Sacramento Regional County Sanitation District

Interceptor Sequencing Study

February 2013

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EXECUTIVE SUMMARY

Purpose

The Interceptor Sequencing Study (ISS) was prepared to determine Sacramento Regional Sanitation District's (SRCSD) long term needs to provide sanitary sewer service to a growing Sacramento region. The ISS evaluated proposed interceptor facilities identified in SRCSD's previous planning document, the SRCSD Interceptor System Master Plan 2000 (MP2000), to determine if there were other alternatives including delaying, realigning, or eliminating proposed interceptors. The ISS performed the following six tasks; 1) re-evaluated planning area growth predictions, 2) identified alternative flow generation criteria based on projected population densities and anticipated future flow per household, 3) developed additional modeling capabilities to evaluate conservative and realistic flow conditions, 4) prepared multiple interceptor sewer service alternatives, 5) evaluated recycled water alternatives including satellite treatment and scalping facilities, 6) prepared a cost analysis for the top interceptor alternatives.

The ISS provides a high level evaluation of interceptor alternatives and identifies interceptor alignment corridors as well as anticipated capacity needs and interceptor pipe sizes. Proposed projects will be further evaluated through the District's asset management program and must be approved by the Project Authorization Committee before requesting approval from the SRCSD Board of Directors to begin environmental review and project implementation.

ISS Contents

The Sacramento Area Sewer District (SASD) updates its Sewer System Capacity Plan (SCP) every five years. As the final draft of the ISS was being prepared, SASD began preparing its update to the SCP. The update, the 2010 System Capacity Plan (SCP or 2010 SCP), performed a detailed analysis of the timing and alignment of planned trunk sewers. SASD coordinated the 2010 SCP with SRCSD to consider additional options for planned interceptors. Completion of the ISS was delayed to incorporate the findings of the 2010 SCP.

The ISS primarily focused on cost saving opportunities for planned interceptors in the south and east areas of the SRCSD service boundary. Most of the interceptors planned for the north area were constructed in previous years with exception of the Dry Creek Relief and Rio Linda interceptors. These two interceptors were previously evaluated in the District's asset management program and remain unchanged from the MP2000. In the southern portion of the service boundary, there are several interceptors planned for future growth. These areas presented the greatest opportunity for cost saving alternatives. The ISS study area included the SRCSD Sphere of Influence (SOI) as well as the Folsom and Elk Grove proposed SOI's.

The ISS included a scope of work to update the interceptor hydraulic computer model. The model was used to examine the capacity needs for each of the interceptor alternatives.

The model was designed to evaluate a conservative future flow scenario as well as a less conservative, or “realistic” flow scenario. The conservative flow scenario was applied to consider capacity needs with a higher margin of safety. The realistic flow scenario provided an opportunity to evaluate existing interceptors with a higher level of risk and determine if their capacity could support more growth than planned. Analysis using the realistic flow scenario provided an opportunity to consider eliminating or significantly delaying planned interceptors.

The ISS evaluated alternatives for recycled water distribution including satellite treatment, scalping facilities, and recycled water distribution from SRWTP. Satellite treatment alternatives were considered in areas where flow could be picked up from the interceptor system, treated to recycled water standards, and used for nearby recycled water applications. Satellite treatment would require a separate waste discharge permit to discharge unused recycled water when demands were low. Scalping facilities would operate similarly, but would be operated only when there was demand for recycled water and would otherwise allow the interceptor system to convey flow to the SRWTP. Satellite treatment provided the benefit of reduced future interceptor facilities due to year round operation, while scalping facilities offered no reduction in future interceptors. Both provided the benefit of reduced recycled water transmission lines. Recycled water produced at the SRWTP provided the flexibility to treat and distribute recycled water equal to the demand but required longer transmission piping. The ISS found that producing recycled water at SRWTP and then distributing it to the desired location was more cost effective than constructing and operating satellite treatment or scalping facilities. In addition, the District’s new NPDES permit requires treatment of SRWTP’s effluent to recycled water standards. With the new permit requirements, no additional treatment facilities will be needed to produce recycled water, making distribution from SRWTP even more cost effective.

Conclusions

The ISS concluded that the following interceptors identified in the MP2000 can be eliminated; Laguna Creek Interceptor, Grant Line Interceptor, and the Sunrise Interceptor. Hydraulic modeling with a realistic flow scenario has predicted that the Bradshaw Interceptor will have capacity to serve areas previously planned for service by the Laguna Creek Interceptor. The elimination of the Laguna Creek Interceptor will lead to a surcharge condition in the Bradshaw and Central Interceptor systems when the sewer shed is built out and during a design peak storm event, but no sewer overflows are predicted. While predicted surcharging in the interceptor system is a higher level of risk to the District, build-out conditions are expected to take several decades to occur, and future water conservation measures will likely reduce sewer flow and surcharge conditions. The Grant Line Interceptor and the Sunrise Interceptor will be replaced with trunk size sewers as recommended in the SASD 2010 SCP.

The ISS identified six new interceptor conveyance projects that are revisions from the MP2000. The new interceptor projects are the Aerojet, White Rock, Florin, Elder Creek, Douglas, and South Interceptors. As development leads to the need for additional sewer capacity, each interceptor project will be further evaluated through the District's Asset Management Program and coordinated with the contributing agency as well as the local jurisdiction and development communities. With current development trends, Interceptor construction may not be needed for 10 years or more. The following table identifies the proposed interceptor projects that are changed from MP2000. The date provided represents the earliest times interceptor projects may be initiated and is highly dependent upon the timing and location of future development as well as the available capacity of existing sewers.

Table ES-1 Future Interceptor Facilities

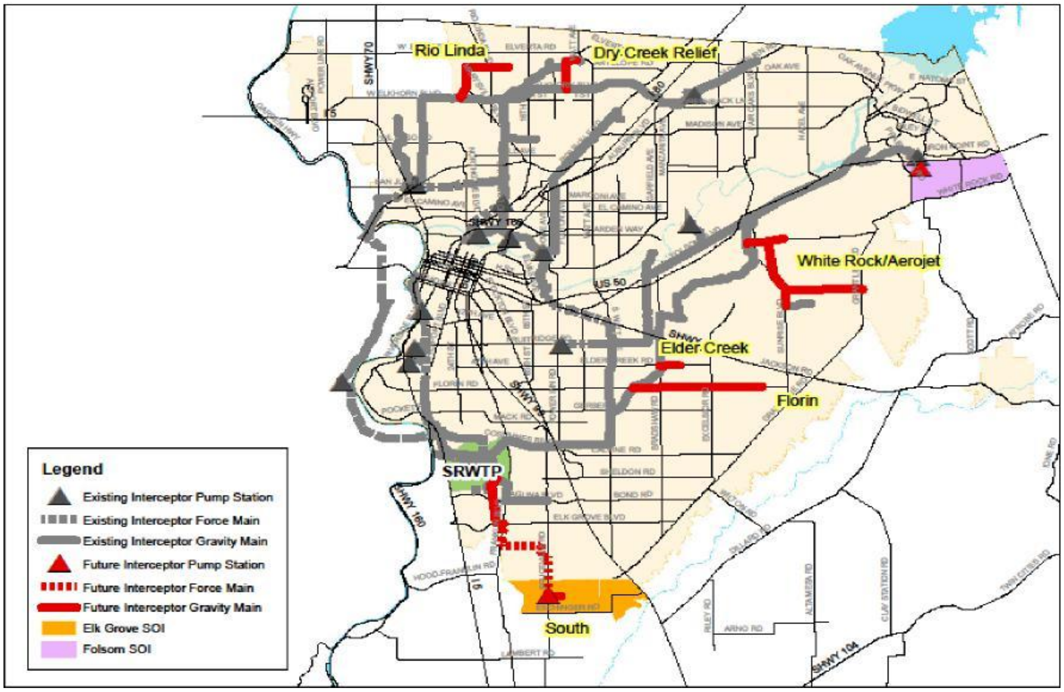
Interceptor Reach	[1]Date planned	Cost (2010 $)
Aerojet Interceptor	2030	$36.3M
White Rock Interceptor	2020	$19.5M
Florin Interceptor	2035	$38.9M
Elder Creek Interceptor	2038	$9.5M
Douglas Interceptor	2025	$19.5M
[2]South Interceptor	2044	$77.9M
Dry Creek Relief	TBD[3]	$9.5M
Rio Linda Interceptor	TBD[3]	$14.5M
Folsom Pump Station	TBD[3]	$11.3M
Total		**$236.9M**

1 The date identified is the earliest year growth is expected to generate flow to meet minimum cleansing velocity.

2 South Interceptor is modified from the South Interceptor described in the MP2000.

3 TBD: To be determined based on development need

The following map shows the proposed ISS interceptor system. Interceptors in grey are existing interceptors and colored interceptors are future interceptors. Additional detail is provided in Appendix 18.


Rio Linda
Dry Creek Relief
White Rock/Aerojet
Elder Creek
Florin
SRWTP
South
Legend
Existing Interceptor Pump Station
Existing Interceptor Force Main
Existing Interceptor Gravity Main
Future Interceptor Pump Station
Future Interceptor Force Main
Future Interceptor Gravity Main
Elk Grove SOI
Folsom SOI

1.0 INTRODUCTION

This Interceptor Sequencing Study (ISS) was prepared to determine Sacramento Regional Sanitation District (SRCSD) long term needs to provide sanitary sewer service to a growing Sacramento region. This study evaluated the criteria in which SRCSD conveyance facilities are planned, designed, built and operated. This study also evaluated and updated the need for some of the facilities that were identified in the Interceptor System Master Plan 2000 (MP2000).

The ISS is a high level planning document that evaluates the capacity of the existing interceptor system and proposed lowest cost alternatives for future interceptors. It provides an updated interceptor plan from the previous MP2000 utilizing an updated hydraulic model. The ISS provides planning level details for future interceptors, including alignment corridors, expected pipe sizes, and approximate depth of gravity sewers.

This study also considered the use of new satellite treatment facilities along with strategies to provide recycled water to portions of SRCSD's service area. Further information regarding these facilities and strategies can be found in the 2007 Water Recycling Opportunities Study (WROS).

1.1 Background

The original Interceptor Expansion Master Plan for the SRCSD was based on the 1993-94 Sacramento Sewerage Expansion Study (SSES) and was approved by the SRCSD Board of Directors in 1996. The draft report titled "Interceptor System Master Plan 2000" (MP2000) was prepared to update the SSES. The Draft MP2000 was released in November 2000 and included a two volume draft report and Appendices A through K, as well as the draft Executive Summary. The updated Interceptor Master Plan in its final form and the associated programmatic Environmental Impact Report were approved by the SRCSD Board of Directors on April 9, 2003.

Since the completion of MP2000, numerous interceptor projects identified in MP2000 have been constructed. These projects were identified to meet the Sacramento region's interceptor sewer needs based on a 2003 predicted growth rate. In 2007, the Sacramento region experienced an economic downturn, which substantially slowed growth within the SRCSD service area, prompting a re-evaluation of several projects that were previously identified in MP2000.

The ISS re-examined strategies to provide recycled water based on the projected future increase in demand of this resource. The 2007 WROS evaluated recycled water needs and opportunities; however, projects within the WROS did not include proposed locations for satellite treatment facilities which have since been identified in the ISS.

By 2010, previously rapid development trends declined, delaying the need to construct interceptor facilities. SASD began preparing an update to the 2006 Sewer System Capacity Plan. The 2010 System Capacity Plan (SCP) performed broader analyses that further develop interceptor options that were proposed in the ISS. This final report presents the findings from the ISS, ERCMP and SCP.

1.2 Scope

The ISS was initiated with the understanding that MP2000 may not accurately reflect the current changing growth projections in the Sacramento region. The findings from the ISS will supplement the findings from MP2000.Thus, the intent of the ISS was to update the growth projections and patterns in the Sacramento area and better predict capacity needs of the interceptor system. The ISS did this by evaluating the proposed projects in MP 2000; determining if they could be eliminated by reevaluating the criteria which determines the need for an interceptor and combining adjacent interceptor sheds to maximize the use of existing interceptors.

To do this, the ISS also developed a hydraulic sewer model. Recognizing that nearer term interceptor conveyance needs may differ from longer term needs, the ISS was separated into two separate efforts. The ISS concentrated on long-term interceptor needs from the year 2020 until build-out, and a Mid-Range Planning (MRP) project focused on current interceptor needs until the year 2020.

The original intent of the ISS was to evaluate all of the remaining projects proposed in MP 2000. However, it was determined there were no foreseeable need for changes to the interceptors planned in the North and West service areas therefore, no changes to previous plans are proposed. The ISS focused on the expansion areas of the South and East county areas where project alternatives had potential to save significant cost. The remaining MP 2000 project areas that were not evaluated in the ISS were examined using the updated hydraulic model and the results are shown in TM 13. These areas were either previously evaluated through the Project Development Plan process or evaluated in the model and determined to not be capacity constrained.

In addition to long range interceptor planning needs, the ISS evaluated the feasibility of providing satellite wastewater treatment facilities to replace interceptors. It also evaluated ways to provide recycled water to the south and east Sacramento County areas through the use of scalping plants and/or recycled water conveyance pipelines.

1.3 Purpose

The purpose of this report is to provide a plan to provide sewer conveyance to the SRWTP, satellite treatment, and recycled water for the SRCSD study area. This report is a planning document that addresses how projected flows may be accommodated.

In this report, sewer flows were estimated based on: 1) Existing flows from our GIS information and 2) Assumptions of future growth based on current growth projections. The flows considered are not guaranteed and was used only for planning purposes.

1.4 Report Organization

The scope of work for the ISS consisted of preparing a series of Technical Memorandums (TMs). TMs were prepared to evaluate criteria, cost and planning needs for interceptor conveyance, satellite treatment and recycled water. The TMs provide the basis in which the text of this report was written.

The following TMs were prepared and are included as Appendices to this report:

TM 1 Land Use Planning and Growth Criteria
TM 2 Design and Performance Storms and Approach for Modeling Spatial Rainfall Variation
TM 3 Flow Generation Criteria
TM 4 Facility Criteria
TM 5 Unit Costs for Interceptor Pipe
TM 6 Life Cycle Cost Criteria for Interceptor Conveyance Facilities
TM 7 ESD Absorption Rate Analysis
TM 8 Risk Analysis
TM 9 Unit Costs for Centralized, Scalping, and Satellite Wastewater Treatment Plants
TM 10 Life Cycle Cost for Centralized, Scalping, and Satellite Facilities
TM 11 Interceptor Conveyance Alternatives
TM 12 Treatment Technologies Used for Centralized, Scalping, and Satellite Alternatives
TM 13 Hydraulic Model Evaluation
TM 14 Development of Model Loads for Non-SASD Contributing Agencies
TM 15 Centralized, Scalping, and Satellite Treatment Alternatives
TM 16 Growth Projections for Long Range Funding Projections
TM 17 City of Folsom SOI Flow Generation
TM 18 Proposed Future Interceptors Plans and Profiles

1.5 Acknowledgements

The ISS has undergone several scope of work changes and taken a few years to complete. It has been a collaboration of several different sections within SRCSD including Capacity Management, Mid-Range Planning, Interceptor Engineering, and Policy and Planning. It has been evaluated at all levels of staff, management and leadership within the Sanitation Districts Agency (SDA).

Collaboration began with formation of the Technical Advisory Committee (TAC) and Technical Working Group (TWG) and gained approvals at the highest level within SDA through a series of Leadership Group meetings. The following people (and the people who supported them) were instrumental to the completion of the ISS.

TAC Members
Robert Gillette, Carollo Engineers
Neal Allen, Carollo Engineers
Gisa Ju, RMC
Ruben Robles, SRCSD Policy and Planning
David Ocenosak, SRCSD Interceptor Engineering
Michael Meyer, SRCSD Policy and Planning
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TWG Members
Kyle Frazier, SRCSD Interceptor Engineering
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Gonzalez, SRCSD Interceptor Engineering Jodie
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Huang, SRCSD Capacity Management

Leadership Group Members
Stan Dean, Agency Administrator

Prabhakar Somavarapu , Director of Policy and Planning
Ruben Robles, Director of SRCSD
Christoph Dobson, Director of SASD
Rosemary Clark, SASD Engineering Manager
Erin Harper, SASD Asset Management Manager

1.6 Abbreviations, Acronyms, and Definitions

BWF	Base Wastewater Flow
C1	Conveyance-Only Option 1
C2	Conveyance-Only Option 2
C3	Conveyance-Only Option 3
C4	Conveyance-Only Option 4
CLU	Consolidated Land Use
CUBS	Consolidated Utility Billing and Service
DWF	Dry Weather Factor
ESD	Equivalent Single-Family Dwelling
fps	feet per second
ft	feet
gpd	gallons per day
GIS	Geographical Information Systems
GWI	Groundwater Infiltration
HGL	Hydraulic Grade Line
ID	Identification
I/I	Infiltration/Inflow
IDF	Intensity-Duration-Frequency
IDM	Interceptor Design Manual
IJS	Influent Junction Structure
ISS	Interceptor Sequencing Study
LNWI	Lower Northwest Interceptor
MIA	Master Interagency Agreement
MBP	McClellan Business Park
MBR	Membrane BioReactor
Mgal	Million Gallons
MGD	Million Gallons per Day
MH	Manhole
MP2000	Interceptor System Master Plan 2000
MRP	Mid-Range Planning
O&M	Operations and Maintenance
PDP	Project Development Plan
PS	Pump Station
PWWF	Peak Wet Weather Flow

RDI/I	Rainfall-Dependent Infiltration/Inflow
SACOG	Sacramento Area Council of Governments
SASD	Sacramento Area Sewer District
SCP	System Capacity Plan
SDA	Sanitations Districts Agency
SOI	Sphere of Influence
SRCSD	Sacramento Regional County Sanitation District
SRWTP	Sacramento Regional Wastewater Treatment Plant
SSD	Somach Simmons & Dunn
SSES	Sacramento Sewerage Expansion Study
SSOs	Sanitary Sewer Overflows
TAC	Technical Advisory Committee
TM	Technical Memoranda, Technical Memorandum
TWG	Technical Working Group
UNWI	Upper Northwest Interceptor
USB	Urban Service Boundary
WRF	Water Reclamation Facility
WROS	Water Recycling Opportunity Study

2.0 PLANNING AREA CHARACTERISTICS

Land use planning and growth information was gathered to estimate future wastewater flow generation and to evaluate locations where new interceptor facilities will be required.

2.1 Study Area

The study area for the ISS includes areas within the existing SRCSD Sphere of Influence (SOI) along with potential growth areas that lie outside of the SRCSD SOI. The SRCSD SOI includes the service areas within Sacramento County's Urban Services Boundary (USB), the City of West Sacramento, and the area South of Highway 50 in Folsom. The Sacramento County USB includes the Cities of Sacramento, Elk Grove, Citrus Heights, and Rancho Cordova. The SRCSD SOI and the Contributing Agency boundaries are presented in Figure 2.1.

2.1.1 Areas Outside SRCSD Study Area

Areas outside the existing SOI were also identified for potential development within the next 20 years. These areas include Northern West Sacramento Expansion, Southern West Sacramento Expansion, Natomas Joint Vision, and South of Folsom SOI and are shown in Figure 2.2. The areas that were not part of the ISS were evaluated using the hydraulic model prior to eliminating them from the ISS study area.

2.1.2 South of Folsom SOI

South of Folsom SOI is located east of Prairie City Road and south of State Highway 50 in a proposed master planned development approximately 3,565 acres. The flow generation for this area was evaluated to determine its future facilities. See Technical Memorandum 17 – City of Folsom SOI Flow Generation for the discussion.

After the flow generation evaluation, it was recommended that this area be re-evaluated when more planning information is provided. In the meantime, the facilities identified in MP2000 will serve this area. Service to the initial phases of the development may need to rely on City owned infrastructure. Once sufficient flow has been established, an SRCSD sized facility will be constructed.

2.2 Land Use Planning

SRCSD relies on land use jurisdictions to identify its planned service area and each of its contributing agencies to determine the ultimate capacity to be served. Because SRCSD does not have land use authority, it relies on adopted land use plans and SACOG projections to make long-term infrastructure investment decisions.

Land use designations have traditionally been used by SRCSD to determine development density. These densities are then used to project future wastewater system connections. In the previous Master Plan (MP 2000), SRCSD identified large representative sewer sheds and estimated flow from each shed by using a standard set of assumptions. In this study, planning documents were collected from each jurisdiction to assess future land use trends and more accurately represent the relationship between planning and flow assumption criteria.

Each contributing agency has its own set of assumptions related to wastewater planning and determination of capacity needs within its own system. Additionally, each of the planning jurisdictions also has their own approach to their development and redevelopment needs. Because of this, the descriptions of trends and land use issues for each jurisdiction are not consistent.

In general, the land use agencies are adopting general plans with a focus on development within their current boundaries, identifying strategic areas to accommodate planned future growth, allowing for mixed-use developments, and other smart growth concepts to avoid the past reliance on greenfield development at the urban fringe. In general, these concepts result in more compact development within the existing community, but also create more open space. The implications of these land use plans on wastewater service are that they may result in serving a high population base within the existing planned service area, potentially requiring relief projects and/or different operating criteria within the interceptor system. These implications were not evaluated as part of the ISS; however it is important to recognize the impacts that densification could affect the interceptor system in the future. Detailed land use planning information from the contributing agencies and land use jurisdictions can be found in Technical Memorandum 1 – Land Use Planning and Growth Criteria.

2.3 Growth Projections

Previous master plan efforts relied on SACOG population projections to estimate the growth rate of new ESD's to the SRCSD. SACOG projections are based on a sophisticated model that starts with existing population and then ages that population by applying rates of births and deaths. The model also accounts for people moving in and out of the region based on job and housing trends.

SACOG projections only provide population data out to the year 2050. Master Plan 2000 limited growth projections to 20 years due to the availability of SACOG data. Projects that were identified after 2020 were based on buildout densities but were not assigned any particular timeframe.

