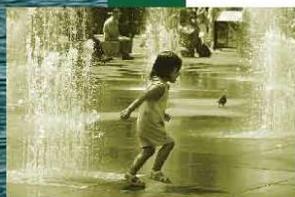




# Sonoma Valley CSD SOI Expansion Master Plan



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Prepared for  
**Sonoma County Water Agency**

December 2013

WEST YOST  
  
ASSOCIATES  
*Consulting Engineers*

553-00-12-01

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**WEST YOST ASSOCIATES**  
*consulting engineers*

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# Table of Contents

## Chapter 1. Introduction

- 1.1 Project Background ..... 1-1
- 1.2 Scope of Services ..... 1-1
  - 1.2.1 Gather and Review Data ..... 1-1
  - 1.2.2 SOI Expansion Area Flow Projections ..... 1-2
  - 1.2.3 Develop Collection System Layout ..... 1-2
  - 1.2.4 Funding Alternatives ..... 1-3
- 1.3 Report Contents ..... 1-3

## Chapter 2. Sewer Flows

- 2.1 SOI Expansion Area Land Use ..... 2-1
- 2.2 Average Dry Weather Flow Projections ..... 2-2
- 2.3 Peak Dry Weather Flow Projections ..... 2-3
- 2.4 Peak Wet Weather Flow Projections ..... 2-3

## Chapter 3. Required Sewer Facilities

- 3.1 Criteria ..... 3-1
- 3.2 Existing Sewer Infrastructure ..... 3-1
- 3.3 Required Sewer Infrastructure ..... 3-1
  - 3.3.1 Birch Road ..... 3-2
  - 3.3.2 Palmer Ave ..... 3-2
  - 3.3.3 20663 Hwy 12 ..... 3-2
  - 3.3.4 Fisher Lane ..... 3-2
  - 3.3.5 20989 Hwy 12 ..... 3-2
  - 3.3.6 Speckt Road ..... 3-2
  - 3.3.7 Watmaugh Road & Hwy 12 ..... 3-3
  - 3.3.8 Watmaugh Road ..... 3-3
  - 3.3.9 Shainsky Road ..... 3-3
  - 3.3.10 21665 Hwy 12 ..... 3-3
  - 3.3.11 Splude Road ..... 3-3
  - 3.3.12 21089 Hwy 12 ..... 3-3
  - 3.3.13 San Luis Road ..... 3-4
  - 3.3.14 22210 Hwy 12 Connection ..... 3-4
  - 3.3.15 Schellville Road ..... 3-4
  - 3.3.16 Eighth Street East ..... 3-4

## Chapter 4. Planning Level Cost Estimate

- 4.1 Unit Construction Costs for Gravity Pipelines and Manholes ..... 4-1
- 4.2 Unit Construction Costs for Lift Stations ..... 4-2
- 4.3 Unit Costs for Easement Acquisition ..... 4-2
- 4.4 Contingencies and Capital Cost Multipliers ..... 4-2
- 4.5 Level of Accuracy ..... 4-3
- 4.6 Recommended Infrastructure with Planning Level Cost Estimates ..... 4-3



# Table of Contents

## Chapter 5. Funding Alternatives

5.1 Alternative Description.....	5-1
5.2 Alternative 1. Assessment District Formation.....	5-1
5.2.1 Background on Assessment District Costs.....	5-1
5.2.2 Key Assumptions for Assessment Costs.....	5-2
5.2.3 Costs Associated with District Formation.....	5-3
5.3 Alternative. No Assessment District Formation.....	5.4

## List of Appendices

- Appendix A: Design and Construction Standards Excerpt
- Appendix B: Project Area Photos
- Appendix C: Budget Level Construction Cost Estimate for Package Pump Station
- Appendix D: Detailed Project Costs

## List of Tables

Table 2-1. Sonoma County Land Use Classifications Within SOI Expansion Area.....	2-1
Table 2-2. SOI Expansion Area Projected Sewer Flows.....	2-4
Table 4-1. Gravity Pipeline and Manhole Unit Costs.....	4-1
Table 4-2. Recommended Collection System Facilities Planning Level Cost Estimate.....	4-5
Table 5-1. Estimated Bond Proceeds.....	5-3
Table 5-2. Average Cost per ESD of Assessment District Formation.....	5-4
Table 5-3. Average Cost per ESD without Assessment District Formation.....	5-4

## List of Figures

Figure 1-1 Project Location.....	1-5
Figure 2-1. SOI Expansion Area Land Use.....	2-5
Figure 2-2. Parcels Already Served.....	2-6
Figure 2-3. Parcels Currently Receiving Service.....	2-7
Figure 3-1. Existing Infrastructure.....	3-5
Figure 3-2. Proposed Infrastructure Layout.....	3-6
Figure 3-3. Proposed Infrastructure Layout – Detail 1.....	3-7
Figure 3-4. Proposed Infrastructure Layout – Detail 2.....	3-8
Figure 3-5. Proposed Infrastructure Layout – Detail 3.....	3-9
Figure 3-6. Proposed Infrastructure Layout – Detail 4.....	3-10
Figure 3-7. Proposed Infrastructure Layout – Detail 5.....	3-11

This introductory chapter provides background information on the scope and objectives of the Collection System Master Plan for the Sonoma Valley County Sanitation District's Sphere of Influence Expansion Area. This chapter is organized as follows:

- Project Background
- Scope of Services
- Report Contents

### 1.1 PROJECT BACKGROUND

The Sonoma County Water Agency (SCWA) manages the Sonoma Valley County Sanitation District (Sonoma Valley CSD), which currently provides sewer service to the City of Sonoma and nearby unincorporated areas within Sonoma County. The Sonoma Valley CSD, which began operation in 1953, provides sewer service to approximately 17,000 Equivalent Single Family Dwelling Units (ESDs). Sewer flow is treated at the Sonoma Valley Wastewater Treatment Plant (SVWTP), which has a design capacity of 3.0 million gallons per day (mgd) average daily dry weather flow, and which provides tertiary treatment.

The Sonoma Valley CSD Sphere of Influence (SOI) Expansion Area encompasses the area along Highway 12, between the City of Sonoma and Highway 121. Various parcels in the Expansion Area are already provided service by the Sonoma Valley CSD, but the majority of parcels are served by individual septic systems. SCWA wishes to have a plan in place for servicing the entire SOI Expansion Area. The project area location can be seen on Figure 1-1.

The Collection System Master Plan for the Sonoma Valley CSD SOI Expansion Area (SOI Master Plan) identifies the necessary sanitary sewer facilities that are required for service of the entire SOI Expansion Areas. Additionally, it identifies planning level costs for these facilities, as well as possible funding mechanisms for these costs when service is required. In arriving at the required facilities with planning level costs, the SOI Master Plan develops projected sewer flows and facility layouts that will serve these flows. The full scope of services for the SOI Master Plan is described below.

### 1.2 SCOPE OF SERVICES

The scope of services for the SOI Master Plan Project was divided into four major tasks. The major tasks are summarized below:

#### 1.2.1 Gather and Review Data

West Yost Associates (West Yost) reviewed available information and compiled mapping to serve as the basis of the SOI Expansion Area sewer plan. This data included:

- General Plan Land Use and Existing Zoning maps, in GIS format
- GIS data including base map, existing collection system layout, connected parcels, unconnected parcels, waterways, roadways, Sonoma Valley CSD Service Area boundary, and the SOI Expansion Area boundary

- As-built drawings of existing facilities within the SOI, including the existing trunk sewer
- Design Standards and Criteria
- Atlas Maps of the existing collection system in pdf format
- Aerial Photography, in GIS format
- Flow monitoring and other data collected for the existing trunk sewer
- Previously completed reports and studies

West Yost performed a site reconnaissance of the SOI Expansion Area from the public roadways. The site reconnaissance involved visually inspecting the area to identify physical constraints for the potential gravity collection system. The reconnaissance confirmed the topography taken from publically available GIS data.

### **1.2.2 SOI Expansion Area Flow Projections**

West Yost developed flow projections for average dry weather flow, peak dry weather flow, and peak wet weather flow. The flow projections were used to develop the sizing of the infrastructure within the SOI Expansion Area, and to determine the projected peak flows that will enter the existing collection system at each major point of connection.

Average dry weather flow was developed using land-use based unit flow factors applied to the available General Plan Land Use designations within the SOI Expansion Area. Flow factors were confirmed with SCWA staff prior to their assignment. Peak dry weather flow was based on the peaking factor equation provided in the SCWA design standards. The peak wet weather flow was calculated by adding to the peak dry weather flow rainfall derived inflow and infiltration (RDII) using SCWA design criteria.

### **1.2.3 Develop Collection System Layout**

West Yost developed a conceptual layout of the collection system within the SOI Expansion Area. The layout was developed such that it maximizes the use of gravity sewers, yet remains within existing street rights-of-way to the maximum practicable extent and limits the number of connections to the existing 30-inch trunk sewer. The conceptual layout has been developed in GIS, benchmarked to the publicly available topographic data. Maximum and minimum pipe depth, pipe slopes, and manhole spacing follow design criteria provided by SCWA. One pumping facility is required by the topography, and the location of this facility has been determined in order to maximize the use of gravity sewers. Locations must be finalized during facility design, and may vary depending on actual site conditions.

GIS maps were developed that delineate sewer basins and subbasins. Dry weather flows and estimated Inflow & Infiltration (I&I) from Task 2 were applied to the sewer network to generate estimated dry weather and peak wet weather SOI Expansion Area flows. Sewer main pipeline sizes, and pump station capacity requirements were developed to accommodate projected flows. The system assumes that the trunk line does not restrict collector sewer peak wet weather flows.

Detailed figures of the Expansion Area were developed in GIS to illustrate graphically the alignment of the proposed collection system within the SOI Expansion Area. The figures present the proposed alignment of new gravity sewers and pump station, including the location of connections to the existing 30-inch diameter trunk sewer. Tables listing the necessary infrastructure were prepared and submitted with the figures for review.

Planning-level cost estimates were prepared for the proposed collection system. Unit pipeline and per-gallon pump station costs were used to prepare the cost estimate, indexed to the most current Engineering News Record 20-City average Construction Cost Index.

#### **1.2.4 Funding Alternatives**

Several alternative mechanisms for funding the proposed collection system were described by our sub-consultant, HF&H Consultants (HF&H). HF&H summarized the funding alternatives in a memorandum covering special benefit assessments, special taxes, connection fees, and fees and charges. A conference call was held with SCWA staff to review the funding alternatives. HF&F prepared a summary memorandum summarizing discussions and recommendations.

In preparing the memorandum, the existing funding mechanisms used for the Sonoma Valley CSD were reviewed to determine the current practices. Previously-determined connection fees and annual charges were not re-evaluated for the purposes of this analysis.

Capital and operating costs were used for estimating the cost per customer in the expansion area. The costs were itemized into the cost to connect to the common interceptor and treatment facilities.

### **1.3 REPORT CONTENTS**

The report comprises the following chapters. The sequence of chapters generally conforms to the tasks outlined in the scope of services for the project. The contents of each of the five chapters and appendices are presented below.

- Chapter 1 Introduction: This introductory chapter provides background information on the SOI Master Plan scope of services, and presents the contents and organization of the report.
- Chapter 2 Sewer Flows: This chapter presents the methodology used to develop sewer flow projections for the SOI Expansion Area.
- Chapter 3 Required Sewer Facilities: This chapter presents the methodology for developing the location, alignment, and sizing of the required sewer facilities in the SOI Expansion Area.
- Chapter 4 Planning Level Costs for Required Facilities: This chapter presents the methodology used to develop planning level costs for the required sewer facilities.
- Chapter 5 Funding Alternatives: This chapter presents funding alternatives and possible sources for the required infrastructure in the SOI Expansion Area.
- Appendix A Design and Construction Standards Excerpt
- Appendix B Project Area Photos

# Chapter 1

## Introduction

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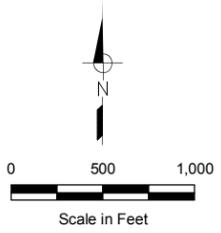


- Appendix C Budget Level Construction Cost Estimate for Package Pump Station
- Appendix D Detailed Project Cost



Sources  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community

**LEGEND**  
 Sphere of Influence Boundary



**Figure 1-1**  
**Sonoma County Water Agency**  
**SOI Expansion**  
**PROJECT LOCATION**



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## CHAPTER 2

### Sewer Flows



The SOI Expansion Area includes approximately 542 acres of land to the south of the City of Sonoma. The purpose of this chapter is to present wastewater flow projections for the land included this area. The major elements of this chapter include:

- SOI Expansion Area Land Use
- Average Dry Weather Flow Projections
- Peak Dry Weather Flow Projections
- Peak Wet Weather Flow Projections

#### 2.1 SOI EXPANSION AREA LAND USE

The SOI Expansion Area is in unincorporated Sonoma County, and parcels within the area are designated with the county's land use classifications. Sonoma County recognizes over 100 land use classifications, but only 10 classifications are represented in the SOI Expansion Area. The land use classifications within the SOI Expansion area can be seen in Table 2-1, and are presented on Figure 2-1.

Land Use Classification	Description	Area, acre
Diverse Agriculture	Small acreage intensive farming and part time farming activities.	189.20
Limited Commercial	Parcels for which commercial activities are limited. Retail sales and services are included.	5.77
Land Intensive Agriculture	Large acreage agriculture.	0.51
Light Industrial	Limited industrial uses that fall outside of Urban Use Areas.	75.32
Light Industrial / Diverse Agriculture	Hybrid parcels with industrial and agricultural uses permitted.	18.33
Public / Quasi Public	Sites that serve community or public need and are owned or operated by government agencies, nonprofit entities, or public utilities.	40.56
Rural Residential 1.5	Parcels with very low density residential development on lands that have few if any urban services (1.5 acres per unit).	3.51
Rural Residential 2.5	Parcels with very low density residential development on lands that have few if any urban services (2.5 acres per unit).	37.12
Rural Residential 3	Parcels with very low density residential development on lands that have few if any urban services (3.0 acres per unit).	81.18
Rural Residential 5	Parcels with very low density residential development on lands that have few if any urban services (5.0 acres per unit).	64.51
Right-of-Way (ROW)	Roads.	26.45
<i>Total Area</i>		<b>542.46</b>

## 2.2 AVERAGE DRY WEATHER FLOW PROJECTIONS

Sewer flow projections for the SOI Expansion Area will be used to assess the size and hydraulic capacity of the infrastructure required the area. Although Average Dry Weather Flow (ADWF) projections are not used for sizing infrastructure, ADWF values are convenient to calculate using typical unit values, and ADWF values are used to build the Peak Dry Weather Flow (PDWF) and Peak Wet Weather Flow (PWWF) projections that are used for sizing infrastructure.

