City of South Gate™

SEWER MASTER PLAN

Final Report • June 2019

Prepared by:
Kennedy/Jenks Consultants, Inc.

KJ Project Number: 1744508*00

Kennedy Jenks

Kennedy/Jenks Consultants

300 N. Lake Ave, Suite 1020
Pasadena, CA 91101
626-568-4300
FAX: 626-683-8938

Sewer Master Plan

19 June 2019

Prepared for

City of South Gate
8650 California Avenue
South Gate, CA 90280

K/J Project No. 1744508*00

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Executive Summary

To be provided in the final report.

Section 1: Introduction

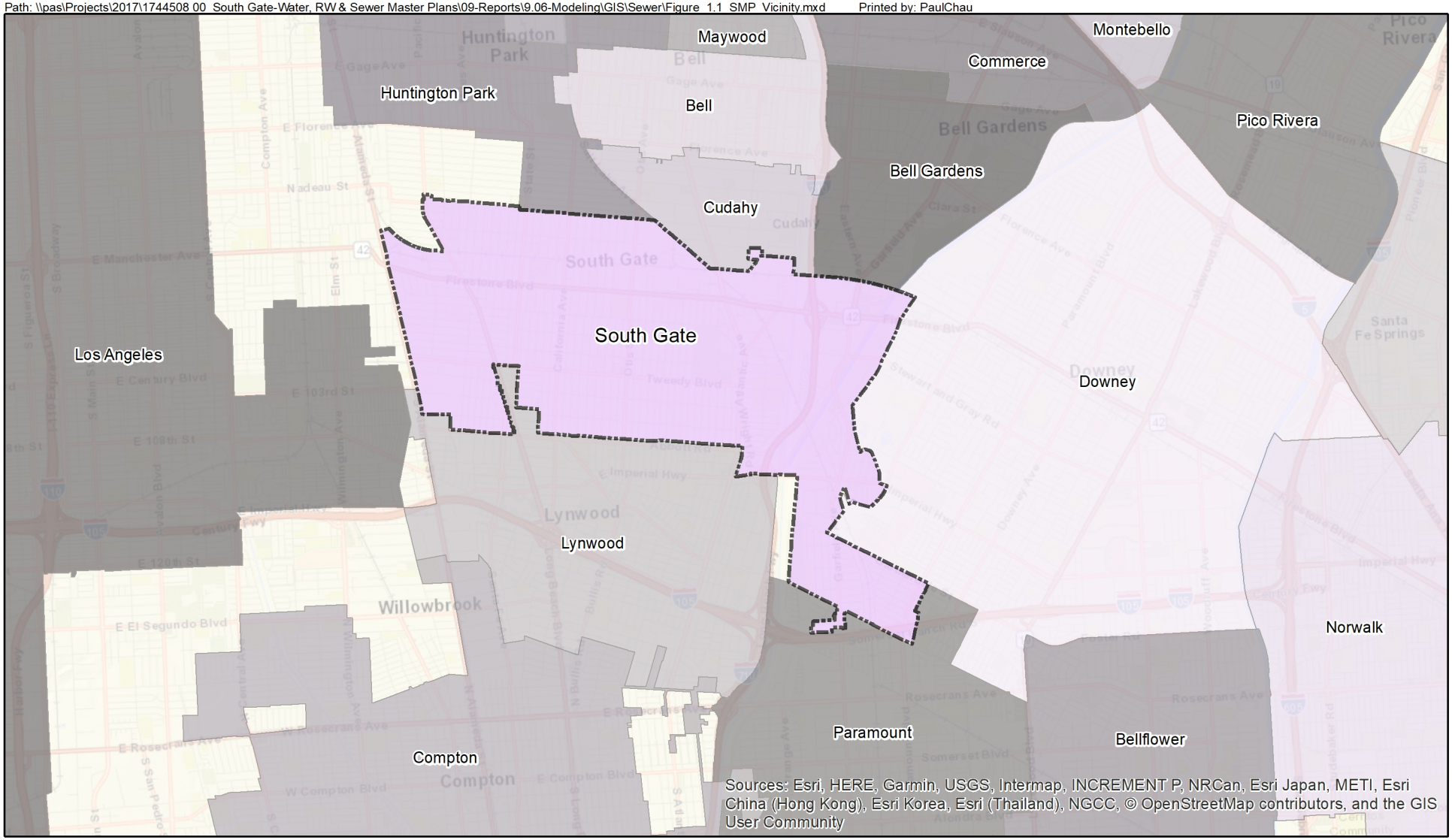
1.1 Background

The City of South Gate, shown in Figure 1-1, is located in Los Angeles County, approximately seven miles south of the downtown area of the City of Los Angeles. Incorporated in 1923, South Gate encompasses approximately 7.5 square miles. South Gate is bordered by the cities of Huntington Park, Cudahy, Bell, and Bell Gardens to the north; by Downey to the east; Lynwood to the south, and Paramount to the southeast.

South Gate uses groundwater as its primary water source with annual pumping rights of 11,183 acre-feet (AF). The City also has two Metropolitan Water District of Southern California (MWD) potable water connections and five connections with other local agencies that can be used in an emergency. The City has over 135 miles of water mains and 14,250 service connections which serves the majority of the City's population of 99,578. A small portion of the City is served potable water by Golden State Water Company.

South Gate's Public Works Department manages a sewer collection system with approximately 120 miles of gravity sewer pipelines with varying diameters ranging from 4 to 27 inches, no pump/lift stations, and about 100 sewer siphons. There are approximately 2,400 manholes and 19,500 service laterals within the City. The sewer collection system primarily discharges into County Sanitation Districts of Los Angeles County (LACSD) facilities for transportation, treatment and disposal. A small percentage of waste collected by the City joins the City of Paramount system and is then discharged into LACSD facilities.

Path: \\pas\Projects\2017\1744508 00 South Gate-Water, RW & Sewer Master Plans\09-Reports\9.06-Modeling\GIS\Sewer\Figure 1.1 SMP Vicinity.mxd Printed by: PaulChau



Legend

South Gate City Boundary

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Sewer Master Plan
City of South Gate

City of South Gate Vicinity Map

KJ 1744508*00
August 2018
Figure 1-1

1.2 Previous Work

In 2006, the State Water Resources Control Board adopted the Statewide General Waste Discharge Requirements (WDR) for Sanitary Sewer Systems (Order No. 2006-0003-DWQ) and Monitoring and Reporting Program. Regulations in this Order resulted from a growing concern about Sanitary Sewer Overflows (SSO) and the resulting effect on human health and the environment. Two major components of the WDR are (1) owners and operators of publicly owned sanitary sewers apply for coverage under the WDR and (2) they develop and implement specific Sewer System Management Plans (SSMPs). In compliance with this Order, the City initially prepared its first SSMP in 2009. The plan sets forth goals and actions to be followed, and guidelines for various activities involved in managing, operating, maintaining, repairing, replacing, and expanding the sewer system. An evaluation of the sewer system capacity was also included, which identified locations with high pipe flows. An internal program audit report was performed in 2011 and an updated SSMP was created in January of 2017. SSMPs are required to be updated every five years, at minimum.

South Gate's sewer collection system was last evaluated as part of a master plan in 1996. This master plan included the removal and replacement of 5.3 miles of sewer pipe with vitrified clay pipe (VCP). Additionally, 83.3 miles of sewer pipe were lined in place using cast in place pipe (CIPP) lining methods. This rehabilitation work was initiated in 2002 and is on-going.

1.3 Objectives

The City of South Gate Sewer Master Plan has been prepared to evaluate the City's sewer system for existing and future conditions. The purpose of this Master Plan is to identify deficiencies in the existing public sewer system, prioritize the deficient reaches, recommend alternatives to eliminate the deficiencies, and thereby provide the City with a basis for improvements in its sewer infrastructure management system. As the City is in the process of upgrading its Geographic Information System (GIS), an important element of the project was ensuring that all sewer maps be compatible for ArcView GIS software for importing and exporting data into any future sewer modeling programs.

The main objectives of this master plan are to:

1) Review and update a hydraulic model of the existing system to identify capacity deficiencies, features, item/elements, and necessary upgrades and improvements or new systems based upon future growth and development;

2) Identify a timeframe and the cost of maintaining, repairing, replacing, upgrading, and installing of new sewer system improvements based upon the growth forecast and condition, age, and capacity of existing sewer lines;

3) Identify funding mechanisms and strategies for the maintenance, repair, replacement, upgrade, and installation of sewer system improvement.

1.4 Report Organization

This Master Plan is organized into the following sections:

- **Section 1: Introduction** presents background information on the City of South Gate, previous reports on the sewer system, and discussions of the Master Plan's objectives.
- **Section 2: Existing System Description** describes the boundaries, geography, land use, population, and existing sewer system considered within the study.
- **Section 3: Sewer Flows** describes the existing and future sewer flows that are calculated for the sewer system.
- **Section 4: Sewer System Evaluation** describes the hydraulic analysis conducted for the sewer system and the City's on-going rehabilitation program
- **Section 5: Capital Improvement Program** describes the proposed Capital Improvement Program for the sewer system

1.5 Abbreviations and Definitions

The following lists and defines abbreviations often used in this study.

AF	acre-feet
CIP	Capital Improvement Program
CIPP	Cured-in-place piping
City	City of South Gate
d/D	Depth to Diameter
GIS	Geographic Information System
gpm	gallons per minute
I/I	Inflow and Infiltration
LACSD	County Sanitation Districts of Los Angeles County
MWD	Metropolitan Water District of Southern California
PWWF	Peak Wet Weather Flow
SSMP	Sewer System Management Plan
SSO	Sanitary Sewer Overflows
VCP	Vitrified Clay Pipe
WDR	General Waste Discharge Requirements
WMP	Water Master Plan

Section 2: Existing System Description

2.1 Description and Boundaries

As shown in Figure 1-1, the City of South Gate is located in Los Angeles County, south of the downtown area of the City of Los Angeles. The City provides sewer collection service to users within its boundaries.

2.2 Population

The City began as a small agricultural outpost but has become an increasingly urbanized city, with a prevalent Spanish and Latino heritage[1]. Currently, South Gate is home to approximately 99,000 people, which is double the City's population in 1960 and about 4 percent higher than the population in 2010[2]. The City is largely made up of families and residential neighborhoods but does still retain areas dedicated to manufacturing and industrial uses. Because the City is nearly built out, the population is not expected to grow more than 2 percent every five years until 2040[2]. As such, the City's sewer flows are not expected to increase dramatically.

2.3 Land Use

As described in the 2018 Water Master Plan, land uses within the City include residential, commercial, general industrial, and several public/institutional categories. The City is almost built out, with only two areas currently planned for development: the Gateway Specific Plan mixed use development, and the Garfield Avenue residential development.

