WestLAND Group, Inc.

Land Surveyors ▪ Civil Engineers ▪ GIS

TPM 083738
Sanitary Sewer Analysis

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2021-186

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Introduction

The following sanitary sewer hydraulic analysis was completed using the following two methods. Method 1 utilizes the LA County Title 20 Division 2 Chapter 20.32 Part 3 Main Line Sewers Size Specifications Table found in Appendix A. Method 2 utilizes the LA County Sanitation District's 2020 Loading Rates found in Appendix B. The two separate methods were used to compare the anticipated sewer demands from the proposed project. The proposed project consists of 11 parcels ranging from 7 to 79 acres, a 6.5 acre shopping center, and 111 acres of future warehousing development (Phase 4).

Sanitary Sewer Hydraulic Analysis

Each proposed building/parcel will have its own sewer lateral to service the site. The western half of the site (Buildings 4, 10, 11 and Shopping Center) will have a cumulative sewer flow at Node A, see Appendix C for the Sewer Node Exhibit. Node A will connect to the existing dry 8" sewer stub found on 4th St. Buildings 1 and 2 will each connect to the existing dry 18" sewer main found on East Ave M at Nodes E2 and E3. The eastern half of the site (Buildings 3, 5, 6, 7, 8, 9, and Phase 4) will have a cumulative sewer flow at Node B. Node B will connect to the existing dry 18" sewer stub found on Challenger Way.

Method 1: Utilizing the LACSD Sewer Coefficient method along with the City Zoning Map determined that the existing site falls under General Industrial (M-2). The proposed zoning for the majority of the site is Light Industrial (M-1) with a small parcel being Commercial Center (C-4). Table 1 shows the anticipated average (ADF) and peak (PDF) daily flow for each of the parcels based on the parcel area and sewer coefficient factor. The PDF was calculated utilizing the unit flow factor. The ADF was then back calculated from the PDF by dividing by a factor of 2.5. Table 2 shows the cumulative flows at significant nodes. Table 5 breaks down the capacity of the existing 8" and 18" sewer lines. From the two tables Node A's ADF of 0.4993 mgd and PDF of 1.2484 mgd surpasses the capacity of Reach A to E-1 0.2597 mgd. At Node E5 the cumulative flow from the entire project site has an ADF of 2.0991 mgd and PDF of 5.2478 mgd whereas the capacity of Reach E5 and East is 4.1176 mgd. Therefore, per the LACSD Sewer Coefficient method the existing sewer lines do not provide adequate capacity for the flow conditions.

Method 2: Utilizing the LACSD 2020 Loading Rates categorizes the buildings into Warehousing less than or greater than 300,000 sqft and Shopping Center. Table 3 shows the anticipated ADF and PDF for each of the parcels based on the parcel area and sewer flow loadings. At the request of the city, the Phase 4 PDF was calculated using Method 1. The Phase 4 ADF was then back calculated from the PDF by dividing by a factor of 2.5. Table 4 shows the cumulative flows at significant nodes. Table 5 breaks down the capacity of the existing 8" and 18" sewer lines. From the two tables Node A's ADF of 0.1392 mgd and PDF of 0.3481 mgd surpasses the capacity of Reach A to E-1 0.2597 mgd. At Node E5 the cumulative flow from the entire project site has an ADF of 0.7043 mgd and PDF of 1.7608 mgd whereas the capacity of Reach E5 and East is 4.1176 mgd. Therefore, per the LACSD 2020 Loading Rate method the existing 8" sewer lines serving the western half of the site do not provide adequate capacity while the 18" sewer lines serving the eastern half of the site do provide adequate capacity for the flow conditions.

