Sacramento Regional County Sanitation District

Interceptor Sequencing Study

Technical Memorandum 3
Flow Generation Criteria

DRAFT
February 2010

Sacramento Regional County Sanitation District

Interceptor Sequencing Study

TECHNICAL MEMORANDUM 3

Flow Generation Criteria

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FLOW GENERATION CRITERIA

1.0 INTRODUCTION

This Technical Memorandum (TM) documents the results of Subtask 2.8 (Recommend Flow Criteria for Sequencing Study) of the Sacramento Regional County Sanitation District (SRCSD) Interceptor Sequencing Study (ISS). The objective of Subtask 2.8 is to develop criteria, called *flow generation criteria,* for estimating flow inputs to the interceptor system. The flow generation criteria will be used in conjunction with *facilities criteria* to evaluate the performance of the interceptor system under various flow scenarios to be considered in the ISS.

Flow generation criteria determine the estimates of flows that must be conveyed by the interceptor system. Examples of flow generation criteria are land use densities, unit flow factors, and infiltration/inflow (I/I) rates. Facilities criteria identify the parameters used to evaluate how interceptor facilities perform or should be designed. Examples of facilities criteria are Manning's 'n' factor, acceptable level of surcharge or freeboard, and minimum and maximum flow velocities. Facilities criteria will be addressed in a subsequent ISS TM.

The ISS project team developed flow generation criteria to be utilized in the ISS. The criteria were presented for approval to the SRCSD Leadership Team at workshops held in March and May 2009. This TM documents the basis for the recommended flow generation criteria, focusing primarily on the criteria to be used for estimating flows from future development. Criteria for determining flows from existing development are largely based on results of hydraulic model calibration, which will be documented in more detail in the ISS TM on model development.

This TM is divided into the following sections:

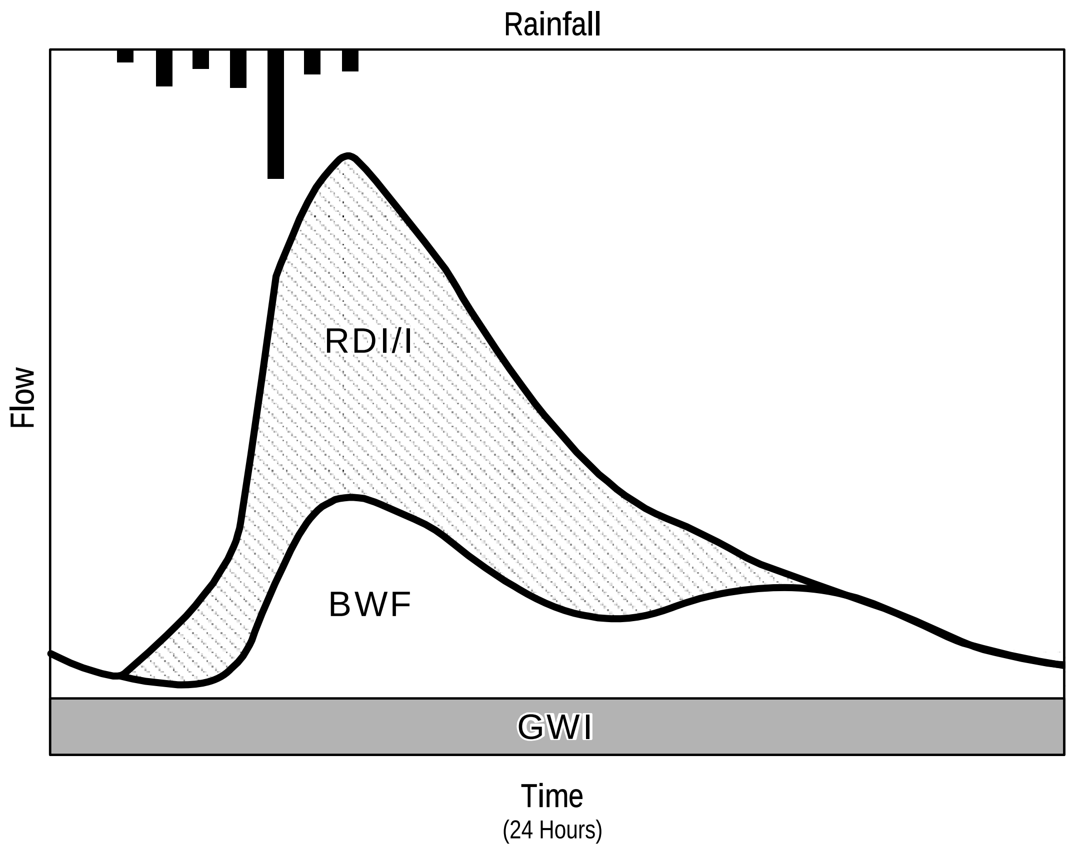
1. Introduction
2. Wastewater Flow Components
3. Realistic and Conservative Flow Scenarios
4. Consolidated Land Uses and Density Assumptions
5. Domestic Flow Factor
6. Diurnal Flow Patterns
7. Infiltration/In flow Factors
8. Design Storm
9. Summary

2.0 WASTEWATER FLOW COMPONENTS

Wastewater flows typically include three components: base wastewater flow (BWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I). BWF represents the sanitary and process flow contributions from residential, commercial, institutional, and industrial users of the system. GWI is groundwater that infiltrates into the sewer through defects in pipes and manholes. GWI is typically seasonal in nature and remains relatively constant during specific periods of the year. RDI/I is storm water inflow and infiltration that enter the system in direct response to rainfall events. RDI/I can occur through direct connections such as holes in manhole covers or improperly connected roof leaders or area drains, or through defects in sewer pipes, manholes, and service laterals. RDI/I typically results in short term peak flows that recede quickly after the rainfall ends. The term I/I refers to the combination of GWI and RDI/I.

These three flow components are illustrated conceptually in Figure 3.1. For the ISS and as depicted in Figure 3.1, the timing of the BWF peak and the RDI/I peak are assumed to coincide, which would represent the worst case scenario resulting in the greatest estimate of wastewater flows to be conveyed.

Figure 3.1 Wastewater Flow Components



Base wastewater flows are typically determined based on the type of users or land uses (e.g., residential, commercial, industrial) and associated densities, unit flow factors, and diurnal flow patterns. In the case of SRCSD, the flow contributions from various types of users are converted to units of equivalent single family dwelling units (ESDs). One ESD represents the flow equivalent of the average wastewater flow generated by a typical single family home. SRCSD's largest contributing agency, the Sacramento Area Sewer District (SASD), maintains a database of existing ESDs for each parcel in its service area.

I/I flows are dependent on a number of factors including the age and condition of the sewers in a given area, as well as local groundwater level, soil type, topography, and relative rainfall. Therefore, GWI and RDI/I must be determined based on actual flow monitoring data. SRCSD and its contributing agencies currently and historically have monitored flows in various locations. This data forms the basis for estimating I/I flows in the SRCSD system, as will be discussed later in this TM.

3.0 REALISTIC AND CONSERVATIVE FLOW SCENARIOS

SRCSD provides wastewater conveyance, treatment and disposal services to four contributing agencies; SASD, the City of Sacramento, the City of Folsom, and the City of West Sacramento. These four contributing agencies provide wastewater collection services to a total of seven land use authorities including the contributing agency cities, the County of Sacramento, the City of Citrus Heights, the City of Elk Grove, and the City of Rancho Cordova. With the exception of the City of West Sacramento, the SRCSD sphere of influence or planned ultimate service area is coterminous with Sacramento County's Urban Services Boundary (USB). Properties within the USB are identified in the Sacramento County General Plan as ultimately requiring urban services. In general, the existing SRCSD service area is coterminous with the County's Urban Policy Area (UPA) and the incorporated limits of each of the contributing agency cities. The exceptions include the unincorporated communities of Courtland and Walnut Grove which are sewered by SASD, but are not included in either the UPA or USB. A third exception is the unincorporated community of Rancho Murrieta, which is designated as an isolated urban policy area served by its own private collection and treatment systems.

The previous SRCSD Interceptor System Master Plan (Master Plan 2000) utilized a blanket assumption of 6 equivalent single family dwelling units (ESDs) per acre minimum as the basis for estimating base wastewater flows for the entire (existing and future) SRCSD service area. This density assumption was used for both performance evaluation of existing interceptors and design (sizing) of future interceptor facilities. While this assumption provided a simple and consistent methodology for estimating flows, it was suspected of being too simplistic and possibly overly conservative for purposes of evaluating existing interceptor system performance and timing of the need for new interceptor facilities.

Therefore, a different approach was developed for the ISS. Specifically, two flow scenarios have been defined: a *realistic* scenario intended to more credibly project land use densities for future development and redevelopment and a *conservative* scenario to be used primarily for sizing future interceptor facilities. The realistic flow scenario is to be used primarily for assessing interceptor performance and facility timing and was created using the actual development density characteristics of recent residential and commercial projects. The realistic flow scenario represents the ISS team's best estimate of *likely* future development density or growth within the SRCSD service area. The purpose of the realistic scenario is to provide estimates for evaluating how interceptor facilities are actually performing and thereby more accurately assess the potential risk of overflows or backups in the system and identify the timing of need for new facilities. ; The conservative scenario represents a more cautious estimate of each land use jurisdiction's planned development. The conservative flow scenario was created using an estimate of potential development densities based on each land use jurisdiction's identified upper limit for allowable densities within each land use category. Another deviation from previous SRCSD Interceptor planning efforts is that areas (parcels) that are already developed and connected to the sewer system are assumed to continue to contribute flow based on their existing ESDs or land use densities and will not redevelop to higher densities unless specifically identified for redevelopment by an overriding planning document such as a specific plan, redevelopment plan, “corridor” study, or similar plan. The basis for the realistic and conservative land use density assumptions for future development and redevelopment is presented in the next section of this TM.

4.0 CONSOLIDATED LAND USES AND DENSITY ASSUMPTIONS

The source documents for identifying future land use densities for the ISS are the General Plans and other planning documents of the seven planning jurisdictions located within the SRCSD service area: the Cities of Sacramento, Folsom, West Sacramento, Elk Grove, Citrus Heights, and Rancho Cordova, and the County of Sacramento. Each of the land use agencies was contacted and the most current land use documents were obtained and reviewed as discussed in ISS Draft TM1, Land Use Planning and Growth Criteria. Appendix A contains a listing of the documents reviewed.

