

Appendix

Appendix K Sewer Technical Memorandum

Appendix

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Technical Memorandum

June 28, 2019 (Updated November 7, 2019)

To: Keith Linker, City of Anaheim

Ref. No.: 11140066

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Tel: 949-585-5203

cc: Shawn Azarhoosh, City of Anaheim

Subject: Lincoln at Euclid (OTH2019-01154) Updated Sewer Analysis

1. Background

The City of Anaheim (City) has retained GHD to evaluate the impact of the Lincoln at Euclid development, a proposed mixed-use multi-family residential project to the existing City sanitary sewer system. The proposed development is located within the West Anaheim Master Plan of Sanitary Sewer (WAMPSS) study area at the northeast corner of Lincoln Avenue and Euclid Street. The development consists of 115 multi-family residential units. A sewer hydraulic analysis was conducted to quantify the effects of this development to the sanitary sewer system.

2. Methodology

The sewer hydraulic analysis utilizes the current iteration of the sewer hydraulic model prepared for the 2015 WAMPSS update. The WAMPSS sewer model includes all sewer improvements the City has constructed since the previous 2005 Combined West Anaheim Area Master Plan of Sanitary Sewers as well as sewer loadings that have been calibrated to recent flow monitoring data to reflect the current sewer flow conditions.

Sewage generation factors for each type of facility were adopted from the WAMPSS update. Sewer pipe alignments, elevations, connections, and manholes were verified during the WAMPSS update. The anticipated sewer generation changes are inputted into the hydraulic model for analysis. The following sections describe the study area for this sewer analysis, the proposed land use changes, the methodology for preparing the sewer hydraulic model, and the development of sewer loadings from the proposed development.

2.1 Study Area

The proposed development is located at the northeast corner of Lincoln Avenue and Euclid Street. The 7.17-acre development, hereby designated as Study Area, is bounded by Lincoln Avenue to the south, Euclid Street to the west and Union Pacific Railroad to the northeast. The existing land uses consist of two transitional parcels in the northern portion of the site and two industrial parcels in the southern portion of the site. Six retail commercial parcels are located adjacent to the Study Area immediately to the south and east.

Existing sewer mains in the vicinity of the Study Area include an 8-inch sewer main in the north side of Lincoln Avenue that is currently serving the commercial and industrial parcels within the Study Area, and a 10-inch sewer main in the south side of Lincoln Avenue and east side of Euclid Street that outlets into a 33-inch Orange County Sanitation District trunk sewer in Euclid Street. The 8-inch sewer main is connected to the 10-inch sewer main at Manhole SW054102.

The Study Area and nearby sewer mains are shown in **Figure 2.1**.

