

# **DEXTER WILSON ENGINEERING, INC.**

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CONSULTING ENGINEERS

## **SAFARI HIGHLANDS RANCH WASTEWATER REPORT**

**May 26, 2017**

**SAFARI HIGHLANDS RANCH  
WASTEWATER REPORT**

May 26, 2017

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Job No. 750-003

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## DEFINITIONS

edu, equivalent dwelling unit

gpd, gallons per day

gpm, gallon per minute

mgd, million gallons per day

sf, square feet

# CHAPTER 1

## INTRODUCTION

This report provides an overview of sewer service for the Safari Highlands Ranch Project and recommends sewage facilities specific to the needs of the project. The Safari Highlands Ranch Project is not currently within the City of Escondido (City). The project plans to annex to the City at which time the City will be the sewer service provider. The City has existing facilities adjacent to the project. This report will calculate sewage flows from the project, and recommend onsite and offsite facilities necessary to accommodate project flows. All sewage from the project will be conveyed from the project to the Hale Avenue Resource Recovery Facility (HARRF) for treatment and disposal.

## PROJECT OVERVIEW

The Safari Highlands Ranch project is located in the County of San Diego bordering the city limits of the City of Escondido. Elevations within the project range from 900 feet above mean sea level (AMSL) to 1791 feet AMSL. The project is bordered to the south by the San Diego Zoo Safari Park. Access is provided via Rockwood Road through the southern boundary of the site as shown on Figure 1-1.

## PROJECT DESCRIPTION

The land uses proposed by Safari Highlands Ranch are shown on Table 1-1 and consist of single-family neighborhoods, recreational facilities, and a fire station.

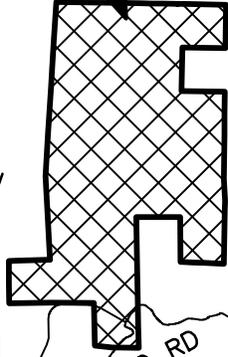
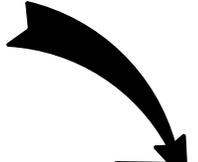
<b>TABLE 1-1 SAFARI HIGHLANDS RANCH LAND USAGE</b>	
<b>Land Use</b>	<b>Units</b>
Single-Family Residential	550 edu
Recreational Center	3,000 sf
Fire Station	6,825 sf

\\ARTIC\DWG\750003\SEWER\SHR\_SWR\_FIGURE\_1-1\_VICINITY.DWG 10-03-16 14:32:34 LAYOUT: LAYOUT1



NO SCALE

PROJECT  
LOCATION



CITY OF  
ESCONDIDO



WASHINGTON AVE

OLD  
RANCH  
RD

ROCKWOOD  
RD

ZOO RD

SAN DIEGO ZOO  
SAFARI PARK

VALLEY RD



VALLEY  
PKWY

SAN  
PASQUAL

SAN PA SQUAL RD

VIA RANCHO  
PKWY

BEAR

LAKE  
HODGES



FIGURE 1-1

VICINITY MAP

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SAFARI HIGHLANDS RANCH

## CHAPTER 2

### PLANNING AND DESIGN CRITERIA

This chapter presents the design criteria used in master planning sewer facilities for the Safari Highlands Ranch Project. Sewer facility sizing will be based on the City Design Standards and Standard Drawings from April 2014.

#### WASTEWATER FLOW GENERATION FACTORS

The sewage generation factors used to project average flows from the project are summarized in Table 2-1. Residential flow factors were taken from the City Design Standards and Standard Drawings. The assumed sewage generation factors for the fire station and the recreational center are shown below.

<b>Land Use</b>	<b>Average Flow Factor</b>
Residential	200 gpd/unit
Recreational Center	200 gpd/1,000 sf
Fire Station	1,500 gal/day/acre

#### PROJECTED SEWAGE FLOWS

Based on the sewage generation factors previously presented and the proposed development plan for Safari Highlands Ranch, Table 2-2 provides the projected wastewater flows for the project.

<b>TABLE 2-2 SAFARI HIGHLANDS RANCH PROJECTED SEWAGE FLOWS</b>			
<b>Land Use</b>	<b>Quantity</b>	<b>Sewage Generation Factor</b>	<b>Total Average Sewage Flow, gpd</b>
Residential	550 units	200 gpd/unit	110,000
Recreational Center	3,000 sf	200 gpd/1,000 sf	600
Fire Station	6,825 sf = 0.16 acres	1,500 gal day/acre	240
<b>TOTAL</b>			<b>110,840 gpd (0.111 mgd) (77 gpm)</b>

In order to convert average flow to peak flow the formula below was used.

$$Q_{peak} = 2.17 * (Q_{average})^{0.975} \quad (Q \text{ in mgd})$$

Table 2-3 summarizes the average and peak flows from the project.

<b>TABLE 2-3 SAFARI HIGHLANDS RANCH AVERAGE AND PEAK SEWAGE FLOWS</b>	
<b>Average Flow, mgd</b>	<b>Peak Flow, mgd</b>
0.111	0.254

### **GRAVITY SEWERS**

All existing and proposed gravity sewers will be designed to convey peak dry weather flow in accordance with the Escondido 2012 Wastewater Master Plan (2012 Master Plan). For pipes with a diameter of smaller than 12-inches, the sewers will be designed to convey this flow when half full. For pipes with a diameter of 12-inches and larger, the sewers will be designed to convey a peak dry weather flow when flowing three-fourths full by depth. Manning's equation with  $n = 0.013$  will be used to size all gravity sewers. All new sewers will be designed to maintain a minimum velocity of two feet per second at design capacity to prevent the deposition of solids.

## CHAPTER 3

### EXISTING SEWER FACILITIES

This chapter analyzes the existing City sewer system from the project downstream to, and including, the Eagle Crest Lift Station (also known as Lift Station 13, LS-13). The 2012 Master Plan analyzed all facilities downstream of LS-13 including HARRF and all needed improvements downstream of LS-13 are covered by the City Sewer Connection Fee.

#### **Description of Existing Facilities**

The City has existing sewer facilities in the vicinity of the Safari Highlands Ranch Project. The existing sewer system consists of an 8-inch gravity sewer in Rockwood Road that extends to the Rancho San Pasqual and Rancho Vistamonte communities and connects to a 12-inch gravity sewer that extends from Rockwood Road south the along the creek, under San Pasqual Valley Road (Highway 78), and south nearly to Old Pasqual Road. At the southwest corner of the intersection of Old Pasqual Road and San Pasqual Road, the gravity sewer system discharges into LS-13. LS-13 pumps to an 8-inch force main that extends approximately 11,000 feet in San Pasqual Road to the south and west. The force main transitions to a gravity sewer in San Pasqual Road just inside the City boundary. From this point, a 10-inch gravity sewer flows west and connects to the 15-inch gravity sewer flowing south in Bear Valley Parkway. Figure 3-1 shows these facilities up to LS-13.

#### **Existing Flows**

The sewer service area upstream of LS-13 currently serves the Rancho San Pasqual community, which includes Eagle Crest Golf Course, the Rancho Vistamonte community, and San Pasqual Union Elementary School. Table 3-1 shows existing average flows from these developments. The Rancho San Pasqual community has been separated into two areas for this analysis. The first area utilizes the same 8-inch gravity line that Rancho Vistamonte currently uses and that the Safari Highland Project proposes to use. The second subdivision utilizes a separate 8-inch gravity line. Both of these gravity lines connect to a 12-inch gravity line that flows into LS-13. The existing and future flows to LS-13 are summarized in Table 3-2.

