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Preliminary Sewer Sizing Memo

DPC Redlands
Redlands, California

Southeast Corner of Tennessee Street and Future Pennsylvania Avenue

Date:

October 2023

Prepared for:

Diversified Pacific Communities

10621 Civic Center Drive

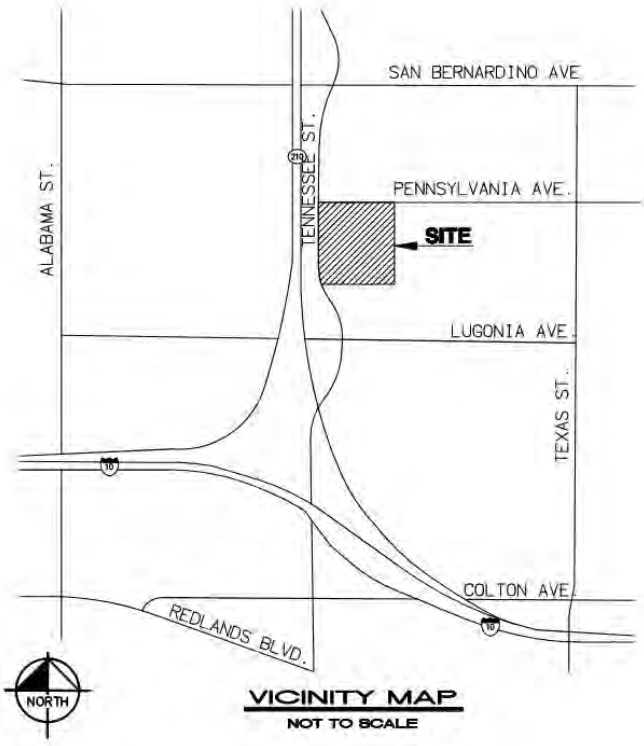
Rancho Cucamonga, CA 91730

909.481.1150

DPC REDLANDS PRELIMINARY SEWER SIZING MEMO

1. INTRODUCTION & PURPOSE

DPC Redlands (Project or Proposed Project) is a proposed development of 12.8-acres of undeveloped land into 10 high-density residential buildings and 1 commercial building. The Project Site (TPM 20688 or Tennessee Village) is located in Redlands, CA, East of Tennessee Avenue and South of the future Pennsylvania Avenue.



This technical memorandum provides sizing for the mainline proposed in the future Pennsylvania Avenue and Tennessee St based on City of Redlands Sewer Standards. This study was limited to the connection to the existing sewer in San Bernardino Avenue. The existing sewer downstream of this point was not studied as part of this report.

2. PROJECT ANALYSIS

Flow Rate Determination

The proposed Pennsylvania Avenue sewer mainline shall connect to the existing maintenance hole adjacent to TPM 20469 and flow westerly to Tennessee Street. The proposed Tennessee Street sewer mainline shall flow from Pennsylvania Avenue north to a mainline in San Bernardino Avenue. This analysis will include estimated peak flow from the existing sewer line within Pennsylvania Avenue and the tributary areas of TPM 20688, TPM 20469, and the Walmart Properties. Approximate tributary areas, and proposed sewer alignment and points of connection (POC) are shown in tributary map (**Attachment A**).

Flow monitoring was conducted by Downstream Services, Inc. in an existing maintenance hole at the intersection of Karon Street and Pennsylvania avenue. See **Attachment B** for the flow monitoring report. Based on the available as-built information, it is assumed that the monitored flow accurately represents the flow from the existing sewer into the proposed system. To be conservative, the largest measured daily maximum flow was selected to represent peak flow. Based on this assumption, the peak flow from the Pennsylvania Avenue mainline is estimated to be 26.3 gpm.

Building plans were not provided for the Walmart Properties, so peak flow from the tributary areas (A-1, A-2, and A-3) was estimated based on land use per City of Redlands Sanitary Sewer Systems Standard Specifications. Per City of Redlands instruction, the easterly 2 APN parcels of the Walmart Properties (A-1 and A-2) shall be considered multi-family land use. The tributary area outside of those APN parcels (A-3) will be considered commercial land use. Average flows for the tributary areas were obtained from Table 3, Section D of the Standard Specifications and multiplied by a peak factor obtained from Table 4, Section D (**Attachment F**). The average flow calculated was lower than the minimum average flow indicated in the table. Consequently, the peak factor for the minimum average flow in Table 4, Section D was used for the tributary areas, 3.3. Based on these assumptions the expected peak flow for the Walmart Properties is 52.1 GPM. *Table 1* provides expected peak flows and the values used for their computation.

