Appendix L. Sewer Service Analysis

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SEWER SERVICE ANALYSIS
FOR THE
MARJA ACRES PROJECT
IN THE CITY OF CARLSBAD

August 3, 2018

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REGISTERED PROFESSIONAL ENGINEER
STEVEN J. HENDERSON
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STATE OF CALIFORNIA

8-3-2018

Prepared by:
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Job No.: 736-013

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August 3, 2018 736-013

New Urban West, Inc.
16935 West Bernardo Drive, Suite 260
San Diego, CA 92127

Attention: Jonathan P. Frankel, Community Development Coordinator

Subject: Sewer Service Analysis for the Marja Acres Project in the City of Carlsbad

Introduction

The Marja Acres project is located in the north-central portion of the City of Carlsbad. It is situated along El Camino Real to the southeast of Kelly Drive. See Figure 1 for the location of the project.

The Marja Acres project is proposing to develop a total of 298 residential units (252 townhome units and 46 apartment units) and 9,700 square feet of commercial space spread across approximately 24 acres.

The Marja Acres project will receive sewer service from the City of Carlsbad. The purpose of this letter report is to provide an analysis of sewer service to the Marja Acres project.

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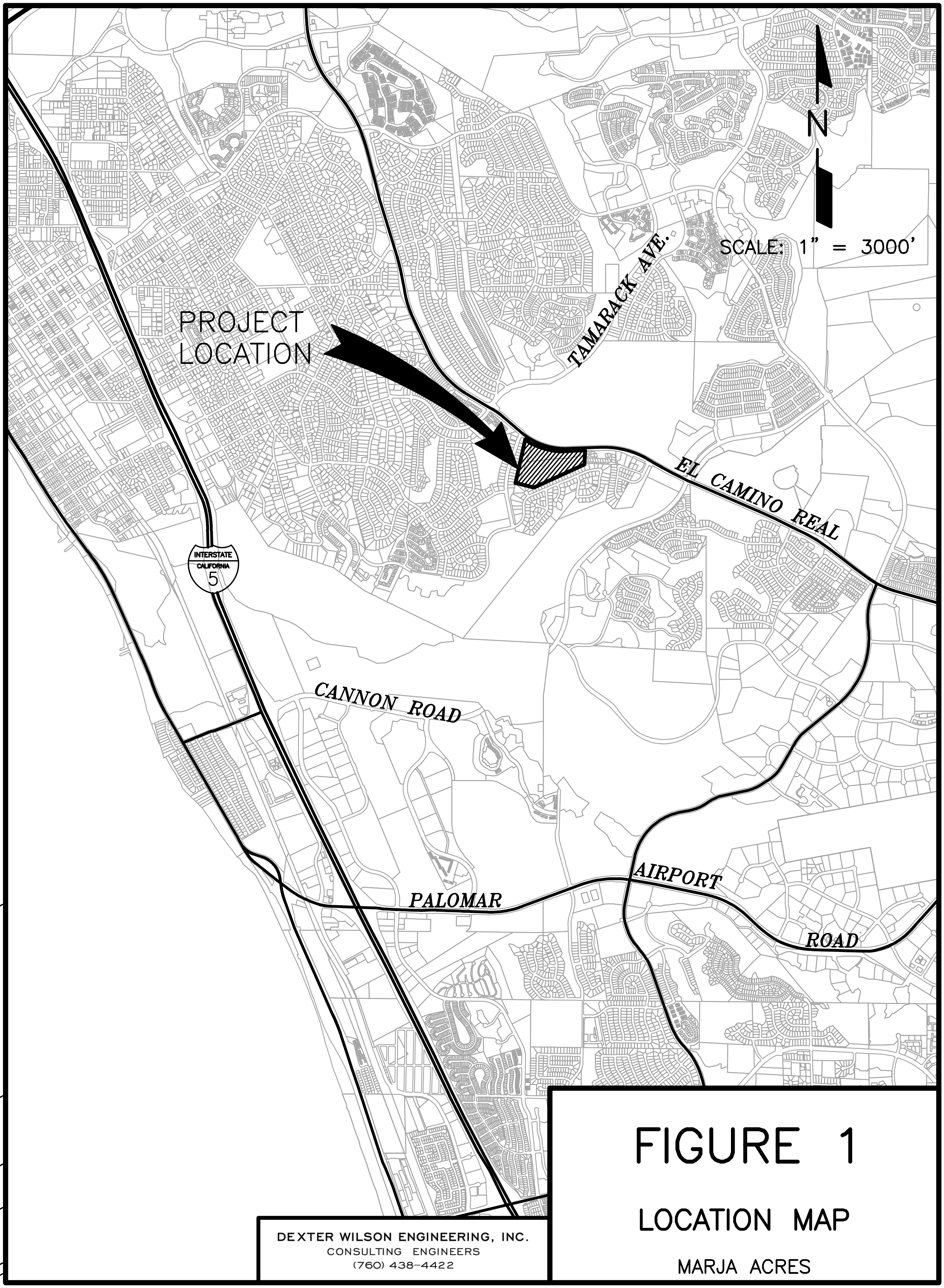

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FIGURE 1

LOCATION MAP

MARJA ACRES

Sewer System Design Criteria

The design criteria used for the evaluation of the offsite sewerage system impacts by the Marja Acres project are based on the City of Carlsbad Engineering Standards and Sewer Master Plan. The master plan was also used for verification and confirmation of existing wastewater facilities surrounding the project.

Relevant sections of the City's Engineering Standards and Sewer Master Plan regarding the design criteria for sewer lines and appurtenances are included in Appendix A.

Sewer Generation Rates

Chapter 6 in the City's Engineering Standards identifies the average daily sewage flow to be 220 gpd per EDU. The City's Engineering Standards states that an EDU equates to one single family residence. Some of Marja Acres will consist of apartment-style multi-family residential units and therefore will likely generate less wastewater than a typical single family residence. In fact, unlike the City's Engineering Standards, the City's Sewer Master Plan accounts for a lower unit flow factor for high-density residential development (176 gpd per EDU). Note that the master plan indicates that this lower flow factor is for apartments only. Residential low density to medium-high density is indicated as 220 gpd per EDU (akin to the City's Engineering Standards) in the master plan. The sewer generation rates for the Marja Acres and the surrounding area are presented as Table 1.

TABLE 1
SEWER GENERATION RATES

Land Use	Generation Rate
Single Family Residential	220 gpd/EDU
Multi-Family Residential (Apartments)	176 gpd/EDU
Industrial (Warehouse)	220 gpd/5,000 ft^2
Industrial (Office)	220 gpd/1,800 ft^2
Commercial	220 gpd/1,800 ft^2

Peaking Factors

The peaking factor for sewage flow less than 100,000 gpd is identified in the City's Engineering Standards. It states for average daily flows of less than 100,000 gpd, a peaking factor of 2.5 shall be used to determine peak daily flows. The City's Engineering Standards do not state what the peaking factor is for average daily flows that are greater than 100,000 gpd; however, the City's Master Plan does provide more detail on peaking factors. The master plan breaks down peaking factors by tributary basin within the City. The tributary basin that Marja Acres is located in is identified as 17D-3. 17D-3 is shown to have a peak of 1.75 times the average which is what was used for estimating peak sewer flows in this report. Excerpts from the master plan regarding peaking factors and an e-mail correspondence from the City are included in Appendix A as well.

Manning's "n"

The gravity sewer analyses are made using a computer program which uses the Manning Equation for all of its calculations. The Manning's "n" used by the computer program is held as a constant for all depths in a circular conduit. The value of Manning's "n" used for this study is 0.011 which corresponds with the recommended value in the City's Engineering Standards.

Depth and Velocity of Flow in Gravity Sewers

Gravity sewer lines are designed to convey peak dry weather flow. Pipes that are 12-inches in diameter and smaller are designed to convey this flow with a maximum depth-to-diameter (d/D) ratio of 0.50. Pipes that are larger than 12-inches in diameter are designed for a maximum d/D ratio of 0.75. Gravity sewer lines are designed to maintain a minimum velocity of 2.0 feet per second at peak dry weather flow to prevent the deposition of solids.

Estimated Sewer Flows for Marja Acres

Based on the sewage generation factors presented in Table 1, the estimated average sewer generation for the project is calculated in Table 2 and the estimated peak flow is shown in Table 3.

TABLE 2
AVERAGE SEWER FLOW FROM MARJA ACRES

Land Use	Quantity	Sewer Generation	Total (Average) Flow
Residential (Townhomes)	252 DUs	220 gpd/DU	55,440 gpd
Residential (Apartments)	46 DUs	176 gpd/DU	8,096 gpd
Commercial	9,700 sq. ft.	800 gpd/10,000 sq. ft.	776 gpd
Total			**64,312 gpd**

TABLE 2
PEAK SEWER FLOW FROM MARJA ACRES

Land Use	Average Flow	Peaking Factor	Peak Flow
Residential (Townhomes)	55,580 gpd	2.5	138,950 gpd
Residential (Apartments)	8,800 gpd	2.5	22,000 gpd
Commercial	800 gpd	2.5	2,000 gpd
Total			**162,950 gpd**

Existing and Proposed Sewer System

There are several existing sewer lines in the vicinity of the Marja Acres project. Figure 2 provides the location of existing facilities in the vicinity of the project. There is an existing 12-inch sewer interceptor in Kelly Drive (labeled NAHT1B in the Master Plan) that conveys flow south from El Camino Real. From this line in Kelly Drive, an 8-inch sewer line runs southeast in El Camino Real and has been extended approximately 365 feet easterly in El Camino Real on account of the Robertson Ranch project which is directly across El Camino Real from Marja Acres.

The recommended onsite gravity sewer system is presented on Figure 3.

Sewer System Analysis

Offsite Analysis. To analyze the impact of the Marja Acres project on the existing gravity sewer system, a sewer system analysis was conducted. The system was analyzed under existing flow conditions and under existing flows plus flow from the Marja Acres development project. The As-Built drawings and offsite sewer access hole locations included in Appendix B were utilized to determine the sizes and slopes of the sewer lines analyzed in this study.

The analyses of the offsite sewer system under both existing flows and existing plus proposed flows is presented in Appendix C. Exhibit A presents the sewer access hole and pipe diagram and the public sewer system within the project's sub-basin. The existing average sewage flow in the sub-basin flowing in El Camino Real adjacent to the project site was estimated to be 159,055 gpd. This is based on previous sewer studies (Robertson Ranch) and an estimation of the existing development adjacent to El Camino Real.

