City of Escondido

2012 Wastewater Master Plan

Prepared for:
City of Escondido

June 2012

CITY OF ESCONDIDO
2012 WASTEWATER MASTER PLAN

June 2012

Prepared for:

ESCONDIDO
City of Choice

Hale Avenue Resource Recovery Facility
1521 South Hale Avenue
Escondido, California 92029-3052

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Acronyms

AMSL	Above Mean Sea Level
CIP	capital improvement program
d/D	depth to diameter ratios
DIP	ductile iron pipe
ELO	Escondido Land Outfall
GIS	Geographical Information System
gpcd	gallons per capita per day
HARRF	Hale Avenue Resource Recovery Facility
HDPE	high density polyethylene
HFF	hourly flow factor
I-15	Interstate 15
NPDES	National Pollution Discharge Elimination System
PDWF	peak dry weather flow
PVC	polyvinyl chloride
RCP	reinforced concrete pipe
Rincon MWD	Rincon del Diablo Municipal Water District
SANDAG	San Diego Association of Governments
SEJPA	San Elijo Joint Powers Authority
SOI	Sphere of Influence
SR-78	State Route 78
VCP	vitrified clay pipe

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Section 1
Introduction

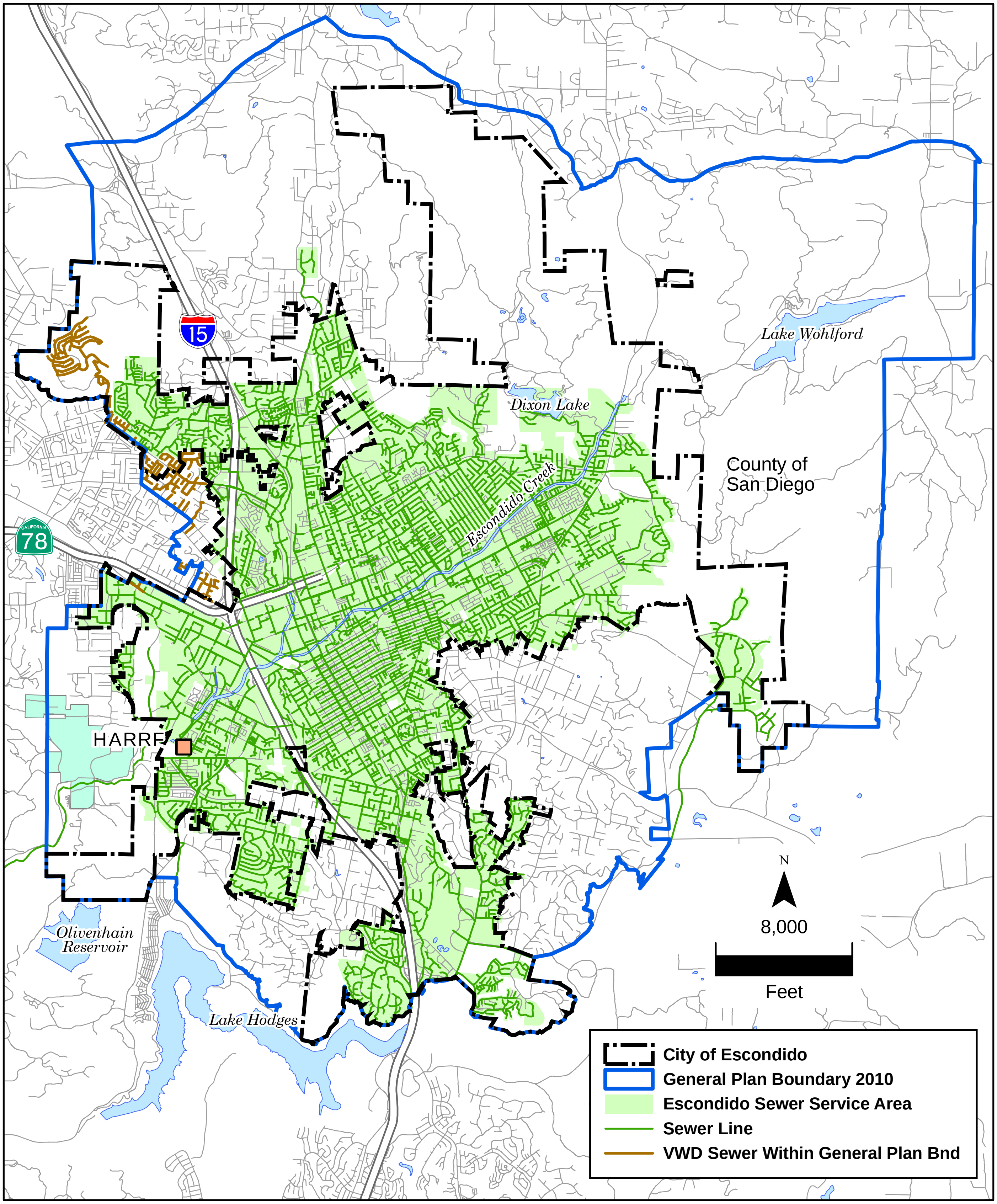
The Escondido Wastewater Master Plan Update documents the existing wastewater system facilities and flows, and identifies required improvements for build-out within the City's service area, which is anticipated to occur by 2035. The wastewater system analyses conducted as a part of this project and documented in this report were performed to identify existing deficiencies in the system, confirm facility sizing, and recommend a future capital improvement program (CIP) based on updated wastewater flow generation analyses and hydraulic modeling. This Master Plan provides an update to the 2005 Wastewater Master Plan Update for continued reliable wastewater service through buildout in accordance with the City's most recent amendments to the General Plan.

1.1 Wastewater Service in Escondido

The City of Escondido (City) is located in the northeastern portion of the County of San Diego (County) and is intersected by Interstate 15 (I-15) and Highway 78. To the west is the City of San Marcos, and the south is bounded by Lake Hodges and the City of San Diego. Unincorporated areas of the County surround the northern and eastern boundaries of the City. Escondido's wastewater service area, which is not aligned with the City's incorporated boundary, is comprised of a variety of land uses including residential, commercial, industrial, and open space.

The sewer study area in this Master Plan Update is based on the City's sphere of influence, which is shown on the vicinity map provided in Figure 1-1. The City's sphere of influence is the projected ultimate sewer service area which encompasses approximately 44,000 acres and includes the existing City boundary plus additional surrounding areas of the County ultimately planned for annexation. The sewer area is near build-out within the City boundary. Also shown on Figure 1-1 are the adjacent agencies that provide sewer service, which include Vallecitos Water District, Valley Center Municipal Water District and the City of San Diego. The developed areas to the east that are within the City boundary but are not currently connected to the City's wastewater collection system are on septic systems.

The City owns and operates the Hale Avenue Resource Recovery Facility (HARRF), which treats and disposes of all wastewater collected within the Escondido wastewater service area, plus flows from a portion of the Rancho Bernardo community in the City of San Diego. The facility treats all wastewater flows to a secondary level of treatment, and a portion of the wastewater flow is further treated at the tertiary level for use as recycled water. Wastewater that is not reused is conveyed from the HARRF to the San Elijo Ocean Outfall through the 14-mile long Escondido Land Outfall (ELO) pipeline. The wastewater collection system that delivers flow to the HAARF is comprised of approximately 380 miles of pipelines, 7,500 manholes, and 14 pumping stations. The Escondido wastewater collection and treatment systems currently serve an estimated population of 142,000.



Vicinity Map

Figure 1-1

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1.2 Previous Master Plans

The first comprehensive wastewater master plan for the City was completed in 1980 and was revised in 1989. The 1989 Wastewater Master Plan developed ultimate flow projections for the City's sphere of influence, a hydraulic model, an evaluation of the existing conveyance system, and a Capital Improvement Program. In 2005, the Master Plan was updated to incorporate the 1990 General Plan land uses and proposed amendments to project ultimate flows using the 1989 Wastewater Master Plan's unit flow factors. An updated hydraulic model was developed to evaluate the existing conveyance system with ultimate flows, and a trunk sewer replacement program was identified. The capital improvement program for trunk sewer and lift station improvements was updated using the same cost estimating methodology developed in the 1989 Master Plan. Additionally, findings were summarized from a 2001 conceptual-level evaluation of Lift Stations 1 through 13, which estimated the cost-effectiveness of eliminating lift stations by constructing additional gravity facilities.

1.3 Purpose of the 2011 Wastewater Master Plan Update

The objectives of this 2011 Escondido Wastewater Master Plan Update are to incorporate recent trends in lower wastewater generation rates due to water conservation, evaluate adequacy of the system's capacity to accommodate existing and future sewer flows, and provide a general assessment of the condition of the existing wastewater collection system in order to develop a comprehensive CIP. The revised flow projections will be based on the 2011 General Plan Update, which includes redevelopment areas with mixed use projects that may require significant upgrades to the wastewater collection system in those neighborhoods. A more detailed hydraulic model with updated GIS data identifies these areas of concern and is used to analyze proposed operational changes and/or future facilities. The end result of this master plan update is a prioritized list of capital improvement projects required to maintain an efficient and reliable wastewater collection system at buildout conditions.

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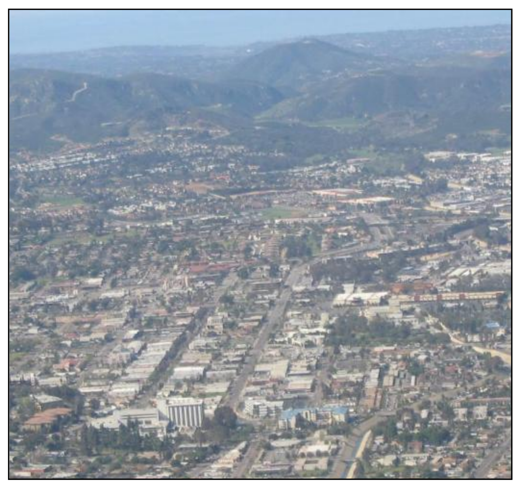
Section 2
Land Use and Wastewater Flows

Wastewater flows within Escondido's sewer service area varies widely with the various land uses of the area. This section will discuss the City of Escondido's General Plan, land uses, historic wastewater flows, and the development of unit wastewater generation rates for the different land use categories. Wastewater peaking factors are developed and future wastewater flows are projected for the ultimate system.

2.1 Land Use and Setting

The City of Escondido is located in northern San Diego County, approximately 30 miles north of downtown San Diego and 18 miles east of the Pacific Ocean. The City is situated in a natural valley at approximately 615 feet Above Mean Sea Level (AMSL) and surrounded by rolling hills and rugged terrain ranging up to 4,200 AMSL. The City is bounded on the north by the unincorporated San Diego County communities of Valley Center and Hidden Meadows, on the west by the City of San Marcos, on the south by Lake Hodges and the City of San Diego, and on the east by unincorporated San Diego County. I-15 bisects Escondido in a north-south direction and State Route 78 (SR-78) transitions from freeway to surface streets in an east-west direction through the City.

The City of Escondido's geographic setting is characterized by hills and mountains surrounding an open valley bisected by Escondido Creek. The City includes a historic downtown and urban core area. Escondido's prominent public facilities are located downtown, providing convenient access for the community. City Hall, the performing arts and conference center, a central library, the multi-modal transit center, museums, theaters, Palomar Hospital's downtown campus, and an office, financial, and commercial employment base combine to establish the downtown area.



Aerial View of Downtown Escondido

Escondido's urbanized core surrounds downtown within the "valley floor" of Escondido. It includes a variety of land uses including new and established single and multi-family neighborhoods and industrial and commercial developments offering a wide variety of employment opportunities. Surrounding the City's urbanized core area are many established neighborhoods with vacant or underdeveloped properties available for growth. Around Escondido's perimeter, large areas of open space, such as Daley Ranch, San Dieguito River Valley, and land around Lake Wohlford, are adjacent to the community's urbanized areas and offer recreational activities with hiking and multi-use trails. Western Escondido forms the community's primary employment area, paralleling SR-78. A system of urban and rural trails is being implemented that will provide residents with a variety of connections to city parks and large open space areas. Escondido Creek contains a paved trail system that includes plans for recreational improvements such as par courses with exercise stations, seating areas, and mini-playgrounds.

Growth over the past 125 years has transformed Escondido from a rural agricultural town to a bustling urban and suburban area offering a range of residential and employment opportunities. The growth process has brought master-planned neighborhoods and infill development; thoroughfares and freeways; major shopping centers; downtown revitalization including a new city hall, a joint police and fire headquarters; a regional medical center; employment centers; a main library; community centers; several neighborhood and community parks; a transit center with rail service; and a regional cultural and performing arts center.

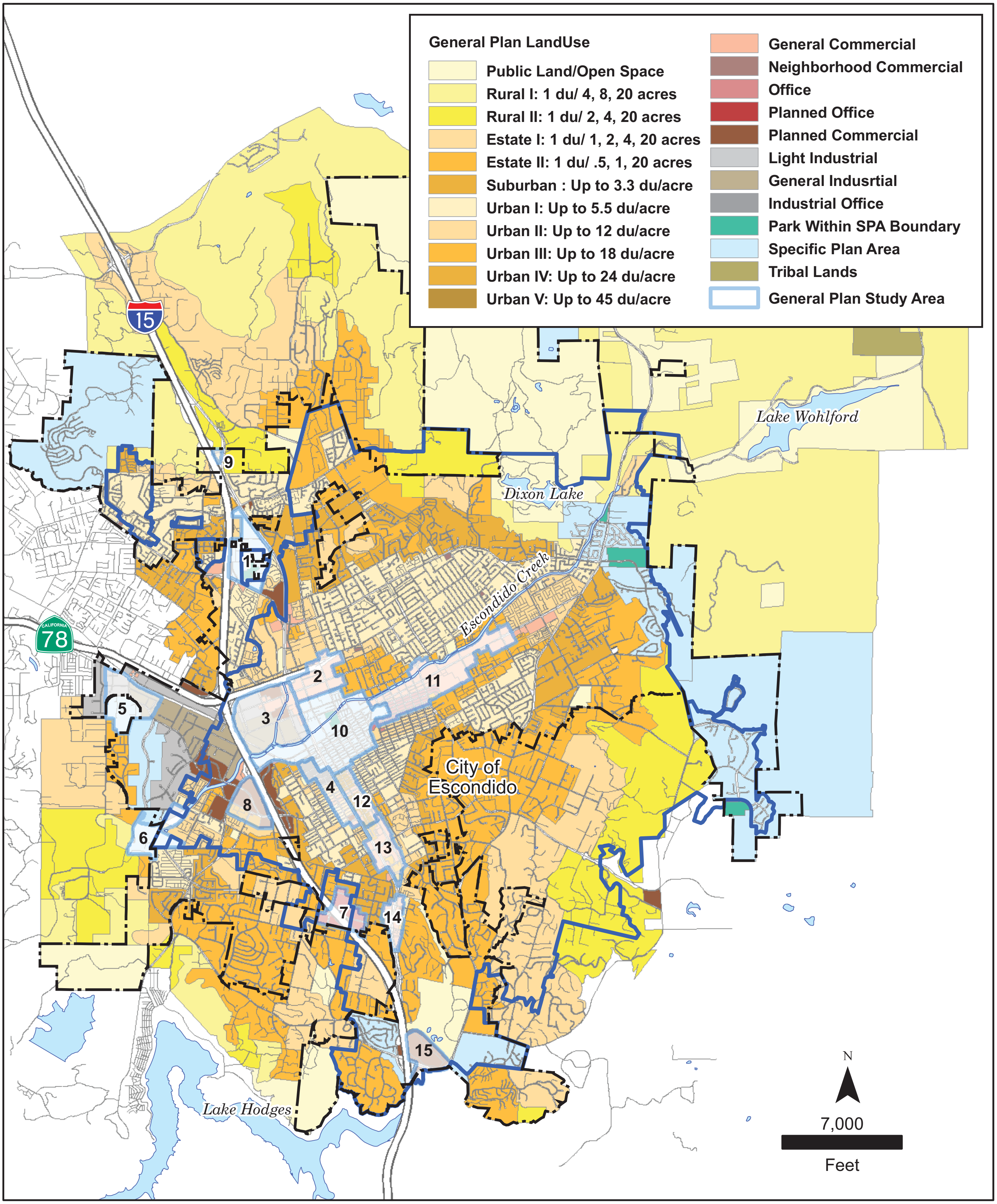
Residential and employment population estimates for the City of Escondido were provided by SANDAG based on their Series 12 data. The Series 12 data includes the residential population, employment population, and land use information. Parcels that currently receive sewer service from the City of Escondido were identified and assigned a sewer basin identification number based on proximity to existing collection sewers. Using this methodology, the 2010 sewer service residential population was determined to be 141,539 and the employment population is 58,539.

2.2 2011 General Plan Update[1]

The existing City of Escondido General Plan was adopted in 1990 and an update is currently in progress. The 1990 General Plan defines land use categories and illustrates their locations within the City. The General Plan Update boundary encompasses about 80 square miles, of which 68 square miles are within the City's SOI and 37.5 square miles are within the corporate boundaries. The General Plan Update identifies 15 study areas, which are areas proposed for land use changes as compared to the existing General Plan. The General Plan land use and 15 study areas are shown on Figure 2-1. A summary of the proposed land use changes and 2035 buildout scenarios for the 15 study areas is provided in Table 2-1, and more detailed study area descriptions are provided in Appendix A. Buildout assumptions for each study area are based on dwelling units and densities being distributed in smart growth areas and established neighborhoods, taking into account community input and visioning as well as infrastructure capabilities and quality of life standards.

The San Diego Association of Governments (SANDAG) estimates that an additional one million people will reside in the San Diego region by 2050, necessitating an additional 400,000 dwelling units. The General Plan Update considers a range of 3,350 to 5,825 new residential units that would be added to the General Plan's current build-out projection of approximately 67,900 dwelling units. Local fertility rates are anticipated to account for two-thirds of this projected growth, while one-third of new population growth is anticipated to be from residents relocating to the City.

[1] This information was obtained from the City's 2nd draft Screencheck of the General Plan EIR, October 2011.



SOURCE: City of Escondido, March 22, 2011

Study Area
and Proposed Land Uses

Figure 2-1

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Table 2-1 2035 Buildout of 2011 General Plan Study Areas

General Plan Update Study Areas	2035 Growth in 2011 General Plan Update					
	Residential		Non-Residential building area, sqft			
	SFDU	MFDU	Commercial	Office	Industrial	Comments
1. Imperial Oakes SPA	(64)	-		2,085,000	490,000	64 existing SFDUs to be replaced; FAR = 1.25
2. Hwy-78/Broadway		-	534,000	49,000	-	FAR = 1.25
3. Transit Station		640	254,000	401,000	566,000	FAR = 1.25
4. S. Quince Street	10	80	135,000	42,000	143,000	MFDU - Urban I & Urban II; FAR = 1.0
5. ERTC North SPA[(1)]	(39)		5,000	540,000	5,000	39 existing SFDUs to be replaced; FAR = 1.5
6. ERTC South SPA[(1)]	(20)		-	74,000	664,000	20 existing SFDUs to be replaced; FAR = 1.0
7. 1-15/Felicita Rd Corp. Office	(19)		186,000	800,000	-	19 existing SFDUs to be replaced; FAR 1.75
8. Promenade Retail Center			355,000	263,000	-	school to be replaced; MFDU=Urban IV; FAR=1.5
9. Nutmeg Street		50	-	30,000	-	area is currently vacant
10. Downtown SPA		3,326	1,547,000	281,000	60,000	FAR=2.0
11. East Valley Parkway	(100)	700	355,000	380,000	-	100 existing SFDUs to be replaced; FAR=1.25
12. S Escondido Blvd/ Centre City Pkwy		610	336,000	35,000	-	MFDU - Urban V; FAR = 1.25
13. S Escondido Blvd/Felicita Rd		300	137,000	17,000	-	MFDU - Urban III & IV; FAR = 1.25
14. Centre City Pkwy/ Brotherton Rd		700	407,000	206,000	-	MFDU - Urban III; FAR= 1.5
15. Westfield Shoppingtown			434,000	284,000	-	FAR = 1.25
Total for Study Areas:	**(232)**	**6,406**	**4,685,000**	**5,487,000**	**1,928,000**	

SFDU = Single Family Dwelling Unit SPA = Specific Planning Area
MFDU = Multi-Family Dwelling Unit FAR = Floor to Area Ratio
(1) Study area extends beyond the City of Escondido service area and into the Rincon MWD wastewater service area

The SANDAG 2030 forecast for the City of Escondido is 169,929 people and 53,087 dwelling units. Under existing conditions, an estimated 20,000 additional people live in the General Plan planning area, outside of the City boundaries but within the City's Sphere of Influence (SOI). In 2010, approximately 147,500 residents lived within the City of Escondido's boundaries and the household median size was 3.23 persons. The majority of homes in the City of Escondido are single family residences (27,474 units) with other residences including apartments and condos (16,469 units) and mobile homes (3,736 units). The 2030 forecast shows a projected 14 percent increase in population and 10 percent increase in housing units within the City. Because population is projected to grow faster than the number of dwelling units, the average persons per household is projected to increase in 2030.

In order to accommodate the anticipated population growth proposed in the General Plan Update future residential development will focus on smart growth principles, particularly in Study

Areas 10, 11, 12, 13, and 14 comprising area around downtown, East Valley Parkway, and South Escondido Boulevard. Smart growth principles enhance land use and urban design and provide a framework for developing the land use plan and General Plan policies. Smart growth principles include preserving urban centers, ensuring adequate infrastructure, establishing urban growth limits, encouraging mixed-use, developing for "human scale," encouraging high density development near transit, and protecting environmental resources. Smart growth seeks to expand transportation options to include walking, biking, public transit, and driving.

2.3 Metered Wastewater Flows

Wastewater flows generated in the City of Escondido are conveyed from both the south and the eastern portions of the City to the City owned HARRF for treatment, reuse, and disposal. The HARRF also treats wastewater flows generated in a portion of the Rancho Bernardo community in the City of San Diego. The flows from Rancho Bernardo also include a small contribution from the City of Poway.

All influent flows to the HARRF are metered. Figure 2-2 illustrates average daily flows to the HARRF from 2000 to 2011. In 2011, the HARRF received an annual average daily flow rate of approximately 10.1 MGD from Escondido and 2.9 MGD from Rancho Bernardo.

Historical flows from Escondido are further characterized in Figure 2-3. Since 2000 average annual flows gradually increased from approximately 10 MGD to a maximum of 11.9 MGD in 2007, and then decreased back down to 2000 levels. The overall reduction in wastewater flows per capita during this period can be attributed primarily to the effects of water conservation programs (low-flow toilets, shower heads, washing machines, etc.). The more recent decline in flows since 2007 is due to a combination of factors, most notably the economic recession, rising water rates, and drought conditions. Water Shortage Level 1-Water Watch Condition was declared in Escondido in October 2008 and a Stage 2-Water Alert Condition was declared in response to reduced water deliveries from the SDCWA in July 2009. Mandated water use restrictions include an eight percent water use reduction.

Peak flows to the HARRF from Escondido are also shown on Figure 2-3. The average daily peak flow is approximately 1.5 to 1.7 times the average annual flow, and corresponds to typical water usage throughout the day, which can be represented by a diurnal curve. The maximum peak flow for each year occurs during periods of heavy rainfall and includes a significant amount of storm water inflow and infiltration.

Storm water inflow and infiltration is the combination of wet weather infiltration and direct inflow that establishes the maximum required hydraulic capacity of wastewater conveyance facilities. Storm water infiltration is water that enters the collection system underground through holes, cracks and leaky joints in pipelines and manholes as a result of rainfall percolation and temporary rising of groundwater levels. While the amount of infiltration from rainfall events can be estimated from an evaluation of flow data and rainfall records, infiltration that occurs year-round in areas of high groundwater can typically only be detected from pipeline video inspections or manhole inspections. Storm water inflow refers to surface storm water that enters the collection system at manholes or from illicit connections to the sewer system, such as roof and yard drains and storm flows from parking lots. The primary characteristics of inflow are the rapid response to the onset and cessation of rainfall. The rate of inflow depends on the amount and intensity of a specific rainfall event and also previous rainfall events, which affect ground water saturation levels and hence the amount of surface runoff.

Figure 2-2 Historical Average Daily Flows to the HARRF

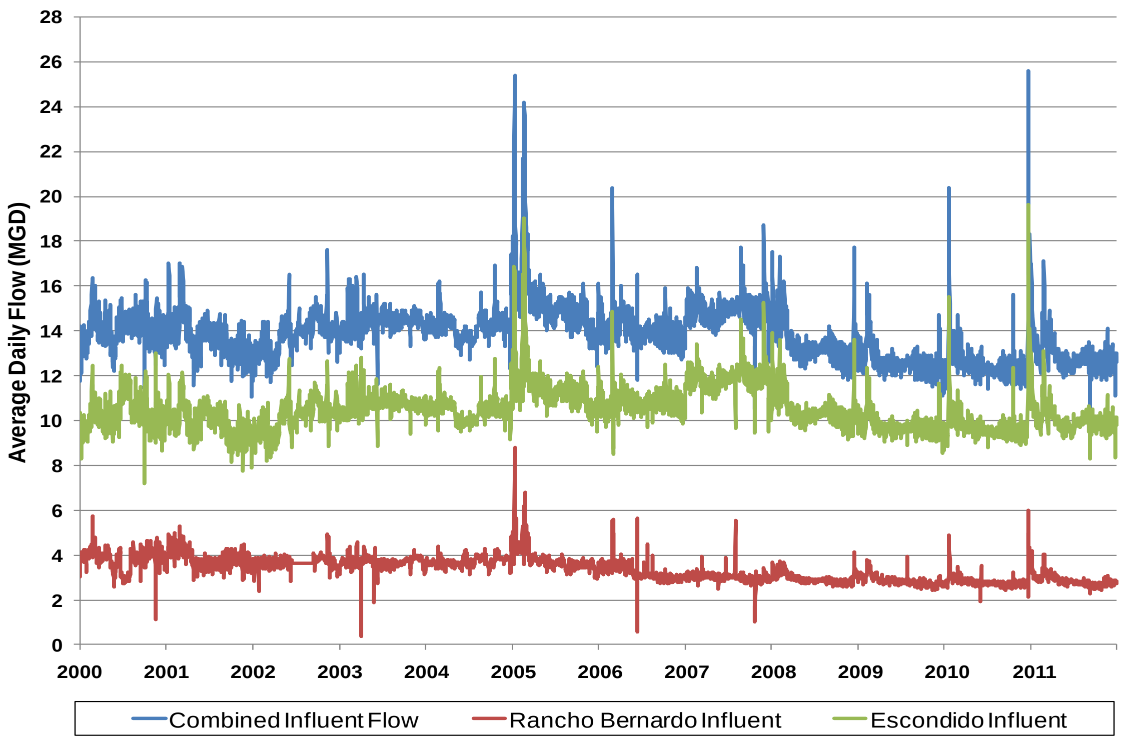
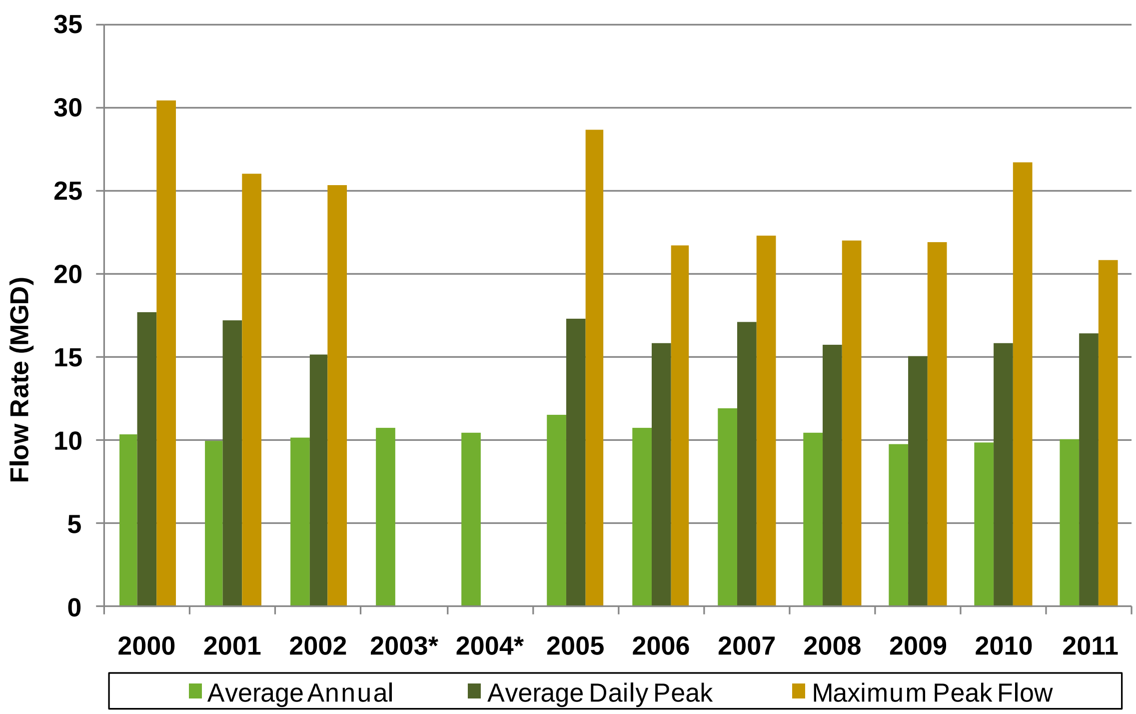


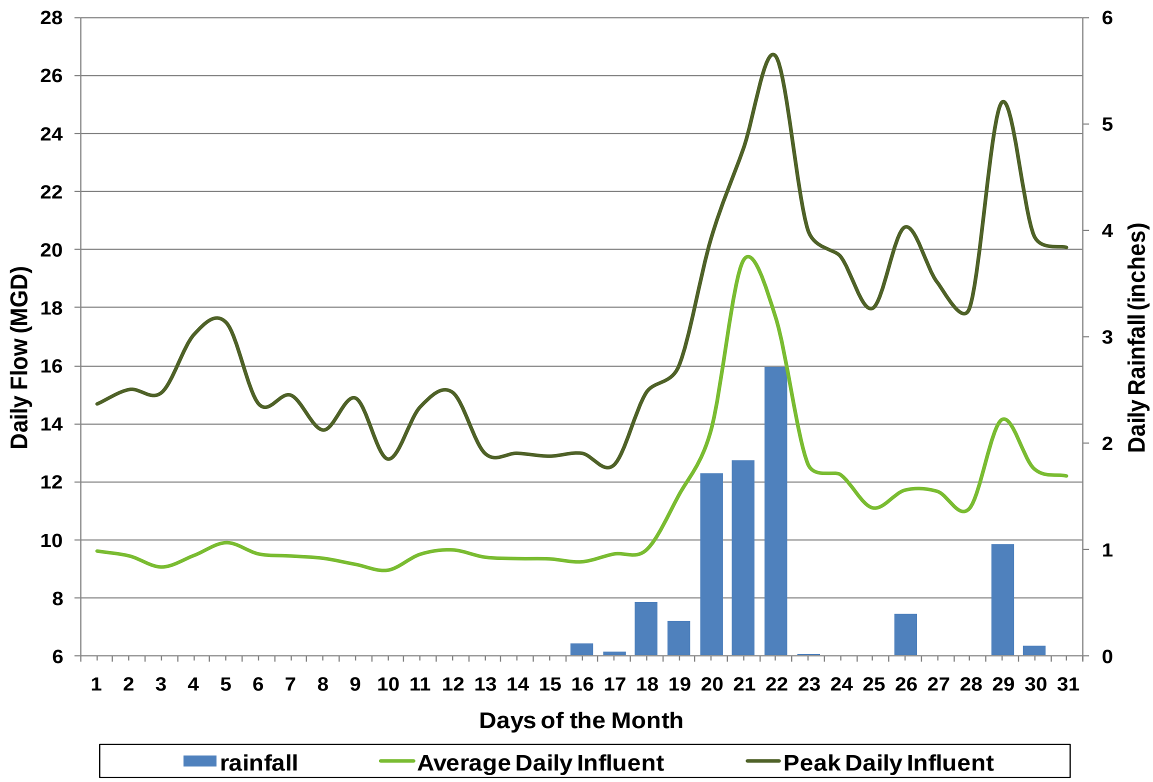
Figure 2-3 Escondido Average and Peak Flows to the HARRF



* Peak Flow data is missing from HARRF flow records

The increase in wastewater flows during storm events is shown in Figure 2-4, which provides a graph of the average and peak daily flows during December 2010, plotted together with the daily rainfall for the same period. December 2010 was a very wet period, with approximately ten inches of rain falling in the last half of the month. The rapid increase in wastewater flows following periods of heavy rainfall is attributed primarily to storm water inflow, which resulted in an average daily flow rate on December 21 of 19.7 MGD, approximately 9.9 MGD higher, or nearly double, the average daily flow for 2010. It is noted that one week after that specific storm event, daily wastewater flows from Escondido to the HARRF still averaged over 1 MGD higher than annual average daily flows, indicating a storm water infiltration component as well.

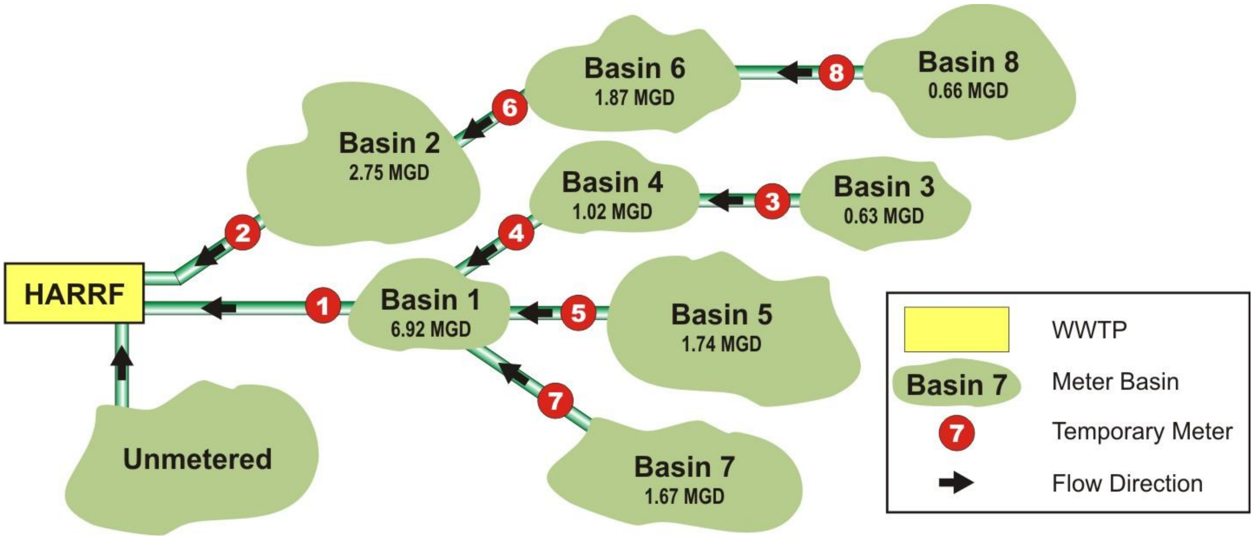
Figure 2-4 Escondido Flows to the HARRF and Rainfall, December 2010



2011 Temporary Flow Monitoring

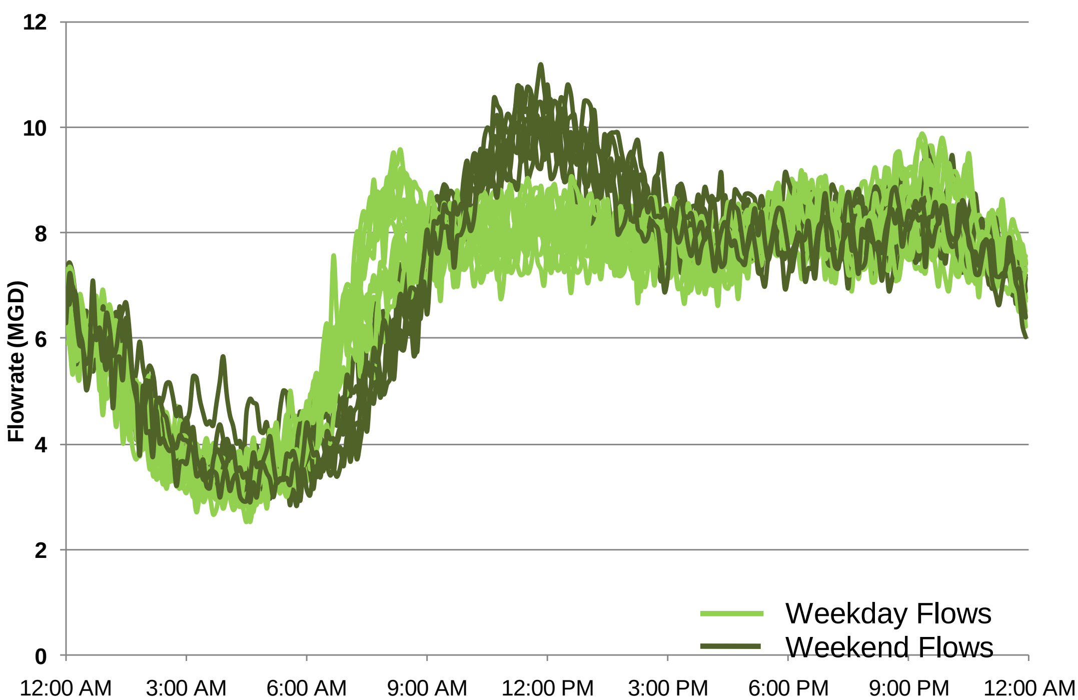
Temporary flow monitoring was conducted by ADS Environmental Services as part of this Master Plan Update. Metering was conducted at eight locations with the Escondido collection system for a duration of 28 days from April 07, 2011 through May 04, 2011. There was no precipitation during the flow monitoring period. Flow depth, quantity, and velocity were recorded every five minutes and quantity hydrographs were prepared from this data. The overall quality of the collected data was good, and the recorded flow depth and velocity measurements were consistent with field confirmations. The average flows recorded at each meter are shown on the schematic provided in Figure 2-5. The complete flow monitoring report is provided in Appendix B and descriptions of the metered sub-basins are provided in Section 4 of this report.

Figure 2-5 Average Metered Flows, April 7 – May 4, 2011



In general, flow measurement data from the temporary meters reveals distinct and repeatable daily peaking trends for weekdays and weekends, with the highest daily peak flows recorded during weekends. Figure 2-6 illustrates the daily flows recorded by Meter 1, which metered flow on the largest trunk sewer approximately one mile upstream from the HARRF. It is noted that flow oscillations shown on the graph are due to the stop/start operation of upstream pump stations.

Figure 2-6 Daily Flows at Temporary Meter No. 1 – 4/7/11-5/4/11



2.4 Existing Wastewater Generation Rates

Existing wastewater flows were compared with land use data, population estimates and water meter records from the City and portions of Rincon del Diablo Municipal Water District (Rincon MWD) to develop unit wastewater generation rates. This methodology coupled with treatment plant flow records, temporary sewer flow meter records and lift station records can produce fairly accurate sewer flow estimates for individual sewer basins in evaluating existing system capacities.

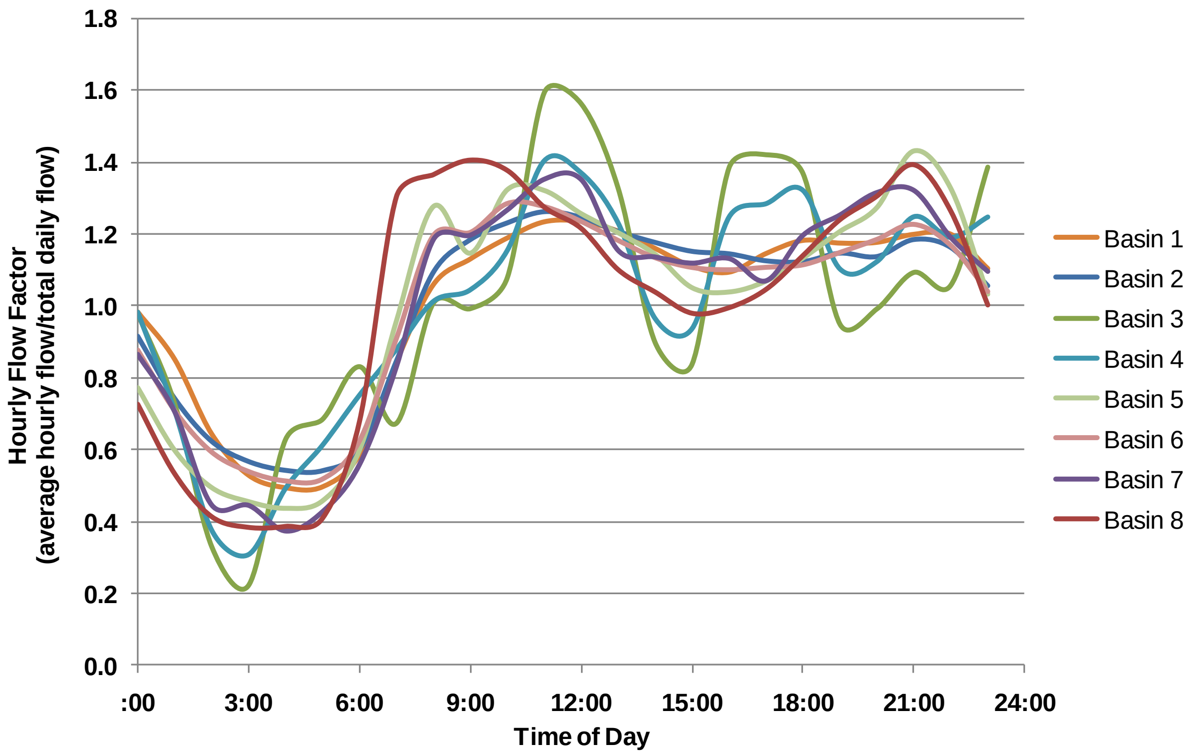
As a first step in determining the wastewater generation rates, over 70 specific land use categories in the SANDAG database were combined into nine general land use categories. For residential land use, a unit flow generation factor was developed based on the 2010 population per the SANDAG Series 12 data. For non-residential land use, water billing records for 2010 were obtained and assigned to each parcel, and a return-to-sewer generation rate was developed. Water use from irrigation accounts was excluded for this analysis. Flow generation factors were developed through an iterative process in which generated flows were compared with recorded flows at the HARRF and the metered sub-basins. Unit wastewater generation rates were “calibrated” to within one percent of HARRF flows. The unit wastewater generation rates developed from this process are 55 gallons per capita per day (gpcd) for residential population, and 38 gpcd for employment population.

Typically, design and planning standards for agencies in a San Diego County assume per capita wastewater generation rates between 60 to 80 gallons gpcd for residential and 15 to 35 gpcd for employment populations. Wastewater generation rates for non-residential land use can vary widely, and flow estimates based on return to sewer rates are generally more accurate than employment per capita factors. The existing return to sewer rates for commercial, industrial and institutional land use areas was calculated to be 60 percent of the water demand, which excludes irrigation demands supplied from separate meters.

2.5 Peaking Factors

Diurnal peaking curves, also referred to as dry weather hydrogaphs, were determined for upstream basins based on the temporary flow meter data. A 24-hour flow curve was calculated for each upstream basin by averaging the hourly flow for each day during the flow metering period. A peaking curve was then developed for each basin in terms of the hourly flow factor (HFF), which is the hourly average flow divided by the average daily flow. The peak dry weather flow (PDWF) is the maximum HFF times the average daily flow for that basin. Figure 2-7 illustrates each characteristic peaking curve for the temporary flow meter sites. Most of the metered basins are dominated by residential flows, which typically have morning and evening peak flow periods. As is typical with most collections systems, upstream meters, such as Basins 3 and 8, have higher peaks than downstream meters, such as Basin 1, where peak flows are attenuated. It is noted that Basin 3 exhibits atypical peaks, which are presumed to be due to the relatively large number of schools in the service area.

Figure 2-7 Diurnal Peaking Curves for Metered Basins

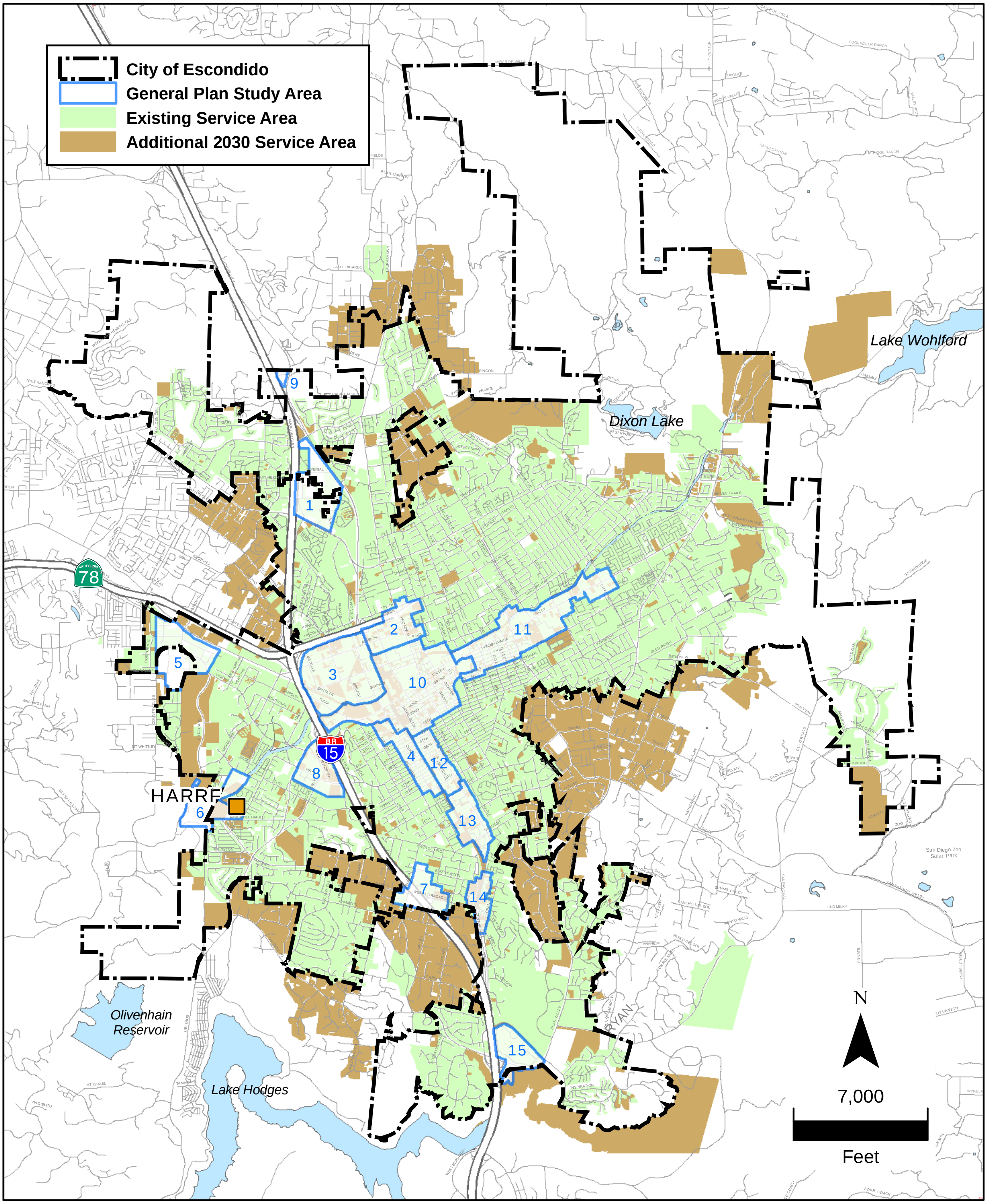


2.6 Projected Sewer Flows

In this Master Plan Update, sewer flows are projected for 2030 based on a combination of data sources, including SANDAG Series 12 residential and employment population projections, the General Plan Update, which identifies septic conversion customers and provides development data for the 15 specific study areas and planning information provided by City staff for specific development projects.

2030 Wastewater Service Area

The 2030 wastewater service area will be appreciably larger than the existing service area due to expansions of the collection system to serve new development and areas that are currently served by septic systems. As part of the General Plan Update, City staff expended significant effort to identify these septic conversion areas. Many of the future service areas are outside of the existing City boundary and will require annexation for wastewater service. Figure 2-8 illustrates the anticipated expansion of the service area by year 2030. As shown on the map, the primary areas of expansion are along the City's northern and eastern boundary and at several locations west of Interstate 15. The future annexed areas are comprised primarily of low-density rural and residential estate land use. Also shown on the map are the 15 General Plan Update Study Areas, which will discharge all future flows to the City of Escondido collection system. It is noted that some parcels within Study Areas 1, 5 and 6 are currently outside of the City boundary and will require annexation for sewer service.



Existing and Future Sewer Service Areas

Figure 2-8

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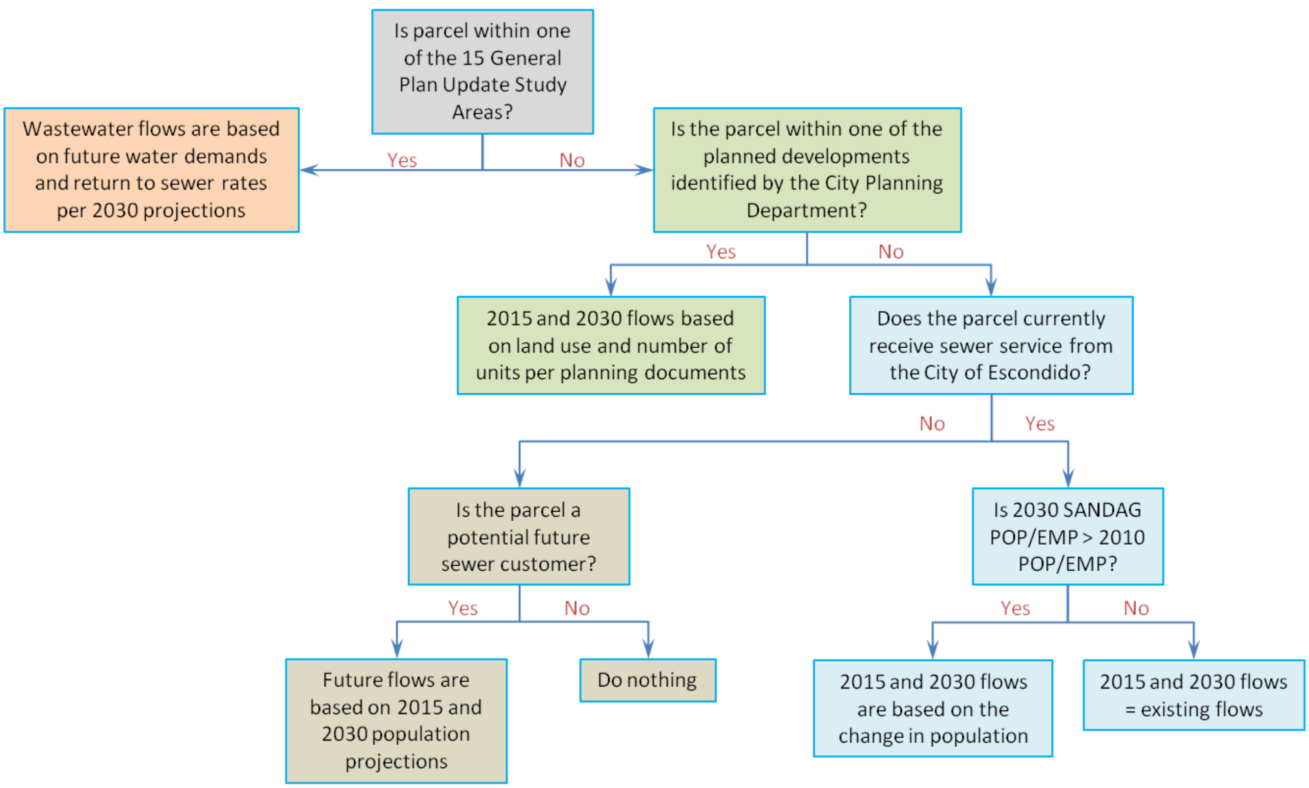
ATKINS

Flow Projection Methodology

In this Master Plan Update, future wastewater flows are projected based on a 20-year planning horizon (Horizon Year) and input to the 2030 collection system hydraulic model. Wastewater flow projections are made using several different methods based on the available planning data. The flow chart provided in Figure 2-9 summarizes the parcel-based wastewater flow projection and allocation methodology. For developments with approved tentative maps or other specific planning information, sewer flows are projected based on the proposed land use and number of future dwelling units as provided by the City planning department. Within the General Plan Study Areas, specific development information provided in the General Plan Update EIR for the 2035 buildout condition (shown previously in Table 2-1) is used to project water demands, and sewer flows are estimated based on estimated return to sewer rates. For all other parcels within the 2030 service area, future flows are calculated on a parcel basis using SANDAG 2030 population projections and unit sewer flows developed in Section 2.4. For parcels that are currently connected to the sewer system, additional future flows are based on population increase.

Figure 2-9 Flow Projection Methodology



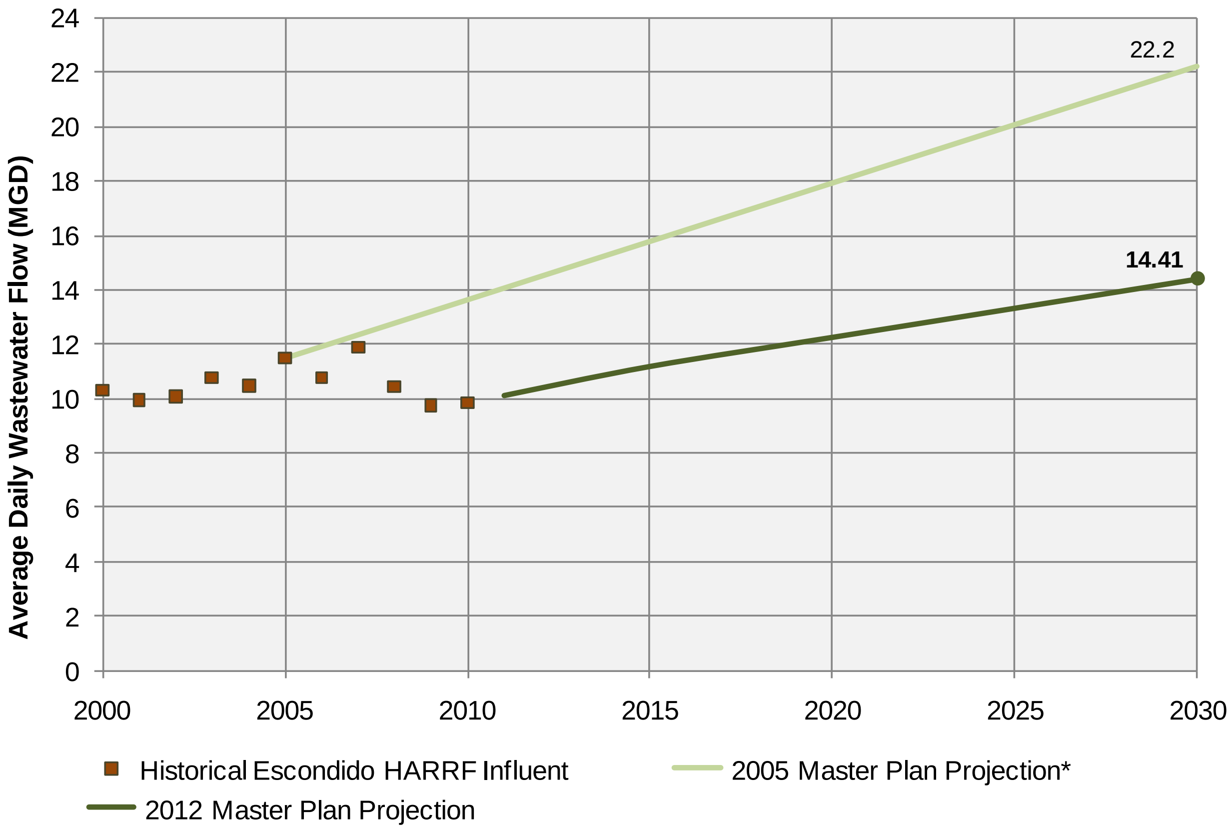
Wastewater Flow Projections

Using the methodology described in the previous section, the average daily wastewater flow projected for the City of Escondido in 2030 is approximately 14.4 MGD. This is an increase of 4.27 MGD or 42 percent over the 2011 metered flows, which averaged 10.13 MGD. Of this increase, 1.39 MGD is attributed to development within the General Plan Update Study Areas, 1.06 MGD is due to an increase in residential and employment population for existing customers outside of the General Plan Update Study Areas, and the largest increase, 1.82 MG, will be from new connections to the expanded sewer system. Approximately 50 percent of the flow increase from new connections is attributed to the addition of approximately 3,600 parcels that are currently served by septic systems.

Figure 2-10 illustrates historical flows from Escondido to the HARRF since 2000 and the flow projection for 2030. As a comparison, the average daily flow projected in the 2005 Wastewater Collection System Master Plan Update for *ultimate* buildout of the collection system is included on Figure 2-10. No date was assigned to the ultimate condition, so a date of 2030 was used for comparison purposes.

It should be pointed out that no projection is assured of accuracy in an environment where changing economic conditions, political climates, and community values all affect growth rates, water consumption, and wastewater flows. Flow projections in this Master Plan Update assume that unit wastewater flows and peaking will remain at approximately 2011 levels. Future flow projections may also be subject to modification if the community adopts strong policies either in favor of or opposing growth in general. As a final note, while a 20-year planning horizon is considered in this Master Plan Update, SANDAG 2050 regional growth forecasts for the City of Escondido project a seven percent population increase beyond 2030.

Figure 2-10 2030 Wastewater Flow Projections



* An ultimate flow projection of 22.2 MGD was made in the 2005 Wastewater Collection System Master Plan Update and no year was assigned to the ultimate buildout condition.

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Section 3
Design Criteria

Design criteria were developed to evaluate the capacity of the existing wastewater collection system under existing and projected dry and wet weather flow conditions. The recommended evaluation criteria presented in Tables 3-1 and 3-2 will be utilized to identify deficient facilities and size replacement infrastructure.

3.1 Existing Design Criteria

The existing wastewater system design criteria are documented in the 2005 Wastewater Collection System Master Plan Update. The criteria, which are similar to other Southern California sewer agencies, are summarized in Table 3-1.

Table 3-1 Existing Design and Evaluation Criteria

Category	Design/Evaluation Criteria
Gravity Mains	• Minimum Velocity – 2 feet per second at peak flow rate • Max Peak depth to diameter ratio for existing sewers – 0.50 Peak Dry Weather Flow for diameter $\leq$ 12-inch – 0.75 Peak Dry Weather Flow for diameter > 12-inch • Inflow and Infiltration – 4,800 gallons per day per mile of pipe • Manning's Roughness Coefficient – 0.013
Force Mains	• Minimum Velocity – 3 feet per second • Maximum Velocity – 10 feet per second • Hazen Williams 'C' Factor – 100
Lift Stations	• Minimum Pump Capacity – ultimate peak wet weather flow Standby Capacity – 100% of largest pump capacity Emergency Power – required • Emergency Storage Capacity – 8 hours of average daily flow
Peaking Factors	$Q_{peaked} = 2.17(Q_{average})^{0.975}$

3.2 Recommended Design Criteria

Additional criteria for design and evaluation of the sewer system were developed based on the existing design criteria to include suggestions to improve operations, reliability, and cost savings. The additional criteria are listed in Table 3-2.

In addition to the updated criteria, the following elements can help with reliability and cost savings in the wastewater system:

- Conduct CCTV inspections of all gravity mains 8" and larger in diameter to determine likely locations of pipe failures.

- Perform smoke testing in areas where high H_2S concentrations occur to identify possible pipe replacement candidates.
- Specify variable speed pumps for future lift stations to reduce power consumption and lower operating costs over the life cycle of the pumps.

Table 3-2 Additional Recommended Design and Evaluation Criteria

Category	Design/Evaluation Criteria
Gravity Mains	• Minimum Pipe Diameter – 8 inches
Force Mains	• Maximum Velocity – 8 feet per second • Minimum Pipe Diameter – 4 inches • Hazen Williams 'C' Factor – 120
Siphon	• Minimum Pipe Diameter – 6-inch • Minimum Number of Pipes – 2 • Minimum Velocity – 3 feet per second at peak dry weather flow
Lift Stations	• Minimum Number of Pumps – 2 • Minimum Pump Capacity – ***Duty*** pumps capable of handling ultimate peak wet weather flows • Emergency Power – ***24-hour on-site*** standby power • Emergency Storage Capacity – ***12 hrs*** of average daily flow • Pump motors – variable speed
Peak Factors	• Dry Weather – individual diurnal peaking curves derived for each metered sub-basin based on metered flows • Wet Weather – I&I based on December 2010 storm event, calibrated to HARRF meter flows.

Section 4
Existing Collection System

This section summarizes the existing facilities that collect, treat and dispose of domestic and industrial wastewater generated within the City of Escondido. All wastewater is treated at the HARRF, which is located adjacent to Escondido Creek along the City's western boundary. The general direction of wastewater conveyance is from east to west, with the major trunk sewers following Escondido Creek. A series of additional gravity trunk sewers convey flows from the northern and southern areas of the City towards the creek. South of approximately Citracado Parkway surface drainage is tributary to Lake Hodges, and wastewater flows generated in this area are conveyed to the HARFF utilizing a series of lift stations. The Escondido wastewater collection system includes more than 380 miles of sewer pipelines, 7,500 manholes, and 14 sewer lift stations.

4.1 Major Facilities

The major wastewater collection, conveyance, and treatment facilities are shown on Figure 4-1 and summarized in the following report sections.

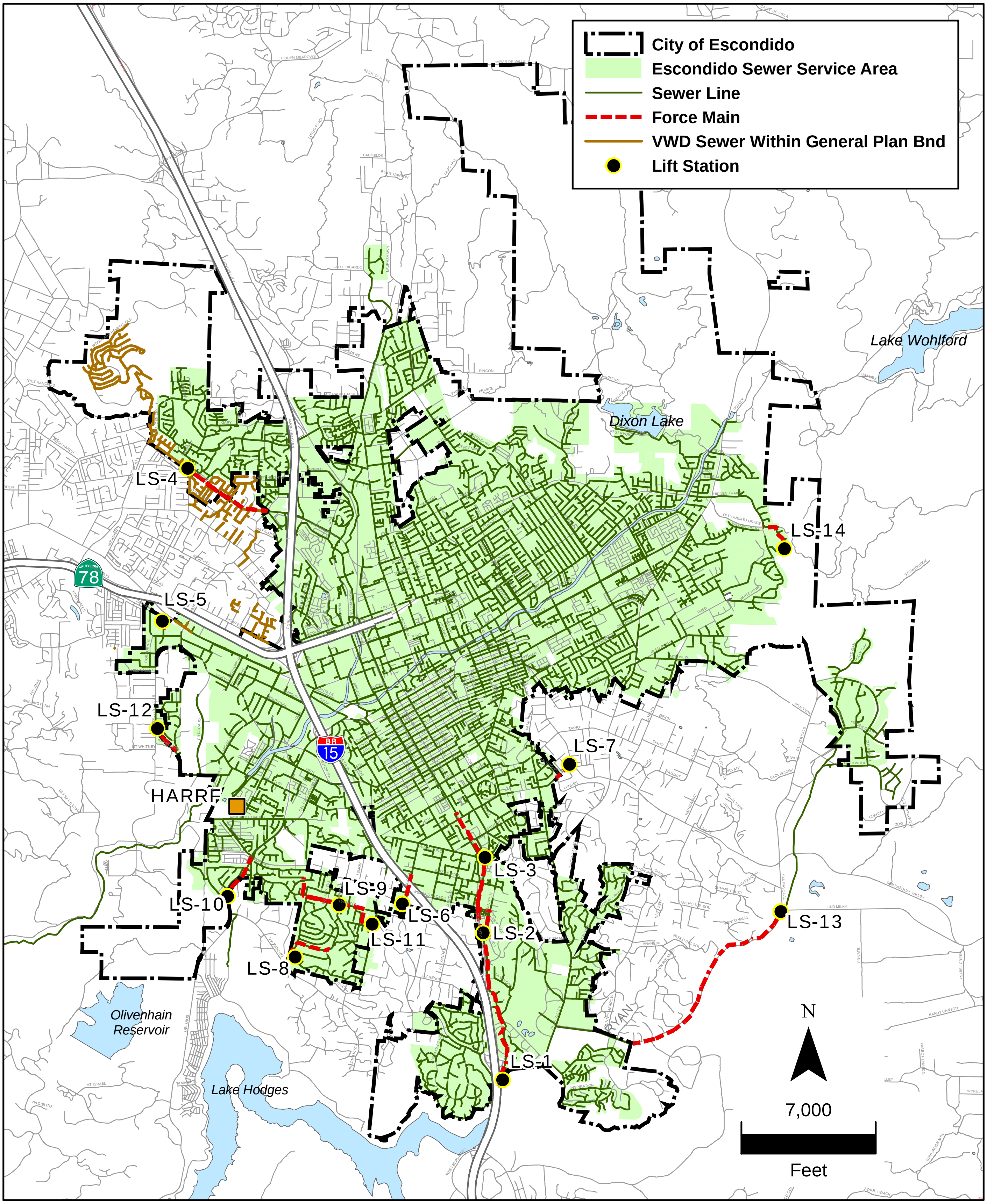
Hale Avenue Resource Recovery Facility

The HARRF is a wastewater treatment and reclamation facility that is owned and operated by the City of Escondido. The location of the HARRF and its service area is shown on Figure 4-1.

Escondido's first treatment plant was constructed in 1929 at Spruce Street and Norlak Avenue, just north of the City's main drainage channel. In 1959 a new treatment plant was constructed further west, at the site of today's HARRF. Originally constructed as a 1.0 MGD activated sludge facility, the treatment plant underwent five phases of capacity expansion between 1965 and 2000. In 2001 tertiary treatment facilities were added to produce high quality water recycled water for irrigation and industrial water uses, and the treatment plant was renamed the HARRF.

The HARRF is currently rated to provide 18.0 MGD of secondary wastewater treatment and 9.0 MGD of tertiary wastewater treatment with its existing process units. The City of San Diego has contracted for treatment of up to 5.5 MGD of wastewater from Rancho Bernardo. In 2011, the HARRF received an annual average daily flow rate of approximately 10.07 MGD and 2.86 MGD from the City and San Diego, respectively. Additional upgrades are currently in design to replace the administration building, rebuild the influent pump station and primary treatment building, and convert waste methane gas into natural gas.

The HARRF uses mechanically cleaned bar screens, cyclonic grit chambers and preliminary clarifiers for primary treatment. The wastewater then flows to aeration basins equipped with fixed fine-bubble diffusers followed by secondary clarifiers. An equalization basin is available to equalize peak flows. All incoming sewer flows are treated to a secondary standard and disposed of via the Land Outfall. Some of the flow (up to 9 MGD) is further treated to California Title 22 recycled water standards (tertiary treatment). Tertiary treatment occurs through chemical coagulation and flocculation, monomedia continuous backwash upflow filters (DynaSand), and UV and/or chlorination for disinfection. After filtration and disinfection, the



Major Wastewater Facilities

Figure 4-1

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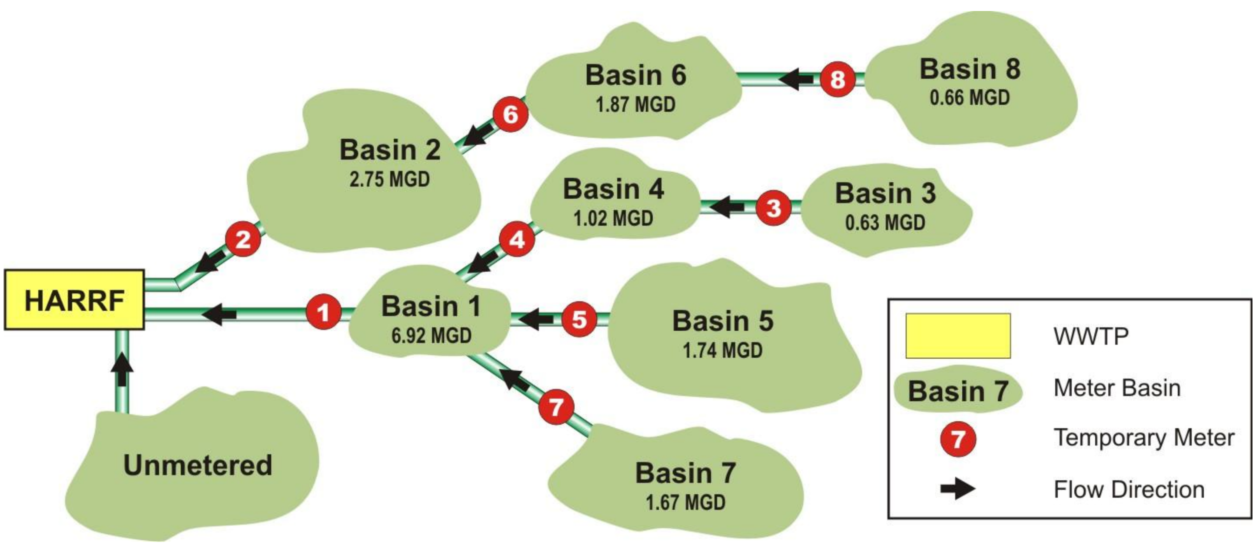
recycled water is pumped to the distribution system pump station forebay for distribution or to an onsite storage basin. The stored water is typically distributed into the system during periods of low plant flow.

Recycled water that is not reused can be dechlorinated as needed and discharged backed to the outfall. National Pollution Discharge Elimination System (NPDES) permits limit discharge flow to the outfall to an average flow of 18 MGD.

Peak flows to the HARRF can exceed the permitted capacity during severe wet weather conditions. The HARRF is designed to handle an instantaneous flow of 36 MGD, which is two time the rated capacity. Under extreme wet weather conditions, up to 9 MGD of tertiary treated wastewater can also be discharged to Escondido Creek.

Solids from the primary treatment process go directly to the anaerobic digesters. Sludge from the secondary process is treated. through dissolved air flotation thickeners then sent to the primary and secondary anaerobic digesters, and centrifuge dewatering units with an odor control system. Screened solids are trucked for disposal to a landfill and dewatered sludge is trucked off site for land application. A schematic of the wastewater treatment system is provided as Figure 4-2.

Figure 4-2 Schematic HARRF Treatment Process



Outfall Facilities

Prior to 1973, treated water effluent was discharged to the Escondido Creek and downstream San Elijo Lagoon. Treated effluent from the HARRF is now discharged to the Pacific Ocean via the 14-mile long Escondido land Outfall that connects to the San Elijo Ocean Outfall pipeline near the San Elijo Lagoon. The effluent exits the outfall pipeline approximately 1.5 miles offshore through diffuser ports 110-feet deep in the Pacific Ocean.

The outfalls are regulated under separate orders. The Escondido Land Outfall is owned by the City and consists of pipelines that vary from 30 to 36 inches in diameter. The land outfall roughly parallels Escondido Creek in a 20-foot-wide easement and operates under gravity flow to a point near Lone Jack Road in Olivenhain. From that point to the land outfall's connection with the ocean outfall, the pipeline flows under pressure. The hydraulic design capacity is reported at 27.6 MGD, but discharge to the land outfall is limited by the downstream ocean outfall. The City is considering several options for upgrading the Escondido Land Outfall including: replacement with larger pipe in the existing alignment; installation of a parallel outfall in the existing alignment, installation of a larger outfall in an alternative location; and pressurization of the existing outfall.

The junction of the Escondido Land Outfall and the San Elijo Ocean Outfall is located just west of Interstate 5 and north of the San Elijo Lagoon. The San Elijo Ocean Outfall is owned by the San Elijo Joint Powers Authority (SEJPA), and 79 percent of the outfall capacity is leased to the City. The ocean outfall traverses the San Elijo Lagoon, crosses under the railroad and Pacific Coast Highway, and extends 800 lineal feet into the ocean. The outfall pipeline has an internal diameter of 30-inch from the junction with the land outfall to a point 4,000 feet west of the beach. The pipeline has a structural pressure limitation based upon pressure head. At the terminus of the 30-inch diameter section, the outfall turns and parallels the beach for 200 feet in a 48-inch diameter pipeline. The pipeline then turns west and extends an additional 4,000 feet into the ocean. The last 1,200 feet of the ocean outfall consist of the diffuser.

The current hydraulic capacity of the ocean outfall is 25.5 MGD and the City's leased capacity is 20.1 MGD of instantaneous flow. Operating capacity of the outfall is limited by the inshore 30-inch diameter section that has a design pressure limitation. Consequently, flows through the outfall are limited to 24.3 MGD through a flow-regulating valve of the Escondido Land Outfall. The City of Escondido leases 79 percent of the ocean outfall capacity, which is 19.2 MGD.