Figure 2.1 SRCSD Contributing Agency Boundaries

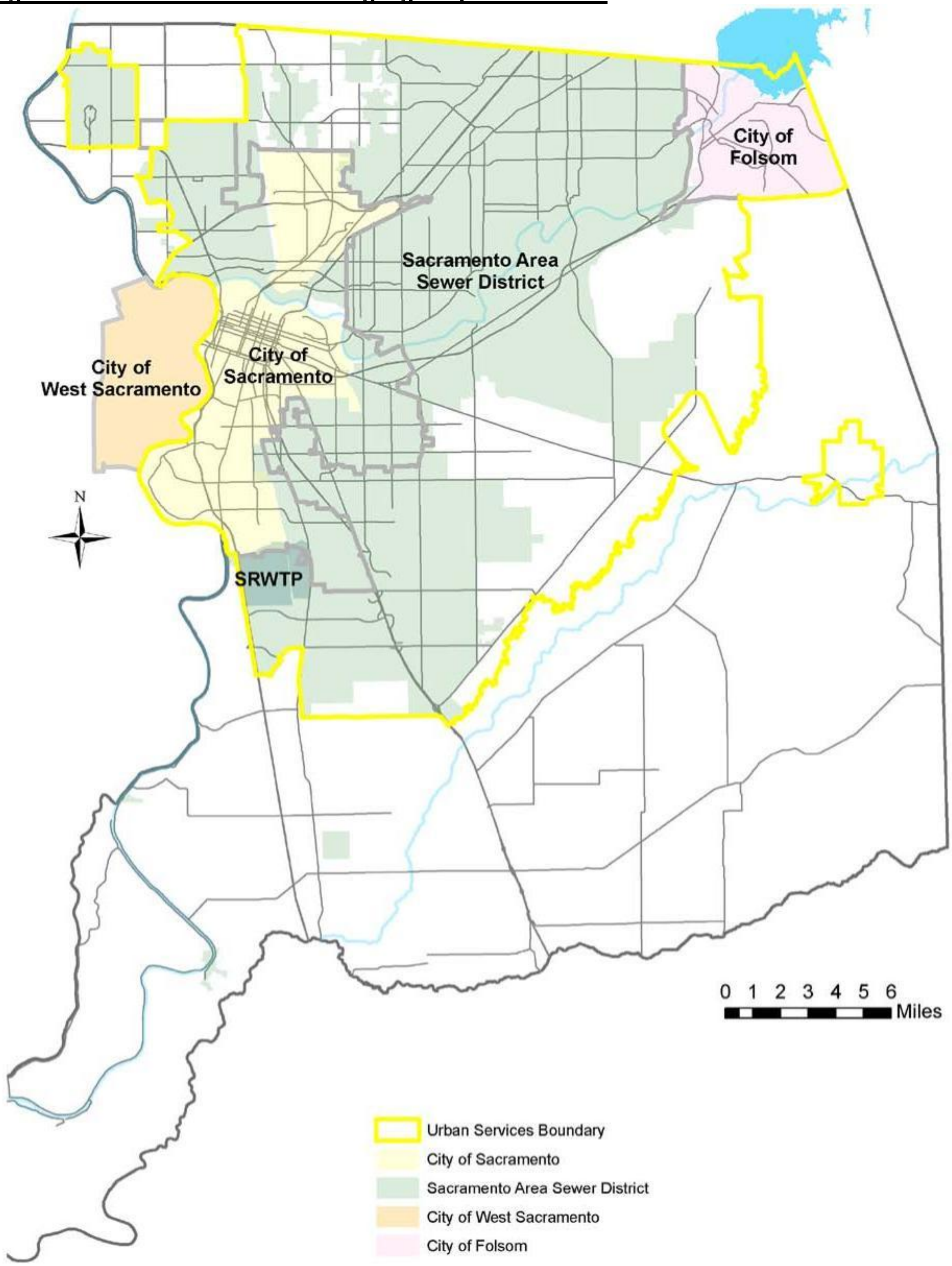
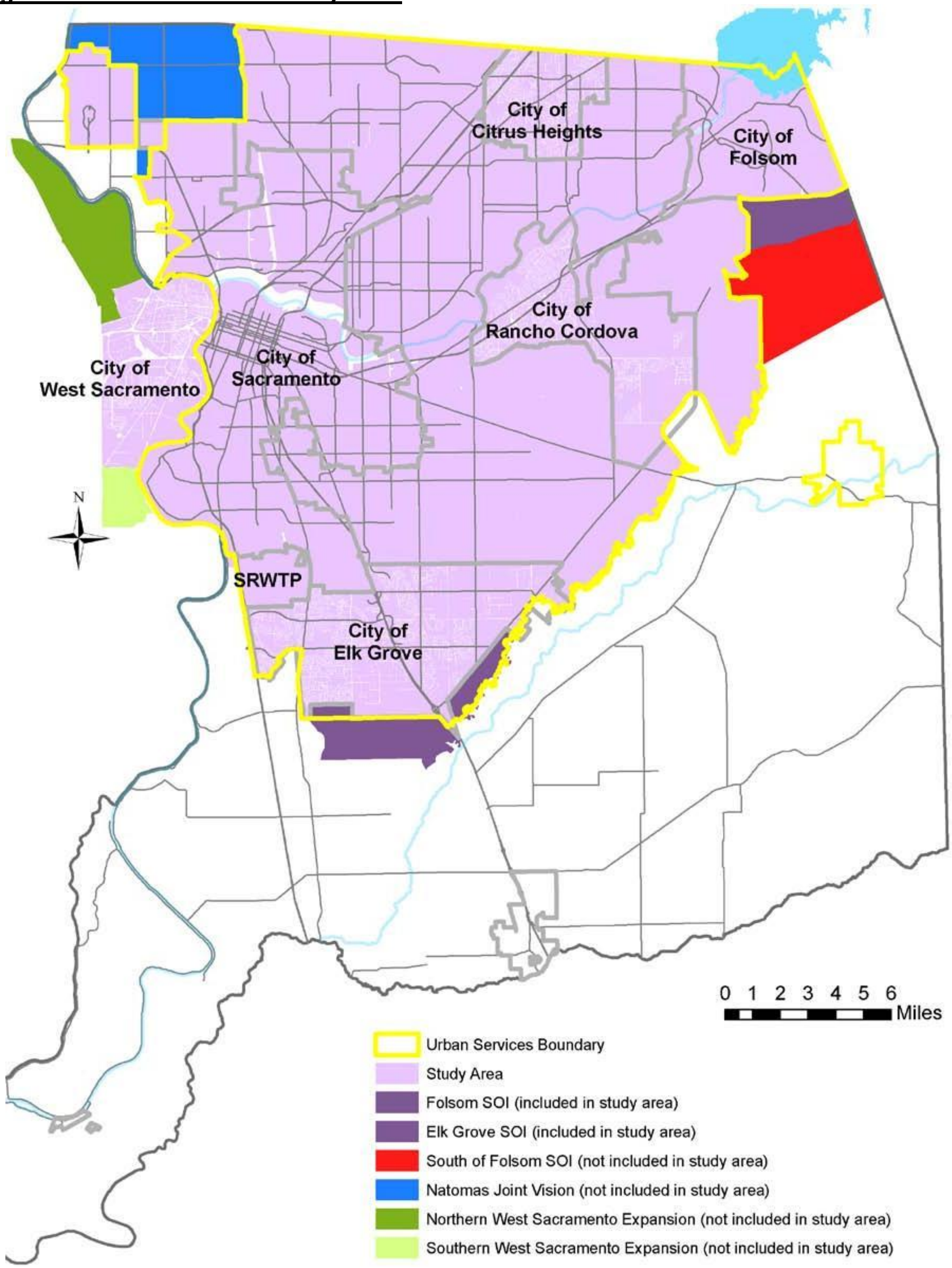


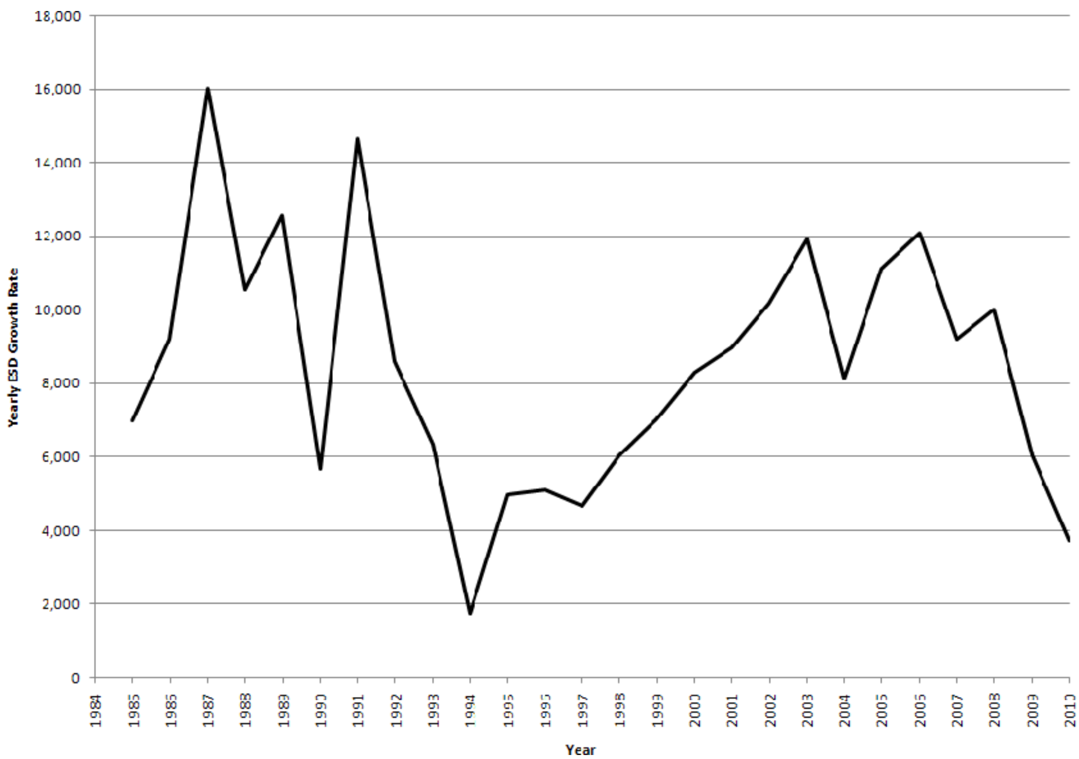
Figure 2.2 SRCSD ISS Study Area



2.3.1 Historic Growth Trends

Historical growth rate data has been gathered on a yearly basis from the SRCSD billing system from 1984 to 2010 (see Figure 2.3).

Figure 2.3 Historical ESD Growth



Note that there is a 1-2 year lag between new ESD paying impact fees and the reporting in the billing system. Therefore, the graph shows relatively high growth rates into 2008 when the actual development slow down started in 2006. The current rate of new ESDs has slowed dramatically compared to the previous years.

2.3.2 Build-Out Analysis

Master Plan 2000 did not project population growth beyond the year 2020. In order to help understand the time frame associated with long range planning, a build-out analysis was performed and documented in TM 7. Growth rates from the year 2010 to build-out were categorized into 3 types of rates: slow, moderate, and aggressive. This range provides a way to evaluate different growth scenarios that may occur. These growth rates are shown in Table 2.1.

Table 2.1 Projected Growth Rates

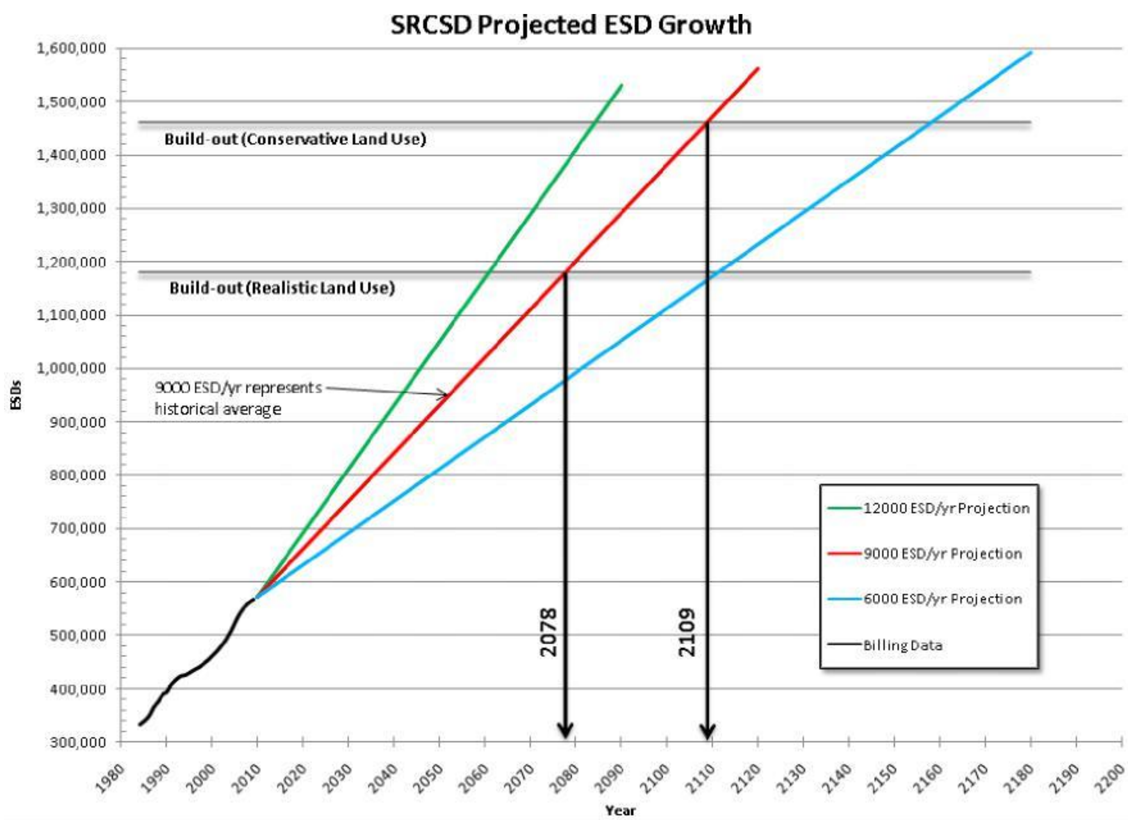
Slow	**6000 ESD/YR**
Moderate	**9000 ESD/YR**
Aggressive	**12000 ESD/YR**

Using the historical data, conservative and realistic land use scenarios build-out ESD's (described in 3.1.2), and the assumed projected growth rates, it was estimated that the existing service area may reach build-out conditions as early as 2060 and as late as the year 2160 (see Figure 2.4).

Conservative and realistic buildout scenarios refer to land use density scenarios that are used to evaluate the performance of the interceptor system under future conditions where the service area has reached a maximum ESD density. Realistic and conservative scenarios are discussed in more detail in Section 3.1.2 and TM 3.

Caution must be used when extrapolating historical data into the future due to the uncertainty of future conditions that could change the trends that have been experienced in the past.

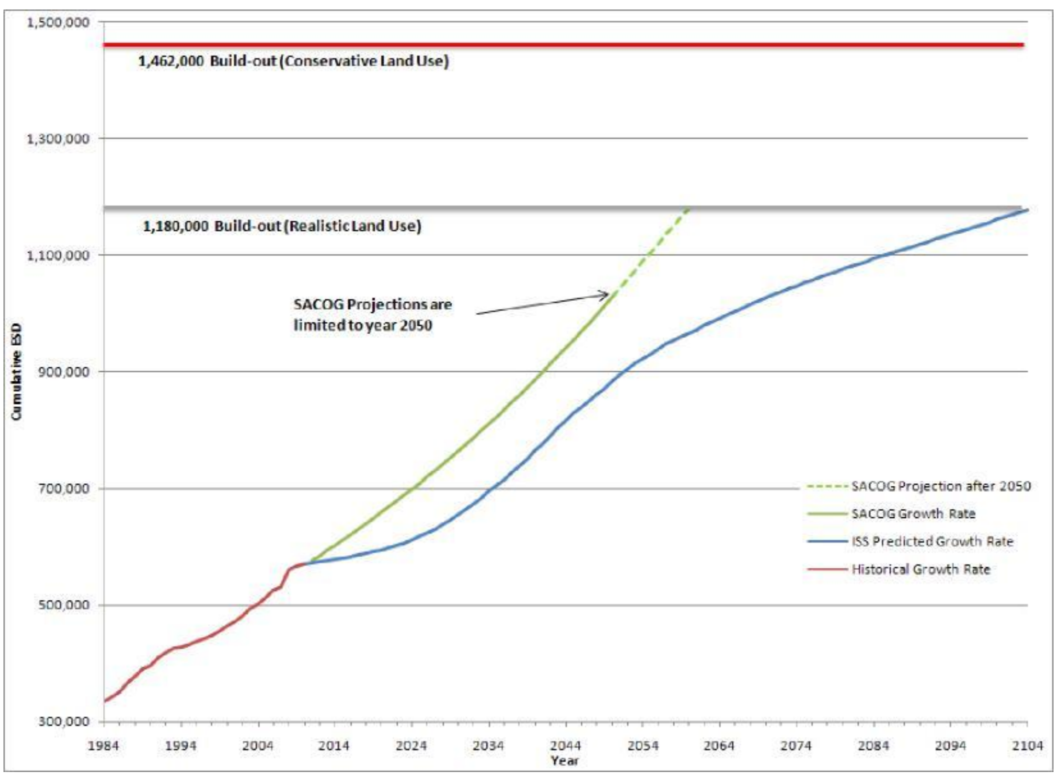
Figure 2.4 ESD Growth Projection & Corresponding Year Build-Out Occurs



2.4 ISS Growth Projections

Growth projections for the ISS effort were derived from a combination of historical experience and SACOG population projections published in 2005. In the near term, the growth projections use historical growth rates to recognize the current economic downturn and eventual recovery. The ISS growth rates assumed 2000 ESD/yr between 2010 and 2015, and 3000 ESD/yr between 2015 and 2020. In the long term, the growth projections slowly ramp back up to match SACOG predicted growth rates by the year 2030. A similar methodology is currently being used in the SRCSD Rate and Fee study to establish long range funding needs and revenue requirements. The growth rates were then applied to various sheds in the study area. Beginning at approximately year 2060, the expansion sheds have reached maximum ESD density and the growth shifts from expansion to redevelopment and densification of existing areas. It was assumed that redevelopment growth rates would be less than growth rates comprised mostly of expansion areas. The predicted growth rate is shown in Figure 2.5 with SACOG projections for comparison. An effort was not made to develop growth projections that would correspond to a conservative land use scenario due to the uncertainty of the assumptions so far into the future.

Figure 2.5 Growth Rates – SACOG and ISS Predicted Growth Rates



3.0 PLANNING AND DESIGN CRITERIA

3.1 Flow Generation Criteria

Flow generation criteria were developed to estimate flow inputs to the interceptor system and to evaluate the performance of the interceptor system. Examples of flow generation criteria are land use densities, unit flow factors, and infiltration/inflow (I/I) rates.

3.1.1 Wastewater Flow Components

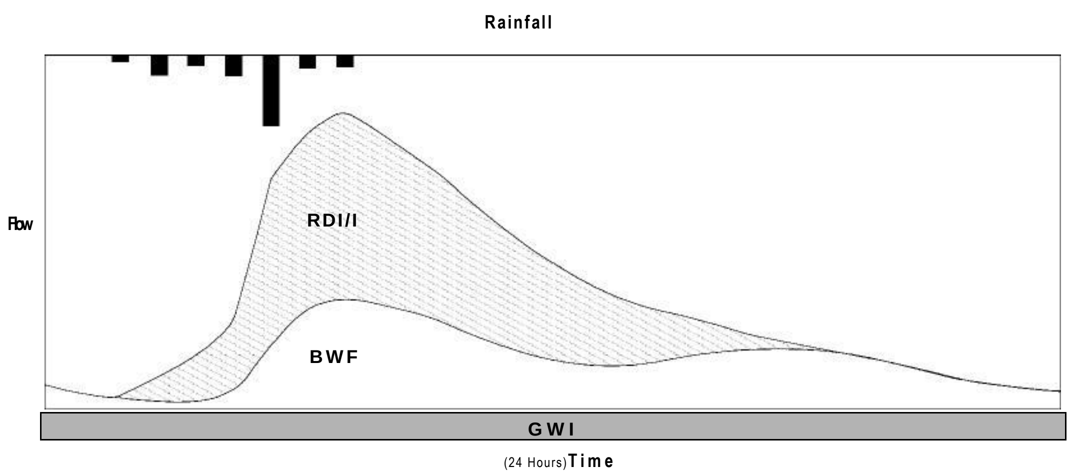
Wastewater flows consists of three components:

- Base wastewater flow (BWF) which represents the sanitary and process flow contributions from residential, commercial, institutional, and industrial users of the system

- Groundwater infiltration (GWI) is groundwater that infiltrates into the sewer through defects in pipes and manholes that is typically seasonal in nature and remains relatively constant during specific periods of the year.

- Rainfall-dependent infiltration/inflow (RDI/I) is storm water inflow and infiltration that enters the system in direct response to rainfall events. RDI/I can occur through direct connections such as holes in manhole covers or illegally connected roof leaders or area drains, or through defects in the sewer pipe, manholes, and service laterals. RDI/I typically results in short term peak flows that recede quickly after the rainfall ends. These flow components are illustrated conceptually in the figure below:

Figure 3.1 Wastewater Flow Components



3.1.2 Realistic and Conservative Flow Scenarios

The previous SRCSD Interceptor Master Plan (MP 2000) utilized a blanket assumption of 6 ESD's per acre minimum as the basis for estimating base wastewater flows for new development or redevelopment. This assumption was used for both performance evaluations for existing facilities as well as design (sizing) of future interceptors. Because the previous assumptions were thought to be overly simplistic and potentially overly conservative, the ISS developed a different approach.

This new approach defines two flow scenarios for evaluating the performance of an interceptor facility:

> **Realistic Flow Scenario**: The realistic scenario will provide estimates for evaluating how interceptor facilities are actually performing and will be used to assess the potential risks for overflows and backups within the existing system as well as determining when new facilities will be needed. The realistic scenario is based on the actual characteristics of recent developments and assumes 50^{th} percentile of the density distribution of existing development as calculated by SRCSD Capacity Management Section.
>
> **Conservative Flow Scenario**: The conservative scenario will be used primarily for sizing future interceptors and based on growth estimates and each land use jurisdictions planned development. The conservative scenario assumes the 85^{th} percentile of the density distribution of existing development as calculated by SRCSD Capacity Management Section.

3.1.3 ESD Flow Factor

MP2000 and the previous 93/94 SSES establish a flow factor of 310 gallons per day per ESD. This value was a conservative estimate base on hydraulic monitoring efforts of the interceptor system. The ISS established a new ESD flow factor to evaluate the performance of the existing interceptor system. The design of new interceptors will still rely on the MP2000 flow factor of 310 gallons per day per ESD.

The ISS ESD flow factor is based on the calculated average dry weather factor (DWF) and total ESDs from select sewer sheds that are representative of the interceptor sewer sheds. Capacity Management (CM) identified sheds that had adequate dry weather flow monitoring data. Table 3.1 summarizes the results of this evaluation.

Table 3.1 Results of Dry Weather Flow Data Analysis

Sewer Sheds Evaluated	Calculated ESD Flow Factor (gpd/ESD)
SASD Service Area *(excluding Elk Grove and Natomas trunk sheds)*	250
Range of Representative Interceptor Sheds	198 to 262

Based on the results, an ESD flow factor of 250 gpd/ESD is recommended for both realistic and conservative scenarios for new development and redevelopment. For existing development, the ESD flow factor will be determined from the model calibration. Since flow monitoring data was used to estimate this flow factor, it is recommended to re-evaluate the ESD flow factor over time.

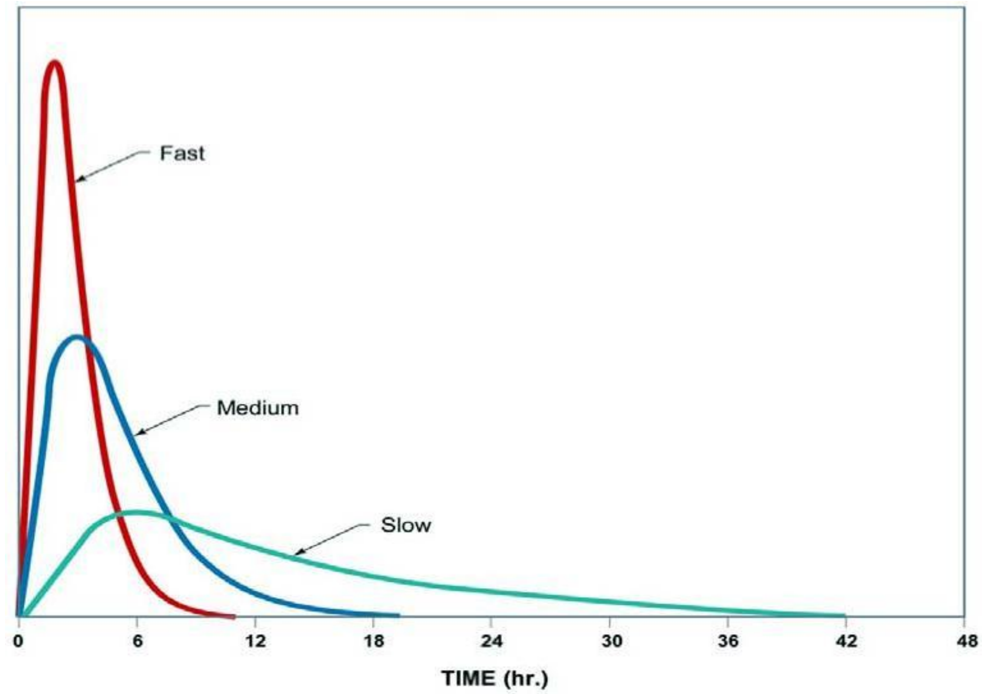
3.1.4 Inflow and Infiltration

Inflow and infiltration (I/I) refers to the combination of GWI and RDI/I. GWI is extraneous flow that enters the sewer system underground due to localized and often seasonally elevated groundwater levels. GWI is area-specific and can only be determined based on actual flow monitoring data. While GWI may vary throughout the year, in the context of developing design flow generation criteria, GWI is intended to represent the highest infiltration rates that typically occur during the wet weather season.

GWI rates were estimated based on flow monitoring data through the process of developing and calibrating contributing agency flow inputs to the interceptor model. Because GWI is area-specific, it is recommended that GWI rates for new development areas be estimated based on engineering judgment using calibrated values from similar, adjacent areas.