Table 1: Peak Flows of Walmart Properties Tributary Areas

Tributary Area	Land Use	Area (AC)	Average Flow (CFS/AC)	Average Flow (CFS)	Peak Factor	Peak Flow (CFS)	Peak Flow (GPM)
A-1	Medium Density Residential	8.04	0.0033	0.0265	3.3	0.0876	39.3
A-2	Medium Density Residential	1.33	0.0033	0.00439	3.3	0.0145	6.50
A-3	Commercial	1.93	0.0022	0.00425	3.3	0.0140	6.29
							Total: 52.1

The architects provided fixture counts for B-1 (tributary area of TPM 20688) and C-1 (tributary area of TPM 20469), provided in **Attachment C and D** respectively. The fixtures were converted

into DFUs (Drainage Fixture Units) using equivalent values from Table A103.1 in the California Plumbing Code (**Attachment E)**. Next, the DFUs were converted to peak flow by using Chart A 103.1(1) (**Attachment E**). The DFUs for B-1 exceed the maximum specified on the chart. To address this issue, the DFUs were divided into four equal parts, and peak flow values were determined for each part before being combined. *Table 2* summarizes the DFU to peak flow conversions for the Project.

Table 2: Conversion Summary and Total Flow Rate

Tributary Area	Associated Property	DFU Value	Peak Flow (GPM)
B-1	TPM 20688	9266	1440
C-1	TPM 20469	2216	350

B-1 and C-1 will both discharge into the Pennsylvania Avenue mainline at POC #2 and POC #3 respectively. To size the line conservatively, the Walmart Properties' tributary areas (A-1, A-2, and A-3) are assumed to discharge at POC #3.

Facility Sizing

Invert elevations of 1289.34 at POC #1 and 1250.91 at POC #4 were obtained from as-builts of the existing maintenance holes (**Attachment G**). Based on the approximate proposed sewer length of 2700 ft, the average slope is estimated to be 1.4%. Bentley Flowmaster was used to analyze the normal depth and velocity in the gravity sewer pipe. The proposed sewer was sized according to City of Redlands Sanitary Sewer Systems Standard Specifications (**Attachment F**). During peak flow conditions, pipes with a diameter of 12 inches or smaller should be flowing at less than half full, while pipes with a diameter of 15 inches or larger should be flowing at less than three-quarters full. Velocities in all sewers should be between 2.5 ft/s and 10 ft/s. The minimum pipe size is 8 inches. Based on these criteria and Bentley Flowmaster Calculations (**Attachment H**) the proposed sewer segments were sized. *Table 3* summarizes results.

Table 3: Gravity Sewer Mainline Sizing Summary

Segment Start	Segment End	Peak Flow (GPM)	Slope (ft/ft)	Diameter (in)	Velocity (ft/s)	d/D
POC #1	POC #2	26.3	0.014	8	2.01	0.14
POC #2	POC #3	78.4	0.014	8	2.78	0.24
POC #3	POC #4	1868	0.014	15	6.36	0.53