Influent rates to the HARRF can exceed the capacity of the outfall during severe storm events. The City implements several flow management strategies to handle excess storm water flows, including on-site storage in three reservoirs (6 MG total capacity) and off-site storage in the Lesley Lane recycled water reservoir (2 MG total capacity). Both the land and ocean outfalls are approaching their capacity limits and the City is investigating future options to reduce flow to the outfalls, including an increase in recycled water production and an aggressive I&I reduction program. Additionally, the City is investigating indirect potable reuse, which would significantly, if not completely, reduce the use of the outfall for disposal of treated wastewater.

Lift Stations

The City of Escondido currently operates and maintains 14 sewer lift stations within the wastewater collection system. The lift stations are referenced by number (LS-1 to LS-14) and are summarized in Table 4-1. The stations are located south of Escondido Creek with the exception of Lift Station 4 and Lift Station 12, which are located further north along the City's western boundary. All pumps have constant speed motors and each lift station has both duty and standby pumps that operate with lead/lag or alternating pump calls based on wet well levels. In addition, all lift stations have either a diesel- or propane-fueled backup generator. It is noted that Lift Station 4 is currently being upgraded, and the information in Table 4-1 reflects data associated with the original lift station.

Table 4-1 Lift Station Summary

Lift Station	Location	No. of Pumps (Duty/ Standby)	Rated Station Capacity gpm	Firm(1) Pumping Capacity	Motor Size Hp	Force Main Size	Comments
LS-1	3680 Sunset Drive	2/1	1,100	1,040	75	16"	3 sets of 2 pumps in series due to high lift
		2/1	1,100	1,040	75		
LS-2	2698 S Escondido Blvd	2/1	215	150	15	6"	submersible station
LS-3	2045 S Escondido Blvd	2/1	2,050	2,120	125	10"	submersible station; 2 pumps can't operate
LS-4	Edgebrook Place	2/2	500	--	--	--	station is currently being upgraded
LS-5	735 Opper Street	2/1	225	240	7.5	6"	partially buried GR package station
LS-6	2101 Felicita Road	2/1	120	80	7.5	4"	GR package station
LS-7	870 E 17th Street	2/1	160	60	7.5	4"	GR package station, fiberglass enclosed
LS-8	2472 Eucalyptus Av.	2/1	200	160	25	6"	S&L package station, deep dry pit
LS-9	1399 Hamilton Lane	2/1	250	510	60	6"	S&L package station, deep dry pit
LS-10	2356½ Willobrook St	2/1	230	160	10	6"	S&L package station, deep dry pit
LS-11	2451 Bernardo Av.	2/1	200	150	10	6"	S&L package station, deep dry pit
LS-12	1400 Country Club Dr	2/1	150	70	20	6"	partially buried GR package station
LS-13	20950 San Pasqual Rd	2/1	340	200	30	8"	newer dry pit/wet well station w/spill basin
LS-14	397 Oak Valley Lane	2/1	140	155	25	2-6"	newest station (2001); submersible pumps

(1) Current firm pumping capacity is based on actual pump tests conducted in 2010. For Lift Station 1, pump set No. 1 is assumed out of service with pump set Nos. 2 and 3 running in parallel.

Gravity Pipelines

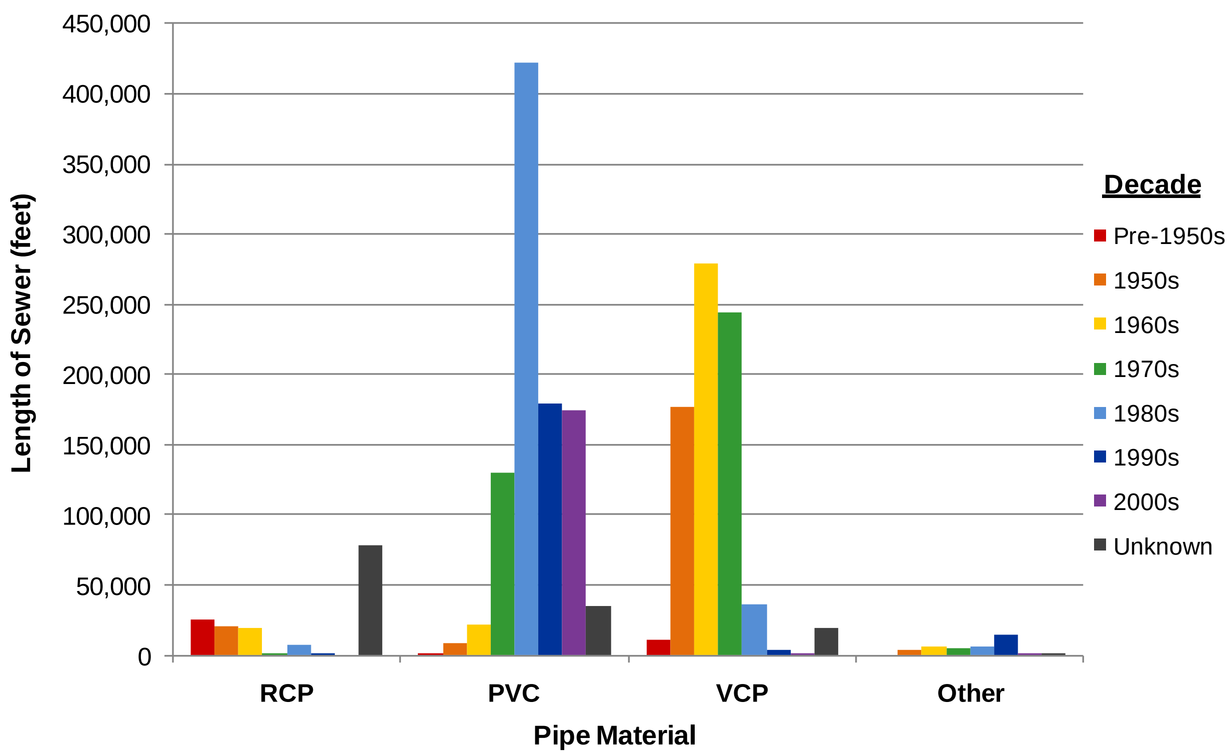
The trunk sewers in the sewer collection system were shown previously on Figure 4-1, which includes all sewer pipelines 12 inches in diameter and larger, as well as some smaller pipelines that are downstream of lift stations. Based on information in the City's sewer pipeline GIS, the sewer pipelines range in diameter from 4-inches to 42-inches. The oldest trunk sewer is a 12-inch and 15-inch diameter reach in Quince Street that was constructed in 1928. Information on pipeline materials and age obtained from the City's GIS is provided in Table 4-2 and shown graphically on Figure 4-3. In general, the collection system includes predominantly 8-inch to 12-inch diameter pipelines constructed of either vitrified clay pipe (VCP), generally before the 1980s. The main trunk sewer from Quince Street to HARRF was constructed on the south side of Escondido Creek with extra strength VCP in the 1980s. Poly vinyl chloride (PVC) pipe was predominantly used from the 1980s and beyond. Several of the larger diameter trunk mains are constructed with reinforced concrete pipe (RCP). There are also a long reach of 36-inch ductile iron pipe (DIP), encased in concrete, that runs along the Escondido Creek floor from Quince to

Broadway. High density polyethylene (HDPE) pipe was used for the Centre City Parkway trunkline and for special applications such as bridge installations and creek crossings. The Escondido collection system has seven inverted siphons which convey wastewater under creek beds.

Table 4-2 Pipeline Material and Age Summary

Age	Material Type (in feet)					
	RCP	PVC	VCP	Other	Total	Percent
Pre-1950	25,357	724	10,506	0	36,587	1.9%
1950s	20,477	8,661	176,345	3,517	208,999	10.8%
1960s	19,608	21,817	278,842	6,756	327,023	16.9%
1970s	330	130,316	244,665	4,469	379,780	19.6%
1980s	7,880	422,495	35,820	6,707	472,901	24.4%
1990s	1,293	179,487	3,823	14,243	198,846	10.3%
2000s	0	174,127	1,575	1,324	177,027	9.1%
Unknown	78,224	35,607	19,326	607	133,764	6.9%
Total	153,168	973,235	770,901	37,622	**1,934,926**	
Percentage	7.9%	50.3%	39.8%	1.9%		100%

Figure 4-3 Gravity Pipeline Length of Material by Age



4.2 Metered Sub-Basins

Separate drainage basins or "sub-basins" were identified within the collection system for the purpose of locating temporary flow meters as part of the model calibration effort (discussed in Section 5). The areas served within each of the eight metered basins and the one unmetered basin are shown on Figure 4-4. Each metered basin includes an upstream collection system and several trunk sewers that combine at a single downstream location where the meter was installed. Figure 4-5 provides a flow schematic for the metered sub-basins.

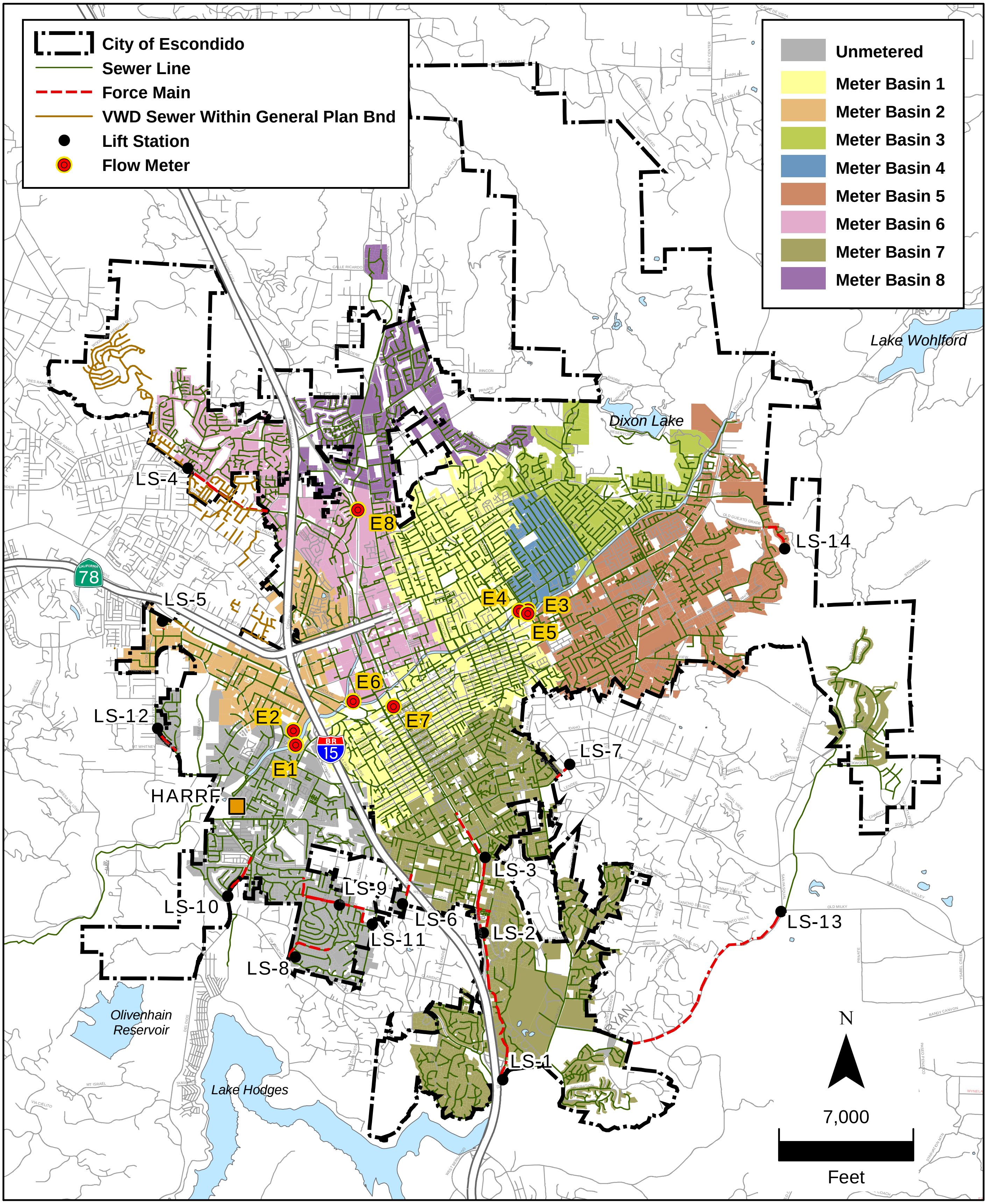
Basins 3, 4 and 5 are located at the east end of the City and discharge to Basin 1 through the main trunk sewers that follow Escondido Creek. Basin 1 extends both north and south of the channel, and includes the downtown area. The main trunk sewer in Basin 1 follows the creek and discharges to the HARRF. Basins 8 and 6 include the northernmost areas of the City and discharge to Basin 2, which includes a primarily industrial area directly north of the HARRF. Basin 2 discharges to a trunk sewer that crosses under Escondido Creek before discharging to the HARRF. Basin 7 includes the southernmost areas of the City and several lift stations, including the station that serves the Rancho San Pasqual area, and discharges to Basin 1. The unmetered "basin" consists of areas near the HARRF with smaller trunk sewers that discharge to the HARRF at several locations, and were thus impractical to meter.

The characteristics of each metered basin with respect to existing development are summarized in Table 4-3. This information is based on information provided by SANDAG for 2010.

Table 4-3 Development Information for Metered Basins

Metered Basin	Residential Area (Acres)	Non Residential Area (Acres)	Percent by Area		Estimated Occupied Dwelling Units	Employment Population
			Residential	Commercial		
1	1,304	413	76%	24%	9,738	11,036
2	1,023	843	55%	45%	4,561	13,542
3	2,480	392	86%	14%	8,263	5,583
4	253	16	94%	6%	1,706	132
5	692	45	94%	6%	2,365	441
6	2,303	528	81%	19%	11,027	10,474
7	4,900	573	90%	10%	9,080	9,288
8	2,233	152	94%	6%	3,940	1,307
TOTALS	**15,190**	**2,961**			**50,679**	**51,803**

Source: SANDAG Series 12



Metered Sewer Basins

Figure 4-4

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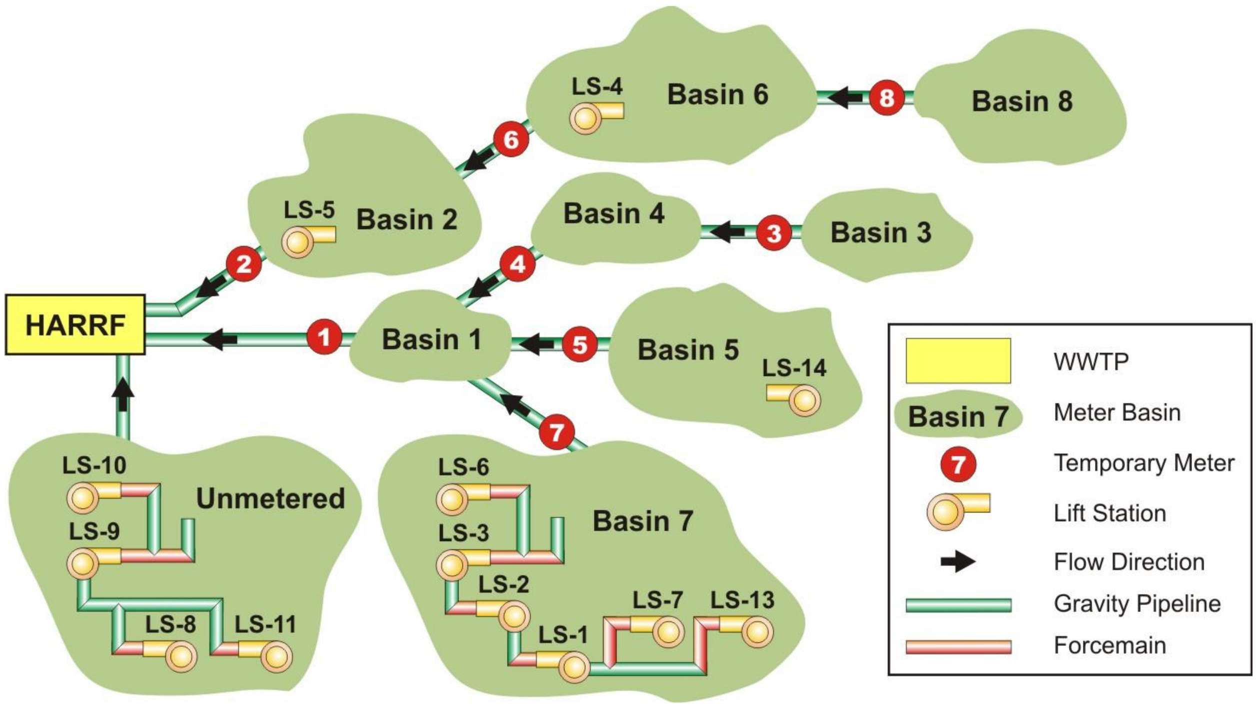
Figure 4-5 Metered Sub-Basin Flow Schematic



4.3 Collection System Condition Assessment

A sewer lift station evaluation study which evaluated 13 of the 14 sewer lift stations was conducted in 2009-2010 by a consultant for the City. Lift Station 4 was in the process of being replaced and was therefore not included as part of the study. Lift station evaluations were based on site visits, a review of questionnaires completed by City operations and maintenance staff, a review of record drawings, and draw-down pump tests conducted in August 2009. Specifically, the study evaluated:

- station condition
- pumping capacity
- electrical equipment
- ease of operation and maintenance
- wet well capacity
- emergency storage and power
- flows in suction/discharge piping and force mains

The study report, dated May 2010, summarizes the condition of each lift station, evaluates and ranks each station based on developed criteria, summarizes station deficiencies, and recommends upgrades and improvements. The evaluation matrix, which assigns ranking scores from 5 (worst) to 1 (best) in each category, is provided in Table 4-4 and the full study report is provided in Appendix C.

Table 4-4 Lift Station Evaluation Condition Matrix

Lift Station	Reliability	Safety	Pumping Capacity	Mechanical Equipment	Electrical Equipment	SCADA	Maintenance	Visual Assessment	Wet Well Capacity	Emergency Storage	Site Provisions	Total Score
	Evaluation Category, Relative Importance Factor[1] and Score[2]											
	1.64	0.36	1.64	1.09	1.64	0.55	1.27	0.55	0.91	0.18	0.18	
LS-9	4	4	1	3	4	5	4	3	5	5	3	34.9
LS-12	3	3	5	3	5	5	2	3	1	4	3	34.8
LS-2	2	4	3	5	5	4	3	4	1	4	3	33.7
LS-3	4	3	1	2	5	5	3	2	5	5	2	33.1
LS-8	1	4	1	4	4	5	4	4	5	3	3	31.3
LS-1	4	2	4	3	4	4	1	3	1	4	1	30.6
LS-6	3	3	4	2	3	5	4	1	1	3	1	29.7
LS-10	1	4	1	3	4	5	4	2	4	1	3	27.8
LS-17	1	2	3	2	5	5	2	2	3	3	2	27.7
LS-13	4	2	5	2	2	4	2	1	1	1	1	27.5
LS-11	1	4	1	3	4	5	4	3	1	5	2	26.2
LS-7	1	3	1	3	3	5	4	2	1	1	4	23.3
LS-5	1	2	1	2	0	5	3	1	2	5	2	16.4

(1) Weight factor indicating relative importance, higher factor = more important
(2) Score from 1 to 5, with 1 indicating acceptable conditions and 5 indicating severe need of an upgrade

Recommended upgrades and improvements are provided for each lift station in the lift station evaluation report. However, the City is planning additional system improvements that will eliminate some stations. Specifically, a new gravity sewer is proposed to eliminate Lift Station 9 and Lift Station 11. A longer force main is also planned for Lift Station 6, which will disharge downstream of Lift Station 3. These proposed changes are analyzed with the hydraulic model, and recommmendations for lift station improvements are provided with the cpaital improvement program in Section 7.

Gravity Pipelines

The City of Escondido maintains approximately 370 miles of wastewater collection pipe ranging in size from 8 to 42 inch in diameter. To estimate the general condition of the collection system, data pertaining to the material type and the approximate date of installation is important. Based on this information, the remaining life of the facilities can be estimated. Additional factors that should be considered for determining the expected remaining life include:

- current age of the pipe
- potential impact of pipe failure
- facility maintenance efforts
- quantity and location of pipeline line breaks
- overall condition of the facilities

Based on the analysis of age and material of the City's 370 miles of sewer collection pipe provided in Section 4.1, approximately 100 miles of VCP gravity sewer were installed in the 1950s through the 1970s and are approaching the end of their useful life. An assessment of life cycle budgetary costs to replace or repair/rehabilitate aging infrastructure is included in Section 7.

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Section 5
Existing Collection System Analysis

A capacity evaluation of the existing wastewater collection system was completed to identify sewer reaches that may be deficient under recommended design criteria and to identify any upgrades needed to accommodate existing wastewater flows. This section presents results from the existing wastewater system hydraulic evaluation and evaluates the ability of the collection system to convey existing wastewater flows. Development of the hydraulic model is documented, and analysis results are summarized. Improvement projects necessary to meet the system planning criteria presented in Section 3 are identified.

5.1 Existing System Model Development

The hydraulic model simulates flow conditions, such as wastewater flow depth, flow rate, and velocity, within pipes and manholes in the wastewater collection system. It is used to evaluate the capacity of the collection system, identify possible deficiencies in the system, and prioritize future work for the City of Escondido. Model simulations are performed with both dry and wet weather flows.

As part of this master plan update, the City's existing H2OMap sewer model was initially reviewed to determine if the model could be updated. Due to the significant amount of missing elevation data and approximated slopes based on minimum design criteria, it was determined that development of a new model would be the most efficient and accurate way to proceed with analysis of the wastewater collection system.

Software Selection

Selection of a modeling software package was the first step in the model development process. Several non-proprietary sewer modeling software packages were evaluated and results of the evaluation process were provided in a technical memo to the City entitled *Wastewater Collection System Modeling Software - City of Escondido*. A recommendation was made with the concurrence of City staff to develop a new model using InfoSWMM, which belongs to a class of models referred to as dynamic wave models. These models provide a reasonable representation of hydraulic flow conditions over an extended period of time.

InfoSWMM uses the dynamic solution scheme of the full Saint Venant (energy) equations and incorporates variable time steps based on stability criterion. This solution method more accurately represents complex conditions in the sewer system, such as surcharged manholes and siphon flows, yet still has a similar interface to the H20Map program that some City staff members are already familiar with. This should result in a shorter learning curve during the model training phase of this project.

Physical Data Input

Data required to create the model includes information describing the physical wastewater collection system, such as physical location, pipe diameters and reach lengths, manhole invert elevations, and estimated pipe roughness coefficients. The City maintains a sewer system geographical information system (GIS), but it did not have the pipeline invert elevations or slope data required to develop a gravity flow model. As a first step in the model development process, the sewer system GIS was reviewed to identify the location of trunk sewers, generally pipelines 12-inches in diameter and greater. Smaller pipelines necessary to model the lift stations were also indentified. As-built drawings were then collected and reviewed for the modeled sewers to obtain the missing elevation data, which was added to the City's GIS. Once the GIS information was complete for the modeled pipelines, the sewer system GIS was imported to the Info SWMM model. Connectivity and topology checks were made and several meetings were held with City staff to review results. The existing collection system is shown on Figure 5-1.

All of the City's 14 lift stations are included in the model. Information input to the model includes the individual pump curves, wet well dimensions, pump controls based on wet well levels, and the lift station force main. Information on the lift stations was obtained from the May 2010 Lift Station Evaluation Study. It is noted that the collection system for the Lift Station 7 service area is not included in the City's GIS, and flows to this station could not be generated. Lift Station 7, which is a package pump stations that serves a small residential area, was therefore not operational in the existing system model.

Model Loading

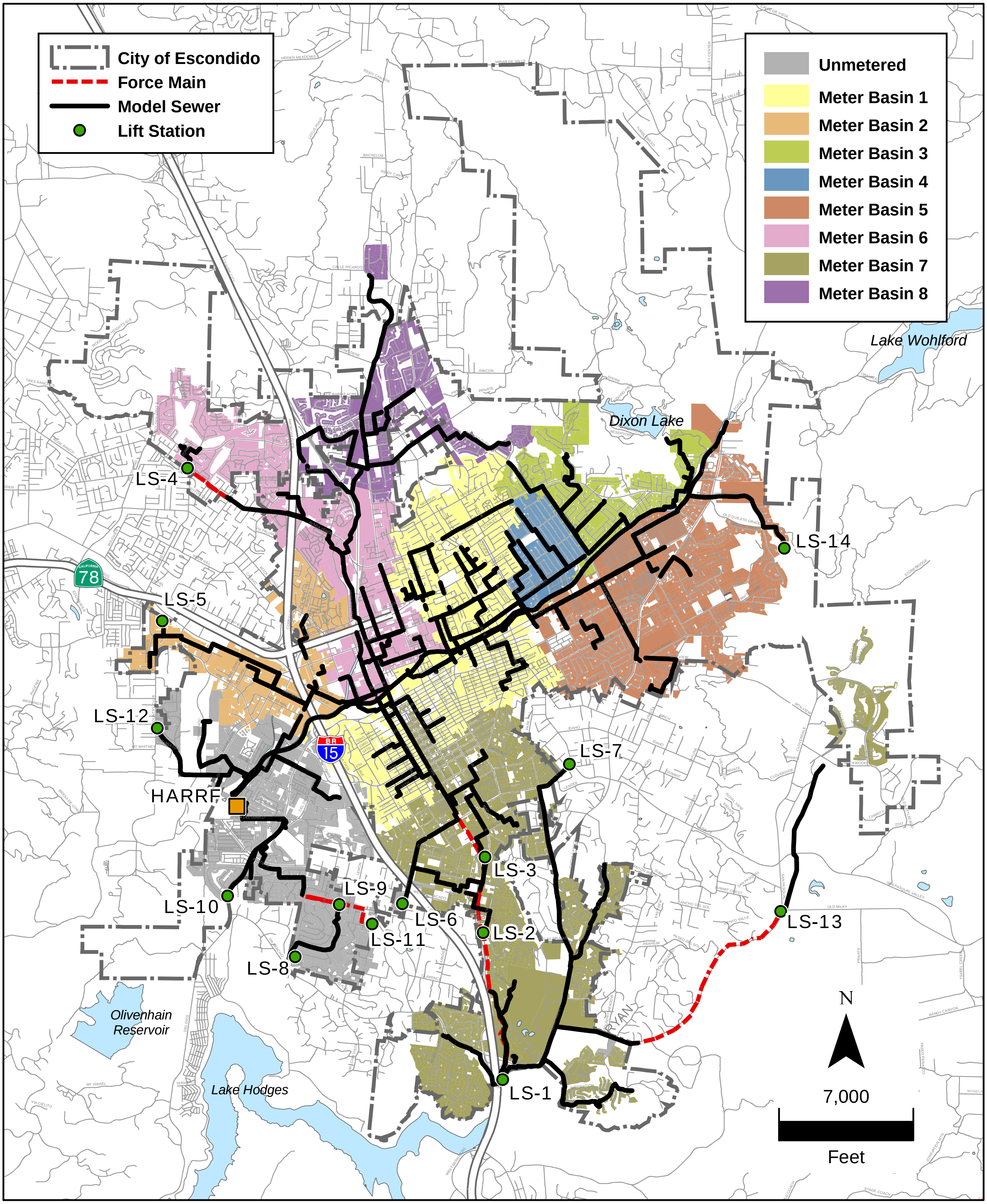
Wastewater flows were input to the model based on HARRF flow records and flow data from the 2011 flow monitoring program. Dry weather flows are input based on the residential and employment population data generated for each sub basin and applying the calibrated unit sewer generation rate, shown in Table 5-1.

Table 5-1 Calibrated Unit Sewer Generation Rate

	Residential Unit Generation Rate		Non-Residential Return To Sewer Rate	
Meter Basin	**Unit Rate (gpdc)**	**Loading (mgd)**	**Sewer Return**	**Loading (mgd)**
Meter 1	70	2.49	60%	0.50
Meter 2	70	0.28	60%	0.25
Meter 3	80	0.55	60%	0.11
Meter 4	65	0.49	60%	0.01
Meter 5	70	1.69	60%	0.39
Meter 6	70	1.45	60%	0.35
Meter 7	65	1.58	60%	0.32
Meter 8	80	0.56	60%	0.02
Un-Metered	70	0.75	60%	0.12
Total	**--**	**9.84**	**--**	**2.07**

Wet Weather Flows

Rainfall events are applied to the model to identify the impacts of peak wet weather flows on the collection system. Rainfall derived inflow and infiltration is modeled by applying infiltration and routing coefficients to a specific rainfall event. These coefficients are refined during the wet weather model calibration to better simulate the observed peaking of the wastewater flows. A storm event occurring December 20 to 22, 2010 was selected for use in applying inflow and infiltration in the wet weather analysis. The total rainfall recorded in Escondido over the three days was 6.3 inches, and fifteen minute rainfall totals are shown on Figure 5-2. The precipitation readings for the December 2010 storm are between the five-year and 10-years design storms for San Diego County, as shown on Figure 5-3. The increased flows at the HARRF from this storm event, shown previously in Figure 2-4, resulted in an average daily flow rate on December 21 of 19.7 MGD, and a peak flow rate of 26.7 MGD on December 22, 2010.



Modeled System

Figure 5-1

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Escondido Wastewater Master Plan
June 2012

Figure 5-2 15-Minute Rain Gauge Data – Dec 20-22 Storm Event

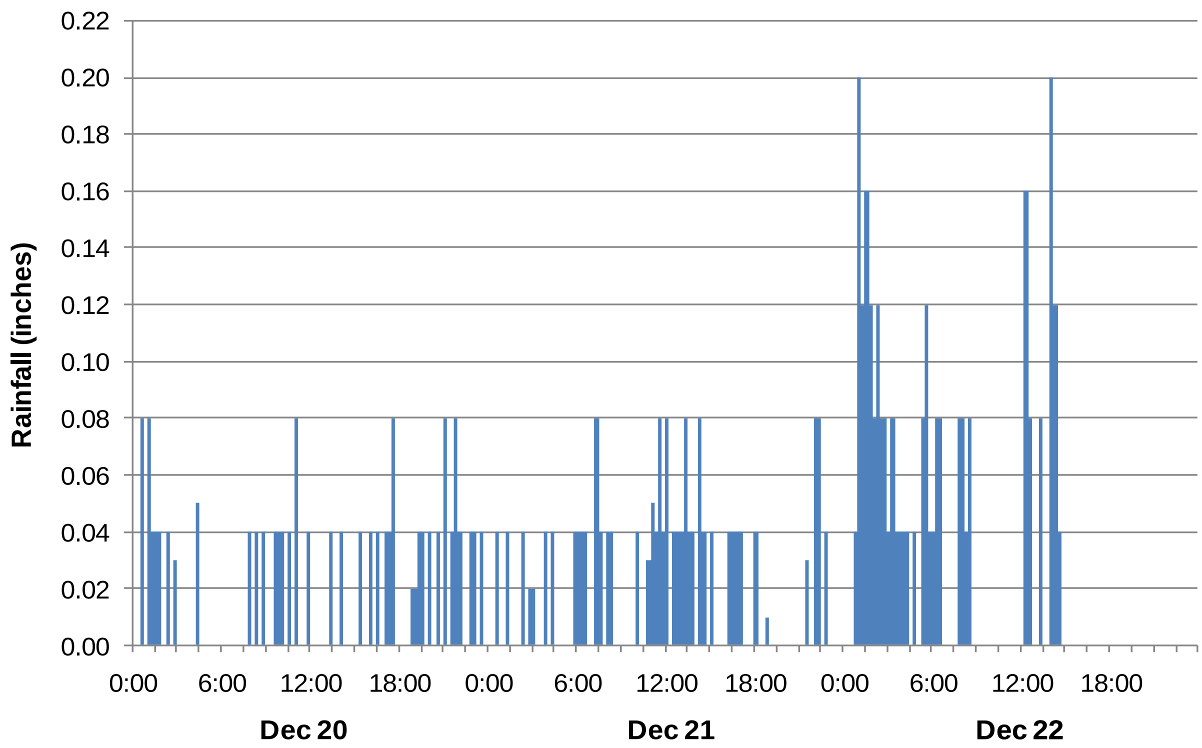
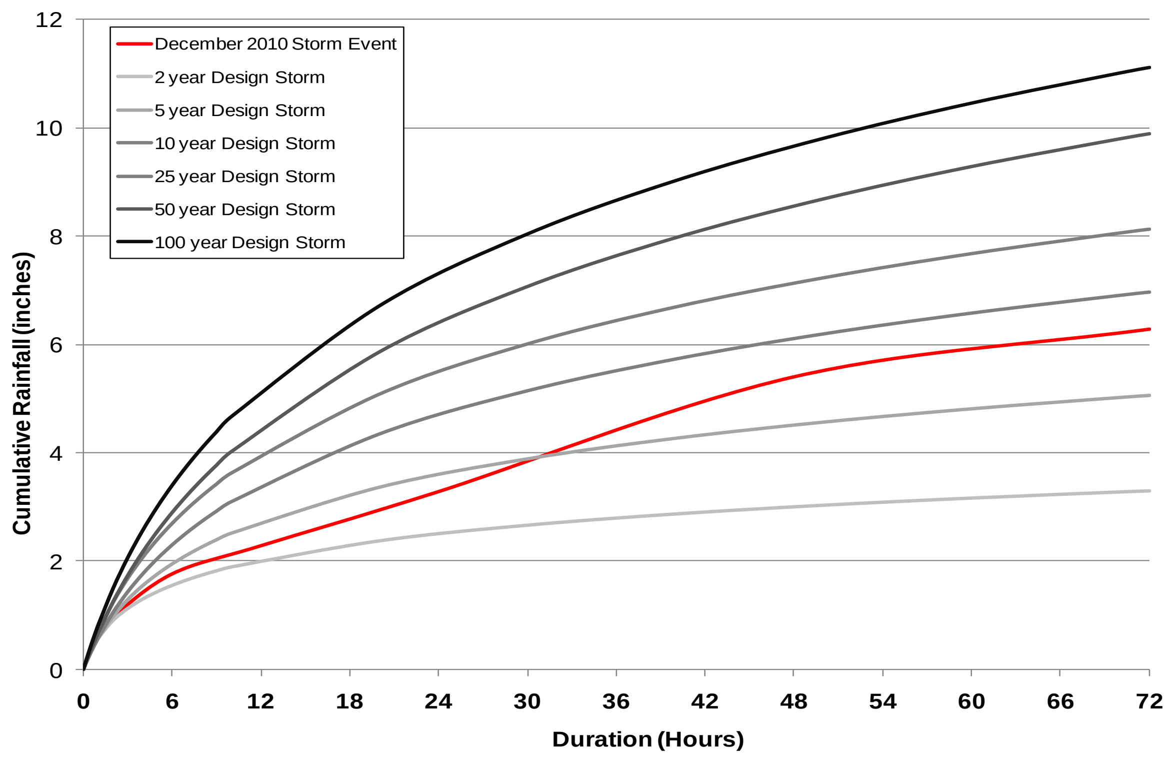


Figure 5-3 Storm Intensity Duration Frequency Chart



5.2 Hydraulic Model Verification/Calibration

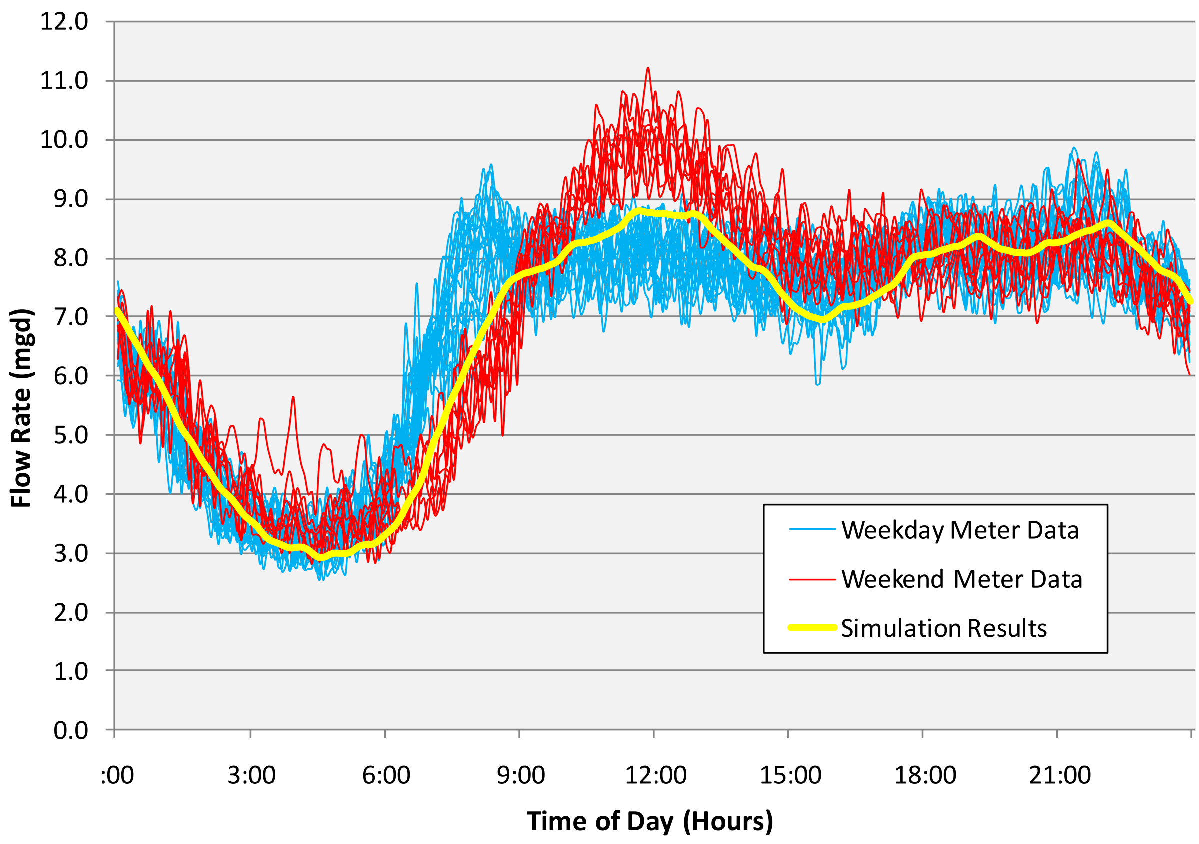
The hydraulic model was calibrated by refining estimated model parameters under dry and wet weather conditions so that the simulated model flow conditions reasonably approximated the measured flow conditions. Diurnal curves were adjusted for the dry weather calibration such that simulated and recorded wastewater flow and depth hydrographs matched to within a reasonable level of accuracy for each of the metered sub-basins.

Dry Weather Calibration

The model was calibrated to dry-weather meter data recorded between April 7 and May 4, 2011 at each of the sub-basins. Simulated flow hydrographs at each meter location were compared with recorded discharge measurements. The purpose of the comparison was to allow for refinement of estimated model parameters so that the simulated flow conditions reasonably approximated the measured flow conditions. These parameters generally include diurnal curve patterns and peak to average flow ratios (peaking factors).

Results of the dry weather calibration for are best presented graphically, and are shown in Figure 5-4 for Meter 1. Graphs for the remaining sub-basins are similar, and are provided in Appendix D.

Figure 5-4 Dry Weather Calibration at Meter 1



Wet Weather Calibration

The model was calibrated to the peak wet-weather flow event that occurred December 20 through 22, 2010 and the Escondido influent flows recorded at the HARRF. It is noted that flow records were only available for the daily average and peak flows during this event, and there was no rainfall during the temporary flow monitoring period.

After applying storm water inflow and infiltration to the model, simulated flow hydrographs at this location were compared with peak and average recorded flows. The purpose of the comparison was to allow for refinement of estimated model parameters so that the simulated flow conditions reasonably approximate the measured flow conditions. These parameters include the infiltration coefficients, which determine what percentage of the rainfall enters the system, and routing coefficients, which determine how fast or slow the rainfall enters the system.

In general, the system exhibited a significant and rapid response to the storm event. Based on typical master planning calibration criteria, the hydraulic model is within acceptable ranges when compared to metered flow data and observed rainfall data. The model is considered a calibrated model and can be used for future planning scenarios.

5.3 Hydraulic Model Evaluation

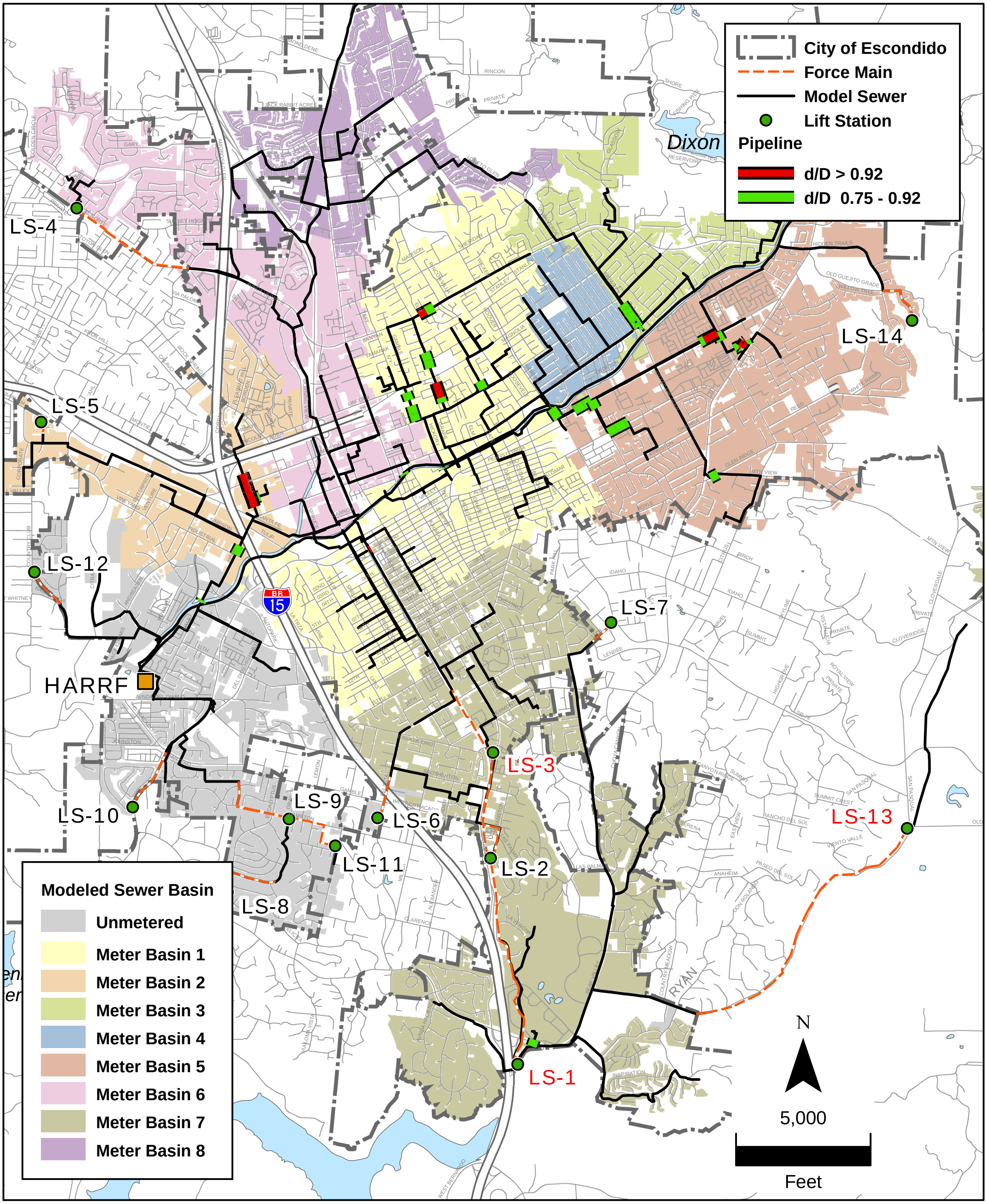
A capacity analysis of the existing collection system was performed under existing dry and wet weather flow conditions to identify facilities that do not meet the design criteria discussed in Chapter 3.

Gravity Pipelines

There are no observed deficiencies in gravity pipelines evaluated with the model under existing dry weather flow conditions. Figure 5-5 shows the location of gravity pipelines that exceed the depth to diameter (d/D) ratios of 0.75 and 0.92 under peak wet weather flow conditions. The identified capacity limitations were analyzed for reasonableness by verifying that the capacity constraint reported by the model is a function of a downstream pipeline size not extending far enough upstream and/or a pipe slope flatter than adjacent segments. Model results indicate that there are approximately 11,800 linear feet of pipeline flowing over 75 percent full with existing peak wet weather flows, ranging in size from 8 to 24-inches in diameter. Pipelines with d/D ratios in excess of 0.92 at peak flows are located within sub-basins 1, 2, 5, and 7 and total 3,600 linear feet. There are four single reaches of 12-inch diameter pipes less than 100-feet in length that are flowing full. The remaining pipelines with d/D ratios exceeding 0.92 are 8 or 10-inch diameter collector pipelines, and the largest stretch is an 8-inch diameter 660-foot long section in Metcalf Street, just south of SR-78.

Siphons

Simulation results with dry weather flows were reviewed to determine if minimum daily cleansing velocities are obtained at the three modeled siphons. Model results showing the daily peak dry weather flow and resulting average velocity in the siphon reaches are provided in Table 5-2. Only the largest diameter siphon crossing under the drainage channel at Hale Avenue has velocity that come close to meeting the recommended minimum cleansing velocity of 3 feet per second.



Modeled System Deficiencies

Figure 5-5

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Table 5-2 Siphon Analysis

Location	Diameter (inches)	Peak Dry Weather Flow (gpm)	Peak Dry Weather Velocity (fps)	Adequate Cleansing Velocity
Hale Avenue	20	2,726	2.8	yes
Harding Street	12	17	0.05	no
Quince Street	18	109	0.14	no

Lift Station and Force Mains

Table 5-3 summarizes the existing lift station capacities and makes a comparison with existing average dry and peak wet weather flows. Analysis results indicate that all of the lift stations are adequately sized for existing average dry weather flows. Lift Stations 1, 3 and 13 do not have adequate capacity based on peak wet weather flows. It is noted that Lift Station 13, which serves the Eagle Crest area in the easternmost area of the City, is currently operating well below its design capacity based on recent pump drawdown tests. The original pump curve was input to the model, and model results confirm a pumping capacity close to the rated station capacity based on existing system hydraulics. The reduced pump capacity is therefore most likely due to pump wear, a system blockage or a throttled discharge valve.

Table 5-3 Lift Station Pump Capacities

Lift Station	Force Main Diameter (in.)	Firm[1] Pumping Capacity (gpm)	Existing Capacity Analysis			
			ADWF (gpm)	PWWF (gpm)	Capacity Status	Additional Required Capacity (gpm)
LS-1	16	1,040	493	1,356	inadequate	316
LS-2	6	150	38	50	adequate	--
LS-3	10	2,120	1,239	2,252	inadequate	132
LS-4	6	--	214	452	adequate	--
LS-5	4	240	6	24	adequate	--
LS-6	4	80	16	39	adequate	--
LS-7	6	60	--	--	adequate	--
LS-8	6	160	25	84	adequate	--
LS-9	6	510	269	330	adequate	--
LS-10	6	160	12	53	adequate	--
LS-11	6	150	33	121	adequate	--
LS-12	6	70	12	49	adequate	--
LS-13	8	200	94	229	inadequate	29
LS-14	4	155	8	8	adequate	--

(1) Current firm pumping capacity is based on actual pump tests conducted in 2010.

The May 2010 Sewer Lift Station Evaluation Report (2010 Lift Station Report) provided a list of recommended improvements based on detailed condition assessments, and the findings were summarized in an evaluation matrix, provided previously in Table 4-3. Three of the eleven criteria considered in the evaluation matrix are dependent on flows to the lift station: pumping capacity, emergency storage capacity, and reliability (redundant equipment). The capacity evaluation performed with the hydraulic computer model in this master plan updates and refines the existing flows to each lift station. In the 2010 Lift Station Report, the firm capacity of Lift Stations 1, 3 and 12 were found to be less than existing peak wet weather flows to the station based on wastewater flow estimates provided by the City. With the updated flow analysis performed with the hydraulic model, Lift Station 12 is no longer deficient, and Lift Station 13 is now slightly deficient based on peak wet weather flows, in addition to Lift Stations 1 and 3. The lift station evaluation is updated based on both existing and projected 2030 flows in the following report section. It is noted that the force main, wet well capacity and suction and piping discharge analysis performed in the 2010 Lift Station Report are still valid, since they are based on existing pumped flows and not the flow rate entering the wet well.

Undersized wet wells in the lift stations can reduce the lift of the pump motor resulting from shortened pump cycle times. The wet wells in Lift Stations 3, 8, 9 and 10 were found, in the 2010 Lift Station Report, to be undersized. The wet well in Lift Station 14 was undergoing improvements to increase wet well volume by raising the pump lag level and minimizing exposure of the submersible pumps in operation.

Low velocity of sewer flows in forcemains is undesirable as it requires additional operation and maintenance servicing by City staff. The 2010 Lift Station Report reported that the forcemains for Lift Stations 1, 2, 7, 8, 10, 11, 12 and 13 did not meet the minimum 2 fps velocity requirement under the actual pumping capacity rates. The worst was Lift Station 12, which had a velocity of less than 1 fps. Lift Station 3 forcemain was slightly above the maximum velocity requirement of 8 fps.

5.4 Summary of Deficiencies and Recommended Improvements

In general, results of the existing system capacity analysis are used to prioritize facility improvements, which are sized based on the ultimate flow analysis presented in the following report section. Although several gravity pipelines were identified as flowing full under the hydraulic simulation with peak wet weather flows, the model did not indicate any loss of flow (sewer overflows) due to capacity limitations. Recommended improvements for gravity pipelines will therefore be based on 2030 flows.

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Section 6
2030 Collection System Analysis

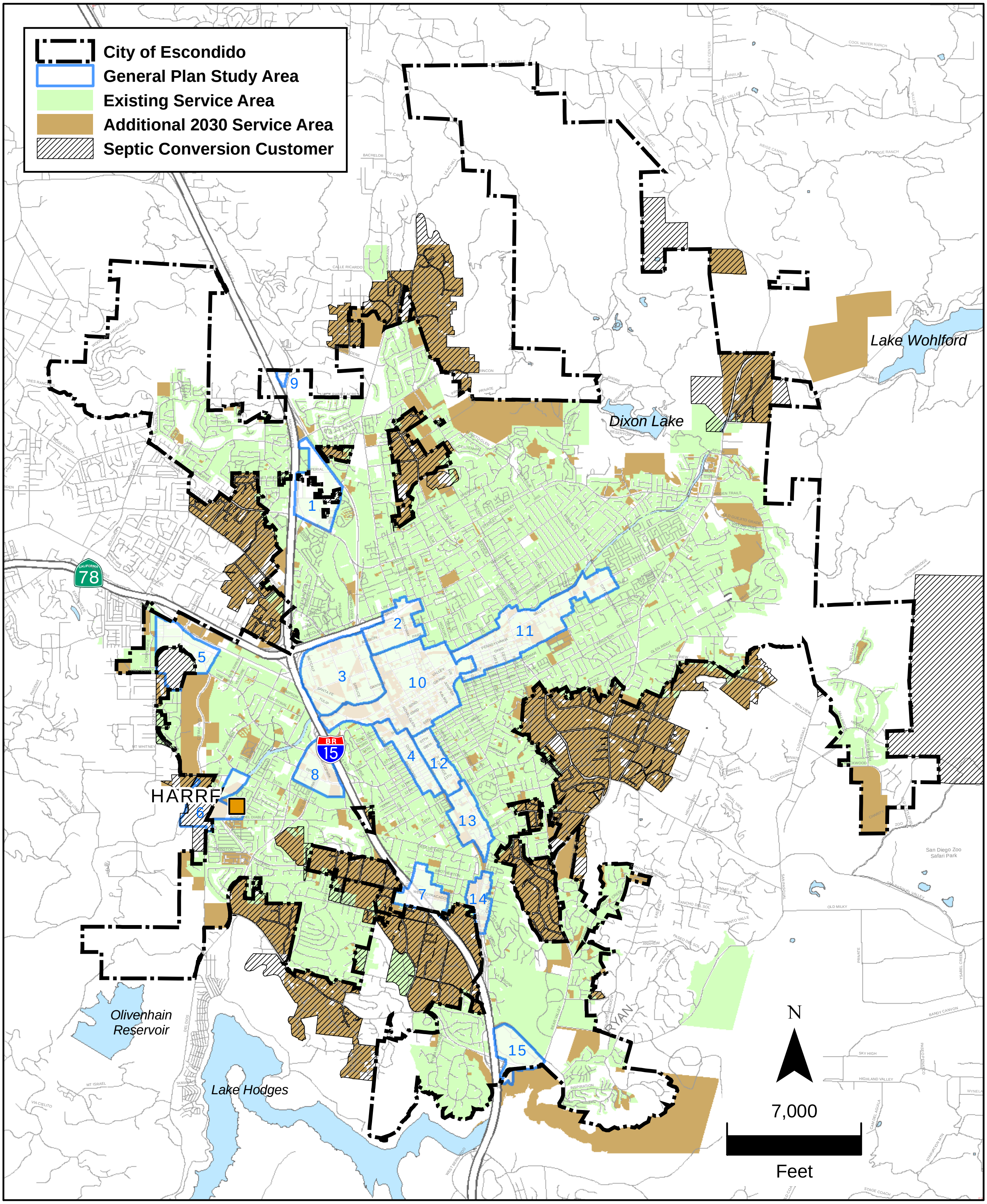
This report section identifies the wastewater system improvements required to convey the projected 2030 wastewater loads presented in Section 2. To evaluate the 2030 wastewater system, the GIS and existing system hydraulic model were updated to include planned improvements and recommendations proposed for the existing wastewater collection system to determine the wastewater these areas would contribute in the future. The service area boundary was updated with information supplied by the City as part of their General Plan Update. Using the InfoSWMM model, the 2030 wastewater system was evaluated under average dry weather flow and peak wet weather flow conditions to identify deficiencies according to the design criteria provided in Section 3 of this report. Recommended improvements to the wastewater system are summarized in Table 6-3 and are prioritized based on immediacy of need and severity of the deficiency.

6.1 Planned Wastewater System Expansion

As discussed in Section 2, the 2030 wastewater service area is larger than the existing service area due to expansions of the collection system to serve new development and areas that are currently served by septic systems. As part of the General Plan Update, City staff identified these septic conversion areas, as shown in Figure 6-1. Many of the future service areas are outside of the existing City boundary and will require annexation for wastewater service. As shown on the map, the primary areas of expansion are along the City's northern and eastern boundary and at several locations west of I-15. The future annexed areas are comprised primarily of low-density rural and residential estate land use.

Table 6-1 shows a breakdown of 2030 wastewater flows by category, described as follows:

- **General Plan Update Study Areas**: These areas were identified by the City as future redevelopment areas with specific 2035 buildout projections.
- **SANDAG Projections:** This represents parcels which do not currently receive sewer service from the City, but are within the 2030 General Plan service area boundary and have a SANDAG employment or population projection. SANDAG projections include both septic conversion customers and future development of vacant parcels.
- **Tentative Map Developments:** Special developments with approved tentative maps were identified by City staff during this Master Plan project, and are expected to be developed in the near future. Only three tentative maps were identified for inclusion.
- **Existing Customers:** These are current City sewer customers. If SANDAG projections indicated an increase in either employment or population by year 2030, a corresponding increase in wastewater flow was added to the current wastewater load to account for densification of existing parcels.



Existing and Future Customers

Figure 6-1

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Table 6-1 2030 Wastewater Flows by Planning Category

2030 Planning Category	Existing Flow (MGD)	% of Existing Flow	2030 Flow (MGD)	% of 2030 Flow	% Increase from Existing to 2030
General Plan Update Study Areas	1.95	19%	3.34	23%	71%
Tentative Map Developments	0.00	0%	0.10	1%	N/A
SANDAG Projections	0.00	0%	1.72	12%	N/A
Existing Customers outside of General Plan Study Areas	8.18	81%	9.24	64%	13%
Total	10.13	100%	14.40	100%	42%

6.2 2030 System Analysis

This section includes a systematic approach to prioritizing wastewater deficiencies associated with hydraulic capacity and pipeline age issues. Evaluating the results of both the existing and 2030 peak wet weather flow analyses, deficient pipelines were prioritized based on the severity of the deficiency and immediacy of need to develop planned capital improvement projects. Lift station deficiencies and proposed consolidation plans are also discussed.

6.1.1 Gravity Pipeline Analysis

Trunk sewer deficiencies in the existing system with peak wet weather flows routed through the network model are shown in Figure 6-2 (located in map pocket). Only a few areas were identified in the existing system to be hydraulically deficient based on surcharging, depth to diameter ratio or low velocity issues. Although several gravity pipelines were identified as flowing full under the hydraulic simulation with existing peak wet weather flows, the model did not indicate any loss of flow (sewer overflows) due to capacity limitations. Aging infrastructure is evident, however, with a substantial amount of the trunk lines having been installed prior to 1960. In general, results of the existing system capacity analysis are used to prioritize facility improvements, which are sized based on the 2030 flow analysis. Pipeline deficiencies identified in the 2030 analysis are shown on Figure 6-3 (located in map pocket). Detailed analysis results for both existing and 2030 analysis are included in Appendix E.

Where improvements were deemed necessary, the associated pipeline was assigned a priority ranking from 1 to 6, with 1 being of the highest priority and 6 being of the lowest. The highest priority is surcharged pipes under existing peak wet weather flows, with decreasing priority down to pipe age.

Priority rankings were assigned to deficiencies based on the following criteria:

- **Priority 1:** Sewers with a ratio of flow depth to full diameter (d/D) equal to 1 are classified as surcharged pipes and assigned a priority value of 1 with a critical hydraulic condition that presents a high risk of potential sanitary sewer overflows.

- **Priority 2**: Sewers with d/D between 0.75 and 1 and an installation date of 1960 or earlier are assigned a priority value of 2 and are classified as hydraulically deficient with a moderate risk of potential sanitary sewer overflows as well as condition deficient due to their age.

- **Priority 3**: Sewers with d/D between 0.75 and 1 and an installation date later than 1960 are assigned a priority value of 3 and are classified as hydraulically deficient with a critical hydraulic moderate risk of potential sanitary sewer overflows. However, unlike priority 2 pipes, these pipes do not present the same condition deficiency and thus receive a lower priority score.

- **Priority 4**: Sewers with velocity less than 2 feet per second and an installation date of 1960 or earlier are assigned a priority value of 4 and are classified as non-critically deficient pipes. These pipes are recommended to be replaced on an as-needed basis due to age and at time of replacement should be designed to achieve minimum velocities of 2 feet per second.

- **Priority 5**: Sewers with velocity less than 2 feet per second and an installation date later than 1960 are assigned a priority value of 5 and are classified as non-critically deficient pipes. These pipes are recommended to be replaced if there is a history of frequent work order requests or customer complaints about odor.

- **Priority 6**: Sewers with an installation date of 1960 or earlier and no hydraulic deficiencies are assigned a priority value of 6 and are classified as non-critically deficient pipes that should be replaced as needed.

Trunk sewer deficiencies with priority values of 1 to 3 were investigated in the hydraulic model. Deficiencies with priority values of 4 to 6 were not further evaluated in the hydraulic model as they represent non-critical failures; however they are included in the overall capital improvement program for systematic replacement.

Priority pipeline improvement projects were developed using the results of both existing and 2030 analyses and are shown on Figure 6-4 (located in map pocket).There were two main steps to developing pipeline improvement projects for the City:

1. Prioritizing hydraulic deficiencies from the model (surcharges and d/D failures, presented in Figure 6-3 and Appendix E); and

2. Iteratively working with the dynamic SWMM engine to target specific improvement projects.

The benefit of this approach is noticeable when comparing Figures 6-3 and 6-4; by fixing the hydraulic bottlenecks and pipes in the path of critical flow through the City's wastewater network, we were able to address all hydraulic deficiencies by developing 12 strategic improvement projects. This will help the City spend their improvement dollars effectively, as well as provide confidence that by making the recommended pipeline improvements, their wastewater network will be able to handle projected flows through 2030. A detailed description of the recommended pipeline improvement projects is provided in Section 6.3.

6.1.2 Lift Station Analysis

The 2010 Lift Station Report, provided in Appendix C, included pump test data and an evaluation of the lift station capacities. In the 2010 Lift Station Report, Lift Stations 1, 3 and 12 were found to be deficient in their ability to convey peak wet weather flows. Table 5-3 evaluated the lift station capacities based on the average dry and peak wet weather flows developed for this Master Plan Update. Analysis results indicate that all of the lift stations are adequately sized for existing average dry weather flows, but Lift Stations 1, 3 and 13 do not have adequate capacity based on existing peak wet weather flows. Table 6-2, below, updates the lift station analysis in Table 5-3 with future 2030 wet weather flow projections.

Table 6-2 Lift Station Pumping Capacity Analysis

Lift Station	Average Dry Weather Flow(1) (gpm)	Rated Pump Capacity(2) (gpm)	Firm Pumping Capacity(3) (gpm)	Existing			2030		
				Peak Wet Weather Flow(1) (gpm)	Surplus or Deficit (gpm)	Capacity Status (gpm)	Peak Wet Weather Flow(1) (gpm)	Surplus or Deficit (gpm)	Capacity Status (gpm)
LS-1	383	1,100	1,040	1,356	-316	Deficient	2,347	-1,307	Deficient
LS-2	29	215	150	50	100	OK	420	-270	Deficient
LS-3	653	2,050	2,120	2,252	-132	Deficient	3,703	-1,583	Deficient
LS-4	159	500	--	452	--	OK	468	--	OK
LS-5	5	225	240	24	216	OK	24	216	OK
LS-6	12	120	80	39	41	OK	174	-94	Deficient
LS-7	--	160	60	--	--	OK	163	-103	Deficient
LS-8	18	200	160	84	76	OK	176	-16	Deficient
LS-9	69	250	510	330	180	OK	591	-81	Deficient
LS-10	9	230	160	53	107	OK	121	39	OK
LS-11	23	200	150	121	29	OK	268	-118	Deficient
LS-12	9	150	70	49	21	OK	85	-15	Deficient
LS-13	71	340	200	229	-29	Deficient	188	12	OK
LS-14	6	140	155	8	147	OK	16	139	OK

(1) Per InfoSWMM existing system model
(2) From 2010 Lift Station Report; design-based capacity from pump manufacturer data
(3) From 2010 Lift Station Report; assumes largest pump is out of service on actual pump test data

It appears that with the 2030 wastewater flow projections, most of the lift stations lack pumping capacity to handle peak wet weather flow conditions. Since the flow metering was done during dry conditions, it is recommended that the City consider metering inflow to some of the lift stations during a wet weather event. Since Lift Station 3 is being recommended for decommissioning (described in the next section) and Lift Station 1 will receive new pumps as part of that project, they can be excluded from the wet weather metering at this time. Lift Station 13 should be investigated since it is currently deficient. Although the pumps at Lift Station 13 are designed to handle the peak wet weather flows, the tests from the 2010 Lift Station Report indicate it is not providing the pumping capacity indicated by the design capacity.

6.1.3 Lift Station Consolidation

The City would like to eliminate or reduce the number of lift stations through consolidation, in particular lift stations that are in series, are antiquated or pose a maintenance risk. There are two lift station consolidation projects recommended for the 2030 CIP: (1) Consolidation of Lift Stations 9 and 11, and (2) Consolidation of Lift Stations 2 and 3. These projects are illustrated in Figures 6-5 and 6-6, respectively. Lift Stations 9 and 11 will be replaced with a gravity line that discharges to Lift Station 6, and the Lift Station 6 force main will be extended to the same discharge point as the current Lift Station 3. Lift Stations 2 and 3 will be eliminated with a gravity line heading southward to Lift Station 1, and the Lift Station 1 force main will be extended to the same discharge point as the current Lift Station 3.

Consolidation of Lift Stations 9 and 11

Figures 6-5a and 6-5b illustrate the concept of replacing Lift Stations 9 and 11 with new gravity pipelines that collect wastewater from the respective drainage basins and route the flows by gravity directly to Lift Station 6. Since Lift Station 6 discharges to Lift Station 3, and Lift Station 3 is also being consolidated, a new force main will be needed to allow Lift Station 6 to discharge at the current discharge location of Lift Station 3. The items included in this consolidation project are as follows:

- 2,520 feet of 8 inch gravity pipeline
- 2,830 feet of 12 inch gravity pipeline
- 6,100 feet of 12 inch force main
- New pumps at Lift Station 6 with peak wet weather flow capacity of 1,000 gpm at 65 feet of total dynamic head

The 2030 peak wet weather flow from Lift Stations 9 and 11 are about 580 and 250 gpm, respectively. That flow is combined with the 2030 peak wet weather flow inflow to Lift Station 6 of approximately 170 gpm to total approximately 1,000 gpm in peak wet weather flow that Lift Station 6 will need to pump in 2030.

Consolidation of Lift Stations 2 and 3

Figures 6-6a and 6-6b illustrate the concept of replacing Lift Stations 2 and 3 with new gravity pipelines that collect wastewater from the respective drainage basins and route the flows by gravity directly to Lift Station 1. Also included is an extension of the existing Lift Station 1 force main to the same discharge point of the existing Lift Station 3 force main. The items included in this consolidation project are as follows:

- 7,240 feet of 12 inch gravity pipeline
- 3,020 feet of 16 inch force main
- New pumps at Lift Station 1 with peak wet weather flow capacity of 4,000 gpm at 50 feet total dynamic head

The 2030 peak wet weather flow from Lift Stations 2 and 3 are about 400 and 1,450 gpm, respectively. That flow is combined with the 2030 inflow to Lift Station 1 of approximately 2,200 gpm to total approximately 4,000 gpm that Lift Station 1 will need to pump in 2030.

Figure 6-5a Lift Stations 9 and 11 – Existing System

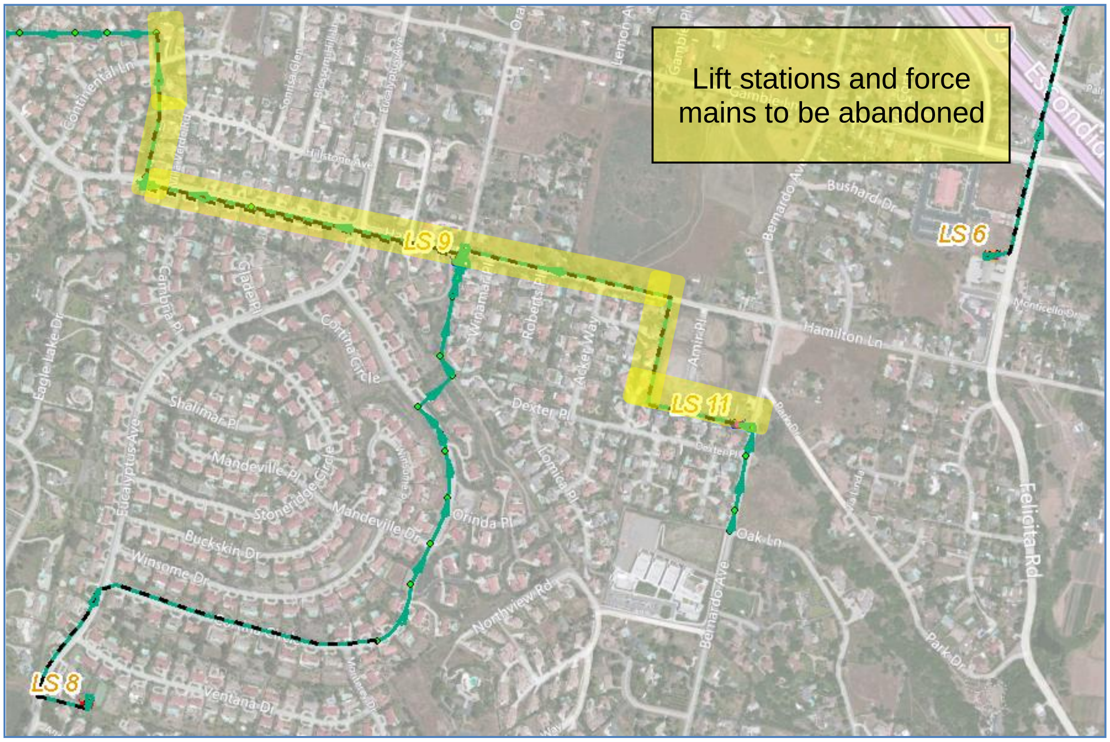


Figure 6-5b Lift Stations 9 and 11 – Future System

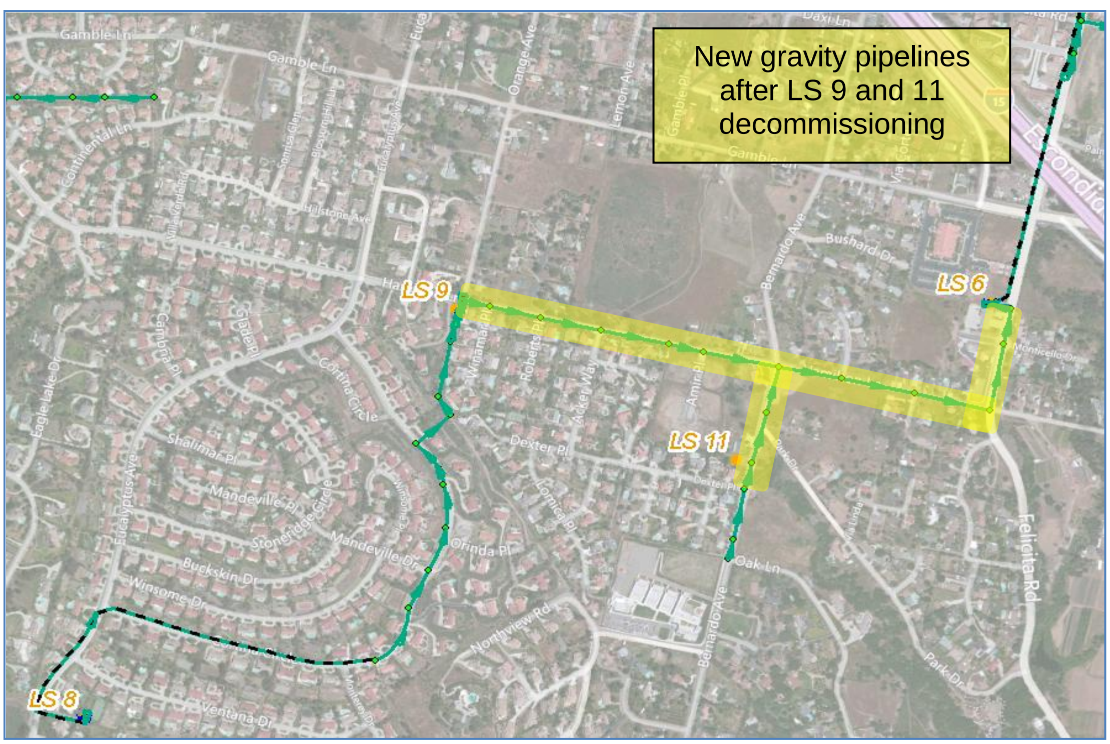
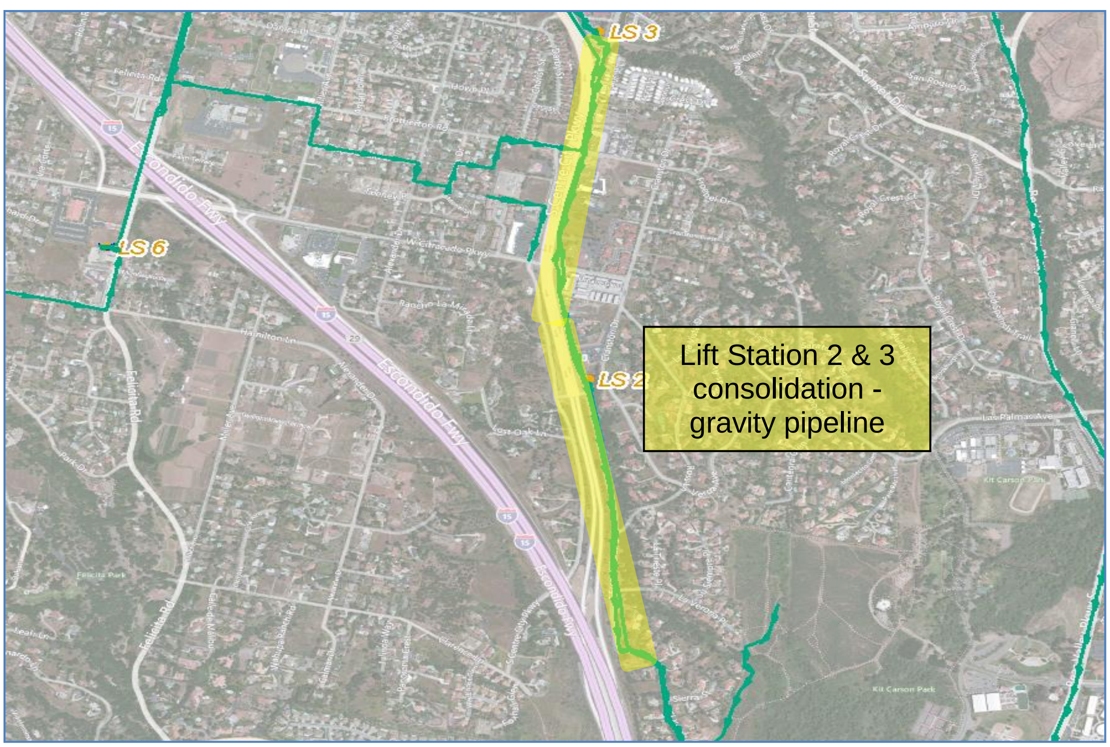


Figure 6-6a Lift Station 3 Force Main Extension/Replacement

Figure 6-6b Lift Station 2 and 3 Consolidation – Future Gravity Main



6.3 Recommended Improvements

As shown on Figure 6-4, projects with high priority are recommended for improvement under the City's CIP. Details such as length and diameter of pipeline projects are presented in Table 6-3 and described below. Estimated costs for these projects are provided in Section 7.