RDI/I flows are represented by parameters that define the volume percentage of rainfall that enters the sewer system as RDI/I and the corresponding time of peak flow response and recession. Conceptually, RDI/I hydrographs may be separated into components, each representing a different time of response to rainfall: fast, medium, and slow as illustrated in Figure 3.2.

Figure 3.2 RDI/I Hydrograph Components



Appropriate RDI/I hydrograph parameters are determined for each interceptor sewershed by model calibration. For SASD, these values are incorporated into its trunk system model and documented in the 2006 SCP For the non-SASD contributing agencies, RDI/I parameters were developed based on flow monitoring data through the process of developing and calibrating contributing agency flow inputs to the interceptor model.

For the ISS, the project team recommends a *minimum* RDI/I of 0.6 percent for the realistic flow scenario and 1.0 percent for the conservative scenario. These values are supported by data from monitored flows for areas in the SRCSD service area constructed within the last 15 years.

3.1.5 Design Storm

A “design storm” is a rainfall event to which RDI/I hydrograph parameters are applied to generate design RDI/I flows. SRCSD has historically used a 10-year recurrence frequency “synthetic” design storm as the basis for design flow estimates. A synthetic storm is one that is constructed based on historical rainfall intensity-duration-frequency (IDF) statistics. This synthetic design storm is a 6-hour event with each shorter duration within the 6 hours representing a 10-year frequency rainfall intensity for that duration. The SRCSD/SASD synthetic design storm is a 1.65-inch event with a peak hour intensity of 0.77 inches in the lower portions of the service area, with the rainfall increasing proportionally at higher elevations.

For the ISS, an alternate approach for defining the design storm has been utilized. This approach utilizes a continuous simulation hydrologic model to develop estimates of long-term flow response in the system for an approximate 70-year historical rainfall record. Based on the continuous simulation analysis documented in Appendix B of TM 2, the storm event of December 31, 2005 (known as the "New Years Storm") was identified as representative of an approximate 10-year frequency peak flow event for the SRCSD interceptor system. For comparison to the 10-year synthetic event, the December 31, 2005 storm had a total rainfall of about 2.52 inches over 17 hours with a peak hour intensity of 0.39 inches as measured in downtown Sacramento. This event meets the criteria of suitability for a large tributary area – long duration with moderate rainfall intensities.

3.1.6 Recommended Flow Generation Criteria

The recommended flow generation criteria for the ISS are summarized below.

ESD Density Consolidated Land Use Categories with Realistic and Conservative Densities for New Development & Redevelopment Existing sewered properties remain same density unless identified for redevelopment	**ESD Flow Factor** By Model Calibration for Existing Development 250 gpd/ESD for New Development & Redevelopment	**Diurnal Flow Pattern** By Model Calibration for Existing Development Typical Patterns for New Development & Redevelopment
Rainfall Dependent I/I By Model Calibration w/ min 0.6% Realistic and w/ min 1.0% Conservative	**Groundwater Infiltration** By Model Calibration or Typical Values from Similar Areas	**Design Storm** December 31, 2005 Storm Event

3.2 Consolidated Land Uses and Density Assumptions

The multiple land use categories from all of the land use jurisdictions were consolidated into a set of “Consolidated Land Use” (CLU) categories, as presented in Table 3.2. CLU categories were created starting with an existing set of categories which were used in the SASD Master Plan. These categories were matched to land use zoning from each land use jurisdiction’s planning documentation to the best-fit categories based on land use densities.

For each CLU category, a realistic and conservative density for both development and redevelopment areas were determined. For the realistic scenario, the density for each category was assumed to be the 50th percentile of the density distribution of for each land use density and was based on existing development. The conservative scenario was assumed to be the 85th percentile density distribution for each land use density, and was also based on existing development.

New land use categories were created to encompass certain types of land uses that did not fit into one of the existing categories. These categories are defined below:

- **Future Urban Development Area (FUDA).** The FUDA category is used for areas with unspecified future development. This includes those agricultural designated parcels located between the UPA and the USB.

- **Mixed Use (MU).** The MU category is used for areas generally identified for “urban high densities”. The MU category represents a mix of commercial, office and residential development, and is used to represent the higher, redeveloped densities anticipated within the “corridor” studies and within the “urban centers” of several of the land use jurisdictions.

- **Transit Oriented Development (TOD).** The TOD category represents a more intensive or higher density mixed use development and is used where designated by the land use jurisdictions’ planning documents.

- **Central Business District (CBD).** The CBD category is unique to the City of Sacramento and represents the City’s downtown specific land uses. The land use densities for the CBD category listed in the City of Sacramento 2030 General Plan range from 61 to 450 dwelling units (DU) per acre.

- **Exception (EXC).** The EXC category is used for areas where the ESD densities for the normal Public and Quasi-public (PQP) category would overestimate the flow from some of these parcels. Manual editing may be needed on a case-by-case basis.

The land use maps of the various jurisdictions were also consolidated into a Consolidated Land Use (CLU) Map in GIS format. The specific GIS files and processes used to create the CLU Map are documented in TM 3.

Table 3.2 Consolidated Land Use Descriptions and Densities

Land Use Description	CLU Code	Density (ESD/gross ac.)		Notes
		Realistic	Conservative	
Agricultural-Residential	AR	0.65	0.73	(1)
Very Low Density Residential	VLDR	1.5	3.2	(1)
Low Density (Normal) Residential	LDR	5.5	7.1	(1)
Medium Low Density Residential	MLDR	8.3	10.	(2) Range = 7.1-15 DU/ac
Medium Density Residential	MDR	12	15	(2) Range = 10-22 DU/ac
Medium High Density Residential	MHDR	17	21	(2) Range = 15-30 DU/ac
High Density Residential	HDR	27	34	(3) Range = 22-50 DU/ac
Future Urban Development Area	FUDA	6.0	8.0	(5)
Mixed Use	MU	14	20	(5) Range = 6-30 DU/ac
Transit Oriented Development	TOD	30	35	(5) Range = 30-50 DU/ac
Central Business District	CBD	100	190	(4) Range = 61-450 DU/ac
Commercial	COM	2.1	5.4	(1)
Offices	OFF	2.3	3.5	(1)
Industrial	IND	3.5	6.0	(5)
Open Space / Unsewered	OSU	0	0	
Public & Quasi-Public	PQP	3.5	6.0	(5)
Exception	EXC	0	0	(6)
Folsom Plan Area Specific Plan	FSP	2.8	4.1	(7)
Sacramento County Elverta Specific Plan	SCoESP	3.2	4.1	(7)
Natomas Joint Vision Panhandle	NJVPH	3.7	4.8	(7)
Natomas Joint Vision Greenbriar	GRNBR	6	8	(7)
Sacramento County Jackson Highway Vision	SCoJHY	2.9	3.9	(7)
Sacramento County McClellan / North Watt Corridor	MCCNW	30	35.3	(7)
City of Rancho Cordova Rio Del Oro	RCRDO	3.7	5.0	(7)
City of Rancho Cordova Glenborough	GLBR	6	8	(7)
City of Rancho Cordova Westborough	WSTBR	6	8	(7)
City of Rancho Cordova South Mather	SOMAT	6	8	(7)
City of Rancho Cordova Reddington	REDGT	6	8	(7)
City of Rancho Cordova Sunrise Blvd. North	SRBNO	6	8	(7)
City of Rancho Cordova Sunrise Blvd South	SRBSO	6	8	(7)
City of Rancho Cordova Countryside / Lincoln Village	CSLV	6	8	(7)
City of Rancho Cordova Downtown	RCDNT	6	8	(7)
City of Rancho Cordova Grant Line North	GLNO	6	8	(7)
City of Rancho Cordova Grant Line South	GLSO	6	8	(7)
City of Rancho Cordova Grant Line West	GLW	6	8	(7)
City of Rancho Cordova East	RCEST	6	8	(7)
Elk Grove Southeast Policy Area	EGSEPA	4.9	6.8	(7)
Elk Grove Laguna Ridge	LAGRD	5.5	7.1	(7)
City of Sacramento Delta Shores	SCDS	5.0	6.9	(7)
City of Sacramento Railyards	SCRY	44	80	(7)
City of Sacramento McKinley Village	SCMV	6.5	12	(7)
City of Sacramento Curtis Park Village	CPV	8.1	11	(7)

Notes:
(1) Densities determined from ESD analysis of existing parcel data
(2) Target density determined from the design densities of the SASD Master Plan
(3) Land use categories and density ranges from the City of Sacramento 2030 General Plan
(4) Land use categories and density ranges from the Sacramento County General Plan
(5) Recommended values from ISS Team.
(6) Exception category meant for use with Public lower densities& Quasi-Public lands greater than 100 acres that may develop at higher or will input density for these parcels on a case-by-case basis based on data from. Capacity Management staff sewer studies.

Special Planning Area shown as a single polygon on the Consolidated Land Use Map.

3.3 Facilities Criteria

Facilities criteria identify the parameters used to evaluate how interceptor facilities perform or should be designed. Facilities criteria have been separated into two separate categories based on its application in the ISS:

- Design Criteria – Criteria used to design new facilities. The design criteria are generally a conservative value that is typically used in design standards to allow for various factors that can impact a facility's real world performance. These range from construction defects to varying flow conditions.
- Performance Criteria – Criteria used when evaluating the performance of the existing system. Lower performance criteria values generally tend to carry more risk but can also show a cost savings by delaying interceptor relief projects.

The facility criteria and flow generation criteria developed in the ISS will be used to evaluate existing facilities, plan future interceptor facilities plan, perform hydraulic modeling, and design interceptor sewer facilities. These criteria are summarized in the table below:

Table 3.3 Facility Criteria

Criteria	**Design** (future sizing and design)		**Performance** (interceptor timing and relief projects)	
	Gravity Pipe	**Force Main**	**Gravity Pipe**	**Force Main**
Friction Factors	n = 0.013	C = 110	n = 0.013	C = 110
Slope, min	0.0005	none	0.0005	none
Slope, max	none	none	none	none
Velocity, min	3 fps PDWF at realistic flow scenario	3 fps PDWF at realistic flow scenario	Consider cleaning costs until minimum is reached	Consider cleaning costs until minimum is reached
Velocity, max	10 fps or greater (case by case basis)	8 fps	none	Evaluate surge, risk, and cost
Pumping Station Firm Capacity	Largest pump out of service		Evaluate risk and cost of utilizing out of service pump to increase interim capacity	
Emergency Storage	As needed, based on O&M response time		None	
Allowable freeboard	N/A		Based on allowable surcharge	
Allowable surcharge	None		Evaluate risk and cost of impacts to system (including Contributing Agencies)	
d/D	1.0		Based on allowable surcharge	

3.3.1 Gravity Sewers

Wastewater flow velocity and the invert slope of a pipeline are closely related to each other. A minimum velocity is required to ensure that the system is “self-cleansing”. This will reduce the amount of particulate matter that builds up on the bottom of the pipe resulting in maximizing flow and reducing sulfide generation. The proper invert slope is necessary to achieve this minimum velocity. The slope is also critical in making effective use of the available grade so as to carry flows the furthest distance by gravity within the system.

Although not as critical, the maximum velocity and slope are important to protect the sewer facilities from corrosion, erosion and separation of solid matter. Supercritical flow does not fatally flaw a system, but it does require that additional design efforts must be expended to guard against pipe erosion, corrosion and excessive turbulence. Hydraulic jumps are acceptable but they must be located in the system and special design is necessary for the section of the pipe that they occur.

3.3.2 Pump Stations and Force Mains

The firm capacity of any pumping facility should be determined with one pump out of service, or on standby, to ensure that adequate capacity is available to meet peak wet weather demand.

Because pumping stations are designed with an “extra” pump, it is possible to utilize the out of service pump to increase the station capacity for a period of time at the expense of operational reliability. An evaluation of the station and force main that addressed surge potential should be performed to ensure that operating beyond the firm capacity does not cause damage to the station.

Both the low flow and high flow through force mains are important considerations. Minimum cleansing velocity is necessary in force mains to avoid solids build up. Excessive velocity within a pressure pipe will cause unacceptable dynamic head losses and may lead to surge forces that jeopardize the pipe.

3.3.3 Emergency Storage

Emergency storage is the utilization of in-line or off-line facilities to store sewage flows tributary to a pump station during an uncontrolled shut down event. When incorporated into design, it may provide approximately 6-8 hours of storage depending on the situation.

In-line storage can provide an economical storage option that can be used to provide down time for a downstream pump station or provide flow attenuation during peak flows. In-line storage is created by up-sizing gravity pipes to provide storage volume. Currently there is only one pump station with constructed in-line storage capacity. At build out, the Upper Northwest Interceptor provides the New Natomas Pump Station 6-8 hours of shut down with its increased pipe size.

Off-line storage is created by construction of facilities specifically designed to provide storage of sewage flow without utilizing any capacity in the pipeline system. This typically requires significant space for tanks or detention basins, and usually requires that the sewage be pumped into or out of the storage facility. SRCSD currently does not have any off-line storage within the existing system.

4.0 EXISTING SYSTEM AND HYDRAULIC MODEL

This chapter describes the hydraulic model development and the hydraulic analysis for the ISS. These models were used to evaluate the existing interceptor system capacity and to determine future system needs.

4.1 System Overview

The ISS study area, shown in Figure 2.2, includes all of the areas within the existing SRCSD SOI and potential future developments outside the existing SOI such as the South Elk Grove and Sutter Pointe. The ISS models, however, only focus on the areas within the SRCSD's existing SOI and the South Elk Grove area. South Elk Grove area was added to the study area because it is currently believed to have a near term annexation into the SRCSD service area. The areas included in the ISS models are shown in Figure 4.1.

4.2 Hydraulic Model Development

The ISS models were created using InfoWorks, a dynamic hydraulic program developed by Wallingford Software. The model data consist of three basic components:

1. **Nodes –** These components include manholes and pump station wet wells. The primary data is rim elevation. PS wet wells also have other attribute data like chamber roof elevations, chamber floor elevations, and cross sectional areas.

2. **Links –** These are the physical connections between two nodes. They are typically pipelines, but may also include flow control structures such as pumps, weirs, sluice gates, and orifices. Attribute data include pipeline type (gravity or force main), length, diameter, upstream and downstream invert elevations, Manning's coefficient, and head loss coefficient. For pumps, data includes discharge rate data and pump on and off levels.

3. **Subcatchments –** These are sewer sheds tributary to a node. Attribute data include loading node ID, absolute number of ESD's, contributing acreage, and land use ID.

Wastewater flows in the ISS models were generated according to the flow generation criteria presented in Section 3.2 of this report and in TM 3.

4.2.1 Existing System Model

An overview of the existing SRCSD system including interceptors, regional pumping stations (PS), and force mains is shown in Figure 4.2. Manholes and pipes within the existing interceptor system were imported from the SRCSD GIS data. Regional PS information was also incorporated into the piping network. Sections 3.2 and 3.3 of TM 13 describe in detail how the existing interceptor models were constructed.

After constructing the existing interceptor model, the interceptor loadings from the four contributing agencies were incorporated.

Sacramento Area Sewer District (SASD) Contributing Agency

The existing SASD trunk model, including trunk manholes, pipes, flow control structures, and sewer sheds were added to the SRCSD Interceptor model network. The wastewater flow generated from SASD's service area was routed through SASD's trunk systems before discharging into the interceptors. Section 3.2 of TM 13 provides more information on how the SASD existing model was constructed.

Non-SASD Contributing Agencies

Unlike the SASD portion of the ISS model, the non-SASD contributing areas were broken down into larger sewer sheds tributary to the interceptor connection points. Flows generated from the non-SASD sewer sheds were point loaded directly into the interceptors at their connection points without modeling the upstream trunk systems. Since the Cities of Sacramento, West Sacramento, and Folsom do not have customer billing databases containing ESD information similar to CUBS, alternative methods were developed to estimate their ESDs and contributing area:

- **Sacramento**: ESDs for each connected parcel were determined based on the sewer connection type and land use (single-family residential, multi-family residential, commercial, or industrial). Contributing acreage was set equal to parcel acreage, up to a maximum of 1 acre/ESD.

- **Folsom**: Existing model loadings for the City of Folsom were obtained from the Folsom's 2008 InfoWorks model including population (later on converted to ESDs), non-residential flow, and contributing area data.

- **West Sacramento**: Since existing land use or sewer connection information for West Sacramento was not available, existing ESDs were estimated by fitting modeled flow to metered pump station data. Contributing acreage was calculated based on the total gross sewered area of the basin.

Detailed information on the non-SASD model development is presented in TM 14.

Figure 4.1 ISS Modeled Area

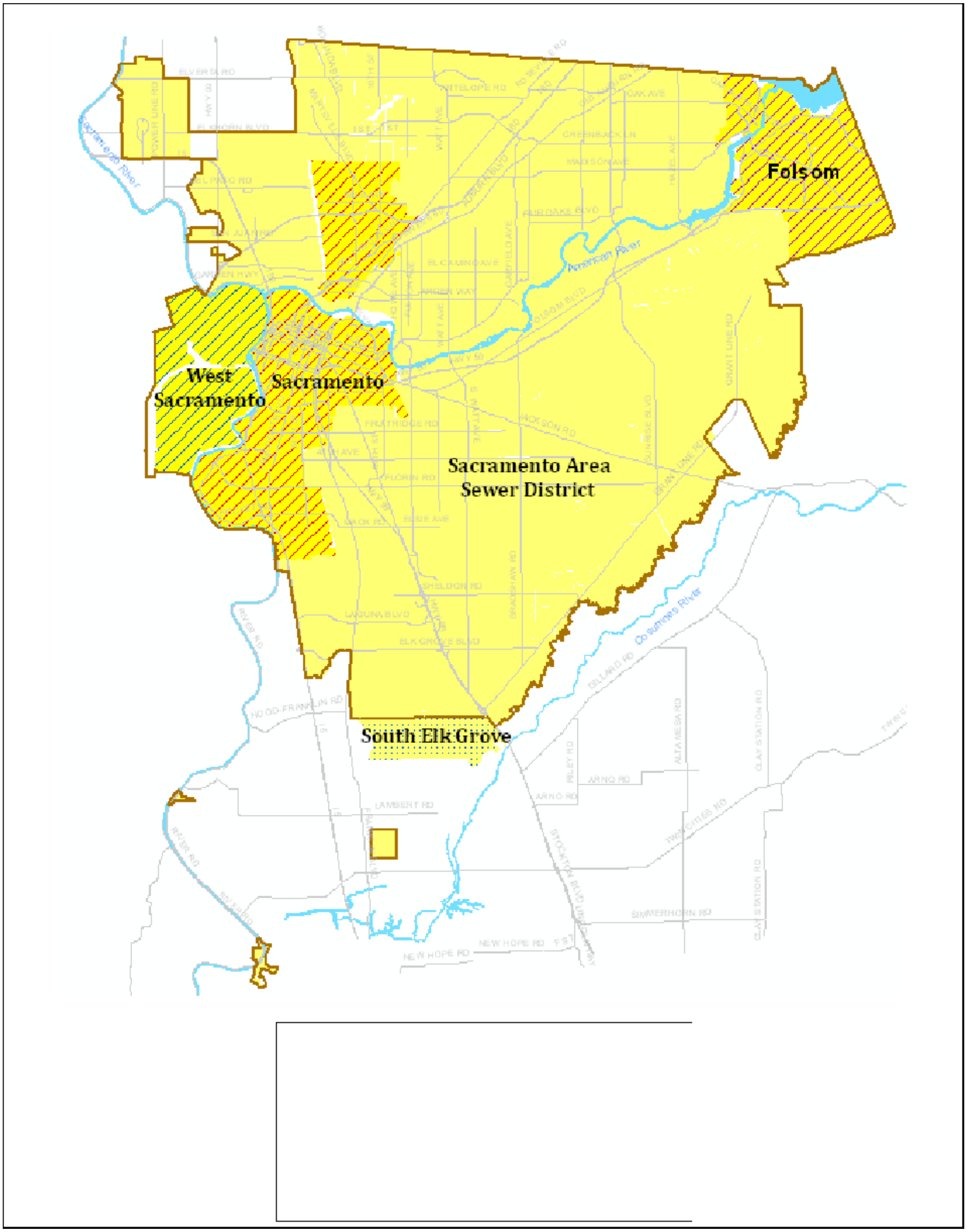
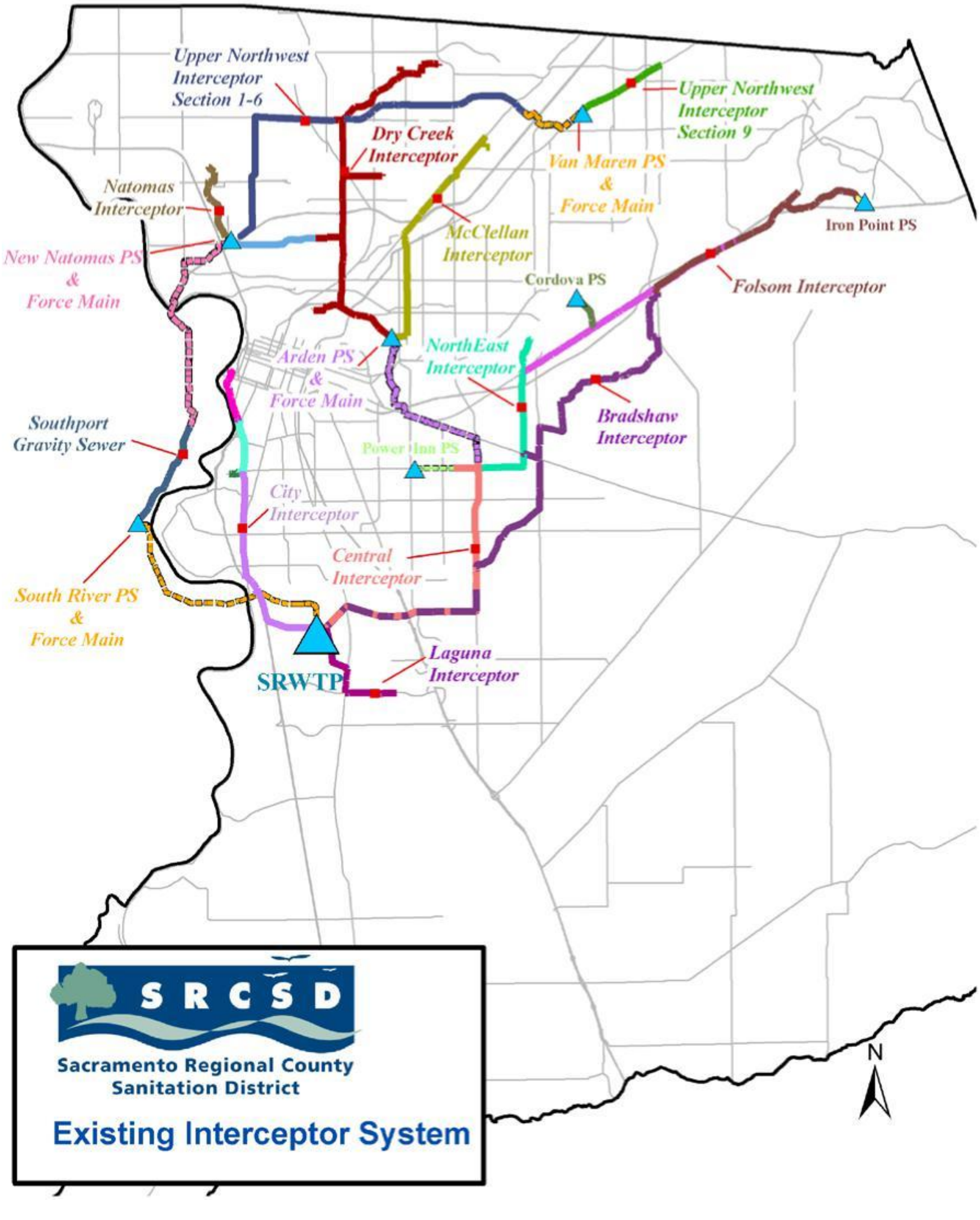


Figure 4.2 SRCSD Existing Interceptor System



4.2.1.1 Existing Hydraulic Boundary Conditions

The elevations of sewage as it flows into the Sacramento Regional Wastewater Treatment Plant's (SRWTP) Influent Junction Structure (IJS) were considered to be the hydraulic boundary conditions in the ISS model. Sewage elevations of -5.5 ft and -11.0 ft (provided by SRWTP staff) were used as the hydraulic boundary conditions for wet weather and dry weather simulations of the existing ISS model, respectively.

