ATKINS

Winter Gardens Sewer Service Area

Sewer Master Plan

January 2013

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Prepared For:

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Acronyms

ac	acre
CEQA	California Environmental Quality Act
CIP	Capital Improvement Program
d/D	depth to pipe diameter ratio
District	County Sanitation District
du	dwelling unit
du/ac	dwelling units per acre
EDUs	Equivalent Dwelling Units
EIR	Environmental Impact Report
GIS	Graphical Information System
gpcd	gallons per capita per day
gpd/ac	gallons per day per acre
gpd/du	gallons per day per dwelling unit
Master Plan	Winter Gardens SSA Sewer Master Plan Update
Metro	Metropolitan Wastewater System
mgd	million gallons per day
MWWD	Metropolitan Wastewater Department
PVC	polyvinyl chloride pipe
RDI&I	Rainfall derived inflow and infiltration
SANDAG	San Diego Association of Governments
SSA	Sewer Service Area
SSMP	Sewer System Management Plan
SSO	Sanitary Sewer Overflows
SWRCB	State Water Resources Control Board
VCP	vitrified clay pipe
WDR	Waste Discharge Requirement

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CHAPTER 1
INTRODUCTION

The County of San Diego (County) is updating Sewer Master Plans for its sewer service areas. Due to increased growth, system expansions, and aging infrastructure, the County is addressing its capacity needs and updating its 10-year Capital Improvement Program (CIP). This Sewer Master Plan Update addresses the Winter Gardens Sewer Service Area (SSA).

This introductory chapter to the Winter Gardens SSA Sewer Master Plan Update (Master Plan) provides a summary of:

- master plan objectives,
- contents and organization of this report,
- background information on the District,
- overview of regulatory requirements, and
- environmental compliance and policy considerations.

1.1 Sewer Master Plan Objectives

The objectives of this Master Plan are to evaluate the system capacity and provide an assessment of the condition of identified portions of the existing sewer collection system in order to develop a comprehensive 10-year CIP. The 10-year CIP includes pipeline and pump station condition and capacity improvement projects, long range maintenance program enhancements and regional treatment and transportation needs and opportunities. This recommended CIP forms the basis for capital facility needs, sewer rate evaluations, and long-range financial plans to be completed in separate financial studies.

1.2 Report Organization

This Master Plan provides a comprehensive review and evaluation of the SSA's wastewater collection, conveyance, and capacity requirements under existing and ultimate conditions. Based on findings of the evaluation, the Master Plan recommends facility improvements and capital cost requirements to ensure that aging infrastructure remains serviceable and to allow for the continued buildout of the County General Plan.

The Master Plan is presented in six (6) chapters:

- Chapter 1 provides an introduction to the project.
- Chapter 2 presents an overview of the study area and existing wastewater collection facilities.

- Chapter 3 presents an overview of the sewer basins and provides estimates of future wastewater generation rates and regional treatment capacity requirements.
- Chapter 4 presents the methodology and findings of the sewer capacity evaluation, including summaries of hydraulic computer models used to analyze flow conditions.
- Chapter 5 presents a condition assessment of identified SSA facilities and identifies specific condition deficiencies, as well as recommends enhancements to the County's ongoing Video Inspection Program.
- Chapter 6 presents a recommended 10-year CIP for the SSA's wastewater facilities.

1.3 Background

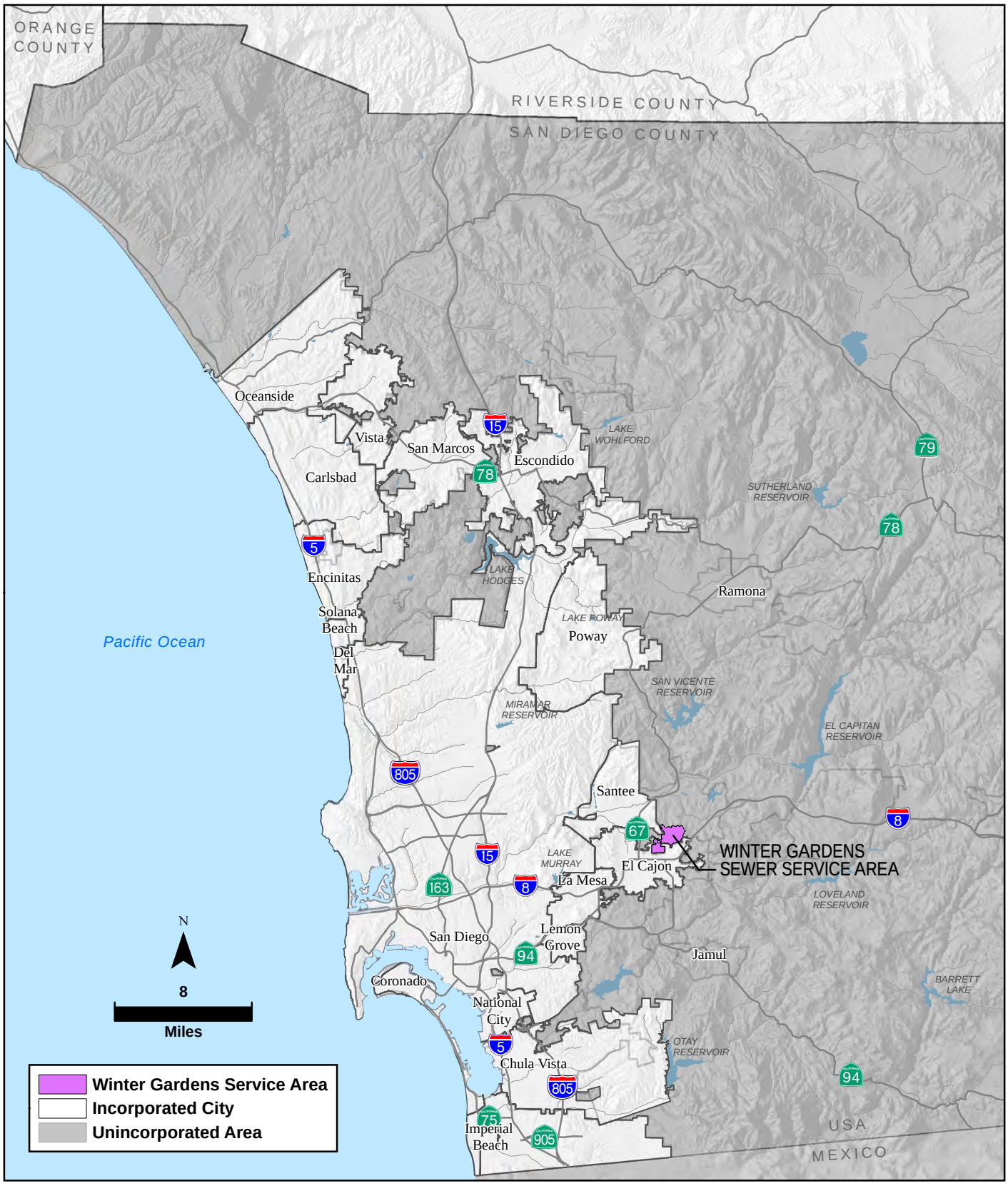
The County Board of Supervisors serves as the Board of Directors (Governing Board) for the San Diego County Sanitation District (District), which includes the Winter Gardens SSA. The SSA serves the community of Winter Gardens and is maintained by the County of San Diego Wastewater Management Section. Operation and maintenance costs required for the SSA are collected through connection and service fees assessed to each connection to the sewerage system. The location of the Winter Gardens SSA is shown on Figure 1-1.

The Winter Gardens SSA conveys all sewer flows into the City of San Diego Metropolitan Wastewater System (Metro) under a comprehensive Regional Wastewater Disposal Agreement enacted between the City of San Diego and the participating agencies within Metro. The Metro Treatment Plant, located in Point Loma, treats sewage from all of the participating agencies. While there are several separate County SSAs within the District (a total of 9), the District is considered one entity by Metro for purposes of capacity rating and its current Metro capacity is 17.503 million gallons per day (mgd). Within the District, the SSAs are apportioned, based on historical regional agreements, a share of Metro capacity for the purposes of projecting future regional capacity needs. The Winter Gardens SSA has been apportioned 1.200 mgd of Metro capacity.

The Winter Gardens Sewer Maintenance District was formed in 1962 by the County Board of Supervisors and serves the community of Winter Gardens. Based upon a County Board of Supervisors action, on July 1, 2011 Winter Gardens Sewer Maintenance District was officially reorganized and annexed into the Spring Valley Sanitation District and the Spring Valley Sanitation District was renamed the San Diego County Sanitation District.

1.4 Regulatory Requirements

On May 2, 2006, the State Water Resources Control Board (SWRCB) adopted Order 2006-0003, the Statewide General Waste Discharge Requirements (WDRs) for Sanitary Sewer Systems, which requires all federal and state agencies, municipalities, counties, districts, and other public entities that own or operate a sanitary sewer system greater than one mile in length to comply with the elements of the WDRs. The WDRs serve to provide a unified statewide approach for reporting and tracking Sanitary Sewer Overflows (SSO), establishing consistent and uniform requirements for Sewer System Management Plan (SSMP) development and implementation, establishing consistency in reporting, and facilitating consistent enforcement for violations.



PROJECT LOCATION

Figure 1-1

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The County's state mandated SSMP was initially approved July 2009 and encompassed all of the separate sanitation and sewer maintenance districts at the time. The SSMP documents include detailed information demonstrating the County's efforts to comply with each of the mandatory and applicable elements required. Revisions are currently being made to the SSMP documents to reflect the reorganization of previously separated sanitation and sewer maintenance districts into the consolidated San Diego County Sanitation District.

1.5 Environmental Compliance

The SSA's Sewer Master Plan is statutorily exempt from the preparation of an Environmental Impact Report (EIR) or a Negative Declaration per Section 15262 of the California Environmental Quality Act (CEQA) guidelines. However, the approval or adoption of this Master Plan represents a discretionary action by the County, which is subject to review under CEQA.

1.6 Policy Considerations

The County of San Diego Board of Supervisors has adopted a number of policies which affect wastewater service in the County. These policies were reviewed for their applicability and impact to the SSAs. Appendix A summarizes the policies reviewed. Policy I-106 "Establishment of Priorities for Limited Sewer Capacity in the Mission Gorge Trunk Sewer Line" adopted in 1986 and updated in 2008, was applicable to the Winter Gardens SSA. The policy was adopted in response to limited available wet weather capacity in the Mission Gorge Trunk Sewer, which is owned and operated by the Metropolitan Wastewater Department (MWWD). The policy established priorities for providing sewer capacity within the Mission Gorge Trunk Sewer, and apply to the District and SSAs which utilize the Mission Gorge Trunk Sewer for wastewater disposal into Metro. In 1993, MWWD completed construction of the Mission Gorge Pump Station and Force Main to parallel the existing Mission Gorge Trunk Sewer and in 1998 MWWD completed the rehabilitation of the Mission Gorge Trunk Sewer, relieving peak wet weather capacity constraints. Since the capacity constraints in the Mission Gorge Trunk Sewer have been resolved by the completion of the East Mission Gorge Pump Station and related improvements, Policy I-106 was repealed by the County of San Diego Board of Supervisors May 2, 2012.

CHAPTER 2
STUDY AREA

This chapter provides a description of the Master Plan study area including:

- existing and planned land uses,
- existing and projected populations,
- physical attributes of the collection system, and
- regional wastewater facilities serving the SSA.

2.1 Study Area Description

The Winter Gardens SSA is located in a rural, unincorporated area of San Diego County, northeast of the intersection between Interstate 8 and Highway 67, approximately 20 miles east of San Diego. Topographically, the study area varies considerably. Generally, the Winter Gardens SSA drains from the northeast to the southwest towards Fletcher Parkway, in the City of El Cajon. Terrain ranges in elevation from 450 to 850 feet. The Winter Gardens SSA boundary includes both developed and undeveloped areas and encompasses approximately 1,000 acres. Flows from the Winter Gardens SSA flow through the City of El Cajon sewer system to the Metro system. The sewer study area includes parcels within the SSA boundary and Figure 2-1 presents the study area for the Winter Gardens SSA.

2.2 Potential Impacts to the Wastewater Collection System

As part of this master plan update, Atkins reviewed the County's sewer permit database and attributed them to the parcel database. The Winter Gardens SSA provides sewer service to permitted parcels located within the current SSA boundary. Within the current SSA boundary, approximately 90 percent of parcels are connected to the sewer system, with the remaining parcels either vacant or on septic systems. This Master Plan considers the future impacts of all of the private septic system connections to the sewer system, due to potentially failing septic systems in the future.

2.3 Land Uses

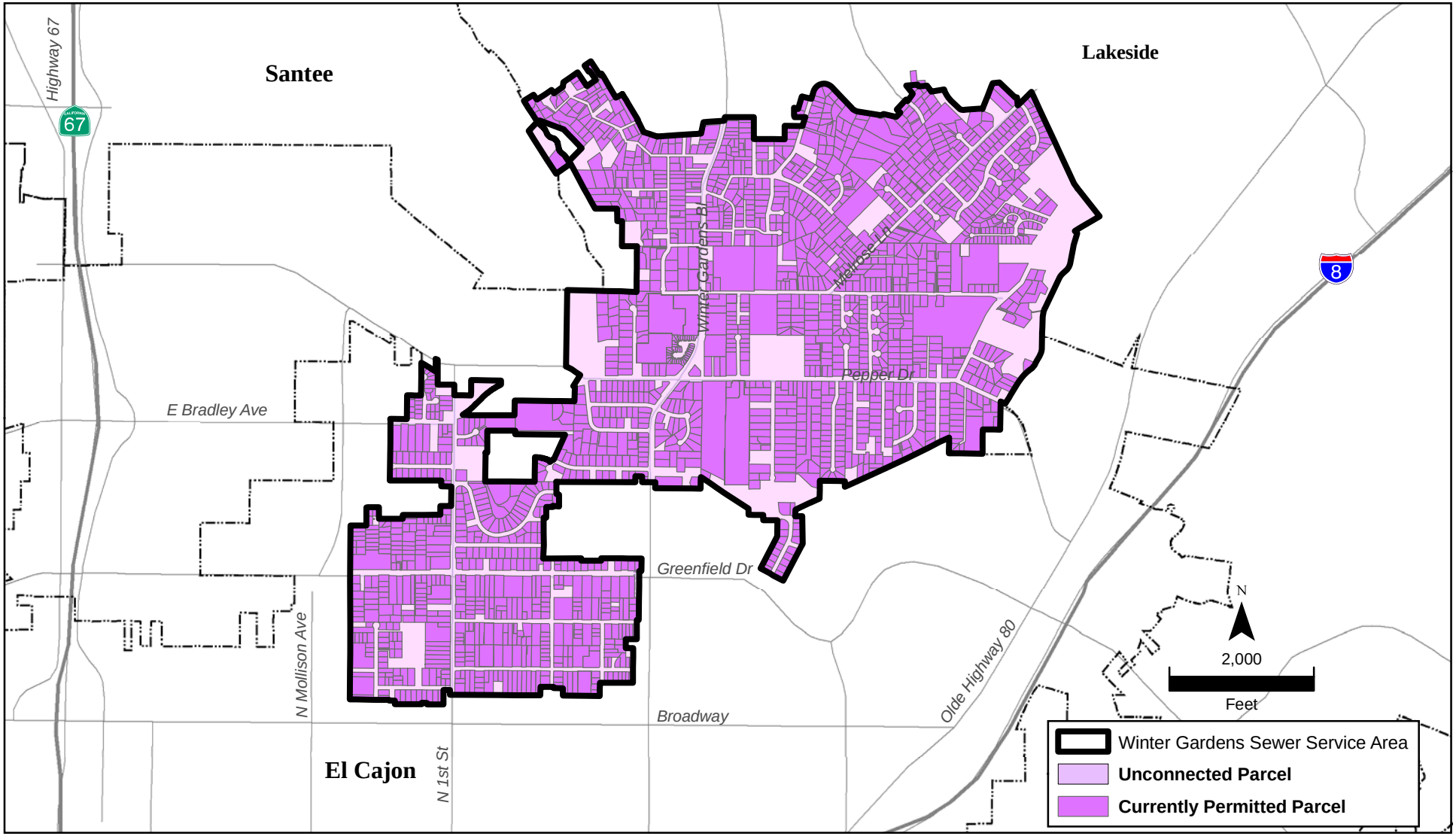
In August of 2011, the County of San Diego Board of Supervisors adopted an updated General Plan. The General Plan Update establishes future growth and development thresholds for the unincorporated areas of the County. When compared to the former General Plan adopted in 1979, this update concentrated population growth in the western areas of the County where infrastructure and services are more readily available. The evaluations of proposed land uses in this Master Plan were conducted prior to the adoption of the General Plan.

Prior to the adoption of the General Plan, the Board of Supervisors previously endorsed two land use maps (the "Referral Map" and "Draft Land Use Map") for consideration in the EIR for the General Plan Update. Because the Board specifically directed the creation of the Referral Map (May 2008) and it is more intensive than the Draft Land Use Map, it was anticipated that the Referral Map would become the Proposed Project upon the County Board's adoption of the General Plan Update. Therefore, as directed by County staff, the future land uses shown in the Referral Map were used for this analysis. Appendix B includes the Referral Map for the Winter Gardens community.

To document land use and population projections within the study areas, the San Diego Association of Governments (SANDAG) 2030 Regional Growth Forecast was utilized. The primary function of the SANDAG land use model is to produce mid-range and long-range demographic and economic forecasts for the San Diego region. Essential model inputs include assumptions about birth and death trends, international and domestic migration, and national economic and demographic forecasts, as well as forecasts for the California population and economy. These forecasts act as independent driving variables in the model, supplying the overall trend and direction that the local demographics and economy are likely to follow. The forecast utilized (Series 11 – 2030 San Diego Regional Growth Forecast Update) was completed in April 2008 and is the eleventh forecast completed since SANDAG began forecasting in the late 1970s. The Series 11 forecast was generated based on regional land use plans from the June 2006 version of the General Plan Update. For this study, existing land use and population projections were extracted from the Series 12 data. The County's Referral Map was used to project future land use.

The land uses within the study area were divided into eight categories; single-family residential, multi-family residential, commercial, industrial, institutional, parks and open space, undeveloped land, and agricultural. Multi-family land uses were defined as having a residential density equal to or greater than 8 dwelling units per acre (du/ac). SANDAG Series 12 existing land use coverage was used as the existing land use and the County's General Plan 2020 Update Referral Map was used for the planned land uses, shown on Figure 2-2 and Figure 2-3, respectively. The land use coverages were overlaid with parcels from the most recent SANGIS parcel database (September 2008). Parcels were attributed with a Master Plan land use category based on the location of the parcel centroid and the SANDAG or General Plan land use overlay. Table 2-1 summarizes existing and planned dwelling unit counts for residential parcels and acreage for nonresidential parcels for the study area. Appendix C includes the land use files provided by SANDAG.