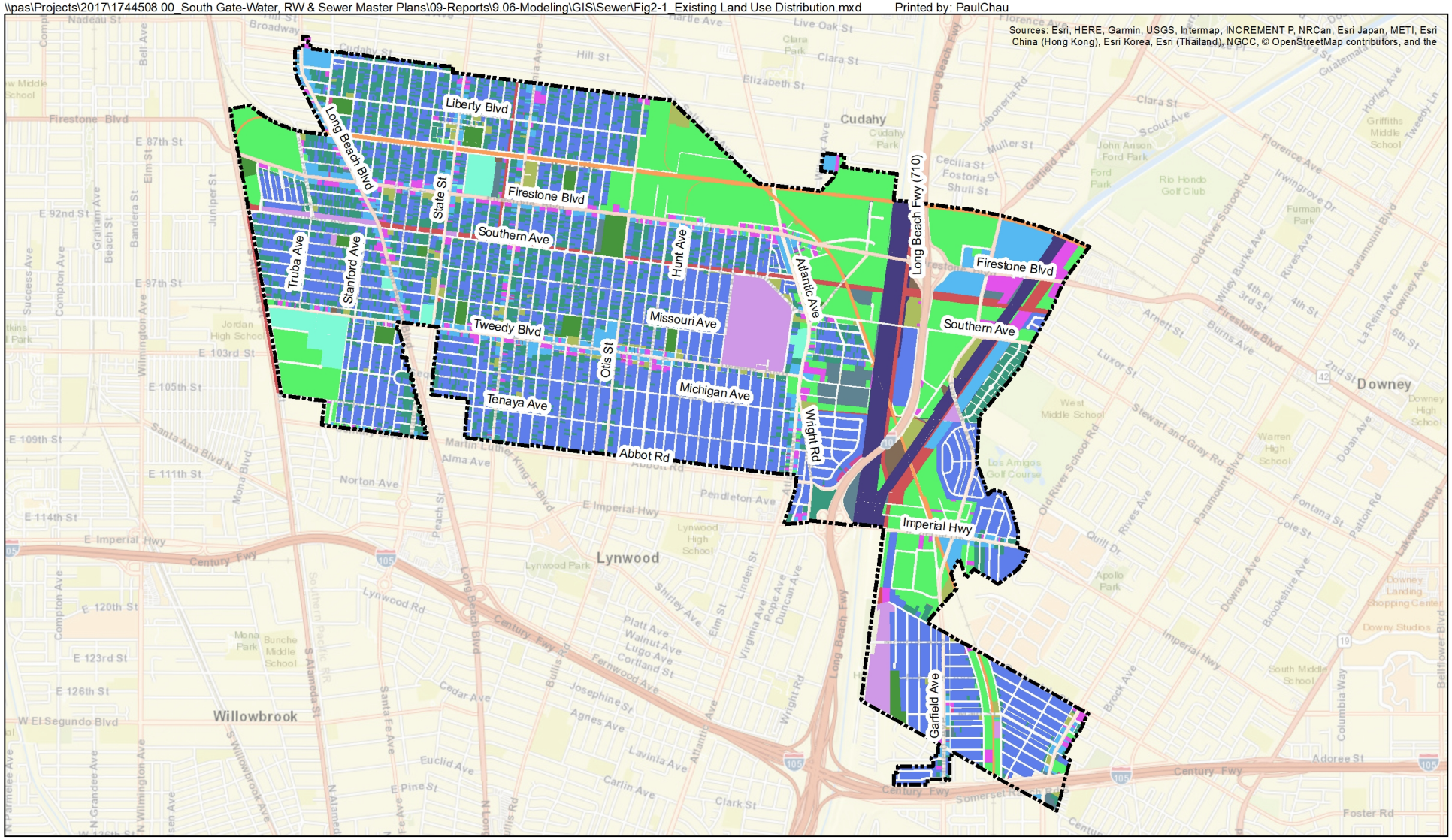
The size in acres and the percentages of each land use category within City boundaries are shown in Table 2-1. The City's existing and future land use distribution is shown on Figure 2-1.

Table 2-1: South Gate Existing Land Use

Use	Acres	Percent of Total
Residential	1,966	41.0%
Transportation	968	20.1%
Industrial	762	15.9%
Public Works, Water Bodies, Easements	342	7.1%
Commercial	308	6.4%
Parks	166	3.4%
Schools	109	2.3%
Civic/Institutional	99	2.1%
Vacant	80	1.7%
Total	4,800	

[1] https://www.cityofsouthgate.org/258/City-Statistics
[2] City of South Gate 2015 Urban Water Management Plan (2016)

\\pas\Projects\2017\1744508 00_South Gate-Water, RW & Sewer Master Plans\09-Reports\9.06-Modeling\GIS\Sewer\Fig2-1_Existing Land Use Distribution.mxd Printed by: PaulChau



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City Limits

Existing Landuse

- CIVIC/INSTITUTIONAL
- COMMERCIAL 1
- COMMERCIAL 2
- EASEMENT
- FLOOD CONTROL EASEMENT
- GENERAL INDUSTRIAL
- MULTI-FAMILY RESIDENTIAL
- PARK
- PUBLIC WORKS
- RAILROAD
- RESIDENTIAL/LANDSCAPING
- SCHOOL
- SCHOOL WITH GREEN AREA
- SINGLE-FAMILY RESIDENTIAL
- VACANT

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City of South Gate Sewer Master Plan
South Gate, California

Existing Land Use Distribution

K/J 1744508*00
August 2018
Figure 2-1

2.4 General Sewer System Description

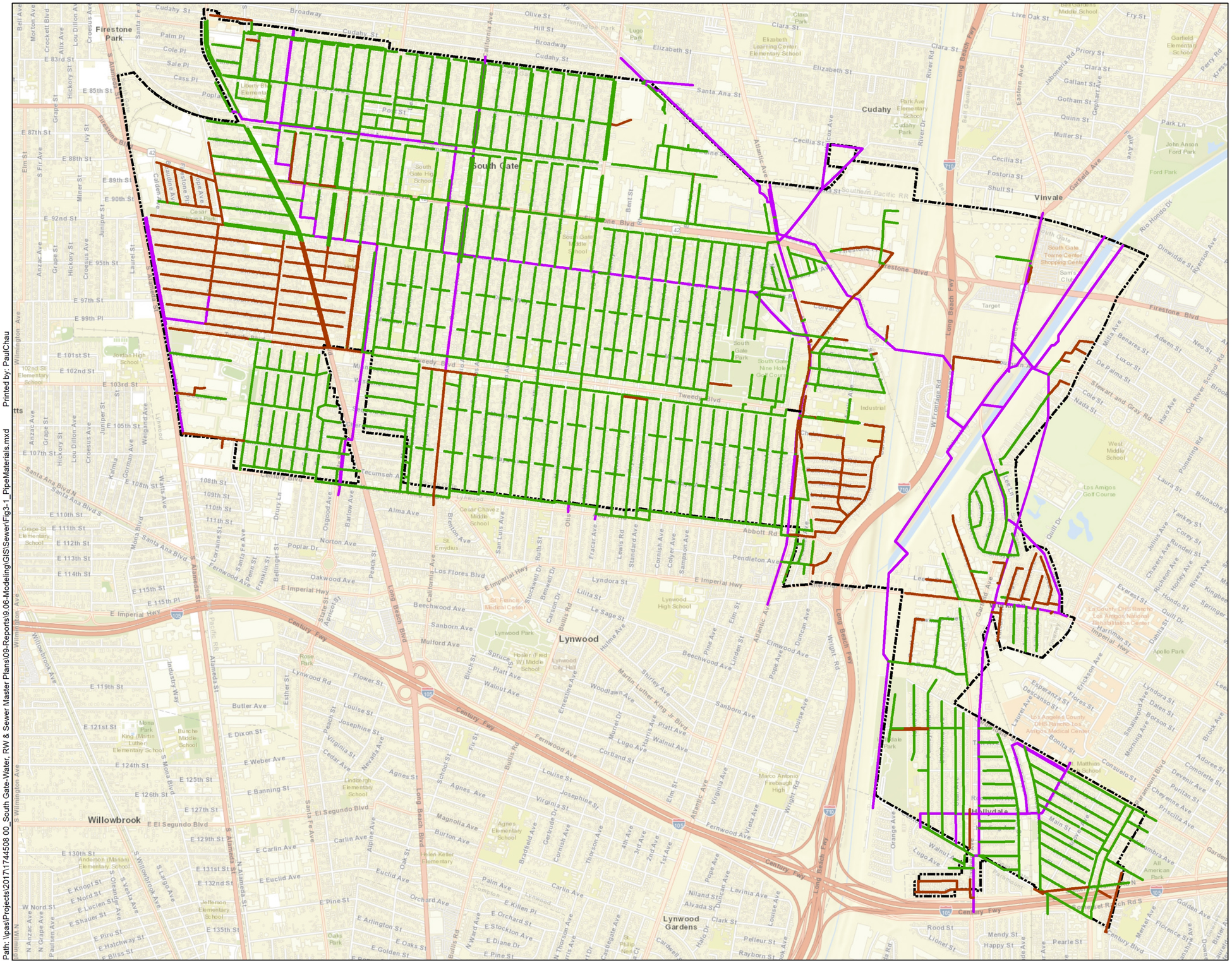
The sewer system is managed by the City's Public Works Department and consists of approximately 120 miles of gravity sewer lines. Nearly all sewer pipelines within the City are made of concrete or vitrified clay, as shown in Figure 2-2. The pipelines range in diameter from 4-inch to 27-inch, with majority 8-inches in diameter. The current sewer system age ranges from 40 years to over 90 years old. Approximately 96 miles of pipeline were relined with cured-in-place piping (CIPP) between 2002 and present. There are approximately 2,400 manholes within the system and no lift stations.

Generally, sewer flows within the City flow by gravity from north to south, as shown in Figure 2-3. Approximately 99 percent of local wastewater flows discharge into LACSD facilities for transportation, treatment, and disposal. The remaining one percent of total sewage passes into the City of Paramount system and is then discharged into LACSD facilities.

Table 2-2: Linear Feet of Pipeline by Diameter

Diameter (in.)	Linear Feet
4	302
6	1,007
8	560,509
10	24,559
12	15,717
15	16,562
16	79
18	3,201
21	1,852
24	397
27	35
Total	**624,218**

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community



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South Gate Pipelines

- Concrete
- Unknown
- VCP
- LACSD Pipelines
- South Gate City Boundary

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Miles

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South Gate Sewer Master Plan
South Gate, CA

South Gate Sewer System Pipeline Materials

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Figure 3-1

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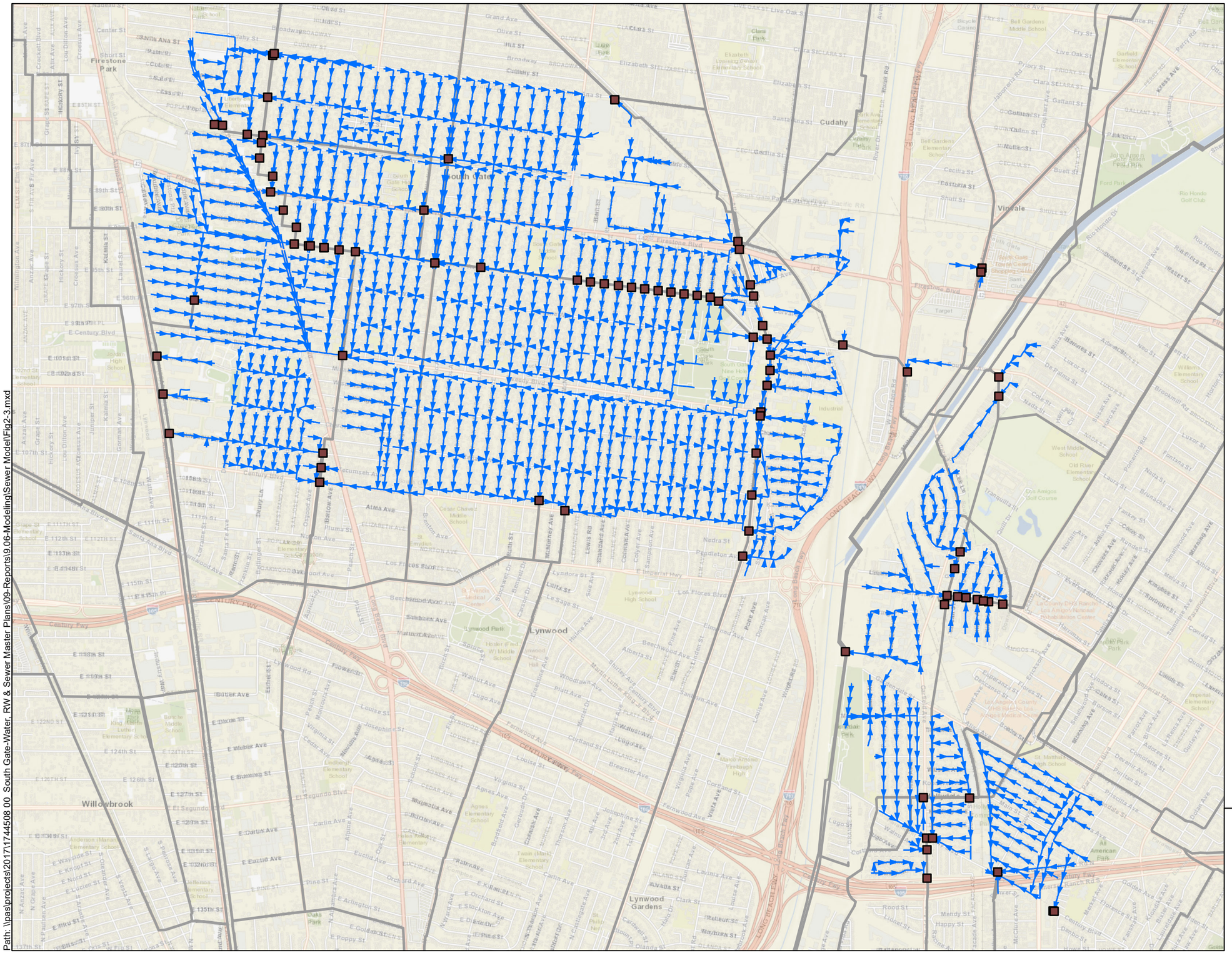

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Pipe

- South Gate Sewer System
- LACSD Sewer System

Outlet

- Connections to LACSD System

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South Gate Sewer Master Plan
South Gate, CA

Flow Directions

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June 2019

Figure 2-3

Section 3: Sewer Flows

This section describes the estimated sewer flows utilized to analyze the sewer system capacity under existing and future conditions.