4.2.1.2 Existing Model Calibration

Model calibration is necessary to ensure model predictions reflect actual flow conditions.

SASD Contributing Area

Portions of SASD's trunk model were calibrated to recent flow monitoring or pump station flow data (periods of data between 2005 through 2008). For those areas of SASD that were not recently calibrated, the model used the RDI/I percentages and GWI factors from SASD's 2000 Sewer System Capacity Plan's calibrated model. To generate dry weather flows in these areas, the model considered the ISS project's 250 gpd/ESD flow factor.

The SASD trunk model will be calibrated and updated as more flow data is collected. The latest SASD trunk model will be used to construct the ISS model as part of the next ISS update.

Non-SASD Contributing Areas

Modeled flows for the Cities of Sacramento, West Sacramento, and Folsom were calibrated using flow monitoring data from several sources:

- Temporary flow monitoring conducted as part of the ISS from late January through March 2008 on major trunk sewers in the City of Sacramento sewer system that discharges into SRCSD interceptors.
- Pump station flow data from the City of Sacramento for Sumps 2, 21, and 119.
- Temporary flow monitoring data conducted for the City of Sacramento in the winter 2007/08 as part of its ongoing sewer master plan for Basins 85 and 87.
- Flow monitoring data for permanent meters installed in the City of Folsom sewer system on the City's 27- and 33-inch trunk sewers.
- Pump station flow data for the SRCSD Iron Point Road (FE3B) Pump Station.
- Pump station flow data for City of West Sacramento pump stations.

Only basins with available flow monitoring data were calibrated. For other basins where monitoring data was not available, dry weather and wet weather flow generation parameters were assumed to be similar to adjacent calibrated basins. TM 14 explains this in further detail.

4.2.2 Near-Term (2010) System Model

The near-term interceptor model was created from the updated existing model. Interceptors currently under construction and anticipated to be in operation by 2010 (e.g., the UNWI Sections 1 & 2 and Bradshaw Section 7C – these have been completed since the writing of this section) were added to the existing model to reflect SRCSD's "near-term" system. The ARD-2 and ARD-3 trunk relief projects were also incorporated since the projects re-routed flow to the UNWI and therefore reduced the amount of flow going to the McClellan Interceptor.

4.2.3 Build-Out System Model

4.2.3.1 Build-Out Model Construction

Starting with the near-term model, the preliminary build-out model was created by incorporating the future interceptor systems identified in the:

- SRCSD Master Plan 2000
- Subsequent Reconciliation Report
- Latest PDP projects (e.g., North-Watt Corridor PDP-1)

The next step was to incorporate the expansion areas from the SASD and non-SASD contributing agencies and calculate the build-out ESDs and acreage in the model. This was done by applying conservative and realistic build-out scenarios. Detailed information on the build-out model development is presented in TMs 13 and 14.

SASD Contributing Agency

The 2006 SASD Master Plan expansion trunk models (including future trunk sewers and their tributary sewer sheds) were incorporated into the interceptor model. The South Elk Grove shed which lies outside the SRCSD SOI was also added to the preliminary build-out model.

The build-out ESDs within the SASD service area were calculated as noted below:

- **Existing Areas**: Except redevelopment areas such as corridors, existing areas remained unchanged, meaning they were not densified at build-out.

- **Redevelopments and New Developments**: ESDs were calculated from the consolidated land use map based on two land use assumptions: realistic land use or conservative land use. The McClellan Business Park's (MBP) ESD information was obtained from a more detailed sewer study called the "McClellan Park Sewer Replacement Project Sewer System Study" by Tetra Tech, Inc. dated May 2004.

It was anticipated that the ISS model generated build-out flows may cause potential capacity deficiencies in some existing SASD trunks. To evaluate the interceptor system's performance (independent of any potential trunk system's capacity issues), SASD's Category 1 and 2 trunk relief projects (identified in SASD's 2006 Sewer System Capacity Plan Update) were added to the realistic and conservative ISS models.

Non-SASD Contributing Agencies

The same methodology was applied to develop the realistic and conservative build-out model loads for the non-SASD contributing agencies.

- **Sacramento**: New developments and redevelopments within the City of Sacramento were densified to the realistic and conservative consolidated land use (CLU) densities. Contributing areas were calculated in the same way as for existing loads.

- **Folsom**: The Folsom's 2008 InfoWorks model also includes build-out data for the area within the existing City's limit. These build-out projections appeared to be more consistent with the conservative densities developed for the CLU map; therefore, they were used to generate the ISS conservative flows for the City of Folsom. Populations and non-residential flows for the realistic scenario were estimated as 70 percent of the conservative values. Since the Folsom's model does not include information for the areas outside the existing City's limit, build-out ESDs for the Folsom area south of highway 50 were determined from the CLU map.

- **West Sacramento**: Realistic and conservative build-out ESD assumptions for the City of West Sacramento were computed based on the area in acres and the densities associated with the CLU categories.

Similar to the existing non-SASD development sheds, the future non-SASD development sheds were point loaded directly to the interceptors. More detailed information regarding this build-out model development for non-SASD Contributing Agencies can be found in TM 14.

4.2.3.2 Build-Out Hydraulic Boundary Conditions

A sensitivity analysis was performed to select the hydraulic boundary condition at the SRWTP to be used for the wet weather, build-out flow simulations. The analysis was done using the conservative build-out ISS model with the future interceptor system identified in the Conveyance-Only Option 4, which is described later in Section 4.3.4. Four different boundary conditions were modeled at the IJS to evaluate their potential impacts on the contributing interceptor systems.

1. IJS's water surface elevation = -5.5 ft (equivalent to a 12-ft depth in the IJS)
2. IJS's water surface elevation = -9.0 ft (equivalent to a 8.5-ft depth in the IJS)

3. IJS's water surface elevation = -13.5 ft (equivalent to a 4-ft depth in the IJS)
4. Free outfall at the IJS

The results of the analysis indicated that the predicted surcharging in the existing interceptor systems (Bradshaw, Central, Northeast, and City's) was primarily due to the capacity deficiencies within the interceptors themselves, not the SRWTP boundary conditions. After modeling these four different conditions, it was determined that the IJS water surface elevation of -9.0 ft should be the hydraulic boundary condition for build-out.

4.3 Hydraulic Model Evaluation

This section describes the hydraulic modeling analyses of the SRCSD sewer system to identify capacity deficiencies in the existing interceptors and capacity requirements for future interceptors. The system's hydraulic performance was evaluated for the near-term and build-out scenarios under wet weather (December 31, 2005 storm event) conditions.

4.3.1 Near-Term (2010) System Evaluation

With the completion of the entire UNWI and Bradshaw Interceptor, the overall interceptor system (except the City Interceptor) is able to convey the near-term (2010) peak wet weather flows (PWWFs). The following provides more information on the predicted modeling results:

- **General**:
  - Most of the predicted overflows are within the trunk systems.
  - Flows in the new interceptors such as UNWI, LNWI, Bradshaw, Folsom East, Natomas, and Laguna interceptors are well below their design capacities (approximately from 5% to 50% of their pipe full capacity at existing PWWF conditions).
  - Other interceptors such as the Central and Northeast interceptors are between 50% and 90% of their pipe full capacity.
- **Dry Creek Interceptor**:
  - The 18-inch Dry Creek Interceptor on Santa Ana Avenue which serves the McClellan Business Park (MBP), is not predicted to overflow under PWWF conditions because MBP is limited to 2 mgd of flow into the 18-inch Dry Creek Interceptor. Without the 2 mgd limitation, the model predicts a potential overflow.
  - The Upper Dry Creek Interceptor is predicted to have minor throttle surcharge under PWWF conditions.
- **McClellan Interceptor**: After the completion of the ARD-2 and 3 trunk relief projects, which divert flow to the UNWI and reduce the amount of flow into the McClellan Interceptor, model results indicate no SSO's under PWWF conditions.

- **Folsom Interceptor**: The model predicts very low flow since the upstream portion is relieved by the Bradshaw interceptor.
- **City Interceptor**: System is predicted to be critically surcharged. The City Interceptor is limited to 98 mgd from Sumps 2, 2A, 119, 55, and 21. With this limitation, the model does not predict an overflow.

4.3.2 Build-Out System Evaluation

This section describes the hydraulic performance evaluation of the SRCSD interceptor system under realistic and conservative build-out conditions for various interceptor conveyance alternatives. Conservative build-out flows were used to size the future interceptors. Realistic flows were used to prove a more optimistic estimate of when interceptors will reach capacity and need relief, or in some cases whether the relief will be needed at all.

There were two main goals to the ISS:

1. How to serve the area south of Elk Grove and the East County Area (see Figure 4.3)
2. Maximizing the use of existing facilities.

Eastern Portion

The eastern portion was broken into three main sheds:

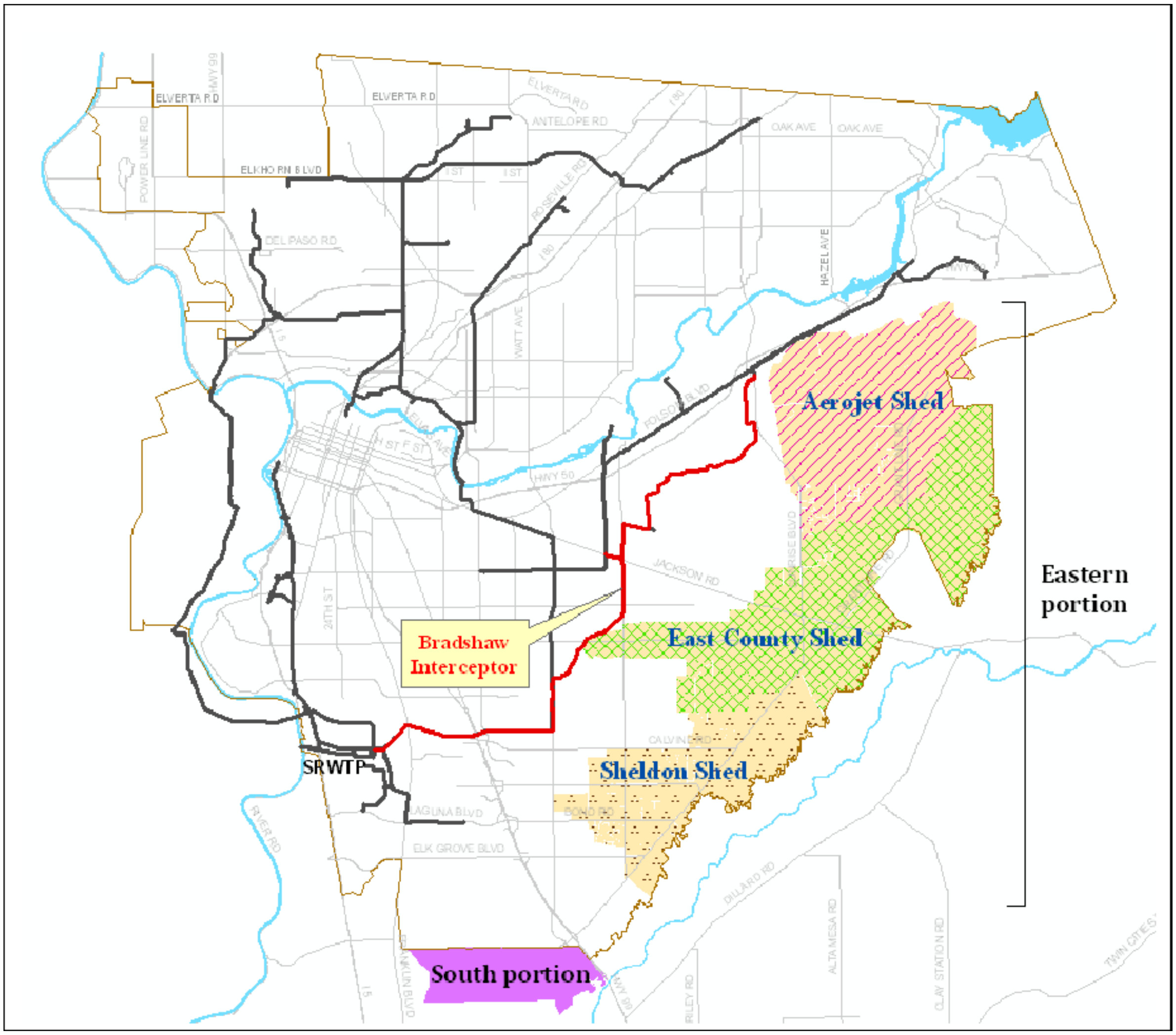
- Aerojet shed
- East County shed
- Sheldon shed

In all of the ISS conveyance alternatives, build-out flow from the Aerojet shed was routed to the Bradshaw Interceptor Section 8 at White Rock Road. The facilities needed to convey this flow to the Bradshaw Interceptor are investigated in SASD's SCP and SRCSD's Mid-Range Planning efforts.

For the East County Shed, flows from the Upper Deer Creek shed were pumped to the new Laguna Creek 5 Interceptor along the Suncreek development. These flows were then combined with flows from the Waegell development and Florin Road areas and routed west via the new Florin Interceptor connecting to the Bradshaw Interceptor at manhole N38-MH0057A, where the Bradshaw Interceptor intersects Florin Road.

In the Sheldon shed, the models assumed this area will be served by the future Sheldon Interceptor, whose proposed alignments varied for different alternatives considered.

Figure 4.3 Eastern and South Portions of the SRCSD Service Area



South Portion

The South portion is the South Elk Grove area south of Kammerer Road, an expansion area outside of the existing urban services boundary. This shed was planned to be serviced by the future South Interceptor.

5.0 SANITARY SEWER SERVICE ALTERNATIVES

5.1 Conveyance Alternatives

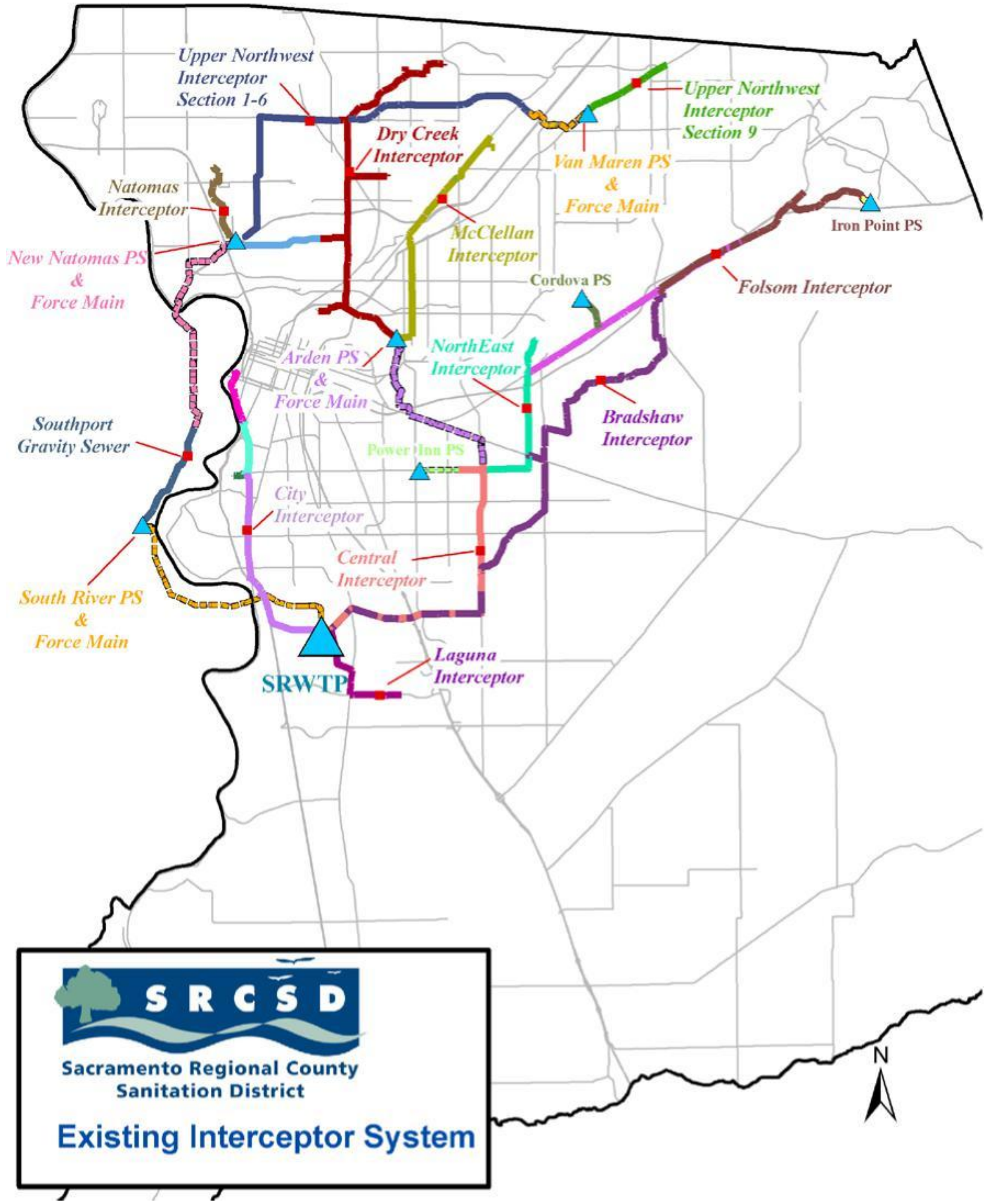
Regional sewer conveyance services for the County of Sacramento were originally discussed in the 1993/94 Sacramento Sewer Expansion Study and later in the Master Plan 2000 (MP2000) and MP2000 Reconciliation Report. Up to 52 conveyance system projects were identified to serve all areas within the region's Sphere of Influence (SOI). By the end of 2010, 30 of these projects (58%) were constructed (see Figure 5.0). Those expansion projects that remain unconstructed are primarily in the southern and eastern portions of the County and include projects associated with:

1. The Aerojet Interceptor.
2. The Mather Interceptor.
3. The Laguna Creek Interceptor.
4. The Grantline Road Interceptor.
5. The South Interceptor.

Other, smaller projects that have not been constructed are the Sunrise Interceptor, the Dry Creek Relief project, and the Rio Linda Interceptor in the northern part of the region.

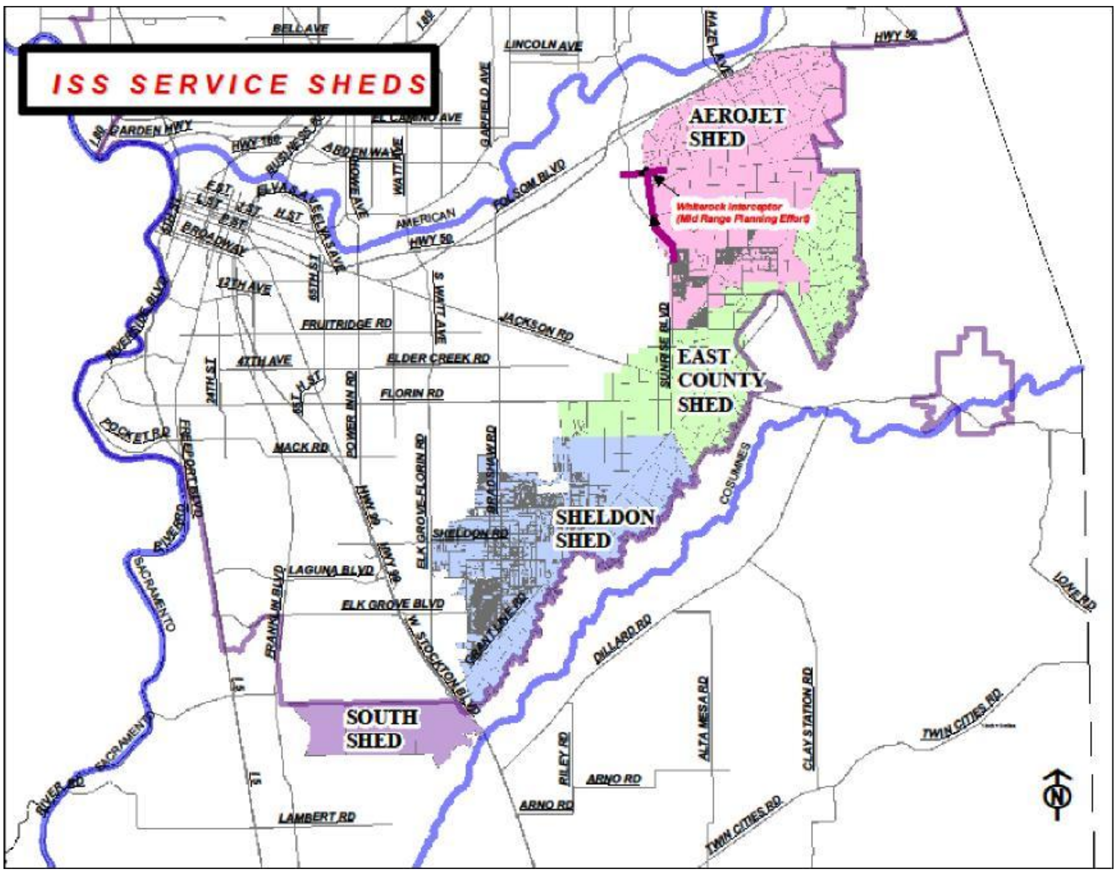
The Folsom Sphere of Influence (SOI), Eastborough, Glenborough, Aerojet, Westborough, Rio del Oro, Anatolia, Suncreek, Waegell, and Cordova Hills were recognized as areas that are likely to start developing within the next 10 years and would therefore be studied in more detail under the SASD 2010 System Capacity Plan. Folsom SOI's discussion can be found in TM17. Alternatives were identified to serve four main undeveloped areas that are described as follows and shown in Figure 5.1.

Figure 5.1 Existing SRCSD Interceptor System (As of December 2010)



1. **The Aerojet Shed**: Aerojet, Westborough, Rio del Oro, and Anatolia.
2. **The East County Shed**: Suncreek, Waegell, Cordova Hills, Florin Road areas
3. **The Sheldon Shed**: south of the *East Area* in the proximity of Sheldon Road, along Grantline Road
4. **The South Shed**: South of the *Sheldon Area* and primarily Elk Grove

Figure 5.2 ISS Service Sheds



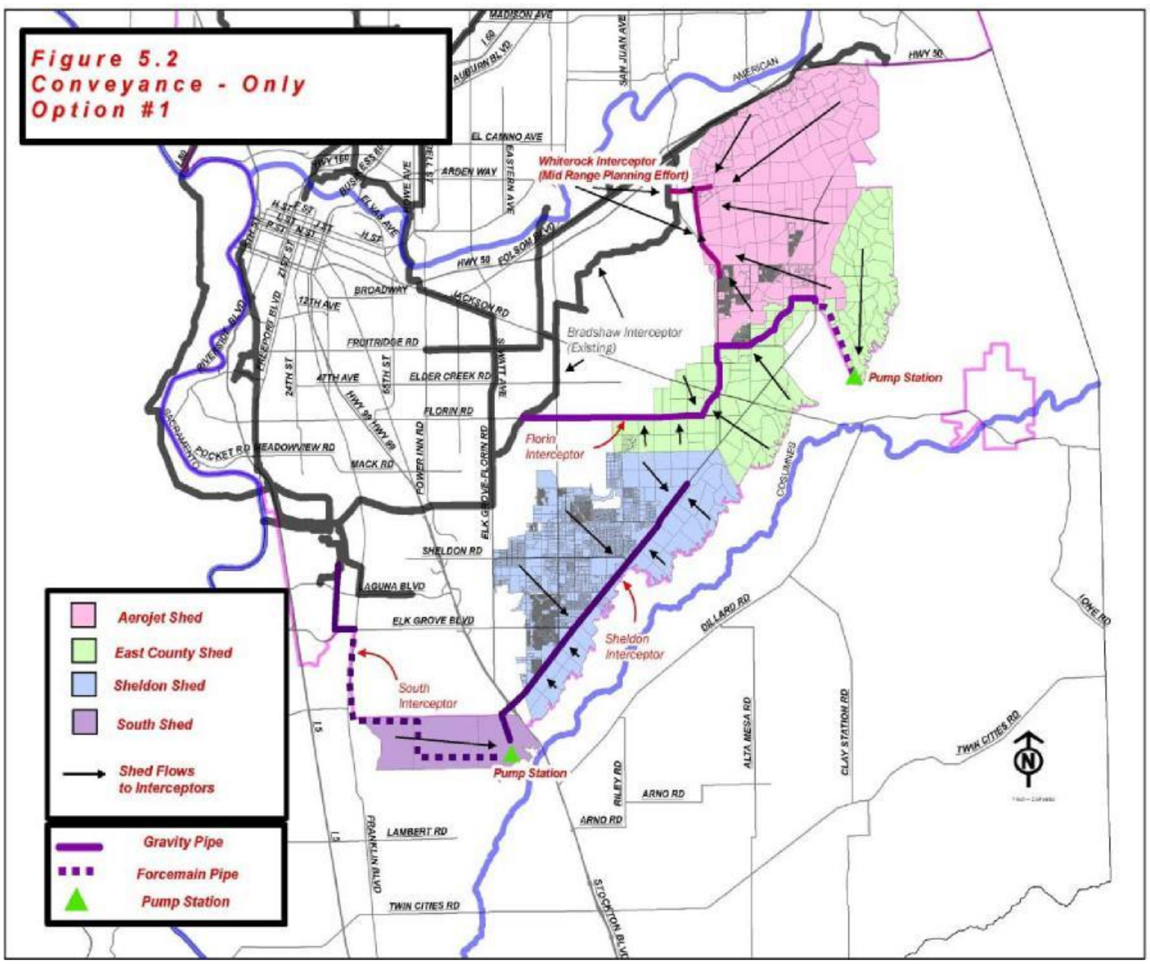
While choosing economically viable alternatives to serve these four areas, ISS flow generation criteria made it possible to utilize the excess future capacity of the existing Bradshaw Interceptor system. Selected alternatives connect one or more of these areas to the existing Bradshaw Interceptor, either by gravity or by pump station and force main, depending on topography. Satellite wastewater treatment plants were investigated to determine if there is a savings on conveyance costs to the SRWTP in Elk Grove and to possibly bring recycled water closer to prospective customers. The satellite alternatives are discussed in TM 15.