There are several options available to develop ADWF projections within a given area. Typically, land use data is used along with sewer unit flow factors to generate average daily flow. For the SOI Expansion Area Study, the method used to develop ADWF projections is based on identifying the appropriate number of ESDs that will be served based upon the land use described in the section above, and calculating the ADWF projections based upon ADWF per ESD values provided by SCWA.

The first step in developing the number of ESD's in the SOI Expansion Study Area was to determine which parcels in the area are already being served by the Sonoma Valley CSD collection system. Flow from these parcels is already conveyed to treatment by the collection system and does not need to be accounted for in future projections. SCWA identified the parcels currently receiving service through billing records. These parcels are presented on Figure 2-2.

For the remaining parcels in the SOI Expansion Area, the number of prospective ESDs was identified for each parcel. Initially, parcels with a land use designation of Limited Commercial, Light Industrial, and Light Industrial/Diverse Agriculture were assigned ESD values equivalent to 1,500 gallons per day (gpd) of ADWF. This value is industry standard for non-residential parcels that are fully developed. However, it was determined by SCWA that one of the conditions for provision of service in the SOI Expansion Area would be limiting each parcel to a single ESD. This condition significantly limits the amount of ESDs and therefore ADWF projected to be generated in the SOI Expansion Area.

A small number of parcels not currently being served were not assigned projected ESD and ADWF values. Inspection of the SOI Expansion area via aerial photo shows a solar installation array on parcel 128-422-051, and this parcel is not expected to generate flow in the future. Inspection of the aerial photo also identified parcel 128-443-014 and parcel 128-443-011 as having extremely low potentials for future development. Each of these parcels was assigned a value of zero ESD and therefore zero ADWF. The parcels that are not currently being served are identified as having projected future flow or not having projected future flow on Figure 2-3.

Different zones and districts within the collections systems owned and operated by SCWA generate different amounts of ADWF per ESD, based primarily upon differing values for the average number of people per ESD in these areas. SCWA has established the ADWF per ESD for the various zones and districts that it operates as part of its most recent design and construction standards, updated in 2009. The ADWF per ESD in the Sonoma Valley District is 200 gpd/ESD. The page from the design and construction standards that relates this flow value is included in Appendix A.

### **2.3 PEAK DRY WEATHER FLOW PROJECTIONS**

PDWF differs from ADWF because sewer generation varies predictably throughout the day, and is often expressed as a ratio of ADWF. The ratio between PDWF and ADWF varies throughout the collection systems owned and operated by SCWA. This variation depends upon the mixture of commercial and residential sewer generation that changes daily generation patterns. SCWA has established PDWF to ADWF ratios for the various zones and districts that it operates as part of its most recent design and construction standards, updated in 2009. The PDWF to ADWF ratio in the Sonoma Valley CSD is 1.94. Given the value of 200 gpd/ESD in the Sonoma Valley CSD, the calculated PDWF per ESD is 388 gpd/ESD.

### **2.4 PEAK WET WEATHER FLOW PROJECTIONS**

I&I is a general term that describes non-sanitary flows that enter a sanitary sewer collection system. RDII describes non-sanitary flows that enter a sanitary sewer collection system during wet weather events. PDWF added to the RDII in the collection system is termed PWWF. Because RDII values can be high and can occupy significant capacity in the collection system, collection systems are most often designed to handle PWWF.

Potential PWWF can be estimated using several methods. These methods include estimating the percentage of precipitation that falls over a given area that enters the collection system (R-value method), estimating the amount of flow that enters a collection system as a function of the amount of gravity pipelines in a collection system (gpd/linear foot or gpd/inch diameter-mile), and estimating the amount of flow that enters a collection system as a function of the area served by the collection system (gpd/acre). SCWA utilizes the area served method for estimating RDII and PWWF. SCWA has established an RDII unit value for the collection systems that it operates as part of its most recent design and construction standards, updated in 2009. This value has been established as 800 gpd/acre.

One of the fundamental assumptions of the area served method for estimating RDII is that the area included in the calculation has a minimum density of sanitary sewer gravity mains through which RDII can enter the collection system. If the area does not have this minimum density of gravity mains, which is assumed to be typical urban density, there is no route through which precipitation that falls on the area can enter the system, and the RDII unit value will overestimate RDII. The assumption of minimum density is not maintained in the SOI Expansion Area. This area contains some large parcels that, as described above, will serve only one ESD. These parcels will presumably have only a single gravity main serving them, resulting in a large amount of area for which precipitation will have no route into the collection system. For these large parcels, the projected PWWF would be greater than 20 times the projected ADWF, which is far higher than typically seen.

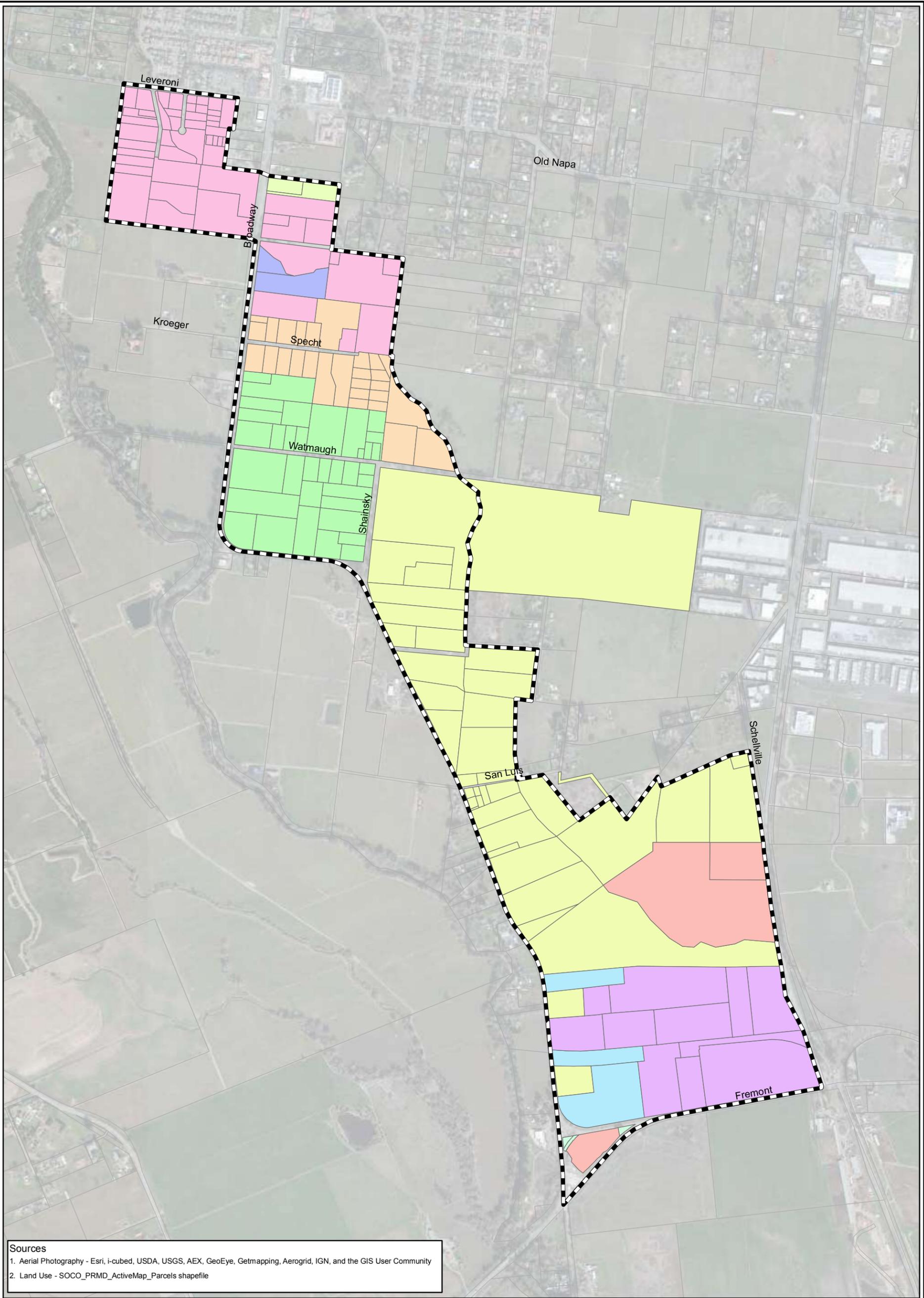
In order to apply the SCWA methodology for estimating RDII and PWWF values in a manner that accounts for the low density of collection system gravity mains and large parcels of the SOI Expansion Area, GIS analysis of aerial photos was used to determine the amount of land associated with a typical ESD in the Sonoma Valley area. The analysis determined that the typical value is 0.3 acres per ESD. If each parcel in the SOI Expansion Area is assumed to have 0.3 acres that potentially contributes RDII to the collection system, the estimated RDII flow per parcel is 240 gpd. PWWF is calculated by adding RDII to PDWF, so the PWWF calculated for



each parcel using this adjustment is 628 gallons per day. The resulting ratio between PWWF and ADWF is 3.14. This ratio is typical of a reasonably performing collection system, and is reasonable and conservative for new infrastructure as will be found in the SOI Expansion area.

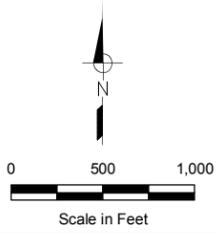
The ADWF, PDWF, and PWWF calculated as described above are shown in Table 2-2, where these flows have been summarized by Land Use classification. The acreage shown in this table represents parcels that are not currently served within the SOI Expansion Area.

<b>Table 2-2. SOI Expansion Area Projected Sewer Flows</b>						
Land Use Classification	Area, acre	ESDs	ADWF, gpd	PDWF, gpd	RDII, gpd	PWWF, gpd
Diverse Agriculture	163.75	27	5,400	10,476	6,480	16,956
Limited Commercial	1.36	1	200	388	240	628
Land Extensive Agriculture	0.51	1	200	388	240	628
Light Industrial	67.85	10	2,000	3,880	2,400	6,280
Light Industrial / Diverse Agriculture	18.33	3	600	1,164	720	1,884
Public / Quasi Public	9.42	1	200	388	240	628
Rural Residential 1.5	0	0	-	-	-	-
Rural Residential 2.5	6.97	5	1,000	1,940	1,200	3,140
Rural Residential 3	45.18	24	4,800	9,312	5,760	15,072
Rural Residential 5	63.62	34	6,800	13,192	8,160	21,352
<i>Totals</i>	<i>376.99</i>	<i>106</i>	<i>21,200</i>	<i>41,128</i>	<i>25,440</i>	<i>66,568</i>



**Sources**  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community  
 2. Land Use - SOCO\_PRMD\_ActiveMap\_Parcels shapefile

LEGEND	
Sphere of Influence Boundary	Light Industrial / Diverse Agriculture
<b>Land Use</b>	Public / Quasi Public
Diverse Agriculture	Rural Residential 1.5
Limited Commercial	Rural Residential 2.5
Land Extensive Agriculture	Rural Residential 3
Light Industrial	Rural Residential 5



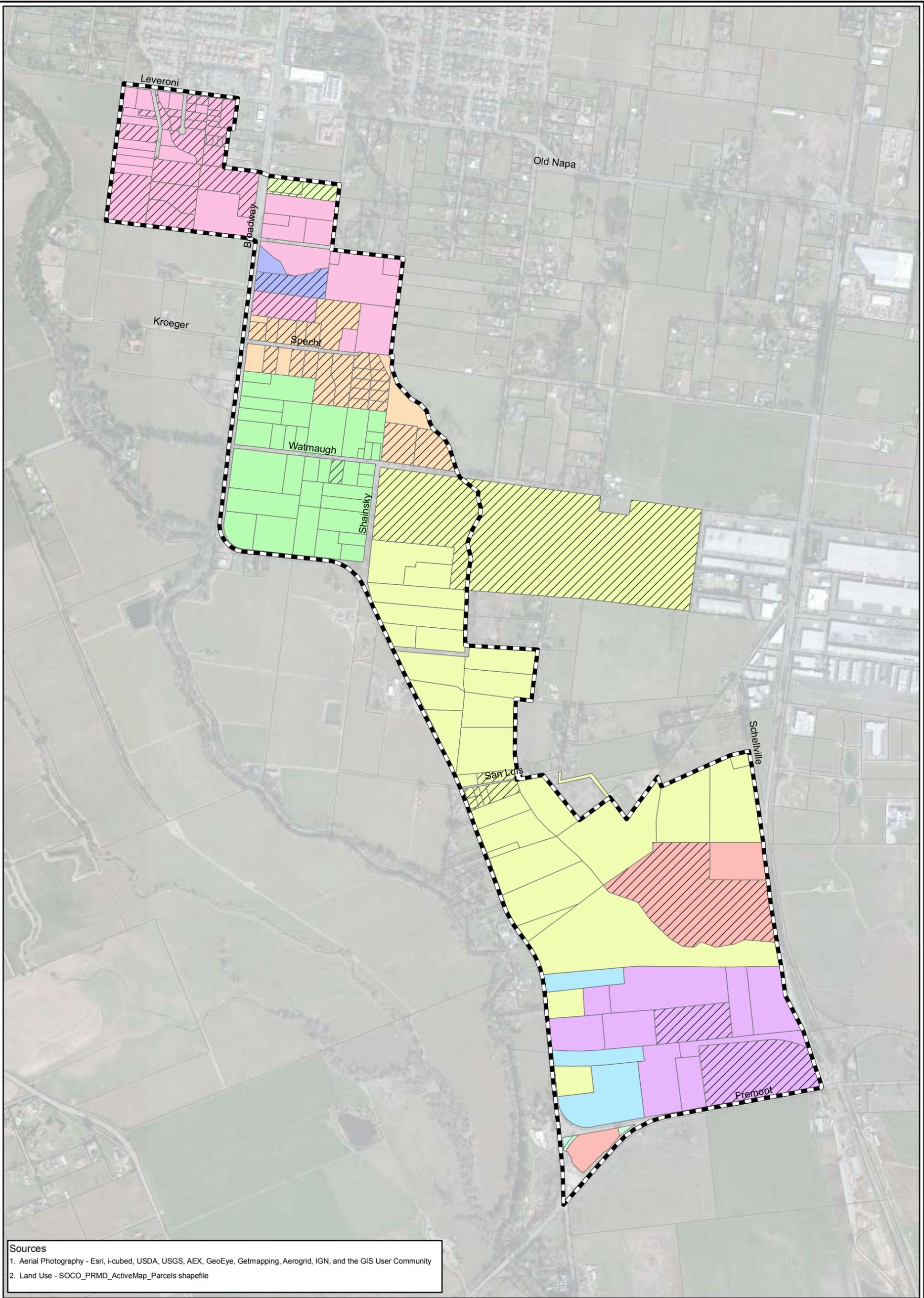
**Figure 2-1**  
**Sonoma County Water Agency**  
**SOI Expansion**  