Within the Winter Gardens SSA, the General Plan shows that all park/open space, agricultural, and vacant land is planned to be developed. Residential growth within the study area shows single family residential units will slightly decrease, while multi-family residential growth approximately triples existing density. Commercial areas also show consistent growth within the study area.



STUDY AREA

Figure 2-1

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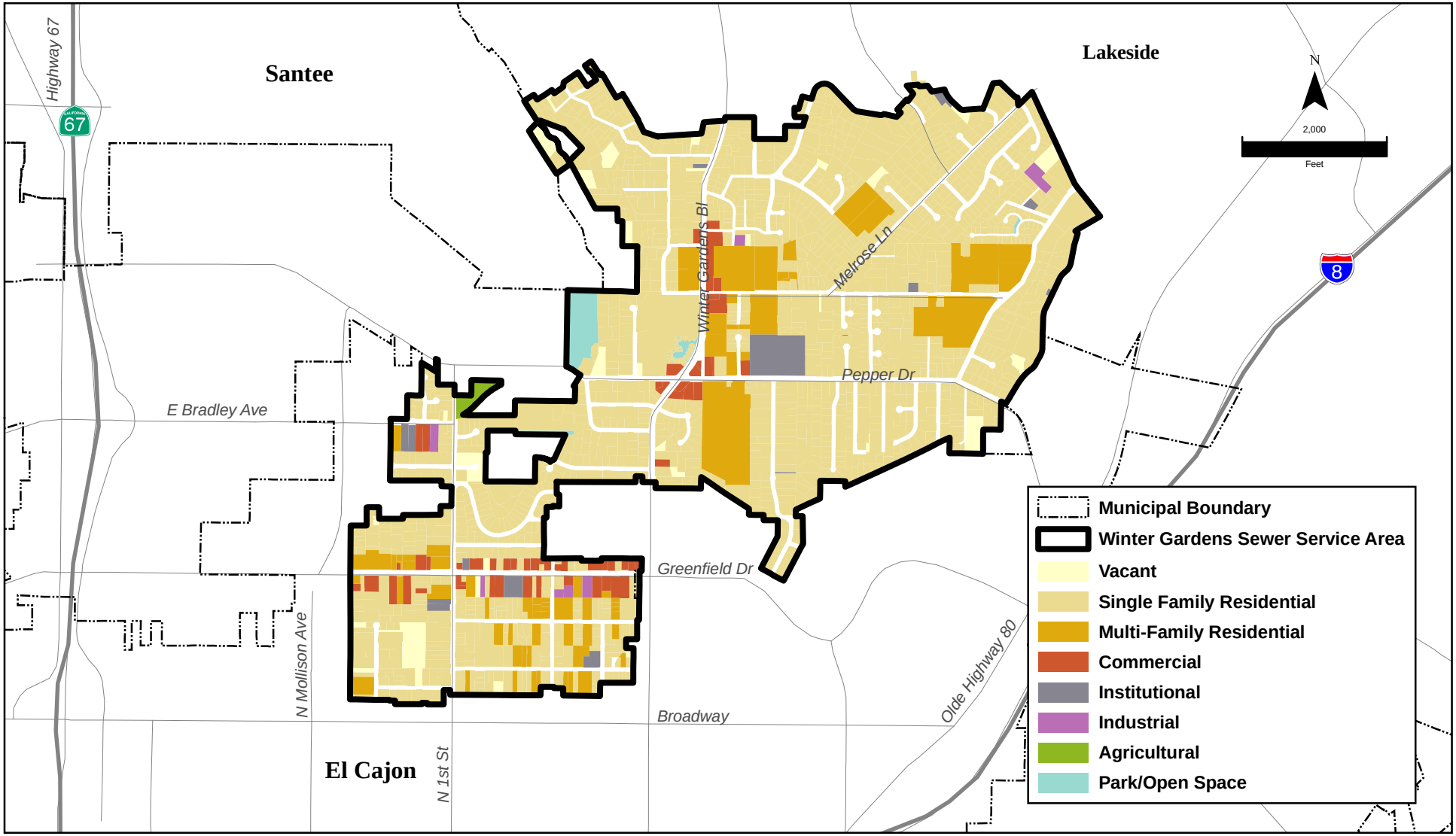

Source: SANDAG Series 11 Existing Land Use

EXISTING LAND USE

Figure 2-2

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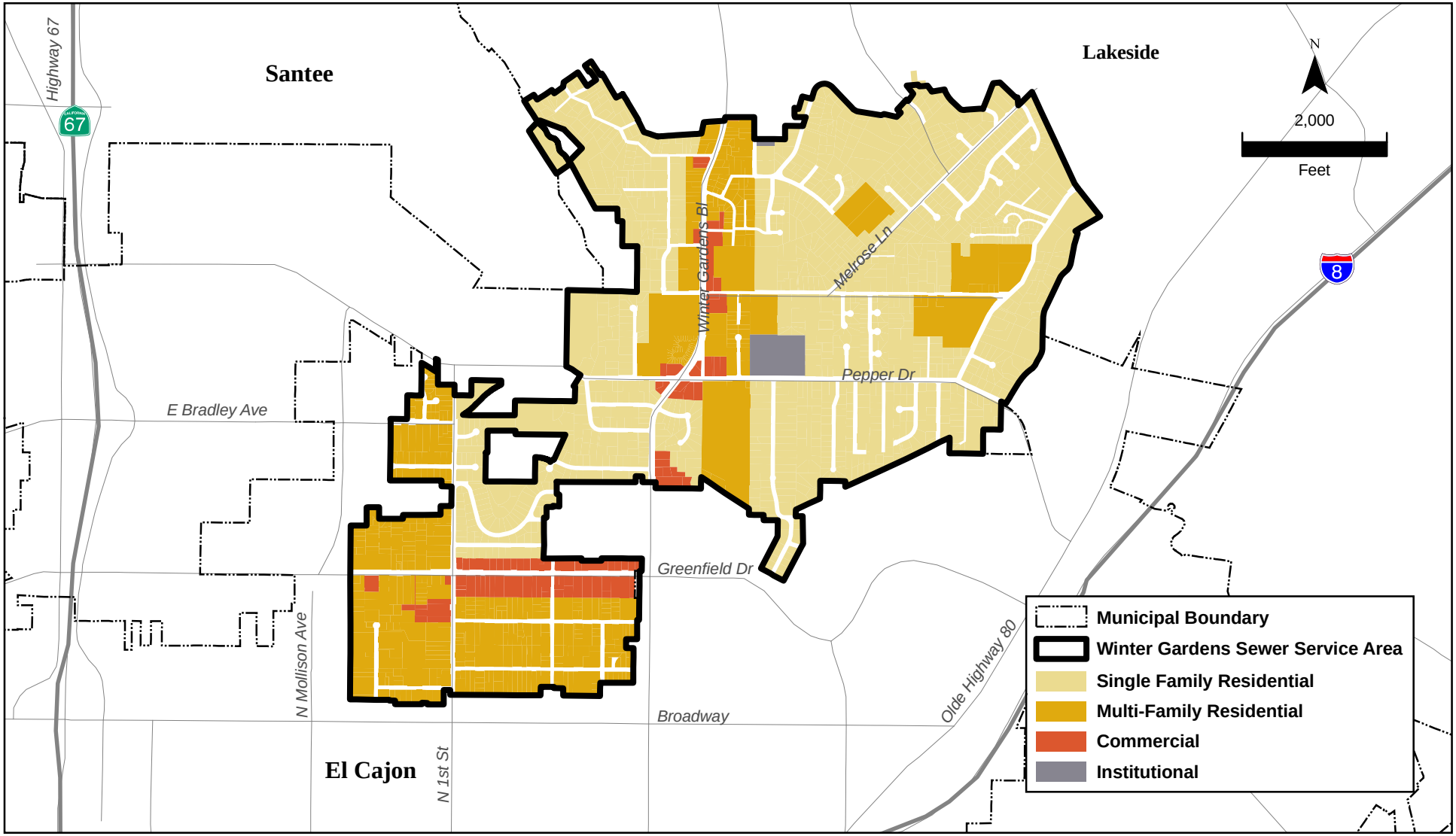

Source: General Plan Referral Map (May 2009)

PLANNED LAND USE

Figure 2-3

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Table 2-1 Existing and Planned Land Use

Land Use	Existing Permitted Acres/Units	Existing Non-Permitted Acres/Units[(1)]	Total Planned Acres/Units
Single-Family Residential	635 ac	69 ac	571 ac
Single-Family Residential	2,434 du	110 du	2,256 du
Multi-Family Residential	111 ac	7 ac	289 ac
Multi-Family Residential	1,403 du	75 du	4,739 du
Commercial	30 ac	1 ac	48 ac
Industrial	2 ac	3 ac	0 ac
Institutional	7 ac	11 ac	10 ac
Parks/Recreation/Open Space	0 ac	12 ac	0 ac
Agricultural	0 ac	3 ac	0 ac
Undeveloped Land/Vacant	5 ac	23 ac	0 ac
Total	**789 ac**	**130 ac**	**919 ac**

ac = acre; du = dwelling unit

(1) Parcels within the SSA boundary that are not permitted can be either vacant or utilizing on-site septic systems.

2.4 Existing and Forecasted Populations

Residential and employment population estimates for the study area were provided by SANDAG for years 2008, 2015, 2020, 2025, and 2030 at the parcel level and are based on the Series 11 data. SANDAG regional growth model develops their existing estimates from data provided by the US Census Bureau, San Diego County Assessor, local jurisdictions, and the California Department of Finance. Residential populations represent persons residing in a given area. Employment populations represent persons employed and performing work functions in a given area. Table 2-2 summarizes the residential and employment population projections through 2030 for the Winter Gardens SSA. Appendix D includes the population files provided by SANDAG.

Within the Winter Gardens SSA, the population projections show no growth for residential populations and slight growth in employment populations, very typical of a built out community such as Winter Gardens. The population projections suggest that the growth in multi-family residences will be offset by a decrease in household densities, resulting in very little growth within the SSA.

Table 2-2 Winter Gardens SSA Existing and Forecasted Populations

Land Use Category	Residential Populations					Employment Populations				
	2008	2015	2020	2025	2030	2008	2015	2020	2025	2030
Permitted	12,276	11,950	11,570	11,570	11,736	758	1,112	1,121	1,124	1,124
Non-Permitted	486	621	764	815	824	142	114	128	133	133
Total	**12,763**	**12,571**	**12,334**	**12,385**	**12,560**	**900**	**1,226**	**1,249**	**1,257**	**1,257**

Non-Permitted are parcels that are within the SSA boundary but are not permitted for sewer service and may be either vacant or utilizing on-site septic systems.

2.5 Existing Wastewater Collection System

The Winter Gardens SSA conveys all wastewater flows into Metro under a comprehensive Regional Wastewater Disposal Agreement enacted between the City of San Diego and the Metro-participating agencies. Wastewater from the Winter Gardens SSA flows southwest and discharges into the City of El Cajon's sewer collection system. County flows join El Cajon flows and are conveyed to the City of San Diego's municipal wastewater collection system at the Mission Gorge Pump Station diversion structure. The diversion structure diverts flows to either the Mission Gorge Pump Station or to the Mission Gorge Trunk Sewer. The existing wastewater collection system is shown on Figure 2-4. This figure also illustrates the locations that the Winter Gardens SSA system connects with the City of El Cajon's system.

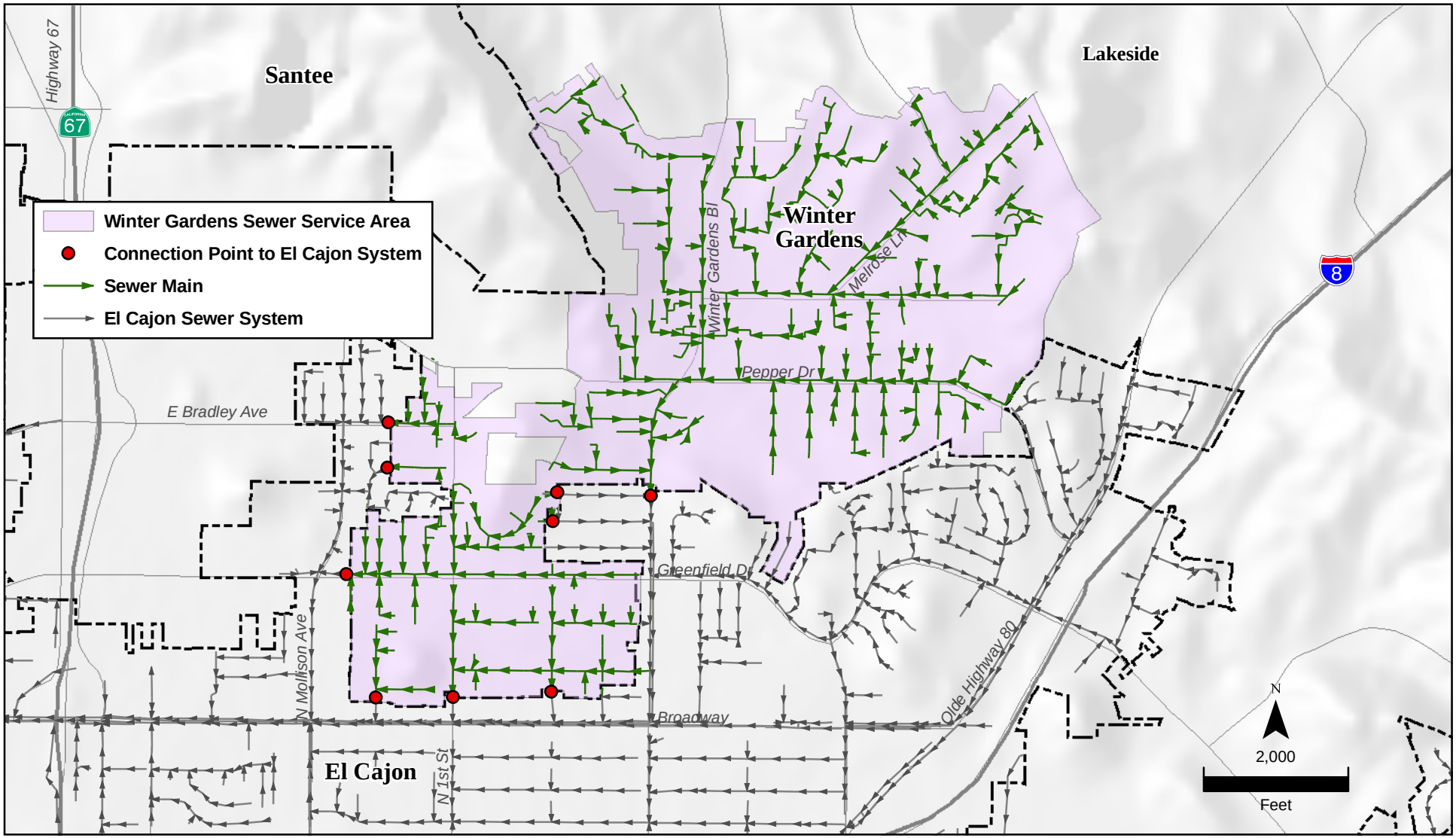
Tables 2-3, 2-4, and 2-5 summarize the gravity collection system facilities within the Winter Gardens SSA by size, age and material, respectively. The system inventory is based on information contained within the County's Graphical Information System (GIS) database. The GIS database was created for the County Wastewater Section by digitizing the as-built record drawings. The Winter Gardens SSA wastewater collection system consists of 436 manholes, and 137,614 feet (26.1 miles) of gravity sewer. The information from the tables is also shown in Figures 2-5, 2-6, and 2-7. In general, the Winter Gardens SSA includes predominantly 8-inch diameter pipelines constructed of vitrified clay pipe (VCP) in the 1960s.

Table 2-3 Gravity Sewer Pipelines by Diameter

Diameter (inches)	Length		Percent of System (%)
	Feet	Miles	
6	4,300	0.8	3.1
8	131,277	24.9	95.4
10	1,462	0.3	1.1
12	250	0.0	0.2
15	325	0.1	0.2
Total	**137,614**	**26.1**	**100.0**

Table 2-4 Gravity Sewer Pipelines by Age

Age (Decade)	Length		Percent of System (%)
	Feet	Miles	
1950 – 1959	5,138	1.0	3.7
1960 – 1969	105,155	19.9	76.4
1970 – 1979	13,577	2.6	9.9
1980 – 1989	6,231	1.2	4.5
1990 – 1999	5,017	1.0	3.6
2000 – 2009	2,496	0.5	1.8
Total	137,614	26.1	100.0



EXISTING SEWER SYSTEM

Figure 2-4

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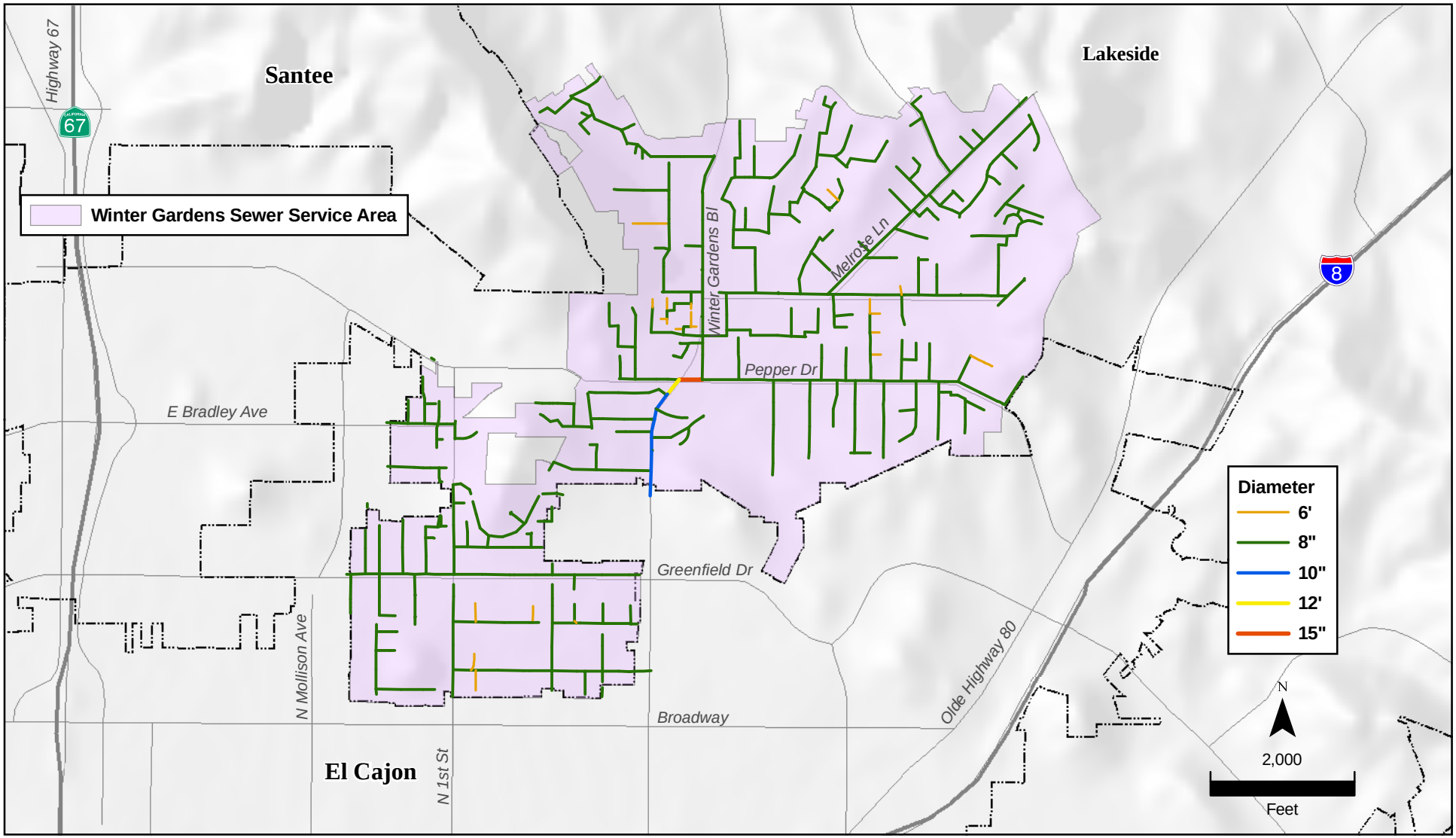