3.1 Existing Flows

The City's sewer system conveys flows from users within the City, including the Hollydale neighborhood. Since Hollydale is served potable water by the Golden State Water Company, the methodology for calculating sewer flow for the neighborhood is slightly different than for the rest of the City, as described in Section 3.1.2. A discussion on sewer conveyance for Walnut Park is also provided in Section 3.1.3, which describes how flow from Walnut Park directly enters the LACSD sewer system and does not impact the City's system.

3.1.1 City Sewer Flows

Sewer flows for the City under existing conditions are developed based on existing water demands and sewer flow return ratios organized by land use categories.

Existing average day potable water demands are developed as part of the 2018 Water Master Plan (WMP) project. Based on an analysis of demands over the past several years, 2016 is selected as the representative year to reflect existing water demands, which had a total demand of 6,756 acre-feet (AF)

For each customer account, a sewer flow is calculated based on land use and an associated sewer flow return flow ratio assigned for each land use category. The return ratios provide the percentage of potable water demand that is returned to the sewer system via drains, sinks, and other outlets. Typically, almost all indoor potable water demand is assumed to return to the sewer system. Almost all outdoor water demand, such as landscape irrigation, is assumed to not return to the sewer system. Hence, users with intense outdoor water demands are assumed to have low sewer return ratios. Based on industry standards and past project experience, Table 3-1 provides the sewer return ratios utilized for each land use category within the City.

Table 3-1: Sewer Flow Return Ratios by Land Use Category

Land Use Category	Sewer Flow Return Ratio
Civic/Institutional	60%
Commercial 1	80%
Commercial 2	80%
Easement [1]	50%
Flood Control Easement	0%
General Industrial	90%
Mixed Use	90%
Multi-Family Residential	80%
Park	20%
Public Works	70%
Railroad [2]	60%
Residential/Landscaping	0%
School	50%

Land Use Category	Sewer Flow Return Ratio
School With Green Area [3]	50%
Single-Family Residential	70%

Notes:

1. Mainly consists of properties owned by Southern California Edison and Los Angeles Department of Water & Power
2. Mainly consists of residential areas
3. Based on a visual analysis of GIS data, users within this land use category are similar to users under the School category

Utilizing existing annual average potable water demands and the sewer return ratios, existing average sewer flows for each land use category are provided in Table 3-2. The total sewer flow for the City is 3,461 gpm, which is approximately 66 percent of the total existing annual average potable water demand.

Table 3-2: Existing Average Sewer Flows by Land Use Category

Land Use Category	Existing Average Sewer Flows (gpm)
Civic/Institutional	106
Commercial 1	159
Commercial 2	449
Easement	24
Flood Control Easement	-
General Industrial	355
Mixed Use	12
Multi-Family Residential	1,090
Park	57
Public Works	6
Railroad	21
Residential/Landscaping	-
School	61
School with Green Area	72
Single-Family Residential	942
Total	**3,354**

3.1.2 Hollydale Sewer Flows

The Hollydale neighborhood is located in the southeast corner of the City, as shown in Figure 3-1. This neighborhood is served potable water by Golden State Water Company, but sewer collection is conducted by the City. Estimating sewer flows in this area requires a different methodology than the one utilized for the rest of the City. For Hollydale, sewer flows are estimated using duty factors (gpm per acre) calculated from sewer flow and land use data for the overall City. For each parcel, a sewer flow is calculated based on its acreage and the duty factors.

The sewer flow duty factors for each land use category are provided in Table 3-3. The duty factors are calculated by dividing the existing average sewer flow for each land use category by the total area of that category. The duty factors are applied to the parcels within the Hollydale neighborhood and the resultant sewer flows are summarized in Table 3-4. The neighborhood has an estimated total existing average sewer flow of 204 gpm, which is about 6 percent of the total City sewer flow.

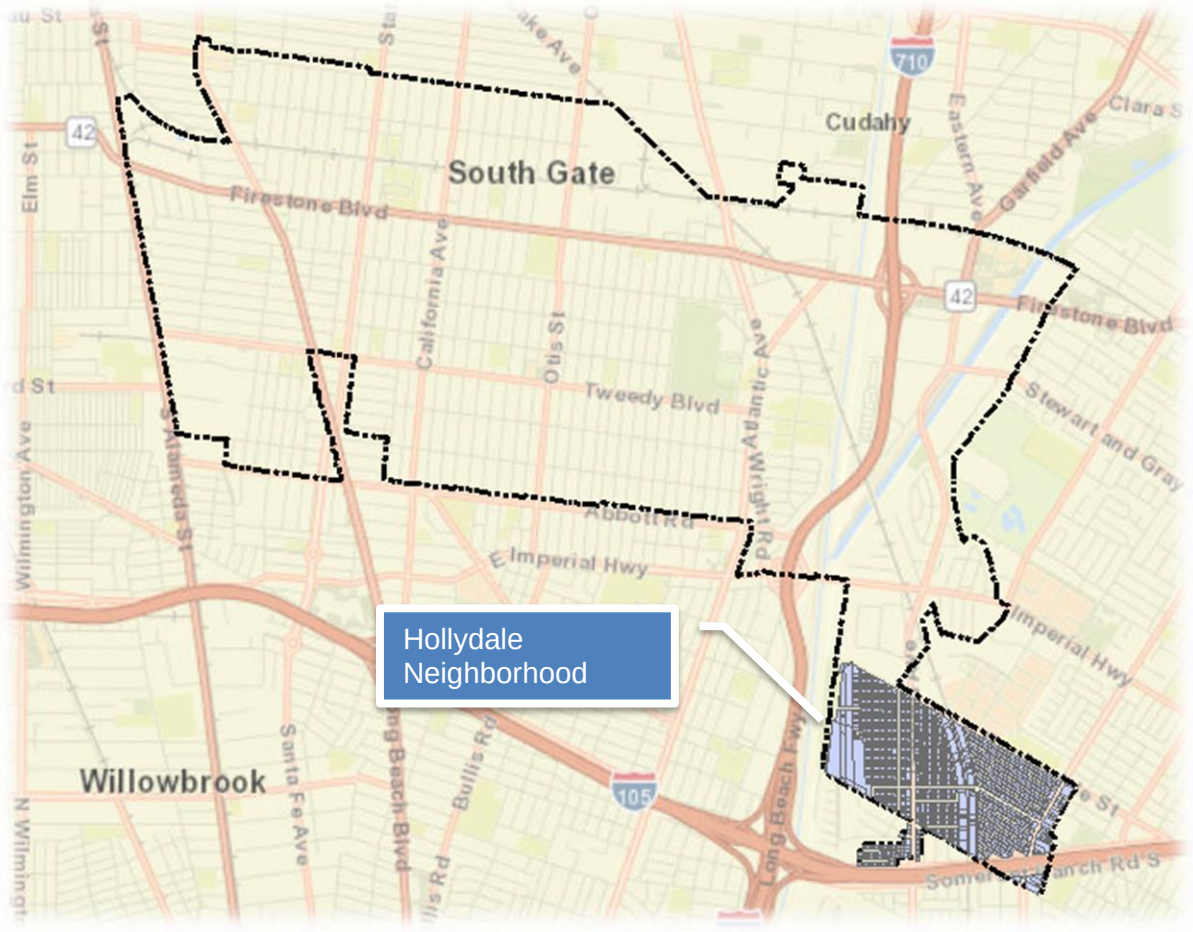


Figure 3-1: Hollydale Location Map

Table 3-3: City Sewer Flow Duty Factors

Land Use Category	Existing Average Sewer Flows (gpm)	Area (acres)	Flow Duty Factors (gpm/acre)
Civic/Institutional	106	73	1.46
Commercial 1	159	108	1.47
Commercial 2	449	240	1.87
Easement	24	73	0.33
Flood Control Easement	-	158	-
General Industrial	355	677	0.52
Mixed Use	12	29	0.42
Multi-Family Residential	1,090	569	1.91
Park	57	147	0.39
Public Works	6	10	0.65
Railroad	21	72	0.29

Land Use Category	Existing Average Sewer Flows (gpm)	Area (acres)	Flow Duty Factors (gpm/acre)
Residential/Landscaping	-	6	-
School	61	133	0.46
School with Green Area	72	80	0.90
Single-Family Residential	942	1,370	0.69
Total	**3,354**	**3,747**	**0.90**

Table 3-4: Hollydale Sewer Flow Analysis

Land Use Category	Area (acres)	Flow Duty Factors (gpm/acre)	Existing Average Sewer Flow (gpm)
Civic/Institutional	4.4	1.46	6.4
Commercial 1	9.6	1.47	14.1
Commercial 2	8.6	1.87	16.1
General Industrial	22.1	0.52	11.6
Multi-Family Residential	9.8	1.91	18.8
Park	31.1	0.39	12.0
Railroad	4.4	0.29	1.3
Residential/Landscaping	0.7	-	-
School	8.8	0.46	4.0
Single-Family Residential	177.3	0.69	121.8
Total	**276.7**		**206.1**

3.1.3 Walnut Park Sewer Flows

Walnut Park is census-designated place in unincorporated Los Angeles County that straddles the northwestern border of the City, as shown in Figure 3-2. There was a general understanding that sewer flow collected in Walnut Park is discharged in the City. Upon a close analysis of Walnut Park's sewer collection system, which flows by gravity from north to south, it is determined that although Walnut Park's sewer flows terminate within the City's limit, they ultimately discharge to a LACSD trunk sewer, not a City sewer main.

Based on a review of the sewer system as-builts, Walnut Park's sewer collection system can be delineated into three distinct sewersheds, as shown in Figure 3-3. Each sewershed discharges directly to the LACSD sewer system. The discharge locations for each sewershed are shown in Figure 3-4, Figure 3-5, and Figure 3-6.