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**SOI EXPANSION AREA**  
**LAND USE**

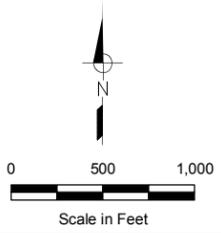


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**Sources**  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community  
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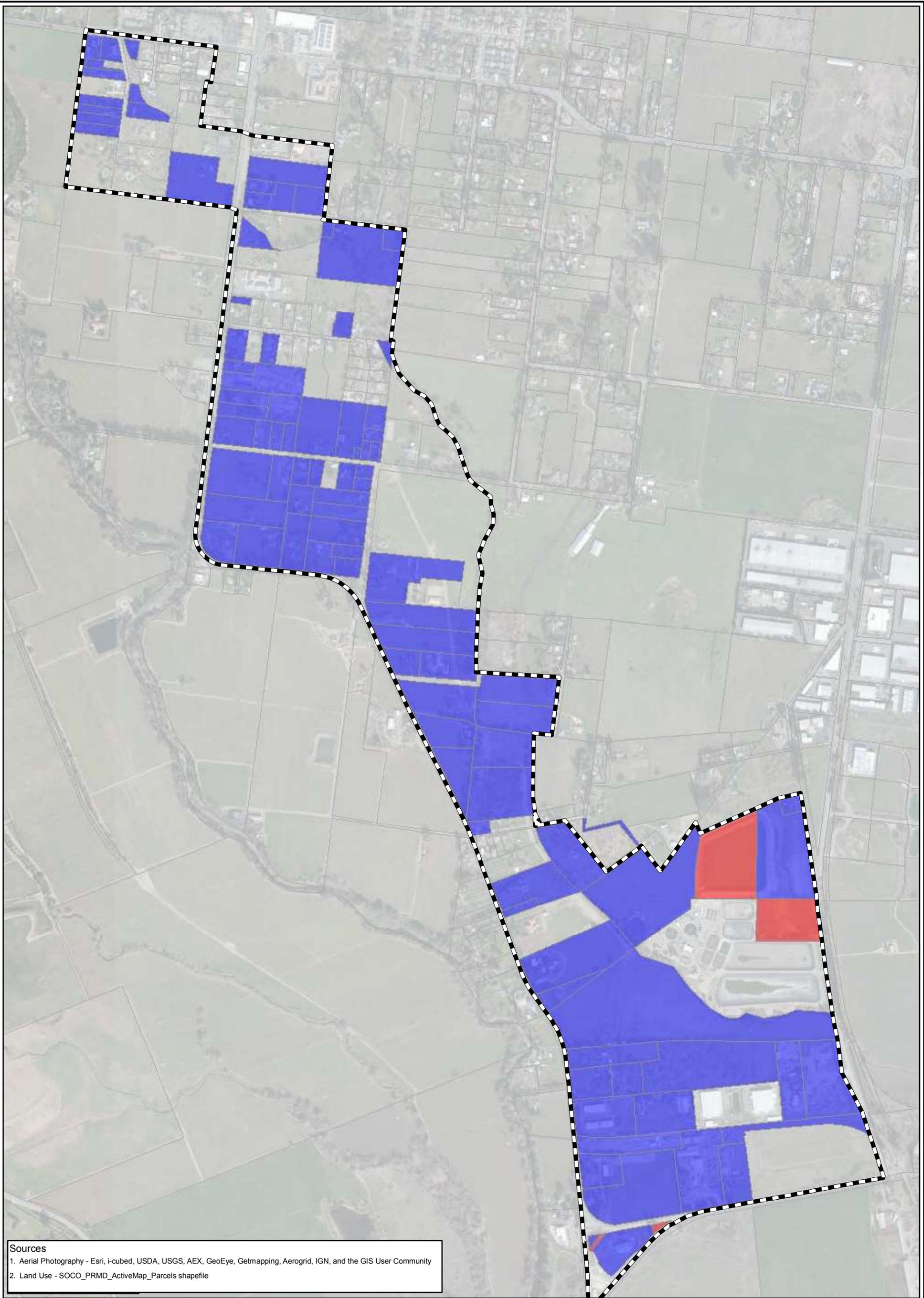
LEGEND	
	Sphere of Influence Boundary
	Currently Receiving Service
Land Use	
	Diverse Agriculture
	Limited Commercial
	Land Extensive Agriculture
	Light Industrial
	Light Industrial / Diverse Agriculture
	Public / Quasi Public
	Rural Residential 1.5
	Rural Residential 2.5
	Rural Residential 3
	Rural Residential 5



**Figure 2-2**  
**Sonoma County Water Agency**  
**SOI Expansion**  
**PARCELS CURRENTLY**  
**RECEIVING SERVICE**



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Sources  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community  
 2. Land Use - SOCO\_PRMD\_ActiveMap\_Parcels shapefile

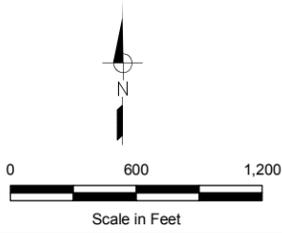
**LEGEND**

Sphere of Influence Boundary

**Parcels Not Currently Being Served**

No Projected Future Flow

Future Flow Projected



**Figure 2-3**  
**Sonoma County Water Agency**  
**SOI Expansion**

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**PARCELS WITH**  
**PROJECTED FUTURE FLOW**



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## CHAPTER 3

### Required Sewer Facilities

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Chapter 3 presents the sewer facilities that are required to provide sewer service for the flows identified in the SOI Expansion Area in Chapter 2. The development of the sewer facilities is described in the following sections:

- Criteria
- Existing Sewer Infrastructure
- Required Sewer Infrastructure

#### 3.1 CRITERIA

In an area that does not have existing sewer infrastructure, there are many possible infrastructure configurations that could successfully convey flow to existing infrastructure and then to treatment. In order to develop preferred alignments for the infrastructure, criteria must be in place to prioritize one alignment over another. The following criteria were used to develop the infrastructure layout for the SOI Expansion Area:

1. Infrastructure must have the hydraulic capacity to convey PWWF calculated in Chapter 2.
2. Infrastructure must conform to SCWA Design and Construction Standards.
3. Infrastructure should maximize the use of gravity sewers as opposed to pump stations and siphons.
4. Infrastructure should remain in the public right-of-way to the maximum extent possible.
5. Infrastructure should limit the number of connections to the existing trunk sewers.

#### 3.2 EXISTING SEWER INFRASTRUCTURE

The SVWTP is found in the southeast corner of the SOI Expansion Area. Flows from areas north and outside of the SOI Expansion Area and from the parcels currently served in the SOI Expansion Area flow generally southeast through a 30-inch diameter trunk sewer to the treatment plant. An RDII conveyance line whose capacity is reserved for RDII flows from outside of the SOI Expansion Area run in parallel and in very close alignment with this trunk sewer.

Flows from areas west and outside of the SOI Expansion Area are conveyed to the treatment plant in the Temelec Trunk Sewer. The existing sewer infrastructure in and around the SOI Expansion area are presented on Figure 3-1. Flow monitoring data gathered in the trunk sewers was reviewed to confirm that flows from the SOI Expansion Area can be added to these gravity mains without exceeding the hydraulic capacity of the trunk pipelines. It appears that that the trunk pipelines have available capacity to accept the SOI Expansion Area flows without backups or surcharging.

#### 3.3 REQUIRED SEWER INFRASTRUCTURE

The following sections describe the sewer infrastructure required to serve the SOI Expansion Area. The infrastructure was developed using GIS provided by SCWA, record drawings of existing infrastructure provided by SCWA, and project area photographs taken by West Yost. The project area photographs can be seen in Appendix B. Infrastructure for the entire SOI Expansion Area can be seen on Figure 3-2.

### 3.3.1 Birch Road

Two new gravity collector pipelines and two new manholes are required to provide service to a single isolated parcel that is currently not receiving service. The pipelines have more than enough capacity to serve the parcel, and have been sized by minimum size and slope standards to 8-inch diameter. Although a connection could conceivably be made directly to the trunk pipeline in Leveroni, thereby eliminating the need for one new pipeline, the proposed new gravity collector pipeline alignment also eliminates the need for a new manhole in a busy right-of-way. The alignment is presented on Figure 3-3.

### 3.3.2 Palmer Ave

A single new gravity pipeline is required to serve five parcels on Palmer Avenue. The pipeline would be sized at the minimum of 8-inch diameter, but since it is connecting to an existing 6-inch diameter pipeline, it has been sized at 6-inch diameter. The alignment in Palmer Avenue is presented on Figure 3-3.

### 3.3.3 20663 Hwy 12

This location requires a single new manhole or cleanout and a small amount of 6-inch diameter gravity pipeline in order to serve two parcels. The projected PWWF is well below the capacity of the pipeline, and the pipeline is sized by minimum size and slope standards. The alignment can be seen on Figure 3-4.

### 3.3.4 Fisher Lane

Several parcels on either side of Fisher Lane require service in the future, and four new manholes and four new 8-inch diameter gravity pipelines, totaling approximately 1,450 feet, are required to provide service in the future. This total includes approximately 150 feet of encased pipeline under Fryer Creek and Hwy 12. The elevation contours provided for the area, in conjunction with the record drawings of the existing trunk pipeline in Hwy 12, indicate that the new pipeline can go under the creek and still connect to the existing pipeline under gravity conditions. The alignment for this infrastructure can be seen on Figure 3-4.

### 3.3.5 20989 Hwy 12

A single parcel in this area along Hwy 12 requires service in the future. One new manhole/cleanout and one new gravity pipeline is required for this service. The gravity pipeline runs to an existing pipeline so that a new manhole and connection under Hwy 12 is not required. The alignment for this infrastructure can be seen on Figure 3-4.

### 3.3.6 Specht Road

Several isolated parcels along Specht Road require infrastructure for service in the future. Because there are existing gravity pipelines in Specht Road, the required infrastructure is several short gravity pipelines connecting individual parcels to the existing gravity mains. In all cases, the gravity pipelines are 8-inch diameter because of minimum size standards, and in all cases they have been extended to existing manholes so that new connections to the existing gravity pipelines, which are up to 18 feet deep, aren't required. As these parcels are

connected to the existing collection system, individual connections can be evaluated to determine if a gravity pipeline or a simple lateral is required. The infrastructure is shown on Figure 3-4.

### 3.3.7 Watmaugh Road & Hwy 12

Five parcels along Hwy 12 north of Watmaugh Road do not currently have sewer service. There is a trunk pipeline in Hwy 12 through this area, but its alignment is on the side of Hwy 12 opposite of the parcels. Two new manholes and two new gravity pipelines running along the frontage of these parcels are required to provide service. Construction and permanent easements will be required, unless constructed within the Caltrans right-of-way under a Caltrans encroachment permit. The infrastructure is shown on Figure 3-5.

### 3.3.8 Watmaugh Road

Several individual connections to the trunk pipeline in Watmaugh Road are required to provide service to parcels north of Watmaugh Road. Gravity pipelines have been identified running parallel to the trunk pipeline in order to minimize the number of connections to the trunk. The infrastructure can be seen on Figure 3-5.

### 3.3.9 Shainsky Road

A large block of parcels south of Watmaugh Road and west of Shainsky Road will require service in the future. An alignment has been developed that uses the public right-of-way in Shainsky Road in combination with gravity pipelines running in permanent all-weather surfaced easements to some of the parcels to serve the area. This alignment is shown on Figure 3-5.

### 3.3.10 21665 Hwy 12

One new manhole and one new gravity pipeline is required to serve several parcels with only a single connection to the existing trunk pipeline. The new 8-inch diameter pipeline is sized by the minimum size standards. Easements will be required. The alignment is shown on Figure 3-6.

### 3.3.11 Splude Road

The parcels along Splude Road will require two new manholes and two new 8-inch diameter gravity pipelines. The gravity pipeline to the east of the existing trunk pipeline will require encasement under Schell Creek before connection to the existing pipeline. The alignment is shown on Figure 3-6.

### 3.3.12 21809 Hwy 12

A single new manhole and gravity main will be required to serve the parcels west of the existing trunk gravity main. Easements will be required. The required infrastructure can be seen on Figure 3-6.

### 3.3.13 189 San Luis Road

A single new manhole and gravity main will be required to serve the easternmost parcel on San Luis Road in the SOI Expansion Area. Easements will be required, and the gravity main will be required to cross under a creek. However, this alignment is preferable to the long distance and adverse grade that would be traversed if the parcel is served from the east rather than the west. The alignment is shown on Figure 3-6.

### 3.3.14 22210 Hwy 12 Connection

Two parcels along Hwy 12 require a single new manhole and a single new gravity pipeline to connect to the existing trunk sewer. Easements will be required. This pipeline is shown on Figure 3-6.