EXISTING GRAVITY MAIN
PIPELINE DIAMETER
Figure 2-5

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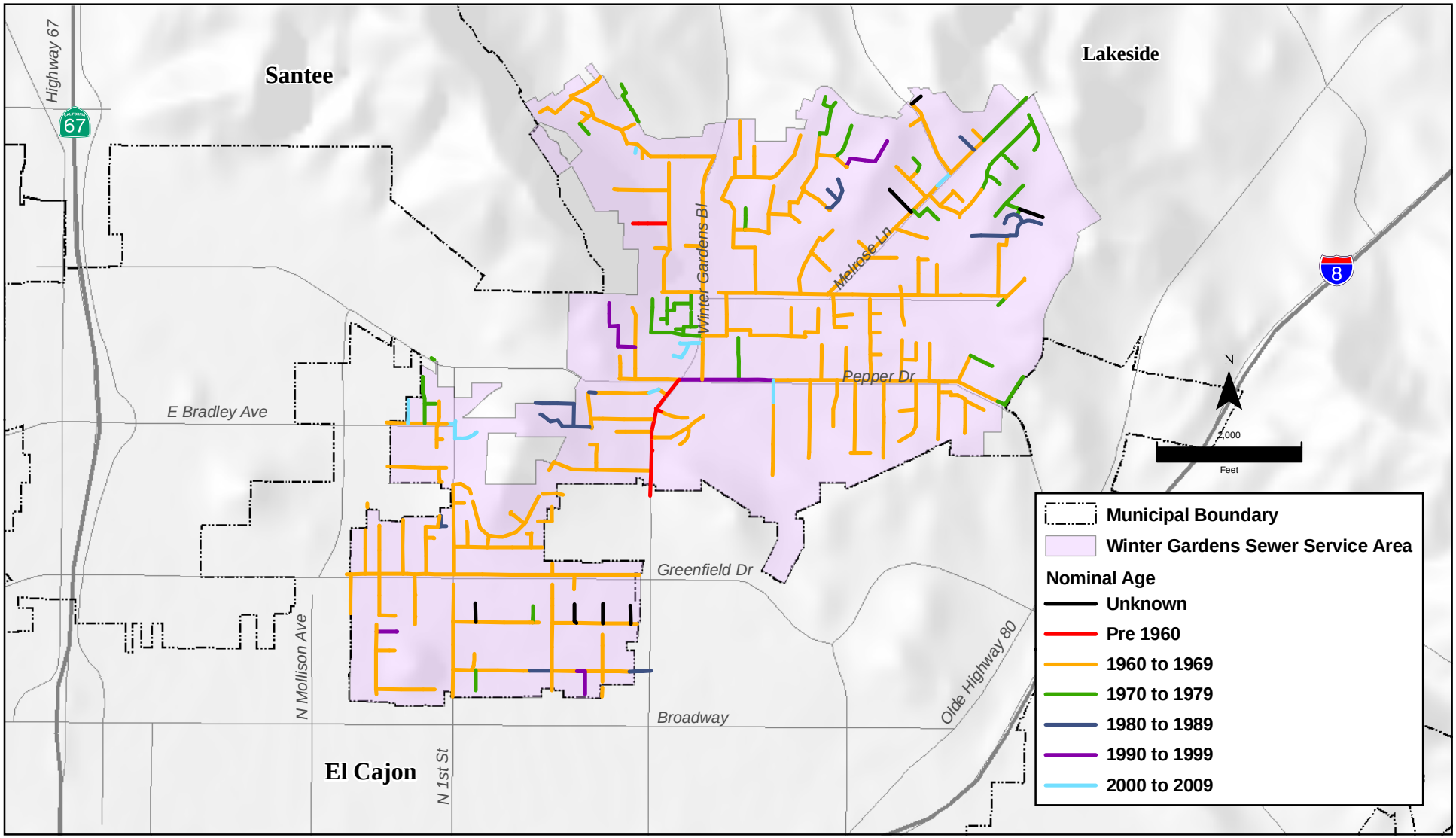

EXISTING GRAVITY MAIN PIPELINE AGE

Figure 2-6

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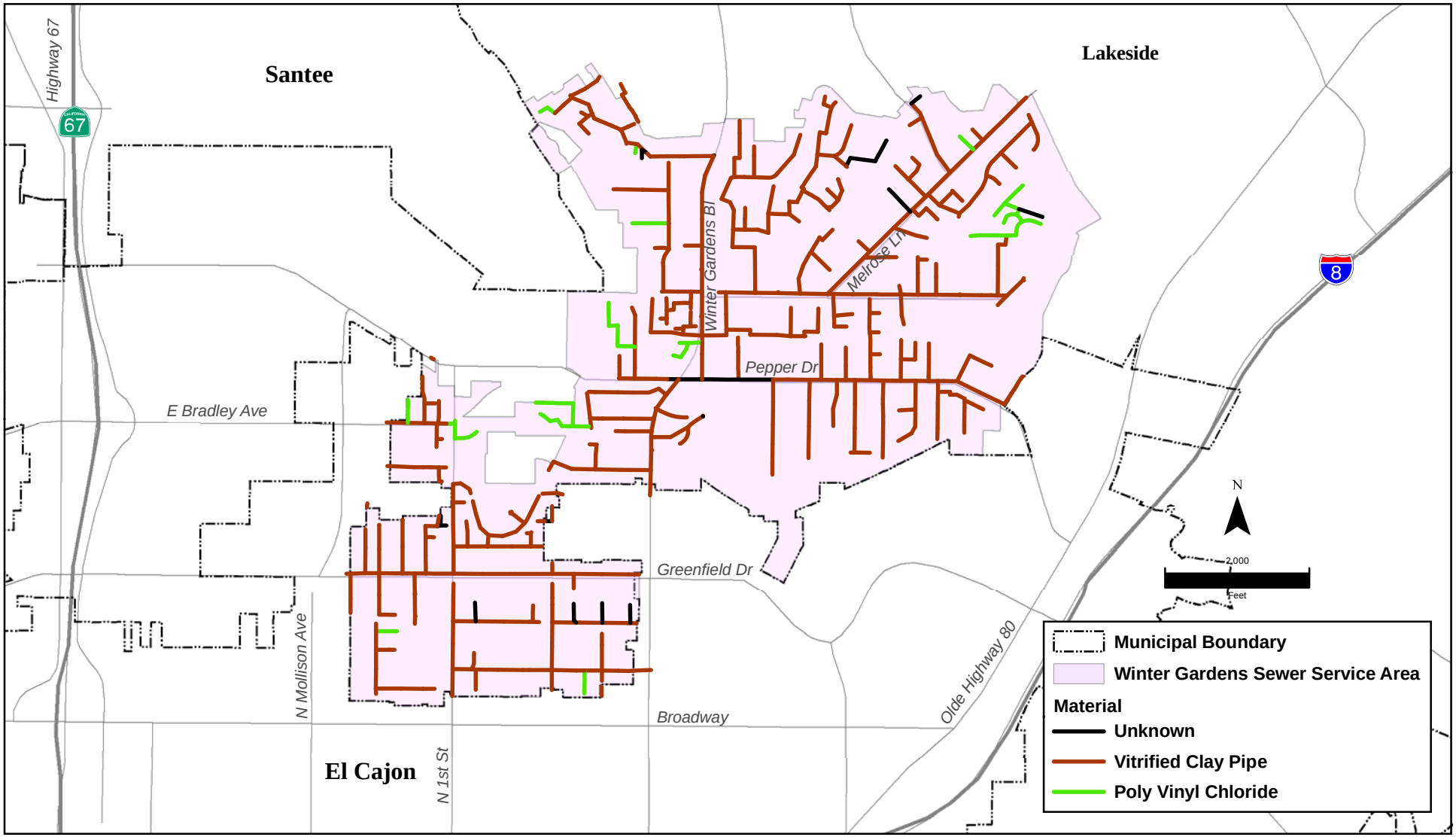

EXISTING GRAVITY MAIN PIPELINE MATERIAL

Figure 2-7

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Table 2-5 Gravity Sewer Pipelines by Material

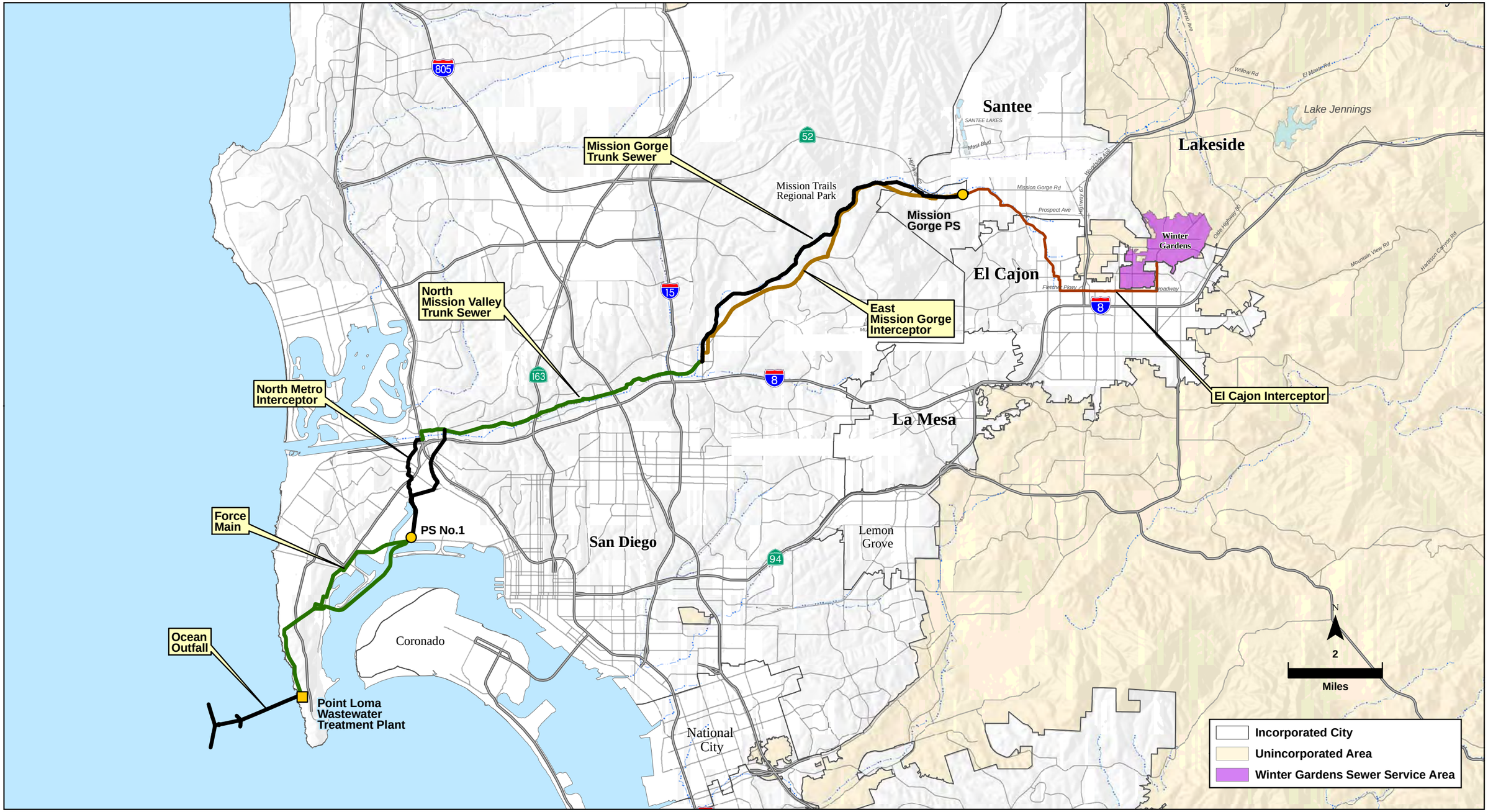
Material	Length		Percent of System (%)
	Feet	Miles	
Poly-Vinyl Chloride Pipe (PVC)	10,056	1.9	7.3
Vitrified Clay Pipe (VCP)	121,957	23.1	88.6
Unknown	5,601	1.1	4.1
Total	**137,614**	**26.1**	**100.0**

2.6 Regional Sewerage Facilities

All wastewater collected from the Winter Gardens SSA flows into Metro under a comprehensive Regional Wastewater Disposal Agreement enacted between the City of San Diego and the Metro-participating agencies. Winter Gardens SSA flows enter the City of El Cajon's sewer collection system prior to the City of San Diego's municipal collection system. The entire San Diego County Sanitation District is considered one entity by Metro for purposes of capacity rating and its current Metro capacity is 17.503 mgd. Within the District, the SSAs are apportioned a share of Metro capacity, based on historical agreements, for the purposes of projecting future regional capacity needs. The Winter Gardens SSA have been apportioned with a total of 1.200 mgd of Metro Capacity.

Regional sewerage facilities are shown in Figure 2-8. Metro facilities include regional sewer interceptors and trunk sewers, pump stations, and treatment and disposal facilities. Wastewater in the Lakeside Interceptor is joined with flows from the Padre Dam Municipal Water District and enters the City of San Diego's municipal collection system at the Mission Gorge Pump Station diversion structure.

The Mission Gorge Pump Station diversion structure diverts flows into either the Mission Gorge Pump Station or the Mission Gorge Trunk Sewer, which both convey flows to the North Mission Valley Trunk Sewer. The Mission Gorge Pump Station pumps flows through the East Mission Gorge Interceptor to the North Mission Valley Trunk Sewer. Flows are then conveyed through the North Mission Valley Trunk Sewer to the North Metro Interceptor, which conveys flows to Metro Pump Station No. 1. Pump Station No. 1 pumps flows to the City of San Diego's Point Loma Wastewater Treatment Plant for treatment and disposal.



REGIONAL SEWERAGE FACILITIES

Figure 2-8

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CHAPTER 3
WASTEWATER GENERATION ANALYSIS

This chapter provides descriptions of the wastewater generation including:

- existing flow meter data summary,
- methodology for developing unit generation rates,
- recommended unit generation rates,
- estimated future wastewater flows, and
- Metro capacity needs.

3.1 Flow Meters

As described in Chapter 2, wastewater generated within the Winter Gardens SSA is collected by County-owned facilities that ultimately connect to Metro for treatment and disposal. The combined flows enter Metro through the El Cajon Interceptor. The County has apportioned 1.200 mgd of their 17.503 mgd of Metro capacity rights to the Winter Gardens SSA.

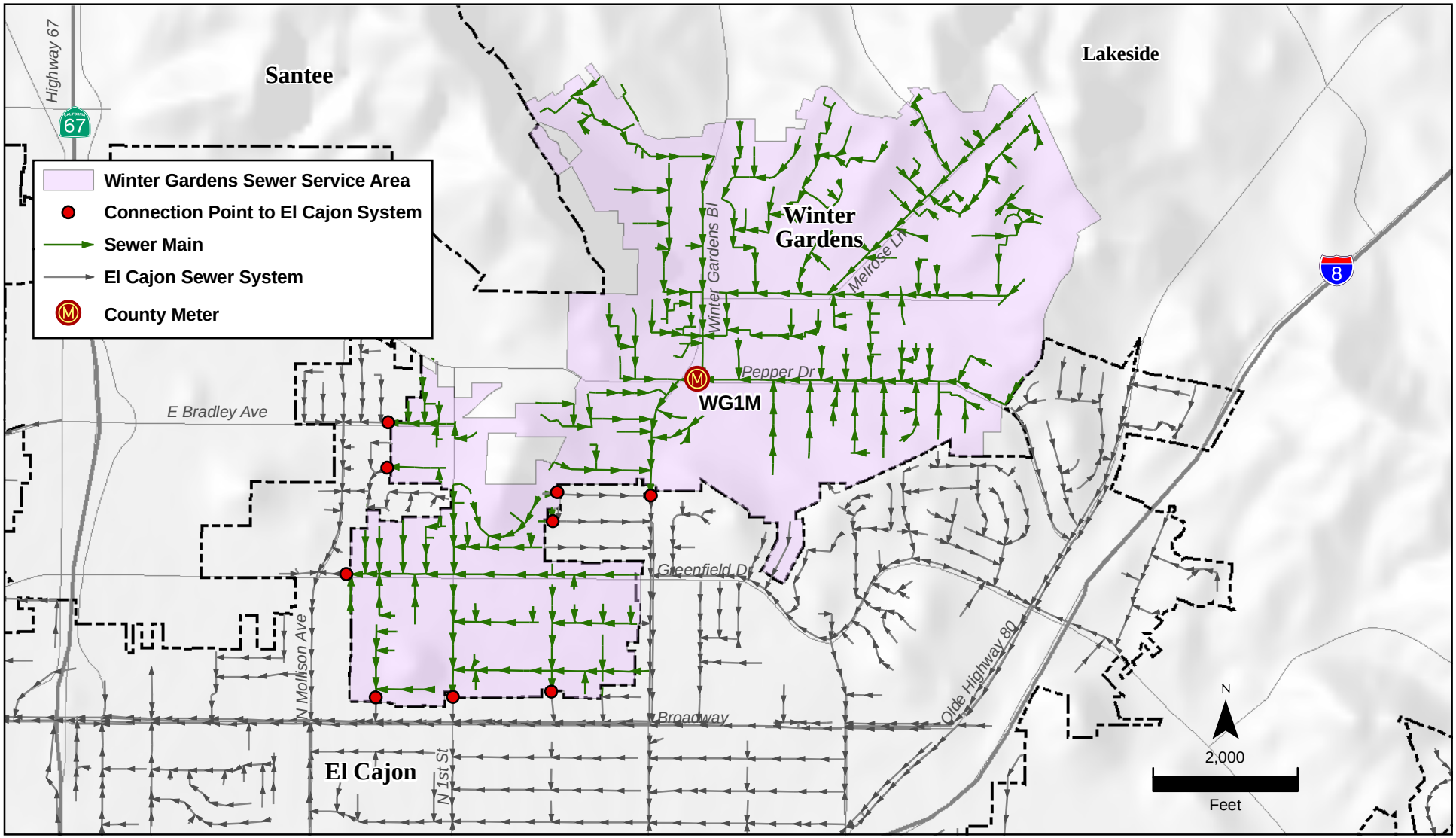
The County has one flow meter in the Winter Gardens SSA and there are nine interconnections with the City of El Cajon. Flow meter data used for calibration is included in Appendix E. Figure 3-1 presents the locations of the flow meter and interconnections. The City of San Diego bills the County for wastewater flows from the Winter Gardens SSA based on readings from Metro meter WG-1 and estimated house counts at the El Cajon interconnections. Meter WG-1 has an average dry weather flow (August 2010) of 0.54 mgd and an average wet weather flow (January 2010) of 0.61 mgd.