Table 6-3 Recommended Pipeline Improvement Projects

Recommended Project	Basin	Existing Diameter (inches)	Replacement Diameter (inches)	Length (feet)
P-01	Basin 8	8	18	649
P-02	Basin 1	8	15	736
P-03	Basin 1	8 10	12 12	1,514 1,984
P-04	Basin 1	8 10 12	12 15 15	1,081 1,315 1,305
P-05	Basin 1	8	10	4,483
P-06	Basin 1	8 12 15 18 18	12 15 21 21 21	474 1,172 4,073 458 454
P-07	Basin 11	8	12	1,168
P-08	Basin 11	8 10	10 12	997 653
P-09	Basin 11	8	10	1,474
P-10	Basin 16	8	15	1,657
P-11	Basin 14	24 24	27 30	3,356 466
P-12	Basin 17	12 8 10 12	15 15 15 15	42 789 216 253
Total				**30,767**

Additional collection system pipelines will be required to serve new development and septic conversion customers, but will be the responsibility of those customers to construct. As development projects are proposed, the project proponents will be required to prepare a study that will define the location and size of the proposed sewer facilities required to serve the development, including the necessary improvements to the regional collection system.

Improvement projects were developed for pipes that surcharged or experienced a d/D greater than the allowable amount set forth by the design criteria under existing or 2030 peak wet weather flow conditions (d/D > 0.75) in the hydraulic model. In cases where a pipe is deficient in the existing scenario, the recommended improvement pipe was sized to handle 2030 peak wet weather flows.

- **P-01:** Project P-01 fixes surcharging pipes along North Broadway bounded by Village Road on the north and Stanley Avenue on the south. The existing pipelines create a hydraulic bottleneck since the upstream and downstream pipes are larger diameters. Approximately 650 feet of 8-inch diameter pipe will be replaced with 18-inch diameter pipe.

- **P-02:** Project P-02 fixes surcharging pipes along Wanek Road beginning near the intersection of Albert Court and Wanek Road and heading southwest. The existing pipelines create a hydraulic bottleneck since the upstream and downstream pipes are larger diameters. Approximately 740 feet of 8-inch diameter pipe will be replaced with 15-inch diameter pipe.

- **P-03:** Project P-03 fixes surcharging and d/D failure pipes along several interconnected reaches of the sewer system. The upstream area of P-3 begins at the intersection of Bear Valley Parkway and North Hayden Drive, heads southwest through a residential neighborhood and then heads northwest along North Citrus Avenue. The improvements continue up to the intersection of North Citrus Avenue and East Valley Parkway, then head southwest along East Valley Parkway up to the existing 12-inch diameter pipe. Approximately 1,500 feet of 8-inch diameter pipe and 2,000 feet of 10-inch pipe will be replaced with 12-inch diameter pipe.

- **P-04:** Project P-04 fixes surcharging and d/D failure pipes along Mountain View Drive and Midway Drive to the intersection of Midway Drive and East Valley Parkway. The pipe along Bear Valley Parkway in between the two reaches of improvement pipes has sufficient capacity and does not need to be improved. Approximately 1,000 feet of 8-inch diameter pipe will be replaced with 12-inch diameter pipe, and approximately 1,300 feet of 10-inch and 1,300 feet of 12-inch will be replaced with 15-inch diameter pipe.

- **P-05:** Project P-05 fixes a reach of surcharging pipes along several roads, beginning on Oak Hill Drive heading northeast and continues from the intersection of Oak Hill Drive and Acorn Street along Acorn Street down to Fernwood Avenue. The project continues along Fernwood Avenue to the intersection with East Grand Avenue and follows East Grand Avenue southwest down to the intersection with North Rose Street. The project then heads northwest along North Rose Street to the intersection with East Valley Parkway. Approximately 4,500 feet of 8-inch diameter pipe will be replaced with 10-inch diameter pipe.

- **P-06:** Project P-06 is one of the more significant projects due to its size and hydraulic necessity for the system to handle increased future flows. The project collects flow from improvement projects P-3, P-4 and P-5 and begins along East Valley Parkway southwest of the termination of project P-3. It continues along East Valley Parkway, crossing the termination of projects P-4 and P-5, heads northwest on Harding Street, then turns and heads southwest and connects to the existing 21-inch diameter pipe. Approximately 500 feet of 8-inch diameter pipe will be replaced with 12-inch diameter pipe, 1,200 feet of 12-inch pipe will be replaced with 15-inch, and 5,000 feet of 15 and 18-inch pipe will be replaced with 21-inch diameter pipe.

- **P-07:** Project P-07 fixes surcharging and d/D failure pipes along East El Norte Parkway, between the intersections of North Ash Street and North Fig Street, terminating at the intersection of East El Norte Parkway and North Fig Street. The existing pipes lack sufficient capacity to handle increased flows. Approximately 1,170 feet of 8-inch diameter pipe will be replaced with 12-inch diameter pipe.

- **P-08:** Project P-08 fixes surcharging and d/D failure pipes and is downstream of project P-7. It begins at the intersection of Millbrook Place and North Fig Street, and heads south/southeast along North Fig Street to the intersection of North Fig Street and East

Mission Ave. Approximately 1,000 feet of 8-inch diameter pipe will be replaced with 10-inch pipe, and 650 feet of 10-inch will be replaced with 12-inch diameter pipe.

- **P-09:** Project P-09 fixes surcharging pipes along Gamble Street between East Lincoln Avenue and East Mission Avenue. The existing pipes lack sufficient capacity to handle increased flows. Approximately 1,500 feet of 8-inch diameter pipe will be replaced with 10-inch diameter pipe.

- **P-10:** Project P-10 fixes surcharging pipes along Metcalf Street bounded by West Mission Avenue on the north and West Washington Avenue on the south. The existing pipelines create a hydraulic bottleneck since the upstream and downstream pipes are larger diameters. Approximately 1,650 feet of 8-inch diameter pipe will be replaced with 15-inch diameter pipe.

- **P-11:** Project P-11 fixes surcharging and d/D pipe failures along one of the main trunk lines in the City. The project begins at the confluence of Mission Road, West Washington Avenue and North Hale Avenue and heads southwest along North Hale Avenue, terminating upstream of the Hale Avenue siphon. This project includes fixing a hydraulic bottleneck as well as increasing pipe capacity needed to handle increased flows. Approximately 3,360 feet of 24-inch pipe will be replaced with 27-inch diameter pipe, and 470 feet of 24-inch pipe will be replaced with 30-inch diameter pipe.

- **P-12:** Project P-12 fixes surcharging pipes along Harmony Grove Road bounded by Princess Kyra Place on the west/north and the 27-inch trunk line on the east/south. The existing pipelines create a hydraulic bottleneck since the upstream and downstream pipes are larger diameters. Approximately 1,300 feet of 8, 10 and 12-inch diameter pipeline will be replaced with 15-inch diameter pipeline.

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Section 7
Recommendations and Capital Improvement Projects

This chapter summarizes the recommended Capital Improvement Projects (CIP) for the City of Escondido wastewater collection system based on the findings of this master plan. The recommended projects are capacity, , or replacement and rehabilitation improvements for the existing collection system and a future system expansion which will convey projected 2030 wastewater flows. The projects are grouped into three phases and an estimate of probable construction cost is provided for each improvement project. It will be in the best interest of the City to conduct feasibility or preliminary engineering evaluations before embarking on a major capital investment.

7.1 Unit Costs

The unit cost estimates reflect full capitalization inclusive of planning, engineering design, environmental, legal, construction, construction management and contract administration. The values are presented in mid-2012 dollars based on an anticipated ENR Construction Cost Index (ENR-CCI) of 10300 for the Los Angeles/Orange County area. These estimates are based on representative available data at the time of this report; however, since prices of materials and labor fluctuate over time, new estimates should be obtained at or near the time of construction of proposed facilities. A scaling factor has been included to account for pipeline projects that are relatively short in distance or have more significant environmental or construction challenges.

Gravity Pipelines and Force Mains

Base unit costs for pipeline material and installation including repaving and system appurtenances that, collectively, constitute principal elements of the wastewater collection system facilities, are provided in Table 7-1.

Table 7-1 Sewer Pipeline Unit Costs

Diameter (inches)	Gravity Sewer ($/LF)	Force Main ($/LF)
4	210	90
6	310	210
8	360	270
10	440	310
12	520	350
15	620	--
16	--	480
18	670	--
21	720	--
24	770	--
27	830	--
30	880	--
36	930	--

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

Lift Stations

While no new lift stations are planned, two lift station consolidation projects are recommended which will require significant capacity upgrades at Lift Station 1 and Lift Station 6. Since the capacity will need to be increased by approximately 260 percent and 730 percent at Lift Station 1 and Lift Station 6, respectively, it is assumed that entirely new lift stations will be required. A unit cost of $1,000 per gpm, which is a rough planning-level estimate used for new lift stations, is therefore considered appropriate for these extensive lift station upgrades.

7.2 Recommended Projects

The recommended CIP identifies facilities needed to meet existing system capacity needs based on City of Escondido design criteria for the wastewater collection system as well as the needs to accommodate future growth and development projected for 2030. The CIP has been divided into three phases as follows:

- Phase I – 2012-2015
- Phase II – 2016-2020
- Phase III – 2021-2030

The proposed projects recommended for the wastewater collection system are shown on Figure 7-1 (map pocket) and listed in Table 7-3. The CIP projects are presented in three major phases of work based on priority needs. The total CIP costs including Phase 1 through 3 are estimated to be $35.7 million. This amounts to an average of $2 million per year through 2030 for capacity related improvements. These costs are summarized by phase in Table 7-2.

Table 7-2 CIP Summary

Description	CIP Cost
Phase I	$15,209,000
Phase II	$15,736,000
Phase III	$4,706,000
Total	$35,651,000

Table 7-3 Capital Improvement Projects

CIP #	Type	Project	Description	Units	Base Unit Cost	Scaling Factor	Comments	CIP Cost	Phase I	Phase II	Phase III	Phased Cost I	Phased Cost II	Phased Cost III
P-01	Pipeline	Replacement of undersized pipeline in North Broadway, between Village Road and Stanley Avenue.	Replace approximately 650 feet of existing 8" diameter pipe with 18" diameter pipe.	650 LF	$ 670 /LF	1.0		$436,000	0%	0%	100%	$0	$0	$436,000
P-02	Pipeline	Replacement of undersized pipeline along Wanek Road, beginning near Albert Court and heading southwest.	Replace approximately 740 feet of existing 8" diameter pipe with 15" diameter pipe.	740 LF	$ 620 /LF	1.5	The scaling factor was taken at 1.5 to account for construction through businesses parking lot.	$688,000	0%	0%	100%	$0	$0	$688,000
P-03	Pipeline	Replacement of undersized pipeline in sections of Bear Valley Pkwy, North Citrus Ave, and Valley Pkwy	Replace approximately 1,500 feet of existing 8" diameter pipe and 2,000 feet of existing 10" diameter pipe with 12" diameter pipe.	3500 LF	$ 520 /LF	1.2	A 1.2 scaling factor is assigned to account for traffic control.	$2,184,000	100%	0%	0%	$2,184,000	$0	$0
P-04	Pipeline	Replacement of undersized pipeline in Mountain View Dr., extending approximately 1,000 feet east from Bear Valley Pkwy, and in Midway Drive, south of Valley Parkway to Kingston Dr.	Replace approximately 1,000 feet of existing 8" diameter pipe with 12" diameter pipe, and 1,300 feet of existing 10" and 1,300 feet of 12" diameter pipe with 15" diameter pipe.	1000 LF 2600 LF	$ 520 /LF $ 620 /LF	1.0 1.2	A 1.2 scaling factor is assigned to account for traffic control in Midway Dr.	$520,000 $1,934,000	0%	0%	100%	$0	$0	$2,454,000
P-05	Pipeline	Replacement of undersized pipeline beginning in Oak Hill Dr., heading northeast and north to Acorn St, then southwest to Fernwood Ave, turning north and then heading west in East Grand Ave, and then north in N. Rose St. to Valley Pkwy	Replace approximately 4,500 feet of existing 8" diameter pipe with 10" diameter pipe.	4500 LF	$ 440 /LF	1.0		$1,980,000	0%	100%	0%	$0	$1,980,000	$0
P-06	Pipeline	Replacement of undersized pipe based on existing and future flows in East Valley Pkwy, from Quarry Glen west to Harding St., then north in Harding St., and turning west before the drainage channel	Replace approximately 420 feet of existing 8" diameter pipe with 12" diameter pipe, 1,170 feet of existing 12" pipe with 15" pipe, 4,100 feet of 15" pipe with 21" pipe, and 900 feet of 18" pipe with 21" pipe.	500 LF 1200 LF 5000 LF	$ 520 /LF $ 620 /LF $ 720 /LF	1.2 1.2 1.2	A 1.2 scaling factor is assigned to account for traffic control in Valley Pkwy.	$312,000 $893,000 $4,320,000	100%	0%	0%	$5,525,000	$0	$0
P-07	Pipeline	Replacement of undersized pipe in East El Norte Pkwy, from North Ash St. to North Fig St.	Replace approximately 1,170 feet of existing 8" diameter pipe with 12" diameter pipe.	1170 LF	$ 520 /LF	1.2	A 1.2 scaling factor is assigned to account for traffic control in El Norte Pkwy.	$730,000	0%	100%	0%	$0	$730,000	$0
P-08	Pipeline	Replacement of undersized pipe in North Fig St., between Millbrook Place and East Mission Ave.	Replace approximately 1,000 feet of existing 8" diameter pipe with 10" diameter pipe, and 650 feet of 10" pipe with 12" pipe.	1000 LF 650 LF	$ 440 /LF $ 520 /LF	1.0 1.0		$440,000 $338,000	100%	0%	0%	$778,000	$0	$0
P-09	Pipeline	Replacement of undersized pipe in Gamble St., between East Lincoln Ave. and East Mission Ave.	Replace approximately 1,500 feet of existing 8" diameter pipe with 10" diameter pipe.	1500 LF	$ 440 /LF	1.0		$660,000	0%	100%	0%	$0	$660,000	$0
P-10	Pipeline	Replacement of undersized pipe in Metcalf St., between West Mission Ave. and West Washington Ave.	Replace approximately 1,650 feet of existing 8" diameter pipe with 15" diameter pipe.	1650 LF	$ 620 /LF	1.0		$1,023,000	100%	0%	0%	$1,023,000	$0	$0
P-11	Pipeline	Replacement of undersized pipe based on existing and future flows on the east side of I-15 in Santa Fe Ave and N. Hale Ave, and west of I-15 In N. Hale Ave between Simpson Way and the Hale Ave siphon.	Replace approximately 3,360 feet of existing 24" diameter pipe with 27" diameter pipe, and 470 feet of 24" diameter pipe with 30" diameter pipe.	3360 LF 470 LF	$ 830 /LF $ 770 /LF	1.0 1.0		$2,789,000 $362,000	0%	100%	0%	$0	$3,151,000	$0
P-12	Pipeline	Replacement of undersized pipe in Harmony Grove Road, between Princess Kyra Pl. and the 27" diameter trunk line to the east.	Replace approximately 1,300 feet of 8", 10" and 12" diameter pipe with 15" diameter pipe.	1300 LF	$ 620 /LF	1.4	A 1.4 scaling factor is assigned to account for construction under the drainage channel.	$1,128,000	0%	0%	100%	$0	$0	$1,128,000

CIP #	Type	Project	Description	Units	Base Unit Cost	Scaling Factor	Comments	CIP Cost	Phase			Phased Cost		
									I	II	III	I	II	III
Lift Station Consolidation Projects for Lift Station 9 and Lift Station 11 Abandonment														
LS-6	LS Upgrade	Increase lift station capacity and upsize and extend existing force main to discharge location of LS-3 .	Approximately 6,100 feet of 12-inch force main and increase capacity from 120 gpm to 1,000 gpm	1000 gpm 6100 LF	$1,000/gpm $ 350 /LF	1.0 1.0	Current LS-6 capacity is 120 gpm - new lift station is assumed based on supplying 1,000 gpm at 65 feet, 25 Hp	$1,000,000 $2,135,000	100%	0%	0%	$3,135,000	$0	$0
P-13	Pipeline	Construct new gravity pipes in Hamilton Ln from LS-9 at Orange Ave to Felicita Rd, north in Felicita Rd to LS-6, and in Bernardo Ave from Oak Ln north to Hamilton Ln.	Approximately 2,500 feet of 8" diameter pipe and 3,200 feet of 12" diameter pipe	2500 LF 3200 LF	$ 360 /LF $ 520 /LF	1.0 1.0		$900,000 $1,664,000	100%	0%	0%	$2,564,000	$0	$0
Lift Station Consolidation Projects for Lift Station 2 and Lift Station 3 Abandonment														
LS-1	LS Upgrade	Increase lift station capacity; Extend existing force main north in Center City Pkwy to discharge location of LS-3 force main.	Approximately 3,020 feet of 16-inch force main and increase capacity from 1,100 gpm to 4,000 gpm.	4000 gpm 3020 LF	$1,000/gpm $ 480 /LF	1.0 1.0	Current LS-1 capacity is 1,100 gpm - new lift station is assumed based on supplying 4,000 gpm at 50 feet, 75 Hp	$4,000,000 $1,449,600	0%	100%	0%	$0	$5,450,000	$0
P-14	Pipeline	Construct new gravity pipe in S. Escondido Blvd from LS-3 south to El Ku Ave.	Approximately 7,240 feet of 12" diameter pipe	7240 LF	$ 520 /LF	1.0		$3,765,000	0%	100%	0%	$0	$3,765,000	$0
SEWER TOTAL								**$35,650,600**				**$15,209,000**	**$15,736,000**	**$4,706,000**

7.3 Condition Related Projects

Addressing the physical condition and remaining useful life of the City's wastewater collection system is essential to avoiding sewer overflows and for efficiently operating the collection system. Therefore, it is necessary that appropriate budgetary estimates for pipeline rehabilitation and replacement improvements be identified to mitigate potential physical system deficiencies and minimize risk of overflows..

A review of CCTV video inspection data was not performed as part of the Master Plan and therefore specific pipeline improvements were not able to be identified. However, a detailed analysis was performed of maintenance and inspection data provided by City staff that included the City's GIS database. The data included, but was not limited to, installation year, pipe lengths, pipe material and diameter, maintenance related information, methods used for maintenance, and other field conditions documented by field crews.

A useful life assessment and analysis was performed only on the collection system that was constructed between the 1920s through the 1980s as it was assumed that pipelines installed after 1990 are in good operating condition. The analysis included an evaluation of the average life cycle of the various pipe materials that constitute the City's collection system including concrete, vitrified clay pipe (VCP), and reinforced concrete pipe (RCP) that were installed between the 1920s through the 1960s. The analysis was extended to also include pipe materials installed from the 1970s and through the 1980s that included primarily VCP and polyvinylchloride (PVC) pipe. The information used to develop this assessment is provided in Appendix E.

To estimate the potential rehabilitation or replacement improvements for the City's collection system, each decade was assessed based on system characteristics including age, pipe size and material and the City's rehabilitation rating included in the database. Based on the average life-cycle for each type of material, an estimated timeline was projected for replacement and rehabilitation improvements. The City confirmed that all concrete pipes will require replacement. The City's goal is to minimize total pipeline replacement and maximize pipeline rehabilitations, while also minimizing capital costs and community impacts. Accordingly the projections assume that, of the total length of pipeline identified, 90 percent would be rehabilitated and 10 percent would be replaced.

Table 7-4 includes a summary of the length of pipe by diameter estimated for replacement or rehabilitation. A total of approximately 390,000 feet or 20 percent of the system was identified in the useful life analysis as likely needing rehabilitation or replacement over the next 10_years. Based on the unit cost per diameter an estimated life-cycle budget costs is presented. As summarized in Table 7-4, it is estimated that approximately six (6) percent of the system would be replaced while fourteen (14) percent of the system would be rehabilitated. As specific types of projects have not been identified, for cost estimating purposes, pipe material costs plus a twelve (12) percent for Design and Construction Management Services was assumed to generate the total estimated life-cycle budget cost of $41,553,000.

It should be noted that the analysis did not include manhole repair, rehabilitation or replacement. Therefore, the budget life-cycle costs do not reflect costs for potential improvements to system manholes.

Table 7-4 Estimated Life-Cycle Budget Costs

Diameter	Replace (ft)	Rehab (ft)	Unit Cost (Replace)	Unit Cost (Rehab)	Estimated Replace. Cost	Estimated Rehab. Cost	Subtotal	Design & CM (12%)	Estimated Cost
6-inch	49,230	0	$162	$55	$7,975,260	$0	$7,975,260	$957,031	$8,932,300
8-Inch	63,767	211,243	$162	$60	$10,330,222	$12,674,592	$23,004,814	$2,760,578	$25,765,400
10-inch	4,819	15,155	$185	$65	$891,571	$985,056	$1,876,626	$225,195	$2,101,800
12-inch	1,952	15,525	$215	$70	$419,680	$1,086,750	$1,506,430	$180,772	$1,687,200
15-inch	0	4,700	$270	$80	$0	$376,000	$376,000	$45,120	$421,100
16-inch	0	1,450	$0	$80	$0	$116,000	$116,000	$13,920	$130,000
18-inch	0	4,684	$0	$85	$0	$398,140	$398,140	$47,777	$445,900
20-inch	0	175	$0	$95	$0	$16,625	$16,625	$1,995	$18,600
21-inch	0	4,039	$325	$95	$0	$383,705	$383,705	$46,045	$429,800
24-inch	0	6,624	$325	$110	$0	$728,640	$728,640	$87,437	$816,100
27-inch	0	3,745	$0	$115	$0	$430,675	$430,675	$51,681	$482,400
28-inch	0	230	$0	$115	$0	$26,450	$26,450	$3,174	$29,600
30-inch	0	0	$0	$0	$0	$0	$0	$0	$0
33-inch	0	0	$0	$0	$0	$0	$0	$0	$0
36-inch	0	550	$0	$250	$0	$137,500	$137,500	$16,500	$154,000
39-inch	0	450	$0	$275	$0	$123,750	$123,750	$14,850	$138,600
Total	**119,768**	**268,570**			**$19,616,732**	**$17,483,883**	**$37,100,615**	**$4,452,074**	**$41,552,800**
% of System	**6%**	**14%**							

* Estimated costs do not include repair/replacement/rehabilitation of manholes

Appendix A – 2011 General Plan Study Areas

Within the General Plan Update boundary, the General Plan Update identifies 15 study areas, which are areas proposed for land use changes as compared to the existing General Plan. The 15 study areas are shown in Figure 3-3. Characteristics of each study area are described in Table 3-2, General Plan Update Study Area, and summarized below. The land use designations identified for each study area are defined in Table 3-3, Definitions of Proposed Land Use Categories.

1. **Imperial Oakes Specific Planning Area (SPA) (Imperial Oakes SPA).** The Imperial Oakes SPA is approximately 163 acres in size and bounded by I-15 on the west, Country Club Lane on the north, El Norte Parkway on the south, and Iris Lane and Centre City Parkway on the east. Under the proposed General Plan Update, Imperial Oakes SPA would have a land use designation of Specific Plan Area that accommodates employment-oriented land uses (office, Research and Development, minor supporting commercial uses, etc.) integrated with existing residential, open space and commercial uses in a master planned environment).

2. **Hwy-78/Broadway Target Area.** The SR-78/Broadway Target Area is approximately 122 acres in size and located at the terminus of SR-78, north of downtown, east of Centre City Parkway, and west of Juniper Street. Under the proposed General Plan Update, the SR-78/Broadway Target Area would have a land use designation of General Commercial.

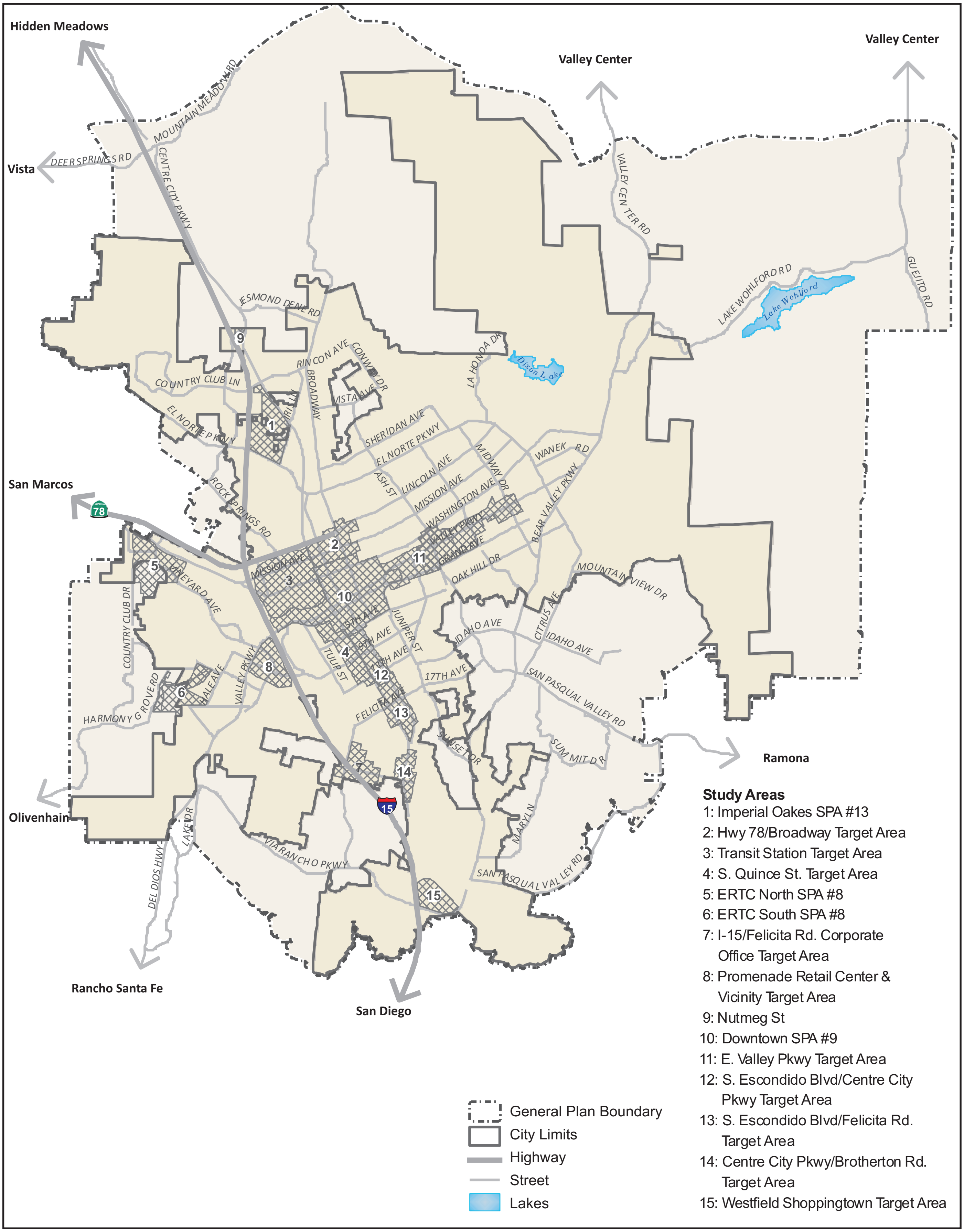
3. **Transit Station Target Area.** The Transit Station Target Area is approximately 296 acres in size and is located southeast of I-15 and SR-78. Under the proposed General Plan Update, the Transit Station Target Area would have the following land use designations: General Commercial, General Industrial and Light Industrial.

4. **South Quince Street Target Area.** The South Quince Street Target Area is approximately 184 acres in size and located south of downtown and north of 15th Avenue along both sides of Quince Street. Under the proposed General Plan Update, the South Quince Target Area would have the following land use designations: Urban I, Urban II, Planned Commercial, General Commercial and Office Industrial.

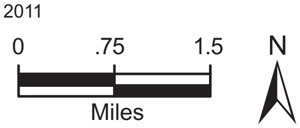
5. & 6. **Escondido Research Technology Center (ERTC) North Specific Planning Area (SPA) and ERTC South SPA.** Combined, ERTC North SPA and ERTC South SPA are approximately 476 acres in size and located along Citracado Parkway between Auto Park Way and Avenida del Diablo. Under the proposed General Plan Update, ERTC North SPA and ERTC South SPA would have a land use designation of Specific Plan Area.

7. **I-15/Felicita Road Corporate Office Target Area**. The I-15/Felicita Road Corporate Office Target Area is approximately 87 acres in size and located at the interchange of I-15 and Felicita Road. Under the proposed General Plan Update, the I-15/Felicita Road Corporate Office Target Area would have a land use designation of Planned Office.

8. **Promenade Retail Center and Vicinity Target Area.** The Promenade Retail Center and Vicinity Target Area is approximately 106 acres in size and is located in the area of I-15, Auto Park Way and Valley Parkway. Under the proposed General Plan Update, the Promenade Retail Center and Vicinity Target Area would have a land use designation of Planned Commercial.



Source: City of Escondido 2011



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STUDY AREAS
FIGURE 3-3

Table 3-2 General Plan Update Study Areas

Study Area (Refer to Figure 3-3)	Location	Size (in acres)	Adopted General Plan Land Use Designation	General Plan Update Land Use Designation	Current Status	Guiding Principals
#1 Imperial Oakes SPA	In the northern portion of the General Plan Update planning area, bounded by I-15 on the west, Country Club Lane on the north, El Norte Parkway on the south, Iris Lane and Centre City Parkway on the east	163	Suburban; Planned Commercial; General Commercial; Park; Office	Specific Plan Area	The Specific Plan Area is developed with visitor service and general retail uses, church, office, Rod McLeod Community Park, single family residential and vacant land. The site is bisected by SDG&E overhead utility lines and there is limited access to the interior.	▪ The SPA shall establish provisions for a comprehensively planned development focused on high paying, high employee density employment opportunities. The SPA shall include smart growth principles, and provide details on appropriate access, unifying design themes, attractive development standards and guidelines, appropriate land uses, and the prioritization of infrastructure improvements to accommodate growth. In addition, opportunities for a trail system or other recreational amenities that will connect with Rod McLeod Community Park shall be integrated into the plan. ▪ Increased building heights and intensities shall be focused along I-15 and in areas more distanced from residential uses to ensure compatibility. Specific attention shall be given to achieving compatibility with semi-rural residential areas along "edges" near Iris Lane by incorporating lower intensity land uses, building materials, heights, orientation, colors, heights, screening, lighting and signage. ▪ The SPA shall include programs addressing legal non-conforming residential uses that ensure their eventual integration into future planned business park operations while allowing their continued operation prior to transitioning to non-residential uses. Criteria and standards for proposed grading, circulation, and utility extensions shall be included to avoid adverse impacts and allow integration of adjacent SPA properties. ▪ Floor Area Ratio (FAR): 1.25 ▪ 5,740,593 square feet (sf) non-residential development at buildout.
#2 Hwy-78/ Broadway Target Area	Terminus of SR-78, north of downtown, east of Centre City Parkway, and west of Juniper Street	122	General Commercial	General Commercial	Low intensity general and auto-related retail, restaurants, office and commercial services and supply	▪ Evaluate opportunities to enhance vehicular entrance to the community along SR-78 and consider a gateway element to the City along Lincoln Avenue. ▪ Promote higher intensities along Broadway and consider establishing a unifying architectural and landscaping theme as a means to improve the overall image and serve as an entry into downtown. ▪ Consider opportunities and incentives for increasing employment densities and attracting businesses with salaries that raise the City's median income and improves the jobs/housing balance. ▪ FAR: 1.25 ▪ 330 residential dwelling units (du) and 2,573,320 sf non-residential development at buildout.

Table3-2 continued

Study Area (Refer to Figure 3-3)	Location	Size (in acres)	Adopted General Plan Land Use Designation	General Plan Update Land Use Designation	Current Status	Guiding Principals
#3 Transit Station Target Area	Southeast of I-15 and SR-78	296	General Industrial (148 acres); Light Industrial (74 acres); General Commercial (74 acres)	General Commercial (74 acres) General Industrial (148 acres); Light Industrial (74 acres)	Developed with low intensity general and auto-related retail, restaurants, manufacturing, commercial/ industrial services, building/landscaping/irrigation supply, concrete/asphalt production	▪ Establish the area north of the transit station and generally east of Reidy Creek for locating a regional attraction involving entertainment, employment, commercial and residential uses incorporating unified development standards and design guidelines that also provides a strong pedestrian connection to downtown. ▪ Consider opportunities and incentives for increasing employment densities and attracting businesses with salaries that raise the City's median income and improves the jobs/housing balance. ▪ Allow existing construction material manufacturing, trash transfer, and agricultural supply land uses west of Reidy Creek to continue operating and prohibit similar new uses. ▪ FAR 1.25 ▪ 960 du and 4,850,741 sf non-residential development at buildout.
#4 South Quince Street Target Area	South of downtown, north of 15th Avenue, and along both sides of Quince Street	184	Industrial Office ; Urban I; Urban II; Planned Commercial; General Commercial	Urban I (20 acres); Urban II (25 acres); Urban V (44 acres); Planned Commercial (5 acres); General Commercial (51 acres); Industrial Office (39 acres)	Mid-range density multi-family, low intensity general retail, office restaurants, small scale industrial and manufacturing services	▪ Establish an Area Plan that incorporates smart growth principles, promotes increased density and intensity near the transit center, encourages façade improvements, property revitalization and integrates public/private recreational space. ▪ Consider opportunities and incentives for increasing employment densities and attracting businesses with salaries that raise the City's median income and improves the jobs/housing balance. ▪ FAR: 1.0 ▪ 400 du and 1,764,833 sf non-residential development at buildout.
#5, #6 ERTC North & South SPA	On the western side of the General Plan Update planning area along Citracado Parkway between Auto Park Way and Avenida del Diablo	476	North SPA: Light Industrial; General Industrial; Estate I; Estate II South SPA: Public; Urban I; Estate I; Estate II	Specific Plan Area	Partially developed with industrial and commercial uses, an SDG&E power plant and a hospital campus	▪ The SPA envisions a high quality business park, encouraging clean research and development, medical office and industrial park uses to expand Escondido's employment base, increase median incomes and improve the jobs/housing balance. The SPA includes attractive design standards, landscape features, integrated recreation, and compatible land uses. ▪ Increased building heights and intensities shall be focused along Citracado Parkway and in areas more distanced from residential uses to ensure compatibility. Specific attention shall be given to achieving compatibility with semi-rural residential areas along "edges" near Harmony Grove Road, Kauna Loa Drive and in Eden Valley by incorporating lower intensity land uses, building materials, heights, orientation, colors, heights, screening, lighting and signage.

Table3-2 continued

Study Area (Refer to Figure 3-3)	Location	Size (in acres)	Adopted General Plan Land Use Designation	General Plan Update Land Use Designation	Current Status	Guiding Principals
						▪ The SPA shall include programs addressing legal non-conforming residential uses that ensure their eventual integration into future planned business park operations while allowing their continued operation prior to transitioning to non-residential uses. Criteria and standards for proposed grading, multimodal transportation, and utility extensions shall be included to avoid adverse impacts and allow integration of adjacent SPA properties. ▪ The drainage areas running north and south through the center of this SPA, as well as Escondido Creek, represent a desirable visual amenity. The SPA shall include provisions for the enhancement of riparian areas and for the incorporation of the Escondido Creek Trail into the ultimate development plans while minimizing impacts to these resources. ▪ North SPA FAR: 1.50 ▪ South SPA FAR: 1.0 ▪ North SPA: 7,256,007 sf non-residential development at buildout. ▪ South SPA: 1,555,092 sf non-residential development at buildout.
#7 I-15/Felicita Road Corporate Office Target Area	I-15 and Felicita Road interchange area	87	Office; Suburban; Estate II	Planned Office	Low intensity medical offices, single family units, churches, agriculture, and vacant properties	▪ Promote opportunities and incentives for increasing employment densities and attracting businesses with salaries that raise the City's median income and improving the jobs/housing balance. ▪ Land uses shall be consistent with the Planned Office designation with a focus on attracting high paying, high employee density employment opportunities. ▪ Development shall incorporate high quality, unified design elements that provide for superior architecture and features such as building height, mass, colors, materials, signage, landscaping, lighting, parking and circulation that are sensitive to adjacent single family zoning. Increased building heights and intensities shall be located closer to the freeway and distanced from lower density residential with appropriate buffers to ensure compatibility. ▪ FAR: 1.75 ▪ 3,042,281 sf non-residential development at buildout.

Table3-2 continued

Study Area (Refer to Figure 3-3)	Location	Size (in acres)	Adopted General Plan Land Use Designation	General Plan Update Land Use Designation	Current Status	Guiding Principals
#8 Promenade Retail Center and Vicinity Target Area	In-15, Auto Park Way and Valley Parkway	106	Planned Commercial; Urban IV	Planned Commercial	Retail shopping center with several anchor tenants, smaller shops, auto dealership, middle school, and apartments	▪ Work with the school district to coordinate a transition to retail use. Establish high quality, unified architectural design features for new development with particular attention to visibility from I-15 and southern residential areas. ▪ Consider opportunities and incentives for increasing employment densities and attracting businesses including offices, theaters, hotels, entertainment and visitor serving uses that complement existing retail and offer salaries that raise the city's median income and improving the jobs/housing balance. ▪ A planning alternative will evaluate mixed use commercial uses on the south side of Ninth Avenue in this study area. ▪ FAR: 1.50 ▪ 628 du and 6,153,148 sf non-residential development at buildout.
#9 Nutmeg Street	Both sides of Nutmeg Street east of I-15 and west of Centre City Parkway	7	Estate II	Urban II	Site is vacant. Approximately 2-acres on the north side of Nutmeg Street is constrained by topography and sensitive habitat. Southern areas of the site have been disturbed.	▪ The site will be evaluated for Urban II residential densities. Given the site's "Gateway" location at the northern entrance of the community attention shall be given to high quality unified architecture with particular attention to visibility from I-15. ▪ A planning alternative will evaluate an office use for the site with the same design considerations noted above. ▪ FAR: 0.45 ▪ 50 du and 75,000 sf non-residential development at buildout.
#10 Downtown SPA	Central Escondido generally located east of I-15, north of 6th Avenue, south of Mission Avenue and west of Fig Street	475	Specific Planning Area; General Commercial; Planned Commercial; Industrial Office	Specific Plan Area	The SPA is divided into seven districts and is partially developed. The SPA includes a historic, walkable retail and service core around Grand Avenue with suburban-style shopping centers on the western and northern ends. A historic residential neighborhood borders the downtown on the south with office and retail to the east.	▪ The Downtown SPA is envisioned as a dynamic, attractive, economically vital city center providing a social, cultural, economic, and residential focus while respecting its historic center. The environment is pedestrian-oriented, attracting local and non-local visitors to experience an atmosphere that is entertaining and vibrant with activity occurring throughout the day, evening and weekend hours. The SPA is intended to increase employment densities and attract businesses with salaries that raise the City's median income and improve the jobs/housing balance. The SPA is also intended to: – Prioritize infrastructure improvements to accommodate growth. – Target residential development around Grape Day Park. – Expand Grape Day Park to Washington Avenue to promote additional recreation opportunities and facilitate more convenient access from northern areas. – Expand the Grand Avenue pedestrian environment through-out downtown by encouraging vertical mixed-use developments.

Table3-2 continued

Study Area (Refer to Figure 3-3)	Location	Size (in acres)	Adopted General Plan Land Use Designation	General Plan Update Land Use Designation	Current Status	Guiding Principles
						– Strengthen the Escondido Creek path connection with downtown. – Provide convenient transit access, innovative housing options and pedestrian-oriented design. – Link downtown to the future regional attraction within Target Area #1 with attractive and safe pedestrian access. – FAR: 2.00 – 5,275 du and 13,566,484 non-residential development at buildout.
#11 East Valley Parkway Target Area	Generally between Escondido Creek, Grand Avenue, Palomar Hospital and Midway Drive	331	General Commercial; Office	Office (70 acres); General Commercial (261 acres); Mixed Use Overlay	Low intensity general retail, office, restaurants, and small-scale service businesses. Existing adopted plan is East Valley Parkway Area Plan.	▪ Update the Area Plan for the Target Area that includes smart growth principles, enhanced Escondido Creek path connections, aesthetically improved streetscapes along Lincoln Avenue and Ash Street, and integrated public/private recreational spaces. ▪ Establish a Mixed Use Overlay between Palomar Hospital and Ash Street to focus residential growth with increased building heights and intensities distanced from lower density residential uses and appropriate buffers to ensure compatibility. ▪ Promote opportunities and incentives for attracting job training, technical, vocational schools and educational institutions that enhance employment opportunities for residents. ▪ FAR: 1.25 ▪ 2,100 du and 8,328,596 sf non-residential development at buildout.
#12 South Escondido Boulevard/ Felicita Road Target Area	South of 15th Avenue between Escondido Boulevard and Centre City Parkway (on both sides of both streets)	167	General Commercial; Urban IV	Urban III (29 acres); Urban IV (12 acres); General Commercial (126 acres); Mixed Use Overlay	Mid-range density multi-family, low intensity suburban shopping, general retail, office, restaurants, and small scale services. Existing adopted Plan is S. Escondido Boulevard Commercial Area Plan.	▪ Update the existing Area Plan for the Target Area to include smart growth principles, strong connections to transit, and integration of public/private recreational space. ▪ Establish a Mixed Use Overlay with increased density and intensity in close proximity to transit and services. Ensure compatibility with adjacent lower density residential with appropriate building heights, intensities, and buffers. ▪ FAR: 1.25 ▪ 740 du and 714,366 sf non-residential development at buildout.
#13 South Escondido Boulevard/ Centre City Parkway Target Area	Between 6th and 15th Avenues, Escondido Boulevard and Centre City Parkway	80	General Commercial; Urban III; Urban IV	Urban V (44 acres); General Commercial (36 acres)	Single family and mid-range density multi-family, small scale commercial services. Existing adopted plan is South Escondido Boulevard Commercial Area Plan.	▪ Update the existing Area Plan for the Target Area to include smart growth principles, strong connections to transit and integration of public/private recreational space. ▪ Ensure building heights and intensities are compatible with the adjacent Old Escondido Neighborhood Historic District. ▪ FAR: 1.25 ▪ 1,847 du and 2,063,500 sf non-residential development at buildout.

Table3-2 continued

Study Area (Refer to Figure 3-3)	Location	Size (in acres)	Adopted General Plan Land Use Designation	General Plan Update Land Use Designation	Current Status	Guiding Principals
#14 Centre City Parkway/ Brotherton Road Target Area	In the vicinity of Brotherton Road and Citracado Parkway on both sides of Centre City Parkway	55	General Commercial; Urban III	Urban III (7 acres); General Commercial (48 acres); Planned Commercial; Mixed Use Overlay	Mid-range density mixed use, low intensity suburban shopping, general retail, office, and small scale services. Existing adopted Plan is S. Escondido Boulevard Commercial Area Plan.	▪ Update the existing Area Plan for the Target Area to include smart growth principles, a gateway element for the City, aesthetic enhancements along Centre City Parkway, strong connections to transit, integration of public/private recreational space, and features to ensure pedestrian safety. ▪ Establish a Mixed Use Overlay with increased density and intensity in close proximity to transit and services. Ensure compatibility with adjacent lower density residential uses with appropriate building heights, intensities, and buffers. ▪ FAR: 1.50 ▪ 1,625 du and 1,565,120 sf non-residential development at buildout.
#15 Westfield Shoppingtown Target Area	I-15 and Via Rancho Parkway interchange	77	Planned Commercial	Planned Commercial	Multi-story regional shopping center with several anchor tenants, smaller shops and free-standing up-scale dining establishments. Site is owned by the City under long-term lease contract to Westfield.	▪ Coordinate future shopping center expansion efforts that continue to attract a regional customer base and support City revenues. Opportunities for amending parking requirements shall be evaluated as transit use to and from the site increases. ▪ Consider opportunities and incentives for increasing employment densities and attracting businesses including offices, theaters, hotels, entertainment and visitor-serving uses that complement existing retail uses and offer salaries that raise the City's median income and improve the jobs/housing balance. ▪ Promote transit access and connections for the site and consider opportunities for amending parking requirements as transit use to and from the site increases. ▪ FAR: 1.25 ▪ 2,896,325 sf non-residential development at buildout.

Table 3-3 Definitions of Proposed Land Use Categories

Land Use Category	Land Use Definition
Rural I Rural II	The Rural designation applies to areas that are not intended to receive substantial urban services, distant from the developed valley floor, or steep (generally over 25 percent in slope) or contain sensitive natural resources. Development clustering is permitted pursuant to General Plan Residential Clustering policies.
Estate I Estate II	The Estate designation accommodates detached single-family homes on large lots. This designation applies to areas that are on the edge of urban development or in areas that are already characterized by an estate development pattern. Development clustering is permitted pursuant to General Plan Residential Clustering policies.
Suburban	The Suburban designation applies to areas that generally surround the urbanized core of the community and accommodate single family detached homes on relatively large lots. Development clustering is permitted pursuant to General Plan Residential Clustering policies.
Urban I	The Urban I designation applies to many residential areas of the main Escondido "valley floor" and accommodates single family detached homes on smaller urban lots. Development clustering is permitted pursuant to General Plan Residential Clustering policies
Urban II and Urban III	The Urban II and III designations accommodate a wide range of housing types and generally applies to transitional areas between single family neighborhoods and higher density residential and commercial areas.
Urban IV and Urban V	The Urban IV and Urban V designations accommodate higher densities for urban multi-family housing characterized by taller structures in more densely developed areas that provide convenient access to a wider range of facilities and services.
Neighborhood Commercial	The Neighborhood Commercial designation accommodates very small scale neighborhood-oriented limited retail and office activities designed to serve residents in the immediate vicinity.
General Commercial	The General Commercial designation accommodates a wide variety of retail and service activities intended to serve a broad customer base.
Planned Commercial	The Planned Commercial designation accommodates a variety of commercial activities within a self-contained comprehensively planned development.
General Office	The General Office designation accommodates a variety of activities in an office environment and in Mixed Use Overlay areas and is intended to prevent the proliferation of individual isolated offices.
Planned Office	The Planned Office designation accommodates a variety of office activities within a self-contained comprehensively planned development.
Industrial Office	The Industrial Office designation accommodates a variety of activities in an industrial environment adjacent to downtown near the transit station.
Light Industrial and General Industrial	The Light Industrial and General Industrial designations accommodate a variety of activities in an industrial environment.
Vertical Mixed-Use and Horizontal Mixed-Use	The Vertical Mixed-Use and Horizontal Mixed-Use overlay designations accommodate a combination of commercial and/or office activities that include a residential component within a self-contained comprehensively planned development in specified General Plan locations.
Specific Planning Areas	Specific Planning Areas accommodate areas which require submittal of Planned Development or Specific Plans prior to development as described in the General Plan.
Public Facility Overlay	The Public Facility Overlay accommodates public facilities including government facilities, libraries, community centers, and schools.
Parks and Open Space	The Parks and Open Space designation accommodates land for public recreational activity and habitat preservation. Permitted uses include active and passive parks as well as land to protect, maintain, and enhance the community's natural resources and includes detention basins and creek corridors.
Native American Tribal Lands	Native American Tribal Lands accommodate areas that are federally recognized reservations or Indian Villages. The City has no land use authority over Tribal Lands.

9. **Nutmeg Street Study Area.** The Nutmeg Street Study Area is approximately 7 acres in size and located on both sides of Nutmeg Street, east of I-15 and west of Centre City Parkway. The existing General Plan designation is Estate II (single family residential; 20,000 SF minimum lot size). Under the proposed General Plan Update, the site would have a land use designation of Urban II.

10. **Downtown Specific Planning Area (Downtown SPA).** Downtown SPA is approximately 475 acres in size and located in central Escondido, east of I-15, north of 6th Avenue, south of Mission Avenue and west of Fig Street. Under the proposed General Plan Update, the Downtown SPA would have a land use designation of Specific Plan Area.

11. **East Valley Parkway Target Area.** The East Valley Parkway Target Area is approximately 331 acres in size and bounded generally by Escondido Creek, Grand Avenue, the existing Palomar Hospital campus and Midway Drive. Under the proposed General Plan Update, the East Valley Parkway Target Area would have a Mixed-Use Overlay with land use designations of Office and General Commercial.

12. **South Escondido Boulevard/Center City Parkway Target Area.** The South Escondido Boulevard/ Center City Parkway Target Area is approximately 80 acres in size and bound by 6th and 15th Avenues, Escondido Boulevard, and Centre City Parkway. Under the proposed General Plan Update, the South Escondido Boulevard/Center City Parkway Target Area would have the following land use designations: Urban V and General Commercial.

13. **South Escondido Boulevard/Felicita Road Target Area.** The South Escondido Boulevard/Felicita Road Target Area is approximately 167 acres in size and located south of 15th Avenue between Escondido Boulevard and Centre City Parkway (on both sides of both streets). Under the proposed General Plan Update, the South Escondido Boulevard/Felicita Road Target Area would have a Mixed-Use overlay with land use designations of General Commercial, Urban III, and Urban IV.

14. **Centre City Parkway/Brotherton Road Target Area.** The Centre City Parkway/Brotherton Road Target Area is approximately 55 acres in size and located in the vicinity of Brotherton Road and Citracado Parkway on both sides of Centre City Parkway. Under the proposed General Plan Update, the Centre City Parkway/Brotherton Road Target Area would have a Mixed-Use overlay with land use designations of Urban III, General Commercial and Planned Commercial.

15. **Westfield Shoppingtown Target Area.** The Westfield Shoppingtown Target Area is approximately 77 acres in size and located at the I-15 and Via Rancho Parkway interchange. Under the proposed General Plan Update, the Westfield Shoppingtown Target Area would have a land use designation of Planned Commercial.

The following discussion provides General Plan Update background information, buildout information, a summary of each General Plan element, and the updated quality of life standards.

3.1.1.1 General Plan Buildout

The term buildout refers to the maximum number of potential residential units and maximum amount of commercial, industrial and non-residential square footage allowable under implementation of the General Plan Update. The horizon year for the General Plan Update is 2035, by which time a large portion, but not all, of the planned development under the Plan will have occurred. Full buildout of the General Plan Update would not occur until all development allowed under the Plan is achieved, the exact timing of which is unknown. 2035 buildout is considered to be a reasonable development scenario for the General Plan Update and buildout to this level has been estimated for all the study areas in the General Plan Update. Table 3-4, General Plan Update Buildout Conditions, identifies 2035 buildout scenarios for each study area. Buildout assumptions for each study area are based on dwelling units and densities being distributed in smart growth areas and established neighborhoods, taking into account community input and visioning as well as infrastructure capabilities and quality of life standards. 2035 buildout estimates are used as the basis for the analysis of impacts in this EIR. Therefore, all references to General Plan Update buildout in the EIR should be assumed to mean 2035 buildout, unless stated otherwise. Should any future development be proposed that is beyond 2035 buildout estimates, additional environmental review under CEQA would be required.

Table 3-4 General Plan Update Buildout Conditions

ID No.	Study Area	Existing Conditions	Adopted General Plan Full Buildout	General Plan Update Full Buildout	Buildout by 2035 (Horizon Year)	2035 Growth in New General Plan Above Existing Conditions	General Plan Update Full Buildout Above Adopted General Plan Full Buildout
Single Family Residences (in dwelling units)							
1.	Imperial Oakes SPA	64	289	0	0	-64	-289
2.	Hwy-78/Broadway Target Area	0	0	0	0	0	0
3.	Transit Station Target Area	0	0	0	0	0	0
4.	South Quince Street Target Area	140	150	150	150	10	0
5.	ERTC North SPA	39	135	0	0	-39	-135
6.	ERTC South SPA	20	200	0	0	-20	-200
7.	1-15/Felicita Road Corporate Office Target Area	19	155	0	0	-19	-155
8.	Promenade Retail Center and Vicinity Target Area	0	0	0	0	0	0
9.	Nutmeg Street	0	10	0	0	0	-10
10.	Downtown SPA	0	0	0	0	0	0
11.	East Valley Parkway Target Area	100	0	0	0	-100	0
12.	South Escondido Blvd/Centre City Pkwy Target Area	0	0	0	0	0	0
13.	South Escondido Blvd/Felicita Road Target Area	0	0	0	0	0	0
14.	Centre City Parkway/Brotherton Road Target Area	0	0	0	0	0	0
15.	Westfield Shoppingtown Target Area	0	0	0	0	0	0
Remainder of City (Non-Study Areas)		30,725	35,200	35,200	32,725	2,000	0
Total City		***31,107***	***36,139***	***35,350***	***32,875***	***1,768***	***-789***
Total SOI		***6,450***	***7,800***	***7,800***	***6,950***	***500***	***0***
Total City + SOI		***37,557***	***43,939***	***43,150***	***39,825***	***2,268***	***-789***
Multifamily Residences (in dwelling units)							
1.	Imperial Oakes SPA	0	0	0	0	0	0
2.	Hwy-78/Broadway Target Area	330	330	330	330	0	0
3.	Transit Station Target Area	160	160	960	800	640	800
4.	South Quince Street Target Area	170	250	250	250	80	0
5.	ERTC North SPA	0	0	0	0	0	0
6.	ERTC South SPA	0	0	0	0	0	0
7.	1-15/Felicita Road Corporate Office Target Area	0	0	0	0	0	0

Table 3-4 continued

ID No.	Study Area	Existing Conditions	Adopted General Plan Full Buildout	General Plan Update Full Buildout	Buildout by 2035 (Horizon Year)	2035 Growth in New General Plan Above Existing Conditions	General Plan Update Full Buildout Above Adopted General Plan Full Buildout
8.	Promenade Retail Center and Vicinity Target Area	628	628	628	628	0	0
9.	Nutmeg Street	0	0	50	50	50	50
10.	Downtown SPA	674	2,000	5,275	4,000	3,326	3,275
11.	East Valley Parkway Target Area	600	1,100	2,100	1,300	700	1,000
12.	South Escondido Blvd/Centre City Pkwy Target Area	690	1,072	1,847	1,300	610	775
13.	South Escondido Blvd/Felicita Road Target Area	440	640	740	740	300	100
14.	Centre City Parkway/Brotherton Road Target Area	300	500	1,625	1,000	700	1,125
15.	Westfield Shoppingtown Target Area	0	0	0	0	0	0
Remainder of City (Non-Study Areas)		12,485	17,327	17,327	13,735	1,250	0
Total City		***16,477***	***24,007***	***31,132***	***24,133***	***7,656***	***7,125***
Total SOI		***0***	***0***	***0***	***0***	***0***	***0***
Total City + SOI		***16,477***	***24,007***	***31,132***	***24,883***	***7,656***	***7,125***
Total Housing Units (in dwelling units)							
1.	Imperial Oakes SPA	64	289	0	0	-64	-289
2.	Hwy-78/Broadway Target Area	330	330	330	330	0	0
3.	Transit Station Target Area	160	160	960	800	640	800
4.	South Quince Street Target Area	310	400	400	400	90	0
5.	ERTC North SPA	39	135	0	0	-39	-135
6.	ERTC South SPA	20	200	0	0	-20	-200
7.	1-15/Felicita Road Corporate Office Target Area	19	155	0	0	-19	-155
8.	Promenade Retail Center and Vicinity Target Area	628	628	628	628	0	0
9.	Nutmeg Street	0	10	50	50	50	40
10.	Downtown SPA	674	2,000	5,275	4,000	3,326	***3,275***
11.	East Valley Parkway Target Area	700	1,100	2,100	1,300	600	1,000
12.	South Escondido Blvd/Centre City Pkwy Target Area	690	1,072	1,847	1,300	610	775
13.	South Escondido Blvd/Felicita Road Target Area	440	640	740	740	300	100
14.	Centre City Parkway/Brotherton Road Target Area	300	500	1,625	1,000	700	1,125
15.	Westfield Shoppingtown Target Area	0	0	0	0	0	0

Table 3-4 continued

ID No. Study Area		Existing Conditions	Adopted General Plan Full Buildout	General Plan Update Full Buildout	Buildout by 2035 (Horizon Year)	2035 Growth in New General Plan Above Existing Conditions	General Plan Update Full Buildout Above Adopted General Plan Full Buildout
Remainder of City (Non-Study Areas)		43,210	52,527	52,527	46,460	3,250	0
Total City Residential		***47,584***	***60,146***	***66,482***	***57,008***	***9,424***	***6,336***
Total SOI Residential		***6,450***	***7,800***	***7,800***	***6,950***	***500***	***0***
Total Housing Units City + SOI		***54,034***	***67,946***	***74,282***	***63,958***	***9,924***	***6,336***
Commercial/Retail Units (in square feet)							
1.	Imperial Oakes SPA	0	0	0	0	0	0
2.	Hwy-78/Broadway Target Area	666,000	900,000	2,445,000	1,200,000	534,000	1,545,000
3.	Transit Station Target Area	596,000	625,000	970,000	850,000	254,000	345,000
4.	South Quince Street Target Area	165,000	179,000	538,000	300,000	135,000	359,000
5.	ERTC North SPA	82,000	87,000	726,000	87,000	5,000	639,000
6.	ERTC South SPA	0	0	0	0	0	0
7.	1-15/Felicita Road Corporate Office Target Area	0	0	437,000	186,000	186,000	437,000
8.	Promenade Retail Center and Vicinity Target Area	420,000	516,000	1,846,000	775,000	355,000	1,330,000
9.	Nutmeg Street	0	0	0	0	0	0
10.	Downtown SPA	2,053,000	2,466,000	9,442,000	3,600,000	1,547,000	6,976,000
11.	East Valley Parkway Target Area	1,895,000	2,100,000	5,414,000	2,250,000	355,000	3,314,000
12.	South Escondido Blvd/Centre City Pkwy Target Area	817,000	897,000	1,960,000	1,153,000	336,000	1,063,000
13.	South Escondido Blvd/Felicita Road Target Area	238,000	299,000	679,000	375,000	137,000	380,000
14.	Centre City Parkway/Brotherton Road Target Area	169,000	290,000	861,000	576,000	407,000	571,000
15.	Westfield Shoppingtown Target Area	1,600,000	1,600,000	2,462,000	2,034,000	434,000	862,000
Remainder of City (Non-Study Areas)		4,300,000	4,778,000	4,778,000	4,500,000	200,000	0
Total City		***13,001,000***	***14,737,000***	***32,558,000***	***17,886,000***	***4,885,000***	***17,821,000***
Total SOI		***0***	***300,000***	***300,000***	***150,000***	***150,000***	***0***
Total City + SOI		***13,001,000***	***15,037,000***	***32,858,000***	***18,036,000***	***5,035,000***	***17,821,000***
Office (in square feet)							
1.	Imperial Oakes SPA	15,000	30,000	4,592,000	2,100,000	2,085,000	4,562,000
2.	Hwy-78/Broadway Target Area	35,000	47,000	129,000	84,000	49,000	82,000
3.	Transit Station Target Area	149,000	156,000	728,000	550,000	401,000	572,000

Table 3-4 continued

ID No.	Study Area	Existing Conditions	Adopted General Plan Full Buildout	General Plan Update Full Buildout	Buildout by 2035 (Horizon Year)	2035 Growth in New General Plan Above Existing Conditions	General Plan Update Full Buildout Above Adopted General Plan Full Buildout
4.	South Quince Street Target Area	18,000	20,000	60,000	60,000	42,000	40,000
5.	ERTC North SPA	660,000	694,000	5,805,000	1,200,000	540,000	5,111,000
6.	ERTC South SPA	4,000	4,000	156,000	78,000	74,000	152,000
7.	1-15/Felicita Road Corporate Office Target Area	150,000	154,000	2,477,000	950,000	800,000	2,323,000
8.	Promenade Retail Center and Vicinity Target Area	180,000	221,000	1,231,000	443,000	263,000	1,010,000
9.	Nutmeg Street	0	0	0	30,000	30,000	0
10.	Downtown SPA	969,000	1,025,000	3,921,000	1,250,000	281,000	2,896,000
11.	East Valley Parkway Target Area	1,020,000	1,131,000	2,915,000	1,400,000	380,000	1,784,000
12.	South Escondido Blvd/Centre City Pkwy Target Area	43,000	47,000	103,000	78,000	35,000	56,000
13.	South Escondido Blvd/Felicita Road Target Area	13,000	33,000	36,000	30,000	17,000	3,000
14.	Centre City Parkway/Brotherton Road Target Area	139,000	237,000	704,000	345,000	206,000	467,000
15.	Westfield Shoppingtown Target Area	0	0	434,000	284,000	284,000	434,000
Remainder of City (Non-Study Areas)		696,000	773,000	773,000	746,000	50,000	0
Total City		***4,091,000***	***4,572,000***	***24,064,000***	***9,628,000***	***5,537,000***	***19,492,000***
Total SOI		***0***	***0***	***0***	***0***	***0***	***0***
Total City + SOI		***4,091,000***	***4,572,000***	***24,064,000***	***9,628,000***	***5,537,000***	***19,492,000***
Industrial/Other (in square feet)							
1.	Imperial Oakes SPA	60,000	120,000	1,148,000	550,000	490,000	1,028,000
2.	Hwy-78/Broadway Target Area	0	0	0	0	0	0
3.	Transit Station Target Area	2,234,000	2,346,000	3,638,000	2,800,000	566,000	1,292,000
4.	South Quince Street Target Area	357,000	388,000	1,167,000	500,000	143,000	779,000
5.	ERTC North SPA	82,000	87,000	726,000	87,000	5,000	639,000
6.	ERTC South SPA	36,000	36,000	1,400,000	700,000	664,000	1,364,000
7.	1-15/Felicita Road Corporate Office Target Area	129,000	129,000	129,000	129,000	129,000	0
8.	Promenade Retail Center and Vicinity Target Area	0	0	0	0	0	0
9.	Nutmeg Street	0	0	0	0	0	0
10.	Downtown SPA	31,000	50,000	203,000	91,000	60,000	153,000
11.	East Valley Parkway Target Area	0	0	0	0	0	0

Table 3-4 continued

ID No.	Study Area	Existing Conditions	Adopted General Plan Full Buildout	General Plan Update Full Buildout	Buildout by 2035 (Horizon Year)	2035 Growth in New General Plan Above Existing Conditions	General Plan Update Full Buildout Above Adopted General Plan Full Buildout
12.	South Escondido Blvd/Centre City Pkwy Target Area	0	0	0	0	0	0
13.	South Escondido Blvd/Felicita Road Target Area	0	0	0	0	0	0
14.	Centre City Parkway/Brotherton Road Target Area	0	0	0	0	0	0
15.	Westfield Shoppingtown Target Area	0	0	0	0	0	0
Remainder of City (Non-Study Areas)		9,460,000	11,771,000	11,771,000	10,610,000	1,150,000	0
Total City		***12,389,000***	***14,927,000***	***20,182,000***	***15,467,000***	***3,078,000***	***5,255,000***
Total SOI		***0***	***0***	***0***	***0***	***0***	***0***
Total City + SOI		***12,389,000***	***14,927,000***	***20,182,000***	***15,467,000***	***3,078,000***	***5,255,000***
Nonresidential Summary							
1.	Imperial Oakes SPA	75,000	150,000	5,740,000	2,650,000	2,575,000	5,590,000
2.	Hwy-78/Broadway Target Area	701,000	947,000	2,574,000	1,284,000	583,000	1,627,000
3.	Transit Station Target Area	2,979,000	3,127,000	5,336,000	4,200,000	1,221,000	2,209,000
4.	South Quince Street Target Area	540,000	587,000	1,765,000	860,000	320,000	1,178,000
5.	ERTC North SPA	824,000	868,000	7,257,000	1,374,000	550,000	6,389,000
6.	ERTC South SPA	40,000	40,000	1,556,000	778,000	738,000	1,516,000
7.	1-15/Felicita Road Corporate Office Target Area	279,000	283,000	3,043,000	1,265,000	986,000	2,760,000
8.	Promenade Retail Center and Vicinity Target Area	600,000	737,000	3,077,000	1,218,000	618,000	2,340,000
9.	Nutmeg Street	0	0	0	30,000	30,000	0
10.	Downtown SPA	3,053,000	3,541,000	13,566,000	4,941,000	1,888,000	10,025,000
11.	East Valley Parkway Target Area	2,915,000	3,231,000	8,329,000	3,650,000	735,000	50,980,000
12.	South Escondido Blvd/Centre City Pkwy Target Area	860,000	944,000	2,063,000	1,231,000	371,000	1,119,000
13.	South Escondido Blvd/Felicita Road Target Area	251,000	332,000	715,000	405,000	154,000	383,000
14.	Centre City Parkway/Brotherton Road Target Area	308,000	527,000	1,565,000	921,000	613,000	1,038,000
15.	Westfield Shoppingtown Target Area	1,600,000	1,600,000	2,896,000	2,318,000	718,000	1,296,000
Remainder of City (Non-Study Areas)		14,456,000	17,322,000	17,322,000	15,856,000	1,400,000	0
Total City Nonresidential		***29,481,000***	***34,236,000***	***76,804,000***	***42,981,000***	***13,500,000***	***42,568,000***
Total SOI Non-Residential		***0***	***300,000***	***300,000***	***150,000***	***150,000***	***0***
Total City + SOI Non-residential Total		***29,481,000***	***34,536,000***	***77,104,000***	***43,131,000***	***13,650,000***	***42,568,000***

The General Plan Update buildout estimates shape how the City will look and feel and drive municipal infrastructure and facility needs. Detailed public facility plans that delineate the location and improvements associated with each public facility are prepared once the buildout and quality of life standards are determined. Once facility plans are developed, development fees are determined. If buildout estimates are too high, unnecessary improvements will be planned and the per-unit fees will be too low. If buildout is underestimated, then facility plans will not be able to accommodate actual development.

Table 3-4, General Plan Update Buildout Conditions, identifies the residential and non-residential 2035 buildout conditions under implementation of the proposed General Plan Update by study area, total city, and SOI. The 2035 buildout conditions for the General Plan Update boundary would result in 39,825 single family residential units, 24,883 multi-family residential units, 18,036,00 sf of commercial/retail uses, 9,628,000 sf of office uses, and 15,467,000 sf of industrial/other uses.

FLOWVIEW™

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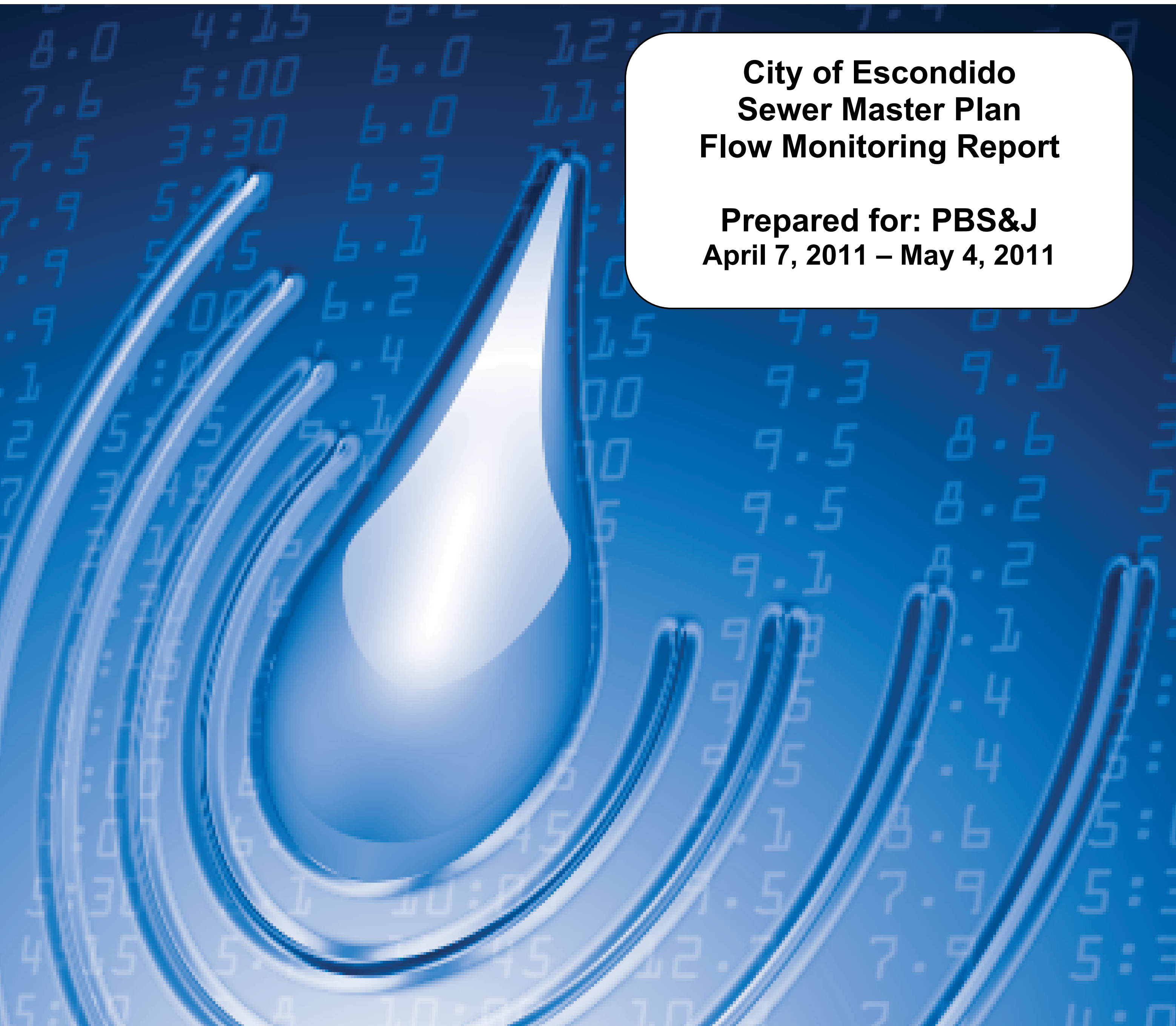


City of Escondido
Sewer Master Plan
Flow Monitoring Report

Prepared for: PBS&J

April 7, 2011 – May 4, 2011

Temporary Flow Monitoring for the City of Escondido Sewer Master Plan

April 07, 2011 - May 04, 2011

Prepared for:

Mr. Kyle McCarty

PBSJ

9275 Sky Park Court, SUITE 200
San Diego , CALIFORNIA 92123

Prepared by:

ADS, LLC
4820 Mercury Street, Suite C
San Diego, CA 92111

Letter of Transmittal

A Division of ADS LLC

4820 Mercury Street, Suite C
San Diego, CA 92111

www.adsenv.com

May 20, 2011

Mr. Kyle McCarty, PE
PBS&J
9275 Sky Park Court, Ste 200
San Diego, CA 92123

Dear Mr. McCarty,

ADS is pleased to submit the Temporary Flow Monitoring Report for the City of Escondido Sewer Master Plan conducted for PBS&J . Metering was conducted at eight (8) locations for the duration of 28 days from April 07, 2011 through May 04, 2011 . This data submittal includes two copies of the report. Included in the report are depth, velocity and quantity hydrographs as well as daily long tables for the metering period.

Also included with this report is a CD, which contains data for the report in Excel and PDF format. The Excel file contains Depth, Quantity, and Velocity entities for the flow monitoring location in 5-minute format.

In addition, we would be happy to further explain any details about the report that may seem unclear. You may contact the Project Manager, Neil Volk at (858) 571-0045.

Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Kristen Daye

Senior Data Analyst

Table of Content

Methodology

Introduction

Background

PBS&J entered into agreement with ADS Environmental Services to conduct flow monitoring at (8) eight metering locations located in the City of Escondido, CA. The study was for a (28) twenty eight day monitoring period. The objective of this study was to measure depth, velocity, quantify flows.

Project Scope

The scope of this study involved using temporary flow monitors to quantify wastewater flow at the designated locations. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions.
- Flow monitor installation.
- Flow monitor confirmations and data collections.
- Flow data analysis.

Equipment installation was accomplished on April 6, 2011. The monitoring period began on April 07, 2011 and was completed on May 04, 2011 .

Equipment and Methodology

Flow Quantification Methods

There are two main equations used to measure open channel flow: the Continuity Equation and the Manning Equation. The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow. Most modern flow monitoring equipment, including the ADS Models, measure both depth and velocity and therefore use the Continuity Equation to calculate flow quantities.

