Appendix M
Sewer Area Study

SEWER AREA STUDY

FOR
ALEXAN ARCADIA
150 N. SANTA ANITA AVENUE
ARCADIA, CA

PSOMAS PROJECT: 1ARC040100

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1. INTRODUCTION

The purpose of this sewer area study is to determine and show

1. The capacity of the existing sewer pipe sizes and
2. The existing sewer facilities are adequate or inadequate for the proposed development

Figure 1: Project Site Location

2. PROJECT DESCRIPTION

The proposed development is a 319-unit residential apartment project with 5 stories above a two-story parking structure and two (2) levels of subterranean parking. The project extends over five (5) existing lots described as Parcel Map in book 34 page 64 of the county recorder's office, consisting of lots 2, 7, 8, 27 and 28. Lot two needs to be subdivided to establish a separate lot for the existing buildings along the Santa Anita Avenue frontage and the remaining lot consolidated with lots, 7,8, 27 and 28 to form a larger lot for the project development. Lots 27 and 28 are already tied together. The 20' alley between lots 7 and 8 and 27 and 28 is to be vacated.

The three existing buildings located on the east side of the project site and west of the alley will be demolished. These buildings are served by the existing 8" sewer line that extends onto the site.

3. EXISTING SEWER CAPACITY ANALYSIS

The existing sewer pipes were analyzed using the County of Los Angeles Department of Public Works (LADPW) Sewer Manual S-C4 chart which requires a maximum design capacity at half full for pipes less than 15" and at three quarters full for pipes 15" and greater. The chart is based on Kutter's Formula. The sewer capacity for existing pipes were obtained by using Kutter's Formula with "n = 0.013". The cumulative calculated flow for each segment was compared to the sewer capacity at each segment. The equation for the tributary sewer discharge is as follows:

$$Q = qA$$

Where: Q = Sewer discharge (cfs); q = Average Daily Flow (gal/day); A = Area (acres) and Dwelling Unit for the Apartment

All existing sewer lines were obtained from as-built plans (Appendix C) from City of Arcadia. Capacity in these lines will be analyzed using Kutter's Formula, zoning map (Appendix B) from the City of Arcadia website and estimated flows based from occupancies (Appendix E) from LA County. The pipe capacity for half full was calculated using FlowMaster, refer to appendix D.

The existing condition analysis is shown in Table 1.

Table 1 Existing conditions

TABLE 2: SEWER STUDY CALCULATION (EXISTING CONDITION)															
STREET NAME	SEGMENT		PIPE		CAPACITY (CFS)	AREA	Occupancy	Floor Area	Average Daily Flow (gal/day)	1000 SF GROSS FLOOR AREA	gal/day	Peak Flow (2.5x)	INCREASED CUMULATIVE FLOW BY 2.5	CUMULATIVE FLOWS/ CAPACITY x100 (%)-	COMMENTS
	M.H.#	M.H.#	SIZE (IN).	SLOPE(%)	1/2 FULL	(ACRES)									
Alley 1 A1	41 U-4	41 U-3	8	0.40	0.349	1.95	Existing Office Building	9,000	200	0.20	1,800	4,500	0.01	1.99%	BELOW PIPE CAPACITY
							Existing Office Building	4,600	200	0.20	920	2,300	0.01	3.01%	BELOW PIPE CAPACITY
							Existing Office Building	3,750	200	0.20	750	1,875	0.01	3.85%	BELOW PIPE CAPACITY
Alley 2 A2	41 U-3	41 U-2	8	0.40	0.349	0.70	Existing Office Building (USPS)	23,605	200	0.20	4,721	11,803	0.03	9.08%	BELOW PIPE CAPACITY
Wheeler A3	41 U-2	41 U-1	8	0.40	0.349	1.42	Existing Commercial	68,417	200	0.20	13,683	34,209	0.08	24.24%	BELOW PIPE CAPACITY
Wheeler A4	41 U-1	JMH	8	0.40	0.349	1.86	Existing Medical Building	16,134	300	0.30	4,840	12,101	0.10	29.61%	BELOW PIPE CAPACITY

Refer to graphical description of the existing condition on Appendix A.

4. SEWER CAPACITY ANALYSIS WITH PROJECT FLOW

The proposed project vacates a section of public alley and therefore increased the developable area marginally.

The analysis of the sewer capacity based on the proposed condition is shown in Table 2 below.