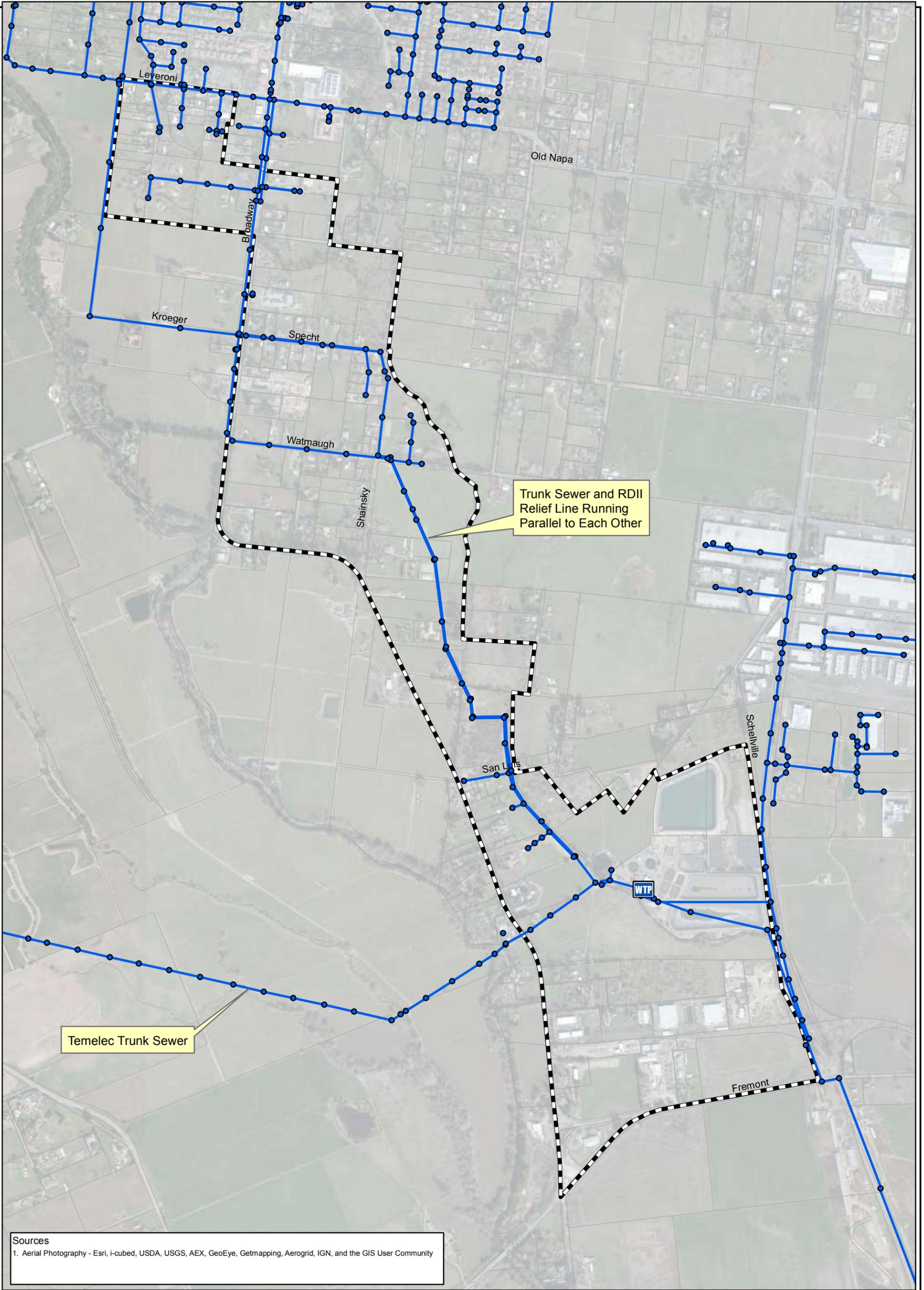
### 3.3.15 Schellville Road

A single new manhole and gravity pipeline are required to serve two parcels in the corner of the SOI Expansion Area. This pipeline is shown on Figure 3-7.

### 3.3.16 Eighth Street East

The Eighth Street East area requires the most significant infrastructure, because much of the area is at an unfavorable elevation relative to the exiting gravity pipelines and SVWTP. Numerous alignments were tried in order to find an alignment for which a pump station is not required, but all proved infeasible. The alignment shown here combines 5,598 feet of gravity pipeline with a lift station to lift the flow into the 12-inch diameter Eighth Street East Trunk Sewer. The required infrastructure is shown on Figure 3-7.

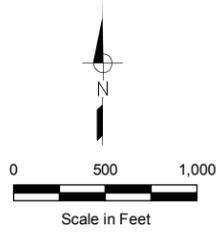
Planning-level cost estimates for each of the projects described above are provided in Chapter 4.



Sources  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community

**LEGEND**

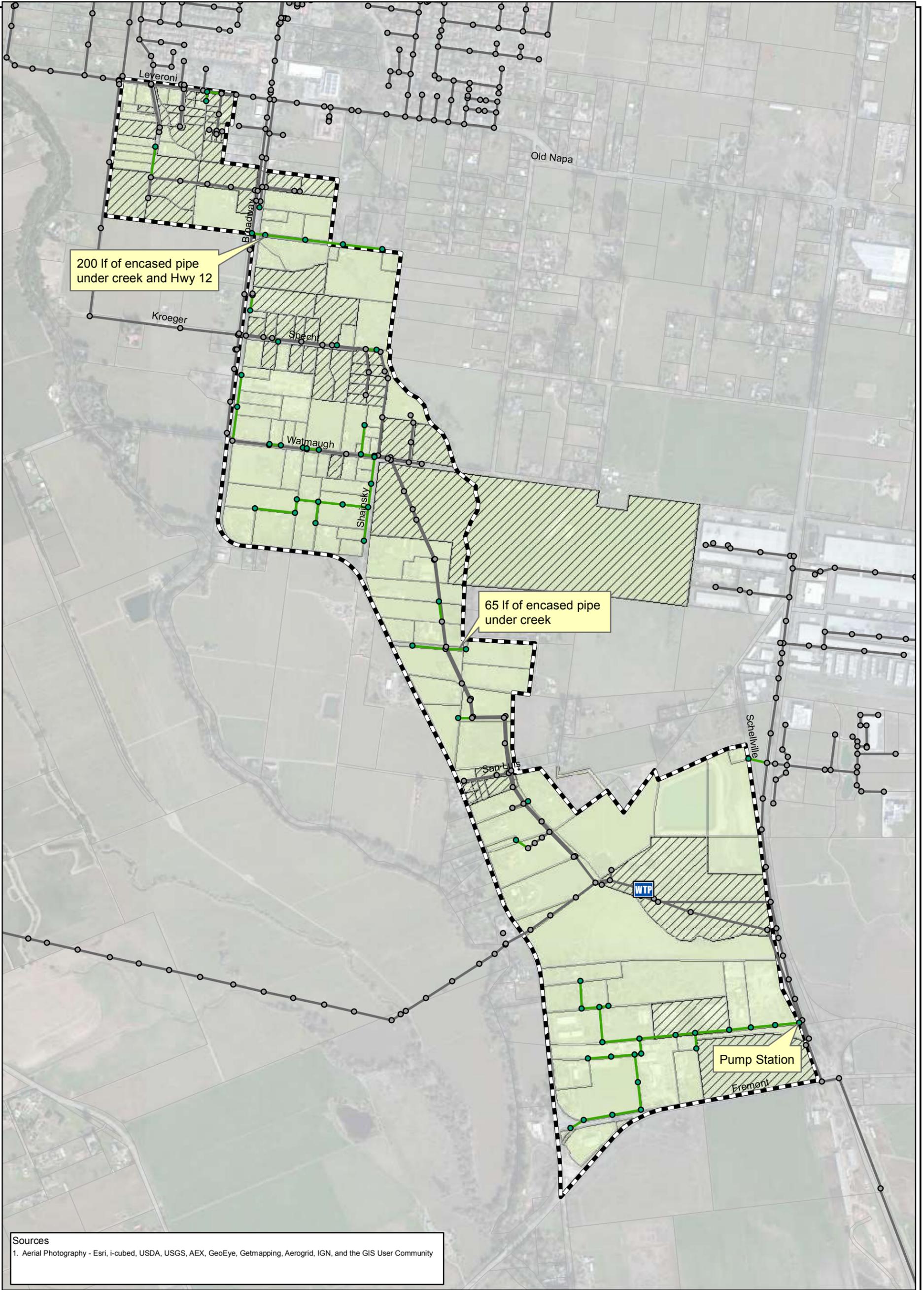
-  Sonoma Valley Wastewater Treatment Plant
-  Existing Manholes
-  Existing Pipelines
-  Sphere of Influence Boundary
-  Parcels in Sphere of Influence



**Figure 3-1**  
**Sonoma County Water Agency**  
**SOI Expansion**  
**EXISTING INFRASTRUCTURE**

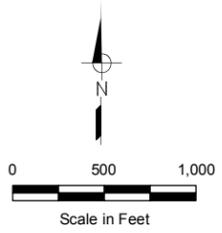


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**Sources**  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community

- LEGEND**
- Proposed Manholes
  - Existing Manholes
  - Proposed Pipelines
  - Existing Pipelines
  - ⬜ Sphere of Influence Boundary
  - ▨ Parcels Currently Receiving Service
  - ▨ Parcels in Sphere of Influence



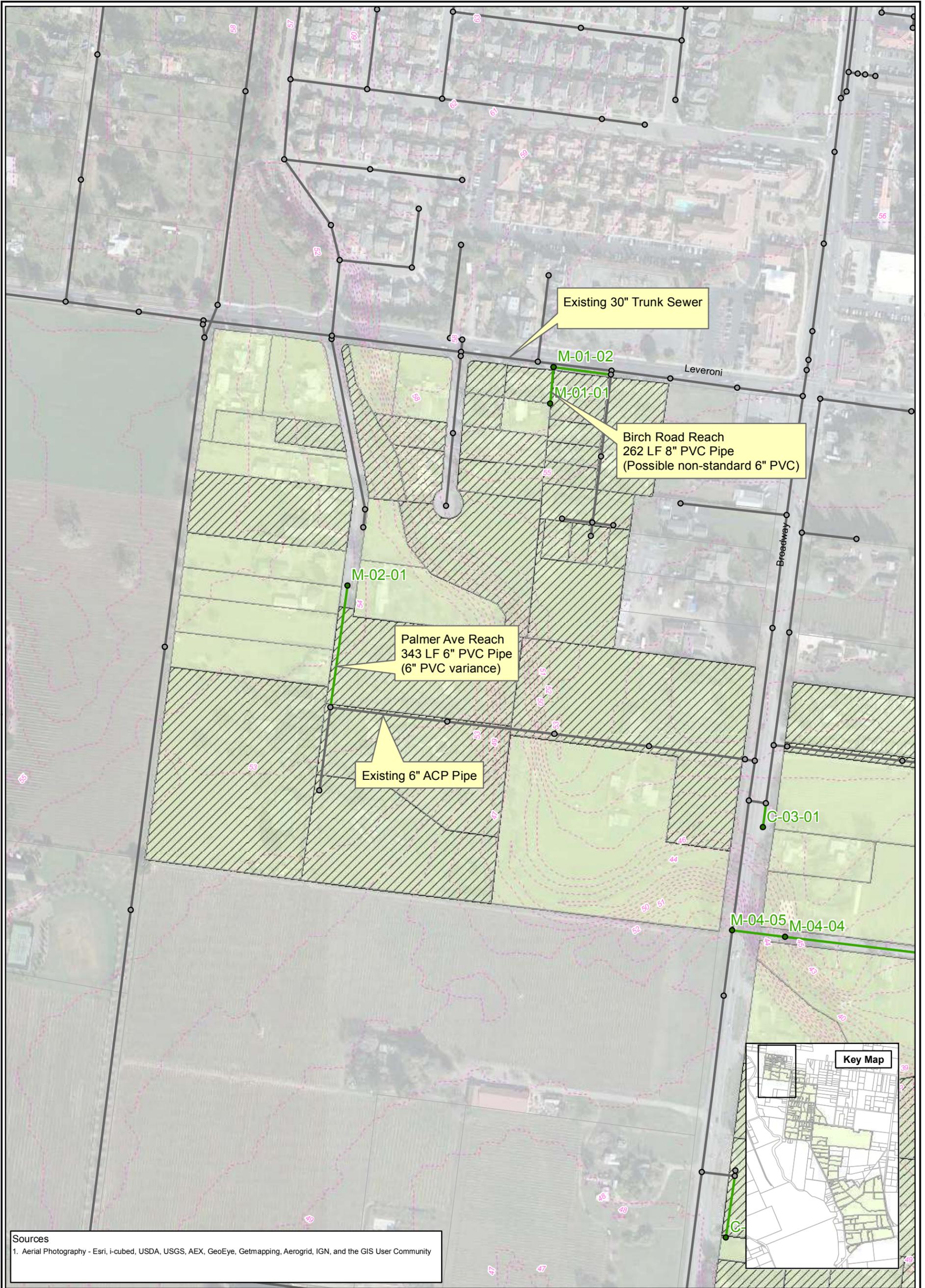
**Figure 3-2**

**Sonoma County Water Agency  
SOI Expansion**

**PROPOSED INFRASTRUCTURE  
LAYOUT**



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**Sources**  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community



LEGEND	
● Proposed Manholes	▨ Parcels Currently Receiving Service
○ Existing Manholes	▭ Parcels in Sphere of Influence
— Proposed Pipes	
— Existing Pipes	
— Ground Elevation (Feet)	