Flow Monitoring Equipment

The monitor selected for this project was the ADS Model 3600-flow monitor. This flow monitor is an area velocity monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Model 3600-flow monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

Three types of data acquisition sensors are available for the Model 3600 flow monitor. The primary depth measurement device is the ADS quad-redundant ultrasonic level sensor. This sensor uses four independent ultrasonic transceivers in pairs to measure the distance from the face of the transceiver housing to the water surface (air range) with up to four transceiver pairs, of the available ones, active at one time. The elapsed time between transmitting and receiving the ultrasonic waves is used to calculate the air range between the sensor and flow surface based on the speed of sound in air. Sensors in the transceiver housing measure temperature, which is used to compensate the ultrasonic signal travel time. The speed of sound will vary with temperature. Since the ultrasonic level sensor is mounted out of the flow, it creates no disturbance to normal flow patterns and does not affect site hydraulics.

Redundant flow depth data can be provided by a pressure depth sensor, and is independent from the ultrasonic level sensor. This sensor uses a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube. Pressure depth sensors are typically used in large size channels and applications where surcharging is anticipated. Its streamlined shape minimizes flow distortion.

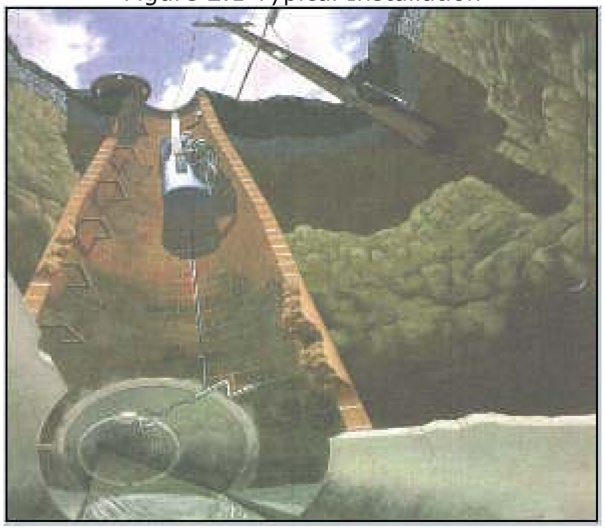
Velocity is measured using the ADS V-3 digital Doppler velocity sensor. This sensor measures velocity in the cross-sectional area of flow. An ultrasonic carrier is transmitted upstream into the flow, and is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity. Collected peak velocity information is filtered and processed using field confirmation information and proprietary software to determine the average velocity, which is used to calculate flow quantities. The sensor's small profile, measuring 1.5 inches by 1.15 inches by 0.50 inches thick, minimizes the affects on flow patterns and site hydraulics.

Installation

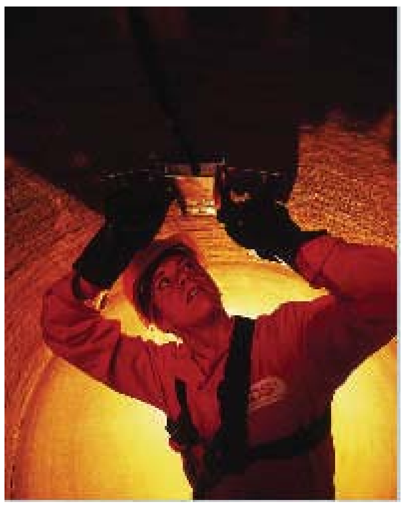
Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed. A typical flow monitor installation is shown in Figure 2.1.

The installations depicted in Figures 2.1 are typical for circular or oval pipes up to approximately 104-inches in diameter or height. In installations into pipes 42-inches or less in diameter, depth and velocity sensors are mounted on an expandable stainless steel ring and installed one to two pipe diameters upstream of the pipe/manhole connection in the incoming sewer pipe. This reduces the affects of turbulence and backwater caused by the connection. In pipes larger than 42 inches in diameter, a special installation is made using two sections of the ring installed one to two feet upstream of the pipe/manhole connection; one bolted to the crown of the pipe for the depth sensor, and the other bolted to the bottom of the pipe (bolts are usually placed just above the water line) to hold the velocity sensor.

Figure 2.1 Typical Installation



Large Pipe (> 42" Diameter)



Small Pipe (8" to 42" Diameter)

Data Collection, Confirmation, and Quality Assurance

During the monitoring period, field crews visit each monitoring location to retrieve data, verify proper monitor operation, and document field conditions. The following quality assurance steps are taken to assure the integrity of the data collected:

- **Measure Power Supply:** The monitor is powered by a dry cell battery pack. Power levels are recorded and battery packs replaced, if necessary. A separate battery provides back-up power to memory, which allows the primary battery to be replaced without the loss of data.

- **Perform Pipe Line Confirmations and Confirm Depth and Velocity:** Once equipment and sensor installation is accomplished, a member of the field crew descends into the manhole to perform a field measurement of flow rate, depth and velocity to confirm they are in agreement with the monitor. Since the ADS V-3 velocity sensor measures peak velocity in the wetted cross-sectional area of flow, velocity profiles are also taken to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

- **Measure Silt Level:** During site confirmation, a member of the field crew descends into the manhole and measures and records the depth of silt at the bottom of the pipe. This data is used to compute the true area of flow.

- **Confirm Monitor Synchronization:** The field crew checks the flow monitor's clock for accuracy.

- **Upload and Review Data:** Data collected by the monitor is uploaded and reviewed for comparison with previous data. All readings are checked for consistency and screened for deviations in the flow patterns, which indicate system anomalies or equipment failure.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at either 15-minute or 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the air range (distance from sensor to top of flow) for each active ultrasonic depth sensor pair and (2) the peak velocity. If the monitor is equipped with a pressure sensor, then a depth reading from this sensor may also be stored. When the field personnel collects the data, the air range is converted to depth data based on the pipe height and physical offset (distance from the top of the pipe to the surface of the ultrasonic sensor). The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which ultrasonic pairs and/or depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the tables and hydrographs.

DEPTH - Final calculated depth measurement (in inches)

QUANTITY - Final calculated flow rate (in MGD)

VELOCITY - Final calculated flow velocity (in feet per second)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

Site Commentary

Site Information

E_1	
Pipe Dimensions	35.75 "
Silt Level	0.00"

Overview

Site E_1 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 40% of full pipe during the recorded peak and approximately 33% during the recorded average depth.

Observed Flow Conditions

Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	11.62	5.36	6.922
Minimum	8.17	3.10	2.528
Maximum	14.43	6.62	11.207
Time of Minimum	5/2/2011 4:50 AM	4/21/2011 4:35 AM	4/18/2011 4:30 AM
Time of Maximum	4/10/2011 11:50 AM	4/10/2011 11:50 AM	4/10/2011 11:50 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

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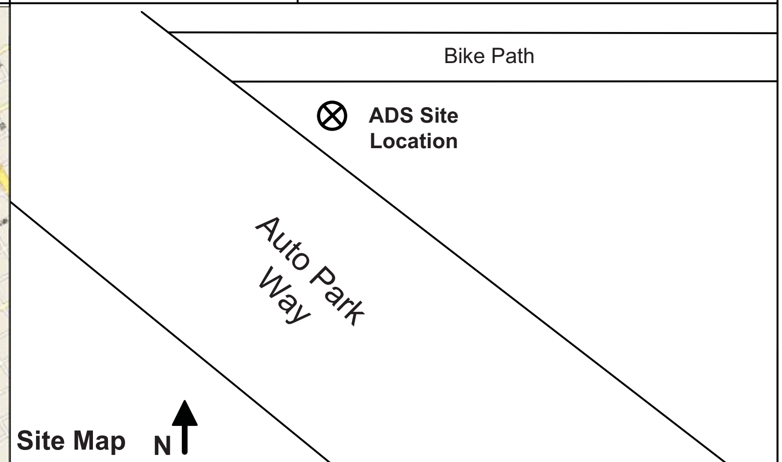
ADS Site Report — Quality Form

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_1	**Monitor Series:** 3600
Address/Location: 1340 Auto Park Way	
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]

Monitor S/N:	2875
Manhole #	1-36
Thomas Bros Map Page:	1129-F4
Pipe Height:	35.75"
Pipe Width:	35.50"
IP Address:	N/A



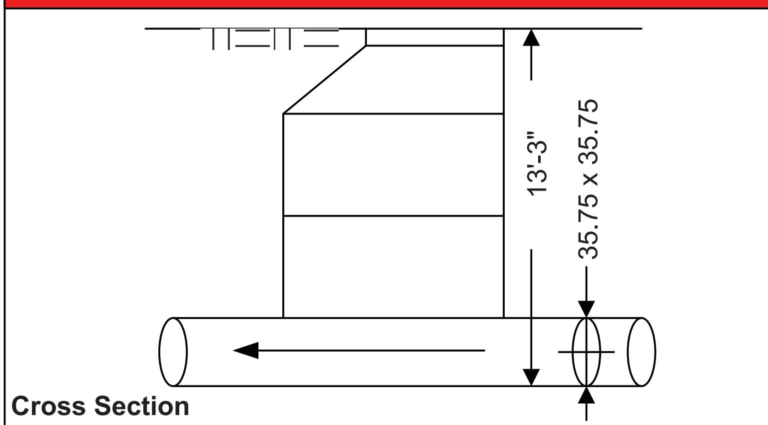
Investigation Information:

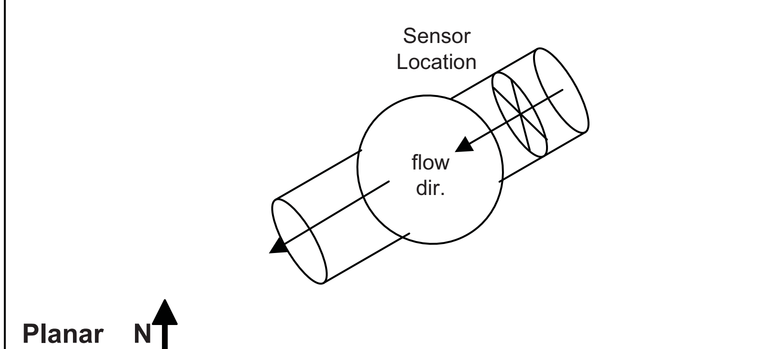
Date/Time of Investigation:	4-4-11 @ 1100		
Site Hydraulics:	Good Straight Through Flow		
Upstream Input: (L/S, P/S)	DNI		
Upstream Manhole:	Did Not Investigate		
Downstream Manhole:	DNI		
Depth of Flow:	12.75	+/-	0.13"
Range (Air DOF):		+/-	0.25"
Peak Velocity:	6.76	fps	
Silt:	0.00"	Inches	

Manhole Information:

Manhole Depth:	13'-3"	Feet
Manhole Material / Condition	Precast /Good	
Pipe Material / Condition:	VCP / Good	
Mini System Character:	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]	
Telephone Information:	N/A	
Access Pole #:	N/A	
Distance From Manhole:	N/A	Feet
Road Cut Length:	N/A	Feet
Trench Length:	N/A	Feet

Other Information:





Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure
Surcharge Height:	None Feet
Rain Gauge Zone:	N/A

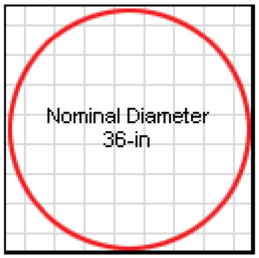
Backup	Yes	No	?	Distance
Trunk		X		
Lift / Pump Station		X		
WWTP		X		
Other	X			

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

Flow Monitor

E_1



Report Period

4/7/2011
To
5/4/2011

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth

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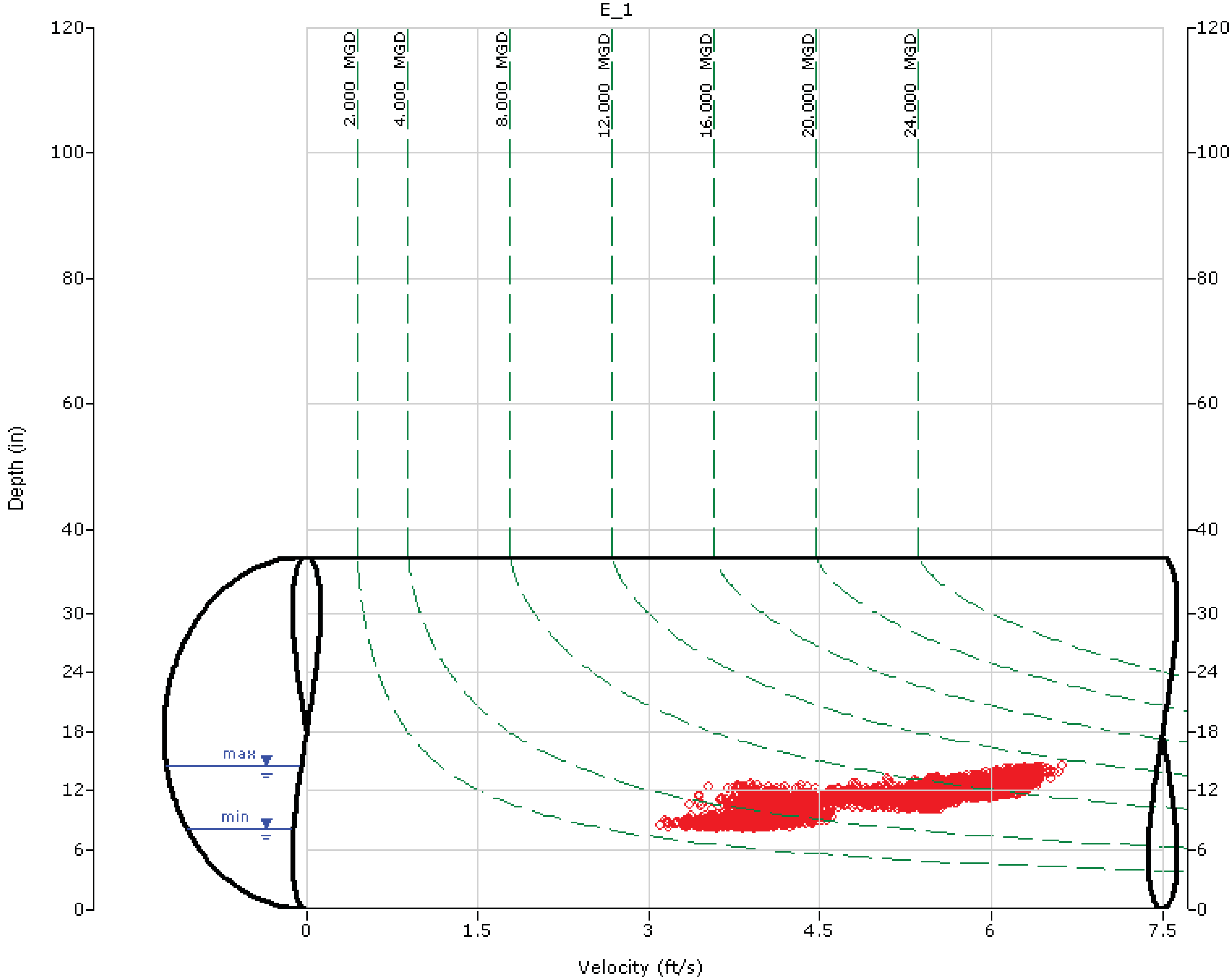
SCATTERGRAPH REPORT

E_1

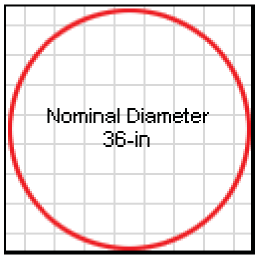


HYDROGRAPH REPORT

E_1

Flow Monitor

E_1

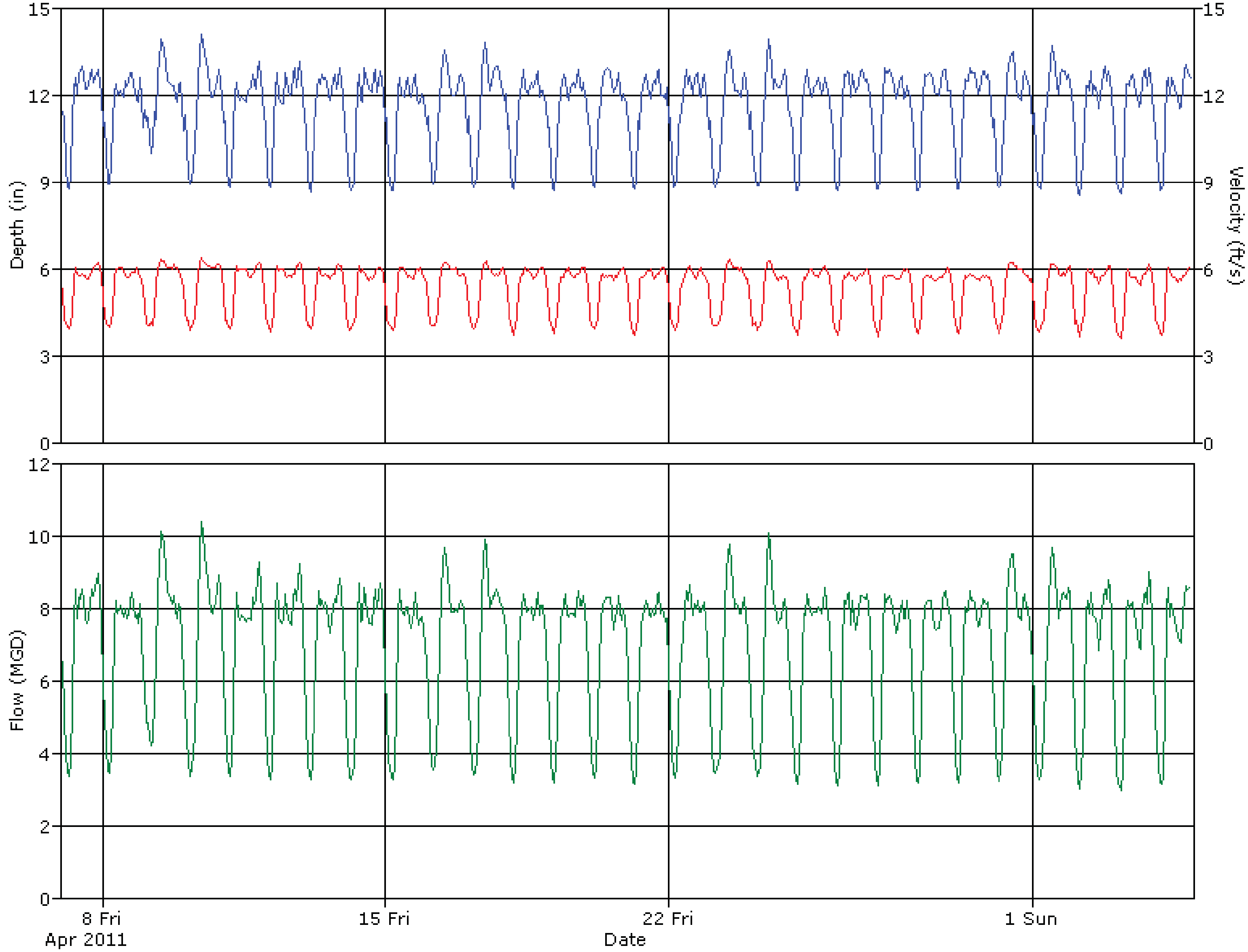


Report Period

4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity



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Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_1, Pipe Height: 36"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	03:45	8.36	12:45	13.37	11.78	04:50	3.53	21:30	6.39	5.39	04:35	2.916	21:35	9.640	7.082	7.082	
4/8/2011	04:15	8.26	18:35	13.23	11.57	06:00	3.49	07:55	6.26	5.40	04:10	3.055	18:35	9.015	6.891	6.891	
4/9/2011	05:50	9.24	12:00	14.31	11.99	06:40	3.61	11:35	6.52	5.45	06:40	3.451	12:30	10.807	7.302	7.302	
4/10/2011	04:15	8.45	11:50	14.43	11.69	04:25	3.38	11:50	6.62	5.45	04:15	2.944	11:50	11.207	7.135	7.135	
4/11/2011	04:10	8.31	21:50	13.58	11.57	04:20	3.41	21:25	6.52	5.46	04:25	2.781	21:20	9.885	6.985	6.985	
4/12/2011	04:45	8.20	21:20	13.61	11.64	03:55	3.36	22:30	6.42	5.43	04:40	2.795	21:15	9.757	7.022	7.022	
4/13/2011	04:20	8.25	21:00	13.30	11.64	05:00	3.45	20:30	6.39	5.40	03:55	2.776	21:30	9.382	6.988	6.988	
4/14/2011	04:25	8.33	21:55	13.32	11.61	04:35	3.49	08:20	6.39	5.39	04:25	2.845	08:20	9.575	6.949	6.949	
4/15/2011	03:10	8.27	18:05	13.19	11.47	04:20	3.49	08:20	6.22	5.40	04:25	2.795	08:00	9.053	6.829	6.829	
4/16/2011	04:25	8.25	11:15	13.94	11.65	05:35	3.35	12:20	6.46	5.42	05:35	2.846	12:20	10.350	7.026	7.026	
4/17/2011	04:25	8.34	11:40	14.23	11.66	04:30	3.33	12:15	6.49	5.37	05:45	2.832	11:35	10.608	6.989	6.989	
4/18/2011	03:25	8.27	18:20	13.15	11.49	03:15	3.18	20:45	6.26	5.36	04:30	2.528	11:05	8.933	6.804	6.804	
4/19/2011	04:05	8.20	18:50	13.27	11.52	04:10	3.25	20:45	6.29	5.35	04:10	2.737	18:50	9.053	6.814	6.814	
4/20/2011	03:50	8.22	11:55	13.32	11.57	04:50	3.31	20:00	6.22	5.33	03:55	2.772	11:50	8.889	6.818	6.818	
4/21/2011	04:25	8.26	17:45	13.25	11.47	04:35	3.10	13:00	6.16	5.34	04:35	2.533	18:20	8.964	6.771	6.771	
4/22/2011	03:55	8.35	17:55	13.18	11.58	05:00	3.26	12:10	6.29	5.34	05:00	2.785	12:35	9.059	6.848	6.848	
4/23/2011	04:45	8.39	11:30	13.89	11.60	04:35	3.43	12:30	6.46	5.40	04:35	2.890	12:40	10.252	6.969	6.969	
4/24/2011	04:35	8.44	11:50	14.28	11.66	05:50	3.35	10:45	6.46	5.30	04:25	2.905	11:15	10.589	6.894	6.894	
4/25/2011	04:45	8.35	10:40	13.15	11.54	03:50	3.36	12:55	6.36	5.34	03:50	2.737	22:00	9.259	6.825	6.825	
4/26/2011	03:50	8.25	11:20	13.19	11.65	05:50	3.35	21:00	6.19	5.30	03:50	2.677	10:45	9.040	6.870	6.870	
4/27/2011	03:35	8.27	11:50	13.16	11.59	04:25	3.16	19:35	6.22	5.32	04:25	2.710	08:45	8.884	6.838	6.838	
4/28/2011	03:15	8.28	18:25	13.19	11.67	04:30	3.36	21:40	6.22	5.31	04:30	2.693	19:10	8.888	6.888	6.888	
4/29/2011	03:30	8.35	19:15	13.25	11.67	03:35	3.15	11:05	5.99	5.28	04:10	2.719	11:10	8.899	6.858	6.858	
4/30/2011	03:35	8.41	11:35	13.82	11.55	04:30	3.36	10:55	6.49	5.36	04:35	2.879	10:55	10.176	6.887	6.887	
5/1/2011	05:05	8.35	11:20	14.04	11.69	04:20	3.35	11:45	6.42	5.33	04:20	2.804	11:50	10.242	6.975	6.975	
5/2/2011	04:50	8.17	21:55	13.32	11.57	04:30	3.18	22:20	6.39	5.34	04:40	2.624	21:55	9.451	6.868	6.868	
5/3/2011	03:45	8.30	21:50	13.50	11.58	04:50	3.23	22:20	6.29	5.31	04:50	2.647	21:50	9.627	6.842	6.842	
5/4/2011	04:35	8.21	08:15	13.37	11.59	05:05	3.30	08:20	6.36	5.32	05:05	2.651	08:15	9.454	6.850	6.850	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			193.816
Report Avg	11.62	5.36	6.922

Site Commentary

Site Information

E_2	
Pipe Dimensions	24.25 "
Silt Level	0.00"

Overview

Site E_2 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 46% of full pipe during the recorded peak and approximately 37% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	9.08	3.72	2.746
Minimum	6.28	2.34	1.079
Maximum	11.08	4.46	4.014
Time of Minimum	5/4/2011 4:40 AM	5/2/2011 4:20 AM	5/2/2011 4:55 AM
Time of Maximum	4/17/2011 11:20 AM	4/9/2011 12:10 PM	4/9/2011 11:00 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

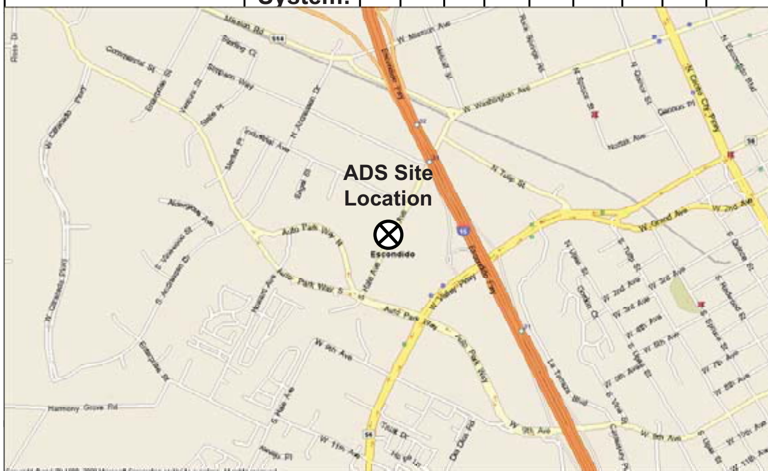
Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

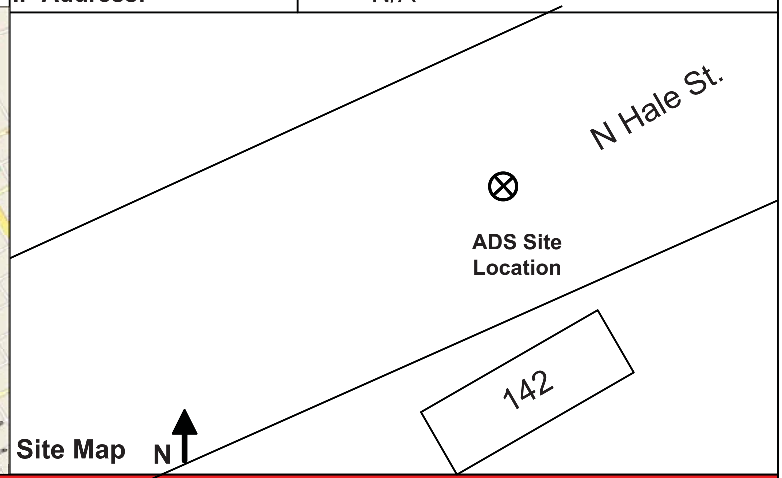
ADS Site Report — Quality Form

ADS ENVIRONMENTAL SERVICES®

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_2	**Monitor Series:** 3600	**Monitor S/N:**	2862
Address/Location: 142 N Hale Ave		**Manhole #**	2-24
		Thomas Bros Map Page:	1129-F3
		Pipe Height:	24.25"
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	24.75"
		IP Address:	N/A





Site Map N

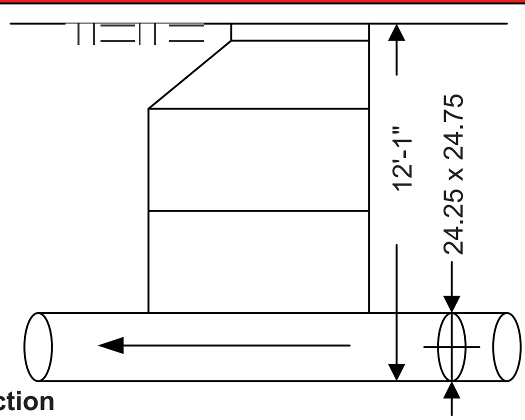
Investigation Information:

Date/Time of Investigation:	4-4-11 @ 1100	
Site Hydraulics:	Good Straight Through Flow	
Upstream Input: (L/S, P/S)	DNI	
Upstream Manhole:	Did Not Investigate	
Downstream Manhole:	DNI	
Depth of Flow:	9.63	+/- 0.13"
Range (Air DOF):		+/- 0.25"
Peak Velocity:	4.53	fps
Silt:	0.00"	Inches

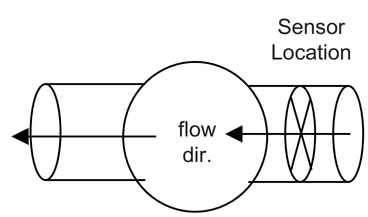
Manhole Information:

Manhole Depth:	12'-1"	Feet
Manhole Material / Condition	Precast /Good	
Pipe Material / Condition:	Concrete / Good	
Mini System Character:	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]	
Telephone Information:	N/A	
Access Pole #:	N/A	
Distance From Manhole:	N/A	Feet
Road Cut Length:	N/A	Feet
Trench Length:	N/A	Feet

Other Information:



Cross Section



Planar N

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure
Surcharge Height:	None Feet
Rain Gauge Zone:	N/A

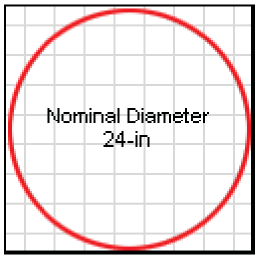
Backup	Yes	No	?	Distance
Trunk		X		
Lift / Pump Station		X		
WWTP		X		
Other	X			

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

Flow Monitor

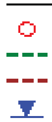
E_2

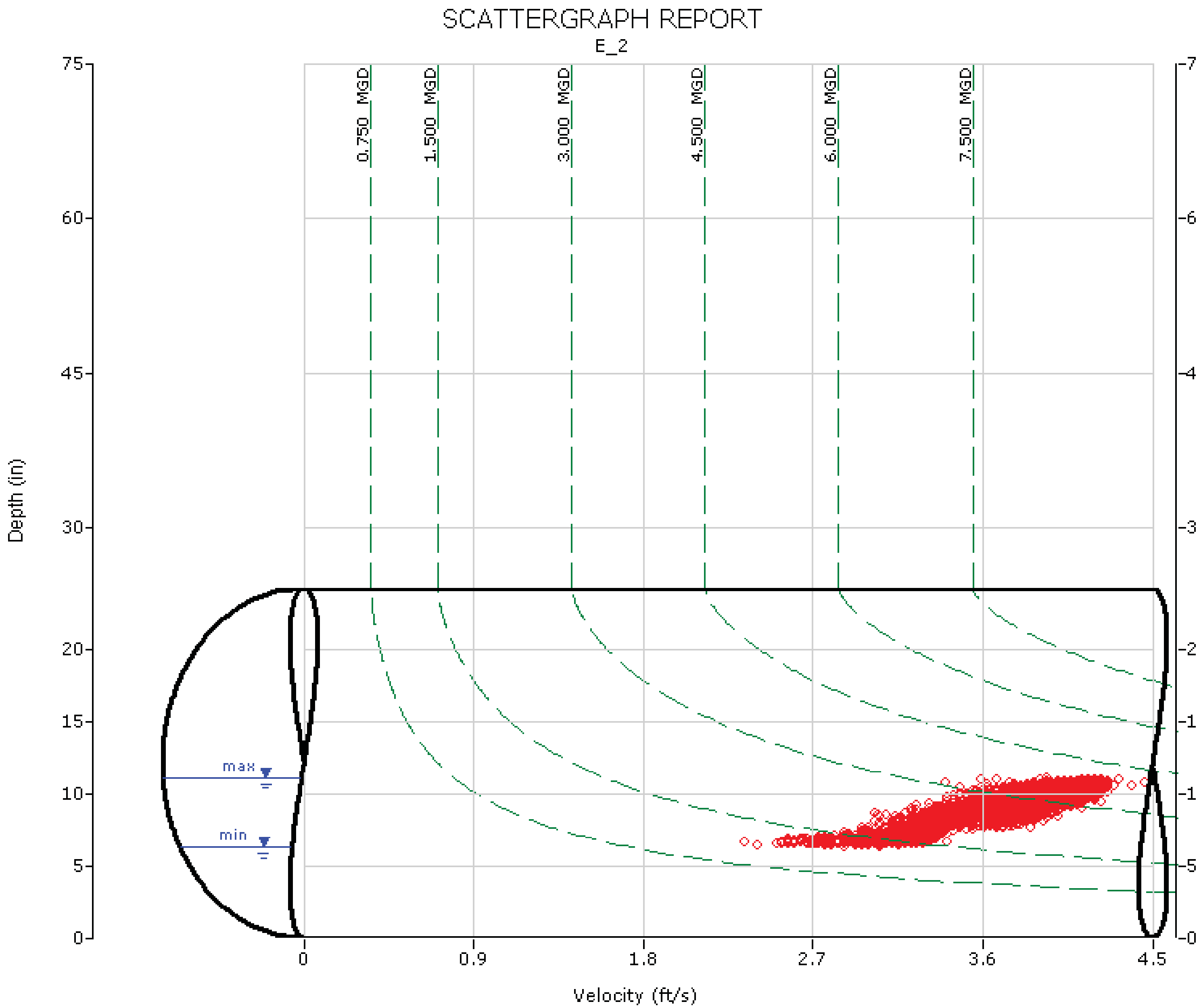


Report Period

4/7/2011
To
5/4/2011

Legend



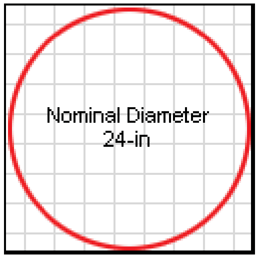


HYDROGRAPH REPORT

E_2

Flow Monitor

E_2

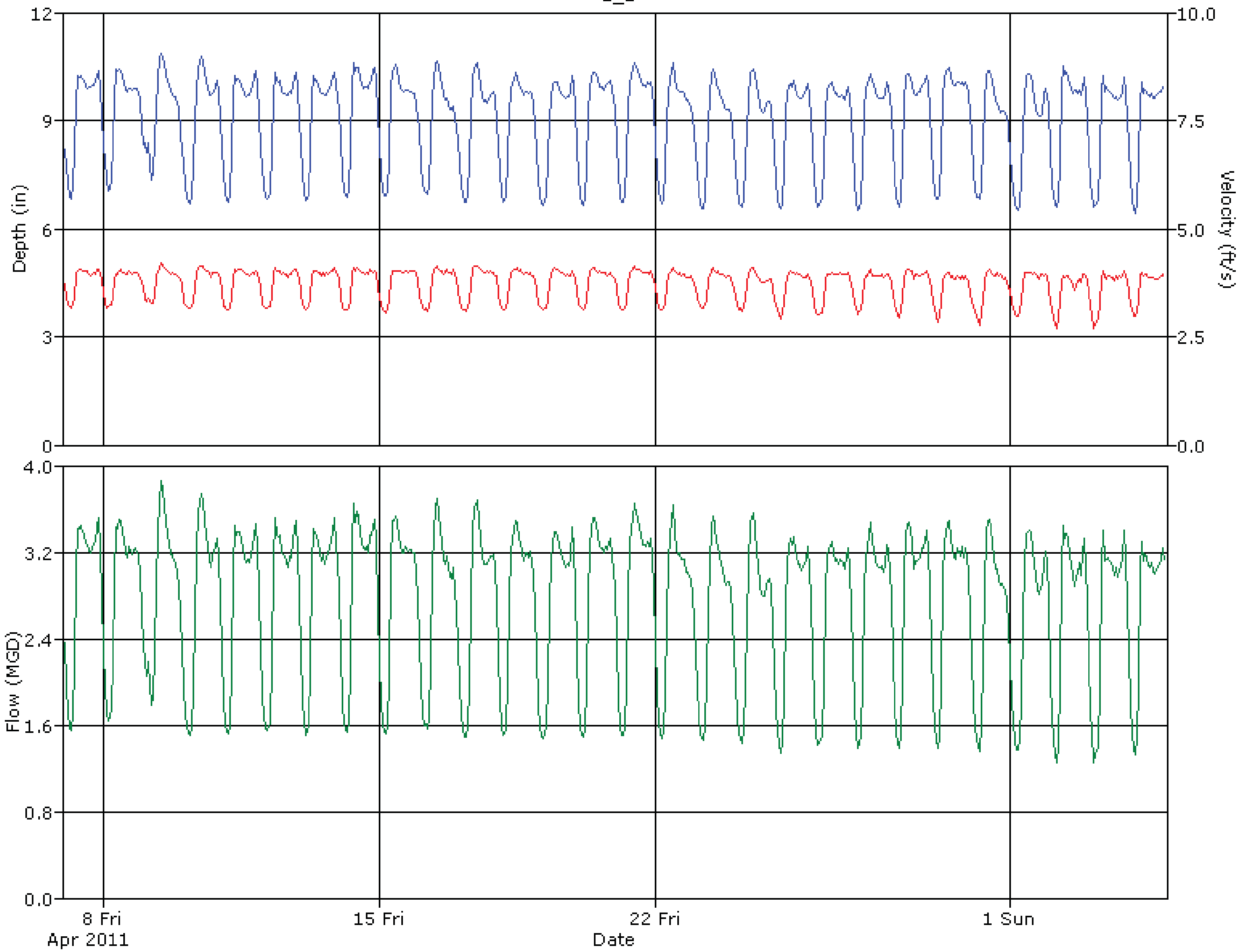


Report Period

4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

PBS&J

Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_2, Pipe Height: 24"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	03:40	6.65	21:50	10.54	9.26	04:25	3.06	11:30	4.16	3.80	04:25	1.501	21:25	3.626	2.868	2.868	
4/8/2011	03:25	6.90	08:15	10.98	9.26	02:05	2.96	11:25	4.26	3.76	03:20	1.561	11:25	3.691	2.833	2.833	
4/9/2011	05:55	7.28	10:55	10.95	9.32	05:30	3.12	12:10	4.46	3.79	05:30	1.692	11:00	4.014	2.878	2.878	
4/10/2011	05:40	6.65	11:05	10.95	9.05	06:25	2.93	10:55	4.23	3.75	06:00	1.426	11:00	3.881	2.754	2.754	
4/11/2011	04:15	6.60	07:50	10.58	9.17	01:20	2.99	09:00	4.23	3.77	04:15	1.426	21:40	3.565	2.811	2.811	
4/12/2011	05:00	6.62	21:20	10.54	9.17	01:45	2.99	13:40	4.20	3.78	05:00	1.462	08:15	3.631	2.821	2.821	
4/13/2011	03:30	6.66	21:00	10.50	9.17	03:15	3.06	20:55	4.23	3.77	03:30	1.443	20:55	3.687	2.814	2.814	
4/14/2011	04:50	6.77	08:30	10.74	9.35	01:30	2.96	09:10	4.23	3.76	04:35	1.486	09:10	3.764	2.887	2.887	
4/15/2011	05:00	6.83	10:00	10.85	9.18	02:25	2.96	20:10	4.20	3.76	05:00	1.465	09:50	3.730	2.812	2.812	
4/16/2011	05:15	6.83	11:30	10.78	9.02	03:20	2.99	11:40	4.39	3.75	05:15	1.479	11:40	3.882	2.736	2.736	
4/17/2011	04:40	6.63	11:20	11.08	8.96	02:45	2.93	11:50	4.29	3.75	04:25	1.425	11:15	3.778	2.717	2.717	
4/18/2011	03:45	6.59	11:35	10.43	9.07	04:10	2.99	09:45	4.23	3.76	03:35	1.437	10:40	3.565	2.767	2.767	
4/19/2011	04:15	6.54	21:50	10.39	9.04	01:40	2.99	11:45	4.26	3.76	03:30	1.442	10:40	3.570	2.752	2.752	
4/20/2011	04:45	6.57	12:40	10.52	9.16	03:45	3.03	10:05	4.23	3.76	03:45	1.424	11:30	3.671	2.812	2.812	
4/21/2011	03:40	6.54	11:45	10.73	9.26	06:45	3.04	11:20	4.23	3.77	03:40	1.436	11:20	3.784	2.857	2.857	
4/22/2011	04:55	6.57	11:35	10.81	9.00	03:50	2.96	10:25	4.20	3.73	03:50	1.431	11:35	3.768	2.713	2.713	
4/23/2011	04:50	6.48	11:45	10.52	8.80	06:00	3.03	11:20	4.16	3.73	04:45	1.428	11:45	3.639	2.631	2.631	
4/24/2011	04:25	6.50	10:40	10.65	8.77	05:20	2.93	10:45	4.20	3.66	05:20	1.350	10:45	3.706	2.573	2.573	
4/25/2011	04:20	6.46	12:15	10.30	8.98	04:40	2.57	10:10	4.20	3.69	04:40	1.179	12:20	3.502	2.683	2.683	
4/26/2011	04:05	6.43	10:50	10.17	8.99	03:55	2.67	11:35	4.10	3.71	03:55	1.224	11:25	3.391	2.698	2.698	
4/27/2011	03:15	6.44	11:35	10.46	9.03	03:50	2.67	11:25	4.23	3.71	03:50	1.207	11:25	3.652	2.719	2.719	
4/28/2011	05:00	6.38	19:20	10.60	9.15	04:50	2.70	15:55	4.20	3.72	04:50	1.257	10:55	3.649	2.779	2.779	
4/29/2011	03:55	6.66	11:30	10.65	9.24	04:40	2.64	09:35	4.16	3.66	04:25	1.288	09:35	3.657	2.762	2.762	
4/30/2011	05:05	6.73	10:15	10.50	8.89	05:10	2.57	12:10	4.13	3.63	05:10	1.232	11:25	3.595	2.607	2.607	
5/1/2011	05:05	6.43	10:55	10.44	8.75	04:55	2.70	09:15	4.13	3.67	04:55	1.237	11:10	3.518	2.579	2.579	
5/2/2011	04:55	6.42	08:10	10.76	9.13	04:20	2.34	08:20	4.10	3.59	04:55	1.079	08:15	3.622	2.675	2.675	
5/3/2011	03:30	6.46	08:15	10.42	9.01	03:35	2.51	21:20	4.26	3.65	03:35	1.134	08:15	3.561	2.671	2.671	
5/4/2011	04:40	6.28	08:20	10.29	8.97	04:30	2.77	12:00	4.13	3.68	04:35	1.224	08:10	3.438	2.674	2.674	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			76.883
Report Avg	9.08	3.72	2.746

Site Commentary

Site Information

E_3	
Pipe Dimensions	21.25 "
Silt Level	0.00"

Overview

Site E_3 functioned under backup conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that the site operates under normal and backup flow conditions wer throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 39% of full pipe during the recorded peak and approximately 24% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	5.03	2.25	0.625
Minimum	1.82	0.86	0.090
Maximum	8.19	4.07	1.538
Time of Minimum	5/3/2011 3:00 AM	4/24/2011 7:05 AM	5/3/2011 1:45 AM
Time of Maximum	4/17/2011 10:50 AM	5/2/2011 10:35 AM	5/2/2011 9:50 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

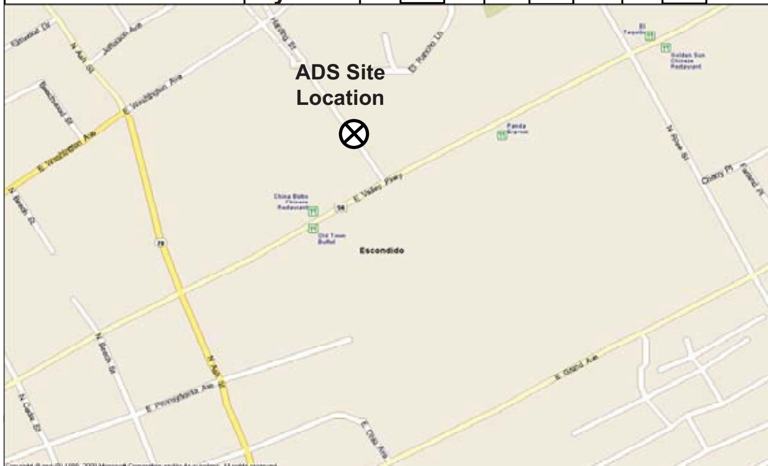
Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

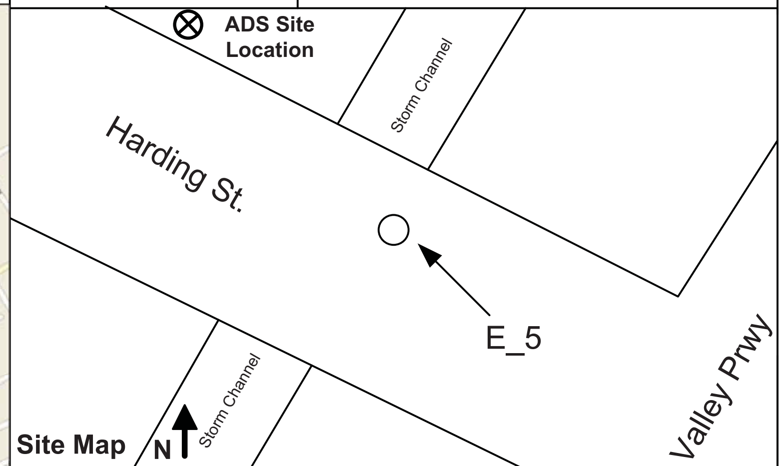
ADS Environmental Services

ADS Site Report — Quality Form

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_3	**Monitor Series:** 3600	**Monitor S/N:**	2122
Address/Location: Harding St. & Valley Pkwy		**Manhole #**	3-15
		Thomas Bros Map Page:	1130-B1
		Pipe Height:	21.25"
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	21.00"
		IP Address:	N/A



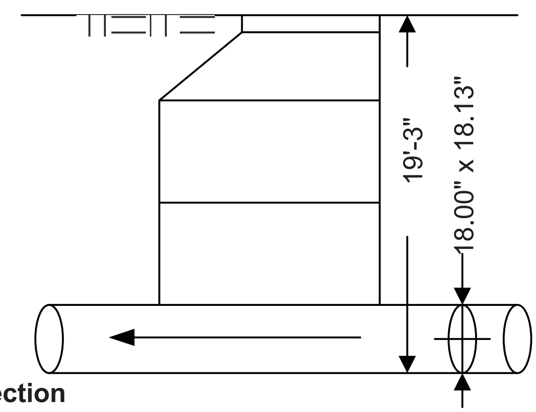


Site Map

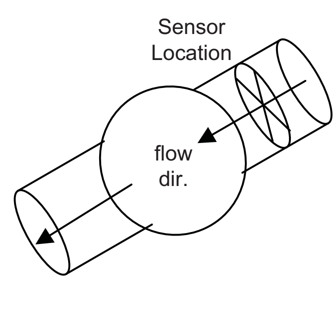
Investigation Information: / Manhole Information:

Date/Time of Investigation:	4-4-11 @ 0900	**Manhole Depth:**	19'-3" Feet
Site Hydraulics:	Good Straight Through Flow	**Manhole Material / Condition**	Precast /Good
Upstream Input: (L/S, P/S)	DNI	**Pipe Material / Condition:**	VCP / Good
Upstream Manhole:	Did Not Investigate	**Mini System Character:**	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]
Downstream Manhole:	DNI	**Telephone Information:**	N/A
Depth of Flow:	5.75 +/- 0.13 "	**Access Pole #:**	N/A
Range (Air DOF):	+/- 0.25 "	**Distance From Manhole:**	N/A Feet
Peak Velocity:	1.95 fps	**Road Cut Length:**	N/A Feet
Silt:	0.00" Inches	**Trench Length:**	N/A Feet

Other Information:



Cross Section



Planar

Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk		X		
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure	Lift / Pump Station		X		
Surcharge Height:	None Feet	WWTP		X		
Rain Gauge Zone:	N/A	Other	X			

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

SCATTERGRAPH REPORT

E_3

Flow Monitor

E_3

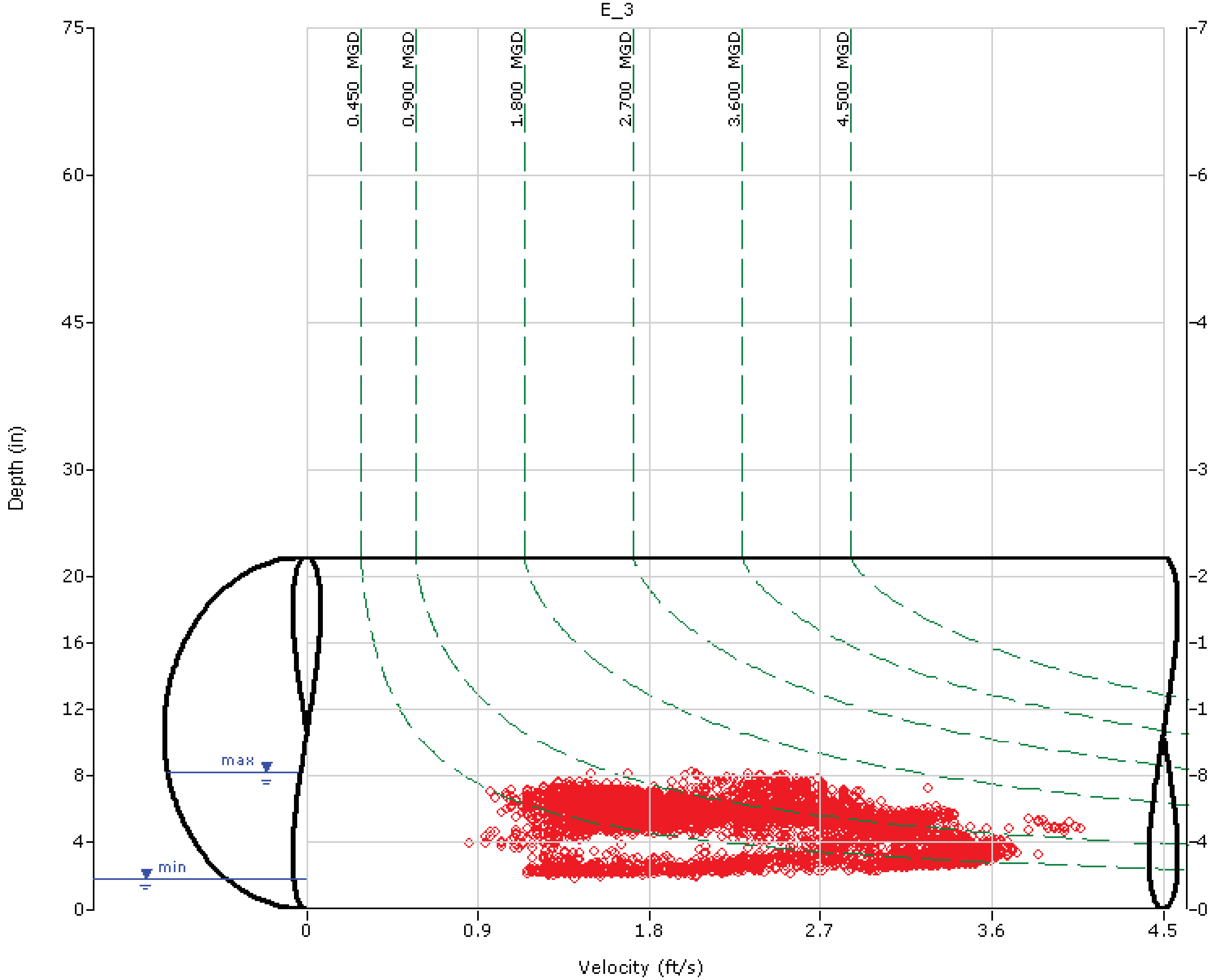
Nominal Diameter
21-in

Report Period

4/7/2011
To
5/4/2011

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



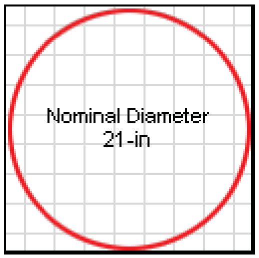
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

E_3

Flow Monitor

E_3

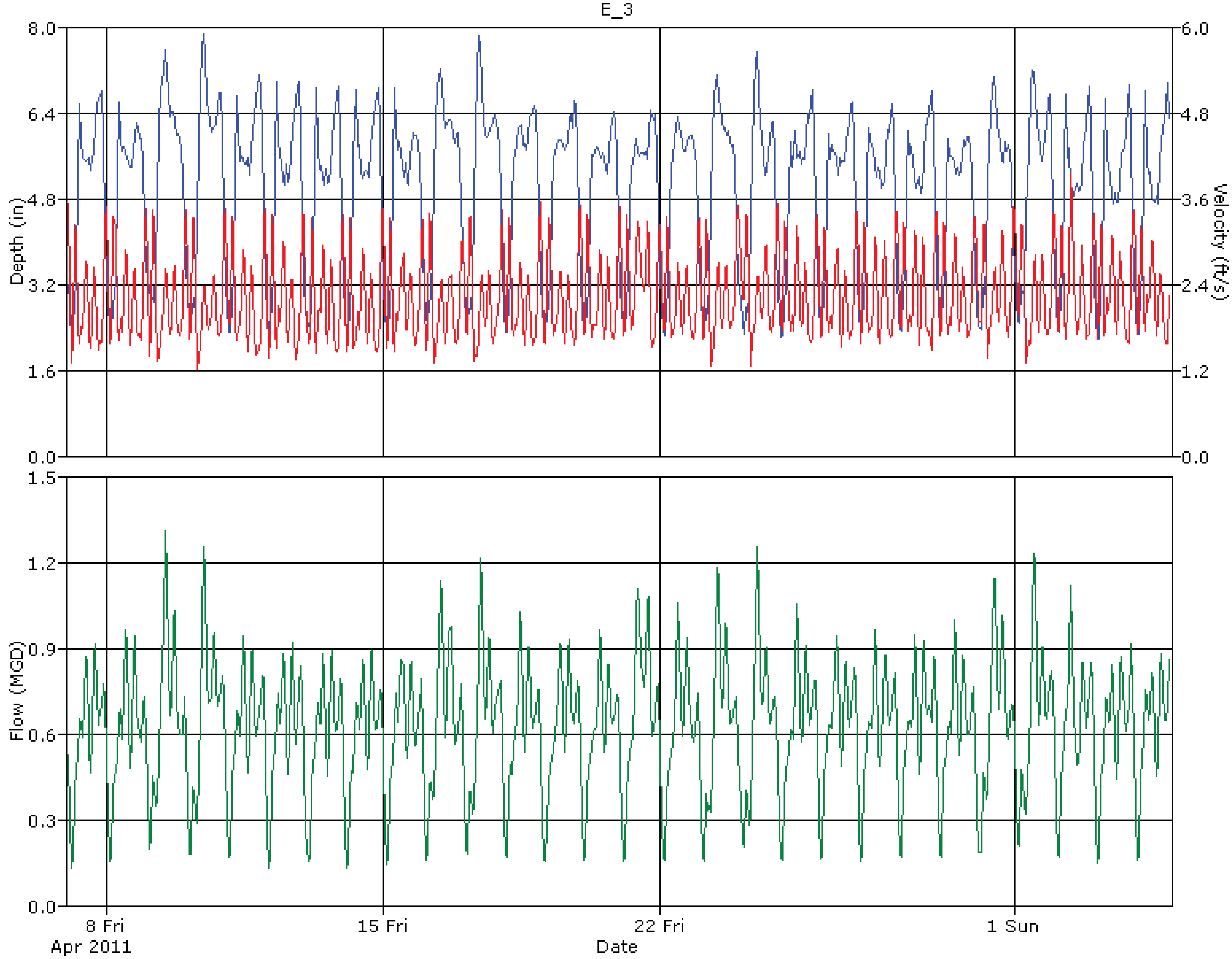


Report Period

4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_3, Pipe Height: 21"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	03:40	2.30	20:55	7.17	5.09	15:15	1.08	23:50	3.63	2.15	03:40	0.112	16:55	1.004	0.604	0.604	
4/8/2011	03:40	2.19	07:15	6.96	4.96	06:50	1.05	00:00	3.65	2.23	03:05	0.105	17:40	1.109	0.606	0.606	
4/9/2011	05:30	2.54	10:55	7.96	5.30	07:15	1.11	00:05	3.65	2.18	03:10	0.159	11:40	1.406	0.659	0.659	
4/10/2011	03:30	2.27	11:25	8.16	5.35	07:00	1.02	23:45	3.63	2.18	03:30	0.122	11:00	1.374	0.662	0.662	
4/11/2011	03:15	2.11	20:35	7.32	5.10	14:35	1.00	23:50	3.71	2.21	03:25	0.111	22:55	1.077	0.614	0.614	
4/12/2011	03:35	2.31	21:00	7.41	5.05	06:55	1.05	23:30	3.67	2.20	03:15	0.111	22:45	1.022	0.608	0.608	
4/13/2011	03:00	2.26	21:30	7.16	4.99	07:05	0.97	00:05	3.63	2.18	03:00	0.109	17:15	1.010	0.595	0.595	
4/14/2011	03:40	2.05	20:55	7.13	5.03	07:00	1.05	23:40	3.71	2.15	03:05	0.099	17:30	1.003	0.592	0.592	
4/15/2011	02:20	2.21	07:10	7.23	4.93	06:55	1.13	00:10	3.60	2.19	03:15	0.104	11:15	1.005	0.592	0.592	
4/16/2011	03:10	2.36	11:00	7.37	5.26	07:50	1.02	00:15	3.54	2.12	03:30	0.120	12:05	1.211	0.632	0.632	
4/17/2011	03:30	2.32	10:50	8.19	5.29	07:15	0.97	00:20	3.51	2.15	03:00	0.129	11:05	1.365	0.644	0.644	
4/18/2011	03:40	2.15	12:05	7.02	5.10	03:35	1.25	23:55	3.60	2.20	03:40	0.113	11:25	1.128	0.622	0.622	
4/19/2011	03:10	2.19	20:40	7.09	5.06	03:40	1.19	00:05	3.85	2.21	03:40	0.104	17:10	1.024	0.617	0.617	
4/20/2011	03:40	2.13	20:35	6.68	4.89	03:00	1.22	23:35	3.71	2.28	03:30	0.110	11:20	1.086	0.606	0.606	
4/21/2011	02:20	2.20	09:45	7.17	4.96	18:45	1.27	00:10	3.60	2.44	03:20	0.116	17:15	1.225	0.678	0.678	
4/22/2011	03:35	2.12	11:50	6.75	4.95	03:40	1.33	00:20	3.49	2.23	03:35	0.113	11:50	1.142	0.612	0.612	
4/23/2011	03:25	2.15	11:25	7.33	5.08	07:15	0.97	23:55	3.65	2.22	03:35	0.110	11:50	1.281	0.639	0.639	
4/24/2011	03:15	2.15	11:05	7.83	4.98	07:05	0.86	23:40	3.74	2.35	03:35	0.154	11:10	1.352	0.641	0.641	
4/25/2011	03:40	2.02	21:20	7.07	4.99	03:40	1.30	00:00	3.68	2.29	03:40	0.099	11:25	1.246	0.627	0.627	
4/26/2011	02:45	2.23	20:55	6.89	4.99	03:30	1.27	23:30	3.65	2.25	03:15	0.123	11:20	1.008	0.620	0.620	
4/27/2011	03:25	2.11	10:45	7.12	4.94	07:00	1.22	00:00	3.57	2.27	02:30	0.132	12:10	1.035	0.614	0.614	
4/28/2011	01:45	2.09	21:45	6.96	4.90	07:05	1.27	23:50	3.60	2.34	03:30	0.123	17:30	1.068	0.625	0.625	
4/29/2011	02:50	2.22	20:45	6.25	4.85	07:00	1.13	00:05	3.54	2.32	03:45	0.125	11:10	1.051	0.617	0.617	
4/30/2011	02:30	1.95	11:45	7.22	5.01	06:50	1.13	23:25	3.60	2.35	03:15	0.122	10:55	1.227	0.658	0.658	
5/1/2011	03:25	2.21	09:50	7.46	5.17	07:00	1.02	23:55	3.63	2.31	03:45	0.123	12:10	1.323	0.666	0.666	
5/2/2011	03:25	2.04	07:10	7.29	4.89	07:05	1.16	10:35	4.07	2.40	03:25	0.098	09:50	1.538	0.642	0.642	
5/3/2011	03:00	1.82	21:35	7.08	4.80	01:45	1.16	23:30	3.57	2.33	01:45	0.090	22:40	1.105	0.604	0.604	
5/4/2011	03:25	1.99	21:05	7.25	4.90	07:00	1.25	00:05	3.54	2.31	03:35	0.105	22:45	1.070	0.618	0.618	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			17.512
Report Avg	5.03	2.25	0.625

Site Commentary

Site Information

E_4	
Pipe Dimensions	26.38 "
Silt Level	0.00"

Overview

Site E_4 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 38% of full pipe during the recorded peak and approximately 25% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	6.62	2.04	1.025
Minimum	3.28	1.08	0.239
Maximum	9.90	2.64	2.045
Time of Minimum	4/19/2011 3:10 AM	4/26/2011 1:30 AM	4/18/2011 2:40 AM
Time of Maximum	4/10/2011 11:25 AM	4/9/2011 7:45 PM	4/17/2011 10:50 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

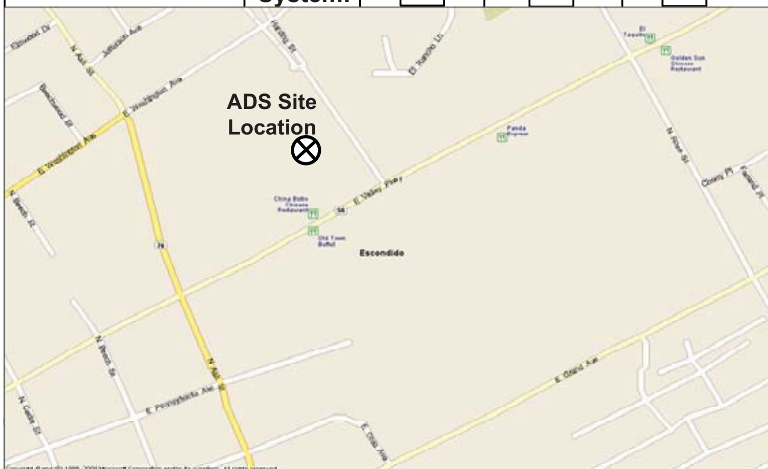
ADS ENVIRONMENTAL SERVICES®

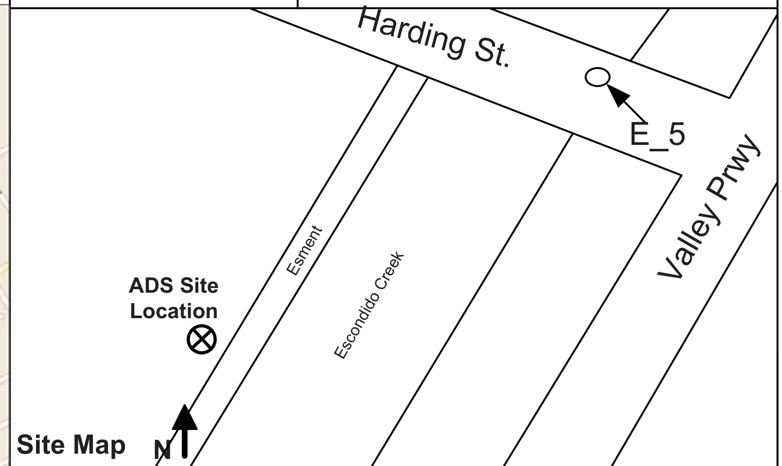
ADS Site Report

Quality Form

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_4	**Monitor Series:** 3600	**Monitor S/N:**	2796
Address/Location: Harding St. & Valley Pkwy		**Manhole #**	4-24
		Thomas Bros Map Page:	1130-B1
		Pipe Height:	26.38"
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	26.50"
		IP Address:	N/A





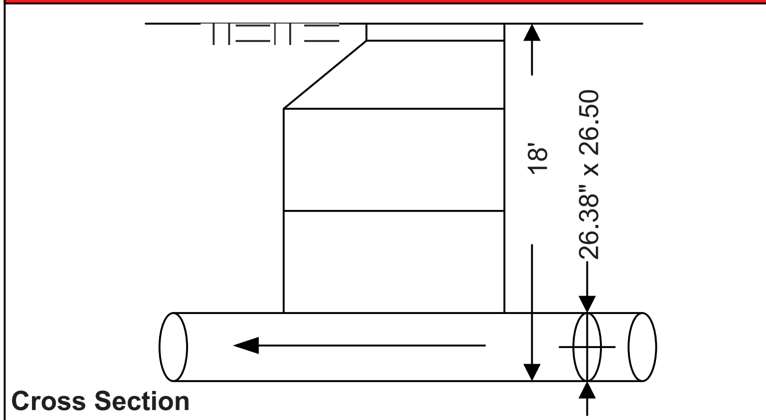
Investigation Information:

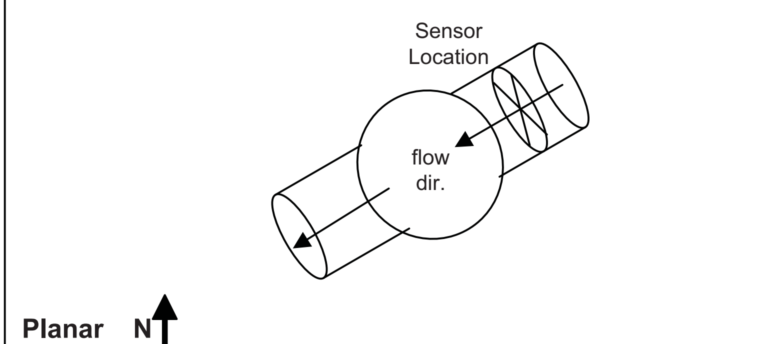
Date/Time of Investigation:	4-4-11 @ 0928
Site Hydraulics:	Good Straight Through Flow
Upstream Input: (L/S, P/S)	DNI
Upstream Manhole:	Did Not Investigate
Downstream Manhole:	DNI
Depth of Flow:	7.13" +/- 0.13"
Range (Air DOF):	+/- 0.25"
Peak Velocity:	2.45 fps
Silt:	0.00" Inches

Manhole Information:

Manhole Depth:	18'	Feet
Manhole Material / Condition	Precast /Good	
Pipe Material / Condition:	VCP / Good	
Mini System Character:	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]	
Telephone Information:	N/A	
Access Pole #:	N/A	
Distance From Manhole:	N/A	Feet
Road Cut Length:	N/A	Feet
Trench Length:	N/A	Feet

Other Information:





Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure
Surcharge Height:	None Feet
Rain Gauge Zone:	N/A

Backup	Yes	No	?	Distance
Trunk		X		
Lift / Pump Station		X		
WWTP		X		
Other	X			

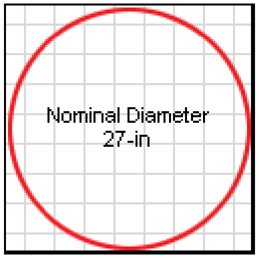
Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

SCATTERGRAPH REPORT
E_4

Flow Monitor

E_4

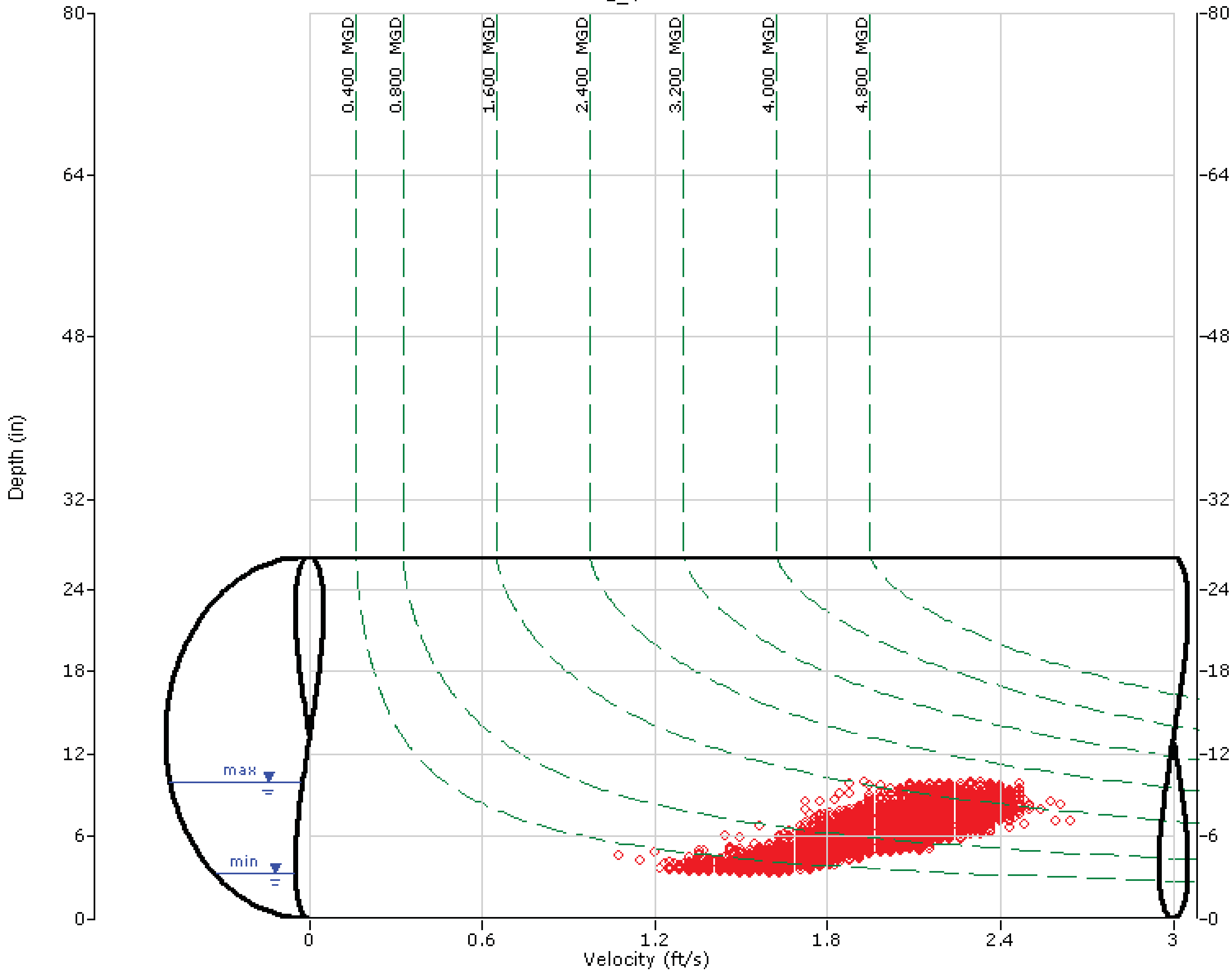


Report Period

4/7/2011
To
5/4/2011

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

E_4

Flow Monitor

E_4

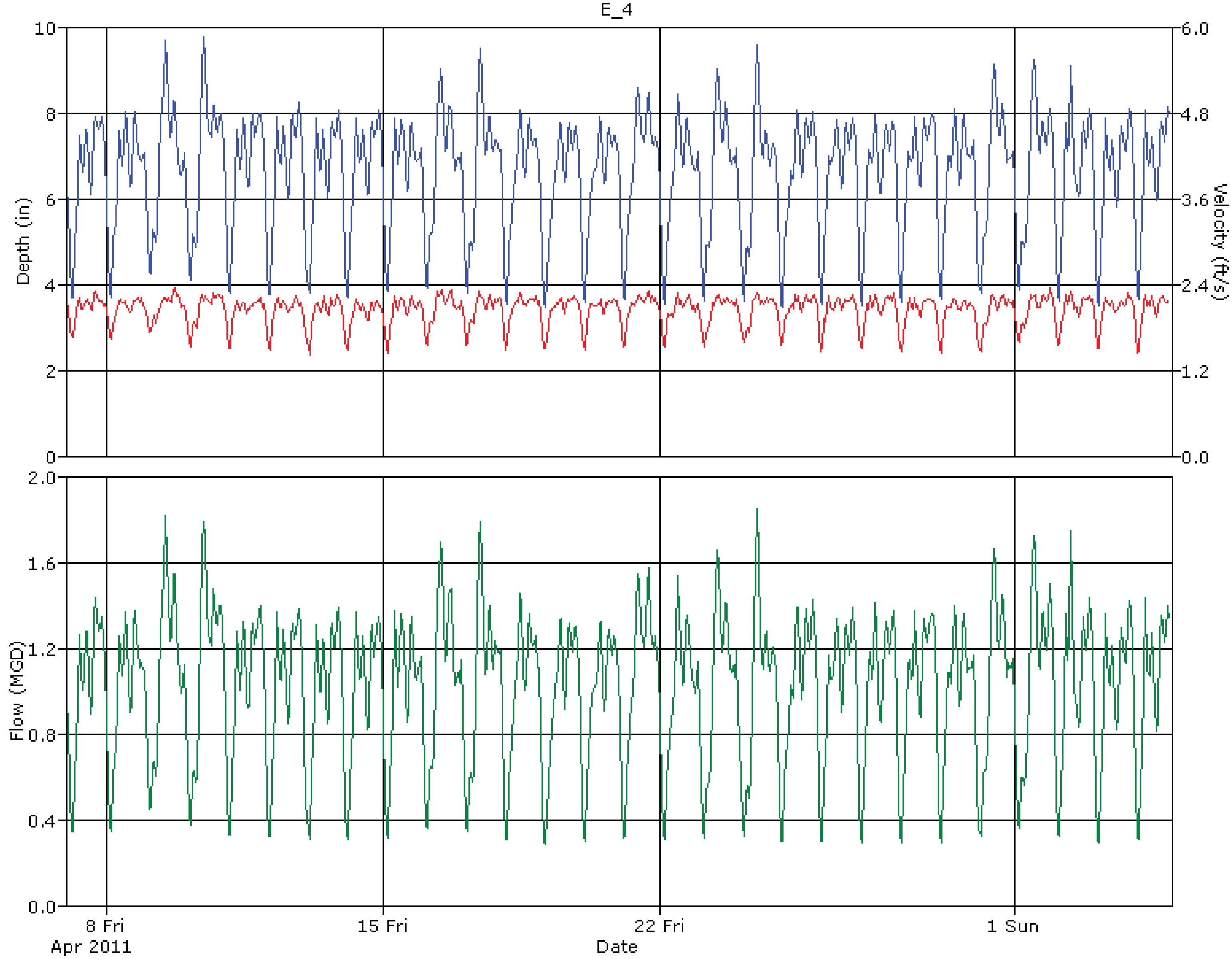
Nominal Diameter 27-in

Report Period

4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_4, Pipe Height: 27"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	03:45	3.47	21:10	8.14	6.60	03:30	1.37	18:55	2.52	2.07	03:30	0.269	17:30	1.536	1.030	1.030	
4/8/2011	03:40	3.49	11:25	8.17	6.55	02:25	1.50	10:25	2.40	2.06	03:10	0.298	11:30	1.522	1.006	1.006	
4/9/2011	03:10	4.03	11:20	9.82	6.82	02:55	1.53	19:45	2.64	2.08	02:55	0.374	11:40	1.976	1.085	1.085	
4/10/2011	03:35	3.92	11:25	9.90	6.98	03:30	1.36	13:40	2.47	2.05	03:30	0.316	11:30	1.969	1.118	1.118	
4/11/2011	03:25	3.64	21:15	8.26	6.68	02:30	1.32	07:45	2.37	2.02	03:25	0.285	20:55	1.517	1.023	1.023	
4/12/2011	03:40	3.57	21:15	8.43	6.64	03:20	1.25	19:40	2.43	2.02	03:20	0.262	21:10	1.595	1.017	1.017	
4/13/2011	03:40	3.64	21:15	8.20	6.60	03:40	1.22	21:55	2.43	2.01	03:40	0.250	21:10	1.529	1.003	1.003	
4/14/2011	03:35	3.58	07:45	8.29	6.60	03:35	1.29	07:45	2.43	1.98	03:35	0.258	07:45	1.615	0.989	0.989	
4/15/2011	03:35	3.68	07:20	8.14	6.53	03:05	1.29	07:30	2.40	2.01	03:30	0.270	07:30	1.509	0.987	0.987	
4/16/2011	03:35	3.76	11:40	9.13	6.72	02:20	1.32	09:25	2.50	2.05	03:40	0.287	11:15	1.817	1.055	1.055	
4/17/2011	03:35	3.60	10:55	9.79	6.74	03:50	1.25	10:10	2.47	2.05	03:25	0.279	10:50	2.045	1.057	1.057	
4/18/2011	03:45	3.37	12:10	8.23	6.46	02:40	1.25	11:20	2.50	2.06	02:40	0.239	11:20	1.637	0.998	0.998	
4/19/2011	03:10	3.28	17:45	7.98	6.45	02:20	1.32	11:25	2.40	2.05	03:45	0.252	17:35	1.464	0.989	0.989	
4/20/2011	03:45	3.33	11:25	8.00	6.44	03:00	1.32	12:15	2.37	2.03	03:05	0.258	11:30	1.465	0.977	0.977	
4/21/2011	03:25	3.49	11:15	8.78	6.76	01:50	1.27	11:00	2.43	2.07	02:45	0.267	11:00	1.719	1.073	1.073	
4/22/2011	03:40	3.35	11:55	8.58	6.46	03:15	1.32	11:50	2.40	2.02	03:15	0.257	11:55	1.669	0.979	0.979	
4/23/2011	03:45	3.45	11:35	9.17	6.64	03:35	1.32	12:15	2.40	2.04	03:35	0.260	12:15	1.715	1.034	1.034	
4/24/2011	03:45	3.40	11:05	9.80	6.58	04:20	1.20	11:50	2.47	2.04	03:10	0.286	11:50	1.970	1.024	1.024	
4/25/2011	03:40	3.29	21:20	8.30	6.56	01:45	1.34	22:40	2.47	2.06	02:05	0.269	12:10	1.544	1.021	1.021	
4/26/2011	03:45	3.42	21:00	8.01	6.55	01:30	1.08	21:05	2.43	2.05	03:20	0.250	21:05	1.519	1.011	1.011	
4/27/2011	03:35	3.38	10:50	8.41	6.55	03:15	1.32	23:05	2.47	2.04	03:15	0.247	10:50	1.575	1.011	1.011	
4/28/2011	03:30	3.45	22:45	8.23	6.62	03:10	1.29	17:25	2.40	2.01	03:10	0.251	17:25	1.538	1.009	1.009	
4/29/2011	03:45	3.50	11:45	8.18	6.55	03:05	1.25	10:50	2.40	2.02	03:05	0.253	17:20	1.534	0.994	0.994	
4/30/2011	03:35	3.66	11:20	9.20	6.77	02:25	1.30	12:55	2.49	2.03	03:40	0.281	11:50	1.797	1.053	1.053	
5/1/2011	03:40	3.66	10:50	9.32	6.81	02:45	1.39	21:55	2.54	2.06	02:45	0.310	12:10	1.879	1.085	1.085	
5/2/2011	03:35	3.50	09:55	9.50	6.67	03:35	1.29	09:45	2.57	2.06	03:35	0.250	09:50	1.917	1.047	1.047	
5/3/2011	03:10	3.38	21:35	8.20	6.48	02:50	1.36	20:35	2.43	2.04	03:10	0.256	21:10	1.555	0.993	0.993	
5/4/2011	03:20	3.50	21:10	8.23	6.61	02:05	1.23	07:30	2.47	2.04	03:30	0.250	07:30	1.615	1.023	1.023	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			28.692
Report Avg	6.62	2.04	1.025

Site Commentary

Site Information

E_5	
Pipe Dimensions	18 "
Silt Level	0.00"

Overview

Site E_5 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period until flows reached up to 7.5". A bottleneck occurs above 7.5".