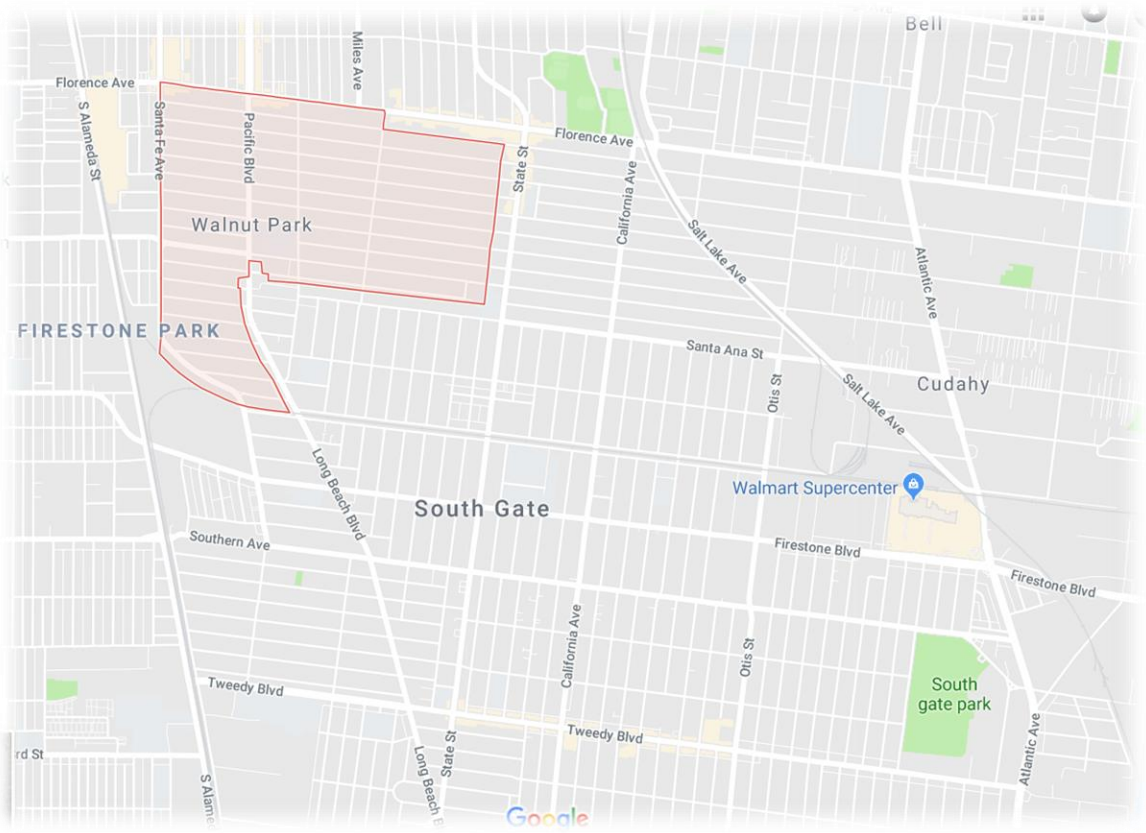
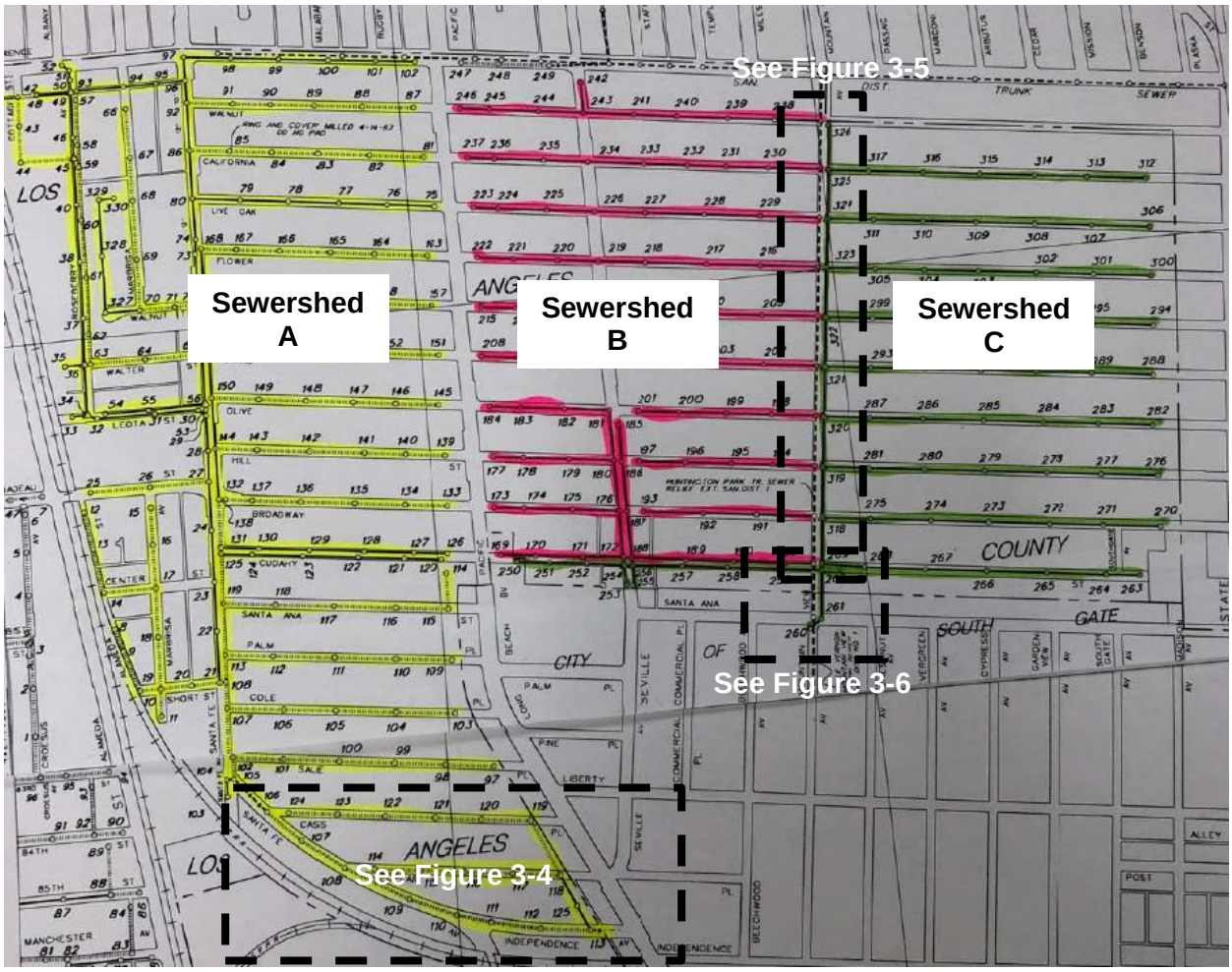


Figure 3-2: Walnut Park Location Map



Note: each colored area represents a sewershed within Walnut Park, with flows draining by gravity from north to south. Each sewershed drains to an LACSD trunk main.