3.2 Metered Sewer Basins

Meter WG-1 monitors wastewater flow from an area of approximately 1,800 acres within the northern half of the Winter Gardens SSA and is generally located around Winter Gardens Boulevard and Pepper Drive. Meter WG-1 is located in Winter Gardens Boulevard on the 10-inch diameter pipeline.

3.3 Interconnections

The County has an interagency agreement with the City of El Cajon to convey flow from a maximum of 3,773 equivalent dwelling units (EDUs) or 1.0 mgd of average annual flow through the El Cajon sewer system into Metro. The current agreement expired in 2003 and should be reviewed prior to negotiating a new agreement.



FLOW MONITORING
AND INTERAGENCY CONNECTION

Figure 3-1

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3.4 Wastewater Generation Rates

The purpose of establishing wastewater generation rates is to characterize the existing unit use by either population or land use, and for use in forecasting wastewater flows. The existing metered flows were compared with land use data and population estimates to develop unit wastewater generation rates. Unit generation rates were estimated using two sources for comparison purposes: 1) population estimates compiled by SANDAG (Series 12 for existing, Series 11 for forecasts), and 2) the County's current land use data (Referral Map, May 2008). Based on the findings of the unit generation rate analysis by land use and population, recommended unit rates will be established for use in forecasting future wastewater flows.

The unit generation rate calibration of each basin is described in the following sections and summarized in Table 3-1 and Table 3-2.

3.4.1 Generation Rates Using SANDAG Population

The purpose of estimating population based unit generation rates is to establish the amount of wastewater a typical residential person and non-residential employee generate over a given day in order to assist in forecasting the amount of wastewater that the SSA can expect through 2030. Per capita unit generation rates are determined through a comparison of the existing SANDAG population data within a given meter basin against the average wastewater flows observed at that flow meter, and industry standard ranges.

SANDAG provided 2008 residential and employment population projections by basin for the SSA based on Series 12 data. Through an iterative process, per capita generation rates for residential and employment populations were estimated. Table 3-3 summarizes the estimated unit generation rates by population through the flow calibration process. Per capita unit generation rates were calibrated to within five percent of existing metered flows.

Typically, design and planning standards for agencies in San Diego County assume per capita wastewater generation rates between 60 to 100 gallons per capita per day (gpcd) for residential and 15 to 35 gpcd for employment populations. Table 3-1 summarizes the flows and calibration for the Winter Gardens SSA. Winter Gardens has an estimated residential per capita unit generation rate of 80 gpcd and an employment per capita unit generation rate of 25 gpcd.

3.4.2 Generation Rates Using County Land Use Data

The purpose of estimating land use based unit generation rates is to establish the amount of wastewater is generated in a day over an acre of land by general land use types in order to assist in estimating the amount of wastewater that the SSA can expect at the buildout of the study area. Land use based unit generation rates are determined through a comparison of the existing area per land use type within a given meter basin against the average wastewater flows observed at that flow meter, and industry standard ranges.

As shown in Figure 2-3 of the previous chapter, existing land uses include single-family residential, multi-family residential, industrial, commercial, and institutional. When the GIS land use coverage is overlaid with the County's permitted parcel database, it was possible to estimate the number of single-family and multi-family dwelling units and calculate industrial, commercial, and institutional acreage for the Winter Gardens SSA.

Table 3-2 summarizes the calibration of sewer flows for the Winter Gardens SSA with estimated unit wastewater generation rates summarized by land use. Unit wastewater generation rates were calibrated to within five percent of existing flows measured at Meter WG-1. The 2010 census projected an average of 2.68 persons per household for Winter Gardens. The calculated household population density for Winter Gardens is approximately 3.51 persons per household.

Table 3-1 Wastewater Unit Generation Rate Calibration Based on Population

Basin	Existing Population	Unit Generation Rate	Estimated Wastewater Generation
Winter Gardens - Metered			
Residential	6,799	80 gpcd	543,924 gpd
Employment	196	20 gpcd	3,922 gpd
Metered Subtotal			547,846 gpd
		Existing Flows =	538,700 gpd
		Calibration =	1.9
Winter Gardens - Not Metered			
Residential	5,477	80 gpcd	438,180 gpd
Employment	561	20 gpcd	11,229 gpd
Unmetered Subtotal			449,409 gpd
Total			**997,255 gpd**

gpd = gallons per day

Table 3-2 Wastewater Unit Generation Rate Calibration Based on Land Use

Basin	Units	Unit Generation Rate	Estimated Wastewater Generation
Winter Gardens - Metered			
Single-Family Residential	1,445 du	280 gpd/du	405,296 gpd
Multi-Family Residential	659 du	210 gpd/du	138,628 gpd
Commercial	8 ac	500 gpd/ac	4,245 gpd
Industrial	1 ac	500 gpd/ac	260 gpd
Institutional	1 ac	500 gpd/ac	545 gpd
Metered Subtotal			548,974 gpd
		Existing Flows =	538,700 gpd
		Calibration =	1.9 %
Winter Gardens - Not Metered			
Single-Family Residential	989 du	280gpd/du	277,396 gpd
Multi-Family Residential	744 du	210 gpd/du	156,509 gpd
Commercial	21 ac	500 gpd/ac	10,590 gpd
Industrial	1 ac	500 gpd/ac	700 gpd
Institutional	6 ac	500 gpd/ac	2,755 gpd
Unmetered Subtotal			447,950 gpd
Total			**996,924 gpd**

ac = acre; du = dwelling unit; gpd = gallons per day

In the Winter Gardens SSA the single-family residential land use unit generation rate was first assigned a value equal to the higher of the calculated or census population density multiplied by the calibrated population unit generation rate. The multi-family residential land use unit generation rate was then set equal to 75 percent of the single-family unit generation rate, and the rates were adjusted through an iterative process to reasonably match the estimated residential wastewater generation, as presented in Table 3-1. Non-residential land use unit generation rates were set equal to each other and then were adjusted through an iterative process to reasonably match the estimated employment wastewater generation for presented in Table 3-1. Non-residential land use within Winter Gardens contributes a relatively small percentage of total sewer flows. For the purposes of estimating non-residential sewer generation, the unit generation analysis assumes similar generation rates for industrial, commercial, and institutional land uses.

Typically, design standards for agencies in San Diego County assume wastewater flows between 200 to 400 gallons per day per dwelling unit (gpd/du) for single-family residential, with multi-family residential ranging from 60 percent to 75 percent of single-family residential, and 500 to 1,500 gallons per day per acre (gpd/ac) for non-residential land uses. When compared to typical design standards, the calibrated unit generation rates suggest that the Winter Gardens SSA is within the acceptable range of generation rates.

3.4.3 Recommended Unit Generation Rates

For future development, it is typical to develop uniform unit generation rates. The County has relatively uniform wastewater generation for land use and population projections based on our unit generation rate analyses. Therefore, for the existing system analysis, the calibrated unit generation rates shown above will be used. For future wastewater generation, more conservative generation rates will be used. The wastewater generation rates used to estimate future flows are summarized in Table 3-3. The County utilizes EDUs for non-single family residential land uses and equates an EDU to 240 gpd.

Table 3-3 Recommended Unit Generation Rates

Land Use / Population	Recommended Unit Generation Rate
Land Use	
Single-Family Residential	280 gpd/du
Multi-Family Residential	210 gpd/du
Commercial	500 gpd/ac
Industrial	500 gpd/ac
Institutional	500 gpd/ac
Population	
Residential	80 gpcd
Employment	25 gpcd

gpcd = gallons per capita per day
gpd/ac = gallons per day per acre
gpd/du = gallons per day per dwelling unit

It should be noted that non-residential land uses may vary considerably due to type of industry and variations in flow patterns. Standard unit generation rates may not apply to future non-residential development and the County should request development-specific sewer flow analyses to verify sewer generation assumptions.

3.5 Wastewater Flow Projections

Wastewater flow projections were developed through 2030 and for buildout. Flow projections through 2030 were estimated by applying the recommended population unit generation rates to the anticipated forecasted population. Buildout wastewater flow projections were determined by applying the land use based unit generation rates to the land use acreages and allowable densities (Referral Map, May 2008). These projections form the basis for sewer input flows to the hydraulic model, and analyses of future capacity needs in the wastewater collection system. Table 3-4 summarizes the estimated future flows based on population through 2030 and Table 3-5 summarizes the estimated buildout flow based on the land use for ultimate conditions in each SSA.

Table 3-4 Winter Gardens Wastewater Flow Projections through 2030 (by Population)

Basin	Population					Estimated Wastewater Generation (mgd)				
	2010	2015	2020	2025	2030	2010	2015	2020	2025	2030
Residential	12,276	11,950	11,570	11,570	11,736	0.98	0.96	0.93	0.93	0.94
Employment	758	1,112	1,121	1,124	1,124	0.02	0.03	0.03	0.03	0.03
Total						**1.00**	**0.99**	**0.96**	**0.96**	**0.97**

mgd = million gallons per day

Table 3-5 Winter Gardens Buildout Wastewater Flow Projections (by Land Use)

Land Use	Units/Acres	Recommended Unit Generation Rate	Estimated Wastewater Generation (mgd)
Single-Family Residential	2,256 du	280 gpd/du	0.63
Multi-Family Residential	4,739 du	210 gpd/du	1.00
Commercial	48 ac	500 gpd/ac	0.02
Industrial	0 ac	500 gpd/ac	0.00
Institutional	10 ac	500 gpd/ac	0.01
Total			**1.66**

ac = acre; du = dwelling unit; gpd = gallons per day; mgd = million gallons per day

3.6 Conclusions

Existing average wastewater flows generated within the Winter Gardens SSA are approximately 1.0 mgd, including metered and unmetered areas. Based on SANDAG population projections, the total Winter Gardens SSA average flow rate at 2030 is estimated to be 0.97 mgd. Assuming the buildout of the entire study area at the proposed residential densities based on the General Plan, the estimated average flow rate is estimated at approximately 1.66 mgd, which will likely not occur until beyond 2050.

Winter Gardens has a current Metro capacity of 1.200 mgd but only 1.0 mgd of capacity in the City of El Cajon sewer system, which is being used by existing flows. Based on the estimated wastewater flow projections, the current City of El Cajon and Metro capacity rights for the Winter Gardens SSA are sufficient for existing conditions but the County should review their current agreement with the City of El Cajon and consider revised capacity within the City of El Cajon's sewer system. The County should continue to monitor flows into Metro over the next five to ten years to determine whether the projected phased populations are consistent with future flow projections.

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CHAPTER 4
CAPACITY EVALUATION

This chapter provides a description of the capacity analysis performed as part of the Master Plan, and includes:

- evaluation criteria,
- model selection, development and calibration,
- capacity analysis, and
- recommended phased improvements.

4.1 Background

A capacity evaluation of the Winter Gardens SSA existing wastewater collection system was completed to identify sewer reaches that may be deficient under recommended design criteria and to identify any upgrades needed to accommodate existing and projected dry and wet weather wastewater flows. Based on the capacity evaluation, phased facility improvements were identified to reduce the potential for sanitary sewer overflows as well as to allow for projected growth within the study area.

4.2 Methodology

The principal tool utilized in the capacity analysis was the dynamic hydraulic model. The hydraulic model simulates flow conditions, such as wastewater flow depth, flow rate, and velocity, within pipes and manholes in the SSAs wastewater collection systems. The model selected in this study, InfoWorks CS (Innovyze, Version 8.5), belongs to a class of models referred to as dynamic wave models. These models provide a reasonable representation of hydraulic flow conditions over an extended period of time.

The model was developed using the physical collection system data, existing and forecasted populations, per capita unit generation rates, diurnal patterns, and rainfall events. The model was then calibrated to flow metering records for dry and wet weather conditions. Once the model was calibrated, it was utilized to evaluate the existing collection system under existing and projected dry and wet weather flow conditions in order to identify potential recommended improvements to the existing collection system.

4.3 Flow Monitoring

The Winter Gardens SSA has one flow meter that continuously records flow, depth and velocity measurements. Flow monitoring data from August 2010 at Meter WG-1 was used to develop initial diurnal patterns and calibrate the existing dry weather hydraulic model scenario. The

month of January 2010 was identified as having a rainfall event typical of a 2-year return storm, and was used to calibrate wet weather events.

4.4 Limitations of Hydraulic Modeling

The hydraulic model was utilized as the primary planning tool for the sewer capacity analysis and provides a reasonable representation of actual flow conditions within a sanitary sewer system in response to existing and future sewage loading. The accuracy of the simulation, however, is directly related to the accuracy of the model input data, including physical parameters and sewage loading projections. For example, in a case where roots had entered the sewer causing a blockage, the model would be unable to predict a resulting surcharge condition. Consequently, an understanding of the data sources is critical in interpreting the modeling results.

4.5 Evaluation Criteria

Recommended criteria were developed to evaluate the capacity of the existing collection system under existing and projected dry and wet weather flow conditions. The recommended evaluation criteria were developed by comparing existing County criteria to criteria for similar Southern California sewer agencies. The recommended evaluation criteria are presented in Table 4-1 and will be utilized to identify deficient facilities and size replacement infrastructure. The evaluation criteria presented in this master plan is not intended to replace the County's existing criteria, which shall continue to be utilized for the design of new infrastructure.

Table 4-1 Recommended Evaluation Criteria

Gravity Main Criteria	Recommended Evaluation Criteria
Minimum Pipe Diameter	8 inches
Minimum Velocity	2 fps at peak flow rate
Manning's Roughness Coefficient	0.013
Maximum Peak d/D Ratio for Existing Sewers	0.50 Peak Dry Weather Flow for dia. $\leq$ 15-inch
	0.75 Peak Dry Weather Flow for dia. > 15-inch
	0.92 Peak Wet Weather Flow for a 2-year storm
Maximum Peak d/D Design Criteria for New Sewers	0.50 Peak Wet Weather Flow for dia. $\leq$ 15-inch
	0.75 Peak Wet Weather Flow for dia. > 15-inch

4.6 Model Development

The model was developed with the physical collection system data, existing and forecasted populations, per capita unit generation rates, diurnal patterns, and rainfall events. Details regarding the collection system and the application of sewage loading factors and rainfall events are described below.

4.6.1 Collection System Attributes

Data required to create the model includes information describing the physical wastewater collection system, such as physical location, pipe diameters and reach lengths, manhole invert elevations, and estimated pipe roughness coefficients. Model connectivity was reviewed and

verified against County as-built records. The physical parameters of the model, including pipe diameter, slope, and roughness coefficients were based principally on the County's GIS records. Where the data appeared to be inaccurate or unclear, data was inferred.

The source of the model attributes was the County's GIS system. Concurrently with this project, the County instituted an ongoing program to improve their GIS system. As the part of the GIS system update, the sewer system attributes were populated in GIS from geo-referenced scanned as-built drawings. This process developed a good data source to build the model from.

4.6.2 Model Loading

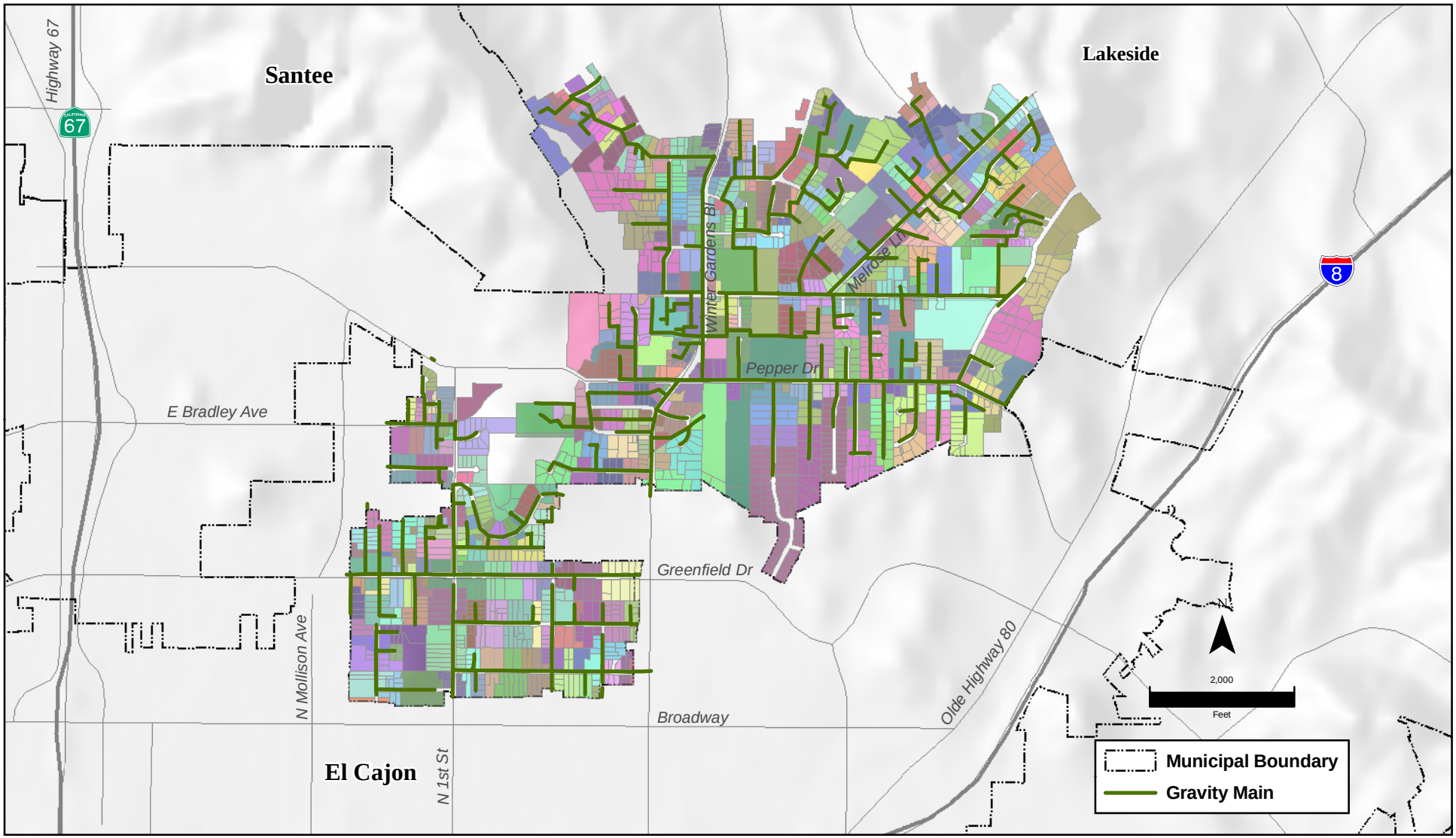
Wastewater flows are generated in the model by applying basin populations to per capita unit generation rates and time-varying hydrographs (diurnal patterns) at the basin's identified tributary node. Populations were applied for existing, interim and ultimate conditions at the parcel level. Each parcel was assigned a corresponding tributary model node based on available lateral information and topography. Model basins were then formed by merging parcels with identical tributary nodes.