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 73% of full pipe during the recorded peak and approximately 35% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	6.34	4.76	1.742
Minimum	3.79	2.30	0.648
Maximum	13.09	6.23	3.606
Time of Minimum	4/7/2011 3:15 AM	4/30/2011 3:35 AM	4/24/2011 4:15 AM
Time of Maximum	4/10/2011 10:40 AM	4/14/2011 7:05 AM	4/19/2011 8:50 PM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

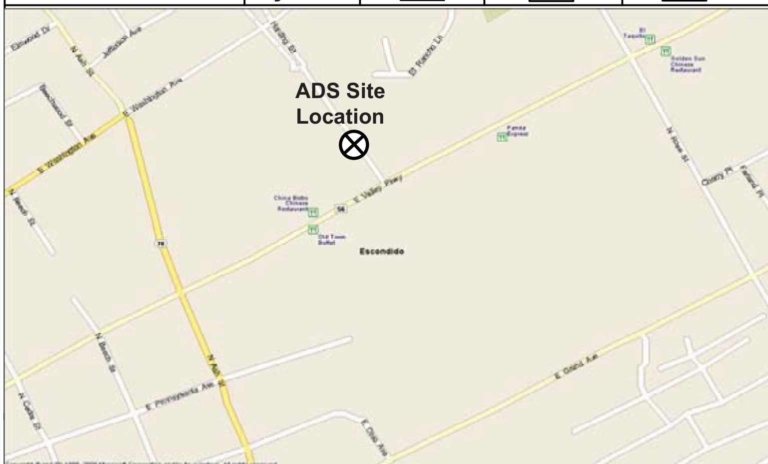
Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

ADS Site Report — Quality Form

ADS ENVIRONMENTAL SERVICES®

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_5	**Monitor Series:** 3600	**Monitor S/N:**	2807
Address/Location: Harding St. & Valley Pkwy		**Manhole #**	5-28
		Thomas Bros Map Page:	1130-B1
		Pipe Height:	18.00"
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	18.13"
		IP Address:	N/A



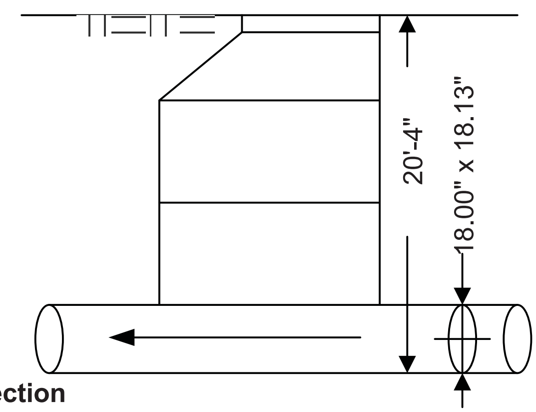
Investigation Information:

Date/Time of Investigation:	4-4-11 @ 0825
Site Hydraulics:	Good Straight Through Flow
Upstream Input: (L/S, P/S)	DNI
Upstream Manhole:	Did Not Investigate
Downstream Manhole:	DNI
Depth of Flow:	6.25 +/- 0.13"
Range (Air DOF):	+/- 0.25"
Peak Velocity:	4.44 fps
Silt:	0.00" Inches

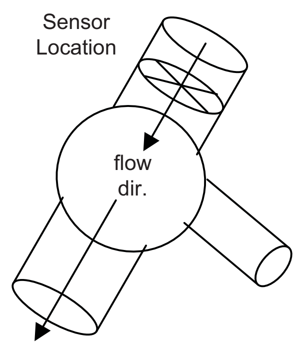
Manhole Information:

Manhole Depth:	20'-4"	Feet
Manhole Material / Condition	Precast /Good	
Pipe Material / Condition:	PVC / Good	
Mini System Character:	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]	
Telephone Information:	N/A	
Access Pole #:	N/A	
Distance From Manhole:	N/A	Feet
Road Cut Length:	N/A	Feet
Trench Length:	N/A	Feet

Other Information:



Cross Section



Planar N

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure
Surcharge Height:	None Feet
Rain Gauge Zone:	N/A

Backup	Yes	No	?	Distance
Trunk		X		
Lift / Pump Station		X		
WWTP		X		
Other	X			

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

Flow Monitor

E_5

Nominal Diameter
18-in

Report Period

4/7/2011
To
5/4/2011

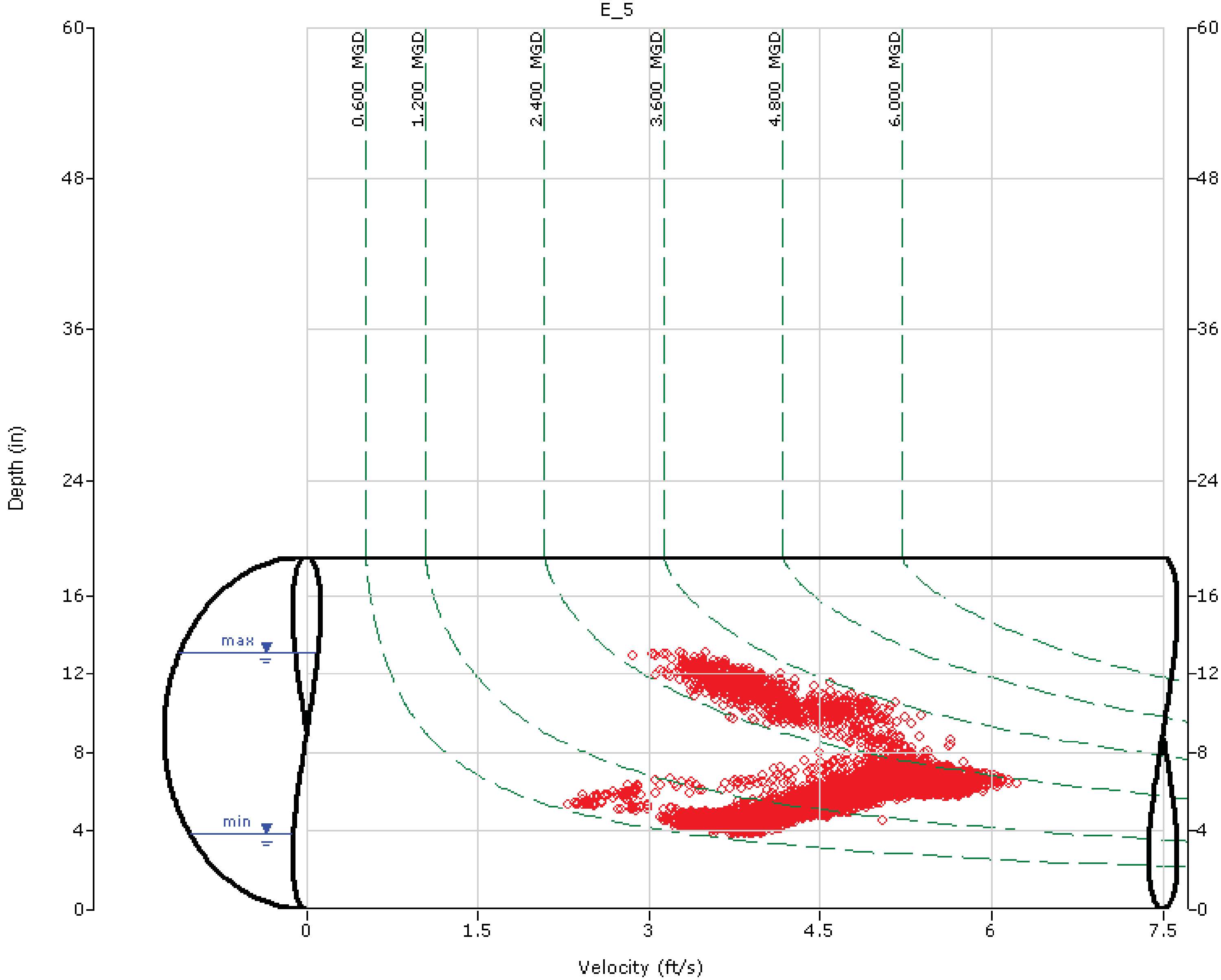
Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES

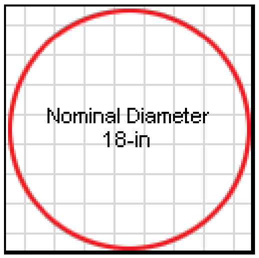
SCATTERGRAPH REPORT

E_5



Flow Monitor

E_5



Report Period

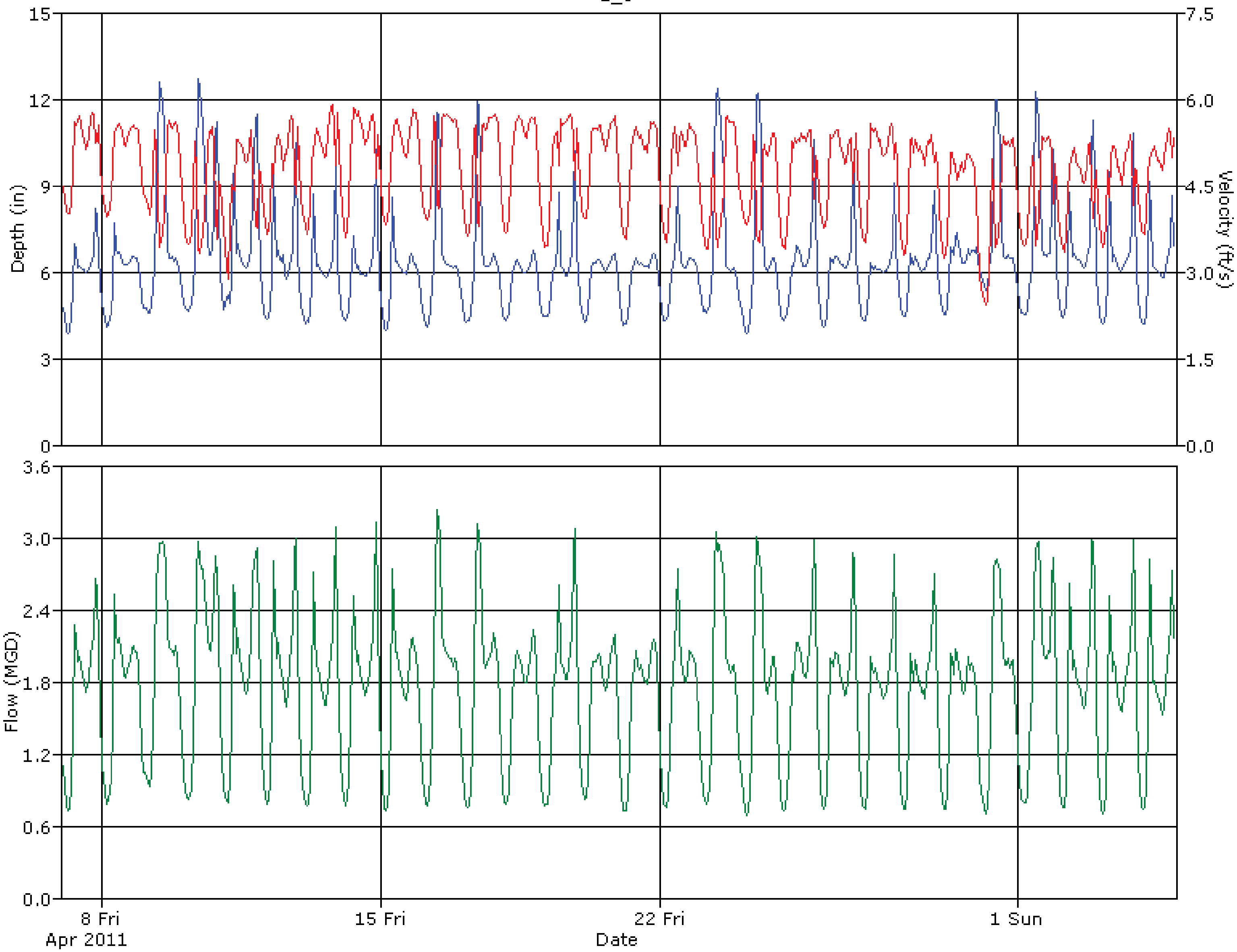
4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity

HYDROGRAPH REPORT

E_5



Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_5, Pipe Height: 18"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	03:15	3.79	08:00	10.73	5.88	03:55	3.88	10:10	6.02	5.10	03:20	0.700	21:10	3.202	1.713	1.713	
4/8/2011	03:25	4.02	07:55	10.48	5.93	04:05	3.85	07:10	5.79	5.08	04:05	0.753	07:55	3.395	1.725	1.725	
4/9/2011	05:15	4.43	10:25	13.07	7.00	10:35	3.05	19:55	5.75	4.73	05:25	0.890	09:50	3.224	1.907	1.907	
4/10/2011	04:40	4.57	10:40	13.09	7.67	11:05	2.86	09:00	5.79	4.25	04:35	0.784	10:10	3.201	1.948	1.948	
4/11/2011	01:50	4.56	20:50	11.95	6.86	04:00	2.74	10:55	5.58	4.51	04:15	0.733	20:45	3.194	1.822	1.822	
4/12/2011	03:45	4.27	21:00	11.76	6.38	04:10	3.44	18:50	5.89	4.82	04:10	0.731	07:20	3.331	1.787	1.787	
4/13/2011	02:35	4.08	07:50	11.37	6.02	03:20	3.51	20:00	6.09	4.99	03:20	0.731	07:40	3.445	1.722	1.722	
4/14/2011	03:55	4.25	22:05	10.81	6.03	03:20	3.54	07:05	6.23	5.08	03:25	0.755	20:40	3.487	1.759	1.759	
4/15/2011	02:55	3.91	07:45	10.31	5.85	03:35	3.71	19:15	5.92	5.06	03:35	0.704	08:00	3.473	1.687	1.687	
4/16/2011	04:20	4.04	10:20	12.06	6.35	11:25	3.54	08:40	6.09	4.97	04:20	0.735	10:15	3.558	1.822	1.822	
4/17/2011	03:25	4.09	10:35	12.64	6.41	11:25	3.44	09:20	6.09	4.86	03:50	0.724	09:55	3.410	1.801	1.801	
4/18/2011	03:20	4.23	20:50	6.96	5.73	02:55	3.57	18:00	5.85	5.05	03:10	0.747	20:35	2.297	1.638	1.638	
4/19/2011	04:00	4.35	11:10	11.30	6.16	03:15	3.34	17:45	5.92	4.95	03:35	0.733	20:50	3.606	1.762	1.762	
4/20/2011	03:10	4.16	21:15	6.88	5.79	02:15	3.85	20:40	5.79	5.05	04:00	0.784	21:15	2.338	1.654	1.654	
4/21/2011	03:05	4.04	20:20	6.91	5.77	04:15	3.40	21:30	5.75	4.93	03:05	0.690	20:10	2.245	1.617	1.617	
4/22/2011	04:05	4.23	11:35	10.28	5.98	04:05	3.40	18:10	5.75	4.86	04:05	0.701	11:35	3.259	1.672	1.672	
4/23/2011	04:05	4.51	11:30	12.69	7.12	11:00	3.13	17:40	5.89	4.46	04:20	0.736	10:35	3.160	1.856	1.856	
4/24/2011	05:05	3.81	11:10	12.77	6.64	11:20	3.34	09:00	5.82	4.55	04:15	0.648	09:40	3.265	1.736	1.736	
4/25/2011	03:30	4.14	21:00	11.66	6.26	04:05	3.23	13:45	5.68	4.78	02:35	0.683	21:00	3.220	1.748	1.748	
4/26/2011	03:10	4.04	20:50	10.87	6.10	04:30	3.57	11:15	5.75	4.83	03:35	0.711	21:10	3.401	1.699	1.699	
4/27/2011	04:25	4.20	21:25	10.18	5.91	04:05	3.27	20:20	5.79	4.89	04:05	0.683	21:35	3.231	1.654	1.654	
4/28/2011	03:10	4.40	21:50	10.83	6.05	03:35	3.17	10:20	5.58	4.71	04:35	0.708	21:50	3.200	1.644	1.644	
4/29/2011	04:30	4.44	10:50	7.67	6.20	03:05	3.10	07:10	5.34	4.50	03:15	0.706	07:40	2.209	1.619	1.619	
4/30/2011	04:30	5.28	10:15	12.26	7.27	03:35	2.30	15:20	5.55	4.13	03:35	0.659	09:15	3.258	1.791	1.791	
5/1/2011	04:05	4.43	10:15	12.37	7.11	10:15	3.20	09:25	5.55	4.43	04:05	0.742	09:35	3.493	1.879	1.879	
5/2/2011	04:10	4.35	20:55	11.65	6.61	04:45	3.17	07:10	5.58	4.47	04:10	0.694	21:35	3.212	1.743	1.743	
5/3/2011	03:20	4.15	21:15	11.49	6.35	03:30	3.23	19:45	5.58	4.58	03:30	0.660	20:45	3.523	1.695	1.695	
5/4/2011	04:30	4.14	07:50	11.01	6.06	03:45	3.54	07:00	5.68	4.77	04:30	0.713	21:35	3.440	1.666	1.666	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			48.765
Report Avg	6.34	4.76	1.742

Site Commentary

Site Information

E_6	
Pipe Dimensions	23.88 "
Silt Level	0.00"

Overview

Site E_6 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 50% of full pipe during the recorded peak and approximately 39% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	9.39	2.49	1.868
Minimum	5.99	1.81	0.736
Maximum	12.04	3.13	3.104
Time of Minimum	5/4/2011 4:50 AM	5/3/2011 3:00 AM	5/4/2011 3:30 AM
Time of Maximum	4/10/2011 10:45 AM	4/9/2011 12:25 PM	4/10/2011 10:50 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

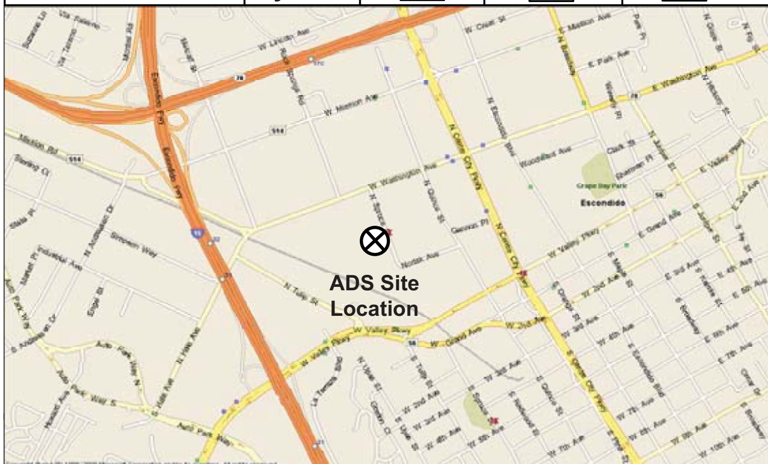
ADS ENVIRONMENTAL SERVICES®

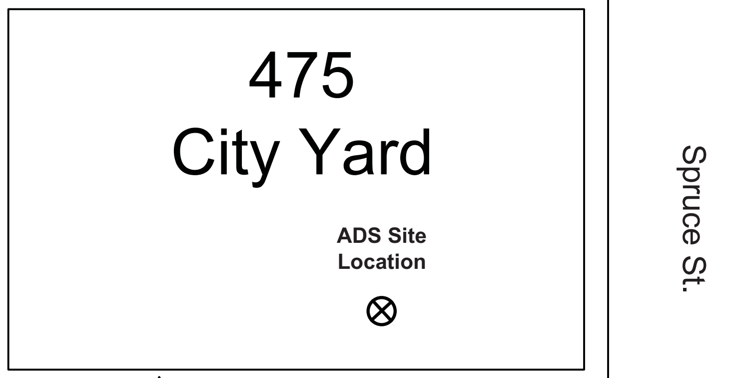
ADS Site Report

Quality Form

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_6	**Monitor Series:** 3600	**Monitor S/N:**	2853
Address/Location: 475 N. Spruce St.		**Manhole #**	6-27
		Thomas Bros Map Page:	1129-G3
		Pipe Height:	23.88"
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	23.88"
		IP Address:	N/A

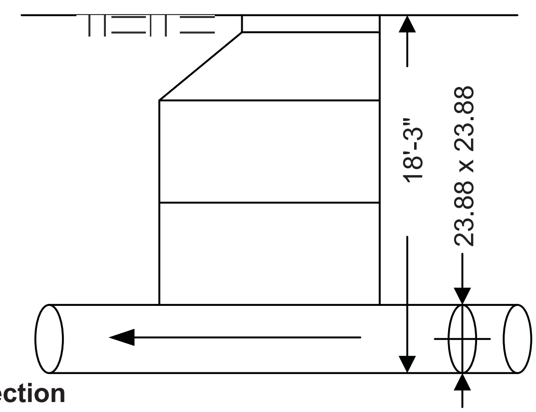




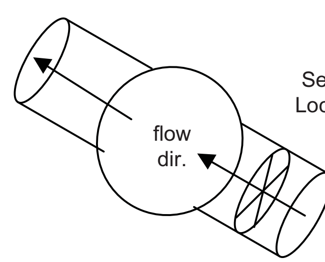
Site Map N

Investigation Information:		**Manhole Information:**	
Date/Time of Investigation:	4-4-11 @ 1045	**Manhole Depth:**	18'-3" Feet
Site Hydraulics:	Good Straight Through Flow	**Manhole Material / Condition**	Precast /Good
Upstream Input: (L/S, P/S)	DNI	**Pipe Material / Condition:**	VCP / Good
Upstream Manhole:	Did Not Investigate	**Mini System Character:**	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]
Downstream Manhole:	DNI	**Telephone Information:**	N/A
Depth of Flow:	+/- 0.13"	**Access Pole #:**	N/A
Range (Air DOF):	11.00" +/- 0.25"	**Distance From Manhole:**	N/A Feet
Peak Velocity:	2.96 fps	**Road Cut Length:**	N/A Feet
Silt:	0.00" Inches	**Trench Length:**	N/A Feet

Other Information:



Cross Section



Planar N

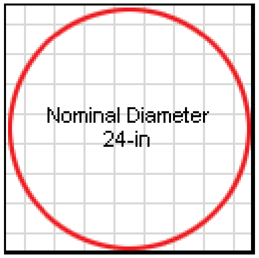
Installation Information		**Backup**	**Yes**	**No**	**?**	**Distance**
Installation Type:	Standard	Trunk		X		
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure	Lift / Pump Station		X		
Surcharge Height:	None Feet	WWTP		X		
Rain Gauge Zone:	N/A	Other	X			

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

Flow Monitor

E_6



Report Period

4/7/2011
To
5/4/2011

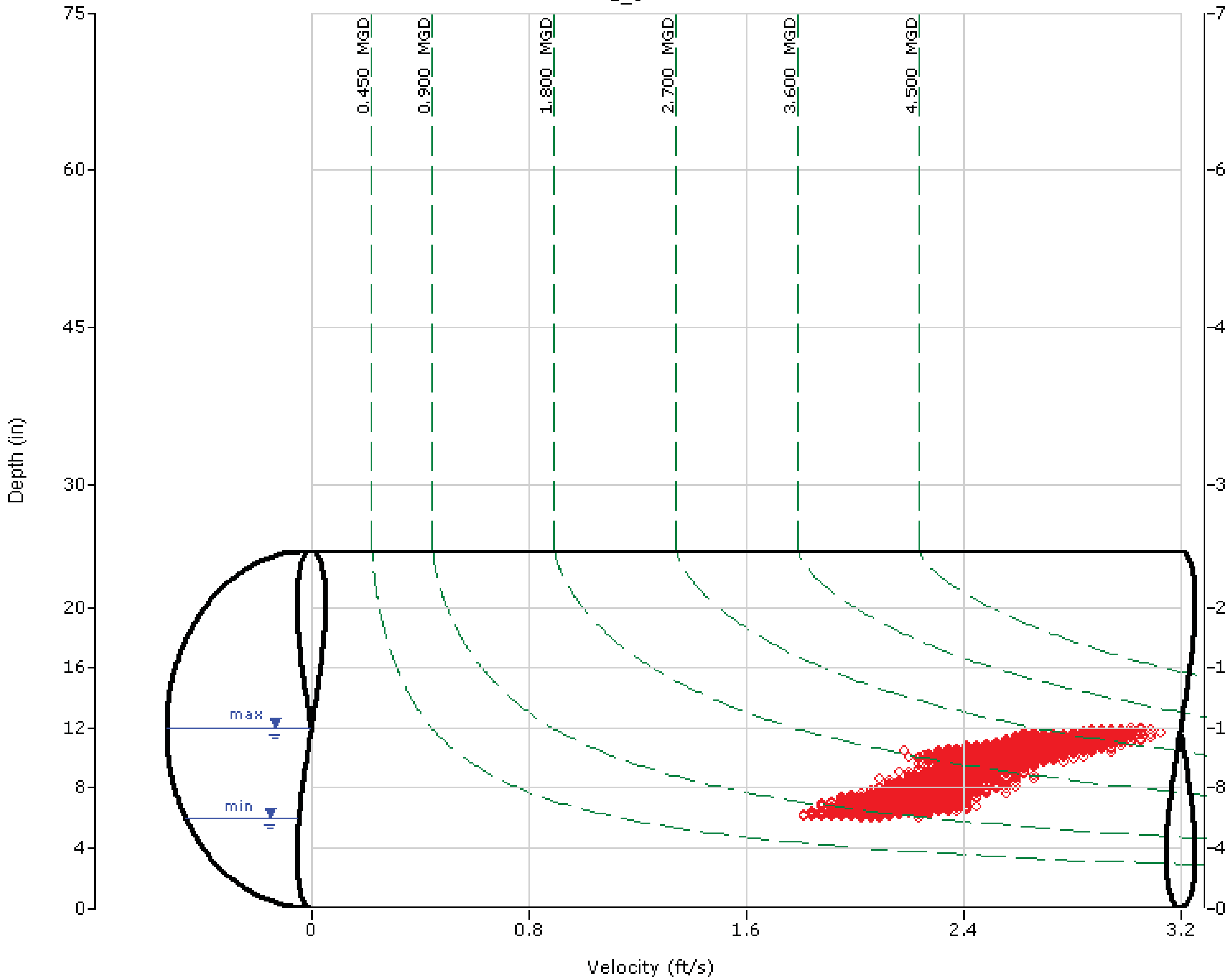
Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES

SCATTERGRAPH REPORT

E_6

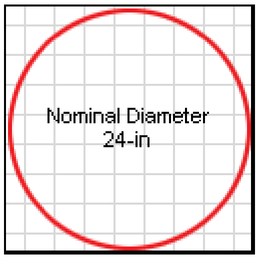


HYDROGRAPH REPORT

E_6

Flow Monitor

E_6

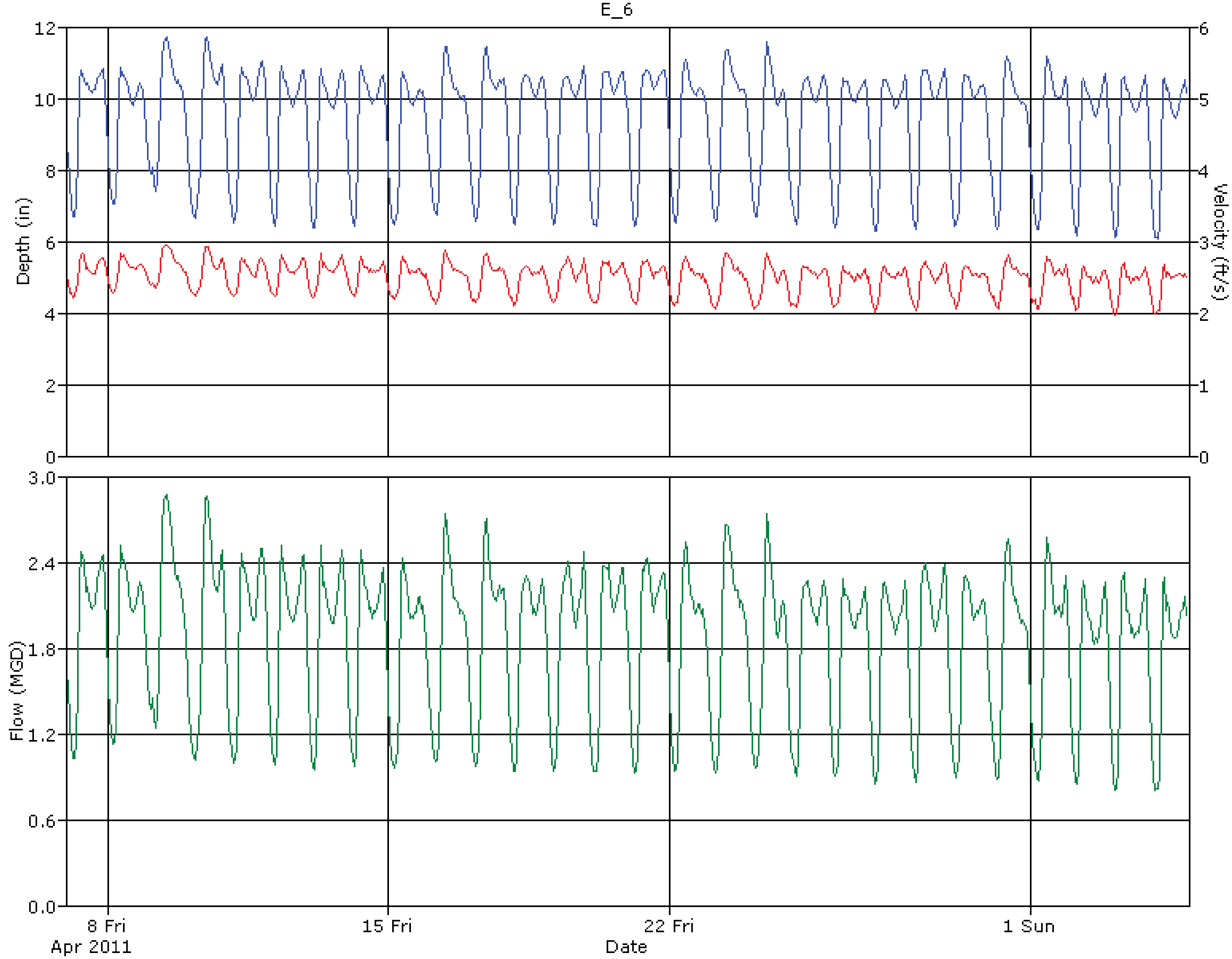


Report Period

4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity



Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_6, Pipe Height: 24"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	03:35	6.49	08:00	11.18	9.53	03:35	2.06	20:00	3.02	2.57	03:35	0.911	07:55	2.700	1.954	1.954	
4/8/2011	04:00	6.90	08:05	11.07	9.46	03:00	2.20	08:00	2.95	2.59	04:00	1.077	08:05	2.690	1.942	1.942	
4/9/2011	05:35	7.26	11:20	11.92	9.76	01:45	2.17	12:25	3.13	2.64	05:30	1.190	12:25	3.066	2.071	2.071	
4/10/2011	05:25	6.51	10:45	12.04	9.61	05:00	2.13	10:40	3.09	2.59	05:00	0.961	10:50	3.104	2.004	2.004	
4/11/2011	03:55	6.38	08:00	11.30	9.51	03:55	2.13	08:10	2.91	2.54	03:55	0.920	08:00	2.694	1.933	1.933	
4/12/2011	04:50	6.33	08:00	11.15	9.41	05:30	2.13	08:05	2.91	2.56	04:40	0.946	08:05	2.656	1.914	1.914	
4/13/2011	04:30	6.30	08:20	11.10	9.35	02:40	2.03	08:00	2.95	2.55	03:50	0.913	08:05	2.634	1.898	1.898	
4/14/2011	04:00	6.36	08:05	11.19	9.38	03:35	2.13	08:10	2.95	2.54	04:30	0.940	08:10	2.710	1.889	1.889	
4/15/2011	04:55	6.39	08:00	11.02	9.28	03:10	2.03	08:05	2.91	2.51	03:10	0.895	08:05	2.622	1.845	1.845	
4/16/2011	04:35	6.64	11:00	11.92	9.46	05:25	1.95	10:15	3.02	2.51	05:25	0.916	10:40	2.938	1.897	1.897	
4/17/2011	04:45	6.48	11:35	11.58	9.50	04:20	1.95	09:20	3.02	2.50	04:20	0.899	11:05	2.847	1.904	1.904	
4/18/2011	04:50	6.36	11:35	10.77	9.39	03:35	1.92	08:35	2.81	2.46	03:35	0.830	11:35	2.470	1.842	1.842	
4/19/2011	03:45	6.35	21:10	11.11	9.43	04:45	1.95	11:15	2.95	2.50	03:20	0.873	21:35	2.581	1.878	1.878	
4/20/2011	04:20	6.34	09:40	11.03	9.50	02:10	1.99	08:30	2.84	2.50	03:35	0.872	09:35	2.517	1.904	1.904	
4/21/2011	03:40	6.34	11:15	11.05	9.56	02:20	2.03	09:15	2.88	2.50	04:05	0.881	12:50	2.525	1.916	1.916	
4/22/2011	04:30	6.40	11:20	11.52	9.41	03:10	1.92	10:30	2.91	2.46	03:30	0.861	11:15	2.710	1.851	1.851	
4/23/2011	05:10	6.39	10:40	11.56	9.44	02:40	1.88	10:30	3.02	2.47	04:30	0.874	11:30	2.837	1.873	1.873	
4/24/2011	05:00	6.56	10:15	11.67	9.38	03:05	1.95	10:50	3.09	2.44	04:50	0.885	10:50	2.990	1.830	1.830	
4/25/2011	04:30	6.35	10:00	10.76	9.35	01:55	1.92	07:50	2.81	2.45	04:55	0.857	11:45	2.442	1.824	1.824	
4/26/2011	03:45	6.27	21:10	10.68	9.31	02:15	1.88	09:25	2.77	2.42	03:20	0.803	09:25	2.362	1.791	1.791	
4/27/2011	03:45	6.17	21:25	10.80	9.27	03:40	1.85	08:00	2.77	2.44	03:40	0.775	21:35	2.425	1.794	1.794	
4/28/2011	04:35	6.21	08:20	11.02	9.44	04:20	1.92	07:45	2.84	2.45	04:25	0.800	07:45	2.551	1.850	1.850	
4/29/2011	03:35	6.29	08:25	10.80	9.37	04:05	1.92	08:40	2.84	2.46	04:05	0.835	08:40	2.461	1.831	1.831	
4/30/2011	05:05	6.23	10:15	11.28	9.25	04:20	1.92	10:15	2.91	2.47	04:35	0.818	10:15	2.722	1.820	1.820	
5/1/2011	05:00	6.21	10:50	11.26	9.24	02:30	1.88	10:45	3.06	2.46	05:05	0.791	10:45	2.846	1.812	1.812	
5/2/2011	04:30	6.11	08:00	10.99	9.18	03:35	1.85	08:05	2.91	2.41	03:35	0.774	08:05	2.605	1.752	1.752	
5/3/2011	03:55	6.02	07:50	11.10	9.18	03:00	1.81	07:55	2.88	2.40	04:15	0.742	07:55	2.610	1.750	1.750	
5/4/2011	04:50	5.99	07:55	11.05	9.12	03:30	1.81	07:50	2.91	2.42	03:30	0.736	07:50	2.625	1.741	1.741	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			52.309
Report Avg	9.39	2.49	1.868

Site Commentary

Site Information

E_7	
Pipe Dimensions	32.5 "
Silt Level	0.00"

Overview

Site E_7 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 32% of full pipe during the recorded peak and approximately 21% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	6.72	2.83	1.669
Minimum	2.64	1.39	0.208
Maximum	10.49	3.70	3.847
Time of Minimum	5/2/2011 4:30 AM	5/2/2011 4:20 AM	5/2/2011 3:30 AM
Time of Maximum	4/16/2011 10:55 AM	4/16/2011 10:55 AM	4/16/2011 10:55 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

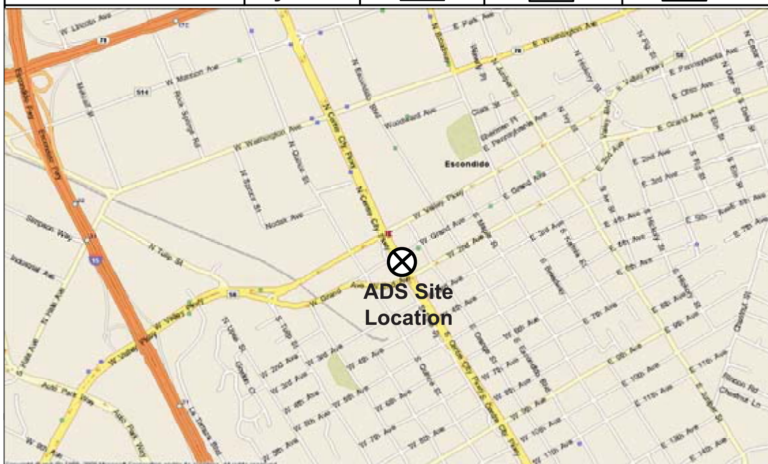
ADS ENVIRONMENTAL SERVICES®

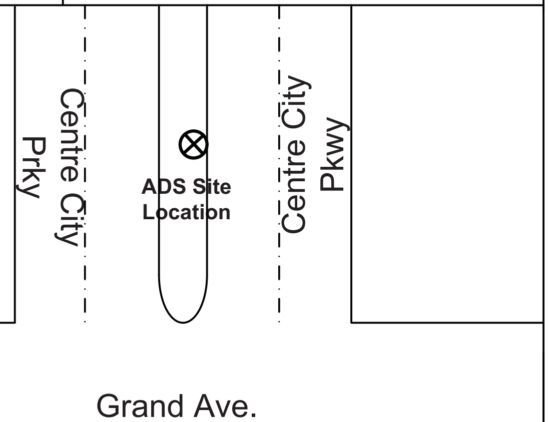
ADS Site Report

Quality Form

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:** 4-4-11	**FM Initials:** SK

Site Name: E_7	**Monitor Series:** 3600	**Monitor S/N:**	2851
Address/Location: 150 N. Centre City Pkwy. & Grand Ave.		**Manhole #**	7-33
		Thomas Bros Map Page:	1129-H3
		Pipe Height:	32.50 "
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	32.50 "
		IP Address:	N/A





Site Map N

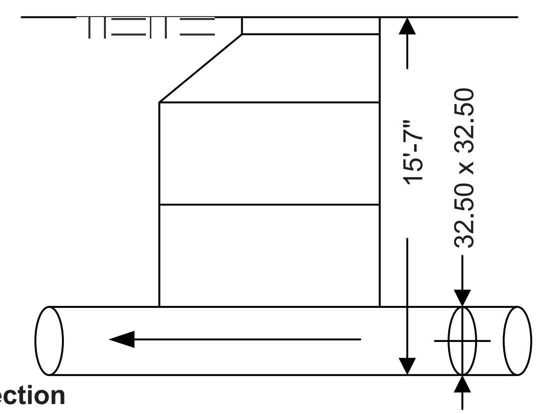
Investigation Information:

Date/Time of Investigation:	4-4-11 @ 1000
Site Hydraulics:	Good Straight Through Flow
Upstream Input: (L/S, P/S)	DNI
Upstream Manhole:	Did Not Investigate
Downstream Manhole:	DNI
Depth of Flow:	9.75 +/- 0.13 "
Range (Air DOF):	+/- 0.25 "
Peak Velocity:	3.55 fps
Silt:	0.00" Inches

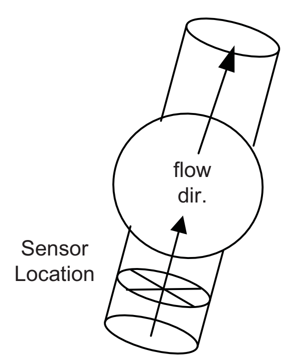
Manhole Information:

Manhole Depth:	15'-7"	Feet
Manhole Material / Condition	Precast /Good	
Pipe Material / Condition:	VCP / Good	
Mini System Character:	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]	
Telephone Information:	N/A	
Access Pole #:	N/A	
Distance From Manhole:	N/A	Feet
Road Cut Length:	N/A	Feet
Trench Length:	N/A	Feet

Other Information:



Cross Section



Planar N

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure
Surcharge Height:	None Feet
Rain Gauge Zone:	N/A

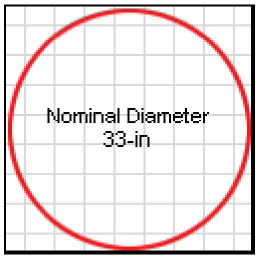
Backup	Yes	No	?	Distance
Trunk		X		
Lift / Pump Station		X		
WWTP		X		
Other	X			

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

Flow Monitor

E_7

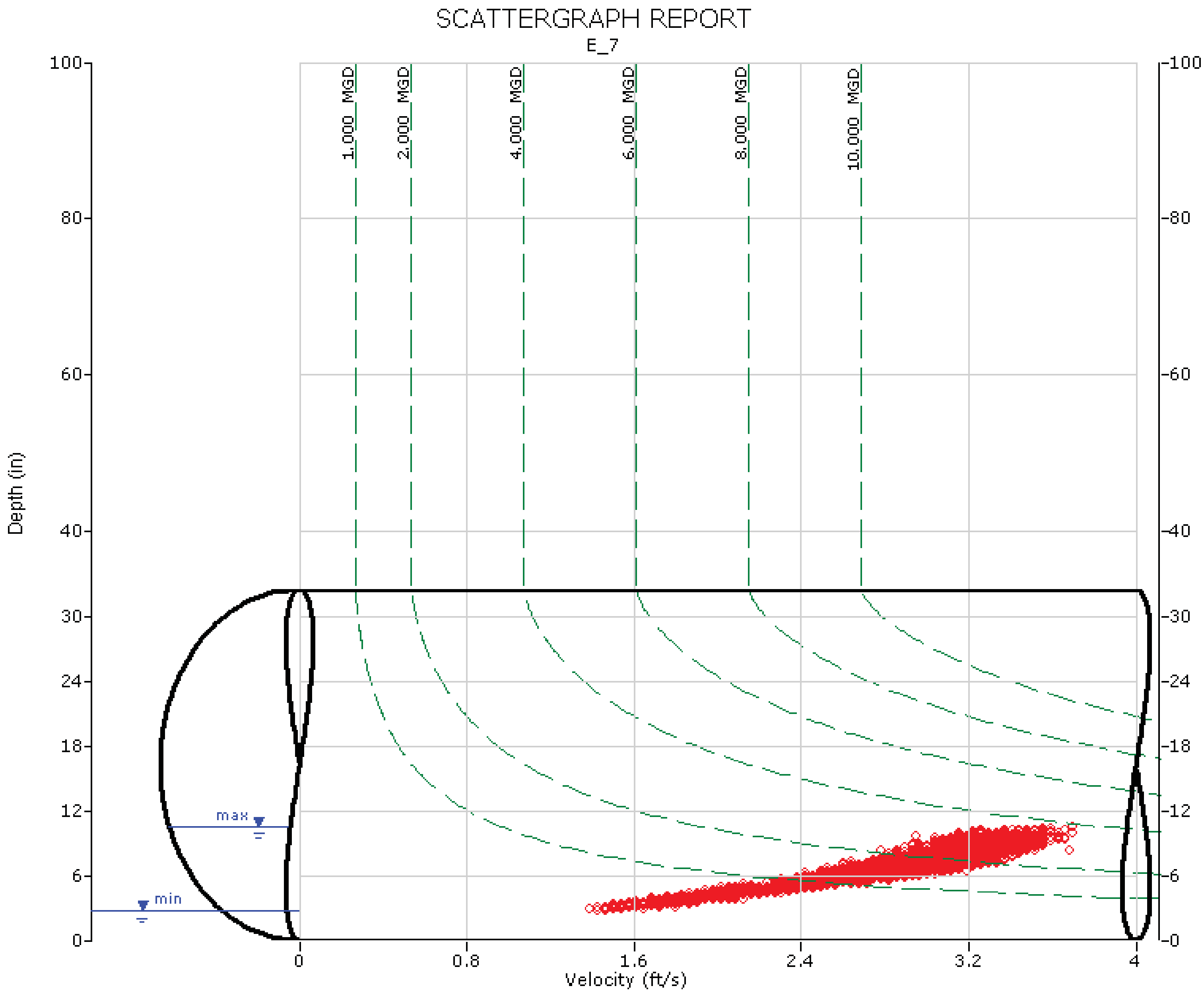


Report Period

4/7/2011
To
5/4/2011

Legend

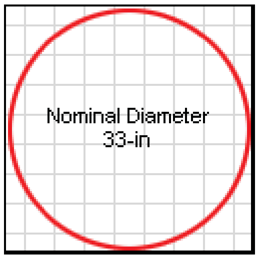
- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



HYDROGRAPH REPORT

Flow Monitor

E_7

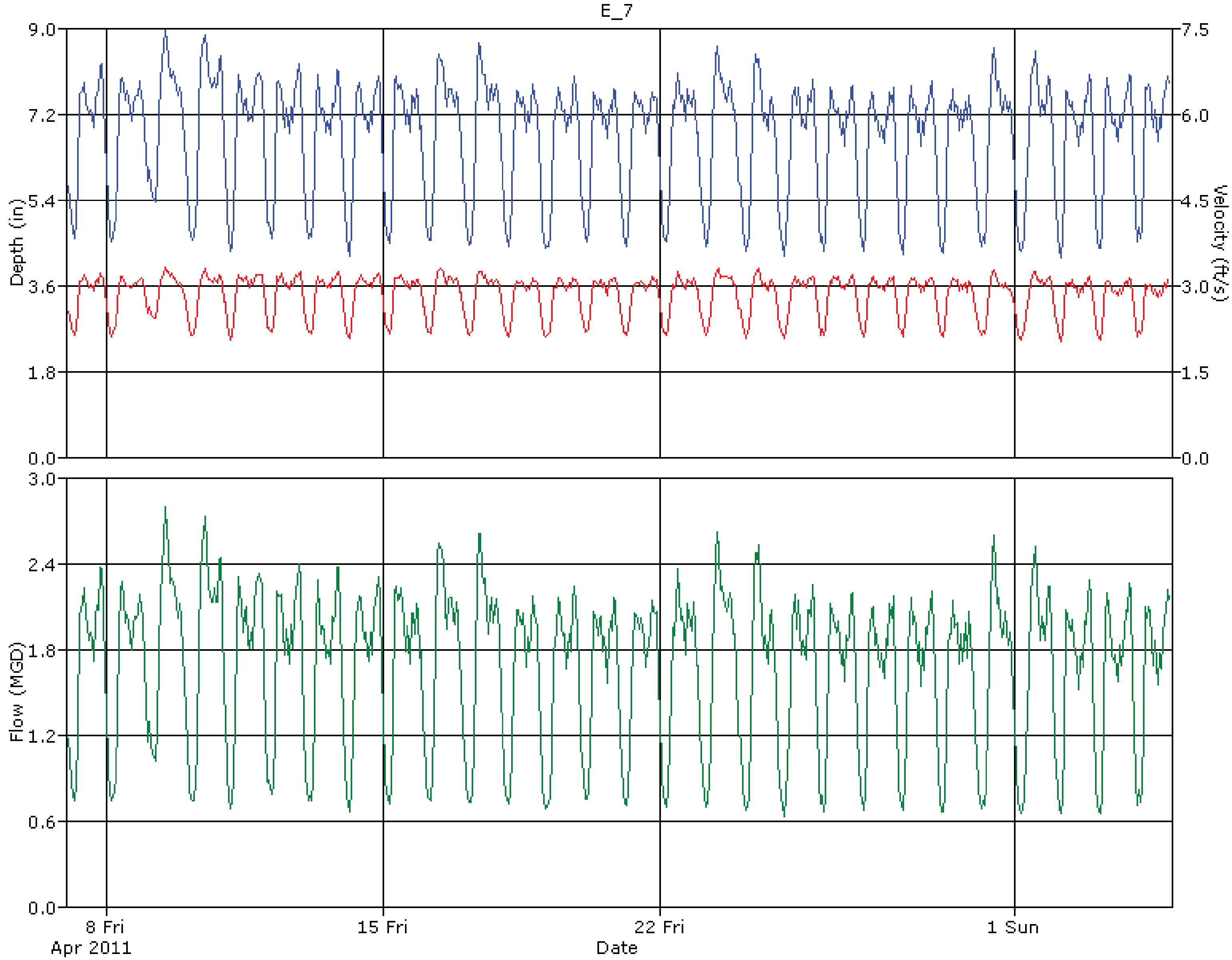


Report Period

4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_7, Pipe Height: 33"

Daily Tabular Report

Depth (in) Velocity (ft/s) Quantity (MGD - Total MG) Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	04:20	3.15	21:15	9.71	6.82	04:20	1.54	20:40	3.52	2.85	04:20	0.285	20:40	3.278	1.714	1.714	
4/8/2011	03:00	3.06	09:15	9.60	6.85	03:00	1.47	08:40	3.56	2.84	03:00	0.260	09:15	3.103	1.714	1.714	
4/9/2011	05:30	3.68	12:10	10.30	7.17	05:25	1.76	11:40	3.67	2.90	05:30	0.417	11:40	3.689	1.857	1.857	
4/10/2011	04:00	3.18	10:25	10.36	7.05	04:00	1.54	20:00	3.63	2.83	04:00	0.289	10:25	3.632	1.810	1.810	
4/11/2011	04:00	3.01	21:30	9.90	6.81	03:55	1.50	08:05	3.63	2.87	04:00	0.260	21:30	3.445	1.730	1.730	
4/12/2011	04:30	3.08	21:00	10.10	6.79	02:40	1.54	07:50	3.56	2.87	04:30	0.276	21:00	3.364	1.720	1.720	
4/13/2011	02:45	3.20	20:40	9.89	6.71	02:45	1.54	21:50	3.56	2.86	02:45	0.292	21:50	3.290	1.679	1.679	
4/14/2011	04:25	2.80	21:35	9.74	6.70	03:20	1.50	21:30	3.52	2.86	04:25	0.240	21:35	3.231	1.682	1.682	
4/15/2011	03:45	3.19	07:40	9.77	6.74	02:50	1.65	14:05	3.68	2.87	04:50	0.312	07:40	3.211	1.691	1.691	
4/16/2011	05:05	3.06	10:55	10.49	6.85	05:55	1.58	10:55	3.70	2.87	04:05	0.300	10:55	3.847	1.744	1.744	
4/17/2011	04:20	2.94	11:20	10.21	6.81	04:10	1.58	10:40	3.56	2.83	04:20	0.263	11:20	3.523	1.717	1.717	
4/18/2011	04:15	2.88	20:20	9.40	6.62	04:15	1.47	12:30	3.52	2.80	04:15	0.238	10:15	3.057	1.613	1.613	
4/19/2011	04:00	2.89	20:45	9.76	6.61	05:00	1.43	10:35	3.48	2.81	05:00	0.245	20:45	3.208	1.620	1.620	
4/20/2011	04:25	3.03	09:50	9.31	6.58	04:25	1.58	20:00	3.56	2.81	04:25	0.276	09:50	3.035	1.603	1.603	
4/21/2011	04:15	2.95	11:55	9.40	6.60	04:15	1.47	19:10	3.56	2.80	04:15	0.246	11:55	3.076	1.611	1.611	
4/22/2011	04:50	3.07	11:40	9.33	6.70	04:50	1.47	11:40	3.48	2.83	04:50	0.261	11:40	3.077	1.656	1.656	
4/23/2011	04:15	3.14	11:10	9.89	6.81	03:25	1.65	11:10	3.70	2.86	04:15	0.311	11:10	3.547	1.729	1.729	
4/24/2011	04:05	2.92	10:55	9.98	6.64	04:05	1.47	12:00	3.67	2.82	04:05	0.243	12:05	3.480	1.642	1.642	
4/25/2011	03:25	3.09	21:00	9.29	6.60	01:45	1.65	12:00	3.56	2.82	03:25	0.296	21:00	3.124	1.625	1.625	
4/26/2011	04:25	3.15	20:40	9.23	6.56	02:40	1.50	20:40	3.52	2.84	02:40	0.278	20:40	3.064	1.611	1.611	
4/27/2011	04:10	2.89	22:10	9.20	6.55	04:05	1.50	21:25	3.56	2.83	04:10	0.251	21:25	3.056	1.602	1.602	
4/28/2011	05:00	2.89	20:35	9.09	6.54	04:05	1.47	11:00	3.45	2.83	04:05	0.240	20:35	2.843	1.604	1.604	
4/29/2011	04:55	3.03	10:45	9.02	6.55	02:10	1.54	10:45	3.45	2.81	04:55	0.276	10:45	2.904	1.589	1.589	
4/30/2011	06:00	3.26	10:00	9.93	6.73	05:10	1.61	10:35	3.56	2.79	05:10	0.315	11:45	3.209	1.652	1.652	
5/1/2011	03:55	2.85	11:30	9.78	6.71	03:55	1.54	12:05	3.56	2.80	03:55	0.246	11:30	3.253	1.669	1.669	
5/2/2011	04:30	2.64	21:35	9.54	6.58	04:20	1.39	21:00	3.45	2.79	03:30	0.208	21:35	3.142	1.602	1.602	
5/3/2011	03:55	3.25	22:05	9.78	6.67	03:30	1.61	21:30	3.48	2.78	04:30	0.326	07:30	3.155	1.616	1.616	
5/4/2011	02:45	2.98	07:55	9.76	6.73	02:45	1.43	07:55	3.41	2.75	02:45	0.244	07:55	3.206	1.619	1.619	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D Velocity (ft/s) : V Quantity (MGD - Total MG) : Q Rain (in) : Rain

	D	V	Q
Report Total			46.721
Report Avg	6.72	2.83	1.669

Site Commentary

Site Information

E_8	
Pipe Dimensions	15 "
Silt Level	0.00"

Overview

Site E_8 functioned under normal conditions during the period Thursday, April 07, 2011 to Wednesday, May 04, 2011 . No surcharge conditions were experienced at this location. Review of the scattergraph shows that free flow conditions were maintained throughout the study period.

Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, April 07, 2011 to Wednesday, May 04, 2011 , along with observed minimum and maximum data, are provided in the following table. The maximum and minimum flow rate presented in the table below are absolute recorded values. In regards to depth, this site flows at just over 45% of full pipe during the recorded peak and approximately 29% during the recorded average depth.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	4.34	3.32	0.663
Minimum	2.80	1.37	0.158
Maximum	6.78	4.76	1.443
Time of Minimum	5/2/2011 3:10 AM	4/7/2011 3:05 AM	5/3/2011 3:10 AM
Time of Maximum	4/14/2011 7:05 AM	4/11/2011 7:25 AM	4/13/2011 7:15 AM

Data Quality

Data uptime observed during the Thursday, April 07, 2011 to the Wednesday, May 04, 2011 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (in)	100.00
Velocity (ft/s)	100.00
Quantity (MGD)	100.00

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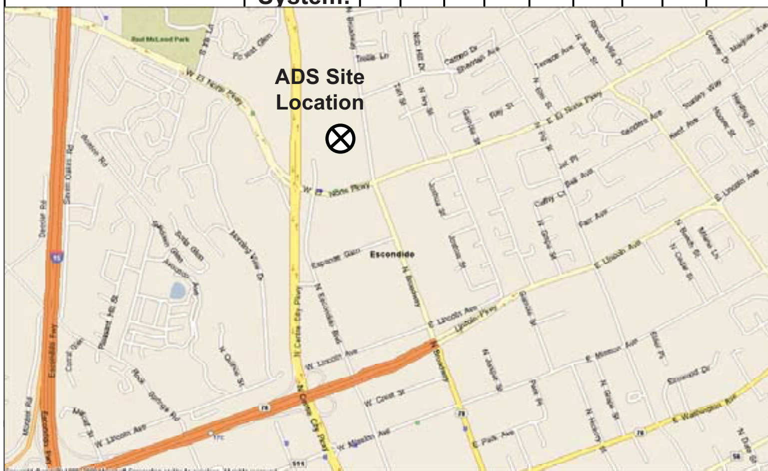
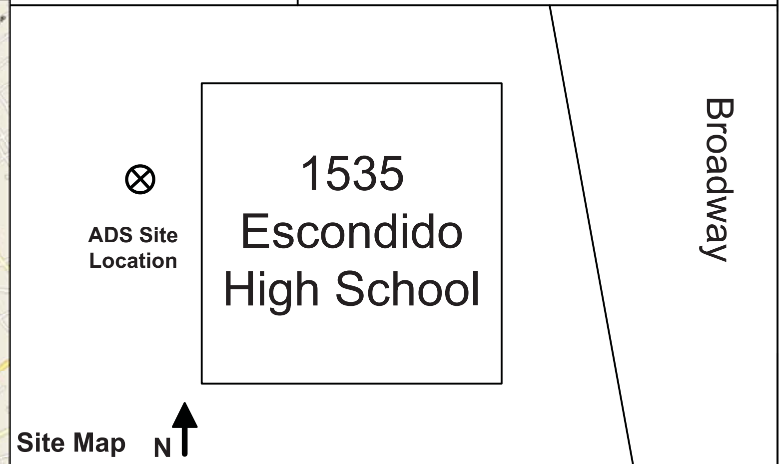
ADS Site Report

Quality Form

Project Name: Escondido Temp Study	**City / State:** Escondido, Ca	**Date Installed:**	4-4-11	**FM Initials:**	SK

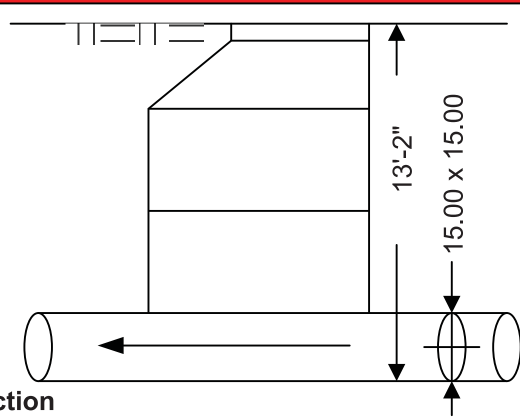
Site Name: E_8	**Monitor Series:** 3600	**Monitor S/N:**	1840
Address/Location: 1535 Broadway		**Manhole #**	8-15
		Thomas Bros Map Page:	1129- H1
		Pipe Height:	15.00 "
Access: Drive	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	15.00 "
		IP Address:	N/A



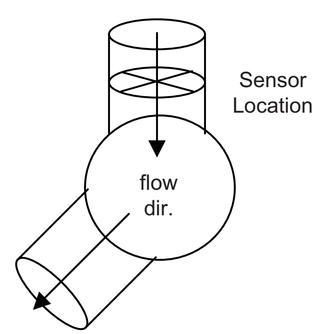


Investigation Information:				**Manhole Information:**		
Date/Time of Investigation:	4-4-11 @ 1201			**Manhole Depth:**	13'-2"	Feet
Site Hydraulics:	Good Straight Through Flow			**Manhole Material / Condition**	Precast /Good	
Upstream Input: (L/S, P/S)	DNI			**Pipe Material / Condition:**	VCP / Good	
Upstream Manhole:	Did Not Investigate			**Mini System Character:**	Residential [X] Commercial [ ] Industrial [ ] Trunk [ ]	
Downstream Manhole:	DNI			**Telephone Information:**	N/A	
Depth of Flow:	5.38	+/-	0.13 "	**Access Pole #:**	N/A	
Range (Air DOF):		+/-	0.25 "	**Distance From Manhole:**	N/A	Feet
Peak Velocity:	3.35	fps		**Road Cut Length:**	N/A	Feet
Silt:	0.00"	Inches		**Trench Length:**	N/A	Feet

Other Information:



Cross Section



Planar N

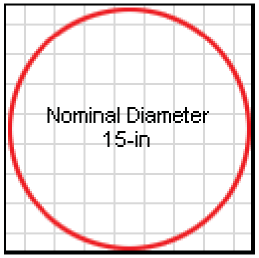
Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	[ ]	[X]	[ ]	
Sensors Devices:	Ultrasonic Depth / Velocity/ Pressure	Lift / Pump Station	[ ]	[X]	[ ]	
Surcharge Height:	None Feet	WWTP	[ ]	[X]	[ ]	
Rain Gauge Zone:	N/A	Other	[X]	[ ]	[ ]	

Additional Site Information / Comments:

No safety concerns; standard traffic control. Good site for flow monitoring.