To simplify data management and model input, 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 3.1. CLU categories were created starting with the existing set of categories used by the SASD Master Plan. These categories were modified and new categories were created as needed to provide a set of anticipated land use densities that would be consistent with the contributing agency planning documents. To accomplish this, a CLU category was assigned to each contributing agency land use designation based on a best-fit of the allowable land use density. Tables comparing CLU categories to contributing agency planning document land use designations were used as the basis for the assignment of each land use designation to the consolidated categories. These tables are contained in Appendix B. The land use maps of the various jurisdictions were also consolidated into a Consolidated Land Use Map in GIS format. The specific GIS files and process used to create the CLU Map are documented in Appendix C. (Note that as more specific land uses for certain developments become available through preparation of sewer studies or other similar documents, is anticipated that SRCSD Capacity Management section staff will update the CLU GIS mapping as appropriate to develop the most realistic estimates of future land uses for these areas.)

Table 3.1 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 Sacramento County General Plan.
(4) Land use categories and density ranges from the City of Sacramento 2030 General Plan.
(5) Recommended values from ISS Team.
(6) Exception category meant for use with Public & Quasi-Public lands greater than 100 acres that may develop at higher or lower densities. Capacity Management staff will input density for these parcels on a case-by-case basis based on data from sewer studies.
(7) Special Planning Area shown as a single polygon on the Consolidated Land Use Map.

For each CLU category, the team determined the appropriate realistic and conservative densities to be used for future development and redevelopment. Under the realistic scenario, the density for each category was assumed to be the 50th percentile of the density distribution of existing development as calculated by SRCSD Capacity Management (see analysis in Appendix D). Where existing density distributions could not be calculated, values were assigned based on other analyses including historic assumptions and continuity between categories. Notes presented in Table 3.1 document the development of the densities for each CLU category.

The conservative scenario assumes the 85th percentile density distribution for each land use category, based on existing development. Where existing density distributions could not be calculated, values were assigned based on additional analysis and values assigned under the realistic scenario. Appendix E contains detailed documentation for the calculation of realistic and conservative densities.

Note that the densities presented in Table 3.1 are expressed in units of ESDs per acre. to account for multi-family land use densities, residential land uses with densities greater than 10 dwelling units per acre (DU/ac), being consistent with multi-family densities, were multiplied by 0.75 to convert from DU/ac to ESD/ac., as defined within existing SRCSD Sewer Ordinances. ESD densities for non-residential land uses are based on values determined through analysis of data for existing non-residential customers.

A few new land use categories were created for the ISS to encompass certain types of land uses that did not fit well into one of the previously used categories. Special consideration was also required for some special planning areas that did not have GIS land use mapping. These special categories are described 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. The FUDA densities are based on actual development densities of North Natomas, which was found to provide the most representative modern green-field development with a complete mix of land use categories.

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. The County commercial corridors identified on the County of Sacramento General Plan Land Use Map were indicated as single polygons in the CLU Map using the MU code. Corridor plans for North Watt Avenue, Fair Oaks Boulevard, and Florin Road were examined to be consistent with the MU category.

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. The realistic and conservative densities were calculated as described in Appendix D.

Exception (EXC). There are a number of large parcels/polygons classified as Public and Quasi-public (PQP) in the CLU Map. Likely the ESD densities for the normal PQP category would overestimate the flow from some of these parcels, so manual editing may be needed on a case-by-case basis. Densities are not provided for these EXC parcels, as it is anticipated that Capacity Management would use sewer study data or other information in lieu of the CLU Map to develop ESD estimates for these parcels.

Special Planning Area (SPA). In some cases, GIS mapping was not available for some specific plan or special planning areas. In these cases, the land use categories in the area were assigned to the CLU codes, if appropriate, or tabular data were used to compute an overall ESD density for the SPA. In the latter cases, the SPA is shown as a single polygon on the CLU Map, with its own CLU code and associated realistic and conservative densities. These specific plans are also identified in Table 3.1 with their associated CLU codes and land use densities.

City of Folsom. The consolidated land use approach was not used to develop flow estimates for areas within the current City of Folsom boundaries; instead the City's InfoWorks model for the buildout scenario was used. The densities and flow factors used in the InfoWorks model, as documented in the City's Collection System Capacity Analysis Update reports (2006 and 2008), were compared to the values from the CLU table. The model values appeared to approximately represent the conservative buildout scenario densities. A typical ratio of conservative densities to realistic densities is 0.7 for the consolidated land use categories; therefore, the realistic scenario land uses for Folsom were established by multiplying the quantities in the buildout InfoWorks model by 0.7. However, the buildout estimates for the Folsom South of Highway 50 area are based on the CLU categories and densities listed in Table 3.1. The land use planning documents for this future growth area provide more detailed information than accounted for in Folsom's Infoworks Sewer Model. Figures 3.2 and 3.3 show the variation in ESD densities throughout the SRCSD service area for the realistic and conservative scenarios, respectively, based on the CLU Map. It should be emphasized that although the CLU Map covers the entire future SRCSD service area, the CLU Map and land use densities are intended to be applied only to areas of future new development and redevelopment. As noted previously, both the realistic and conservative scenarios assume that existing developed areas, unless identified specifically for redevelopment, are assumed to remain at current densities.

As land use mapping is critical to flow generation, it is recommended that SRCSD review and update the consolidated land use information as more current or specific planning documents are approved. ESD density assumptions should also be reviewed periodically and updated as necessary.

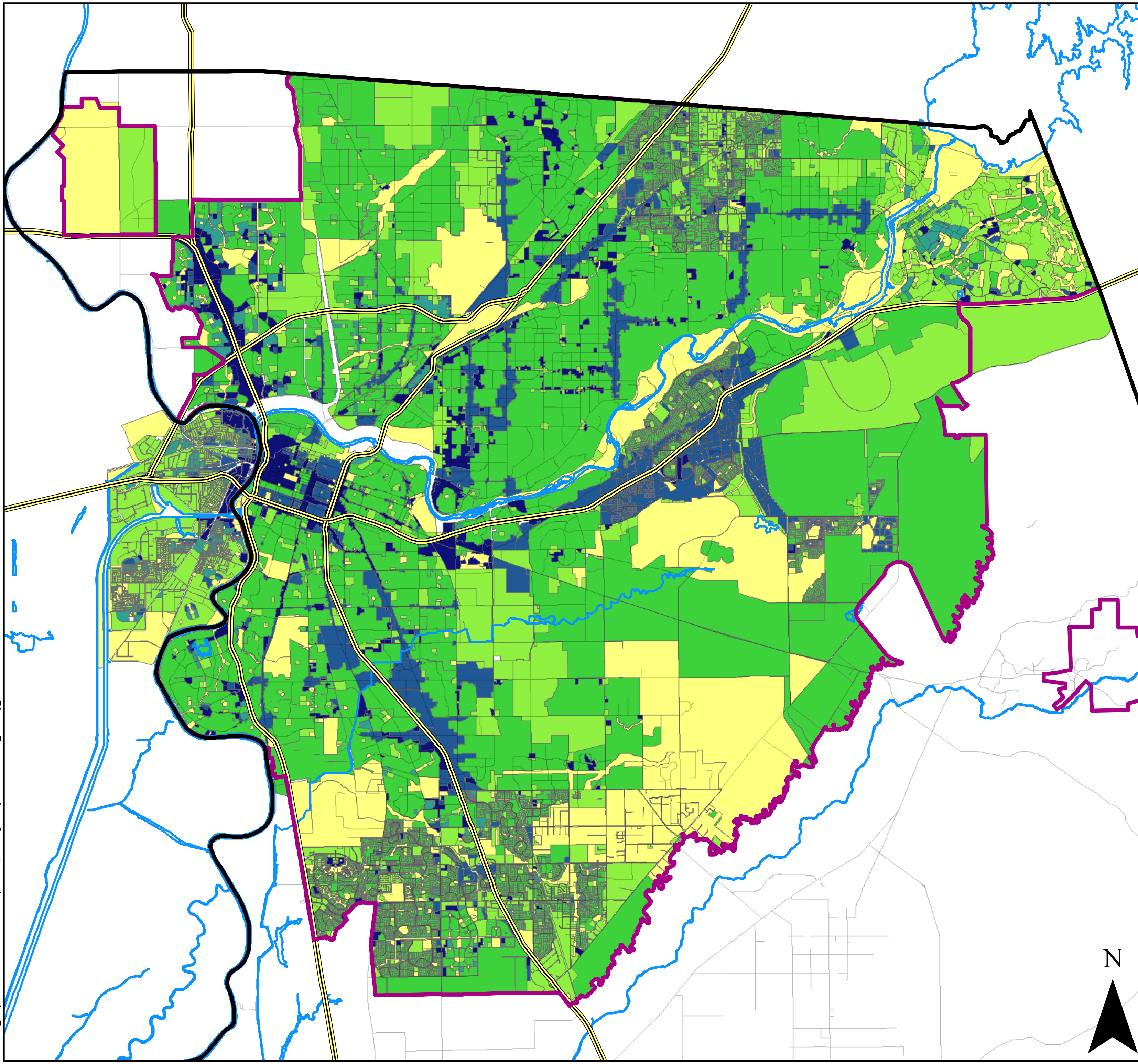


Figure 3.2 Variations in Realistic ESD Densities

Legend

- 0 - 0.5 ESD/ac
- 0.6 - 3.5 ESD/ac
- 3.6 - 6.0 ESD/ac
- 6.1 - 10.0 ESD/ac
- 10.1 - 15 ESD/ac
- > 15 ESD/ac
- County Boundary
- Urban Services Boundary