3. CONCLUSIONS

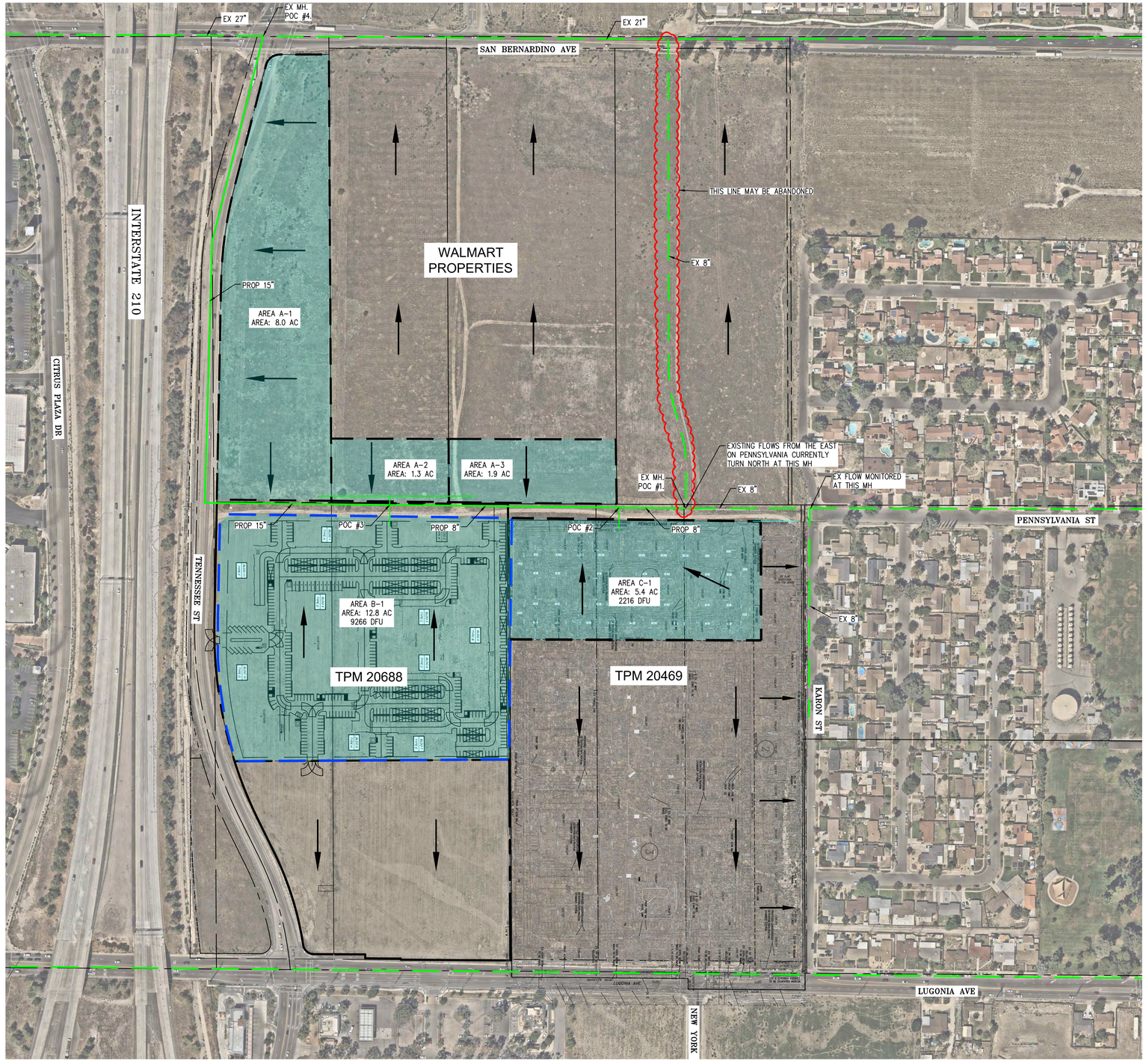
Based on the calculations and estimates provided in this report, a 8-inch and 15-inch diameter will be sufficient to convey flow through the proposed gravity sewer after development of TPM 20688, TPM 20469, and the Walmart Properties.

Taylor Thorig, P.E.
C93239 Exp. 3/31/2024

ATTACHMENTS

A. TRIBUTARY MAP

PROPOSED PENNSYLVANIA AVENUE AND TENNESSEE STREET SEWER LINE
TRIBUTARY MAP



LEGEND

- EXISTING SEWER
- PROPOSED SEWER
- PROPOSED TRIBUTARY AREAS
- PROPOSED PROJECT AREA
- TRIBUTARY FLOWLINE

SCALE 1"=150'

150 75 0 150 300 450

SCALE: 1"=150'

PREPARED BY:

Kimley»Horn

KIMLEY-HORN AND ASSOCIATES, INC.
3880 LEMON STREET, SUITE 420, RIVERSIDE, CA 92501
PHONE: 951-543-9868

B. FLOW MONITORING REPORT

DownStream Services, Inc.

2855 Progress Place
Escondido, CA 92029
760.746.2544/1.800.262.0999

Tennessee Village Sewer

Flow Monitoring

7/5/2023 - 7/17/2023

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CP CERTIFICATION PAGE

Diversified Pacific Community Flow Monitoring Study
Tennessee Village Sewer

"I certify that Downstream Services, Inc. flow monitoring data reports were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the data submitted. Based on my inquiry of the person or persons who installed the system and those persons directly responsible for gathering the data, the information submitted in these reports are, to the best of my knowledge and belief, true, accurate, and complete. As the project manager, I am committed to provide services honestly and to protect the public health, safety, and welfare."

TD TECHNICAL DOCUMENTS

Confined Space Entry

A confined space (Photo 1.1) is defined as any space that is large enough and so configured that a person can bodily enter and perform assigned work, has limited or restricted means for entry or exit and is not designed for continuous employee occupancy. In general, the atmosphere must be constantly monitored for sufficient levels of oxygen (19.5% to 23.5%), and the presence of hydrogen sulfide (H2S) gas, carbon monoxide (CO) gas, and lower explosive limit (LEL) levels. A typical confined space entry crew has members with OSHA-defined responsibilities of Entrant, Attendant and Supervisor. The Entrant is the individual performing the work. He or she is equipped with the necessary personal protective equipment needed to perform the job safely, including a personal four-gas monitor (Photo 1.2). If it is not possible to maintain line-of-sight with the Entrant, then more Entrants are required until line-of-sight can be maintained. The Attendant is responsible for maintaining contact with the Entrants to monitor the atmosphere using another four-gas monitor and maintaining records of all Entrants, if there is more than one. The Supervisor is responsible for developing the safe work plan for the job at hand prior to entering.