**TABLE 3-1  
SAFARI HIGHLANDS RANCH  
EXISTING AND FUTURE AVERAGE SEWAGE FLOWS**

<b>Development</b>	<b>edus</b>	<b>Flow Generation Factor</b>	<b>Calculated Average Flow, gpd</b>	<b>SWMM Model Average Flow, gpd *</b>	<b>Actual and Estimated Flow Generation Factor *</b>	<b>Actual and Estimated Future Flows, gpd</b>
<b>Existing</b>						
Rancho San Pasqual 1	359	200 gpd/edu	71,800	48,200	135 gpd/edu	48,200
Rancho San Pasqual 2	223	200 gpd/edu	44,600	30,100	135 gpd/edu	30,100
Rancho Vistamonte	79	200 gpd/edu	15,800	10,600	135 gpd/edu	10,600
Elementary School	99	---	19,800	13,300	135 gpd/edu	13,300
<b>Subtotal</b>	<b>760</b>		<b>152,000 (106 gpm)</b>	<b>102,200 (71 gpm)</b>		<b>102,200 (71 gpm)</b>
<b>Future</b>						
Safari Highlands Ranch	550	200 gpd/edu	110,840		200 gpd/edu	110,840
<b>TOTAL</b>	<b>1,310</b>		<b>262,840 (183 gpm)</b>			<b>213,040 (148 gpm)</b>

\* The Estimated Actual Flow Generation Factor of 135 gpd/edu is calculated based on the existing SWMM Model Average Dry Weather Flow of 71 gpm to LS-13 (provided in Table 6-2 of the 2012 Master Plan) divided by the number of existing edus (760 edus) served by LS-13.

**TABLE 3-2  
SAFARI HIGHLANDS RANCH  
EXISTING AND FUTURE AVERAGE AND PEAK FLOWS TO LIFT STATION 13 (LS-13)**

<b>Methodology</b>	<b>Existing Average Flow</b>	<b>Existing Peak Flow</b>	<b>Future Average Flow*</b>	<b>Future Peak Flow*</b>
Calculated Flows	152,000 gpd (106 gpm)	345,746 gpd (240 gpm)	262,840 gpd (183 gpm)	589,738 gpd (410 gpm)
Actual and Estimated Future Flows	102,200 gpd (71 gpm)	234,787 gpd (163 gpm)	213,040 gpd (148 gpm)	480,518 gpd (334 gpm)

\*Existing flows plus flows from Safari Highland Ranch.

Table 3-1 projects average flow to LS-13 using the criteria presented in Chapter 2 (“Calculated Flows”) and the criteria used in the 2012 Master Plan (“Estimated Flows”). The first methodology leads to an average flow of 262,840 gpd or 183 gpm. The second leads to an average flow 213,040 gpd or 148 gpm. The first methodology will be used to analyze the piping system. The second methodology will be used for analyzing LS-13 in order to be consistent with the 2012 Master Plan.

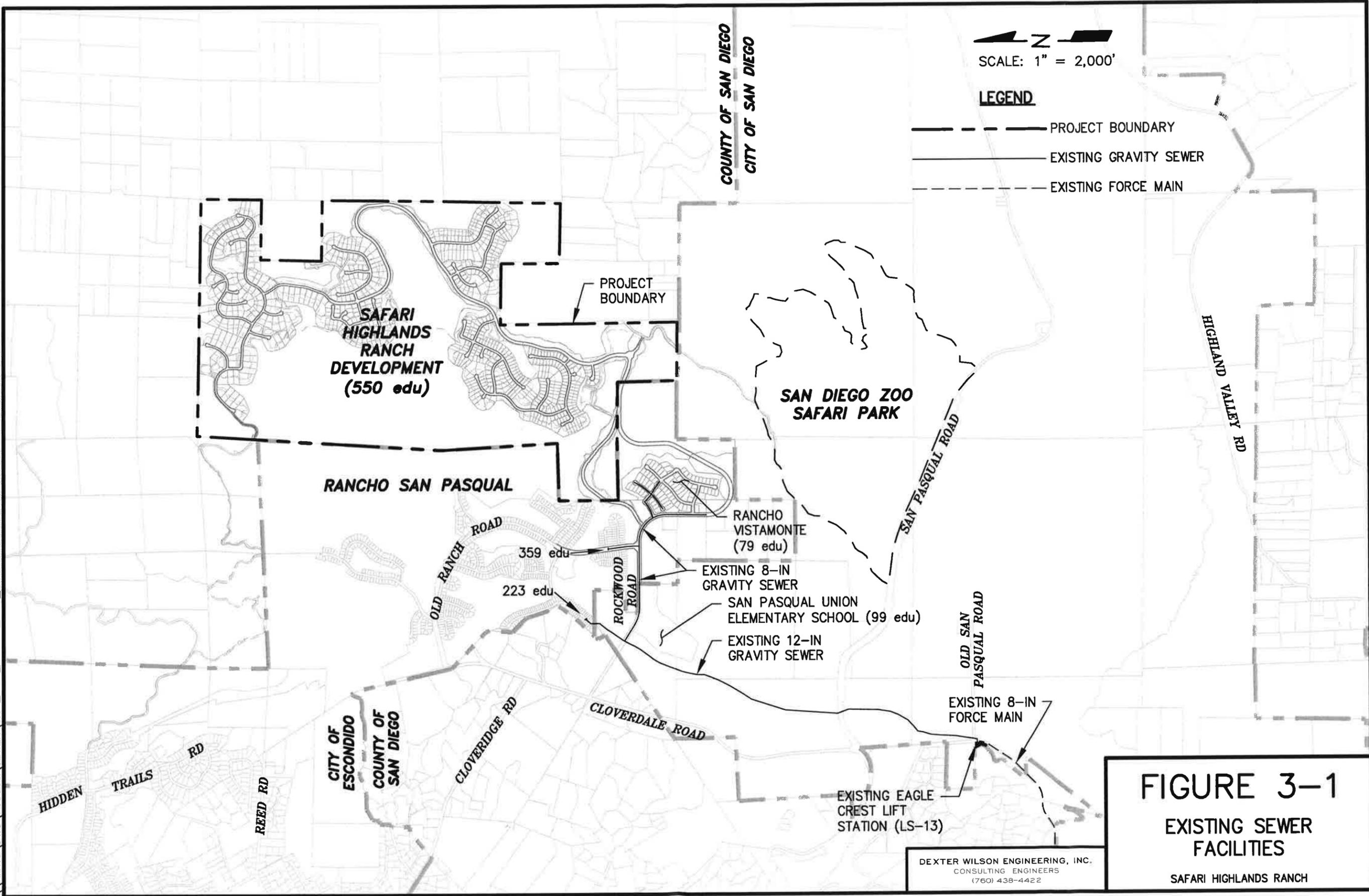
**Lift Station 13 (LS-13)**

The 2012 Master Plan states that LS-13 consists of two, 30 hp constant speed type pumps. The station operates with one duty and one standby pump, automatically alternating. Appendix C of the 2012 Master Plan contains the RMC 2010 Pump Assessment Report which states that the rated pump capacity of the station is 340 gpm @ 146 ft. TDH. It should be noted however, that the firm capacity used in the 2012 Master Plan is 200 gpm based on pump tests conducted in 2010. The 2012 Master Plan cites that this discrepancy between rated capacity and actual capacity is likely due to pump wear, a system blockage or a throttled discharge valve. In late 2016, City Staff field verified that discharge valves are fully opened. Table 3-3 lists pertinent information regarding LS-13.

<b>TABLE 3-3 CITY OF ESCONDIDO LIFT STATION 13 CAPACITY SUMMARY<sup>1</sup></b>					
<b>Number of Pumps</b>	<b>Force Main Diameter (in.)</b>	<b>Rated Pump Capacity with One Pump on Standby, gpm</b>	<b>Pump Test Capacity, gpm</b>	<b>Current Estimated Flow</b>	
				<b>ADWF, gpm</b>	<b>PWWF, gpm</b>
2	8	340	200	71	229

<sup>1</sup> Per 2012 Master Plan, Table 6-2.