In conclusion, the anticipated flow rates and sewer demand varies significantly between the methods. This is due to the high sewer coefficient applied by Method 1. Method 1 groups all industrial zoning (M-1 to M-4) into the same coefficient. When comparing types of industrial usage, manufacturing would require significantly higher sewer demand whereas warehousing would be considerably less. The proposed warehouse buildings will typically have 1-4 offices and bathrooms. Method 2 more accurately represents the anticipated flow rates by providing a loading rate specific to warehousing.

Table 1: Method 1 Proposed Land Use Demand							
Parcel	**Parcel Area (AC)**	**Land Use**	**Unit Flow Factor ($ft^3/s/ac$)**	**Average Daily Flow (ft^3/s)**	**Peak Daily Flow (ft^3/s)**	**Average Daily Flow (mgd)**	**Peak Daily Flow (mgd)**
1	7.31	Light Industrial (M-1)	0.021	0.0614	0.1535	0.0397	0.0992
2	7.31	Light Industrial (M-1)	0.021	0.0614	0.1535	0.0397	0.0992
3	6.98	Light Industrial (M-1)	0.021	0.0586	0.1465	0.0379	0.0947
4	30.75	Light Industrial (M-1)	0.021	0.2583	0.6459	0.1670	0.4174
5	46.33	Light Industrial (M-1)	0.021	0.3892	0.9730	0.2515	0.6288
6	12.49	Light Industrial (M-1)	0.021	0.1049	0.2622	0.0678	0.1695
7	12.49	Light Industrial (M-1)	0.021	0.1049	0.2622	0.0678	0.1695
8	12.38	Light Industrial (M-1)	0.021	0.1040	0.2601	0.0672	0.1681
9	78.56	Light Industrial (M-1)	0.021	0.6599	1.6499	0.4265	1.0663
10	43.53	Light Industrial (M-1)	0.021	0.3656	0.9141	0.2363	0.5908
11	13.02	Light Industrial (M-1)	0.021	0.1093	0.2734	0.0707	0.1767
Commercial	6.55	Commercial Center (C-4)	0.015	0.0393	0.0982	0.0254	0.0635
Phase 4	110.82	Light Industrial (M-1)	0.021	0.9309	2.3272	0.6016	1.5041
Total	**388.52**			**3.2478**	**8.1195**	**2.0991**	**5.2478**

Note:
The existing land use per the City of Palmdale Zoning (12/14/94) is General Industrial (M-2) and uses the same Unit Flow Factor of 0.021

Table 2: Method 1 Proposed Land Use Demand Totals			
	Buildings	**Total ADF (mgd)**	**Total PDF (mgd)**
Node A	4, 10, 11, Comm	0.4993	1.2484
Node E2	1	0.0397	0.0992
Node E3	2	0.0397	0.0992
Node B	3, 5, 6, 7, 8, 9, Phase 4	1.5204	3.8010
Total		**2.0991**	**5.2478**

Table 3: Method 2 Proposed Land Use Demand							
Parcel	**Parcel Area (sqft)**	**Land Use**	**Unit Flow Factor (gpd/1,000 sqft)**	**Average Daily Flow (gpd)**	**Peak Daily Flow (gpd)**	**Average Daily Flow (mgd)**	**Peak Daily Flow (mgd)**
1	318,360	Warehousing ≤ 300,000 sq ft	25	7,959	19,897	0.0080	0.0199
2	318,442	Warehousing ≤ 300,000 sq ft	25	7,961	19,903	0.0080	0.0199
3	303,982	Warehousing ≤ 300,000 sq ft	25	7,600	18,999	0.0076	0.0190
4	1,339,684	Warehousing > 300,000 sq ft	10	13,397	33,492	0.0134	0.0335
5	2,018,193	Warehousing > 300,000 sq ft	10	20,182	50,455	0.0202	0.0505
6	543,895	Warehousing ≤ 300,000 sq ft	25	13,597	33,993	0.0136	0.0340
7	543,883	Warehousing ≤ 300,000 sq ft	25	13,597	33,993	0.0136	0.0340
8	539,454	Warehousing ≤ 300,000 sq ft	25	13,486	33,716	0.0135	0.0337
9	3,422,276	Warehousing > 300,000 sq ft	10	34,223	85,557	0.0342	0.0856
10	1,896,044	Warehousing > 300,000 sq ft	10	18,960	47,401	0.0190	0.0474
11	567,018	Warehousing ≤ 300,000 sq ft	25	14,175	35,439	0.0142	0.0354
Commercial	285,274	Shopping Center	325	92,714	231,785	0.0927	0.2318
Phase 4	*See Table 1 for calculation*			*601,637*	*1,504,092*	*0.6016*	*1.5041*
Total	**12,096,504**			**859,489**	**2,148,721**	**0.8595**	**2.1487**