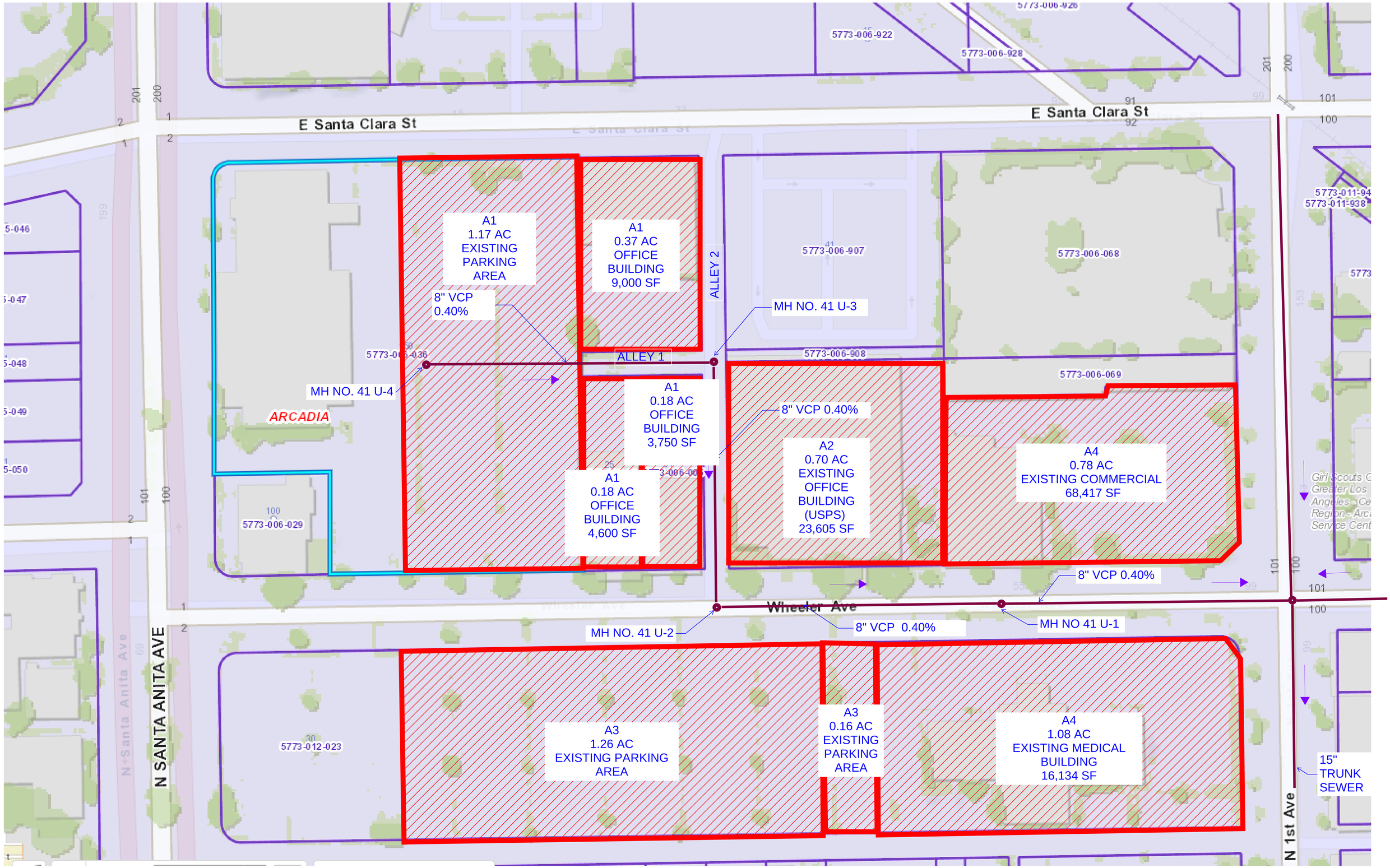
TABLE 2: SEWER STUDY CALCULATION (PROPOSED CONDITION)																
STREET NAME	SEGMENT		PIPE		CAPACITY (CFS)	LOT AREA (ac)	Occupancy	Description / Occupant Load Factor (OLF)	No. Units or Floor Area	Occupant (Area/OLF)	Average Daily Flow (gal/day)	1000 SF GROSS FLOOR AREA	gal/day	Peak Flow (2.5x)	INCREASED CUMULATIVE FLOW BY 2.5 (cfs)	CUMULATIVE Q/ CAPACITY x100 (%)-HALF FULL (cfs)	COMMENTS
	M.H.#	M.H.#	SIZE (IN).	SLOPE(%)													
Project A2	41 U-3	41 U-2	8	0.40	0.349	1.95	New Residential Appartment (319 units)	2-bed	79	NA	250	NA	19,750	49,375	0.076	21.89%	BELOW PIPE CAPACITY
								1-bed	168	NA	200	NA	33,600	84,000	0.206	59.13%	BELOW PIPE CAPACITY
								studio	63	NA	150	NA	9,450	23,625	0.243	69.60%	BELOW PIPE CAPACITY
								Live work	9	NA	200	NA	1,800	4,500	0.250	71.60%	BELOW PIPE CAPACITY
							Fitness Occupants	50	2637	53	5	NA	264	659	0.251	71.89%	BELOW PIPE CAPACITY
