	1.61	1.46	1.32	1.20	0.95	0.93	1.25	1.31	1.17	1.24	1.37
15:00	0.87	1.03	1.47	1.50	1.51	1.26	1.21	0.96	0.82	1.18	1.18	1.15	1.20	1.18
16:00	0.74	0.99	1.39	1.34	1.33	1.16	1.11	0.82	0.91	1.09	1.12	1.03	1.08	1.06
17:00	0.85	1.01	1.36	1.20	1.16	1.06	0.94	0.85	0.88	0.89	0.77	0.69	0.95	0.86
18:00	0.94	0.98	1.14	1.09	0.98	0.94	0.74	0.94	0.82	0.84	0.74	0.56	0.86	0.75
19:00	0.97	0.97	1.07	1.00	0.93	0.81	0.82	0.87	0.79	0.72	0.58	0.55	0.59	0.66
20:00	0.91	0.84	1.06	1.03	0.90	0.82	0.76	0.90	0.78	0.63	0.56	0.53	0.58	0.56
21:00	0.95	1.05	1.07	0.90	0.86	0.76	0.85	0.95	0.64	0.61	0.60	0.53	0.58	0.60
22:00	0.88	1.04	1.07	0.87	1.00	0.79	0.87	0.69	0.84	0.57	0.54	0.52	0.59	0.59
23:00	0.92	1.02	1.06	0.88	0.82	0.86	0.76	0.80	0.85	0.54	0.61	0.50	0.64	0.63
Average	0.86	0.97	1.21	1.19	1.10	1.00	0.95	0.86	0.84	0.91	0.81	0.77	0.82	0.83
Median	0.87	1.00	1.12	1.05	0.98	0.90	0.88	0.88	0.84	0.84	0.69	0.60	0.67	0.69
Max Hr. Mean	1.02	1.15	1.59	1.68	1.61	1.35	1.28	0.96	1.04	1.27	1.31	1.25	1.35	1.37
Min Hr. Mean	0.68	0.78	0.85	0.87	0.75	0.73	0.67	0.69	0.62	0.54	0.50	0.50	0.48	0.52
Inst. Max	1.17	1.21	1.63	1.89	1.65	1.42	1.32	0.99	1.11	1.32	1.38	1.36	1.50	1.48
Inst. Min	0.57	0.71	0.77	0.77	0.72	0.69	0.58	0.60	0.53	0.51	0.49	0.48	0.46	0.51

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM07 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.50	1.41	1.82	1.56	1.96	1.90	1.99	1.85	2.20	2.39	2.27	2.26	2.22	2.07
1:00	1.30	1.76	1.87	1.78	2.00	1.93	1.80	2.05	2.21	2.49	2.24	2.30	2.19	2.20
2:00	1.67	1.84	1.82	1.87	2.04	1.95	2.07	2.08	2.25	2.12	2.04	2.19	2.20	2.29
3:00	1.65	1.85	1.53	1.89	1.94	1.97	2.04	2.10	2.28	2.43	2.12	1.97	1.91	1.97
4:00	1.61	1.74	1.90	1.89	1.60	1.94	1.95	2.08	2.06	2.41	2.23	2.23	2.18	2.18
5:00	1.59	1.79	1.79	1.95	1.95	2.09	2.02	1.92	2.23	2.42	2.24	2.22	2.20	2.31
6:00	1.56	1.56	2.12	1.99	2.08	1.96	2.00	2.04	2.28	2.61	2.42	2.48	2.47	2.51
7:00	1.74	1.77	2.26	2.06	2.27	2.23	2.28	2.20	2.33	2.53	2.28	2.66	2.56	2.61
8:00	1.83	1.86	2.49	2.58	2.55	2.54	2.59	2.28	2.35	2.94	2.73	2.66	2.71	2.64
9:00	1.96	1.94	2.66	2.74	2.69	2.80	2.82	2.33	2.16	3.26	2.93	2.96	2.84	2.89
10:00	1.92	1.96	2.85	2.96	2.85	2.98	3.03	2.21	2.54	3.39	3.21	3.14	3.16	3.17
11:00	1.79	2.01	2.99	2.96	2.95	3.04	2.91	2.25	2.54	3.23	3.17	3.20	3.14	3.13
12:00	1.83	1.85	2.92	3.18	3.00	3.05	3.05	2.31	2.62	3.23	3.13	3.22	3.26	3.20
13:00	1.79	1.72	2.90	3.01	2.94	2.88	3.07	2.28	2.58	3.27	3.14	3.16	3.25	3.23
14:00	1.93	2.03	2.95	2.99	2.93	3.06	3.09	2.33	2.52	3.26	3.18	3.15	3.12	3.26
15:00	1.90	1.98	2.94	2.90	2.95	2.95	3.02	2.31	2.32	3.18	3.10	3.06	3.11	3.08
16:00	1.79	1.86	2.68	2.73	2.74	2.82	2.93	2.13	2.45	3.02	2.96	3.01	2.91	2.76
17:00	1.98	1.99	2.43	2.48	2.39	2.65	2.64	2.14	2.40	2.69	2.69	2.69	2.82	2.51
18:00	1.60	1.89	2.27	2.29	2.31	2.49	2.33	2.29	2.49	2.69	2.60	2.55	2.76	2.47
19:00	1.82	1.84	2.04	2.10	2.23	2.12	2.20	2.22	2.42	2.50	2.49	2.41	2.54	2.51
20:00	1.77	1.51	1.91	2.26	2.05	2.06	2.16	2.23	2.38	2.40	2.39	2.32	2.39	2.24
21:00	1.98	1.96	2.02	2.03	2.11	2.21	2.18	2.29	2.19	2.39	2.45	2.05	2.29	2.48
22:00	1.85	1.97	1.87	1.76	2.06	2.12	2.12	1.92	2.42	2.04	1.99	2.16	1.88	2.05
23:00	1.76	1.83	1.81	1.94	1.67	2.07	1.95	2.14	2.40	2.28	2.30	2.22	2.14	2.61
Average	1.75	1.83	2.29	2.33	2.34	2.41	2.43	2.17	2.36	2.72	2.59	2.59	2.59	2.60
Median	1.76	1.87	2.20	2.17	2.23	2.28	2.24	2.21	2.38	2.59	2.51	2.50	2.55	2.57
Max Hr. Mean	1.98	2.03	2.99	3.18	3.00	3.06	3.09	2.33	2.62	3.39	3.21	3.22	3.26	3.26
Min Hr. Mean	1.30	1.41	1.53	1.56	1.60	1.90	1.80	1.85	2.06	2.04	1.99	1.97	1.88	1.97
Inst. Max	2.17	2.13	3.09	3.40	3.03	3.11	3.17	2.38	2.66	3.43	3.22	3.35	3.43	3.56
Inst. Min	1.11	1.30	1.34	1.44	1.44	1.70	1.59	1.62	1.93	1.99	1.76	1.83	1.73	1.79

Services, Inc.

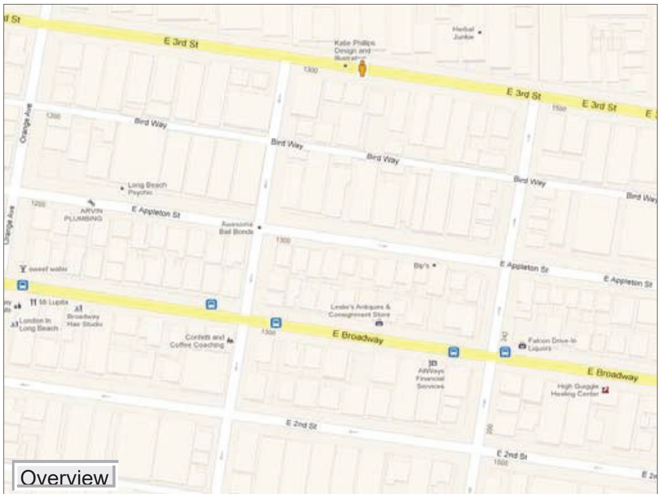
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

Site #: FM08 **Date:** 12/27/201

Address: 1347 E. 3rd St.

Traffic: Moderate, residential **Job #** 2012.5.166

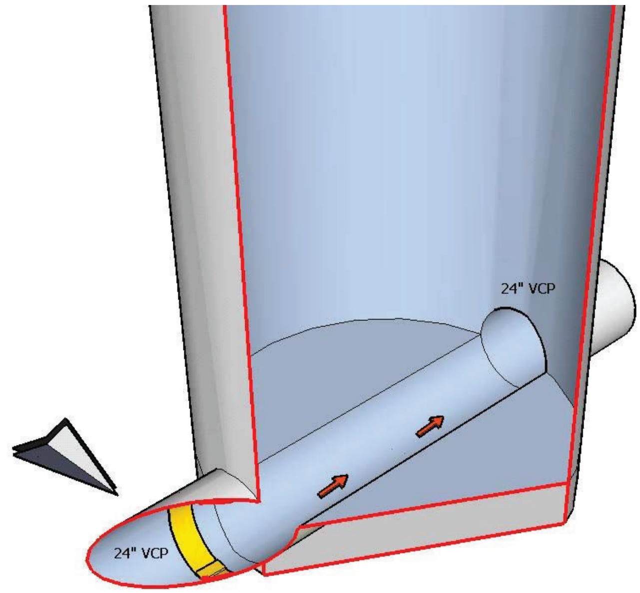


Overview

Detail Vie

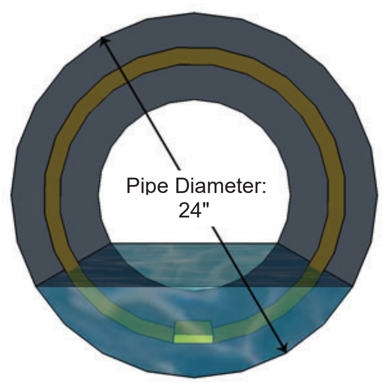

Planar Vie

Profile



MH Condition:	Good	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	No	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	18.9'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 2.38 fps

Flow Depth: 10.38"

Pipe Material: VCP

Comments: Excellent hydraulics, straight-through,scouring velocity

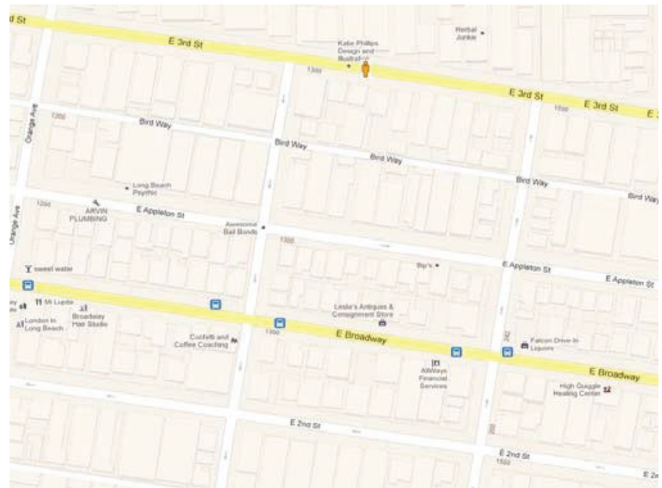
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM08
Map Page: K09-SMH-016
Location: 1347 E. 3rd St.
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 11:55:00 AM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Moderate, residential
Manhole Depth: 18.9'

Overview



Facility Inspection

Cover

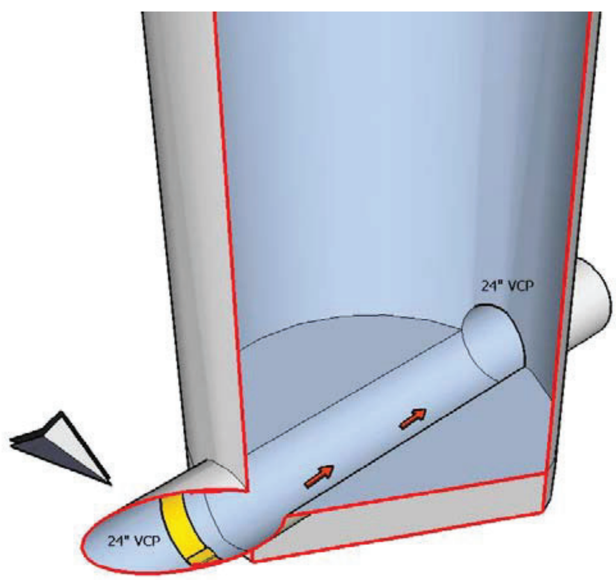
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: moderate

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Concentric
Material: Lined
Condition: Good
Infiltration: None



Barrel

Material: Lined
Condition: good
Infiltration: none

Rungs

Rungs: No
Material: N/A
Condition: N/A

Bench

Material: Lined
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: None
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

Observations and Comments

Flow Velocity: 2.38 fps
Flow Depth: 10.38"
Observation Location: Influent Pipe

Comments: Rehabilitated manhole: lined; rungs have been removed

Area Reference

Down Manhole

Effluent

Influent

Site Data Summary

Project #	2012.5.166	
Location ID	FM08	
Pipe Diameter	24	Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	8.91
Maximum	11.58
Minimum	6.11
Max d/D	48.3%

Velocity - Feet per Second

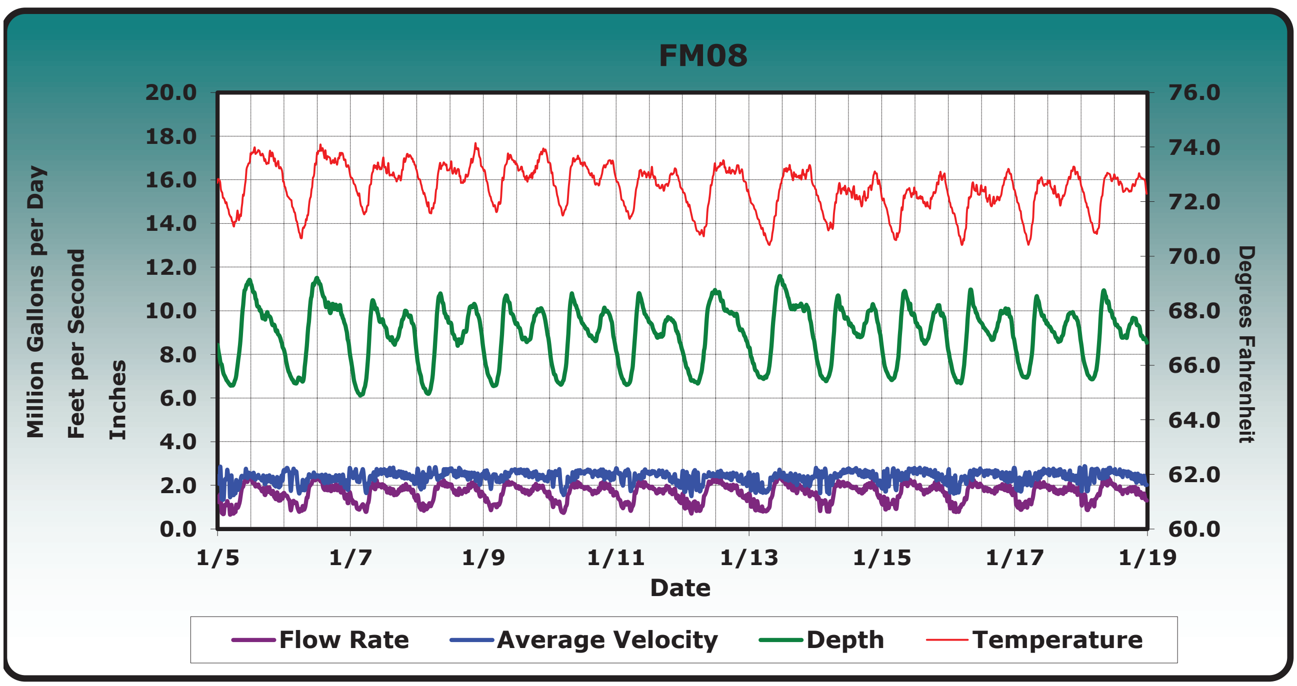
Average	2.37
Maximum	2.87
Minimum	1.32

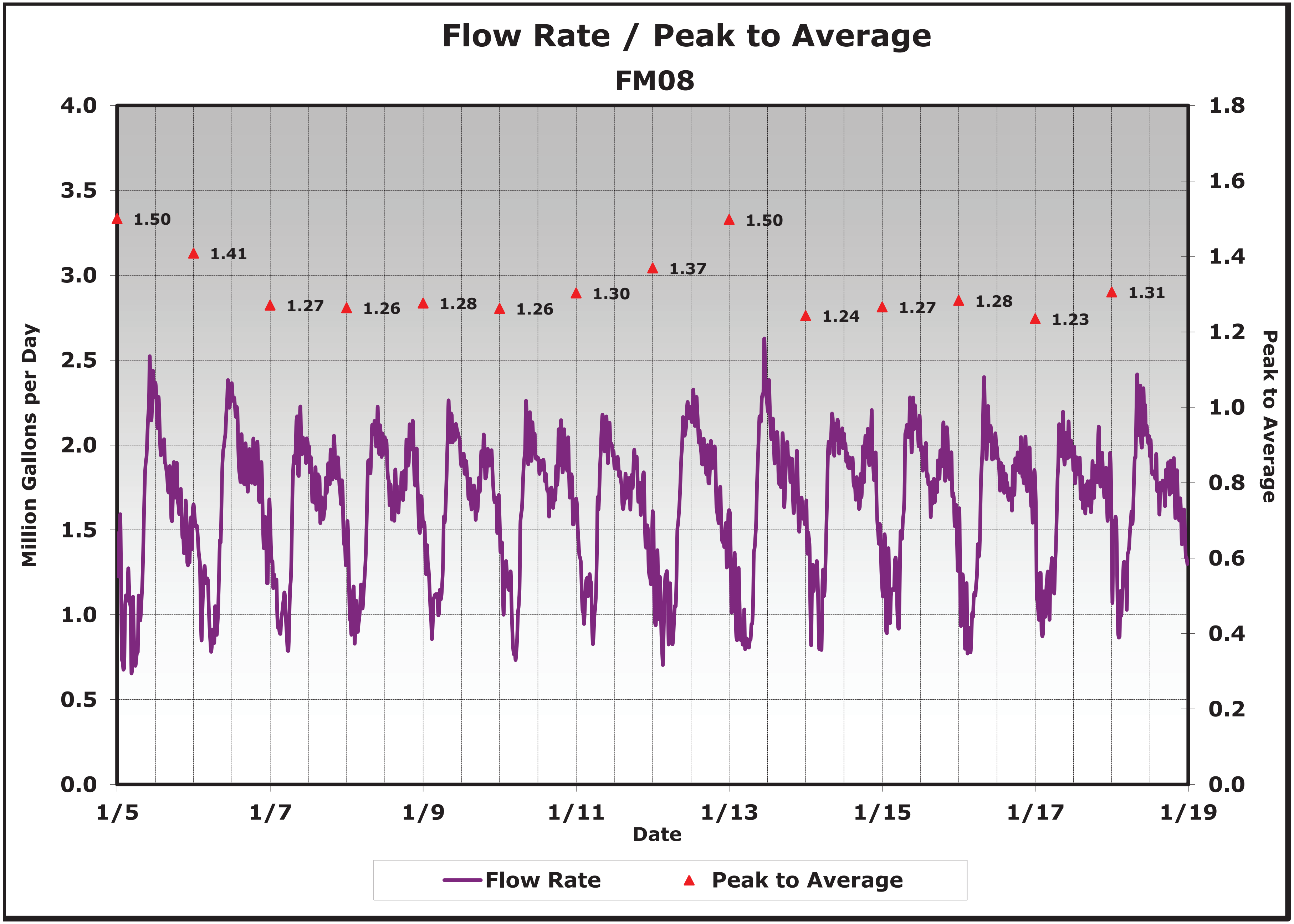
Flow - Million Gallons per Day

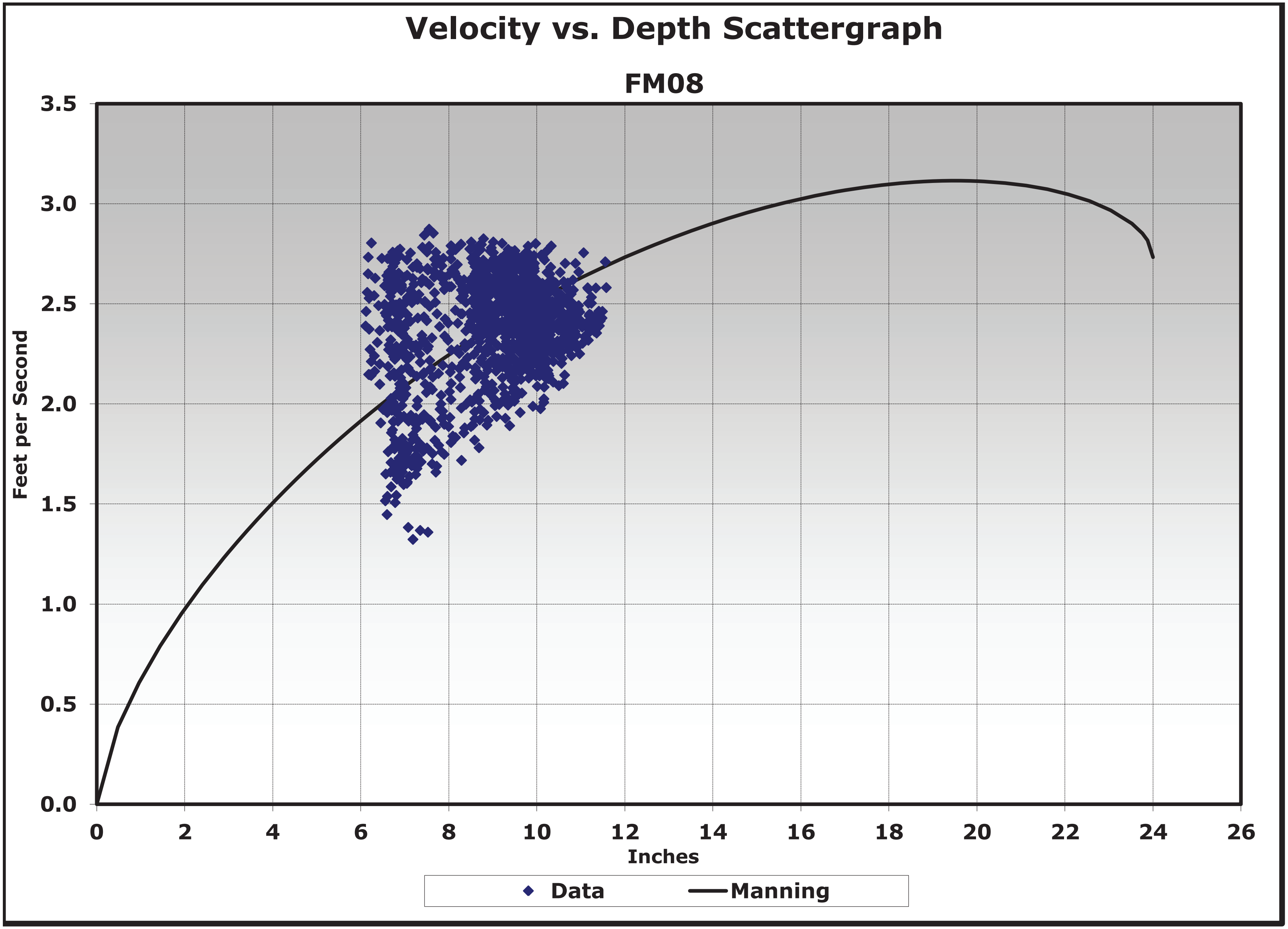
Average	1.64
Maximum	2.62
Minimum	0.66
Peak Factor	1.60

Temperature - Deg. F

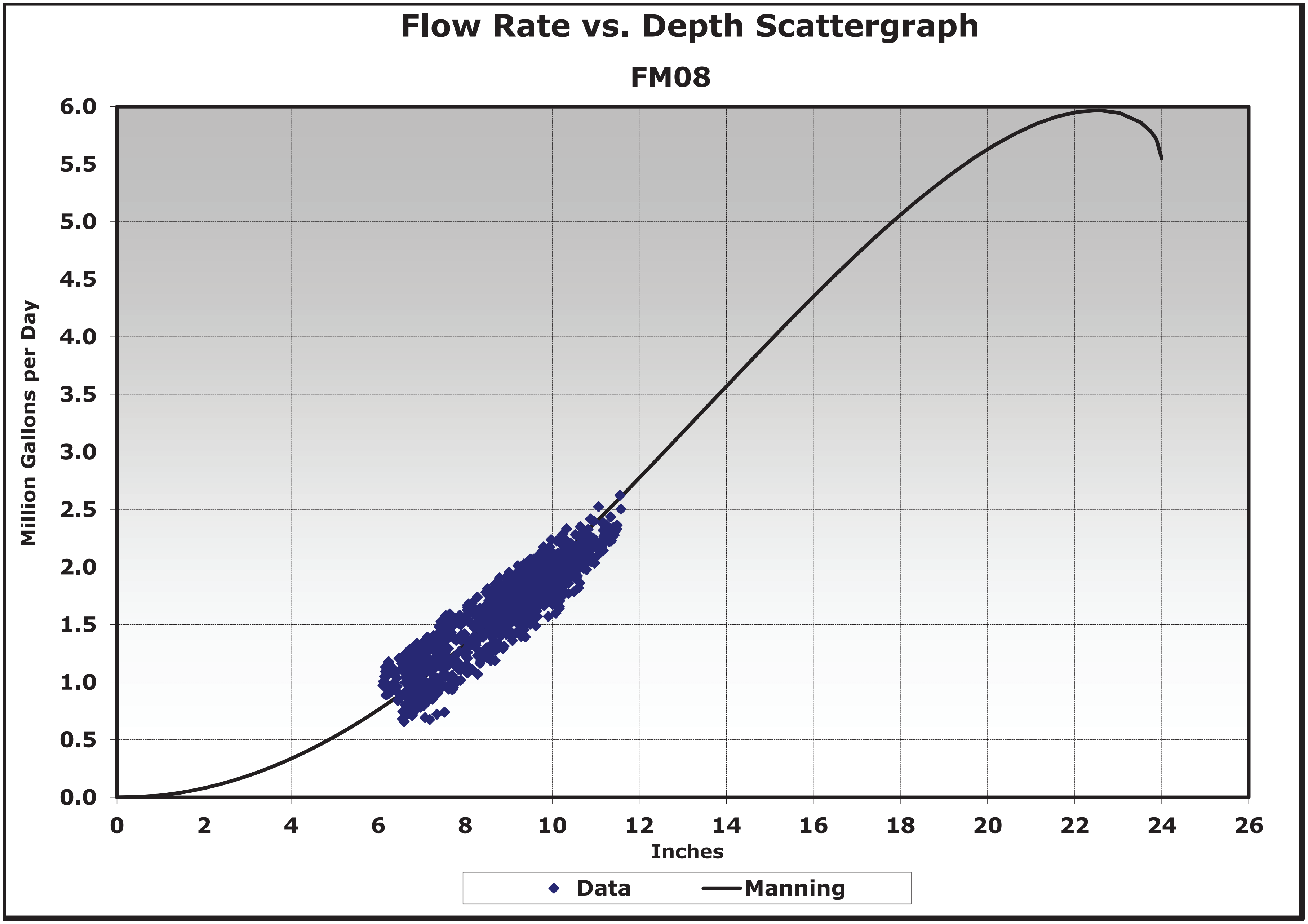
Average	72.52
Maximum	74.15
Minimum	70.41




Flow Rate / Peak to Average
FM08
Million Gallons per Day
Peak to Average
Date
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.50
1.41
1.27
1.26
1.28
1.26
1.30
1.37
1.50
1.24
1.27
1.28
1.23
1.31
Flow Rate
Peak to Average



Velocity vs. Depth Scattergraph
FM08
Feet per Second
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Inches
Data
Manning



Flow Rate vs. Depth Scattergraph
FM08
Million Gallons per Day
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM08 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.35	1.58	1.40	1.40	1.47	1.44	1.57	1.31	1.40	1.53	1.22	1.32	1.40	1.41
1:00	1.07	1.44	1.19	0.93	1.30	1.12	1.29	1.15	1.18	1.17	1.10	1.18	1.12	1.46
2:00	0.88	1.04	1.01	1.01	1.02	1.23	1.01	1.05	0.98	1.21	1.14	0.91	0.95	0.94
3:00	1.15	1.22	0.94	0.97	1.06	1.17	1.18	0.89	1.02	1.26	1.15	0.86	1.09	1.15
4:00	0.86	1.16	1.09	1.08	1.09	0.82	1.20	1.22	0.90	0.88	1.24	0.99	1.15	1.21
5:00	0.86	0.85	0.85	1.14	1.09	0.85	0.91	0.95	0.83	1.09	1.12	1.17	1.28	1.41
6:00	0.85	0.91	1.17	1.63	1.40	1.33	1.31	0.88	0.83	1.42	1.53	1.41	1.34	1.58
7:00	1.03	0.96	1.85	1.89	1.84	1.79	1.79	1.21	1.08	1.99	1.99	1.98	1.96	1.96
8:00	1.53	1.44	2.03	2.10	2.14	2.09	2.11	1.66	1.55	2.11	2.13	2.13	2.05	2.19
9:00	2.02	1.96	2.04	2.09	2.09	2.02	2.04	2.05	2.07	2.04	2.11	2.09	1.98	2.14
10:00	2.30	2.22	1.99	2.03	2.08	2.02	2.04	2.11	2.26	2.07	2.15	2.03	1.99	2.18
11:00	2.33	2.29	2.00	1.99	2.02	1.96	1.98	2.21	2.43	2.02	2.09	1.98	1.99	2.05
12:00	2.24	2.30	1.94	1.98	1.91	1.89	1.88	2.21	2.26	2.00	1.96	1.92	1.86	1.91
13:00	2.10	2.21	1.76	1.75	1.87	1.89	1.87	2.18	2.10	1.91	1.95	1.81	1.88	1.82
14:00	2.00	1.86	1.71	1.64	1.74	1.81	1.71	2.10	1.96	1.90	1.80	1.80	1.78	1.78
15:00	1.86	1.90	1.71	1.73	1.70	1.69	1.72	1.93	1.92	1.74	1.70	1.73	1.67	1.71
16:00	1.78	1.88	1.62	1.68	1.68	1.71	1.78	1.93	1.86	1.72	1.73	1.71	1.73	1.72
17:00	1.68	1.86	1.69	1.74	1.70	1.74	1.74	1.85	1.79	1.74	1.79	1.83	1.70	1.83
18:00	1.82	1.86	1.81	1.84	1.89	1.91	1.90	1.93	1.96	1.93	1.90	1.91	1.79	1.81
19:00	1.64	1.83	1.87	1.97	1.92	1.97	1.80	1.92	1.88	1.97	1.97	1.93	1.87	1.78
20:00	1.56	1.82	1.92	2.04	1.91	1.97	1.68	1.59	1.68	2.01	2.00	1.85	1.88	1.71
21:00	1.51	1.72	1.85	1.85	1.92	1.91	1.67	1.62	1.79	1.88	1.86	1.82	1.81	1.61
22:00	1.31	1.46	1.73	1.72	1.70	1.76	1.43	1.44	1.61	1.66	1.66	1.79	1.73	1.51
23:00	1.53	1.39	1.40	1.63	1.62	1.60	1.25	1.43	1.57	1.43	1.47	1.71	1.84	1.36