Photo 1.1. Confined Space Entry

Photo 1.2. Typical Personal Four-Gas Monitor

Flow Meter Installation

A flow meter uses sonar to measure velocity and an ultrasonic sensor to measure depth. The sensor transmits ultrasonic pulses that travel through the water and reflect off the liquid surface. To monitor fluid velocity, the flow meter uses Doppler. This high frequency sound is reflected back to the sensor from particles or bubbles suspended in the liquid. If the fluid is in motion, the echoes return at an altered frequency proportionate to flow velocity.

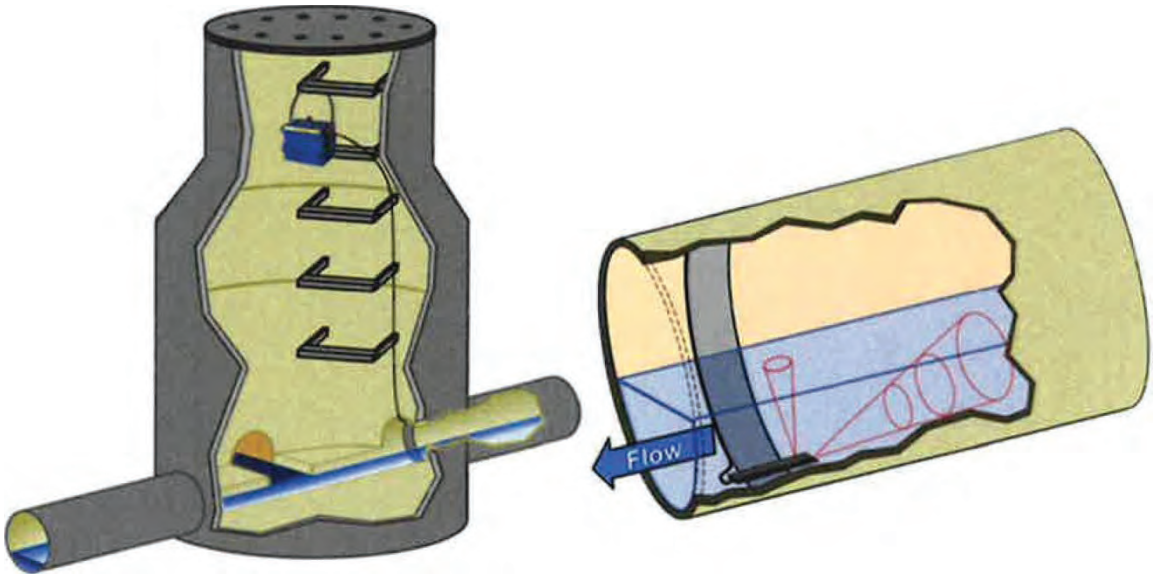


Figure 1.1 Typical Installation for Flow Meter with Submerged Sensor

Flow Calculations

Data retrieved from the flow meter was placed into a spreadsheet program for analysis. Data analysis includes data comparison to field calibration measurements, as well as necessary geometric adjustments as required for sediment (sediment reduces the pipe's wetted cross-sectional area available to carry flow). Area-velocity flow metering uses the continuity equation,

$Q = v \cdot A = v \cdot (AT - AS)$

where Q: volume flow rate
v: average velocity as determined by the ultrasonic sensor
A: cross-sectional area available to carry flow
AT: total cross-sectional area with both wastewater and sediment
As: cross-sectional area of sediment.

For circular pipe,

$$A_T = \left[\frac{D^2}{4}\cos^{-1}\left(1 - \frac{2d_w}{D}\right)\right] - \left[\left(\frac{D}{2} - d_w\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1 - \frac{2d_w}{D}\right)\right)\right]$$

$$A_S = \left[\frac{D^2}{4}\cos^{-1}\left(1 - \frac{2d_s}{D}\right)\right] - \left[\left(\frac{D}{2} - d_s\right)\left(\frac{D}{2}\right)\sin\left(\cos^{-1}\left(1 - \frac{2d_s}{D}\right)\right)\right]$$

where dw: distance between wastewater level and pipe invert

ds: depth of sediment.

AREA 1

Site Name:	**Area 1**	Client:	**Diversified Pacific Community**
Site Type:	**Sewer Monitoring**	Effluent Type:	**Sewer**
Manhole ID:	**Area 1**	Site Address:	**Pennsylvania Ave & Karon St**
GPS Latitude:	**34.073745°**	GPS Longitude:	**-117.194415°**
Start Date:	**July 5, 2023**	End Date:	**July 17, 2023**

Map Image: Area 1

Site Name:	**Area 1**	Client:	**Diversified Pacific Community**

Site Image: Area 1

Flow Meter Serial Number: 220A01386

DownStream

Flow Monitor Installation Report

Client	Project Name	DSI Job #
Diversified Pacific Community	Tennessee Village Flow	2023.5.169
Manhole ID	**Install Date**	**Flow Measurement Increment**
	7-5-2023	Minutes: 15 mins.
Address / Intersection		**Location**
1501 Karon St. Redlands CA 92374		Middle of the Intersection!