The parcel's existing, interim, and ultimate residential and employment populations were summed and input into the model at the basin level. Residential and employment population estimates for the existing and interim conditions were provided by SANDAG. Residential and employment population estimates for the buildout condition were calculated based on proposed land use. Figure 4-1 presents the location of the model basins.

A diurnal pattern is expressed as a varying flow rate over time and is applied to the estimated average residential and employment flows to develop model flow inputs into the collection system. It is necessary to develop multiple diurnal patterns in order to properly model communities with varying types of sewer discharge patterns. For instance residential users typically discharge the most sewage during the early morning and early evening hours, while employment users typically discharge the most sewage in the middle of the day. Initial residential diurnal patterns were developed for the Winter Gardens SSA based upon the flow metering data. The flow pattern for the Winter Gardens SSA is typical of largely residential communities, which exhibit the largest peak in the morning and a smaller peak in the early evening. Employment populations represent only a small portion of the overall flows and as such, diurnal patterns for employment populations were assumed as a typical bell curve with the peak occurring at midday, which is conservative. The shapes of the residential diurnal patterns were refined during the dry weather model calibration to better simulate the observed peaking of the sewage flows. Appendix F includes model basin population projections and diurnal patterns.

4.6.3 Rainfall Events

Rainfall events are applied to the model to identify their potential impacts on the collection system. Rainfall derived inflow and infiltration (RDI&I) flows into the system are modeled by applying infiltration and routing coefficients to rainfall event. These coefficients were refined during the wet weather model calibration to better simulate the observed peaking of the sewage flows. A storm event occurring January 18 to 22, 2010 was selected for use in calibrating the wet weather model. The Granite Hills rain gauge is closest in proximity to the Winter Gardens SSA and was used for this study. The precipitation readings for the January storm are slightly lower than typical two-year design storms for San Diego County.



WINTER GARDENS MODEL BASINS

Figure 4-1

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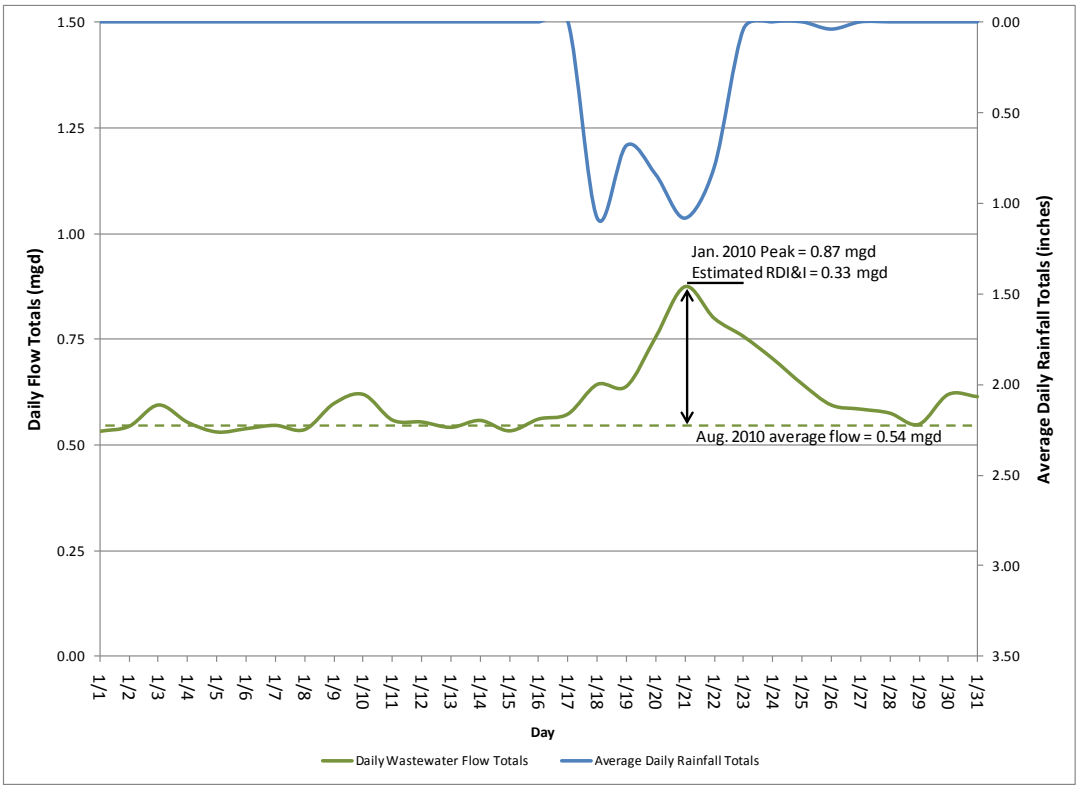
Figure 4-2 presents a comparison of the average daily flows recorded at Meter WG-1 to the average daily rainfall totals at the Granite Hills rain gauge. Rainfall totals for the Granite Hills rain gauge are summarized in Appendix G along with a storm intensity comparison chart.

As shown on Figure 4-2, the January storm event produced a peak increase of approximately 0.87 mgd, or a 62 percent increase over average flow, at Meter WG-1 from a storm event that averaged over an inch of rain during its 5-day period.

Figure 4-2 Meter WG-1 Wet Weather Flow Assessment



4.7 Model Calibration (at Meter WG-1 only)

The model was calibrated by refining estimated model parameters under dry and wet weather conditions so that the simulated model flow conditions reasonably approximated the measured flow conditions. Diurnal curves were adjusted for the dry weather calibration such that simulated and recorded wastewater flow and depth hydrographs matched to within a reasonable level of accuracy. Infiltration and routing coefficients were adjusted in the wet weather calibration such that simulated and recorded wastewater peak flows matched to within a reasonable level of accuracy.

4.7.1 Dry Weather Calibration

The model was calibrated to dry-weather meter data recorded in the month of August 2010 at Meter WG-1. The flow records for August 22, 2010 were selected to calibrate volume because

they represented the maximum day in that month. Simulated flow hydrographs at the meter location were compared with recorded discharge measurements. The purpose of the comparison was to allow for refinement of estimated model parameters so that the simulated flow conditions reasonably approximated the measured flow conditions. These parameters generally include diurnal curve patterns and peak to average flow ratios (peaking factors).

Results of the dry weather calibration are best presented graphically and are shown in Figure 4-3. The typical range of sewer volume and peak flows for dry weather model calibration is within +/–10 percent of field measurements for master planning purposes. The dry weather model was calibrated to within 2 percent of peak observed flows and within 1 percent of average observed flows. Table 4-2 summarizes the results of the dry weather calibration.

Figure 4-3 Dry Weather Calibration at Meter WG-1

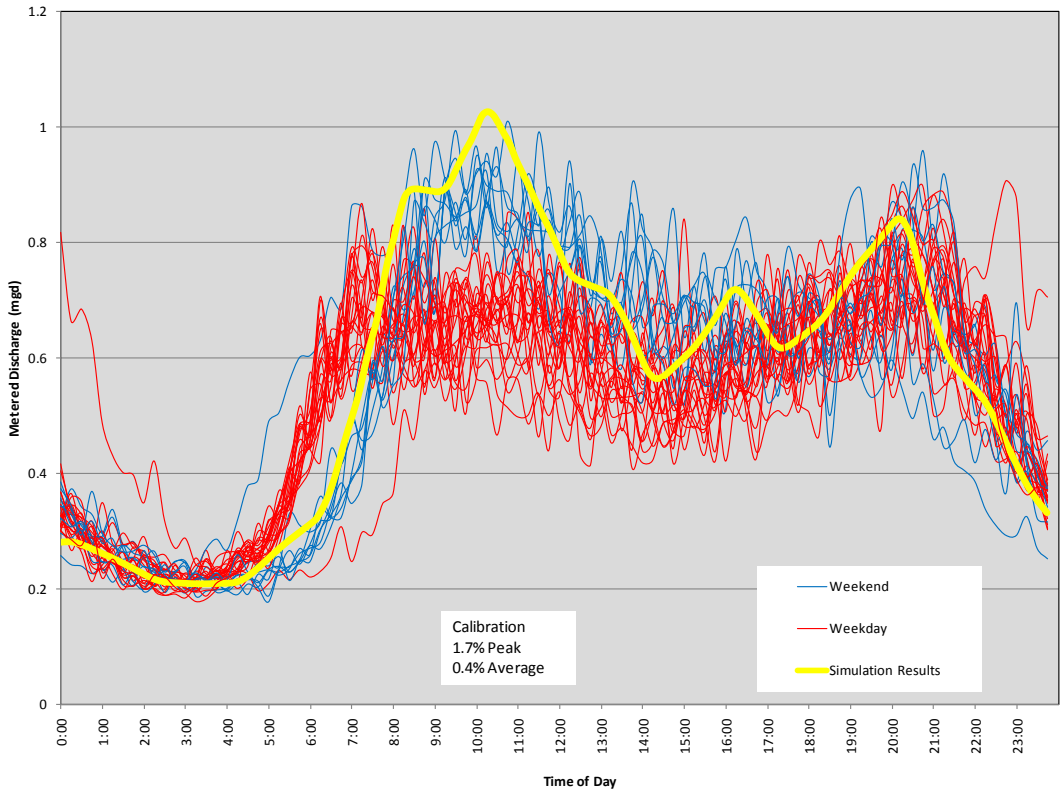


Table 4-2 Dry Weather Calibration Summary

Meter Name	Observed Peak Flow	Modeled Peak Flows
WG-1	1.010 mgd	1.027 mgd

4.7.2 Wet Weather Calibration

The model was calibrated to the peak wet-weather flow event that occurred on January 20, 2010 at the County-maintained flow meters. The flow records for January 20 were selected because they represented the largest spike in flows, approximately 0.87 mgd above average January flows that corresponded with the peak intensity of the storm. Simulated flow hydrographs at each meter location were compared with recorded discharge measurements. The purpose of the comparison was to allow for refinement of estimated model parameters so that the simulated flow conditions reasonably approximated the measured flow conditions. These parameters include the infiltration and routing coefficients. The infiltration coefficient determines what percentage of the rainfall enters the system. The routing coefficient determines how fast or slow the rainfall enters the system.

In general, the system exhibited a significant rapid response to the storm event. The system's response to the storm event suggests wet weather infiltration flows based on manhole locations (low elevations, proximity to waterways) or through the collection system. The SSA may also experience wet weather inflows from storm drain connections to the sewer system or other direct connections conveying rainfall into the collection system. The system's response and wet weather calibration results are best presented graphically and are shown in Figure 4-4. Table 4-3 summarizes the results of the wet weather calibration.

Figure 4-4 Wet Weather Calibration at Meter WG-1

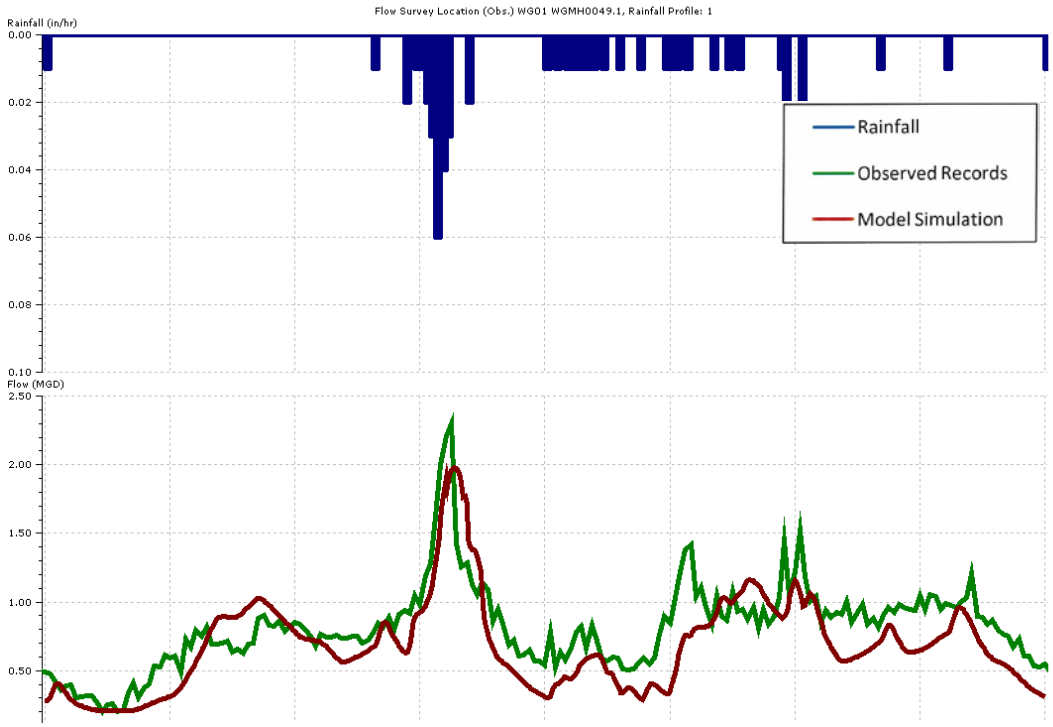


Table 4-3 Wet Weather Calibration Summary

Meter Name	Observed Peak Flow	Modeled Peak Flows
WG-1	2.297 mgd	1.978 mgd

Based on typical master planning calibration criteria, the hydraulic model is within acceptable ranges when compared to metered flow data and observed rainfall data. The model is considered a calibrated model and can be used for future planning scenarios.

4.8 Capacity Analysis

A capacity analysis of the existing collection system was performed under existing and forecasted dry and wet weather flow conditions. Model simulations were performed for the recommended 2030 wastewater generation, discussed in Chapter 3, in order to identify potential improvement projects. The identified improvement projects were then sized to accommodate the buildout flow projections based on the land use. Projects were evaluated under the existing and recommended 2020 wastewater generation to identify project priority and phasing. Identified improvement projects were evaluated against identified condition related projects presented in the next chapter to form the Capital Improvement Plan presented in Chapter 6.

4.8.1 Gravity Pipelines

The gravity pipelines were evaluated under existing and projected wastewater flows based upon the criteria listed in Table 4-1. Under dry weather flow conditions, pipeline capacity projects were identified if the peak flows exceeded a flow depth to pipe diameter (d/D) ratio of 0.50 for pipeline diameters 15 inch and smaller and 0.75 for pipelines greater than 15 inches in diameter. Under wet weather flow conditions, pipeline capacity projects were identified if the peak flows exceeded a d/D ratio of 0.92 for all pipeline diameters, per the County's current pipe criteria.

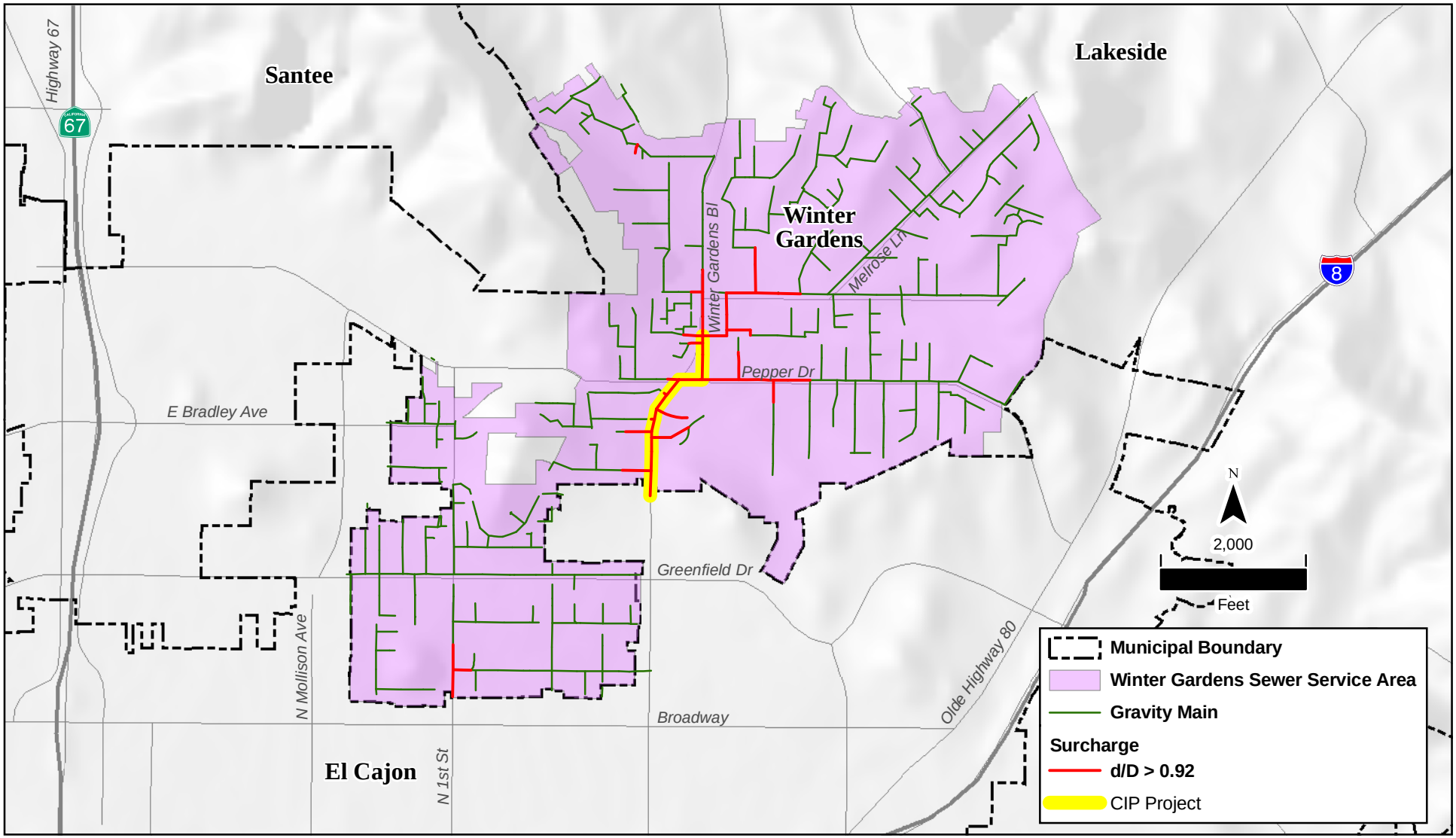
Capital improvement projects (CIP) were evaluated through an iterative process and were less extensive than the identified deficient pipelines presented in Table 4-4 once hydraulic bottlenecks are relieved. The identified deficiencies were analyzed for reasonableness by verifying that the capacity constraint reported by the model is a function of a downstream pipe size not extending far enough upstream and/or a pipe slope flatter than adjacent segments rather than capacity limitations. Table 4-4 summarizes the total length of the identified deficiencies in gravity pipeline capacity based on model condition. A detailed summary of the identified deficiencies in gravity pipeline capacity is provided in Appendix H.