Average	1.55	1.63	1.61	1.66	1.67	1.65	1.62	1.62	1.62	1.69	1.70	1.66	1.66	1.68
Median	1.59	1.71	1.72	1.75	1.76	1.76	1.69	1.67	1.71	1.82	1.79	1.78	1.78	1.73
Max Hr. Mean	2.33	2.30	2.04	2.10	2.14	2.09	2.11	2.21	2.43	2.11	2.15	2.13	2.05	2.19
Min Hr. Mean	0.85	0.85	0.85	0.93	1.02	0.82	0.91	0.88	0.83	0.88	1.10	0.86	0.95	0.94
Inst. Max	2.52	2.38	2.23	2.23	2.26	2.26	2.18	2.33	2.62	2.21	2.28	2.40	2.20	2.42
Inst. Min	0.66	0.78	0.79	0.84	0.86	0.73	0.83	0.71	0.80	0.80	0.89	0.78	0.87	0.87
Peak To Avg.	1.50	1.41	1.27	1.26	1.28	1.26	1.30	1.37	1.50	1.24	1.27	1.28	1.23	1.31

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM08 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	2.22	2.67	2.54	2.52	2.50	2.47	2.67	2.22	2.29	2.61	2.07	2.24	2.24	2.32
1:00	1.95	2.72	2.53	1.88	2.52	2.19	2.48	2.15	2.11	2.22	2.08	2.24	2.04	2.68
2:00	1.77	2.11	2.35	2.27	2.10	2.55	2.10	2.08	1.88	2.47	2.30	1.87	1.88	1.88
3:00	2.44	2.60	2.29	2.29	2.34	2.53	2.57	1.87	2.05	2.64	2.40	1.84	2.23	2.37
4:00	1.89	2.52	2.62	2.58	2.41	1.78	2.63	2.61	1.86	1.83	2.55	2.14	2.36	2.52
5:00	1.90	1.75	1.88	2.45	2.20	1.69	1.86	2.05	1.72	2.09	2.10	2.29	2.44	2.72
6:00	1.77	1.93	2.01	2.69	2.26	2.14	2.16	1.80	1.69	2.21	2.35	2.20	2.15	2.52
7:00	1.86	1.87	2.37	2.39	2.28	2.19	2.31	2.14	1.97	2.45	2.41	2.42	2.43	2.40
8:00	2.23	2.19	2.41	2.40	2.46	2.41	2.40	2.40	2.28	2.45	2.40	2.40	2.40	2.46
9:00	2.38	2.44	2.54	2.50	2.51	2.45	2.44	2.49	2.48	2.52	2.49	2.56	2.47	2.52
10:00	2.50	2.45	2.61	2.61	2.66	2.57	2.58	2.43	2.41	2.66	2.68	2.61	2.58	2.68
11:00	2.46	2.42	2.65	2.64	2.69	2.60	2.59	2.48	2.52	2.63	2.68	2.64	2.67	2.65
12:00	2.44	2.43	2.66	2.72	2.62	2.60	2.54	2.50	2.43	2.70	2.63	2.62	2.56	2.58
13:00	2.39	2.42	2.56	2.58	2.66	2.65	2.62	2.49	2.33	2.64	2.70	2.55	2.66	2.52
14:00	2.40	2.15	2.57	2.52	2.62	2.65	2.49	2.50	2.30	2.73	2.66	2.60	2.58	2.58
15:00	2.31	2.29	2.62	2.66	2.58	2.51	2.53	2.41	2.37	2.56	2.62	2.59	2.52	2.54
16:00	2.31	2.32	2.48	2.52	2.56	2.60	2.61	2.42	2.28	2.55	2.63	2.55	2.64	2.55
17:00	2.17	2.25	2.48	2.49	2.45	2.51	2.43	2.33	2.18	2.46	2.55	2.58	2.47	2.53
18:00	2.33	2.28	2.47	2.44	2.48	2.55	2.51	2.47	2.37	2.57	2.49	2.51	2.44	2.41
19:00	2.18	2.27	2.40	2.41	2.42	2.47	2.35	2.47	2.30	2.46	2.48	2.43	2.42	2.33
20:00	2.14	2.24	2.42	2.47	2.38	2.46	2.23	2.20	2.07	2.47	2.44	2.30	2.37	2.34
21:00	2.16	2.27	2.39	2.28	2.40	2.42	2.30	2.29	2.22	2.32	2.37	2.29	2.32	2.29
22:00	1.94	2.04	2.33	2.24	2.26	2.38	2.08	2.11	2.18	2.20	2.15	2.32	2.28	2.26
23:00	2.41	2.19	2.09	2.37	2.39	2.44	1.98	2.21	2.37	2.08	2.17	2.48	2.62	2.07

Average	2.19	2.28	2.43	2.46	2.45	2.41	2.39	2.30	2.19	2.44	2.43	2.39	2.41	2.45
Median	2.28	2.33	2.45	2.48	2.46	2.48	2.47	2.40	2.27	2.51	2.48	2.44	2.44	2.51
Max Hr. Mean	2.50	2.72	2.66	2.72	2.69	2.65	2.67	2.61	2.52	2.73	2.70	2.64	2.67	2.72
Min Hr. Mean	1.77	1.75	1.88	1.88	2.10	1.69	1.86	1.80	1.69	1.83	2.07	1.84	1.88	1.88
Inst. Max	2.85	2.79	2.81	2.83	2.73	2.72	2.77	2.69	2.71	2.79	2.80	2.79	2.81	2.87
Inst. Min	1.32	1.61	1.64	1.80	1.82	1.54	1.73	1.51	1.65	1.60	1.71	1.61	1.70	1.72

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM08 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	8.13	7.97	7.59	7.64	7.94	7.89	7.95	7.95	8.14	7.93	8.00	7.95	8.27	8.17
1:00	7.53	7.35	6.80	7.00	7.26	7.22	7.26	7.45	7.66	7.33	7.33	7.34	7.60	7.51
2:00	7.06	7.00	6.35	6.52	6.89	6.89	6.87	7.10	7.29	6.96	7.02	6.94	7.15	7.10
3:00	6.80	6.76	6.16	6.29	6.60	6.68	6.64	6.80	7.04	6.83	6.86	6.75	6.96	6.90
4:00	6.62	6.69	6.20	6.24	6.58	6.67	6.64	6.75	6.94	6.88	6.93	6.71	6.96	6.90
5:00	6.59	6.90	6.63	6.73	7.02	7.07	6.99	6.70	6.91	7.25	7.39	7.17	7.33	7.26
6:00	6.85	6.79	7.88	8.09	8.27	8.26	8.07	6.97	7.00	8.45	8.59	8.48	8.30	8.36
7:00	7.64	7.24	9.79	9.93	10.05	10.13	9.75	7.69	7.51	10.12	10.23	10.15	10.06	10.15
8:00	8.86	8.62	10.38	10.70	10.63	10.62	10.71	8.94	8.82	10.55	10.83	10.80	10.51	10.84
9:00	10.43	10.05	10.04	10.34	10.32	10.24	10.34	10.22	10.30	10.09	10.43	10.16	9.99	10.46
10:00	11.09	11.01	9.63	9.79	9.84	9.86	9.88	10.64	11.26	9.77	10.03	9.81	9.72	10.10
11:00	11.36	11.36	9.55	9.55	9.52	9.55	9.64	10.85	11.50	9.66	9.82	9.53	9.48	9.76
12:00	11.09	11.35	9.30	9.33	9.35	9.32	9.43	10.81	11.22	9.41	9.48	9.34	9.30	9.43
13:00	10.74	11.05	8.91	8.85	9.08	9.15	9.18	10.71	10.92	9.25	9.24	9.15	9.11	9.26
14:00	10.28	10.62	8.71	8.58	8.71	8.89	8.90	10.39	10.47	8.98	8.81	8.97	8.94	8.95
15:00	10.04	10.24	8.60	8.58	8.66	8.77	8.83	10.03	10.09	8.87	8.54	8.75	8.69	8.78
16:00	9.72	10.11	8.57	8.70	8.64	8.64	8.87	9.97	10.17	8.80	8.64	8.74	8.61	8.83
17:00	9.72	10.21	8.86	9.04	9.00	8.96	9.21	9.90	10.19	9.12	9.05	9.12	8.91	9.25
18:00	9.80	10.15	9.37	9.55	9.63	9.53	9.60	9.83	10.24	9.54	9.66	9.60	9.39	9.54
19:00	9.55	10.06	9.78	10.16	9.94	9.96	9.64	9.79	10.14	9.98	9.97	9.94	9.75	9.63
20:00	9.32	10.07	9.90	10.23	10.03	10.00	9.53	9.27	10.12	10.13	10.20	10.00	9.90	9.36
21:00	9.04	9.63	9.75	10.07	9.99	9.87	9.28	9.10	10.07	10.10	9.87	9.97	9.80	9.06
22:00	8.82	9.19	9.44	9.67	9.55	9.45	8.90	8.86	9.40	9.55	9.70	9.72	9.62	8.76
23:00	8.42	8.44	8.76	8.92	8.82	8.61	8.41	8.51	8.70	8.90	8.81	8.96	9.08	8.65

Average	8.98	9.12	8.62	8.77	8.85	8.84	8.77	8.97	9.25	8.94	8.98	8.92	8.89	8.87
Median	9.29	9.72	8.94	9.04	9.11	9.09	9.01	9.19	10.01	9.22	9.23	9.16	9.11	9.01
Max Hr. Mean	11.36	11.36	10.38	10.70	10.63	10.62	10.71	10.85	11.50	10.55	10.83	10.80	10.51	10.84
Min Hr. Mean	6.59	6.69	6.16	6.24	6.58	6.67	6.64	6.70	6.91	6.83	6.86	6.71	6.96	6.90
Inst. Max	11.41	11.49	10.47	10.79	10.69	10.79	10.80	10.94	11.58	10.69	10.90	10.96	10.66	10.93
Inst. Min	6.56	6.66	6.11	6.19	6.54	6.60	6.59	6.66	6.87	6.77	6.82	6.67	6.93	6.85

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM08 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	72.78	72.56	72.89	72.97	73.14	73.27	72.75	72.36	72.13	72.35	72.10	72.09	72.29	72.49
1:00	72.47	72.22	72.67	72.72	72.73	72.77	72.47	72.07	71.89	72.07	71.86	71.72	71.91	72.15
2:00	72.09	72.08	72.38	72.36	72.27	72.44	72.04	71.85	71.67	71.72	71.47	71.49	71.51	71.79
3:00	71.88	71.74	72.12	72.06	71.95	71.98	71.78	71.48	71.37	71.36	71.04	71.08	71.06	71.36
4:00	71.55	71.41	71.73	71.76	71.77	71.66	71.57	71.23	71.08	71.10	70.75	70.65	70.69	71.03
5:00	71.28	70.96	71.59	71.67	71.82	71.64	71.45	70.94	70.89	71.09	70.69	70.52	70.53	70.86
6:00	71.23	70.74	71.94	71.95	72.15	71.98	71.74	70.85	70.64	71.21	70.97	71.10	71.14	71.11
7:00	71.49	71.09	72.69	72.69	72.94	72.96	72.47	70.84	70.46	71.99	71.75	71.96	72.16	72.06
8:00	71.55	71.42	73.21	73.28	73.41	73.47	72.99	71.11	70.74	72.49	72.22	72.36	72.58	72.73
9:00	72.21	72.01	73.25	73.35	73.66	73.52	73.05	71.87	71.40	72.43	72.43	72.54	72.82	73.00
10:00	72.97	72.69	73.30	73.37	73.59	73.60	73.05	72.56	72.05	72.50	72.33	72.44	72.66	72.98
11:00	73.40	73.31	73.31	73.15	73.45	73.42	72.98	73.13	72.56	72.35	72.35	72.31	72.64	72.80
12:00	73.77	73.81	73.36	73.28	73.30	73.39	72.96	73.20	72.97	72.43	72.30	72.46	72.73	72.91
13:00	73.86	73.92	73.17	73.12	73.20	73.27	73.02	73.32	73.15	72.33	72.14	72.37	72.50	72.77
14:00	73.82	73.78	73.01	73.10	73.10	73.06	72.74	73.40	73.22	72.26	72.16	72.08	72.40	72.69
15:00	73.78	73.69	73.01	73.06	72.87	72.95	72.57	73.27	73.04	72.13	71.94	71.97	72.22	72.41
16:00	73.70	73.62	72.83	72.70	72.84	72.74	72.55	73.08	72.94	72.01	71.89	72.03	72.02	72.46
17:00	73.47	73.45	72.89	72.83	72.94	72.64	72.49	73.11	72.93	72.17	71.88	72.07	72.15	72.40
18:00	73.48	73.47	72.94	72.97	73.07	72.81	72.62	73.12	72.93	72.13	72.21	72.11	72.40	72.49
19:00	73.76	73.48	73.42	73.36	73.32	73.21	72.84	73.16	73.01	72.43	72.38	72.37	72.78	72.62
20:00	73.60	73.71	73.66	73.56	73.61	73.31	73.02	73.21	72.94	72.57	72.74	72.76	72.99	72.85
21:00	73.37	73.68	73.67	73.99	73.83	73.48	73.17	73.12	73.17	73.03	72.93	73.08	73.23	72.94
22:00	73.30	73.42	73.56	73.80	73.86	73.45	72.90	72.76	73.12	72.86	72.95	73.06	73.06	72.84
23:00	73.04	73.25	73.34	73.36	73.55	73.18	72.56	72.49	72.60	72.61	72.56	72.66	72.87	72.57

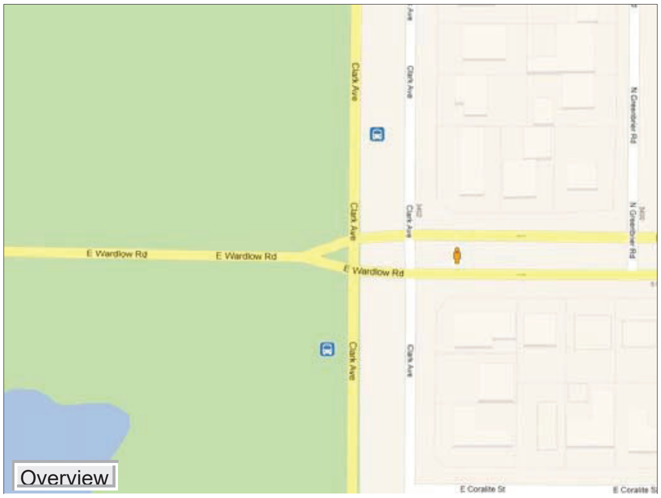
Average	72.83	72.73	72.91	72.94	73.02	72.92	72.57	72.40	72.20	72.15	72.00	72.05	72.22	72.35
Median	73.23	73.29	73.00	73.08	73.14	73.07	72.66	72.73	72.59	72.24	72.13	72.16	72.38	72.54
Max Hr. Mean	73.86	73.92	73.67	73.99	73.86	73.60	73.17	73.40	73.22	73.03	72.95	73.08	73.23	73.00
Min Hr. Mean	71.23	70.74	71.59	71.67	71.77	71.64	71.45	70.84	70.46	71.09	70.69	70.52	70.53	70.86
Inst. Max	73.98	74.10	73.74	74.15	73.95	73.69	73.28	73.52	73.35	73.11	73.10	73.20	73.28	73.05
Inst. Min	71.09	70.66	71.54	71.57	71.62	71.49	71.37	70.74	70.42	70.95	70.60	70.41	70.42	70.82

DownStream Services, Inc.

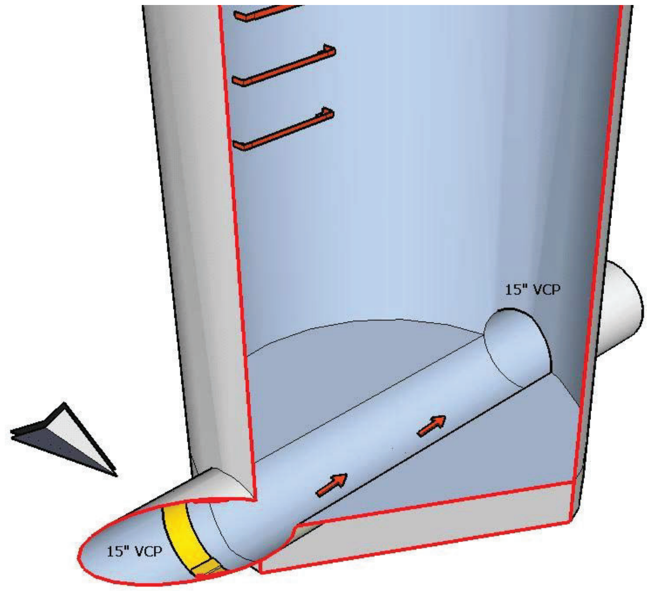
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

Site #: FM09 **Date:** 12/27/201
Address: Wardlow & Clark
Traffic: Light, residential **Job #** 2012.5.166

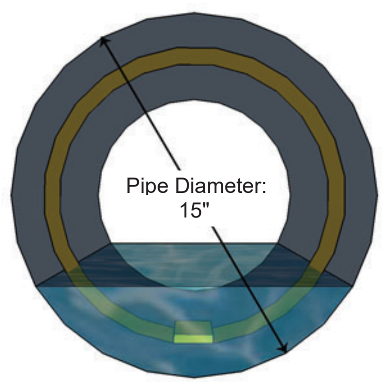


Profile



MH Condition:	Fair	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	12.8'

Cross Section



Monitor SN: ISCO
SensorType: Pressure transducer, Doppler Velocity
Velocity: 1.58 fps
Flow Depth: 4.88"
Pipe Material: VCP
Comments: Gradient change in channel; moderate-slow velocity

DownStream Services, Inc.

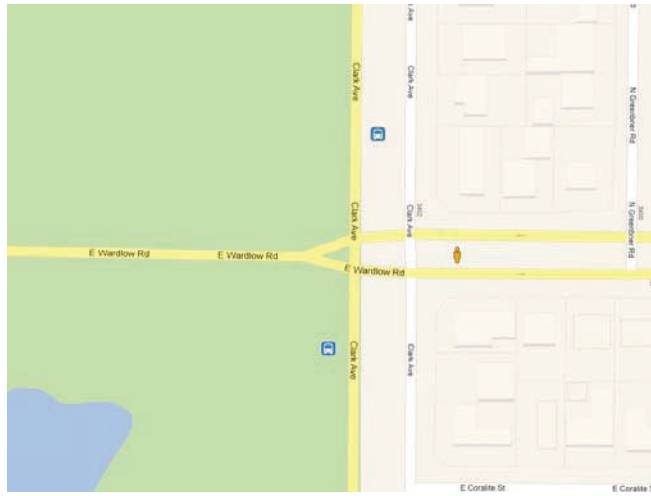
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

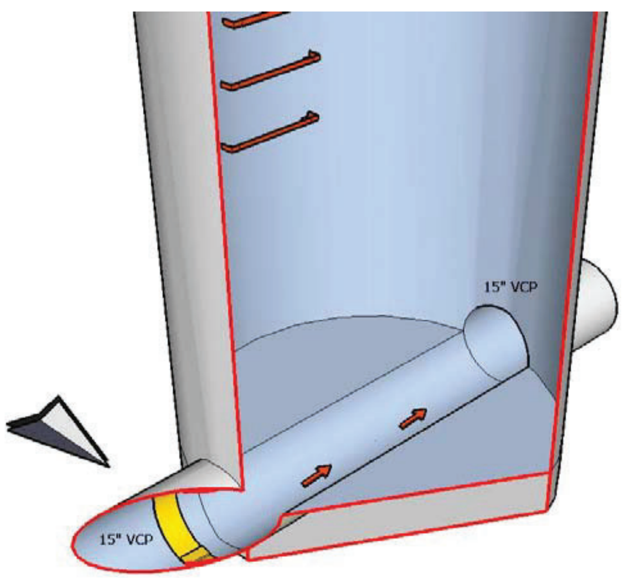
Site Details

Job Number: 2012.5.166
Site Identifier: FM09
Map Page: Q22-SMH-068
Location: Wardlow & Clark
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 1:05:00 PM
Site Status: Metered in 2007
Surroundings: Grass
Surface Condition: Center Divider
Traffic Setup: Roadway
Traffic Volume: Light, residential
Manhole Depth: 12.8'

Overview



Facility Inspection



Cover

Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: Moderate

Grade Ring / Frame

Condition: Good
Corrosion: Moderate
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Concentric
Material: Brick
Condition: Fair
Infiltration: stains

Barrel

Material: Brick
Condition: Fair
Infiltration: stains

Rungs

Rungs: Yes
Material: Cast Iron
Condition: Corroded

Bench

Material: Cast in place Concrete
Condition: fair
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: fair
Infiltration: stains

Defect Observation

Surcharge

Active: None
Evidence: old
Level: 6"

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: None
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

Observations and Comments

Flow Velocity: 1.58 fps **Flow Depth:** 4.88" **Observation Location:** Influent Pipe

Comments: Gradient change in channel; trough widens at center

 Illustrations may not be to scale

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM09


Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project # 2012.5.166
Location ID FM09
Pipe Diameter 15 Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	4.46
Maximum	5.56
Minimum	3.14
Max d/D	37.1%

Velocity - Feet per Second

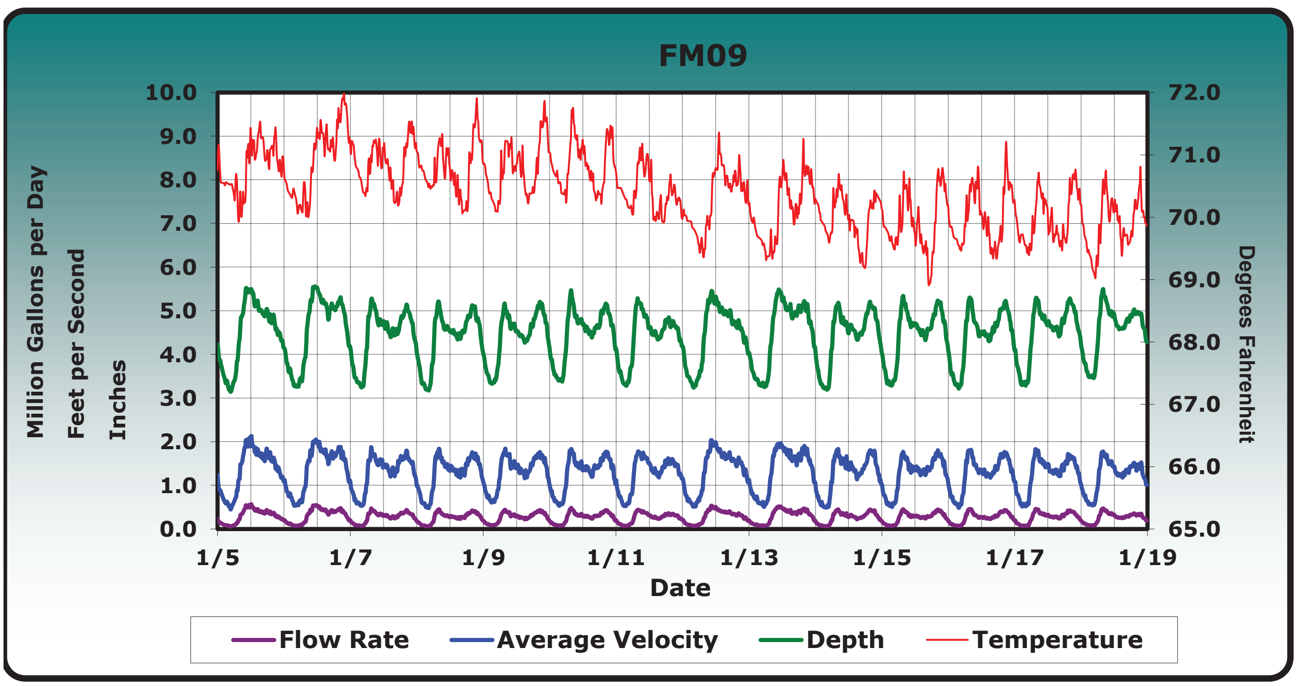
Average	1.29
Maximum	2.13
Minimum	0.45

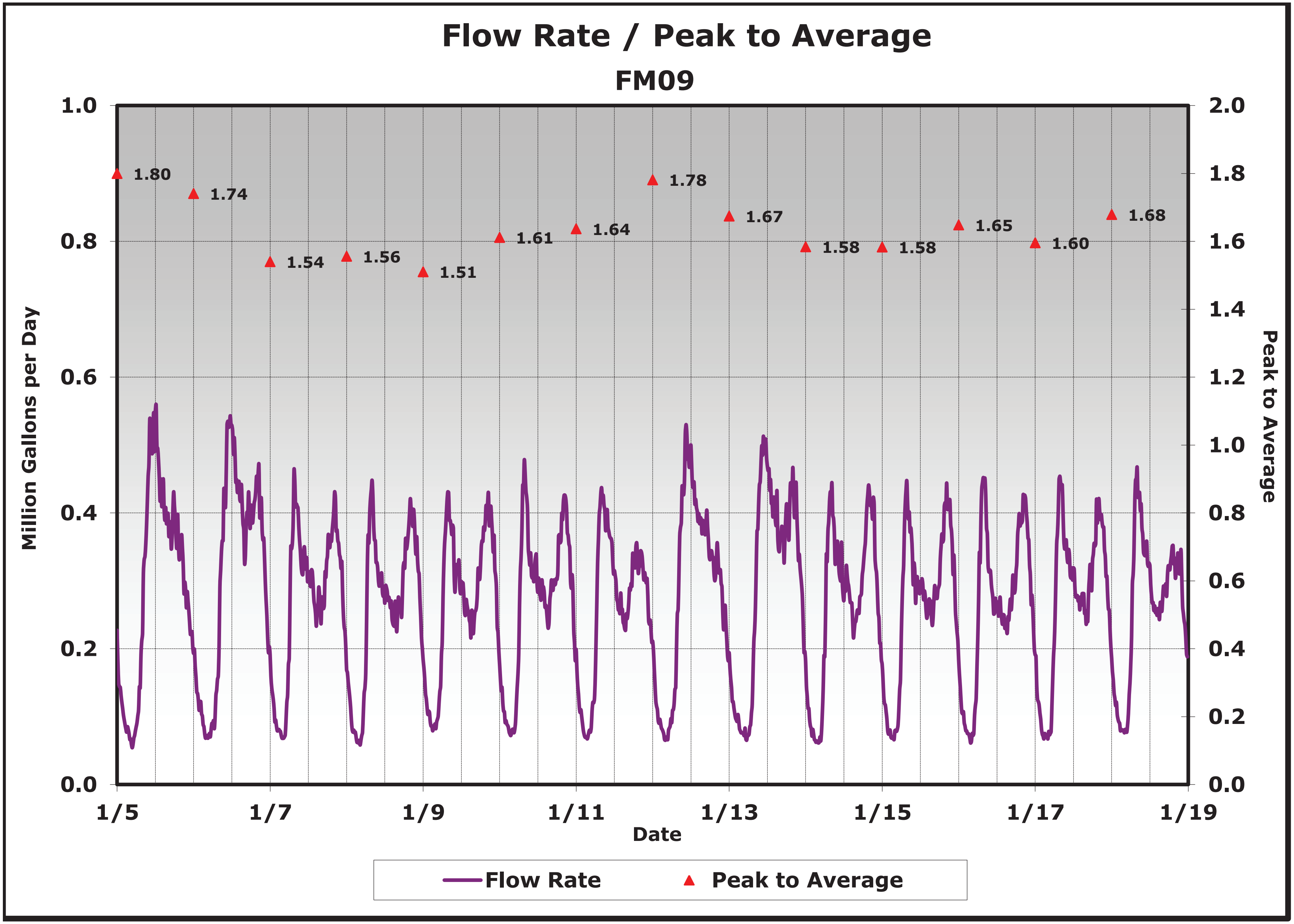
Flow - Million Gallons per Day

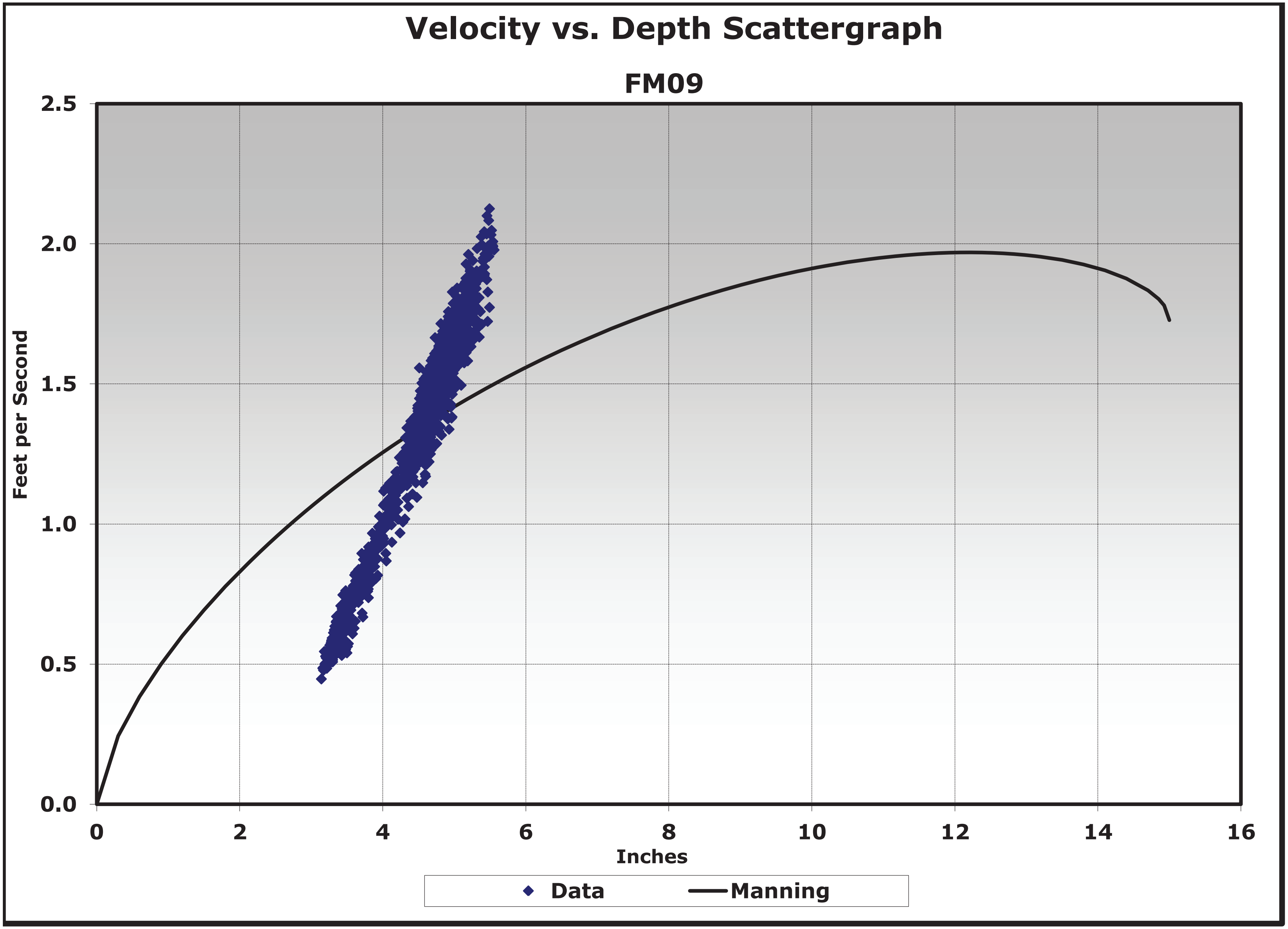
Average	0.27
Maximum	0.56
Minimum	0.05
Peak Factor	2.05