Flow Monitoring Observations and Records:

✓	DESCRIPTION	COMMENT / DATA
☑	A. Visual inspection of surrounding area.	
☑	B. Inspect for intruding laterals. If it will disturb flow another manhole must be chosen.	Theres one but Looks For Future future to Pictures in one Drive. Theres No signs of Flow.
☑	C. Inspect for signs of grease, scrub if necessary.	Super clean.
☑	D. Inspect for sediment. Record depth:	None.
☑	E. Inspect mounting surface of meter for imperfections.	Clean.
☑	F. Inspect for signs of surcharging.	None, Looks Good!
☑	G. Pipe Material:	Green PVC
☑	H. Pipe Shape:	☑ Round ☐
☐	I. Pipe Diameter (inches)	Top/Bottom 8" Diagonal 8" Side/Side 8" Opposite Diagonal 8"
☐	J. Flow Depth (inches)	Actual 1.00" Indicated 1.005"
☐	K. Flow Velocity (feet per second)	Actual 1.00FPS Indicated 1.00FPS
☑	L. With meter installed, take a downhole photograph with the top facing North.	Photo in One Drive
☑	M. Record the serial number of the flow meter and the sensor.	Meter: 219H02144 Sensor: 220A01386

General Comments:

The flow is very low. More then likley we wont be reading a flow! Unless High flow times. The sensor is reading accurately with the low Flow. 10:00AM

Technician: Chris Moeller Date: 7-5-23

Area 1

Diversified Pacific Community

Diameter: 8 inches **Shape: Circular** **Material: PVC**

From: 7/5/2023 10:00 AM to 7/17/2023 8:45 AM

Flow Level Summary (Inches)

Average: 0.47
Maximum: 1.27
Minimum: 0.01

Flow Level (Inches)

7/5/2023		7/6/2023		7/7/2023		7/8/2023	
Average	0.53	*Average*	0.48	*Average*	0.44	*Average*	0.55
Maximum	0.96	*Maximum*	0.93	*Maximum*	0.80	*Maximum*	1.27
Minimum	0.19	*Minimum*	0.05	*Minimum*	0.15	*Minimum*	0.11
7/9/2023		**7/10/2023**		**7/11/2023**		**7/12/2023**	
Average	0.50	*Average*	0.50	*Average*	0.34	*Average*	0.46
Maximum	0.77	*Maximum*	0.88	*Maximum*	0.80	*Maximum*	0.94
Minimum	0.06	*Minimum*	0.01	*Minimum*	0.13	*Minimum*	0.09

Inflow Rate Summary (GPM)

Average: 2.9
Maximum: 26.3
Minimum: 0.0

Flow Rate (In GPM)

7/5/2023		7/6/2023		7/7/2023		7/8/2023	
Average	3.7	*Average*	3.1	*Average*	2.5	*Average*	4.1
Maximum	15.3	*Maximum*	10.8	*Maximum*	7.9	*Maximum*	26.3
Minimum	0.0	*Minimum*	0.0	*Minimum*	0.2	*Minimum*	0.1
7/9/2023		**7/10/2023**		**7/11/2023**		**7/12/2023**	
Average	3.0	*Average*	3.4	*Average*	1.4	*Average*	2.7
Maximum	6.9	*Maximum*	9.1	*Maximum*	7.4	*Maximum*	10.3
Minimum	0.0	*Minimum*	0.0	*Minimum*	0.0	*Minimum*	0.0

Area 1

Diversified Pacific Community

Diameter: 8 inches **Shape: Circular** **Material: PVC**

From: 7/5/2023 10:00 AM to 7/17/2023 8:45 AM

Flow Level Summary (Inches)

Average: **0.44**
Maximum: **1.20**
Minimum: **0.04**

Flow Level (Inches)