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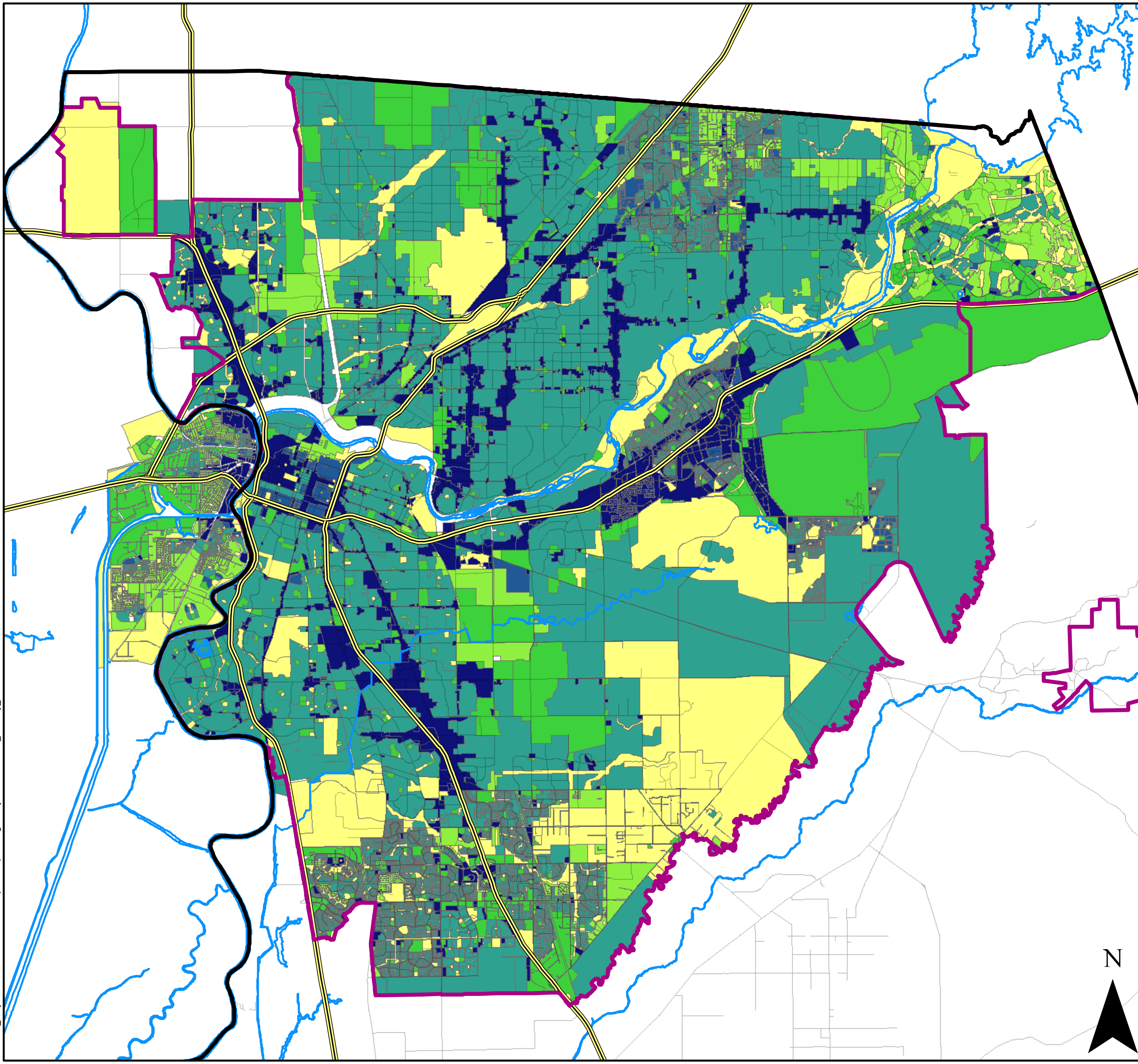

Figure 3.3 Variations in Conservative ESD Densities

Legend

- 0 - 0.5 ESD/ac
- 0.6 - 3.5 ESD/ac
- 3.6 - 6.0 ESD/ac
- 6.1 - 10.0 ESD/ac
- 10.1 - 15 ESD/ac
- > 15 ESD/ac
- County Boundary
- Urban Services Boundary

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5.0 DOMESTIC FLOW FACTOR

The ESD flow factor is the basis for converting land use estimates to base wastewater flows. For the past 15years, SRCSD has used a value of 310 gallons per day (gpd) per ESD for planning, evaluation, and design of its interceptor system. This value was developed as part of the work conducted for the 1994 Sacramento Sewerage Expansion Study based on analysis of permanent monitoring data at several key locations in the SRCSD system. That analysis determined that the average ESD flow at that time was about 280 gpd; however, it was decided to use a value about 10 percent higher for purposes of interceptor system master planning and design.

Recent flow monitoring conducted by the Capacity Management section indicates that ESD rates vary throughout the service area. For purposes of developing a typical average ESD value, Capacity Management analyzed historical flow monitoring data from a number of sites representing large trunk and interceptor sheds and determined that 250 gpd/ESD represents a realistic flow factor for the overall service area. A summary of this analysis is included in Appendix F.

It is therefore recommended that an ESD flow factor of 250 gpd be used to estimate BWF for new development areas for the ISS. This lower value than historically used is considered reasonable in that new development areas will be constructed with metered water systems and low flow fixtures to encourage water conservation. However, for areas of existing development, model-calibrated ESD flow factor values based on flow monitoring would be used for both existing and future flow scenarios.

It should be noted that the ESD flow factor is intended to represent typical *dry weather flow*, which in some cases may include some amount of dry weather GWI in addition to base wastewater (sanitary) flow.

6.0 DIURNAL FLOW PATTERNS

Diurnal flow patterns represent the hourly variation in base wastewater flows throughout the day. Diurnal patterns vary based on type of land uses, size of upstream tributary area (or, alternately, time of flow travel to the point of connection to the interceptor system), and day of the week (e.g., weekday vs. weekend). For the ISS, it is recommended that diurnal patterns be based on model-calibrated values from flow monitoring data to the extent possible. For new development areas, a typical diurnal pattern based on an average of monitored areas (e.g., SASD's standard residential diurnal curves) would be used.

7.0 INFILTRATION/INFLOW FACTORS

I/I factors include parameters to estimate groundwater infiltration and rainfall-dependent I/I.

7.1 Groundwater Infiltration

GWI is extraneous flow that enters the sewer system underground due to localized and often seasonally elevated groundwater levels. As such, 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.

For the ISS, GWI rates have been determined for each contributing agency sewershed through the model calibration process. For SASD, GWI is assumed to be included in the ESD unit flow factor. For the non-SASD contributing agencies (Cities of Sacramento, Folsom, and West Sacramento), GWI rates were estimated based on flow monitoring data through the process of developing and calibrating contributing agency flow inputs to the interceptor model. This process, including the resulting GWI rates, will be presented in the subsequent ISS TM on Interceptor Model Development.

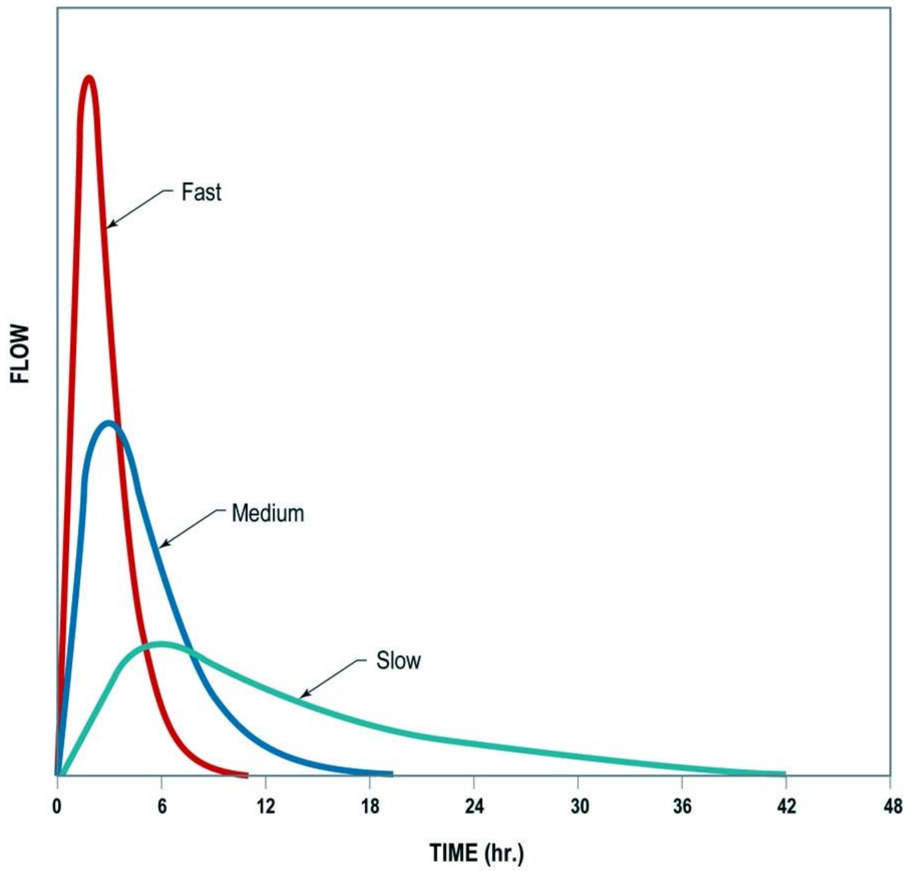
Because GWI is area-specific, it is recommended that GWI rates for new development areas be estimated based on engineering judgment using calibrated values from similar, adjacent areas, taking into consideration the materials used and age of the existing system.

7.2 Rainfall-Dependent Infiltration/Inflow

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. The parameters are applied in the model to a specific rainfall event to generate RDI/I hydrographs for each contributing sewershed. Conceptually, the RDI/I hydrographs may be separated into components, each representing a different time of response to rainfall: fast, medium, and slow. This concept is illustrated in Figure 3.4.

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 SASD Master Plan. 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. This process, including the resulting RDI/I percentages, will be presented in the subsequent ISS TM on Interceptor Model Development.

Figure 3.4 RDI/I Hydrograph Components



In the SRCSD area, RDI/I percentages typically range from less than 1 percent to over 10 percent in some cases. For the ISS, the project team recommends that a *minimum* RDI/I percentage be established, recognizing that all sewer systems will contribute some amount of I/I over the course of their useful lives. Newer sewer systems, typically constructed of more watertight materials and better pipe joints, will likely exhibit lower I/I rates than older systems. The recommended minimum RDI/I percentages are 0.6 percent for the realistic flow scenario and 1.0 percent for the conservative scenario. The recommended RDI/I peak flow response for both scenarios is the fast component. These values are supported by data from monitored flows for areas in the SRCSD service area constructed within the last 15 years.

8.0 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. In the case of SRCSD and SASD, the 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 lowest portions of the service area, with the rainfall increasing proportionately at higher elevations. The variation in rainfall with elevation is as defined in the Sacramento City and County Drainage Manual.

It should be noted that the impact of a synthetic storm such as the one described above may vary based on the assumptions made as to the timing of the storm with respect to the diurnal BWF, and flow travel time through the system. A short-duration, high intensity event, when assumed to coincide with the diurnal peak BWF, may result in a high peak flow in upstream areas of the system, but may not necessarily be critical for interceptors serving very large areas, because the timing of peak flows from various upstream areas of the system may not necessarily coincide. For these areas, longer duration, lower intensity events may be more significant.