Note:
Phase 4 flow rates were calculated using Method 1 per City's request.

Table 4: Method 2 Proposed Land Use Demand Totals			
	Parcel	**Total ADF (mgd)**	**Total PDF (mgd)**
Node A	4, 10, 11, Comm	0.1392	0.3481
Node E2	1	0.0080	0.0199
Node E3	2	0.0080	0.0199
Node B	3, 5, 6, 7, 8, 9, Phase 4	0.7043	1.7608
Total		**0.8595**	**2.1487**

Table 5: Capacity of Existing Sewer Lines														
				Hydarulic Radius Calculation								Flow Calculation		
Reach	Pipe Diameter [D] (in)	Pipe Diameter [D] (ft)	Radius [r] (ft)	depth/Diameter @ PDF [d/D]	depth [d] (ft)	[h] (ft)	Theta [Θ] (rad)	Cross Sectional Area of Flow More than Half Full [A] (ft^2)	Wetted Perimeter [WP] (ft)	Hydraulic Radius [R_h] (ft)	Roughness Coefficient Vitrified Clay Full [n_{full}]	Existing Slope [S] (ft/ft)	Flow Capacity [Q] [ft3/s]	Flow Capacity [Q] [mgd]
Node A to Node E1	8	0.67	0.33	0.5	0.333	0.333	3.142	0.175	1.047	0.167	0.013	0.0044	0.4019	0.2597
Node E1 to Node E2	18	1.5	0.75	0.75	1.125	0.375	2.094	1.422	3.142	0.453	0.013	0.0052	6.9259	4.4763
Node E2 to Node E3	18	1.5	0.75	0.75	1.125	0.375	2.094	1.422	3.142	0.453	0.013	0.0052	6.9259	4.4763
Node E3 to Node E4	18	1.5	0.75	0.75	1.125	0.375	2.094	1.422	3.142	0.453	0.013	0.0052	6.9259	4.4763
Node E4 to Node E5	18	1.5	0.75	0.75	1.125	0.375	2.094	1.422	3.142	0.453	0.013	0.0122	10.6085	6.8564
Node E5 and East	18	1.5	0.75	0.75	1.125	0.375	2.094	1.422	3.142	0.453	0.013	0.0044	6.3709	4.1176

Appendix A

LACSD Title 20 Division 2 Chapter 20.32.440 Main Line Sewer – Size Specifications (Dated 2013)

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§ 20.32.440. Main-line sewers—Size specifications

Latest version.

A. The size of main-line sewer pipe shall be determined by standards of design and the coefficients listed below, but in no case shall it be less than eight inches inside diameter.

For zoning in the following categories for residential areas:	Coefficient cu. ft. per sec. per acre
R-1	0.004
R-2	0.008
R-3	0.012
R-4	0.016*
For commercial areas:	
C-I through C-4	0.015*
For heavy industrial areas:	
M-I through M-4	0.021*

* Individual building, commercial or industrial plant capacities shall be the determining factor when they exceed the coefficients shown.

B. The coefficient to be used for any zoned area not listed will be determined by the county engineer based upon the intended development and use.