Flow Monitor

E_8



Report Period

4/7/2011
To
5/4/2011

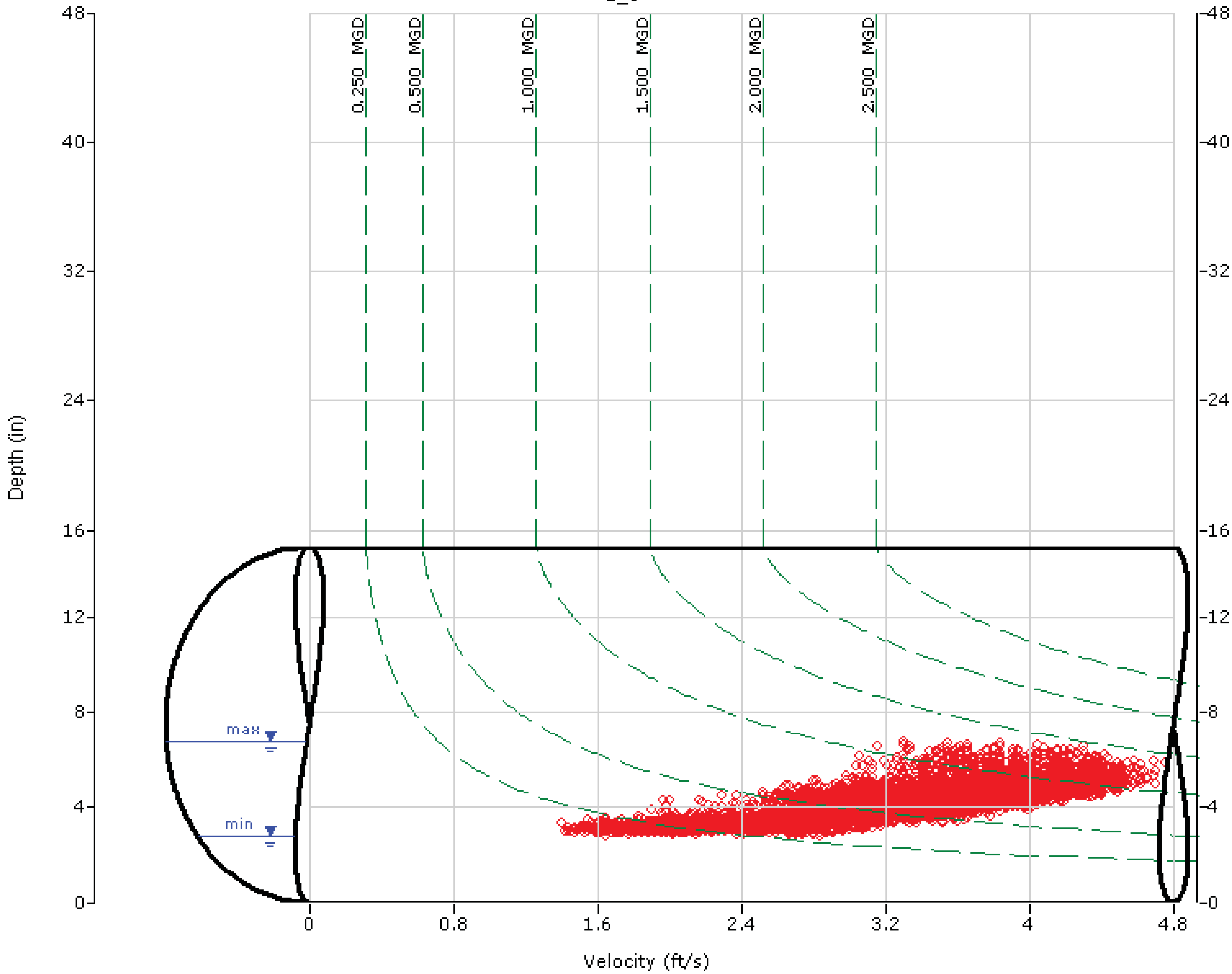
Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES

SCATTERGRAPH REPORT

E_8



Flow Monitor

E_8

Nominal Diameter
15-in

Report Period

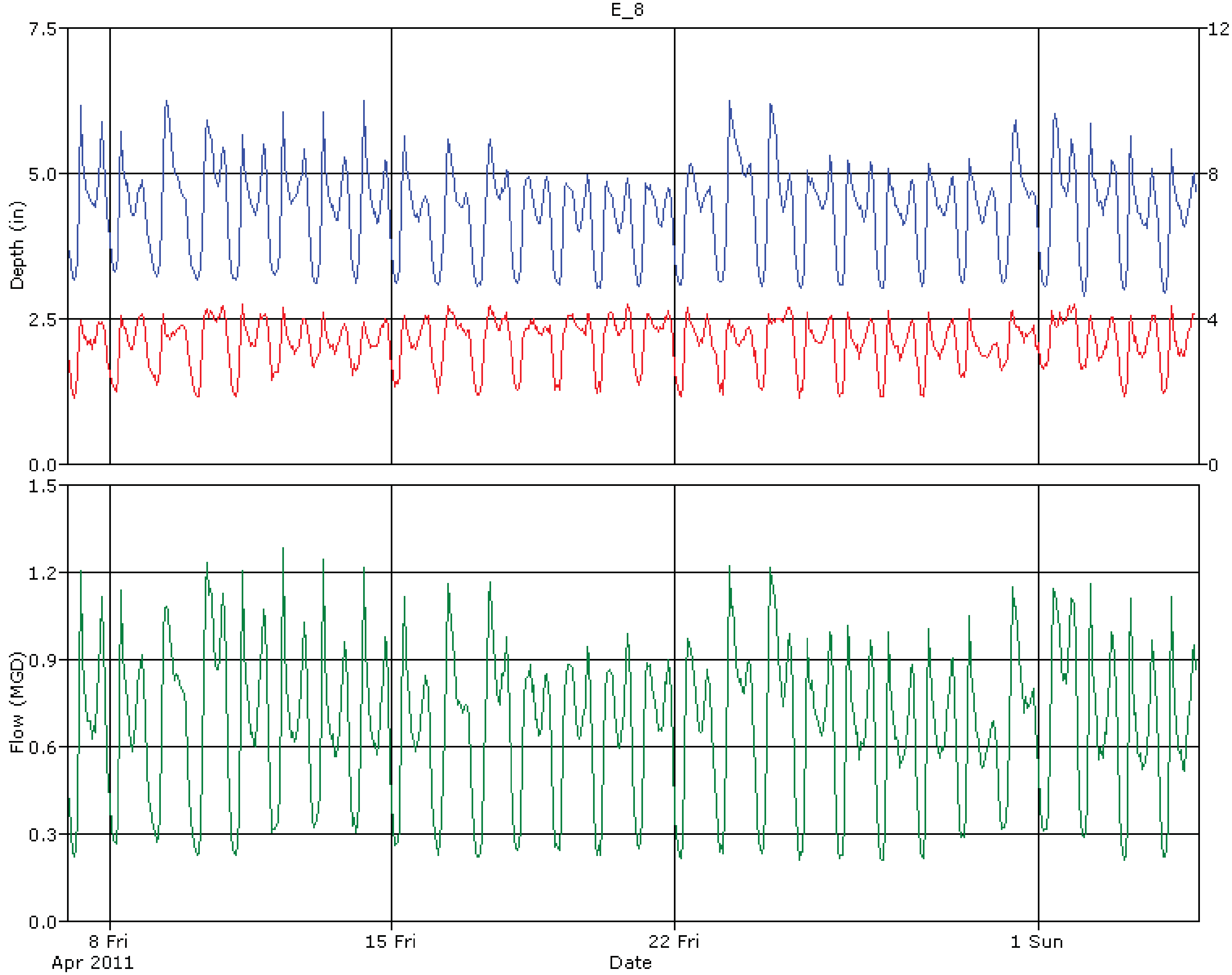
4/6/2011
To
5/4/2011

Legend

- Depth
- Velocity
- Quantity

HYDROGRAPH REPORT

E_8



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 4/7/2011 - 5/4/2011

E_8, Pipe Height: 15"

Daily Tabular Report

Depth (in)   Velocity (ft/s)   Quantity (MGD - Total MG)   Rain (in)

Date	Depth					Velocity					Quantity						Rain
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
4/7/2011	02:50	3.04	07:15	6.60	4.51	03:05	1.37	07:00	4.37	3.20	03:05	0.164	07:10	1.309	0.677	0.677	
4/8/2011	03:55	3.08	07:05	6.15	4.37	02:10	1.55	18:40	4.49	3.28	03:30	0.203	07:20	1.349	0.657	0.657	
4/9/2011	04:20	3.13	10:25	6.59	4.60	04:50	1.67	08:20	4.51	3.27	04:50	0.212	11:35	1.177	0.705	0.705	
4/10/2011	04:20	3.05	09:55	6.35	4.59	02:05	1.62	10:00	4.69	3.46	04:25	0.193	10:05	1.384	0.764	0.764	
4/11/2011	02:35	3.05	07:25	5.90	4.41	04:20	1.47	07:25	4.76	3.36	04:20	0.179	07:25	1.380	0.689	0.689	
4/12/2011	03:40	3.14	07:40	6.33	4.49	01:45	1.62	07:20	4.58	3.31	01:45	0.211	07:40	1.355	0.686	0.686	
4/13/2011	04:20	2.97	07:15	6.59	4.38	23:30	2.29	07:35	4.37	3.33	02:10	0.278	07:15	1.443	0.662	0.662	
4/14/2011	03:40	3.04	07:05	6.78	4.41	01:15	2.03	06:45	4.57	3.31	03:50	0.257	07:15	1.376	0.667	0.667	
4/15/2011	03:00	3.02	07:10	6.03	4.25	02:50	1.81	07:15	4.30	3.30	02:50	0.219	07:10	1.241	0.633	0.633	
4/16/2011	05:05	2.96	09:25	6.01	4.26	04:35	1.63	08:50	4.48	3.41	04:35	0.185	09:25	1.234	0.668	0.668	
4/17/2011	03:50	2.97	10:25	5.73	4.32	04:30	1.47	12:20	4.55	3.36	04:30	0.171	10:25	1.226	0.680	0.680	
4/18/2011	03:50	3.04	20:40	5.18	4.20	04:50	1.55	10:00	4.48	3.32	04:50	0.193	20:35	1.035	0.629	0.629	
4/19/2011	04:10	2.89	20:45	5.17	4.14	02:50	1.60	20:05	4.55	3.43	02:50	0.190	20:05	1.081	0.639	0.639	
4/20/2011	04:20	2.89	07:25	5.05	4.09	03:00	1.46	20:50	4.62	3.46	03:00	0.166	20:50	1.068	0.636	0.636	
4/21/2011	03:50	2.96	10:20	5.05	4.16	04:45	1.87	08:45	4.49	3.49	04:10	0.210	20:30	1.008	0.650	0.650	
4/22/2011	04:15	2.98	09:30	5.43	4.29	04:15	1.44	08:30	4.44	3.29	04:15	0.161	08:30	1.045	0.646	0.646	
4/23/2011	04:05	3.00	10:00	6.65	4.65	02:50	1.51	08:45	4.41	3.23	02:50	0.184	09:10	1.366	0.711	0.711	
4/24/2011	04:35	2.94	09:40	6.74	4.49	02:45	1.55	13:25	4.48	3.49	04:20	0.175	09:55	1.347	0.737	0.737	
4/25/2011	02:50	2.95	20:10	5.47	4.30	02:45	1.53	19:40	4.48	3.28	02:45	0.168	07:10	1.124	0.648	0.648	
4/26/2011	02:50	2.93	20:30	5.49	4.28	02:00	1.42	07:30	4.44	3.20	02:00	0.158	07:40	1.093	0.629	0.629	
4/27/2011	04:00	2.91	07:15	5.29	4.18	03:45	1.47	07:10	4.65	3.13	03:45	0.161	07:10	1.156	0.592	0.592	
4/28/2011	03:40	2.97	07:30	5.42	4.30	02:05	1.40	20:55	4.53	3.15	04:30	0.171	07:30	1.158	0.619	0.619	
4/29/2011	03:00	2.98	07:30	5.62	4.25	04:25	2.01	07:25	4.60	3.10	04:25	0.245	07:25	1.115	0.590	0.590	
4/30/2011	02:55	3.00	09:45	6.18	4.46	01:40	2.04	09:00	4.71	3.40	01:40	0.249	09:55	1.291	0.699	0.699	
5/1/2011	04:15	2.92	10:45	6.39	4.53	06:35	2.22	09:05	4.69	3.64	03:15	0.263	10:00	1.253	0.768	0.768	
5/2/2011	03:10	2.80	07:20	6.38	4.37	01:00	2.06	06:45	4.51	3.29	03:15	0.227	06:55	1.332	0.655	0.655	
5/3/2011	04:15	2.81	06:50	5.92	4.23	03:10	1.42	22:20	4.49	3.15	03:10	0.158	07:05	1.241	0.609	0.609	
5/4/2011	03:20	2.87	07:00	5.68	4.19	01:55	1.58	07:20	4.71	3.23	02:05	0.181	07:10	1.255	0.616	0.616	

Report Summary For The Period 4/7/2011 - 5/4/2011

Depth (in) : D   Velocity (ft/s) : V   Quantity (MGD - Total MG) : Q   Rain (in) : Rain

	D	V	Q
Report Total			18.558
Report Avg	4.34	3.32	0.663

SEWER LIFT STATION EVALUATION
May 2010

1 Introduction

The City of Escondido (City) currently operates fourteen sewer lift stations within their wastewater collection system. The City contracted with W3E/RMC to evaluate thirteen of the fourteen sewer lift stations within the City wastewater collection system. Lift Station No. 4 is currently being replaced and was therefore not included as part of this sewer lift station evaluation. The information will be used to assist the City with the planning and prioritizing of necessary capital improvement projects for the lift station portion of the collection system. The City is also evaluating the feasibility of combining some of the existing lift stations.

2 Sewage Lift Station Evaluation

This study includes an evaluation of various components of the existing lift stations including:

- station condition
- pumping capacity
- electrical equipment
- ease of operation and maintenance
- wet well capacity
- emergency storage
- emergency power
- force main analysis
- suction/discharge piping analysis

A variety of information was gathered to assist in the evaluation of the thirteen sewer lift stations. These included a site visit to investigate the physical condition of the existing lift stations, a review of questionnaires completed by City operations and maintenance staff, a review of record drawings, pump down tests at each lift station to compare actual capacities verses designed or rated capacities, and a comparison of the configuration of existing facilities with current standard industry practice. The goal of this evaluation was to develop a priority ranking of the City's existing lift stations with respect to rehabilitation needs and improvements.

2.1 Summary of Lift Station Condition

The following is a brief summary of the existing facilities by lift station. The location of all of the City's sewer lift stations is shown in **Figure 1**. The physical conditions for the evaluated lift stations were noted during site visits with City operations staff. Questionnaires and data sheets completed by the City on the lift station design characteristics are provided in **Attachment A**. The existing facilities are described below and their design and reliability characteristics are summarized in **Attachment B**.

Lift Station No. 1

This lift station site was originally the site of a small wastewater treatment plant remnants of which are still visible today. Because of the high lift requirements the station has three sets of two pumps in series. The first pump of the two pump system is a submersible-type, which feeds the suction end of the second set of pump which is a dry-pit centrifugal pump. The system pumps to a 16-inch forcemain that is approximately 2.5 miles in length after which the flow breaks to gravity before discharging into Lift Station #3. The site is at the end of Sunset Drive and the address is 3680 Sunset Drive. Each two-pump-combination is capable of delivering up to 875 gpm. The City typically runs two two-pump-combinations simultaneously for a total pumping capacity of about 1,100 gpm at 155 ft TDH. This lift station receives flow from the nearby shopping mall and residential areas. There are two sets or combinations of duty pumps and one set of stand-by pumps. Each pump within each combination is equipped with 75 Hp constant speed motors with soft start motor starters. This is one of the City's oldest lift stations that is in fair shape and operation is fairly reliable. The ultimate projected peak wet weather flow to this station is estimated to be 4,000 gpm which is greater than the current station capacity. The current peak flows to the station are about 1,250 gpm.

There is a diesel fueled 350 KW standby generator, ATS and electrical power and control equipment, an emergency pump connection, flow meter and remote monitoring of high wet well level through a radio transmitter. The on-site storage volume is approximately 86,000 gallons. Security chain link fencing surrounds the station fitted with two gate systems, one a rolling automatic chain link gate and the other a double swing manual gate. Other appurtenances include a surge tank, diesel fuel storage, activated carbon odor scrubber, bioxide storage and injection equipment, safety shower and eye wash, multiple jib crane system, remnants of an old wastewater treatment plant, potable water with backflow preventer and several other structures.

City staff indicated that the station has had problems with scum/solids build-up on the surface of the wet well. When the blanket is broken up using water hoses and the solids are pumped out of the wet well they end up at Lift Station #3 and a similar issue occurs there. As an alternate method of dealing with the scum/solids blanket the City has successfully used their vactor truck to remove the solids and then trucked them to the HARRF for disposal. Currently the City bleeds back a portion of the pumped flow into the wet wells to help keep the build-up moving through the system. This has been working well.

Lift Station No. 2

This lift station was originally a dry pit-wet well arrangement that was converted to a submersible station approximately 15-17 years ago. This lift station pumps to a 6-inch 0.6 mile long forcemain and from there the wastewater flow breaks to gravity flow and then on to Lift Station #3. The site is located east of South Escondido Boulevard and the address is 2698 South Escondido Boulevard. The rated pump capacity is 215 gpm at 95 ft TDH. The lift station operates with one duty and one stand-by submersible pump and automatically alternates between pumps. The pump motors are 15 Hp and are constant speed type. Overall, the station is in fair condition and operation is fairly reliable. The current peak flows to the station are about 150 gpm. The ultimate projected flow to this station is estimated to be 200 gpm which is less than the current rated station capacity. There is a diesel fueled 50 KW stand by generator, ATS, electrical power and control equipment, an emergency pump connection, remote monitoring of high water level in wet well through a radio transmitter and bubbler system, and a duplicate SmartCover™ level indicator with cellular phone communicator.

The wet well volume is approximately 1,900 gallons. Security chain link fencing with three strand barb wire surrounds the station fitted with a double swinging chain link gates. Other appurtenances include 264 gallon surge tank, diesel fuel storage, activated carbon odor scrubber, 1,000 lb jib crane, a redundant high water level alarm on a relay-controlled backup circuit installed in 1988, wood framed storage structure, and potable water meter with backflow preventer.

Other issues and observed conditions associated with this station include occasional pump failure as a result of clogging from debris, instances of trespassing, corroded piping and peeled interior coating in wet well, and in an upstream manhole on-site.

Lift Station No. 3

This is the City's largest lift station. It was originally a small submersible station that was expanded and remodeled to incorporate stucco walled, open roof enclosure to resemble an industrial building. Wastewater flows into the lift station from Lift Stations No. 1, No. 2, No. 6, Eagle Crest (Lift Station No. 13) and the gravity collection system in the local area. The sewage is pumped to a 10-inch forcemain that is approximately 0.7 miles in length, from there the flow breaks to gravity flow and then on to the HARRF. The site is on South Escondido Boulevard just north of the split from S. Center City Parkway at 2045 South Escondido Boulevard. There are two submersible type pumps, each pump has a rated capacity of 2,050 gpm @ 144 ft TDH. The lift station operates with one duty and one stand-by pump that automatically alternates between pumps. This station cannot operate with both pumps running simultaneously in the event of high water in wet well. The motors are 125 Hp and are constant speed with a soft start motor starter. The pump operation is level controlled using a bubbler system.

The current peak flows to the station are about 1,600 gpm. The ultimate flow to this station is estimated to be 2,000 gpm which matches the current station capacity. There is a diesel fueled 150 KW stand by generator, ATS, electrical power and control equipment, an emergency pump connection, 4,755 gpm capacity magnetic flow meter, remote monitoring of high level through a radio transmitter, a 942 gallon surge tank, emergency storage, air compressor for equipment and surge tank, dial-up phone modem for monitoring and alarm notifications through radio telemetry. The on-site storage volume is approximately 43,240 gallons. Stucco block walls in combination with decorative wrought iron fencing surround the station fitted with one rolling wrought iron equipment gate and two swinging wrought iron man gates. The metal frame open roof structure was designed in order to minimize confined space regulatory requirement. Other appurtenances include diesel fuel storage, a soil bed odor scrubber with duplex fans, monorail crane system, safety shower and eyewash, potable water meter with backflow preventer, and several other compartments in the lift station stucco structure.

City staff indicated that the electrical and instrumentation systems for this station needs upgrading. The electrical system was not up-graded during the last expansion and systems useful life has been eclipsed. Access and maintenance of the electrical bus and other electrical equipment is dangerous and difficult.

Other issues and observed conditions associated with this station include an undersized stand-by engine generator with capacity to run only one pump, stucco repair needed at various locations, and lack of automated pressure control in the surge tank. The station has been retrofitted with a Gorman Rupp relay-control-based pump control that requires a City-installed converter to transmit a standard 4-20mA signal of the water level to the HARRF's SCADA system. This station also has a similar maintenance issue as identified in Lift Station No. 1 which is build up on the surface of the wet well with scum and a solids blanket.

Lift Station No. 4

This lift station is currently being upgraded and is not included in this the lift station evaluation study.

Lift Station No. 5

This is a package-type low-profile (partially buried) Gorman Rupp station that pumps into a 6-inch, 0.2 mile long forcemain where the sewage then breaks to gravity flow and then on to the HARRF. The site is near the intersection of Barham Drive and Opper Street in a predominantly industrial area of the City. The site address is 735 Opper Street. There are two pumps; each pump has a rated pump capacity of 225 gpm @ 92 ft TDH. The lift station operates with one duty and one stand-by pump that automatically alternates between pumps. The pump motors are 7.5 Hp and constant speed. The lift station is in good shape and receives relatively low flow. This is a smaller station that operates well. The pump dry pit is approximately 4 feet below ground with 1 to 2 feet of the pit exposed above ground. The circular locking lid is motor-operated and swings to the side for access.

The current peak flows to the station are about 130 gpm. The ultimate projected flow to this station is estimated to be 200 gpm which is less than the current station capacity. The pumps are controlled by an ultrasonic level sensor. A float system is used to detect a high water level. There is a propane fueled 35 KW stand-by engine generator with a propane storage cylinder, ATS and electrical power and control equipment and remote monitoring of high wet well level through a radio transmitter. The wet well operating volume is approximately 790 gallons. A 3/4 - inch potable water meter and backflow supplies the potable water needs at the lift station. Combination chain link fencing and slump block wall and two double swing chain link gates provide security and access for the site while sun covers are provided over the electrical components. There is a meter vault set up to incorporate a magnetic flow meter, but no meter has been installed to date. Thermal switches are installed on the legs of the pumps to detect overheating of pumps.

Other issues and observed conditions associated with this station include the presence of water in the flow meter vault and lack of proximity switches on the discharge check valves for pump failure detection. The slump block wall retains soil behind the adjacent commercial property that is situated about 4 feet higher in elevation than the lift station site. A storm drain inlet and swale is located behind the block wall. Additional investigation is required to determine the source of the water intrusion into the meter vault. The station has a Gorman Rupp pump control that uses an ultrasonic level with a 4-20mA signal. The electrical panels have plenty of room for a PLC based control system and other and additional control panels.

Lift Station No. 6

This is a package Gorman Rupp station that pumps east and then south through a 4-inch 0.4 mile long forcemain where the flow breaks to gravity before flowing on to Lift Station No. 3. The site is adjacent to Felicita Road and south of Brotherton Road. The site address is 2101 Felicita Road. There are two pumps; each pump has a rated capacity of 120 gpm @ 55 ft TDH. The lift station operates with one duty and one stand-by pump that automatically alternates between pumps. The pump motors are 7.5 Hp and constant speed type. Overall, the lift station is in good shape. This is a smaller station that operates fairly well. The ultimate projected flow to this station is estimated to be 120 gpm which matches the current station capacity. The current peak flows to the station are about 60 gpm. There is a propane 20 KW stand-by engine generator with propane storage cylinder, ATS and electrical power and control equipment, an emergency pump connection and remote monitoring of high level through a radio transmitter. The pumps are controlled with a submersible pressure transducer and transmitter. The local pump control panel is a Gorman Rupp relay-controlled panel that has the City-installed converter to transmit the standard 4-20 mA signal to control the system. The wet well volume is approximately 720 gallons which provides about 12 minutes of storage at peak flow assuming the wet well is low. A 1-1/4 -

inch potable water meter and backflow supplies the potable water needs at the lift station. Security is provided by a slump block wall which surrounds the station fitted with a rolling chain link gate.

Other issues and observed conditions associated with this station include regular pump failure as a result of clogging and inconvenient access to equipment within the fiberglass enclosure. The City mentioned that they have had frequent clogging problems from what appears to be mop heads and are in the process of trying to determine their origin.

Lift Station No. 7

This is a package-type above-ground fiberglass enclosed Gorman Rupp station that pumps to a 4-inch, 0.3 mile long forcemain and then breaks to gravity at a high point in 17th Street and then flows by gravity to the HARRF. The site is located in a residential area near the intersection of East 17th Street and San Pasqual Valley Road. The site address is 870 East 17th Street. The lift station was installed to serve only the Church and School just to the north of the site.

There are two pumps and each pump has a rated pump capacity of 160 gpm @ 44 ft TDH. The lift station operates with one duty and one stand-by pump that automatically alternates between pumps. The pump motors are 7.5 Hp and are constant speed. The lift station is in good shape. This is a smaller station that operates well. The current peak flows to the station are about 25 gpm. The ultimate flow to this station is estimated to be 50 gpm which is much less than the current station capacity. The pumps are controlled with a bubbler system. There is a propane fueled 17 KW stand-by engine generator with a propane storage cylinder, ATS, electrical power and control equipment, remote monitoring of high level through a radio transmitter, bioxide tank for odor control, safety shower and eyewash, local visual and audible high temperature alarm, proximity switches on the discharge check valves and thermal sensors on the base of the pumps. The wet well volume is approximately 480 gallons which provides a little over 19 minutes of storage at peak flow assuming a low wet well. A 3/4-inch potable water meter and backflow supplies the potable water needs at the lift station. Chain link fencing and a double swing chain link equipment gate and man gate provide security and access for the site.

Other issues and observed conditions associated with this station include aging and cracking of the concrete floor slab and general settling of the station in direction of the creek (northeast). This may be from the sandy soils the site was built on and/or poor sub base compaction beneath the slab.

Lift Station No. 8

This is a package-type Smith & Loveless station that pumps to a 6-inch forcemain approximately 0.7 miles in length then breaks to gravity flow continuing on to Lift Station #9. The site is down an alley/easement dead end road about 300 feet off of Eucalyptus Avenue. The address is 2472 Eucalyptus Avenue. The rated pump capacity is 200 gpm @ 142 ft TDH. The lift station has two pumps and operates with one duty and one stand-by pump and automatically alternates between pumps. The pump motors are 25 Hp and are constant speed. The current peak flows to the station are about 75 gpm. The ultimate projected flow to this station is 150 gpm which is less than the current station capacity. The City indicated that they have had several forcemain breaks near the entrance to the lift station on the main road which is at one of the lowest points in the line and this segment would experience the highest pressure along the 0.7 mile long 6" forcemain. It is recommended a review of the material and pressure rating of the pipe that is used for the forcemain be made.

The lift station is in fairly good condition although it is older and areas of the steel floor in the pump pit are rusting. This appears to be from the operational practice of flushing or rinsing the seal water filter system onto the pump pit floor. The City indicated that the S&L stations present operational and maintenance challenges as equipment is 20 to 30 feet down in the dry pit which makes it very labor intensive to pull a pump or to service other equipment. The City indicated that they are planning on upgrading the electrical panels and moving this equipment up to the surface for all of the S&L stations. There is a propane fueled 95 KW stand by engine generator with a propane storage cylinder, ATS and electrical power and control equipment, an emergency pump connection and flow metering, as well as remote monitoring of high level through a radio transmitter. The wet well volume is approximately 400 gallons which provides about 5 minutes and 20 seconds of storage at peak flow assuming the wet well is low. A 1- inch potable water meter and backflow supplies the potable water needs at the lift station. Security fencing and two double swing gates provide access and security and a wooden shade cover provides some protection for the generator. The pump pit ventilator was not operational at the time of this inspection and portable ventilation was required.

Lift Station No. 9

This is a package S&L station that pumps to a 6-inch forcemain approximately 0.8 miles in length then breaks to gravity flow and then on to the HARRF. The site is on Hamilton Lane and the address is 1399 Hamilton Lane. Rated pump capacity is 250 gpm @ 175 ft TDH, one duty and one stand-by with automatic alternating, and 60 Hp constant speed motors. The City indicated that they have to replace/rebuild pumps at this station several times per year due to fatigue caused by overloading and overheating. The current peak flow to the station is currently at about 250 gpm. The ultimate projected flow to this station is 400 gpm. The station pumping capacity will need to be increased to meet future flow projections. The lift station is in fair condition although it is older and the metal floor in the pump pit is showing some rust similar to the condition at Lift Station No. 8.

The same issues discussed for Lift Station No. 8 also apply to this S&L stations regarding equipment operation and maintenance in the below ground dry pit. Again, the City is planning on upgrading the electrical panels and moving them up to the surface for all of the S&L stations. There is a diesel fueled 175 KW stand by engine generator, diesel fuel storage tank, ATS and electrical power and control equipment, an emergency pump connection, flow meter and remote monitoring of high level through a radio transmitter. The wet well volume is approximately 2,300 gallons which provides about 9 minutes and 12 seconds of storage at peak flow assuming the wet well is low. There is also bioxide storage and injection equipment for injecting bioxide into the wet well for odor control. Security fencing and double swing gate provide security and access to the station and a wooden shade cover is provided for the engine generator along with a safety shower and eye wash. A 1- inch potable water meter and backflow supplies the potable water needs at the lift station.

Lift Station No. 10

This is a package-type Smith & Loveless station that pumps to a 6-inch, 0.6 mile long forcemain and then breaks to gravity flow near Citracado Parkway and then flows on to the HARRF. The site is on West Valley Parkway and the address is 2356 ½ Willowbrook Street. The pumps have a rated capacity of 230 gpm @ 69 ft TDH. The lift station operates with one duty and one stand-by pump that automatically alternates between pumps. The pump motors are 10 Hp and are constant speed. The current peak flows to the station are about 50 gpm. The ultimate flow to this station is estimated to be 75 gpm which is significantly less than the current station capacity. The lift station is generally in good shape, although the metal floor in the pump pit is showing rust similar to Station's 8 and 9. There is a propane 45 KW stand by engine generator with a propane storage cylinder, ATS, electrical power and control equipment, a blow off that serves as an emergency pump connection, flow meter and remote monitoring of high level through a float and radio transmitter. The pumps are controlled by a bubbler system. The wet well volume is approximately 460 gallons which provides about 9-1/4 minutes of storage at peak flow assuming the wet well is low. A ¾ - inch potable water meter and backflow supplies the potable water needs at the lift station. Slump Block walls on three sides and chain link fencing along the front with two double swing gates provide security and access for the site.

Other issues and observed conditions associated with this station includes lack of proximity switches on check valves of discharge piping to detect pump failure, miscellaneous abandon concrete pads that once held air compressors for air injection into wet well for odor control, a storm water inlet on-site, malfunctioning dehumidifier in the station, a non-functioning Interlink PLC device that was intended for communication with the City SCADA system in the pump dry pit. The City has not received any odor complaints from local residences after the removal of the air injection odor control system.

In addition City staff indicated that there is a proposed development situated downhill from Lift Station No. 10 consisting of approximately 38 new homes that is currently developing sewer disposal alternatives. Previous discussions with the developer have prompted the following possible alternatives for sewer service for the proposed development; 1) Pump flows directly to Lift Station No. 10; 2) Construct a new pump station for the development and run force main past Lift Station No. 10 to gravity; and 3) Direct flows from Lift Station No. 10 to the new pump station at proposed development which would then pump combined flows to Citracado Parkway where it breaks to gravity and flows to the HARRF. Lift Station No. 10 would then be abandoned.

Lift Station No. 11

This is a package-type Smith & Loveless station that pumps to a 6-inch forcemain approximately 0.6 miles long where the flow breaks togravity flow and continues on to Lift Station #9. The site is north of the intersection of Bernardo Avenue and Dexter Place in a residential area. The site address is 2451 Bernardo Avenue. The rated pump capacity is 200 gpm @ 70 ft TDH. The lift station operates with one duty and one stand-by pump and automatically alternates between pumps. The pump motors are 10 Hp and are constant speed. The current peak flows to the station are about 100 gpm. The ultimate projected flow to this station is 150 gpm which is less than the current station capacity. The lift station is in fair shape, although it is older and as expected the metal floor in the pump pit is showing some rust. As mentioned, the Smith & Loveless stations are not popular with City Maintenance staff. Again, the City plans on upgrading the electrical panels and moving them up to the surface for all of the Smith & Loveless packaged stations.

There is a propane 45 KW stand by engine generator with a propane storage cylinder, ATS, electrical power and control equipment, an emergency pump connection and remote monitoring of high level through a radio transmitter. The wet well volume is approximately 1,000 gallons which provides about 10 minutes of storage at peak flow assuming the wet well is low. A 1-1/4 - inch potable water meter and backflow supplies the potable water needs at the lift station. Security fencing and double swing gate and single man gate provide security and access for the site.

Lift Station No. 12

This is a package-type low profile (partially buried) Gorman Rupp station that pumps to a 6-inch, 0.4 mile long forcemain where the flow breaks to gravity flow and then flows to the HARRF. The site is north of Kauana Loa Drive on Country Club Drive at 1400 Country Club Drive. There are two pumps, each pump has a rated pump capacity of 150 gpm @ 91 ft TDH. The lift station operates with one duty and one stand-by pump that automatically alternates between pumps. The pump motors are constant speed 20 Hp . The lift station is in good shape and sits approximately 4 feet below ground with a ladder for pit access. The top portion of the station and lid sits about 1 foot above the ground. This is a smaller station that operates well. The current peak flows to the station are about 100 gpm. The ultimate flow to this station is estimated to be 150 gpm which matches the current station capacity.

The pumps are controlled by a bubbler system consisting of two air compressors and one bubbler line. There is a diesel fueled 40 KW stand by engine generator, ATS, electrical power and control equipment, remote monitoring of high level through a radio transmitter, a surge relief valve at the pumps, and proximity switches on the discharge check valves to detect pump failure. There is an abandoned air compressor panel located in the electrical equipment panel area that is no longer used. This was part of the air injection system for wet well odor control. The air compressors were removed and abandoned concrete pads are all that remain. The wet well volume is approximately 900 gallons which provides about 9 minutes of storage at peak flow assuming the wet well is low. A 3/4 - inch potable water meter and backflow supplies the potable water needs at the lift station. Chain link fencing and a double swing chain link gate provide security and access for the site while a metal cover is provided over the generator and electrical components.

Other issues and observed conditions associated with this station include replacement of the older electrical panels; and removal of the unused air compressor panel and associated piping, pressure gauge, and valve configuration panel. The City has not received any odor complaints from local residences subsequent to the removal of the air injection odor control system. The pumps are controlled by pressure, but it is not equipped to transmit a 4-20mA signal of the water level to the control system. Additionally, the proximity switches on the discharge check valves appear to require some adjustment.

Lift Station No. 13

This is a newer developer built lift station that has a dry pit-wet well arrangement. In an effort to maintain political correctness this station is also referred to as the Eagle Crest Lift Station. The lift station pumps to a 8-inch, 2.6 mile long forcemain then breaks to gravity flow continuing on to Lift Station #1. The site is located near the intersection of San Pasqual Road and Old Milky Way. The site address is 20950 San Pasqual Road. The rated pump capacity is 340 gpm @ 146 ft TDH. The lift station operates with one duty and one stand-by pump which automatically alternates between pumps. The pump motors are 30 Hp and constant speed type. The 8" forcemain is 2.6 miles long. The current peak flow to the station is about 300 gpm which is slightly below the current station capacity. The ultimate projected flow to this station is 600 gpm. Larger pumps will be required to meet the ultimate flow condition.

The pumps are controlled by Buller pressure switches via an Allen Bradley PLC, AB 504. There is a propane fueled 80 KW stand by engine generator with a propane storage cylinder, ATS, electrical power and control equipment, an emergency pump connection, flow meter and remote monitoring of high level through a radio transmitter. The wet well has an operating storage volume of 2,550 gallons and a on-site covered concrete emergency storage tank of 92,200 gallons for a combined storage volume of approximately 94,750 gallons. The total on-site storage provides about 5 hours of storage at peak flow assuming the initial stored volume is low. Slump block walls topped with three strand barb wire fencing surrounds the station fitted with two sets of swinging double chain link entrance gates. Other appurtenances include bioxide storage tank, bioxide injection equipment, safety shower and eye wash, activated carbon odor scrubber with single fan, dry pit ventilation equipment, grated sump and sump pump, electrical equipment cover, on-site ground water well and chlorine injection equipment meet the potable water needs.

Other issues and observed conditions associated with this station include; a discharge piping arrangement in the pump pit is not conducive for running both pumps in the event of an emergency. There is a telephone box on-site but it is not hooked up to the controls. The station is ready for connection to the SCADA system.

Lift Station No. 14

This is the newest lift station and was constructed in 2001 and is equipped with two submersible-type pumps and dual 6-inch forcemains. This station is fairly maintenance free and handles a very low wastewater flow from the residential development in the area. The lift station pumps to one of the 6-inch forcemains approximately 0.7 miles to the intersection of Meadow Creek and Hidden Trails where there are two air vacuum valves (one for each force main) and then flows by gravity to the HARRF. The forcemains are operated with one duty and one stand-by. The site is located at the southern terminus of Oak Valley Lane. The address is 397 Oak Valley Lane. Each pump has a rated pumping capacity of 140 gpm @ 144 ft TDH. The station operates with one duty and one stand-by pump with automatic alternating between pumps. Each pump is equipped with a 25 Hp constant speed motor. The ultimate projected flow to this station is estimated to be _____ gpm. The current peak flows to the station are about ____ gpm. There is a propane fueled 45 KW stand-by engine generator with a propane storage cylinder, backup forcemain, ATS and electrical power and control equipment, an emergency pump connection, non-functioning dual frequency Doppler Polysonic flow meter by Thermo, pressure transducer for pump control, and remote monitoring of high level through a radio transmitter. The wet well storage volume is approximately 1,090 gallons which provides about ____ minutes of storage at peak flow assuming the stored volume is low. Stucco block walls in combination with chain link fencing surrounds the station fitted with two sets of double swinging chain link entrance gates. Other appurtenances include a Biocube™ for odor control, electrical equipment cover consisting of a tiled roof with block wall on three sides, on-site potable water, and 1 ton capacity jib crane without a hoist.

Other issues and observations about Lift Station No. 14 include poorly designed electrical controls that would require increased maintenance personnel and precautions to be NFPA 70E compliant, ineffective weather shelter for electrical equipment, and pump failure detection equipment was not identified at the time of the site visit. The pump control panel has a single disconnect that controls both pumps, requiring both pumps to be turned off when one needs maintenance. Directly behind the front panel is live 480 volts, thereby, requiring an electrician with a special suit to perform maintenance on them in order to meet the new NFPA 70E regulations. The existing panels are anticipated to last about another 10 years before they need to be replaced, but maintenance will be an issue once the new regulations are enforced. Possible options would be to replace the existing control panels in the electrical control area which may present space limitations or put separate pump disconnects at the electrical "wye" near the southeast corner of the lift station.

2.2 Lift Station Evaluation Criteria

Evaluation criteria was developed for this analysis based on generally excepted industry design standards, the City and the evaluator's preferences and experience in wastewater lift station design. Eleven criteria were included. This section presents a brief description of what the criteria covers and in some cases how it was applied. The overall philosophy was that lift stations should be conservatively designed and should incorporate reliability and redundancy features of critical components.

Recommended evaluation criteria for this project include the following:

- Reliability
- Safety
- Pumping Capacity
- Mechanical Equipment
- Electrical Equipment
- SCADA/Instrumentation
- Maintenance
- Visual Assessment
- Wet Well Capacity
- Emergency Storage
- Site Provisions

2.2.1 Reliability

The reliability of the lift station was identified as a significant concern for the City. Reliability features considered in this evaluation included the following:

Redundant Equipment. Lift station reliability should incorporate a redundant pump to handle the expected peak wet weather flow. Where a pump station has two pumps, a single pump should have the capacity to provide the necessary peak flow pumping. With a three pump arrangement, the peak flow pumping capacity should be provided with two pumps. In addition, other critical redundant equipment including electrical, controls and instrumentation should be provided to enhance reliability.

Stand-by Power. Stand-by power is a standard feature in sewer lift stations and provides additional reliability particularly for those stations with limited storage. All of the City's lift stations have stand-by power. Five out of the thirteen lift stations evaluated were equipped with engine generators that operate on diesel fuel, while the remaining stations were equipped with propane engine generators.

Emergency Pump Connection. Another reliability feature that is important for sewer lift stations is a emergency connection point in the station piping system for connecting an emergency portable pump(s). this allows for quickly connecting a portable engine driven pump in the event of a catastrophic failure of the electrical or mechanical systems.

2.2.2 Safety

Safety is always a concern in the wastewater industry. For purposes of this evaluation issues covered under safety included; fall protection, confined space, electrical exposure, site lighting, and safety equipment.

2.2.3 Pumping Capacity

Pumping capacity of the lift station was identified as a significant concern for the City. Standard industry practice is to equip lift stations with firm capacity capable of pumping the peak hour wet weather flows. Firm capacity is defined as the capacity of the pump station with the largest pump out of service. The actual pump station capacity and pumping capacity for each pump within the evaluated lift stations was determined by performing a pump down test.

A pump down test is a timed pumping test that was performed by the City operations staff and W3E/RMC. The purpose of the test is to calculate the volume of fluid pumped over a measured time period. The data collected during the test will also be used to verify the operating wet well capacity. The pumping procedure, methodology and results from the pump down tests are provided in **Attachments C** and **E**.

All of the City's lift stations are equipped with adequate firm capacity to meet the current peak wet weather flows, except for Lift Station Nos. 1, 12 and 13. Lift Station No. 1 pumps 80% of its current peak wet weather flow at firm capacity, whereas, Lift Station Nos. 12 and 13 pump about 70% of the peak flow. When compared to ultimate peak wet weather flow requirements, five lift stations do not have adequate firm capacity. These include Lift Station Nos. 1, 2, 6, 12 and 13. Lift Station No. 1 had the highest deficiency in pumping the ultimate peak flow with the ability to pump only 26% of the projected flow. The next lowest is Lift Station No. 13 which can pump only 33%, followed by Lift Station No. 12 with the ability to pump 47% of the ultimate peak flow. Finally, Lift Station Nos. 6 and 2 are able to pump only 67% and 75% of the ultimate peak flow, respectively. The results of the lift station pumping capacity analysis are summarized in **Table 1**.

Over time and usage, the pumping capacity of the pumps will decrease and ultimately need to be replaced. **Table 1** shows the rated pump capacities of the pumps in each lift station which is based on the design plans, manufacturer's pump data, pump nameplate or City provided data. This was compared to the actual pumping capacity obtained from the pump test results to determine where the pumps operated relative to its original design. Based on the pump test results, the actual pumping capacities of Lift Station Nos. 1, 3, 5 and 14 were relatively close to the rated pump capacities. Lift Station Nos. 2, 6, 7, 8, 10, 11, 12 and 13 were significantly lower than the rated pump capacity. At Lift Station No. 9, the actual pumping capacity was more than double that of the rated pump capacity. As previously stated, there have been several operational issues and various up-grade associated with this Lift Station No. 9. It should also be noted that Lift Station Nos. 3, 5, 7, 8, 9, and 10 have pumps that meet or exceed the current and the projected ultimate peak wet weather flows into these stations.

The capacity of both pumps running simultaneously was also verified during the pump testing. The lift station capacity for this scenario is provided in the right column of **Table 1**. Lift Station No. 3 pump controls are not set up to run both pumps at the same time so data for this station was not applicable. Also Lift Station No. 1 typically runs 2 sets of pump systems simultaneously. We did not attempt to operate the three sets of pumps for this station; therefore, the data for the firm pump station capacity and two pumps running remained the same.

Table 1: Lift Station Pumping Capacity Analysis

Lift Station	Avg Dry Weather Flow	Rated Pump Capacity	Firm Pumping Capacity	Current			Ultimate			Capacity with Both Pumps On
				Peak Wet Weather Flow	Capacity Status	Additional Capacity Required for PWWF	Peak Wet Weather Flow	Capacity Status	Additional Capacity Required for PWWF	
(No.)	(GPM)	(GPM)	(GPM)	(GPM)		(GPM)	(GPM)		(GPM)	(GPM)
1	580	1,100	1,040	1,250	Inadequate	210	4,000	Inadequate	2,960	1,040
2	66	215	150	150	Adequate	0	200	Inadequate	50	180
3	747	2,050	2,120	1,600	Adequate	0	1,800 to 2,000	Adequate	0	N/A
5	57	225	240	130	Adequate	0	200	Adequate	0	320
6	26	120	80	60	Adequate	0	120	Inadequate	40	100
7	10	160	60	25	Adequate	0	50	Adequate	0	67
8	32	200	160	75	Adequate	0	150	Adequate	0	210
9	111	250	510	250	Adequate	0	400	Adequate	0	445
10	21	230	160	50	Adequate	0	75	Adequate	0	210
11	43	200	150	100	Adequate	0	150	Adequate	0	160
12	43	150	70	100	Inadequate	30	150	Inadequate	80	90
13	134	340	200	300	Inadequate	100	600	Inadequate	400	220
14	DNP	140	155	DNP	DNP	DNP	DNP	DNP	DNP	180

Notes:
1. Current and ultimate peak wet weather flows were provided by the City.
2. Current firm pumping capacity assumes the largest pump is out of service and pump capacity is based on actual pump test data.
3. DNP denotes data not provided by City.
4. Current firm pumping capacity assumes Pump Set No. 1 is out of service with Pump Set Nos. 2 and 3 running in parallel.
5. Rated pump capacity was either based on design plans, obtained from City or manufacturer pump curve data.

By running this test, it was apparent that some of these stations did not provide significant additional capacity benefit by operating both pumps. This appears to be the case for Lift Station Nos. 7, 9, 11 and 13. For Lift Station No. 9, when running both pumps, the capacity actually decreased by 65 gpm.

2.2.4 Mechanical Equipment

This criterion covers the age and physical condition of the piping, valves, pumps and other ancillary equipment based on a visual assessment and discussions with staff. The results of the age and physical condition assessment are incorporated in Section 3. Calculations were also performed to compare the velocities through the suction and discharge piping as well as the forcemain based on the following velocity criteria.

a. Pump suction maximum velocity of 6 feet per second (fps).
b. Discharge piping maximum velocity of 10 fps.
c. Forcemain piping maximum velocity of 8 fps.

Suction and Discharge Piping Analysis. The purpose of this analysis is to determine if the pumps in each lift station evaluated have adequately sized suction and discharge piping.

The function of the suction piping is to supply an evenly distributed flow of liquid to the suction side of the pump, with sufficient pressure to the pump to avoid cavitation and related damage in the pump. An uneven flow distribution is characterized by strong local currents, swirls and/or an excessive amount of entrained air. The ideal approach is a straight pipe (of some minimum length), coming directly to the pump, with no turns or flow disturbing fittings close to the pump. Furthermore, the suction piping should be at least as large as the pump suction nozzle and be sized to ensure that the maximum liquid velocity at any point in the inlet piping does not exceed 6 fps. Failure of the suction piping to deliver the liquid to the pump in this condition can result in one or more of the following pump problems:

- Noisy operation.
- Random axial load oscillations.
- Deterioration in performance.
- Premature bearing and/or seal failure
- Cavitation damage to the impeller and inlet portions of the casing.
- Occasional damage from liquid separation on the discharge side.

The discharge velocity of the pump impacts the system piping size and is normally dictated by friction losses. This does have an impact on the lift cycle cost of the pumps and the cost of pumping. The maximum recommended velocity at any point in the pump discharge piping is 10 fps.

The results of this analysis are provided in **Table 2**. Lift Station No. 5 is only slightly over the maximum suction velocity which can cause some performance deterioration and/or reduce the life expectancy and reliability rating for this station. On the discharge piping analysis, Lift Station No. 3 exceeded the maximum discharge velocity criteria with Pump No. 2 having the highest velocity of 16.1 fps. The major impact this would have on the lift station is life cycle cost due to power consumption.

Table 2: Suction and Discharge Piping Analysis

Lift Station	Suction Size	Discharge Size	Pump No. 1 Capacity			Pump No. 2 Capacity		
			Flow Capacity	Suction Velocity	Discharge Velocity	Flow Capacity	Suction Velocity	Discharge Velocity
(No.)	(IN)	(IN)	(GPM)	(FPS)	(FPS)	(GPM)	(FPS)	(FPS)
1	8	8	870	5.6	5.6	850	5.4	5.4
2	N/A	6	160	--	1.8	150	--	1.7
3	N/A	8	2120	--	13.5	2520	--	16.1
5	4	4	245	6.3	6.3	240	6.1	6.1
6	3	4	90	4.1	2.3	80	3.6	2.0
7	3	4	60	2.7	1.5	65	3.0	1.7
8	4	6	170	4.3	1.9	160	4.1	1.8
9	8	6	510	3.3	5.8	515	3.3	5.8
10	4	4	170	4.3	4.3	160	4.1	4.1
11	4	4	160	4.1	4.1	150	3.8	3.8
12	3	4	80	3.6	2.0	70	3.2	1.8
13	8	8	210	1.3	1.3	200	1.3	1.3
14	N/A	4	160	--	4.1	155	--	4.0

Notes:

1. Capacity of pumps is based on pump test results.
2. Suction velocities were not calculated for lift stations 2, 3 and 14 because these are submersible pumps.
3. Lift station No. 3, Pump Set No. 3 has pump capacity of 840 gpm and suction and discharge velocities of 9.5 fps for both.

Forcemain Analysis. The existing forcemain size at each lift station was evaluated based on the pumped fluid velocity and a comparison of pipe friction loss between current and ultimate flow conditions. A minimum flow velocity of 2 feet per second is required to minimize solids settling in the pipeline.

Generally, a maximum velocity of 8 fps is recommended to provide for more cost effective pumping, reduce excessive scouring of the force main and possibly extend the life expectancy of other system components. A comparison of pipe friction losses between current and ultimate conditions was made to identify any significant increases that may warrant upsizing of the force main, installation of a parallel force main or the installation of new pumps. Results of this force main analysis are provided in **Table 3**.

Based on the forcemain analysis, Lift Station Nos. 1, 2, 7, 8, and 10-13 did not meet the minimum 2 fps velocity requirement under the actual pumping capacity rates. Of these the worst was Lift Station No. 12 which had a velocity less than 1 fps. Under "ultimate" peak flow conditions, five of the lift stations (1, 7 and 11-13) fell below the minimum velocity requirement. Low velocities in the forcemain will require more maintenance for City operation staff. Only Lift Station No. 3 was slightly above the maximum velocity requirement of 8 fps.

2.2.5 Electrical Equipment

This criterion covers the age/physical condition of equipment and compatibility with City's desired standards for electrical components. The results of the age and physical condition assessment are incorporated in Section 4. Many of the City's older stations will require replacement of electrical control panels. They are outdated and inconsistent with the City's plan to standardize the equipment for ease of maintenance and operation. Additionally, the Smith & Loveless below-ground package lift stations require confined space entry procedures be followed to repair and maintain the control panels. This requires at least two employees to visit the site to perform a one man activity. The below grade electrical panels also present a greater safety concern as well as allow for the potential of failure due to station flooding. Relocation of the electrical equipment from below ground in the pump pit to above ground for these stations is highly recommended.

2.2.6 SCADA/Instrumentation

This section covers the criterion for the SCADA/Instrumentation systems. Ideally the City would like to have a PLC based controls and instrumentation system that include telemetry for remote control of

Table 3: Force Main Analysis

Lift Station	Force Main Size	Length	Current - One Pump Operation			Current - Two Pump Operation			Ultimate		
			Pump Capacity	Velocity	Pipe Friction Loss	Pump Capacity	Velocity	Pipe Friction Loss	Peak Wet Weather Flow	Velocity	Pipe Friction Loss
(No.)	(IN)	(FT)	(GPM)	(FPS)	(FT/1000 FT)	(GPM)	(FPS)	(FT/1000 FT)	(GPM)	(FPS)	(FT/1000 FT)
1	16	9,913	840	1.3	1	1,040	1.7	1	4,000	6.4	**14**
2	6	2,643	150	1.7	4	180	2.0	5	200	2.3	6
3	10	2,915	2,120	8.7	**42**	N/A	N/A	N/A	2,120*	8.7	**42**
5	6	445	240	2.7	9	320	3.6	**15**	240*	2.7	9
6	4	1,343	80	2.0	9	100	2.6	**13**	120	3.1	**18**
7	4	1,060	60	1.5	5	67	1.7	6	60*	1.5	5
8	6	2,883	160	1.8	4	210	2.4	7	160*	1.8	4
9	6	3,000	510	5.8	**37**	445	5.0	**28**	510*	5.8	**37**
10	6	2,387	160	1.8	4	210	2.4	7	160*	1.8	4
11	6	2,569	150	1.7	4	160	1.8	4	150	1.7	4
12	6	1,526	70	0.8	1	90	1.0	1	150	1.7	4
13	8	13,330	200	1.3	2	220	1.4	2	600	3.8	**12**
14	4	2,829	155	4.0	**29**	180	4.6	**38**	DNP	DNP	DNP

Notes:

1. Length of pipe was obtained from Record Drawings and previous design plans.
2. Frictional headloss calculated using Hazen Williams equation, assume C=100.
3. Friction headloss was increased by 5% to account for minor losses.
4. Lift Station No. 1 shows a two-pump operation capacity that was observed during site visit.

   The capacities with two pumps operating for the remaining lift stations will be provided after the pump tests are performed.
5. DNP denotes data not provided.
6. Lift Station No. 3 does not have the capability to run both pumps simultaneously.

* If the projected ultimate peak wet weather flow to the station was less than the current firm pumping capacity, the current firm pumping capacity was presented.

equipment and monitoring for alarms at each lift station. Currently, the City does not have the capability to have remote continuous control and monitoring of any of the lift stations with the HARRF SCADA system. The City is in the process of evaluating the equipment and communication methodology necessary to incorporate the lift stations into the SCADA system. Some of the newer stations are better equipped for connection to the SCADA system than the older ones.

To date, the only remote communication available between the lift station and an operator at the HARRF is through the preset alarms and radio telemetry. There are two stations that may be equipped with the ability to use a "hard wired" telephone service to be used as backup but these will need to be verified to determine if they are in service. Other forms of alarm notification that can serve as backup communication methods would be a leased telephone line to a central service that would contract an on-call person, automatic dialers that would call the phone number of an on-call person through a telephone line, and communication through cell phone.

All of the lift stations are equipped with multiple alarms that notify the plant operator through radio telemetry when an alarm is triggered. The following are the recommended minimum alarms that each pump station should have:

- High level in wet well (indicates a pump failure or excessive influent flows)
- Low level in wet well (indicates that a pump did not shutoff)
- Water in dry pit and/or valve pit (indicates a leak in the discharge piping)
- Pump failed (for each pump)
- Engine generator running (indicates that the power failed)
- Intrusion alarm (indicates security breach)

For a more robust monitoring system back-up instruments provide additional reliability. If there are not back-up instruments it is important that the high level and low level alarms not be connected through the pump controller so that they will still function even if the pump controller fails.

2.2.7 Maintenance

This section covers the criterion for system maintenance and includes; space/accessibility, availability of service and parts and lifting devices and other equipment or procedures related to maintenance. The results of the findings for maintenance issues are incorporated in Section 3.

One of the major maintenance concerns is the confined-space entry required at the Smith & Loveless package lift stations. Since these lift stations were constructed, OSHA requirements have become more stringent. Considerable time and staffing resources are required to perform routine operations and maintenance. Removal of pumps for repair is very difficult and time consuming. Relocation of controls is recommended. Additionally, the lack of access to mechanical equipment in the Gorman-Rupp above-ground fiberglass structures requires removal of the enclosure for repair or maintenance.

2.2.8 Visual Assessment

This section covers the criterion for the visual assessment of the stations age and condition and includes; observable condition of station concrete wet well walls, floors slabs and ceiling and other equipments and structures at the station. The results of the findings for visual assessment issues are incorporated in Section 3.

2.2.9 Wet Well Capacity

The size of each lift station wet well was evaluated based on the pump capacity and minimum cycle time for pumps. Acceptable cycle times for various pump motor horse power are based on typical industry standards. The calculated pump cycle time was determined using the formula below. The operating wet well volume for each lift station was provided by the City.

$$T = Q/(4*Vmin)$$

Where:

Q = nominal pump capacity in gallons per minute

T = cycle time in minutes

V = required operating volume in gallons

The analysis of the lift station wet well sizing is shown in **Table 4**. The pump cycle time was evaluated based on the firm pumping capacity and the size of the pump motor to determine if there is adequate time between pump starts to minimize overheating and the excessive wear on the pumps. The pump cycle times are presented without considering automatic pump alternating. This approach is considered most conservative as in a two pump arrangement with one duty and one stand-by pump; one pump may be out of service. If we considered automatic operation then the cycle times would double. In addition, although submersible pumps generally do not have issues with overheating they still suffer premature wear and tear due to inadequate cycle times and were evaluated similarly.

Based on this evaluation, the wet well volumes in Lift Station Nos. 3, and 8- 10 are undersized. Inflow variations throughout the day can result in shortened cycle times which can reduce the life of the pump motor. At the time of the pump test for Lift Station No. 14, the City was in the process of raising the pump lag on level in the wet well to minimize exposure of the submersible pumps while they are in operation. This would increase the operational wet well volume that would improve the pump cycle time.

Table 4: Lift Station Wet Well Capacity

Lift Station	Firm Pump Capacity	Pump Motor Rating	Estimated Operational Wet Well Volume	Pump Cycle Time	Status
(No.)	(GPM)	(HP)	(Gallons)	(Minutes)	
1	1,040	75	33,000	127	Adequate
2	150	15	1,900	51	Adequate
3	2,120	125	7,000	14	Inadequate
5	240	7.5	790	14	Adequate
6	80	7.5	720	36	Adequate
7	60	7.5	480	32	Adequate
8	160	25	400	10	Inadequate
9	510	60	2,300	18	Inadequate
10	160	10	460	12	Inadequate
11	150	10	1,000	27	Adequate
12	70	20	900	51	Adequate
13	200	30	2,550	51	Adequate
14	155	25	564	15	Adequate

Notes:

1. $T = 4 * V_{min} / Q$ where,

   V_{min} = Minimum wet well volume required, gallons

   Q = Nominal Pump Capacity, gpm

   T = Pump Cycle Time, minutes (Time between Pump Starts)
2. Estimated operational wet well volume was provided by the City, except for Lift Station No. 14 which is calculated based on the Lead On and Lead/Lag Off pump setting levels.
3. Firm pump capacities are based on actual pump test results.
4. DNP denotes data not provided by City.

2.2.10 Emergency Storage Capacity

Emergency storage is that storage volume available that is not part of the operational storage. Emergency storage is utilized in the event of pump failure or equipment failure that results in the inability to pump the sewage or reduces the pumping capacity. The required storage volume can be reduced if an emergency standby engine generator is present at the lift station. All of the City's lift stations include a stand-by generator and therefore have a reduced emergency storage volume requirement. A combination of emergency generator capacity and emergency storage provides the flexibility for operation under a wide range of abnormal operating conditions. Emergency storage may include any combination of the following storage options; a separate storage basin, the wet well volume from "lag pump on" to just below point of overflow or sewage spill, and storage within upstream sewer pipes. In this study to be conservative, the upstream sewer pipes were not included in the emergency storage capacity analysis.

Sewer lift stations with capacities of 1 mgd or greater are required to have minimum of 6 hours of emergency storage at average dry weather flow per Regional Water Quality Control Board requirements. Lift Station No. 3 is the only station that is above the 1mgd threshold. However, there are no established storage requirements for lift stations less than 1 mgd. Therefore, the remaining, smaller capacity lift stations in this study are based on 120 minutes of average dry weather flow in accordance with industry standards for stations with installed emergency generators. The actual emergency storage volumes at each lift station as well as the desired emergency storage requirements are provided in **Table 5**.

The results of the emergency storage analysis indicate that additional emergency storage is required for at least 7 of the lift stations evaluated, which includes Lift Station Nos. 1, 2, 3, 5, 9, 11 and 12. Lift Stations Nos. are marginal but are both smaller les critical stations. The available emergency storage for Lift Station No. 14 could not be calculated because the average dry and peak wet weather flows to this station was not provided. Only three of the thirteen lift stations evaluated are equipped with dedicated emergency storage, these include Nos. 1, 3, and 13. For the remaining lift stations, the available emergency storage volume available was estimated by taking the total wet well volume minus the wet well operational storage volume.

2.2.11 Site Provisions

This section covers the criterion for the site provisions category and includes; age and condition of key site components such as security, aesthetics, access road, odor, parking. The results of the findings for the evaluation of site provisions are incorporated in Section 3.

3 Evaluation Matrix

An evaluation matrix was developed that summarizes the results of the lift station evaluation process. Each lift station was evaluated relative to the eleven criteria discussed in Section 2.2. A relative importance weight factor was developed for each of the eleven criteria. This importance factor or importance multiplier was applied to the score of each evaluation criterion with respect to the relative importance of that category. The higher the importance factor the more important the criteria.

Table 5: Lift Station Emergency Storage Analysis

Lift Station	Average Dry Weather Flow	Average Dry Weather Flow	Peak Wet Weather Flow	Recommended Storage Criteria	Emergency Storage Volume		Status
					Recommended Minimum	Volume Available	
(No.)	(MGD)	(GPM)	(GPM)		(Gallons)	(Gallons)	
1	0.84	580	1,250	6 hrs	208,705	93,100*	Inadequate
2	0.10	66	150	120 min	7,906	3,608	Inadequate
3	1.08	747	1,600	6 hrs	268,838	59,749*	Inadequate
5	0.08	57	130	120 min	6,827	2,211	Inadequate
6	0.04	26	60	120 min	3,089	2,748	Marginal
7	0.01	10	25	120 min	1,259	1,282	Adequate
8	0.05	32	75	120 min	3,884	3,188	Marginal
9	0.16	111	250	120 min	13,351	2,834	Inadequate
10	0.03	21	50	120 min	2,562	3,360	Adequate
11	0.06	43	100	120 min	5,216	2,468	Inadequate
12	0.06	43	100	120 min	5,216	3,683	Inadequate
13	0.19	134	300	120 min	16,096	110,589*	Adequate
14	0.11	DNP	DNP	120 min	DNP	3,542	Unknown

Notes:

1. The average dry weather flow is calculated using the peaking factor equation and peak wet weather flows from the *Wastewater Collection System Master Plan Update, November 2005.*

$$Q_{peaked} = 2.17\ (Q_{average})^{0.975}$$

2. Recommended storage criteria for lift stations ≥ 1 mgd is 6 hours of average dry weather flow per regulatory standards. Includes Lift Station No. 1.
3. Recommended storage criteria for lift stations < 1 mgd is 120 minutes of average dry weather flow per industry standards.
4. Available dedicated emergency storage volume was provided by the City or obtained from record drawings. It does not include available wet well volume above wet well operational storage, which will be incorporated after actual pump start/stop data is provided by City.
5. DNP denotes data not provided by City.
6. Emergency storage volume shown in Volume Available column is incomplete until pump level control points are obtained.
7. * Denotes the emergency storage volume available is from a dedicated emergency storage on-site plus available wet well storage volume. The emergency storage volume available for the other lift stations is based on wet well storage volume only which does not include the operational wet well volume.

Reliability, pumping capacity and electrical equipment were weighted most heavily. The criteria and importance factors sorted from most important to least important are presented in **Table 6**.

Each lift station was given a score for each criteria relative to need, with a score of 5 to indicate a severe need of upgrade and 1 indicating acceptable conditions for the associated category. The worst possible score a lift station can obtain is 50 and the best possible score would be 10. The resulting matrix is sorted from worst to best of the total scores for each lift station and presented in **Table 7**.

Lift Station No. 9 had the worst possible score of all of the lift stations with a score of 34.9 followed closely by Lift Station No. 12 with 34.8. The next highest ranked lift stations with scores between 33.7 and 31.3 were Nos. 2, 3, 8. Lift station Nos. 1, 6, 10, 14, 13 and 11 had scores between 30.6 and 26.2. The best ranked stations requiring the least amount of improvements were Nos. 5, and 7 with scores between 18 and 23.3 respectively.

Table 6: Lift Station Evaluation Relative Importance Factors

No.	Criteria	Relative Importance Factor
1.	Reliability	1.64
3.	Pumping Capacity	1.64
5	Electrical Equipment	1.64
7.	Maintenance	1.27
4.	Mechanical Equipment	1.09
9.	Wet Well Capacity	0.91
6	SCADA/Instrumentation	0.55
8.	Visual Assessment	0.55
2.	Safety	0.36
10.	Emergency Storage	0.18
11.	Site Provisions	0.18

Table 7

Lift Station Evaluation Condition Matrix

		Reliability	Safety	Pumping Capacity	Mechanical Equipment	Electrical Equipment	SCADA/Instrum entation	Maintenance	Visual Assessment	Wet Well Capacity	Emergency Storage	Site Provisions	TOTAL
Lift Station Number	Relative Importance Factor	1.64	0.36	1.64	1.09	1.64	0.55	1.27	0.55	0.91	0.18	0.18	
9		4	4	1	3	4	5	4	3	5	5	3	34.9
12		3	3	5	3	5	5	2	3	1	4	3	34.8
2		2	4	3	5	5	4	3	4	1	4	3	33.7
3		4	3	1	2	5	5	3	2	5	5	2	33.1
8		1	4	1	4	4	5	4	4	5	3	3	31.3
1		4	2	4	3	4	4	1	3	1	4	1	30.6
6		3	3	4	2	3	5	4	1	1	3	1	29.7
10		1	4	1	3	4	5	4	2	4	1	3	27.8
14		1	2	3	2	5	5	2	2	3	3	2	27.7
13		4	2	5	2	2	4	2	1	1	1	1	27.5
11		1	4	1	3	4	5	4	3	1	5	2	26.2
7		1	3	1	3	3	5	4	2	1	1	4	23.3
5		1	2	1	2	1	5	3	1	2	5	2	18.0

Reliability - Stand by power, firm backup
Safety - Fall protection, confined space, electrical exposure, etc.
Pumping Capacity - Ability to meet peak wet weather flows
Mechanical Equipment - Age/physical condition of the piping, valves, pumps and other ancillary equipment
Electrical Equipment - Age/physical condition of equipment and compatibility with City's desired standards
SCADA/Instrumentation - Existence/condition of SCADA system, adequacy/condition of existing instrumentation
Maintenance - Space/accessibility, availability of service/parts, lifting devices
Visual Assessment - Observable condition of station/wet well walls, floors and ceiling
Wet Well Capacity - Operational storage relating to pump cycle times relative to industry standards
Emergency Storage - Volume of emergency storage as compared to desired volume
Site Provisions - Security, aesthetics, access road, odor, parking

4 Summary of Lift Station Deficiencies and Issues

A summary of deficiencies and issues associated with each lift station based on the aforementioned evaluations is provided below.

Lift Station No. 1

- Inadequate firm capacity for "current" peak wet weather flow
- Inadequate firm capacity for "ultimate" peak wet weather flow
- Inadequate emergency storage capacity
- Instrumentation upgrade for control/monitoring with SCADA system
- Scum/solids blanket buildup in wet well
- Forcemain velocity < 2fps at current pump capacity

Lift Station No. 2

- Electrical systems need replacing
- Inadequate emergency storage capacity
- Instrumentation upgrade for control/monitoring with SCADA system
- Inadequate firm pump capacity for "ultimate" peak wet weather flow
- Forcemain velocity < 2fps at current pump capacity
- Corroded piping and peeled coating in wet well
- Occasional pump failure as a result of clogging
- Security issues

Lift Station No. 3

- Electrical systems need replacing
- Instrumentation upgrade for control/monitoring with SCADA system
- Difficult access to electrical equipment
- Undersized engine generator
- Lack of automated pressure control in the surge tank
- Scum/solids buildup in wet well from Lift Station No. 1
- Inadequate operational wet well capacity
- Inadequate emergency storage capacity
- High velocity (13.1 fps) through 8-inch discharge piping
- Stucco repair needed

Lift Station No. 5

- Lack of proximity switches on the discharge check valves for pump failure detection
- Inadequate emergency storage capacity
- Instrumentation upgrade for control/monitoring with SCADA system
- Marginally high suction velocities
- Water intrusion in flow meter vault observed during site visit

Lift Station No. 6

- Inadequate firm pump capacity for "ultimate" peak wet weather flow
- Difficult access to equipment within fiberglass above-ground dog-house enclosure
- Inadequate emergency storage capacity
- Instrumentation upgrade for control/monitoring with SCADA system
- Regular pump failure as a result of clogging from rags

Lift Station No. 7

- Instrumentation upgrade for control/monitoring with SCADA system
- Forcemain velocity < 2fps at current pump capacity
- Cracks in concrete pad of lift station
- Settling of the station in direction of the nearby creek

Lift Station No. 8

- Access to pumps and controls is through confined space entry and below ground
- Electrical panels need to be upgraded and moved above ground
- Inadequate operational wet well capacity
- Marginally adequate emergency storage provided on-site
- Instrumentation upgrade for control/monitoring with SCADA system
- Rusting of steel floor in pump pit
- Difficulty removing pumps for maintenance
- Pump pit ventilation not functioning
- Forcemain velocity < 2fps at current pump capacity
- Several forcemain breaks near lift station entrance

Lift Station No. 9

- Access to pumps controls is through confined space entry and below ground
- Electrical overheating and overloading of pumps
- Electrical panels need to be upgraded and moved above ground
- Instrumentation upgrade for control/monitoring with SCADA system
- Inadequate emergency storage capacity
- Inadequate operational wet well capacity
- Rusting of steel floor in pump pit
- Difficulty removing pumps for maintenance

Lift Station No. 10

- Electrical panels need to be upgraded and moved above ground
- Inadequate operational wet well capacity
- Instrumentation upgrade for control/monitoring with SCADA system
- Access to pumps controls is through confined space entry and below ground
- Rusting of steel floor in pump pit
- Difficulty removing pumps for maintenance
- Forcemain velocity < 2fps at current and ultimate pump capacity (160 gpm at 1.8 fps)

Lift Station No. 11

- Access to pumps controls is through confined space entry and below ground
- Electrical panels need to be upgraded and moved above ground
- Inadequate emergency storage capacity
- Instrumentation upgrade for control/monitoring with SCADA system
- Rusting of steel floor in pump pit
- Difficulty removing pumps for maintenance
- Forcemain velocity < 2fps at current pump capacity

Lift Station No. 12

- Electrical systems need replacing
- Instrumentation upgrade for control/monitoring with SCADA system
- Inadequate emergency storage capacity
- Inadequate firm capacity for "current" peak wet weather flow
- Inadequate firm pump capacity for "ultimate" peak wet weather flow
- Forcemain velocity < 2fps at current pump capacity (0.8 fps)

Lift Station No. 13

- Electrical systems need replacing
- Instrumentation upgrade for control/monitoring with SCADA system
- Inadequate firm capacity for "current" peak wet weather flow
- Inadequate firm pump capacity for "ultimate" peak wet weather flow
- Forcemain velocity < 2fps at current pump capacity

Lift Station No. 14

- Electrical controls not compliant with latest NFPA 70E electrical code.
- Pump control panel has only one disconnect for both pumps
- Ineffective shelter for electrical equipment
- Verify pump failure detection method or recommend one if not currently available.
- No emergency storage provided on-site, adequacy is not known without flow data
- Instrumentation upgrade for control/monitoring with SCADA system

5 Recommended Lift Station Upgrades and Improvements

Based on the evaluation of the lift stations the following improvements are recommended for the five (5) worst ranked stations. These include Lift Station Nos. 9, 12, 2, 3, and 8 in decreasing order of priority. The recommended improvements and estimated capital costs for these stations are identified as follows.

Lift Station No. 9.

No.	Recommended Improvement	Priority Status	Engineer's Opinion of Probable Cost
1.	Provide emergency storage capacity of 10,500 gallons	High	$250,000
2.	Provide additional operational wet well capacity of 1,500 gallons	High	$120,000
3.	Relocate above ground and replace electrical equipment	High	$50,000
4.	Instrumentation upgrade for remote control and monitoring	Medium	$50,000
5.	Replace the bubbler system with ultrasonic level sensor for pump control	Low	$7,000
	Total for Lift Station No. 9 Improvements		**$477,000**

Lift Station No. 12

No.	Recommended Improvement	Priority Status	Engineer's Opinion of Probable Cost
1.	Replace outdated electrical equipment	High	$30,000
2.	Replace pumps to increase firm pumping capacity to 150 gpm[1] to meet current and ultimate PWWF.	High	$20,000
3.	Instrumentation upgrade for remote control and monitoring	Medium	$50,000
4.	Provide additional 1,600 gallons of emergency storage	Low	$60,000
5.	Remove air compressor panel, piping and appurtenances from abandoned air injection system	Low	$8,000
	Total for Lift Station No. 12		**$168,000**

1 Station does not meet current PWWF, 150 gpm is the projected ultimate PWWF to this station. However, the forcemain velocity will only be 1.7 fps at this flow. Consider increasing to 180 gpm to provide minimum 2.0 fps.

Lift Station No. 2.

No.	Recommended Improvement	Priority Status	Engineer's Opinion of Probable Cost
1.	Replace outdated electrical equipment	High	$30,000
2.	Provide additional emergency storage of 4,300 gallons[1]	High	$125,000
3.	Instrumentation upgrade for remote control and monitoring	Medium	$50,000
4.	Replace bubbler system with ultrasonic level sensor	Medium	$3,000
5.	Replace pumps to increase firm pumping capacity to 200 gpm[2] to meet ultimate PWWF[3].	Low	$30,000
6.	Re-coating in wet well	Low	$9,000
7.	Replace corroded discharge piping in wet well	Low	$7,000
	Total for Lift Station No. 2		**$254,000**

1 Consider converting abandoned dry pit to emergency storage to provide additional storage to reduce cost. Estimated cost of conversion is $40,000.

2 Existing pumps are rated at 215 gpm and are only pumping 150 gpm.

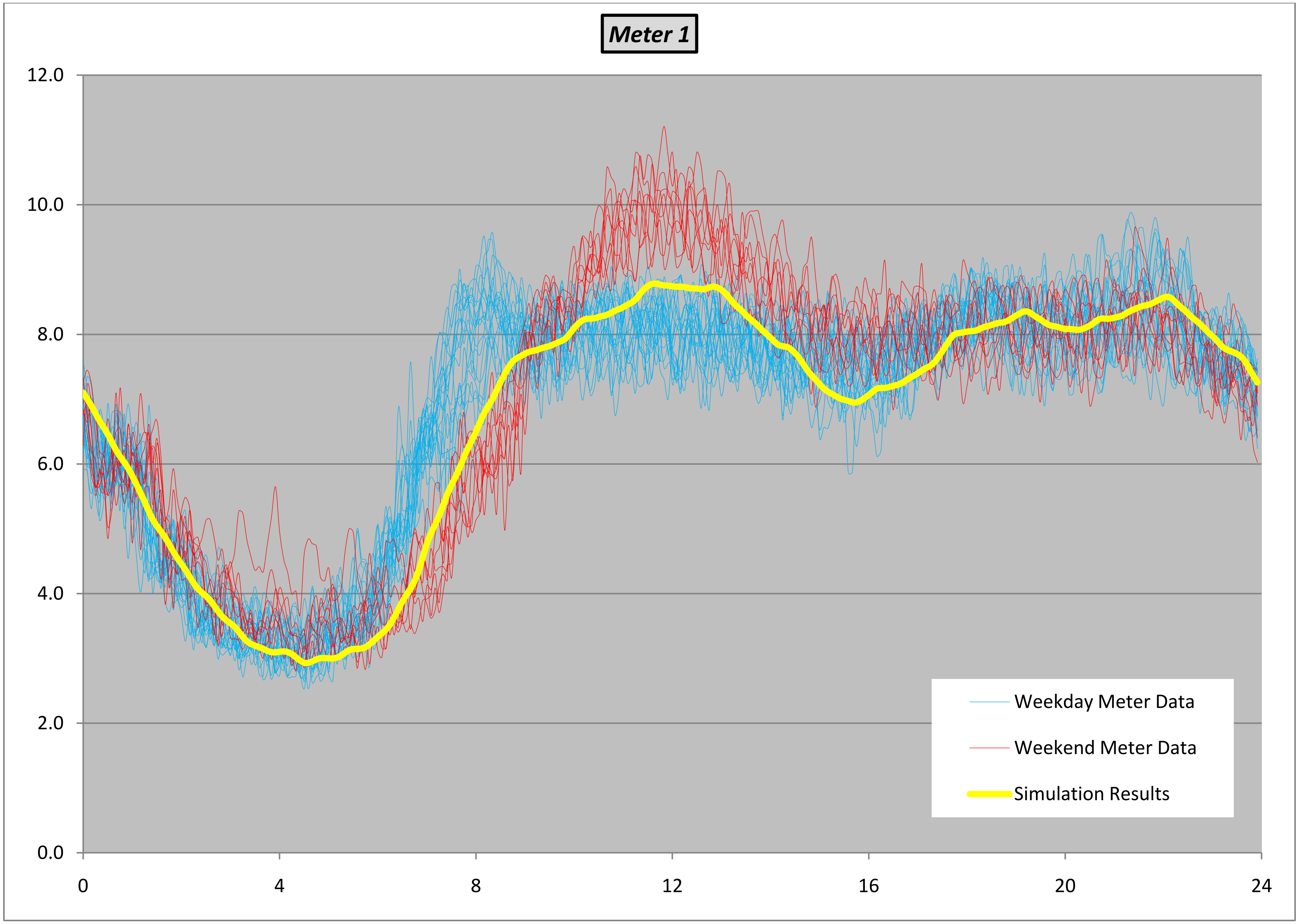
3 For a more robust station consider installing additional submersible pumps in converted dry pit for added redundancy.

Lift Station No. 3.

No.	Recommended Improvement	Priority Status	Engineer's Opinion of Probable Cost
1.	Replace outdated electrical equipment	High	$110,000
2.	Provide emergency storage capacity of 210,000 gallons	High	$380,000
3.	Provide additional operational wet well capacity of 12,000 gallons	High	$160,000
4.	Instrumentation upgrade for remote control and monitoring	Medium	$50,000
5.	Rehabilitate surge tank controls	Low	$10,000
6.	Provide mitigation to control scum/sludge blanket buildup in wet wells	Low	$6,000
7.	Replace discharge piping to lower velocity	Low	$20,000
8.	Repair stucco various locations	Low	$8,000
	Total for Lift Station No. 3		**$744,000**

Lift Station No. 8.