Table 4-4 Gravity Pipeline Identified Deficiencies by Model Condition

Model Condition	Length (feet)
Existing Dry Weather	2,396
Existing Wet Weather	2,625
2030 Dry Weather	2,396
2030 Wet Weather	2,625

Figure 4-5 presents the location of the identified pipeline deficiencies based on modeled surcharge (d/D) results. Identified capacity deficiencies were also evaluated in conjunction with identified condition related projects (presented in Chapter 5) to form the Capital Improvement Plan presented in Chapter 6.

Prior to construction of improvements, it is recommended that the County conduct detailed engineering investigations of the identified reaches that may include field inspections, flow metering during peak flow periods (such as holidays) and under wet-weather conditions, and video inspection to accurately assess the improvements needed.



Note: Proposed CIP project shown will alleviate upstream d/D deficiencies.

GRAVITY PIPELINE
MODEL IDENTIFIED DEFICIENCIES

Figure 4-5

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CHAPTER 5
CONDITION ASSESSMENT

This chapter provides a description of the condition assessment performed as part of the Master Plan, and includes:

- collection system characteristics,
- current maintenance goals and practices,
- video inspection and assessment process,
- inspection and assessment results, and
- recommended rehabilitation program.

5.1 Background

A wastewater system condition assessment provides agencies and municipalities with valuable information used to determine the funding required to repair and rehabilitate an aging collection system and to prioritize the allocation of funds. An assessment of existing facilities serves to identify the existing system conditions and defects which may contribute to potential overflows and excessive infiltration. Such conditions include root intrusion at misaligned joints or cracks, breaks in the pipe, inflow and infiltration (I/I) entering into the system through cracks in pipes or manholes or via illegal storm drain connections, all of which affect pipe capacity and treatment costs. The condition assessment of the existing Winter Gardens SSA collection system was based on the physical inspection of 6,550 linear feet of 8-inch sewer mains which accounts for approximately 5 percent of the wastewater collection system in the SSA. The pipeline segments selected for inspection and assessment included pipelines that are approximately 45 years of age and consisting primarily of vitrified clay pipe (VCP).

5.2 Collection System Characteristics

The majority of the Winter Gardens collection system was constructed in the 1960s when VCP was the most common pipe material used for construction. Gravity pipelines constructed of VCP accompanied the major growth in Winter Gardens with polyvinyl chloride pipe (PVC) being used in the 1980s. A breakdown of the total pipeline length in the Winter Gardens SSA by length of material and age is provided in Table 5-1 and presented graphically in Figure 5-1.

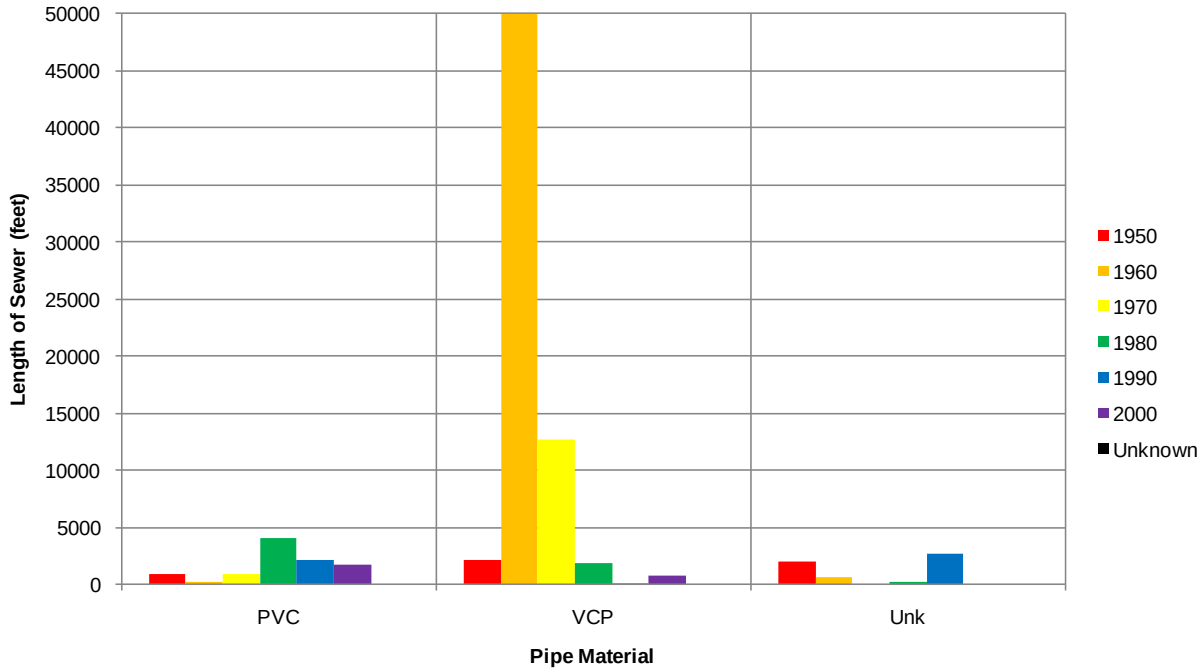
The wastewater collection system data presented in this chapter, including length, material and pipe sizes, are based on information obtained from the County's database. The database has not been updated to reflect any corrections and/or discrepancies noted through the CCTV inspection findings. Based upon the CCTV data and as necessary, the County's GIS and

mapbooks should be updated to reflect more accurate information obtained through the inspection and assessment process.

Table 5-1 Winter Gardens SSA Gravity Pipeline Length of Material by Age

Age	Material			
	PVC	VCP	Unknown	Total
1950s	942	2,189	2,007	5,138
1960s	237	104,341	577	105,155
1970s	866	12,711	0	13,577
1980s	4,075	1,886	270	6,231
1990s	2,160	110	2,747	5,017
2000s	1,776	720	0	2,496
Total	**10,056**	**121,957**	**5,601**	**137,614**

Figure 5-1 Winter Gardens SSA Gravity Pipeline Length of Material by Age



As may be determined from Table 5-1 and Figure 5-1, approximately 90 percent of the Winter Gardens system was constructed of VCP pipe of which over 75 percent was constructed in the 1950s and 1960s. Historically, VCP pipe has a life span ranging from 50-70 years. Based on the information presented above, 80 percent of the VCP pipe has reached the initial years of the pipe material life cycle. Therefore, as the wastewater collection system continues to age, routine inspection is critical for monitoring and establishing the condition of the pipelines and identifying methods to extend its service life.

5.3 Current Maintenance Practices

The County's Facility Operations staff conducts routine cleaning and inspection of pipelines within Winter Gardens SSA, as well as the additional eight (8) SSAs within the County's jurisdiction. The County's goal is to clean the Winter Gardens SSA pipelines on a yearly basis. Additionally, crews clean Special Maintenance locations on a quarterly basis. The Special Maintenance locations within the Winter Gardens SSA are presented in Figure 5-2 and include several of the County's pipelines in the SSA that may contain sags and areas identified as having excessive amounts of grease and/or sludge accumulation and root concentrations. Approximately 5 percent of the pipelines within the Winter Gardens SSA are video inspected annually.

5.4 Inspection and Assessment

Closed circuit television cameras offer valuable insight to the structural and maintenance condition of underground infrastructure. Video inspection of sewer pipelines is used to identify and evaluate the existence and severity of defects including cracks, misaligned joints, accumulation of roots or silt, and potential sources of infiltration. Figure 5-3 shows the location of the pipelines in the Winter Gardens SSA that were inspected and assessed.

The video inspection for the Winter Gardens SSA was performed by Houston and Harris, PCS, Inc. Standard observations and severity ratings were documented on video inspection logs, which included various locations of sewer mains with deficiencies including broken or cracked pipe, misaligned joints, debris, and root intrusion. Inspection log reports are provided in Appendix I. The inspection logs were independently reviewed by Atkins and each observation was assessed for its criticality to assist in determining the final sewer rehabilitation recommendations. The following sections describe the criteria used and procedures performed during the inspection and assessment process.

5.4.1 Inspection Criteria and Procedures

For the purposes of this project, National Association of Sewer Service Companies (NASSCO) inspection codes and ratings were used. Implementation of the NASSCO codes provides a consistent method in the manner with which the inspection was conducted and the observations noted. A summary of the observation codes used for the CCTV inspection are included in Appendix J. The numeric severity rating (1-5) assigned to the specific structural and/or maintenance observations are also defined. A NASSCO severity rating of one (1) is minor while a severity rating of five (5) is severe. The severity ratings, as noted, are automatically assigned based on the structural and/or maintenance observation noted by the CCTV operator.

5.4.2 Assessment Criteria and Procedures

For each sewer pipeline inspection conducted, the video record and log was independently reviewed as a quality check of the noted observations and respective ratings included in the database results and as confirmation that the data provided for performing the condition assessment was acceptable. The video inspection log for each sewer segment was analyzed and ranked to indicate the criticality of the asset condition using a scale of "A" through "E" to indicate the severity of the pipeline's condition, with "E" being the worst condition. Table 5-2

provides a summary of the general criticality ranking associated with the severity of the overall condition of the asset, as well as a general response time. It should be noted that the actual response time for implementing a recommended action is dependent upon several factors. Therefore, assets with rankings of B or C should be re-inspected and reassessed prior to implementing the recommended action as further deterioration may occur or the condition of the pipe may remain in relatively stable and the improvement may be reprioritized.

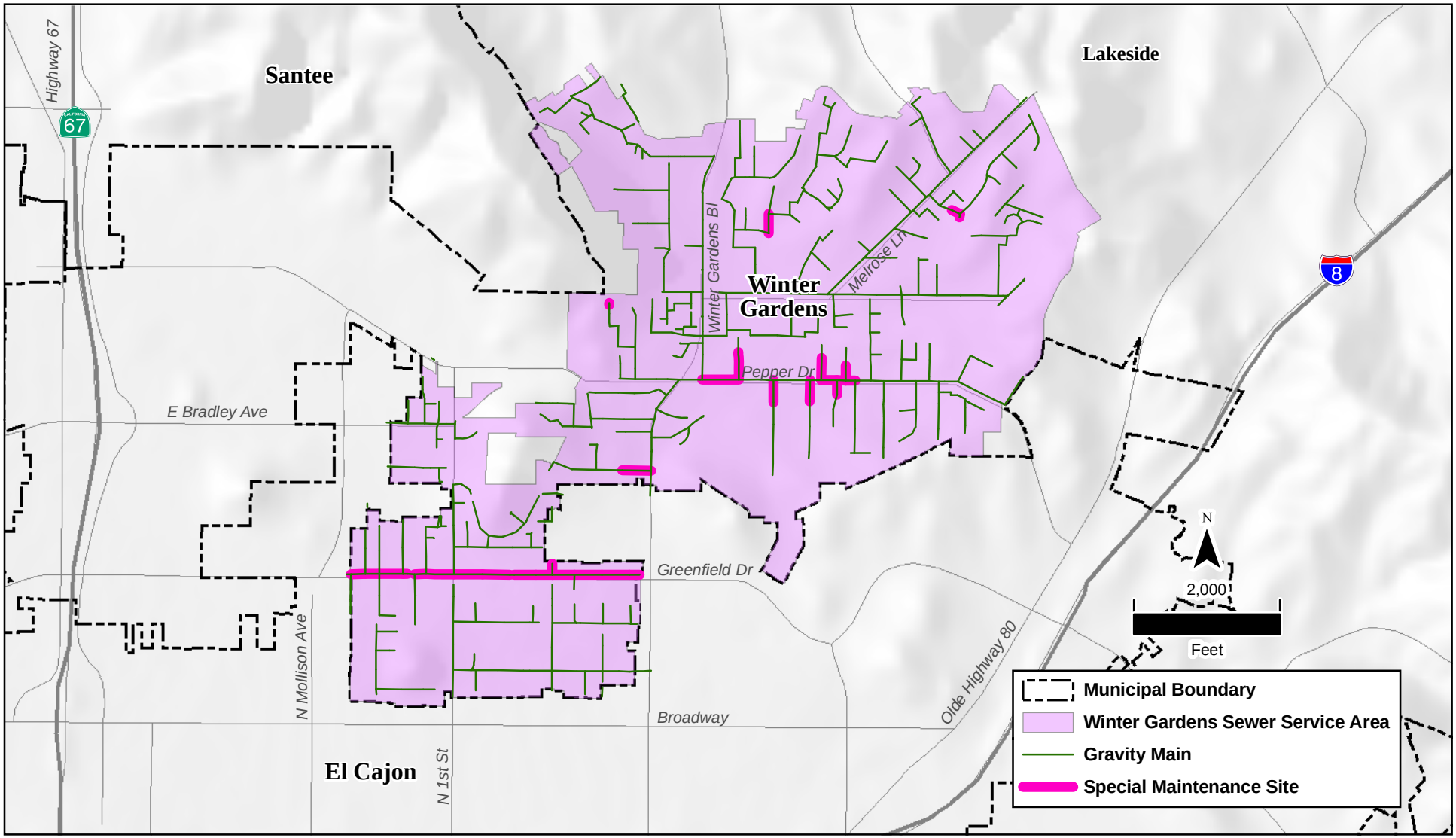
Table 5-2 Condition Severity Ranking

A	B	C	D	E
Good	Adequate	Moderate	Poor	Failing
Maintenance	5+ years	3 to 5 years	1 to 2 years	Immediate

The severity assigned to each sewer pipeline is based on the criteria listed in Table 5-3 to ensure consistency and uniformity in the process.

Table 5-3 Condition Assessment Criteria – Severity

Observation	Condition Criticality Ranking				
	A	B	C	D	E
Cracks • Circular • Longitudinal • Multiple	None	Very small hair line crack(s)	Hair line crack(s) <50% of ID in length	Cracks ≤1/8" wide or >50% of ID in length	Cracks >1/8" wide
Broken Pipe	None	Connecting cracks, no displacement	Connecting cracks, displacement≤1/4"	Connecting cracks, displacement >1/4"	Collapsed pipe, impassable
Joints - Offset	Minimal	Up to 1/2 of the pipe thickness	1/2 to thickness of the pipe	Thickness of the pipe to 1½ times	> 1½ times the thickness of the pipe
Joints – Separation	None	Gasket exposed	Bell exposed	Dirt exposed at top	Dirt exposed at invert
Roots	Minimal	10% to 35% Fine roots	35% to 60% Fine/medium roots	60% to 80% Medium roots	80% to 100% Tap root(s) visible
Debris Accumulation	Minimal	Sporadic deposits (no rocks)	≤10% of ID (no rocks)	10% to 25% of ID and/or rocks	>25% of ID or impassable
Erosion (typical concrete pipe)	None	Rough surface	Exposed aggregate	Exposed rebar	Missing concrete
Mineral Deposits	None	Minimal (possible infiltration)	≤10% ID thickness	>10% ID thickness	Impassable, heavy mineral deposits
Infiltration	None	Dripping	Seeping	Constant stream	Gushing water
Sag	None	Minimal (probably not perceptible)	≤25% of ID	25% to 75% of ID	>75% of ID
Flow Capacity	Minimal	2/5 or less full	2/5 to 1/2 full	1/2 to 3/4 full	3/4 to totally full



SPECIAL MAINTENANCE LOCATIONS

Figure 5-2

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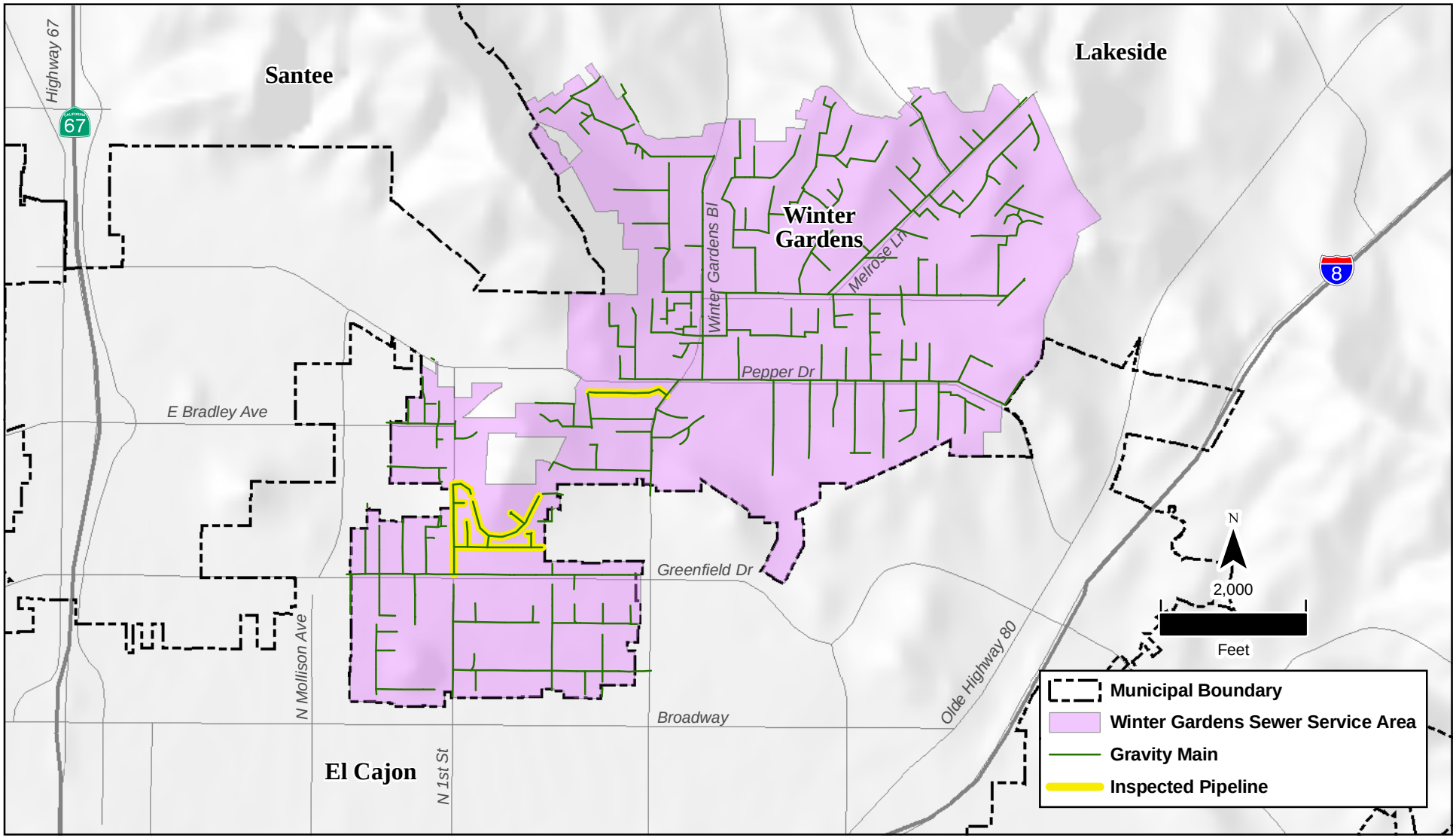

INSPECTED
AND ASSESSED PIPELINES

Figure 5-3

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Using the applicable observation and severity, a preliminary recommendation for each sewer segment was determined. Table 5-4 summarizes the preliminary recommendations for each observed condition and severity ranking.