							Leasing Occupants	100	598	6	5	NA	30	75	0.251	71.92%	BELOW PIPE CAPACITY
							Lounge Lobby Occupants	100	5635	56	5	NA	282	704	0.252	72.24%	BELOW PIPE CAPACITY
							Gaming Occupants	15	3904	260	5	NA	1,301	3,253	0.257	73.68%	BELOW PIPE CAPACITY
							Business Center Occupants	100	2185	22	5	NA	109	273	0.258	73.80%	BELOW PIPE CAPACITY
							Pool Deck Occupants	15	5307	354	5	NA	1,769	4,423	0.264	75.76%	BELOW PIPE CAPACITY
							Pool Spa Occupants	50	1360	27	5	NA	136	340	0.265	75.91%	BELOW PIPE CAPACITY
							Roof Deck Occupants	15	1813	121	5	NA	604	1,511	0.267	76.58%	BELOW PIPE CAPACITY
Alley 2 A2	41 U-3	41 U-2	8	0.40	0.349	0.70	Existing Office		23,605	NA	200	0.20	4,721	11,803	0.286	81.81%	BELOW PIPE CAPACITY
Wheeler A3	41 U-2	41 U-1	8	0.40	0.349	1.42	Existing Commercial		68,417	NA	200	0.20	13,683	34,209	0.338	96.98%	BELOW PIPE CAPACITY
Wheeler A4	41 U-1	JMH	8	0.40	0.349	1.86	Existing Medical Building		16,134	NA	300	0.30	4,840	12,101	0.357	102.34%	AT PIPE CAPACITY