\\ARTIC\DWG\750003\SEWER\SHR\_SWR\_FIGURE\_3-1\_EXISTFACILITY.DWG 05-26-17 10:04:45 LAYOUT: LAYOUT



  
 SCALE: 1" = 2,000'

**LEGEND**

-  PROJECT BOUNDARY
-  EXISTING GRAVITY SEWER
-  EXISTING FORCE MAIN

**FIGURE 3-1**  
EXISTING SEWER FACILITIES

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## FLOW ANALYSIS IN EXISTING OFFSITE GRAVITY SEWERS

Appendix A provides an analysis of the offsite existing gravity sewers that will serve Safari Highlands Ranch. As previously stated, two methodologies were used in analyzing the existing gravity sewers and both of these methods can be seen in Appendix A. The first approach, labeled “Calculated Sewer Model,” analyzes both existing and proposed flows based on the standards presented in Chapter 2. The second approach, labeled “Estimated Actual Sewer Model,” analyzes the same system based on the criteria presented in the 2012 Master Plan. The results of both methods are summarized below in Table 3-4.

Utilizing the more conservative projected sewer model, if the Safari Highlands Ranch Project used the existing 8-inch line along Rockwood Road the maximum depth to diameter ratio ( $dn/D$ ) would increase from 0.47 to 0.74, well above the criteria set forth in Chapter 2. Therefore, the capacity of the gravity line in Rockwood Road will be insufficient to accommodate the Safari Highlands Ranch Project. Recommended improvements to the line are proposed in Chapter 4.

The maximum  $dn/D$  ratio of the existing 12-inch gravity line leading from Rockwood Road to LS-13 will only increase from 0.36 to 0.48, so it will still have adequate capacity to support the project.

**TABLE 3-4  
EXISTING OFFSITE SEWER  
CAPACITY ANALYSIS OF SCENARIOS**

<b>Existing Facilities</b>	<b>Lowest Capacity in Stretch at Design Criteria Limit, gpm</b>	<b>Calculated Existing Peak Flow, gpm</b>	<b>Calculated Future Peak Flow, gpm</b>	<b>Actual and Estimated Existing Peak Flow, gpm</b>	<b>Actual and Estimated Future Peak Flow, gpm</b>
8-inch sewer Rockwood Road	172	171	342	116	288
12-inch sewer to LS-13	805	240	410	163	334

## CHAPTER 4

### RECOMMENDED IMPROVEMENTS

In this chapter we will present the recommended improvements for sewer service to the Safari Highlands Ranch project, both offsite and onsite.

#### CONNECTION TO THE CITY OF ESCONDIDO SYSTEM

Figure 4-1 shows the offsite system that would take sewage from the Safari Highlands Ranch project to the main trunk line in Bear Valley Parkway. This figure also shows the reaches where improvements are needed. Those sections where improvements are needed are discussed in detail below. For the purposes of this report, it is assumed that City connection fees, paid by the developer, would fund any improvements needed for conveyance, treatment, and disposal downstream of the LS-13 force main.

#### Rockwood Road Sewer Line

As shown in Figure 4-1, a new parallel sewer would be required in Rockwood Road because the existing 8-inch line does not have the appropriate capacity. This parallel sewer would connect the project to the existing 12-inch line which would then transport the flows from both the existing and proposed sewer downstream to LS-13.

#### LS-13 Improvements

The original pump station capacity was 340 gpm. If this capacity could be restored, then the project could be accommodated within the existing design parameters of the station.

Based on computer modeling and calculations, it appears that there may be a substantial air bubble in the piping system. Field testing was done to assure that an air bubble was not at the design high point in the line. This involved removing the air release and evacuating sewage from the line. The air bubble was not at the design high point, so it appears that the force main may not have been installed per the as-built drawings. It is speculated that the

contractor who installed the pipe encountered rock and raised the pipe accordingly. This may have created a high point in the line where one was not anticipated and an air release was not installed. An air bubble in the line would increase the static head on the pipeline and causes the flow capacity to be decreased.

There are two improvements which could be completed to restore the station's design capacity. These are (1) to find the air bubble and install a new air release to eliminate the air bubble or (2) to replace the pumps with higher head pumps. Both of these improvements are discussed below.

**Force Main Improvements Removal of Air Bubble.** Figures 4-2A and 4-2B show possible locations for an air bubble in the force main. These locations are Station 46+00, 64+00, and 78+00. The most likely spot is shown in Figure 4-3 and is around Station 46+00. This is considered the most likely spot because a rock outcrop is visible adjacent to the roadway. In order to remove the air bubble, the pipeline would need to be excavated and an air release installed on the pipeline. Prior to completing this, work the pipeline would need to be profiled to see if there is indeed a high point at this location. If there is no high point at this location, then the other two spots should be profiled. If an air bubble is found, then an air release should be installed. Removal of this air bubble would create the capacity needed to serve the Safari Highlands Ranch project.

**Pump Improvements.** If an air bubble cannot be found and eliminated, then the pumps at the pump station will need to be replaced. It is estimated that an air bubble is causing approximately 20 feet additional head loss in the piping system. The existing design point of the pumps is 340 gpm at 146 feet TDH. The pumps will have to be replaced with pumps capable of pumping 340 gpm at 166 feet TDH, if the bubble cannot be eliminated.

## ONSITE IMPROVEMENTS

The proposed onsite sewer system is shown in Figure 4-4. Table 4-1 presents sizing of the proposed lift station and force main to serve the northern portion of the project. All onsite proposed improvements shall be public facilities which are owned, operated, and maintained by the City. Note that the pumping capacity of each pump at the station is proposed to be 120 gpm to provide sufficient cleansing velocities in the 4-inch force main. Preliminary sizing of the gravity sewer indicates all proposed onsite gravity sewer shall be 8-inch as confirmed in Appendix B.

<b>TABLE 4-1 SAFARI HIGHLANDS RANCH PROPOSED ONSITE SEWER LIFT STATION AND FORCE MAIN</b>	
<b>City Requirements*</b>	<b>Proposed Facility**</b>
<b><u>LIFT STATION</u></b>	
Minimum of 2 Pumps	2 Pumps
Pump Capacity = PWWF	40 gpm required 120 gpm proposed
Emergency Storage = 12 hrs of ADF	11,600 gallons
Emergency Power = 24 hr Onsite Standby Power	
Pump Motors=Variable Speed	
<b><u>FORCE MAIN</u></b>	
Max. Velocity = 8 ft/s	V = 3.06 ft/s
Min. Diameter = 4"	D = 4" PVC
Hazen Williams 'C' Factor = 120	