C. The county engineer shall determine which of the coefficients or combination of coefficients shall be used for design, as determined by the established or proposed zoning in the study area. Any modifications to these coefficients due to topography, development or hazard areas shall be approved by the county engineer.

(Ord. 8690 § 12 (part), 1964: Ord. 6130 Part 5 Ch. 6 § 5606, 1952.)

Estimated Average Daily Sewage Flows for Various Occupancies

Occupancy	Abbreviation	*Average daily flow	
Apartment Buildings:			
Bachelor or Single dwelling units	Apt	100	gal/D.U. → 150
1 bedroom dwelling units	Apt	150	gal/D.U. → 200
2 bedroom dwelling units	Apt	200	gal/D.U. → 250
3 bedroom or more dwelling units	Apt	250	gal/D.U. → use 300 GPD per SMD
Auditoriums, churches, etc.	Aud	5	gal/seat
Automobile parking	P	25	gal/1000 sq ft gross floor area
Bars, cocktails lounges, etc.	Bar	20	gal/seat
Commercial Shops & Stores	CS	100	gal/1000 sq ft gross floor area
Hospitals (surgical)	HS	500	gal/bed
Hospitals (convalescent)	HC	85	gal/bed
Hotels	H	150	gal/room
Medical Buildings	MB	300	gal/1000 sq ft gross floor area
Motels	M	150	gal/unit
Office Buildings	Off	200	gal/1000 sq ft gross floor area
Restaurants, cafeterias, etc.	R	50	gal/seat
Schools:			
Elementary or Jr. High	S	10	gal/student
High Schools	HS	15	gal/student
Universities or Colleges	U	20	gal/student
College Dormitories	CD	85	gal/student

*Multiply the average daily flow by 2.5 to obtain the peak flow

Zoning Coefficients

Zone	Coefficient (cfs/Acre)
Agriculture	0.001
Residential+:	
R-1	0.004
R-2	0.008
R-3	0.012
R-4	0.016*
Commercial:	
C-1 through C-4	0.015*
Heavy Industrial:	
M1 through M-4	0.021*

*Individual building, commercial or industrial plant capacities shall be the determining factor when they exceed the coefficients shown

+ Use 0.001 (cfs/unit) for condominiums only

1 gal = 0.13368 ft^3

1 ft^3 = 7.48 gal

1 gpd = 1.55×10^{-6} cfs

1 cfs = 646,190 gpd

Appendix B

LACSD Loading Rate Table (Dated 2020)