For the ISS, an alternate approach for defining the design storm has been utilized. This approach is similar to the concept of a “performance storm” that SASD has developed for its sewer system planning. The 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. The model is calibrated to develop a relationship between rainfall and I/I based on flow and rainfall data from recent years, and then the calibrated parameters are applied to simulate a long-term flow record that can be statistically analyzed to rank the historical events based on magnitude of peak flows. The continuous simulation approach was documented in ISS Draft TM 2, Design and Performance Storms Approach for Modeling Spatial Rainfall Variation.

Based on the continuous simulation analysis documented in 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. As a bonus, it was a recent event that occurred during the continuous simulation model calibration period, and there is radar rainfall data available to accurately determine the storm rainfall in every portion of the SRCSD service area. In addition, the event is more “real,” in that most people can recall it and have a feel for its magnitude from personal experience. SASD has already adopted the December 31, 2005 storm as a performance event, and the City of Folsom, the only other of the SRCSD contributing agencies that utilizes a fully dynamic hydraulic model, also uses the December 31, 2005 storm as its design event.

Therefore, the December 31, 2005 storm is recommended as the design event for the ISS for both system performance evaluation and design.

9.0 SUMMARY

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

APPENDIX A
LAND USE DOCUMENTS

Land use data from the following planning documents were reviewed and included in the development of the consolidated land use spreadsheet contained in Appendix B:

County of Sacramento

- County of Sacramento General Plan - *Draft May 30, 2007*
- Elverta Specific Plan - *Final August 2007*
- Natomas Joint Vision Background Report - *November 12, 2008*
- Fair Oaks Boulevard Corridor Plan - *Progress Draft February 2, 2009*
- Florin Road Corridor Plan Overview - *November 2008*
- North Watt Avenue Corridor Plan - *Public Draft October 21, 2008*

City of Sacramento

- City of Sacramento 2030 General Plan - *Public Review Draft May 2008*
- McKinley Village Land Use Summary Website (http://www.mckinleyvillage.net/access.html)
- Delta Shores PUD Design Guidelines - *October 2006*
- Sacramento Railyards Specific Plan - *Public Review Draft November 2007*

City of West Sacramento

- City of West Sacramento General Plan Policy Document - *Revised and adopted December 8, 2004*

City of Citrus Heights

- City of Citrus Heights General Plan - *November 2000*
- Stock Ranch Guide for Development - *Amended February 2003*
- Auburn Boulevard Specific Plan - *April 2003*

City of Rancho Cordova

- City of Rancho Cordova General Plan - *Adopted June 26, 2006*
- Folsom Boulevard Specific Plan - *Adopted November 2006*
- Rio Del Oro Specific Plan - *December 2006*

City of Elk Grove

- City of Elk Grove General Plan - *Adopted November 11, 2003*
- Laguna Ridge Specific Plan - *June 2004*
- Old Town Special Planning Area Design Standards and Guidelines - *Adopted August 2005*
- Southeast Area Specific Plan - *December 2006*
- South Pointe (Sterling Meadows) Special Planning Area - *City Council Staff Report, File EG-01-130, May 28, 2008*
- Triangle Special Planning Area Comprehensive Plan - *April 2004*
- South of Kammerer Road City Expansion

City of Folsom

- City of Folsom Wastewater Collection System Capacity Management Update - *February 2008*
- Folsom Plan Area Specific Plan - *Proposed Land Use Plan September 22, 2008*

County of Sutter

- Sutter Pointe Specific Plan - *July 2006*

Sacramento Area Sewer District (SASD)

- Master Plan 2002

APPENDIX B
CONSOLIDATED LAND USE SPREADSHEETS

Consolidated Land Uses					
LU_DESC	**CLU_CODE**	**LAND _CODE (a)**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Description**
AGRICULTURAL-RESIDENTIAL	AR	10	0.65	0.73	(0.65 & 0.73 du/ac) - From ESD analysis of existing parcels for 50th and 85th percentiles. Rural residential uses, e.g. animal husbandry, small-scale agriculture, and other limited agricultural activities.
VERY LOW DENSITY	VLDR	11	1.5	3.2	(1.5 & 3.2 du /ac) - From ESD analysis of existing parcels for 50th and 85th percentiles.
LOW DENSITY (NORMAL) RESIDENTIAL	LDR	20	5.5	7.1	(5.5 & 7.1 du/ac)- From ESD analysis of existing parcels for 50th and 85th percentiles.
MEDIUM LOW DENSITY	MLDR	21	8.3	10.	(Target: 10 du/ac, Range: 6.5-15 du/ac) - Target value from SASD Master Plan 2002.
MEDIUM DENSITY RESIDENTIAL	MDR	30	12	15	(Target: 15 du/ac, Range: 10-22 du/ac) - Target value from SASD Master Plan 2002.
MEDIUM HIGH DENSITY	MHDR	31	17	21	(Target: 22 du/ac, Range: 15-30 du/ac) - Target value from SASD Master Plan 2002.
HIGH DENSITY RESIDENTIAL	HDR	190	27	34	(Range: 22 - 50 du/ac) - Target value from SASD Master Plan 2002. Multiple-floor apartments and
FUTURE URBAN DEVELOPMENT AREA	FUDA	200	6.0	8	
MIXED USE	MU	32	14	20	Range: 6 - 30 du/ac
TRANSIT ORIENTED DEVELOPMENT	TOD	42	30	35	Range: 30 - 50 du/ac - High Intensity Transit Oriented Development / Mixed Use
CENTRAL BUSINESS DISTRICT	CBD	194	104	192	Downtown City of Sacramento, Range: (61 - 450 du/ac)
COMMERCIAL	COM	40	2.1	5.4	(2.11 & 5.38 du/ac)- From ESD analysis of existing parcels for 50th and 85th percentiles.
OFFICES	OFF	70	2.3	3.5	(2.28 & 3.48 du/ac) - From ESD analysis of existing parcels for 50th and 85th percentiles.
INDUSTRIAL	IND	80	3.5	6.0	(3.5 & 6.0 du/ac) - From suggestion by CM based on Industrial point discharges. This suggestion superceded the ESD density analysis performed for industrial parcels.
OPEN SPACE / UNSEWERED	OSU	100	0	0	Recreation, Cemeteries, Community parks, County parks, natural preserves, and activity areas within the American River Parkway. Some facilities types are too small or numerous to be identified on the Land Use Diagram.
PUBLIC & QUASI-PUBLIC	PQP	170	3.5	6.0	(3.5 & 6.0 du/ac) - From suggestion that previous values of 0.56 and 1.16 ESD/ac were too low. CSD-1 sewer rate ordinace
EXCEPTION	EXC		3.5	6.0	From RMC.

Notes:
a) This is the “Equiv. GIS Land Code” in subsequent tables and is used to associate the land use jurisdictions’ categories with the consolidated land use categories.

Sacramento County General Plan					
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
Agricultural Residential	1	10.0	10	0.65	0.73
Low Density Residential	1	12.0	20	5.5	7.1
Medium Density Residential	13	30.0	31	17	21
High Density Residential	31	50.0	190	27	34
Transit Oriented Development	6	50	42	30	35
Mixed Use	6	50	32	13.5	20
Core Commercial			40	2.1	5.4
Commercial and Offices			40	2.1	5.4
Intensive Industrial			80	3.5	6.0
Extensive Industrial			80	3.5	6.0
Public/Quasi-Public			170	3.5	6.0
Recreation			100	0	0
Agricultural Urban Reserve			100	0	0
Natural Preserve			100	0	0
Agricutural Cropland			100	0	0
General Agriculture			100	0	0
Urban Development Area			40	2.1	5.4
Agricutural Recreation Reserve			100	0	0

Elverta Specific Plan										
Land Use Code	**Land Use Description**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
AR-1, AR1	Agricultural Residential	1	10.0	10	0.65	0.73	552	359	403
RD1-2	Residential Development	1	2.0	11	1.5	3.2	10	15	33
RD3,4,5	Residential Development	3	5.0	20	5.5	7.1	663	3645	4705
RD6,7	Residential Development	6	7.0	20	5.5	7.1	162	889	1148
RD10	Residential Development	7.1	10	21	8.3	10.	7	58	73
RD20	Residential Development	10.1	20	30	12	15	39	466	588
	Office Professional			70	2.3	3.5	4	10	15
	Commercial			40	2.1	5.4	15	32	81
	Parks			100	0	0	199	0	0
	Roads/Other			100			74	0	0
	Public/Quasi-Public			170	3.5	6.0	20	71	121
						Total	1745	5544	7167
						Overall Density, ESD/ac		3.2	4.1

Greebriar Specific Plan						
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**
NO DATA AVAILABLE - Land uses have not been assigned.	17	20	**200**	**6**	**8**	
					Total	627

Panhandle Specific Plan								
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
Single Family Large Lot			**20**	**5.5**	**7**	357	1964	2535
Single Family Small Lot	8.1	12	**21**	**8.3**	**10.**	26	216	270
Agriculture			**100**	**0**	**0**	205	0	0
					Total	588	2,179	2,805
					Overall Density, ESD/ac		3.7	4.8

Camino Norte Specific Plan						
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**
NO DATA AVAILABLE - Land uses have not been assigned.			**200**	**6**	**8**	
					Total	318

City of Folsom Land Uses (a)						
Land Use Code	**Land Use Description**	**Area acres**	**EDU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
SF	Single Family	4,890	3	**11**	**1.5**	**3.2**
SFMD*			4.2	**20**	**5.5**	**7.1**
SFHD	Single Family High Density	1,020	5.4	**20**	**5.5**	**7.1**
MLD	Multifamily Low Density	643	9.4	**21**	**8.3**	**10.**
MMD	Multifamily Medium Density	165	15	**30**	**12**	**15**
MHD	Multifamily High Density	287	21.5	**31**	**17**	**21**
GC	General Commercial	22		**40**	**2.1**	**5.4**
NC	Neighborhood Commercial	59		**40**	**2.1**	**5.4**
CC	Community Commercial	329		**40**	**2.1**	**5.4**
CA	Specialty Commercial	565		**40**	**2.1**	**5.4**
CCD	Central Commercial Mixed Use Distri	231		**21**	**8.3**	**10.**
RCC	Regional Commercial	336		**40**	**2.1**	**5.4**
IND	Industrial/Office Park	775		**80**	**3.5**	**6.0**
PUB	Public	1,160		**170**	**3.5**	**6.0**
S	School	292		**170**	**3.5**	**6.0**
JHS	Junior High School	71		**170**	**3.5**	**6.0**
OS	Open Space	2,838		**100**	**0**	**0**
P	Parks	274		**100**	**0**	**0**
	Total	13,958				

Notes:

* Not a General Plan category

(a) This table is being presented for completeness. These land use densities were subsequently replaced by the values indicated in the Folsom Vacant Land Uses table so that the flows would be consistent with the City's Capacity Analysis Update, dated February 2008 and the City's InfoWorks model.