\*Per 2012 City of Escondido Wastewater Master Plan

\*\*See Appendix C for Calculations

PWWF = Peak Wet Weather Flow

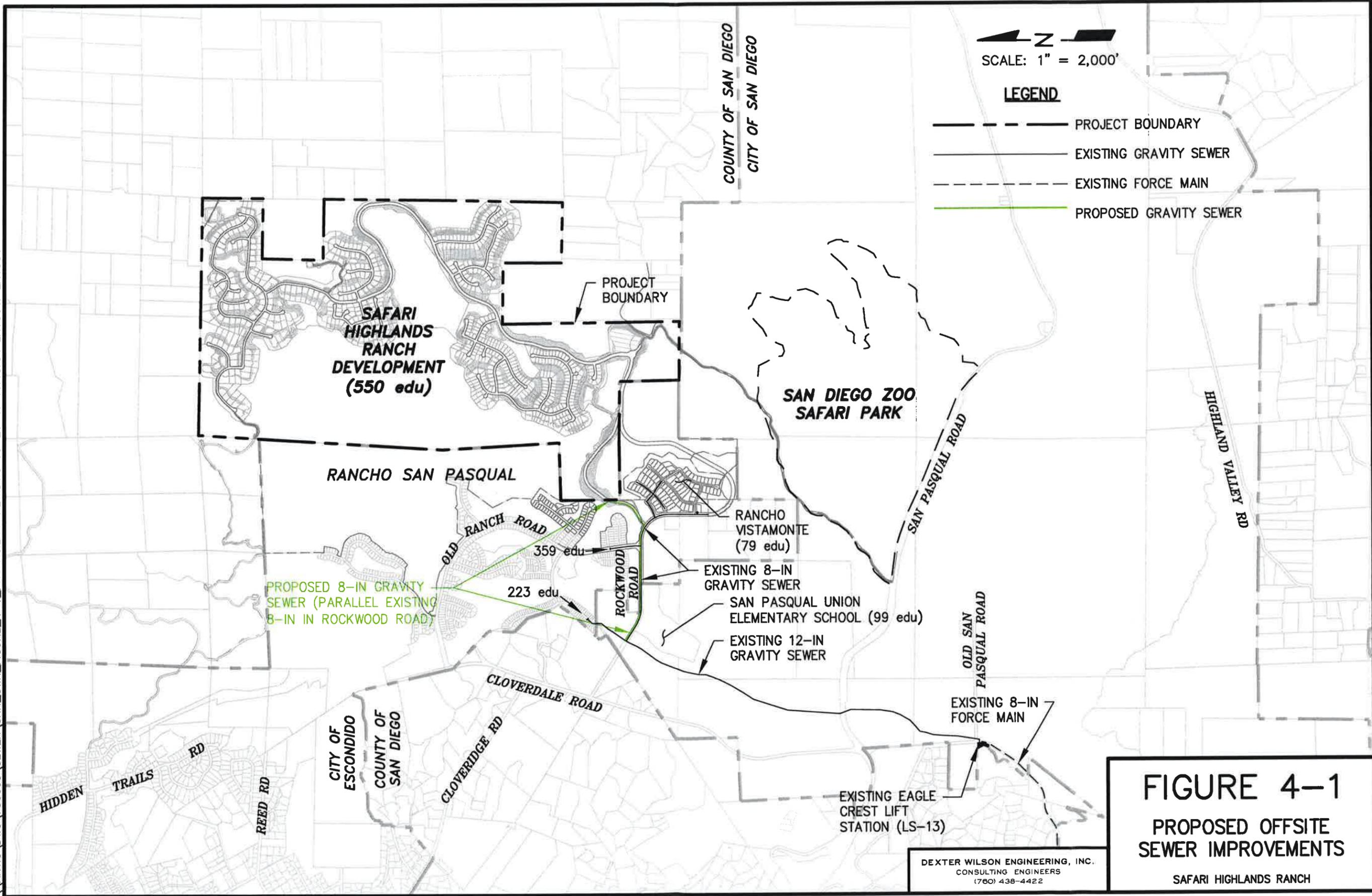
ADF = Average Daily Flow

\\ARTIC\DWG\750003\SEWER\SHR\_SWR\FIGURE\_4-1\_PROFACILITY-NEW.DWG 05-26-17 10:18:54 LAYOUT: LAYOUT

SCALE: 1" = 2,000'

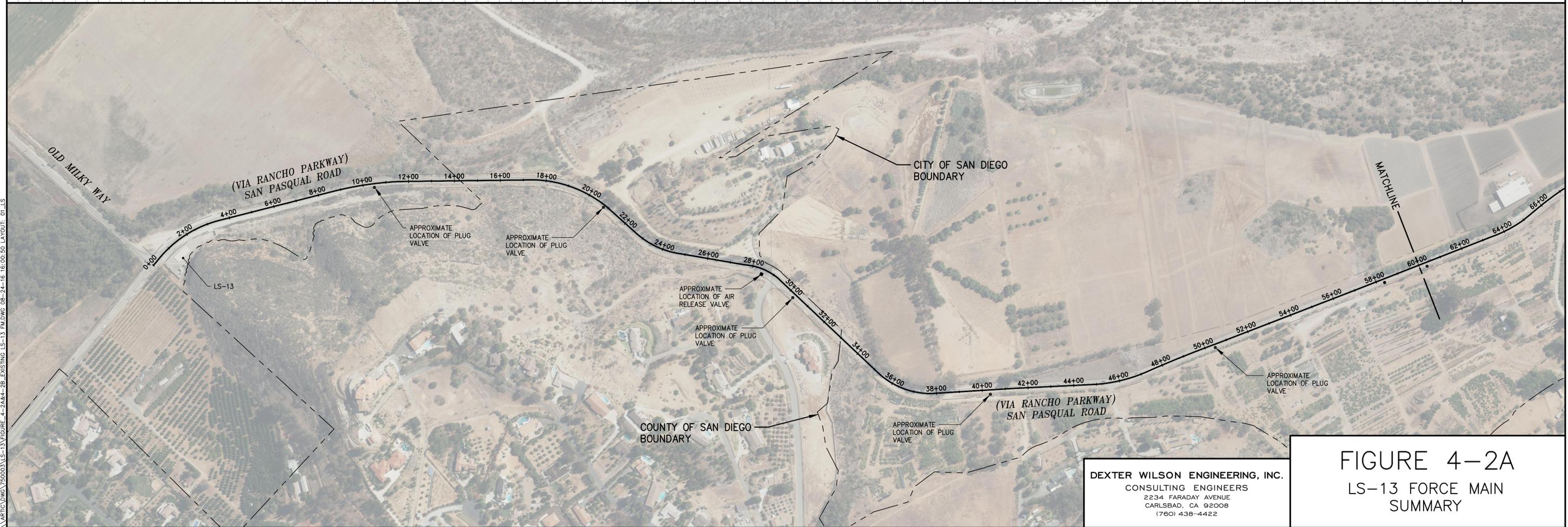
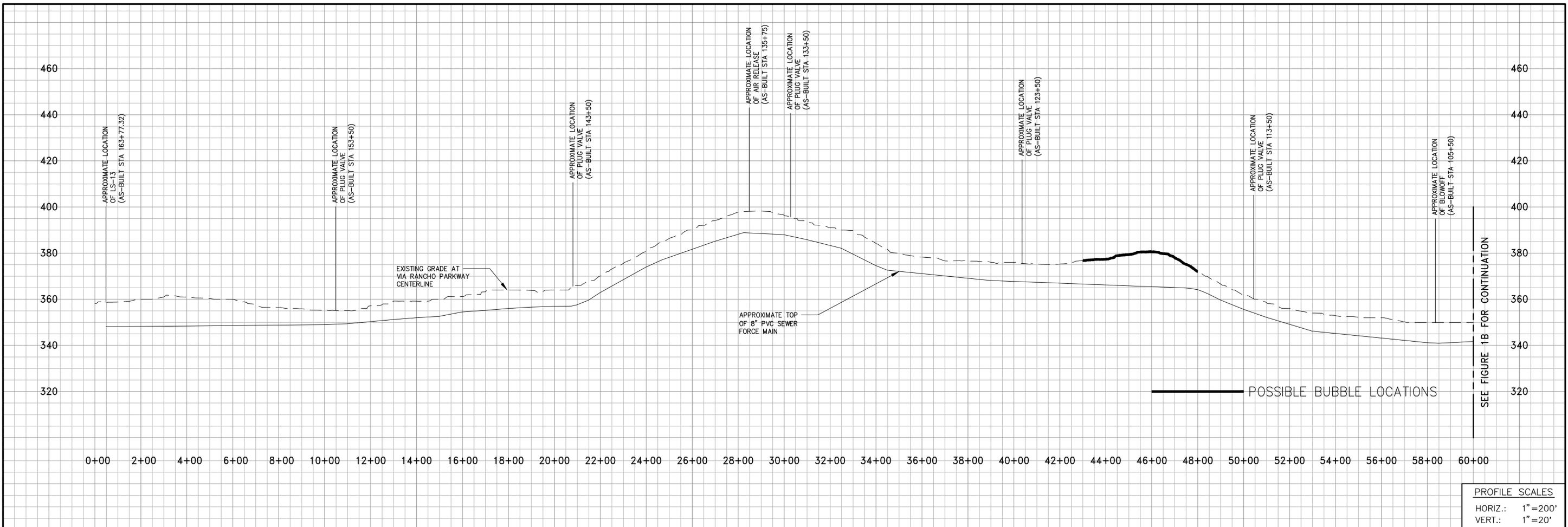
**LEGEND**