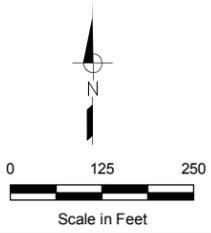


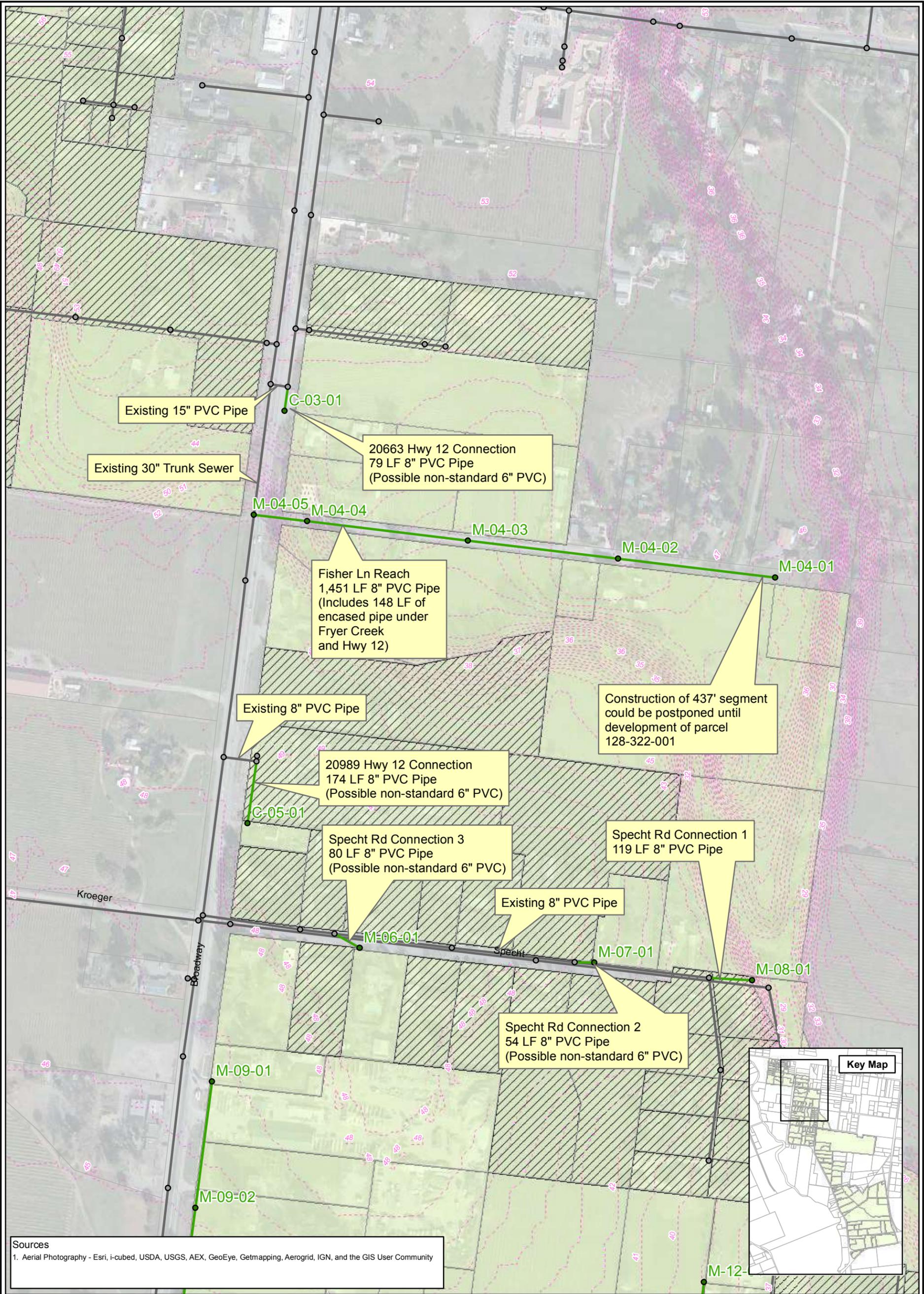
Figure 3-3

Sonoma County Water Agency  
SOI Expansion

**PROPOSED INFRASTRUCTURE  
LAYOUT - DETAIL 1**



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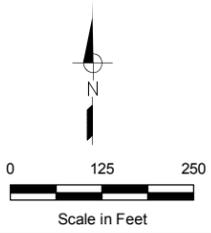


**Sources**  
1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community



**LEGEND**

● Proposed Manholes	▨ Parcels Currently Receiving Service
○ Existing Manholes	▭ Parcels in Sphere of Influence
— Proposed Pipes	
— Existing Pipes	
— Ground Elevation (Feet)	



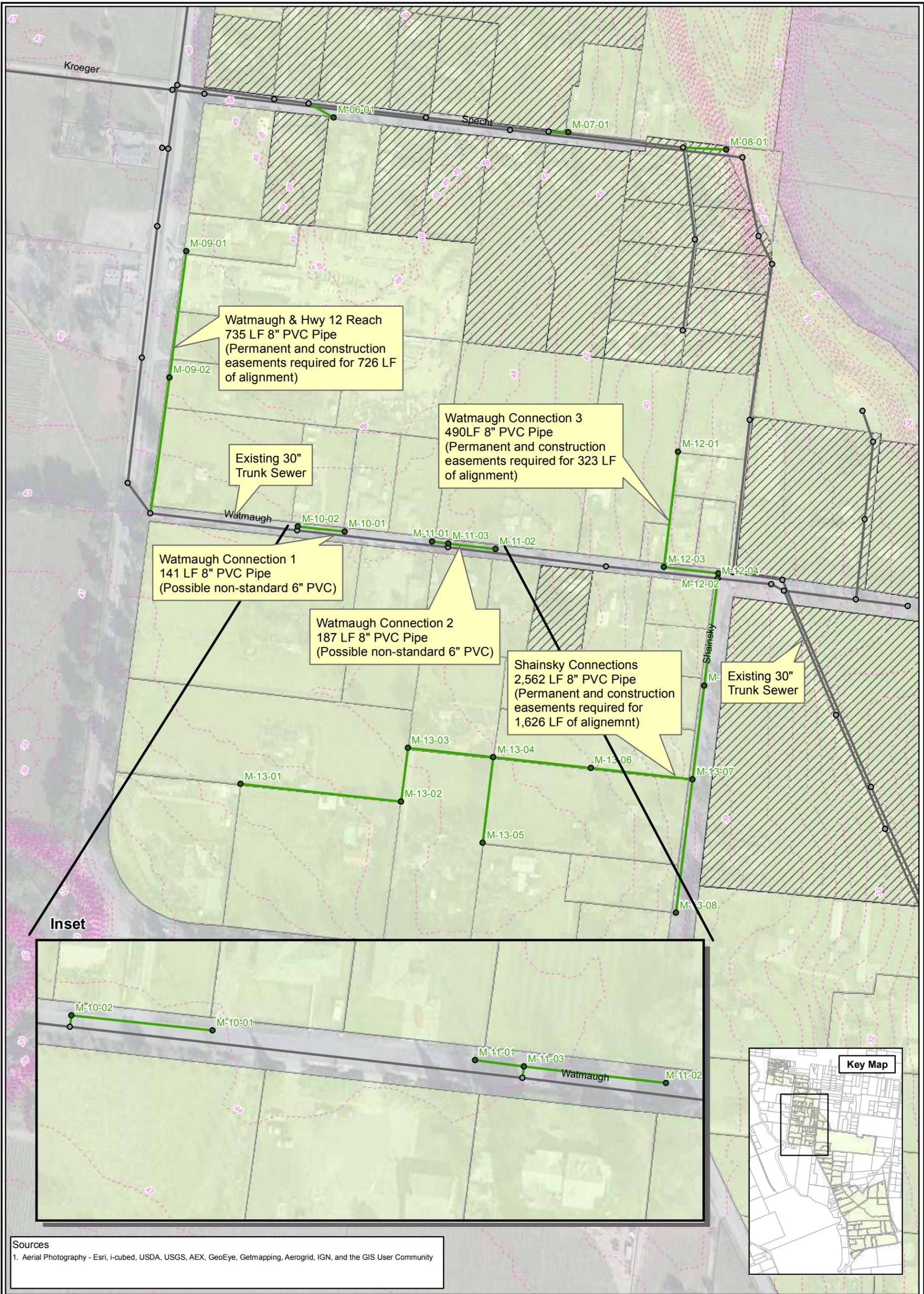
**Figure 3-4**

**Sonoma County Water Agency  
SOI Expansion**

**PROPOSED INFRASTRUCTURE  
LAYOUT - DETAIL 2**

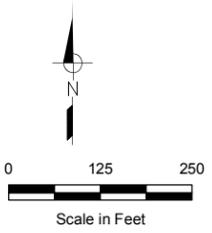


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**Sources**  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community

LEGEND	
●	Proposed Manholes
○	Existing Manholes
—	Proposed Pipes
—	Existing Pipes
—	Ground Elevation (Feet)
▨	Parcels Currently Receiving Service
□	Parcels in Sphere of Influence



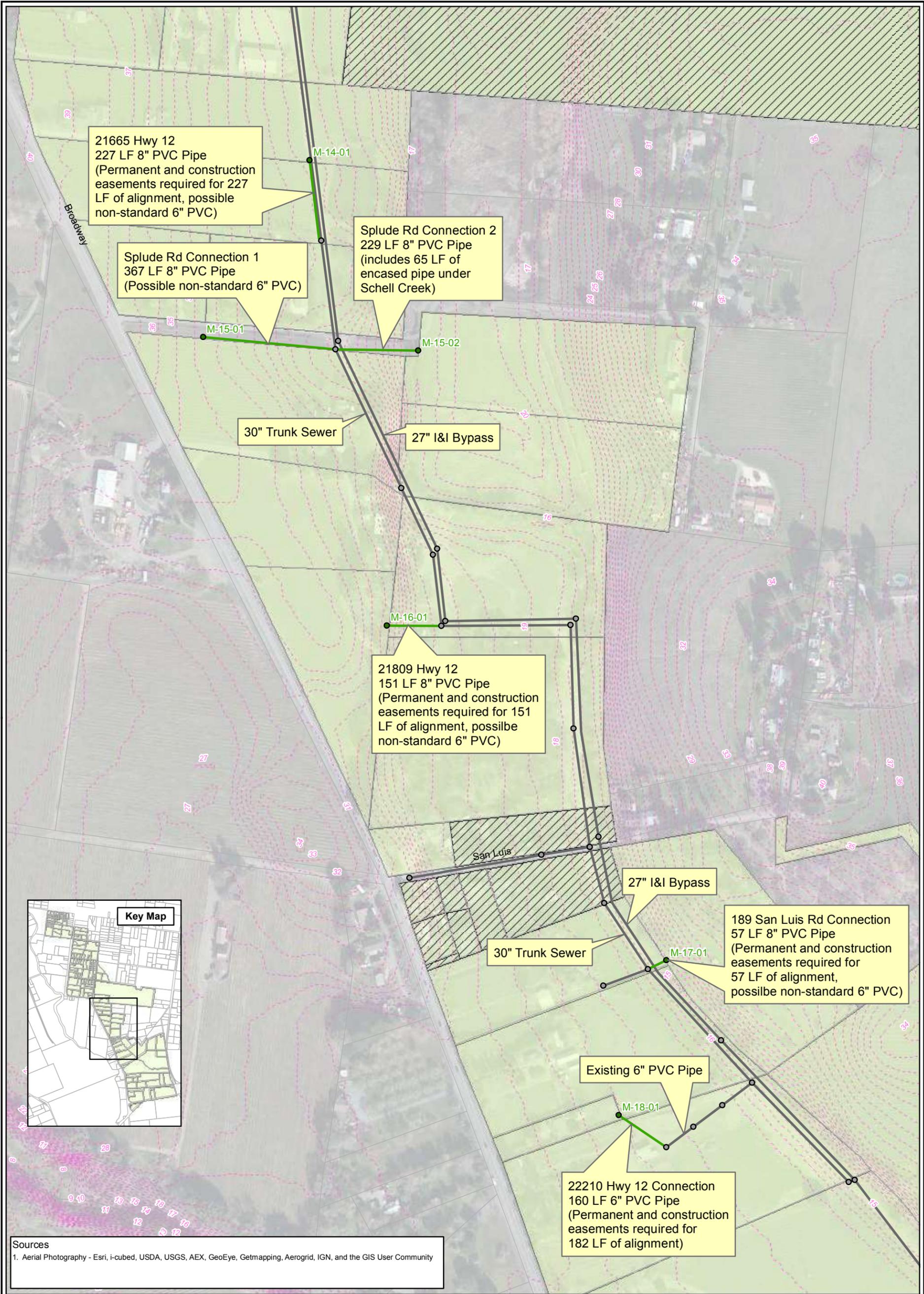
**Figure 3-5**

**Sonoma County Water Agency  
 SOI Expansion**

**PROPOSED INFRASTRUCTURE  
 LAYOUT - DETAIL 3**

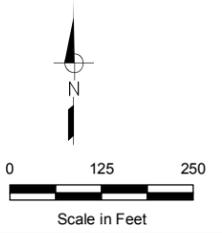


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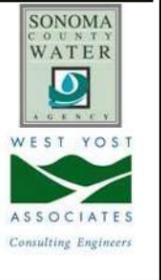


**LEGEND**

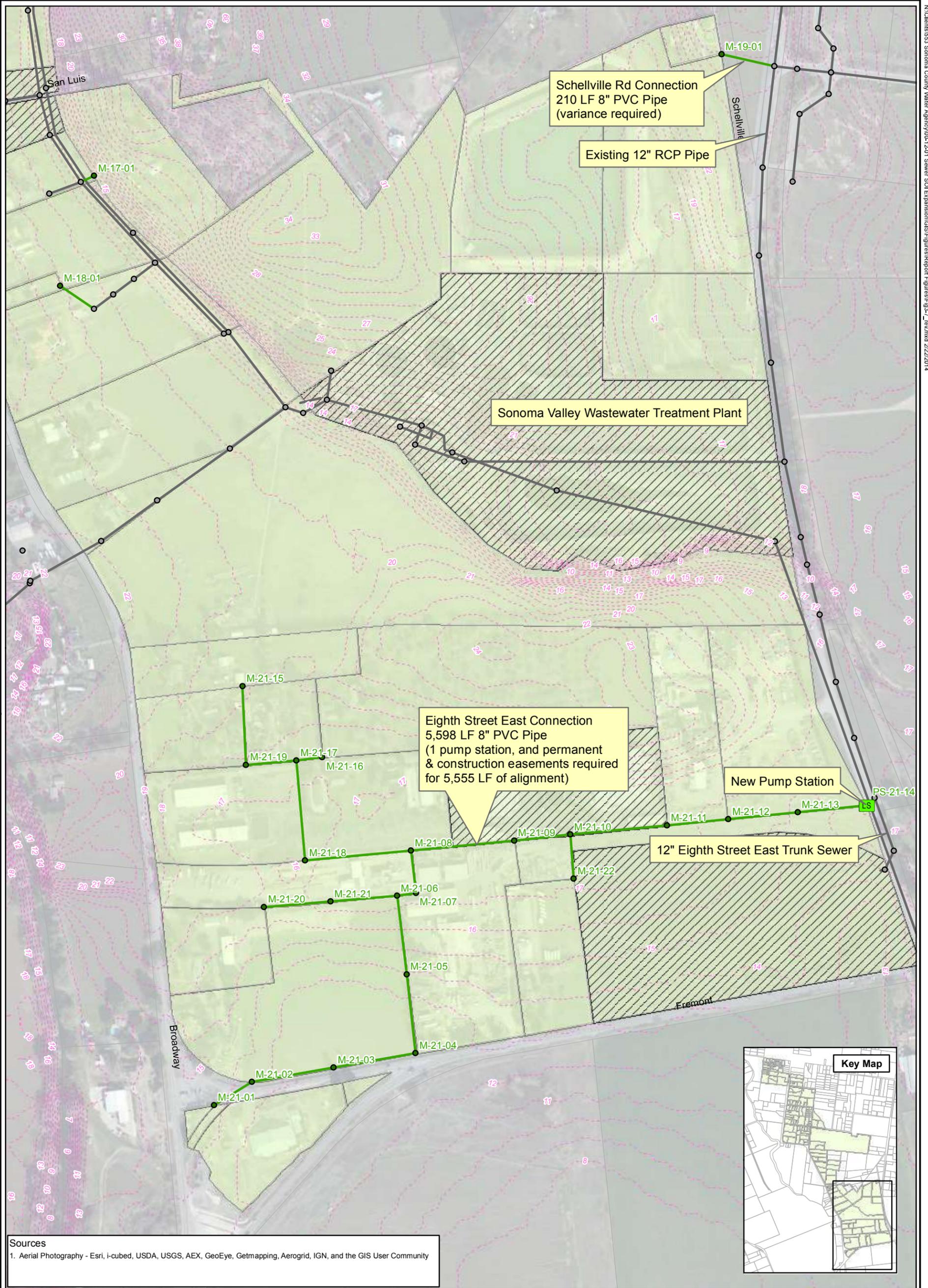
- Proposed Manholes
- Existing Manholes
- Proposed Pipes
- Existing Pipes
- Ground Elevation (Feet)
- ▨ Parcels Currently Receiving Service
- ▭ Parcels in Sphere of Influence