Figure 3-3: Walnut Park Sewer System Delineation

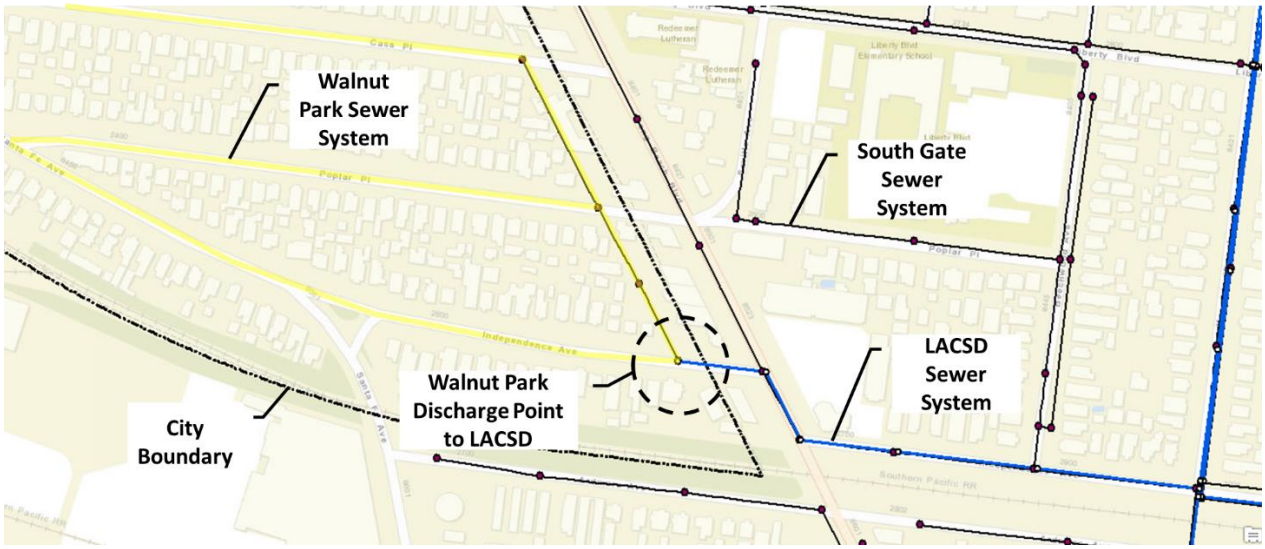


Figure 3-4: Walnut Park Sewershed A Discharge Location

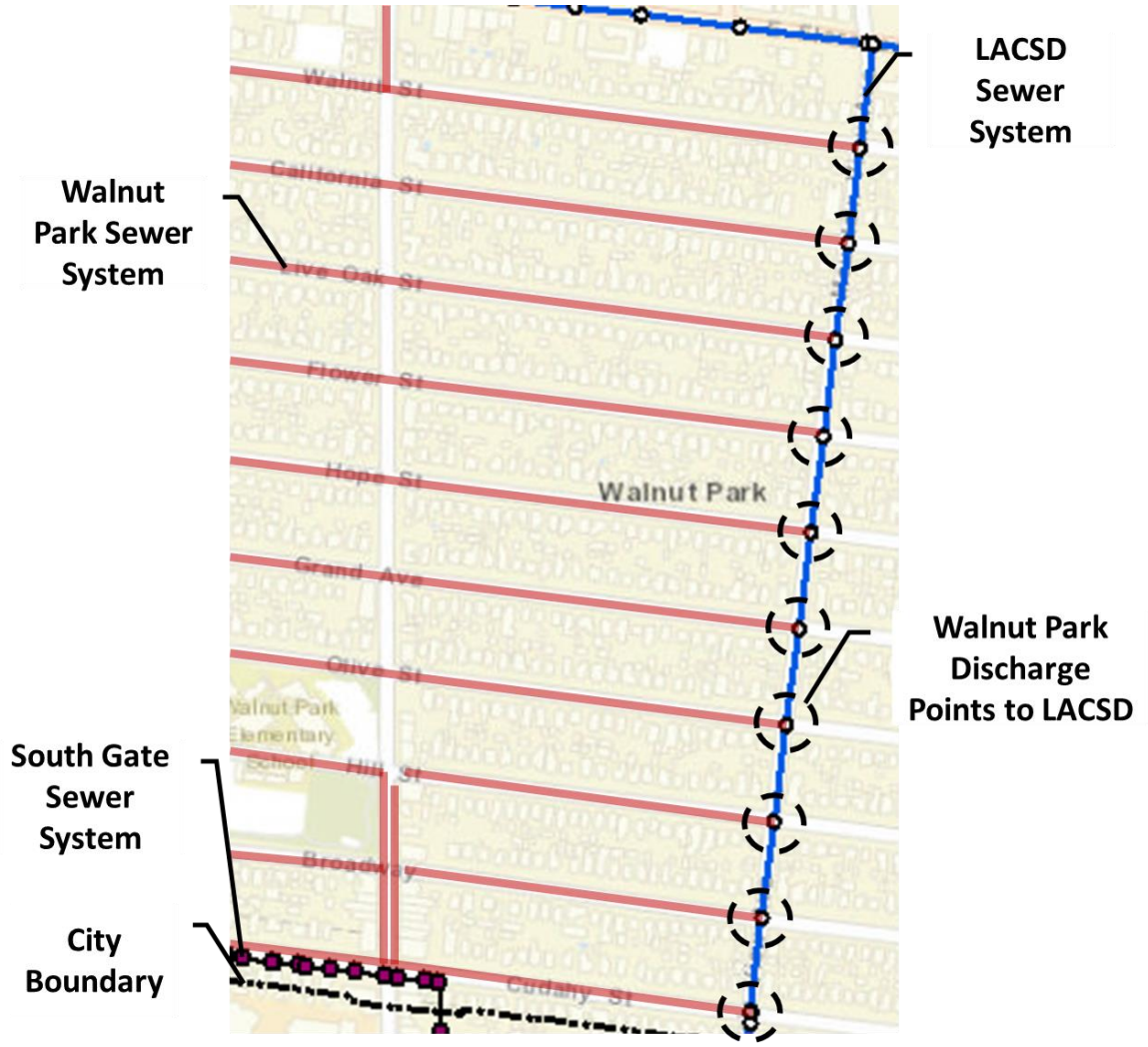


Figure 3-5: Walnut Park Sewershed B Discharge Locations to LACSD

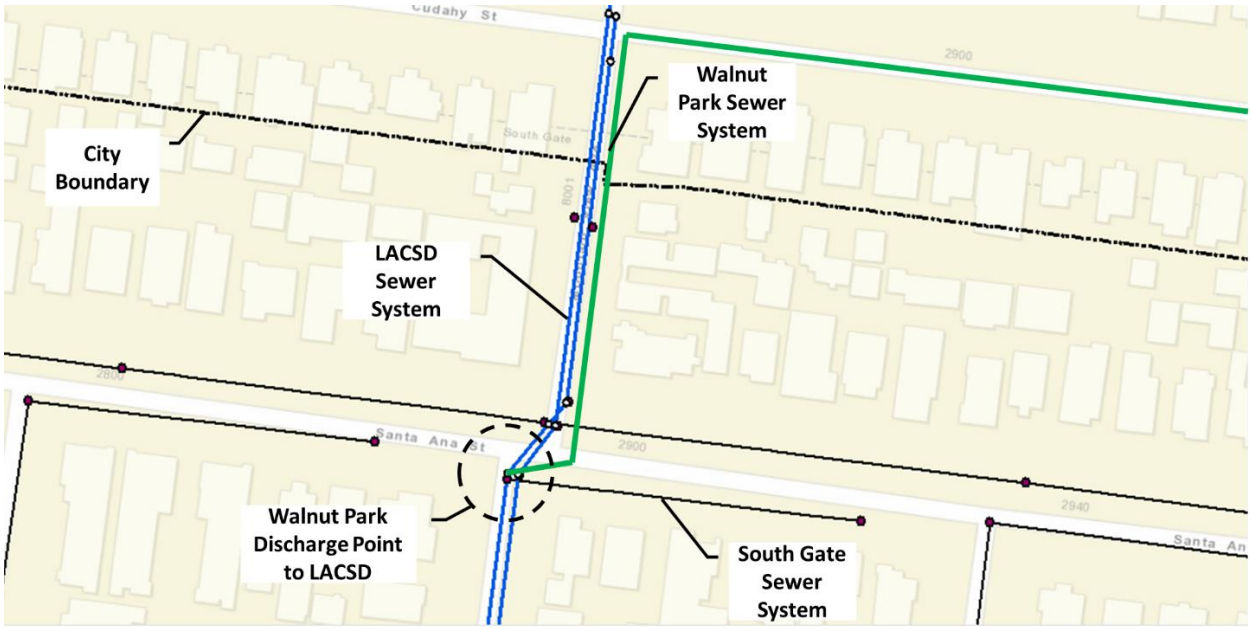


Figure 3-6: Walnut Park Sewershed Discharge Location to LACSD

3.1.4 Total Flows

The total existing average sewer flows for the City, including the Hollydale neighborhood, is provided in Table 3-5. As previously described, flows from Walnut Park are conveyed directed to the LACSD sewer system and do not impact the City sewer system.

Table 3-5: Total Existing Average Sewer Flows by Land Use Category

Land Use Category	Existing Average Sewer Flows (gpm)
General City Area	
Civic/Institutional	106
Commercial 1	159
Commercial 2	449
Easement	24
Flood Control Easement	-
General Industrial	355
Mixed Use	12
Multi-Family Residential	1,090
Park	57
Public Works	6
Railroad	21
Residential/Landscaping	-
School	61
School with Green Area	72
Single-Family Residential	942
Subtotal	**3,354**
Hollydale Neighborhood	

Land Use Category	Existing Average Sewer Flows (gpm)
Civic/Institutional	6
Commercial 1	14
Commercial 2	16
General Industrial	12
Multi-Family Residential	19
Park	12
Railroad	1
Residential/Landscaping	-
School	4
Single-Family Residential	122
Subtotal	206
Total Existing Flows	**3,560**

3.2 Future Flows

As described in the 2019 WMP, the City is nearly built out, with approximately 60 acres of developable vacant land. The vacant land is planned to be developed into several different land uses including commercial, residential, industrial, and schools. The City's total potable demand at buildout is estimated as sum of the following demand components:

- Existing Demands
- Future Demands Associated with Known Developments (Gateway Specific Plan and Garfield Avenue Apartments)
- Demand Increase Due to Change in Land Use

Future build-out average sewer flows for the City are provided in Table 3-6, which are calculated using a similar methodology to the one used for calculating existing average sewer flows.

Table 3-6: Future Average Build-Out Sewer Flows by Land Use Category

Land Use Category	Future Average Build-Out Sewer Flows (gpm)
General City Area	
Civic/Institutional	107
Commercial 1	197
Commercial 2	553
Easement	24
Flood Control Easement	-
General Industrial	367
Mixed Use	43
Multi-Family Residential	1,095
Park	61
Public Works	8
Railroad	46
Residential/Landscaping	-

Land Use Category	Future Average Build-Out Sewer Flows (gpm)
School	67
School with Green Area	74
Single-Family Residential	951
Subtotal	***3,591***
Hollydale Neighborhood	
Civic/Institutional	6
Commercial 1	14
Commercial 2	16
General Industrial	12
Multi-Family Residential	19
Park	12
Railroad	1
Residential/Landscaping	-
School	4
Single-Family Residential	122
Subtotal	***206***
Total Future Buildout Flows	**3,798**

3.3 Peak Wet Weather Flow

Peak wet weather flow (PWWF) is defined as the sewer flow expected during a wet weather event, when stormwater is expected to contribute flows to the sewer system via inflow and infiltration (I/I). This is the peak flow expected in a sewer system and is utilized as the design flow criterion for evaluating the system.

For the City, the PWWF is calculated using the following Federov equation:

$$Q_{peak} = 2.4 \times Q_{average}^{0.89}$$

The peaking equation provides for a larger peaking factor for smaller flows and a smaller peaking factor for larger flows. As shown in Figure 3-7, the peaking factor for a 1 gpm base flow is 2.4, equating to a PWWF of 2.4 gpm, while the peaking factor for a 200 gpm flow is 1.3, equating to a PWWF of 260 gpm.

This peaking equation reflects the fact that I/I flows are mainly influenced by physical factors, such as high groundwater table levels, sewer pipe integrity, and illicit connections. A larger base flow does not necessarily equate to a proportionally larger I/I flow.

Utilizing results from the hydraulic model, the total PWWF for the City is 7,178 gpm under existing conditions and 7,587 under future built out conditions, which are approximately two times the average annual flows, as shown in Table 3-7.

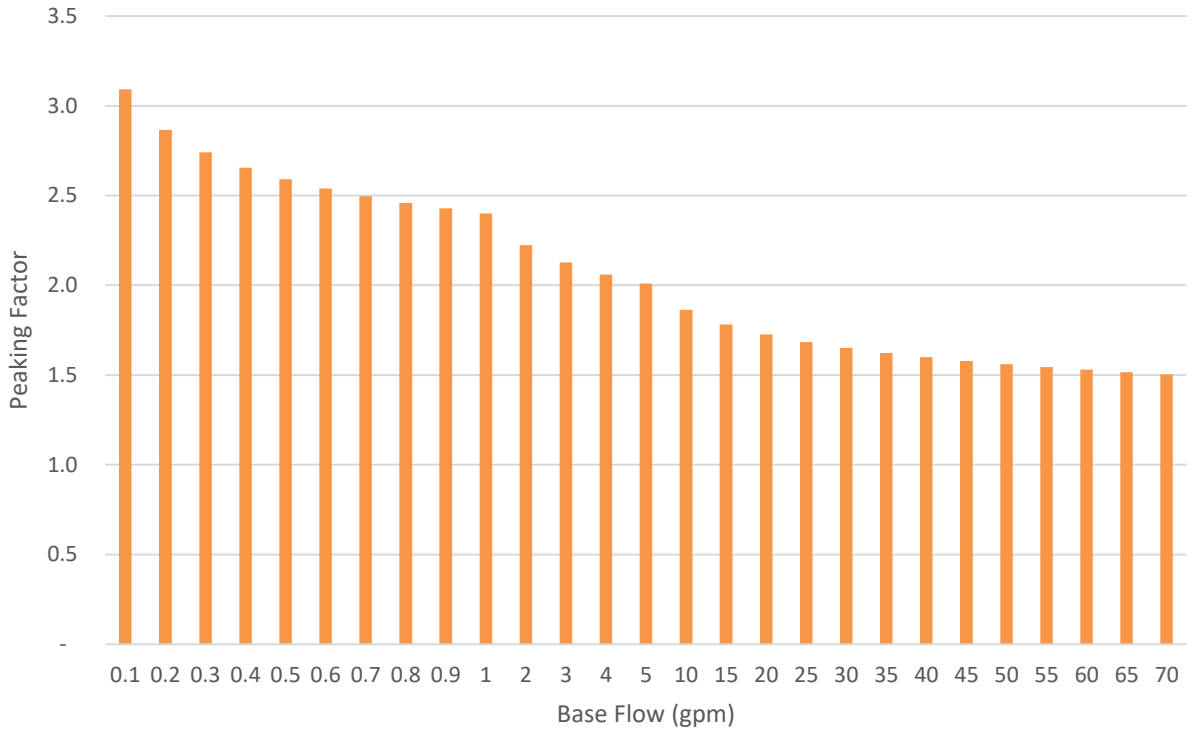


Figure 3-7: Peaking Factors based on Flow Rates

Table 3-7: Total Average and Peak Wet Weather Flows

Demand Scenario	Average Annual Flows (gpm)	Peak Wet Weather Flows (gpm)
Existing	3,560	7,178
Future Buildout	3,798	7,587

Section 4: Sewer System Evaluation

This section describes the hydraulic capacity evaluation for the sewer system.

4.1 Sewer System Design Criteria

As shown in Table 4-1, the sewer system is evaluated under PWWF conditions for both existing and future buildout demands. The pipelines are evaluated by a maximum depth to diameter (d/D) ratio of 0.75. There are no lift stations or storage facilities in the sewer system.

Table 4-1: Sewer System Design Criteria

Item	Value
Design Flow	Peak Wet Weather Flow
Maximum d/D	0.75

4.2 Hydraulic Model Development

A hydraulic model of the sewer system was created utilizing Innovyze InfoSewer software for the purposes of system evaluation. The model consists of elements that represent the City's pipelines, manholes, and connection points (manholes) to the LACSD sewer system. Four steady state scenarios were developed for evaluation, based on demands: existing average demands, existing peak wet weather demands, future buildout average demands, and future buildout peak wet weather demands.

The average demand scenarios were utilized to geocode and allocate demands for each user, whereas the PWWF demand scenarios were utilized for evaluation. The PWWF scenarios apply the peaking factor previously described to each demand node to develop the PWWF.

4.3 Collection System Capacity Evaluation

This section describes the capacity evaluation for the collection system under existing and future buildout flows.

4.3.1 Existing Flows

PWWF for existing conditions are shown in Figure 4-1. The majority of pipelines convey less than 50 gpm. The few pipelines that convey larger flows are either trunk lines collecting flow for tributary areas or serve industrial areas with larger sewer flows.

The d/D ratio for each pipeline is color coded in Figure 4-2. The majority of pipelines have a d/D ratio of less than 0.25 with a small number of pipelines that have a d/D ratio between 0.25 and 0.50. There are a handful of pipelines with a d/D ratio between 0.50 and 0.75 and none with a d/D ratio over 0.75. Hence, no pipelines are recommended for capacity upgrades.