No.	Recommended Improvement	Priority Status	Engineer's Opinion of Probable Cost
1.	Provide additional operational wet well capacity of 750 gallons	High	$10,000
2.	Relocate above ground and replace electrical equipment	High	$50,000
4.	Instrumentation upgrade for remote control and monitoring	Medium	$50,000
5.	Replace the bubbler system with ultrasonic level sensor for pump control	Low	$7,000
6.	Miscellaneous site improvements	Low	$5,000
	Total for Lift Station No. 8 Improvements		**$122,000**



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10.0
8.0
6.0
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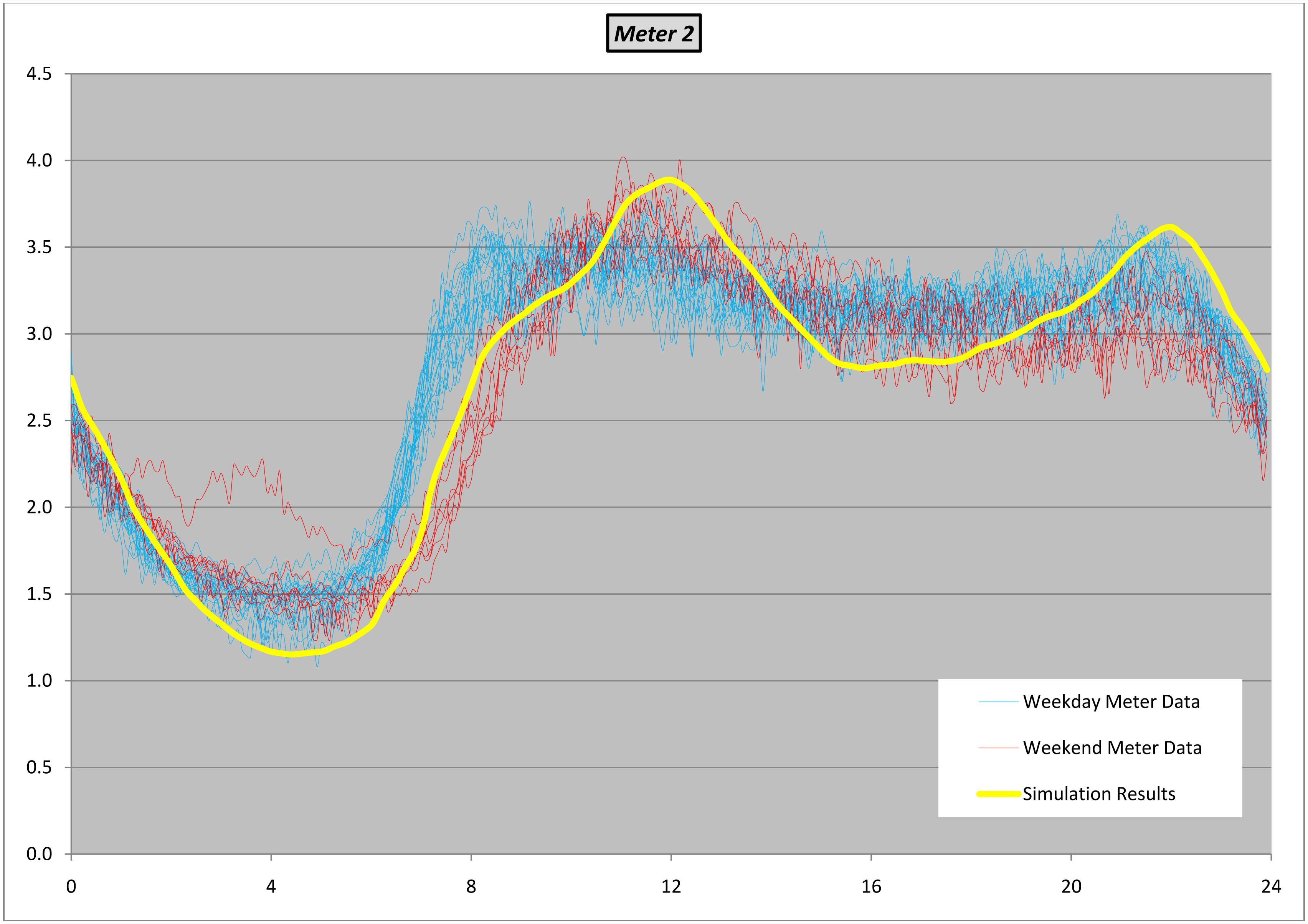
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results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3.5
3.0
2.5
2.0
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1.0
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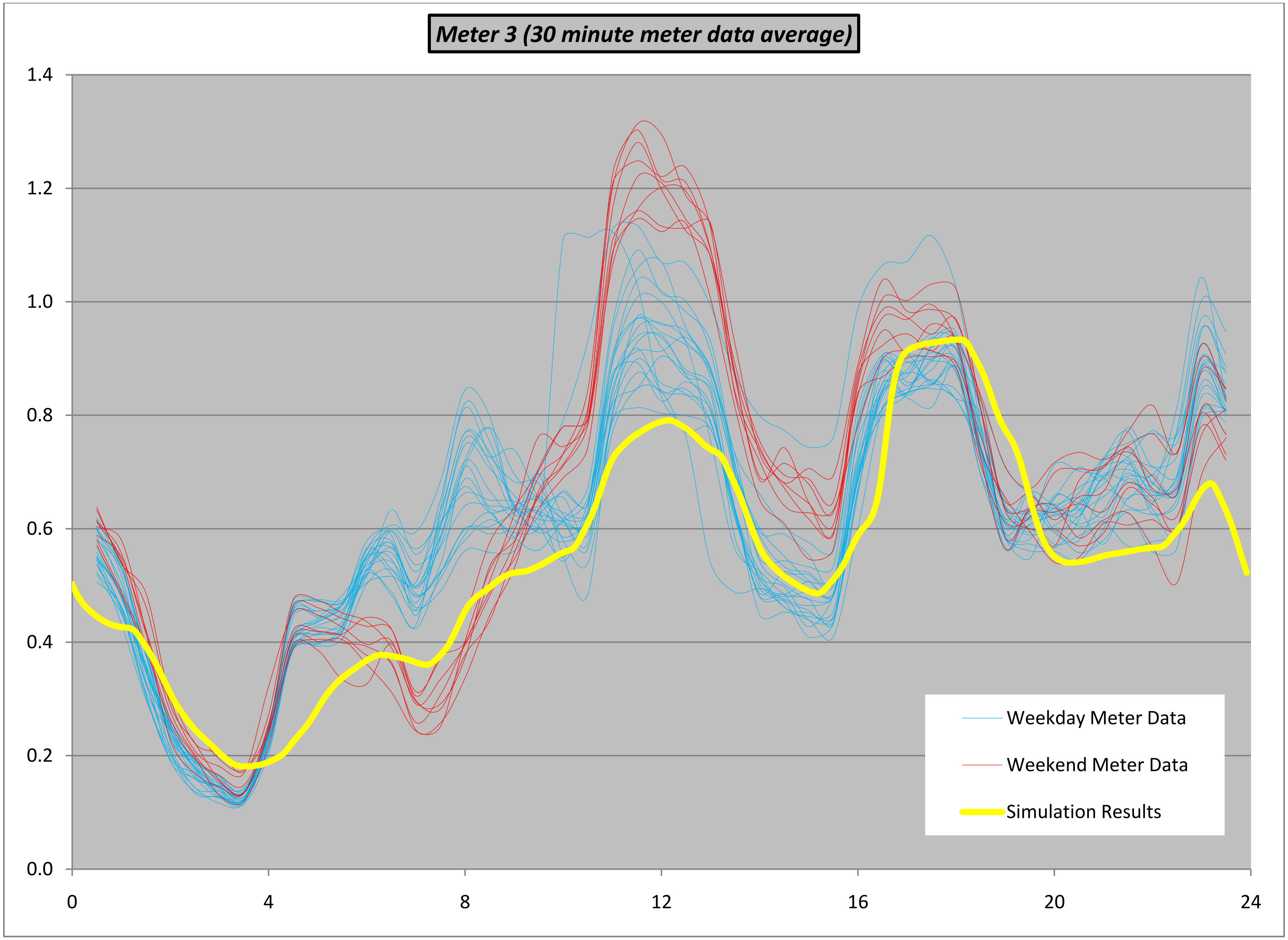
0.0
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results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0.6
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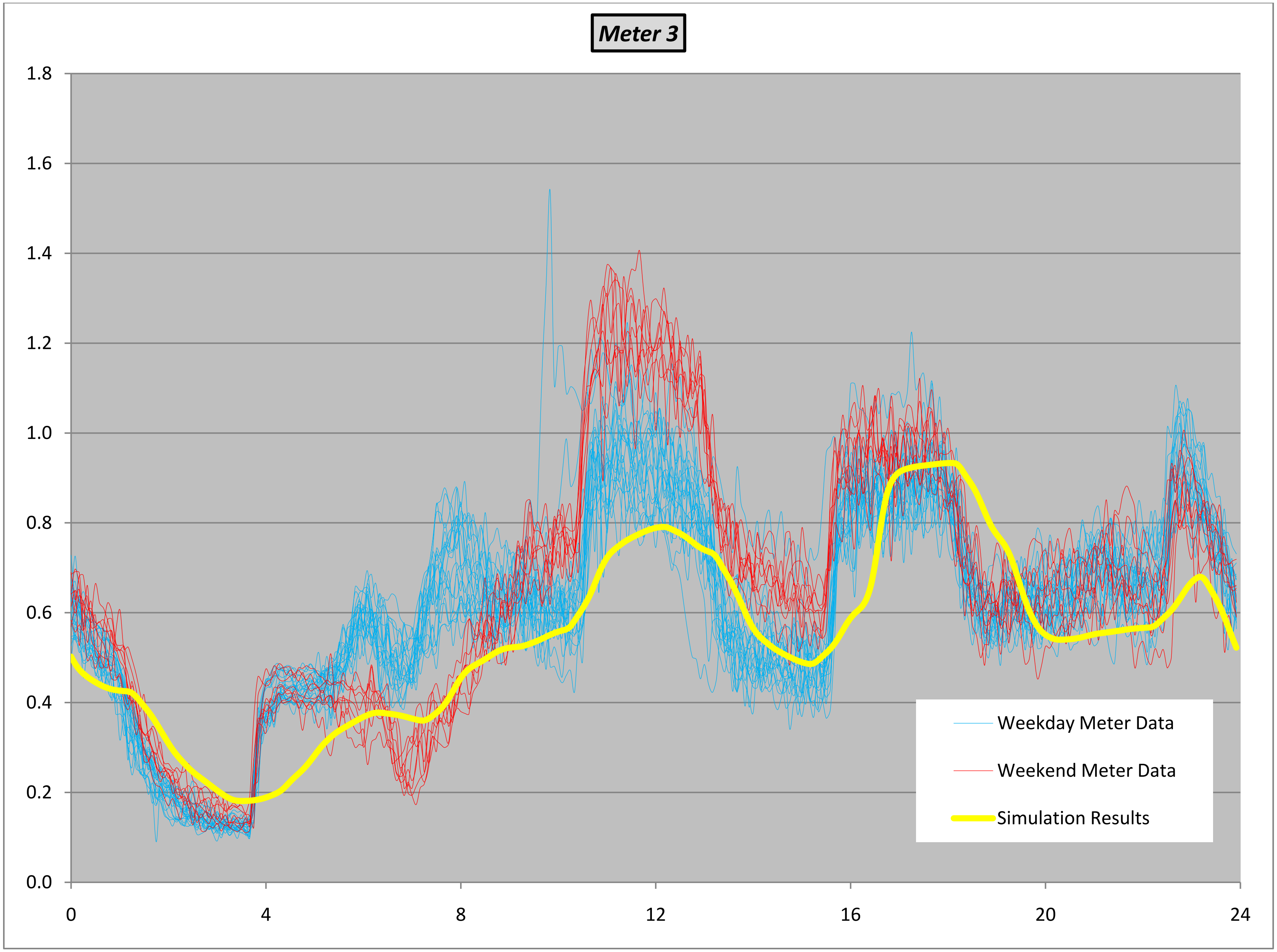
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results



Meter 3
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1.6
1.4
1.2
1.0
0.8
0.6
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0.2
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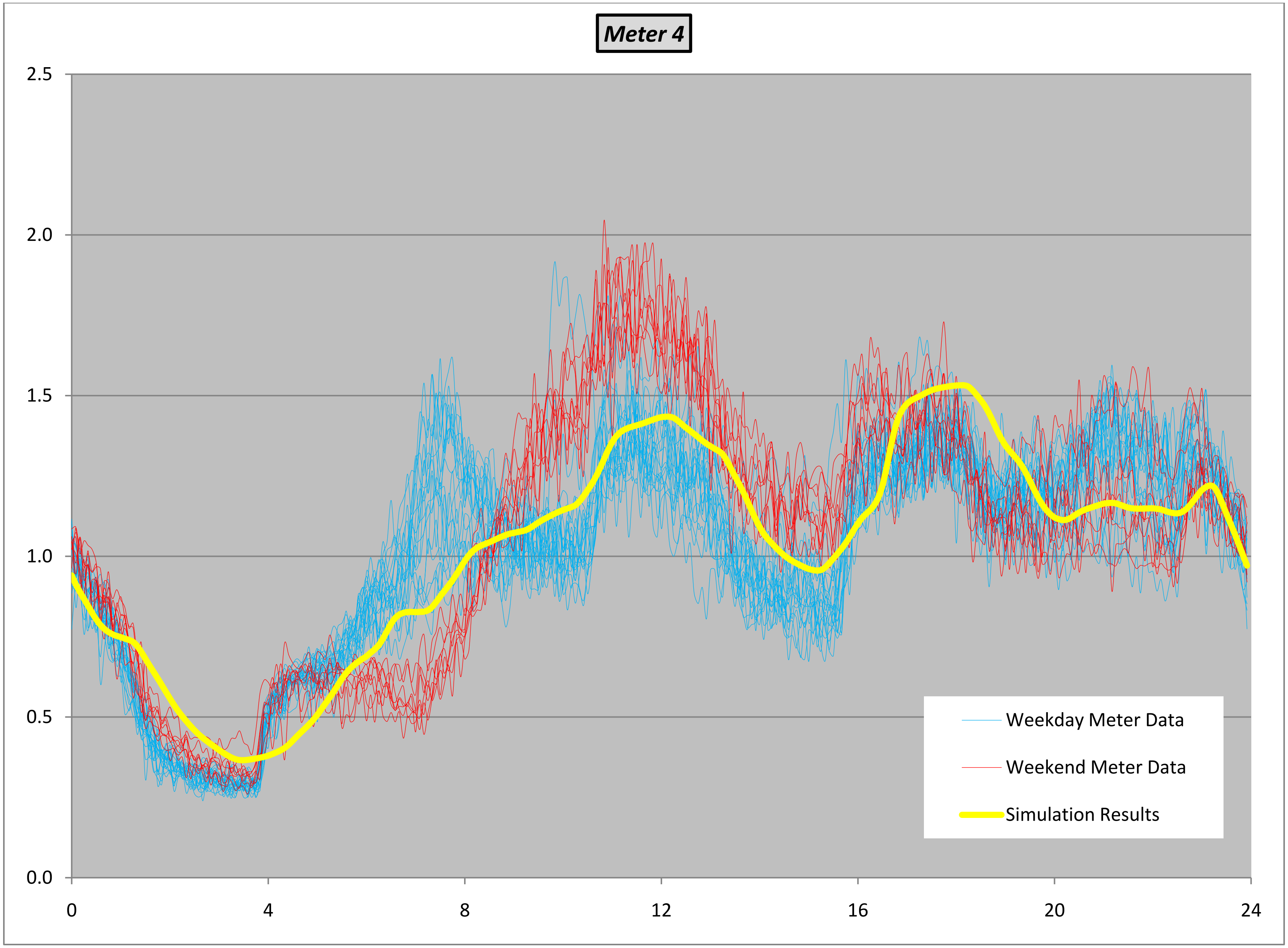
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results



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1.5
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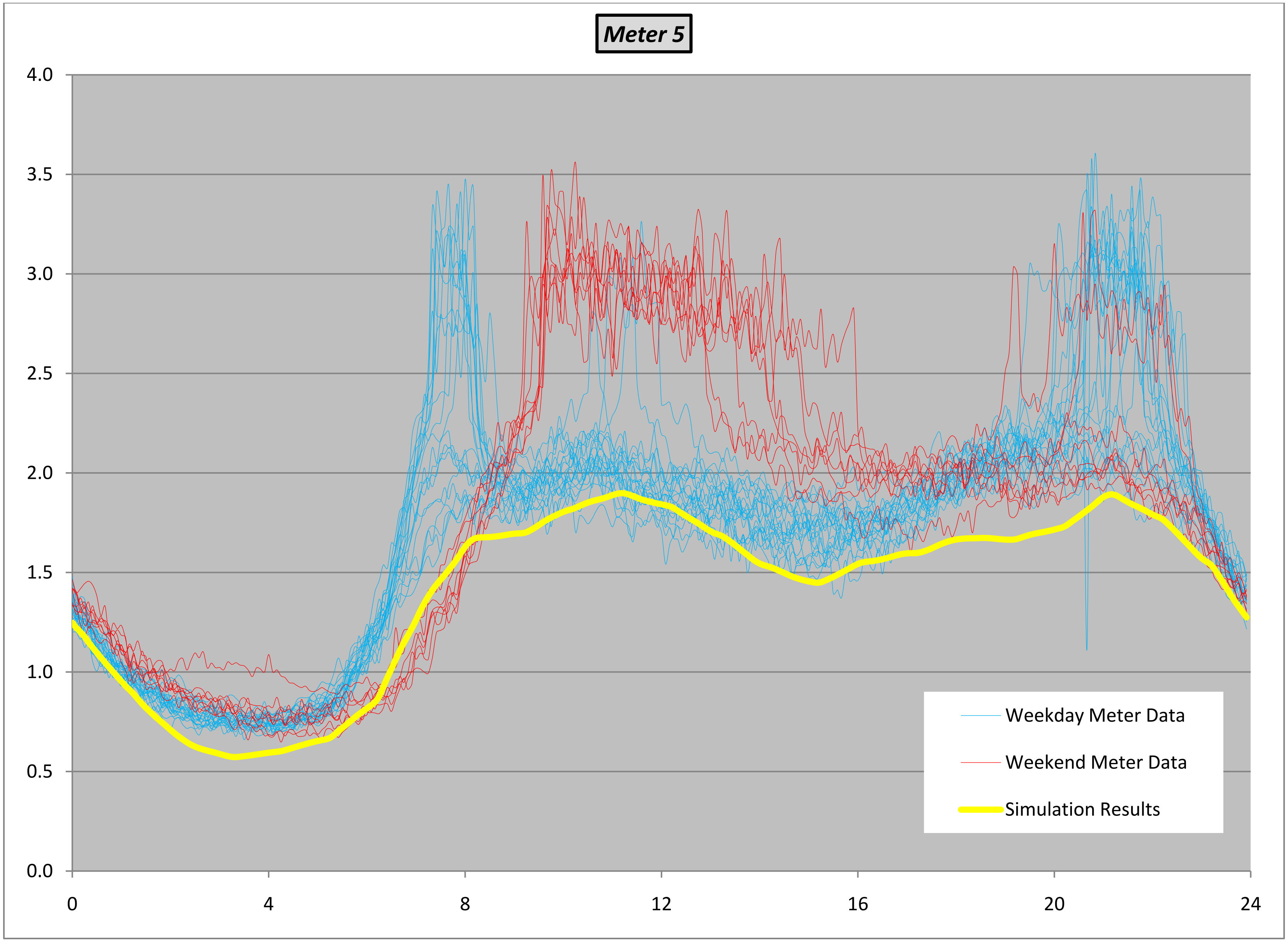
0.0
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results



Meter 5
4.0
3.5
3.0
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2.0
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0.0
0
4
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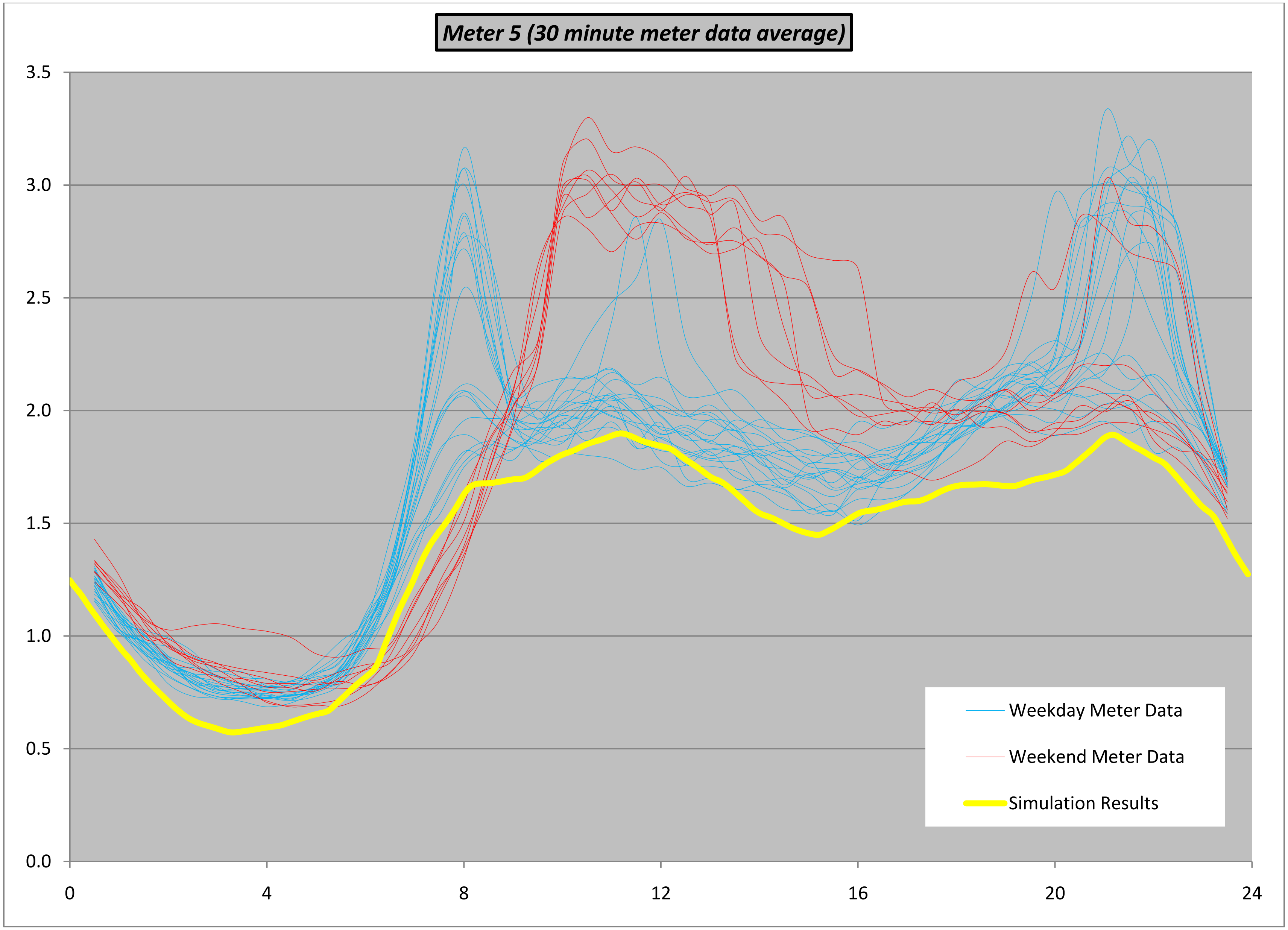
Weekday Meter Data
Weekend Meter Data
Simulation Results



Meter 5 (30 minute meter data average)
3.5
3.0
2.5
2.0
1.5
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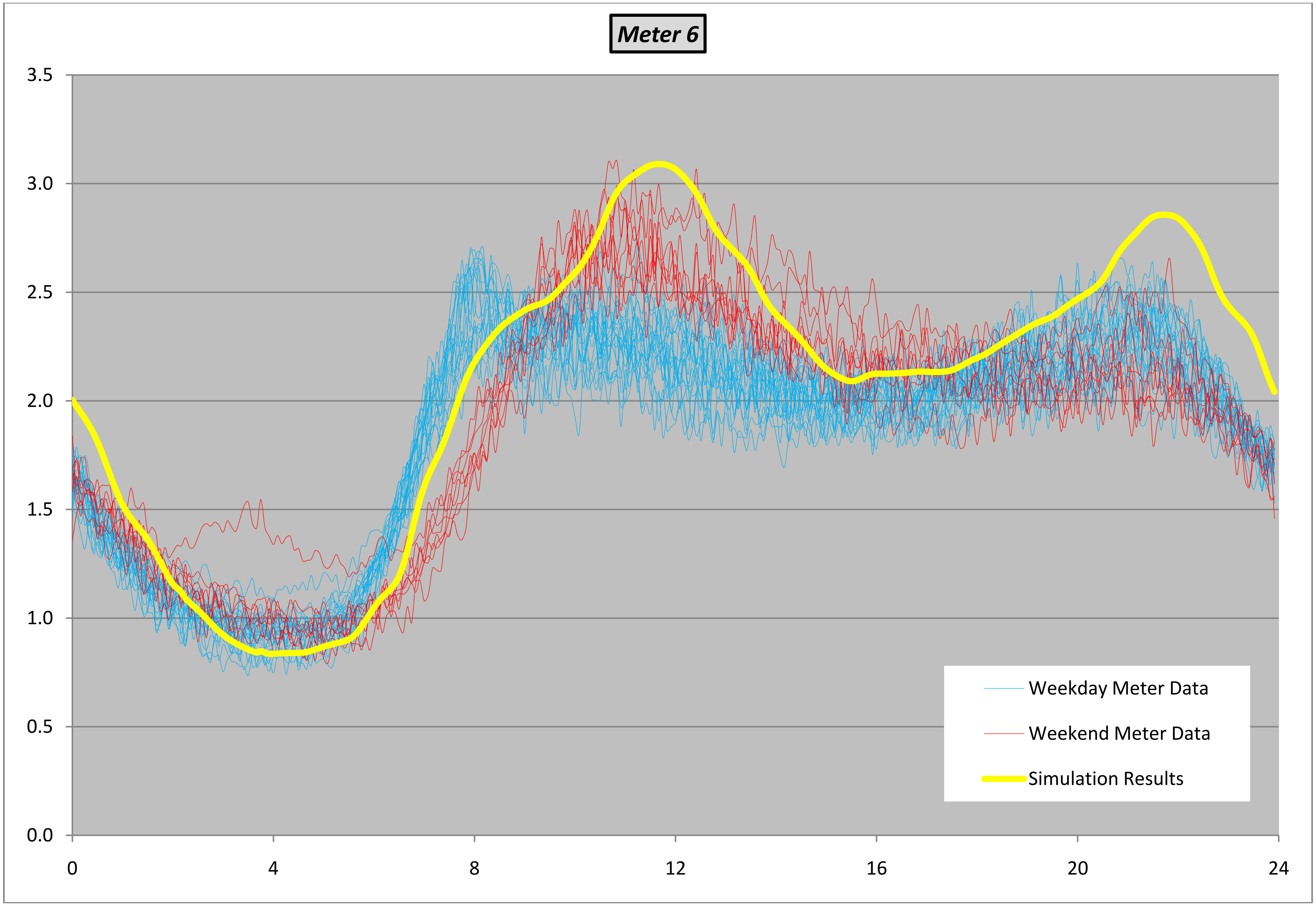
0.5
0.0
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results



Meter 6
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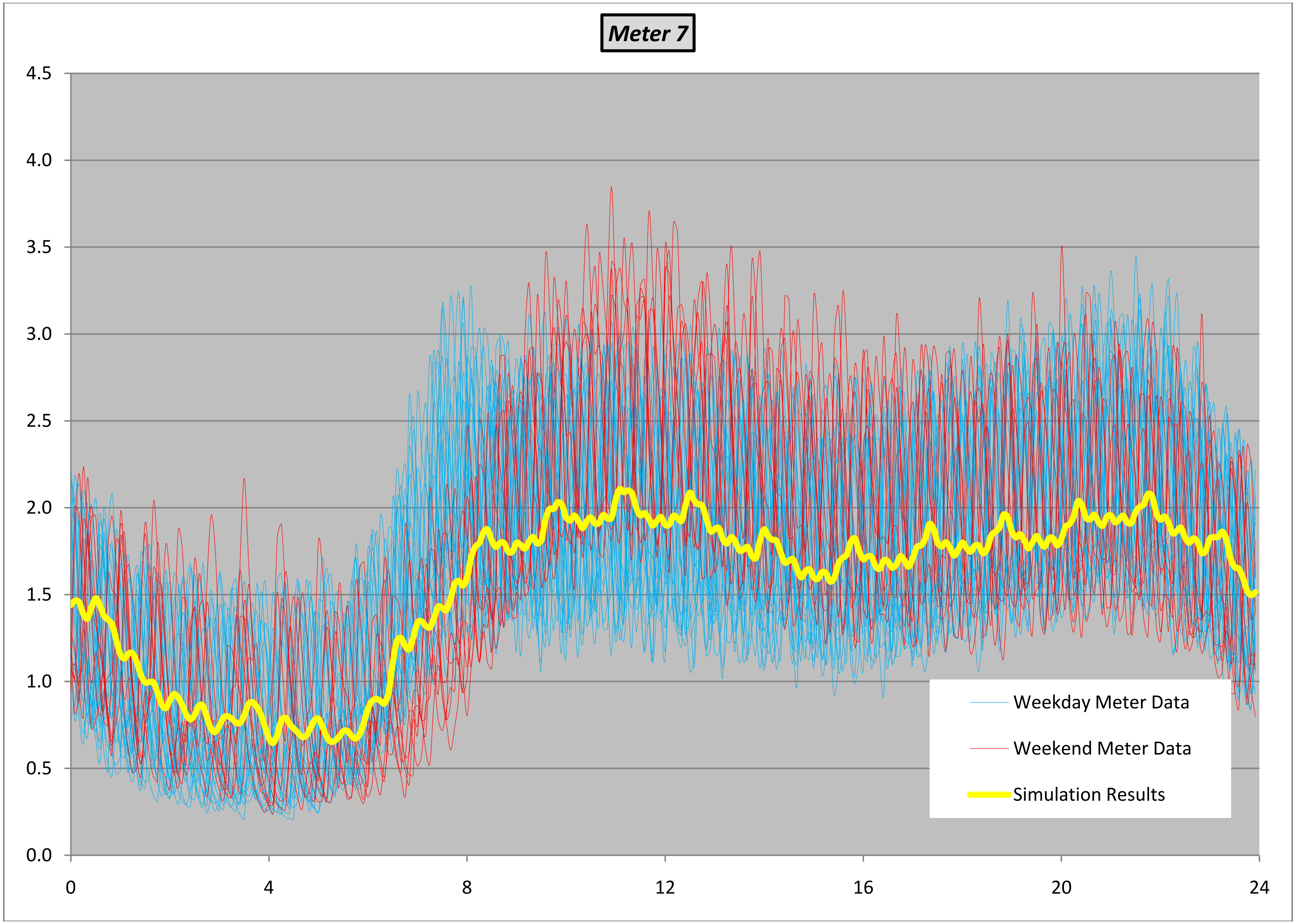
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results



Meter 7
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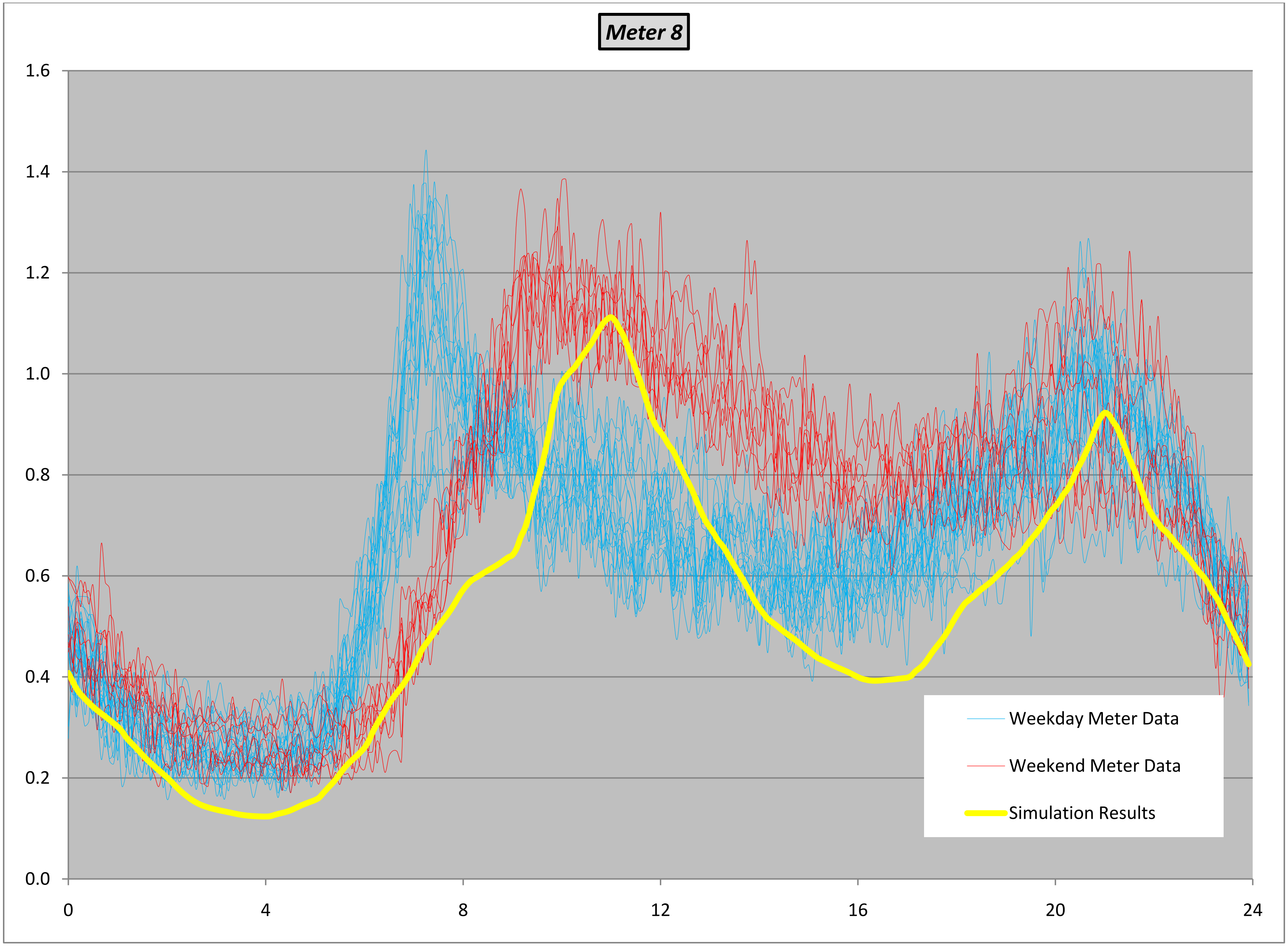
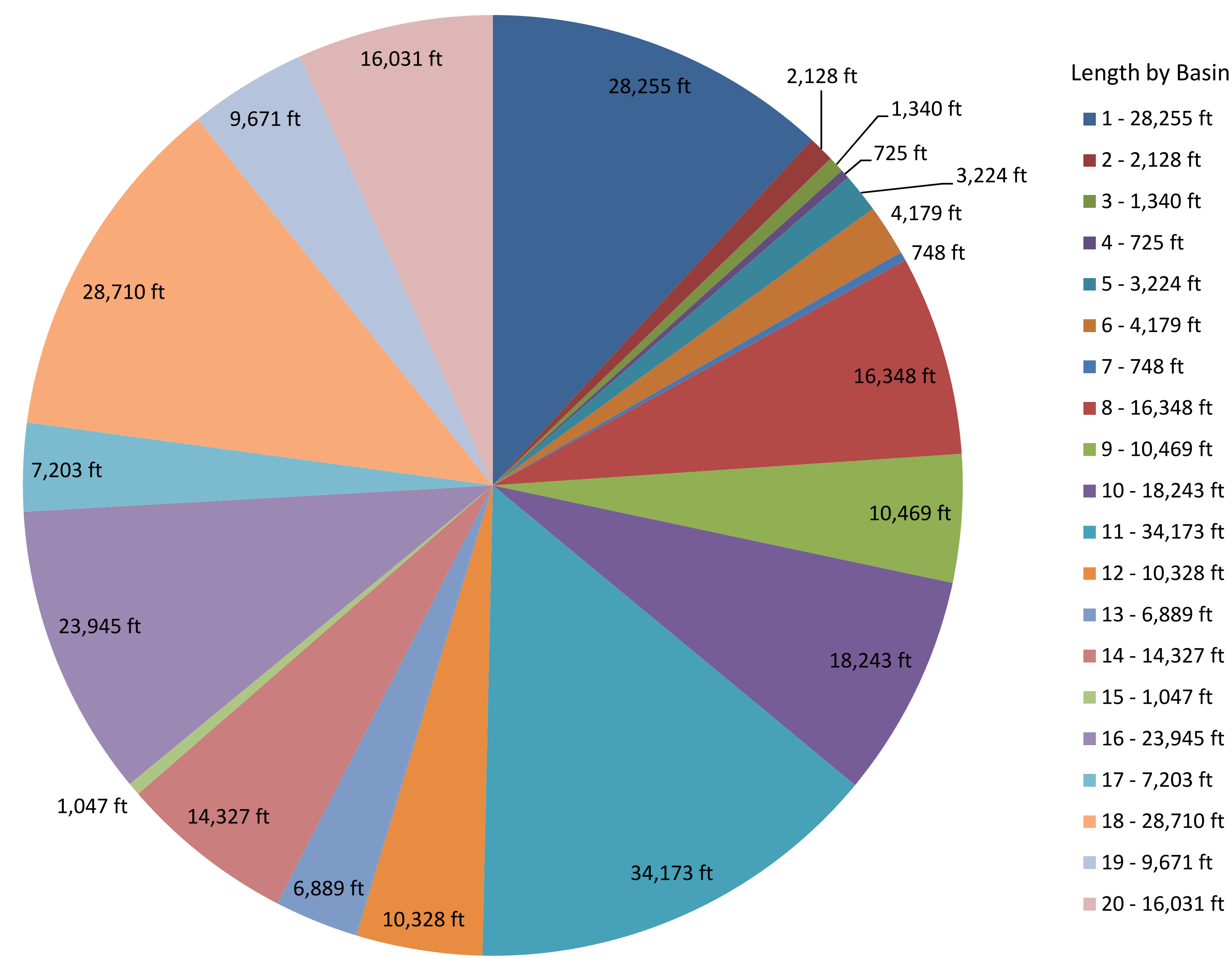
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results

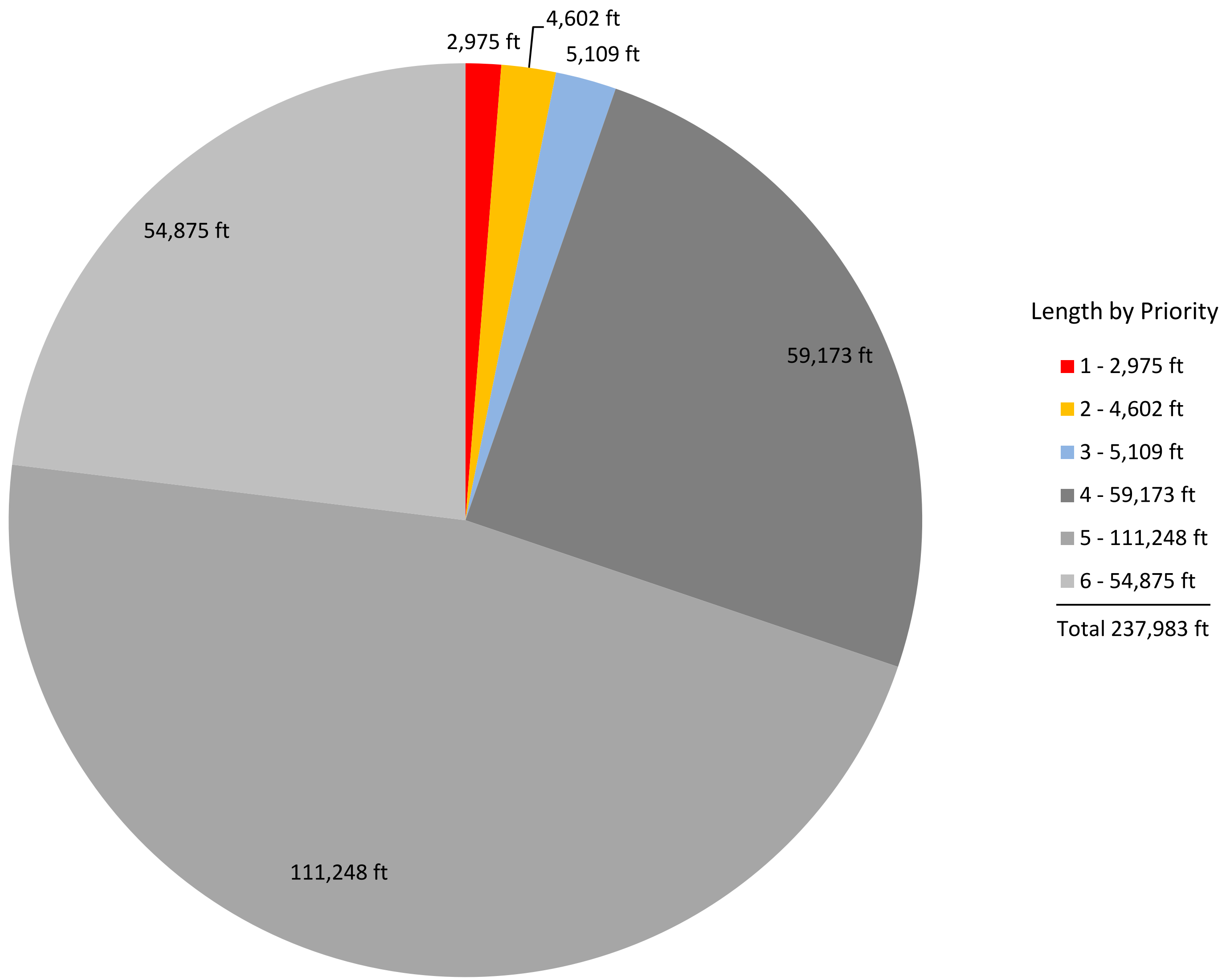


Meter 8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
4
8
12
16
20
24
Weekday Meter Data
Weekend Meter Data
Simulation Results

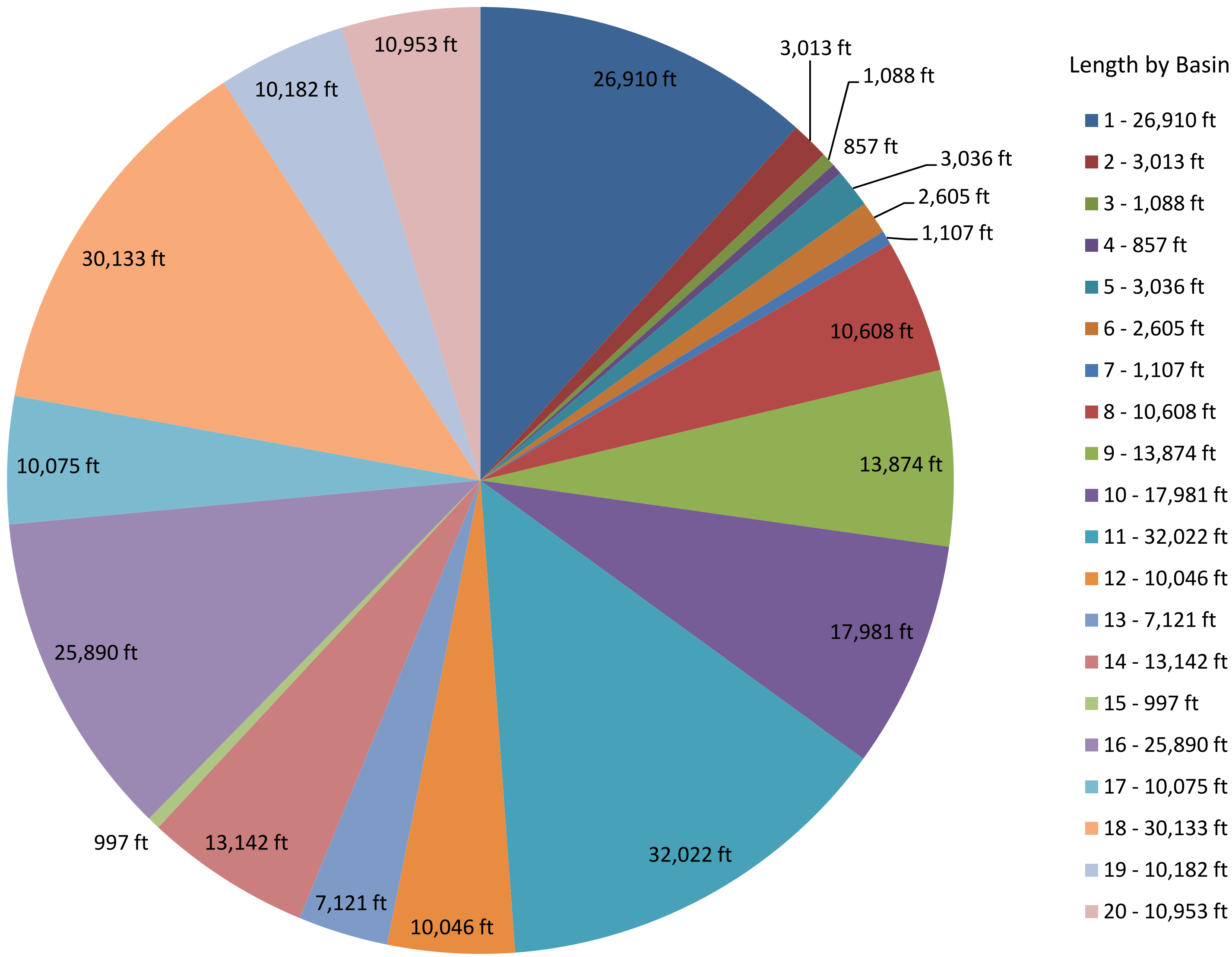
Existing Pipe Deficiency Lengths by Basin

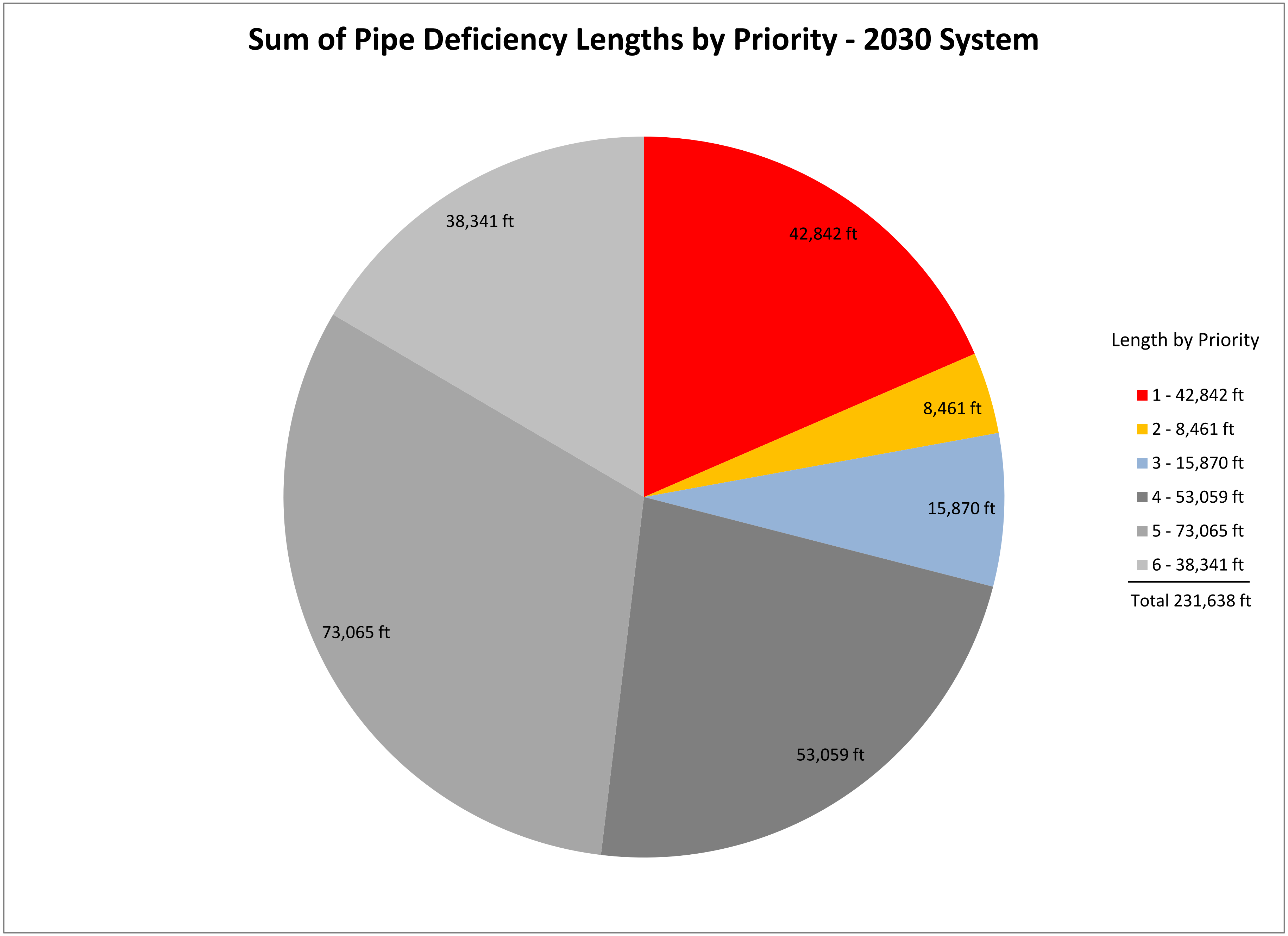


Sum of Pipe Deficiency Lengths by Priority - Existing System



2030 Pipe Deficiency Lengths by Basin




Sum of Pipe Deficiency Lengths by Priority - 2030 System
42,842 ft
8,461 ft
15,870 ft
53,059 ft
73,065 ft
38,341 ft
Length by Priority
1 - 42,842 ft
2 - 8,461 ft
3 - 15,870 ft
4 - 53,059 ft
5 - 73,065 ft
6 - 38,341 ft
Total 231,638 ft

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(gray)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
			Basin 1			
PI-9559	8	32	VCP	S A	1	
PI-5571	8	335	--	D V A	2	
PI-9289	8	23	VCP	D A	2	
PI-9560	8	420	VCP	D A	2	
PI-1564	8	319	VCP	D	3	
PI-1649	8	172	VCP	D	3	
PI-5577	8	323	VCP	D	3	
PI-5579	8	393	VCP	D V	3	
PI-5580	8	106	VCP	D	3	
PI-9294	8	374	VCP	D	3	
PI-9566	8	170	VCP	D	3	
PI-9569	8	40	PVC	D V	3	
PI-1618	8	379	VCP	V	5	
PI-1619	8	198	VCP	V	5	
PI-2117	8	32	VCP	V	5	
PI-2738	8	436	VCP	V	5	
PI-2934	8	250	VCP	V	5	
PI-2944	8	326	VCP	V	5	
PI-2946	8	323	VCP	V	5	
PI-4923	8	261	VCP	V	5	
PI-5439	8	271	VCP	V	5	
PI-5455	8	280	VCP	V	5	
PI-5460	8	246	VCP	V	5	
PI-5461	8	275	VCP	V	5	
PI-5644	8	305	VCP	V	5	
PI-5648	8	168	VCP	V	5	
PI-5649	8	115	VCP	V	5	
PI-6476	8	345	VCP	V	5	
PI-8297	8	74	VCP	V	5	
PI-8975	8	286	PVC	V	5	
PI-8976	8	104	PVC	V	5	
PI-8977	8	146	PVC	V	5	
PI-8978	8	305	PVC	V	5	
PI-8979	8	167	PVC	V	5	
PI-9281	8	76	PVC	V	5	
PI-9528	8	67	VCP	V	5	
PI-9624	8	242	PVC	V	5	
PI-9626	8	184	PVC	V	5	
PI-2933	8	286	VCP	A	6	
PI-5570	8	272	VCP	A	6	
PI-6541	8	112	VCP	A	6	
PI-6542	8	219	--	A	6	
PI-6543	8	106	--	A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

Hydraulic Deficiency

Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class [1]*	*Priority [2]*	*Cost*
PI-8971	8	110	PVC	A	6	
PI-2736	10	234	PVC	S	1	
PI-5445	10	44	VCP	S	1	
PI-5453	10	59	PVC	S	1	
PI-5209	10	321	VCP	D	3	
PI-5446	10	189	VCP	D	3	
PI-5452	10	231	VCP	D	3	
PI-5171	10	265	VCP	V	5	
PI-5172	10	166	VCP	V	5	
PI-5564	10	270	VCP	V	5	
PI-5565	10	231	VCP	V	5	
PI-5753	10	269	VCP	V	5	
PI-1587	10	261	VCP	A	6	
PI-1591	10	277	VCP	A	6	
PI-1592	10	434	VCP	A	6	
PI-1593	10	343	VCP	A	6	
PI-8300	12	392	VCP	V A	4	
PI-1898	12	305	PVC	V	5	
PI-5576	12	437	PVC	V	5	
PI-5782	12	75	PVC	V	5	
PI-1596	12	289	VCP	A	6	
PI-1597	12	359	VCP	A	6	
PI-1598	12	348	VCP	A	6	
PI-1599	12	325	VCP	A	6	
PI-1899	15	344	VCP	D A	2	
PI-1900	15	392	VCP	D A	2	
PI-1620	15	242	PVC	V	5	
PI-1621	15	89	PVC	V	5	
PI-1636	15	289	PVC	V	5	
PI-1637	15	278	PVC	V	5	
PI-1640	15	216	PVC	V	5	
PI-2140	15	256	PVC	V	5	
PI-2141	15	326	PVC	V	5	
PI-2142	15	87	PVC	V	5	
PI-2143	15	255	PVC	V	5	
PI-2144	15	275	PVC	V	5	
PI-2145	15	258	PVC	V	5	
PI-2146	15	277	PVC	V	5	
PI-2147	15	283	PVC	V	5	
PI-2167	15	211	PVC	V	5	
PI-2168	15	246	PVC	V	5	
PI-2169	15	359	PVC	V	5	
PI-2173	15	110	PVC	V	5	
PI-4787	15	337	PVC	V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-4788	15	185	PVC	V	5	
PI-4789	15	237	PVC	V	5	
PI-4790	15	421	PVC	V	5	
PI-4918	15	78	PVC	V	5	
PI-4924	15	219	PVC	V	5	
PI-4927	15	281	PVC	V	5	
PI-5156	15	286	PVC	V	5	
PI-7016	15	354	PVC	V	5	
PI-7647	15	66	PVC	V	5	
PI-7649	15	359	PVC	V	5	
PI-9038	15	79	PVC	V	5	
PI-9282	15	246	PVC	V	5	
PI-9283	15	98	PVC	V	5	
PI-9284	15	165	PVC	V	5	
PI-9285	15	99	PVC	V	5	
PI-9286	15	102	PVC	V	5	
PI-9568	15	27	PVC	V	5	
PI-9617	15	157	PVC	V	5	
PI-2148	15	378	VCP	A	6	
PI-2149	15	27	VCP	A	6	
PI-2766	15	374	VCP	A	6	
PI-2767	15	331	VCP	A	6	
PI-2769	15	15	VCP	A	6	
PI-5399	15	385	VCP	A	6	
PI-5407	15	151	VCP	A	6	
PI-5408	15	214	VCP	A	6	
PI-5414	15	461	VCP	A	6	
PI-7139	15	319	VCP	A	6	
PI-7141	15	339	VCP	A	6	
PI-8520	15	155	VCP	A	6	
PI-8521	15	187	VCP	A	6	
PI-9561	18	305	PVC	V A	4	
PI-9562	18	228	PVC	A	6	
Basin 2						
PI-6744	12	426		V	5	
PI-6745	12	544		V	5	
PI-6754	12	307		V	5	
PI-6755	12	377		V	5	
PI-6761	12	475		V	5	
Basin 3						
PI-1289	8	263		V	5	
PI-7998	8	252		V	5	
PI-7999	8	104		A	6	
PI-8000	8	277		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]				***Priority*** [2]	***Cost***
PI-6672	10	444				V		5	
Basin 4									
PI-6591	8	31		S				1	
PI-6168	10	12		S		V		1	
PI-6170	10	14		S				1	
PI-6212	10	341				V		5	
PI-6213	10	92				V		5	
PI-6281	10	185				V		5	
PI-6169	12	51		S		V		1	
Basin 5									
PI-3557	8	21				V		5	
PI-1490	8	48					A	6	
PI-3366	8	229					A	6	
PI-2223	10	356				V		5	
PI-3229	10	235				V		5	
PI-3230	10	156				V		5	
PI-3486	10	337				V		5	
PI-3487	10	44				V		5	
PI-3489	10	167				V		5	
PI-3355	12	359				V	A	4	
PI-3610	12	35				V	A	4	
PI-3098	12	129				V		5	
PI-3551	12	96				V		5	
PI-3552	12	85				V		5	
PI-3553	12	84				V		5	
PI-3554	12	86				V		5	
PI-6694	12	177				V		5	
PI-3611	21	91				V	A	4	
PI-6705	21	11				V	A	4	
PI-3619	21	238					A	6	
PI-6700	21	16					A	6	
HAARF_INLET	42	0					A	6	
PI-7478	42	141					A	6	
PI-7479	42	84					A	6	
Basin 6									
PI-3075	8	346				V		5	
PI-6016	8	115					A	6	
PI-9619	8	133					A	6	
PI-2802	12	0				V		5	
PI-8901	12	305				V		5	
PI-8902	12	301				V		5	
PI-3076	15	213				V		5	
PI-5969	15	211				V		5	
PI-5970	15	391				V		5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

Hydraulic Deficiency (white)

Non-Hydraulic Deficiency (shaded)

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-5971	15	357		V	5	
PI-5972	15	330		V	5	
PI-5973	15	398		V	5	
PI-5974	15	272		V	5	
PI-5975	15	299		V	5	
PI-5976	15	221		V	5	
PI-5977	15	145		V	5	
PI-6000	15	144		V	5	
Basin 7						
PI-4456	8	56		S	1	
PI-1119	8	144		V	5	
PI-1122	8	169		V	5	
PI-1118	10	151		V	5	
PI-1127	12	93		S V	1	
PI-6644	12	61		S A	1	
PI-1126	12	75		D	3	
Basin 8						
PI-2000	8	161		V	5	
PI-2036	8	324		V	5	
PI-2406	8	129		V	5	
PI-2407	8	300		V	5	
PI-2408	8	190		V	5	
PI-2472	8	299		V	5	
PI-4540	8	296		V	5	
PI-4541	8	262		V	5	
PI-4542	8	275		V	5	
PI-4764	8	233		V	5	
PI-4765	8	140		V	5	
PI-4766	8	93		V	5	
PI-4768	8	241		V	5	
PI-4769	8	225		V	5	
PI-4770	8	320		V	5	
PI-4771	8	340		V	5	
PI-4772	8	149		V	5	
PI-4773	8	126		V	5	
PI-8156	8	261		V	5	
PI-8157	8	239		V	5	
PI-8158	8	244		V	5	
PI-9498	8	28		A	6	
PI-9499	8	325		A	6	
PI-9500	8	118		A	6	
PI-6956	12	392		V	5	
PI-6957	12	345		V	5	
PI-6959	12	157		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class [1]***	***Priority [2]***	***Cost***
PI-6960	12	112		V	5	
PI-6961	12	146		V	5	
PI-6962	12	290		V	5	
PI-6963	12	111		V	5	
PI-6964	12	77		V	5	
PI-6965	12	253		V	5	
PI-6966	12	341		V	5	
PI-6967	12	221		V	5	
PI-6968	12	381		V	5	
PI-6969	12	352		V	5	
PI-6970	12	336		V	5	
PI-6971	12	329		V	5	
PI-7124	12	201		V	5	
PI-7505	12	359		V	5	
PI-7506	12	303		V	5	
PI-7507	12	145		V	5	
PI-7508	12	138		V	5	
PI-7509	15	291		V	5	
PI-7510	15	309		V	5	
PI-7511	15	289		V	5	
PI-7512	15	291		V	5	
PI-7711	15	119		V	5	
PI-8640	15	337		V	5	
PI-8641	15	358		V	5	
PI-8642	15	439		V	5	
PI-8643	15	105		V	5	
PI-8647	15	31		V	5	
PI-2057	18	27		V A	4	
PI-2056	18	127		V	5	
PI-2058	18	270		V	5	
PI-2060	18	140		V	5	
PI-2061	18	223		V	5	
PI-2536	18	157		V	5	
PI-2537	18	412		V	5	
PI-2539	18	308		V	5	
PI-2540	18	133		V	5	
PI-2541	18	339		V	5	
PI-4629	18	219		V	5	
PI-4631	18	312		V	5	
PI-6538	18	158		V	5	
PI-7845	18	290		V	5	
PI-9539	18	155		A	6	
PI-9540	18	11		A	6	
PI-9541	18	58		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]	***Priority*** [2]	***Cost***
PI-9542	18	10		A	6	
PI-9543	18	123		A	6	
Basin 9						
PI-5147	8	14		D V A	2	
PI-6533	8	34		D A	2	
PI-8290	8	89		D V A	2	
PI-2098	8	206		D	3	
PI-2674	8	99		D	3	
PI-2758	8	286		D	3	
PI-2759	8	354		D	3	
PI-3458	8	189		D	3	
PI-2707	8	17		V A	4	
PI-1659	8	235		V	5	
PI-2692	8	55		V	5	
PI-2705	8	269		V	5	
PI-2708	8	315		V	5	
PI-4867	8	214		V	5	
PI-5140	8	281		V	5	
PI-5141	8	411		V	5	
PI-5148	8	360		V	5	
PI-5150	8	303		V	5	
PI-5151	8	148		V	5	
PI-5220	8	108		V	5	
PI-1881	8	113		A	6	
PI-1882	8	415		A	6	
PI-2100	8	393		A	6	
PI-2102	8	227		A	6	
PI-5131	8	422		A	6	
PI-8507	8	391		A	6	
PI-9494	8	180		A	6	
PI-9537	8	169		A	6	
PI-4883	10	58		V	5	
PI-4885	10	204		V	5	
PI-9397	10	57		V	5	
PI-9398	10	90		V	5	
PI-9399	10	178		V	5	
PI-9400	10	250		V	5	
PI-9401	10	135		V	5	
PI-9402	10	405		V	5	
PI-9403	10	234		V	5	
PI-9404	10	336		V	5	
PI-9405	10	92		V	5	
PI-9406	10	162		V	5	
PI-9407	10	211		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(gray)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]	***Priority*** [2]	***Cost***
PI-9408	10	128		V	5	
PI-2691	12	51		V A	4	
PI-1622	12	79		V	5	
PI-1623	12	72		V	5	
PI-7640	12	327		V	5	
PI-7651	12	351		V	5	
PI-8510	12	229		V	5	
PI-8695	12	355		V	5	
PI-2764	12	22		A	6	
PI-8694	16	142		V	5	
Basin 10						
PI-1845	8	153		V A	4	
PI-1846	8	130		V A	4	
PI-1847	8	260		V A	4	
PI-1908	8	250		V A	4	
PI-2762	8	371		V A	4	
PI-2785	8	276		V A	4	
PI-5108	8	384		V A	4	
PI-5127	8	133		V A	4	
PI-5128	8	271		V A	4	
PI-5390	8	269		V A	4	
PI-5391	8	252		V A	4	
PI-6473	8	431		V A	4	
PI-7923	8	424		V A	4	
PI-8277	8	468		V A	4	
PI-8282	8	349		V A	4	
PI-8325	8	350		V A	4	
PI-8326	8	376		V A	4	
PI-8327	8	250		V A	4	
PI-1839	8	268		V	5	
PI-1840	8	270		V	5	
PI-1841	8	251		V	5	
PI-1842	8	245		V	5	
PI-1843	8	283		V	5	
PI-1844	8	70		V	5	
PI-1849	8	327		V	5	
PI-1850	8	266		V	5	
PI-1853	8	322		V	5	
PI-1854	8	346		V	5	
PI-2106	8	172		V	5	
PI-2107	8	90		V	5	
PI-2646	8	99		V	5	
PI-2648	8	141		V	5	
PI-4735	8	106		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(shaded box)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]	***Priority*** [2]	***Cost***
PI-4736	8	354		V	5	
PI-4738	8	108		V	5	
PI-4739	8	317		V	5	
PI-5064	8	307		V	5	
PI-5065	8	280		V	5	
PI-5111	8	141		V	5	
PI-5132	8	258		V	5	
PI-5133	8	403		V	5	
PI-6359	8	80		V	5	
PI-8315	8	93		V	5	
PI-8321	8	130		V	5	
PI-8322	8	200		V	5	
PI-8324	8	332		V	5	
PI-8328	8	304		V	5	
PI-1861	10	261		A	6	
PI-1862	10	55		A	6	
PI-2760	10	259		A	6	
PI-2763	10	169		A	6	
PI-5224	10	268		A	6	
PI-5225	10	260		A	6	
PI-8286	10	102		A	6	
PI-8292	10	127		A	6	
PI-8293	10	134		A	6	
PI-8316	10	415		A	6	
PI-8317	10	325		A	6	
PI-9684	12	135		S V A	1	
PI-9532	12	135		V A	4	
PI-1838	12	396		V	5	
PI-1848	12	336		V	5	
PI-1851	12	422		V	5	
PI-1852	12	250		V	5	
PI-1904	12	422		A	6	
PI-1905	12	360		A	6	
PI-2786	12	223		A	6	
PI-5384	12	113		A	6	
PI-5392	12	425		A	6	
PI-5393	12	178		A	6	
PI-5561	12	134		A	6	
PI-8512	12	133		A	6	
PI-8513	12	223		A	6	
PI-5560	24	21		A	6	
Basin 11						
PI-9654	8	98		S	1	
PI-1958	8	330		D V A	2	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-2827	8	293		D A	2	
PI-4981	8	292		D V A	2	
PI-4986	8	329		D A	2	
PI-5335	8	298		D A	2	
PI-7563	8	291		D A	2	
PI-1798	8	300		D V	3	
PI-8253	8	302		D V	3	
PI-9655	8	190		D	3	
PI-1912	8	434		V A	4	
PI-1920	8	447		V A	4	
PI-1923	8	280		V A	4	
PI-1924	8	166		V A	4	
PI-1925	8	159		V A	4	
PI-1926	8	301		V A	4	
PI-1927	8	37		V A	4	
PI-1953	8	303		V A	4	
PI-2087	8	214		V A	4	
PI-2088	8	220		V A	4	
PI-2089	8	200		V A	4	
PI-2090	8	368		V A	4	
PI-2828	8	170		V A	4	
PI-2829	8	111		V A	4	
PI-4979	8	340		V A	4	
PI-5044	8	364		V A	4	
PI-5045	8	152		V A	4	
PI-5069	8	115		V A	4	
PI-5071	8	116		V A	4	
PI-5095	8	348		V A	4	
PI-5349	8	21		V A	4	
PI-5376	8	323		V A	4	
PI-5378	8	254		V A	4	
PI-5379	8	175		V A	4	
PI-5381	8	253		V A	4	
PI-5545	8	253		V A	4	
PI-6362	8	409		V A	4	
PI-6427	8	43		V A	4	
PI-6974	8	348		V A	4	
PI-6976	8	215		V A	4	
PI-7476	8	237		V A	4	
PI-8258	8	295		V A	4	
PI-8524	8	217		V A	4	
PI-1797	8	107		V	5	
PI-1800	8	314		V	5	
PI-1801	8	330		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-1813	8	330		V	5	
PI-1917	8	314		V	5	
PI-1918	8	429		V	5	
PI-2071	8	183		V	5	
PI-2072	8	469		V	5	
PI-2653	8	290		V	5	
PI-2844	8	337		V	5	
PI-2845	8	336		V	5	
PI-2848	8	167		V	5	
PI-4994	8	324		V	5	
PI-4995	8	123		V	5	
PI-4999	8	234		V	5	
PI-5010	8	264		V	5	
PI-5078	8	288		V	5	
PI-5079	8	261		V	5	
PI-5091	8	216		V	5	
PI-5092	8	295		V	5	
PI-5100	8	254		V	5	
PI-5299	8	367		V	5	
PI-5380	8	218		V	5	
PI-6426	8	44		V	5	
PI-8188	8	306		V	5	
PI-8189	8	318		V	5	
PI-8228	8	109		V	5	
PI-8254	8	369		V	5	
PI-8259	8	31		V	5	
PI-8260	8	54		V	5	
PI-8264	8	391		V	5	
PI-8330	8	359		V	5	
PI-8332	8	144		V	5	
PI-8376	8	31		V	5	
PI-8391	8	252		V	5	
PI-9645	8	231		V	5	
PI-1792	8	147		A	6	
PI-1793	8	358		A	6	
PI-1794	8	185		A	6	
PI-1795	8	121		A	6	
PI-1959	8	251		A	6	
PI-2603	8	314		A	6	
PI-2604	8	269		A	6	
PI-2610	8	279		A	6	
PI-2611	8	206		A	6	
PI-2826	8	227		A	6	
PI-4978	8	343		A	6	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2] Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	Diameter (in)	Length (ft)	Material	CIP Deficiency Class [1]	Priority [2]	Cost
PI-5070	8	210		A	6	
PI-5094	8	127		A	6	
PI-5096	8	340		A	6	
PI-5296	8	196		A	6	
PI-5298	8	305		A	6	
PI-7477	8	30		A	6	
PI-7554	8	34		A	6	
PI-8523	8	76		A	6	
PI-5354	10	176		S V	1	
PI-5355	10	176		S V	1	
PI-1957	10	130		D V	3	
PI-1964	10	427		V A	4	
PI-2073	10	189		V A	4	
PI-2074	10	212		V A	4	
PI-2825	10	311		V A	4	
PI-5043	10	326		V A	4	
PI-5292	10	135		V A	4	
PI-5295	10	260		V A	4	
PI-5559	10	367		V A	4	
PI-5719	10	471		V A	4	
PI-6789	10	29		V A	4	
PI-7444	10	308		V A	4	
PI-8526	10	176		V A	4	
PI-8527	10	193		V A	4	
PI-1828	10	209		V	5	
PI-1913	10	320		V	5	
PI-1914	10	296		V	5	
PI-1956	10	225		V	5	
PI-2080	10	231		V	5	
PI-2081	10	122		V	5	
PI-2796	10	191		V	5	
PI-2797	10	174		V	5	
PI-5055	10	131		V	5	
PI-5102	10	367		V	5	
PI-8252	10	359		V	5	
PI-7487	10	155		A	6	
PI-1963	12	436		V A	4	
PI-6524	12	57		V A	4	
PI-5103	12	141		V	5	
PI-7555	12	54		V	5	
PI-7557	12	259		V	5	
PI-7558	12	409		V	5	
PI-7559	12	310		V	5	
PI-7564	12	157		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]	***Priority*** [2]	***Cost***
PI-7566	12	289		V	5	
PI-6525	12	324		A	6	
PI-7561	12	24		A	6	
PI-7562	15	320		A	6	
PI-6798	18	310		V	5	
PI-6799	18	327		V	5	
PI-6800	18	293		V	5	
PI-7567	18	63		V	5	
PI-7569	18	22		V	5	
Basin 12						
PI-7939	6	191		V A	4	
PI-1283	6	481		A	6	
PI-6399	6	165		A	6	
PI-7947	6	195		A	6	
PI-5878	8	176		V A	4	
PI-7938	8	378		V A	4	
PI-8404	8	397		V A	4	
PI-8406	8	188		V A	4	
PI-8407	8	191		V A	4	
PI-5849	8	53		V	5	
PI-7440	8	304		V	5	
PI-7441	8	251		V	5	
PI-8405	8	186		V	5	
PI-8611	8	282		V	5	
PI-6398	8	187		A	6	
PI-8388	8	349		A	6	
PI-8393	8	181		A	6	
PI-8422	8	50		A	6	
PI-2164	10	55		V A	4	
PI-7946	10	160		V A	4	
PI-8395	10	186		V A	4	
PI-2909	10	185		V	5	
PI-5850	10	354		V	5	
PI-9685	12	135		D V A	2	
PI-5725	12	404		V	5	
PI-7942	12	50		V	5	
PI-8394	12	186		V	5	
PI-7472	12	229		A	6	
PI-8691	18	185		A	6	
PI-9531	18	269		A	6	
PI-1928	21	187		A	6	
PI-1929	21	499		A	6	
PI-1930	21	248		A	6	
PI-1931	21	56		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class [1]***	***Priority [2]***	***Cost***
PI-1932	21	465		A	6	
PI-1933	21	488		A	6	
PI-1969	21	479		A	6	
PI-1970	21	445		A	6	
PI-6446	21	25		A	6	
PI-8381	21	494		A	6	
PI-8387	21	340		A	6	
Basin 13						
PI-1209	8	146		V A	4	
PI-1211	8	274		V A	4	
PI-1212	8	293		V A	4	
PI-1216	8	146		V A	4	
PI-3187	8	132		V A	4	
PI-6070	8	154		V A	4	
PI-6071	8	311		V A	4	
PI-6657	8	282		V A	4	
PI-7492	8	400		V A	4	
PI-8856	8	44		V A	4	
PI-9312	8	87		V A	4	
PI-9308	8	49		V	5	
PI-1337	8	355		A	6	
PI-8855	8	183		A	6	
PI-1215	10	368		V A	4	
PI-1340	10	271		V A	4	
PI-4283	10	203		V A	4	
PI-7493	10	165		V A	4	
PI-7494	10	98		V A	4	
PI-9656	10	234		V A	4	
PI-9657	10	48		V A	4	
PI-1219	10	468		A	6	
PI-3000	10	390		A	6	
PI-4284	10	175		A	6	
PI-4285	10	501		A	6	
PI-6650	10	384		A	6	
PI-6652	10	37		A	6	
PI-7044	10	267		A	6	
PI-7046	10	38		A	6	
PI-1217	12	386		V A	4	
Basin 14						
PI-2338	8	324		V	5	
PI-2339	8	332		V	5	
PI-2340	8	255		V	5	
PI-2351	8	311		V	5	
PI-2352	8	206		V	5	