**Figure 3-6**  
**Sonoma County Water Agency**  
**SOI Expansion**  
**PROPOSED INFRASTRUCTURE**  
**LAYOUT - DETAIL 4**

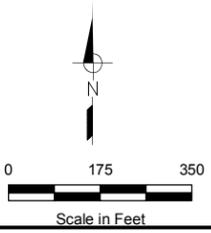


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**Sources**  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community

LEGEND	
●	Proposed Manholes
■	Parcels Currently Receiving Service
LS	Proposed Pump Station
■	Parcels in Sphere of Influence
○	Existing Manholes
—	Proposed Pipes
—	Existing Pipes
—	Ground Elevation (Feet)



**Figure 3-7**

**Sonoma County Water Agency  
SOI Expansion**

**PROPOSED INFRASTRUCTURE  
LAYOUT - DETAIL 5**



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## CHAPTER 4

### Planning Level Cost Estimates



Chapter 4 presents the planning level cost estimates for the infrastructure that is recommended in Chapter 3 to provide wastewater service to the SOI Expansion Area. Unit construction costs provided by SCWA and confirmed as part of this project are applied to the infrastructure quantities required in order to develop construction costs, soft costs, and contingencies appropriate to planning at this level were applied to the construction in order to calculate project costs.

This chapter is organized as follows:

- Unit Construction Costs for Gravity Pipelines and Manholes
- Unit Construction Costs for Lift Stations
- Unit Costs for Easement Acquisition
- Contingencies and Capital Cost Multipliers
- Level of Accuracy
- Recommended Infrastructure with Planning Level Cost Estimates

#### 4.1 UNIT CONSTRUCTION COSTS FOR GRAVITY PIPELINES AND MANHOLES

The SCWA provided bid results for three projects of similar complexity and magnitude to those recommended as part of the SOI Master Plan in Chapter 3. The projects included

- Biwana Drive Collection System Replacement,
- Moorland Avenue Collection System Replacement, and
- Kenmore Lane Collection System and Water Main Replacement.

From these projects, the average unit costs for 6-inch diameter gravity pipeline installation, 8-inch diameter gravity pipeline installation, 8-inch diameter gravity pipeline installation with steel encasement, manhole installation, and connection to a new manhole were extracted and averaged. All unit costs were scaled to August 2013 using San Francisco Bay Area Engineering News Record Construction Cost Index (ENR CCI) of 10,388. The gravity pipeline and manhole unit costs used for the SOI Master Plan planning level cost estimates are shown in Table 4-1.

Table 4-1. Gravity Pipeline and Manhole Unit Costs		
Item	Unit	Cost per Unit, \$
6-inch diameter gravity pipeline <sup>(a)</sup>	linear foot	132
8-inch diameter gravity pipeline <sup>(a)</sup>	linear foot	176
8-inch diameter gravity pipeline, steel encased <sup>(a)</sup>	linear foot	718 <sup>(b)</sup>
Manhole, new	Each	5,620
Manhole, connection to existing	Each	5,485
<sup>(a)</sup> At this level of planning, differences in gravity pipeline installation costs for undeveloped and developed areas was not considered.		
<sup>(b)</sup> This unit cost includes both the 8-inch diameter pipeline and the steel casing.		

## **4.2 UNIT CONSTRUCTION COSTS FOR LIFT STATIONS**

As described in Chapter 3, customers in the 8th Street East portion of the SOI Expansion Area cannot be served by gravity facilities alone. Topography requires that a lift station be constructed in order to flow from this area to reach the wastewater treatment plant. In order to estimate the cost of what would be a very small lift station, West Yost worked with Romtec Utilities, Inc. in order to estimate the cost of a package lift station for the area. The following package lift station was specified:

1. Design and supply of the package pump station including:
  - a. All design and engineering of the structural, mechanical, electrical and communication aspects of the lift station.
  - b. The supply of all structural, mechanical, electrical and communication related to the lift station, including:
    - i. The wet well, pumps and all mechanical.
    - ii. Pre-fabricated valve vault with all associated valve piping and other mechanical.
    - iii. UL listed control panel.
    - iv. Permanent onsite generator and ATS.

From this specification, a planning level cost of \$100,000 for the lift station unit and \$75,000 for the installation and construction were estimated. Therefore, the total planning level cost is estimated to be \$175,000. The costs provided by Romtec Utilities, Inc. can be seen in Appendix C.

## **4.3 UNIT COSTS FOR EASEMENT ACQUISITION**

Some of the projects recommended in Chapter 3 require both construction and permanent easements in order to be completed, as they cross private property en route to the public Right-of-Way. Per estimates provided by the SCWA, easement acquisition costs were estimated to be \$105,000 per acre. Construction easements were estimated to be 30 feet wide, and permanent easements were estimated to be 15 feet wide.

## **4.4 CONTINGENCIES AND CAPITAL COST MULTIPLIERS**

At the master planning phase, it is important to include contingencies reflecting the level of planning in addition to the normal construction contingency. Final alignments may vary from those identified, no field information has been evaluated, and there is significant probability that either the lengths or construction conditions will vary from those anticipated. As more detailed project information is developed and the estimate of construction cost is refined, this contingency may be appropriately reduced for a given project. The contingency will not affect the actual project costs, which are determined by final project scope, economic forces and other factors at the time of bidding. For this analysis, a combined construction and level-of-planning contingency of 20 percent is included.

Other project costs, sometimes referred to as “soft costs” include items such as engineering (owner and/or consultant), construction management, owner administration costs associated with the project, legal costs, and minor environmental compliance costs. These costs are incorporated in an allowance of 25 percent of the estimated construction cost, which is consistent with previous master planning conducted by SCWA.

Major environmental compliance costs and financing costs are not included in the capital cost estimate. These costs must be accounted for during the budgeting process if expected to be significant.

#### **4.5 LEVEL OF ACCURACY**

The estimated costs are Class 4 estimates, as defined by the Association for the Advancement of Cost Engineering.

*Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage. Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances<sup>1</sup>.*

The final costs of a project, and the resulting feasibility of the project, will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. Therefore, the final project costs will vary from the estimate presented in the SOI Master Plan. Because of these factors, project feasibility, benefit-cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding. Prior to design and construction of any recommended projects in this report, a detailed project cost estimate should be performed to account for specific issues not considered or impossible to predict in this analysis.

#### **4.6 RECOMMENDED INFRASTRUCTURE WITH PLANNING LEVEL COST ESTIMATES**

The planning level project costs for the projects recommended to provide wastewater service in the SOI Expansion Area are shown in Table 4-2. The detailed costs associated with each of the projects can be found in Appendix D. As shown these costs do not include financing or internal administrative costs associated with establishing and operating the expansions and/or outside service area agreement facilities. These costs are discussed and estimated in Chapter 5.

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<sup>1</sup> Association for the Advancement of Cost Engineering, AACE; “Cost Estimating Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries, TCM Framework: 7.3 – cost Estimating and Budgeting”; February 2, 2005.

**Table 4-2. Recommended Collection System Facilities Planning Level Cost Estimate**

Project	Description	Easement Required	Construction Cost, \$	Soft Costs, \$	Contingency Costs, \$	Project Cost, \$
Birch Road	262 ft. of 8-inch pipe and 2 manholes	No	62,837	15,709	12,567	91,114
Palmer Avenue	343 ft. of 6-inch pipe and 1 manhole	No	56,381	14,095	11,276	81,752
20663 Highway 12	79 ft. of 8-inch pipe and 1 manhole	No	25,009	6,252	5,002	36,263
Fisher Road	1,451 ft of 8-inch pipe (148 ft. to be steel encased) and 4 manholes	No	363,557	90,889	72,711	527,158
20989 Highway 12	174 ft. of 8-inch pipe and 1 manhole	No	41,729	10,432	8,346	60,507
Specht Road	253 ft. of 8-inch pipe and 3 manholes	Yes	86,521	21,630	17,304	125,455
Watmaugh Road & Highway 12	735 ft. of 8-inch pipe and 2 manholes	Yes	225,811	56,453	45,162	327,426
Watmaugh Road	818 ft. of 8-inch pipe and 9 manholes	Yes	240,633	60,158	48,127	348,918
Shainsky Road	2,555 ft. of 8-inch pipe and 9 manholes	Yes	667,992	166,998	133,598	968,589
21665 Highway 12	227 ft. of 8-inch pipe and 1 manhole	Yes	75,680	18,920	15,136	109,736
Splude Road	596 ft of 8-inch pipe (65 ft. to be steel encased) and 2 manholes	No	156,851	39,213	31,370	227,434
21809 Highway 12	151 ft. of 8-inch pipe and 1 manhole	Yes	54,060	13,515	10,812	78,387
189 San Luis Road	57 ft. of 8-inch pipe and 1 manhole	Yes	27,320	6,830	5,464	39,614
22210 Highway 12	160 ft. of 8-inch pipe and 2 manhole	Yes	55,200	13,800	11,040	80,041
Schellville Road	210 ft. of 8-inch pipe and 1 manhole	Yes	70,844	17,711	14,169	102,724
Eighth Street East	5,600 ft. of 8-inch pipeline, 19 manholes, and 1 package pump station	Yes	1,755,199	438,800	351,040	2,545,039
<b>Total</b>			<b>\$3,965,625</b>	<b>\$991,406</b>	<b>\$793,125</b>	<b>\$5,750,157</b>

## CHAPTER 5

### Funding Alternatives

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Chapter 5 presents alternatives for funding expansion of the collection system into the SOI Expansion Area.

- Alternative Descriptions
- Alternative 1: Assessment District Formation
- Alternative 2: No Assessment District Formation

#### 5.1 ALTERNATIVE DESCRIPTIONS

As described in the preceding four chapters, expansion of the collection system to provide service in the SOI Expansion Area will require construction of collection system infrastructure in order to connect the SOI expansion area to the existing conveyance and treatment systems for wastewater. The costs for new infrastructure are in addition to any connection fees, or annual user fees, owed to Sonoma Valley CSD, which are presumed to allow customers in the SOI Expansion Area to buy into existing conveyance and treatment facilities, but not to pay for new required infrastructure.

In Chapter 3, 16 distinct infrastructure projects were identified to connect potential customers to Sonoma Valley CSD's existing conveyance system. Each of these projects is stand-alone, and does not require any of the others to be built in order to proceed. Thus, connection of the SOI Expansion Area, or portions thereof, to the existing conveyance system could proceed with individual projects being completed as individual customers wish to connect, could proceed all at once with all of the projects being completed, or could proceed in some combination that falls between these two extremes. The number of possibilities renders the determination of exact funding alternatives difficult.

Although there are limited supplies of grants that may be available in order to help pay for connection of the SOI Expansion Area to the Sonoma Valley CSD conveyance system, the most likely source of up-front funds for such connections is a bond that requires the formation of an assessment district for the properties that are connecting. This chapter evaluates the alternative of formation of an assessment district with the alternative of the individual property owners supplying the costs for the connections.

#### 5.2 ALTERNATIVE 1: ASSESSMENT DISTRICT FORMATION

##### 5.2.1 Background on Assessment District Costs

In 1996, the Eighth Street East Sewer Assessment District was formed whereby 20 additional parcels were assessed a total cost of \$3,044,982 in order to connect to Sonoma Valley CSD's existing sewer collection system. In July 1998, 20-year bonds were issued to cover the cost of construction. Assumptions from this bond issuance associated with the Eighth Street East Sewer Assessment District were used to estimate the costs associated with expanding the Sonoma Valley CSD's current sphere of influence to include an additional 106 ESDs.

#### 5.2.2 Key Assumptions for Assessment Costs

The assessment costs were derived using the following assumptions:

1. **Total Construction Costs.** Total construction costs comprise the cost of pipes, manholes, easements and pump-stations necessary for the additional ESDs to connect to the existing collection system. The cost estimate does not include the cost of laterals for individual parcels to connect to the system. The cost of laterals will be financed by each parcel in addition to the assessments.
2. **Construction Contingencies.** Construction contingencies account for uncertainties such as estimating accuracy based on quantities assumed or measured, unanticipated market conditions, and potential scheduling delays. The contingency is calculated as 20 percent of total construction costs.
3. **Indirect Costs.** Indirect costs represent engineering and administration costs such as preliminary surveys, design and mapping and are assumed to be 25 percent of total construction costs.
4. **Connection Fees.** The connection fees were not included as part of the total assessment costs. However, property owners could be allowed to amortize their connection fees, which would be added to their specific assessment.
5. **Issuance Costs.** The incidental costs comprised assessment costs associated with the bond issuance and formation of the assessment district. The following describes the three components that comprise incidental costs in detail:
  - **Assessment Costs.** The assessment cost includes legal fees, bond counsel fees, engineering fees, assessment district administration fees, paying agent fees, financial advisory fees, printing costs, and any other costs associated with the issuance of the bond. The estimated assessment costs were confirmed by an underwriter to be reasonably accurate based on the size of the bond.
  - **Deposit to the Bond Reserve Fund.** The bond reserve fund constitutes a trust fund for the benefit of the owners of the bonds and is a common covenant of most borrowings. We estimated the amount of the deposit to the bond reserve fund using the guidelines presented in the Official Statement of the Eighth Street East Sewer Assessment District 1998 Limited Obligation Improvement Bonds. The calculation assumes the deposit will be the least of (1) 10 percent of bond proceeds, (2) the maximum annual debt service of the bonds, or (3) 125 percent of average annual debt service.
  - **Capitalized Interest.** Consists of the first year of interest on the bonds at 5.5 percent per annum.