Refer to graphical description of the proposed condition on Appendix A.

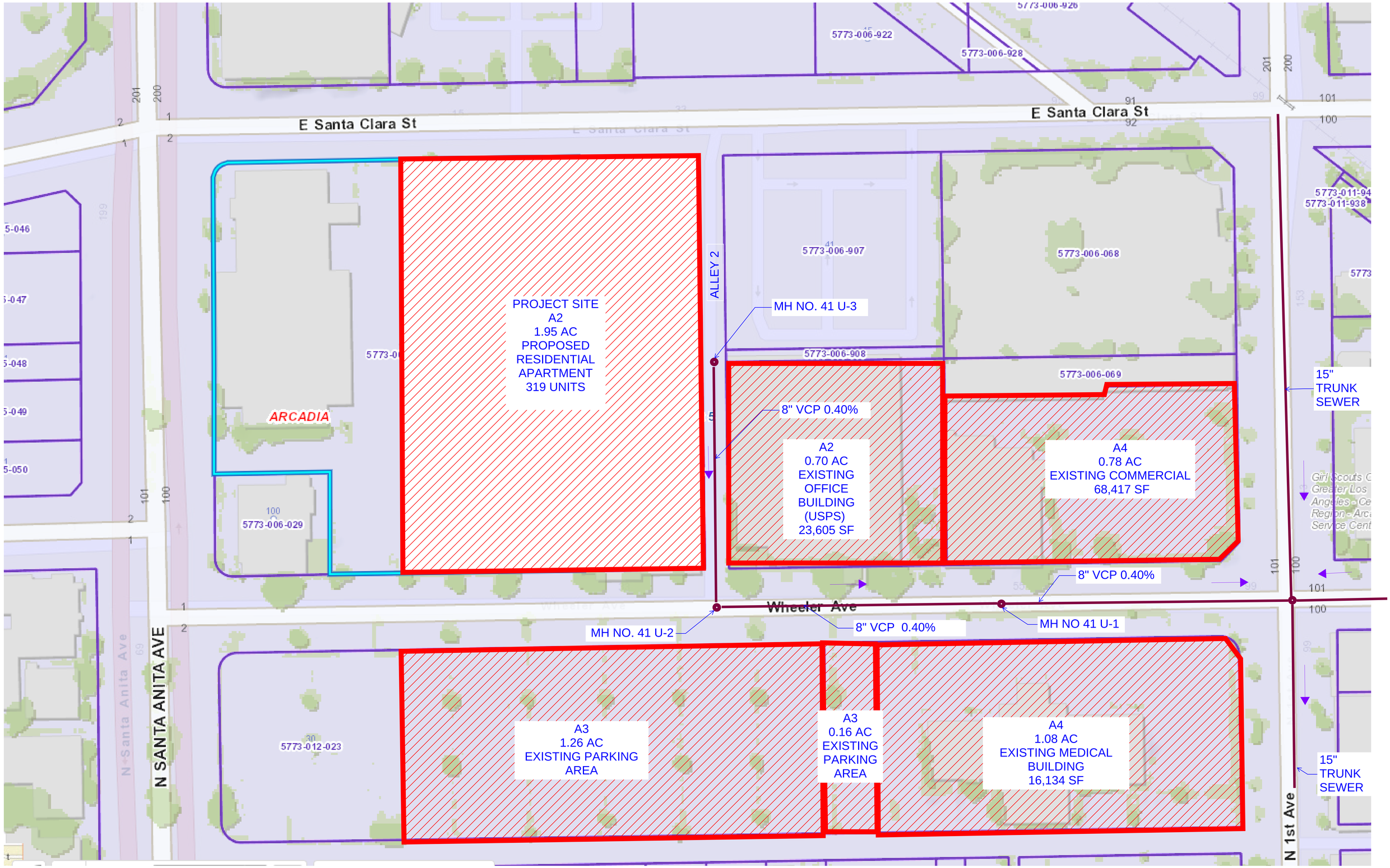
5. CONCLUSION

Based on the analyses presented above the existing 8” sewer in Wheeler street has adequate capacity for the proposed development.