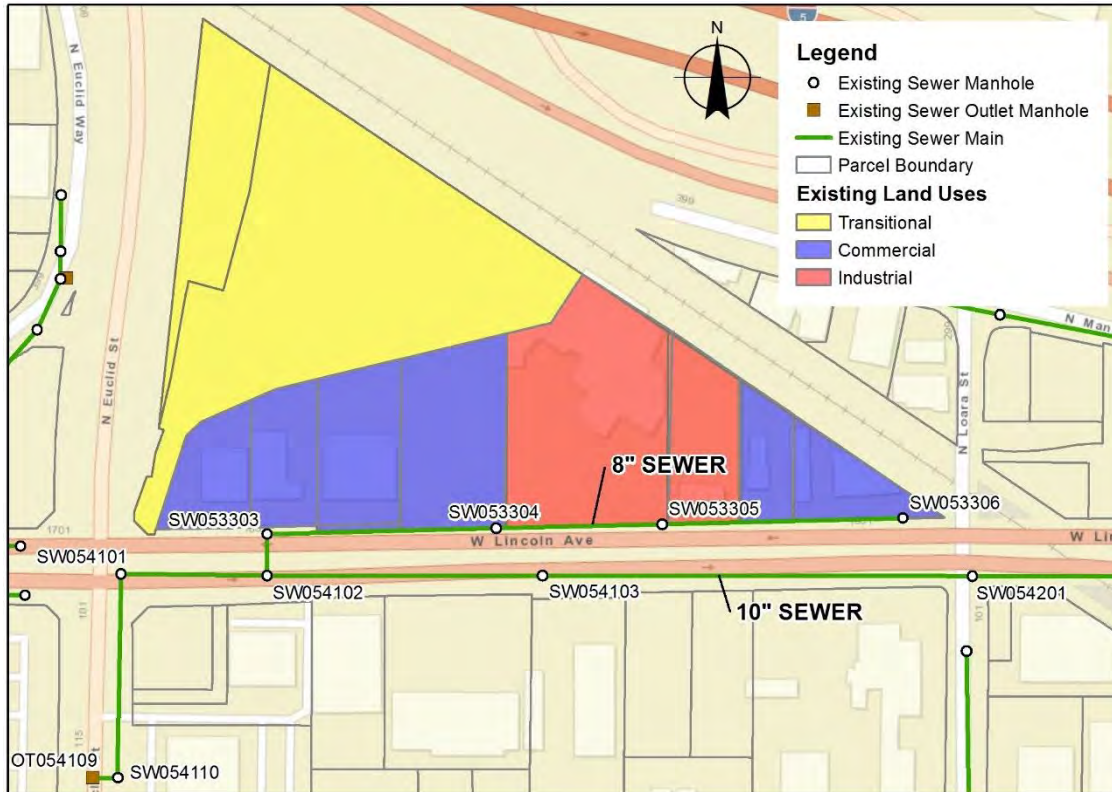


Figure 2.1 Existing Condition of Study Area

2.2 Proposed Development within Study Area

The current City General Plan indicate the Study Area is designated as a general commercial parcel in the long term. The proposed Lincoln at Euclid development aims to revise the long-term land uses to a residential area with 115 multi-family residential units.

The private sewer network within the proposed development will connect to the existing 8-inch sewer main in the north side of Lincoln Avenue at a new manhole located between Manholes SW053305 and SW053304. Figures depicting the proposed development land uses and sewer connection points as provided by the developer are included as **Attachment A**.



2.3 Sewer Model Methodology

As mentioned above, the sewer hydraulic model prepared for the 2015 WAMPSS update was used as a basis for this sewer study. The model was developed using the Innovyze H₂OMAP Sewer hydraulic modeling software. Average sewer flows were calculated based on the land use and census data provided by the City, and unit flow factors were developed for the WAMPSS according to flow monitoring data and past sewer master plan studies. These flows were then allocated to the nearest manholes within the model. Peak flows were determined by applying diurnal curves according to land uses, as described in the next section.

The ratio of flow depth to pipe diameter at the actual peak flow is designated d/D . This d/D was calculated by the modeling program and was used to identify pipes needing improvement. The City's analysis criteria calls for a maximum allowable $d/D = 0.67$ for pipes with diameters less than 12 inches, and $d/D = 0.75$ for pipes with diameters equal to or greater than 12 inches. Thus, pipes with d/D ratios greater than these values were identified as needing improvement.

The City also has a separate criterion for new sewer design. This is more stringent than the analysis criteria specified above. This criteria calls for a maximum allowable $d/D = 0.50$ for pipes with diameters less than 12 inches, and a $d/D = 0.60$ for pipes with diameters equal to or greater than 12 inches.

2.4 Peak Flow Methodology

The methodology for peak sewer flow modeling within the Study Area is based on diurnal curves, which uses a 24-hour flow generation curve to represent the pattern of sewage flows generated by type of land use. The residential and non-residential diurnal curves from the WAMPSS update were applied to the model. The diurnal curves are shown in **Figure 2.3** and **Figure 2.4**. The x-axis represents a 24-hour period starting and ending at midnight, while the y-axis represents the peaking factor applied to the normal flow factor at each hour of the day.