#### 5.2.3 Costs Associated with District Formation

Table 5-1 summarizes the resulting costs for expansion into the SOI Expansion from the sources described above, assuming assessment district formation during the expansion.



<b>Table 5-1. Estimated Bond Proceeds</b>	
Source	Proceeds, \$
<b>Construction Costs</b>	
8-inch Pipeline	2,432,676
6-inch Pipeline	66,396
Manhole	331,580
Connection to Existing Manhole	65,820
Easements	861,243
Pump Station	175,000
Laterals	-
<i>Construction Cost Subtotal</i>	<i>3,932,715</i>
<b>Soft Costs</b>	
Construction Contingencies	793,125
Indirect Costs	991,406
Connection Fees	-
<i>Project Cost Subtotal</i>	<i>5,717,247</i>
<b>Issuance Costs</b>	
Assessment Costs	250,000
Bond Reserve Fund	581,571
Capitalized Interest	382,250
<i>Issuance Cost Subtotal</i>	<i>1,213,821</i>
<b>Total Bond Proceeds</b>	<b>6,931,068</b>

Table 5-2 summarizes the costs associated with forming the assessment district, and calculates the average total cost and average annual cost per connection, assuming a 20-year amortization period. The payoff period of 20 years from the Eighth Street East Sewer Assessment District 1998 Limited Obligation Improvement Bonds was the basis for the interest calculation shown in Table 5-2. The interest rate used in the calculation was also confirmed by an underwriter to be reasonably accurate.



**Table 5-2. Average Cost per ESD of Assessment District Formation**

Source	Amount
<b>Proceeds</b>	
Bond Size	\$6,950,000
Assessment Costs	(\$250,000)
Bond Reserve Fund	(\$581,571)
Capitalized Interest	(\$382,250)
<i>Net Proceeds</i>	\$5,736,179
Annual Interest Rate	5.50%
Term (Years)	20
<b>Assessment District Totals</b>	
Total Principal	\$6,950,000
Total Interest	\$4,299,177
<i>Assessment District Totals</i>	\$11,249,177
<b>Total ESDs</b>	<b>106</b>
<i>Average Total Cost Per ESD</i>	\$106,124
<i>Average Annual Cost per ESD</i>	\$5,306

**5.3 ALTERNATIVE 2: NO ASSESSMENT DISTRICT FORMATION**

By contrast, if an assessment district were not formed and individual property owners paid for their respective connections, the average total cost per ESD would be approximately half of the assessment district cost, as shown in Table 5-3. This assumes that the entire cost is paid for front without loans.

**Table 5-3. Average Cost per ESD without Assessment District Formation**

Source	Amount
<b>Costs</b>	
Construction	\$3,932,715
Construction Contingencies	\$793,125
Indirect Costs	\$991,406
<b>Cost Totals</b>	<b>\$5,717,247</b>
<b>Total ESDs</b>	<b>106</b>
<b>Average Total Cost Per ESD</b>	<b>\$53,936</b>

Although Table 5-3 shows the average cost per ESD for connection if an assessment district were not formed, if individual property owners were to connect on their own schedule, and were to pay for only the costs required for their connection, the costs per ESD would vary greatly depending on the amount of infrastructure required for any given connection. For example, the potential customers that require the pump station will pay a higher cost per ESD than those that require only one or two segments of gravity main.

# **APPENDIX A**

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Design and Construction Standards Excerpt

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EFFECTIVE JANUARY 1, 2009

SANITATION AREA ZONE or DISTRICT	A	B	C	D	E	F	G
	PEOPLE PER ESD	FLOW per ESD gpd	ADWF per ESD	PDWF PER ESD	PEAK TO AVERAGE RATIO	CONNECTED ESD LOAD	ESTIMATED EQUIVALENT POPULATION
AIRPORT SZ	2.50	280	280	790	2.82	3,613.42	9,034
GEYSERVILLE SZ	2.30	200	200	574	2.87	344.03	791
PENNGROVE SZ	2.50	180	180	432	2.74	512.49	1,281
SEA RANCH SZ	2.50	200	200	542	2.71	572.60	1,432
OCCIDENTAL CSD	2.30	66	66	193	2.92	283.09	651
RUSSIAN RIVER CSD	2.30	120	120	277	2.31	3,185.74	7,327
SONOMA VALLEY CSD	2.60	200	200	388	1.94	17,282.74	44,935
SOUTHPARK CSD	2.60	233	233	522	2.24	4,012.76	10,433

- A. THIS PLAN IS BASED UPON NUMBERS FOUND IN THE 2000 U.S. CENSUS.
- B. THIS IS THE FLOW FOUND IN THE BILLING BASIS TABLES FOR EACH SANITATION AREA.
- C. THIS IS THE AVERAGE DRY WEATHER FLOW PER ESD BASED UPON FLOW RECORDS.
- D. THE PEAK DRY WEATHER FLOW IS DETERMINED BY MULTIPLYING THE ADWF (C) BY THE PEAK TO AVERAGE RATIO (E).
- E. THE PEAK TO AVERAGE RATIO WAS DETERMINED BY MULTIPLYING THE ADWF (C) BY A CONSTANT K PRODUCED BY THE FORMULA:  

$$K=5.453/P^{0.0963}$$
 WHERE P=ESTIMATED POPULATION
- F. THIS NUMBER COMES FROM THE AGENCY'S MASTER LIST OF BILLING RECORDS AND IS THE TOTAL NUMBER OF ESDs LISTED FOR EACH SANITATION AREA.
- G. THIS IS ARRIVED AT BY MULTIPLYING THE NUMBER OF PEOPLE PER ESD (A) TIMES THE CONNECTED ESD LOAD (F)
- H. PDWF PLUS 800 GALLONS PER ACRE PER DAY RAINFALL DERIVED INFLOW AND INFILTRATION PRODUCES THE DESIGN PEAK WET WEATHER FLOW (DWWF).

**NOTES:**

1. THE NUMBERS AND FORMULAS USED IN THIS TABLE ARE SUBJECT TO CHANGE.
2. PDWF PLUS 800 GALLONS PER ACRE PER DAY RAINFALL DERIVED INFLOW AND INFILTRATION PRODUCES THE DESIGN PEAK WET WEATHER FLOW (PWWF).

SCALE: NONE

**SANITARY SEWER - SANITARY AREA FLOW CHARACTERISTICS**

DATE: 02/03/09

REVIEWED BY: *[Signature]*

APPROVED: *[Signature]*

SONOMA COUNTY WATER AGENCY

DRAWING NUMBER: **138**

\\sc-data\Proj\general\reports\standard details\sanitation stds\ss\_138.dwg

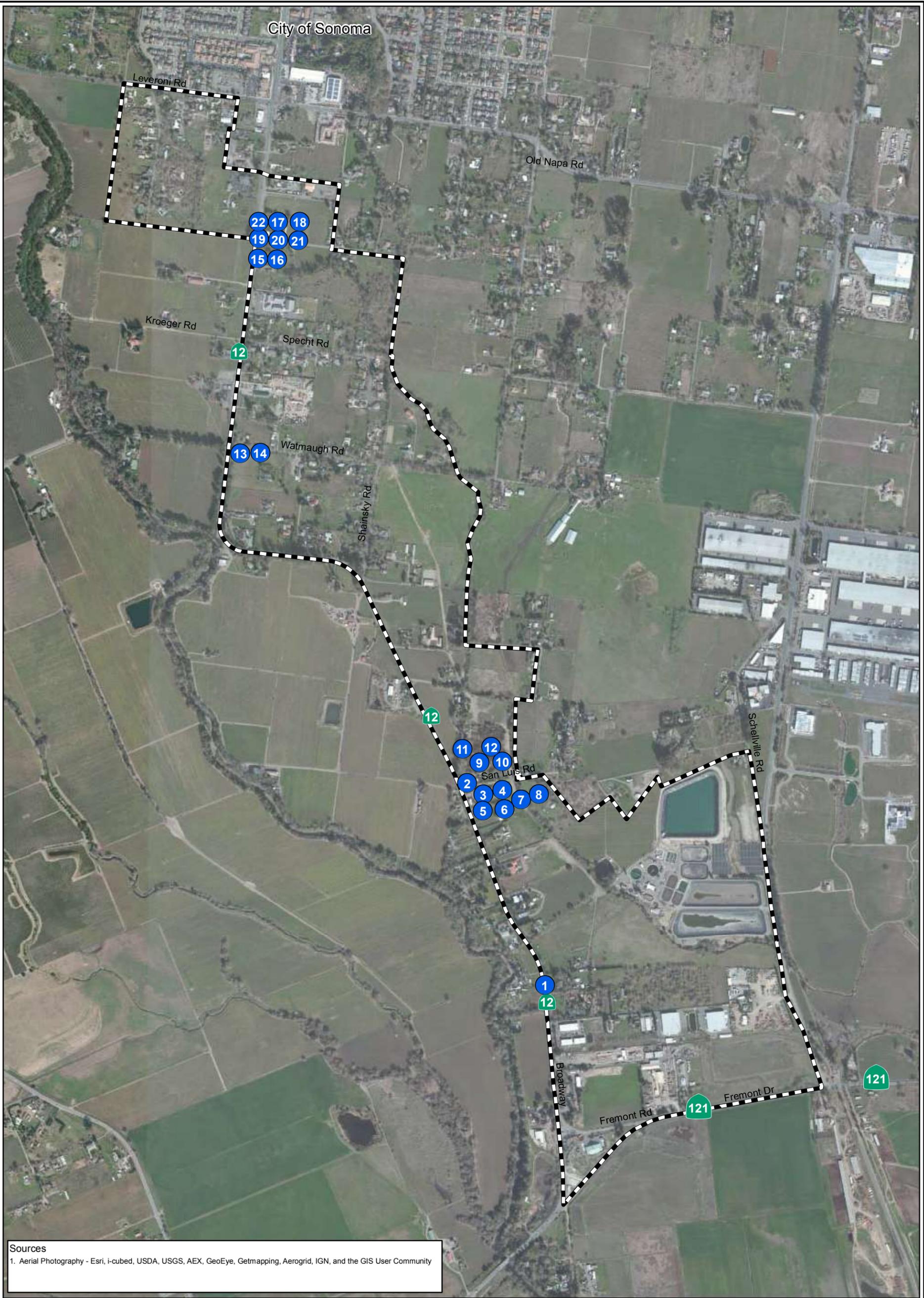
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## **APPENDIX B**

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Project Area Photos

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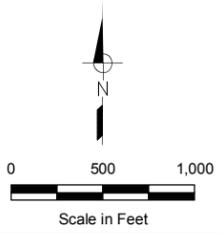


Sources  
 1. Aerial Photography - Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, and the GIS User Community

**LEGEND**

 Sphere of Influence Boundary

 Picture Number



**Figure B-1**  
**Sonoma County Water Agency**  
**SOI Expansion**

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**PROJECT PHOTO LOCATIONS**



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**SOI Expansion Area – Photo 1**



**SOI Expansion Area – Photo 2**



**SOI Expansion Area – Photo 3**



**SOI Expansion Area – Photo 4**



**SOI Expansion Area – Photo 5**



**SOI Expansion Area – Photo 6**



**SOI Expansion Area – Photo 7**



**SOI Expansion Area – Photo 8**



**SOI Expansion Area – Photo 9**



**SOI Expansion Area – Photo 10**



**SOI Expansion Area – Photo 11**



**SOI Expansion Area – Photo 12**



**SOI Expansion Area – Photo 13**



**SOI Expansion Area – Photo 14**



**SOI Expansion Area – Photo 15**



**SOI Expansion Area – Photo 16**



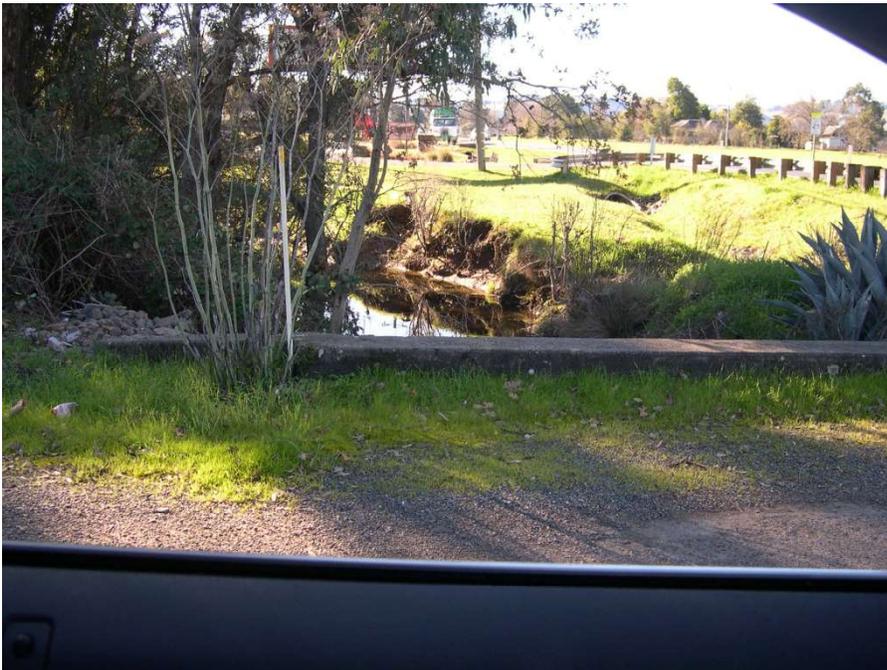
**SOI Expansion Area – Photo 17**



**SOI Expansion Area – Photo 18**



**SOI Expansion Area – Photo 19**



**SOI Expansion Area – Photo 20**



**SOI Expansion Area – Photo 21**



**SOI Expansion Area – Photo 22**

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## **APPENDIX C**

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Budget Level Construction Cost Estimate for Package Pump Station

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February 14, 2013

Jeff Tolentino  
West Yost Associates

**Re: Budgetary Pricing for the Lift Station at Sonoma County Water Agency Sphere of Influence Expansion**

Dear Jeff:

1. Design and supply of the package pump station including:
  - a. All design and engineering of the structural, mechanical, electrical and communication aspects of the lift station.
  - b. The supply of all structural, mechanical, electrical and communication related to the lift station.