The results of the capacity evaluation are not surprising given the numerous connections to the LACSD system throughout the City. There are 89 connections that are strategically located such

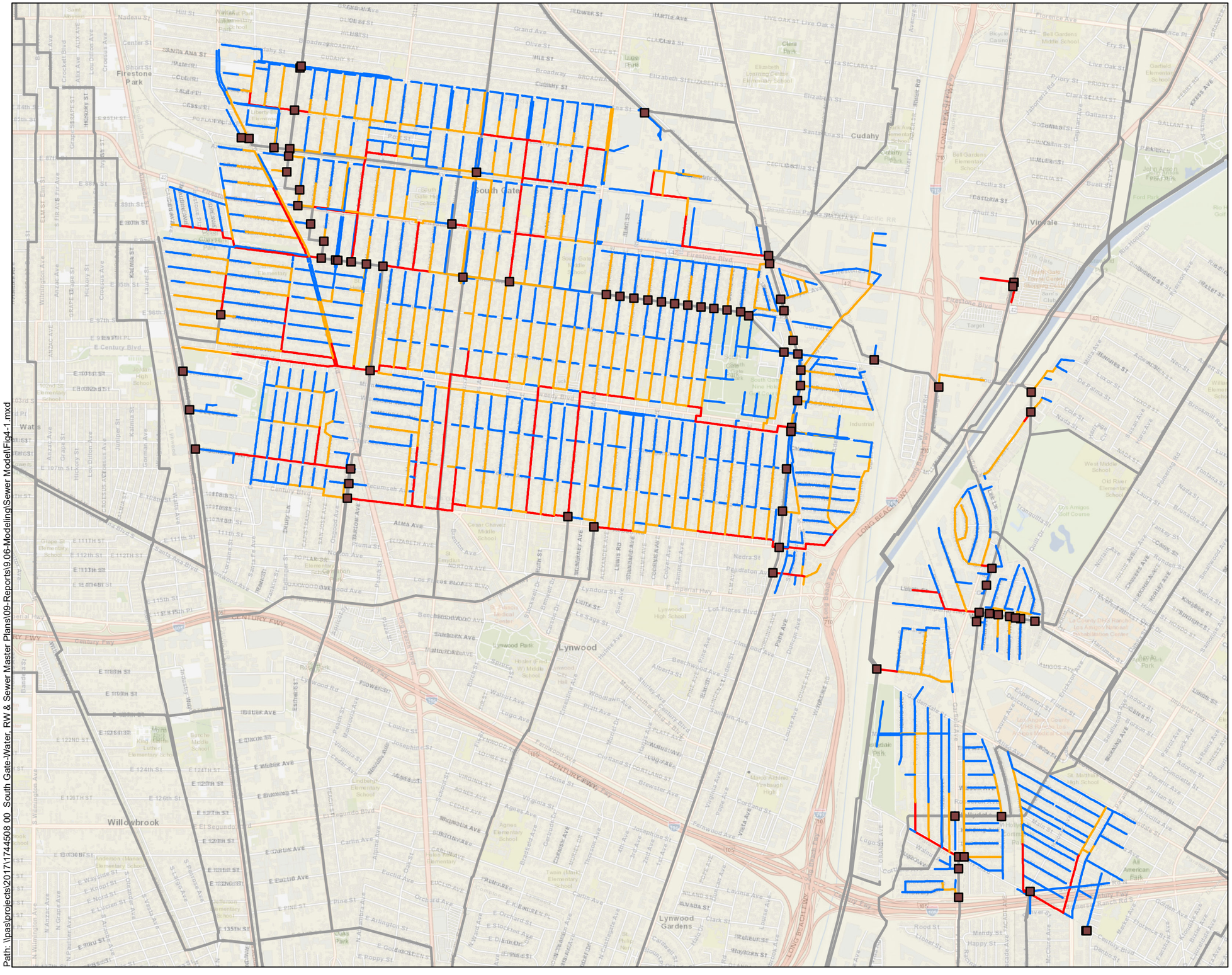
that sewersheds are relatively small and individual pipelines do not need to carry large sewer flows.

4.3.2 Future Flows

With the City essentially built-out, future flows are not anticipated to be that much greater than existing flows. As described in Table 3-7, future buildout PWWF is just six percent greater than existing PWWF. Not surprisingly, the capacity evaluation results for future flow conditions are similar to the existing flow condition. The system flows, and d/D ratios are shown in Figure 4-3 and Figure 4-4, respectively.

Similar to the existing flow capacity evaluation, a majority of pipelines in the system carry small flows and have a d/D ratio of less than 0.25. No pipelines exceed the capacity criterion of d/D greater than 0.75, hence, no pipeline is recommended for capacity expansion.

There are five pipeline segments that have a d/D ratio between 0.5 and 0.75 under modeled PWWF conditions. It is recommended that the City conduct flow monitoring for these pipe segments to validate flows and verify sufficient capacity is available in these reaches. Each pipeline segment and its upstream tributary area is shown in Figure 4-5 through Figure 4-9.



Legend

Sewer Flow

- Less than 10 gpm
- 10 - 50 gpm
- Greater than 50 gpm
- LACSD Sewer System

Outlet

- Connections to LACSD System

N

0 0.5

Miles

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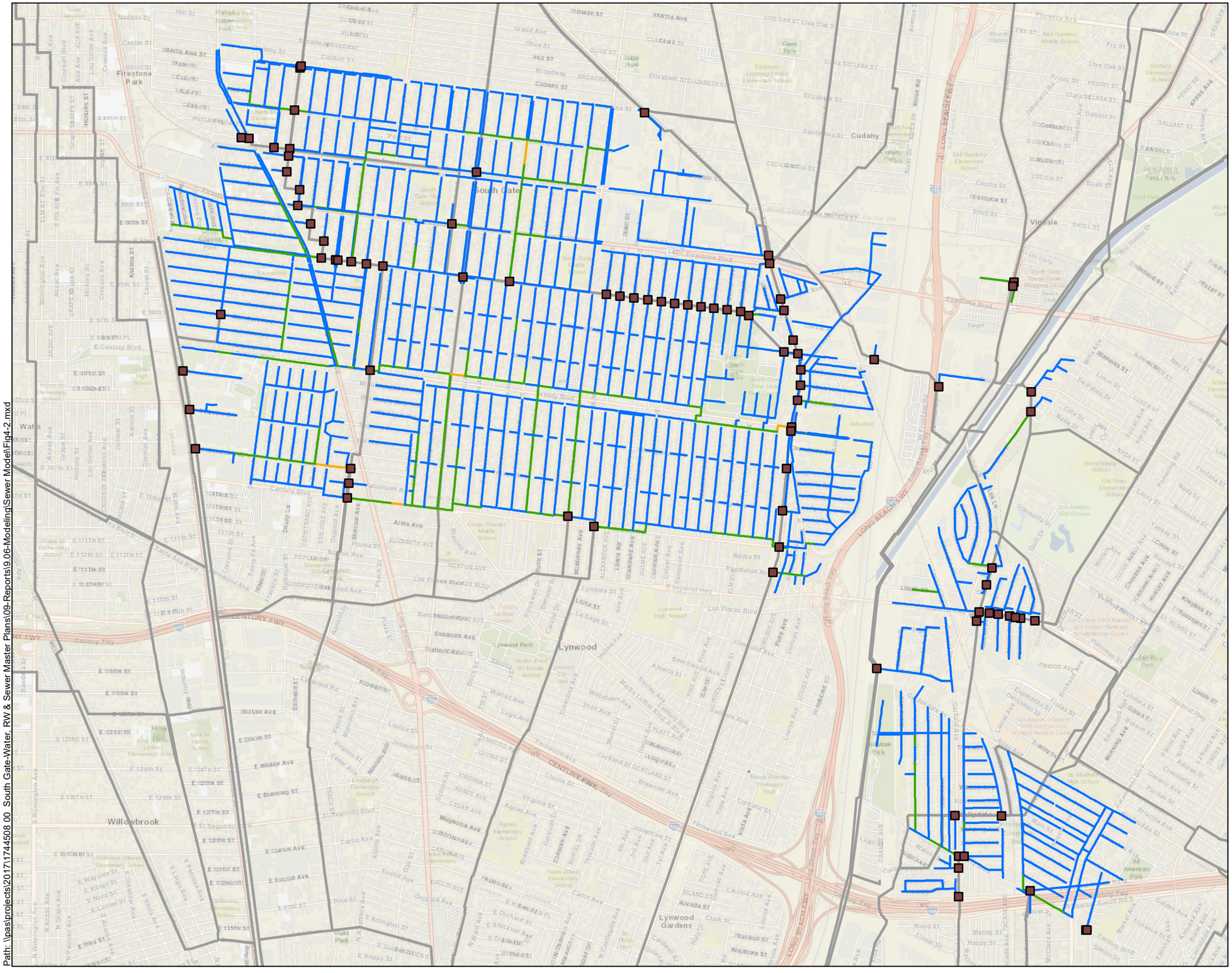
South Gate Sewer Master Plan
South Gate, CA

Existing PWWF Flow

K/J 1744508*00
June 2019

Figure 4-1

Path: \\pas\projects\2017\1744508 00 South Gate-Water, RW & Sewer Master Plans\09-Reports\9.06-Modeling\Sewer Model\Fig4-1.mxd



Legend

d/D Ratio

- Less than 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- Greater than 0.75
- LACSD Sewer System

Outlet

- Connections to LACSD System

N

0 0.5

Miles

Kennedy/Jenks Consultants

South Gate Sewer Master Plan
South Gate, CA

Existing PWWF d/D Ratio

K/J 1744508*00
June 2019

Figure 4-2

Path: \\pas\projects\2017\1744508 00_South Gate-Water, RW & Sewer Master Plans\09-Reports\9.06-Modeling\Sewer Model\Fig4-2.mxd

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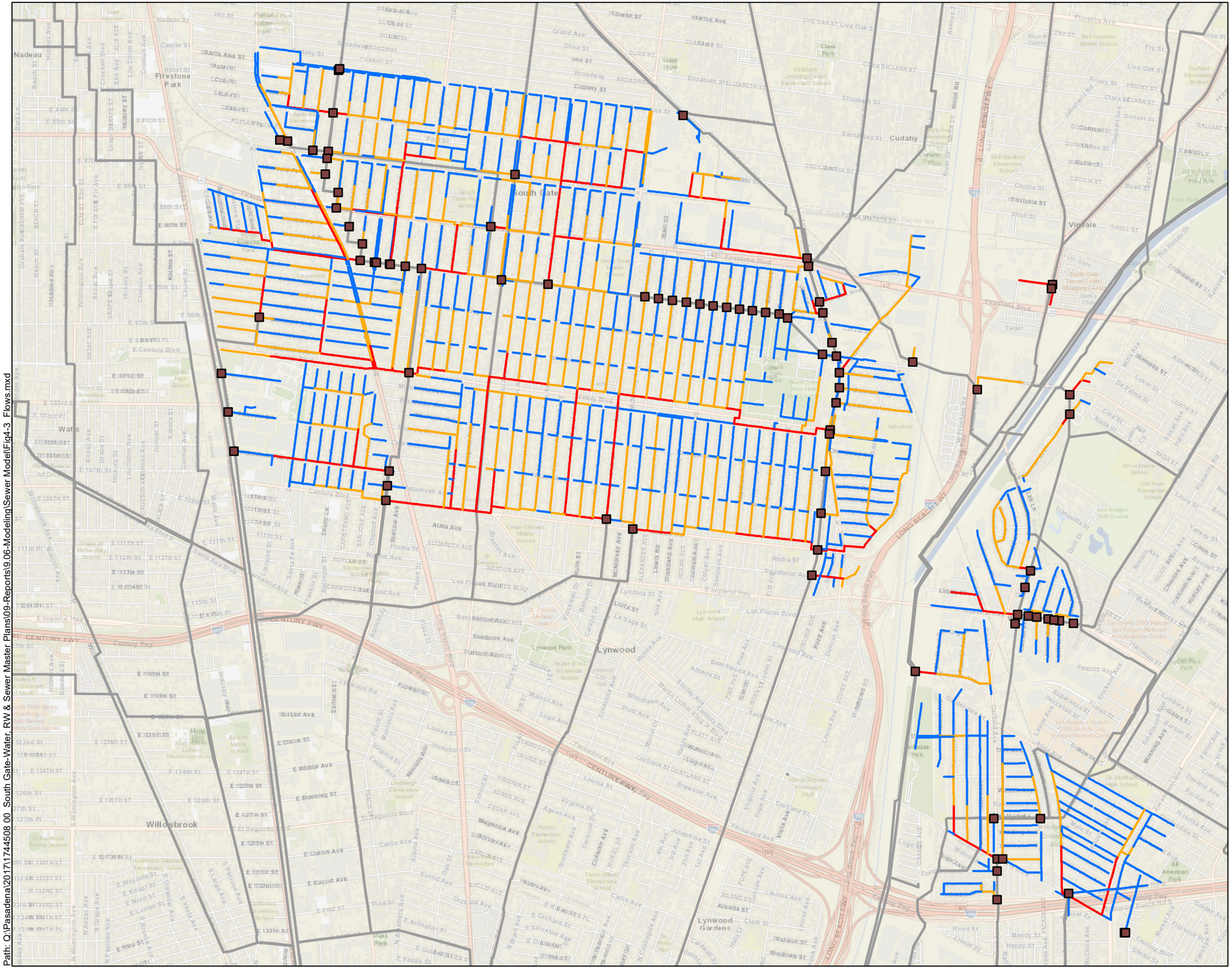