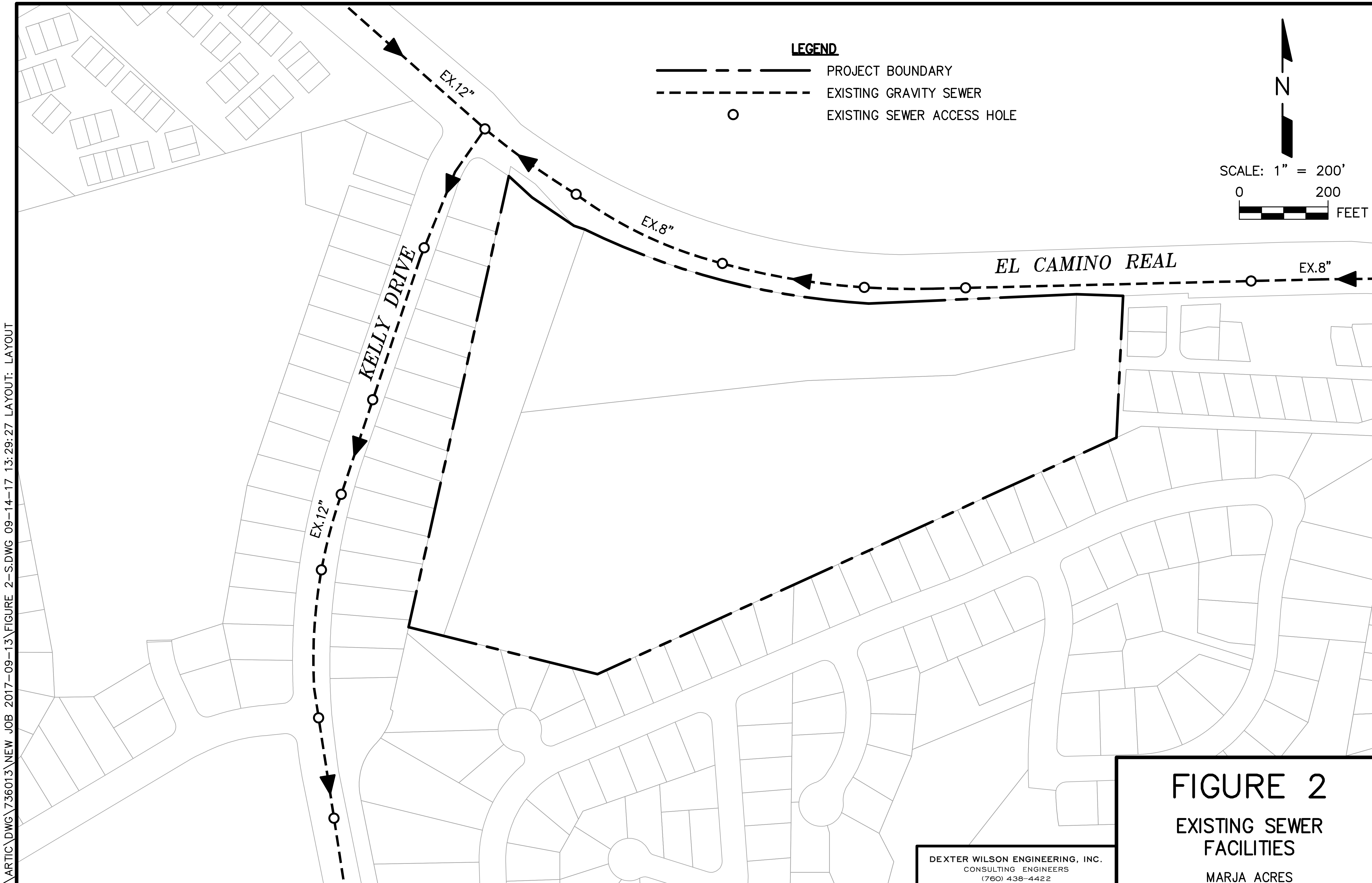
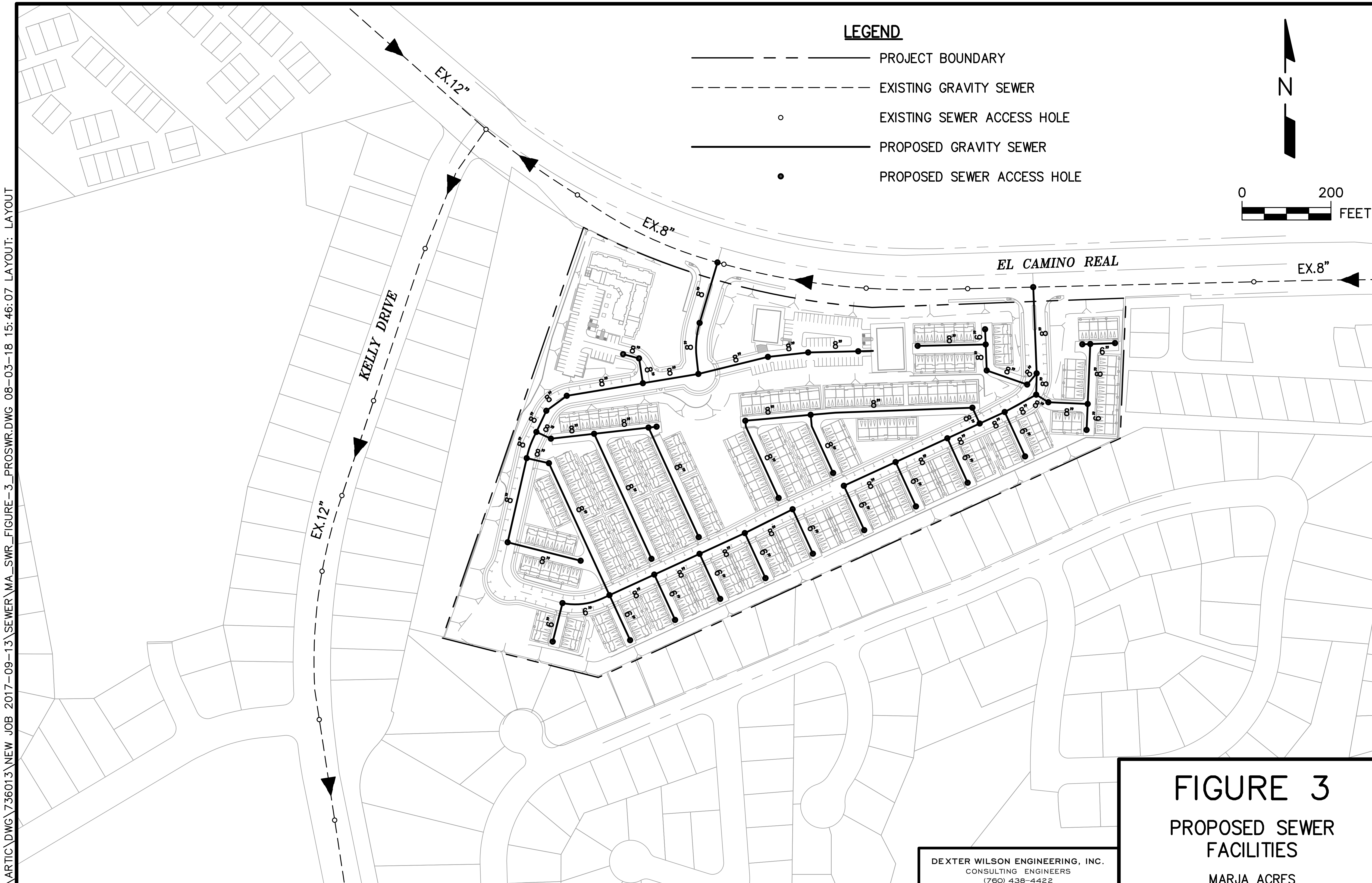


FIGURE 2

EXISTING SEWER FACILITIES

MARJA ACRES



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(760) 438-4422

FIGURE 3

PROPOSED SEWER FACILITIES

MARJA ACRES

The offsite analysis begins at sewer access hole (SAH) 16 in El Camino Real. The wastewater from the project will enter the gravity sewer line in El Camino Real at SAH 8, SAH 12 and SAH 4. The sewer is then conveyed to the 12-inch diameter interceptor in Kelly Drive approximately 150 feet northwest of the project. The analysis ends at this location (SAH 2). This interceptor in Kelly Drive joins the North Agua Hedionda Interceptor before flowing west and being pumped in both the Fox's Landing Lift Station and Agua Hedionda Lift Station before eventually being conveyed southward to the Encina Treatment Plant.

The results of the sewer flow analysis indicate that the sewer lines between the Marja Acres project and the interceptor in Kelly Drive have a maximum d/D ratio of 0.49 under existing peak flows and 0.60 under existing peak flows with the project included. These flows are in 8-inch diameter gravity sewer lines in El Camino Real where depth ratios of up to 0.50 are acceptable per the City's Engineering Standards and Master Plan.

The critical section of this line is the last section prior to the connection to the 12-inch interceptor in Kelly Drive. This section of line is approximately 280 feet in length and was installed at a slope of 0.40 percent with a drop manhole at the upstream end to allow the sewer line to be installed below a gas line and box culvert. The maximum depth-to-diameter (d/D) ratio in this section of line, with Marja Acres included, during peak flows is 0.60.

While new 8-inch sewer lines are to be designed for a maximum d/D ratio of 0.5, it is reasonable to allow an existing gravity sewer to flow at a d/D ratio of up to 0.75 during ultimate peak flows before recommending replacement. An e-mail correspondence with the City confirming adequate capacity is included in Appendix A.

Onsite Analysis. In addition to the offsite analysis, an onsite sewer analysis was completed utilizing the proposed sewer access hole inverts throughout the project. The onsite analysis results are presented in Appendix D. Exhibit B presents the sewer access hole and pipe diagram for the proposed onsite sewer system.

The sewer modeling results show the depth ratios in the proposed onsite gravity sewer lines to be in compliance with City design criteria. Appendix D includes the proposed onsite utility layout which includes the invert elevations of the new sewer lines.

Conclusions

The following conclusions have been made related to providing sewer service to the Marja Acres project.

1. The Marja Acres project will sewer its flow to existing City of Carlsbad gravity lines in El Camino Real.

2. The development of the Marja Acres project is projected to result in average sewage flow of 64,312 gpd.

3. No offsite gravity sewer improvements are needed to provide sewer service to the proposed project.

4. There is one section of 8-inch gravity sewer that goes over half-full when adding Marja Acre's sewage flow. The depth in this line (0.60 d/D) does remain below critical replacement level.

5. The sewer system analysis conducted indicates that the existing gravity sewer lines downstream of the project site can accommodate the wastewater flows for the Marja Acres project.

6. The proposed onsite layout and pipe sizes of the onsite gravity sewer system is presented on Figure 3.

Thank you for the opportunity to provide assistance on this project. If you have any questions about the analysis or conclusions of this study, please let us know.

Dexter Wilson Engineering, Inc.

Steven J. Henderson, P.E.

DSW:SH:pj

APPENDIX A

DESIGN CRITERIA & PEAKING FACTORS FROM THE CITY OF CARLSBAD WATER UTILITIES DEPARTMENT, WATER, SEWER AND RECLAIMED WATER DESIGN & CONSTRUCTION MANUAL AND SEWER MASTER PLAN

CHAPTER 6 – DESIGN CRITERIA FOR GRAVITY SEWER LINES AND APPURTENANCES

Prior to preparation of improvement plans, Engineer-of-work shall submit a rough layout of system for review and approval by the City Engineer.

1. SEWER MAIN DEPTH AND SIZE

   A. Sewer main depth and size shall be as shown below unless approved by the City Engineer.

   B. Minimum depth, finish grade to top of pipe: 6 feet

   C. Maximum depth, finish grade to top of pipe: 15 feet

   D. Design calculations shall be submitted to verify size and bedding design. (Manning "N" PVC = 0.011 is norm).

   E. Minimum size of mainline shall be 8".

   F. 6" main line may be allowed on cul-de-sac streets with a maximum of 10 units.

   G. All sewer laterals and main line invert elevations shall be shown in profile on the improvement plans and shall include stations, slope, and distance.

   H. All sewer mains over 15" in diameter shall require special design subject to City Engineer approval.

2. SEWER LATERAL DEPTH AND SIZE

   A. 4" minimum diameter for single-family residence.

   B. 6" minimum diameter for all other use.

   C. Desirable depth at property line is 5 feet (top of pipe to finish grade @ top of curb).

3. PIPELINE MATERIAL TYPES

   A. Gravity sewer pipe and fittings shall have PVC conforming to ASTM D3034 for diameters 4" – 15" and ASTM F 679 for 18" – 24", with integral-bell gasketed joints (gasket and spigot end joint design). Pipe shall be made of PVC plastic having a cell classification of 12454-B or 12364-B as defined in ASTM D 1784 and shall have SDR of 35 and a minimum stiffness of 46 psi according to ASTM D 2412.

   B. All fittings and accessories shall be as manufactured and finished by the pipe supplier or approved equal and have bell and spigot configurations compatible with that of the pipe.

C. PVC pipe joints shall be elastomeric gasket joints type conforming to Standard Specifications for Public Works (Greenbook) most recent edition. Rubber gaskets shall be factory installed and conform to ASTM F 477. Pipe joints shall have been tested and meet watertight performance requirements of ASTM D 3212, "Joints for Pipe Using Flexible Elastomeric Seals."

D. PVC C-900 shall be used for gravity sewer pipelines with depths equal or greater than 15 feet. Engineering calculations shall be provided to verify that the pipe material will accommodate the design depth.

E. Use of other pipe and fitting materials and types may be required by the City Engineer to meet specific conditions during design or construction.

F. Service connections to the sewer main shall be watertight and not protrude into the sewer pipe. All materials used to make the service connections shall be compatible with each other and with the pipe material to be joined and shall be corrosion proof.

G. Couplings used for repair, or transition to dissimilar pipe materials shall be approved by the City Engineer and provide corrosion proof watertight seal.

4. <u>DESIGN PARAMETERS FOR GRAVITY SEWER MAIN SLOPE, FLOW AND DEMAND</u>

A. Gravity sewer pipelines shall be designed for a minimum velocity of 2 feet/second. Velocity, unless otherwise stated, shall be calculated from peak dry weather flow.

B. Pipeline slopes shall satisfy the minimum velocity requirement aforementioned. Maximum velocities greater than 10 ft/second should be avoided.

Slopes for Specific Pipe Sizes 8 through 12-inch diameter:

1) 8" minimum 0.40% desirable 0.50%
2) 10" minimum 0.28% desirable 0.40%
3) 12" minimum 0.21% desirable 0.30%

Slopes for larger than 12-inch diameter pipe shall be designed to meet flow and velocity criteria and require specific approval of the City Engineer. Pipelines with horizontal curvature will require increase slope to achieve minimum required velocities.

C. Gravity pipelines with diameters of 12" and less shall be designed to flow at depths of 0.5D during peak hour dry weather flow. Gravity pipelines with diameters greater than 12" shall be designed to flow at depths of 0.75D during peak hour dry weather flow.

D. Peak hour sewer flow rates do not include infiltration or inflow (I/I). Infiltration is defined as the addition of groundwater into the sewer collection system and inflow is the addition of storm water into the sewer collection system. Because sewer collection system I/I is dependent on a number of factors including season, age of system, type of pipe material and joints, root intrusion, and presence of storm water system, the I/I flow rates will vary from system to system. The design of sewer pipelines connecting to sewer systems known to have I/I, or are susceptible to I/I, shall utilize peak wet weather flow estimates from the City of Carlsbad Sewer Master Plan or perform wet weather flow monitoring as directed by the City Engineer. Gravity pipelines designed to convey wet weather flow shall not exceed 0.90D for peak hour wet weather flow.