Including:

- i. The wet well, pumps and all mechanical.
- ii. Pre-fabricated valve vault with all associated valve piping and other mechanical.
- iii. UL listed control panel.
- iv. Permanent onsite generator and ATS.

Budgetary: \$90,000.00 to \$100,000.00

2. Construction/Installation estimate: \$75,000.00

Budgetary total = \$175,000.00

Sincerely,  
Romtec Utilities, Inc.

Mark Sheldon  
Vice President

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## **APPENDIX D**

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Detailed Project Costs

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**SVCSD Sewer Master Plan for 2010 SOI Expansion:  
Collection System Facilities Construction Cost Estimate**

Item	Easement Req'd	Quantity	Unit	Unit cost	Item Cost	Project Cost
<b>Birch Road</b>						
8-inch pipe						
M-01-01_M-01-02	N	102	LF	\$ 176	\$ 17,952	
M-01-02_M171-129	N	160	LF	\$ 176	\$ 28,160	
Manhole/Cleanout		2	EA	\$ 5,620	\$ 11,240	
Connect to existing MH		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 62,837
Soft Costs					25%	\$ 15,709
Contingencies					20%	\$ 12,567
<b>Total</b>						<b>\$ 91,114</b>
<b>Palmer Ave</b>						
6-inch pipe						
M-02-01_M175-110	N	343	LF	\$ 132	\$ 45,276	
Manhole		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal						\$ 56,381
Subtotal (Construction Costs)					25%	\$ 14,095
Contingencies					20%	\$ 11,276
<b>Total</b>						<b>\$ 81,752</b>
<b>20663 Hwy 12</b>						
8-inch pipe						
C-03-01_M175-009	N	79	LF	\$ 176	\$ 13,904	
Manhole/Cleanout		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 25,009
Soft Costs					25%	\$ 6,252
Contingencies					20%	\$ 5,002
<b>Total</b>						<b>\$ 36,263</b>
<b>Fisher</b>						
8-inch pipe						
M-04-01_M-04-02	N	437	LF	\$ 176	\$ 76,912	
M-04-02_M-04-03	N	418	LF	\$ 176	\$ 73,568	
M-04-03_M-04-04	N	448	LF	\$ 176	\$ 78,848	
8-inch pipe with steel encasement						
M-04-04_M-04-05		148	LF	\$ 718	\$ 106,264	
Manhole/Cleanout		4	EA	\$ 5,620	\$ 22,480	
Connect to existing MH		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 363,557
Soft Costs					25%	\$ 90,889
Contingencies					20%	\$ 72,711
<b>Total</b>						<b>\$ 527,158</b>

**SVCSD Sewer Master Plan for 2010 SOI Expansion:  
Collection System Facilities Construction Cost Estimate**

Item	Easement Req'd	Quantity	Unit	Unit cost	Item Cost	Project Cost
<b>20989 Hwy 12</b>						
8-inch pipe						
C-05-01_M200-003	N	174	LF	\$ 176	\$ 30,624	
Manhole/Cleanout		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 41,729
Soft Costs					25%	\$ 10,432
Contingencies					20%	\$ 8,346
<b>Total</b>						<b>\$ 60,507</b>
<b>Specht</b>						
8-inch pipe						
M-08-01_M205-003	N	119	LF	\$ 176	\$ 20,944	
M-07-01_M205-013	N	54	LF	\$ 176	\$ 9,504	
M-06-01_M204-007	Y	80	LF	\$ 176	\$ 14,080	
Permenant Easement		0.028	Acres	\$ 105,000	\$ 2,893	
Construction Easement		0.055	Acres	\$ 105,000	\$ 5,785	
Manhole/Cleanout		3	EA	\$ 5,620	\$ 16,860	
Connect to existing		3	EA	\$ 5,485	\$ 16,455	
Subtotal (Construction Costs)						\$ 86,521
Soft Costs					25%	\$ 21,630
Contingencies					20%	\$ 17,304
<b>Total</b>						<b>\$ 125,455</b>
<b>Watmaugh &amp; Hwy 12</b>						
8-inch pipe						
M-09-01_M-09-02	Y	354	LF	\$ 176	\$ 62,304	
M-09-02_M207-002	Y	381	LF	\$ 176	\$ 67,056	
Permenant Easement		0.253	Acres	\$ 105,000	\$ 26,575	
Construction Easement		0.506	Acres	\$ 105,000	\$ 53,151	
Manhole/Cleanout		2	EA	\$ 5,620	\$ 11,240	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 225,811
Soft Costs					25%	\$ 56,453
Contingencies					20%	\$ 45,162
<b>Total</b>						<b>\$ 327,426</b>
<b>Watmaugh</b>						
8-inch pipe						
M-10-01_M-10-02	N	130.45	LF	\$ 176	\$ 22,959	
M-10-02_M208-012	N	11	LF	\$ 176	\$ 1,936	
M-11-01_M-11-03	N	45	LF	\$ 176	\$ 7,920	
M-11-02_M-11-03	N	131	LF	\$ 176	\$ 23,056	
M-11-03_M208-011	N	11	LF	\$ 176	\$ 1,936	
M-12-01_M-12-03	Y	323	LF	\$ 176	\$ 56,848	
M-12-02_M-12-03	N	152	LF	\$ 176	\$ 26,752	
M-12-03_M-12-04	N	15	LF	\$ 176	\$ 2,640	
Permenant Easement		0.111	Acres	\$ 105,000	\$ 11,679	
Construction Easement		0.222	Acres	\$ 105,000	\$ 23,357	

**SVCSD Sewer Master Plan for 2010 SOI Expansion:  
Collection System Facilities Construction Cost Estimate**

Item	Easement Req'd	Quantity	Unit	Unit cost	Item Cost	Project Cost
Manhole/Cleanout		9	EA	\$ 5,620	\$ 50,580	
Connect to existing		2	EA	\$ 5,485	\$ 10,970	
Subtotal (Construction Costs)						\$ 240,633
Soft Costs					25%	\$ 60,158
Contingencies					20%	\$ 48,127
<b>Total</b>						<b>\$ 348,918</b>

**SVCSD Sewer Master Plan for 2010 SOI Expansion:  
Collection System Facilities Construction Cost Estimate**

Item	Easement Req'd	Quantity	Unit	Unit cost	Item Cost	Project Cost
<b>Shainsky</b>						
8-inch pipe						
M-13-01_M-12-02	Y	445	LF	\$ 176	\$ 78,320	
M-13-02_M-13-03	Y	150	LF	\$ 176	\$ 26,400	
M-13-03_M-13-04	Y	238	LF	\$ 176	\$ 41,888	
M-13-04_M-13-06	Y	271	LF	\$ 176	\$ 47,696	
M-13-06_M-13-07	Y	283	LF	\$ 176	\$ 49,808	
M-13-07_M-13-09	N	263	LF	\$ 176	\$ 46,288	
M-13-09_M-13-10	N	292	LF	\$ 176	\$ 51,392	
M-13-05_M-13-04	Y	239	LF	\$ 176	\$ 42,064	
M-13-08_M-13-07	N	374	LF	\$ 176	\$ 65,824	
Permenant Easement		0.478	Acres	\$ 105,000	\$ 50,150	
Construction Easement		1.120	Acres	\$ 105,000	\$ 117,583	
Manhole/Cleanout		9	EA	\$ 5,620	\$ 50,580	
Subtotal (Construction Costs)						\$ 667,992
Soft Costs					25%	\$ 166,998
Contingencies					20%	\$ 133,598
<b>Total</b>						<b>\$ 968,589</b>
<b>21665 Hwy 12</b>						
8-inch pipe						
M-14-01_M213-001	Y	227	LF	\$ 176	\$ 39,952	
Permenant Easement		0.078	Acres	\$ 105,000	\$ 8,208	
Construction Easement		0.156	Acres	\$ 105,000	\$ 16,415	
Manhole/Cleanout		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 75,680
Soft Costs					25%	\$ 18,920
Contingencies					20%	\$ 15,136
<b>Total</b>						<b>\$ 109,736</b>
<b>Splude Rd</b>						
8-inch pipe						
M-15-01_M213-003	N	367	LF	\$ 176	\$ 64,592	
M-15-02_M213-003	N	164	LF	\$ 176	\$ 28,864	
8-inch pipe with steel encasement						
M-15-02_M213-003		65	LF	\$ 718	\$ 46,670	
Manhole/Cleanout		2	EA	\$ 5,620	\$ 11,240	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 156,851
Soft Costs					25%	\$ 39,213
Contingencies					20%	\$ 31,370
<b>Total</b>						<b>\$ 227,434</b>

**SVCSD Sewer Master Plan for 2010 SOI Expansion:  
Collection System Facilities Construction Cost Estimate**

Item	Easement Req'd	Quantity	Unit	Unit cost	Item Cost	Project Cost
<b>21809 Hwy 12</b>						
8-inch pipe						
M-15-01_M213-003	Y	151	LF	\$ 176	\$ 26,576	
Permenant Easement		0.052	Acres	\$ 105,000	\$ 5,460	
Construction Easement		0.104	Acres	\$ 105,000	\$ 10,919	
Manhole/Cleanout		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 54,060
Soft Costs					25%	\$ 13,515
Contingencies					20%	\$ 10,812
<b>Total</b>						<b>\$ 78,387</b>
<b>189 San Luis Rd</b>						
8-inch pipe						
M-17-01_M219-104	Y	57	LF	\$ 176	\$ 10,032	
Permenant Easement		0.020	Acres	\$ 105,000	\$ 2,061	
Construction Easement		0.039	Acres	\$ 105,000	\$ 4,122	
Manhole/Cleanout		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 27,320
Soft Costs					25%	\$ 6,830
Contingencies					20%	\$ 5,464
<b>Total</b>						<b>\$ 39,614</b>
<b>22210 Hwy 12</b>						
6-inch pipe						
M-18-10_M219-002	Y	160	LF	\$ 132	\$ 21,120	
Permenant Easement		0.055	Acres	\$ 105,000	\$ 5,785	
Construction Easement		0.110	Acres	\$ 105,000	\$ 11,570	
Manhole/Cleanout		2	EA	\$ 5,620	\$ 11,240	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 55,200
Soft Costs					25%	\$ 13,800
Contingencies					20%	\$ 11,040
<b>Total</b>						<b>\$ 80,041</b>
<b>Schellville Rd</b>						
8-inch pipe						
M-19-01_M218-808	Y	210	LF	\$ 176	\$ 36,960	
Permenant Easement		0.072	Acres	\$ 105,000	\$ 7,593	
Construction Easement		0.145	Acres	\$ 105,000	\$ 15,186	
Manhole/Cleanout		1	EA	\$ 5,620	\$ 5,620	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 70,844
Soft Costs					25%	\$ 17,711
Contingencies					20%	\$ 14,169
<b>Total</b>						<b>\$ 102,724</b>

**SVCSD Sewer Master Plan for 2010 SOI Expansion:  
Collection System Facilities Construction Cost Estimate**

Item	Easement Req'd	Quantity	Unit	Unit cost	Item Cost	Project Cost
<b>Eighth Street East</b>						
8-inch pipe						
M-21-01_M-21-02	Y	172	LF	\$ 176	\$ 30,274	
M-21-02_M-21-03	Y	323	LF	\$ 176	\$ 56,772	
M-21-03_M-21-04	Y	323	LF	\$ 176	\$ 56,772	
M-21-04_M-21-05	Y	309	LF	\$ 176	\$ 54,447	
M-21-05_M-21-06	Y	308	LF	\$ 176	\$ 54,294	
M-21-06_M-21-07	Y	74	LF	\$ 176	\$ 12,987	
M-21-07_M-21-08	Y	167	LF	\$ 176	\$ 29,346	
M-21-08_M-21-09	Y	402	LF	\$ 176	\$ 70,794	
M-21-09_M-21-10	Y	219	LF	\$ 176	\$ 38,560	
M-21-10_M-21-11	Y	377	LF	\$ 176	\$ 66,290	
M-21-11_M-21-12	Y	240	LF	\$ 176	\$ 42,203	
M-21-12_M-21-13	Y	271	LF	\$ 176	\$ 47,722	
M-21-13_PS-21-14	Y	267	LF	\$ 176	\$ 47,054	
M-21-15_M-21-16	Y	310	LF	\$ 176	\$ 54,488	
M-21-16_M-21-17	Y	101	LF	\$ 176	\$ 17,806	
M-21-17_M-21-18	Y	391	LF	\$ 176	\$ 68,883	
M-21-18_M-21-08	Y	413	LF	\$ 176	\$ 72,630	
M-21-19_M-21-17	Y	197	LF	\$ 176	\$ 34,596	
M-21-20_M-21-21	Y	259	LF	\$ 176	\$ 45,623	
M-21-21_M-21-06	Y	259	LF	\$ 176	\$ 45,623	
M-21-22_M-21-10	Y	173	LF	\$ 176	\$ 30,473	
PS-21-14_M226-002	N	43	LF	\$ 176	\$ 7,545	
Permenant Easement		1.533	Acres	\$ 105,000	\$ 160,917	
Construction Easement		3.065	Acres	\$ 105,000	\$ 321,834	
Pumpstation		1	EA	\$ 175,000	\$ 175,000	
Manhole/Cleanout		19	EA	\$ 5,620	\$ 106,780	
Connect to existing		1	EA	\$ 5,485	\$ 5,485	
Subtotal (Construction Costs)						\$ 1,755,199
Soft Costs					25%	\$ 438,800
Contingencies					20%	\$ 351,040
<b>Total</b>						<b>\$ 2,545,039</b>
Grand Subtotal (Construction Costs)						\$ 3,965,625
Soft Costs Subtotal					25%	\$ 991,406
Contingencies					20%	\$ 793,125
<b>Grand Total</b>						<b>\$ 5,750,157</b>