-  PROJECT BOUNDARY
-  EXISTING GRAVITY SEWER
-  EXISTING FORCE MAIN
-  PROPOSED GRAVITY SEWER

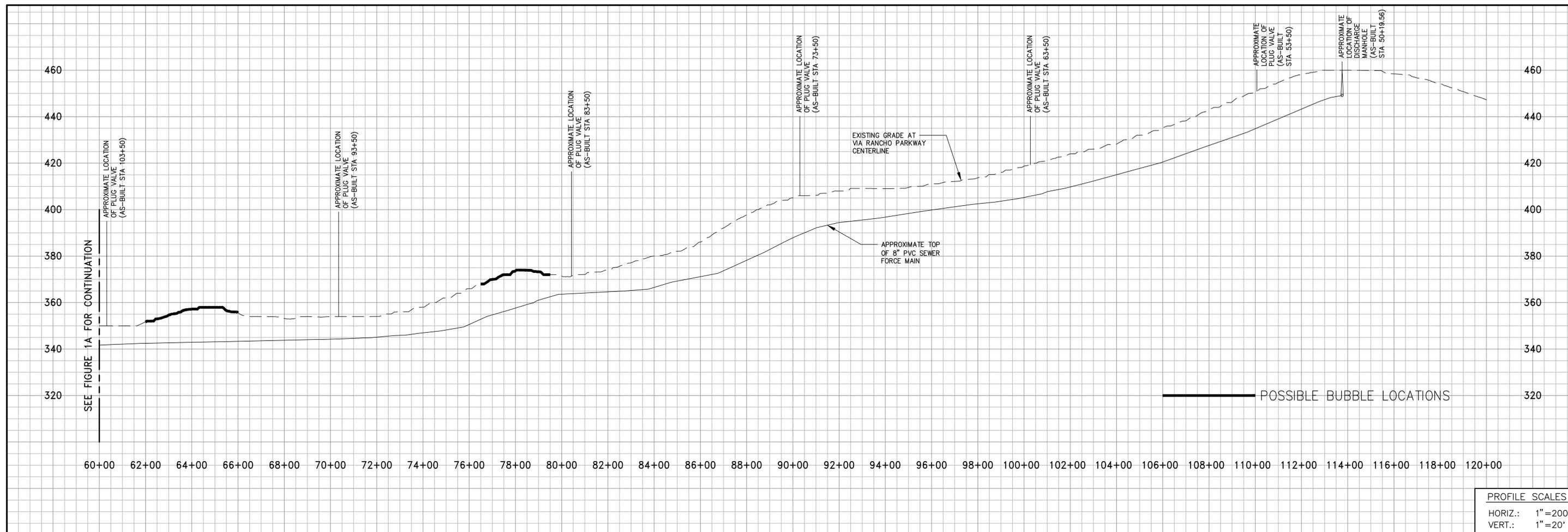


**FIGURE 4-1**  
**PROPOSED OFFSITE SEWER IMPROVEMENTS**  
 SAFARI HIGHLANDS RANCH

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\\ARTIC\DWG\750003\LS-13\FIGURE\_4-2A&4-2B\_EXISTING\_LS-13\_FINAL.DWG 08-24-16 16:00:50 LAYOUT: 01-LS



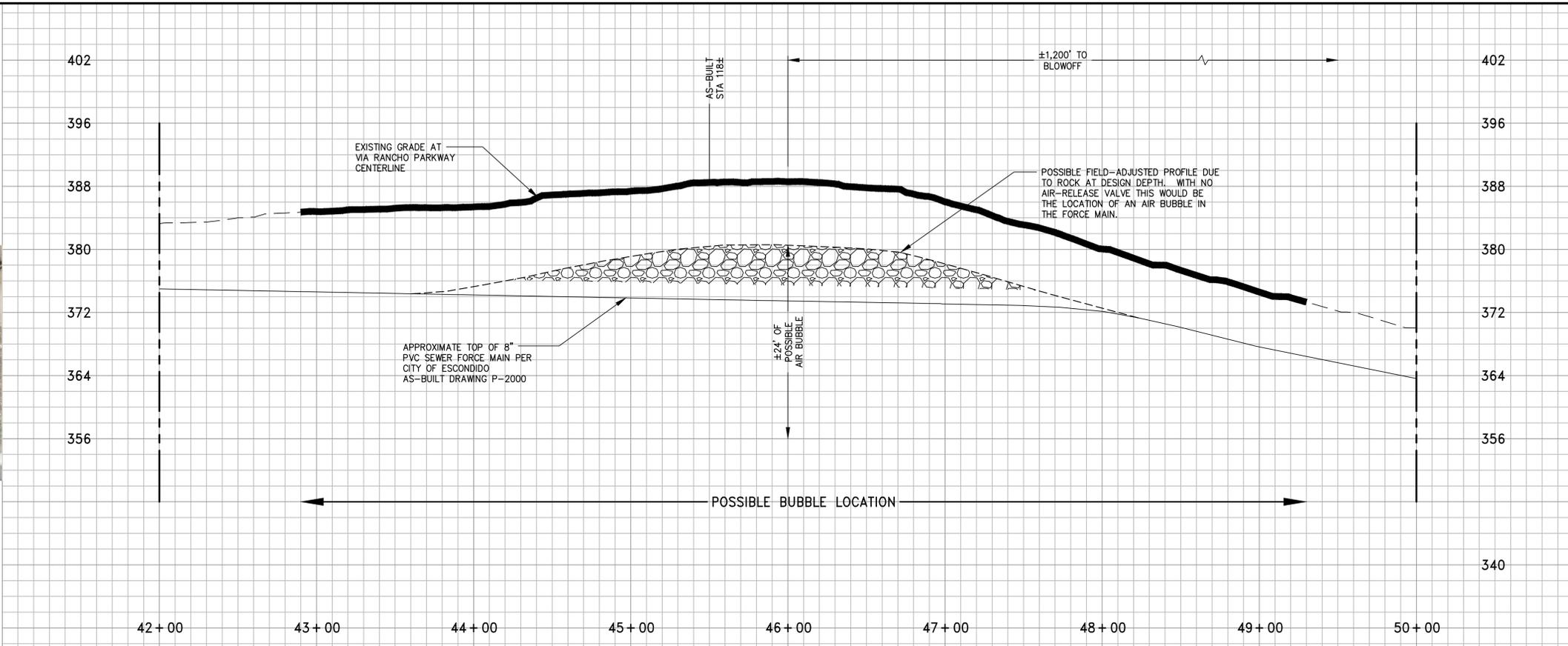
\\ARTIC.DWG\750003\EAGLECREST\LS-13\_F04\_08-17-16\_11:56:53\_LAYOUT\_02\_DISCHARGE