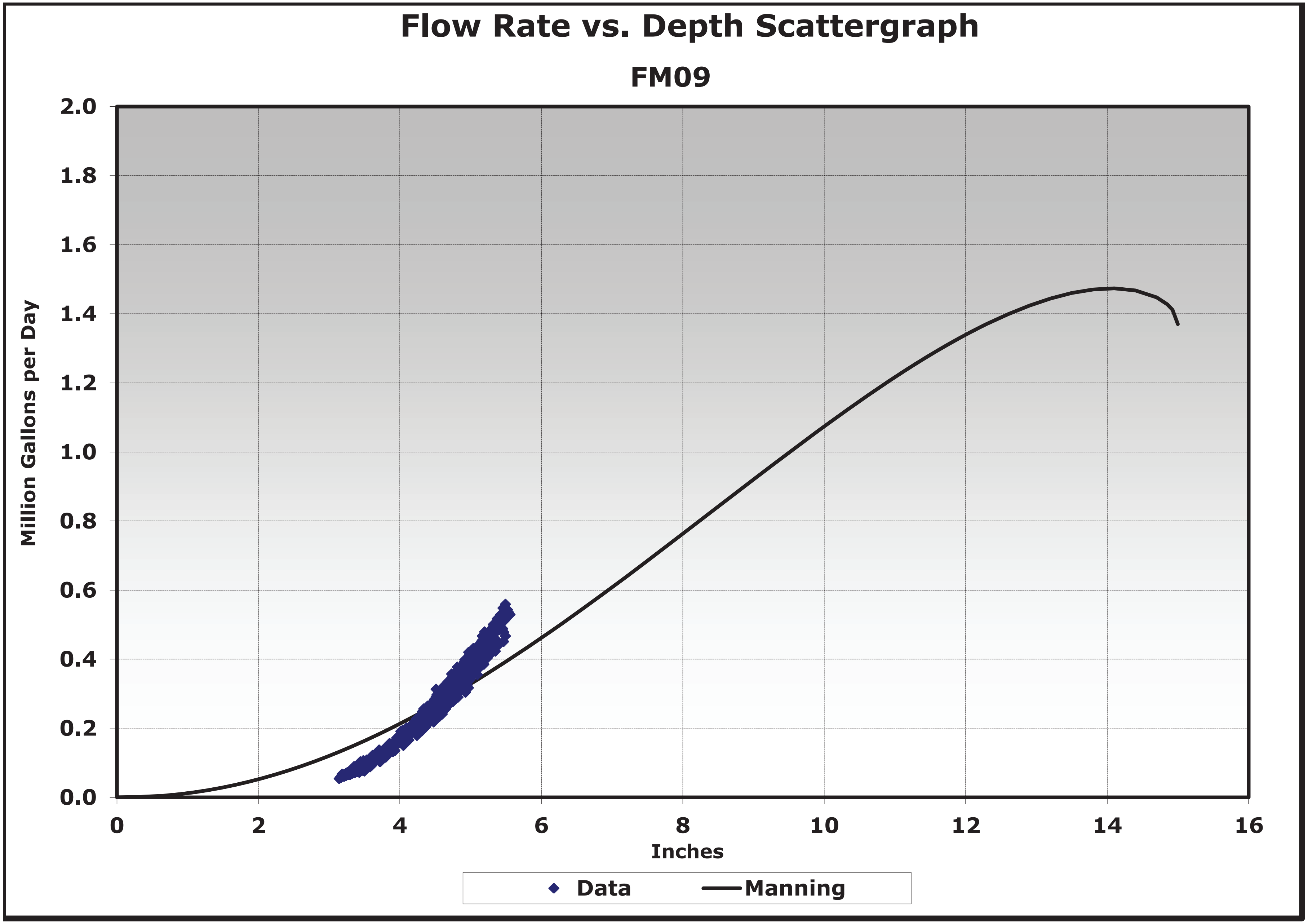
Temperature - Deg. F

Average	70.39
Maximum	71.98
Minimum	68.91




Flow Rate / Peak to Average
FM09
Million Gallons per Day
Peak to Average
Date
1.0
0.8
0.6
0.4
0.2
0.0
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.80
1.74
1.54
1.56
1.51
1.61
1.64
1.78
1.67
1.58
1.58
1.65
1.60
1.68
Flow Rate
Peak to Average


Velocity vs. Depth Scattergraph
FM09
Feet per Second
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM09
Million Gallons per Day
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
16
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM09 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.18	0.18	0.16	0.16	0.16	0.15	0.16	0.18	0.17	0.14	0.15	0.15	0.16	0.16
1:00	0.13	0.13	0.11	0.10	0.11	0.11	0.11	0.11	0.12	0.09	0.10	0.10	0.11	0.12
2:00	0.09	0.11	0.08	0.08	0.09	0.09	0.08	0.09	0.10	0.07	0.08	0.08	0.07	0.09
3:00	0.08	0.08	0.07	0.06	0.08	0.07	0.07	0.07	0.08	0.06	0.07	0.07	0.07	0.08
4:00	0.06	0.07	0.07	0.07	0.09	0.08	0.08	0.07	0.07	0.06	0.08	0.07	0.07	0.08
5:00	0.07	0.08	0.13	0.11	0.15	0.13	0.12	0.09	0.07	0.13	0.12	0.13	0.13	0.12
6:00	0.10	0.09	0.29	0.27	0.29	0.28	0.24	0.11	0.08	0.28	0.28	0.29	0.28	0.25
7:00	0.17	0.15	0.41	0.40	0.40	0.43	0.40	0.18	0.15	0.40	0.42	0.43	0.42	0.41
8:00	0.30	0.29	0.41	0.40	0.40	0.43	0.42	0.33	0.30	0.41	0.39	0.42	0.43	0.44
9:00	0.40	0.40	0.35	0.33	0.36	0.34	0.39	0.42	0.42	0.35	0.34	0.33	0.35	0.39
10:00	0.52	0.48	0.33	0.30	0.31	0.30	0.37	0.50	0.49	0.33	0.30	0.29	0.34	0.34
11:00	0.51	0.53	0.32	0.29	0.31	0.32	0.34	0.48	0.49	0.31	0.29	0.26	0.31	0.33
12:00	0.53	0.51	0.30	0.28	0.29	0.29	0.30	0.46	0.46	0.29	0.30	0.26	0.30	0.29
13:00	0.45	0.45	0.30	0.27	0.26	0.29	0.26	0.42	0.42	0.30	0.27	0.25	0.27	0.26
14:00	0.42	0.43	0.25	0.25	0.25	0.27	0.26	0.39	0.40	0.26	0.26	0.24	0.27	0.25
15:00	0.39	0.40	0.27	0.24	0.23	0.24	0.24	0.39	0.37	0.23	0.25	0.24	0.27	0.26
16:00	0.38	0.36	0.26	0.26	0.25	0.29	0.26	0.37	0.37	0.25	0.27	0.27	0.25	0.29
17:00	0.39	0.40	0.30	0.28	0.30	0.30	0.30	0.37	0.36	0.29	0.28	0.29	0.30	0.30
18:00	0.38	0.40	0.35	0.34	0.35	0.34	0.33	0.34	0.39	0.34	0.34	0.35	0.34	0.33
19:00	0.36	0.43	0.37	0.37	0.39	0.38	0.33	0.31	0.43	0.42	0.39	0.39	0.39	0.34
20:00	0.35	0.44	0.41	0.40	0.41	0.42	0.34	0.33	0.43	0.42	0.42	0.42	0.40	0.32
21:00	0.28	0.39	0.36	0.37	0.39	0.37	0.31	0.30	0.38	0.39	0.40	0.39	0.37	0.33
22:00	0.26	0.32	0.32	0.33	0.33	0.31	0.28	0.25	0.31	0.29	0.33	0.31	0.31	0.27
23:00	0.22	0.22	0.23	0.24	0.24	0.23	0.23	0.21	0.22	0.21	0.23	0.24	0.24	0.21
Average	0.29	0.31	0.27	0.26	0.27	0.27	0.26	0.28	0.30	0.26	0.26	0.26	0.27	0.26
Median	0.33	0.36	0.30	0.28	0.28	0.29	0.28	0.31	0.36	0.28	0.28	0.27	0.28	0.28
Max Hr. Mean	0.53	0.53	0.41	0.40	0.41	0.43	0.42	0.50	0.49	0.42	0.42	0.43	0.43	0.44
Min Hr. Mean	0.06	0.07	0.07	0.06	0.08	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.07	0.08
Inst. Max	0.56	0.54	0.46	0.45	0.43	0.48	0.44	0.53	0.51	0.44	0.45	0.45	0.45	0.47
Inst. Min	0.05	0.07	0.07	0.06	0.08	0.07	0.07	0.07	0.07	0.06	0.07	0.06	0.07	0.08
Peak To Avg.	1.80	1.74	1.54	1.56	1.51	1.61	1.64	1.78	1.67	1.58	1.58	1.65	1.60	1.68

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM09 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.02	1.04	0.94	0.95	0.99	0.91	0.96	1.05	1.00	0.87	0.89	0.92	0.96	0.92
1:00	0.82	0.82	0.73	0.73	0.77	0.71	0.73	0.75	0.78	0.67	0.69	0.71	0.74	0.74
2:00	0.65	0.77	0.60	0.59	0.69	0.63	0.58	0.65	0.71	0.57	0.57	0.60	0.55	0.62
3:00	0.60	0.60	0.57	0.51	0.64	0.55	0.54	0.57	0.62	0.50	0.53	0.54	0.55	0.57
4:00	0.50	0.55	0.55	0.52	0.68	0.58	0.59	0.53	0.58	0.51	0.59	0.55	0.56	0.56
5:00	0.55	0.60	0.83	0.77	0.94	0.81	0.78	0.63	0.55	0.82	0.79	0.83	0.83	0.74
6:00	0.69	0.66	1.38	1.33	1.42	1.33	1.23	0.73	0.61	1.36	1.32	1.39	1.34	1.20
7:00	1.00	0.91	1.72	1.72	1.73	1.74	1.66	1.05	0.92	1.73	1.71	1.78	1.74	1.66
8:00	1.41	1.40	1.70	1.72	1.73	1.75	1.74	1.51	1.45	1.73	1.64	1.74	1.75	1.71
9:00	1.71	1.67	1.55	1.56	1.64	1.50	1.66	1.73	1.77	1.57	1.52	1.51	1.56	1.62
10:00	1.98	1.88	1.52	1.46	1.46	1.42	1.65	1.96	1.91	1.53	1.41	1.39	1.52	1.50
11:00	1.96	2.00	1.50	1.40	1.47	1.48	1.57	1.93	1.92	1.47	1.38	1.32	1.44	1.47
12:00	2.02	1.97	1.44	1.41	1.44	1.37	1.45	1.88	1.85	1.42	1.40	1.30	1.41	1.33
13:00	1.84	1.82	1.42	1.34	1.33	1.40	1.31	1.80	1.77	1.43	1.34	1.27	1.32	1.25
14:00	1.75	1.76	1.27	1.27	1.29	1.32	1.30	1.70	1.71	1.31	1.28	1.25	1.31	1.24
15:00	1.69	1.70	1.34	1.24	1.24	1.24	1.23	1.68	1.63	1.20	1.31	1.21	1.31	1.24
16:00	1.68	1.59	1.31	1.32	1.30	1.42	1.33	1.65	1.64	1.28	1.35	1.30	1.26	1.32
17:00	1.69	1.69	1.49	1.35	1.45	1.43	1.46	1.63	1.58	1.39	1.38	1.38	1.39	1.37
18:00	1.69	1.69	1.60	1.53	1.59	1.53	1.51	1.58	1.67	1.51	1.54	1.55	1.52	1.45
19:00	1.62	1.79	1.64	1.65	1.67	1.63	1.54	1.49	1.78	1.75	1.66	1.66	1.61	1.48
20:00	1.57	1.78	1.72	1.70	1.69	1.76	1.56	1.57	1.78	1.74	1.71	1.72	1.65	1.40
21:00	1.39	1.65	1.58	1.66	1.65	1.64	1.48	1.49	1.67	1.68	1.67	1.67	1.59	1.44
22:00	1.32	1.48	1.49	1.53	1.52	1.46	1.38	1.29	1.49	1.37	1.49	1.45	1.41	1.26
23:00	1.17	1.15	1.21	1.26	1.21	1.18	1.22	1.15	1.19	1.12	1.21	1.24	1.19	1.07
Average	1.35	1.37	1.30	1.27	1.31	1.28	1.27	1.33	1.36	1.27	1.27	1.26	1.27	1.21
Median	1.52	1.59	1.42	1.36	1.39	1.41	1.38	1.52	1.58	1.37	1.37	1.33	1.36	1.29
Max Hr. Mean	2.02	2.00	1.72	1.72	1.73	1.76	1.74	1.96	1.92	1.75	1.71	1.78	1.75	1.71
Min Hr. Mean	0.50	0.55	0.55	0.51	0.64	0.55	0.54	0.53	0.55	0.50	0.53	0.54	0.55	0.56
Inst. Max	2.13	2.05	1.87	1.84	1.84	1.83	1.78	2.04	1.96	1.83	1.80	1.81	1.83	1.77
Inst. Min	0.45	0.53	0.53	0.48	0.61	0.53	0.52	0.51	0.51	0.49	0.51	0.49	0.52	0.54

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM09 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	4.03	4.06	3.95	3.91	3.89	3.97	3.95	4.05	3.94	3.87	3.89	3.92	3.97	4.08
1:00	3.74	3.72	3.57	3.53	3.58	3.65	3.60	3.62	3.61	3.49	3.55	3.55	3.63	3.79
2:00	3.48	3.60	3.40	3.33	3.40	3.50	3.39	3.46	3.45	3.30	3.35	3.36	3.34	3.56
3:00	3.35	3.34	3.32	3.21	3.34	3.42	3.30	3.33	3.37	3.23	3.30	3.27	3.34	3.49
4:00	3.18	3.28	3.27	3.21	3.42	3.42	3.38	3.27	3.29	3.22	3.40	3.29	3.34	3.49
5:00	3.26	3.33	3.76	3.62	3.78	3.79	3.70	3.42	3.29	3.71	3.73	3.73	3.79	3.81
6:00	3.49	3.45	4.61	4.47	4.54	4.60	4.38	3.59	3.32	4.51	4.63	4.58	4.58	4.59
7:00	4.02	3.85	5.14	5.04	5.02	5.28	5.14	4.05	3.81	5.01	5.22	5.18	5.15	5.28
8:00	4.69	4.56	5.15	5.04	4.96	5.22	5.19	4.76	4.53	5.12	5.14	5.19	5.22	5.37
9:00	5.04	5.09	4.92	4.72	4.79	4.88	5.06	5.18	5.07	4.82	4.90	4.79	4.93	5.15
10:00	5.45	5.40	4.73	4.59	4.65	4.73	4.90	5.39	5.40	4.73	4.71	4.64	4.85	4.95
11:00	5.45	5.54	4.70	4.59	4.63	4.78	4.75	5.23	5.41	4.66	4.69	4.46	4.73	4.93
12:00	5.44	5.45	4.67	4.52	4.52	4.65	4.60	5.22	5.26	4.60	4.68	4.50	4.71	4.78
13:00	5.20	5.26	4.65	4.51	4.44	4.59	4.46	5.05	5.07	4.60	4.57	4.47	4.62	4.62
14:00	5.16	5.20	4.45	4.41	4.38	4.51	4.47	5.01	5.05	4.49	4.49	4.38	4.59	4.59
15:00	5.01	5.09	4.53	4.41	4.31	4.45	4.36	4.97	4.94	4.38	4.41	4.40	4.56	4.61
16:00	4.94	4.93	4.50	4.50	4.40	4.57	4.47	4.93	4.93	4.47	4.51	4.58	4.48	4.76
17:00	4.95	5.09	4.55	4.59	4.63	4.64	4.63	4.92	4.95	4.58	4.58	4.69	4.75	4.81
18:00	4.88	5.06	4.81	4.83	4.78	4.82	4.76	4.73	5.04	4.88	4.80	4.88	4.91	4.90
19:00	4.81	5.14	4.94	4.93	5.01	5.00	4.73	4.65	5.14	5.11	5.00	5.04	5.19	4.97
20:00	4.82	5.24	5.08	5.09	5.13	5.14	4.74	4.70	5.10	5.10	5.19	5.16	5.20	4.96
21:00	4.54	5.06	4.92	4.90	5.07	4.94	4.64	4.56	4.96	5.00	5.09	5.05	5.06	4.93
22:00	4.47	4.71	4.69	4.74	4.81	4.70	4.53	4.34	4.67	4.71	4.78	4.75	4.78	4.67
23:00	4.28	4.27	4.31	4.27	4.40	4.33	4.28	4.15	4.31	4.29	4.37	4.39	4.47	4.39

Average	4.49	4.57	4.44	4.37	4.41	4.48	4.39	4.44	4.50	4.41	4.46	4.43	4.51	4.56
Median	4.73	4.97	4.60	4.53	4.53	4.64	4.53	4.64	4.89	4.56	4.59	4.52	4.66	4.75
Max Hr. Mean	5.45	5.54	5.15	5.09	5.13	5.28	5.19	5.39	5.41	5.12	5.22	5.19	5.22	5.37
Min Hr. Mean	3.18	3.28	3.27	3.21	3.34	3.42	3.30	3.27	3.29	3.22	3.30	3.27	3.34	3.49
Inst. Max	5.52	5.56	5.28	5.21	5.20	5.47	5.29	5.45	5.49	5.21	5.34	5.30	5.30	5.49
Inst. Min	3.14	3.26	3.24	3.17	3.33	3.38	3.28	3.24	3.25	3.19	3.29	3.22	3.29	3.46

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM09 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	70.97	70.65	71.15	71.00	70.85	70.96	70.57	70.04	70.13	70.26	70.02	69.99	70.10	70.03
1:00	70.59	70.46	71.06	70.81	70.63	70.75	70.47	70.00	69.94	70.13	69.83	69.81	69.74	69.72
2:00	70.53	70.35	70.79	70.73	70.40	70.69	70.40	69.94	69.84	69.93	69.73	69.67	69.69	69.49
3:00	70.55	70.39	70.66	70.59	70.27	70.57	70.30	69.88	69.68	69.85	69.64	69.60	69.63	69.37
4:00	70.53	70.28	70.47	70.51	70.14	70.42	70.18	69.79	69.64	69.72	69.51	69.49	69.49	69.15
5:00	70.49	70.14	70.39	70.48	70.17	70.40	70.15	69.67	69.55	69.68	69.62	69.58	69.50	69.18
6:00	70.46	70.12	70.67	70.65	70.60	70.50	70.23	69.52	69.38	70.09	70.00	70.05	69.73	69.57
7:00	70.22	70.47	70.82	70.82	70.77	71.07	70.50	69.48	69.42	70.27	69.94	70.13	69.94	69.96
8:00	70.14	70.08	71.18	71.21	71.22	71.64	70.97	69.68	69.53	70.51	70.54	70.54	70.54	70.50
9:00	70.28	70.24	71.14	71.07	71.10	71.32	70.99	69.91	69.54	70.44	70.30	70.39	70.44	70.48
10:00	70.66	70.81	71.08	70.81	71.01	71.10	70.73	70.16	69.81	70.18	70.28	70.58	70.26	70.02
11:00	71.06	71.16	70.90	71.00	70.78	71.06	70.96	70.69	70.54	70.16	69.88	70.31	70.22	70.21
12:00	71.19	71.35	71.04	70.69	70.92	71.11	70.69	70.77	70.75	69.93	69.71	69.96	69.84	70.16
13:00	71.04	71.41	70.87	70.64	70.86	70.83	70.16	71.13	70.63	69.95	69.96	69.97	69.99	70.00
14:00	71.15	71.21	70.67	70.46	70.83	70.70	70.00	70.87	70.38	69.80	69.60	69.80	69.66	69.69
15:00	71.41	71.33	70.47	70.36	70.42	70.67	70.05	70.67	70.18	69.64	69.47	69.52	69.78	69.70
16:00	71.25	71.08	70.27	70.18	70.29	70.37	70.14	70.58	69.99	69.35	69.40	69.44	69.59	69.71
17:00	70.94	71.21	70.26	70.12	70.38	70.37	69.97	70.47	70.13	69.26	68.96	69.43	69.68	69.58
18:00	70.92	70.98	70.44	70.25	70.47	70.33	70.26	70.56	70.21	69.38	69.33	69.62	69.63	69.74
19:00	71.11	71.49	70.85	70.97	70.77	70.49	70.52	70.62	70.75	70.05	69.93	69.76	70.00	70.17
20:00	71.17	71.60	71.14	71.27	71.21	71.17	70.40	70.75	70.73	70.20	70.65	70.60	70.47	70.20
21:00	71.13	71.91	71.45	71.67	71.48	71.28	70.40	70.52	70.74	70.30	70.60	70.84	70.66	70.55
22:00	70.82	71.79	71.43	71.41	71.69	71.40	70.27	70.43	70.62	70.35	70.62	70.50	70.59	70.07
23:00	70.82	71.34	71.20	71.15	71.30	70.87	70.17	70.38	70.38	70.26	70.34	70.34	70.33	69.92
Average	70.81	70.91	70.85	70.79	70.77	70.83	70.40	70.27	70.10	69.99	69.91	70.00	69.98	69.88
Median	70.89	71.05	70.87	70.75	70.75	70.80	70.35	70.41	70.14	70.04	69.84	69.89	69.85	69.90
Max Hr. Mean	71.41	71.91	71.45	71.67	71.69	71.64	70.99	71.13	70.75	70.51	70.65	70.84	70.66	70.55
Min Hr. Mean	70.14	70.08	70.26	70.12	70.14	70.33	69.97	69.48	69.38	69.26	68.96	69.43	69.49	69.15
Inst. Max	71.53	71.98	71.53	71.90	71.86	71.75	71.18	71.36	71.26	70.69	70.79	71.21	70.76	70.81
Inst. Min	69.93	70.00	70.19	70.06	70.09	70.21	69.92	69.36	69.31	69.18	68.91	69.33	69.39	69.03

Services, Inc.

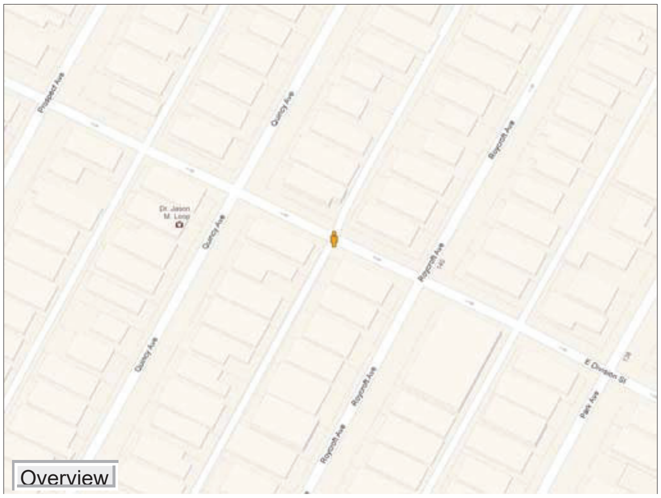
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

Site #: FM10 **Date:** 12/27/201

Address: Division, NW/of Roycroft

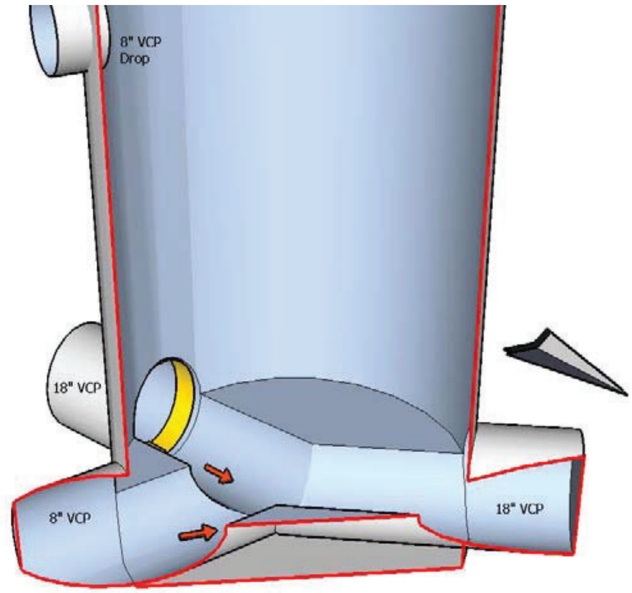
Traffic: Light, residential **Job #** 2012.5.166


Overview


Detail Vie

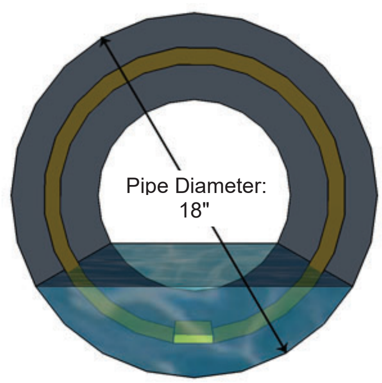

Planar Vie

Profile



MH Condition:	Fair	**Infiltration:**	Yes
Laterals:	Yes	**Surcharge Evidence:**	No
Rungs:	No	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	10.3'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 1.80 fps

Flow Depth: 4.25"

Pipe Material: VCP

Comments: Outside-drop lateral does not disrupt flow dynamic

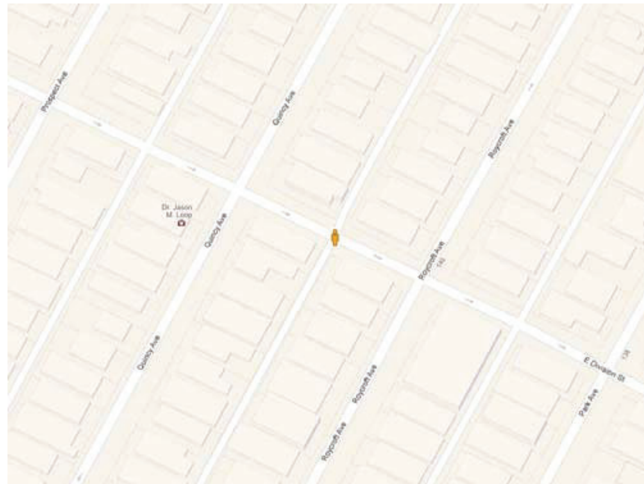
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

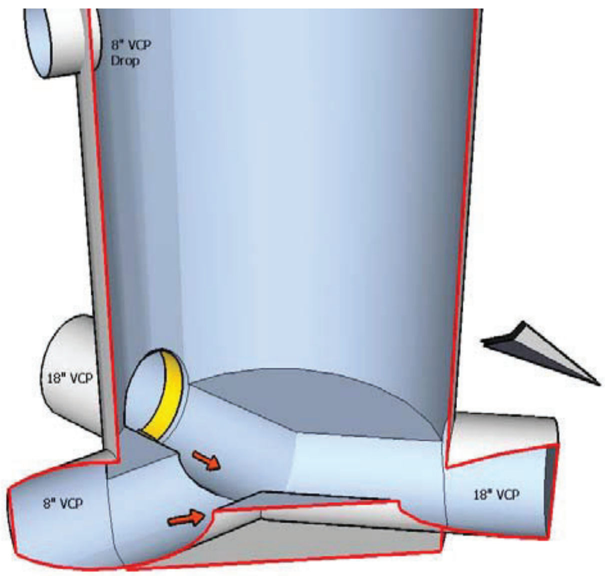
Site Details

Job Number: 2012.5.166
Site Identifier: FM10
Map Page: P06-SMH-022
Location: Division, NW/of Roycroft
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 7:25:00 AM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Light, residential
Manhole Depth: 10.3'

Overview



Facility Inspection



Cover

Status: Normal
Shape: Round
Size: 36" diameter
Material: Cast iron
Corrosion: Moderate

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Offset

Cone

Shape: Eccentric
Material: Precast Concrete
Condition: Fair
Infiltration: stains

Barrel

Material: Precast Concrete
Condition: good
Infiltration: none

Rungs

Rungs: No
Material: N/A
Condition: N/A

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: None
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

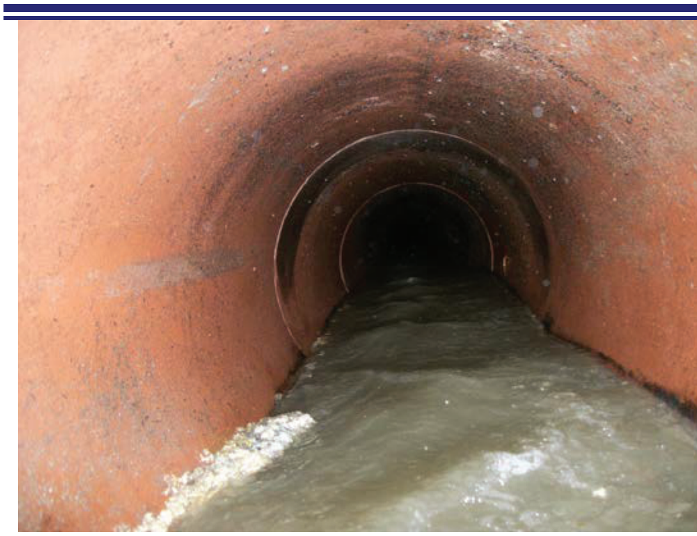
Observations and Comments

Flow Velocity: 1.80 fps
Flow Depth: 4.25"
Observation Location: Influent Pipe

Comments: Large manhole lid has an inflow-dish

Area Reference

Down Manhole



Effluent

Influent

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM10


Lateral – Lower Elevation


Lateral – Upper Elevation

Site Data Summary

Project # 2012.5.166
Location ID FM10
Pipe Diameter 18 Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	3.83
Maximum	5.23
Minimum	2.44
Max d/D	29.1%