Table 5-4 Preliminary Pipeline Recommendation Criteria

Observation	Condition Criticality Ranking				
	A	B	C	D	E
Cracks • Circular • Longitudinal • Multiple	No Action	No Action or Rehabilitate	No Action or Rehabilitate	Rehabilitate	Rehabilitate or Replace
Broken Pipe	No Action	No Action or Rehabilitate	Point Repair or Rehabilitate/ Replace	Point Repair or Replace	Immediate Point Repair
Joints – Offset	No Action	No Action or Rehabilitate	Point Repair and/or Rehabilitate	Point Repair and/or Rehabilitate/ Replace	Point Repair and/or Rehabilitate/ Replace
Joints – Separation	No Action	Rehabilitate	Rehabilitate	Point Repair and/or Rehabilitate/ Replace	Rehabilitate or Replace
Roots	No Action	Clean and Rehabilitate	Clean and Rehabilitate	Clean and Rehabilitate	Clean and Rehabilitate/ Replace
Debris Accumulation	No Action	Clean	Clean	Clean	Clean
Erosion (typical concrete pipe)	No Action	Rehabilitate	Rehabilitate or Replace	Rehabilitate or Replace	Replace
Mineral Deposits	No Action	No Action or Rehabilitate	Point Repair or Rehabilitate	Rehabilitate	Rehabilitate
Infiltration	No Action	No Action or Rehabilitate	Point Repair or Rehabilitate	Rehabilitate	Rehabilitate
Sag	No Action	No Action	Any Option	Replace	Replace
Flow Capacity	No Action	No Action	No Action	Evaluate Capacity	Evaluate Capacity

5.5 Sewer Pipeline Inspection and Assessment Results

The sewer pipelines inspected were initially evaluated using the NASSCO Rating System and were subsequently more thoroughly assessed by conducting a comprehensive review of the videos, still images, and any additional data available. Prior to scheduling maintenance efforts and/or implementing repair and rehabilitation improvements, information included in the appendices should be further reviewed for additional detailed information pertaining to the specific condition of the pipelines inspected and assessed.

Overall, the pipe segments inspected are generally in fair condition. Generally, over 70 percent of the observed pipelines were identified as requiring some form of repair or rehabilitation while over 25 percent were identified as requiring No Action. Table 5-5 includes a summary of the

recommended actions based on the number of pipe segments and pipe length inspected and assessed while Table 5-6 includes a summary of the criticality rankings based on the number of pipe segments and pipe length inspected and assessed. Figure 5-4 graphically presents the pipeline inspection and assessment findings by percentage of length of pipe inspected and assessed.

Although Table 5-5 illustrates that over 70 percent of the inspected pipelines were identified as requiring repair or rehabilitation, Table 5-6 illustrates that 50 percent (3,470 linear feet) of the deficiencies documented should be further evaluated for implementation within the next 5 years.

Table 5-5 Pipeline Inspection and Assessment Findings by Segment and Length

Description	No Action	Repair/Rehabilitate	Total
Number of Segments	10	22	32
Length (feet)	1,789	4,755	6,544
Percentage by Length	27.3%	72.7%	100.0%

Table 5-6 Summary of Criticality Ratings by Segment and Length

Description	Criticality					Total
	A	B	C	D	E	
No of Pipeline Segments	10	7	9	6	0	32
Length (feet)	1,789	1,289	1,662	1,804	0	6,544
Percentage by Length	27.3%	19.7%	25.4%	27.6%	0.0%	100.0%

Figure 5-4 Pipeline Inspection and Assessment Findings by Percentage of Length

Figure 5-5 illustrates the recommendations for the pipelines within the SSA that were inspected and assessed based on age. It should be noted that only two of the pipelines inspected and assessed were constructed in the 2000s according to the information provided by the County. The pipelines consist of one Rib-Loc lined pipe (146 linear feet) identified as requiring No Action and a VCP pipe (130 linear feet) identified as requiring a form of repair and/or rehabilitation. The remaining pipelines inspected and assessed were constructed in the 1960s and have been in service for approximately 40-50 years.

Figure 5-5 Pipeline Inspection and Assessment Findings by Age

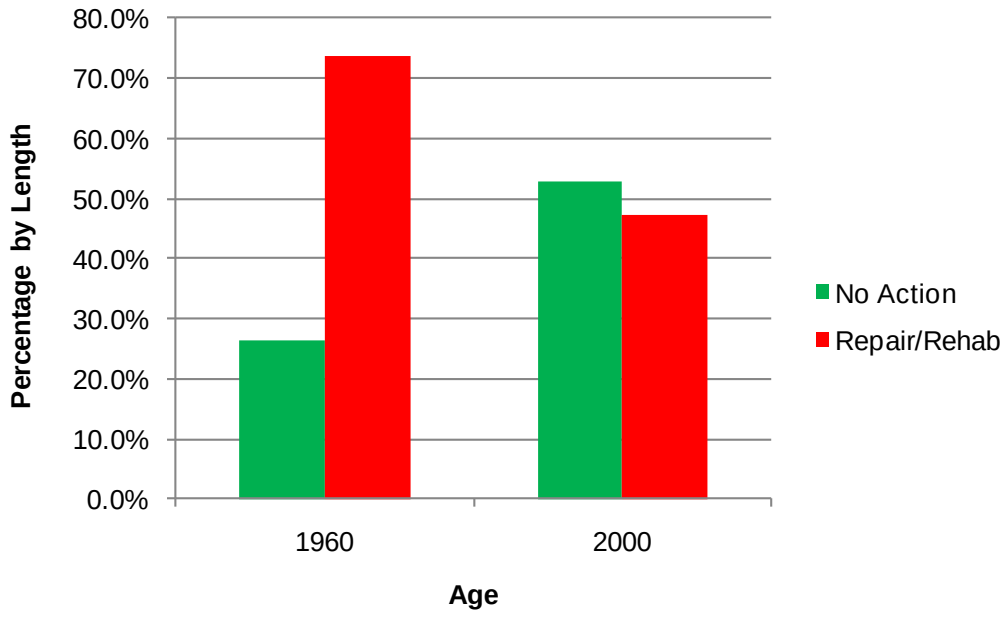


Table 5-7 summarizes the number of pipe segments and the length of pipe inspected and assessed by material type. Furthermore, Figure 5-6 illustrates the recommendations for the inspected pipelines based on material type. The PVC pipe illustrated in Figure 5-6 reflects the only Rib-Loc pipe inspected as assessed.

Table 5-7 Pipeline Inspections by Segment and Material

Description	Material		
	Rib-Loc (Lined-PVC)	VCP	Total
Number of Segments	1	31	32
Length (feet)	146	6,398	6,544
Percentage by Length	2.2%	97.8%	100.0%

Figure 5-6 Pipeline Inspection and Assessment Findings by Material

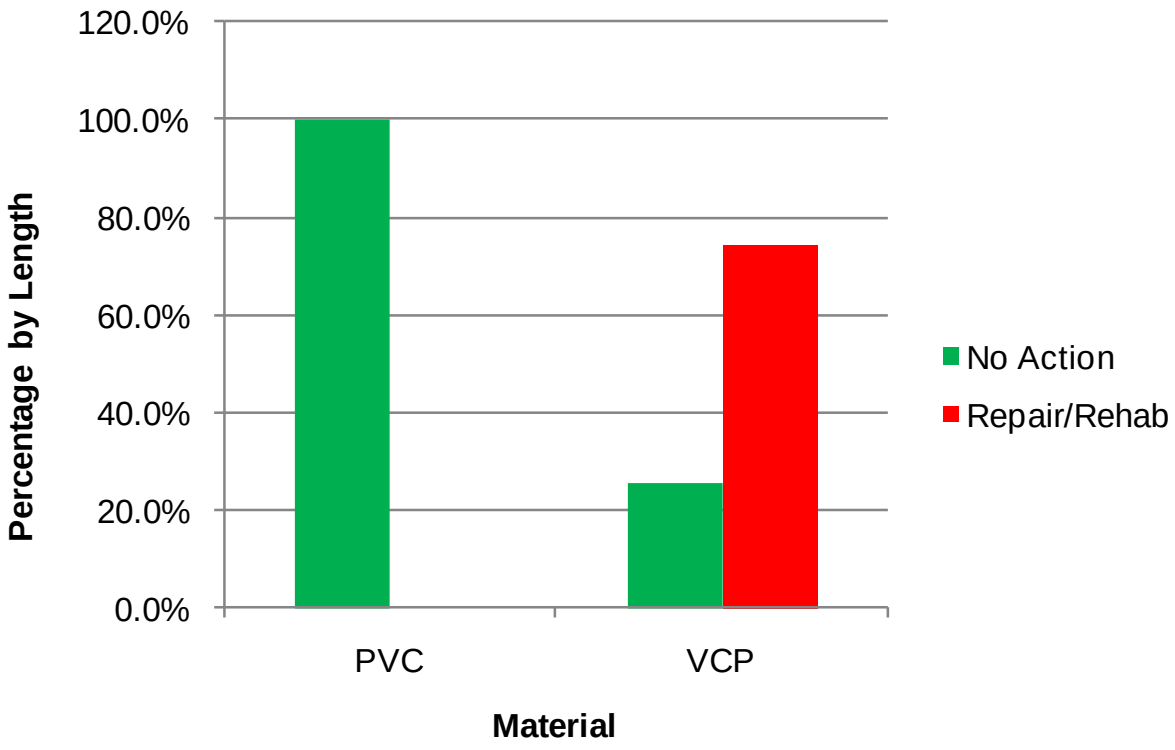
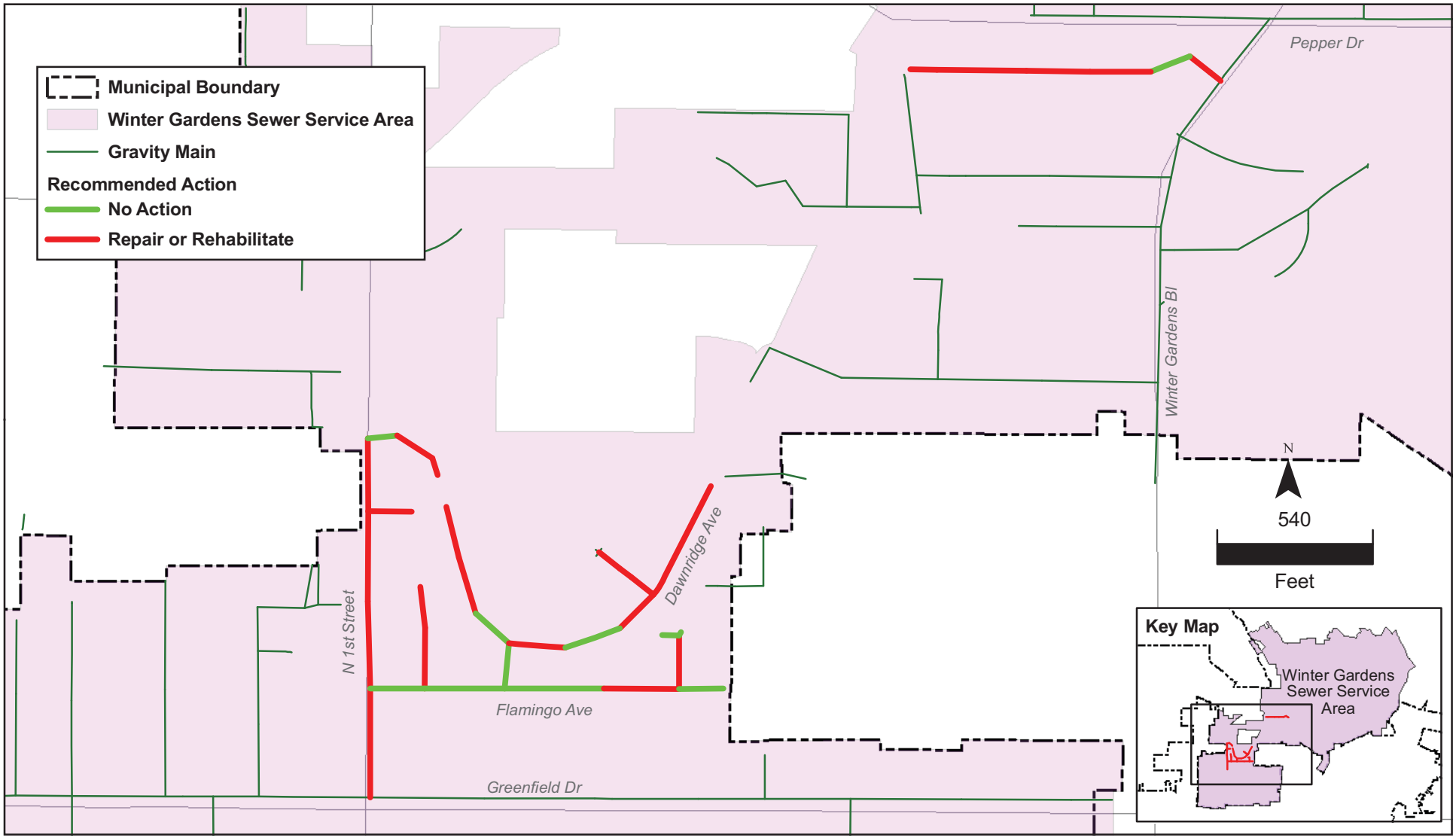


Figure 5-7 illustrates the locations of the recommended actions in the Winter Gardens SSA. The recommendations include No Action and Repair/Rehabilitate. Detailed pipeline recommendations are included in Appendix K.

Based on the inspection and assessment of 5 percent of the collection system for the Winter Gardens SSA, it appears that approximately 75 percent of the VCP pipelines that have been in service for at least 45 - 50 years are likely to need repair or rehabilitation (see Table 5-5). Extrapolating these results over the approximately 106,530 linear feet of VCP pipelines in the SSA that were constructed in the 1950s and 1960s, it is estimated that approximately 80,000 linear feet (15 miles), which equates to approximately 60 percent of the wastewater collection system, potentially requires rehabilitation or repair in the next 5-15 years. Table 5-8 summarizes the projected length of rehabilitation or repair for the SSA.

Table 5-8 Extrapolation of Recommended Actions

Recommended Action	Length Assessed (feet)	Percentage of Total Length Inspected	Extrapolated Length (feet)
VCP (No Action)	1,643	25%	26,600
VCP (Repair/Rehabilitate)	4,759	75%	79,900
		Estimated Total	**106,500**



RECOMMENDED ACTION

Figure 5-7

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5.6 County Condition Assessment Procedures

As part of the County's assessment process, pipelines identified as requiring repair, rehabilitation, or replacement are reviewed and prioritized in compliance with the County's Major Maintenance Project Program. Inspection videos and photos captured during the inspection process, of pipelines which were identified to contain noted defects are reviewed and assessed by staff in the County's Major Maintenance Project Program. The defects are scored according to defined criteria and then ranked to indicate the criticality of the asset condition. The scoring procedure is based on the type of defects noted and defined severity criteria. Points assigned range from 0 to 3, with 3 being the most severe for each criterion.

Table 5-9 includes a summary of the scores and severity rankings for the pipelines inspected and assessed in the Winter Gardens SSA. Additionally, the score for each of the six (6) criterions used to prioritize projects for the Major Maintenance Project Program are summarized. For the purpose of this study, it was assumed that Sanitary Sewer Overflows (SSOs) have not occurred at these facilities.

The total score for each potential project is then ranked to establish the criticality of the project. Table 5-10 provides a summary of the general criticality ranking associated with the total score for each asset as well as the recommended response time to complete the recommended action for Major Maintenance Program projects.

Based on the summary included in Table 5-9, the scores generally range from 1-5 and rankings consist primarily of 1s and 2s with only one project (WG0619) scored at 7 points and ranked a 3 in criticality. Therefore, based on the County Major Maintenance Project Program assessment process, the rankings indicate that there is currently only one project that requires repair or rehabilitation in 6-12 months.

For the pipelines identified as potential improvement projects, Table 5-11 includes a summary of the severity rating results based on the inspection and condition assessment criteria and process presented in Section 5.3 and the total score and ranking based on the County assessment procedures implemented as part of the Major Maintenance Program described above.

The Condition Severity Rankings included in Table 5-3 and the rankings summarized in Table 5-10 are each associated with a recommended response time. Although there is a correlation between the response times in the tables, the response time associated with the County assessment process serves to identify and schedule potential projects within a 24 month period while the response time included in Table 5-3 extends beyond a 5 year period. Therefore, as a project is confirmed for implementation, it is recommended that the project be reviewed in conjunction with the existing CIP and Major Maintenance Project Program as it may have already been identified and planned for construction or its proximity to currently scheduled projects may affect the actual response time. Additionally, the scores for each criterion used to determine the total score for each project should be further reviewed to verify the scores are appropriate (i.e., it was assumed that no previous SSOs occurred at the assets) as it may affect the overall score, project ranking, and thus the recommended response time**.** Further discussion regarding the timing of necessary improvements is included in Chapter 6.