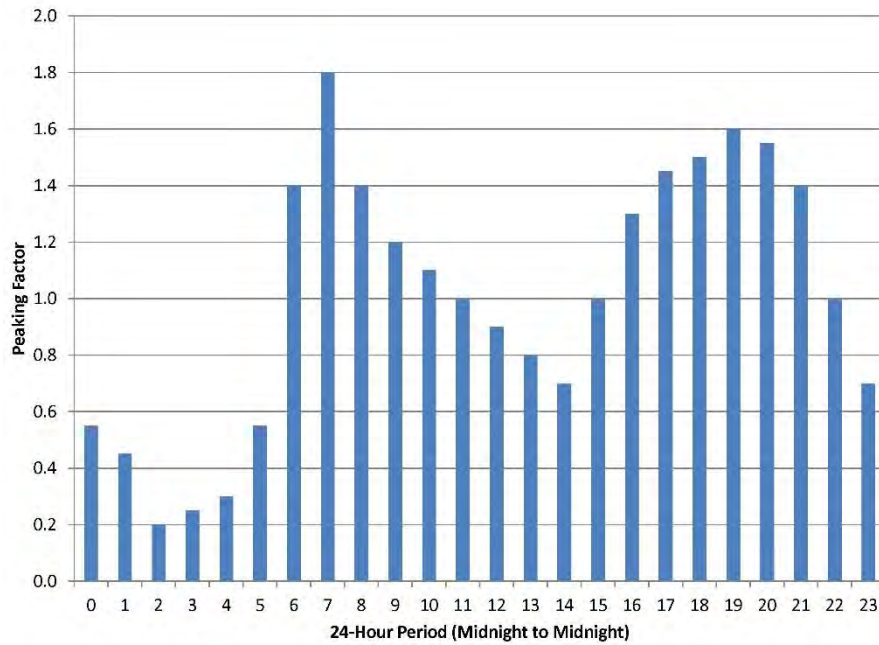


Figure 2.2 Residential Diurnal Curve

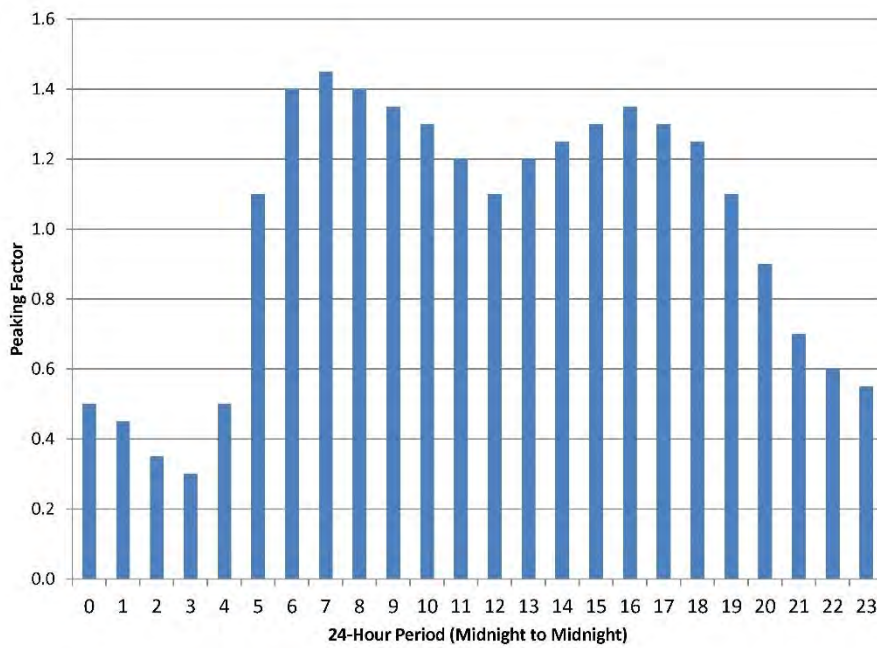


Figure 2.3 Non-Residential Diurnal Curve



2.5 Sewer Loadings for Proposed Development

The proposed land uses, along with the calibrated and adjusted unit flow factors from the WAMPSS update, determined the sewage flows generated within the Study Area. The estimated sewer loading for the proposed development is listed in **Table 2.1** below.

Table 2.1 Estimated Sewer Loading for Proposed Development

Land Use Type	Dwelling Unit (DU) Count or Land Area	Sewer Unit Flow Factor	Sewer Loading	Loading Manhole
Multi-Family Residential	115 DU	215 gpd/DU	17.1 gpm	SW053305

3. Hydraulic Model Analysis

To determine the effects of altering land uses within the study area as proposed by the developer, two (2) model scenarios were analyzed:

- WAMPSS Existing Condition plus Proposed Development
- WAMPSS Build-Out Condition plus Proposed Development

For simplicity, the model results focus on the pipes downstream of the Study Area only. The model results are reported by Pipe ID, which is comprised of each pipe's upstream and downstream manhole identification number.

3.1 Scenario 1 – WAMPSS Existing Condition plus Proposed Development

The first scenario builds on the WAMPSS Existing Condition model scenario, but assumes the proposed development is fully built and occupied. The flows for the existing industrial parcels were removed from the scenario and the flow for the proposed development as presented in **Section 2.5** above was added. The steady state loading from the Study Area in this scenario is 24,725 gallons per day (gpd), an increase of 22,942 gpd over the WAMPSS Existing Condition loadings from the Study Area.