E. Flowrate Generation

1) An Equivalent Dwelling Unit (EDU) = 220 gal/day, Average Daily Flow (ADF)

2) For ADF less than 100,000 gal/day, a peaking factor (PF) of 2.5 multiplied times the ADF shall be used to determine Peak Daily Flows (PDF). PDF = ADF x 2.5

a) Residential: Single Family Residence = 1 EDU

b) Commercial Property: 1 EDU/1,800 ft^2 (building space)

i) To convert raw land to square feet of building space, assume 30% coverage. This could vary significantly dependent development constraints.

ii) To convert improved pads to square feet of building space, assume 40% of coverage.

3) Industrial Property: 1 EDU/5,000 ft^2 (warehouse space)
1 EDU/1,800 ft^2 (office space)

a) To convert raw land to square feet of building space, assume 30% coverage. This could vary significantly dependent issues such as environmental restrictions.

b) To convert improved pads to square feet of building space, assume 40% of coverage.

c) Assume 60% of building space is warehouse, and 40% is office space.

5. <u>HORIZONTAL AND VERTICAL LAYOUT</u>

A. Streets: See City of Carlsbad Standard Drawing No. GS-6 for location.

B. Alley: Main to centerline shall be a minimum of three feet (3') offset.

Steven Henderson

From:	David Hull <David.Hull@carlsbadca.gov>
Sent:	Tuesday, July 24, 2018 4:48 PM
To:	Steven Henderson
Cc:	Lindsey Stephenson
Subject:	RE: Marja Acres Water and Sewer Studies

Hi Steve,

When I mentioned the issue the City was looking into I had assumed you were referring to the sewer peaking factor comment we made on the sewer study. We have updated the model and determined that a 1.75 peaking factor is acceptable. The existing infrastructure will manage the additional waste water flows from the Marja project. We will not require the developer to make improvements to the public waste water system.

We are still open to a meeting if you have other issues you would like to discuss. Please let me know if you would still like to meet and I can arrange at time and location.

Thank you,

City of Carlsbad

David Hull, P.E.
Associate Engineer
City of Carlsbad Public Works
5950 El Camino Real
Carlsbad, CA 92008
Office: 760-603-7322
Mobile: 760-497-4044
David.Hull@carlsbadca.gov

From: Steven Henderson [mailto:Steven@dwilsoneng.com]
Sent: Tuesday, July 24, 2018 9:41 AM
To: David Hull <David.Hull@carlsbadca.gov>
Cc: Lindsey Stephenson <Lindsey.Stephenson@carlsbadca.gov>
Subject: RE: Marja Acres Water and Sewer Studies

Hi David,

Thanks for providing the update on your internal model. Have any results been yielded yet?

Steven Henderson, P.E.
Dexter Wilson Engineering, Inc.
Office: 760-438-4422
Cell: 760-542-5910

From: David Hull [mailto:David.Hull@carlsbadca.gov]
Sent: Monday, July 16, 2018 2:31 PM

To: Steven Henderson <Steven@dwilsoneng.com>
Cc: Lindsey Stephenson <Lindsey.Stephenson@carlsbadca.gov>
Subject: RE: Marja Acres Water and Sewer Studies

Hi Steven,

The City has been looking into this issue. Our consultant has recently revised the sewer model to reflect the most up to date information. The preliminary review has indicated that the Marja Acres peaking factor and estimated flows will be acceptable without an upsize to the system. The City will confirm this result with an updated model run later this week. At this time lets hold off on meeting.

If the model confirms the system can handle the required flow, the City would not require Marja to revise the sewer study and upsize the sewer. Let's plan to touch base when I have the final model results likely Wednesday or Thursday.

Thank you,

City of Carlsbad

David Hull, P.E.
Associate Engineer
City of Carlsbad Public Works
5950 El Camino Real
Carlsbad, CA 92008
Office: 760-603-7322
Mobile: 760-497-4044
David.Hull@carlsbadca.gov

From: Steven Henderson [mailto:Steven@dwilsoneng.com]
Sent: Tuesday, July 10, 2018 11:51 AM
To: David Hull <David.Hull@carlsbadca.gov>
Subject: Marja Acres Water and Sewer Studies

Good Morning David,

My name is Steven Henderson; I prepared the water/sewer studies for Marja Acres. The developer wanted to inquire on a meeting to review the initial comments and to ensure we can address them on the revised studies. If that sounds okay to you let me know your availability in the upcoming week or two and hopefully we can get something scheduled.

Thanks,

Steven Henderson, P.E.
Dexter Wilson Engineering, Inc.
Office: 760-438-4422
Cell: 760-542-5910

of San Diego Water & Sewer Design Guide recommends the use of 80 gallons per capita day (gpcd), which equates to 197 gpd/DU for the City of Carlsbad (based on 2.46 persons per household). Based on these comparisons and the calculated unit flow rate for current conditions, the previously established flow generation rate of 220 gpd/EDU is considered to be appropriately conservative for flow projections in this master plan update. A lower unit flow factor of 176 gpd (80 percent of 220 gpd/EDU) is applied to high-density residential units in excess of approximately 20 units per acre (apartment complexes).

A non-residential land use flow factor of 800 gpd per 10,000 square feet of building area is applied to commercial and industrial development projections in the Growth Database. The composite commercial/industrial unit factor was approved by City Staff for planning purposes, and is higher than the average unit flow calculated in the unit flow analysis documented in Section 3.7. It is noted that projections made using this factor are based on a mix of development types in existing business/industrial parks and may not be representative of smaller areas with a single land use type. Flow projections for future schools, resort hotels, and the expansion of the Legoland Water Park are based on EDU conversions documented in the Carlsbad Municipal Code (Table 13.10.020c).

The unit flow factors established by City Staff to project ultimate wastewater flows in this Master Plan Update are summarized in Table 5-2.

Table 5-2 Wastewater Unit Flow Factors

Land Use Category	Unit Wastewater Flow
Residential Low Density to Med-High Density	220 gpd/DU
Residential High Density (Apartments)	176 gpd/DU
Commercial/Industrial	800 gpd/10,000 sq ft of building area
High School	7.33 gpd/student
Hotel	132 gpd/guest room
Water Park (Legoland)	3,740 gpd/developed acre

5.4 PROJECTED ULTIMATE FLOWS

Wastewater flow projections for future developments are made by applying the unit flow factors to the future build-out data in the modified Growth Database. Future wastewater flows are projected to be approximately 2.1 mgd and are summarized in Table 5-3. The future flows are based on flow projections for future development, and also include unit counts for existing residences that currently have septic systems and areas in LFMZ 6 that previously were pumped to LWWD from the La Golondrina and La Costa Meadows Lift Stations. It is noted that a minor wastewater service area boundary adjustment is assumed in the future to serve existing LWWD customers within the area of a proposed residential development located on the west side of El Camino Real, just south of Poinsettia Lane.

The level of sewer service that is provided to a community is related to the implementation of improvements that are planned and designed in accordance with accepted criteria. The sewer collection system is analyzed with a hydraulic model and results are evaluated with respect to established and verified design criteria to identify capacity deficiencies. This chapter describes the design criteria and hydraulic modeling methodology used in the evaluation of sewer collection system facilities based on 2009 conditions. The evaluation method employs the use of the MHWSoft InfoSWMM hydraulic modeling software, which performs hydraulic calculations with extended period simulations (EPS) and fully dynamic flow routing to calculate water depth in open channels and velocities and headloss in force mains. A summary of the performance of the existing system under both dry and wet weather conditions is provided.

4.1 DESIGN CRITERIA

Design criteria provide the standards against which the existing system is evaluated. These criteria are also the basis for planning of new facilities to improve existing service or to handle future wastewater flows. The design criteria in this Master Plan Update are based on existing City of Carlsbad design standards and are summarized in Table 4-1. It is noted that peaking factors used in the hydraulic analysis are based on historical dry and wet weather peak flows observed from metering data, as previously presented in Chapter 3 and discussed in more detail at the end of this chapter.

Table 4-1 Design and Evaluation Criteria

Depth-to-Diameter Ratio for Gravity Mains	For sewer mains ≤ 12-inch .... 0.50 For sewer mains > 12-inch 0.75
Manning's Roughness Coefficient	For PVC lined pipes in the V/C Interceptor .... 0.012 For all other pipes 0.013
Velocity for Gravity Mains	Minimum allowable velocity .... 2 ft per sec Maximum allowable velocity .... 12 ft per sec
Velocity for Force Mains	Minimum allowable velocity .... 2.5 ft per sec Maximum allowable velocity .... 8 ft per sec

The most important evaluation criteria for gravity sewers is the depth of flow, which is calculated in the hydraulic model based on Manning's Equation. The capacity of each gravity sewer is based on the relative depth of flow within the respective pipeline reach. Sewer interceptors are not typically designed to flow full, as unoccupied space at the top of the pipe is required for conveyance of sewage gasses and to provide contingent capacity for wet weather inflow and infiltration. Interceptor sizing is typically based on the pipeline flowing 75 percent full at the PWWF if the pipe is larger than 12-inches in diameter (D/d = 0.75). If the pipeline is 12-inches in diameter or smaller, a D/d factor of 0.50 is used.

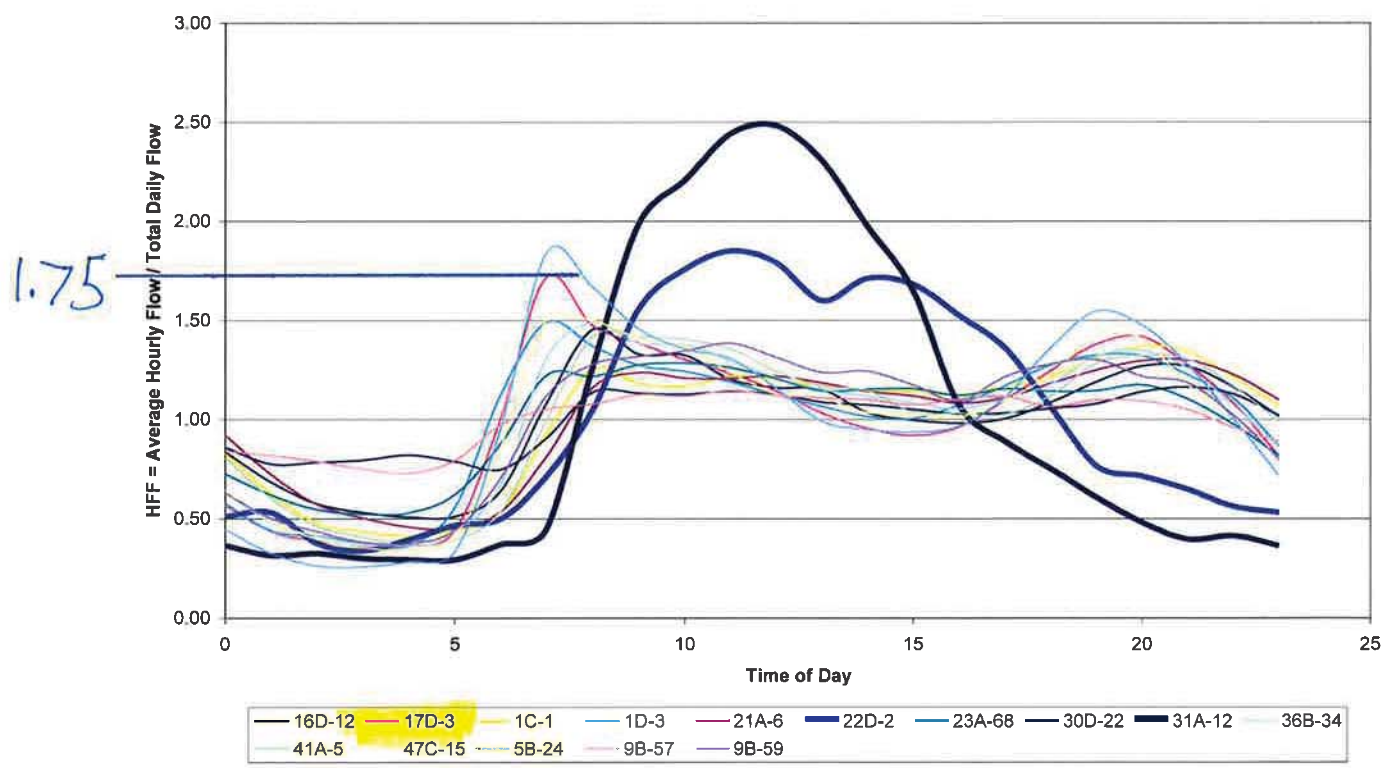
Friction factors for pipelines are a required input to the model. The factors vary with the material and the age of the pipe. A roughness factor as indicated by a Mannings' coefficient ("η") of 0.013 is typically used to evaluate existing interceptors and for projection of future sizing needs. Previous studies have shown that this value typically accounts for most pipe roughness, joints, and fouling that occur after

L1) will produce a 20 percent error in Carlsbad flow calculations (C2-L1). If the accuracy of both the L1 and C2 meters is considered, the flow calculated for Carlsbad in the NB Interceptor be up 40 percent in error with both meters reading within their reported accuracy range of three percent. It is noted that flow measurements from the temporary meters indicated slightly higher flows generated within Carlsbad in the NB Interceptor than calculations performed with Encina flow data, and the temporary flow data is reflected in Table 3-2.