Table 5-9 Winter Gardens SSA Pipeline Assessment Scores and Rankings

Mainline ID No.	Recommended Action	Condition of Facility/ System	Age of Components, System and/or Facility	Pipe Flow Ratio (peak dry weather)	Previous SSOs	Proximity to Watercourse	Blockage or Damage	Total Score	Ranking
WG0629	Sectional Line	1	3	0	0	0	1	5	2
WG0628	T-Liner	0	3	0	0	0	0	3	1
WG0624	Line & T-Liner	1	3	0	0	0	1	5	2
WG0621	Line & T-Liner	1	3	0	0	0	1	5	2
WG0620	No Action	0	3	0	0	0	0	3	1
WG0619	Line	2	3	0	0	0	2	7	3
WG0618	Sectional Line	1	3	0	0	0	1	5	2
WG0617	Line	1	3	0	0	0	2	6	2
WG0616	No Action	0	3	0	0	0	0	3	1
WG0651	No Action	0	3	0	0	0	0	3	1
WG0632	No Action	0	3	0	0	0	0	3	1
WG0634	No Action	0	3	0	0	0	0	3	1
WG0633	Line & T-Liner	0	3	0	0	0	1	4	2
WG0631	Sectional Line	1	3	0	0	0	1	5	2
WG0630	No Action	0	3	0	0	0	0	3	1
WG0614	No Action	0	3	0	0	0	0	3	1
WG0611	No Action	0	3	0	0	0	0	3	1
WG0613	Sectional Line	1	3	0	0	0	1	5	2
WG0612	Sectional Line	0	3	0	0	0	1	4	2
WG0610	Sectional Line	0	3	0	0	0	3	6	2
WG0609	Sectional Line	1	3	0	0	0	1	5	2
WG0608	No Action	0	3	0	0	0	0	3	1
WG0607	Sectional Line	1	3	0	0	0	1	5	2
WG0606	T-Liner	0	3	0	0	0	0	3	1
WG0605	Line	1	3	0	0	0	2	6	2
WG0604	Sectional Line	1	3	0	0	0	2	6	2
WG0603	Line	1	3	0	0	0	2	6	2
WG0058	Line & T-Liner	0	3	0	0	0	3	6	2
WG0057	Line & T-liner	1	3	0	0	0	1	5	2
WG0056	Line & T-Liner	0	3	0	0	0	2	5	2
WG0054	Line	1	0	0	0	0	1	2	1

Table 5-10 Condition Criticality Ranking-Major Maintenance Projects

Score/ Points	Ranking	Design/ Construction Schedule	Project Assessment	Assessment Description
15-13	5	Within 4 Months	Critical	Recent SSO; Exceeded Capacity; Known Failure/Blockage Points; Maintenance Intensive
12-10	4	4-6 Months	High Priority	Severe Deterioration; SSO History: Potential Blockage/SSO; Maintenance Intensive
9-7	3	6-12 Months	Serious	Severe Deterioration; Near Capacity; Maintenance Intensive
6-4	2	12-24 Months	Major	Visible Deterioration and Near Allowable Capacity
3-1	1	24 Months Plus	Discretionary	Functional; Minor Deterioration; Below Capacity

Table 5-11 Summary of Severity Ratings and Major Maintenance Program Rankings

Mainline ID No.	Line Length (feet)	Severity Rating	Recommended Action	Total Score	Ranking
WG0621	159.0	B	Line & T-Liner	5	2
WG0618	183.0	B	Sectional Line	5	2
WG0631	257.0	B	Sectional Line	5	2
WG0613	149.0	B	Sectional Line	5	2
WG0609	147.0	B	Sectional Line	5	2
WG0607	246.0	B	Sectional Line	5	2
WG0606	148.0	B	T-Liner	3	1
WG0629	171.5	C	Sectional Line	5	2
WG0628	250.0	C	T-Liner	3	1
WG0624	241.0	C	Line & T-Liner	5	2
WG0617	200.0	C	Line	6	2
WG0633	185.0	C	Line & T-Liner	4	2
WG0612	206.0	C	Sectional Line	4	2
WG0610	58.0	C	Sectional Line	6	2
WG0057	220.0	C	Line & T-liner	5	2
WG0054	130.0	C	Line	2	1
WG0619	192.0	D	Line	7	3
WG0605	312.0	D	Line	6	2
WG0604	300.0	D	Sectional Line	6	2
WG0603	386.0	D	Line	6	2
WG0058	404.0	D	Line & T-Liner	6	2
WG0056	210.0	D	Line & T-Liner	5	2

CHAPTER 6
PROPOSED CAPITAL IMPROVEMENT PROGRAM

This chapter presents the proposed CIP based on the findings of the Master Plan and includes:

- development of unit costs,
- capital improvement project summary of cost and timing, and
- proposed condition upgrades and estimated costs.

6.1 Development of Unit Costs

The unit cost estimates reflect full capitalization inclusive of planning, engineering design, environmental, legal, construction, construction management and contract administration. The values are presented in mid-2010 dollars based on an anticipated ENR Construction Cost Index (ENR-CCI) of 9969 for the Los Angeles/Orange County area. These estimates are based on representative available data from the County and Atkins' available data at the time of this report; however, since prices of materials and labor fluctuate over time, new estimates should be obtained at or near the time of construction of proposed facilities. A scaling factor has been included to account for pipeline projects that are relatively short in distance or have more significant environmental or construction challenges. The CIP has been divided into four phases.

6.1.1 Pipelines

The base unit costs for new pipelines required for upsizing due to capacity constraints in existing developed corridors including all pipeline material, installation, repaving, manholes, bypassing, and system appurtenances, are presented in Table 6-1.

Table 6-1 Pipeline Unit Costs

Diameter (inches)	Sewer, Gravity ($/LF)
12	500
15	600

The unit costs provided above reflect an average County cost for full capitalization inclusive of planning, engineering design, environmental, legal, construction (including all appurtenances), construction management and contract administration. Special circumstances (e.g., jacking, trenchless installations, tunnels, etc.) are considered separately on a case-by-case basis. A scaling factor was applied to each project to account for project specific issues such as difficult conditions, constrained access, congested areas, etc.

6.2 Recommended Capacity CIP Program

The CIP projects identify facilities needed to meet existing system needs based on the County's capacity design criteria for the wastewater collection systems. Winter Gardens SSA CIP projects are proposed for Phase II at an estimated cost of $1.94 million. The proposed CIP project recommended for the Winter Gardens SSA collection system is listed in Table 6-2, and shown and described in further detail on the subsequent pages.

Table 6-2 Winter Gardens Master Plan Capital Improvement Program

CIP #	Project	Description	Units	Base Unit Cost	Scaling Factor[(1)]	CIP Cost
WG-1	Winter Gardens Trunk Sewer Pipeline Replacement Project	Replace approximately 2,700 feet of existing 8 inch through 12 inch diameter with 15-inch diameter.	2,700 Linear feet	$600 per Linear foot	1.2	$1,944,000

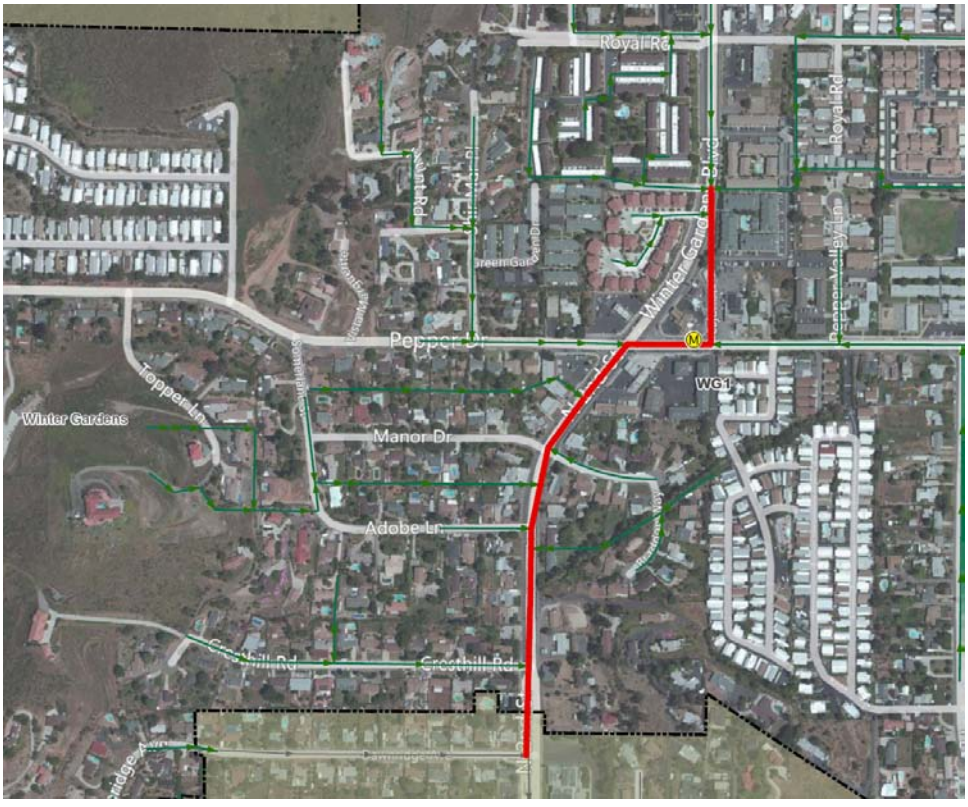
(1) The scaling factor was taken at 1.2 to account for traffic control

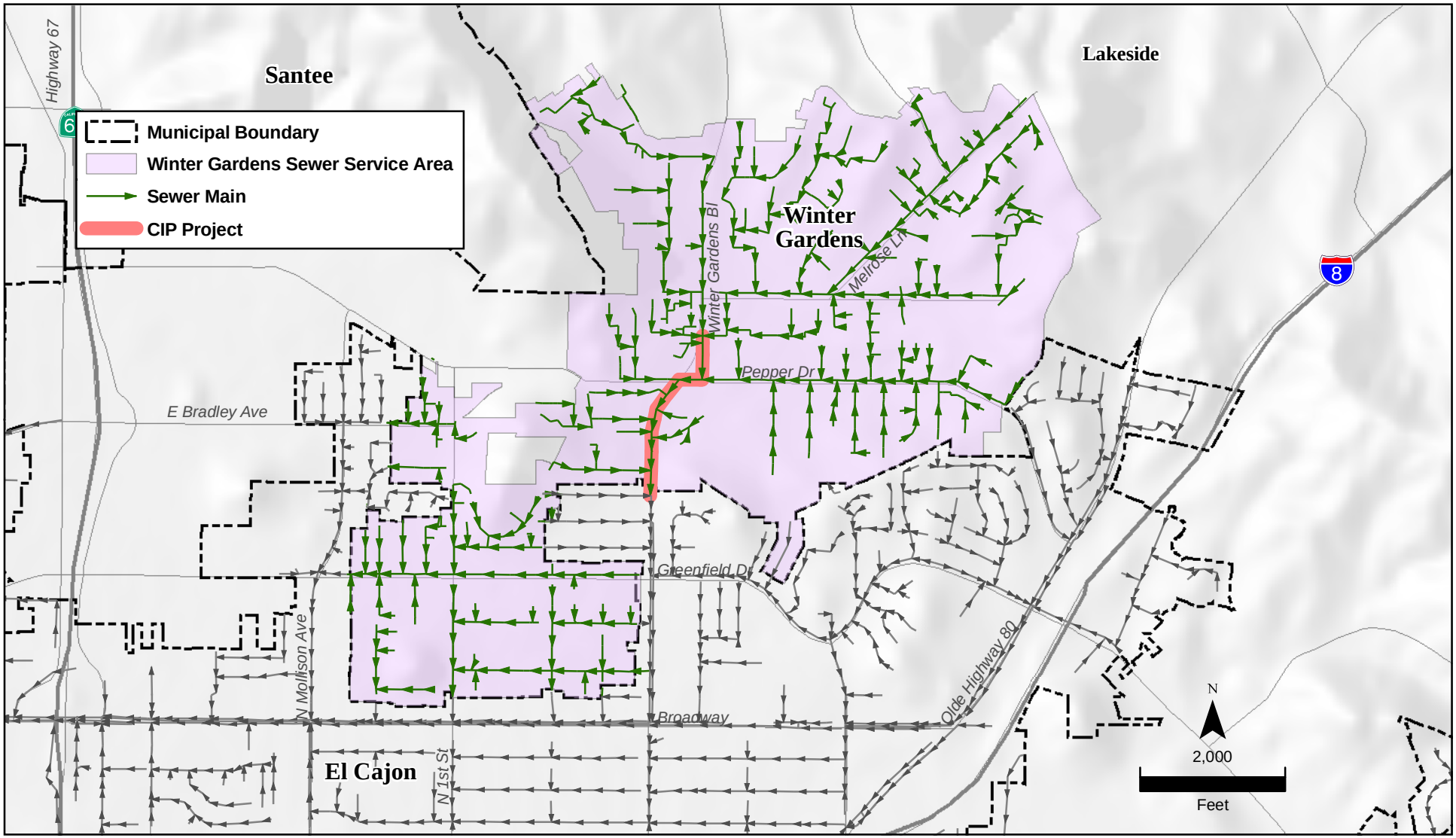
CIP Project: WG-1 – Winter Gardens Trunk Sewer Pipeline Replacement Project

Description: Replace approximately 2,700 feet of existing 8 inch through 12 inch diameter with 15-inch diameter along Winter Gardens Boulevard north of Peppci Drive to Cresthill Road.

Estimated Construction Cost: $1,944,000

Estimated Construction Schedule: Phase II





CAPITAL IMPROVEMENT PROJECTS

Figure 6-1

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6.3 Condition Related CIP Projects

The CCTV inspection and condition assessment of selected pipelines within the Winter Gardens SSA served to identify condition related defects in the wastewater collection system. The condition of the selected pipelines was used to determine the most effective method of repair or rehabilitation to restore the asset to its most efficient operating condition. Consequently, recommendations for improvements based on the noted defects will assist in optimizing the expenditures for the wastewater collection system by targeting available funds to the pipelines that require attention with the most cost effective improvement method.

Specific recommendations were developed based on the results of the condition assessment for the pipelines televised and assessed. Detailed pipeline condition assessment and repair and/or rehabilitation recommendations are included in Appendix L.

6.3.1 Basis of Costs

The wastewater collection system within the Winter Gardens SSA consists of pipelines ranging in diameter from 6- to 15-inches. The pipelines televised in the Winter Gardens SSA included 8-inch diameter and the recommended rehabilitation methods primarily include a form of lining including full-length lining, sectional lining, and T-Liners at various locations. The base unit costs for material and installation constitute the principal elements of the wastewater collection system facilities and reflect factors that include eighteen (18) percent to account for design and construction management costs and a twenty (20) percent contingency to account for potential unanticipated design and construction conditions, and traffic control issues. Special circumstances (e.g., jacking, trenchless installations, tunnels, etc.) are considered separately on a case-by-case basis. Unit costs ranging from approximately $205/LF to $215/LF were used for estimating potential improvement costs.

Table 6-3 summarizes the estimated cost to repair or rehabilitate the recommended pipelines within the Winter Gardens SSA. The estimated costs are based on the documented length of the pipeline segments and the recommended actions. Recommended actions that included cleaning and/or televising/re-televising were not included in the estimate as the necessary effort is managed as part of the County's overall preventative maintenance program.

The total cost for the condition related projects for the portion of the wastewater collection system that was inspected is approximately $624,000. Generally, the cost for an individual project identified for the Major Maintenance Project Program is approximately $50,000. Based on the summary included in Table 6-3, six of the projects (totaling $409,000) listed are large enough that they would warrant inclusion in the CIP program while the other projects could be included in the Major Maintenance Project Program (totaling $215,000) or combined to create a larger rehabilitation project.

Addressing the needs of the County's wastewater collection system is essential to avoiding sewer overflows and for efficiently operating the collection system. Therefore, it is imperative that appropriate budgetary estimates for pipeline rehabilitation and replacement improvements be identified to mitigate projected system deficiencies.

Table 6-3 Estimated Costs for Pipeline Repair/Rehabilitation Projects

Mainline ID No.	Line Length (feet)	Severity Rating	Recommended Action	Estimated Total
WG0621	159	B	Line & T-Liner	$34,566
WG0618	183	B	Sectional Line	$3,047
WG0631	257	B	Sectional Line	$4,678
WG0613	149	B	Sectional Line	$3,262
WG0609	147	B	Sectional Line	$3,047
WG0607	246	B	Sectional Line	$1,631
WG0606	148	B	T-Liner	$1,416
WG0629	171.50	C	Sectional Line	$1,631
WG0628	250	C	T-Liner	$1,416
WG0624	241	C	Line & T-Liner	$53,431
WG0617	200	C	Line	$42,239
WG0633	185	C	Line & T-Liner	$42,013
WG0612	206	C	Sectional Line	$3,262
WG0610	58	C	Sectional Line	$3,047
WG0057	220	C	Line & T-liner	$57,730
WG0054	130	C	Line	$26,508
WG0619	192	D	Line	$39,879
WG0605	312	D	Line	$65,077
WG0604	300	D	Sectional Line	$3,262
WG0603	386	D	Line	$80,895
WG0058	404	D	Line & T-Liner	$97,436
WG0056	210	D	Line & T-Liner	$54,275
			Total	**$623,751**

The extrapolation of the condition assessment results revealed that overall approximately 60 percent of the wastewater collection system, which equates to approximately 80,000 linear feet (15 miles), within the Winter Gardens SSA may require a form of repair or rehabilitation in the next 5-15 years. Currently, the majority of the wastewater collection system within the Winter Garden SSA is approximately 50 years old and consists of VCP pipe. While VCP sewer pipe typically has a service life of 50-70 years when it is properly installed, not disturbed, and roots are controlled, CCTV inspection assessment will serve to confirm the existing condition of the system. Therefore, until the entire system is inspected, estimated projections should be used only for pre-planning purposes.

A long term repair and rehabilitation budget was estimated based on the analysis of the data obtained via the CCTV inspection and assessment process. It is assumed that implementation of improvements may potentially be necessary over the next 10-15 years based upon the existing condition of the system. A budget amount was estimated for allocating funds to continue to repair, rehabilitate or replace pipe segments that are in poor condition and that may pose a high risk of sewer overflows. Table 6-4 includes an estimated cost to continue to perform potential rehabilitation and/or replacement improvements in the Winter Gardens SSA.

Table 6-4 Estimated Costs for a Long Term Pipeline Repair/Rehabilitation Program

Description	Estimated Length (feet)	Unit Cost	Subtotal	Design & CM (18%)	Contingency (20%)	Estimated Total
Pipeline Rehabilitation / Replacement	80,000	$150	$12,000,000	$2,160,000	$2,832,000	$16,992,000

For budgetary estimating purposes an average base unit cost of $150/LF was assumed. The average base cost assumes that lining of pipe segments will be the principal rehabilitation method. However, some segments may result that some repairs may include point repairs; others will require full lining while still others may require full replacement due to access constraints.

As the system ages and the condition of the pipelines deteriorate, improvement costs increase and often lining cannot be completed due to the condition of the pipeline. Proactive asset management will minimize costs by completing the necessary rehabilitation prior to pipe failure as response to emergencies generally result in significantly higher costs.

Additionally, as the time period in which improvements are necessary can vary significantly based on the type and frequency of maintenance activities performed on the system, it should be noted that the potential for spills to occur increases as the pipes age and additional deficiencies occur. Therefore, it is recommended that the County continue to conduct routine CCTV inspections and assessments to ascertain a more comprehensive understanding of the existing condition of the wastewater collection system. Performing an initial CCTV inspection of the entire system over a 3-5 year period would serve establish a solid baseline from which accurate cost projections could be developed. Subsequent to completing the initial CCTV inspection of the entire system, the inspection program may be adjusted and conducted over a 5-7 year period.

Although it is likely that additional pipelines requiring a form of repair and/or rehabilitation will be identified, additional CCTV inspections and assessments will also serve to further refine the estimated funds necessary to ensure the assets are ultimately restored to the most efficient operating condition and optimize the funds available in the appropriate programs.

Also, it is recommended that projects identified as requiring improvements be reviewed, prioritized, and subsequently included in the appropriate program. Additionally, as the County proceeds towards implementation of the projects presented in this Master Plan, it is recommended that the engineering cost estimates be further refined to reflect project costs due to inflation and/or increases in construction costs.