Analysis of this scenario revealed no deficiencies in the pipelines downstream of the Study Area. The peak flows in these pipelines were within the allowable d/D ratios. The hydraulic model results are presented in **Table 3.1** from upstream to downstream and in **Figure 3.1**.

Table 3.1 Existing Condition plus Proposed Development Model Results

Street Alignment	Pipe ID	Size (inch)	Length (feet)	Slope (feet/feet)	Max Flow (gpm)	Max d/D
Lincoln Ave (North)	SW053306-SW053305	8	346	0.0024	1.5	0.054
Lincoln Ave (North)	SW053305-SW053304	8	261	0.0024	32	0.24
Lincoln Ave (North)	SW053304-SW053303	8	346	0.0024	35	0.25
Lincoln Ave (North)	SW053303-SW054102	8	47	0.0020	37	0.27
Lincoln Ave (South)	SW054102-SW054101	10	243	0.0030	143	0.35
Euclid Street	SW054101-SW054110	10	308	0.012	144	0.25
Euclid Street	SW054110-OT054109	10	7	0.19	144	0.13

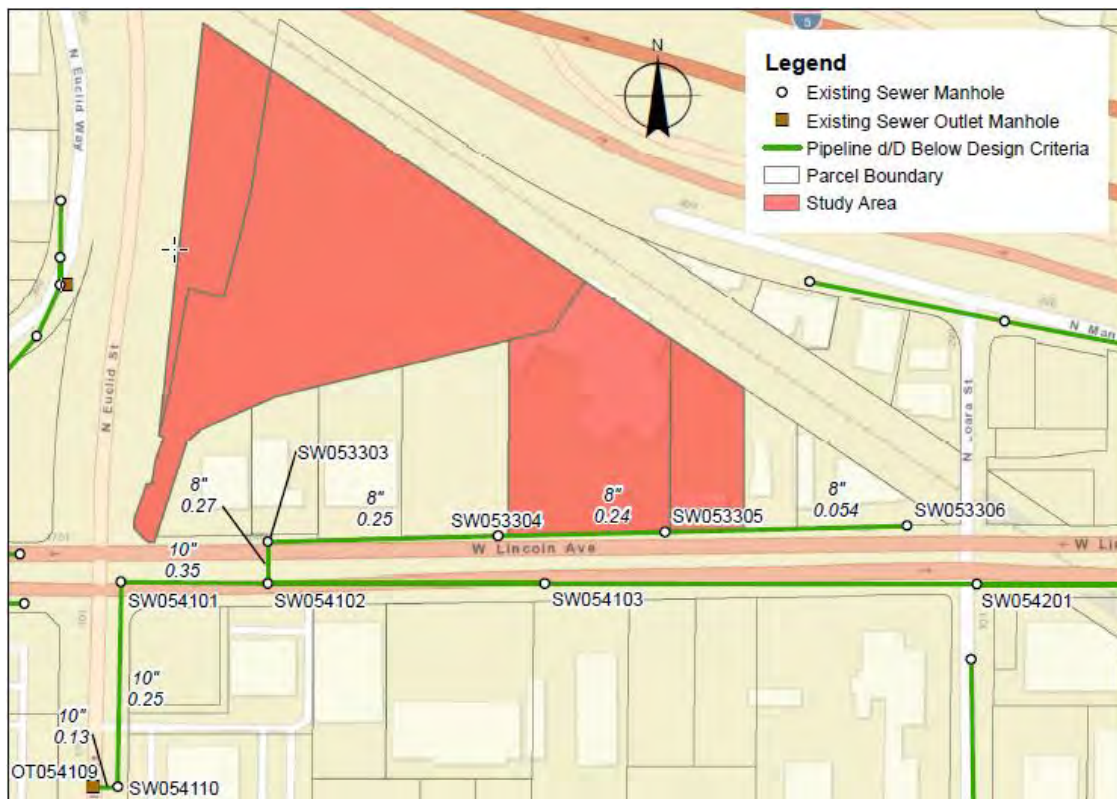


Figure 3.1 Existing Condition plus Proposed Development Model Results



3.2 Scenario 2 – WAMPSS Build-Out Condition plus Proposed Development

Scenario 2 expands on the WAMPSS Build-Out model scenario with the inclusion of the proposed development loadings. For the purpose of the model and based on an evaluation of the historical water usage trends, the WAMPSS established the Existing and Build-Out flow factors to be the same. The proposed per capita sewer generation factor is conservative compared to the Existing Condition sewer flows that were confirmed by sewer flow monitoring data. It is expected that the ongoing water conservation efforts such as the installation of low flow water fixtures will keep the per capita generation factor relatively stable. The average household densities are also expected to remain stable based on historical census trends.