Path: Q:\Pasadena\2017\1744508 00_South Gate-Water, RW & Sewer Master Plans\09-Reports\9.06-Modeling\Sewer Model\Fig4-3_Flows.mxd

Legend

Sewer Flows

- Less than 10 gpm
- 10 - 50 gpm
- Greater than 50 gpm
- LACSD Sewer System

Outlet

- Connections to LACSD System

N

0 0.5

Miles

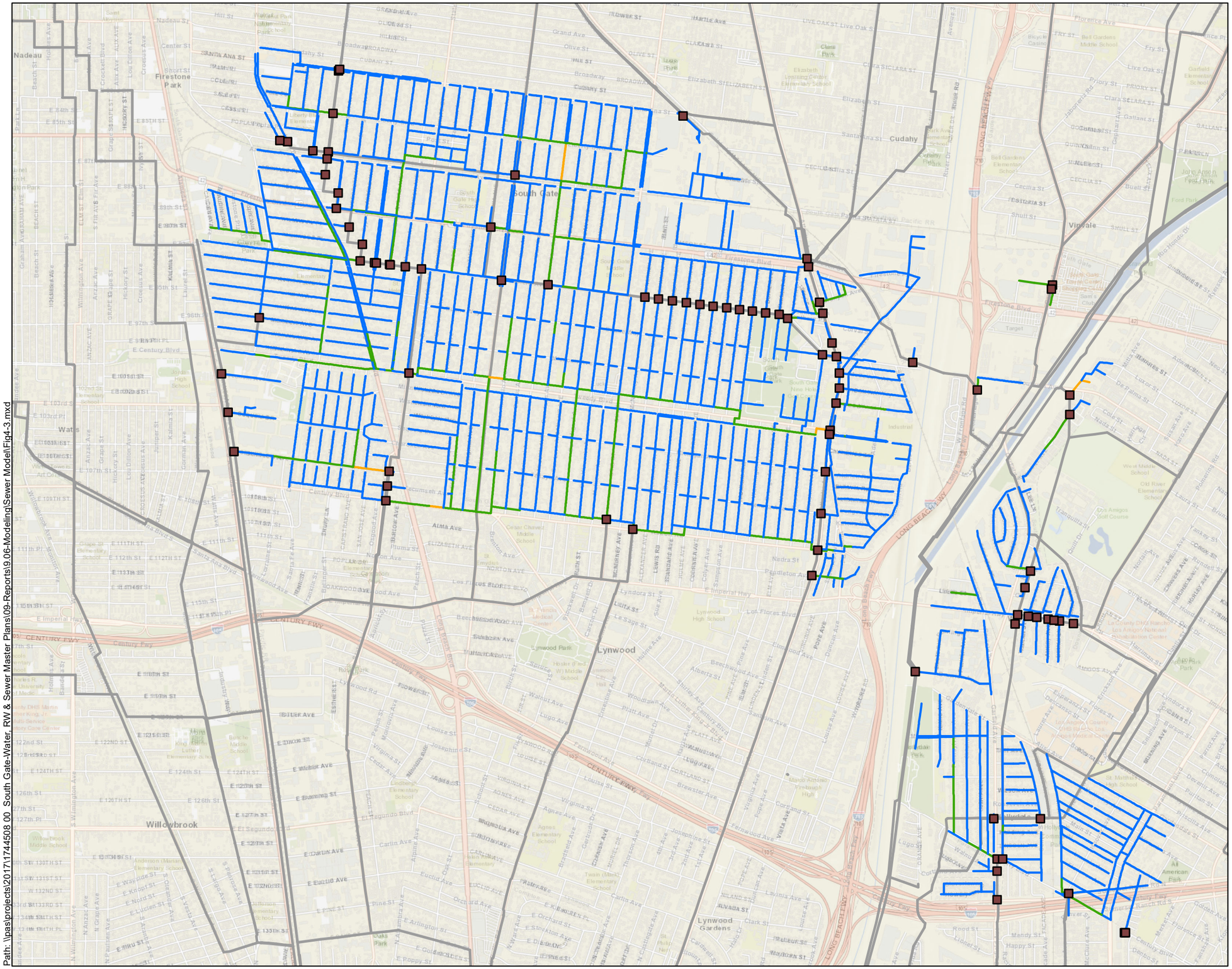
Kennedy/Jenks Consultants

South Gate Sewer Master Plan
South Gate, CA

Future PWWF Flow

K/J 1744508*00
June 2019

Figure 4-3



Legend

d/D Ratio

- Less than 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- Greater than 0.75
- LACSD Sewer System

Outlet

- Connections to LACSD System

N

0 0.5

Miles

Kennedy/Jenks Consultants

South Gate Sewer Master Plan
South Gate, CA

Future PWWF
d/D Ratio

K/J 1744508*00
June 2019

Figure 4-4

Path: \\pas\projects\2017\1744508 00_South Gate-Water, RW & Sewer Master Plans\09-Reports\9.06-Modeling\Sewer Model\Fig4-3.mxd

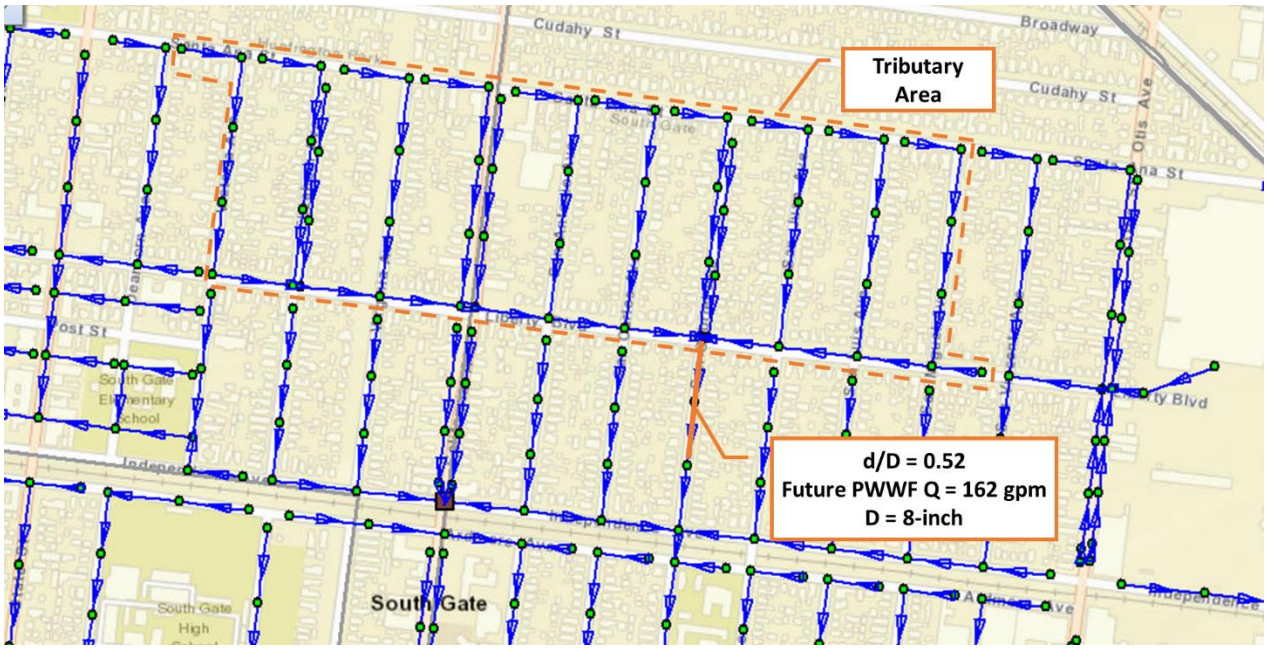


Figure 4-5: d/D > 0.5 Pipeline – San Gabriel Avenue & Liberty Boulevard

Figure 4-6: d/D > 0.5 Pipeline – Tweedy Boulevard Alley & California Avenue

Figure 4-7: d/D > 0.5 Pipeline – Tweedy Boulevard & Atlantic Boulevard

Figure 4-8: d/D > 0.5 Pipeline – Seminole Avenue & State Street

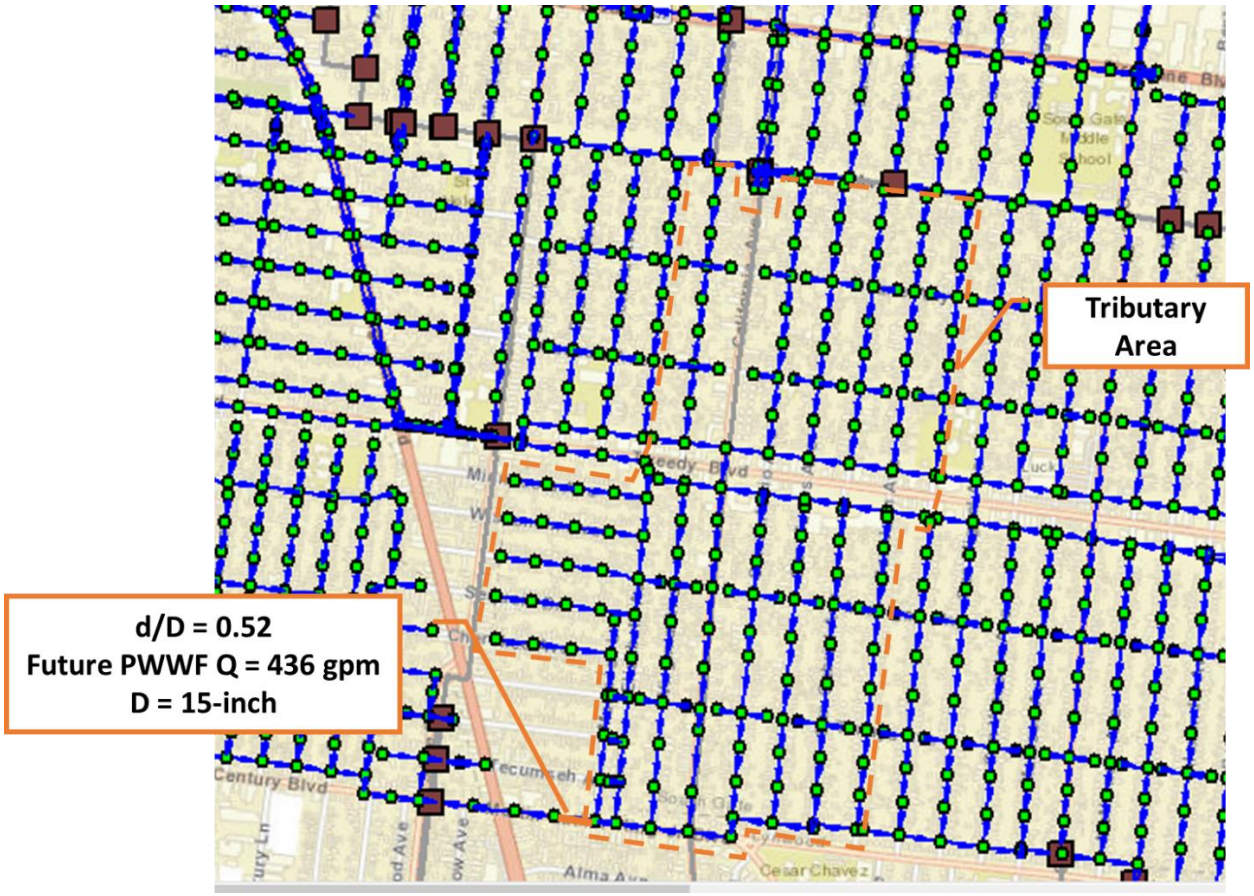


Figure 4-9: d/D > 0.5 Pipeline – Martin Luther King, Jr. Boulevard & Mariposa Lane

4.4 Pipeline Rehabilitation Program

This section describes the City's recent efforts to rehabilitation the sewer system and a proposed pipeline relining program for the City's existing sewer system.