EXISTING PLUG VALVE  
STA ±40+34

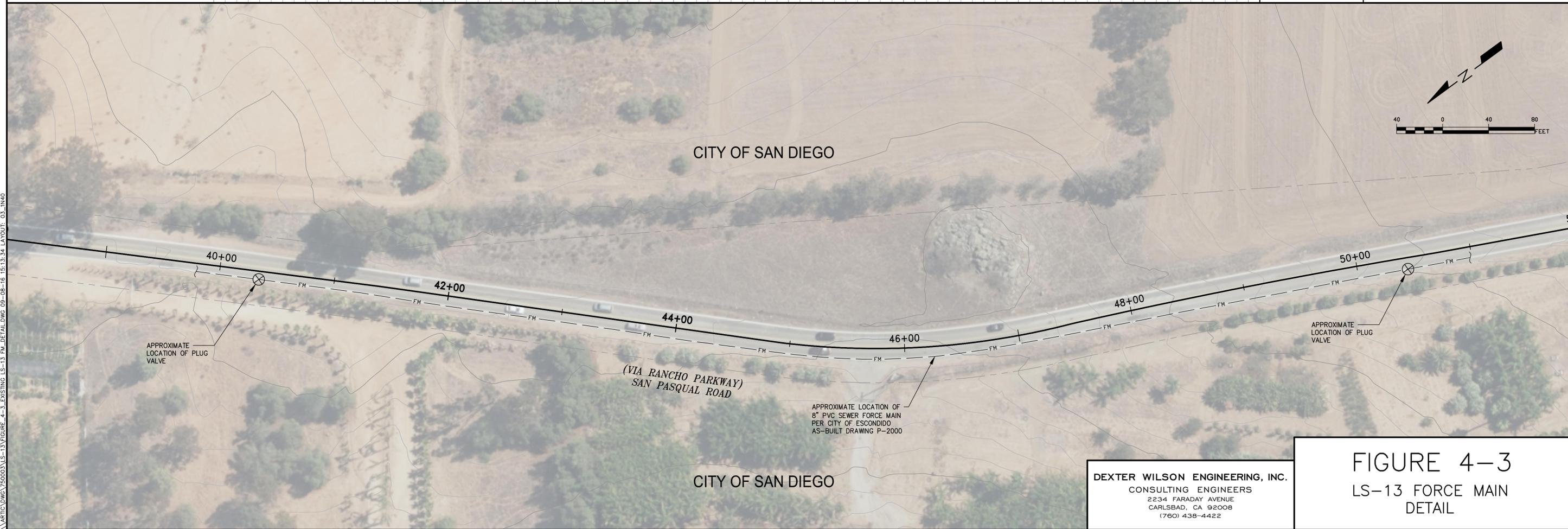


EXISTING PLUG VALVE  
STA ±50+34



PROFILE SCALES  
HORIZ.: 1" = 40'  
VERT.: 1" = 10'

ARTIC.DWG 750003 LS-13 FIGURE 4-3 EXISTING LS-13 FM DETAIL DWG 09-08-16 15:13:34 LAYOUT: 03-IN40



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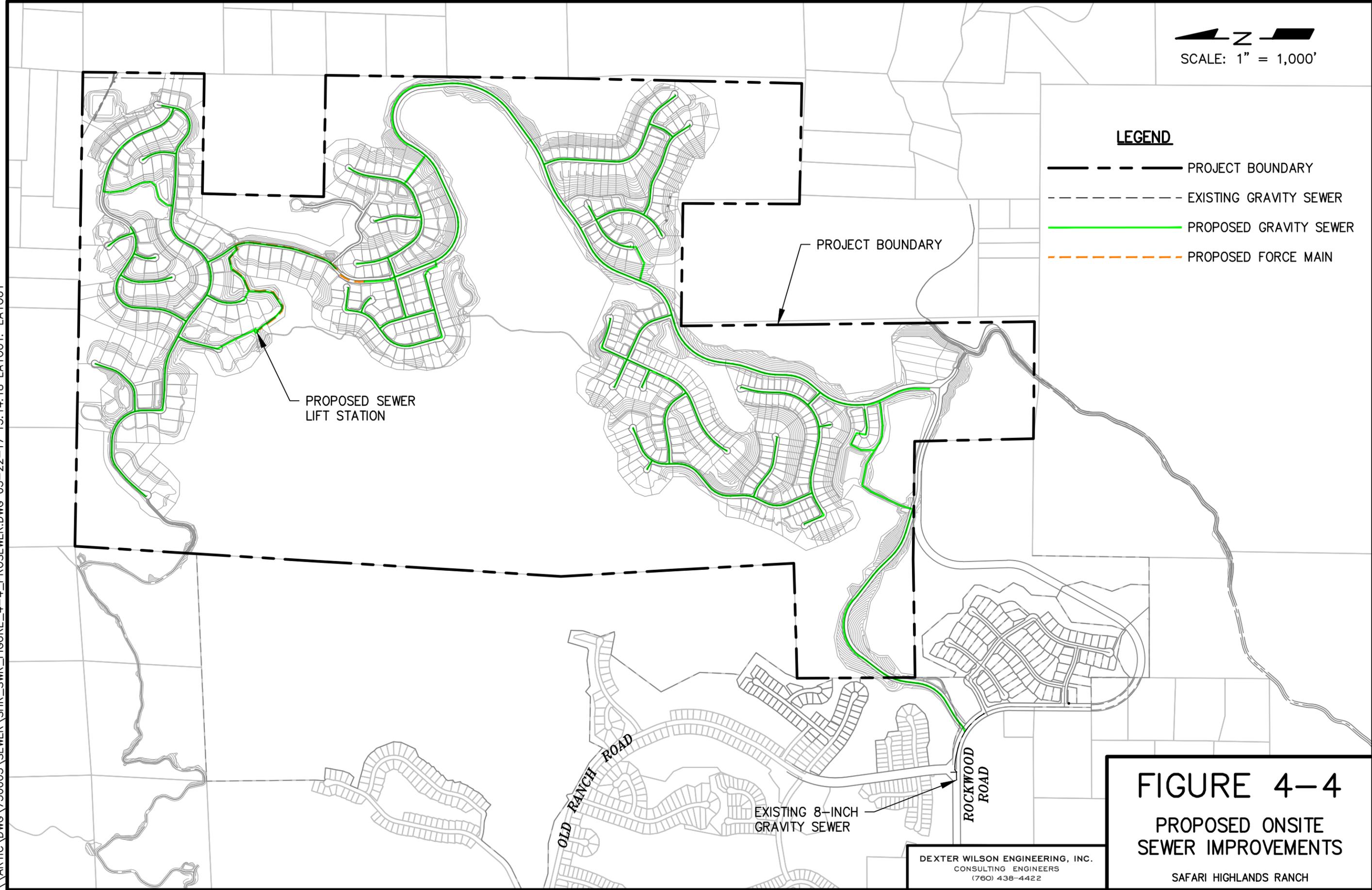
FIGURE 4-3  
LS-13 FORCE MAIN  
DETAIL

\\ARTIC\DWG\750003\SEWER\SHR\_SWR\_FIGURE\_4-4\_PROSEWER.DWG 05-22-17 13:14:18 LAYOUT: LAYOUT

SCALE: 1" = 1,000'

**LEGEND**

- PROJECT BOUNDARY
- - - EXISTING GRAVITY SEWER
- PROPOSED GRAVITY SEWER
- - - PROPOSED FORCE MAIN



PROPOSED SEWER LIFT STATION

PROJECT BOUNDARY

EXISTING 8-INCH GRAVITY SEWER

OLD RANCH ROAD

ROCKWOOD ROAD

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**FIGURE 4-4**  
**PROPOSED ONSITE SEWER IMPROVEMENTS**  
 SAFARI HIGHLANDS RANCH

## **APPENDIX A**

### **OFFSITE GRAVITY SEWER ANALYSIS**

### SEWER STUDY SUMMARY

DATE: 4/5/2017  
 JOB NUMBER: 750-003

FOR: Safari Highlands Offsite Calculated Sewer Model Existing  
 BY: Dexter Wilson Engineering