South of Highway 50 Future Development									
Land Use Code	**Land Use Description**	**Area acres**	**Min DU/ac**	**Max DU/a**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
SF	Single Family	569.4	2	3.9	**11**	**1.5**	**3.2**	860	1839
SFHD	Single Family High-Density	529.3	4	6.9	**20**	**5.5**	**7.1**	2911	3758
MLD	Multi-Family Low Density	272.5	7	11.9	**21**	**8.3**	**10.**	2262	2834
MMD	Multi-Family Medium Density	66.9	12	17.9	**21**	**8.3**	**10.**	555	696
MHD	Multi-Family High Density	44.7	18	25	**30**	**12**	**15**	536	677
CCD	Central Commercial Mixed Use	53.2	10	12	**21**	**8.3**	**10.**	442	553
OP	Office Park	87.9			**70**	**2.3**	**3.5**	200	306
CC	Community Commercial	39.9			**40**	**2.1**	**5.4**	84	215
GC	General Commercial	216.2			**40**	**2.1**	**5.4**	456	1163
RCC	Regional Commercial	106.9			**40**	**2.1**	**5.4**	226	575
P	Parks	112.3			**100**	**0**	**0**	0	0
OS	Open Space	1050.9			**100**	**0**	**0**	0	0
	Schools	179			**170**	**3.5**	**6.0**	627	1074
	Total	3329.1						9,159	13,690
							Overall Density, ESD/ac	2.8	4.1

Folsom Vacant Land Uses (b)						
Land Use Code	**Land Use Description**	**Area acres**	**EDU/ac (c)**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
SF	Single Family	4,890	3		**2.1**	**3.0**
SFMD*	Single Family Medium Density		4.2		**2.9**	**4.2**
SFHD	Single Family High Density	1,020	5.4		**3.8**	**5.4**
MLD	Multifamily Low Density	643	9.4		**6.6**	**9.4**
MMD	Multifamily Medium Density	165	15		**10.5**	**15.0**
MHD	Multifamily High Density	287	21.5		**15.1**	**21.5**

Notes:

b) The Folsom Vacant Land Uses are used to calculate the future development densities within the current City of Folsom boundaries. These values were used to be consistent with the City's Capacity Analysis Update, dated February 2008 and the City's InfoWorks model.

(c) Table 2-2, Folsom Collection System Capacity Analysis Update 2008

City of West Sacramento							
Land Use Code	**Land Use Description**	**Area acres**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
AG	Agricultural	1,462		0.2	**100**	**0**	**0**
RE	Rural Estates	483	0.4	0.8	**10**	**0.65**	**0.73**
RR	Rural Residential	604	0.5	1.0	**10**	**0.65**	**0.73**
LR	Low Density Residential	2,171	1.1	5.0	**11**	**1.5**	**3.2**
MR	Medium Density Residential	687	5.1	12.0	**21**	**8.3**	**10.**
HR	High Density Residential	358	12.1	25	**30**	**12**	**15**
HRR	High Rise Residential	0	25.1	50	**190**	**27**	**34**
NC	Neighborhood Commercial	92	5.1	12.0	**21**	**8.3**	**10.**
CC	Community Commercial	201	5.1	12	**21**	**8.3**	**10.**
HSC	Highway Service Commercial	64			**40**	**2.1**	**5.4**
WRC	Water Related Commercial	19			**40**	**2.1**	**5.4**
GC	General Commercial	87			**40**	**2.1**	**5.4**
O	Office	36			**70**	**2.3**	**3.5**
BP	Business park	367			**70**	**2.3**	**3.5**
MCI	Mixed Commercial/Industrial	124			**80**	**3.5**	**6.0**
LI	Light Industrial	492			**80**	**3.5**	**6.0**
HI	Heavy Industrial	1,108			**80**	**3.5**	**6.0**
H1	??	19			**80**	**3.5**	**6.0**
WRI	Water Related Industrial	674			**80**	**3.5**	**6.0**
CBD	Central Business District	116	12.1	25.0	**32**	**13.5**	**20**
RMU	Riverfront/Mixed Use	758	25.1	50	**42**	**30**	**35**
PQP	Pubic-Quasi Public	717			**170**	**3.5**	**6.0**
RP	Recreation & Parks	319			**100**	**0**	**0**
OS	Open Space	727			**100**	**0**	**0**
none		1,337					
	Total	13,026					

City of Sacramento 2030 General Plan					
Land Use Code	**Land Use Description**	**Land Use Density Range DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
RR	Rural Residential	0.25-3	**11**	**1.5**	**3.2**
SLDR	Suburban Low Density	3-8	**20**	**5.5**	**7.1**
SMDR	Suburban Medium Density	7-15	**21**	**8.3**	**10.**
SHDR	Suburban High Density	15-30	**31**	**17**	**21**
THDR	Traditional Low Density	3-8	**20**	**5.5**	**7.1**
TMDR	Traditional Medium Density	8-21	**30**	**12**	**15**
TLDR	Traditional High Density	18-36	**31**	**17**	**21**
ULDR	Urban Low Density	12-36	**31**	**17**	**21**
UMDR	Urban Medium Density	33-101	**200**	**6**	**8**
UHDR	Urban High Density	101-250	**200**	**6**	**8**
SCnt	Suburban Center	15-36	**32**	**14**	**20**
TCnt	Traditional Center	15-36	**32**	**14**	**20**
RC	Regional Commercial	32-80	**200**	**6**	**8**
UCntLow	Urban Center Low	20-150	**200**	**6**	**8**
UCntHigh	Urban Center High	24-250	**200**	**6**	**8**
CBD	Central Business District	61-450	**194**	**104**	**192**
SCor	Suburban Corridor	15-36	**32**	**14**	**20**
UCorLow	Urban Corridor Low	20-60	**190**	**27**	**34**
UCorHigh	Urban Corridor High	33-150	**200**	**6**	**8**
EC (LR)	Employment Center (Low Rise)		**70**	**2.3**	**3.5**
EC (MR)	Employment Center (Mid Rise)	18-60	**190**	**27**	**34**
INDU	Industrial		**80**	**3.5**	**6.0**
PUB	Public		**170**	**3.5**	**6.0**
PD	Planned Development	various	**40**	**2.1**	**5.4**
PRK	Park		**100**	**0**	**0**
OS	Open Space		**100**	**0**	**0**

(a) From "Model_LUD_Summary_by_landuse.pdf"

McKinley Village Specific Plan

Land Use Description	Land Use Density	Equiv. GIS Land Code	REALISTIC EQUIVALENT ESD/ac	CONSERVATIVE EQUIVALENT ESD/ac	Area, ac	REALISTIC ESD	CONSERVATIVE ESD
Single Family + Mixed Use					20.8	298	539
Public		**170**	**3.5**	**6.0**	7.3	26	46
Park + OS		**100**	**0**	**0**	6.1	0	0
Streets + Alleys		**100**	**0**	**0**	15.3		0
				Total:	49.5	323	585
				Overall Density, ESD/ac		6.5	12

Delta Shores Specific Plan

Land Use Description	Land Use Density Range DU/ac	Equiv. GIS Land Code	REALISTIC EQUIVALENT ESD/ac	CONSERVATIVE EQUIVALENT ESD/ac	Area, ac	REALISTIC ESD	CONSERVATIVE ESD
Residential							
LD	4-7	20	**5.5**	**7.1**	**126**	**693**	**895**
MD	8-14	21	**8.3**	**10.**	**229**	**1901**	**2382**
HD	15-22	30	**12**	**15**	**62**	**742**	**936**
Mixed Use	23-30	31	**17**	**21**	**18**	**314**	**390**
Commercial						**0**	**0**
Regional Center		40	**2.1**	**5.4**	**125.6**	**265**	**676**
Neighborhood Commercial		40	**2.1**	**5.4**	**8.7**	**18**	**47**
Parks		100	**0**	**0**	**62**	**0**	**0**
Open Space		100	**0**	**0**	**41**	**0**	**0**
Schools		170	**3.5**	**6.0**	**20**	**70**	**120**
Backbone Circulation		100	**0.0**	**0.0**	**100**	**0**	**0**
Utilities		170	**3.5**	**6.0**	**4.6**	**16**	**28**
Community Center		170	**3.5**	**6.0**	**3.1**	**11**	**19**
				Total	800	4,030	5,492
				Overall Density, ESD/ac		5.0	6.9

Railyards Specific Plan

Land Use Description	Area acres	Equiv. GIS Land Code	REALISTIC EQUIVALENT ESD/ac	CONSERVATIVE EQUIVALENT ESD/ac	REALISTIC ESD	CONSERVATIVE ESD
Total	244				10,808	19,562
				Overall Density, ESD/ac	44	80

City of Rancho Cordova General Plan							
Land Use Code	**Land Use Description**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	
GA	General Agriculture		0.001	**100**	**0**	**0**	
RA	Rural Agriculture	0.001	0.010	**10**	**0.65**	**0.73**	
RR	Rural Residential	0.1	0.5	**10**	**0.65**	**0.73**	
ER	Estate Residential	0.51	2.0	**11**	**1.5**	**3.2**	
LDR	Low Density Residential	2.1	6.0	**20**	**5.5**	**7.1**	
MDR	Medium Density Residential	6.1	18.0	**21**	**8.3**	**10.**	
HDR	High Density Residential	18	40.0	**31**	**17**	**21**	
RMU	Residential Mixed Use	6.1	40	**32**	**14**	**20**	
CMU	Commerical Mixed Use	2.1	18	**32**	**14**	**20**	
CMU-Dowr	Commerical Mixed Use Downtown	10	40	**32**	**14**	**20**	From Folsom Blvd Specific Plan
OMU	Office Mixed Use	2.1	18.0	**32**	**14**	**20**	
VC	Village Center	6.1	18	**32**	**14**	**20**	
LTC	Local Town Center	6.1	18.0	**32**	**14**	**20**	
RTC	Regional Town Center	6.1	40.0	**31**	**17**	**21**	
LTOD	Local Transit Oriented Development	18	80.0	**42**	**30**	**35**	
RTOD	Regional Transit Oriented Development	18	80.0	**42**	**30**	**35**	
LI	Light Industrial			**80**	**3.5**	**6.0**	
HI	Heavy Industrial			**80**	**3.5**	**6.0**	
SM	Surface Mining			**80**	**3.5**	**6.0**	
	Convention District Overlay	10	18.0	**21**	**8.3**	**10.**	From Folsom Blvd Specific Plan