Fourteen (14) sewer service alternatives were chosen and analyzed. The descriptions and analysis of each of these 14 alternatives can be found in TMs 11 and 15. The following are descriptions and analysis of the six (6) alternatives that were found to be the most cost effective: the four (4) conveyance-only alternatives and one (1) satellite alternative from each of the three areas served (South, Sheldon, and East County).

5.1.1 Conveyance-Only Option 1 (C1)

In this alternative, flows from the north-eastern portion of the East County Shed will be pumped (via pump station and force main) to a gravity system known as the Florin Interceptor. This interceptor will carry all flows from the East County Shed west to the existing Bradshaw Interceptor (See Figure 5.2). Flows from the Sheldon Shed will travel south-west (parallel to Cosumnes River) via a new Grantline Interceptor into the expanded Elk Grove SOI area. Flows from the Sheldon Shed, along with those collected directly from the Elk Grove SOI area, are then directed north, via the South Interceptor**,** which consists of a pump station and force main , to the SRWTP.

Figure 5.3 Conveyance-Only Option 1



The Conveyance-Only Option 1 (Option C1) consists of two pump stations (20 MGD and 68 MGD) and 39 miles of interceptor pipeline making this alternative the second most cost effective amongst the three conveyance-only alternatives analyzed, as shown in Table 5.5.

Hydraulic modeling was carried out for this alternative using the design and performance criteria set out in Chapter 4 of the ISS report and in Technical Memorandum 2 – Design and Performance Storms. The hydraulic grade line (HGL) was monitored in the existing and future interceptor systems to check for surcharges and possible sanitary sewer overflows (SSOs). The results of these modeling runs can be seen in detail in TM 13.

The modeling results for Option C1 are presented in Table 5.1. The surcharge criteria described in Table 5.1 were established based on the amount of freeboard at the system's lowest manhole.

- Critical surcharge: Freeboard is less than or equal to 5 ft
- Moderate surcharge: Freeboard is greater than 5 ft but less than or equal to 10 ft
- Minor surcharge: Freeboard is greater than 10 ft

Table 5.1 Modeling Results Summary for Option C1		
Interceptor	**Realistic Build-Out**	**Conservative Build-Out**
Bradshaw	No surcharge	Moderate surcharge (10 ft freeboard at N38-MH0020A)
Central	Moderate surcharge (7 ft freeboard at N21-MH0074B)	Critical surcharge; Overflows at N21-MH0074B
Northeast	No surcharge	Critical backup surcharge from Central Interceptor (3 ft freeboard at N16 (N24-MH0032A))
Sunrise	No surcharge; (6 ft freeboard at low MH SR2040)	Critical backup surcharge from Bradshaw Interceptor (4 ft freeboard at MH SR1130)
City	Critical surcharge; (Flows limited 108.5 mgd)	Critical surcharge; (Flows limited 108.5 mgd)
McClellan (after relieved)	No surcharge (4 ft freeboard at an upstream low MH (N33-MH0032A))	Minor surcharge downstream; (4 ft freeboard at an upstream low MH (N33-MH0032A))
Upper Dry Creek (after relieved)	No surcharge	Minor surcharge (12 ft freeboard at N17-MH0091A)
Lower Dry Creek	No surcharge	No surcharge
Upper Northwest	No surcharge	No surcharge
Lower Northwest	No surcharge	No surcharge
Natomas	No surcharge	No surcharge
Folsom	No surcharge; (6 ft freeboard at low MH (N23-MH0014A))	No surcharge; (5 ft freeboard at low MH (N23-MH0014A))
Folsom East	No surcharge; (5 ft freeboard at an upstream low MH (N37-MH0047A))	Minor backup surcharge from Bradshaw Interceptor; (5 ft freeboard at an upstream low MH (N37-MH0047A))
Laguna	No surcharge	No surcharge

Using the Conservative Build-Out scenario in Table 5.1 at build-out PWWF, there are critical surcharges in four (4) of these systems (the Central, Northeast, Sunrise and City systems). It should be noted that build-out PWWF is not expected to be reached for well over 50 years, in which time relief projects are assumed to have been constructed to mitigate any SSOs. Relief projects are outside the scope of this ISS and will be evaluated case by case.

Using the criteria set out in TM 8, a risk assessment was done on this alternative with the following results:

Table 5.2 Alt 1: Conveyance Only – Option 1 Risk Assessment

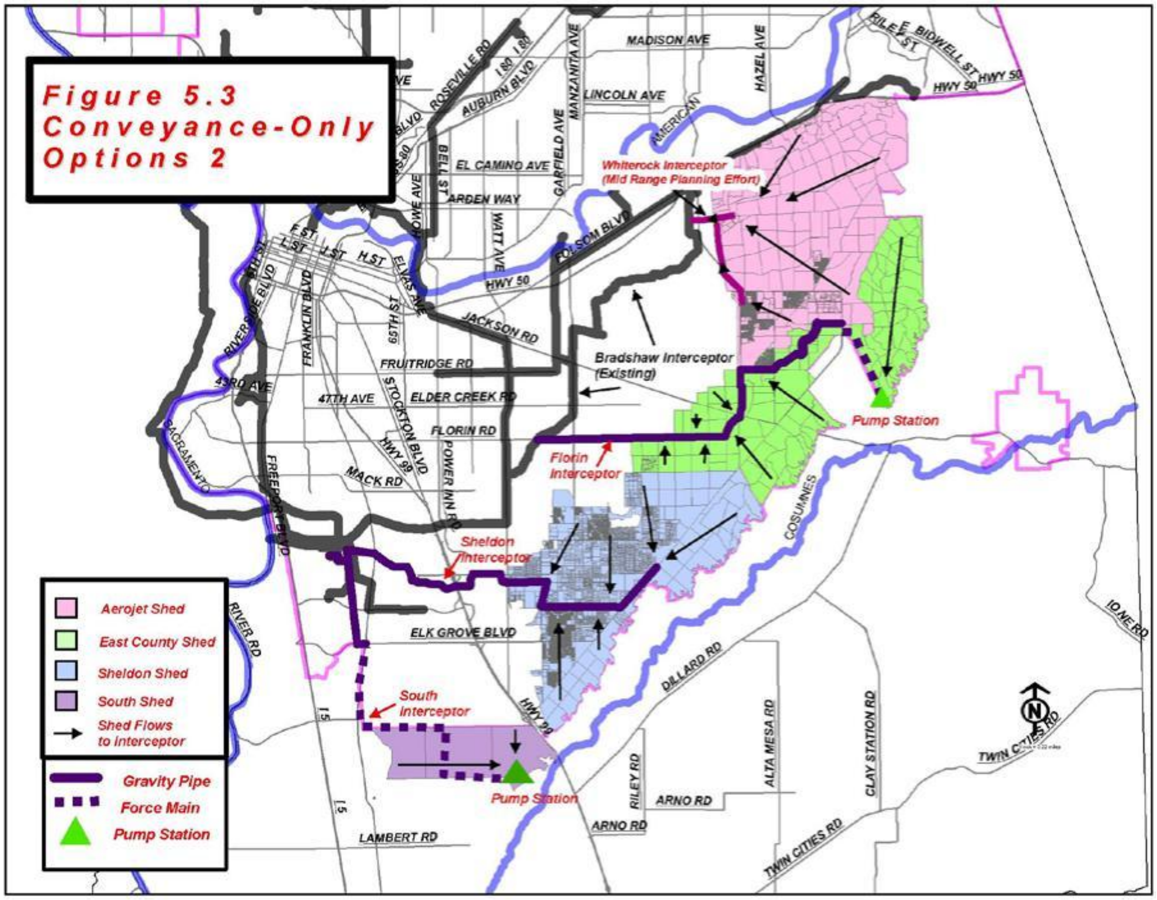
Risk Category	Risk Signature
Asset and Service Reliability	Medium $20,000
Environment	Medium $200,000
Financial	Low $5,000
Legal	Low $5,000
Public Health	Medium $50,000
Public Trust	Low $500
Regulatory	Medium $200,000
Total Annual Risk Cost	$480,500
40 Year NPV (5% Inflation and 5% Discount Rate)	$18,304,762

It should be noted that because this alternative has the largest facility (the South Interceptor's 68 MGD pump station), it carries higher risk costs than the other two alternatives when considering the ***Asset and Service Reliability*** and ***Environmental*** categories.

5.1.2 Conveyance-Only Option 2 (C2)

As in Option 1, flows from the north-eastern portion of the East County Shed will be pumped (via pump station and force main) to a gravity system known as the Florin Interceptor. This interceptor will carry all flows from the East County Shed west to the existing Bradshaw Interceptor (See Figure 5.3). Flows from the Sheldon Shed will be conveyed west to the existing SRWTP, via gravity through the Sheldon Interceptor, along a corridor located on or near Sheldon Rd. The new South Interceptor will carry flows from the expanded Elk Grove SOI area north to the SRWTP via a pump station and force main.

Figure 5.4 Conveyance-Only Option 2



The Conveyance-Only Option 2 (Option C2) consists of two pump stations (20 MGD and 26 MGD) and 40 miles of interceptor pipeline. The smaller 26 MGD pump station in the South Area in this alternative is offset by the longer Sheldon Interceptor to the SRWTP, making this the most expensive alternative amongst the three conveyance-only alternatives analyzed, as shown in Table 5.5.

Hydraulic modeling was carried out for this alternative using the design and performance criteria set out in Chapter 4 of this report and the attached Technical Memorandum *2* – Design and Performance Storms. The hydraulic grade line (HGL) was monitored in 14 existing and future interceptor systems (Bradshaw, Central, Northwest, Sunrise, City of Sacramento, McClellan, Lower Northwest, McClellan, Upper Dry Creek, Lower Dry Creek, Upper Northwest, Folsom, Folsom East and Laguna) to check for surcharges and possible sanitary sewer overflows (SSOs). The results of these modeling runs can be seen in detail in TM 13.

The modeling results for Option C2 are included in Table 5.3. Options C1 and C2 are similar except that the future Sheldon Interceptor discharges into the future South

Interceptor in C1 and into the future Laguna Creek Interceptor in C2. In both options, the Sheldon shed did not contribute flows to the Bradshaw Interceptor, so the impacts on the existing interceptor system in the two options are similar.

Table 5.3 Modeling Results Summary for Option C2

Interceptor	Realistic Build-Out	Conservative Build-Out
Bradshaw	No surcharge	Moderate surcharge (10 ft freeboard at N38-MH0020A)
Central	Moderate surcharge (7 ft freeboard at N21-MH0074B)	Critical surcharge; Overflows at N21-MH0074B
Northeast	No surcharge	Critical backup surcharge from Central Interceptor (3 ft freeboard at N16 (N24-MH0032A))
Sunrise	No surcharge; (6 ft freeboard at low MH SR2040)	Critical backup surcharge from Bradshaw Interceptor (4 ft freeboard at MH SR1130)
City	Critical surcharge; (Flows limited 108.5 mgd)	Critical surcharge; (Flows limited 108.5 mgd)
McClellan (after relieved)	No surcharge (4 ft freeboard at an upstream low MH (N33-MH0032A))	Minor surcharge downstream; (4 ft freeboard at an upstream low MH (N33-MH0032A))
Upper Dry Creek (after relieved)	No surcharge	Minor surcharge (12 ft freeboard at N17-MH0091A)
Lower Dry Creek	No surcharge	No surcharge
Upper Northwest	No surcharge	No surcharge
Lower Northwest	No surcharge	No surcharge
Natomas	No surcharge	No surcharge
Folsom	No surcharge; (6 ft freeboard at low MH (N23-MH0014A))	No surcharge; (5 ft freeboard at low MH (N23-MH0014A))
Folsom East	No surcharge; (5 ft freeboard at an upstream low MH (N37-MH0047A))	Minor backup surcharge from Bradshaw Interceptor; (5 ft freeboard at an upstream low MH (N37-MH0047A))
Laguna	No surcharge	No surcharge

Using the Conservative Build-Out scenario in Table 5.3 at build-out PWWF, there are critical surcharges in four (4) of these systems (the Central, Northeast, Sunrise and City of Sacramento systems). Again, it should be noted that build-out PWWF is not expected to be reached for well over 50 years, in which time relief projects are assumed to have been constructed to mitigate any SSO's.

Using the criteria set out in TM 8, a risk assessment was done on this alternative with the following results:

Table 5.4 Alt 2: Conveyance Only – Option 2 Risk Assessment

Risk Category	Risk Signature
Asset and Service Reliability	Low $2,000
Environment	Medium $20,000
Financial	Low $5,000
Legal	Low $5,000
Public Health	Medium $50,000
Public Trust	Low $500
Regulatory	Medium $200,000
Total Annual Risk Cost	$282,500
40 Year NPV (5% Inflation and 5% Discount Rate)	$10,761,905

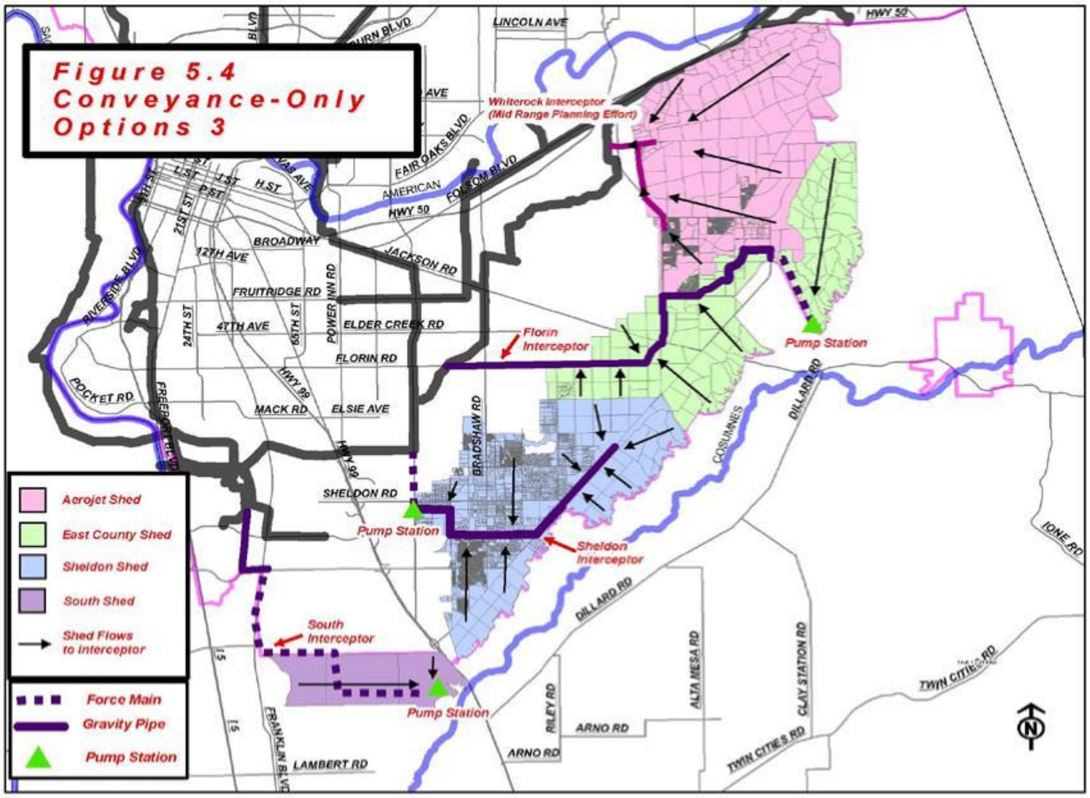
It should be noted that Option 2 carries slightly less risk for the categories of ***Asset & Service Reliability*** and ***Environmental*** than Option 1 because the South Interceptor contains a smaller pump station. This option contains fewer pump stations than Option 3 and carries slightly less risk.

5.1.3 Conveyance-Only Option 3 (C3)

As in Options C1 and C2, flows from the north-eastern portion of the East County Shed will be pumped (via pump station and force main) to a gravity system known as the Florin Interceptor. This interceptor will carry all flows from the East County Shed west to the existing Bradshaw Interceptor (See Figure 5.4). Flows from the Sheldon Shed will be conveyed west toward the SRWTP (via the Sheldon Interceptor) along a corridor located on or near Sheldon Rd. Unlike option 2, instead of traveling by gravity all the way to the SRWTP, flows would be directed north by pump station and force main at Elk Grove-Florin Rd and connect to the existing Bradshaw Interceptor which will carry it on to the SRWTP. This pump station and force main presents the possibility of a small amount of "in-line" storage, as described in Section 3.3.3 of this report. The new South Interceptor will carry flows from the expanded Elk Grove SOI north to the SRWTP via a pump station and force main.

In this alternative there are three pump stations (20 MGD, 42 MGD and 26 MGD) and 37 miles of interceptor pipeline.

Figure 5.5 Conveyance-Only Option 3



Hydraulic modeling was carried out for this alternative using the design and performance criteria set out in Chapter 4 of this report and the attached Technical Memorandum 2 – Design and Performance Storms. The hydraulic grade line (HGL) was monitored in 14 existing and future interceptor systems (Bradshaw, Central, Northwest, Sunrise, City of Sacramento, McClellan, Lower Northwest, McClellan, Upper Dry Creek, Lower Dry Creek, Upper Northwest, Folsom, Folsom East and Laguna) to check for surcharges and possible sanitary sewer overflows (SSO's). The results of these modeling runs can be seen in detail in TM 13.

Table 5.5 Modeling Results Summary for Option C3

Interceptor	Realistic Build-Out	Conservative Build-Out
Bradshaw	No surcharge (13 ft freeboard at N38-MH0020A)	Moderate surcharge (8 ft freeboard at N38-MH0020A)
Central	Moderate surcharge (6 ft freeboard at N21-MH0074B)	Critical surcharge; Overflows at N21-MH0074B and N21-MH0073B
Northeast	No surcharge	Critical backup surcharge from Central Interceptor (1 ft freeboard at N16 (N24-MH0032A))

Sunrise	No surcharge (6 ft freeboard at low MH SR2040)	Critical backup surcharge from Bradshaw Interceptor (4 ft freeboard at MH SR1130)
City	Critical surcharge; (Flows limited 108.5 mgd)	Critical surcharge; (Flows limited 108.5 mgd)
McClellan (after relieved)	No surcharge (4 ft freeboard at an upstream low MH (N33-MH0032A))	Minor surcharge downstream (4 ft freeboard at an upstream low MH (N33-MH0032A))
Upper Dry Creek (after relieved)	No surcharge	Minor surcharge (12 ft freeboard at N17-MH0091A)
Lower Dry Creek	No surcharge	No surcharge
Upper Northwest	No surcharge	No surcharge
Lower Northwest	No surcharge	No surcharge
Natomas	No surcharge	No surcharge
Folsom	No surcharge (6 ft freeboard at low MH (N23-MH0014A))	Minor backup surcharge from Central and Northeast Interceptors (5 ft freeboard at low MH (N23-MH0014A))
Folsom East	No surcharge (5 ft freeboard at an upstream low MH (N37-MH0047A))	Minor backup surcharge from Bradshaw Interceptor (5 ft freeboard at an upstream low MH (N37-MH0047A))
Laguna	No surcharge	No surcharge

Using the worst-case scenario, Conservative Build-Out, in Table 5.6 at build-out PWWF, there are critical surcharges in four (4) of these systems (the Central, Northeast, Sunrise and City of Sacramento systems). There are more potential for overflows in this alternative than the previous two alternatives because this alternative connects to the Bradshaw Interceptor in two locations. It should be stressed again; however, that build-out PWWF is not expected to be reached for well over 50 years, in which time relief projects are assumed to have been constructed to mitigate any SSOs. A discussion of such relief projects is outside the scope of this ISS and will be addressed in a future report.

Using the criteria set out in TM 8, a risk assessment was done on this alternative with the following results:

Table 5.6 Alt 3: Conveyance Only – Option 3 Risk Assessment

Risk Category	**Risk Signature**
Asset and Service Reliability	Low $5,000
Environment	Medium $20,000
Financial	Low $5,000
Legal	Low $5,000
Public Health	Medium $50,000
Public Trust	Low $500
Regulatory	Medium $200,000
Total Annual Risk Cost	$285,500
40 Year NPV (5% Inflation and 5% Discount Rate)	$10,876,190

It should be noted that Option 3, although carrying slightly less risk for ***Asset & Service Reliability*** and ***Environmental*** than Option 1 (because it has a smaller pump station in the South Interceptor), its extra pump station on the Sheldon Interceptor does mean that this alternative carries more risk than Option 2 in the category of ***Asset & Service Reliability***. The potential for higher volumes of SSOs in Option 3 is real, as can be seen in the modeling results above. However, this reality is not believed to raise the risk of any of the categories by any degree of magnitude above the other alternatives.

5.1.4 Conveyance-Only Option (C4)

As in Options C1, C2, and C3, flows from the north-eastern portion of the East County Shed will be pumped (via pump station and force main) to a gravity system known as the Florin Interceptor. This interceptor will carry all flows from the East County Shed west to the existing Bradshaw Interceptor (See Figure 5.4).

Unlike options C1, C2, and C3, in alternative C4 the future sewer along Sunrise Boulevard becomes a trunk line instead of an interceptor. Although modeling predicts a possible future SSO at the Northeast Siphon Outlet Structure (N16), the modeling parameters are believed to be conservative and based on densification of areas that are currently developed. Densification will take many years to occur and may not ever reach the densities contemplated in the hydraulic model. In addition, if capacity becomes constrained, flow diversions to other facilities, such as the Upper Northwest Interceptor, are possible. A more detailed evaluation will be performed in the future when relief capacity is needed.

Flows from the Sheldon Shed will be conveyed west toward the SRWTP (via three trunk sized facilities rather than a Sheldon Interceptor) along a corridor located on or near Sheldon Rd. This will provide greater flexibility to provide sewer service as development occurs.

The South Interceptor will serve only the Elk Grove SOI, picking up flow at the east end of the SOI. This Interceptor will receive flow at the South Interceptor Pump Station located near Bruceville Road, making the pipeline in this alternative shorter than the pipeline proposed in C3.

Option C4 introduces the Elder Creek Interceptor which is located north of the Florin Interceptor. The Elder Creek Interceptor is similar to the Bradshaw Interceptor Section 6B South that was previously identified in SRCSD's MP2000.