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SANITATION DISTRICT NO. 20

CONNECTION FEE LOADINGS, CAPACITY UNITS, AND UNIT RATES

EFFECTIVE JULY 1, 2020

CATEGORY	UNIT OF USAGE	LOADINGS			CAPACITY UNITS	CHARGE
		FLOW (GPD)	COD (PPD)	SS (PPD)		
Single Family Home	Parcel	260	1.22	0.59	1.00	2,073.76
Condominiun	No. of Units	195	0.92	0.44	0.75	1,555.32
Multi-Unit Residential	No. of Units	156	0.73	0.35	0.60	1,244.26
Mobile Home Park	Spaces	156	0.73	0.35	0.60	1,244.26
Hotel/Motel/Rooming House	Rooms	125	0.54	0.28	0.48	995.40
Store	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Supermarket	1000 Sq.Ft.	150	2.00	1.00	0.88	1,824.91
Shopping Center	1000 Sq.Ft.	325	3.00	1.17	1.51	3,131.38
Regional Mall	1000 Sq.Ft.	150	2.10	0.77	0.82	1,700.48
Office Building	1000 Sq.Ft.	200	0.86	0.45	0.76	1,576.06
Medical, Dental, Veterinary Clinic	1000 Sq.Ft.	300	1.29	0.68	1.14	2,364.09
Restaurant	1000 Sq.Ft.	1,000	16.68	5.00	5.71	11,841.17
Indoor Theatre	1000 Sq.Ft.	125	0.54	0.28	0.48	995.40
Car Wash - Tunnel, No Recycling	1000 Sq.Ft.	3,700	15.86	8.33	14.07	29,177.80
Car Wash - Tunnel, Recycling	1000 Sq.Ft.	2,700	11.74	6.16	10.31	21,380.47
Car Wash - Wand	1000 Sq.Ft.	700	3.00	1.58	2.66	5,516.20
Bank, Credit Union	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Service Shop, Auto Maint/Repair	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Animal Kennel	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Gas Station	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Auto Sales	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Wholesale Outlet	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Nursery/Greenery	1000 Sq.Ft.	25	0.11	0.06	0.10	207.38
Lt Manufacturing =< 300,000 sq.ft.	1000 Sq.Ft.	25	0.23	0.09	0.12	248.85
Lt manufacturing > 300,000 sq.ft.	1000 Sq.Ft.	10	0.09	0.05	0.05	103.69
Lumber Yard =< 300,000 sq.ft.	1000 Sq.Ft.	25	0.23	0.09	0.12	248.85
Lumber Yard > 300,000 sq.ft.	1000 Sq.Ft.	10	0.09	0.05	0.05	103.69
Warehousing =< 300,000 sq.ft.	1000 Sq.Ft.	25	0.23	0.09	0.12	248.85
Warehousing > 300,000 sq.ft.	1000 Sq.Ft.	10	0.09	0.05	0.05	103.69
Open Storage =< 300,000 sq.ft.	1000 Sq.Ft.	25	0.23	0.09	0.12	248.85
Open Storage > 300,000 sq.ft.	1000 Sq.Ft.	10	0.09	0.05	0.05	103.69
Drive-In Theatre	1000 Sq.Ft.	20	0.09	0.05	0.08	165.90
Night Club	1000 Sq.Ft.	350	1.50	0.79	1.33	2,758.10
Bowling/Skating	1000 Sq.Ft.	150	1.76	0.55	0.73	1,513.84
Club & Lodge Halls	1000 Sq.Ft.	125	0.54	0.27	0.47	974.67
Auditorium/Amusement	1000 Sq.Ft.	350	1.50	0.79	1.33	2,758.10
Golf Course & Park	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Campground, Marina, RV Park	Spaces	55	0.34	0.14	0.22	456.23
Convalescent Home	Beds	125	0.54	0.28	0.48	995.40
Laundromat	1000 Sq.Ft.	3,825	16.40	8.61	14.55	30,173.21
Mortuary/Funeral Home	1000 Sq.Ft.	100	1.33	0.67	0.59	1,223.52
Health Spa without Showers	1000 Sq.Ft.	300	1.29	0.68	1.14	2,364.09
Health Spa with Showers	1000 Sq.Ft.	600	2.58	1.35	2.28	4,728.17
Special Event Center*	Attendance	10	0.04	0.02	0.04	82.95
College/University	Students	20	0.09	0.05	0.08	165.90
Private School	1000 Sq.Ft.	200	0.86	0.45	0.76	1,576.06
Library/Museum	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Post Office (Local)	1000 Sq.Ft.	100	0.43	0.23	0.38	788.03
Post Office (Regional)	1000 Sq.Ft.	25	0.23	0.09	0.12	248.85
Church	1000 Sq.Ft.	50	0.21	0.11	0.19	394.01

X = 0.7242 Y = 0.1128 Z = 0.1630 Connection Fee Rate = $2,073.76

Doc 5705732

* Including, but not limited to, Convention Center, Fairground, Racetrack, Sports Stadium/Arena