Appendix A – Sewer Study Map

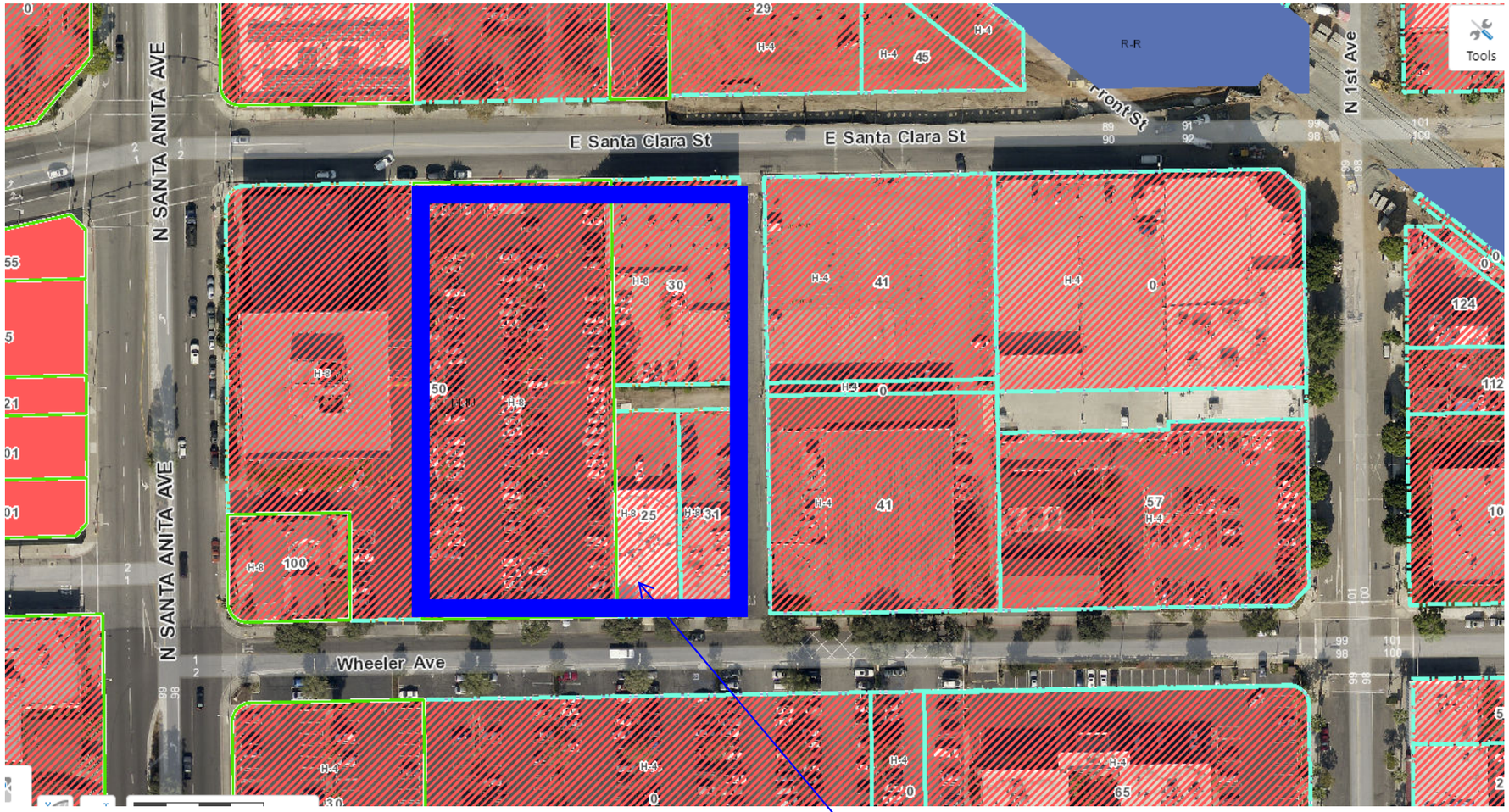


SEWER AREA MAP
EXISTING CONDITION



SEWER AREA MAP
PROPOSED CONDITION

Appendix B -Zoning Map



Zoning Map

CITY OF ARCADIA

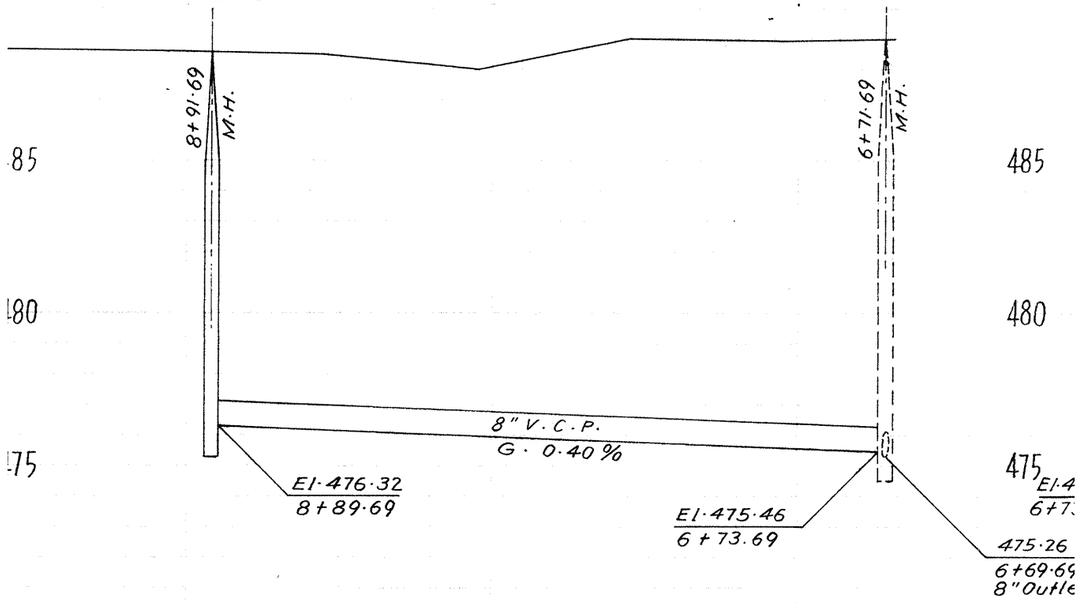
Zones

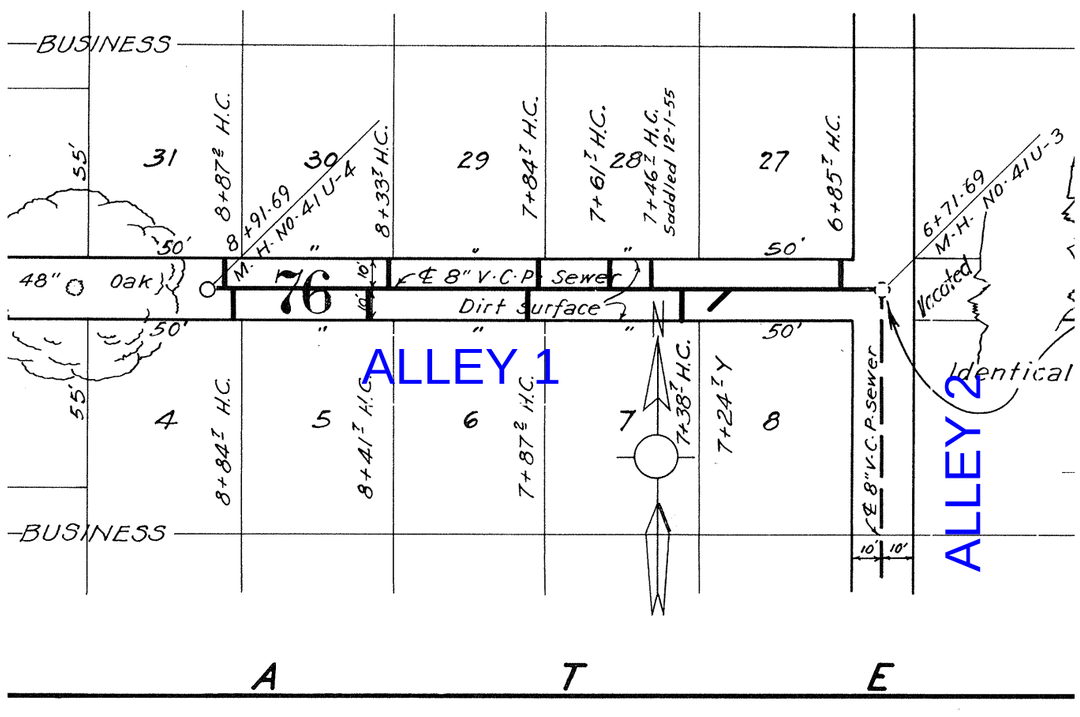
- Residential Mountainous (R-M)
- First One-Family (R-O)
  - Minimum Lot Size
  - (30,000 SF)
  - (15,000 SF)
  - (22,000 SF)
  - (12,500 SF)
- Second One Family (R-1)
  - Minimum Lot Size
  - (15,000 SF)
  - (10,000 SF)
  - (12,500 SF)
  - (7,500 SF)
- Medium Density Residential (R-2)
- High Density Residential (R-3)
- Restricted High Density Residential (R-3-R)
- Central Business District (CBD)
- General Commercial (C-G)
- Professional Office (C-O)
- Regional Commercial (C-R)
- Open Space - Outdoor Recreation (OS-OR)
- Open Space - Resource Protection (OS-RP)
- Mixed Use (MU)
- Downtown Mixed Use (DMU)