Even though the flow factors are the same between the Existing Condition and Build-Out Condition scenarios, the Build-Out Condition flow is equal to or higher than the Existing Condition flow since the maximum building density from the General Plan was used to determine the flow from each parcel, except for the Study Area. It is assumed the proposed development within the Study Area will remain in occupancy under the Build-Out Condition based on typical building life spans.

As a result of this determination, the sewer loadings from the Study Area for Scenario 1 and Scenario 2 are identical. The main purpose of Scenario 2 is to identify any potential deficiencies in the downstream 10-inch sewer main due to the increased Build-Out Condition flows from the rest of the tributary area.

Analysis of this scenario also revealed no deficiencies in the pipelines downstream of the proposed Study Area. The peak flows in these pipelines were within the allowable d/D ratios. The hydraulic model results are presented in **Table 3.2** from upstream to downstream and in **Figure 3.2**.

Table 3.2 Build-Out Condition plus Proposed Development Model Results

Street Alignment	Pipe ID	Size (inch)	Length (feet)	Slope (feet/feet)	Max Flow (gpm)	Max d/D
Lincoln Ave (North)	SW053306-SW053305	8	346	0.0024	1.5	0.054
Lincoln Ave (North)	SW053305-SW053304	8	261	0.0024	32	0.24
Lincoln Ave (North)	SW053304-SW053303	8	346	0.0024	35	0.25
Lincoln Ave (North)	SW053303-SW054102	8	47	0.0020	37	0.27
Lincoln Ave (South)	SW054102-SW054101	10	243	0.0030	153	0.36
Euclid Street	SW054101-SW054110	10	308	0.012	154	0.25
Euclid Street	SW054110-OT054109	10	7	0.19	154	0.13