Aerojet Planning Area	Acreage, ac	Dwelling Units
Light Industrial Heavy Industrial		
Total =	5285	0.0
Density, DU/ac =	0	
Equiv. GIS Land Code =	**80**	

Countryside/Lincoln Village Special Planning Area			
Revitalization (No new development)	Equiv. GIS Land Code =	**200**	

Downtown			
Revitalization (No new development)	Equiv. GIS Land Code =	**200**	

East Planning Area	Acreage, ac	Dwelling Units
Residential - Rural / Estate Residential - Mixed Density Office Mixed Use Open Space Natural Resources		
Total =	7353	10390
Density, DU/ac =	1.4	
Equiv. GIS Land Code =	**200**	

Folsom Boulevard Special Planning Area		
Revitalization (No new development) Equiv. GIS Land Code =	**200**	

Glenborough Planning Area	Acreage, ac	Dwelling Units
Residential - Mixed Density Residential - Higher Density Commercial Mixed Use Open Space Natural Resources Regional Town Center		
Total	1336	4434
Density, DU/ac =	3.3	
Equiv. GIS Land Code =	**200**	

Grant Line North Special Planning Area	Acreage, ac	Dwelling Units
Total	1846	6916
Density, DU/ac =	3.7	
Equiv. GIS Land Code =	**200**	

Grant Line South Special Planning Area	Acreage, ac	Dwelling Units
Total	2490	3667
Density, DU/ac =	1.5	
Equiv. GIS Land Code =	**200**	

Grant Line West Special Planning Area	Acreage, ac	Dwelling Units
Total	1307	3393
Density, DU/ac =	2.6	
Equiv. GIS Land Code =	**200**	

Jackson Planning Area	Acreage, ac	Dwelling Units
Total	8602	5806
Density, DU/ac =	0.7	
Equiv. GIS Land Code =	**200**	

Mather Planning Area			
Revitalization (No new development)	Equiv. GIS Land Code =	**200**	

Rio Del Oro Specific Plan									
Land Use Code	**Land Use Description**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
	Single Family Residential	2.1	6		**4.1**	**5.4**	**1597**	**6468**	**8648**
	Medium Density Residential	6.1	18	**21**	**8.3**	**10.4**	**237**	**1967**	**2465**
	High Density Residential	18.1	40	**31**	**17.25**	**21.45**	**86**	**1484**	**1845**
	Village Commercial			**32**	**13.5**	**20**	**20**	**270**	**396**
	Local Town Center			**32**	**13.5**	**20**	**22**	**297**	**436**
	Regional Town Center			**31**	**17.25**	**21.45**	**111**	**1915**	**2381**
	Business Park			**70**	**2.28**	**3.48**	**86**	**196**	**299**
	Industrial Park			**80**	**3.5**	**6.0**	**282**	**987**	**1692**
	Public / Quasi-Public			**170**	**3.5**	**6.0**	**9.5**	**33**	**57**
	School			**170**	**3.5**	**6.0**	**152**	**532**	**912**
	Community Park			**100**	**0**	**0**	**107**	**0**	**0**
	Neighborhood Park			**100**	**0**	**0**	**63**	**0**	**0**
	Stormwater Detention			**100**	**0**	**0**	**39**	**0**	**0**
	Wetland Preserve			**100**	**0**	**0**	**507**	**0**	**0**
	Drainage Parkway			**100**	**0**	**0**	**143**	**0**	**0**
	Private Recreation			**100**	**0**	**0**	**54**	**0**	**0**
	Open Space			**100**	**0**	**0**	**12**	**0**	**0**
	Open Space / Preserve			**100**	**0**	**0**	**24**	**0**	**0**
	Landscape Corridor			**100**	**0**	**0**	**44**	**0**	**0**
	Greenbelts			**100**	**0**	**0**	**50**	**0**	**0**
	Major Roads			**100**	**0**	**0**	**183**	**0**	**0**
						Total:	3829	14149	19130
					Overall Density, ESD/ac			3.7	5.0

Rancho Cordova

Suncreek/Preserve Planning Area		Acreage, ac	Dwelling Units
Total		1762	9263
	Density, DU/ac =	5.3	
	Equiv. GIS Land Code =	**200**	

Sunrise Boulevard North Special Planning Area			
Revitalization (No new development)	Equiv. GIS Land Code =	**200**	

Sunrise Boulevard South Special Planning Area			
Revitalization (No new development)	Equiv. GIS Land Code =	**200**	

Westborough Special Planning Area		Acreage, ac	Dwelling Units
Total		1695	6078
	Density, DU/ac =	3.6	
	Equiv. GIS Land Code =	**200**	

City of Citrus Heights General Plan						
Zoning Code	**Land Use Description**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
RD-1, RD-2, RD-3, RD-4, RD-5, RD-7, SPA	Very Low Residential	0	4	**11**	**1.5**	**3.2**
RD-1, RD-2, RD-3, RD-4, SPA	Low Density Residential	1	8	**20**	**5.5**	**7.1**
RD-10, RD-15, RD-20, MH (mobile home), SPA	Medium Density Residential	9	20	**30**	**12.0**	**15.**
RD-30	High Density Residential	21	30	**31**	**17.3**	**21.**
Auto Commercial (AC), General Commercial (GC), Limited Commercial (LC), Shopping Center (SC), Special Planning Area (SPA)	General Commerical			**40**	**2.1**	**5.4**
From Stock Ranch Specific Plan	Commercial - Sylvan Commerce District	9	20	**30**	**12**	**15**
BP, SPA	Business Professional	1	20	**70**	**2.3**	**3.5**
All Residential Districts, SPA	Transition Overlay	0	30	**32**	**13.5**	**20**
Industrial/Office Park (MP), SPA	Industrial			**80**	**3.5**	**6.0**
Commerical Recreation (CR), SPA, O (Recreation)	Open Space			**100**	**0**	**0**
O	Public			**170**	**3.5**	**6.0**

Stock Ranch Special Planning Area								
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
Residential			**20**	**5.5**	**7.1**	**43.2**	**238**	**307**
Commercial			**40**	**2.1**	**5.4**	**53.8**	**114**	**289**
Passive Park / Open Space			**100**	**0.0**	**0.0**	**32.0**	**0**	**0**
					Total	129	351	596
					Overall Density, ESD/ac		2.7	4.6

Auburn Boulevard Specific Plan									
Zoning Code	**Land Use Description**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
RD-2	Very Low Residential	0	4	**11**	**1.5**	**3.2**	**43.2**	**65**	**140**
RD-5	Low Density Residential	1	8	**20**	**5.5**	**7.1**	**44.2**	**243**	**314**
RD-10, RD-20	Medium Density Residential	9	20	**30**	**12.0**	**15.**	**45.2**	**542**	**685**
RD-30	High Density Residential	21	30	**31**	**17.3**	**21.**	**46.2**	**797**	**991**
Auto Commercial (AC), General Commercial (GC), Limited Commercial (LC), Shopping Center (SC), Special Planning Area (SPA)	General Commerical			**40**	**2.1**	**5.4**	**47.2**	**100**	**254**
BP, SPA	Business Professional	1	20	**70**	**2.3**	**3.5**	**48.2**	**110**	**168**
Commerical Recreation (CR), SPA, O (Recreation)	Open Space			**100**	**0**	**0**	**49.2**	**0**	**0**
						Total	323	1857	2551
						Overall Density, ESD/ac		5.7	7.9

City of Elk Grove General Plan					
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
Rural Residential	0.1	0.5	**10**	**0.65**	**0.73**
Estate Residential	0.51	4.0	**11**	**1.5**	**3.2**
Low Density Residential	4.1	7.0	**20**	**5.5**	**7.1**
Medium Density Residential	7.1	15.0	**21**	**8.3**	**10.**
High Density Residential	15	30.0	**31**	**17**	**21**
Commercial			**40**	**2.1**	**5.4**
Office			**70**	**2.3**	**3.5**
Office/Multi-family			**32**	**13.5**	**20**
Commercial/Office			**40**	**2.1**	**5.4**
Commercial/Office/Multi-Family			**32**	**13.5**	**20**
Public/Quasi-Public			**170**	**3.5**	**6.0**
Public Parks			**100**	**0**	**0**
Public Open Space/Recreation			**100**	**0**	**0**
Private Open Space/Recreation			**100**	**0**	**0**
Public Schools			**170**	**3.5**	**6.0**
Institutional			**170**	**3.5**	**6.0**
Light Industry			**80**	**3.5**	**6.0**
Heavy Industry			**80**	**3.5**	**6.0**

Laguna Ridge Specific Plan						
Land Use Code	**Land Use Description**	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
RD-4 to RD-7	Single Family Residential	4	7.0	**20**	**5.5**	**7.1**
RD-8 to RD-10	Single Family Residential	7.1	10.0	**21**	**8.3**	**10.**
RD-15	Medium Density Residential	10.1	15.0	**21**	**8.3**	**10.**
RD-20	Multi-Family Residential	15.1	20.0	**30**	**12**	**15**
	Auto Commercial			**40**	**2.1**	**5.4**
	SC Shopping Commerical			**70**	**2.3**	**3.5**
	Office Park			**32**	**13.5**	**20**
	Civic Center			**40**	**2.1**	**5.4**
	Parks			**100**	**0**	**0**
	Schools			**170**	**3.5**	**6.0**
	Water Treatment and Fire Station			**100**	**0**	**0**
	Parkway/Open Space			**100**	**0**	**0**
	Roadways			**100**	**0**	**0**

Old Town Special Planning Area					
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**
Single Family			11	1.5	3.2
Multi Family			21	8.3	10.
Commercial			40	2.1	5.4

South Pointe Special Planning Area								
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
Entire Area			20	5.5	7.1	200	1100	1420
						Overall Density, ESD/ac	5.5	7.1

Elk Grove Triangle Special Planning Area								
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Gross Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
Residential		1.0	10	0.7	0.7	679.3	441.5	495.9
Commercial			40	2.1	5.4	30.7	64.8	165.2
					Total	710	506	661
					Overall Density, ESD/ac		0.71	0.93