Velocity - Feet per Second

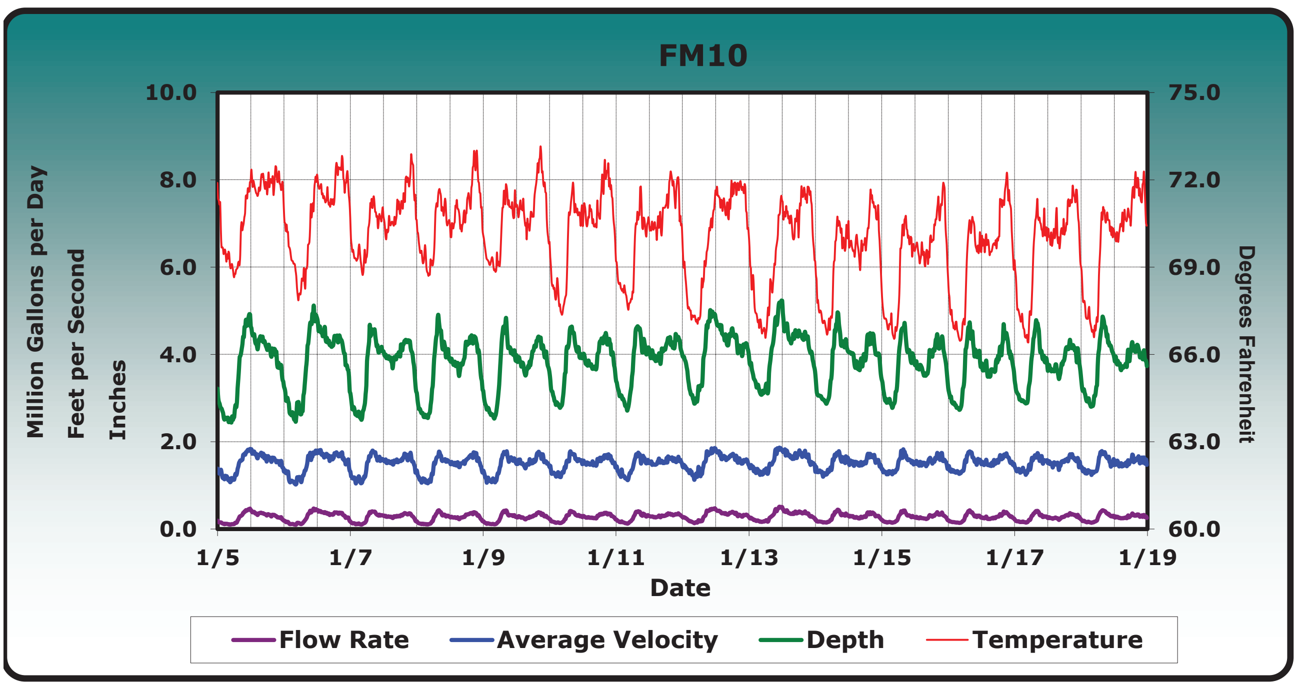
Average	1.51
Maximum	1.87
Minimum	1.02

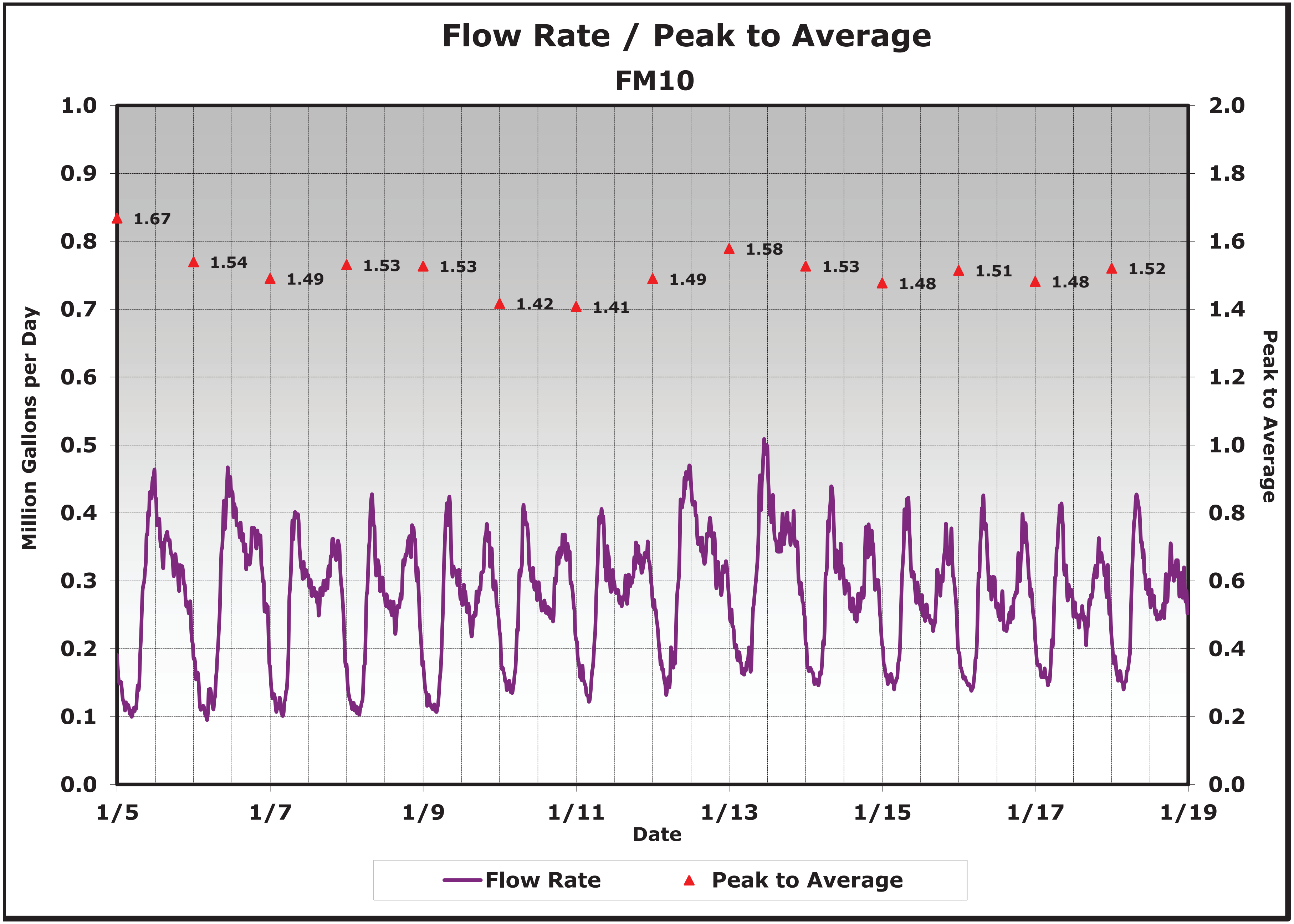
Flow - Million Gallons per Day

Average	0.28
Maximum	0.51
Minimum	0.10
Peak Factor	1.84

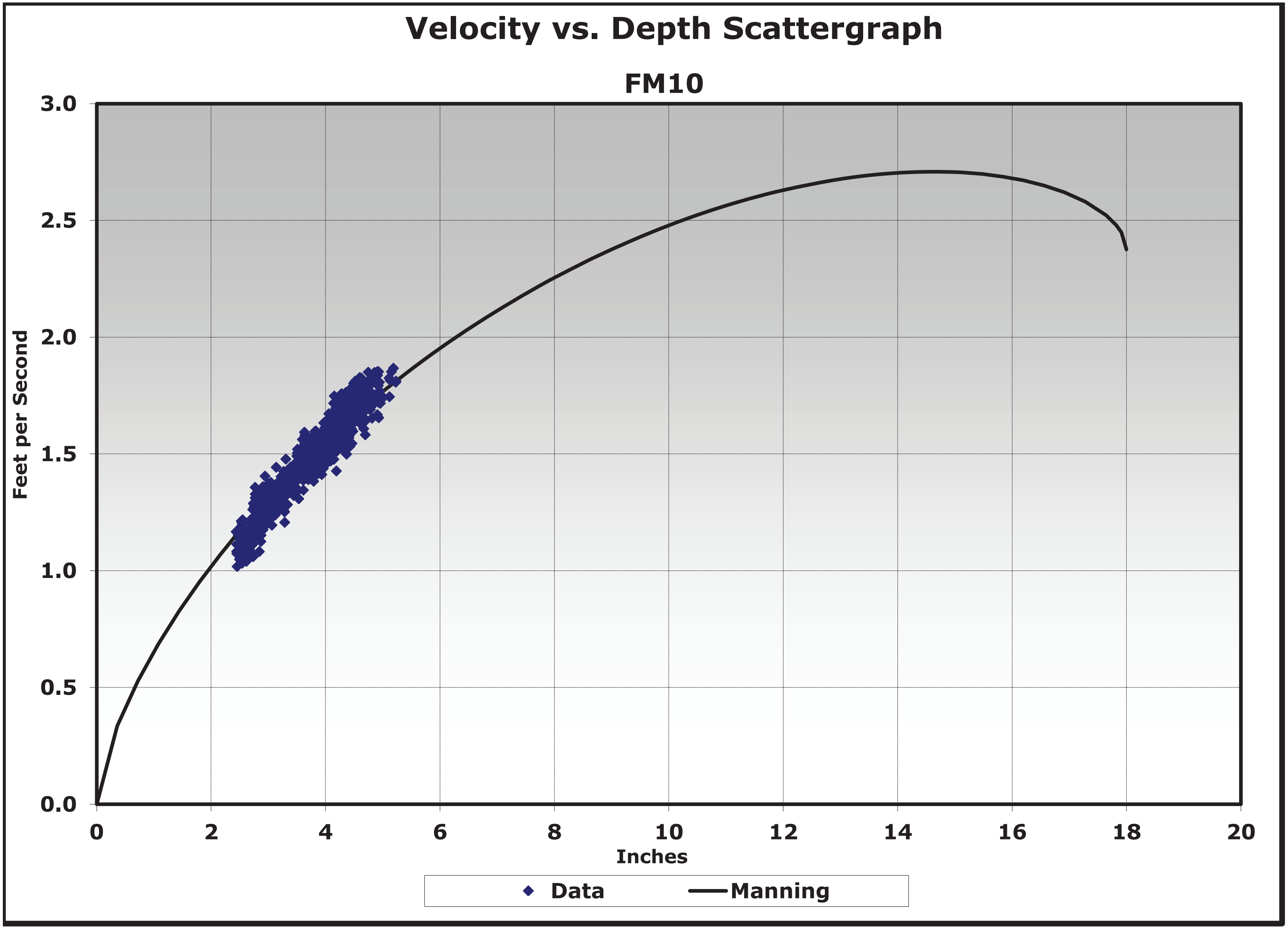
Temperature - Deg. F

Average	70.08
Maximum	73.15
Minimum	66.41

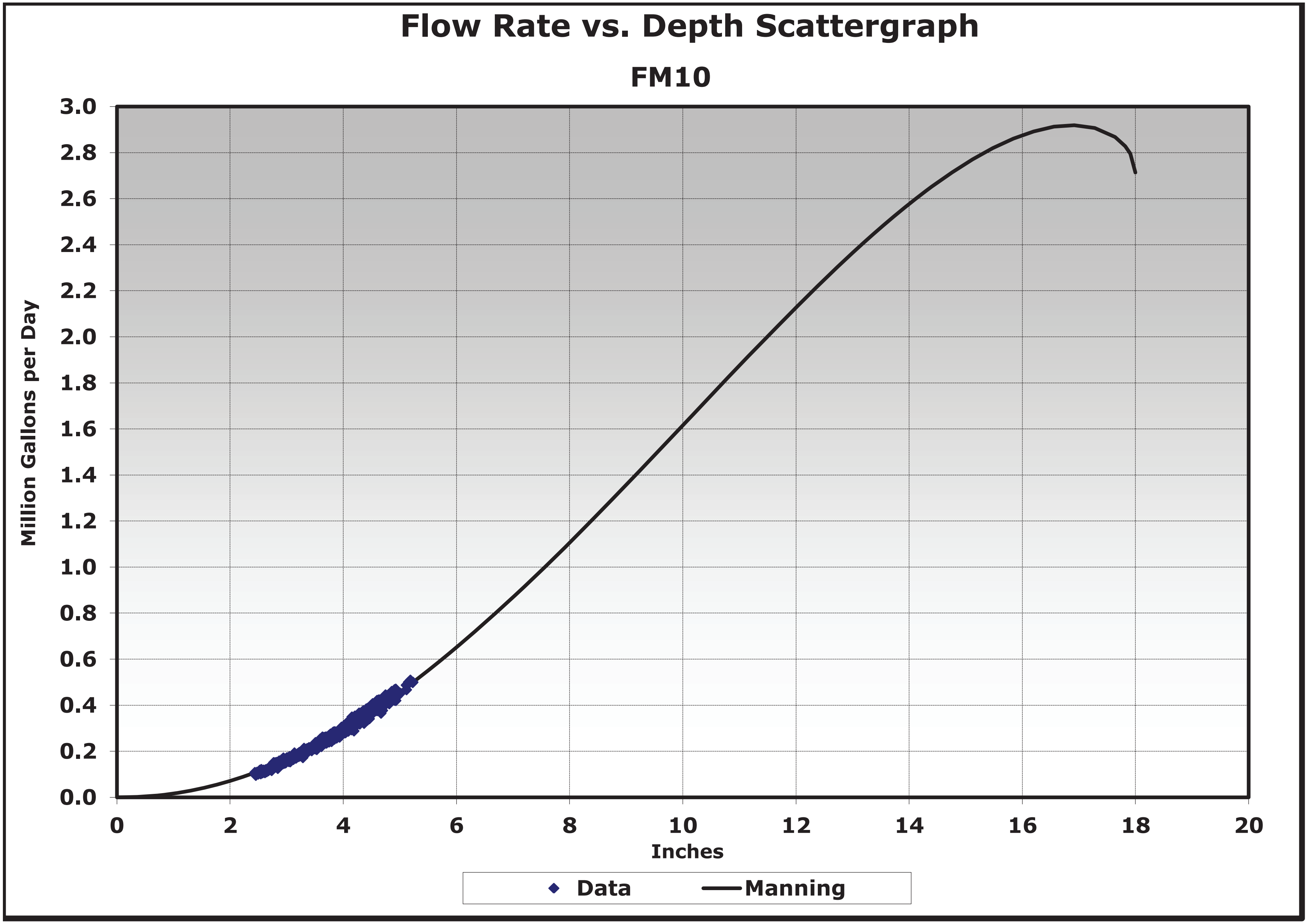




Flow Rate / Peak to Average
FM10
Million Gallons per Day
Peak to Average
Date
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.67
1.54
1.49
1.53
1.53
1.42
1.41
1.49
1.58
1.53
1.48
1.51
1.48
1.52
Flow Rate
Peak to Average



Velocity vs. Depth Scattergraph
FM10
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Feet per Second
0
2
4
6
8
10
12
14
16
18
20
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM10
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Million Gallons per Day
0
2
4
6
8
10
12
14
16
18
20
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM10 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.17	0.18	0.15	0.15	0.16	0.20	0.20	0.26	0.25	0.19	0.19	0.18	0.19	0.19
1:00	0.14	0.15	0.13	0.12	0.13	0.16	0.16	0.24	0.22	0.17	0.16	0.16	0.17	0.17
2:00	0.12	0.11	0.11	0.12	0.12	0.15	0.16	0.19	0.20	0.16	0.16	0.15	0.16	0.16
3:00	0.12	0.11	0.11	0.11	0.11	0.14	0.13	0.16	0.19	0.15	0.15	0.15	0.16	0.15
4:00	0.10	0.11	0.11	0.11	0.11	0.15	0.13	0.14	0.17	0.16	0.15	0.14	0.15	0.15
5:00	0.11	0.13	0.16	0.16	0.16	0.21	0.18	0.17	0.17	0.19	0.19	0.19	0.21	0.18
6:00	0.13	0.12	0.31	0.28	0.29	0.31	0.28	0.18	0.18	0.30	0.31	0.31	0.31	0.30
7:00	0.20	0.18	0.38	0.38	0.39	0.38	0.38	0.23	0.23	0.39	0.39	0.40	0.38	0.41
8:00	0.30	0.29	0.40	0.40	0.40	0.39	0.39	0.34	0.30	0.42	0.39	0.38	0.39	0.41
9:00	0.37	0.38	0.35	0.32	0.32	0.33	0.32	0.41	0.40	0.33	0.31	0.31	0.32	0.36
10:00	0.42	0.43	0.31	0.30	0.31	0.31	0.32	0.45	0.45	0.32	0.29	0.29	0.28	0.31
11:00	0.45	0.43	0.31	0.29	0.29	0.29	0.30	0.46	0.50	0.33	0.28	0.29	0.28	0.29
12:00	0.40	0.42	0.30	0.27	0.28	0.28	0.29	0.43	0.44	0.29	0.26	0.26	0.26	0.27
13:00	0.37	0.40	0.28	0.26	0.27	0.26	0.28	0.41	0.41	0.29	0.26	0.26	0.24	0.26
14:00	0.34	0.38	0.28	0.26	0.26	0.26	0.27	0.36	0.37	0.26	0.25	0.23	0.25	0.25
15:00	0.37	0.36	0.27	0.24	0.23	0.26	0.29	0.35	0.34	0.25	0.24	0.24	0.24	0.25
16:00	0.36	0.34	0.29	0.26	0.26	0.25	0.29	0.33	0.37	0.26	0.24	0.25	0.23	0.26
17:00	0.33	0.33	0.29	0.30	0.28	0.29	0.30	0.37	0.37	0.28	0.30	0.27	0.27	0.29
18:00	0.33	0.37	0.31	0.33	0.31	0.34	0.33	0.38	0.39	0.31	0.30	0.31	0.30	0.33
19:00	0.31	0.36	0.35	0.36	0.35	0.35	0.34	0.35	0.36	0.36	0.33	0.32	0.32	0.31
20:00	0.32	0.36	0.34	0.36	0.37	0.36	0.32	0.31	0.37	0.36	0.35	0.38	0.34	0.32
21:00	0.28	0.33	0.35	0.36	0.33	0.34	0.33	0.29	0.34	0.33	0.35	0.36	0.32	0.29
22:00	0.26	0.27	0.29	0.30	0.29	0.31	0.34	0.32	0.29	0.30	0.31	0.29	0.30	0.30
23:00	0.23	0.23	0.21	0.21	0.26	0.26	0.31	0.31	0.26	0.25	0.25	0.26	0.26	0.27
Average	0.27	0.28	0.27	0.26	0.26	0.27	0.28	0.31	0.32	0.28	0.27	0.27	0.27	0.27
Median	0.30	0.33	0.29	0.27	0.28	0.28	0.30	0.32	0.34	0.29	0.27	0.27	0.27	0.28
Max Hr. Mean	0.45	0.43	0.40	0.40	0.40	0.39	0.39	0.46	0.50	0.42	0.39	0.40	0.39	0.41
Min Hr. Mean	0.10	0.11	0.11	0.11	0.11	0.14	0.13	0.14	0.17	0.15	0.15	0.14	0.15	0.15
Inst. Max	0.46	0.47	0.40	0.43	0.42	0.41	0.41	0.47	0.51	0.44	0.42	0.43	0.41	0.43
Inst. Min	0.10	0.10	0.10	0.10	0.11	0.14	0.12	0.13	0.16	0.15	0.14	0.14	0.15	0.14
Peak To Avg.	1.67	1.54	1.49	1.53	1.53	1.42	1.41	1.49	1.58	1.53	1.48	1.51	1.48	1.52

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM10 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.32	1.32	1.22	1.25	1.26	1.36	1.38	1.43	1.43	1.34	1.34	1.39	1.38	1.37
1:00	1.29	1.27	1.16	1.10	1.14	1.28	1.25	1.39	1.39	1.32	1.29	1.33	1.35	1.33
2:00	1.18	1.09	1.10	1.14	1.11	1.23	1.27	1.32	1.33	1.27	1.30	1.31	1.32	1.31
3:00	1.18	1.08	1.13	1.09	1.11	1.25	1.17	1.27	1.34	1.26	1.29	1.31	1.34	1.29
4:00	1.11	1.07	1.10	1.09	1.10	1.26	1.16	1.19	1.26	1.30	1.31	1.29	1.29	1.30
5:00	1.15	1.18	1.25	1.20	1.27	1.38	1.32	1.28	1.30	1.36	1.37	1.36	1.41	1.33
6:00	1.21	1.14	1.57	1.49	1.52	1.55	1.49	1.31	1.32	1.55	1.59	1.59	1.59	1.57
7:00	1.40	1.29	1.70	1.64	1.73	1.70	1.68	1.39	1.42	1.70	1.72	1.75	1.67	1.75
8:00	1.56	1.52	1.77	1.73	1.72	1.72	1.71	1.62	1.50	1.73	1.72	1.73	1.69	1.73
9:00	1.68	1.65	1.66	1.57	1.58	1.63	1.59	1.73	1.71	1.60	1.60	1.58	1.61	1.64
10:00	1.76	1.70	1.61	1.57	1.61	1.58	1.57	1.77	1.80	1.56	1.56	1.54	1.55	1.54
11:00	1.82	1.76	1.59	1.56	1.58	1.55	1.54	1.83	1.84	1.62	1.52	1.56	1.57	1.53
12:00	1.78	1.77	1.57	1.52	1.52	1.52	1.53	1.78	1.78	1.53	1.52	1.50	1.52	1.50
13:00	1.74	1.74	1.53	1.49	1.54	1.50	1.48	1.75	1.77	1.51	1.51	1.53	1.48	1.51
14:00	1.67	1.68	1.52	1.49	1.48	1.49	1.48	1.62	1.70	1.51	1.49	1.47	1.50	1.47
15:00	1.71	1.70	1.52	1.45	1.43	1.50	1.56	1.63	1.63	1.49	1.51	1.48	1.48	1.48
16:00	1.69	1.63	1.56	1.51	1.51	1.47	1.54	1.62	1.67	1.49	1.48	1.53	1.45	1.49
17:00	1.62	1.63	1.55	1.54	1.52	1.55	1.53	1.68	1.68	1.51	1.60	1.53	1.55	1.53
18:00	1.64	1.71	1.57	1.61	1.55	1.61	1.59	1.69	1.76	1.58	1.55	1.60	1.57	1.64
19:00	1.59	1.71	1.68	1.68	1.68	1.64	1.63	1.62	1.70	1.70	1.60	1.62	1.61	1.57
20:00	1.62	1.70	1.64	1.69	1.73	1.66	1.60	1.57	1.70	1.67	1.69	1.69	1.69	1.62
21:00	1.55	1.64	1.70	1.68	1.64	1.66	1.57	1.51	1.63	1.61	1.67	1.68	1.62	1.55
22:00	1.51	1.53	1.57	1.56	1.55	1.58	1.60	1.57	1.51	1.57	1.57	1.55	1.59	1.60
23:00	1.45	1.46	1.37	1.38	1.49	1.49	1.55	1.55	1.49	1.46	1.48	1.50	1.49	1.52
Average	1.51	1.50	1.49	1.46	1.47	1.51	1.49	1.55	1.57	1.51	1.51	1.52	1.51	1.51
Median	1.57	1.61	1.55	1.52	1.52	1.52	1.53	1.58	1.61	1.52	1.54	1.53	1.54	1.51
Max Hr. Mean	1.82	1.77	1.77	1.73	1.73	1.72	1.71	1.83	1.84	1.73	1.72	1.75	1.69	1.75
Min Hr. Mean	1.11	1.07	1.10	1.09	1.10	1.23	1.16	1.19	1.26	1.26	1.29	1.29	1.29	1.29
Inst. Max	1.84	1.81	1.80	1.77	1.78	1.78	1.75	1.85	1.87	1.79	1.83	1.78	1.74	1.79
Inst. Min	1.07	1.02	1.04	1.05	1.06	1.19	1.12	1.13	1.24	1.20	1.25	1.26	1.24	1.24

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM10 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	3.00	3.13	2.92	2.91	2.99	3.33	3.30	3.93	3.82	3.27	3.27	3.11	3.25	3.27
1:00	2.75	2.93	2.73	2.70	2.77	3.04	3.07	3.74	3.56	3.05	2.95	2.93	3.05	3.09
2:00	2.56	2.64	2.62	2.61	2.67	2.88	2.99	3.29	3.35	3.00	2.93	2.86	2.95	2.96
3:00	2.53	2.59	2.59	2.59	2.60	2.82	2.83	3.05	3.25	2.93	2.85	2.77	2.92	2.84
4:00	2.46	2.63	2.62	2.62	2.60	2.87	2.80	2.92	3.09	2.92	2.87	2.77	2.90	2.90
5:00	2.51	2.80	3.01	3.07	3.05	3.41	3.24	3.06	3.14	3.28	3.27	3.20	3.38	3.18
6:00	2.73	2.67	4.07	3.94	3.99	4.14	3.96	3.25	3.24	4.02	4.11	4.05	4.07	4.04
7:00	3.31	3.24	4.53	4.64	4.57	4.51	4.59	3.65	3.59	4.61	4.58	4.59	4.58	4.62
8:00	4.02	4.00	4.51	4.60	4.61	4.53	4.58	4.33	4.16	4.79	4.55	4.46	4.64	4.71
9:00	4.42	4.60	4.28	4.21	4.15	4.20	4.22	4.72	4.66	4.29	4.10	4.10	4.11	4.41
10:00	4.70	4.91	4.09	4.07	4.05	4.08	4.20	4.94	4.87	4.20	3.91	3.99	3.91	4.22
11:00	4.87	4.84	4.10	3.99	3.97	3.95	4.11	4.92	5.17	4.18	3.93	3.91	3.85	4.05
12:00	4.53	4.67	4.00	3.87	3.90	3.97	3.99	4.72	4.87	4.04	3.75	3.74	3.69	3.89
13:00	4.37	4.55	3.92	3.80	3.82	3.76	3.98	4.63	4.64	4.01	3.70	3.74	3.64	3.79
14:00	4.20	4.51	3.90	3.76	3.75	3.79	3.90	4.51	4.41	3.77	3.70	3.55	3.67	3.70
15:00	4.37	4.33	3.81	3.61	3.57	3.71	3.94	4.40	4.31	3.72	3.54	3.56	3.63	3.71
16:00	4.33	4.26	3.93	3.79	3.73	3.69	3.98	4.25	4.45	3.78	3.56	3.63	3.55	3.80
17:00	4.22	4.19	3.99	4.05	3.90	3.95	4.10	4.48	4.45	3.91	3.98	3.79	3.81	3.97
18:00	4.17	4.38	4.11	4.25	4.14	4.30	4.28	4.49	4.48	4.09	4.04	4.02	4.05	4.18
19:00	4.05	4.35	4.27	4.36	4.29	4.32	4.32	4.35	4.37	4.37	4.24	4.14	4.16	4.12
20:00	4.12	4.37	4.31	4.36	4.37	4.38	4.22	4.14	4.44	4.38	4.27	4.51	4.20	4.15
21:00	3.88	4.14	4.27	4.32	4.16	4.27	4.31	4.07	4.29	4.20	4.28	4.35	4.16	3.98
22:00	3.75	3.82	3.98	4.00	4.01	4.07	4.36	4.20	4.04	4.01	4.11	4.00	4.01	4.00
23:00	3.52	3.48	3.42	3.41	3.74	3.72	4.15	4.17	3.77	3.75	3.64	3.74	3.80	3.84

Average	3.72	3.84	3.75	3.73	3.72	3.82	3.89	4.09	4.10	3.86	3.76	3.73	3.75	3.81
Median	4.05	4.20	3.96	3.87	3.87	3.93	4.09	4.21	4.31	4.00	3.81	3.80	3.78	3.90
Max Hr. Mean	4.87	4.91	4.53	4.64	4.61	4.53	4.59	4.94	5.17	4.79	4.58	4.59	4.64	4.71
Min Hr. Mean	2.46	2.59	2.59	2.59	2.60	2.82	2.80	2.92	3.09	2.92	2.85	2.77	2.90	2.84
Inst. Max	4.92	5.12	4.68	4.91	4.83	4.63	4.64	5.01	5.23	4.96	4.72	4.73	4.78	4.86
Inst. Min	2.44	2.46	2.50	2.54	2.53	2.77	2.71	2.87	3.07	2.87	2.77	2.73	2.87	2.80

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM10 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	71.43	70.58	69.99	70.23	69.89	69.19	68.95	69.37	69.45	68.56	67.73	68.05	68.74	68.51
1:00	70.22	70.15	69.42	69.57	69.31	68.32	68.40	68.34	68.41	67.60	67.22	67.29	67.49	67.65
2:00	69.57	69.49	69.27	69.25	69.13	68.13	68.20	67.58	67.53	67.28	66.94	66.96	67.25	67.31
3:00	69.34	69.17	69.54	69.29	69.22	67.97	68.17	67.34	67.12	67.08	67.10	66.84	66.85	67.18
4:00	69.27	68.74	68.87	68.76	68.89	67.43	67.69	67.28	67.02	66.81	66.61	66.50	66.56	66.74
5:00	68.98	68.02	69.34	69.15	69.21	67.81	67.85	67.16	66.84	67.15	66.93	67.03	67.10	67.03
6:00	68.77	68.37	69.95	69.86	69.76	69.11	68.73	67.41	66.90	68.19	68.34	68.09	68.29	68.19
7:00	69.06	68.56	71.07	71.21	71.34	70.96	70.55	68.49	67.82	69.84	70.11	70.19	70.33	70.40
8:00	69.84	69.18	71.24	71.58	71.58	71.66	70.99	69.21	68.35	70.58	70.53	70.45	70.92	70.90
9:00	70.47	70.30	70.82	70.94	71.15	70.99	70.89	69.95	69.12	70.13	70.17	70.36	70.51	70.69
10:00	71.28	70.94	70.59	71.06	71.03	70.87	70.48	70.47	70.13	69.74	69.92	69.65	70.44	70.47
11:00	71.71	71.91	70.81	70.53	71.03	70.80	70.44	71.02	71.10	70.08	69.59	69.75	70.13	70.20
12:00	72.03	71.92	70.47	70.27	70.99	70.87	70.35	71.59	70.99	69.97	69.70	69.82	70.16	70.06
13:00	71.81	71.72	70.18	70.43	71.07	70.58	70.41	71.32	70.91	69.69	69.42	69.85	69.89	70.05
14:00	71.51	71.43	70.56	71.13	71.05	70.87	70.29	71.19	70.71	69.66	69.53	69.84	70.13	70.42
15:00	71.77	71.40	70.50	70.74	70.38	70.75	70.53	71.04	70.53	69.76	69.27	69.50	70.42	70.67
16:00	72.12	71.19	70.65	70.41	70.44	70.43	70.44	70.91	70.16	69.37	69.43	69.77	69.94	70.65
17:00	71.79	71.26	71.15	70.79	70.76	70.85	71.04	71.43	70.69	69.72	69.74	69.83	70.36	70.84
18:00	71.85	71.62	71.08	71.29	71.11	71.08	71.21	71.67	70.77	69.87	69.91	70.34	70.28	71.16
19:00	71.95	72.41	71.33	71.30	72.13	72.01	71.88	71.74	71.57	70.65	70.55	71.24	71.04	71.85
20:00	71.85	72.38	72.04	72.44	72.71	72.29	71.99	71.78	71.53	71.43	71.08	71.44	71.22	71.89
21:00	72.22	72.39	71.99	72.71	72.33	72.17	71.40	71.79	71.61	71.11	70.98	71.87	71.57	71.46
22:00	72.03	71.88	72.64	71.97	71.70	71.57	71.93	71.70	71.37	70.78	71.75	71.24	71.43	71.81
23:00	71.74	71.71	71.26	71.00	70.19	70.36	70.57	70.62	69.79	69.58	69.90	69.57	70.06	70.98
Average	70.94	70.70	70.61	70.66	70.68	70.29	70.14	70.02	69.60	69.36	69.27	69.39	69.63	69.88
Median	71.53	71.19	70.67	70.75	70.84	70.77	70.46	70.73	70.08	69.71	69.63	69.75	70.14	70.43
Max Hr. Mean	72.22	72.41	72.64	72.71	72.71	72.29	71.99	71.79	71.61	71.43	71.75	71.87	71.57	71.89
Min Hr. Mean	68.77	68.02	68.87	68.76	68.89	67.43	67.69	67.16	66.84	66.81	66.61	66.50	66.56	66.74
Inst. Max	72.47	72.82	72.87	73.00	73.15	72.69	72.29	71.97	71.77	71.67	71.90	72.25	71.79	72.29
Inst. Min	68.65	67.86	68.73	68.70	68.84	67.36	67.54	67.05	66.57	66.68	66.54	66.47	66.41	66.60

DownStream Services, Inc.