Figure 5.6 Conveyance-Only Option 4

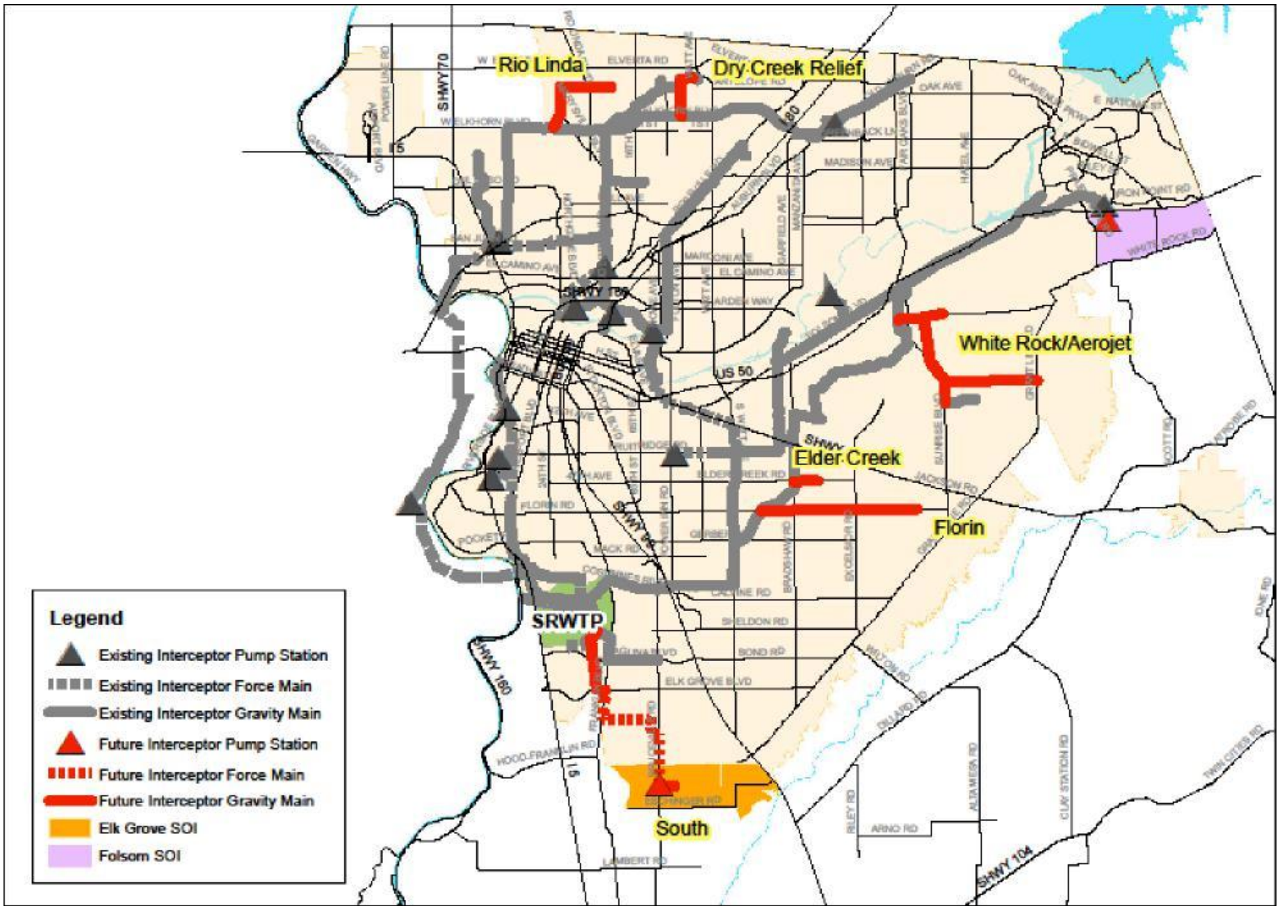


Table 5.7 Modeling Results Summary for Option C4		
Interceptor	**Realistic Build-Out**	**Conservative Build-Out**
Bradshaw	Minor surcharge	Critical surcharge (2 ft freeboard at N38-MH0147B)
Central	Minor surcharge (7 ft freeboard at shallow MH N21-MH0074B)	Critical surcharge Overflows at N21-MH0074B and N21-MH0073B
Northeast	Minor surcharge	Critical backup surcharge from Central Interceptor Overflow at N16 (N24-MH0032A)
City	Critical surcharge (Flows limited 108.5 mgd)	Critical surcharge (Flows limited 108.5 mgd)
McClellan (after relieved)	No surcharge (4 ft freeboard at shallow MH N33-MH0032A)	No surcharge (4 ft freeboard at shallow MH N33-MH0032A)
Upper Dry Creek (after relieved)	No surcharge	Minor surcharge
Lower Dry Creek	No surcharge	No surcharge
Upper Northwest	No surcharge	No surcharge
Lower Northwest	No surcharge	No surcharge
Natomas	No surcharge	Minor surcharge
Folsom	No surcharge (6 ft freeboard at shallow MH N23-MH0014A)	Critical surcharge (2 ft freeboard at MH N23-MH0014A)
Folsom East	No surcharge (5 ft freeboard at shallow MH N37-MH0047A)	Moderate backup surcharge from Bradshaw Interceptor (5 ft freeboard at shallow MH N37-MH0047A)
Laguna	No surcharge	Minor surcharge upstream

Using the worst-case scenario, Conservative Build-Out, in Table 5.7 at build-out PWWF, there are critical surcharges in five (5) of these systems (the Bradshaw, Central, Northeast, Folsom, and City of Sacramento systems). There are more potential for overflows in this alternative than the previous two alternatives because this alternative connects to the Bradshaw Interceptor in two locations at build-out, which creates greater localized flow concentration in the interceptor.

Using the criteria set out in TM 8, a risk assessment was done on this alternative with the following results:

Table 5.8 Alt 4: Conveyance Only – Option 4 Risk Assessment

Risk Category	Risk Signature
Asset and Service Reliability	Low $5,000
Environment	Medium $20,000
Financial	Low $5,000
Legal	Low $5,000
Public Health	Medium $50,000
Public Trust	Low $500
Regulatory	Medium $200,000
Total Annual Risk Cost	$285,500
40 Year NPV (5% Inflation and 5% Discount Rate)	$10,876,190

5.1.5 Alternatives 1 through 4 Cost Comparison

Table 5.9 ISS Cost Summary of Conveyance – Only Alternatives

Alt #	Alternative	Interceptor Pipe Length (miles)	Total Conveyance Capital Cost. ($Millions)	NPV of O&M ($Millions)	Total Cost for Alternative ($Millions)
1	**Conveyance Only - Option 1**	**38.8**	**$435**	**$41**	**$476**
	Florin Interceptor	13.8			
	Laguna/South Interceptor	25.1			
2	**Conveyance Only - Option 2**	**40.3**	**$468**	**$32**	**$500**
	Florin Interceptor	13.8			
	Sheldon Interceptor	12.4			
	South Interceptor	14.1			
3	**Conveyance Only - Option 3**	**37.2**	**$422**	**$43**	**$465**
	Florin Interceptor	13.8			
	Sheldon Interceptor	9.3			
	South Interceptor	14.1			
4	**Conveyance Only – Option 4**	**16.9**	**$202**	**$36**	**$238**
	Florin Interceptor	5.1			
	Elder Creek Interceptor	0.8			
	Douglas Interceptor	3.1			
	South Interceptor	7.9			

5.1.6 Conveyance-Only Option 4 Cost Comparison

The ISS considered alternatives that decreased the length of interceptors which results in increases in the number of trunks needed to serve the areas. A high level cost analysis was performed to determine if the cost of the added trunk lines would be offset by the savings from the reduced length of interceptors. The cost comparison focused on areas in the southeast County where additional trunks were needed to accommodate proposed reductions in planned interceptor system. The cost analysis was performed by calculating the cost increases due to additional trunks from the 2006 SCP to the 2010 SCP. The trunk cost increase was compared to the reduction of interceptor cost from MP2000, which was the interceptor plan at the time of the 2006 SCP, to the proposed lowest cost alternative in the ISS (Conveyance Option C4). To provide an equal comparison, all costs were analyzed in 2010 dollars.

Table 5.10 shows the expansion cost of trunks proposed in the 2010 SCP. Table 5.11 presents the 2006 SCP expansion cost in 2006, and 2010 dollars using an escalation rate of 3%. The trunk expansion cost, the cost from the 2006 to the 2010 SCP increased from **$453,950,333** to **$721,290,000** for a total increase of **$267,339,667**. This estimated cost increase represents the cost of additional trunks in lieu of interceptors.

5.12 presents the interceptor costs for ISS Alternative C4. Table 5.13 presents the interceptor cost from MP2000 escalated to 2010 dollars. The total interceptor cost decreased from **$527,076,819** to **$237,247,000** for a total decrease of **$283,829,819.**

Table 5.10 Trunk System Expansion Projects from the 2010 SCP

BR Bond Sheldon	$53,100,000
BR Calvine	$109,000,000
BR East Rancho	$313,900,000
BR Elder Creek	$36,200,000
BR Florin	$56,200,000
BR Gerber	$10,400,000
BR Gravel East	$27,100,000
BR Mather East	$32,800,000
CE Elk Grove Florin	$4,800,000
CE Gravel West	$22,700,000
FE Folsom	$18,300,000

LA East Franklin	$5,990,000
LA Elk Grove	$11,200,000
LA Laguna Ridge	$19,600,000
EXPANSION AREA TOTAL	**$721,290,000**

Table 5.11 Trunk System Expansion Projects in the 2006 SCP

	Totals	
Trunk Shed	**2006 Dollars**	**2010 Dollars (3% escalation)**
SO East Franklin	$1,625,000	$1,828,951
SO Laguna Ridge	$24,608,000	$27,696,520
Hwy 99/Sheldon	$1,205,000	$1,356,238
EG East Elk Grove	$7,173,000	$8,073,274
CE Elk Grove-Florin	$3,458,000	$3,892,009
CE Gravel Area West	$21,637,000	$24,352,634
BR Gerber Road	$15,758,000	$17,735,767
BR Florin Road	$14,243,000	$16,030,621
BR Elder Creek	$23,616,000	$26,580,016
BR Gravel Area East	$12,559,000	$14,135,265
MA Mather/Keifer	$12,367,000	$13,919,167
LC Sheldon Road	$15,414,000	$17,348,592
LC Calvine Road	$16,191,000	$18,223,113
LC Eagles Nest	$18,446,000	$20,761,135
LC Upper Laguna Creek	$28,598,000	$32,187,300
DC Bond Road	$9,118,000	$10,262,389
DC Lower Deer Creek	$36,130,000	$40,664,633
DC Upper Deer Creek	$31,009,000	$34,900,902
AJ Sunrise Douglas	$13,827,000	$15,562,410
AJ Douglas White-Rock	$26,472,000	$29,794,469
AJ Aerojet	$69,875,000	$78,644,928
Expansion Project Total	**$403,329,000**	**$453,950,333**

Table 5.12 ISS Option C4 Interceptor Cost

White Rock Interceptor	$19,594,000
Aerojet Interceptor	$36,347,000
Douglas Interceptor	$19,575,000
Elder Creek Interceptor	$9,528,000
Florin Interceptor	$38,912,000
South Interceptor	$77,919,000
Dry Creek Relief	$9,515,000
Rio Linda Interceptor	$14,514,000
Folsom Pump Station	$11,343,000
TOTAL	**$237,247,000**

Table 5.13 MP2000 Interceptor Costs

Interceptor Shed	**2000 Dollar**	**2010 Dollars (3% escalation)**
Sunrise Interceptor 1	$10,820,000	$14,541,175
Sunrise Interceptor 2	$9,300,000	$12,498,422
South Interceptor 1	$8,660,000	$11,638,316
South Interceptor 2	$21,360,000	$28,706,054
South Interceptor 3	$18,270,000	$24,553,352
Laguna Creek Int. 1	$24,840,000	$33,382,883
Laguna Creek Int. 2	$44,700,000	$60,073,062
Laguna Creek Int. 3	$36,040,000	$48,434,746
Laguna Creek Int. 4	$20,500,000	$27,550,286
Laguna Creek Int. 5	$5,430,000	$7,297,466
Deer Creek Int. 1	$25,430,000	$34,175,794
Deer Creek Int. 2	$18,210,000	$24,472,717
Deer Creek Int. 3	$16,080,000	$21,610,175
Deer Creek Int. 4	$3,320,000	$4,461,802
Mather Interceptor	$37,020,000	$49,751,784

Aerojet Int. 1 (built)	$0	$0
Aerojet Int. 2	$17,400,000	$23,384,145
Aerojet Int. 2S	$7,490,000	$10,065,934
Aerojet Int. 3	$7,680,000	$10,321,278
Aerojet Int. 3S	$3,930,000	$5,281,591
Aerojet Int. 4	$21,940,000	$29,485,525
Bradshaw Int. 6B south	$2,990,000	$4,018,310
Dry Creek Relief	$7,080,000	$9,515,000
Rio Linda Interceptor	$10,800,000	$14,514,000
Folsom Pump Station	$8,440,000	$11,343,000
Total	**$387,730,000**	**$527,076,819**

The trunk expansion cost, the cost from the 2006 to the 2010 SCP increased **$267,339,667** while the total interceptor cost decreased **$283,829,819**. Given the high level of this cost analysis, the increase in trunk costs is roughly equal to the decrease in interceptor costs. Constructing trunks in lieu of interceptors will result in lower cost because of the lower initial capital investment associated with trunk sized facilities compared to interceptors. The reduced initial capital investment will result in lower cost to finance the facilities. Trunk facilities are also generally less disruptive to construct and require less time to plan, design, and construct which will also allow facilities to be built more timely, when development needs them.

5.2 Satellite Facilities Alternatives

A satellite plant is a MBR treatment facility that treats all influent flows and consistently produces acceptable water quality. As a result, sufficient reliability must be installed to allow for one or more membrane basins to be out of service and still maintain sufficient capacity to treat the influent flow under all conditions. This “end of pipe” treatment facility must accommodate the flow fluctuation from both diurnal flow and peak flows by either installing larger treatment units or by adding equalization tanks. Solid waste is treated on-site at the satellite facility or trucked back to the SRWTP for treatment. It also requires a discharge permit for excess flows and solid handling processes, which makes them less desirable in neighborhood locations due to its footprint.

The advantage of treating solids on-site is that it eliminates the need for an extensive network of interceptor pipes connecting to the SRWTP.

Presented here in the report is the most favorable satellite treatment option in each area. Other options can be found in TM 15.

5.2.1 Satellite A South Area Option 3

The sewer conveyance option for this satellite alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor**.** Flows from the Sheldon area are piped to the Bradshaw Interceptor via the Sheldon Interceptor while flows from the Elk Grove SOI flow directly into the Satellite A treatment plant. The Florin Interceptor begins with a 20 MGD pump station and force main to route Cordova Hills flows to the Suncreek/Waegell areas where the gravity portion takes these and the remaining flows from the East County area to the Bradshaw Interceptor via the Florin Road corridor. The Sheldon Interceptor begins as a gravity line, conveying flows west to Elk Grove-Florin Road where a pump station and force main connect to the north at Bradshaw Interceptor.

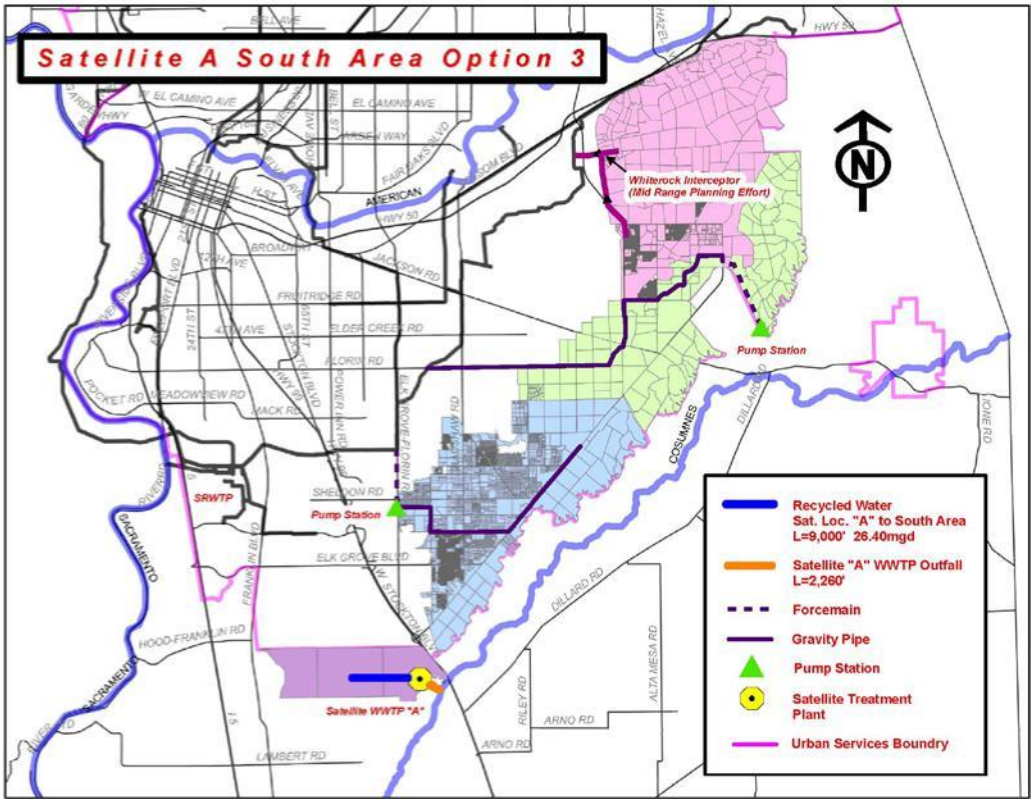
With about 26 miles of interceptor pipeline, two pump stations, and a 26-MGD Satellite treatment facility, this alternative has the lowest total cost among all the satellite treatment alternatives, as shown in Table 5.10.

Using the criteria set out in TM 8, a risk assessment was done on this alternative with the following results:

Table 5.14 Risk Analysis: Satellite A South Area Option 3

Risk Category	Risk Signature
Asset Service and Reliability	Low $5,000
Environmental	Medium $200,000
Financial	Medium $100,000
Legal	Critical $1,000,000
Public Health	Medium $50,000
Public Trust	Medium $20,000
Regulatory	High $500,000
Total Annual Risk Cost	$1,875,000
40 Year NPV (5% Inflation and 5% Discount Rate)	$71,429,000

Figure 5.7 Satellite A South Area Option 3



5.2.2 Satellite B Sheldon Area Option 2

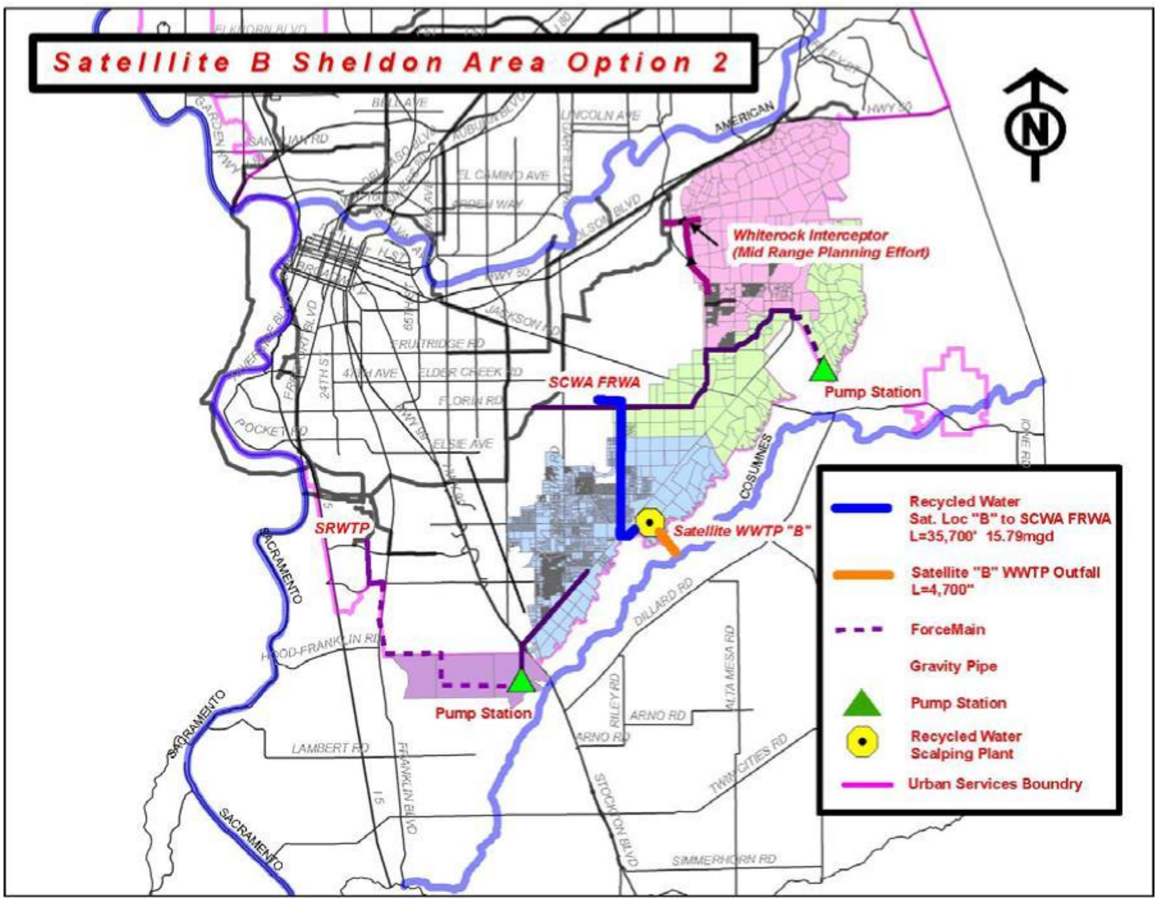
The sewer conveyance option for this satellite alternative diverts the East County area flows to the Bradshaw Interceptor via the Florin Interceptor. A large portion of the Sheldon area, south of the East County area, is conveyed to the Satellite B treatment plant by gravity via the Satellite B Interceptor. The remaining flows south of this area would be conveyed using the Laguna/South Interceptor to the SRWTP. The Florin Interceptor begins with a 20 MGD pump station and force main to route Cordova Hills flows to the Suncreek/Waegell areas where a gravity line conveys these and the remaining flows from the East County area to the Bradshaw Interceptor via the Florin Road corridor. The Laguna/South Interceptor gravity flows to a pump station which conveys the flows through a force main north-west to the SRWTP.

With 37 miles of interceptor pipe and two pump stations, this is the most expensive conveyance system among the four Satellite B alternatives, as shown in Table 5.10.

Using the criteria set out in Technical Memorandum 8 – Alternatives Risks Analysis, a risk assessment was done on this alternative with the following results:

Table 5.15 Risk Analysis: Satellite B Sheldon Area Option 2	
Risk Category	**Risk Signature**
Asset Service and Reliability	Low $5,000
Environmental	Medium $200,000
Financial	Medium $100,000
Legal	Critical $1,000,000
Public Health	Medium $50,000
Public Trust	Medium $20,000
Regulatory	High $500,000
Total Annual Risk Cost	$1,875,000
40 Year NPV (5% Inflation and 5% Discount Rate)	$71,429,000

Figure 5.8 Satellite B Sheldon Area Option 2



5.2.3 Satellite C East County Area Option 2

The sewer conveyance option of this satellite alternative sends all the flows from the East County area to the Satellite C plant in two ways. The first is a 20 MGD pump station and force main that transports the Cordova Hills flows directly to the plant. The other is by gravity using the Satellite C Interceptor. Wastewater from the Sheldon area would initially be gravity fed west through the Sheldon Interceptor. Flows would then be routed through a 31 MGD pump station and force main which will connect to the Bradshaw Interceptor on Elk Grove-Florin Road and then to the SRWTP. The Elk Grove SOI flows will be conveyed north to the SRWTP via the South Interceptor which consists of a 26 MGD pump station and force main.

With 29 miles of interceptor pipeline, three pump stations, and a Satellite treatment facility, this alterative is the highest total cost among the satellite treatment alternatives that are shown in Table 5.10. Under this alternative, 70 MGD of wastewater will be conveyed to a satellite treatment facility.