Southeast Special Planning Area								
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	**Area, ac**	**REALISTIC ESD**	**CONSERVATIVE ESD**
LDR (4 DU/ac)		4.0	**11**	**1.5**	**3.2**	**66.5**	**100.4**	**214.8**
LDR (5 DU/ac)		5.0	**20**	**5.5**	**7.1**	**176.1**	**968.6**	**1250.3**
MDR (8 DU/ac)		8.0	**20**	**5.5**	**7.1**	**27.1**	**149.1**	**192.4**
MDR (10 DU/ac)		10.0	**21**	**8.3**	**10.4**	**167.5**	**1390.3**	**1742.0**
MDR (15 DU/ac)		15.0	**30**	**12.0**	**15.2**	**50.9**	**610.8**	**771.1**
HDR (17 DU/ac)		17.0	**30**	**12.0**	**15.2**	**28.5**	**342.0**	**431.8**
HDR (20 DU/ac)		20.0	**31**	**17.3**	**21.5**	**23.3**	**401.9**	**499.8**
Commercial			**40**	**2.1**	**5.4**	**32.0**	**67.5**	**172.2**
Office			**70**	**2.3**	**3.5**	**114.2**	**260.4**	**397.4**
Office / Commercial Mixed Use			**32**	**13.5**	**19.8**	**108.2**	**1460.7**	**2142.4**
School			**170**	**3.5**	**6.0**	**40.0**	**140.0**	**240.0**
Public / Quasi Public			**170**	**3.5**	**6.0**	**3.5**	**12.3**	**21.0**
Active Park			**100**	**0.0**	**0.0**	**87.6**	**0.0**	**0.0**
Linear Parks			**100**	**0.0**	**0.0**	**25.6**	**0.0**	**0.0**
Passive Park / Open Space			**100**	**0.0**	**0.0**	**86.2**	**0.0**	**0.0**
Roadways / Landscape Corridors			**100**	**0.0**	**0.0**	**157.1**	**0.0**	**0.0**
					Total	1194	5904	8075
					Overall Density, ESD/ac		4.9	6.8

South of Kammerer Road					
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**6**	**0**
Entire Area			**200**	**6.0**	**8.0**

Sutter Pointe Specific Plan						
Land Use Description	**Min DU/ac**	**Max DU/ac**	**Equiv. GIS Land Code**	**REALISTIC EQUIVALENT ESD/ac**	**CONSERVATIVE EQUIVALENT ESD/ac**	
Low Density Residential			**20**	**5.5**	**7.1**	(Assigned value - Specific plan did not indicated density)
Medium Density Residential			**21**	**8.3**	**10.**	(Assigned value - Specific plan did not indicated density)
High Density Residential			**31**	**17**	**21**	(Assigned value - Specific plan did not indicated density)
Employment 1			**40**	**2.1**	**5.4**	(Assigned value - Specific plan did not indicated density)
Employment 2			**40**	**2.1**	**5.4**	(Assigned value - Specific plan did not indicated density)
Open Space/Parks			**100**	**0**	**0**	(Assigned value - Specific plan did not indicated density)
Schools			**170**	**3.5**	**6.0**	(Assigned value - Specific plan did not indicated density)

APPENDIX C
METHODOLOGY FOR DEVELOPMENT OF CONSOLIDATED LAND USE MAP

The consolidated land use map was created through the integration of the general plan land use and zoning GIS files of the land use planning jurisdictions within SRCSD. The following shapefiles were integrated:

- **County of Sacramento**: GPLU_073007.shp
- **County of Sacramento**: Commercial_Corridors_GPLU_0507.shp
- **City of Sacramento**: 2030_GP_Preferred_LUD.shp
- **City of West Sacramento:** COWS_planning.shp
- **City of Elk Grove:** EGGP_Dissolve.shp
- **City of Folsom:** General_plan.shp
- **City of Rancho Cordova:** GP_Dissolve.shp

The integration was performed using the ArcGIS Erase and Identity tools. Erase was used to delete areas with the city jurisdictions from the County General Plan Land Use map based on the cities.shp city limits shapefile received from the County of Sacramento Planning Department, and also the delete the commercial corridors. Identity was used to fill in the portions that had been deleted with the planning shapefiles received by the other planning jurisdictions and with the County's commercial corridors shapefile.

The Commercial_Corridors shapefile provided by the County was used to overwrite the County's General Plan shapefile with the expected mixed use densities. Special Planning Areas were identified based on each jurisdiction's land use shapefile or by visual inspection and digitization. A lookup worksheet was used to assign CLU codes to each polygon based on their data source.

Polygons which were identified as public/quasi-public (PQP) that were greater than 100 acres in size were assigned the EXC code, indicating that wastewater loads within these polygons should not be assigned ESDs based on the PQP ESD densities. Instead, wastewater loads should be assigned ESDs based on an individual examination of the areas. Visual inspection indicated that these areas would likely be assigned minimal future flows.

APPENDIX D
SASD ESD DENSITY DATA ANALYSIS (APRIL 2009)

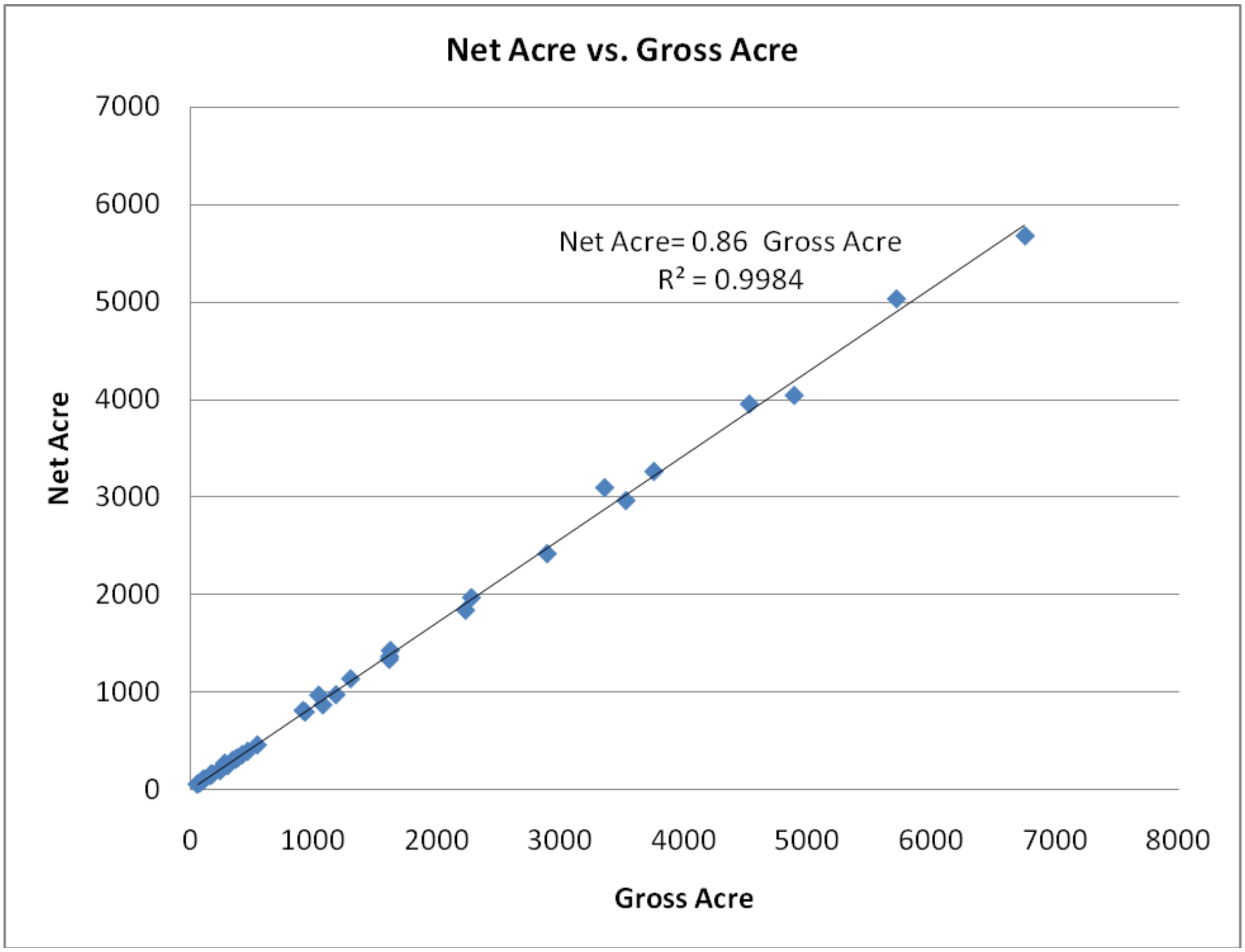
Purpose. To study ESD density distributions for different land use categories. The information will be used to determine ESD densities that could be applied to new developments and redevelopments for the Interceptor Sequencing Study.

Data Pool. 2009 SASD parcel and ESD data.

PARCEL ESD DENSITY (NET ESD DENSITY) DISTRIBUTIONS FOR DIFFERENT LAND USE CATEGORIES:

Land use category	Percentile, ESD/ac				
	50%	65%	75%	85%	95%
Commercial	2.5 3.4 4.5 6.3				10.4
Office	2.7 3.2 3.6 4.1 6.1				
Industrial	1.1 1.5 1.7 2.0 2.7				
School	0.7 0.9 1.0 1.4 2.3				
Residential: Single Family, Non Subdivision	1.8 2.3 2.9 3.8 4.8				
Residential: Single Family, Subdivision (All)	5.5 6.3 6.9 7.5 8.6				
Residential: Single Family, Subdivisions that occurred between 2000 and 2009	6.4 7.1 7.6 8.3 9.8				
Residential: Single Family, Subdivisions that occurred between 2005 and 2009	6.3 7.0 7.6 8.5				13.0

Relationship Between Parcel (Net) Acres and Gross Acres. 42 sheds of different sizes and land uses in the SASD service area were used to plot the Net Acre and Gross Acre scattergraph shown below. The scattergraph shows a linear relationship between Net Acre and Gross Acre. Net Acre = 0.86 Gross Acre → Gross ESD density = 0.86 Net ESD density.



<u>GROSS</u> ESD DENSITY DISTRIBUTIONS FOR DIFFERENT LAND USE CATEGORIES (GROSS ESD DENSITY = 0.86 * NET DENSITY):

Land use category	Percentile, ESD/ac				
	50%	65%	75%	85%	95%
Commercial	2.1 2.9 3.8 5.4 8.9				
Office	2.3 2.7 3.1 3.5 5.2				
Industrial	0.9 1.2 1.4 1.7 2.3				
School	0.6 0.7 0.8 1.2 1.9				
Residential: Single Family, Non Subdivision	1.5 1.9 2.5 3.2 4.1				
Residential: Single Family, Subdivision (All)	4.7 5.4 5.9 6.4 7.4				
Residential: Single Family, Subdivisions that occurred between 2000 and 2009	5.5 6.1 6.7 7.1 8.4				
Residential: Single Family, Subdivisions that occurred between 2005 and 2009	5.4 6.0 6.5 7.3				11.1

APPENDIX E
METHODOLOGY FOR DEVELOPMENT OF REALISTIC AND CONSERVATIVE LAND USE DENSITIES

Agricultural-Residential (AR), Very Low Density Residential (VLDR), Low Density (Normal) Residential (LDR), Commercial (COM), and Offices (OFF): Densities determined from ESD analysis of existing parcel data.