3.5 PEAK DRY WEATHER FLOWS

Flow measurement data from the meters indicate distinct and repeatable peaking trends for weekdays and for weekends. Data from the EWPCF meters and the temporary flow meters was recorded in 15-minute intervals, and typical dry weather flow patterns were determined by averaging weekday and weekend flows during days with no rainfall. Figure 3-8 illustrates each characteristic weekday Hourly Flow Factor (HFF) for each of the temporary flow meter sites. The HFF is calculated by dividing the hourly average flow by the average daily flow. This standardizes the hourly variations regardless of the total daily volume. The peak dry weather flow (PDWF) is the maximum HFF times the average daily flow for that basin.

Figure 3-8 Hourly Flow Factors for Temporary Meters (Weekday ADWF)



As can be seen from the hydrographs in Figure 3-8, there are two distinct flow patterns. Most sites are dominated by residential flows and have an early morning and mid-evening peak, with the highest peak generally occurring between the hours of 7:00 AM and 9:00 AM. Site 5B-24 has the highest peaking factor and is also the most homogenous residential land use. The two hydrographs with midday peaks (shown bolded) are for industrial/commercial basins. It is noted that flows from meter 31-A-12, the

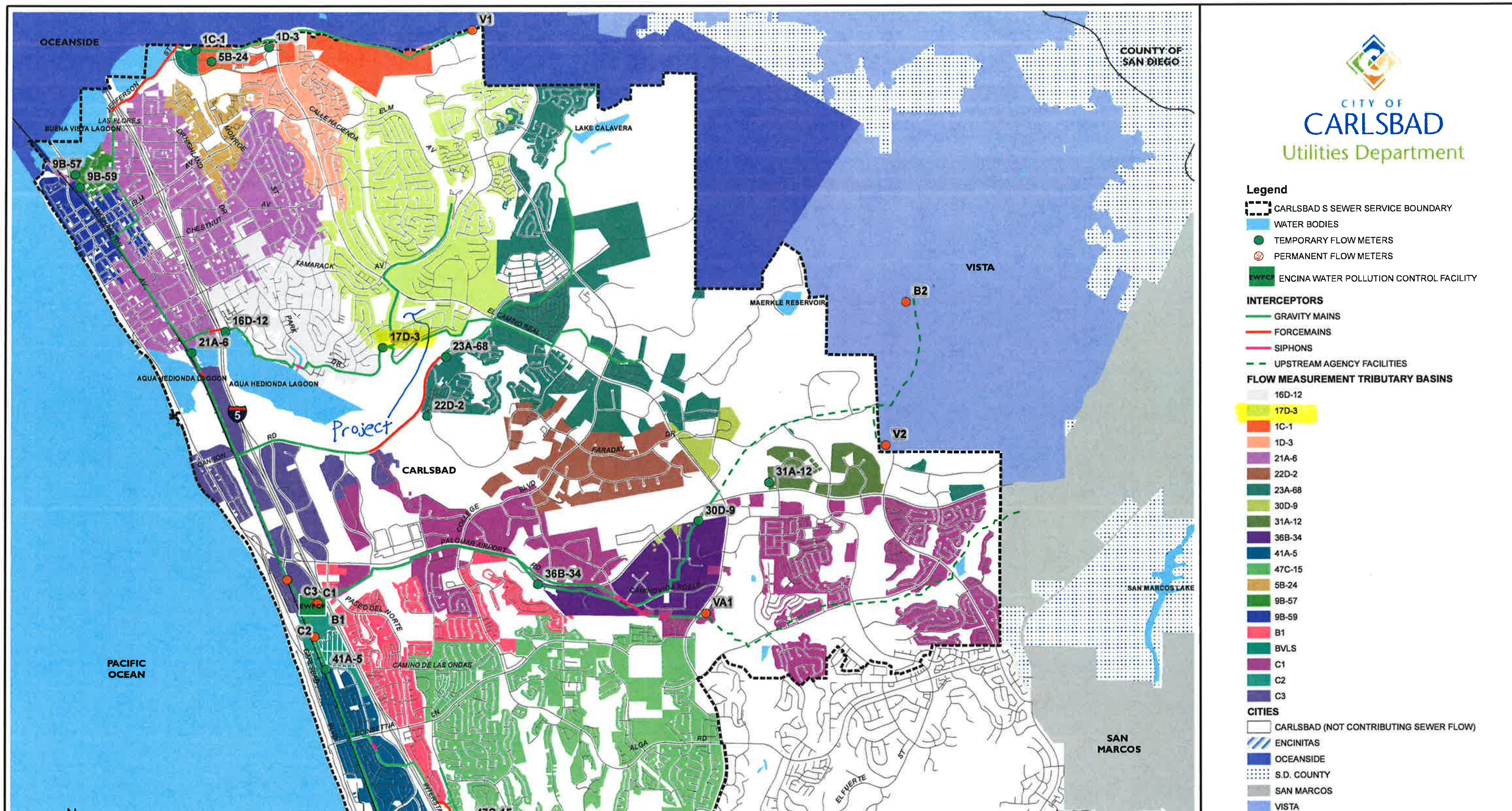
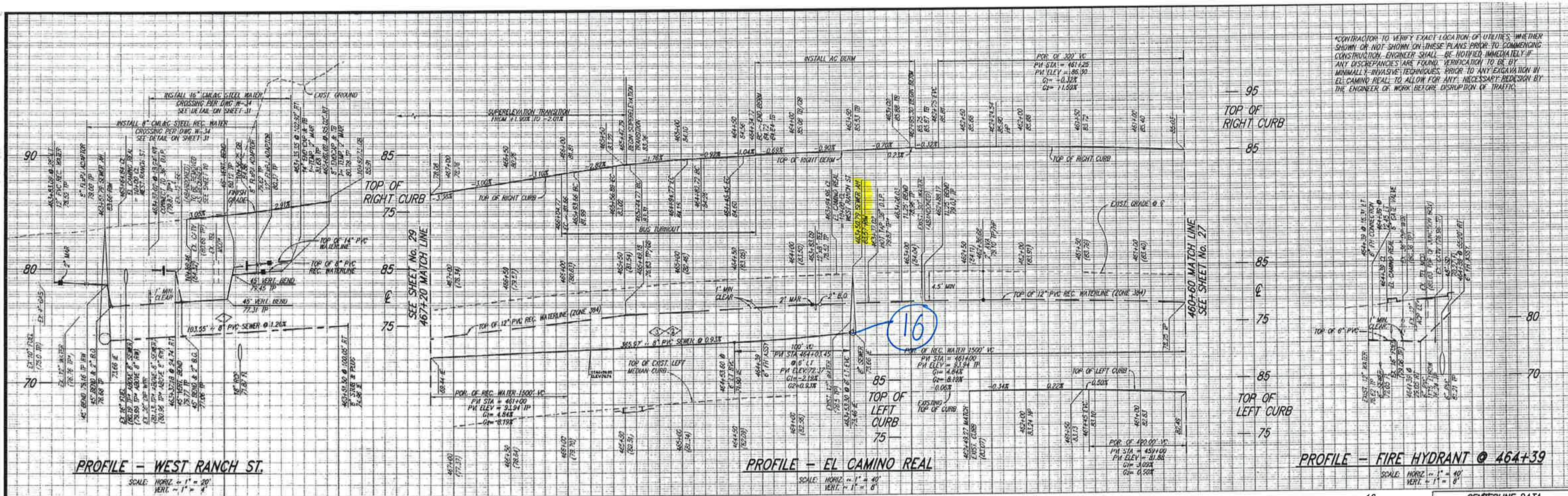


FIGURE 3-4

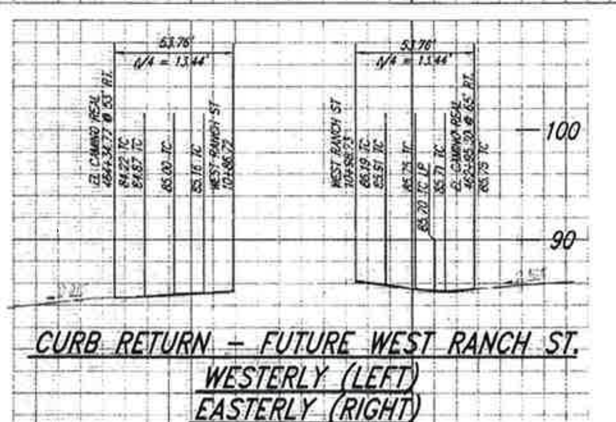
CITY OF CARLSBAD FLOW MEASUREMENT TRIBUTARY BASINS

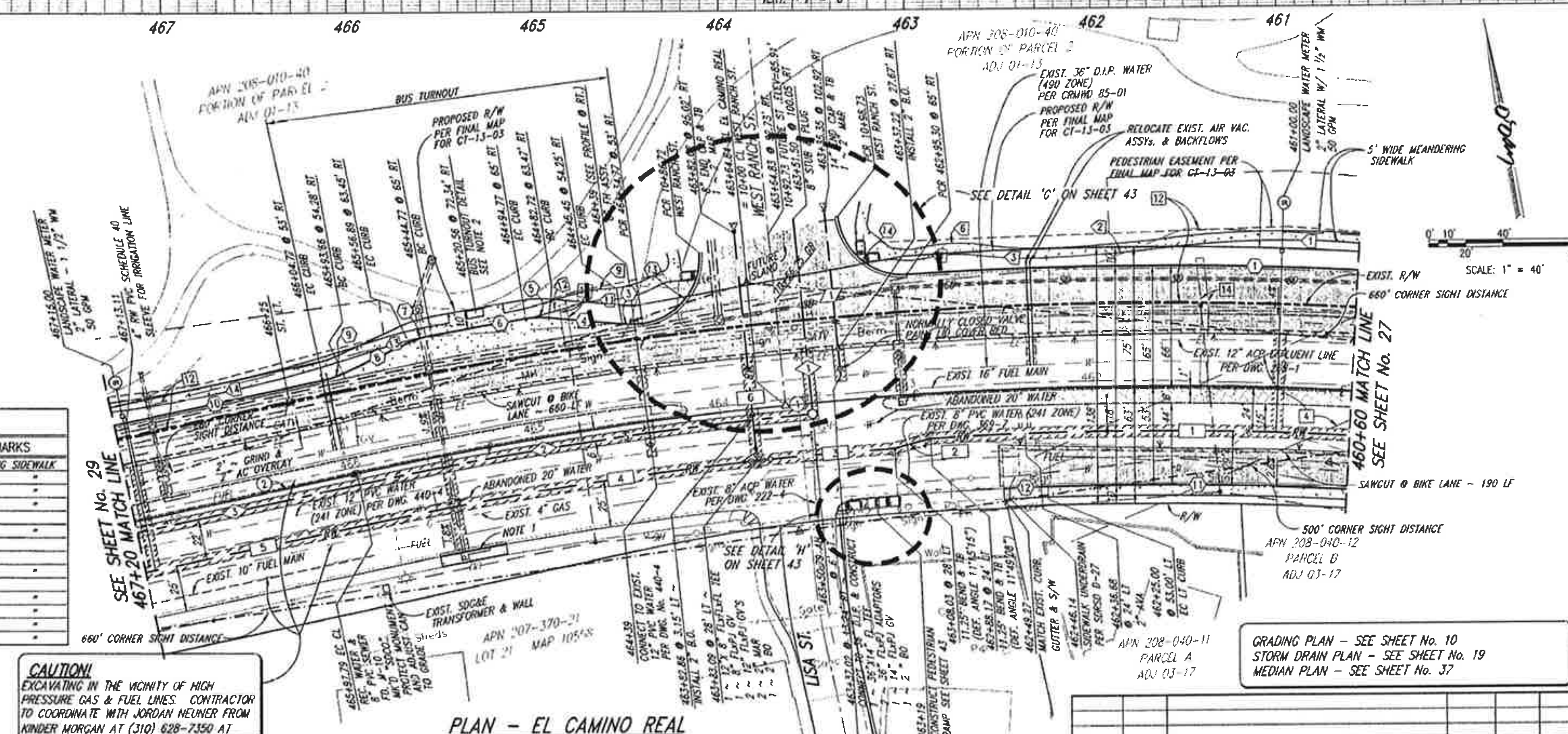
APPENDIX B

SEWER AS-BUILT DRAWINGS IN EL CAMINO REAL



*CONTRACTOR TO VERIFY EXACT LOCATION OF UTILITIES, WHETHER SHOWN OR NOT SHOWN ON THESE PLANS PRIOR TO COMMENCING CONSTRUCTION. ENGINEER SHALL BE NOTIFIED IMMEDIATELY IF ANY DISCREPANCIES ARE FOUND. VERIFICATION TO BE BY MINIMALLY-INVASIVE TECHNIQUES, PRIOR TO ANY EXCAVATION IN EL CAMINO REAL, TO ALLOW FOR ANY NECESSARY REDESIGN BY THE ENGINEER OF WORK BEFORE DISRUPTION OF TRAFFIC.