Appendix C

Sewer Node Exhibit

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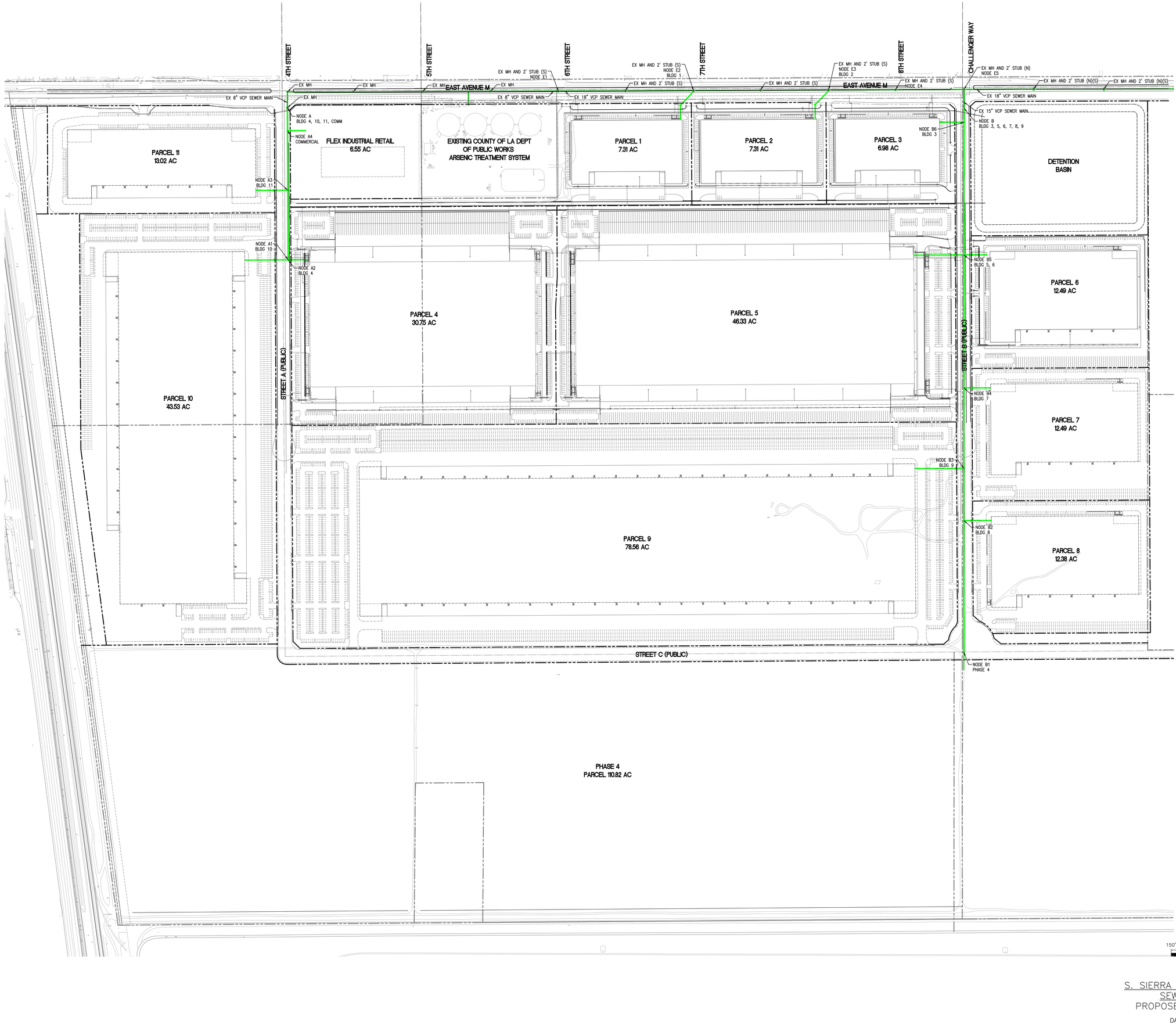

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GLENN CHUNG, P.E. R.C.E. 62794 DATE

S. SIERRA HWY & EAST AVE M
SEWER ANALYSIS
PROPOSED SEWER EXHIBIT

DATE: 5/20/2022