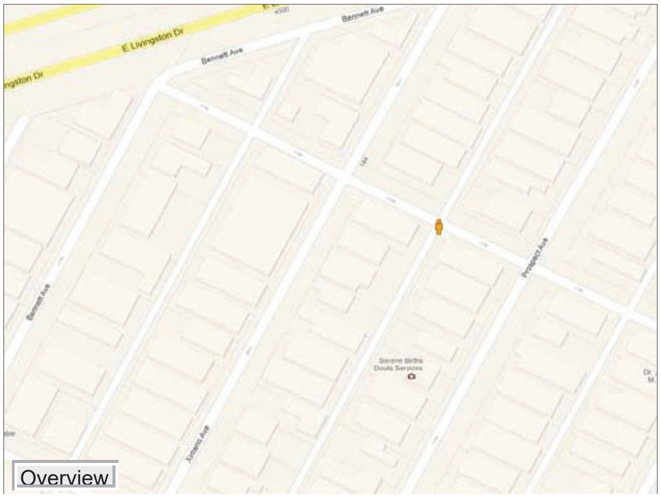
Site Investigation Summary

MWH Global - City of Long Beach Master Plan

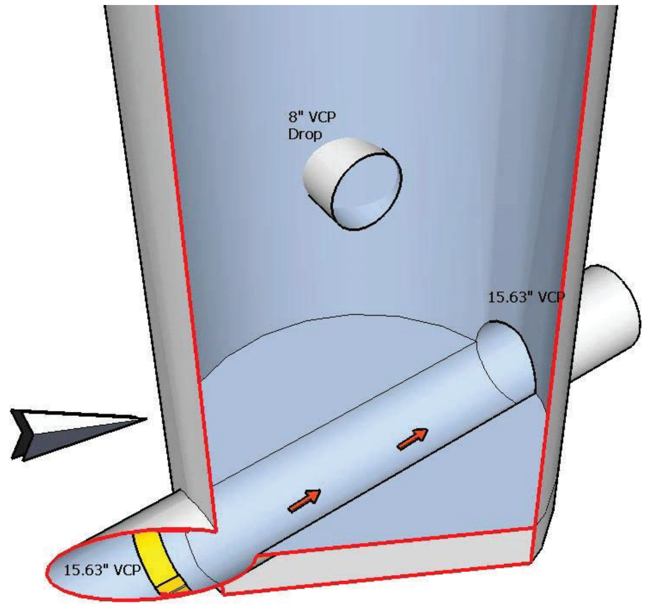
Site #: FM11 **Date:** 12/27/201

Address: Division, SE of Ximeno

Traffic: Light, residential **Job #** 2012.5.166

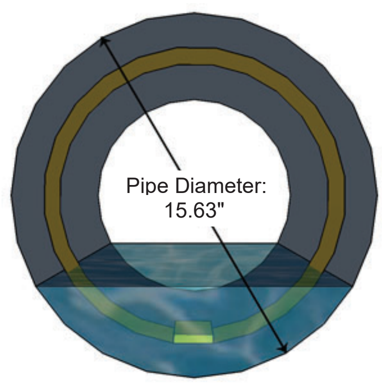


Profile



MH Condition:	Poor	**Infiltration:**	Yes
Laterals:	Yes	**Surcharge Evidence:**	No
Rungs:	No	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	10.45'

Cross Section



Monitor SN: ISCO

SensorType: Pressure transducer, Doppler Velocity

Velocity: 2.39 fps

Flow Depth: 7.13"

Pipe Material: Lined

Comments: inside-drop lateral causes turbulence at effluent channel

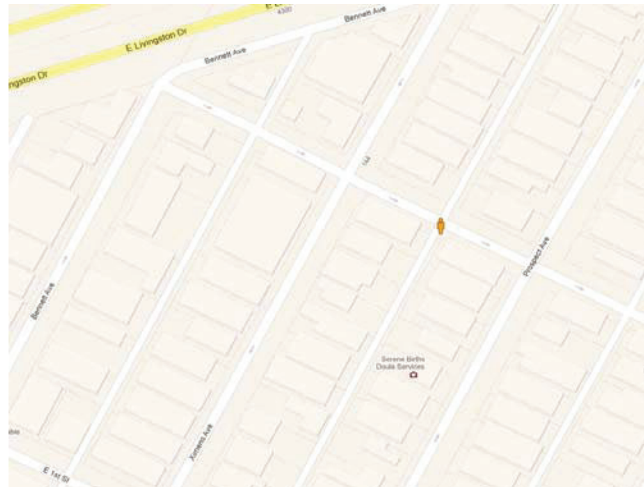
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM11
Map Page: N06-SMH-061
Location: Division, SE of Ximeno
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 9:50:00 AM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Light, residential
Manhole Depth: 10.45'

Overview



Facility Inspection

Cover

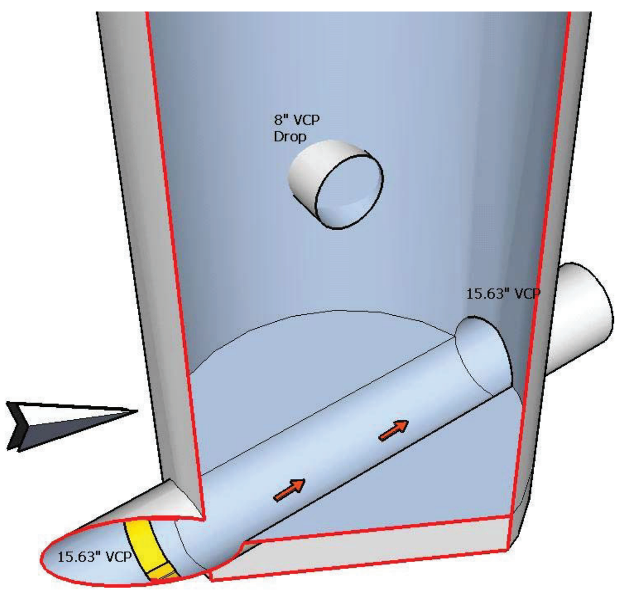
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: moderate

Grade Ring / Frame

Condition: Good
Corrosion: Light
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Concentric
Material: Brick
Condition: Fair
Infiltration: None



Barrel

Material: Brick
Condition: Fair
Infiltration: none

Rungs

Rungs: No
Material: N/A
Condition: N/A

Bench

Material: Cast in place Concrete
Condition: Good
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: Good
Infiltration: None

Defect Observation

Surcharge

Active: None
Evidence: N/A
Level: N/A

Silt

Present: No
Depth: N/A

Debris

Present: No
Desc.: N/A

Other

Grease: None
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

Observations and Comments

Flow Velocity: 2.39 fps
Flow Depth: 7.13"
Observation Location: Influent Pipe

Comments: Active inside-drop connection causes turbulence in manhole

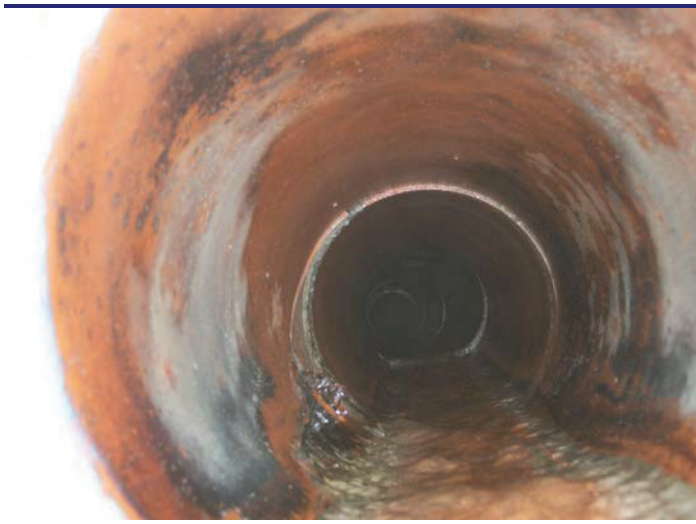
Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM11

Area Reference


Down Manhole


Effluent


Influent



Lateral

Site Data Summary

Project #	2012.5.166	
Location ID	FM11	
Pipe Diameter	16	Inches

Project Date 1/5/2013 to 1/18/2013

Depth - Inches

Average	5.14
Maximum	7.98
Minimum	2.62
Max d/D	49.9%

Velocity - Feet per Second

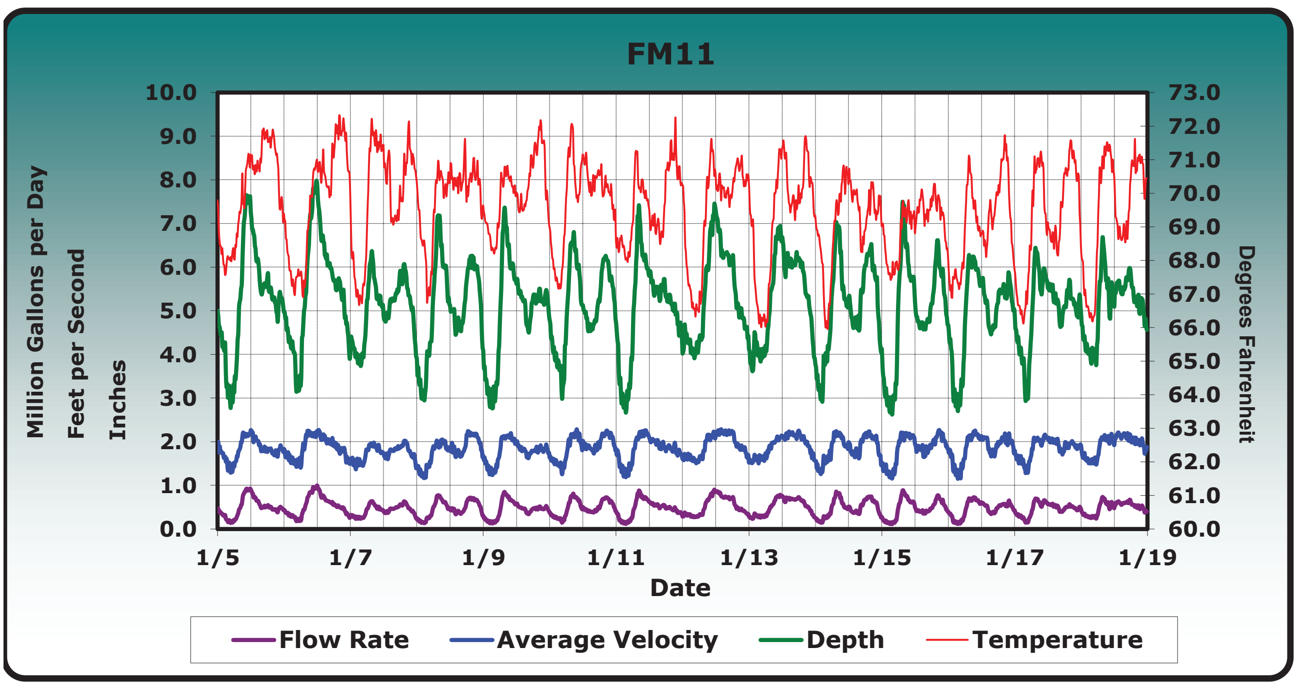
Average	1.85
Maximum	2.28
Minimum	1.15

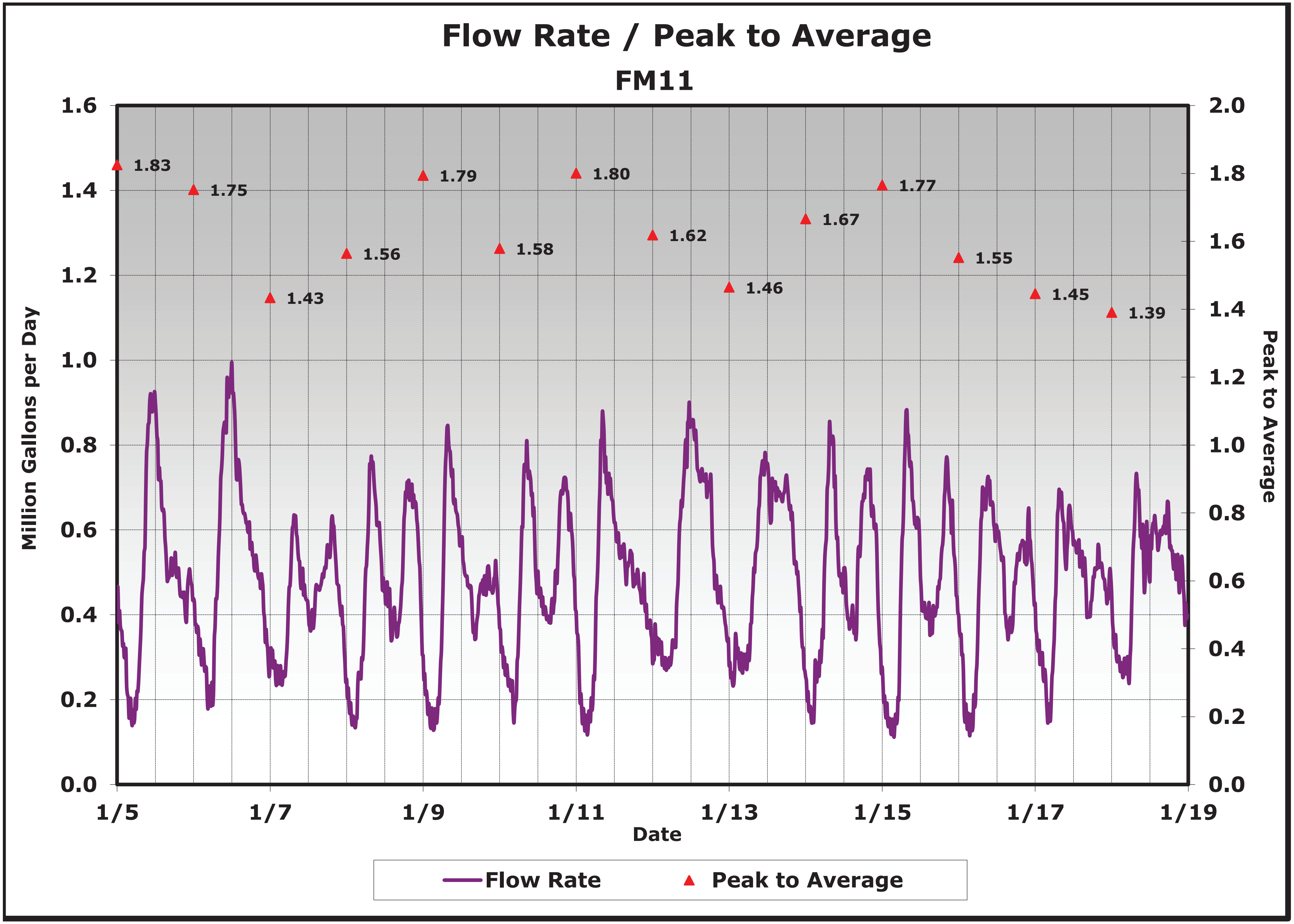
Flow - Million Gallons per Day

Average	0.48
Maximum	0.99
Minimum	0.11
Peak Factor	2.06

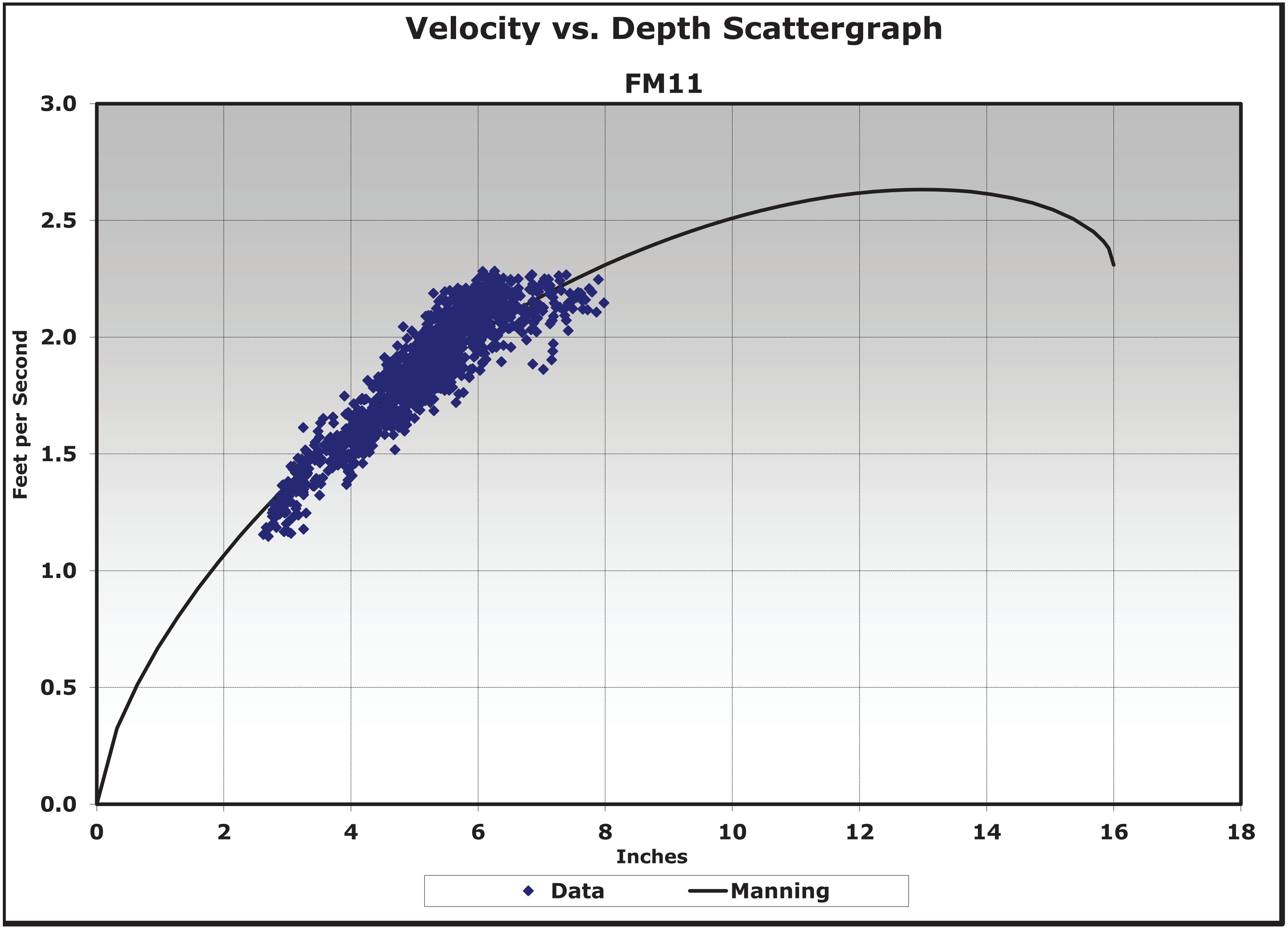
Temperature - Deg. F

Average	69.54
Maximum	72.32
Minimum	65.96

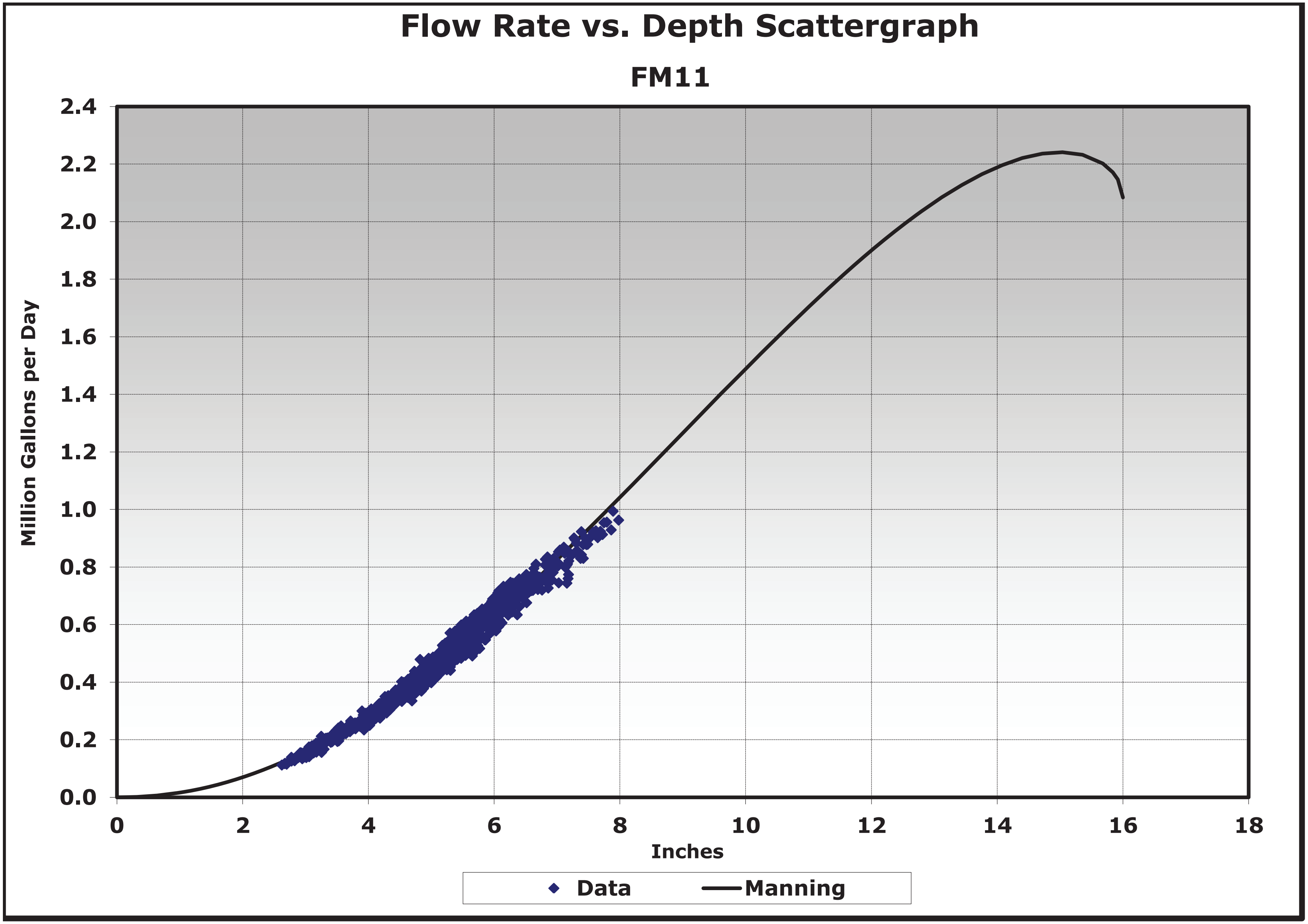




Flow Rate / Peak to Average
FM11
Million Gallons per Day
Peak to Average
Date
1.83
1.75
1.43
1.56
1.79
1.58
1.80
1.62
1.46
1.67
1.77
1.55
1.45
1.39
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
Flow Rate
Peak to Average



Velocity vs. Depth Scattergraph
FM11
Feet per Second
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
Inches
Data
Manning


Flow Rate vs. Depth Scattergraph
FM11
Million Gallons per Day
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
14
16
18
Inches
Data
Manning

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM11 Tabular - Flow Rate in MGD

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	0.43	0.41	0.31	0.22	0.26	0.34	0.36	0.31	0.27	0.23	0.23	0.37	0.37	0.38
1:00	0.36	0.35	0.28	0.16	0.20	0.29	0.21	0.33	0.25	0.17	0.17	0.26	0.31	0.32
2:00	0.31	0.31	0.26	0.15	0.16	0.26	0.15	0.33	0.33	0.16	0.14	0.16	0.28	0.29
3:00	0.20	0.29	0.25	0.20	0.15	0.24	0.14	0.29	0.29	0.27	0.13	0.14	0.23	0.27
4:00	0.17	0.22	0.26	0.26	0.17	0.19	0.17	0.28	0.28	0.28	0.15	0.16	0.16	0.28
5:00	0.17	0.21	0.35	0.36	0.26	0.25	0.22	0.29	0.29	0.37	0.28	0.23	0.26	0.27
6:00	0.21	0.28	0.50	0.54	0.53	0.45	0.43	0.33	0.33	0.59	0.58	0.45	0.44	0.45
7:00	0.36	0.47	0.62	0.73	0.81	0.67	0.68	0.38	0.45	0.79	0.83	0.66	0.67	0.66
8:00	0.52	0.67	0.59	0.73	0.78	0.76	0.84	0.57	0.54	0.81	0.79	0.67	0.66	0.68
9:00	0.78	0.83	0.50	0.64	0.70	0.73	0.74	0.68	0.66	0.66	0.71	0.72	0.55	0.59
10:00	0.90	0.89	0.48	0.59	0.65	0.66	0.71	0.78	0.75	0.52	0.62	0.66	0.61	0.51
11:00	0.90	0.94	0.44	0.48	0.59	0.51	0.66	0.86	0.76	0.48	0.61	0.60	0.62	0.55
12:00	0.85	0.93	0.38	0.46	0.55	0.47	0.60	0.86	0.71	0.49	0.44	0.59	0.57	0.56
13:00	0.72	0.77	0.39	0.43	0.49	0.43	0.56	0.82	0.66	0.39	0.41	0.54	0.56	0.62
14:00	0.65	0.74	0.45	0.36	0.47	0.40	0.55	0.73	0.69	0.40	0.41	0.46	0.53	0.57
15:00	0.54	0.65	0.46	0.38	0.41	0.39	0.52	0.73	0.69	0.37	0.36	0.36	0.51	0.59
16:00	0.49	0.63	0.49	0.38	0.36	0.41	0.52	0.72	0.67	0.49	0.41	0.38	0.41	0.61
17:00	0.52	0.59	0.52	0.48	0.42	0.47	0.53	0.69	0.70	0.60	0.44	0.44	0.41	0.63
18:00	0.51	0.55	0.55	0.66	0.47	0.55	0.48	0.67	0.70	0.69	0.51	0.53	0.49	0.57
19:00	0.48	0.52	0.61	0.70	0.47	0.69	0.49	0.50	0.64	0.73	0.63	0.55	0.52	0.53
20:00	0.44	0.49	0.56	0.69	0.50	0.72	0.44	0.46	0.55	0.69	0.75	0.56	0.53	0.52
21:00	0.41	0.48	0.46	0.67	0.46	0.66	0.45	0.44	0.50	0.63	0.65	0.55	0.49	0.49
22:00	0.48	0.38	0.40	0.58	0.49	0.62	0.39	0.40	0.40	0.53	0.58	0.58	0.45	0.49
23:00	0.47	0.30	0.31	0.41	0.45	0.49	0.36	0.35	0.30	0.32	0.45	0.47	0.48	0.40
Average	0.49	0.54	0.43	0.47	0.45	0.48	0.47	0.53	0.52	0.49	0.47	0.46	0.46	0.49
Median	0.48	0.51	0.46	0.46	0.47	0.46	0.49	0.47	0.55	0.49	0.46	0.52	0.49	0.53
Max Hr. Mean	0.90	0.94	0.62	0.73	0.81	0.76	0.84	0.86	0.76	0.81	0.83	0.72	0.67	0.68
Min Hr. Mean	0.17	0.21	0.25	0.15	0.15	0.19	0.14	0.28	0.25	0.16	0.13	0.14	0.16	0.27
Inst. Max	0.93	0.99	0.64	0.77	0.85	0.81	0.88	0.90	0.78	0.85	0.88	0.73	0.70	0.73
Inst. Min	0.14	0.18	0.23	0.13	0.13	0.15	0.12	0.27	0.23	0.15	0.11	0.12	0.15	0.24
Peak To Avg.	1.83	1.75	1.43	1.56	1.79	1.58	1.80	1.62	1.46	1.67	1.77	1.55	1.45	1.39