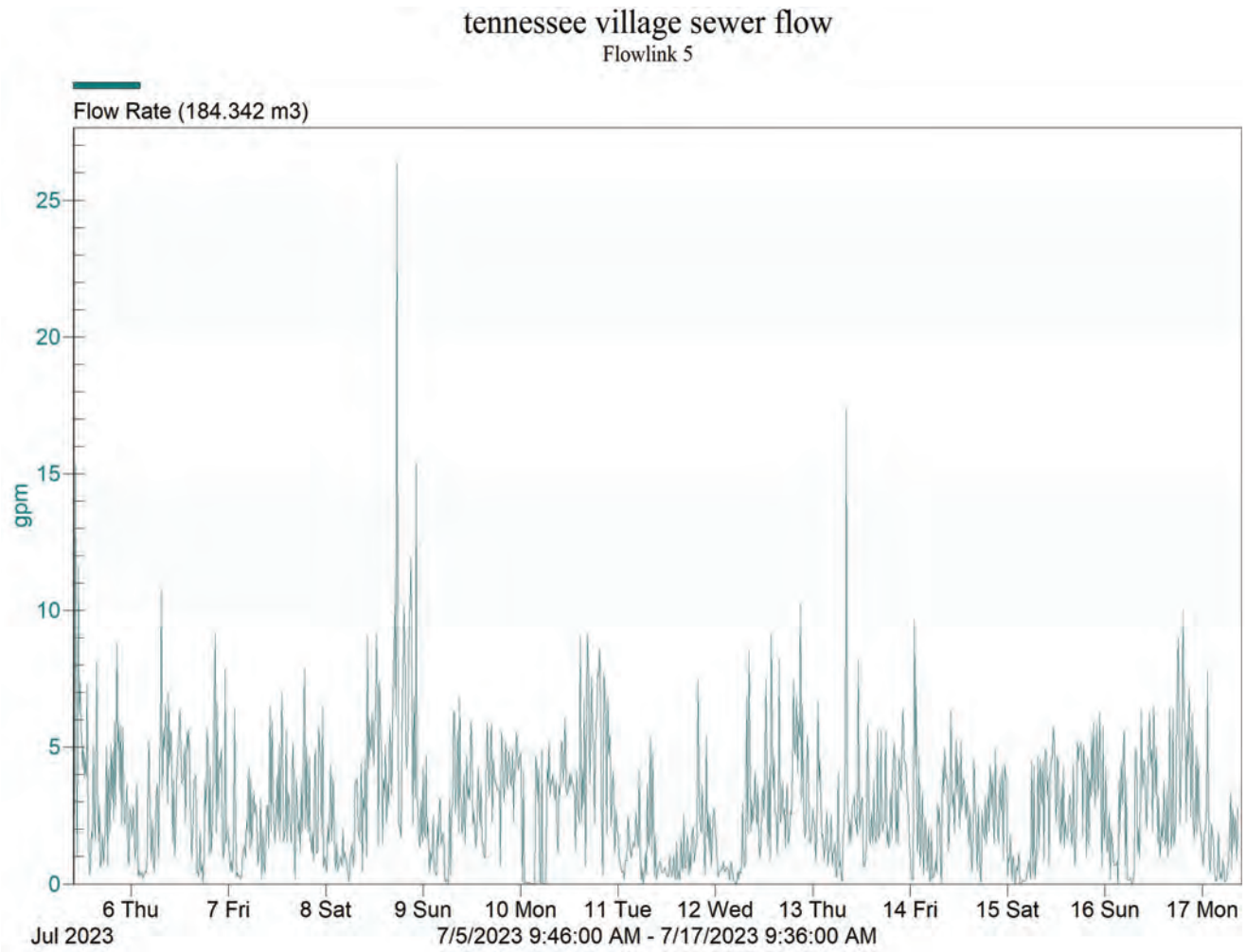
7/13/2023		7/14/2023		7/15/2023		7/16/2023	
Average	0.46	*Average*	0.44	*Average*	0.43	*Average*	0.48
Maximum	1.20	*Maximum*	0.88	*Maximum*	0.71	*Maximum*	0.90
Minimum	0.12	*Minimum*	0.05	*Minimum*	0.05	*Minimum*	0.04
7/17/2023							
Average	0.32	*Average*		*Average*		*Average*	
Maximum	0.79	*Maximum*		*Maximum*		*Maximum*	
Minimum	0.09	*Minimum*		*Minimum*		*Minimum*	

Inflow Rate Summary (GPM)

Average: **2.6**
Maximum: **17.4**
Minimum: **0.0**

Flow Rate (In GPM)

7/13/2023		7/14/2023		7/15/2023		7/16/2023	
Average	2.7	*Average*	2.5	*Average*	2.6	*Average*	3.1
Maximum	17.4	*Maximum*	9.7	*Maximum*	6.2	*Maximum*	10.0
Minimum	0.1	*Minimum*	0.0	*Minimum*	0.0	*Minimum*	0.0
7/17/2023							
Average	1.4	*Average*		*Average*		*Average*	
Maximum	7.8	*Maximum*		*Maximum*		*Maximum*	
Minimum	0.1	*Minimum*		*Minimum*		*Minimum*	