CENTERLINE DATA

NO	DELTA/BEARING	RADIUS	LENGTH
1	Δ = 15°24'21"	2000.09'	537.79'
2	N 87°53'47" E	——	122.21'

CURB DATA

NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	Δ = 06°44'26"	2065.09'	242.94'	6" TYPE "G" CURB & GUTTER
2	N 89°47'19" E	——	144.06'	6" A.C. BERM
3	Δ = 12°40'24"	50.00'	11.06'	6" TYPE "G" CURB
4	N 74°45'38" W	——	39.46'	" "
5	Δ = 14°23'31"	50.00'	12.56'	" "
6	Δ = 01°25'56"	2065.09'	51.62'	" "
7	Δ = 14°29'25"	50.00'	12.65'	" "
8	N 74°55'30" E	——	38.94'	" "
9	Δ = 12°58'17"	50.00'	11.32'	" "
10	N 87°53'47" E	——	115.23'	6" TYPE "G" CURB & GUTTER
11	Δ = 04°43'36"	1947.09'	160.63'	" "
12	N 82°20'09" W	——	23.63'	" "
13	Δ = 87°59'47"	35.00'	53.75'	" "
14	Δ = 88°00'29"	35.00'	53.76'	" "

SEWER DATA

NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	N 04°34'11" E	——	103.55'	8" PVC SDR 35
2	Δ = 07°00'13"	1994.09'	243.75'	" "
3	N 87°53'47" E	——	122.22'	" "

WATER DATA

NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	N 04°34'11" E	——	89.70'	14" PVC ~ DR 18 HG 446*

*OR 16" CML&C STEEL WATERLINE ~ SEE PROFILE

RECLAIMED WATER DATA

NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	Δ = 06°32'11"	1976.09'	225.44'	12" PVC ~ DR 18 HG 384
2	N 84°56'49" E	——	20.00'	" "
3	Δ = 02°09'01"	1972.09'	74.01'	" "
4	Δ = 06°09'01"	1972.09'	211.69'	" "
5	N 87°53'47" E	——	102.21'	" "
6	N 04°34'11" E	——	123.03'	8" PVC ~ DR 18 HG 384*

*OR 8" CML&C STEEL WATERLINE ~ SEE PROFILE

NOTE:

1. REMOVE & REPLACE 36 LF OF EXISTING 6" CURB & GUTTER FOR INLET TRANSITION PER CITY OF CARLSBAD STD DS-1. REMOVE & REPLACE SIDEWALK AS NEEDED TO NEAREST JOINT.
PER G-11.

2. 9' LONG DOMED ROOF NON-ADVERTISING BUS SHELTER PER TOLAR MANUFACTURING MODEL 9NALD-PM OR EQUAL. SEE DETAIL ON SHEET 5

EDGE OF SIDEWALK DATA

NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	Δ = 22°25'21"	505.00'	100.00'	MEANDERING SIDEWALK
2	Δ = 03°53'09"	1000.00'	67.82'	" "
3	Δ = 10°29'28"	200.00'	36.62'	" "
4	Δ = 27°17'34"	80.00'	38.11'	" "
5				
6	Δ = 27°03'58"	86.00'	40.63'	" "
7				
8				
9	Δ = 27°03'58"	86.00'	40.63'	" "
10				
11	Δ = 27°32'07"	80.00'	38.45'	" "
12	Δ = 06°14'59"	200.00'	21.82'	" "
13	Δ = 08°51'29"	200.00'	30.92'	" "
14	Δ = 12°49'13"	760.00'	148.05'	" "

EXISTING EASEMENTS

[4] PIPELINE & INCIDENTALS TO O.M.W.C. REC. JULY 11, 1930, BK. 1796, PG. 142, DEEDS

[12] DRAINAGE CHANNEL TO COUNTY OF SAN DIEGO REC. MAR. 12, 1970, DOC. 44687, O.R.

[14] PUBLIC UTILITIES & INCIDENTALS TO S.D.G.&E. REC. NOV. 20, 1970, DOC. 213363, O.R.

CAUTION !!
CONTRACTOR TO VERIFY THE EXACT LOCATION OF EXISTING UTILITIES IN THE FIELD PRIOR TO CONSTRUCTION!

NOTE !!
ELECTRONIC DATA FILES ARE FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR HORIZONTAL OR VERTICAL SURVEY CONTROL.

CAUTION!
EXCAVATING IN THE VICINITY OF HIGH PRESSURE GAS & FUEL LINES. CONTRACTOR TO COORDINATE WITH JORDAN NEUNER FROM KINDER MORGAN AT (310) 628-7350 AT LEAST TWO WEEKS PRIOR TO COMMENCEMENT OF WORK NEAR FUEL LINES

GRADING PLAN – SEE SHEET No. 10
STORM DRAIN PLAN – SEE SHEET No. 19
MEDIAN PLAN – SEE SHEET No. 37

REGISTERED PROFESSIONAL ENGINEER GEORGE O'DAY NO. 32014 EXP. 12/31/16 CIVIL STATE OF CALIFORNIA

O'Day CONSULTANTS
2710 Loker Avenue West Suite 100 Carlsbad, California 92010 760-931-7700 Fax 760-931-8680 ODayConsultants.com
Civil Engineering Planning Processing Surveying

DESIGNED BY: N.F./K.H. DATE: FEB. 2013
DRAWN BY: T.G./C.M. SCALE: 1" = 40'
PROJECT MGR.: G.O. JOB NO.: 10-1307

ENGINEER OF WORK:
George O'Day DATE: 4/22/15
GEORGE O'DAY RCE: 32014

"AS-BUILT"
GEORGE O'DAY P.E. 32014 EXP. ______ DATE
REVIEWED BY:
INSPECTOR DATE

BENCHMARK

DESCRIPTION: 2.5" DISC STAMPED "CLSB-105, L.S. 6215"
LOCATION: IN NORTHEAST CORNER OF CANNON RD. BRIDGE OVER AGUA HEDIONDA CREEK, 120 FEET SOUTHWEST OF EL CAMINO REAL
RECORD FROM: R.O.S. NO. 17271 (PT. NO. 105)
ELEVATION: 45.410 M.S.L. DATUM: NGVD 1929

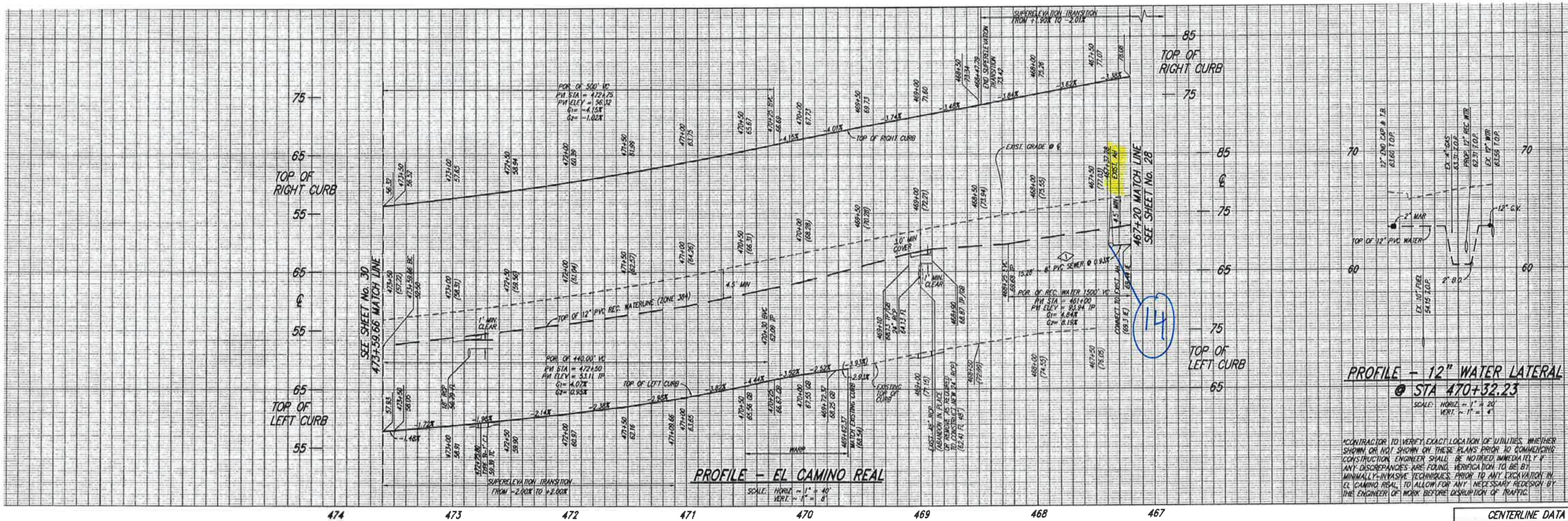
DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 28 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 96

IMPROVEMENT PLANS FOR:
ROBERTSON RANCH WEST VILLAGE
(RANCHO COSTERA)
EL CAMINO REAL
C.D.P. 11-10

APPROVED BY: JASON S. GELDERT 6-16-2015
ENGINEERING MANAGER RCE 63912 EXP. 09/30/16 DATE

DWN BY: CHKD BY: JLG RVWD BY: JLG
PROJECT NO. C.T. 13-03
DRAWING NO. 477-6



*CONTRACTOR TO VERIFY EXACT LOCATION OF UTILITIES, WHETHER SHOWN OR NOT SHOWN ON THESE PLANS PRIOR TO COMMENCING CONSTRUCTION. ENGINEER SHALL BE NOTIFIED IMMEDIATELY IF ANY DISCREPANCIES ARE FOUND. VERIFICATION TO BE BY MINIMALLY-INVASIVE TECHNIQUES, PRIOR TO ANY EXCAVATION IN EL CAMINO REAL, TO ALLOW FOR ANY NECESSARY REDESIGN BY THE ENGINEER OF WORK BEFORE DISRUPTION OF TRAFFIC.

CENTERLINE DATA			
NO	DELTA/BEARING	RADIUS	LENGTH
1	N 87°53'47" E	——	639.66'

CURB DATA				
NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	N 87°53'47" E	——	639.66'	6" TYPE "G" CURB & GUTTER
2	N 87°53'47" E	——	397.29'	" "

EDGE OF SIDEWALK DATA				
NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	Δ = 12°49'13"	760.00'	22.00'	MEANDERING SIDEWALK
2	Δ = 12°18'45"	1000.00'	214.90'	" "
3	Δ = 06°06'55"	800.00'	85.39'	" "
4	Δ = 03°21'13"	1000.00'	58.53'	" "
5	Δ = 26°34'52"	102.51'	47.56'	" "
6	N 62°18'52" W	——	7.00'	" "

MOW CURB DATA	
NO	LENGTH
1	464.38'

SEWER DATA				
NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	N 87°53'47" E	——	15.28'	8" PVC SDR 35