Appendix C – As Built Plans

MH 41 U-4

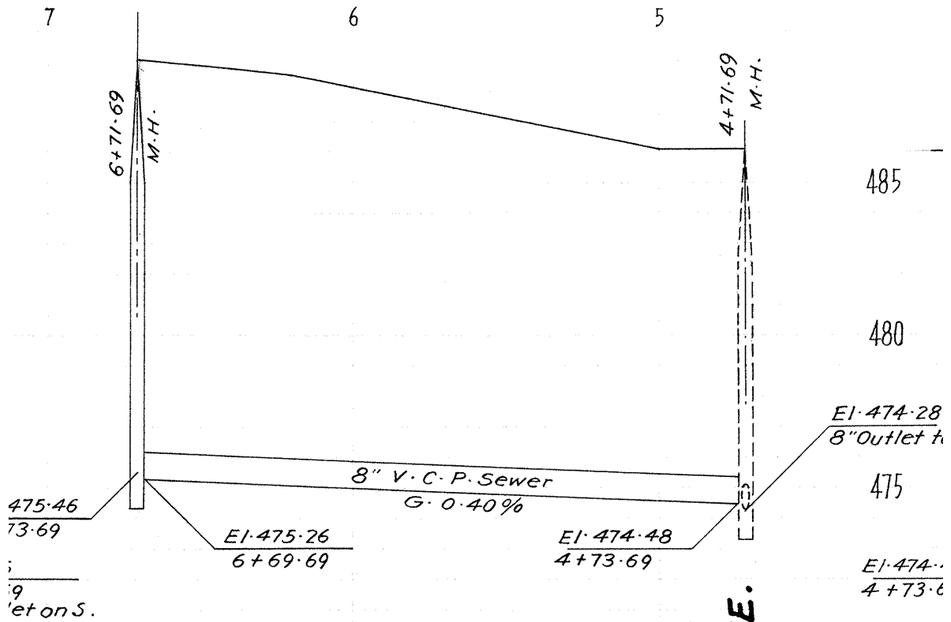
MH 41 U-3

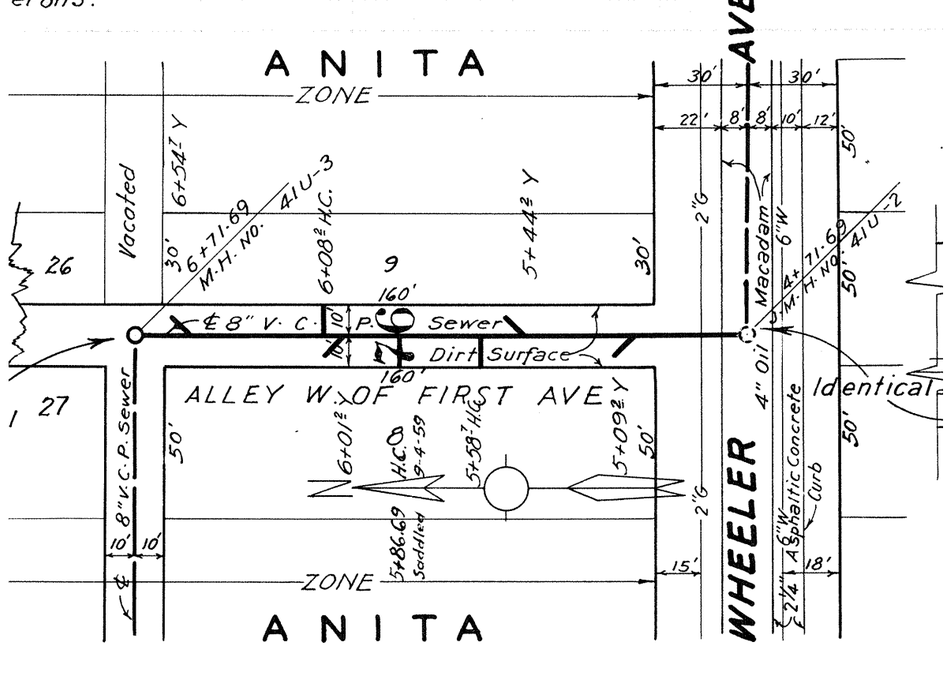


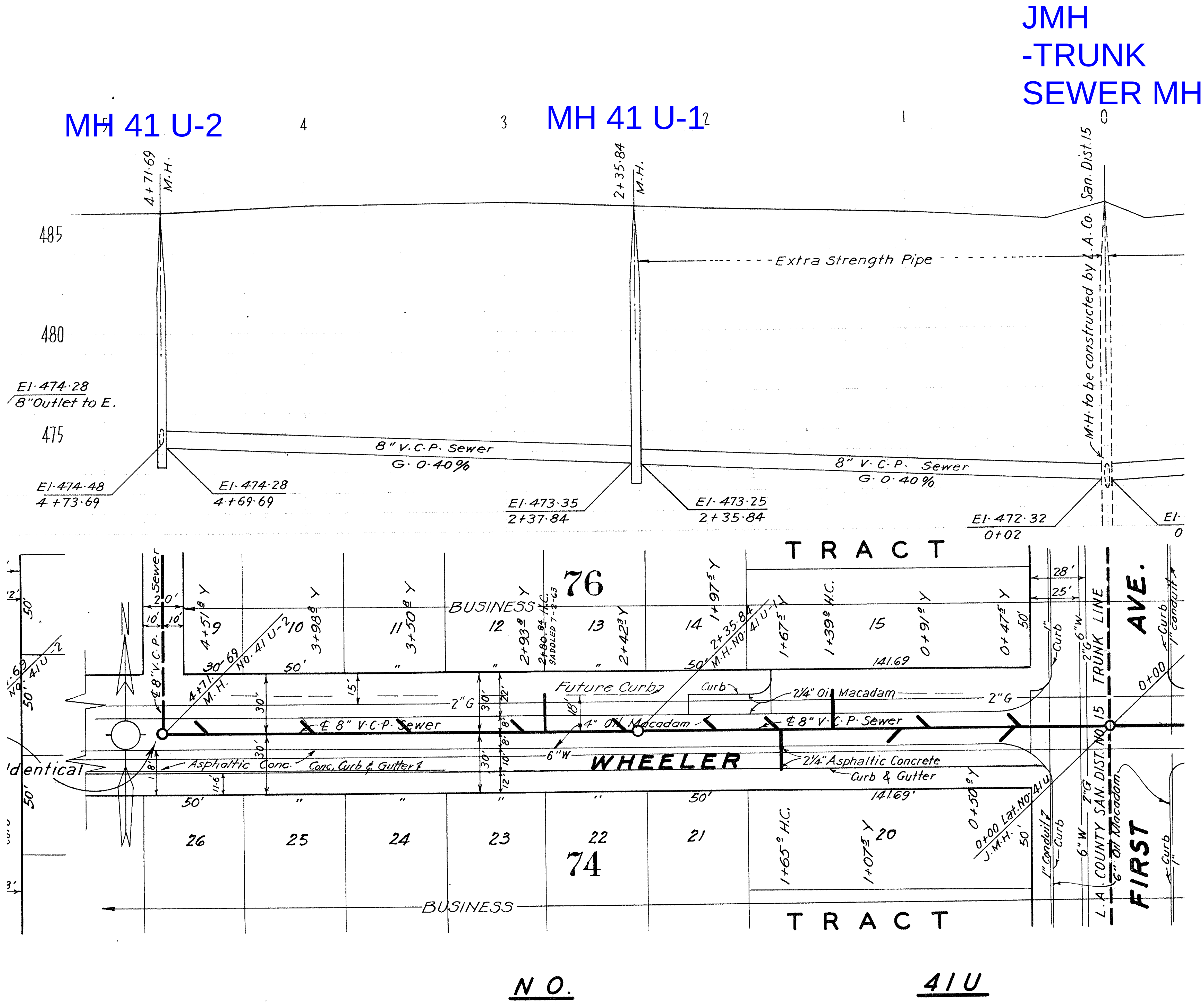


MH 41 U-3

MH 41 U-3







JMH
-TRUNK
SEWER MH
MH 41 U-2
MH 41 U-1
4+71·69
M.H.
2+35·84
M.H.
San. Dist. 15
485
480
475
Extra Strength Pipe
M.H. to be constructed by L.A. Co.
El· 474·28
8" Outlet to E.
8" V.C.P. Sewer
G· 0·40%
8" V·C·P· Sewer
G· 0·40%
El· 474·48
4+73·69
El· 474·28
4+69·69
El· 473·35
2+37·84
El· 473·25
2+35·84
El· 472·32
0+02
TRACT
76
BUSINESS
Future Curb
2¼" Oil Macadam
℄ 8" V.C.P. Sewer
4" Oil Macadam
WHEELER
2¼" Asphaltic Concrete
Curb & Gutter
Asphaltic Conc.
Conc. Curb & Gutter
2+35·84
M.H. No. 41 U-1
4+71·69
M.H.
No. 41 U-2
TRUNK LINE
L.A. COUNTY SAN. DIST. NO. 15
6" Oil Macadam
AVE.
FIRST
0+00 Lat. No. 41 U
J.M.H.
74
BUSINESS
TRACT
NO.
41 U

Appendix D – Flow Calculations

Worksheet for Circular Pipe - 1

Project Description	
Friction Method	Kutter Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.004 ft/ft
Normal Depth	4.0 in
Diameter	8.0 in

Results	
Discharge	0.349 cfs
Flow Area	0.2 ft²
Wetted Perimeter	1.0 ft
Hydraulic Radius	2.0 in
Top Width	0.67 ft
Critical Depth	3.3 in
Percent Full	50.0 %
Critical Slope	0.008 ft/ft
Velocity	2.00 ft/s
Velocity Head	0.06 ft
Specific Energy	0.40 ft
Froude Number	0.688
Maximum Discharge	0.763 cfs
Discharge Full	0.697 cfs
Slope Full	0.001 ft/ft
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.0 in
Critical Depth	3.3 in
Channel Slope	0.004 ft/ft
Critical Slope	0.008 ft/ft

Appendix E - Estimated Average Daily Flow Sewage Flows For Various Occupancies

Estimated Average Daily Sewage Flows for Various Occupancies

Occupancy	Abbreviation	*Average daily flow	
Apartment Buildings:			
Bachelor or Single dwelling units	Apt	150	gal/D.U.
1 bedroom dwelling units	Apt	200	gal/D.U.
2 bedroom dwelling units	Apt	250	gal/D.U.
3 bedroom or more dwelling units	Apt	300	gal/D.U.
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	MB	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:	
M-1 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