Using the criteria set out in Technical Memorandum 8 – Alternatives Risks Analysis, a risk assessment was done on this alternative with the following results:

Table 5.16 Risk Analysis: Satellite C East County Option 2

Risk Category	Risk Signature
Asset Service and Reliability	Low $5,000
Environmental	Medium $200,000
Financial	Medium $100,000
Legal	Critical $1,000,000
Public Health	Medium $50,000
Public Trust	Medium $20,000
Regulatory	High $500,000
Total Annual Risk Cost	$1,875,000
40 Year NPV (5% Inflation and 5% Discount Rate)	$71,429,000

Figure 5.9 Satellite C East County Option 2

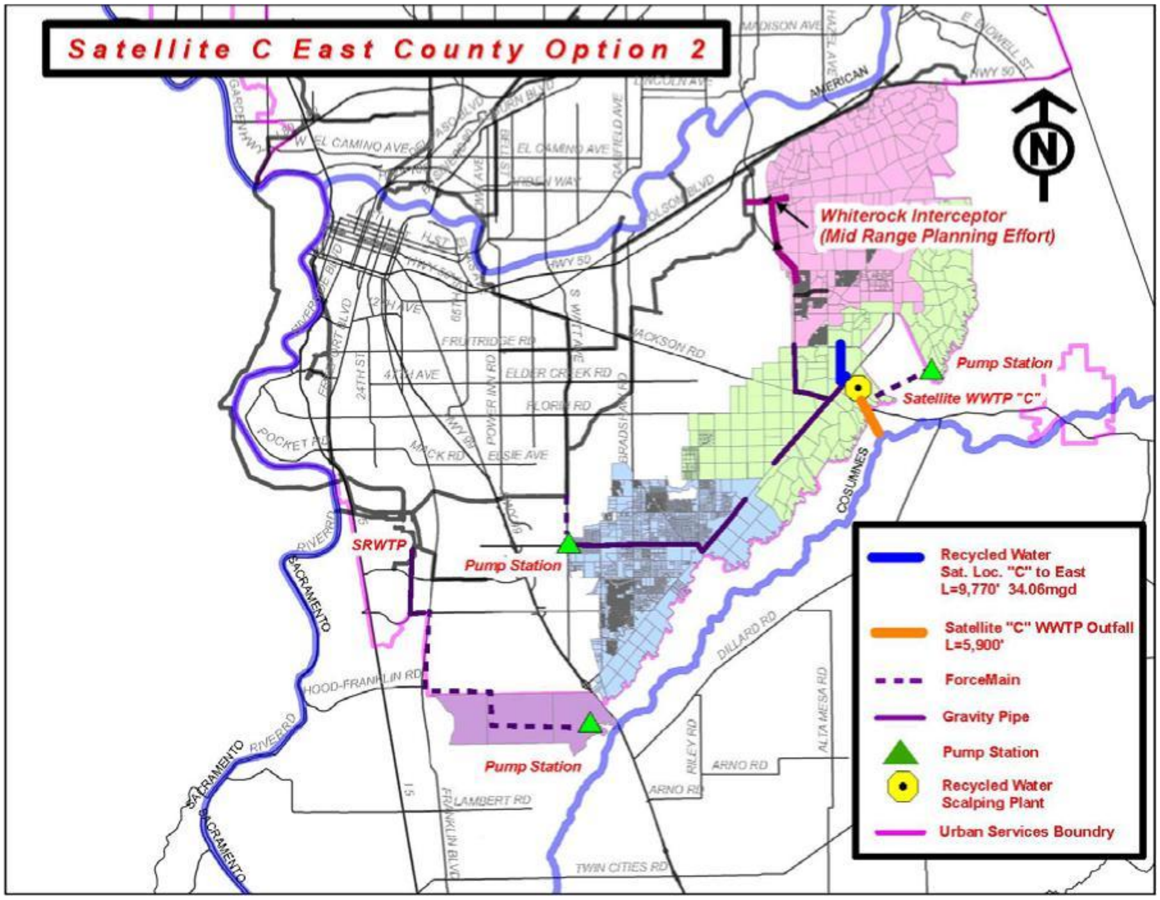


Table 5.17 ISS Cost Summary of Satellite Alternatives

Alt #	Alternative	Interceptor Pipe Length (miles)	Total Conveyance Capital Cost ($M)	Water Recycling Capital Cost ($M)	NPV of Conveyance O&M ($M)	NPV of Sat O&M ($M)	Total Cost for Alt. ($M)
6	**Satellite A South Area Option 3**	**26.3**	**$332**	**$304**	**$24**	**$464**	**$1124**
	Florin Interceptor	**13.8**					
	Sheldon Interceptor	**9.3**					
	Satellite A Interceptor	**3.2**					
9	**Satellite B Sheldon Area Option 2**	**37.1**	**$378**	**$394**	**$34**	**$611**	**$1417**
	Florin Interceptor	**13.8**					
	Satellite B Interceptor	4.5					
	Laguna/South Interceptor	**18.8**					
13	**Satellite C East County Area Option 2**	**29.3**	**$336**	**$795**	**$39**	**$1229**	**$2399**
	Satellite C Interceptor	**7.2**					
	Sheldon Interceptor	**8.0**					
	South Interceptor	14.1					

5.3 Alternatives Analysis

5.3.1 Conveyance-Only Analysis

Maximizing the availability of the existing Bradshaw Interceptor is a key component to providing the most cost effective conveyance solution for the East County, Sheldon and South Areas. By using the available capacity in the Bradshaw Interceptor, Conveyance-Only Option 4 minimizes the need for new interceptor pipeline and is the least expensive alternative of the four analyzed. Conveyance Only Option 4 also provides greater flexibility to provide sewer service as development occurs.

Because Option 4 adds considerable flow to the existing Bradshaw Interceptor, it has the potential to create the greatest spill volume in the Central and City Interceptor lines. But, as previously stated, this would occur during a peak wet weather flow event at build-out, and build-out is not predicted to be reached for well over 50 years. This is ample time to implement relief projects to mitigate such overflows and it is likely that water conservation results in lower per capita flows in the next few decades.

The high level cost analysis of Option 4 concluded that the added cost for the trunks was nearly offset by the reduced cost of interceptors. The cost analysis did not consider the timing of capital expenditures, because the timing of development and the related need for sewer capacity remains uncertain. However, it is believed that constructing trunks in lieu of interceptors will allow great flexibility to provide service, is generally less disruptive to construct, and requires less time to plan, design, and construct. Therefore, trunks are generally more flexible with respect to providing service when it is needed.

5.3.2 Satellite Only Analysis

Analysis shows that the existing Bradshaw Interceptor has capacity availability to accept flows that would be treated by Satellite B (Sheldon area) and Satellite C (East County area). It was also determined that the cost of constructing and operating a satellite treatment facility significantly exceeds the cost of using existing and planned interceptors to convey flow to the SRWTP. Therefore, the Conveyance-Only alternatives 1, 2 and 3 are preferred based on cost and the Satellite B and C alternatives were dropped.

The South area does not currently have an Interceptor system, although the South Interceptor was part of the SRCSD Master Plan 2000. The *Satellite A South Area Option 3* avoids construction of the South Interceptor by constructing a satellite facility. The cost of servicing the south area with a satellite facility when compared to the expected construction costs of the South Interceptor showed that constructing the South Interceptor would cost significantly less than constructing the Satellite A facility. Risks in constructing and operating a satellite facility are also more significant than those related to an interceptor pipeline.

6.0 RECYCLED WATER SERVICE ALTERNATIVES

6.1 Background and Introduction

In 2007, SRCSD completed a Water Recycling Opportunities Study (WROS). The WROS evaluated water recycling opportunities in 5 target areas throughout the Sacramento region, identified potential stakeholders, and evaluated 18 potential recycled water projects at the master planning level. The WROS recommended implementing the phase II expansion of the existing Water Reclamation Facility (WRF) at the SRWTP and performing more detailed feasibility studies on 3 other projects. The draft feasibility studies were completed in 2007.

This chapter will identify and evaluate recycled water projects or decentralized facilities that could reduce or eliminate interceptor conveyance projects within the following areas:

- The East County Area – Suncreek, Waegell, Cordova Hills, Florin Road areas
- The Sheldon Area – south of the East Area in the proximity of Sheldon Road, along Grantline Road
- The South Area – south of the Sheldon Area and primarily Elk Grove

Centralized treatment will be provided by a new or expanded Water Reclamation Facility at the SRWTP, which will provide Title 22 tertiary treatment of the secondary effluent produced by the SRWTP. The tertiary effluent (i.e. Recycled Water) is then transported from the SRWTP via distribution pipes to the point of discharge for the local system. Solid waste is treated on –site at the SRWTP.

Decentralized facilities can include either a scalping or satellite plant. A scalping plant is an MBR treatment facility located along a major interceptor sewer to treat wastewater generated from certain areas. These plants are typically placed in close proximity to water recycling opportunities, which significantly reduces the transmission costs of pumping treated wastewater from the SRWTP to the recycled water place of use.

A satellite plant is a MBR treatment facility that treats all influent flows and consistently produces acceptable water quality. Solid waste is treated on-site at the satellite facility or trucked back to the SRWTP for treatment which eliminates the need for an extensive network of interceptor pipes connecting to the SRWTP.

The treatment alternatives for water recycling in these areas included analysis for discharging to surface waters (such as the Cosumnes River). Cost and risk of decentralized facilities are compared to the risk and cost of conveying the same flow to the SRWTP for centralized treatment and distribution.

6.2 SRWTP Recycled Water Distribution Alternatives

With centralized treatment, wastewater is conveyed to the SRWTP where it is treated and redistributed as recycled water to portions of Sacramento County. Recycled water requires more stringent treatment than the current treatment levels at the SRWTP. This more advanced level of wastewater treatment would be provided by a new or expanded Water Reclamation Facility (WRF) at the SRWTP. The recycled water would be transported from the WRF through distribution pipes to the point of discharge for the local system. The solid waste byproduct of this advanced treatment would be treated on–site at the SRWTP.

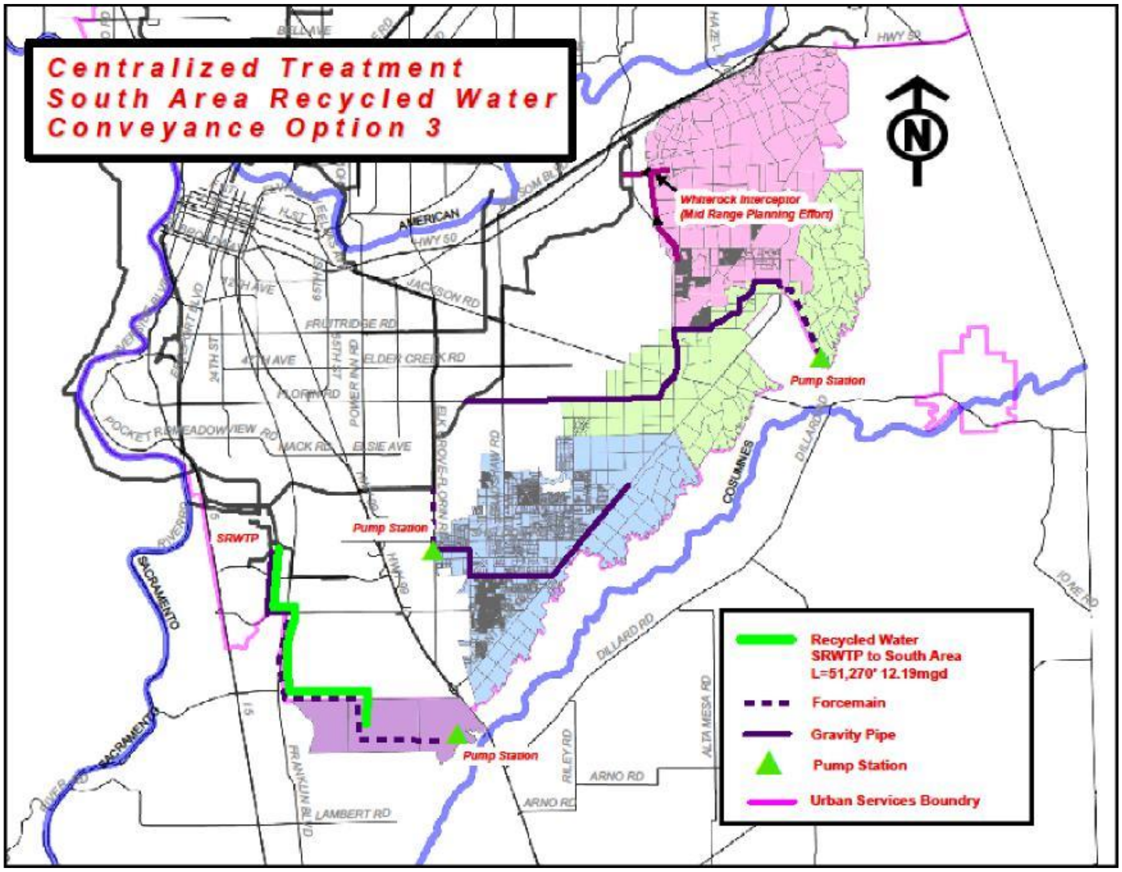
As in Conveyance-Only Option 3 described in TM 11 and Section 5.2.1 of this report, wastewater in all three Centralized SRWTP recycled water alternatives will be conveyed directly west from Cordova Hills and the upper reaches of the Laguna Creek area, via the Florin Interceptor and will then connect to the Bradshaw Interceptor. The remaining southern, Laguna/Grantline wastewater will be conveyed west toward the SRWTP (via the Sheldon Interceptor) along a corridor located on or near Sheldon Rd. Flows would be directed north by pump station and force main at Elk Grove-Florin Rd and connect to the Bradshaw Interceptor which will carry it on to the SRWTP. The new South Interceptor will carry wastewater from the expanded Elk Grove SOI north to the SRWTP via a pump station and force main.

6.2.1 South Area Recycled Water – Conveyance Option 3

For the South Area, three Conveyance Options were analyzed. This section only discusses the chosen option; all three options are discussed in TMs 9, 10, and 12. In this alternative (Conveyance Option 3), wastewater flows will be conveyed from Cordova Hills and the upper reaches of the Laguna Creek area, directly west via the Florin Interceptor and will connect to the Bradshaw Interceptor. The remaining, southern, Laguna/Grantline flows will be conveyed west toward the SRWTP (via the Sheldon Interceptor) along a corridor located on or near Sheldon Rd. Flows would be directed north by pump station and force main at Elk Grove-Florin Rd and connect to the Bradshaw Interceptor which will carry it on to the SRWTP. The new South Interceptor will carry flows from the expanded Elk Grove SOI north to the SRWTP via a pump station and force main.

For the South Area alternative, a pumping facility along with nine miles of new transmission pipeline would be constructed allowing approximately 12 mgd of recycled water to be delivered to a point in the south area where a local water provider would connect to their distribution system. This alternative has the lowest total cost ($874 million) of all the centralized treatment alternatives but supplies the least amount of recycled water.

Figure 6.1 South Area Recycled Water – Conveyance Option 3

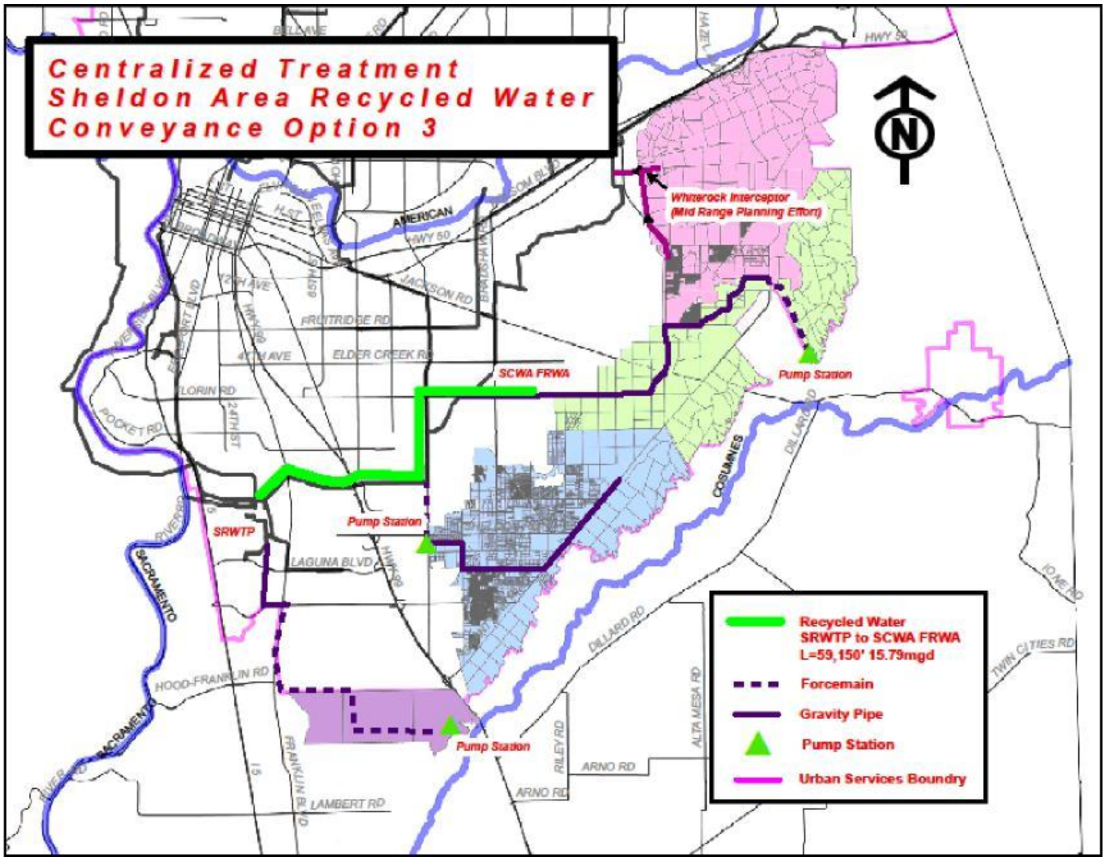


6.2.2 Sheldon Area Recycled Water – Conveyance Option 3

For the Sheldon Area, four Conveyance Options were analyzed. This section only discusses the chosen option; all four options are discussed in TMs 9, 10, and 12. In this alternative (Conveyance Option 2), Flow will be conveyed to the SRWTP as described in Section 6.2.1. For the Sheldon Area alternative, a pumping facility along with eleven miles of new transmission pipeline would be constructed allowing approximately 16 mgd of recycled water to be delivered to a point where a local water provider would connect to their distribution system.

The total cost for this alternative is $958 million which is $84 million more than the South Area recycled water option but provides an additional 4 MGD of recycled water.

Figure 6.2 Sheldon Area Recycled Water – Conveyance Option 3

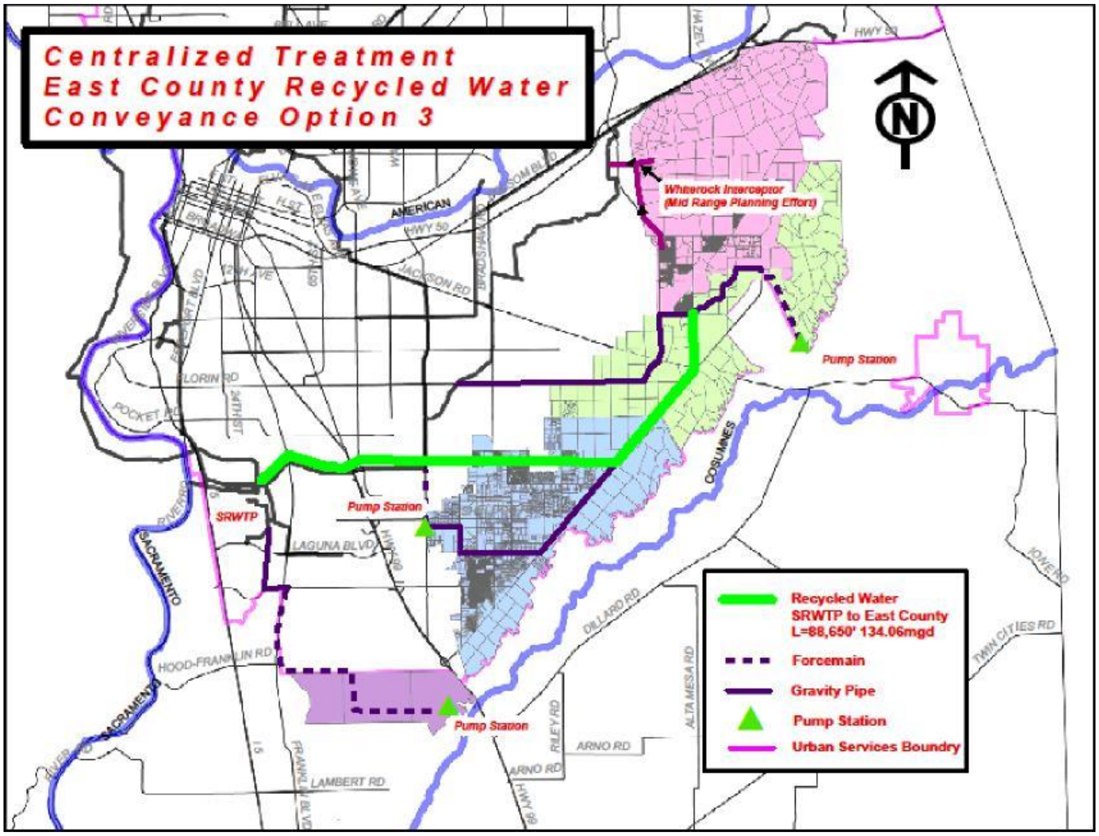


6.2.3 East County Recycled Water – Conveyance Option 3

For the East Area, four Conveyance Options were analyzed. This section only discusses the chosen option; all four options are discussed in detail in TMs 9, 10, and 12. In this alternative (Conveyance Option 3), flow will be conveyed in the same way to the SRWTP as described in Section 6.2.1. For the East County Area alternative, a pumping facility along with seventeen miles of new transmission pipeline would be constructed allowing approximately 34 mgd of recycled water to be delivered to a point where a local water provider would connect to their distribution system.

The total cost for this alternative is $1.62 billion and is the highest among all the centralized alternatives.

Figure 6.3 East County Recycled Water – Conveyance Option 3



6.3 Scalping Treatment Alternatives

A scalping plant is a Membrane BioReactor (MBR) wastewater treatment facility located along an interceptor sewer. These plants are typically placed near areas that would receive this recycled water, in order to significantly reduce costs of pumping treated wastewater from the SRWTP. The savings associated with recycled water conveyance costs for a satellite facility increase the further the facility is from the SRWTP.

One of the benefits of a scalping facility is the ability for flexible design based on the amount of wastewater flow. The scalping facility provides advanced treatment for the wastewater and then discharges the treated recycled water to a local distribution system. The solid byproduct of this treatment process is transported back into the sewer system to the SRWTP.

A scalping plant can be operated seasonally, producing recycled water for irrigation during dry months and then be taken offline during winter months when the demand for recycled water is low or non-existent. During this time, water needs could be met more costeffectively by other sources. Consequently, there is no anticipated savings due to reduced conveyance facilities, because the peak wet weather flow that determines the size of interceptors will still need to be conveyed.

6.3.1 Scalping Alternative A – South Area

Constructing a satellite treatment facility in the South Area eliminated the need for the South Interceptor. Building the South Interceptor along with a scalping facility provides no advantages over building a separate satellite treatment facility in the South Area, and it was decided that exploring scalping options for the South Area would be redundant.