SHT 1 OF 1  
 REFER TO PLAN SHEET: \_\_\_\_\_

LINE	FROM	TO	FLOW INPUT (gpd)	TOTAL AVERAGE FLOW (gpd)	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)			LINE SIZE (inches)	DESIGN SLOPE (%)	CAPACITY (gpm)	DEPTH K' <sup>(1)</sup>	dn (feet)	dn/D <sup>(2)</sup>	C <sub>a</sub> for Velocity <sup>(3)</sup>	VELOCITY (f.p.s.)	Area sq ft
						M.G.D.	G.P.M	C.F.S.									
	42	39	71,800	71,800	166,411	0.166	116	0.257	8	0.40	171.81	0.156047	0.26667	0.40	0.2934	1.97	0.1304
	39	36	15,800	87,600	202,023	0.202	140	0.313	8	0.44	180.20	0.180626	0.28667	0.43	0.3229	2.18	0.1435
	36	29	0	87,600	202,023	0.202	140	0.313	8	0.50	192.09	0.169442	0.28000	0.42	0.3130	2.25	0.1391
	29	28	0	87,600	202,023	0.202	140	0.313	8	0.50	192.09	0.169442	0.28000	0.42	0.3130	2.25	0.1391
	28	27	0	87,600	202,023	0.202	140	0.313	8	2.58	436.35	0.074593	0.18000	0.27	0.1711	4.11	0.0760
	27	25	19,800	107,400	246,427	0.246	171	0.381	8	0.50	192.09	0.206685	0.31333	0.47	0.3627	2.37	0.1612
	25	17	44,600	152,000	345,746	0.346	240	0.535	12	0.40	929.03	0.109965	0.33000	0.33	0.2260	2.37	0.2260
	17	13	0	152,000	345,746	0.346	240	0.535	12	0.34	856.52	0.119274	0.35000	0.35	0.2450	2.18	0.2450
	13	11	0	152,000	345,746	0.346	240	0.535	12	0.40	929.03	0.109965	0.33000	0.33	0.2260	2.37	0.2260
	11	10	0	152,000	345,746	0.346	240	0.535	12	0.50	1038.68	0.098356	0.31000	0.31	0.2074	2.58	0.2074
	10	9	0	152,000	345,746	0.346	240	0.535	12	0.44	974.37	0.104848	0.32000	0.32	0.2167	2.47	0.2167
	9	5	0	152,000	345,746	0.346	240	0.535	12	0.32	830.95	0.122945	0.35000	0.35	0.2450	2.18	0.2450
	5	1	0	152,000	345,746	0.346	240	0.535	12	0.30	804.56	0.126977	0.36000	0.36	0.2546	2.10	0.2546

Node 42, Rancho San Pasqual 1

Node 39, Rancho Vistamonte (15,800 gpd)

Node 27, Elementary School

Node 25, Rancho San Pasqual 2

Max dn/D
0.47

<sup>1</sup> K' based on n = 0.013

<sup>2</sup> dn/D using K' in Brater King Table 7-14

<sup>3</sup> From Brater King Table 7-4 based on dn/D

### SEWER STUDY SUMMARY

DATE: 4/5/2017  
 JOB NUMBER: 750-003

FOR: Safari Highlands Offsite Calculated Sewer Model Proposed  
 BY: Dexter Wilson Engineering

SHT 1 OF 1  
 REFER TO PLAN SHEET: \_\_\_\_\_

LINE	FROM	TO	FLOW INPUT (gpd)	TOTAL AVERAGE FLOW (gpd)	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)			LINE SIZE (inches)	DESIGN SLOPE (%)	CAPACITY (gpm)	DEPTH K' <sup>(1)</sup>	dn (feet)	dn/D <sup>(2)</sup>	C <sub>a</sub> for Velocity <sup>(3)</sup>	VELOCITY (f.p.s.)	Area sq ft
						M.G.D.	G.P.M	C.F.S.									
	42	39	71,800	71,800	166,411	0.166	116	0.257	8	0.40	171.81	0.156047	0.26667	0.40	0.2934	1.97	0.1304
	39	36	126,640	198,440	448,382	0.448	311	0.694	8	0.44	180.20	0.400891	0.48000	0.72	0.6050	2.58	0.2689
	36	29	0	198,440	448,382	0.448	311	0.694	8	0.50	192.09	0.376069	0.45333	0.68	0.5690	2.74	0.2529
	29	28	0	198,440	448,382	0.448	311	0.694	8	0.50	192.09	0.376069	0.45333	0.68	0.5690	2.74	0.2529
	28	27	0	198,440	448,382	0.448	311	0.694	8	2.58	436.35	0.165555	0.27333	0.41	0.3032	5.15	0.1348
	27	25	19,800	218,240	491,950	0.492	342	0.761	8	0.50	192.09	0.412611	0.49333	0.74	0.6230	2.75	0.2769
	25	17	44,600	262,840	589,738	0.590	410	0.913	12	0.40	929.03	0.187567	0.44000	0.44	0.3328	2.74	0.3328
	17	13	0	262,840	589,738	0.590	410	0.913	12	0.34	856.52	0.203445	0.46000	0.46	0.3527	2.59	0.3527
	13	11	0	262,840	589,738	0.590	410	0.913	12	0.40	929.03	0.187567	0.44000	0.44	0.3328	2.74	0.3328
	11	10	0	262,840	589,738	0.590	410	0.913	12	0.50	1038.68	0.167765	0.42000	0.42	0.3130	2.92	0.3130
	10	9	0	262,840	589,738	0.590	410	0.913	12	0.44	974.37	0.178838	0.43000	0.43	0.3229	2.83	0.3229
	9	5	0	262,840	589,738	0.590	410	0.913	12	0.32	830.95	0.209707	0.47000	0.47	0.3627	2.52	0.3627
	5	1	0	262,840	589,738	0.590	410	0.913	12	0.30	804.56	0.216584	0.48000	0.48	0.3727	2.45	0.3727

Node 42, Rancho San Pasqual 1

Node 39, Rancho Vistamonte (15,800 gpd) + Safari Highlands Ranch (110,840 gpd)

Node 27, Elementary School

Node 25, Rancho San Pasqual 2

Max dn/D
0.74

<sup>1</sup> K' based on n = 0.013

<sup>2</sup> dn/D using K' in Brater King Table 7-14

<sup>3</sup> From Brater King Table 7-4 based on dn/D

### SEWER STUDY SUMMARY

DATE: 4/5/2017  
 JOB NUMBER: 750-003

FOR: Safari Highlands Offsite Actual and Estimated Sewer Model Existing  
 BY: Dexter Wilson Engineering

SHT 1 OF 1  
 REFER TO PLAN SHEET: \_\_\_\_\_

LINE	FROM	TO	FLOW INPUT (gpd)	TOTAL AVERAGE FLOW (gpd)	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)			LINE SIZE (inches)	DESIGN SLOPE (%)	CAPACITY (gpm)	DEPTH K' <sup>(1)</sup>	dn (feet)	dn/D <sup>(2)</sup>	C <sub>a</sub> for Velocity <sup>(3)</sup>	VELOCITY (f.p.s.)	Area sq ft
						M.G.D.	G.P.M	C.F.S.									
	42	39	63,184	63,184	146,910	0.147	102	0.227	8	0.40	171.81	0.137761	0.24667	0.37	0.2642	1.94	0.1174
	39	36	13,904	77,088	178,349	0.178	124	0.276	8	0.44	180.20	0.159459	0.26667	0.40	0.2934	2.12	0.1304
	36	29	0	77,088	178,349	0.178	124	0.276	8	0.50	192.09	0.149586	0.26000	0.39	0.2836	2.19	0.1260
	29	28	0	77,088	178,349	0.178	124	0.276	8	0.50	192.09	0.149586	0.26000	0.39	0.2836	2.19	0.1260
	28	27	0	77,088	178,349	0.178	124	0.276	8	2.58	436.35	0.065852	0.16667	0.25	0.1535	4.05	0.0682
	27	25	17,424	94,512	217,550	0.218	151	0.337	8	0.50	192.09	0.182465	0.29333	0.44	0.3328	2.28	0.1479
	25	17	39,248	133,760	305,230	0.305	212	0.472	12	0.40	929.03	0.097079	0.31000	0.31	0.2074	2.28	0.2074
	17	13	0	133,760	305,230	0.305	212	0.472	12	0.34	856.52	0.105297	0.32000	0.32	0.2167	2.18	0.2167
	13	11	0	133,760	305,230	0.305	212	0.472	12	0.40	929.03	0.097079	0.31000	0.31	0.2074	2.28	0.2074
	11	10	0	133,760	305,230	0.305	212	0.472	12	0.50	1038.68	0.086830	0.29000	0.29	0.1890	2.50	0.1890
	10	9	0	133,760	305,230	0.305	212	0.472	12	0.44	974.37	0.092561	0.30000	0.30	0.1982	2.38	0.1982
	9	5	0	133,760	305,230	0.305	212	0.472	12	0.32	830.95	0.108538	0.33000	0.33	0.2260	2.09	0.2260
	5	1	0	133,760	305,230	0.305	212	0.472	12	0.30	804.56	0.112097	0.34000	0.34	0.2355	2.01	0.2355