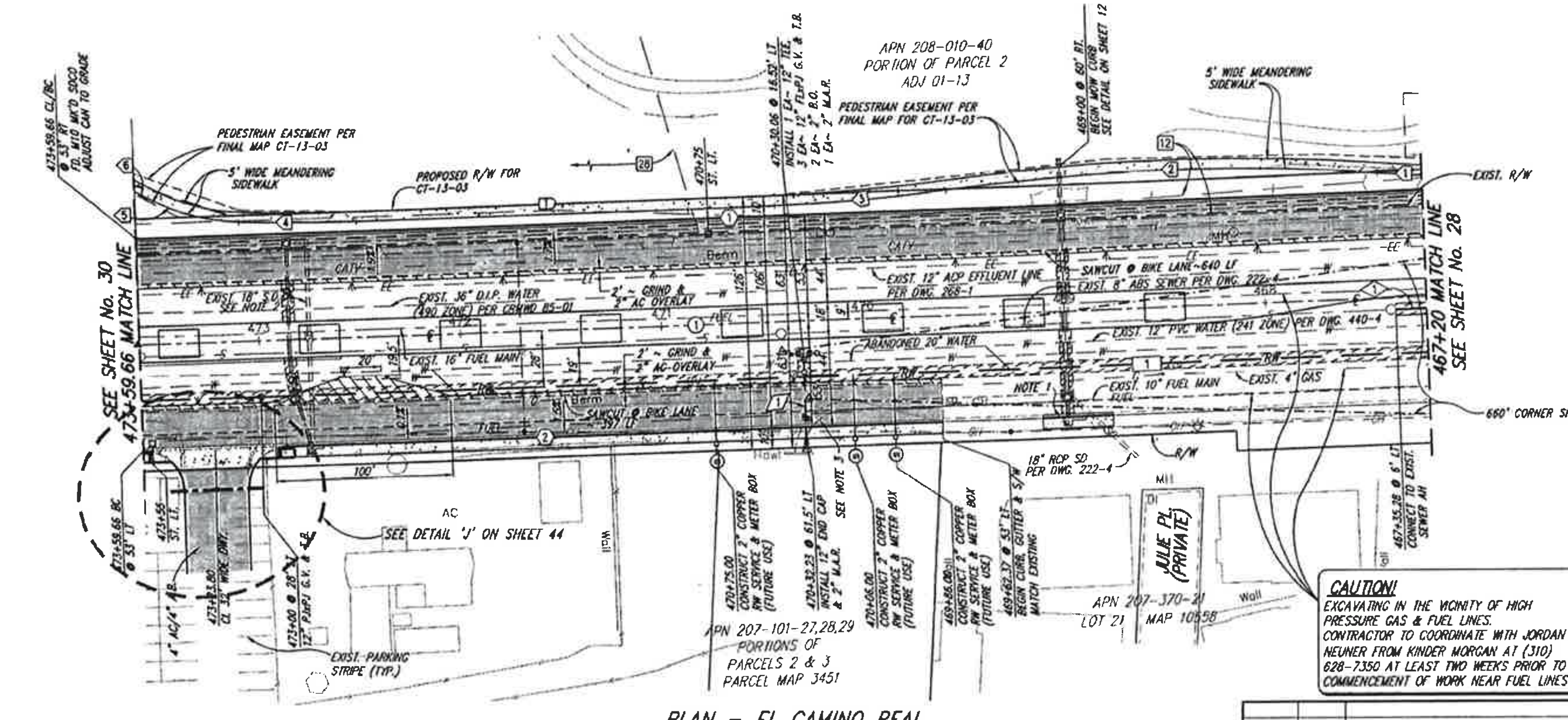
RECLAIMED WATER DATA				
NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	N 87°53'47" E	——	639.66'	12" PVC ~ DR 18 HG 384

WATER DATA				
NO	DELTA/BEARING	RADIUS	LENGTH	REMARKS
1	N 2°06'13" W	——	49.00'	12" PVC ~ DR 14 HG 241

EXISTING EASEMENTS

12 DRAINAGE CHANNEL TO COUNTY OF SAN DIEGO REC. MAR. 12, 1970, DOC. 44687, O.R.

28 MEMORANDUM OF MANAGEMENT AND FUNDING AGREEMENT REC. DEC. 21, 2007, DOC. 2007-0786169, O.R.



NOTES:

1. REMOVE & REPLACE 36 LF OF EXISTING 6" CURB & GUTTER FOR INLET TRANSITION PER CITY OF CARLSBAD STD DS-1. REMOVE & REPLACE SIDEWALK AS NEEDED TO NEAREST JOINT, PER G-11
2. A RECORD SEARCH OF THE EXISTING 18" STORM DRAIN WAS CONDUCTED AND NOTHING FOUND. SEE SHEET 20 FOR ADDITIONAL NOTES.
3. CONTRACTOR TO REMOVE EXIST. 48" STORM DRAIN AS REQUIRED TO CONSTRUCT NEW 12" PVC WATER MAIN

CAUTION!

EXCAVATING IN THE VICINITY OF HIGH PRESSURE GAS & FUEL LINES. CONTRACTOR TO COORDINATE WITH JORDAN NEUNER FROM KINDER MORGAN AT (310) 628-7350 AT LEAST TWO WEEKS PRIOR TO COMMENCEMENT OF WORK NEAR FUEL LINES

GRADING PLAN - SEE SHEET No. 11
STORM DRAIN PLAN - SEE SHEET No. 20
MEDIAN PLAN - SEE SHEET No. 38

CAUTION !!

CONTRACTOR TO VERIFY THE EXACT LOCATION OF EXISTING UTILITIES IN THE FIELD PRIOR TO CONSTRUCTION!

NOTE !!

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REGISTERED PROFESSIONAL ENGINEER GEORGE O'DAY NO. 32014 EXP. 12/31/16 CIVIL STATE OF CALIFORNIA

O'DAY CONSULTANTS
2710 Loker Avenue West Suite 100 Carlsbad, California 92010 760-931-7700 Fax: 760-931-8680 ODayConsultants.com
Civil Engineering Planning Processing Surveying

DESIGNED BY: N.F./K.H. DATE: FEB. 2013
DRAWN BY: T.G./G.M. SCALE: 1" = 40'
PROJECT MGR.: G.O. JOB NO.: 10-1307

ENGINEER OF WORK: GEORGE O'DAY DATE: 5/24/16 RCE: 32014

"AS-BUILT"

GEORGE O'DAY P.E. 32014 EXP. ______ DATE

REVIEWED BY:

INSPECTOR DATE

BENCHMARK

DESCRIPTION: 2.5" DISC STAMPED "CLSB-105, L.S. 6215"
LOCATION: IN NORTHEAST CORNER OF CANNON RD. BRIDGE OVER AGUA HEDIONDA CREEK, 120 FEET SOUTHWEST OF EL CAMINO REAL
RECORD FROM: R.O.S. NO. 17271 (PT. NO. 105)
ELEVATION: 45.410 M.S.L. DATUM: NGVD 1929

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 29 CITY OF CARLSBAD ENGINEERING DEPARTMENT SHEETS 96

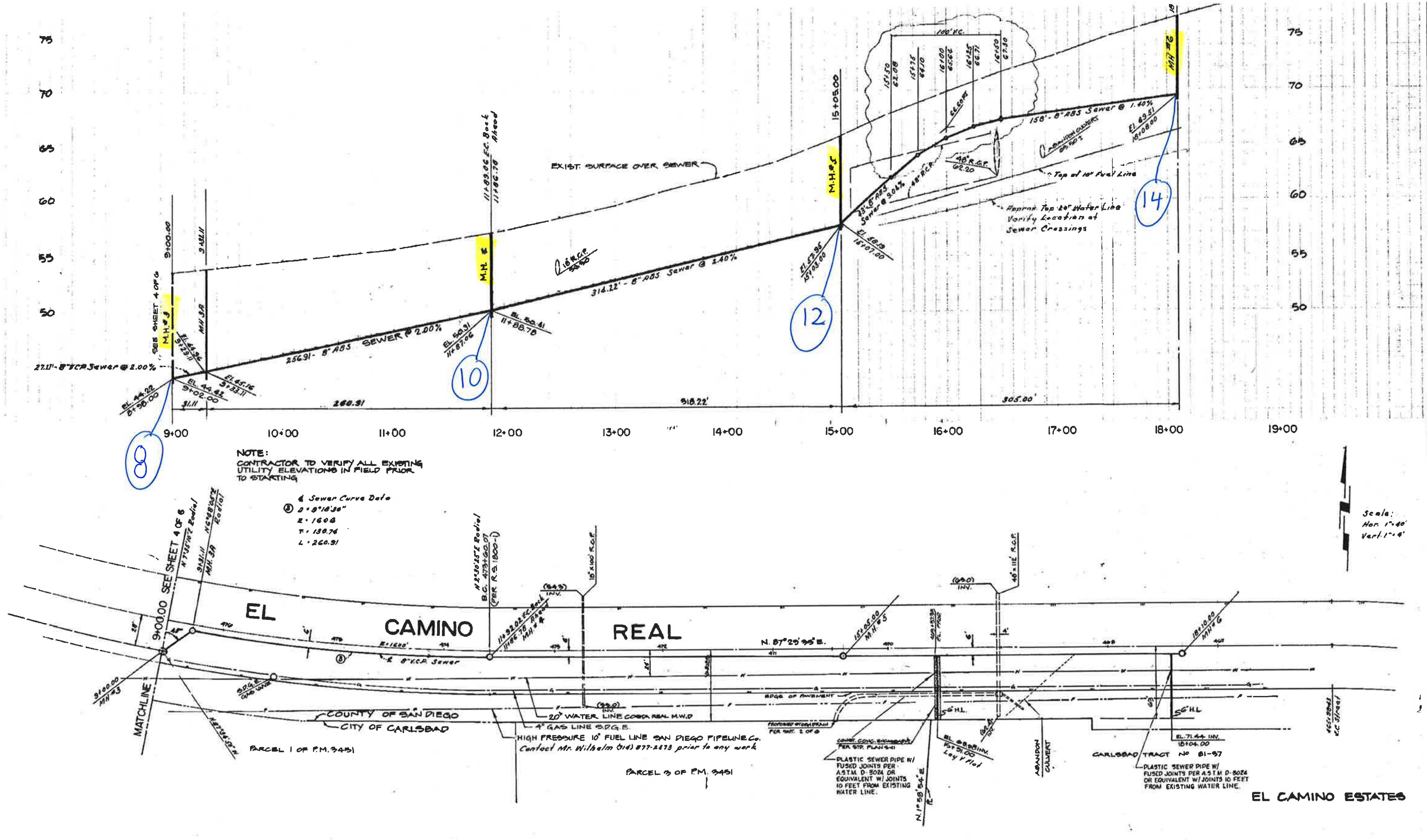
IMPROVEMENT PLANS FOR:
ROBERTSON RANCH WEST VILLAGE
(RANCHO COSTERA)
EL CAMINO REAL C.D.P. 11-10

APPROVED BY: JASON S. GELDERT 6-16-2015
ENGINEERING MANAGER RCE 63912 EXP. 09/30/16 DATE

DWN BY: ______
CHKD BY: JLR
RVWD BY: JLR

PROJECT NO. C.T. 13-03

DRAWING NO. 477-6



BENCH MARK:
R.S. 1800 STREET ℄ MON ON EL CAMINO REAL 2.76 MI. N'LY FROM PALOMAR AIRPORT RD. STA 465+98 ELEV. 73.905

PREPARED BY
J.H. EDWARDS CO.
18811 CRENSHAW PLACE
TORRANCE CA. 90504
(213) 321-6767 (213) 327-0543

DATE	BY	DESCRIPTION	APP'D
9/23/82		Changed alignment and grade from Sta. 9+00 to Sta. 18+10 and revised existing utility location to eliminate conflict with 20" water line.	
8-5-83		As Built Plan	

REVISIONS

SHEET 5 — CITY OF CARLSBAD ENGINEERING DEPARTMENT — SHEETS 6

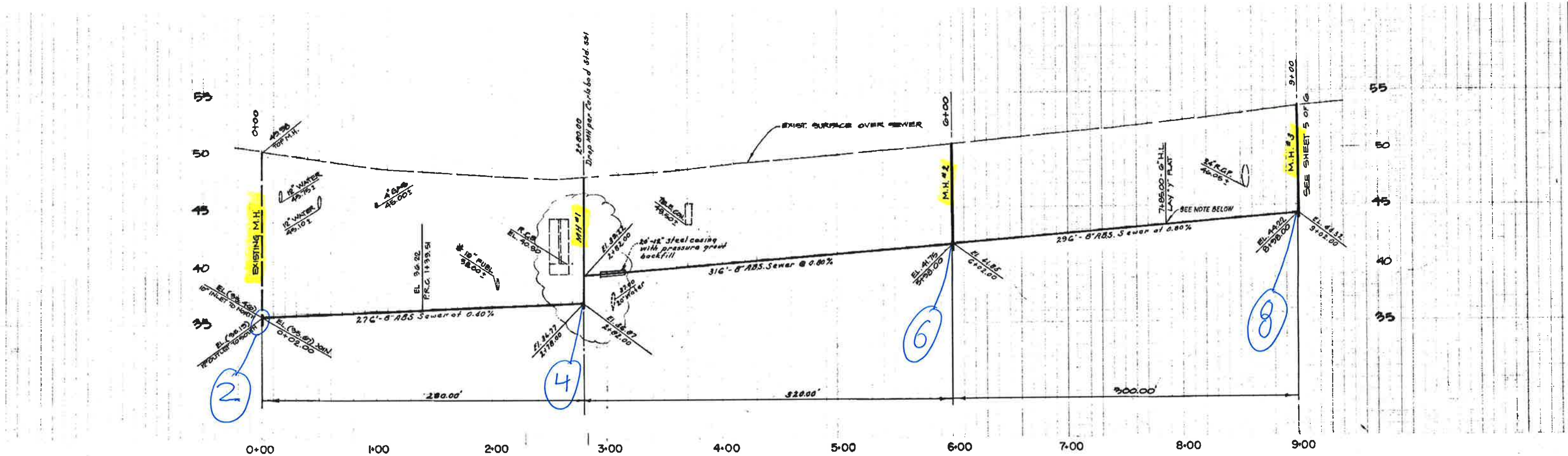
PLANS AND PROFILES OF SEWER IN EL CAMINO REAL CARLSBAD TRACT No 81-37