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM11 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	1.88	1.73	1.59	1.41	1.59	1.62	1.76	1.63	1.55	1.49	1.45	1.79	1.69	1.74
1:00	1.76	1.69	1.51	1.27	1.46	1.56	1.50	1.64	1.53	1.33	1.36	1.59	1.60	1.64
2:00	1.67	1.59	1.50	1.21	1.32	1.53	1.32	1.68	1.64	1.34	1.27	1.34	1.57	1.57
3:00	1.50	1.57	1.51	1.34	1.29	1.46	1.28	1.59	1.59	1.57	1.21	1.26	1.47	1.54
4:00	1.40	1.49	1.49	1.45	1.36	1.37	1.35	1.58	1.61	1.58	1.31	1.30	1.34	1.55
5:00	1.40	1.54	1.66	1.68	1.56	1.49	1.42	1.54	1.62	1.71	1.65	1.50	1.54	1.55
6:00	1.51	1.60	1.83	1.87	1.95	1.81	1.78	1.63	1.70	2.05	2.00	1.82	1.83	1.78
7:00	1.72	1.93	1.93	1.97	2.10	2.04	2.05	1.71	1.86	2.17	2.17	2.09	2.05	2.06
8:00	1.92	2.19	1.93	1.93	2.11	2.14	2.16	1.96	1.94	2.17	2.13	2.10	2.04	2.08
9:00	2.16	2.20	1.85	1.98	2.13	2.19	2.19	2.14	1.99	2.12	2.16	2.23	1.98	2.06
10:00	2.14	2.16	1.85	1.92	2.09	2.16	2.20	2.10	2.07	1.96	2.12	2.16	2.07	2.03
11:00	2.16	2.14	1.75	1.84	2.01	1.93	2.18	2.17	2.10	1.89	2.12	2.09	2.11	2.05
12:00	2.23	2.24	1.66	1.87	1.96	1.93	2.03	2.20	2.11	1.91	1.85	2.09	2.05	2.07
13:00	2.07	2.10	1.66	1.81	1.85	1.87	2.03	2.23	2.11	1.73	1.85	2.09	2.04	2.18
14:00	2.02	2.14	1.79	1.69	1.81	1.88	2.00	2.23	2.17	1.75	1.86	1.94	2.02	2.12
15:00	1.88	2.02	1.79	1.74	1.74	1.79	1.94	2.21	2.19	1.67	1.66	1.71	1.99	2.16
16:00	1.80	2.01	1.84	1.71	1.68	1.83	1.90	2.20	2.15	1.93	1.81	1.74	1.83	2.13
17:00	1.83	1.97	1.86	1.86	1.76	1.89	1.90	2.20	2.15	2.09	1.88	1.86	1.77	2.10
18:00	1.81	1.94	1.89	2.19	1.79	2.00	1.84	2.16	2.19	2.16	1.97	1.98	1.94	2.02
19:00	1.80	1.86	1.98	2.18	1.81	2.16	1.88	1.94	2.08	2.20	2.03	2.04	1.90	2.05
20:00	1.72	1.78	1.95	2.16	1.87	2.22	1.80	1.87	1.99	2.11	2.21	2.06	1.98	2.00
21:00	1.72	1.82	1.77	2.16	1.80	2.17	1.87	1.85	1.92	2.08	2.15	2.00	1.94	1.98
22:00	1.84	1.65	1.67	2.03	1.86	2.14	1.75	1.82	1.75	1.97	2.08	2.06	1.87	1.96
23:00	1.82	1.54	1.56	1.81	1.79	1.91	1.72	1.68	1.63	1.63	1.90	1.89	1.92	1.82
Average	1.82	1.87	1.74	1.80	1.78	1.88	1.83	1.92	1.90	1.86	1.84	1.86	1.86	1.93
Median	1.81	1.88	1.78	1.85	1.81	1.91	1.86	1.90	1.97	1.93	1.91	1.97	1.93	2.02
Max Hr. Mean	2.23	2.24	1.98	2.19	2.13	2.22	2.20	2.23	2.19	2.20	2.21	2.23	2.11	2.18
Min Hr. Mean	1.40	1.49	1.49	1.21	1.29	1.37	1.28	1.54	1.53	1.33	1.21	1.26	1.34	1.54
Inst. Max	2.26	2.27	2.02	2.24	2.19	2.28	2.26	2.28	2.25	2.24	2.27	2.25	2.16	2.21
Inst. Min	1.29	1.41	1.37	1.17	1.23	1.25	1.19	1.50	1.50	1.26	1.16	1.15	1.28	1.47

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM11 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	4.79	4.90	4.27	3.63	3.73	4.56	4.44	4.23	3.97	3.61	3.70	4.45	4.63	4.66
1:00	4.41	4.48	4.10	3.21	3.28	4.11	3.37	4.43	3.73	3.20	3.10	3.77	4.22	4.25
2:00	4.17	4.26	3.92	3.07	3.02	3.87	2.94	4.30	4.36	3.07	2.89	2.98	3.97	4.11
3:00	3.29	4.13	3.84	3.54	2.94	3.75	2.83	4.07	4.08	3.90	2.77	2.90	3.62	3.95
4:00	3.01	3.47	3.94	4.06	3.11	3.30	3.13	4.02	3.95	4.00	2.97	3.10	3.10	4.07
5:00	3.05	3.34	4.49	4.58	3.77	3.81	3.64	4.15	4.02	4.63	3.82	3.60	3.80	3.98
6:00	3.43	3.90	5.46	5.74	5.39	5.07	4.97	4.37	4.26	5.70	5.71	5.10	4.99	5.11
7:00	4.45	5.04	6.18	6.92	7.06	6.25	6.34	4.71	4.99	6.75	7.05	6.08	6.23	6.16
8:00	5.40	5.94	5.95	6.88	6.87	6.64	7.16	5.74	5.55	6.91	6.92	6.15	6.18	6.29
9:00	6.73	6.95	5.42	6.18	6.29	6.33	6.40	6.15	6.29	6.01	6.27	6.19	5.54	5.66
10:00	7.56	7.51	5.28	5.97	6.04	5.97	6.19	6.88	6.77	5.39	5.74	5.95	5.80	5.10
11:00	7.53	7.83	5.14	5.29	5.76	5.31	5.94	7.27	6.74	5.15	5.69	5.69	5.75	5.42
12:00	7.02	7.54	4.80	5.03	5.60	5.02	5.80	7.16	6.43	5.20	4.98	5.63	5.53	5.39
13:00	6.59	6.79	4.88	4.93	5.40	4.82	5.54	6.79	6.07	4.74	4.70	5.28	5.52	5.64
14:00	6.15	6.54	5.16	4.59	5.25	4.61	5.50	6.27	6.15	4.78	4.68	4.90	5.31	5.44
15:00	5.64	6.19	5.26	4.66	4.92	4.63	5.38	6.30	6.10	4.67	4.59	4.53	5.21	5.48
16:00	5.49	6.03	5.35	4.70	4.59	4.75	5.48	6.28	6.07	5.18	4.76	4.62	4.76	5.69
17:00	5.59	5.86	5.55	5.23	5.02	5.10	5.60	6.08	6.23	5.69	4.90	4.95	4.90	5.89
18:00	5.63	5.64	5.75	5.87	5.33	5.51	5.30	6.00	6.13	6.14	5.29	5.39	5.14	5.61
19:00	5.42	5.58	5.97	6.14	5.24	6.12	5.28	5.27	6.00	6.33	6.04	5.43	5.50	5.27
20:00	5.26	5.55	5.67	6.16	5.40	6.20	5.08	5.03	5.52	6.27	6.42	5.45	5.37	5.27
21:00	4.95	5.32	5.29	6.01	5.23	5.95	5.00	4.95	5.27	5.89	5.88	5.49	5.21	5.08
22:00	5.30	4.78	5.01	5.68	5.33	5.69	4.69	4.71	4.85	5.37	5.59	5.63	4.96	5.11
23:00	5.22	4.23	4.28	4.72	5.16	5.20	4.56	4.51	4.09	4.32	4.92	5.10	5.15	4.67
Average	5.25	5.49	5.04	5.12	4.99	5.11	5.02	5.40	5.32	5.12	4.97	4.93	5.02	5.14
Median	5.31	5.48	5.20	5.13	5.24	5.10	5.29	5.16	5.53	5.17	4.99	5.24	5.19	5.33
Max Hr. Mean	7.56	7.83	6.18	6.92	7.06	6.64	7.16	7.27	6.77	6.91	7.05	6.19	6.23	6.29
Min Hr. Mean	3.01	3.34	3.84	3.07	2.94	3.30	2.83	4.02	3.73	3.07	2.77	2.90	3.10	3.95
Inst. Max	7.65	7.98	6.37	7.18	7.36	6.80	7.42	7.45	6.94	7.02	7.49	6.28	6.44	6.68
Inst. Min	2.78	3.14	3.73	2.95	2.76	2.98	2.67	3.92	3.61	2.91	2.62	2.70	2.93	3.76

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM11 Tabular - Degrees in Fahrenheit

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	69.22	69.11	68.80	69.92	69.40	68.68	68.53	69.92	69.73	69.06	68.98	67.55	67.41	68.11
1:00	68.35	68.30	67.79	68.94	69.07	67.90	68.47	68.09	68.98	68.64	68.29	67.13	66.71	67.07
2:00	67.84	67.63	67.07	68.53	68.71	67.48	68.53	67.28	67.20	68.05	67.71	67.60	66.45	66.61
3:00	67.89	67.24	66.83	67.74	68.32	67.21	68.14	66.84	66.44	66.53	67.50	67.38	66.28	66.37
4:00	68.05	67.33	67.02	67.02	68.31	67.51	68.09	66.50	66.22	66.15	67.68	67.32	66.88	66.26
5:00	68.18	67.59	67.66	67.72	68.93	68.76	68.57	66.58	66.28	66.96	67.89	67.90	68.00	67.22
6:00	68.23	67.41	69.81	69.53	70.11	70.50	69.74	66.76	66.15	68.38	68.07	69.52	69.36	69.66
7:00	68.94	67.22	71.64	70.55	70.43	71.44	71.21	67.93	67.24	69.45	69.38	70.74	70.70	70.62
8:00	69.55	68.42	71.77	70.62	70.67	71.71	70.21	69.45	68.68	69.59	69.42	70.37	70.93	71.05
9:00	69.88	69.56	71.55	70.31	70.48	70.29	70.29	70.38	69.83	70.08	69.49	69.68	71.03	71.36
10:00	70.58	70.22	71.44	70.09	70.30	69.89	69.98	71.29	70.50	70.54	69.21	69.20	70.51	71.32
11:00	70.99	70.80	71.43	70.36	70.07	70.67	69.77	70.90	71.22	70.58	69.33	68.87	69.12	70.83
12:00	70.99	70.79	70.94	70.61	69.87	71.00	69.17	70.24	71.41	70.43	69.11	68.82	68.99	69.77
13:00	70.73	70.61	70.65	70.32	69.61	70.92	69.18	70.38	71.01	69.94	69.56	68.39	68.65	68.91
14:00	70.76	70.85	70.37	70.33	69.52	70.22	69.00	70.08	69.86	70.01	69.95	68.86	68.71	68.74
15:00	70.84	70.31	69.16	70.38	69.71	70.13	69.03	69.96	69.60	69.76	69.40	69.52	68.38	68.85
16:00	71.71	70.07	69.25	70.22	70.26	70.38	68.71	70.04	69.63	68.82	69.31	69.16	68.97	68.78
17:00	71.70	70.84	69.42	71.02	70.91	70.58	69.31	69.80	69.69	68.57	69.58	69.86	69.86	69.55
18:00	71.62	71.50	69.90	69.98	71.13	70.65	70.76	70.26	69.91	69.10	69.86	70.13	70.65	70.77
19:00	71.57	71.82	70.49	70.45	71.32	70.00	70.95	70.78	70.12	69.64	69.99	70.89	70.78	70.98
20:00	71.67	72.02	70.94	70.79	71.94	70.29	71.23	70.83	71.48	70.13	69.79	71.34	71.42	70.84
21:00	71.12	72.00	71.68	70.52	71.63	70.10	71.50	70.86	71.04	69.71	69.46	71.07	71.09	71.03
22:00	69.96	71.60	71.08	70.49	70.77	69.90	70.61	70.30	70.34	69.38	69.24	69.51	70.61	70.76
23:00	69.61	70.68	70.73	69.56	69.64	69.39	70.42	70.46	69.72	69.73	68.45	68.27	69.90	70.21
Average	70.00	69.75	69.89	69.83	70.05	69.82	69.64	69.41	69.26	69.13	69.03	69.13	69.22	69.40
Median	70.58	70.20	70.32	70.26	70.03	70.12	69.57	70.13	69.74	69.44	69.29	69.15	69.39	69.88
Max Hr. Mean	71.71	72.02	71.77	71.02	71.94	71.71	71.50	71.29	71.48	70.58	69.99	71.34	71.42	71.36
Min Hr. Mean	67.84	67.22	66.83	67.02	68.31	67.21	68.09	66.50	66.15	66.15	67.50	67.13	66.28	66.26
Inst. Max	71.93	72.32	72.21	71.59	72.17	72.06	72.26	71.62	71.70	70.83	70.28	71.73	71.57	71.62
Inst. Min	67.57	66.91	66.67	66.75	68.20	67.15	67.95	66.33	66.01	65.96	67.42	66.89	66.12	66.18

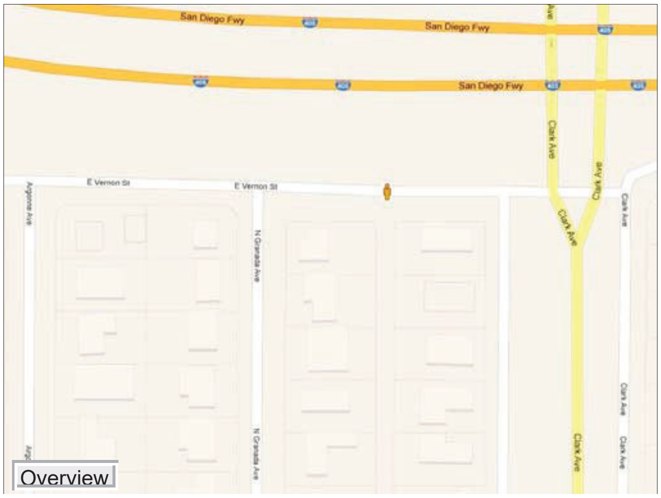
Site Investigation Summary

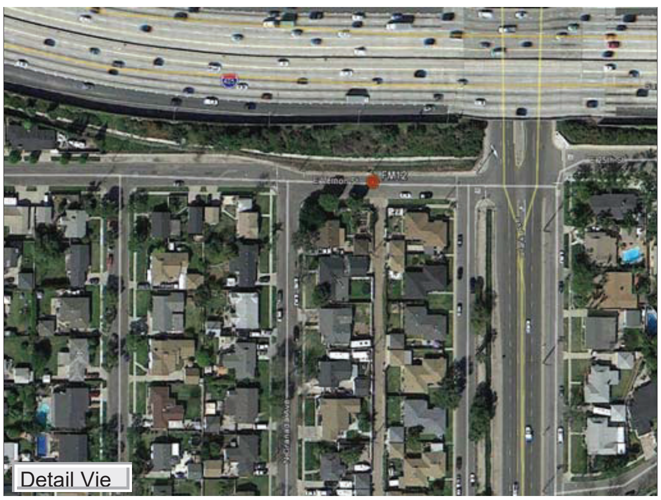
MWH Global - City of Long Beach Master Plan

Site #: FM12 **Date:** 12/27/201

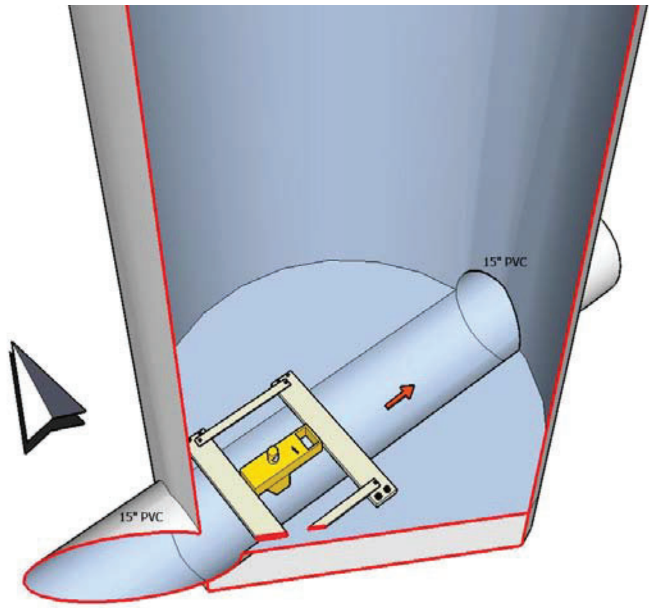
Address: Vernon, W/of Clark

Traffic: Light, residential **Job #** 2012.5.166



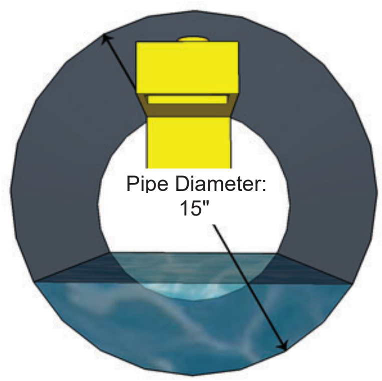


Profile



MH Condition:	Fair	**Infiltration:**	No
Laterals:	No	**Surcharge Evidence:**	No
Rungs:	Yes	**Level:**	N/A
Silt/Sediment:	No	**Manhole Depth:**	7.6'

Cross Section



Monitor SN: FloDar

SensorType: Ultrasonic, radar-Doppler velocity

Velocity: 2.57 fps

Flow Depth: 3.38"

Pipe Material: VCP

Comments: High turbidity (rags in flow); fair hydraulic condition

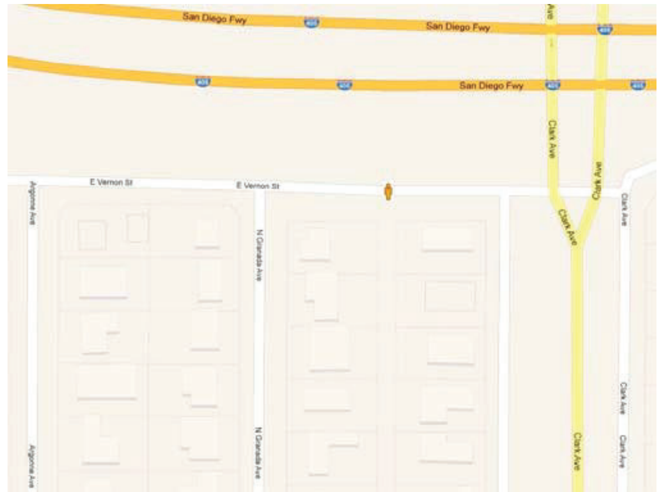
Manhole Inspection Report

MWH Global - City of Long Beach Master Plan

Site Details

Job Number: 2012.5.166
Site Identifier: FM12
Map Page: P18-SMH-028
Location: Vernon, W/of Clark
Weather: Sunny
Team: D. Ramos & J. White
Date/Time: 12/27/2012 7:10:00 AM
Site Status: Metered in 2007
Surroundings: Asphalt
Surface Condition: Roadway
Traffic Setup: Roadway
Traffic Volume: Light, residential
Manhole Depth: 7.6'

Overview



Facility Inspection

Cover

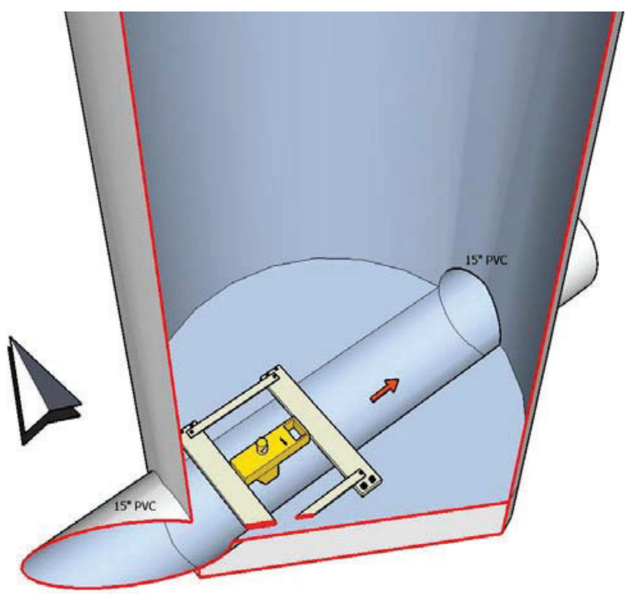
Status: Normal
Shape: Round
Size: 24" diameter
Material: Cast iron
Corrosion: moderate

Grade Ring / Frame

Condition: Good
Corrosion: Moderate
Lid/Frame Seal: None
Frame/Ring Seal: Good

Cone

Shape: Concentric
Material: Brick
Condition: Fair
Infiltration: None



Barrel

Material: Brick
Condition: Fair
Infiltration: stains

Rungs

Rungs: Yes
Material: Cast Iron
Condition: Offset

Bench

Material: Cast in place Concrete
Condition: fair
Infiltration: Stains

Channel

Material: Cast in place Concrete
Condition: fair
Infiltration: stains

Defect Observation

Surcharge

Active: None
Evidence: Old
Level: to 6"

Silt

Present: No
Depth: N/A

Debris

Present: Yes
Desc.: Rags in flow

Other

Grease: Light
Vermin: Few - Roaches
Odor: No - N/A
Vandalism: None

Observations and Comments

Flow Velocity: 2.57 fps **Flow Depth:** 3.38" **Observation Location:** Influent Pipe

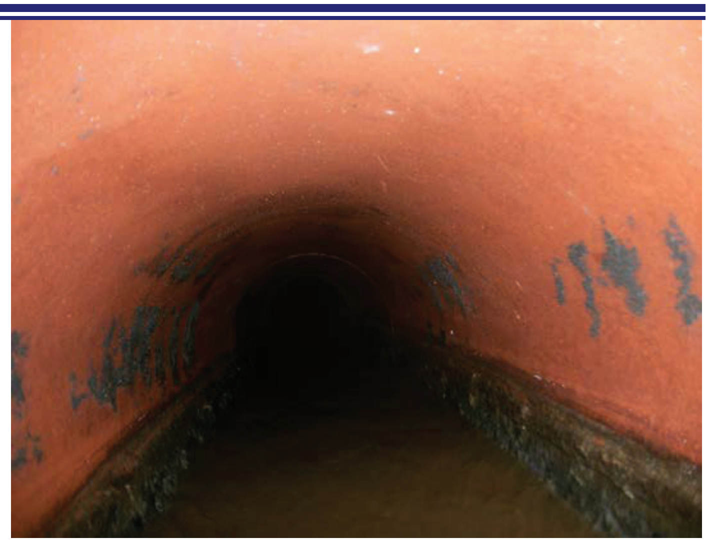
Comments: Syringes on bench; rags, turbidity in flow

Manhole Inspection Images
MWH
City of Long Beach Masterplan Results
FM12


Area Reference


Down Manhole


Effluent


Influent

Site Data Summary

Project #	2012.5.166	
Location	FM12	
Pipe Diameter	15	Inches

Report Date 1/5/2013 to 1/18/2013

Depth - Inches

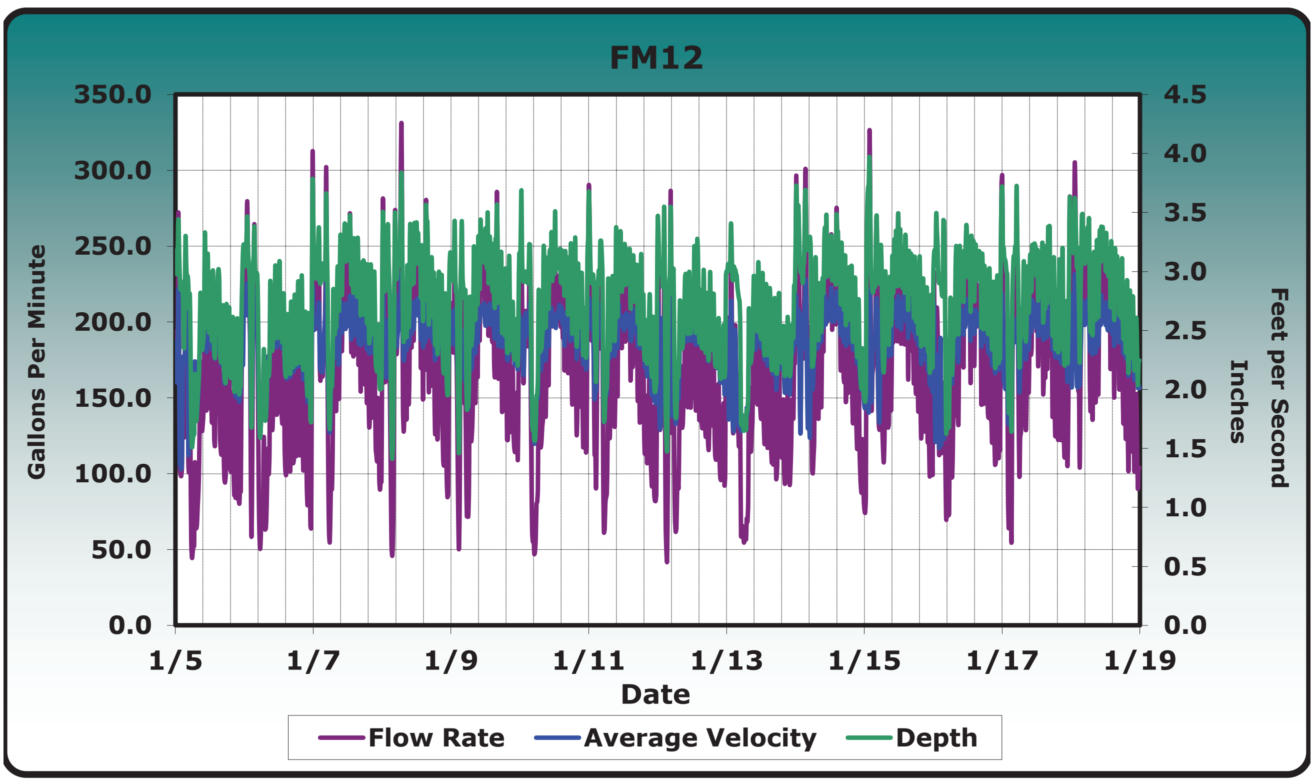
Average	2.73
Maximum	3.97
Minimum	1.41
Max d/D	26.5%