[1]S: Surcharged   D: d/D Deficient   V: Velocity < 2 fps   A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class [1]*	*Priority [2]*	*Cost*
PI-2860	8	136		V	5	
PI-3014	8	94		V	5	
PI-5669	8	319		V	5	
PI-5841	8	312		V	5	
PI-5842	8	338		V	5	
PI-5843	8	214		V	5	
PI-5913	8	40		V	5	
PI-6434	8	391		V	5	
PI-6433	8	21		A	6	
PI-2215	10	131		V	5	
PI-2216	10	216		V	5	
PI-2341	10	308		V	5	
PI-2344	10	422		V	5	
PI-2345	10	278		V	5	
PI-2874	10	140		V	5	
PI-2875	10	52		V	5	
PI-2876	10	295		V	5	
PI-2877	10	234		V	5	
PI-2878	10	324		V	5	
PI-5505	10	319		V	5	
PI-5506	10	143		V	5	
PI-5668	10	272		V	5	
PI-5833	10	307		V	5	
PI-5834	10	307		V	5	
PI-5915	10	22		V	5	
PI-5916	10	319		V	5	
PI-5917	10	341		V	5	
PI-8454	10	367		V	5	
PI-6941	12	15		V A	4	
PI-5836	12	303		V	5	
PI-5837	12	318		V	5	
PI-5838	12	337		V	5	
PI-5839	12	301		V	5	
PI-5840	12	369		V	5	
PI-5918	12	395		V	5	
PI-8455	12	348		V	5	
PI-1520	24	375		D A	2	
PI-1518	24	476		A	6	
PI-1519	24	473		A	6	
PI-1521	24	383		A	6	
PI-1522	24	448		A	6	
PI-1523	24	336		A	6	
PI-1524	24	55		A	6	
PI-1530	24	285		A	6	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2] Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]	***Priority*** [2]	***Cost***
PI-1531	24	23		A	6	
PI-1535	24	286		A	6	
PI-5938	24	391		A	6	
PI-8439	24	325		A	6	
Basin 15						
PI-3363	8	48		V	5	
PI-4596	8	476		V	5	
PI-4950	10	39		V	5	
PI-4606	12	225		V	5	
PI-4607	12	260		V	5	
Basin 16						
PI-1532	8	343		S	1	
PI-1533	8	320		S A	1	
PI-1729	8	309		S	1	
PI-6342	8	283		S	1	
PI-6778	8	61		S	1	
PI-5680	8	314		D V A	2	
PI-1951	8	279		V A	4	
PI-2214	8	310		V A	4	
PI-2871	8	314		V A	4	
PI-5528	8	119		V A	4	
PI-6431	8	350		V A	4	
PI-9385	8	215		V A	4	
PI-9386	8	265		V A	4	
PI-8457	8	341		A	6	
PI-1512	10	374		V A	4	
PI-1949	10	319		V A	4	
PI-2208	10	346		V A	4	
PI-2897	10	369		V A	4	
PI-2900	10	272		V A	4	
PI-2901	10	123		V A	4	
PI-2902	10	283		V A	4	
PI-5677	10	315		V A	4	
PI-5695	10	161		V A	4	
PI-5696	10	470		V A	4	
PI-5705	10	319		V A	4	
PI-5708	10	414		V A	4	
PI-5709	10	282		V A	4	
PI-5921	10	184		V A	4	
PI-6639	10	244		V A	4	
PI-6640	10	237		V A	4	
PI-7014	10	23		V A	4	
PI-8466	10	320		V A	4	
PI-8477	10	229		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class*[1]	*Priority*[2]	*Cost*
PI-8478	10	207		V A	4	
PI-8479	10	111		V A	4	
PI-8533	10	255		A	6	
PI-2125	12	155		V A	4	
PI-2206	12	125		V A	4	
PI-2213	12	34		V A	4	
PI-2886	12	90		V A	4	
PI-5682	12	62		V A	4	
PI-5683	12	158		V A	4	
PI-5684	12	391		V A	4	
PI-5686	12	338		V A	4	
PI-6432	12	375		V A	4	
PI-6641	12	252		V A	4	
PI-7015	12	100		V A	4	
PI-8458	12	316		V A	4	
PI-8459	12	304		V A	4	
PI-8460	12	341		V A	4	
PI-8461	12	357		V A	4	
PI-8468	12	63		V A	4	
PI-1747	12	89		V	5	
PI-1749	12	314		V	5	
PI-2814	12	44		V	5	
PI-5511	12	282		V	5	
PI-6668	12	35		V	5	
PI-1942	12	153		A	6	
PI-1943	12	294		A	6	
PI-1944	12	485		A	6	
PI-1945	12	463		A	6	
PI-1946	12	472		A	6	
PI-1947	12	391		A	6	
PI-1950	12	242		A	6	
PI-2893	12	459		A	6	
PI-5294	12	90		A	6	
PI-5540	12	152		A	6	
PI-8534	12	57		A	6	
PI-8535	12	144		A	6	
PI-8536	12	317		A	6	
PI-9317	12	146		A	6	
PI-6795	15	75		D	3	
PI-8750	15	43		V A	4	
PI-8751	15	43		V A	4	
PI-8752	15	32		V A	4	
PI-6675	15	310		V	5	
PI-9319	18	296		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-9544	18	131		V A	4	
PI-1513	21	231		A	6	
PI-2801	21	38		A	6	
PI-2883	24	406		V A	4	
PI-6549	24	67		V A	4	
PI-8464	24	211		V A	4	
PI-8471	24	379		V A	4	
PI-8472	24	37		V A	4	
PI-8480	24	62		V A	4	
PI-8529	24	140		V A	4	
PI-1745	24	355		V	5	
PI-1746	24	309		V	5	
PI-1748	24	219		V	5	
PI-2207	24	15		V	5	
PI-5694	24	393		V	5	
PI-6548	24	103		V	5	
PI-2242	24	32		A	6	
PI-3392	24	109		A	6	
PI-5920	24	445		A	6	
PI-6550	24	400		A	6	
PI-8080	24	277		A	6	
PI-8456	24	466		A	6	
PI-8465	24	177		A	6	
PI-8467	24	338		A	6	
PI-8473	24	22		A	6	
PI-8474	24	13		A	6	
Basin 17						
PI-1508	8	177		V	5	
PI-4007	8	49		A	6	
PI-1506	10	143		V	5	
PI-1507	10	184		V	5	
PI-5941	10	321		V	5	
PI-5942	10	384		V	5	
PI-5943	10	265		V	5	
PI-5947	10	325		V	5	
PI-7243	12	247		V	5	
PI-7244	12	178		V	5	
PI-7245	12	53		V	5	
PI-7246	12	499		V	5	
PI-9688	20	260		S A	1	
PI-5937	20	260		D A	2	
PI-9689	20	260		A	6	
PI-6616	24	134		V A	4	
PI-6617	24	19		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-9526	24	65		A	6	
PI-1401	27	305		V A	4	
PI-1402	27	202		V A	4	
PI-2236	27	38		V A	4	
PI-3618	27	38		V A	4	
PI-6018	27	299		V A	4	
PI-6022	27	372		V A	4	
PI-6615	27	413		V A	4	
PI-5936	27	479		A	6	
PI-6049	27	452		A	6	
PI-6613	27	398		A	6	
PI-6614	27	349		A	6	
PI-3616	39	17		A	6	
PI-3612	42	18		A	6	
Basin 18						
PI-1326	8	210		V A	4	
PI-1327	8	323		V A	4	
PI-1328	8	364		V A	4	
PI-3062	8	419		V A	4	
PI-3063	8	417		V A	4	
PI-3126	8	381		V A	4	
PI-4111	8	234		V A	4	
PI-4112	8	454		V A	4	
PI-4312	8	356		V A	4	
PI-5962	8	268		V A	4	
PI-9486	8	0		V A	4	
PI-4108	8	134		V	5	
PI-8486	8	36		V	5	
PI-3125	8	308		A	6	
PI-4114	8	439		A	6	
PI-4157	8	400		A	6	
PI-5957	8	0		A	6	
PI-5965	8	290		A	6	
PI-6051	8	411		A	6	
PI-7276	8	184		A	6	
PI-7277	8	90		A	6	
PI-8543	8	44		A	6	
PI-2128	10	36		D V A	2	
PI-1325	10	142		V A	4	
PI-20001	10	457		V A	4	
PI-2129	10	346		V A	4	
PI-3052	10	382		V A	4	
PI-3057	10	370		V A	4	
PI-4110	10	151		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-4268	10	384		V A	4	
PI-4269	10	371		V A	4	
PI-4318	10	286		V A	4	
PI-4328	10	179		V A	4	
PI-4329	10	203		V A	4	
PI-4330	10	379		V A	4	
PI-5699	10	212		V A	4	
PI-5722	10	248		V A	4	
PI-5724	10	460		V A	4	
PI-5922	10	405		V A	4	
PI-7264	10	267		V A	4	
PI-7577	10	347		V A	4	
PI-8487	10	37		V A	4	
PI-4319	10	302		V	5	
PI-6500	10	188		V	5	
PI-1405	10	277		A	6	
PI-4270	10	379		A	6	
PI-7274	10	152		A	6	
PI-7275	10	204		A	6	
PI-5931	12	67		S V	1	
PI-2188	12	224		V A	4	
PI-2189	12	276		V A	4	
PI-4107	12	127		V A	4	
PI-4186	12	198		V A	4	
PI-4317	12	481		V A	4	
PI-5966	12	461		V A	4	
PI-7218	12	231		V A	4	
PI-7265	12	387		V A	4	
PI-7266	12	376		V A	4	
PI-7267	12	379		V A	4	
PI-7268	12	376		V A	4	
PI-7269	12	385		V A	4	
PI-8104	12	187		V A	4	
PI-5930	12	244		V	5	
PI-1345	12	109		A	6	
PI-7273	12	332		A	6	
PI-9464	12	50		A	6	
PI-2190	15	433		V A	4	
PI-3051	15	184		V A	4	
PI-3127	15	238		V A	4	
PI-7212	15	371		V A	4	
PI-7213	15	386		V A	4	
PI-7214	15	377		V A	4	
PI-7215	15	382		V A	4	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2] Priority Scale: 1-6 (Highest → Lowest)

(white box)	Hydraulic Deficiency
(shaded box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-7216	15	373		V A	4	
PI-7217	15	389		V A	4	
PI-8106	15	259		V A	4	
PI-5956	15	364		A	6	
PI-7223	15	149		A	6	
PI-8105	15	230		A	6	
PI-6774	16	73		A	6	
PI-9687	18	59		S V A	1	
PI-1344	18	322		V A	4	
PI-7211	18	203		V A	4	
PI-7219	18	179		V A	4	
PI-7220	18	364		V A	4	
PI-7221	18	59		V A	4	
PI-7222	18	418		V A	4	
PI-7224	18	232		V A	4	
PI-9686	18	59		V A	4	
PI-2132	21	179		A	6	
PI-2133	21	59		A	6	
PI-2134	21	217		A	6	
PI-2151	21	235		A	6	
PI-5718	21	483		A	6	
PI-6598	21	620		A	6	
PI-8386	21	143		A	6	
PI-8483	21	465		A	6	
PI-9295	21	126		A	6	
PI-9296	21	161		A	6	
PI-5954	24	364		V A	4	
PI-5958	24	11		V A	4	
PI-5959	24	411		V A	4	
PI-6777	24	273		V A	4	
PI-8568	24	112		V A	4	
PI-7463	24	49		V	5	
PI-7464	24	58		V	5	
PI-8530	24	26		V	5	
PI-8753	24	147		V	5	
PI-6775	24	507		A	6	
PI-6776	24	139		A	6	
Basin 19						
PI-1424	8	228		V	5	
PI-1426	8	229		V	5	
PI-1427	8	233		V	5	
PI-3316	8	257		V	5	
PI-3323	8	351		V	5	
PI-3328	8	306		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class*** [1]	***Priority*** [2]	***Cost***
PI-3340	8	31		V	5	
PI-3341	8	42		V	5	
PI-3343	8	253		V	5	
PI-4181	8	311		V	5	
PI-6080	8	205		V	5	
PI-6081	8	216		V	5	
PI-6094	8	288		V	5	
PI-6096	8	335		V	5	
PI-6106	8	393		V	5	
PI-6107	8	228		V	5	
PI-6108	8	248		V	5	
PI-6109	8	241		V	5	
PI-6112	8	340		V	5	
PI-6117	8	341		V	5	
PI-6126	8	201		V	5	
PI-6128	8	444		V	5	
PI-6133	8	36		V	5	
PI-6176	8	348		V	5	
PI-6177	8	288		V	5	
PI-6181	8	198		V	5	
PI-6186	8	341		V	5	
PI-6316	8	138		V	5	
PI-6406	8	366		V	5	
PI-6456	8	373		V	5	
PI-6458	8	371		V	5	
PI-9309	8	261		V	5	
PI-9487	8	261		V	5	
PI-9643	8	110		A	6	
PI-6156	10	112		V	5	
PI-1407	12	346		V	5	
PI-3177	18	327		V	5	
PI-2293	24	76		V	5	
Basin 20						
PI-1168	8	103		V	5	
PI-1169	8	124		V	5	
PI-1170	8	179		V	5	
PI-2272	8	201		V	5	
PI-3207	8	314		V	5	
PI-3209	8	409		V	5	
PI-3274	8	243		V	5	
PI-3275	8	255		V	5	
PI-3277	8	133		V	5	
PI-3782	8	155		V	5	
PI-3786	8	195		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-3787	8	203		V	5	
PI-3788	8	261		V	5	
PI-6077	8	342		V	5	
PI-6261	8	175		V	5	
PI-6579	8	453		V	5	
PI-6580	8	341		V	5	
PI-6584	8	202		V	5	
PI-7394	8	113		V	5	
PI-7396	8	296		V	5	
PI-7398	8	316		V	5	
PI-9501	8	181		V	5	
PI-9690	8	0		V	5	
PI-9697	8	0		V	5	
PI-9698	8	0		V	5	
PI-9700	8	0		V	5	
PI-6302	10	267		D V	3	
PI-8024	10	86		V A	4	
PI-8025	10	69		V A	4	
PI-8026	10	80		V A	4	
PI-8027	10	251		V A	4	
PI-1162	10	111		V	5	
PI-1163	10	271		V	5	
PI-1164	10	196		V	5	
PI-1165	10	315		V	5	
PI-1166	10	346		V	5	
PI-6282	10	208		V	5	
PI-6283	10	317		V	5	
PI-7373	10	166		V	5	
PI-7374	10	220		V	5	
PI-7977	10	271		V	5	
PI-2317	10	450		A	6	
PI-2318	10	364		A	6	
PI-2319	10	384		A	6	
PI-2320	10	268		A	6	
PI-2321	10	319		A	6	
PI-2322	10	383		A	6	
PI-2323	10	438		A	6	
PI-2324	10	380		A	6	
PI-2325	10	281		A	6	
PI-6498	10	351		A	6	
PI-8603	10	52		A	6	
PI-8604	10	334		A	6	
PI-1200	18	122		V	5	
PI-1201	18	160		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

Existing Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-1202	18	117		V	5	
PI-3870	18	150		V	5	
PI-3871	18	156		V	5	
PI-3872	18	159		V	5	
PI-3873	18	196		V	5	
PI-3892	18	150		V	5	
PI-3893	18	268		V	5	
PI-3899	18	253		V	5	
PI-3900	18	307		V	5	
PI-3901	18	294		V	5	
PI-3902	18	307		V	5	
PI-6942	18	166		V	5	
PI-6943	18	113		V	5	
PI-7360	18	178		V	5	
PI-7361	18	126		V	5	
PI-7366	18	86		V	5	
PI-7367	18	146		V	5	
PI-FEED-LS07	18	0		V	5	
PI-6764	21	23		A	6	
PI-6765	28	112		A	6	
PI-7007	28	72		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency (unshaded box)

Non-Hydraulic Deficiency (shaded box)

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
Basin 1						
PI-1564	8	319	PVC	S	1	
PI-1582	8	321	PVC	S	1	
PI-1583	8	350	PVC	S	1	
PI-1584	8	123	C900	S	1	
PI-2933	8	286	VCP	S A	1	
PI-2934	8	250	VCP	S	1	
PI-2935	8	246	VCP	S	1	
PI-2946	8	323	VCP	S V	1	
PI-5456	8	453	VCP	S	1	
PI-5570	8	272	VCP	S A	1	
PI-5577	8	323	VCP	S	1	
PI-5579	8	393	VCP	S	1	
PI-5580	8	106	VCP	S	1	
PI-5752	8	217	VCP	S	1	
PI-6393	8	433	VCP	S	1	
PI-6490	8	284	VCP	S	1	
PI-6491	8	209	VCP	S	1	
PI-6541	8	112	VCP	S A	1	
PI-7453	8	223	VCP	S	1	
PI-7454	8	169	VCP	S	1	
PI-9289	8	23	VCP	S A	1	
PI-9559	8	32	VCP	S A	1	
PI-9560	8	420	VCP	S A	1	
PI-9624	8	242	VCP	S	1	
PI-9626	8	184	VCP	S	1	
PI-9627	8	106	VCP	S	1	
PI-5571	8	335	VCP	S A	1	
PI-6542	8	219	PVC	S A	1	
PI-6543	8	106	PVC	S A	1	
PI-1649	8	172	PVC	D	3	
PI-9569	8	40	--	D V	3	
PI-5781	8	268	--	D	3	
PI-9294	8	374	--	D	3	
PI-9566	8	170	VCP	D	3	
PI-9625	8	205	PVC	D	3	
PI-1618	8	379	VCP	V	5	
PI-2738	8	436	VCP	V	5	
PI-4923	8	261	VCP	V	5	
PI-5439	8	271	PVC	V	5	
PI-5455	8	280	VCP	V	5	
PI-5460	8	246	VCP	V	5	
PI-5461	8	275	VCP	V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency (white)

Non-Hydraulic Deficiency (shaded)

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-6476	8	345	VCP	V	5	
PI-8297	8	74	VCP	V	5	
PI-8298	8	84	VCP	V	5	
PI-8975	8	286	VCP	V	5	
PI-8978	8	305	VCP	V	5	
PI-9528	8	67	VCP	V	5	
PI-8971	8	110	VCP	A	6	
PI-1587	10	261	PVC	S A	1	
PI-1591	10	277	PVC	S A	1	
PI-1592	10	434	PVC	S A	1	
PI-1593	10	343	PVC	S A	1	
PI-2720	10	132	VCP	S	1	
PI-2736	10	234	VCP	S	1	
PI-5445	10	44	VCP	S	1	
PI-5446	10	189	VCP	S	1	
PI-5453	10	59	VCP	S	1	
PI-5753	10	269	PVC	S V	1	
PI-5209	10	321	VCP	D	3	
PI-5210	10	219	VCP	D	3	
PI-5211	10	254	PVC	D	3	
PI-5447	10	177	VCP	D	3	
PI-5452	10	231	VCP	D	3	
PI-5171	10	265	VCP	V	5	
PI-5172	10	166	VCP	V	5	
PI-5564	10	270	VCP	V	5	
PI-5565	10	231	VCP	V	5	
PI-1575	12	307	VCP	S	1	
PI-1596	12	289	VCP	S A	1	
PI-1597	12	359	VCP	S A	1	
PI-1598	12	348	VCP	S A	1	
PI-1599	12	325	PVC	S A	1	
PI-1651	12	392	VCP	S	1	
PI-1653	12	388	VCP	S	1	
PI-1898	12	305	VCP	S V	1	
PI-2950	12	62	VCP	S	1	
PI-5778	12	273	VCP	S	1	
PI-5797	12	236	VCP	S	1	
PI-5799	12	293	PVC	S	1	
PI-7142	12	150	PVC	S	1	
PI-7143	12	147	PVC	S	1	
PI-8300	12	392	PVC	S V A	1	
PI-1897	12	296	PVC	D	3	
PI-5782	12	75	PVC	V	5	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2] Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class [1]***	***Priority [2]***	***Cost***
PI-1899	15	344	PVC	S A	1	
PI-1900	15	392	PVC	S A	1	
PI-2148	15	378	PVC	S A	1	
PI-2149	15	27	PVC	S A	1	
PI-2766	15	374	VCP	S A	1	
PI-2767	15	331	VCP	S A	1	
PI-2769	15	15	VCP	S A	1	
PI-5399	15	385	VCP	S A	1	
PI-5407	15	151	VCP	S A	1	
PI-5408	15	214	VCP	S A	1	
PI-5414	15	461	VCP	S A	1	
PI-7139	15	319	VCP	S A	1	
PI-7141	15	339	VCP	S A	1	
PI-8520	15	155	VCP	S A	1	
PI-8521	15	187	VCP	S A	1	
PI-7649	15	359	VCP	D V	3	
PI-1640	15	216	VCP	V	5	
PI-2147	15	283	VCP	V	5	
PI-7016	15	354	VCP	V	5	
PI-9038	15	79	PVC	V	5	
PI-9568	15	27	PVC	V	5	
PI-9561	18	305	PVC	D V A	2	
PI-9562	18	228	PVC	D A	2	
PI-9016	18	229	PVC	D	3	
PI-9292	18	19	PVC	D	3	
Basin 2						
PI-6744	12	426		V	5	
PI-6745	12	544		V	5	
PI-6746	12	396		V	5	
PI-6754	12	307		V	5	
PI-6755	12	377		V	5	
PI-6760	12	303		V	5	
PI-6761	12	475		V	5	
PI-6762	12	186		V	5	
Basin 3						
PI-1289	8	263		D	3	
PI-7999	8	104		A	6	
PI-8000	8	277		A	6	
PI-6672	10	444		D	3	
Basin 4						
PI-6591	8	31		S	1	
PI-6168	10	12		S V	1	
PI-6170	10	14		S	1	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency (white rows)

Non-Hydraulic Deficiency (grey rows)

Conduit ID	***Diameter (in)***	***Length (ft)***	***Material***	***CIP Deficiency Class [1]***	***Priority [2]***	***Cost***
PI-6212	10	341		S	1	
PI-6213	10	92		S	1	
PI-6214	10	132		S	1	
PI-6281	10	185		S	1	
PI-6169	12	51		S V	1	
Basin 5						
PI-1490	8	48		A	6	
PI-3366	8	229		A	6	
PI-2223	10	356		V	5	
PI-3229	10	235		V	5	
PI-3230	10	156		V	5	
PI-3486	10	337		V	5	
PI-3487	10	44		V	5	
PI-3355	12	359		V A	4	
PI-3610	12	35		V A	4	
PI-3098	12	129		V	5	
PI-3551	12	96		V	5	
PI-3552	12	85		V	5	
PI-3553	12	84		V	5	
PI-3554	12	86		V	5	
PI-6694	12	177		V	5	
PI-3611	21	91		V A	4	
PI-6705	21	11		V A	4	
PI-3619	21	238		A	6	
PI-6700	21	16		A	6	
PI-7478	42	141		A	6	
PI-7479	42	84		A	6	
HAARF_INLET	42	0		A	6	
Basin 6						
PI-3075	8	346		S	1	
PI-6016	8	115		S A	1	
PI-9299	8	81		S	1	
PI-9300	8	114		S	1	
PI-9619	8	133		D A	2	
PI-6007	10	216		S	1	
PI-8901	12	305		V	5	
PI-8902	12	301		V	5	
PI-2802	12	0		V	5	
PI-3076	15	213		S V	1	
PI-5974	15	272		V	5	
PI-5976	15	221		V	5	
PI-5977	15	145		V	5	
PI-6000	15	144		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency

Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
Basin 7						
PI-4456	8	56		S	1	
PI-1119	8	144		V	5	
PI-1122	8	169		V	5	
PI-1118	10	151		V	5	
PI-1124	12	45		S	1	
PI-1126	12	75		S	1	
PI-1127	12	93		S V	1	
PI-4455	12	314		S	1	
PI-6644	12	61		S A	1	
Basin 8						
PI-2026	8	179		S	1	
PI-9498	8	28		S A	1	
PI-9499	8	325		S A	1	
PI-9500	8	118		S A	1	
PI-8718	8	73		D	3	
PI-9496	8	8		D	3	
PI-2000	8	161		V	5	
PI-2036	8	324		V	5	
PI-2406	8	129		V	5	
PI-2407	8	300		V	5	
PI-2408	8	190		V	5	
PI-4540	8	296		V	5	
PI-4541	8	262		V	5	
PI-4542	8	275		V	5	
PI-4763	8	301		V	5	
PI-4764	8	233		V	5	
PI-4765	8	140		V	5	
PI-4766	8	93		V	5	
PI-4768	8	241		V	5	
PI-4769	8	225		V	5	
PI-4770	8	320		V	5	
PI-4771	8	340		V	5	
PI-4772	8	149		V	5	
PI-4773	8	126		V	5	
PI-8156	8	261		V	5	
PI-6492	12	362		V	5	
PI-6956	12	392		V	5	
PI-6959	12	157		V	5	
PI-6960	12	112		V	5	
PI-6961	12	146		V	5	
PI-6962	12	290		V	5	
PI-6965	12	253		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency

Non-Hydraulic Deficiency

Conduit ID	Diameter (in)	Length (ft)	Material	CIP Deficiency Class [1]	Priority [2]	Cost
PI-6966	12	341		V	5	
PI-7124	12	201		V	5	
PI-8647	15	31		S	1	
PI-2410	15	30		D	3	
PI-2411	15	323		D	3	
PI-8646	15	315		D	3	
PI-2025	18	328		D	3	
PI-2057	18	27		V A	4	
PI-2056	18	127		V	5	
PI-2060	18	140		V	5	
PI-2061	18	223		V	5	
PI-2536	18	157		V	5	
PI-2537	18	412		V	5	
PI-2541	18	339		V	5	
PI-6538	18	158		V	5	
PI-7845	18	290		V	5	
PI-9539	18	155		A	6	
PI-9540	18	11		A	6	
PI-9541	18	58		A	6	
PI-9542	18	10		A	6	
PI-9543	18	123		A	6	
Basin 9						
PI-5147	8	14		D V A	2	
PI-8290	8	89		D V A	2	
PI-2097	8	280		D	3	
PI-2098	8	206		D	3	
PI-2758	8	286		D	3	
PI-2759	8	354		D	3	
PI-3458	8	189		D	3	
PI-2707	8	17		V A	4	
PI-1659	8	235		V	5	
PI-2674	8	99		V	5	
PI-2692	8	55		V	5	
PI-2705	8	269		V	5	
PI-2708	8	315		V	5	
PI-4867	8	214		V	5	
PI-5140	8	281		V	5	
PI-5141	8	411		V	5	
PI-5148	8	360		V	5	
PI-5150	8	303		V	5	
PI-5151	8	148		V	5	
PI-5220	8	108		V	5	
PI-7604	8	243		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	Diameter (in)	Length (ft)	Material	CIP Deficiency Class [1]	Priority [2]	Cost
PI-1881	8	113		A	6	
PI-1882	8	415		A	6	
PI-2100	8	393		A	6	
PI-2102	8	227		A	6	
PI-5131	8	422		A	6	
PI-6533	8	34		A	6	
PI-8507	8	391		A	6	
PI-9494	8	180		A	6	
PI-9537	8	169		A	6	
PI-2174	10	126		V	5	
PI-2686	10	273		V	5	
PI-4883	10	58		V	5	
PI-4885	10	204		V	5	
PI-6534	10	115		V	5	
PI-8505	10	118		V	5	
PI-9399	10	178		V	5	
PI-9400	10	250		V	5	
PI-9401	10	135		V	5	
PI-9402	10	405		V	5	
PI-9403	10	234		V	5	
PI-9404	10	336		V	5	
PI-9408	10	128		V	5	
PI-2691	12	51		V A	4	
PI-1617	12	205		V	5	
PI-1622	12	79		V	5	
PI-1623	12	72		V	5	
PI-1624	12	99		V	5	
PI-1625	12	253		V	5	
PI-4881	12	170		V	5	
PI-6516	12	79		V	5	
PI-6517	12	94		V	5	
PI-7601	12	201		V	5	
PI-7602	12	196		V	5	
PI-7603	12	317		V	5	
PI-7606	12	194		V	5	
PI-7607	12	212		V	5	
PI-7640	12	327		V	5	
PI-7650	12	146		V	5	
PI-7651	12	351		V	5	
PI-8506	12	42		V	5	
PI-8510	12	229		V	5	
PI-8695	12	355		V	5	
PI-2764	12	22		A	6	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2] Priority Scale: 1-6 (Highest → Lowest)

	Hydraulic Deficiency
(shaded)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-1639	15	246		V	5	
PI-8694	16	142		V	5	
PI-1657	18	409		V	5	
Basin 10						
PI-1845	8	153		V A	4	
PI-1846	8	130		V A	4	
PI-1847	8	260		V A	4	
PI-1908	8	250		V A	4	
PI-2762	8	371		V A	4	
PI-2785	8	276		V A	4	
PI-5108	8	384		V A	4	
PI-5127	8	133		V A	4	
PI-5128	8	271		V A	4	
PI-5390	8	269		V A	4	
PI-5391	8	252		V A	4	
PI-6473	8	431		V A	4	
PI-7923	8	424		V A	4	
PI-8277	8	468		V A	4	
PI-8282	8	349		V A	4	
PI-8325	8	350		V A	4	
PI-8326	8	376		V A	4	
PI-8327	8	250		V A	4	
PI-1839	8	268		V	5	
PI-1840	8	270		V	5	
PI-1841	8	251		V	5	
PI-1842	8	245		V	5	
PI-1843	8	283		V	5	
PI-1844	8	70		V	5	
PI-1849	8	327		V	5	
PI-1850	8	266		V	5	
PI-1853	8	322		V	5	
PI-1854	8	346		V	5	
PI-2646	8	99		V	5	
PI-2648	8	141		V	5	
PI-4735	8	106		V	5	
PI-4736	8	354		V	5	
PI-4738	8	108		V	5	
PI-4739	8	317		V	5	
PI-5064	8	307		V	5	
PI-5065	8	280		V	5	
PI-5111	8	141		V	5	
PI-5132	8	258		V	5	
PI-5133	8	403		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-6359	8	80		V	5	
PI-8315	8	93		V	5	
PI-8321	8	130		V	5	
PI-8322	8	200		V	5	
PI-8324	8	332		V	5	
PI-8328	8	304		V	5	
PI-1861	10	261		A	6	
PI-1862	10	55		A	6	
PI-2760	10	259		A	6	
PI-2763	10	169		A	6	
PI-5224	10	268		A	6	
PI-5225	10	260		A	6	
PI-8286	10	102		A	6	
PI-8292	10	127		A	6	
PI-8293	10	134		A	6	
PI-8316	10	415		A	6	
PI-8317	10	325		A	6	
PI-9684	12	135		S V A	1	
PI-8512	12	133		D A	2	
PI-9532	12	135		V A	4	
PI-1838	12	396		V	5	
PI-1848	12	336		V	5	
PI-1851	12	422		V	5	
PI-1852	12	250		V	5	
PI-1904	12	422		A	6	
PI-1905	12	360		A	6	
PI-2786	12	223		A	6	
PI-5384	12	113		A	6	
PI-5392	12	425		A	6	
PI-5393	12	178		A	6	
PI-5561	12	134		A	6	
PI-8513	12	223		A	6	
PI-5560	24	21		A	6	
Basin 11						
PI-1797	8	107		S V	1	
PI-1798	8	300		S V	1	
PI-1953	8	303		S V A	1	
PI-2610	8	279		S A	1	
PI-2611	8	206		S A	1	
PI-2826	8	227		S A	1	
PI-2827	8	293		S A	1	
PI-2828	8	170		S A	1	
PI-2829	8	111		S V A	1	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-4981	8	292		S A	1	
PI-4986	8	329		S A	1	
PI-5094	8	127		S A	1	
PI-5296	8	196		S A	1	
PI-5335	8	298		S A	1	
PI-5349	8	21		S V A	1	
PI-8253	8	302		S V	1	
PI-9654	8	98		S	1	
PI-1958	8	330		D V A	2	
PI-5044	8	364		D A	2	
PI-7563	8	291		D A	2	
PI-8376	8	31		D V	3	
PI-5297	8	263		D	3	
PI-9655	8	190		D	3	
PI-1912	8	434		V A	4	
PI-1920	8	447		V A	4	
PI-1923	8	280		V A	4	
PI-1924	8	166		V A	4	
PI-1925	8	159		V A	4	
PI-1926	8	301		V A	4	
PI-1927	8	37		V A	4	
PI-2087	8	214		V A	4	
PI-2088	8	220		V A	4	
PI-2089	8	200		V A	4	
PI-2090	8	368		V A	4	
PI-4979	8	340		V A	4	
PI-5069	8	115		V A	4	
PI-5095	8	348		V A	4	
PI-5376	8	323		V A	4	
PI-5378	8	254		V A	4	
PI-5379	8	175		V A	4	
PI-5381	8	253		V A	4	
PI-5545	8	253		V A	4	
PI-6362	8	409		V A	4	
PI-6427	8	43		V A	4	
PI-6974	8	348		V A	4	
PI-6976	8	215		V A	4	
PI-1800	8	314		V	5	
PI-1801	8	330		V	5	
PI-1813	8	330		V	5	
PI-1917	8	314		V	5	
PI-1918	8	429		V	5	
PI-2653	8	290		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency (white)
Non-Hydraulic Deficiency (grey)

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-2844	8	337		V	5	
PI-2845	8	336		V	5	
PI-2848	8	167		V	5	
PI-4994	8	324		V	5	
PI-4995	8	123		V	5	
PI-4999	8	234		V	5	
PI-5010	8	264		V	5	
PI-5078	8	288		V	5	
PI-5079	8	261		V	5	
PI-5091	8	216		V	5	
PI-5092	8	295		V	5	
PI-5100	8	254		V	5	
PI-5299	8	367		V	5	
PI-6426	8	44		V	5	
PI-8189	8	318		V	5	
PI-8228	8	109		V	5	
PI-8254	8	369		V	5	
PI-8259	8	31		V	5	
PI-8260	8	54		V	5	
PI-8264	8	391		V	5	
PI-8330	8	359		V	5	
PI-8332	8	144		V	5	
PI-8391	8	252		V	5	
PI-9645	8	231		V	5	
PI-1792	8	147		A	6	
PI-1793	8	358		A	6	
PI-1794	8	185		A	6	
PI-1795	8	121		A	6	
PI-1959	8	251		A	6	
PI-2603	8	314		A	6	
PI-2604	8	269		A	6	
PI-4978	8	343		A	6	
PI-5045	8	152		A	6	
PI-5070	8	210		A	6	
PI-5071	8	116		A	6	
PI-5096	8	340		A	6	
PI-5298	8	305		A	6	
PI-7476	8	237		A	6	
PI-7477	8	30		A	6	
PI-7554	8	34		A	6	
PI-8258	8	295		A	6	
PI-8523	8	76		A	6	
PI-8524	8	217		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	Diameter (in)	Length (ft)	Material	CIP Deficiency Class [1]	Priority [2]	Cost
PI-1956	10	225		S V	1	
PI-1957	10	130		S V	1	
PI-5354	10	176		S V	1	
PI-5355	10	176		S V	1	
PI-8252	10	359		S V	1	
PI-1964	10	427		D V A	2	
PI-5295	10	260		D V A	2	
PI-5719	10	471		D A	2	
PI-7487	10	155		D A	2	
PI-2073	10	189		V A	4	
PI-2074	10	212		V A	4	
PI-2825	10	311		V A	4	
PI-5043	10	326		V A	4	
PI-5292	10	135		V A	4	
PI-5559	10	367		V A	4	
PI-6789	10	29		V A	4	
PI-7444	10	308		V A	4	
PI-8526	10	176		V A	4	
PI-8527	10	193		V A	4	
PI-1828	10	209		V	5	
PI-1913	10	320		V	5	
PI-1914	10	296		V	5	
PI-2080	10	231		V	5	
PI-2081	10	122		V	5	
PI-2796	10	191		V	5	
PI-2797	10	174		V	5	
PI-5055	10	131		V	5	
PI-5102	10	367		V	5	
PI-1963	12	436		V A	4	
PI-6524	12	57		V A	4	
PI-5103	12	141		V	5	
PI-7555	12	54		V	5	
PI-7557	12	259		V	5	
PI-7558	12	409		V	5	
PI-7564	12	157		V	5	
PI-7566	12	289		V	5	
PI-6525	12	324		A	6	
PI-7561	12	24		A	6	
PI-7562	15	320		A	6	
PI-7567	18	63		V	5	
PI-7569	18	22		V	5	
Basin 12						
PI-7939	6	191		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-1283	6	481		A	6	
PI-6399	6	165		A	6	
PI-7947	6	195		A	6	
PI-5878	8	176		V A	4	
PI-7938	8	378		V A	4	
PI-8404	8	397		V A	4	
PI-8406	8	188		V A	4	
PI-8407	8	191		V A	4	
PI-5849	8	53		V	5	
PI-7440	8	304		V	5	
PI-7441	8	251		V	5	
PI-8405	8	186		V	5	
PI-6398	8	187		A	6	
PI-8388	8	349		A	6	
PI-8393	8	181		A	6	
PI-8422	8	50		A	6	
PI-7946	10	160		V A	4	
PI-8395	10	186		V A	4	
PI-2909	10	185		V	5	
PI-5850	10	354		V	5	
PI-2164	10	55		A	6	
PI-9685	12	135		S V A	1	
PI-5725	12	404		V	5	
PI-7942	12	50		V	5	
PI-8394	12	186		V	5	
PI-7472	12	229		A	6	
PI-8691	18	185		D A	2	
PI-9531	18	269		D A	2	
PI-8381	21	494		D A	2	
PI-8387	21	340		D A	2	
PI-1928	21	187		A	6	
PI-1929	21	499		A	6	
PI-1930	21	248		A	6	
PI-1931	21	56		A	6	
PI-1932	21	465		A	6	
PI-1933	21	488		A	6	
PI-1969	21	479		A	6	
PI-1970	21	445		A	6	
PI-6446	21	25		A	6	
Basin 13						
PI-1209	8	146		V A	4	
PI-1211	8	274		V A	4	
PI-1212	8	293		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-1216	8	146		V A	4	
PI-3187	8	132		V A	4	
PI-6070	8	154		V A	4	
PI-6071	8	311		V A	4	
PI-6657	8	282		V A	4	
PI-7492	8	400		V A	4	
PI-9312	8	87		V A	4	
PI-8856	8	44		V A	4	
PI-9308	8	49		V	5	
PI-1337	8	355		A	6	
PI-8855	8	183		A	6	
PI-1215	10	368		V A	4	
PI-1340	10	271		V A	4	
PI-4283	10	203		V A	4	
PI-7493	10	165		V A	4	
PI-7494	10	98		V A	4	
PI-9656	10	234		V A	4	
PI-9657	10	48		V A	4	
PI-1219	10	468		A	6	
PI-3000	10	390		A	6	
PI-4284	10	175		A	6	
PI-4285	10	501		A	6	
PI-6650	10	384		A	6	
PI-6652	10	37		A	6	
PI-7044	10	267		A	6	
PI-7046	10	38		A	6	
PI-6656	12	232		D V	3	
PI-1217	12	386		V A	4	
Basin 14						
PI-2339	8	332		V	5	
PI-2340	8	255		V	5	
PI-2351	8	311		V	5	
PI-2352	8	206		V	5	
PI-2860	8	136		V	5	
PI-5669	8	319		V	5	
PI-5841	8	312		V	5	
PI-5842	8	338		V	5	
PI-5913	8	40		V	5	
PI-6434	8	391		V	5	
PI-6433	8	21		A	6	
PI-2216	10	216		S	1	
PI-2878	10	324		S V	1	
PI-5833	10	307		S V	1	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-5834	10	307		S V	1	
PI-8454	10	367		S V	1	
PI-2215	10	131		D V	3	
PI-2341	10	308		V	5	
PI-2344	10	422		V	5	
PI-2345	10	278		V	5	
PI-2874	10	140		V	5	
PI-2875	10	52		V	5	
PI-2876	10	295		V	5	
PI-5505	10	319		V	5	
PI-5506	10	143		V	5	
PI-5668	10	272		V	5	
PI-5915	10	22		V	5	
PI-5917	10	341		V	5	
PI-5836	12	303		S	1	
PI-5837	12	318		S	1	
PI-5838	12	337		S	1	
PI-5839	12	301		S V	1	
PI-6941	12	15		S A	1	
PI-8455	12	348		S V	1	
PI-5840	12	369		V	5	
PI-5918	12	395		V	5	
PI-1518	24	476		S A	1	
PI-1519	24	473		S A	1	
PI-1520	24	375		S A	1	
PI-1521	24	383		S A	1	
PI-1522	24	448		S A	1	
PI-1523	24	336		S A	1	
PI-1524	24	55		S A	1	
PI-1530	24	285		S A	1	
PI-1531	24	23		S A	1	
PI-1535	24	286		S A	1	
PI-5938	24	391		S A	1	
PI-8439	24	325		S A	1	
Basin 15						
PI-3363	8	48		V	5	
PI-4950	10	39		V	5	
PI-4606	12	225		V	5	
PI-4607	12	260		V	5	
PI-2442	16	425		D	3	
Basin 16						
PI-1532	8	343		S	1	
PI-1533	8	320		S A	1	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2] Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]				*Priority* [2]	*Cost*
PI-1729	8	309		S				1	
PI-2214	8	310		S		V	A	1	
PI-2871	8	314		S		V	A	1	
PI-5680	8	314		S		V	A	1	
PI-6342	8	283		S				1	
PI-6778	8	61		S				1	
PI-1951	8	279				V	A	4	
PI-5528	8	119				V	A	4	
PI-6431	8	350				V	A	4	
PI-9385	8	215				V	A	4	
PI-9386	8	265				V	A	4	
PI-8457	8	341					A	6	
PI-1512	10	374				V	A	4	
PI-1949	10	319				V	A	4	
PI-2897	10	369				V	A	4	
PI-2900	10	272				V	A	4	
PI-2901	10	123				V	A	4	
PI-2902	10	283				V	A	4	
PI-5677	10	315				V	A	4	
PI-5695	10	161				V	A	4	
PI-5696	10	470				V	A	4	
PI-5705	10	319				V	A	4	
PI-5708	10	414				V	A	4	
PI-5709	10	282				V	A	4	
PI-5921	10	184				V	A	4	
PI-6639	10	244				V	A	4	
PI-6640	10	237				V	A	4	
PI-7014	10	23				V	A	4	
PI-8466	10	320				V	A	4	
PI-8477	10	229				V	A	4	
PI-8478	10	207				V	A	4	
PI-8479	10	111				V	A	4	
PI-2208	10	346					A	6	
PI-8533	10	255					A	6	
PI-5512	12	386		S				1	
PI-2213	12	34			D	V	A	2	
PI-2125	12	155				V	A	4	
PI-2206	12	125				V	A	4	
PI-2886	12	90				V	A	4	
PI-5682	12	62				V	A	4	
PI-5683	12	158				V	A	4	
PI-5684	12	391				V	A	4	
PI-5686	12	338				V	A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency

Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-6432	12	375		V A	4	
PI-6641	12	252		V A	4	
PI-7015	12	100		V A	4	
PI-8458	12	316		V A	4	
PI-8459	12	304		V A	4	
PI-8460	12	341		V A	4	
PI-8461	12	357		V A	4	
PI-8468	12	63		V A	4	
PI-1747	12	89		V	5	
PI-1749	12	314		V	5	
PI-2814	12	44		V	5	
PI-6668	12	35		V	5	
PI-1942	12	153		A	6	
PI-1943	12	294		A	6	
PI-1944	12	485		A	6	
PI-1945	12	463		A	6	
PI-1946	12	472		A	6	
PI-1947	12	391		A	6	
PI-1950	12	242		A	6	
PI-2893	12	459		A	6	
PI-5294	12	90		A	6	
PI-5540	12	152		A	6	
PI-8534	12	57		A	6	
PI-8535	12	144		A	6	
PI-8536	12	317		A	6	
PI-9317	12	146		A	6	
PI-1727	15	70		S	1	
PI-1728	15	277		S	1	
PI-5513	15	319		S	1	
PI-6675	15	310		S	1	
PI-8751	15	43		S V A	1	
PI-8752	15	32		S V A	1	
PI-8750	15	43		D V A	2	
PI-6795	15	75		D	3	
PI-9544	18	131		S V A	1	
PI-9319	18	296		V A	4	
PI-1513	21	231		S A	1	
PI-2801	21	38		S A	1	
PI-8456	24	466		S A	1	
PI-8467	24	338		S A	1	
PI-2242	24	32		D A	2	
PI-8465	24	177		D A	2	
PI-2883	24	406		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

Hydraulic Deficiency

Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-6549	24	67		V A	4	
PI-8464	24	211		V A	4	
PI-8471	24	379		V A	4	
PI-8472	24	37		V A	4	
PI-8480	24	62		V A	4	
PI-8529	24	140		V A	4	
PI-1745	24	355		V	5	
PI-1746	24	309		V	5	
PI-1748	24	219		V	5	
PI-2207	24	15		V	5	
PI-5694	24	393		V	5	
PI-6548	24	103		V	5	
PI-3392	24	109		A	6	
PI-5920	24	445		A	6	
PI-6550	24	400		A	6	
PI-8080	24	277		A	6	
PI-8473	24	22		A	6	
PI-8474	24	13		A	6	
PI-9084	28	145		S	1	
PI-9334	28	275		S	1	
PI-9335	28	324		S	1	
PI-9336	28	431		S	1	
Basin 17						
PI-1508	8	177		V	5	
PI-4007	8	49		A	6	
PI-1506	10	143		V	5	
PI-1507	10	184		V	5	
PI-5942	10	384		V	5	
PI-5947	10	325		V	5	
PI-1403	12	42		D	3	
PI-5937	20	260		S A	1	
PI-9688	20	260		S A	1	
PI-9689	20	260		D A	2	
PI-9526	24	65		D A	2	
PI-6616	24	134		A	6	
PI-6617	24	19		A	6	
PI-1401	27	305		D A	2	
PI-6018	27	299		D V A	2	
PI-6022	27	372		V A	4	
PI-1402	27	202		A	6	
PI-2236	27	38		A	6	
PI-3618	27	38		A	6	
PI-5936	27	479		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(gray)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class [1]*	*Priority [2]*	*Cost*
PI-6049	27	452		A	6	
PI-6613	27	398		A	6	
PI-6614	27	349		A	6	
PI-6615	27	413		A	6	
PI-1515	36	588		D	3	
PI-5935	36	873		D	3	
PI-7414	36	571		D	3	
PI-3613	39	510		D	3	
PI-3617	39	262		D	3	
PI-6006	39	314		D	3	
PI-6017	39	249		D	3	
PI-6019	39	1025		D	3	
PI-3616	39	17		A	6	
PI-3612	42	18		A	6	
Basin 18						
PI-1326	8	210		V A	4	
PI-1327	8	323		V A	4	
PI-1328	8	364		V A	4	
PI-3062	8	419		V A	4	
PI-3063	8	417		V A	4	
PI-3126	8	381		V A	4	
PI-4111	8	234		V A	4	
PI-4112	8	454		V A	4	
PI-4312	8	356		V A	4	
PI-9486	8	0		V A	4	
PI-4108	8	134		V	5	
PI-8486	8	36		V	5	
PI-3125	8	308		A	6	
PI-4114	8	439		A	6	
PI-4157	8	400		A	6	
PI-5962	8	268		A	6	
PI-5965	8	290		A	6	
PI-6051	8	411		A	6	
PI-7276	8	184		A	6	
PI-7277	8	90		A	6	
PI-8543	8	44		A	6	
PI-5957	8	0		A	6	
PI-2128	10	36		D V A	2	
PI-1325	10	142		V A	4	
PI-2129	10	346		V A	4	
PI-3052	10	382		V A	4	
PI-3057	10	370		V A	4	
PI-4110	10	151		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-4268	10	384		V A	4	
PI-4269	10	371		V A	4	
PI-4318	10	286		V A	4	
PI-4328	10	179		V A	4	
PI-4329	10	203		V A	4	
PI-4330	10	379		V A	4	
PI-5699	10	212		V A	4	
PI-5722	10	248		V A	4	
PI-5724	10	460		V A	4	
PI-5922	10	405		V A	4	
PI-7264	10	267		V A	4	
PI-7275	10	204		V A	4	
PI-7577	10	347		V A	4	
PI-8487	10	37		V A	4	
PI-20001	10	457		V A	4	
PI-4319	10	302		V	5	
PI-6500	10	188		V	5	
PI-7282	10	99		V	5	
PI-1405	10	277		A	6	
PI-4270	10	379		A	6	
PI-7274	10	152		A	6	
PI-5931	12	67		S V	1	
PI-2188	12	224		V A	4	
PI-2189	12	276		V A	4	
PI-4107	12	127		V A	4	
PI-4186	12	198		V A	4	
PI-4317	12	481		V A	4	
PI-5966	12	461		V A	4	
PI-7218	12	231		V A	4	
PI-7265	12	387		V A	4	
PI-7266	12	376		V A	4	
PI-7267	12	379		V A	4	
PI-7268	12	376		V A	4	
PI-7269	12	385		V A	4	
PI-7273	12	332		V A	4	
PI-8104	12	187		V A	4	
PI-5930	12	244		V	5	
PI-1345	12	109		A	6	
PI-9464	12	50		A	6	
PI-2190	15	433		V A	4	
PI-3051	15	184		V A	4	
PI-3127	15	238		V A	4	
PI-7212	15	371		V A	4	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-7213	15	386		V A	4	
PI-7214	15	377		V A	4	
PI-7215	15	382		V A	4	
PI-7216	15	373		V A	4	
PI-7217	15	389		V A	4	
PI-8106	15	259		V A	4	
PI-5956	15	364		A	6	
PI-7223	15	149		A	6	
PI-8105	15	230		A	6	
PI-6774	16	73		A	6	
PI-9687	18	59		S V A	1	
PI-1344	18	322		V A	4	
PI-7211	18	203		V A	4	
PI-7219	18	179		V A	4	
PI-7220	18	364		V A	4	
PI-7221	18	59		V A	4	
PI-7222	18	418		V A	4	
PI-7224	18	232		V A	4	
PI-9686	18	59		V A	4	
PI-2132	21	179		D A	2	
PI-2133	21	59		D A	2	
PI-2151	21	235		D A	2	
PI-5718	21	483		D A	2	
PI-6598	21	620		D A	2	
PI-8386	21	143		D A	2	
PI-8483	21	465		D A	2	
PI-9295	21	126		D A	2	
PI-9296	21	161		D A	2	
PI-2134	21	217		A	6	
PI-7464	24	58		D V	3	
PI-5954	24	364		V A	4	
PI-5958	24	11		V A	4	
PI-5959	24	411		V A	4	
PI-6777	24	273		V A	4	
PI-8568	24	112		V A	4	
PI-7463	24	49		V	5	
PI-8530	24	26		V	5	
PI-8753	24	147		V	5	
PI-6775	24	507		A	6	
PI-6776	24	139		A	6	
PI-5940	36	143		D	3	
PI-6478	36	591		D	3	
PI-8567	36	589		D	3	

[1] S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2] Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
Basin 19						
PI-3172	8	158		S	1	
PI-6145	8	87		S	1	
PI-6146	8	134		S	1	
PI-6218	8	17		S	1	
PI-6220	8	104		S	1	
PI-3335	8	320		S	1	
PI-6536	8	150		S	1	
PI-3323	8	351		D	3	
PI-6126	8	201		D	3	
PI-6535	8	148		D	3	
PI-6131	8	287		D	3	
PI-6132	8	321		D	3	
PI-9643	8	110		V A	4	
PI-1424	8	228		V	5	
PI-1426	8	229		V	5	
PI-1427	8	233		V	5	
PI-1429	8	338		V	5	
PI-6316	8	138		V	5	
PI-4181	8	311		V	5	
PI-6080	8	205		V	5	
PI-6081	8	216		V	5	
PI-6094	8	288		V	5	
PI-6096	8	335		V	5	
PI-6107	8	228		V	5	
PI-6108	8	248		V	5	
PI-6133	8	36		V	5	
PI-6177	8	288		V	5	
PI-6181	8	198		V	5	
PI-6406	8	366		V	5	
PI-6456	8	373		V	5	
PI-6458	8	371		V	5	
PI-9309	8	261		V	5	
PI-9487	8	261		V	5	
PI-1204	10	352		S	1	
PI-1205	10	308		S	1	
PI-1206	10	111		S	1	
PI-3173	10	31		S	1	
PI-3344	10	182		S	1	
PI-6149	10	17		S V	1	
PI-6150	10	142		S	1	
PI-6151	10	51		S	1	
PI-6152	10	69		S	1	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)
[2]Priority Scale: 1-6 (Highest → Lowest)

2030 Trunk Sewer Deficiencies

(white box)	Hydraulic Deficiency
(grey box)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-6153	10	205		S	1	
PI-6154	10	384		S	1	
PI-6661	10	390		S	1	
PI-FEED-LS06	18	0		S	1	
PI-3177	18	327		V	5	
PI-2293	24	76		V	5	
Basin 20						
PI-8033	8	384		D	3	
PI-8034	8	316		D	3	
PI-6579	8	453		V	5	
PI-6580	8	341		V	5	
PI-7396	8	296		V	5	
PI-9698	8	0		V	5	
PI-9700	8	0		V	5	
PI-8027	10	251		D V A	2	
PI-6302	10	267		D V	3	
PI-6498	10	351		V A	4	
PI-8024	10	86		V A	4	
PI-8025	10	69		V A	4	
PI-8026	10	80		V A	4	
PI-1162	10	111		V	5	
PI-1163	10	271		V	5	
PI-1164	10	196		V	5	
PI-1165	10	315		V	5	
PI-6282	10	208		V	5	
PI-7374	10	220		V	5	
PI-7977	10	271		V	5	
PI-2317	10	450		A	6	
PI-2318	10	364		A	6	
PI-2319	10	384		A	6	
PI-2320	10	268		A	6	
PI-2321	10	319		A	6	
PI-2322	10	383		A	6	
PI-2323	10	438		A	6	
PI-2324	10	380		A	6	
PI-2325	10	281		A	6	
PI-8603	10	52		A	6	
PI-8604	10	334		A	6	
PI-1200	18	122		V	5	
PI-1201	18	160		V	5	
PI-1202	18	117		V	5	
PI-3870	18	150		V	5	
PI-3872	18	159		V	5	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)

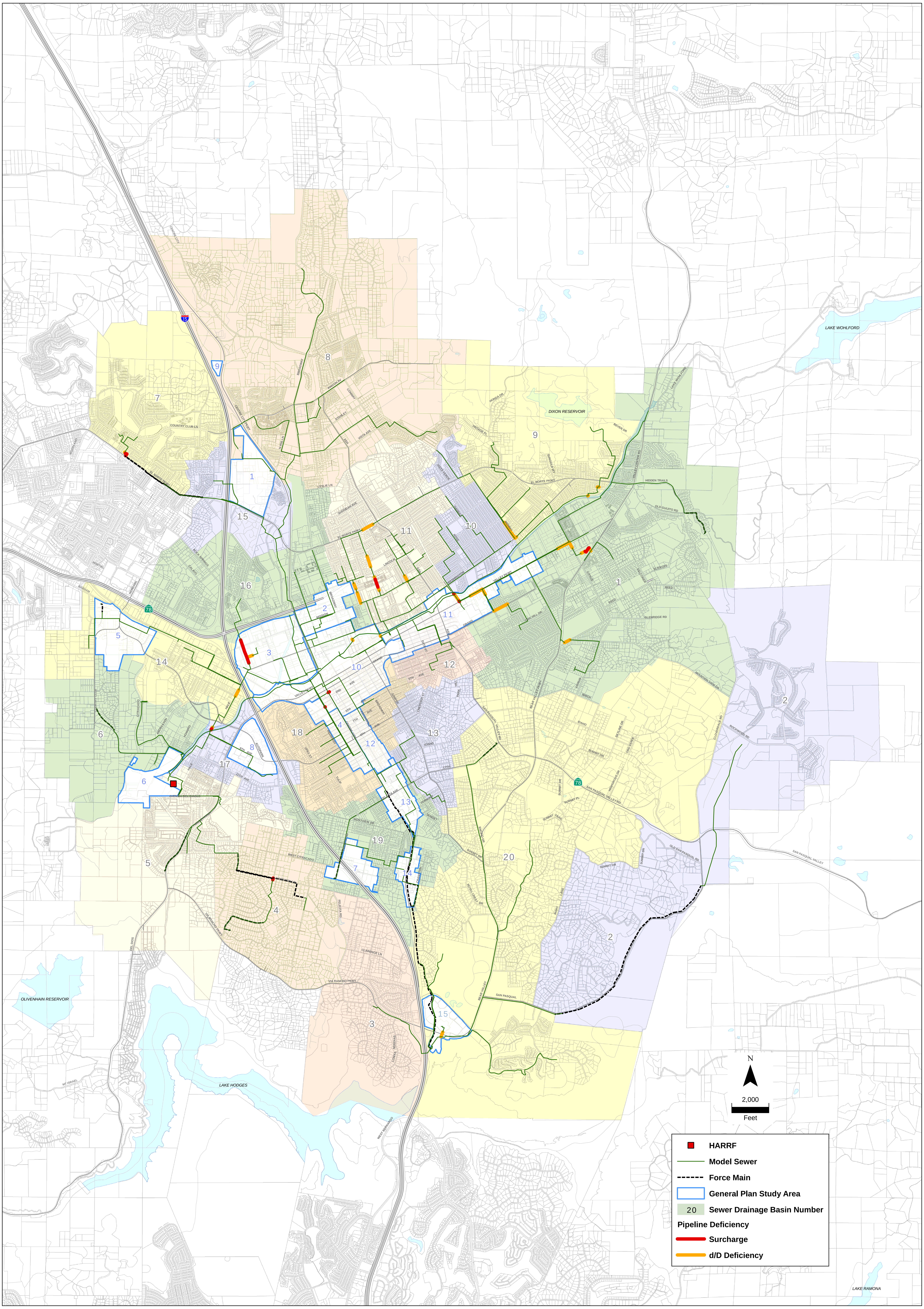
2030 Trunk Sewer Deficiencies

(white)	Hydraulic Deficiency
(grey)	Non-Hydraulic Deficiency

Conduit ID	*Diameter (in)*	*Length (ft)*	*Material*	*CIP Deficiency Class* [1]	*Priority* [2]	*Cost*
PI-3873	18	196		V	5	
PI-3892	18	150		V	5	
PI-3893	18	268		V	5	
PI-3900	18	307		V	5	
PI-3901	18	294		V	5	
PI-3902	18	307		V	5	
PI-6942	18	166		V	5	
PI-7361	18	126		V	5	
PI-7366	18	86		V	5	
PI-6764	21	23		A	6	
PI-6765	28	112		A	6	
PI-7007	28	72		A	6	

[1]S: Surcharged D: d/D Deficient V: Velocity < 2 fps A: Age (1960 or earlier)

[2]Priority Scale: 1-6 (Highest → Lowest)



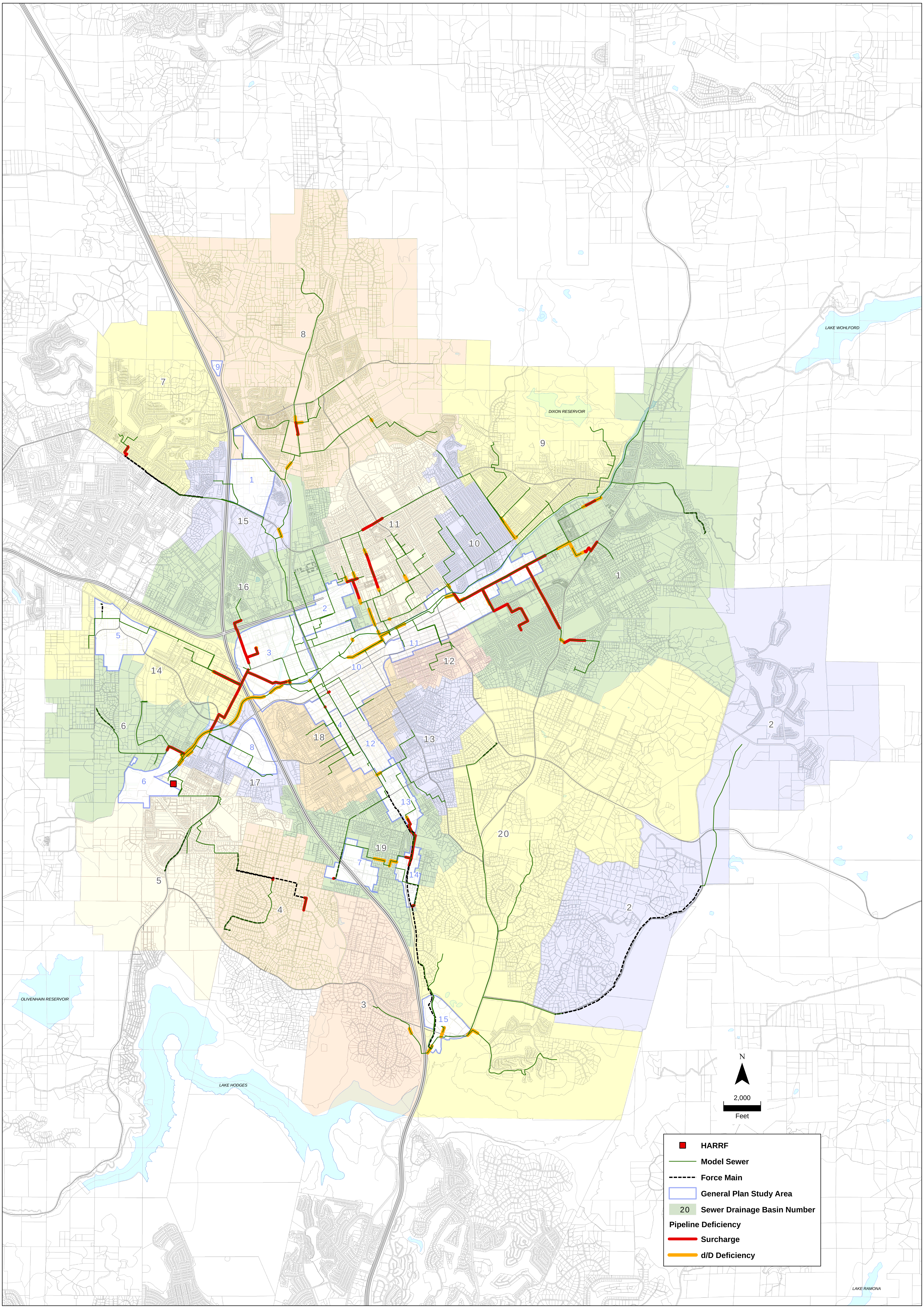
EXISTING WASTEWATER SYSTEM DEFICIENCIES

FIGURE 6-2

6/13/2012 KC SD SDOFS01\Data\Projects\IS\Escondido\WastewaterMP_2011mxd\20362_Escondido_SystDef-WW_EXIST_F6-2_Dsheet.mxd

ATKINS

ESCONDIDO WASTEWATER MASTER PLAN
JUNE 2012



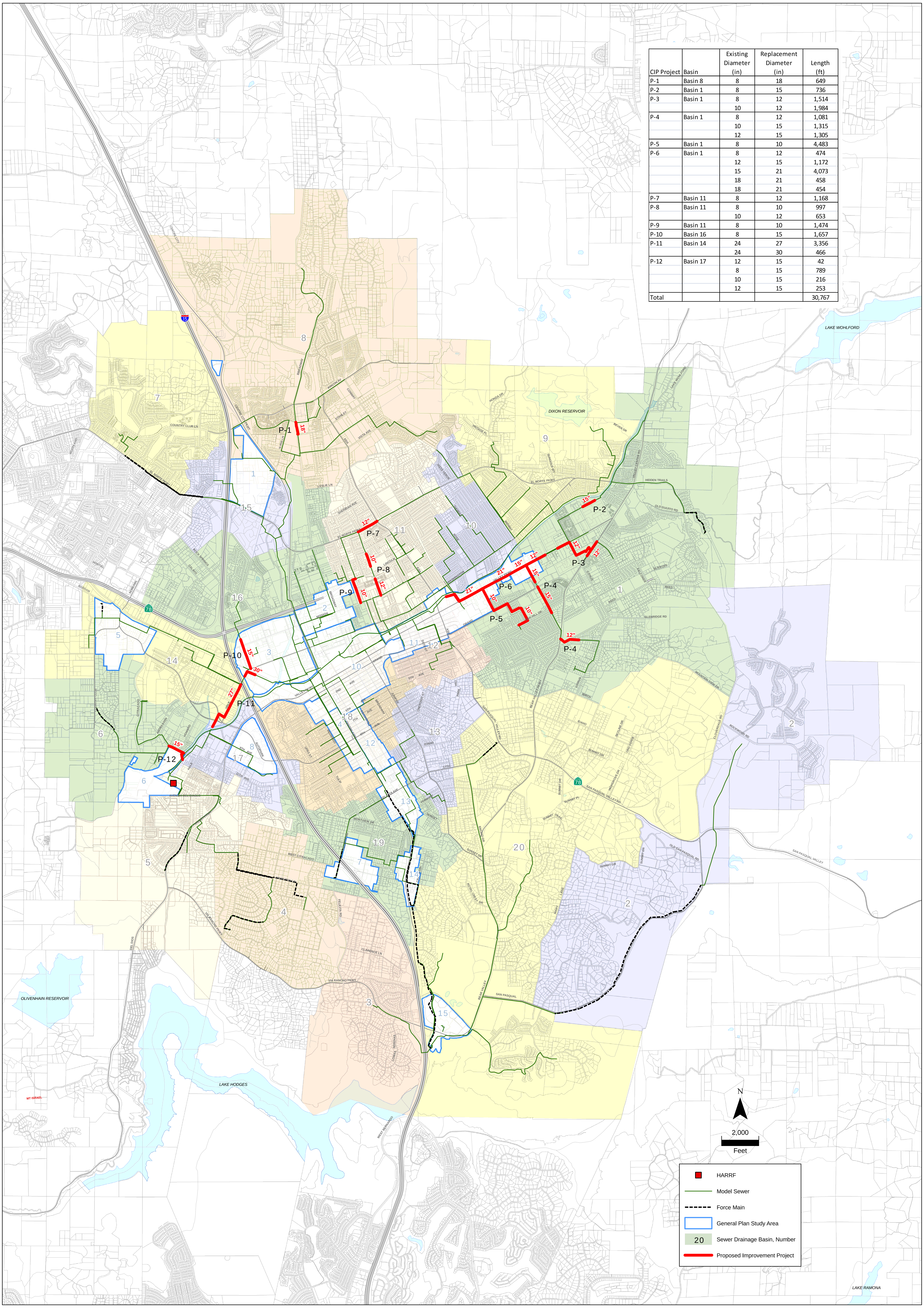
FUTURE WASTEWATER SYSTEM DEFICIENCIES

FIGURE 6-3

6/13/2012 KC SD SDOFS01\Data\Projects\IS\Escondido\WastewaterMP_2011mxd\20362_Escondido_SystDef-WW_2030_F6-3_Dsheet.mxd

ATKINS

ESCONDIDO WASTEWATER MASTER PLAN
JUNE 2012



CIP Project	Basin	Existing Diameter (in)	Replacement Diameter (in)	Length (ft)
P-1	Basin 8	8	18	649
P-2	Basin 1	8	15	736
P-3	Basin 1	8	12	1,514
		10	12	1,984
P-4	Basin 1	8	12	1,081
		10	15	1,315
		12	15	1,305
P-5	Basin 1	8	10	4,483
P-6	Basin 1	8	12	474
		12	15	1,172
		15	21	4,073
		18	21	458
		18	21	454
P-7	Basin 11	8	12	1,168
P-8	Basin 11	8	10	997
		10	12	653
P-9	Basin 11	8	10	1,474
P-10	Basin 16	8	15	1,657
P-11	Basin 14	24	27	3,356
		24	30	466
P-12	Basin 17	12	15	42
		8	15	789
		10	15	216
		12	15	253
Total				30,767

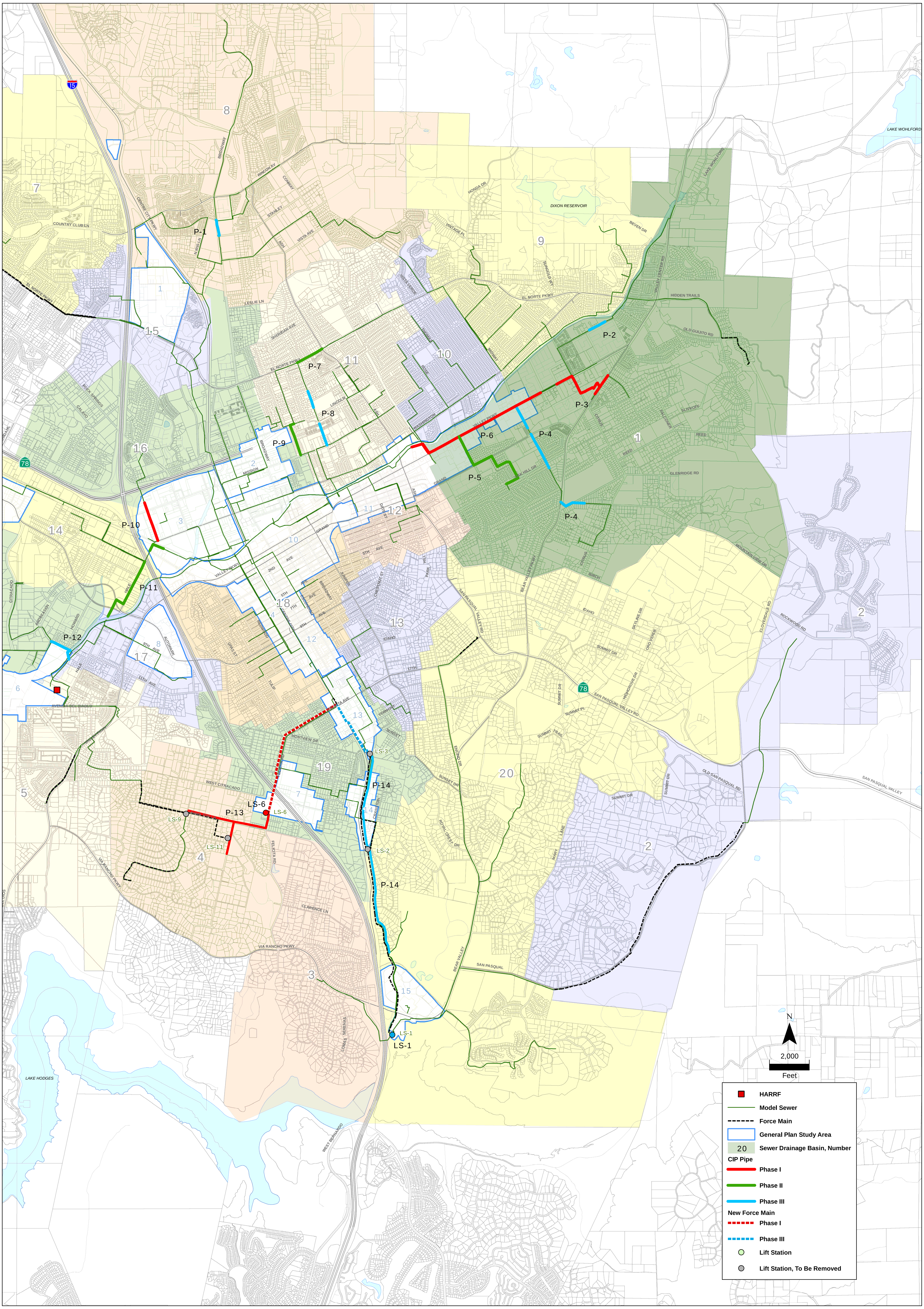
PROPOSED WASTEWATER IMPROVEMENT PROJECTS

FIGURE 6-4

6/14/2012 KC SD SDOFS01\Data\Projects\IS\Escondido\WastewaterMP_2011mxd\20362_Escondido_SystDef-WW_CIP_F6-4_Dsheet.mxd

ATKINS

ESCONDIDO WASTEWATER MASTER PLAN
JUNE 2012



See Table 7-2 for Project Details

PROPOSED CAPITAL IMPROVEMENT PROJECTS

FIGURE 7-1

9/07/2012 KC SD SDOFS01\Data\Projects\IS\Escondido\WastewaterMP_2011mxd\20362_Escondido_SystDef-WW_CIP_F7-1_Dsheet.mxd

ESCONDIDO WASTEWATER MASTER PLAN
SEPTEMBER 2012