APPROVED: RE. 21494 CITY ENGINEER — DATE 9-21-82

DWN BY: CHKD BY: FIELD BK:

PROJECT NO. CT 81-37

DRAWING NO. 222-4

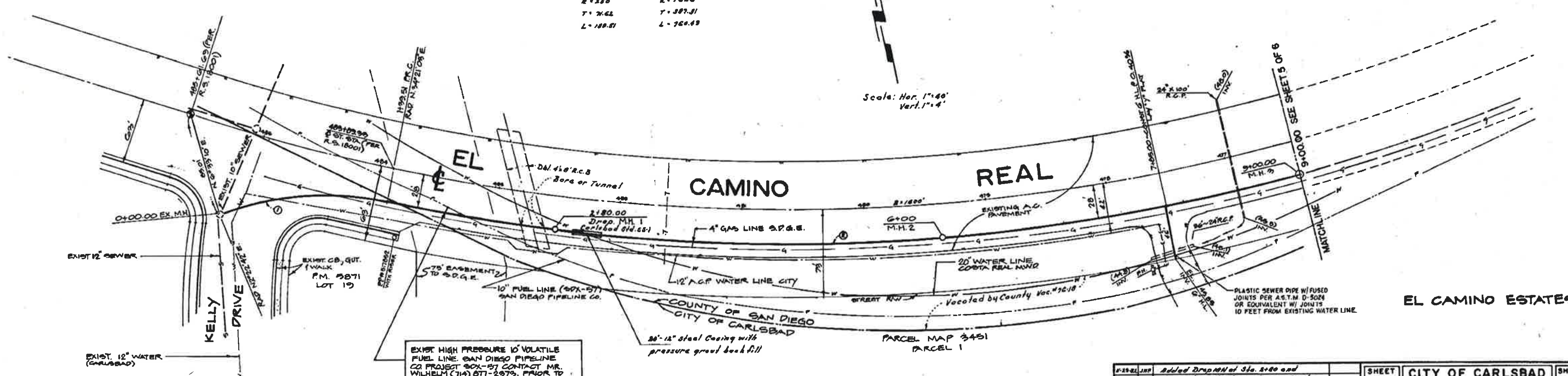


NOTE:
CONTRACTOR TO VERIFY ALL EXISTING UTILITY ELEVATIONS IN FIELD PRIOR TO STARTING CONSTRUCTION

* CAUTION:
EXISTING PUBLIC UTILITY CONDUITS IN AREA OF CONSTRUCTION. CALL PRIOR TO ANY EXCAVATION

℄ Sewer Curve Data

Scale: Hor. 1"=40'
Vert. 1"=4'



BENCH MARK:
R.S. 1800 STREET ℄ MON ON EL CAMINO REAL 2.76 MI. N'LY FROM PALOMAR AIRPORT R.P. STA 403+38

PREPARED BY
J.H. EDWARDS CO.
18811 CRENSHAW PLACE
TORRANCE CA. 90504
(213) 321-6767 (213) 327-0543

DATE	BY	DESCRIPTION	APP'D
8-25-82	JHE	Added Drop MH at Sta. 2+80 and changed grade from Sta. 2+80 to sta. 4+10 to eliminate conflict with 20" water line	DK
8-5-83		As Built Plans	
		REVISIONS	

SHEET 4 — CITY OF CARLSBAD ENGINEERING DEPARTMENT — SHEETS 6

PLANS AND PROFILE OF SEWER IN EL CAMINO REAL CARLSBAD TRACT Nº 81-37

APPROVED: CITY ENGINEER — DATE 9-21-82

PROJECT NO. CT 81-37 — DRAWING NO. 222-4

APPENDIX C

SEWER SYSTEM COMPUTER MODELING RESULTS
EXISTING FLOW &
EXISTING FLOW PLUS THE
MARJA ACRES PROJECT FLOW

SEWER STUDY SUMMARY

DATE: 8/3/2018 FOR: Marja Acres Sewer Study (Existing Flows; Existing Pipe) SHT 1 OF 3

JOB NUMBER: 736-013 BY: Dexter Wilson Engineering REFER TO: Exhibit A

LENGTH (feet)	FROM	TO	IN-LINE FLOW (gpd)	AVG. DRY WEATHER FLOW (gpd)	PEAKING FACTOR	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	AS-BUILT SLOPE (%)	DEPTH K' [1]	dn (feet)	dn/D [2]	C_a for Velocity [3]	VELOCITY (f.p.s.)	Remarks
							M.G.D.	C.F.S.								
365.97	16	14	153,865	153,865	1.75	269,264	0.269	0.417	8	0.93	0.140117	0.25333	0.38	0.2739	3.42	Flow from Robertson Ranch
302.33	14	12	3,360	157,225	1.75	275,144	0.275	0.426	8	1.40	0.116694	0.22667	0.34	0.2355	4.07	Existing Trailer Park (21 Units)
314.22	12	10	0	157,225	1.75	275,144	0.275	0.426	8	2.40	0.089127	0.20000	0.30	0.1982	4.83	
256.91	10	8	1,830	159,055	1.75	278,346	0.278	0.431	8	2.00	0.098770	0.20667	0.31	0.2074	4.67	Existing Commercial (15,000 sf)
296.67	8	6	0	159,055	1.75	278,346	0.278	0.431	8	0.80	0.156169	0.26667	0.40	0.2934	3.30	
316.67	6	4	0	159,055	1.75	278,346	0.278	0.431	8	0.80	0.156169	0.26667	0.40	0.2934	3.30	
276.67	4	2	0	159,055	1.75	278,346	0.278	0.431	8	0.40	0.220856	0.32667	0.49	0.3827	2.53	Junction with Kelly Drive

SEWER STUDY SUMMARY

DATE: 8/3/2018 FOR: Marja Acres Sewer Study (Existing plus Project Flows; Existing Pipe) SHT 2 OF 3

JOB NUMBER: 736-013 BY: Dexter Wilson Engineering REFER TO: Exhibit A

LENGTH (feet)	FROM	TO	IN-LINE FLOW (gpd)	AVG. DRY WEATHER FLOW (gpd)	PEAKING FACTOR	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	AS-BUILT SLOPE (%)	DEPTH K' [1]	dn (feet)	dn/D [2]	C_a for Velocity [3]	VELOCITY (f.p.s.)	Remarks
							M.G.D.	C.F.S.								
365.97	16	14	153,865	153,865	1.75	269,264	0.269	0.417	8	0.93	0.140117	0.25333	0.38	0.2739	3.42	Flow from Robertson Ranch
302.33	14	12	3,360	157,225	1.75	275,144	0.275	0.426	8	1.40	0.116694	0.22667	0.34	0.2355	4.07	Existing Trailer Park (21 Units)
314.22	12	10	26,840	184,065	1.75	322,114	0.322	0.498	8	2.40	0.104342	0.21333	0.32	0.2167	5.18	Marja Acres Partial Flow
256.91	10	8	0	184,065	1.75	322,114	0.322	0.498	8	2.00	0.114301	0.22667	0.34	0.2355	4.76	
296.67	8	6	0	184,065	1.75	322,114	0.322	0.498	8	0.80	0.180725	0.28667	0.43	0.3229	3.47	
316.67	6	4	37,882	221,947	1.75	388,407	0.388	0.601	8	0.80	0.217920	0.32000	0.48	0.3727	3.63	Marja Acres Partial Flow
276.67	4	2	0	221,947	1.75	388,407	0.388	0.601	8	0.40	0.308185	0.40000	0.60	0.4920	2.75	Junction with Kelly Drive

[1] K' based on n = 0.011

[2] dn/D using K' in Brater King Table 7-14

[3] From Brater King Table 7-4 based on dn/D

APPENDIX D

SEWER SYSTEM COMPUTER MODELING RESULTS
MARJA ACRES PROJECT FLOW
PROPSOED ONSITE GRAVITY SEWER SYSTEM

SEWER STUDY SUMMARY

DATE: 7/30/2018 FOR: Marja Acres Sewer Study (Proposed Flows; Onsite) SHT 1 OF 3

JOB NUMBER: 736-013 BY: Dexter Wilson Engineering REFER TO: Exhibit B

LENGTH (feet)	FROM		TO		IN-LINE FLOW (gpd)	AVG. DRY WEATHER FLOW (gpd)	PEAKING FACTOR*	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K' [1]	dn (feet)	dn/D[2]	C_a for Velocity[3]	VELOCITY (f.p.s.)
	S.A.H. #	Elev.	S.A.H. #	Elev.					M.G.D.	C.F.S.							
128	214	80.62	212	76.78	1,760	1,760	2.50	4,400	0.004	0.007	8	3.00	0.001275	0.02667	0.04	0.0105	1.46
128	212	76.78	210	73.58	1,760	3,520	2.50	8,800	0.009	0.014	8	2.50	0.002793	0.04000	0.06	0.0192	1.60
80	210	73.58	208	72.74	1,760	5,280	2.50	13,200	0.013	0.020	8	1.05	0.006464	0.05333	0.08	0.0294	1.56
62	208	72.74	206	69.85	12,100	17,380	2.50	43,450	0.043	0.067	8	4.66	0.010099	0.06667	0.10	0.0409	3.70
81	206	69.85	204	63.77	1,760	19,140	2.50	47,850	0.048	0.074	8	7.51	0.008764	0.06667	0.10	0.0409	4.07
48	204	63.77	202	60.12	4,180	23,320	2.50	58,300	0.058	0.090	8	7.60	0.010610	0.06667	0.10	0.0409	4.96
194	202	60.12	12	52.4	3,520	26,840	2.50	67,100	0.067	0.104	8	3.98	0.016880	0.08667	0.13	0.0600	3.89
128	126	82.12	124	80.92	1,760	1,760	2.50	4,400	0.004	0.007	8	0.94	0.002280	0.03333	0.05	0.0147	1.04
128	124	80.92	122	78.91	1,760	3,520	2.50	8,800	0.009	0.014	8	1.57	0.003524	0.04000	0.06	0.0192	1.60
128	122	78.91	120	76.89	1,760	5,280	2.50	13,200	0.013	0.020	8	1.58	0.005273	0.04667	0.07	0.0242	1.90
128	120	76.89	118	68.42	1,760	7,040	2.50	17,600	0.018	0.027	8	6.62	0.003433	0.04000	0.06	0.0192	3.19
327	118	68.42	116	65.15	7,040	14,080	2.50	35,200	0.035	0.054	8	1.00	0.017664	0.08667	0.13	0.0600	2.04
51	116	65.15	114	63.89	2,420	16,500	2.50	41,250	0.041	0.064	8	2.47	0.013170	0.08000	0.12	0.0534	2.69
63	114	63.89	112	63.26	12,100	28,600	2.50	71,500	0.072	0.111	8	1.00	0.035881	0.12667	0.19	0.1039	2.40
52	112	63.26	110	62.73	0	28,600	2.50	71,500	0.072	0.111	8	1.02	0.035541	0.12667	0.19	0.1039	2.40
57	110	62.73	108	61.24	0	28,600	2.50	71,500	0.072	0.111	8	2.61	0.022192	0.10000	0.15	0.0739	3.37
173	108	61.24	106	52.74	0	28,600	2.50	71,500	0.072	0.111	8	4.91	0.016187	0.08667	0.13	0.0600	4.15
126	106	52.74	104	50.8	8,096	36,696	2.50	91,740	0.092	0.142	8	1.54	0.037102	0.12667	0.19	0.1039	3.07
116	104	50.8	102	47.05	776	37,472	2.50	93,680	0.094	0.145	8	3.23	0.026147	0.10667	0.16	0.0811	4.02
142	102	47.05	6	40	0	37,472	2.50	93,680	0.094	0.145	8	4.96	0.021098	0.10000	0.15	0.0739	4.41
153	222	61.82	220	61.05	2,640	2,640	2.50	6,600	0.007	0.010	8	0.50	0.004669	0.04667	0.07	0.0242	0.95
59	220	61.05	218	60.76	1,100	3,740	2.50	9,350	0.009	0.014	8	0.49	0.006693	0.05333	0.08	0.0294	1.11
96	218	60.76	216	60.28	0	3,740	2.50	9,350	0.009	0.014	8	0.50	0.006636	0.05333	0.08	0.0294	1.11
33	216	60.28	202	60.12	0	3,740	2.50	9,350	0.009	0.014	8	0.48	0.006738	0.05333	0.08	0.0294	1.11
135	230	72.11	226	69.21	2,860	2,860	2.50	7,150	0.007	0.011	8	2.15	0.002448	0.03333	0.05	0.0147	1.69
89	226	69.21	224	65.22	1,320	4,180	2.50	10,450	0.010	0.016	8	4.48	0.002477	0.03333	0.05	0.0147	2.47
32	224	65.22	204	63.77	0	4,180	2.50	10,450	0.010	0.016	8	4.53	0.002464	0.03333	0.05	0.0147	2.47
190	240	81.32	104	77.21	3,300	3,300	2.50	8,250	0.008	0.013	8	2.16	0.002815	0.04000	0.06	0.0192	1.50
148	236	77.21	102	76.49	1,760	5,060	2.50	12,650	0.013	0.020	8	0.49	0.009101	0.06667	0.10	0.0409	1.08
364	234	76.49	6	73.12	7,040	12,100	2.50	30,250	0.030	0.047	8	0.93	0.015777	0.08667	0.13	0.0600	1.76
39	232	73.12	208	72.74	0	12,100	2.50	30,250	0.030	0.047	8	0.97	0.015379	0.08000	0.12	0.0534	1.97
131	132	63.93	130	59.88	776	776	2.50	1,940	0.002	0.003	8	3.09	0.000554	0.02000	0.03	0.0069	0.98
91	130	59.88	128	56.6	0	776	2.50	1,940	0.002	0.003	8	3.60	0.000513	0.01333	0.02	0.0037	1.83