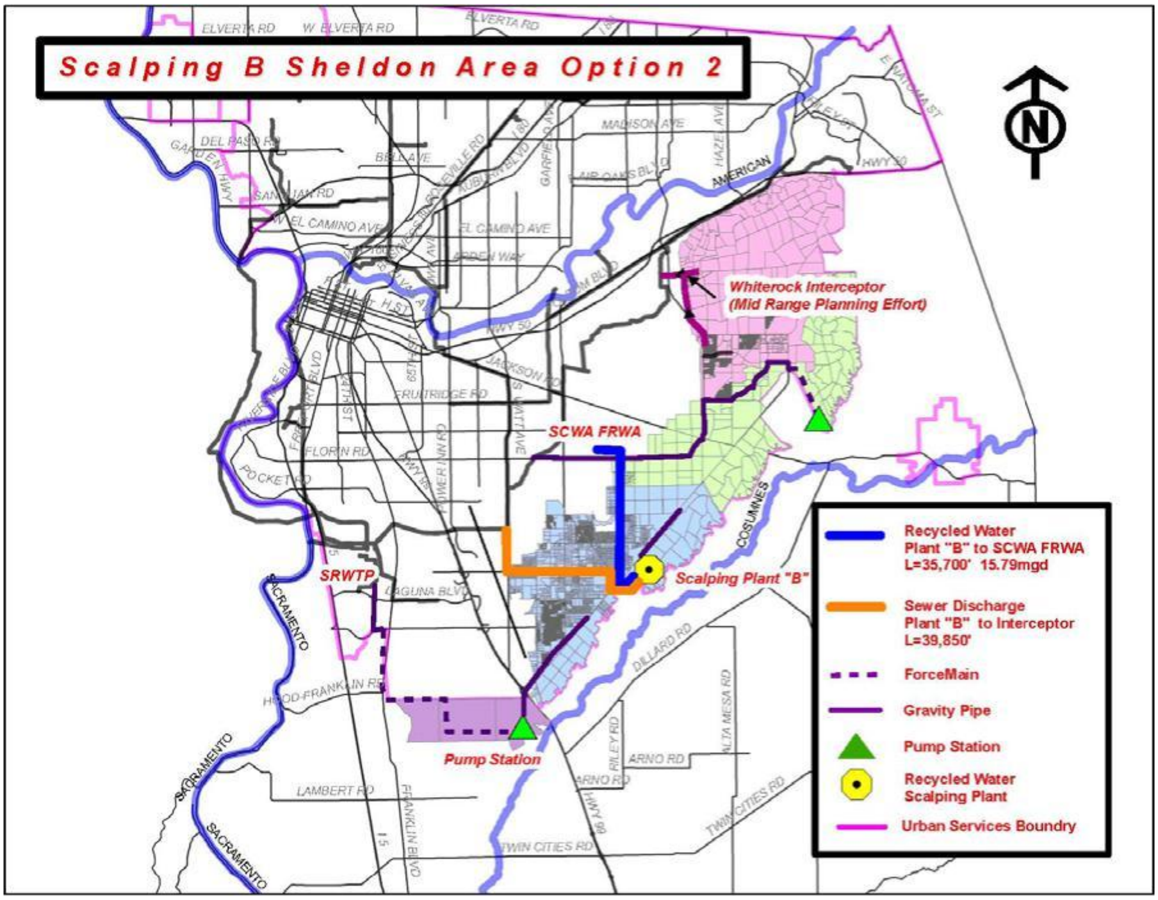
6.3.2 Scalping Alternative B – Sheldon Area Option 2

Flows for this alternative are diverted from the East County area to the Bradshaw Interceptor via the Florin Interceptor. A large portion of the Sheldon area, south of the East County Area, is conveyed by gravity to the Scalping B treatment plant through the Scalping B Interceptor. It was assumed that this scalping facility would only operate for six months out of the year when there is demand for irrigation water. For the months when the scalping plant is not in operation, a separate force main will return flow to the existing Bradshaw Interceptor system. Flows south of the Sheldon area would be conveyed using the Laguna/South Interceptor to the SRWTP.

A pipeline will be constructed from the Scalping B treatment plant to deliver recycled water to central location. A local water provider would then connect to this central location to distribute the water to their customers.

The Scalping B alternative is designed to treat 35 MGD of flow from the interceptor system. This alternative treats and recycles the least amount of wastewater; however, it also has the lowest total cost at $1.14 billion.

Figure 6.4 Scalping B Sheldon Area Option 2

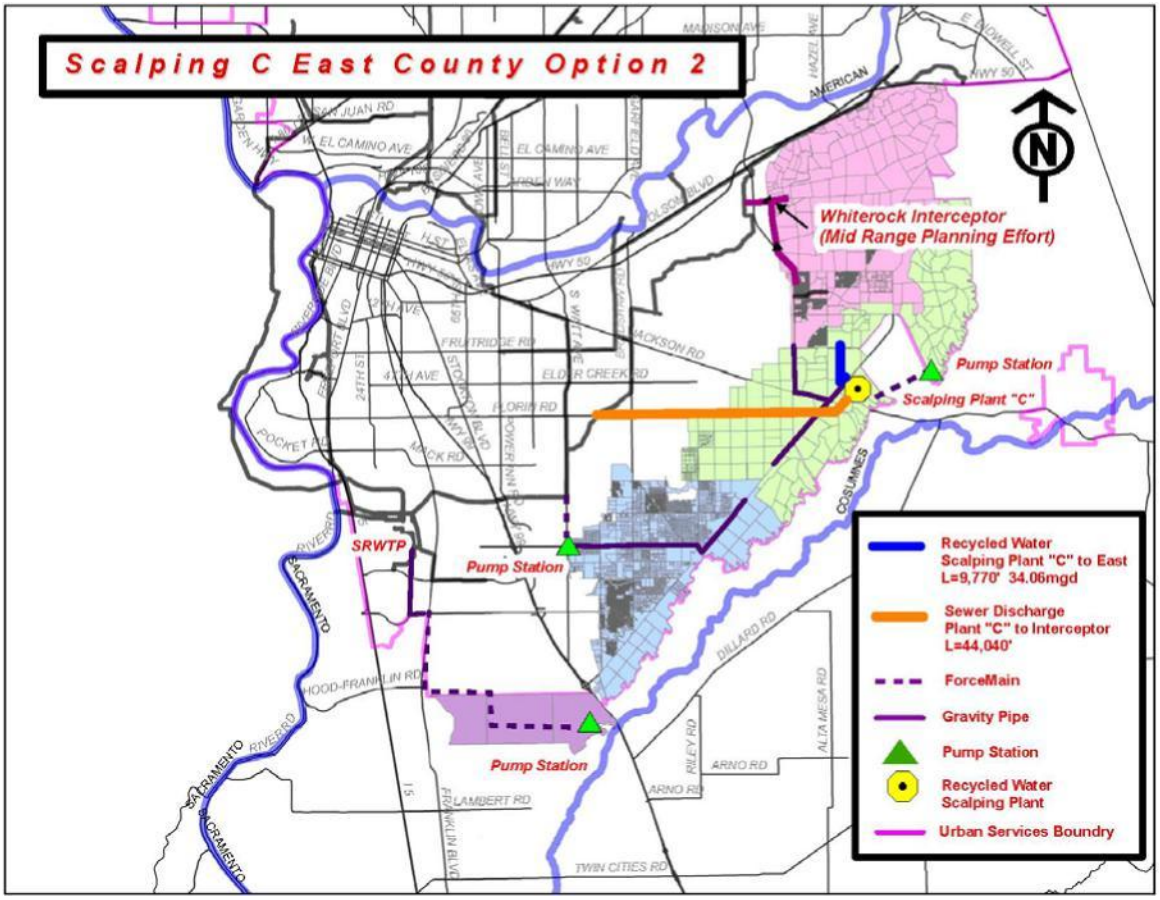


6.3.3 Scalping Alternative C - East County Option 2

This alternative sends flows from the East County area to the Scalping C plant. A 20 MGD pump station and force main will transport flows from the Cordova Hills area directly to the scalping plant. Flows from the East County Area will be transported by gravity using the Scalping C Interceptor. It was assumed that the scalping facility would only operate for six months out of the year when there is demand for irrigation water. For the months when the scalping plant is not in operation, a separate force main will return flow to the existing Bradshaw interceptor system. Wastewater from the Sheldon area would be gravity fed west to the SRWTP via the Sheldon Interceptor while the South Area flows would be conveyed north to the SRWTP via the South Interceptor which consists of a 26 MGD pump station and force main.

A pipeline will be constructed from the Scalping C treatment plant to deliver recycled water to a central location. A local water provider would then connect to this central location to distribute the water to their customers. The Scalping C alternative is designed to treat 70 MGD of flow from the interceptor system. This alternative treats and recycles the second least amount of wastewater; however, it also has the second lowest total cost at $1.81 billion.

Figure 6.5 Scalping B East County Option 2



6.4 Alternatives Analysis

6.4.1 Cost Analysis

A breakdown of the total costs for centralized treatment alternatives is shown in Table 6.1. The South Area Recycled Water – Conveyance Option 3 alternative has the lowest total project cost but provides the least amount of recycled water. However, the benefits of the centralized treatment options are that they provide flexibility in the amount of recycled water delivered by modifying the size of piping and the pumping facility.

Table 6.1 Centralized Treatment Alternatives Cost Analysis Summary				
Alternative	**Total Capital Cost ($Millions)**	**NPV of O&M ($Millions)**	**Total Cost ($Millions)**	**Potential Recycled Water Capacity (MGD)**
South Area Recycled Water – Conveyance Option 3	$540	$334	874	12.2
Sheldon Area Recycled Water – Conveyance Option 3	$542	$416	958	15.8
East County Recycled Water – Conveyance Option 3	$767	$852	1619	34.1

A breakdown of the total costs for scalping treatment alternatives is shown in Table 6.2. The Scalping B Sheldon Area Option 2 alternative has the lowest total project cost but provides the least amount of recycled water. Since the operation and maintenance costs for a scalping treatment facility is higher than centralized treatment at the SRWTP, the costs for the scalping options are higher than the centralized treatment options.

Table 6.2 Scalping Treatment Alternatives Cost Analysis Summary				
Alternative	**Total Capital Cost ($Millions)**	**NPV of O&M ($Millions)**	**Total Cost ($Millions)**	**Potential Recycled Water Capacity (MGD)**
Scalping B Sheldon Area Option 1	$852	$1360	$2,212	42.5
Scalping B Sheldon Area Option 2	$602	$533	$1,135	15.8
Scalping C East County Option 1	$779	$1,080	$1,859	34.1
Scalping C East County Option 2	$771	$1,088	$1,817	34.1

6.4.2 Risk Analysis

Using the criteria in Technical Memorandum 8 – Alternatives Risk Analysis, a risk assessment was done on all centralized and scalping treatment alternatives. The centralized treatment alternatives have a lower risk cost than the scalping treatment alternatives. The risk costs of individual alternatives are shown in Table 6.3 and 6.4.

Table 6.3 Centralized Treatment Alternatives Risk Analysis Summary									
Alternative	Asset Service and Reliability	Environment	Financial	Legal	Public Health	Public Trust	Regulatory	**Total Annual Risk Cost**	**40 yr NPV** (5% Inflation, 5% Discount)
South Area Recycled Water – Conveyance Option 3	Low $2,000	Low $2,000	Low $500	Medium $20,000	Medium $20,000	Low $500	Medium $20,000	$95,000	$3,619,000
Sheldon Area Recycled Water – Conveyance Option 3	Low $2,000	Low $2,000	Low $500	Medium $20,000	Medium $20,000	Low $500	Medium $20,000	$95,000	$3,619,000
East County Recycled Water – Conveyance Option 3	Low $2,000	Low $2,000	Low $500	Medium $20,000	Medium $20,000	Low $500	Medium $20,000	$95,000	$3,619,000

Table 6.4 Scalping Treatment Alternatives Risk Analysis Summary									
Alternative	**Asset Service and** Reliability	Environment	Financial	Legal	Public Health	Public Trust	Regulatory	**Total Annual Risk Cost**	**40 yr NPV** (5% Inflation, 5% Discount)
Scalping B Sheldon Area Option 1	Low $5,000	Low $2,000	Low $500 0	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000
Scalping B Sheldon Area Option 2	Low $5,000	Low $2,000	Low $500 0	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000
Scalping C East County Option 1	Low $5,000	Low $2,000	Low $500 0	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000
Scalping C East County Option 2	Low $5,000	Low $2,000	Low $500 0	Medium $50,000	Medium $200,000	Low $2,000	Medium $50,000	$314,000	$11,962,000

6.5 Recommendations

Staff has reviewed three different options for providing recycled water to the South, Sheldon, and East County areas: Centralized facilities at the SRWTP, and Decentralized (both Satellite and Scalping) facilities located away from the SRWTP. Of these options, Staff recommends using the SRWTP Centralized treatment alternatives as the most cost effective means of providing service, while providing the maximum flexibility for future growth of the service area.

7.0 LONG RANGE CAPITAL FUNDING PROJECTION

7.1 Introduction

The recommended SRCSD Long Range Capital Funding Plan includes 3 expansion interceptor reaches required to provide service to existing and planned development in the expansion areas of the SRCSD service area over the next 35 years. The total cost of the ISS expansion facilities is $237,247,000. This cost is in 2010 dollars and does not include inflation or interest adjustments. Recycled water project opportunities are being evaluated in the Water Recycling Program and will be planned separately from this ISS.

7.2 Schedule

Projects are assumed to start design and construction when the shed is generating enough flow to achieve a peak dry weather flow (PDWF) of 3.0 feet per second. The number of ESDs required to attain minimum flow is based on equations derived from the hydraulic model using the ISS flow generation criteria described in Chapter 4. The projects are assumed to be implemented programmatically with each interceptor reach having an implementation time frame of 8 years including design and construction. The following table provides an estimate of the when development provides the minimum flow for the interceptor construction. Interceptors will be constructed after the flow criteria is met and other services have reached their capacity.

Table 7.1 Project Timing

Interceptor Reach	Minimum Cleansing Flow (PDWF)	ESDs	Max. PWWF	[1]Date planned	Cost (2010 $)
Aerojet Interceptor	7.5 MGD	122,250	64.4	2030	$36.3M
White Rock Interceptor	2.5 MGD	166,365	90.9	2020	$19.5M
[1]Florin Interceptor	7.5 MGD	39,819	28.9	2035	$38.9M
Elder Creek Interceptor	7.2 MGD	11,930	9.5	2038	$9.5M
Douglas Interceptor	7.1 MGD	49,538	25.7	2025	$19.5M
[2]South Interceptor	6.5 MGD	40,445	25.9	2044	$77.9M
Dry Creek Interceptor				TBD[3]	$9.5M
Rio Linda Interceptor				TBD[3]	$14.5M
Folsom Pump Station				TBD[3]	$11.3M
				Total	**$236.9M**

1 Date planned is the year that the minimum cleansing flow is reached
2 South Interceptor is a different from the MP2000 South Interceptor 1, 2, 3.
3 TBD: To be determined based on development need

7.3 MP2000 and 50-Year Funding

SRCSD capital funding needs are updated periodically based on changing projections in revenues and expenses. In 2003, the Master Plan 2000 was approved by the SRCSD Board of Directors which included a recommended capital improvement program. Since 2003, many of the recommended projects have been completed. The recommended ISS projects eliminate the need for the following projects identified in MP2000:

- Laguna Creek Interceptor
- Grant Line Interceptor
- South Interceptor (changed substantially)
- Sunrise Interceptor
- Aerojet Interceptor 2
- Aerojet Interceptor 2S
- Aerojet Interceptor 3
- Aerojet Interceptor 3S
- Aerojet Interceptor 4
- Mather Interceptor

In 2009, the 50 Year Funding Needs Projection report was completed to help establish long term funding requirements from capital and operating expenses. The capital improvement projects identified in the report were based on MP2000 with updated costs and schedules. The capital expansion projects identified in the report are still valid with the exception of the MP2000 projects that are eliminated by the recommended ISS projects.

7.4 Project Verification

Project timing is based on development that is anticipated far into the future. Deviations from the land uses and growth patterns in this study could significantly change the recommended projects. It is recommended that this information be reviewed frequently to ensure that the recommended projects are still viable.

8.0 CONCLUSION

The ISS evaluated the proposed interceptors in MP 2000 to consider opportunities to reduce future interceptor costs. A performance criteria was applied to consider the optimum use of capacity in the existing interceptor system. The ISS produced a readily useable hydraulic sewer model to evaluate the performance of the proposed interceptor system. The ISS also considered satellite wastewater treatment facilities to reduce the number and length of interceptors while increasing recycled water opportunities in the East County and South areas.

Interceptor projects planned in MP2000 for the north County were not further evaluated because more detailed evaluations were previously performed and concluded the proposed interceptors in MP2000 were the lowest cost project alternatives.

Table 8.1 lists the status of MP2000 projects. Projects with the "Complete" status are constructed and in service. Projects that have the status of "Delayed" are planned for a later date due to slowed development and will be re-evaluated as development picks up in the region. Projects with the status of "Replaced" were evaluated in the ISS and new projects will replace those in MP2000.

Table 8.1 Status of MP2000 Project

PROJECT	START	FINISH	STATUS
SRCSD Interceptor Master Plan 2000	1/3/2000	2/16/2001	Completed
Upper NWI Design Report	7/3/2000	5/11/2001	Completed
Lower NWI Design Report	6/8/2000	12/5/2001	Completed
Interceptor Design Manual	1/3/2001	11/13/2001	Completed
Bradshaw Interceptor Section 1 & 2	1/3/2000	10/6/2000	Completed
Bradshaw Interceptor Section 6A	1/3/2000	5/2/2005	Completed
Bradshaw Interceptor Section 6B	1/3/2000	12/1/2004	Completed
Bradshaw Interceptor Section 7	1/2/2001	3/1/2005	Completed
Bradshaw Interceptor Section 8	1/8/2001	1/14/2005	Completed
Sunrise Interceptor Section 1	8/1/2003	8/9/2007	Replaced by SCP
Sunrise Interceptor Section 2	8/1/2003	8/9/2007	Replaced by SCP
Folsom East Interceptor Section 1B	6/5/2000	2/2/2004	Completed
Folsom East Section 3 & Pump Station	1/3/2000	11/29/2002	Completed
Folsom Interceptor Rehabilitation	9/1/2003	9/9/2005	Completed
Laguna Interceptor Extension	2/19/2001	8/2/2004	Completed
North Natomas Interceptor	1/3/2002	7/14/2004	Completed
Arden Pump Station / Force Main	1/3/2000	8/2/2004	Completed
Rancho Cordova Pump Station (Phase 1)	11/1/2000	7/23/2002	Completed
Rancho Cordova Pump Station (Phase 2)	2/15/2018	8/26/2020	Delayed
Upper Northwest Interceptor Section 1	6/2/2003	6/8/2007	Completed
Upper Northwest Interceptor Section 2 & 3	12/3/2004	6/11/2009	Completed
Upper Northwest Interceptor Section 4	4/2/2007	10/9/2009	Completed
Upper Northwest Interceptor Section 5 & 6	2/19/2001	1/14/2005	Completed

Dry Creek Relief	7/8/2002	1/14/2005	Delayed
Upper Northwest Interceptor Section 7 & 8	6/4/2001	4/29/2005	Completed
Upper Northwest Interceptor Section 9	1/3/2007	7/14/2009	Completed
Sacramento Force Main	8/1/2002	11/15/2006	Completed
South Sacramento River Crossing	6/3/2002	9/1/2006	Completed
Yolo Force Main	6/3/2002	10/23/2006	Completed
South River Pump Station (Phase 1)	6/3/2002	10/2/2006	Completed
South River Pump Station (Phase 2)	1/4/2016	4/5/2019	Delayed
South River Pump Station (Phase 3)	1/7/2030	4/8/2033	Delayed
Southport Gravity Sewer	6/3/2002	11/15/2006	Completed
West Sac Collection System Modifications	7/7/2003	1/13/2006	Completed
Barge Canal Crossing	6/3/2002	6/20/2006	Completed
West Sacramento Force Main	6/3/2002	10/6/2006	Completed
North Sacramento River Crossing	6/3/2002	7/17/2006	Completed
Natomas Force Main	6/3/2002	10/2/2006	Completed
Natomas Pump Station (Phase 1)	6/3/2002	10/2/2006	Completed
Natomas Pump Station (Phase 2)	6/1/2007	11/5/2009	Delayed
Natomas Pump Station (Phase 3)	1/4/2012	4/7/2015	Delayed
Natomas Pump Station (Phase 4)	1/6/2020	4/7/2023	Delayed
South Interceptor Section 1	5/7/2007	11/13/2009	Replaced by ISS
South Interceptor Section 2 & Pump Station	10/8/2007	10/14/2011	Replaced by ISS
South Interceptor Section 3	6/14/2010	12/21/2012	Replaced by ISS
Laguna Creek Interceptor Section 1	9/7/2009	3/16/2012	Replaced by ISS
Laguna Creek Interceptor Section 2	3/19/2012	2/12/2016	Replaced by ISS
Laguna Creek Interceptor Section 3	2/15/2016	1/10/2020	Replaced by ISS
Laguna Creek Interceptor Section 4	1/13/2020	12/8/2023	Replaced by ISS
Laguna Creek Interceptor Section 5	1/3/2022	7/12/2024	Replaced by ISS
Laguna Creek Interceptor Section 6 - FM	1/13/2020	7/21/2023	Replaced by ISS
Laguna Creek Interceptor Section 6 - PS	1/13/2020	7/21/2023	Replaced by ISS
Grant Line Road Interceptor Section 1	1/13/2020	7/21/2023	Replaced by ISS
Grant Line Road Interceptor Section 2	7/24/2023	1/29/2027	Replaced by ISS
Mather Interceptor Section 1	7/5/2011	1/12/2015	Replaced by ISS
Aerojet Interceptor Section 1	8/5/2021	2/14/2024	Completed
Aerojet Interceptor Section 2	9/17/2021	3/28/2024	Replaced by ISS
Aerojet Interceptor Section 2S	9/29/2021	4/9/2024	Replaced by ISS
Aerojet Interceptor Section 3	10/25/2021	5/3/2024	Replaced by ISS
Aerojet Interceptor Section 3S	5/6/2024	11/13/2026	Replaced by ISS
Aerojet Interceptor Section 4	2/17/2020	1/12/2024	Replaced by ISS
Rio Linda Interceptor Section 1	2/6/2023	8/15/2025	Delayed
Bradshaw Interceptor Section 6BS	1/4/2021	7/14/2023	Replaced by SCP
Folsom South Pump Station and Force Main	1/3/2020	7/14/2022	Delayed

8.1 Recommendation

After the model evaluations, cost analysis, and risk analysis, the most cost efficient sewer service alternative that provides the most flexibility for development is ***Conveyance-Only Option 4.*** Conveyance-Only Option 4 allows maximum utilization of the newly constructed Bradshaw Interceptor for expansion in the East County and South areas of the Sacramento region as well, providing flexibility to provide sewer service based on development demand.

This ISS report evaluated changes to previous planning documents and included information from the SCP. Proposed trunks in the SCP and interceptor plans from the ISS were evaluated to ensure that the facilities proposed function properly together. The ISS and the SCP used the same hydraulic model for analysis, confirming that both systems work together and that planned gravity trunks flow properly into the interceptors. As mentioned within this report, both SASD and SRCSD will perform more detailed evaluations of the location, timing, and sizing of trunks and interceptors as future development requires new services.

The 2010 SCP proposed a number of additional trunks in lieu of interceptors. A high level cost analysis concluded that the added cost for the trunks was approximately equal to the reduced cost of interceptors. The cost analysis did not consider the timing of capital expenditures because the timing of development and the related need for sewer capacity remains uncertain. However, it is believed that constructing trunks in lieu of interceptors will result in lower cost due to the lower initial capital investment associated with trunk sized facilities compared to interceptors. The reduced initial capital investment will result in lower cost to finance the facilities. Trunk facilities are also generally less disruptive to construct and require less time to plan, design, and construct.

Connection fees are collected to recover the cost of constructing trunks and interceptors. Fees for both SASD and SRCSD are currently based on recovering only the cost of facilities that were constructed in the past and did not include future facilities. Therefore, the fees charged to date would not have changed due to the change in planned facilities. Future fees will need to be adjusted to accommodate the new trunk and interceptor plans.

Staff does not recommend satellite facilities because they are not cost effective. If SRCSD chooses to provide sanitary sewer conveyance through satellite facilities, ***Satellite A South Area Option 3*** would be the most cost efficient and flexible solution to serve the South County and could be evaluated in the future with new technology and regulatory trends. Staff does not recommend the use of satellite facilities for the East County and Sheldon areas.

To provide recycled water to the east and south Sacramento County region, staff recommended centralizing recycled water distribution to provide the most flexibility for SRCSD. This allows SRCSD to treat wastewater to Title 22 tertiary effluent and expand the existing Water Reclamation Facility as needed in future growth areas. Options for recycled water continue to be evaluated as part of SRCSD's Water Recycling Program.