Node 42, Rancho San Pasqual 1

Node 39, Rancho Vistamonte (13,904 gpd)

Node 27, Elementary School

Node 25, Rancho San Pasqual 2

Max dn/D
0.44

<sup>1</sup> K' based on n = 0.013

<sup>2</sup> dn/D using K' in Brater King Table 7-14

<sup>3</sup> From Brater King Table 7-4 based on dn/D

### SEWER STUDY SUMMARY

DATE: 4/5/2017  
 JOB NUMBER: 750-003

FOR: Safari Highlands Offsite Actual and Estimated Sewer Model Proposed  
 BY: Dexter Wilson Engineering

SHT 1 OF 1  
 REFER TO PLAN SHEET: \_\_\_\_\_

LINE	FROM	TO	FLOW INPUT (gpd)	TOTAL AVERAGE FLOW (gpd)	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)			LINE SIZE (inches)	DESIGN SLOPE (%)	CAPACITY (gpm)	DEPTH K' <sup>(1)</sup>	dn (feet)	dn/D <sup>(2)</sup>	C <sub>a</sub> for Velocity <sup>(3)</sup>	VELOCITY (f.p.s.)	Area sq ft
						M.G.D.	G.P.M	C.F.S.									
	42	39	63,184	63,184	146,910	0.147	102	0.227	8	0.40	171.81	0.137761	0.24667	0.37	0.2642	1.94	0.1174
	39	36	124,744	187,928	425,208	0.425	295	0.658	8	0.44	180.20	0.380172	0.46000	0.69	0.5780	2.56	0.2569
	36	29	0	187,928	425,208	0.425	295	0.658	8	0.50	192.09	0.356633	0.44000	0.66	0.5500	2.69	0.2444
	29	28	0	187,928	425,208	0.425	295	0.658	8	0.50	192.09	0.356633	0.44000	0.66	0.5500	2.69	0.2444
	28	27	0	187,928	425,208	0.425	295	0.658	8	2.58	436.35	0.156999	0.26667	0.40	0.2934	5.05	0.1304
	27	25	17,424	205,352	463,603	0.464	322	0.717	8	0.50	192.09	0.388835	0.46667	0.70	0.5870	2.75	0.2609
	25	17	39,248	244,600	549,800	0.550	382	0.851	12	0.40	929.03	0.174865	0.43000	0.43	0.3229	2.63	0.3229
	17	13	0	244,600	549,800	0.550	382	0.851	12	0.34	856.52	0.189668	0.45000	0.45	0.3428	2.48	0.3428
	13	11	0	244,600	549,800	0.550	382	0.851	12	0.40	929.03	0.174865	0.43000	0.43	0.3229	2.63	0.3229
	11	10	0	244,600	549,800	0.550	382	0.851	12	0.50	1038.68	0.156404	0.40000	0.40	0.2934	2.90	0.2934
	10	9	0	244,600	549,800	0.550	382	0.851	12	0.44	974.37	0.166727	0.41000	0.41	0.3032	2.81	0.3032
	9	5	0	244,600	549,800	0.550	382	0.851	12	0.32	830.95	0.195505	0.45000	0.45	0.3428	2.48	0.3428
	5	1	0	244,600	549,800	0.550	382	0.851	12	0.30	804.56	0.201917	0.46000	0.46	0.3527	2.41	0.3527

Node 42, Rancho San Pasqual 1

Node 39, Rancho Vistamonte (13,904 gpd) + Safari Highlands Ranch (110,840 gpd)

Node 27, Elementary School

Node 25, Rancho San Pasqual 2

Max dn/D
0.70

<sup>1</sup> K' based on n = 0.013

<sup>2</sup> dn/D using K' in Brater King Table 7-14

<sup>3</sup> From Brater King Table 7-4 based on dn/D



**APPENDIX B**

**ONSITE GRAVITY SEWER ANALYSIS**



**To:** Jeb Hall, Concordia Homes  
**From:** Ray Martin  
**Date:** 05/15/17  
**Re:** Safari Highlands Ranch, onsite sewer sizing calculations  
**Cc:** Natalie Frascchetti, Dexter Wilson Engineering

Pursuant to your request, we have completed calculations to estimate the sizing for the onsite sanitary sewer system. The sizing calculations incorporate the City of Escondido's 2014 Design Standards and standard drawings as follows;

- Minimum Pipe size = 8"
- Average residential flow = 200 gallons per day, per residential unit
- Flow from Recreation area @ 200 gpd/1,000 s.f.
- Flow from Fire Station @ 1,500 gpd/acre
- Maximum flow = average flow x Peak Factor per Table 3.1 of the 2012 Wastewater Master Plan.
- Manning's  $n = 0.13$
- Gravity Sewers 12-inch or less shall have a depth to diameter (d/D) ratio of 0.5 or less

The attached spreadsheet shows that for the project consisting of 550 residential lots, a fire station and recreation center, a peak flow of 0.518 cfs meets the standard at a minimum slope of 0.79% (d/D=0.49 & V=3.04 fps)

Since the streets are typically 1% minimum grade, but more frequently steeper due to existing terrain, all pipes for the project will be designed as 8-inch diameter meeting the minimum slope.

A handwritten signature in black ink, appearing to read 'Raymond L. Martin'.

Raymond L. Martin, RCE, Vice President  
9707 Waples Street, San Diego, CA 92121  
(858) 558-4500 ph (858) 558-1414 fax  
[RMartin@HunsakerSD.com](mailto:RMartin@HunsakerSD.com)

SH 1 OF 1 n= 0.0130 Gal/day/Lot

DATE 4/11/2017

REFER TO PLAN SHEET:

TM

FOR: Safari Highlands Ranch  
 W.O. 2374-17  
 BY: Ray Martin

# SEWER PIPE SIZE CHECK

LINE	FROM	TO	LOTS SERVED		PEAK DESIGN FLOW		LINE SIZE (INCHES)	DESIGN SLOPE (%)	dn (FEET)	dn/D	VELOCITY (F.P.S.)	COMMENTS	K'	Ca	Area	Gal/Day
			IN-LINE	TOTAL	M.G.D.	C.F.S.										
			550	550	0.333	0.516										110000
			1	1	0.002	0.003						Recreation Center				600
			1	1	0.001	0.001						Fire Station				240
				552	0.335	0.518	8	0.79	0.33	0.49	3.04		0.2233	0.3827	0.170	110400
				552	0.335	0.518	10	0.27	0.40	0.48	2.00		0.2107	0.3727	0.259	110400

**APPENDIX C**

**ONSITE SEWER LIFT STATION AND  
FORCE MAIN INFORMATION**

SAFARI HIGHLANDS RANCH  
ONSITE LIFT STATION

PUMP CAPACITY

- 116 EDUs TO STATION
  - Avg. FLOW = 116 EDUs \* 200 gpd / EDU
    - = 23,200 gpd
    - = 16 gpm
    - = 0.0232 mgd
  - PWWF = 2.17 (0.0232)<sup>0.975</sup>
    - = 0.0553 mgd
    - = 38 gpm
- ⇒ 40 gpm EACH

EMERGENCY STORAGE

- 12 hrs @ ADF
  - 12hr (23,200 gpd)  $\left(\frac{d}{24hr}\right)$ 
    - = 11,600 gallons
    - = 1,550 ft<sup>3</sup>
- ⇒ 11,600 gallons

# DEXTER WILSON ENGINEERING, INC.

## FORCE MAIN SIZING

$$Q = 40 \text{ gpm}$$

$$C = 120$$

$$L = 3300 \text{ ft}$$

$$\text{@ } D = 4''$$

$$Q = VA$$

$$V = \frac{Q}{\frac{\pi D^2}{4}}$$

$$= 1.02 \text{ ft/s} \quad \leftarrow \text{TOO LOW}$$

150-003  
JOB NO.

NF  
BY

Proposed Onsite Sewer Lift Station Sizing

SUBJECT

10-5-16  
DATE

2-2  
SHEET NO.