Flow Rate: Area 1

Flow Monitor Removal Report

Client	**Project Name**	**DSI Job #**
Diversified Pacific Community	Tennessee Village Sewer	2023.5.169
Manhole ID	**Install Date**	**Removal Date**
Area 1	7/5/2023	7/17/2023
Address / Intersection	**Location**	
1501 Karon St. Redlands, CA 92374	Middle of intersection	

Flow Monitoring Observations and Records:

✓	DESCRIPTION	COMMENT / DATA
✓	Sediment Depth (inches)	0.00
✓	Is there any grease?	No
✓	Are there any signs or surcharging?	No
✓	Does the recorded data look OK?	Yes
✓	Is the flowmeter still installed OK?	Yes
✓	Is the sensor ragged?	No
✓	Flow Level (inches)	Actual 1.00 Indicated 1.05
✓	Flow Velocity (feet per second)	Actual 1.00 Indicated 1.00
✓	Did you take a good, north-facing photo of the entire bottom of the manhole which includes the installed sensor?	Yes

General Comments:

Technician: Chris Moeller Date: 7/17/2023

DOWNSTREAMSERVICES.COM

2855 Progress Place
Escondido CA 92029

Toll Free 800.262.0999
Local 760.746.2544
Fax 760.746.2667

info@downstreamservices.com

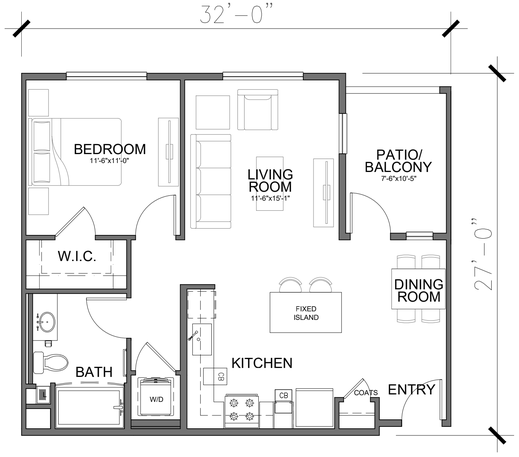
GRIT.INTEGRITY.EXPERTISE.FAMILY.

DownStream
Services, Inc.

C. TPM 20688 (TRIBUTARY AREA B-1) FIXTURE UNIT MATRIX

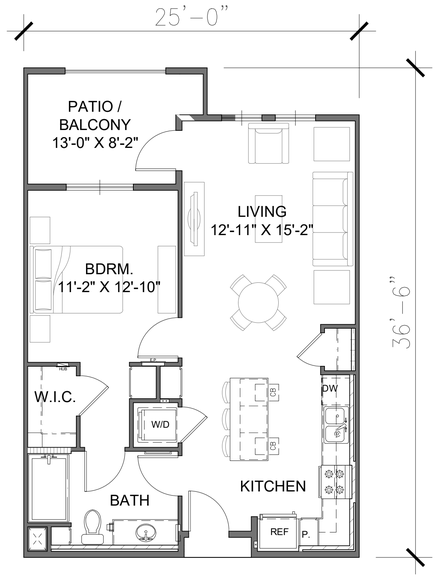
Tennessee Fixture Count:

UNIT TYPE	UNIT QTY.	SINKS	TOTAL SINK	TOILET	TOTAL TOILET	TUB/SHOWER	TOTAL TUB	DISHWASHER	TOTAL DISHWASHER	LAUDRY	TOTAL LAUNDRY
A1	109	2	218	1	109	1	109	1	109	1	109
A1-DEN	21	2	42	1	21	1	21	1	21	1	21
A3	97	2	194	1	97	1	97	1	97	1	97
A4	5	2	10	1	5	1	5	1	5	1	5
A4-DEN	3	3	9	2	6	1	3	1	3	1	3
A3-LW	4	3	12	2	8	1	4	1	4	1	4
B1	53	4	212	2	106	2	106	1	53	1	53
B3	24	4	96	2	48	2	48	1	24	1	24
B4	20	4	80	2	40	2	40	1	20	1	20
B5	96	4	384	2	192	2	192	1	96	1	96
B4-LW	2	5	10	3	6	2	4	1	2	1	2
C1	20	4	80	3	60	3	60	1	20	1	20
C1-DEN	6	4	24	3	18	3	18	1	6	1	6
AMENITY	-	13	13	13	13	2	2	1	1	0	0
TOTAL	**460**	**-**	**1,384**	**-**	**729**	**-**	**709**	**-**	**461**	**-**	**460**