[1] K' based on n = 0.011

[2] dn/D using K' in Brater King Table 7-14

[3] From Brater King Table 7-4 based on dn/D

161	128	56.6	104	50.8	0	776	2.50	1,940	0.002	0.003	8	3.60	0.000513	0.01333	0.02	0.0037	1.83
31	136	53.67	134	53.3	8,096	8,096	2.50	20,240	0.020	0.031	8	1.19	0.009297	0.06667	0.10	0.0409	1.72
50	134	53.3	106	52.74	0	8,096	2.50	20,240	0.020	0.031	8	1.12	0.009597	0.06667	0.10	0.0409	1.72
271	148	79.22	146	71.74	4,620	4,620	2.50	11,550	0.012	0.018	8	2.76	0.003489	0.04000	0.06	0.0192	2.09
123	146	71.74	142	68.51	2,200	6,820	2.50	17,050	0.017	0.026	8	2.63	0.005280	0.04667	0.07	0.0242	2.45
134	142	68.51	112	63.26	5,280	12,100	2.50	30,250	0.030	0.047	8	3.92	0.007669	0.06000	0.09	0.0350	3.01
169	140	72.22	138	69.02	2,420	2,420	2.50	6,050	0.006	0.009	8	1.89	0.002206	0.03333	0.05	0.0147	1.43
194	138	69.02	114	63.89	0	2,420	2.50	6,050	0.006	0.009	8	2.64	0.001867	0.03333	0.05	0.0147	1.43
90	156	70.42	152	69.32	1,320	1,320	2.50	3,300	0.003	0.005	8	1.22	0.001498	0.02667	0.04	0.0105	1.09
109	152	69.32	118	68.42	0	1,320	2.50	3,300	0.003	0.005	8	0.83	0.001822	0.03333	0.05	0.0147	0.78

64,312

* Peaking Factor of 2.50 is used onsite due to average flows in the separate tributary areas being less than 100,000 gpd

[1] K' based on n = 0.011
[2] dn/D using K' in Brater King Table 7-14
[3] From Brater King Table 7-4 based on dn/D


EX 12" ACP WTR PER DWG 180-4 SHT 1
ABANDONED PER DWG 440-4 SHTS 8 & 9
DWG 477-6 SHTS 29 & 30
EX 8" ABS SEWER PER
DWG 222-4, SHT 4
EX ST. LT.
RELOCATE EXIST STREET LIGHT
EX 36" D.I.P. WATER
(490 ZONE) CRMWD 85-101
EX 16" FUEL MAIN
ABND 20" WATER
EX 8" ABS SEWER
PER DWG 222-4
EL CAMINO REAL
(PUBLIC)
EX 18" SD
EX 24" SD
EX 4" GAS
ABND 20" WATER
EX 10" FUEL MAIN
EX SDGE FACILITIES
TO BE RELOCATED
STORMWATER BASIN-1
STORMWATER BASIN-2
RESTAURANT
COMMERCIAL ZONE
RESIDENTIAL ZONE
COMMUNITY
REC AREA 1
(ACTIVE)
COMMUNITY
REC AREA 2
(PASSIVE)
COMMUNITY
REC AREA 3
(PASSIVE)
COMMUNITY
REC AREA 4
(PASSIVE)
COMMUNITY
REC AREA 5
(PASSIVE)
PARK DR.
(PUBLIC)

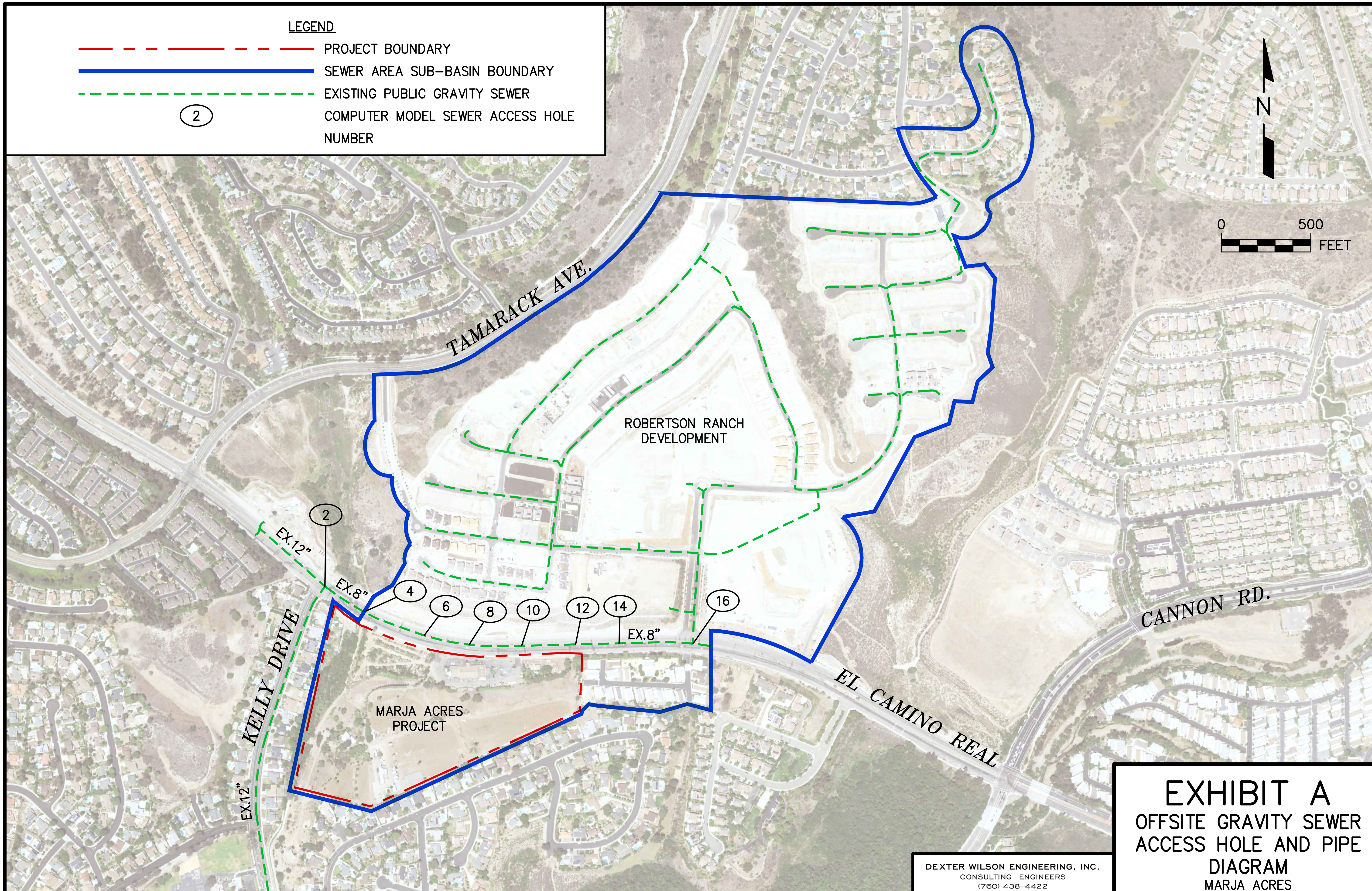
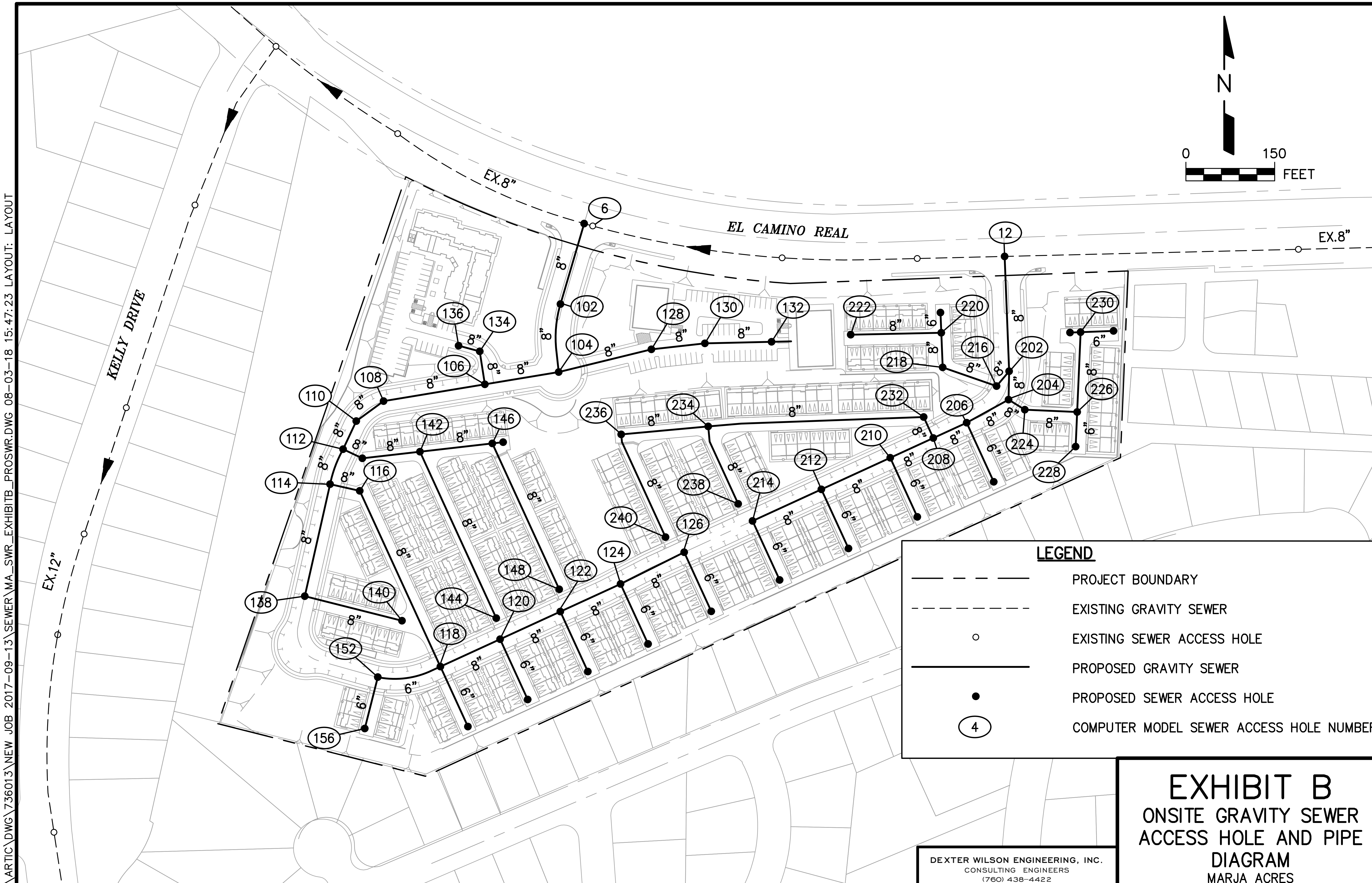


EXHIBIT A
OFFSITE GRAVITY SEWER ACCESS HOLE AND PIPE DIAGRAM
MARJA ACRES

\\ARTIC\DWG\736013\NEW JOB 2017-09-13\SEWER\MA_SWR_EXHIBIT-A.DWG 08-01-18 09:04:40 LAYOUT: LAYOUT



LEGEND

— — —	PROJECT BOUNDARY
- - - - -	EXISTING GRAVITY SEWER
○	EXISTING SEWER ACCESS HOLE
———	PROPOSED GRAVITY SEWER
●	PROPOSED SEWER ACCESS HOLE
(4)	COMPUTER MODEL SEWER ACCESS HOLE NUMBER

DEXTER WILSON ENGINEERING, INC.
CONSULTING ENGINEERS
(760) 438-4422

EXHIBIT B
ONSITE GRAVITY SEWER ACCESS HOLE AND PIPE DIAGRAM
MARJA ACRES

ARTIC\DWG\736013\NEW JOB 2017-09-13\SEWER\MA_SWR_EXHIBITB_PROSWR.DWG 08-03-18 15:47:23 LAYOUT: LAYOUT

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