4.4.1 Existing Pipeline Age & Materials

As shown in Figure 2-2, a majority of the sewer pipelines in the City's service area are concrete with the minority consisting of VCP. In general, the concrete piping is found in the central part of the City, between Long Beach Boulevard and Atlantic Avenue, while the VCP piping is located in the eastern and western edges of the City. The City's pipelines were installed generally between 1920 and 1970, which equates to a pipeline age between 50 to 100 years.

A concrete pipe may be expected to have a useful lifespan between 50 and 75 years, but it can be must greater or less than this depending on the level of hydrogen sulfide corrosion within the pipe. VCP is much more resistance to corrosion and can be expected to last 100 years or more if installed properly. VCP piping is brittle and prone to cracking if the proper bedding was not installed or if the soil drifts and places stress on the pipe wall.

4.4.2 Previous Rehabilitation Work

Recognizing the need to rehabilitate the aging concrete pipe in the collection system, the City executed a sewer rehabilitation program from 2002 to present. The City has utilized a condition assessment company to inspect the existing pipelines and make recommendations for rehabilitation or replacement. Approximately 89 miles of concrete piping, 93% of the total concrete pipe in the system and 81% of the entire system, were either lined using cured-in-place piping (CIPP) or replaced with new piping. The previously rehabilitated piping and remaining unlined piping are shown in Figure 4-10.

The information provided on the rehabilitation work was provided by communication with City staff. There wasn't a formal database available that documented the rehabilitation work that has been completed by the City. It is recommended that the City develop a centralized database to document rehabilitation work on the sewer system, which will allow the City to efficiently manage future rehabilitation work.

4.4.3 Proposed Rehabilitation Work

It is recommended that the City continue to evaluate and rehabilitate the sewer pipeline system. The City should continue to utilize a condition assessment company to evaluate the existing pipelines and make recommendations for rehabilitation or replacement. As shown in Figure 4-10, much of the remaining work to be done on the pipeline system is located in the western edge of the City, west of Long Beach Boulevard, and the eastern edge of the City, east of the 710 Freeway. Focus should be placed on the 7% of concrete piping that has not been lined or replaced yet. For the remaining VCP piping, the evaluations should focus on identifying structural damage, such as cracks, or joint displacement. The Capital Improvement Program (CIP), described in Section 5, includes budget to rehabilitate the remaining existing pipeline, which consists of 19% of the total system.

In addition, the CIP includes replacement of three pipeline segments based on recommendations from the City's condition assessment evaluation. As shown in Figure 4-11 and Figure 4-12, the pipeline replacements include 900 feet of 12-inch piping on Imperial Highway, 400 feet of 18-inch piping on Sequoia Drive, and 500 feet of 18-inch piping on Seminole Avenue.

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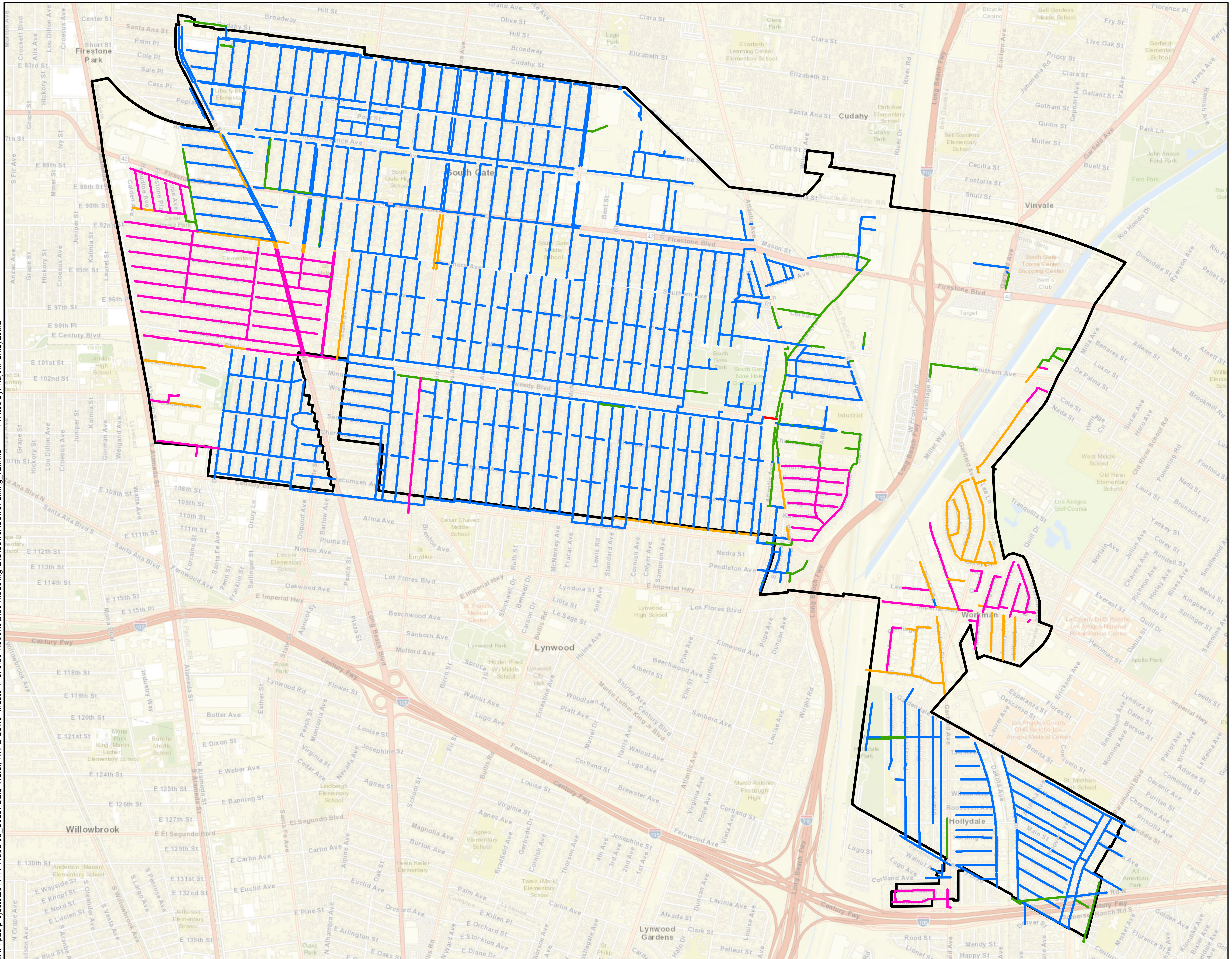

Legend

- Unlined Concrete
- Unlined VCP
- Lined Concrete Pipelines
- Lined VCP
- Lined Unknown Material
- South Gate City Boundary

N

0 0.5 1 Miles

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South Gate Sewer Master Plan
South Gate, CA

Sewer Re-Lining

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June 2019

Figure 4-10

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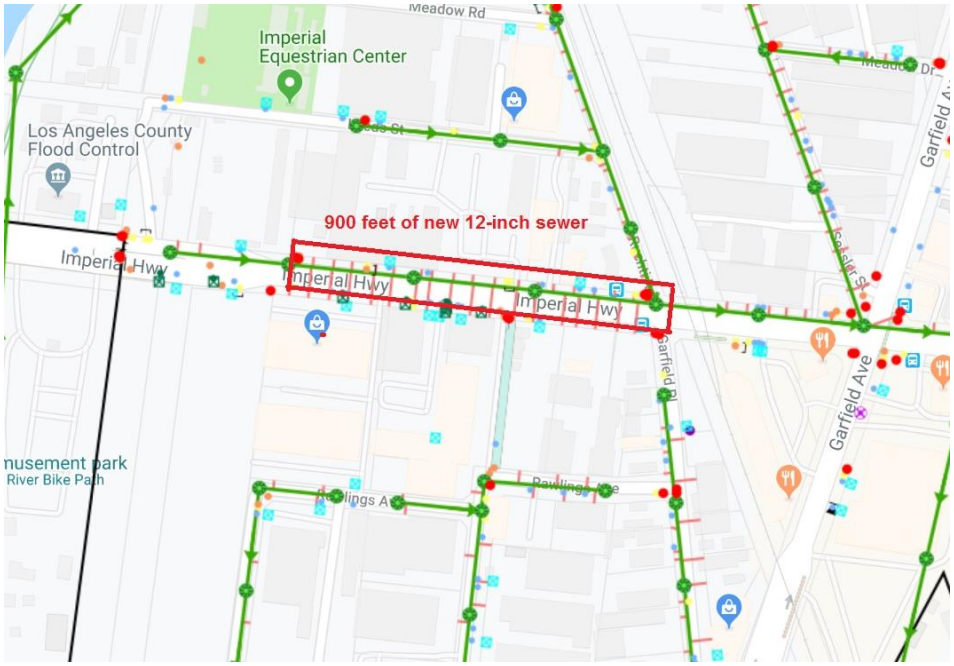

Figure 4-11: Imperial Highway Pipeline Replacement

Figure 4-12: Sequoia Drive and Seminole Avenue Pipeline Replacements

Section 5: Capital Improvement Program

As noted in Section 4, with hydraulic capacity of the sewer system being sufficient for existing and future flows, the 5-year CIP is mainly focused on the pipeline rehabilitation program. As noted in Section 4.4.3, the CIP consists of projects to rehabilitate the remaining portions of the system that have not been recently rehabilitated, and three pipeline replacement projects identified by the City's recent condition assessment evaluations.

The proposed 5-year CIP is described in Table 5-1. The budget for the sewer rehabilitation program would allow for the City to re-line the remaining 19% of the sewer system that has not been recently rehabilitated over the next five fiscal years. This is a conservative estimate as it is likely that the City will not need to re-line all the remaining pipelines, especially since a majority of the pipelines are VCP material. The condition of each pipeline will be evaluated and a rehabilitation recommendation will be provided by the City, similar to the City's recent rehabilitation efforts. The cost estimate is based on a unit relining cost of $7.50 per diameter-inch per linear foot, which includes a 25% contingency.

The 5-year CIP also includes three pipeline replacement projects identified by the City's recent condition assessment evaluations, which are to be executed in the next two fiscal years. The Imperial Highway project cost estimate is based on a unit cost of $240 per linear foot for 12-inch piping plus 20% markup for design, construction management, administrative, and legal costs, and 25% contingency. The Sequoia Drive and Seminole Avenue project cost estimates are based on a unit cost of $310 per linear foot and the same 20% markup and 25% contingency.

Table 5-1: 5-Year Capital Improvement Program

	CIP Project	2019/20	2020/21	2021/22	2022/23	2023/24	5-Year Total
1	**Sewer Rehabilitation Program**	$550,000	$550,000	$550,000	$550,000	$550,000	**$2,750,000**
	Pipeline Replacement						
2	Imperial Highway	$320,000					**$320,000**
3	Sequoia Dr		$180,000				**$180,000**
4	Seminole Ave		$230,000				**$230,000**
	Grand Total	**$870,000**	**$960,000**	**$550,000**	**$550,000**	**$550,000**	**$3,480,000**

City of South Gate

Kennedy/Jenks Consultants, Inc.

300 N. Lake Avenue, Suite 1020
Pasadena, CA 91101
(626) 568-4300

www.kennedyjenks.com

Kennedy Jenks