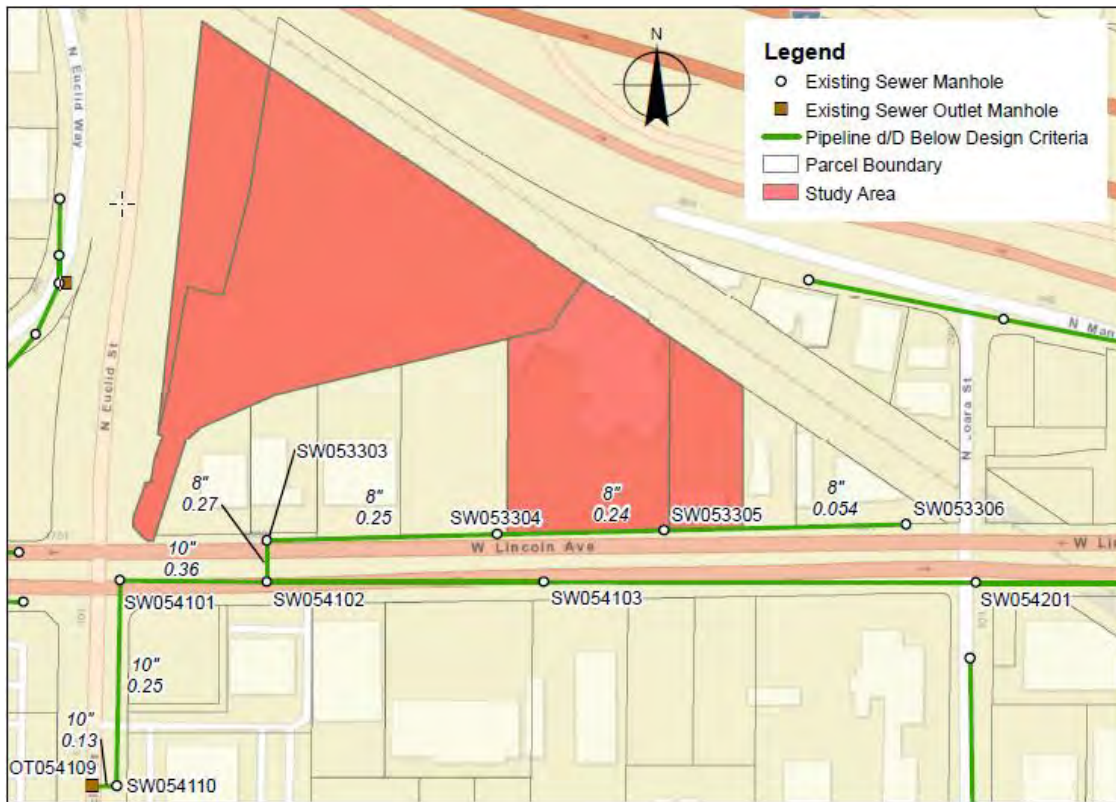


Figure 3.2 Build-Out Condition plus Proposed Development Model Results

4. Conclusion

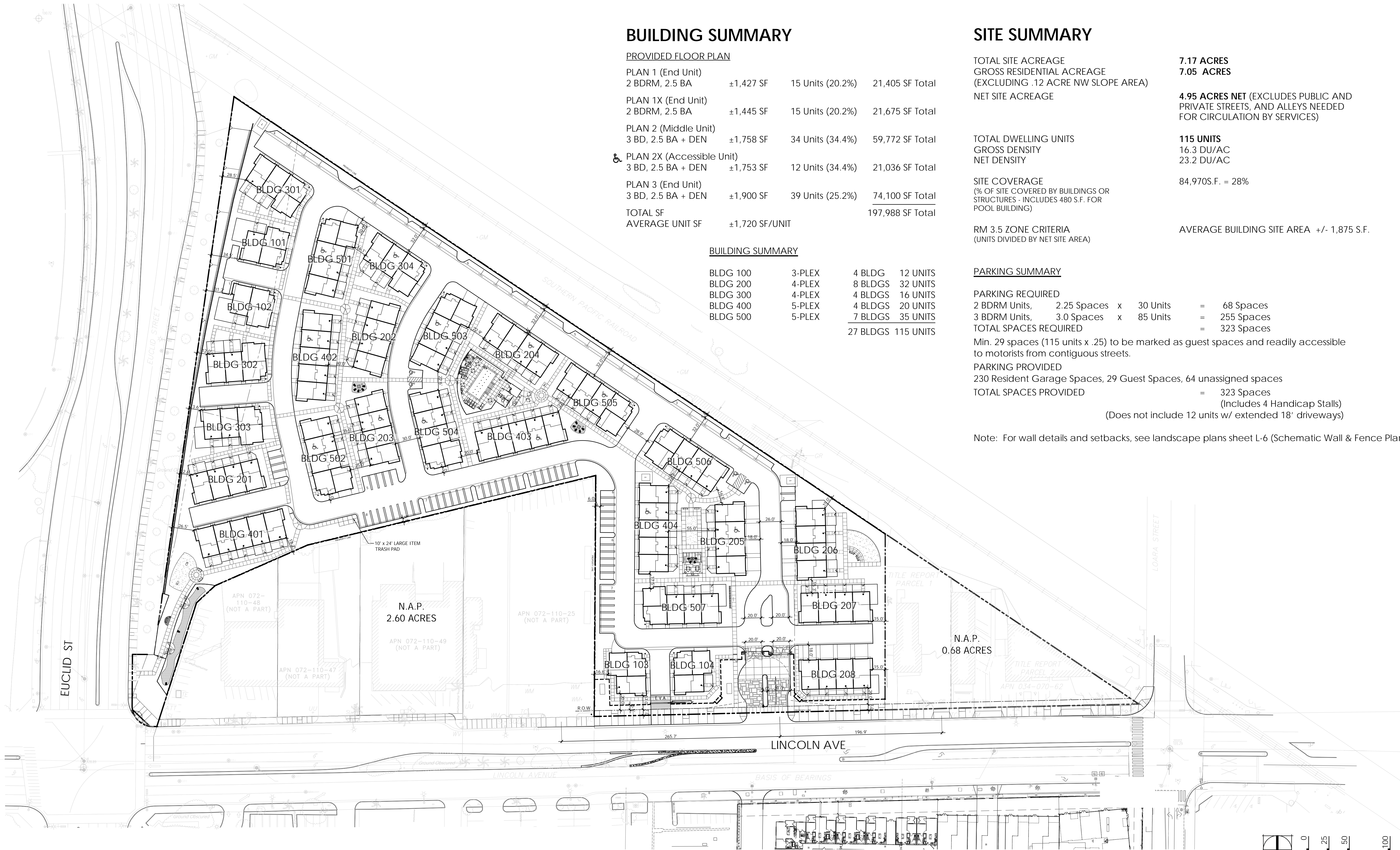
Existing land uses for the Study Area include a vacant transitional parcel in the western portion, and industrial parcels in the eastern portion. The land use changes proposed by the developer for the Study Area include the construction of 115 multi-family residential units. An increase in sewer flow rate is anticipated due to the increase in development density. The above sewer analysis built upon the WAMPSS Existing Condition and Build-Out Condition scenarios to quantify the effects of these proposed land use changes.