Future Urban Development Area (FUDA), Public / Quasi-Public (PQP), and Industrial (IND): Density values based on recommendations of ISS team members. A large portion of the SRCSD service is designated for future urban development, but is currently zoned for non-urban uses only. The ISS team identified the North Natomas development area of the City of Sacramento has being similarly situated prior to approval for development in 2000. The North Natomas development area includes a blend of open space, public, residential, employment center and commercial land uses that is similar to specific plan documents for current planned development and therefore was determined to be a good proxy for the future urban development area category. The number of ESDs connected to sewer and total area served was obtained using GIS data and an average ESD/acre of 6 was calculated and is recommended as the realistic scenario land use density for the FUDA category, with 8 ESD/ac being the recommended conservative scenario land use density. .

Medium Low Density Residential (MLDR): The range of the MLDR category was set such that it would encompass densities from 7.1 dwelling units per gross acre (DU/ac) to 15 (DU/ac). This range is equivalent to the Medium Density Residential categories for West Sacramento, Rancho Cordova, Elk Grove, and Sutter Pointe; the Suburban Medium Density land use for the City of Sacramento; and the Multi-family Low Density land use for the City of Folsom. The realistic land use density was calculated by multiplying the midpoint between 7.1 DU/ac and 15 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 15 DU/ac and 7.1 DU/ac by 0.85 and adding it to 7.1 DU/ac determined the conservative land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE MLDR CONSOLIDATED LAND USE CODE</u>

$$[\frac{(15\frac{DU}{ac}-7.1\frac{DU}{ac})}{2}+7.1\frac{DU}{ac}]*0.75\frac{ESD/ac}{DU/ac}=8.3\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE MLDR CONSOLIDATED LAND USE CODE</u>

$$[(15\frac{DU}{ac}-7.1\frac{DU}{ac})*0.85+7.1\frac{DU}{ac}]*0.75\frac{ESD/ac}{DU/ac}=10.\frac{ESD}{ac}$$

Medium Density Residential (MDR): The range of the MDR category was set such that it would encompass densities from 10 DU/ac to 22 DU/ac. This range is equivalent to the Medium Density Residential category for Citrus Heights; the Traditional Medium Density land use for the City of Sacramento; and the Multi-family Medium Density land use for the City of Folsom. The realistic land use density was calculated by multiplying the midpoint between 10 DU/ac and 22 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 22 DU/ac and 10 DU/ac by 0.85 and adding it to 10 DU/ac determined the conservative land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE MDR CONSOLIDATED LAND USE CODE</u>

$$[\frac{(22\frac{DU}{ac}-10\frac{DU}{ac})}{2}+10\frac{DU}{ac}]*0.75\frac{ESD/ac}{DU/ac}=12\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE MDR CONSOLIDATED LAND USE CODE</u>

$$[(22\frac{DU}{ac}-10\frac{DU}{ac})*0.85+10\frac{DU}{ac}]*0.75\frac{ESD/ac}{DU/ac}=15\frac{ESD}{ac}$$

Medium High Density Residential (MHDR): The range of the MHDR category was set such that it would encompass densities from 15 DU/ac to 30 DU/ac. This range is equivalent to the Medium Density Residential categories for the County of Sacramento; the High Density Residential land use for Sutter Pointe; the Suburban High Density land use for the City of Sacramento; and the Multi-family High Density land use for the City of Folsom. The realistic land use density was calculated by multiplying the midpoint between 15 DU/ac and 30 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 30 DU/ac and 15 DU/ac by 0.85 and adding it to 15 DU/ac determined the conservative land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE MHDR CONSOLIDATED LAND USE CODE</u>

$$[\frac{(30\frac{DU}{ac}-15\frac{DU}{ac})}{2}+15\frac{DU}{ac}]*0.75\frac{ESD/ac}{DU/ac}=17\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE MHDR CONSOLIDATED LAND USE CODE</u>

$$[(30\frac{DU}{ac}-15\frac{DU}{ac})*0.85+15\frac{DU}{ac}]*0.75\frac{ESD/ac}{DU/ac}=21\frac{ESD}{ac}$$

High Density Residential (HDR): The range of the HDR category was set such that it would encompass densities from 22 DU/ac to 50 DU/ac. This range is equivalent to the High Density Residential category for the County of Sacramento; High Rise Residential for West Sacramento; and the Urban Corridor Low and Employment Center (Mid-rise) land uses for the City of Sacramento. The realistic land use density was calculated by multiplying the midpoint between 22 DU/ac and 50 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 50 DU/ac and 22 DU/ac by 0.85 and adding it to 22 DU/ac determined the conservative land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE HDR CONSOLIDATED LAND USE CODE</u>

$$[\frac{(50\frac{DU}{ac} - 22\frac{DU}{ac})}{2} + 22\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 27\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE HDR CONSOLIDATED LAND USE CODE</u>

$$[(50\frac{DU}{ac} - 22\frac{DU}{ac}) * 0.85 + 22\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 34\frac{ESD}{ac}$$

Mixed Use (MU): The range of the MU category was set such that it would encompass mixed use densities from 6 DU/ac to 30 DU/ac. This range is equivalent to the Mixed Use category for the County of Sacramento; Central Business District for West Sacramento; various mixed use categories for Rancho Cordova; Commercial/Office/Multi-family land use for Elk Grove; and the Suburban Corridor land use for the City of Sacramento. The realistic land use density was calculated by multiplying the midpoint between 6 DU/ac and 30 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 30 DU/ac and 6 DU/ac by 0.85 and adding it to 6 DU/ac determined the conservative land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE MU CONSOLIDATED LAND USE CODE</u>

$$[\frac{(30\frac{DU}{ac} - 6\frac{DU}{ac})}{2} + 6\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 14\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE MU CONSOLIDATED LAND USE CODE</u>

$$[(30\frac{DU}{ac} - 6\frac{DU}{ac}) * 0.85 + 6\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 20\frac{ESD}{ac}$$

Transit Oriented Development (TOD): The range of the TOD category was set such that it would encompass mixed use densities from 30 DU/ac to 50 DU/ac. This range is equivalent to the Transit Oriented Development category for the County of Sacramento; Riverfront/Mixed Use category for West Sacramento; and Local and Regional Transit Oriented Development land uses for Rancho Cordova. The realistic land use density was calculated by multiplying the midpoint between 30 DU/ac and 50 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 50 DU/ac and 30 DU/ac by 0.85 and adding it to 30 DU/ac determined the conservative land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE TOD CONSOLIDATED LAND USE CODE</u>

$$[\frac{(50\frac{DU}{ac} - 30\frac{DU}{ac})}{2} + 30\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 30\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE TOD CONSOLIDATED LAND USE CODE</u>

$$[(50\frac{DU}{ac} - 30\frac{DU}{ac}) * 0.85 + 30\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 35\frac{ESD}{ac}$$

Central Business District (CBD): The range of the CBD category was set such that it would encompass densities from 61 DU/ac to 450 DU/ac, which are the densities indicated by the City of Sacramento General Plan 2030. Note that the CBD category is specific to the downtown area of the city and is not equivalent to other contributing area land uses. The conservative land use density was calculated by multiplying the midpoint between 61 DU/ac and 450 DU/ac by 0.75 to convert from DU/ac to ESD/ac. Multiplying the difference of 450 DU/ac and 61 DU/ac by 0.20 and adding it to 30 DU/ac determined the realistic land use density in terms of DU/ac. This number was multiplied by 0.75 to convert it to ESD/ac. The realistic and conservative values were calculated differently from the other land uses because the very high densities of this category would have resulted in growth that exceeded the future buildout population identified in the City's 2030 General Plan. Below are the calculations in numerical terms with the densities displayed to two significant figures:

<u>REALISTIC LAND USE SCENARIO FOR THE CBD CONSOLIDATED LAND USE CODE</u>

$$[(450\frac{DU}{ac} - 61\frac{DU}{ac}) * 0.20 + 61\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 100\frac{ESD}{ac}$$

<u>CONSERVATIVE LAND USE SCENARIO FOR THE TOD CONSOLIDATED LAND USE CODE</u>

$$[\frac{(450\frac{DU}{ac} - 61\frac{DU}{ac})}{2} + 61\frac{DU}{ac}] * 0.75\frac{ESD/ac}{DU/ac} = 190\frac{ESD}{ac}$$

Special Planning Areas (SPA): The realistic and conservative densities were developed for SPAs without GIS information by assigning the applicable consolidated code to each land use identified in the respective specific plan and multiplying those densities by the areas of the land uses, which were also identified in the specific plans, to obtain the total number of ESDs per land use. The ESDs for each land use were then totaled and divided by the total area of the SPA to establish the overall density that was applied to each SPA polygon in the Consolidated Land Use Map.

APPENDIX F
SASD DRY WEATHER FLOW DATA ANALYSIS

Purpose. To calculate average daily dry weather flows per ESD for different SASD sheds. The information will be used to determine domestic flow factors that could be applied to new developments/redevelopments for the Interceptor Sequencing Study.

Data Pool:

- 2008-2009 dry weather flow-monitoring data
- 2009 SASD parcel and ESD data

Study Approach:

- Identified SASD sheds that had adequate dry weather flow data.
- The selected sheds should be representative to Interceptor sewer sheds.
- Dry weather flow (DWF) factor = Average daily dry weather flow/Total ESD.
- The flow data includes industrial point discharges and groundwater infiltration that should not be part of the domestic flows. Therefore, the calculated DWF factors could be slightly high compared to domestic flow factors.

ANALYSIS RESULTS:

Shed (See Study Shed Map on the next page)	Flow-Monitoring Data Used for the Calculation	Calculated Average DWF Factor, gpd/ESD
SASD service area excluding ELK and NAT trunk sheds	FM339_FloDar, FM70101_AccuSonic, FM66_AccuSonic, FM350_AccuSnic, Modeling data of North Sacramento	250
ELK trunk shed	FM3_4250, FM60101_2150, FM61120_ADFM	207
FM 90 shed (Partial NEA trunk shed, after the flow diversion of UNWI-9 and C-line trunk to the V.M.P.S)	FM90_ADS Pulse	207
COR trunk shed	S033 pump station flow data	233
McClellan Interceptor upper shed	FM71022_ADS 262	
Dry Interceptor upper shed	FM50418_ADS	198

Study Shed Map