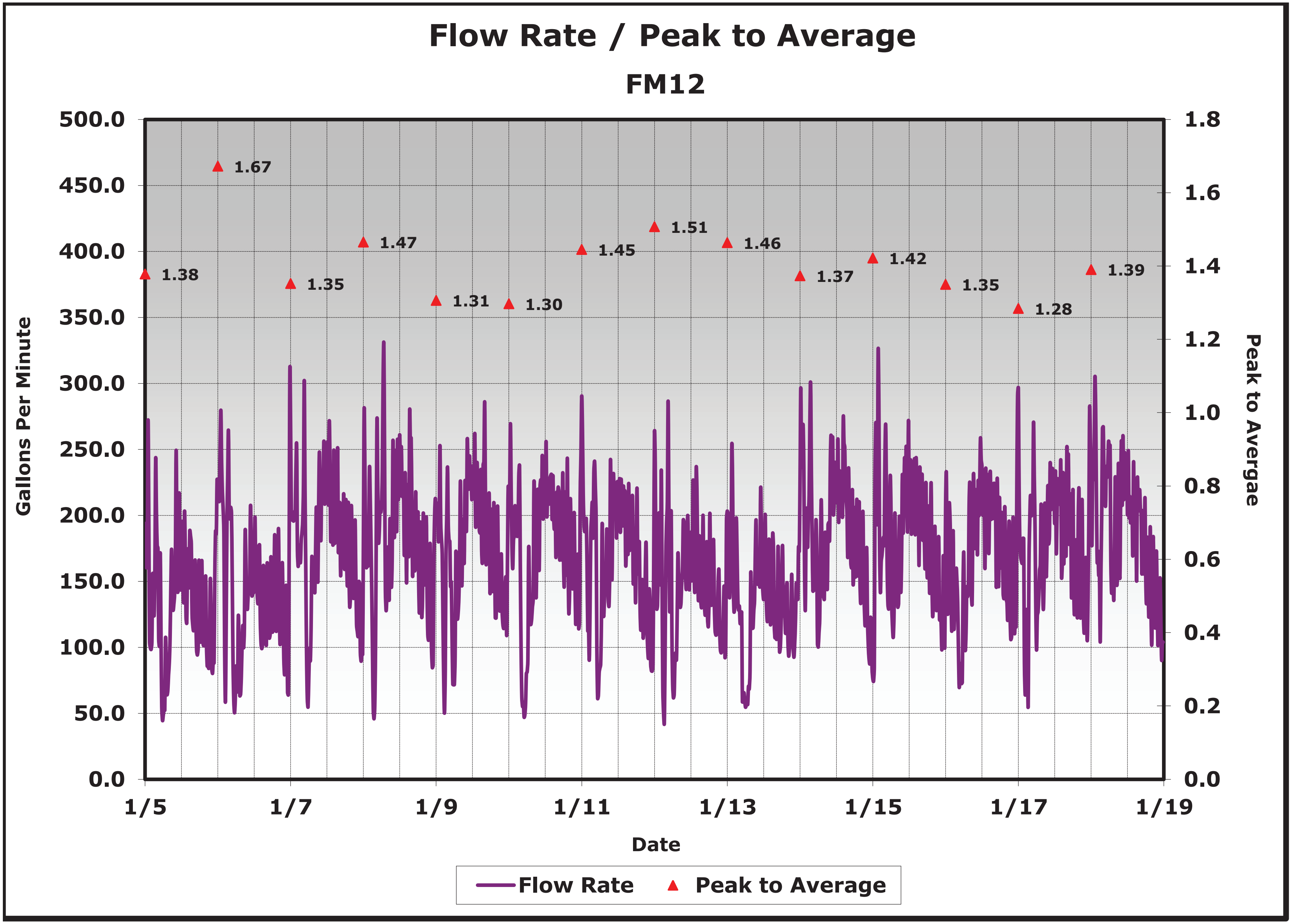
Velocity - Feet per Second

Average	2.38
Maximum	2.98
Minimum	1.32

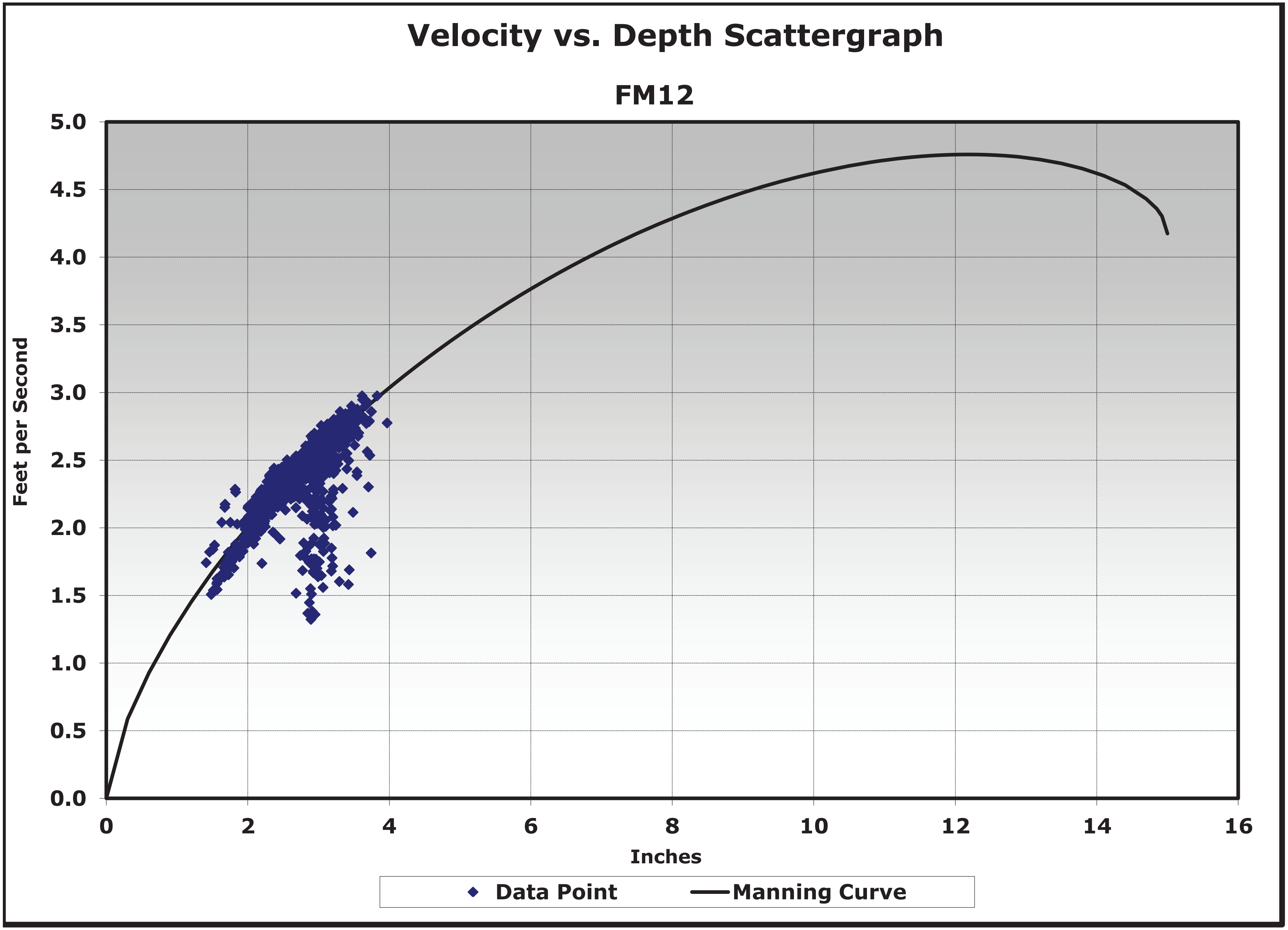
Flow - Gallons per Minute

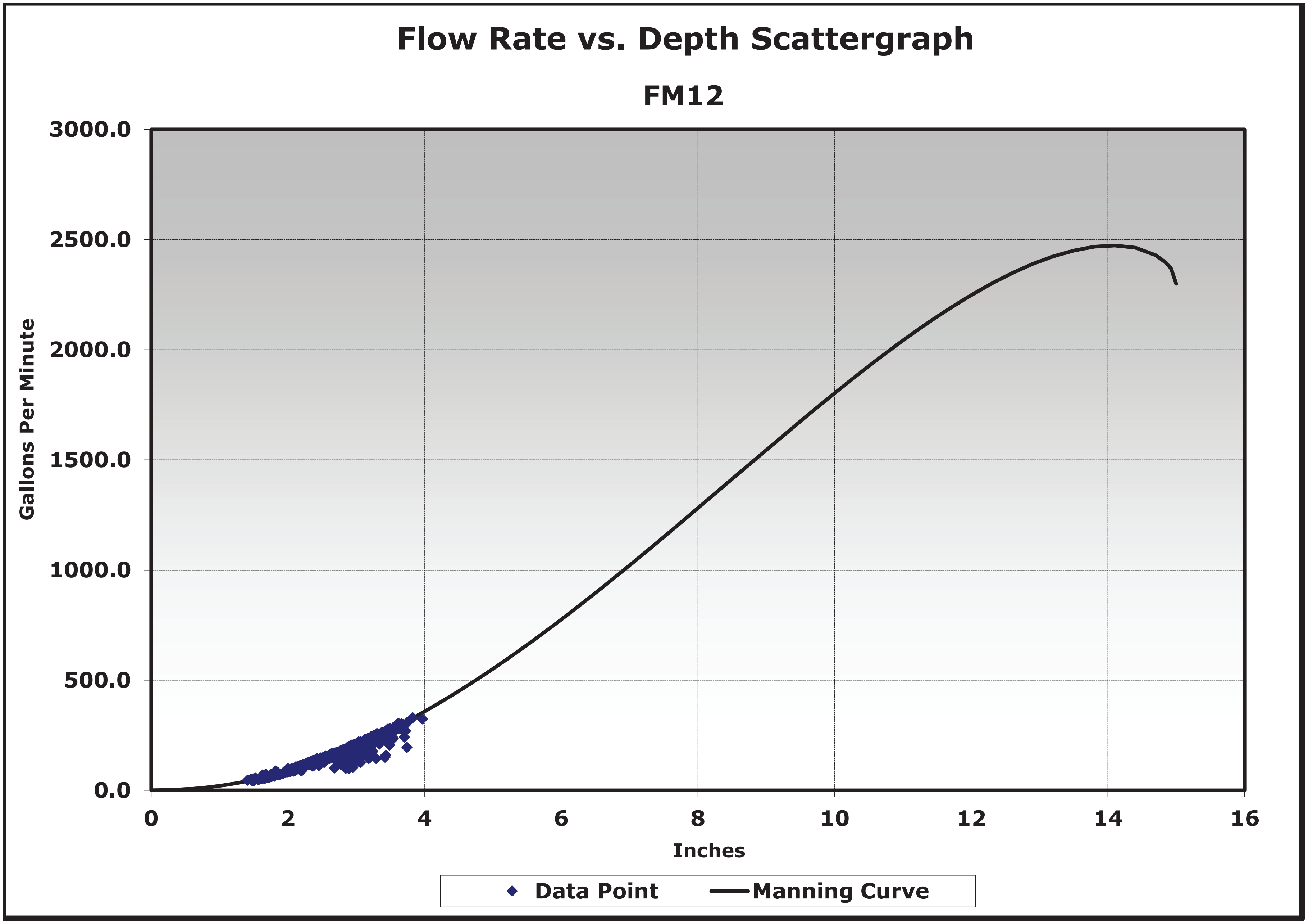
Average	167.48
Maximum	329.41
Minimum	42.51
Peak Factor	1.97





Flow Rate / Peak to Average
FM12
Gallons Per Minute
Peak to Avergae
Date
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/5
1/7
1/9
1/11
1/13
1/15
1/17
1/19
1.38
1.67
1.35
1.47
1.31
1.30
1.45
1.51
1.46
1.37
1.42
1.35
1.28
1.39
Flow Rate
Peak to Average


Velocity vs. Depth Scattergraph
FM12
Feet per Second
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
Inches
Data Point
Manning Curve


Flow Rate vs. Depth Scattergraph
FM12
Gallons Per Minute
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
0
2
4
6
8
10
12
14
16
Inches
Data Point
Manning Curve

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM12 Tabular - Flow Rate in GPM

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	183.00	225.81	215.50	218.67	197.41	226.92	241.02	196.48	181.46	252.00	116.19	180.55	216.32	216.71
1:00	166.64	235.71	207.65	165.67	205.42	175.37	186.62	165.87	197.45	197.75	257.57	193.10	173.59	260.34
2:00	125.05	114.40	191.05	193.42	103.54	193.66	112.26	150.31	145.98	193.61	191.36	135.66	88.01	161.65
3:00	183.10	221.63	176.14	62.71	172.39	204.65	194.43	88.92	158.04	254.39	176.69	142.86	127.45	182.94
4:00	139.94	189.62	235.67	195.61	174.91	68.78	222.83	224.11	124.89	156.38	221.27	96.94	205.56	231.49
5:00	95.98	65.33	93.01	194.85	99.75	58.44	76.23	144.25	60.79	154.22	168.09	94.41	205.54	239.90
6:00	65.01	86.58	95.16	268.54	119.37	123.82	121.05	71.79	56.90	127.02	139.44	122.90	122.02	202.22
7:00	74.00	76.34	151.38	163.62	139.16	121.79	137.17	121.37	94.08	164.43	164.92	158.43	175.62	157.44
8:00	128.89	108.24	168.84	170.47	179.95	177.75	161.81	138.00	121.01	162.55	152.61	163.87	159.82	173.97
9:00	134.01	154.95	202.08	189.70	199.80	177.47	177.81	175.67	165.92	178.37	178.30	196.07	181.45	194.45
10:00	186.01	156.87	218.61	213.72	224.82	202.23	198.76	159.12	152.83	242.09	213.27	206.19	201.68	234.10
11:00	170.23	150.98	234.12	223.65	229.88	219.71	211.57	170.26	177.51	214.88	231.58	230.70	229.10	232.64
12:00	167.72	164.10	242.54	237.48	228.47	219.44	203.01	181.39	157.60	225.64	217.77	219.93	199.40	215.66
13:00	154.38	156.62	210.72	208.50	216.04	220.76	210.92	173.66	144.50	218.47	217.39	199.94	220.81	194.62
14:00	167.74	106.44	202.80	188.30	210.34	214.28	191.20	176.67	136.58	244.73	216.38	209.86	198.13	204.39
15:00	151.03	127.59	208.18	240.32	204.33	197.30	191.56	144.59	146.29	198.74	200.58	206.53	187.72	196.35
16:00	133.55	134.03	191.33	183.60	220.28	204.34	201.60	152.95	130.65	203.28	201.68	195.28	225.23	195.31
17:00	113.94	130.38	180.11	176.52	183.10	193.14	162.67	140.77	111.97	172.13	184.63	195.27	173.87	186.56
18:00	142.66	136.54	174.98	167.79	167.11	177.66	179.02	157.22	144.33	188.76	171.17	180.98	168.10	157.84
19:00	109.31	124.54	159.25	156.18	158.19	173.63	139.93	154.23	131.49	168.12	172.93	164.43	157.61	142.60
20:00	107.56	133.66	168.35	169.79	161.20	169.79	123.47	110.59	100.76	165.10	164.33	141.24	154.00	144.58
21:00	113.86	124.93	153.55	120.78	144.47	163.06	138.83	129.61	123.45	136.21	150.03	133.88	150.38	136.47
22:00	85.61	106.83	129.61	121.86	122.84	140.99	114.36	107.11	115.95	122.65	114.72	143.51	140.19	127.50
23:00	188.82	150.45	93.73	166.50	161.04	173.58	104.35	133.45	156.98	103.88	125.08	189.08	219.57	104.39
Average	137.00	140.94	179.35	183.26	175.99	174.94	166.77	148.68	134.89	185.22	181.17	170.90	178.38	187.26
Median	134.87	135.60	180.40	182.02	180.21	183.18	177.09	146.31	132.91	189.49	183.08	173.46	179.27	192.19
Max Hr. Mean	188.82	235.71	242.54	268.54	229.88	226.92	241.02	224.11	197.45	254.39	257.57	230.70	229.10	260.34
Min Hr. Mean	65.01	65.33	93.01	62.71	99.75	58.44	76.23	71.79	56.90	103.88	114.72	94.41	88.01	104.39
Inst. Max	272.30	308.45	302.18	329.41	285.81	269.46	290.05	286.58	252.28	299.89	324.05	290.58	296.20	304.51
Inst. Min	44.61	50.39	54.80	45.83	50.23	47.13	61.31	42.51	54.75	84.11	74.37	69.61	56.38	90.31
Peak To Avg.	1.38	1.67	1.35	1.47	1.31	1.30	1.45	1.51	1.46	1.37	1.42	1.35	1.28	1.39

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM12 Tabular - Average Velocity in FPS

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	2.22	2.70	2.60	2.59	2.52	2.54	2.67	2.23	2.29	2.61	2.07	2.19	2.38	2.45
1:00	1.95	2.75	2.59	2.18	2.53	2.32	2.46	2.15	2.30	2.22	2.40	2.20	2.18	2.75
2:00	1.77	2.11	2.35	2.42	2.10	2.55	2.05	2.08	1.88	2.47	2.30	1.79	1.88	2.10
3:00	2.44	2.64	2.29	1.89	2.34	2.53	2.57	1.87	2.05	2.72	2.40	1.74	2.13	2.37
4:00	1.89	2.52	2.67	2.53	2.38	1.78	2.63	2.66	1.86	1.83	2.53	2.04	2.46	2.64
5:00	1.90	1.75	1.88	2.45	1.96	1.69	1.86	2.05	1.72	2.09	2.07	2.26	2.44	2.72
6:00	1.77	1.93	2.01	2.77	2.14	2.14	2.16	1.80	1.69	2.21	2.35	2.20	2.15	2.52
7:00	1.86	1.87	2.37	2.40	2.28	2.19	2.31	2.14	1.97	2.45	2.41	2.42	2.43	2.40
8:00	2.23	2.19	2.41	2.40	2.46	2.41	2.40	2.40	2.28	2.45	2.40	2.40	2.40	2.46
9:00	2.38	2.44	2.54	2.50	2.51	2.45	2.44	2.49	2.48	2.52	2.49	2.56	2.47	2.52
10:00	2.50	2.45	2.61	2.61	2.66	2.57	2.58	2.43	2.41	2.70	2.68	2.61	2.58	2.68
11:00	2.46	2.42	2.65	2.64	2.69	2.60	2.59	2.48	2.52	2.63	2.68	2.64	2.67	2.65
12:00	2.44	2.43	2.69	2.72	2.62	2.60	2.54	2.50	2.43	2.74	2.63	2.62	2.56	2.58
13:00	2.39	2.42	2.57	2.58	2.66	2.65	2.62	2.49	2.33	2.64	2.70	2.55	2.66	2.52
14:00	2.40	2.15	2.57	2.52	2.62	2.65	2.49	2.50	2.30	2.77	2.66	2.60	2.58	2.58
15:00	2.31	2.29	2.62	2.66	2.58	2.51	2.53	2.41	2.37	2.56	2.62	2.59	2.52	2.54
16:00	2.31	2.32	2.48	2.52	2.60	2.60	2.61	2.42	2.28	2.55	2.63	2.55	2.64	2.55
17:00	2.17	2.25	2.48	2.49	2.45	2.51	2.43	2.33	2.18	2.46	2.55	2.58	2.47	2.53
18:00	2.33	2.28	2.47	2.44	2.48	2.55	2.51	2.47	2.37	2.57	2.49	2.51	2.44	2.41
19:00	2.18	2.27	2.40	2.41	2.42	2.47	2.35	2.47	2.30	2.46	2.48	2.43	2.42	2.33
20:00	2.14	2.24	2.42	2.47	2.38	2.46	2.23	2.20	2.07	2.47	2.44	2.30	2.37	2.34
21:00	2.16	2.27	2.39	2.28	2.40	2.42	2.30	2.29	2.22	2.32	2.37	2.29	2.32	2.29
22:00	1.94	2.04	2.33	2.24	2.26	2.38	2.07	2.11	2.18	2.20	2.15	2.32	2.28	2.26
23:00	2.41	2.21	2.09	2.37	2.39	2.39	1.98	2.21	2.37	2.08	2.17	2.49	2.62	2.07
Average	2.19	2.29	2.44	2.46	2.43	2.41	2.39	2.30	2.20	2.45	2.44	2.37	2.42	2.47
Median	2.28	2.33	2.47	2.48	2.46	2.49	2.47	2.40	2.27	2.51	2.49	2.44	2.44	2.51
Max Hr. Mean	2.50	2.75	2.69	2.77	2.69	2.65	2.67	2.66	2.52	2.77	2.70	2.64	2.67	2.75
Min Hr. Mean	1.77	1.75	1.88	1.89	1.96	1.69	1.86	1.80	1.69	1.83	2.07	1.74	1.88	2.07
Inst. Max	2.85	2.90	2.90	2.98	2.85	2.72	2.77	2.88	2.73	2.93	2.85	2.82	2.81	2.98
Inst. Min	1.32	1.61	1.64	1.74	1.82	1.54	1.73	1.51	1.65	1.60	1.73	1.51	1.65	2.01

DownStream Services, Inc.
SANITARY SEWER & STORM WATER SPECIALISTS

FM12 Tabular - Depth in Inches

Project ID 2012.5.166

Start Date 1/5/2013
End Date 1/18/2013

Hour	Sat 1/5/2013	Sun 1/6/2013	Mon 1/7/2013	Tue 1/8/2013	Wed 1/9/2013	Thu 1/10/2013	Fri 1/11/2013	Sat 1/12/2013	Sun 1/13/2013	Mon 1/14/2013	Tue 1/15/2013	Wed 1/16/2013	Thu 1/17/2013	Fri 1/18/2013
0:00	3.09	3.13	3.11	3.12	3.00	3.28	3.29	3.21	3.02	3.46	2.25	3.09	3.30	3.26
1:00	3.11	3.18	3.04	2.93	3.06	2.92	2.93	2.96	3.18	3.23	3.75	3.25	3.03	3.41
2:00	2.82	2.22	3.05	3.02	2.09	2.93	2.32	2.75	2.98	3.00	3.08	2.92	2.06	2.97
3:00	2.87	3.13	2.97	1.63	2.79	3.04	2.93	1.97	2.96	3.39	2.88	3.11	2.36	2.89
4:00	2.86	2.90	3.24	2.88	2.86	1.81	3.16	3.13	2.72	3.19	3.21	2.12	3.14	3.23
5:00	2.09	1.77	2.10	3.03	2.19	1.69	1.90	2.75	1.73	2.88	3.05	1.90	3.11	3.26
6:00	1.73	2.00	2.09	3.46	2.31	2.37	2.31	1.87	1.67	2.39	2.44	2.34	2.39	2.99
7:00	1.86	1.89	2.61	2.68	2.51	2.36	2.47	2.35	2.07	2.68	2.70	2.63	2.82	2.63
8:00	2.39	2.17	2.76	2.79	2.84	2.85	2.69	2.42	2.27	2.65	2.58	2.71	2.65	2.77
9:00	2.38	2.58	3.01	2.90	3.02	2.82	2.82	2.79	2.67	2.79	2.79	2.94	2.85	2.94
10:00	2.86	2.59	3.12	3.08	3.15	2.99	2.94	2.64	2.59	3.28	3.02	3.01	2.98	3.23
11:00	2.73	2.55	3.24	3.15	3.19	3.16	3.12	2.73	2.76	3.07	3.20	3.22	3.19	3.24
12:00	2.72	2.70	3.30	3.23	3.26	3.16	3.04	2.83	2.62	3.10	3.12	3.14	2.97	3.13
13:00	2.59	2.62	3.08	3.05	3.08	3.12	3.05	2.74	2.53	3.10	3.04	2.99	3.12	2.94
14:00	2.76	2.17	2.99	2.88	3.04	3.06	2.92	2.77	2.46	3.26	3.07	3.06	2.93	3.00
15:00	2.63	2.35	3.01	3.29	3.00	2.99	2.92	2.48	2.51	2.97	2.93	3.03	2.88	2.95
16:00	2.41	2.42	2.95	2.83	3.14	2.98	2.97	2.56	2.39	3.02	2.94	2.93	3.18	2.94
17:00	2.24	2.41	2.82	2.78	2.88	2.95	2.67	2.48	2.22	2.75	2.82	2.90	2.75	2.86
18:00	2.50	2.46	2.78	2.71	2.68	2.75	2.79	2.58	2.49	2.85	2.72	2.82	2.71	2.63
19:00	2.19	2.33	2.65	2.60	2.61	2.74	2.45	2.55	2.40	2.71	2.73	2.69	2.61	2.50
20:00	2.18	2.45	2.74	2.73	2.70	2.72	2.34	2.21	2.16	2.67	2.69	2.51	2.60	2.51
21:00	2.25	2.32	2.59	2.27	2.49	2.69	2.47	2.37	2.35	2.44	2.57	2.42	2.59	2.46
22:00	2.01	2.23	2.35	2.29	2.32	2.46	2.32	2.20	2.27	2.33	2.29	2.51	2.51	2.38
23:00	2.98	2.48	2.02	2.72	2.66	2.75	2.20	2.44	2.67	2.18	2.40	2.85	3.11	2.21
Average	2.51	2.46	2.82	2.84	2.79	2.78	2.71	2.58	2.49	2.89	2.84	2.80	2.83	2.89
Median	2.53	2.41	2.92	2.92	2.84	2.91	2.81	2.56	2.50	2.97	2.88	2.92	2.88	2.98
Max Hr. Mean	3.11	3.18	3.30	3.46	3.26	3.28	3.29	3.21	3.18	3.46	3.75	3.25	3.30	3.41
Min Hr. Mean	1.73	1.77	2.02	1.63	2.09	1.69	1.90	1.87	1.67	2.18	2.25	1.90	2.06	2.21
Inst. Max	3.44	3.75	3.66	3.83	3.57	3.69	3.68	3.55	3.40	3.72	3.97	3.64	3.73	3.62
Inst. Min	1.51	1.59	1.67	1.41	1.46	1.57	1.73	1.48	1.65	2.00	1.90	1.63	1.66	2.04

This Page Intentionally Left Blank

APPENDIX F:

SEWER SYSTEM HYDRAULIC EVALUATION & PLANNING CRITERIA TM

TECHNICAL MEMORANDUM

To:	Justin Pennington, Long Beach Water Department	**Date:**	April 4, 2013
From:	Jinny Huang, P.E., MWH	**Reference:**	10501555/6.2
Subject:	LBWD Sewer System Hydraulic Evaluation & Planning Criteria – FINAL		

Introduction

This technical memorandum (TM) describes the criteria used to evaluate the hydraulics of the Long Beach Water Department's (LBWD) collection system using the hydraulic model calibrated in 2008 as part of the Sewer Master Plan (SMP) (MWH, 2008). Hydraulic evaluation criteria for existing system and future development system criteria are provided in this TM. The existing system criteria is applied to the hydraulic evaluation of the 2013 Sewer Master Plan Update (SMPU), where the future development criteria will apply only to newly developed areas within the LBWD service area. Criteria provided in this TM serve as a guideline, and additional considerations will need to be taken at each location, such as local constraints (e.g., slope limitation for a large pipe at a constrained site).

The hydraulic model will be validated as part of this SMPU using flow monitoring data obtained from DSI during a two-week period in January 2013. The hydraulic model is used to identify capacity deficiencies in LBWD's collection system for existing and future conditions. Results from the hydraulic model are compared against the criteria discussed in this TM. The hydraulic analysis will identify problems areas such as surcharged pipe segments, hydraulic bottlenecks, areas of high infiltration/inflow (I/I) and other hydraulic inefficiencies. A list of recommendations based on the hydraulic model for existing and future system conditions will be provided in the SMPU.

Hydraulic Evaluation Criteria

System capacity evaluation criteria are established to determine the level of service the collection system must meet. Since the City of Long Beach is fully developed and little growth is anticipated in the near future, the evaluation criteria developed for this master applies to all areas for the LBWD sewer system, as shown in **Table 1.**

The hydraulic model analyzes approximately 30 percent of the entire sewer system, and includes all gravity mains 12-inch and greater in diameter and select smaller gravity mains upstream of the collection system. Flow monitoring results from previous studies, such as the 2008 SMP, indicate a significant variation in wastewater flow patterns during weekday and weekend conditions. Therefore, the evaluation criteria are applied to two system conditions: existing weekday conditions and future weekend conditions (weekend 2035 conditions). Existing weekday conditions reflect typical sewer flows during a five day period, Monday through Friday. The existing weekday model serves as a baseline condition for the LBWD sewer system, which can also be validated through flow meter data. Future weekend conditions attempt to simulate a worst-case scenario. The future weekend model runs will identify ultimate system deficiencies. Higher flows exhibited during weekend conditions may be attributed to tourist-related activities and greater commercial activity during the weekends.

Table 1: Existing System Hydraulic Evaluation Criteria and Parameters

Criteria	Value
d/D[1] Ratio	
All existing gravity sewer pipelines[2]	0.9
Parameter	**Value**
Manning's n (gravity mains and force mains)	0.015[3]
Per Capita Flow	
Flow Generation Rate	Based on Population and Land Use[4]

1. d/D = depth of flow in pipe divided by the pipe diameter
2. d/D ratio criteria excludes analysis of force mains and siphons
3. Manning's n of 0.013 is typically used in system planning for new pipelines.
4. Per capita flow rates are assumed to be same as the flows developed in the 2008 SMP.

In addition to these criteria, all modeled pipelines that experience surcharges during dry weather conditions are investigated for potential infrastructure upgrades.

Future Development Planning Criteria

This section describes typical planning criteria for new sewer infrastructure for future development. Since LBWD's sewer collection system serves an area that is mostly built out, the potential for new development is limited. New pump stations and force mains are also not anticipated in the near future. However, there may be potential for re-development in some areas such as the recently constructed mixed-use apartments in the downtown area.

MWH recommends using the planning criteria shown in **Table 2** for pipelines that may be constructed in the future to serve new developments. The following criteria is a guideline in planning for typical sewer systems in similar areas as Long Beach, but is not anticipated for analysis of the existing system for the SMPU as the system is a fully developed.

Slopes and Velocity

All gravity sewer pipelines shall be designed with hydraulic slopes sufficient to result in mean velocities at the average day rate of flow to avoid settling and sedimentation of solids. A minimum flushing velocity of not less than 3 feet per second (fps) is recommended for sewer pipelines. The mains shall be designed to meet the minimum slope criteria of 0.4 percent for 8-inch pipeline and 0.3 percent for pipelines 10-inches or greater. The maximum allowable velocity for gravity sewer mains shall not be greater than 8 fps. Maximum velocity is recommended to prevent hydraulic jumps, and minimize potential damaging effects of erosion and abrasion.

d/D Ratio

Typically, sewer systems are designed to account for extraneous flows by designing pipes to have a d/D ratio of 0.5 for peak dry weather flows. The additional wet weather flow or peak flows during dry weather can be conveyed by the additional sewer capacity available (in excess of d/D equal to 0.5). Recommended d/D for the LBWD sewer system is:

- Maximum d/D ratio for all new sewers that are less than 18-inch in diameter shall be 0.50; and
- Maximum d/D ratio for all new sewers that are greater than or equal to 18-inch in diameter shall be 0.75.

Manholes

Manholes shall be installed on sewers at all changes in slope, size of pipe or alignment, and at all intersections of main line sewers. The maximum spacing allowable between manholes is suggested at 500 feet unless otherwise approved. Typical manhole spacing for the LBWD system is approximately 300 feet.

Minimum Collection Sewer Size

No sewer shall be less than 8-inches in diameter except at locations authorized by LBWD.

Table 2: System Planning Criteria and Parameters

Pipelines	
Criteria	**Value**
Velocity	
Minimum Velocity (for new pipelines)	3 fps[1]
Maximum Velocity (for new pipelines)	8 fps
d/D Ratio	
New sewers that are less than 18-inch in diameter	0.5
New sewers that are greater than or equal to 18-inch in diameter	0.75
Minimum Design Slopes for Pipes	
8-inch	0.4%
10-inch or greater	0.3%
Pump Stations and Force Mains[2]	
Criteria	**Value**
Maximum velocity at firm pumping capacity during peak dry weather flow (PDWF) at buildout	10 fps
Average Dry Weather Flow (ADWF) (existing conditions) velocity	3.0 fps minimum
Parameter	**Value**
Manning's 'n' to calculate headloss in force mains in the model	0.015

1. fps = feet per second
2. It is anticipated that LBWD system will not be constructing new pump stations and force mains.

Inflow/Infiltration

MWH has selected eight (8) locations to record sewer flows in areas of potential or known high infiltration/inflow (I/I). These locations were selected based on input from LBWD staff and areas showing evidence of infiltration from the 2008 SMP Flow Monitoring Report. Data obtained during flow monitoring will be compared to the model results to determine the extent and the severity of I/I. MWH will provide recommendations to reduce I/I in the SMPU.

APPENDIX G:

REFERENCES

REFERENCES

1. Long Beach Water Department website. 2013. <www.lbwater.org.>
2. MWH. Sewer Master Plan Update Final Report. 2008.
3. National Climatic Data Center. National Oceanic & Atmospheric Administration. Summary of Monthly Normals 1981-2010. Long Beach Daughtery Field, CA US Station. <www.ncdc.noaa.gov>
4. National Climatic Data Center. National Oceanic & Atmospheric Administration. Local Climatological Data Annual Summary with Comparative Data. Long Beach, California (KLGB).
5. Port of Long Beach. Facts at a Glance. www.polb.com
6. U.S. Census Bureau. 2010 Census Gazetteer Files. 2010. <http://www.census.gov/geo/www/gazetteer/files/2010_place_list_06.txt>
7. U.S. Census Bureau. State & County Quick Facts. <http://quickfacts.census.gov/qfd/states/06/0643000.html>

mwhglobal.com

MWH®

BUILDING A BETTER WORLD

618 Michillinda Avenue, Suite 200
Arcadia, California 91007
TEL 626 796 9141 FAX 626 568 6101

Attachment I.
Reserved for Monitoring, Measurement, and Program Modifications Attachments

This page is intentionally left blank.

Attachment J1.
Sewer System Management Plan Program Audit Report 2018

This page is intentionally left blank.

Long Beach Water

Exceptional Water • Exceptional Service

Sewer System Management Plan (SSMP)

2018 Internal Audit

Introduction

The Long Beach Water Department (LBWD) Sewer System is subject to permitting requirements under the Statewide General Waste Discharge Requirement for Sanitary Sewer Systems (WDR SSS). The State Water Resources Control Board (SWRCB) issued Order No. 2006-0003-DWQ to mitigate the potential impact of sanitary sewer overflows (SSOs) on public health and the environment. The WRD SSS applies to all public collection system agencies in California that own and operate collection systems. LBWD is subject to permitting requirements under the WRD SSS, and is required to prepare a Sewer System Management Plan (SSMP) every five (5) years. Its principal elements include how the municipality operates and maintains the collection system, and procedures for reporting all Sanitary Sewer Overflows (SSOs) to the California Integrated Water Quality System (CIWQS) online database, with the ultimate goal of minimizing SSOs.

Background

The LBWD sanitary sewer system comprises 712 miles of gravity sewer mains and 7.6 miles of force mains raging in size from 2 to 48 inches in diameter, 28 pump stations, 115,133 lateral connections, and 16,158 sewer maintenance manholes. The table below summarizes LBWD's Collection System.