The sewer analysis revealed no hydraulic deficiencies in the pipelines downstream of the study area with the proposed land use changes. The d/D ratios of the downstream sewer main segments range from 0.054 to 0.35 under the Existing Condition and 0.054 to 0.36 under the Build-Out Condition, which are within the City's maximum allowable d/D = 0.67 for pipes with diameters less than 12 inches, and d/D = 0.75 for pipes with diameters equal to or greater than 12 inches.

Attachments

Attachment A

Proposed Development Maps



BUILDING SUMMARY

PROVIDED FLOOR PLAN

PLAN 1 (End Unit)			
2 BDRM, 2.5 BA	±1,427 SF	15 Units (20.2%)	21,405 SF Total
PLAN 1X (End Unit)			
2 BDRM, 2.5 BA	±1,445 SF	15 Units (20.2%)	21,675 SF Total
PLAN 2 (Middle Unit)			
3 BD, 2.5 BA + DEN	±1,758 SF	34 Units (34.4%)	59,772 SF Total
PLAN 2X (Accessible Unit)			
3 BD, 2.5 BA + DEN	±1,753 SF	12 Units (34.4%)	21,036 SF Total
PLAN 3 (End Unit)			
3 BD, 2.5 BA + DEN	±1,900 SF	39 Units (25.2%)	74,100 SF Total
TOTAL SF			197,988 SF Total
AVERAGE UNIT SF	±1,720 SF/UNIT		

BUILDING SUMMARY

BLDG 100	3-PLEX	4 BLDG	12 UNITS
BLDG 200	4-PLEX	8 BLDGS	32 UNITS
BLDG 300	4-PLEX	4 BLDGS	16 UNITS
BLDG 400	5-PLEX	4 BLDGS	20 UNITS
BLDG 500	5-PLEX	7 BLDGS	35 UNITS
		27 BLDGS	115 UNITS

SITE SUMMARY

TOTAL SITE ACREAGE	7.17 ACRES
GROSS RESIDENTIAL ACREAGE (EXCLUDING .12 ACRE NW SLOPE AREA)	7.05 ACRES
NET SITE ACREAGE	4.95 ACRES NET (EXCLUDES PUBLIC AND PRIVATE STREETS, AND ALLEYS NEEDED FOR CIRCULATION BY SERVICES)
TOTAL DWELLING UNITS	115 UNITS
GROSS DENSITY	16.3 DU/AC
NET DENSITY	23.2 DU/AC
SITE COVERAGE (% OF SITE COVERED BY BUILDINGS OR STRUCTURES - INCLUDES 480 S.F. FOR POOL BUILDING)	84,970S.F. = 28%
RM 3.5 ZONE CRITERIA (UNITS DIVIDED BY NET SITE AREA)	AVERAGE BUILDING SITE AREA +/- 1,875 S.F.

PARKING SUMMARY

PARKING REQUIRED			
2 BDRM Units,	2.25 Spaces	x	30 Units = 68 Spaces
3 BDRM Units,	3.0 Spaces	x	85 Units = 255 Spaces
TOTAL SPACES REQUIRED			= 323 Spaces
Min. 29 spaces (115 units x .25) to be marked as guest spaces and readily accessible to motorists from contiguous streets.			
PARKING PROVIDED			
230 Resident Garage Spaces, 29 Guest Spaces, 64 unassigned spaces			
TOTAL SPACES PROVIDED			= 323 Spaces
(Includes 4 Handicap Stalls)			
(Does not include 12 units w/ extended 18' driveways)			

Note: For wall details and setbacks, see landscape plans sheet L-6 (Schematic Wall & Fence Plan)