Collections System Overview	
Gravity Sewer Mains	712 miles
Force Mains	7.6 miles
Sewer Lateral Connections	115,133
Sewer Pump Lift Stations	28

SSMP Internal Audit Overview

Section 10 of the WRD SSS requires enrollees to conduct internal audits every two (2) years. The audit focuses on evaluating the plan's effectiveness, compliance with its program elements, identifying steps to correct any deficiencies, and implementing programs as stated in the SSMP. The last internal audit of the SSMP was completed in 2016. This report summarizes the results of LBWD's internal audit for 2018. The 2018 audit addresses whether or not the deficiencies and recommendations from the 2016 audit have been addressed in the 2 years since then. It is also important to note that the current version of the SSMP is nearing the end of its 5-year life span. In 2019, a new SSMP will be completed to cover 2019 -2024. Therefore, some of the discussion may provide recommendations on how the new SSMP could be improved to reflect different aspects of LBWD's program.

The 2018 internal audit addresses the compliance status, effectiveness, and deficiencies and recommendations for the following sections of the SSMP:

- I. LBWD SSMP Goals.
- II. LBWD Organization Structure.
- III. LBWD Legal Authority.
- IV. LBWD Summary of Operation and Maintenance Activities.
- V. LBWD SSO Emergency Response Plans.
- VI. Fats, Oils, and Grease (FOG) Control Program.
- VII. LBWD Design and Performance Provisions.
- VIII. LBWD System Evaluation & Capacity Analysis Plan (SECAP).
- IX. LBWD Monitoring, Measurement, and Program Modifications.
- X. LBWD SSMP Program Audits.
- XI. LBWD Communication Program.

Audit of Section I. Goals

LBWD has defined the following five goals in the SSMP:

1. *To properly manage, operate and maintain all portions of the LBWD wastewater collection system.*
2. *To provide adequate capacity to convey peak flows.*
3. *To minimize the frequency of SSOs.*
4. *To mitigate the impact of SSOs.*
5. *To meet all applicable regulatory notification and reporting requirements.*

Compliance Status
LBWD is compliant with this element of the SSMP.

Effectiveness
The stated goals are meant to concentrate efforts on minimizing occurrences of SSO events, as well as mitigating their impact on public health and the environment.

Deficiencies and Recommendations
No deficiencies have been identified with this element of the SSMP.

Audit of Section II. Organization

This section describes the governance and organizational structure of LBWD. It also designates who is responsible for reporting SSOs. Organizational charts are provided for Executive Management, as well as for Sewer Operations, Water Treatment, and Engineering.

Compliance Status
LBWD is compliant with this element of the SSMP.

Effectiveness
The organizational structure clearly identifies lines of authority as well as the key positions responsible for implementing specific measures in the SSMP. The chain of communication for reporting SSOs is also provided.

Deficiencies and Recommendations
LBWD has gone through a significant structural reorganization, in addition to the normal turnover of personnel that would be expected during a 5-year period. Thus, the current organization is quite different from what it was when the 2014 SSMP was written. The last audit recommended that a procedure be put in place to easily update any organizational changes that may occur during the SSMP's 5-year life cycle. While LBWD's organizational charts are frequently revised, these updates have not been incorporated into the SSMP document that is publicly available through its website. A priority for the 2019 SSMP should be to implement a simple mechanism for such updates. It may be helpful to see multiple examples from other agencies, as this may prompt ideas for what would work best for LBWD.

Audit of Section III. Legal Authority

This section requires LBWD to demonstrate that it has the legal authority to: a) Prevent illicit discharges b) Require proper design and construction of sewers and connections c) Ensure access for maintenance, inspection, and repair of lateral sections owned by the Public Agency d) Limit discharge of fats, oils, and grease, and e) Take enforcement action *on any ordinance violations.*

Compliance Status
LBWD is compliant with the requirements of this section.

Effectiveness
LBWD's legal authority is derived through multiple channels, including the Board of Water Commissioners and the Long Beach City Council. The rules and regulations that govern the Sewer Collections System can be found within several documents, depending on what aspect of the system is being evaluated. These include the Long Beach Municipal Code, LBWD's "Rules, Regulations and Charges Governing Potable Water, Reclaimed Water, Sewer Service, and the Water Conservation and Water Supply Shortage Plan", and the Standard Specifications for Public Works Construction ("Green Book").

Deficiencies and Recommendations
This section of the SSMP has no significant deficiencies and is generally satisfactory. The previous audit recommended exploring ways to strengthen LBWD's enforcement authority with regard to FOG discharges. There is a FOG ordinance in the Long Beach Municipal Code (Chapter 8.46), but LBWD had limited enforcement authority. Since then, LBWD has entered into a Memorandum of Understanding (M.O.U.) with the Department of Health and Human Services to remedy this. Now, inspectors from the Environmental Services Bureau include FOG inspections as part of their regular inspections of City of Long Beach (City) restaurants. Given the inspectors' established authority to enforce public health ordinances, FOG enforcement was immediately strengthened. The FOG program is discussed in more depth in section VI. of this report. Development Services Plan Checkers and Plumbing Inspectors continue to play an integral role in the FOG program. LBWD has also expanded its team of Construction inspectors from 3 to 9 employees. This has greatly improved compliance on sewer construction projects for both outside contractors and in-house crews.

Audit of Section IV. Operation and Maintenance

This section of the SSMP specifies 5 elements that must be addressed in order to meet the compliance requirements under Operations and Maintenance (O&M). The same audit questions asked throughout this report will be answered for each of these 5 elements.

1. Maintain an up-to-date map of the sanitary sewer system with applicable attributes.

Compliance Status
LBWD is compliant with this element of the O&M section.

Effectiveness
LBWD uses a Geographic Information System (GIS) to manage its database of extensive information about the sanitary sewer network. This includes attribute data for mains, laterals,

manholes, and pump stations. Maps of non-sanitary sewer elements include water, storm drain, street, county trunk sewer, and other underground utility data. Maps are routinely updated with new information.

Deficiencies and Recommendations

In response to the issues brought up in the 2016 internal audit, a protocol has been implemented to minimize discrepancies between the information contained in GIS and field observations. Whenever field personnel observe inaccuracies on the GIS map versus actual sewer infrastructure, they are expected to make a notation on the map, including a written explanation and basic drawing of the item(s). They then turn this into to the section's Water Utility Supervisor I (WUS I), who will review and submit the revision to the appropriate GIS technician. If construction activity alters the position or nature of a sewer structure, a new "as-built" drawing is submitted and maps are revised accordingly.

2. Describe routine preventative maintenance activities, including how to address known problem areas. The system used to document and track these activities should also be included.

Compliance Status

LBWD is compliant with this element of the O&M section.

Effectiveness

Key performance measures include miles of sewer pipe cleaned, miles inspected, number of repairs, stoppages cleared, and number of SSOs. Metrics are tracked using a work order system, Excel spreadsheets, and Access databases. Areas prone to blockages are placed on repeat cleaning schedules. Additional preventative maintenance measures include the strategic application of approved chemicals to address specific problems – i.e., root intrusion, grease buildup, and odor issues. In conjunction with routine maintenance activities, Smart Covers® are installed at key locations to provide advance warning of potential SSOs. A Smart Cover® is a monitoring system installed at the manhole cover to remotely communicate when the manhole reaches a preset alarm point.

Deficiencies and Recommendations

Significant strides have been made in this element of the Operations and Maintenance program. The 2016 audit described challenges in meeting Cleaning and CCTV mileage goals as the Sewer Operations division strove to eliminate the use of outside contractors and overtime to achieve its productivity goals. While incremental gains were noted between Fiscal Year (FY) 2014 and FY 2015, LBWD had yet to achieve its objectives when the 2016 audit was written. Fortunately, FY 17 and FY 18 saw the Sewer Operations division surpass its goals in both Cleaning and CCTV with results as follows:

	Cleaning*		CCTV	
	2017	2018	2017	2018
Goal (miles)	355.9	327.9	136.4	136.4
Actual (miles)	376.6	341.5	145.5	140.3
% of Goal	105.8%	104.1%	106.7%	102.9%

*Does not include miles from repeat cleaning

Another program enhancement has been better targeting of trouble areas or sewer "hot spots." These are areas in the sewer system known to be difficult to maintain, such as high-grease areas, or segments containing siphons. Sewer staff has experimented with different frequency intervals to find the ideal schedule for repeat cleaning activities. Continued analysis of these frequencies is recommended for optimal distribution of labor and equipment resources. Procurement of a modern Computerized Maintenance Management System (CMMS) was suggested in the 2016 audit report as a tool to track system trends, evaluate productivity rates, and prompt SSO reduction strategies. Although not complete, significant work has already been done. Sewer staff has had multiple meetings with vendors and other agencies to thoroughly research the options available on the market. One factor that slowed the progress of this project was the decision to widen the scope of the CMMS system such that it could also be used by other Department divisions that were also in need of a work order system. While a more universally applicable system would improve the Department's efficiency overall, it does increase the time it will take the Sewer Division to reach this milestone.

3. Rehabilitation and replacement plan to identify and prioritize system deficiencies.

Compliance Status

LBWD is compliant with this element of the O&M section.

Effectiveness

The Sewer Capital Improvement Plan (CIP) targets segments of sewer system infrastructure that are at highest risk of failure. CCTV data is routinely used to assess and rank pipeline condition.

Deficiencies and Recommendations

LBWD is working on the next Sewer Master Plan which will detail its CIP strategy. An area of the sewer system highlighted in the 2016 internal audit as lacking a clear maintenance and rehabilitation plan was force mains. There are over 7 miles of force mains throughout LBWD's sewer infrastructure. This continues to be an area of concern because the consequences of a failure in any of these pressurized lines is compounded. By definition, a break in a force main will release a much greater volume of sewage than that of a vitrified clay pipe (VCP) gravity line. A program for proactive maintenance of force mains should be explored as both the new Sewer Master Plan and the next edition of the SSMP are being assembled.

4. Regular training for all operations and maintenance staff and contractors.

Compliance Status

LBWD is compliant with this element of the O&M section.

Effectiveness

LBWD has a well-established safety training curriculum that is individualized for each employee. An employee in the sewer section will receive yearly safety training on topics such as confined space entry, trenching and shoring, hydrogen sulfide awareness, personal protective equipment, CPR/1st Aid, and much more. Training is documented per class and per employee. Sewer staff also receive formal training related to pipeline assessment (NASSCO certification), and classes associated with professional certifications (e.g., CWEA Collection Systems Maintenance, SWRCB Water Distribution, etc.) An important change to the Sewer Division's program was the creation of a WUS I who has primary responsibility for overseeing training and quality control. This Supervisor focuses on teaching the field skills needed to be an effective Water Utility Mechanic (WUM). A new hire will spend his/her first several days on the job with the Training Supervisor. This has increased the consistency of the practices and methods applied in the field.

Another measure implemented since the last SSMP to enhance employee training is the assignment of mentors. Each new permanent hire is assigned a more experienced, knowledgeable employee to be their mentor. This is someone below the rank of a Supervisor who is currently active in the field. Mentors have been utilized in Sewer Operations since 2015 with good success. It benefits the new hire, who has an immediate advisor and peer they can go to with questions. Conversely, the mentor is also enriched by the chance to refine their training skills and take on more of a leadership role. Regular meetings are held with the mentors to check in on the progress of their mentees. The mentees are also regularly given feedback regarding areas of strength as well as opportunities for improvement.

Deficiencies and Recommendations

The previous audit noted a deficiency in the documentation of the on-the-job training that took place in the field. The addition of the Training/Quality Control Supervisor has significantly improved this. In order to track an employee's progress, the WUS I must keep records of what was discussed or taught with each employee. These details are recorded in the Supervisor's notes and will also be summarized in a report to the Superintendent. Per the 2016 audit recommendations, checklists were developed as a tool to standardize the knowledge, skills, and abilities that an employee should have after a certain length of time on the job. Since these would be given to the employee after field training with the WUS I, they would improve the communication and transparency around performance expectations. Measurement of an individual employee's progress, as well comparison between employees, would be easier using these checklists. However, these have not been implemented in the field yet, as they must go through the "meet and confer" process first. It is recommended that these checklists be put into practice as soon as the "meet and confer" process is complete.

Another development in this area has been the improved content and record-keeping for the division's weekly tailgate meetings. A different safety topic is still featured at each meeting. Additionally, topics on field practices have increased and expanded. Topics related to SSOs, such as volume estimation, notification procedures, and post-event analysis are regularly discussed. Maintenance-related topics are often included to reinforce proper practices in the field. For example, cleaning nozzle options, customer service protocols, and compaction standards are some recent tailgate topics. A sign-in sheet is completed for each meeting and minutes are attached to summarize the discussion. Previously, only general notes were written to document each meeting. This lack of specificity made it difficult to tell what message was conveyed during past meetings. Now, a detailed recap of each tailgate is completed with important details included. This helps Supervisors to have better "follow-through" on any instructions given, and increases employee accountability.

It is recommended that the 2019 SSMP include the numerous changes that have been implemented in the area of training.

5. Maintains an inventory of critical equipment and replacement parts.

Compliance Status
LBWD is compliant with this element of the O&M section.

Effectiveness
Sufficient inventory of critical equipment and replacement parts is maintained at all times.

Deficiencies and Recommendations
No deficiencies have been identified with this element of the SSMP. An adequate supply of the parts and equipment used in Sewer Operations is maintained on site at the Operations Service Center (OSC) yard. This is LBWD's primary location and where all work vehicles for Sewer Operations are housed. Each WUS I is responsible for monitoring, ordering, and replenishing the items needed in their area of responsibility (e.g., Construction, CCTV, Cleaning, etc.) All Supervisors are trained on the Department's procurement protocols and, with Superintendent approval, may use this process to make purchases for their section. The Department maintains several ongoing contracts such as one for the purchase of tools, equipment, equipment maintenance services, and others needed for the job. This is in addition to the stock kept on hand as part of the Department's Warehouse inventory.

Audit of Section V. Overflow Emergency Response Plan

LBWD is required to implement an overflow emergency response plan that includes a) timely notification of SSOs to primary responders, b) appropriate response measures for all overflows, c) procedures for notifying appropriate regulatory agencies and other affected *parties, d) staff training on all elements of the overflow emergency response plan, e) procedures to address other response activities such as traffic and crowd control, and f) reasonable steps to contain and prevent the discharge of untreated wastewater to bodies of water and to minimize any adverse impact on the environment.*

Compliance Status

LBWD is compliant with this section of the SSMP.

Effectiveness

The 2014 SSMP contains a thorough step-by-step outline of the actions that should be taken when responding to any overflow. It addresses each subsection as required by the State Water Resources Control Board. However, minor adjustments have been implemented since 2014.

Each subsection is addressed below:

a) LBWD has a 24-hour dispatch line to receive calls regarding any Water or Sewer emergencies. The dispatcher notifies appropriate personnel to respond to the emergency. Any report of a possible SSO is considered an emergency and the on-call sewer lead is notified immediately. After business hours, there is a sewer lead, sewer mechanic, sewer Supervisor, and Sewer Superintendent on call. The Sewer lead and mechanic are the first responders to an SSO and are required to be physically at the location within half an hour of receiving the dispatch call.
b) The steps taken when arriving to the scene of an SSO are detailed in Sewer Operations' standard operating procedures for SSOs. These include setting up a barrier to prevent spread of the overflow, protecting storm drains and catch basins, locating the blockage, and clearing the blockage.
c) After the blockage causing the SSO has been relieved, the responding crew lead will then notify the appropriate regulatory agencies. The SSO Field Data Report is a form carried on all Cleaning trucks and is used at the scene of every SSO. It guides the responder to complete all pertinent information needed for reporting purposes. It also has the contact phone numbers for the regulatory agencies that need to be notified. The Sewer Supervisor on call is responsible for executing the internal notification protocol. This protocol consists of a preliminary notification that is sent upon first learning of a potential SSO, and a second (final) notification sent with more detailed information regarding the overflow. The notification list consists of various stakeholders from different City Departments (e.g., Health, Public Works, etc.) This list is updated on an ongoing and as-needed basis. The Sewer Operations Superintendent, or the Sewer Supervisor II, is responsible for ensuring that each SSO is reported to the state database within the mandated time frame.
d) Staff training on SSOs is offered through multiple means, including the weekly tailgate meetings, instruction from the training Supervisor, and individual coaching from mentors, leads, and Supervisors.
e) All Sewer field personnel are required to complete an initial safety course on traffic control before working in the public right of way. Annual refresher courses are also

required. Field personnel are always expected to follow proper safety procedures and traffic control methods.

f) In addition to the standard operating procedures already described to mitigate the consequences of an overflow event, LBWD has also taken proactive measures to prevent their frequency. Since 2008, LBWD has selectively installed Smart Cover® technology to provide advanced warning of rising manhole levels. This technology uses a sensor to detect when the water in a manhole rises above a certain set point. An alarm notice is then sent via text and email to Sewer personnel who can immediately dispatch a crew to the alarm location. The crew can then clear the blockage before it becomes an overflow. This technology has prevented 127 SSOs since 2010.

The online database for reporting SSOs (CIWQS) also provides useful tools for measuring how a collection system compares with others in the same region and throughout the State. The Spill Rate Index is the number of SSOs per 100 miles of Sewer per year. The following tables show Spill Rate Indices for the 3 SSO Categories. Data is shown for LBWD, the Los Angeles Region, and the state of California for the past two fiscal years:

FY 2017*	Spill Rate Index (spills/100mi/yr)		
	Category 1 SSO	Category 2 SSO	Category 3 SSO
Long Beach Water Dept.	0.14	0.0	2.23
State Municipal (Public) Average	5.89	2.7	6.81
Region Municipal Average	2.35	1.03	2.79

* October 1, 2016 – September 30, 2017

FY 2018*	Spill Rate Index (spills/100mi/yr)		
	Category 1 SSO	Category 2 SSO	Category 3 SSO
Long Beach Water Dept.	0.14	0.42	2.93
State Municipal (Public) Average	3.51	2.61	6.43
Region Municipal Average	3.01	3.06	2.16

* October 1, 2017 – September 30, 2018

Deficiencies and Recommendations
Minor deficiencies in staff training that were noted in the 2016 SSMP audit have been corrected with the implementation of several training initiatives. As described in this report's audit of section IV., part 4, the addition of a Training Supervisor, the assignment of mentors for new employees, and more thorough, targeted training in weekly tailgate meetings, have all contributed to better learning outcomes for Sewer personnel. As recommended, regular and frequent training of field personnel incorporates SSO-related topics such as how to estimate spill volume, proper notification procedures, and how to correctly complete the SSO Field Data Form.

With the implementation of a more robust SSO training program, no new deficiencies in this area have been noted. It is recommended that the 2019 SSMP include any revisions made to the OERP.

Audit of Section VI. Fats, Oils and Grease (FOG) Control Program

The FOG control program should address the following elements, as appropriate: a) Public outreach to promote the proper disposal of FOG. b) A plan for the disposal of FOG generated within the sanitary sewer service area. c) The legal authority to prohibit discharges to the system and prevent blockages and SSOs. d) Requirements and standards pertaining to grease removal devices. This may include installation, design, maintenance, best management practices, record keeping, and reporting requirements. e) Authority to inspect and enforce FOG ordinances. f) Identification of areas in the sanitary sewer system subject to FOG blockages and a maintenance cleaning schedule. g) Source control measures for areas identified as subject to FOG blockages.

Compliance Status
LBWD is compliant with requirements a) through g) of this section of the SSMP.

Effectiveness
a) A significant change to the implementation of the FOG Control Program since the previous audit has been the establishment of the M.O.U. between LBWD and the City's Department of Health and Human Services. While LBWD still oversees the FOG program, the Long Beach Health Department has been charged with executing inspections for the City's food service establishments. Health inspectors incorporate the FOG inspection as part of their regular inspection. This has greatly increased the number of restaurants that are inspected, as there are many more Health inspectors out in the field every day then there were dedicated FOG staff in Sewer Operations. LBWD is still responsible for executing a public outreach strategy for residential customers. LBWD has launched its "Healthy Sewers" campaign to educate the public on what not to flush or pour down the drain.

Outreach methods include social media, LBWD's website, bill inserts, and other marketing platforms. The 2014 SSMP includes a sample letter that could be sent to residential customers in the immediate vicinity of a FOG-related SSO.

b) A listing of local grease collection companies, or grease "haulers", is available in the information packets distributed to restaurants by inspectors. Also included is a listing of local grease interceptor suppliers. No recommendation is made on which company to use, as selection is entirely the decision of the food service establishment.

c) The City of Long Beach Municipal Code, Chapter 15.01, asserts that LBWD's General Manager is authorized by the Board of Water Commissioners to administer the rules, regulations, and charges governing water and sewer service. Furthermore, in 2005, the Long Beach City Council amended the City's Municipal Code by adding Chapter 8.46 on the disposal of fats, oils, and grease (ordinance no. ORD-05-0003.)

d) Chapter 8.46, the City's ordinance on the disposal of fats, oils, and grease, details the requirements for grease removal devices, including grease traps and grease interceptors.

e) Since implementation of the 2016 FOG M.O.U. between the City's Health Department and LBWD, inspection activities have been done by the City's Health inspectors. Enforcement of the FOG ordinance falls jointly on the City Health Officer, or designee, and the General Manager of the LBWD, or designee (Chapter 8.46.060.)

f) Records of sewer blockages and SSOs are kept as these events occur. The data recorded includes the location, date, time, cause, volume spilled, and corrective action(s) taken. Additional information includes ambient temperature, date last cleaned, and GPS coordinates. A GIS mapping of these events is routinely done to identify areas of concern.

g) Source control measures for areas of concern include increased cleaning frequency, installation of Smart Cover® warning devices in manholes, and administration of chemical degreasers. This is in addition to the FOG control activities already noted above.

Deficiencies and Recommendations

a) A deficiency noted in the previous audit was the minimal amount of public outreach done to target residential customers. This has begun to be addressed with the launch of LBWD's "Healthy Sewers" campaign. Since this program is relatively new, it is recommended that evaluation of this and other public outreach efforts be regularly conducted to measure their impact and effectiveness.

b) Since FOG outreach for food service establishments is no longer handled by in-house staff at LBWD, it is important to work closely with Health Department staff to ensure their field inspectors always have an adequate supply of literature and outreach materials on hand.

c) No deficiencies have been identified with this element of the FOG control program.

d) No deficiencies have been identified with this element of the FOG control program.

e) The recommendations in the 2016 audit suggested further discussions on FOG inspection activities being handled by the City's Health Department. The result of these discussions was the M.O.U. described earlier in this report. It is important that the details of this M.O.U. are included in the 2019 SSMP.

f) No deficiencies have been identified with this element of the FOG control program.

g) No deficiencies have been identified with this element of the FOG control program.

Audit of Section VII. Design and Performance Provisions

This section of the SSMP must demonstrate that LBWD has the following in place: a) Design and construction standards and specifications for the installation of new sanitary sewer systems, pump stations and other appurtenances; and for the rehabilitation and repair of existing sanitary sewer systems; and b) Procedures and standards for inspecting and testing the installation of new sewers, pumps, and other appurtenances and for rehabilitation and repair projects.

Compliance Status

LBWD is compliant with both a) and b) requirements of this section.

Effectiveness

a) Construction and design requirements are fully covered in both the plans and specifications for each CIP project. LBWD has design guidelines for sanitary sewer posted on its website. Primary references are the Standard Specifications for Public Works Construction (Green Book) and LBWD Standard Drawings and Specifications. For standards that are not fully covered with these 2 references, the following may be used: Los Angeles County Sanitation Districts Standard Drawings of Construction, City of Los Angeles Department of Public Works Bureau of Engineering Part F-Sewer Design, and Los Angeles County Department of Public Works Private Contract Sanitary Sewer Procedural Manual.

b) All design and construction work are subject to inspection and LBWD has its own team of in-house inspectors. The City's Public Works Department issues permits for new Sewer connections and repairs. Sewer CIP projects are also inspected using closed-circuit television (CCTV) equipment operated by LBWD employees from the Sewer Operations division. CCTV inspections are conducted before and after project completion.

Deficiencies and Recommendations

a) No deficiencies were noted for this portion of the SSMP requirement. LBWD's Standard Drawings and Specifications are currently being updated. This project is being led by LBWD's Engineering Bureau with the collaboration of the Operations Bureau. Any significant revisions to the Sewer Standard Plans and Specifications should be included in the 2019 SSMP.

b) The previous SSMP audit recommended more rigorous inspection and testing of in-house spot repairs. Protocols have been implemented to achieve this. For example, LBWD has expanded its team of inspectors such that an inspector is present at each in-house construction job. Additionally, each in-house main repair is inspected via CCTV post construction. Another tool to track the progress of construction work being used regularly is LBWD's construction app. It allows LBWD personnel to track a project's progress from start to finish for all internal construction work.

Audit of Section VIII. System Evaluation & Capacity Analysis Plan (SECAP)

LBWD must prepare and implement a capital improvement plan (CIP) that will provide hydraulic capacity data on key sanitary sewer system elements for dry weather peak flow conditions, as well as the appropriate design for storm or wet weather events. At minimum, the plan must include a) Evaluation, b) Design Criteria, c) Capacity Enhancement Measures, and d) Schedule.

Compliance Status

LBWD is compliant with this section of the SSMP.

Effectiveness

LBWD's Sewer Master Plan evaluates the sewer service area and sewer system facilities to determine current deficiencies, as well as potential deficiencies during future growth. It provides details of the proposed CIP for the sewer system, including prioritization of projects. A final Sewer Master Plan was published in 2008, with updates released in 2013 and 2014. As part of the Sewer Master Plan, a dynamic hydraulic model was developed using ESRI ArcGIS. It was later calibrated to field conditions using flow monitoring equipment placed at strategic points in the system. The results helped to identify capacity deficiencies both now, and during future City growth. Data from the calibrated hydraulic model was verified through field observations to confirm surcharge locations during existing dry weather conditions. An evaluation is then made to determine what segments should be included in the CIP. Areas that have, or are likely to overflow during peak conditions would be strongly recommended to be included or periodically monitored. Based on the 2014 SSMP, there are no capital improvements required due to deficiencies in pipe capacity.

Deficiencies and Recommendations

Based on the 2013 Sewer Master Plan Update and 2014 SSMP, no capital improvement projects were required due to deficiencies in system capacity. Since 2014, LBWD capital improvement projects have been focused on addressing structural deficiencies of existing sewer mains based on a pipe's physical condition rating through CCTV surveys.

A new Sewer Focus Study began in 2018 to address increased Development activity and population growth in the City's downtown area. This study is currently being developed and expected to complete by the end of 2019. The Downtown Area Sewer Focus study includes flow monitoring, updating LBWD's existing sewer model for the downtown area, and identifying potential capacity deficient areas under existing and future dry weather conditions.

Audit of Section IX. Monitoring, Measurement, and Program Modifications

Compliance with this element of the SSMP requires LBWD to: a) Maintain relevant information that can be used to establish and prioritize appropriate SSMP activities. b) Monitor the implementation, and measure the effectiveness of each element of the SSMP. c) Assess the success of the preventative maintenance program. d) Update program elements, as appropriate, based on monitoring or performance evaluations. e) Identify and illustrate SSO trends, including frequency, location, and volume.

Compliance Status

LBWD is compliant with subsections a) through d) of this SSMP element.

Effectiveness

LBWD uses a variety of metrics to measure the effectiveness of different SSMP components. Productivity standards for the Operation and Maintenance Program, for example, use footage/mileage goals for Cleaning and CCTV activities. Data is recorded for each crew daily. Productivity can be assessed for time periods ranging from an hour to a year, and for individuals or for the division. Data recorded in the field is compiled into an Access database and extracted into weekly, monthly, and yearly reports. SSO data is an important measure of sewer system performance. The frequency, location, and volume of SSOs is often used to determine how resources will be allocated. For example, Smart Cover® manhole lids will be strategically placed in areas of the City more prone to overflows. Data will also be used to recalibrate the frequency of cleaning activity for problem areas, or sewer "hot spots." Sewer system management is regularly evaluated for effectiveness and when needed, protocols are updated to produce more favorable outcomes.

Deficiencies and Recommendations

The 2016 SSMP audit listed a deficiency in this area because the 2014 SSMP had not been updated to reflect program changes. The 2016 audit and the current audit report address this. They each provide a summary of current practices within the framework of the 2014 SSMP. Despite this, better tools are needed to facilitate the monitoring, measurement, and modification of various program elements. Procurement of a customized Computer Maintenance Management System (CMMS) is recommended to automate much of the work involved in the collection and analysis of sewer system data.

Audit of Section X. SSMP Program Audits

LBWD should be conducting periodic internal audits to evaluate the effectiveness of the SSMP and compliance with the SSMP requirements. Identification of any deficiencies and steps to *correct them should be included. At a minimum, these audits should occur every two years and a report kept on file.*

__Compliance Status__
LBWD is compliant with the requirements set forth in this section.

__Effectiveness__
The first SSMP Audit was completed in 2016. The current report will fulfill the 2-year requirement as it will be finalized in 2018. Both reports are kept on file and available for review if requested by the State Water Resources Control Board (SWRCB).

__Deficiencies and Recommendations__
The recommendations set forth in the previous audit have been addressed. It was determined that the 2019 SSMP will be completed with the assistance of a professional consultant with expertise in this area. The SSMP audits, however, will be completed by internal LBWD personnel. While the current report does satisfy the audit requirement, it is recommended that the time interval for subsequent reports be more precise. For instance, the 2016 Audit was completed in May of that year. The current report is being finalized in November 2018, making the interval between audits 30 months. Future audits should keep the interval at 24 months to ensure consistency and timeliness of reports.

Audit of Section XI. Communication Program

This section requires LBWD to communicate on a regular basis with the public on the development, implementation, and performance of its SSMP. The public should have the opportunity to provide input as the program is being developed and implemented. There should also be a plan of communication with tributary and/or satellite systems.

__Compliance Status__
LBWD is compliant with this section of the SSMP.

__Effectiveness__
The 2014 SSMP is available on LBWD's public website. This was done as a direct result of the recommendation made in the 2016 SSMP audit.

__Deficiencies and Recommendations__
It is recommended that the public have more opportunity to comment and provide feedback during the completion of the 2019 SSMP. An ideal forum for this is the Board of Water Commissioners' meetings that are held biweekly. Agendas and minutes are made available to

the public and there is also opportunity for public comment. A Board presentation should be made to preview the 2019 SSMP and to get approval for the consultant selected through the procurement process. The final 2019 SSMP should also be presented to the Board and soon after posted on the LBWD website.

Certification of Self-Audit

By signing below, we certify the information contained in this self-audit report is correct to the best of our knowledge.

Name	Position	Signature	Date
Jennifer Rojas	Superintendent of Sewer Operations	J Rojas	12-14-18
Joe Quiroz	Water Utilities Supervisor II	[illegible]	1/7/19
Walter Trujillo	Water Utilities Supervisor II	[illegible]	1/8/19

This page is intentionally left blank.

Attachment K.
Reserved for Communication Plan Attachments

This page is intentionally left blank.