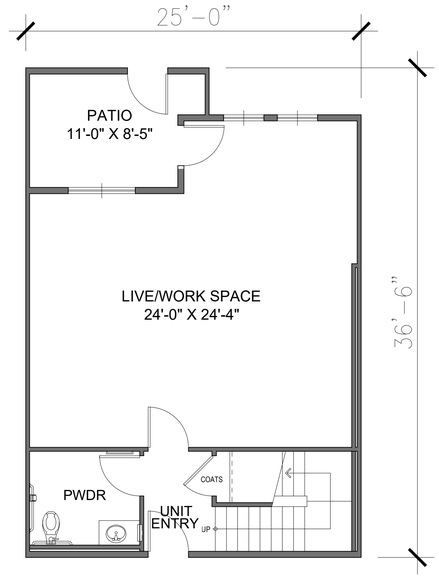
UNIT A1: 1BR/1BA

RENTABLE: 767 SQ.FT.
PATIO/BALCONY: 78 SQ.FT.



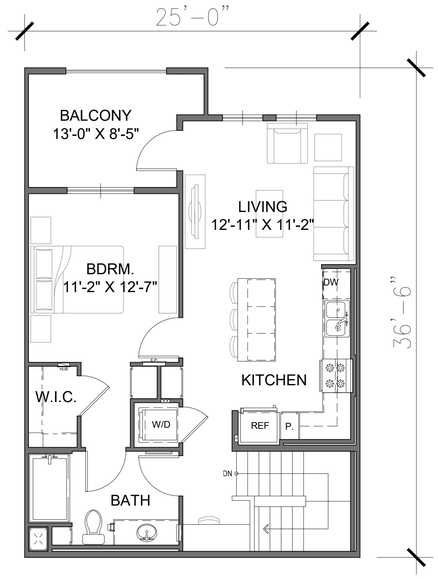
UNIT A3: 1BR/1BA

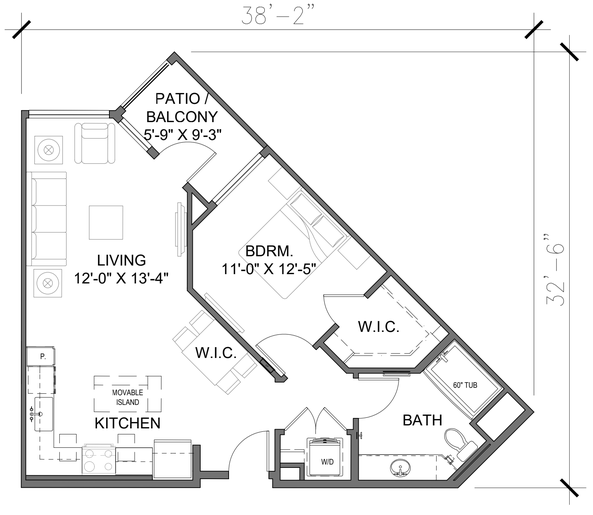
RENTABLE: 766 SQ.FT.
PATIO/BALCONY: 100 SQ.FT.



UNIT A3 LW: 1BR / 1.5BA/ LW

LEVEL 1 AREA: 764 SQ. FT.
LEVEL 2 AREA: 697 SQ. FT.
TOTAL AREA: 1,461 SQ. FT.
BALCONY + PATIO: 100 SQ. FT. + 100 SQ. FT. = 200 SQ. FT.





UNIT A4: 1BR/1BA

RENTABLE: 765 SQ.FT.
PATIO/BALCONY: 54 SQ.FT.

TENNESSEE VILLAGE

REDLANDS, CA 92374

UNIT PLANS 1

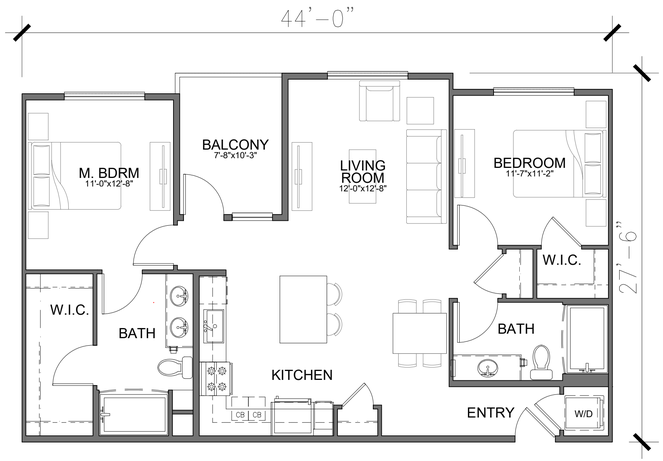
A-3.1

SCALE : 3/16"= 1'-0"
DATE: 10-10-2023
JOB NO.: 2020-322

DIVERSIFIED PACIFIC COMMUNITIES
10621 CIVIC CENTER DRIVE, RANCHO CUCAMONGA, CA 91730
(909) 373-2628

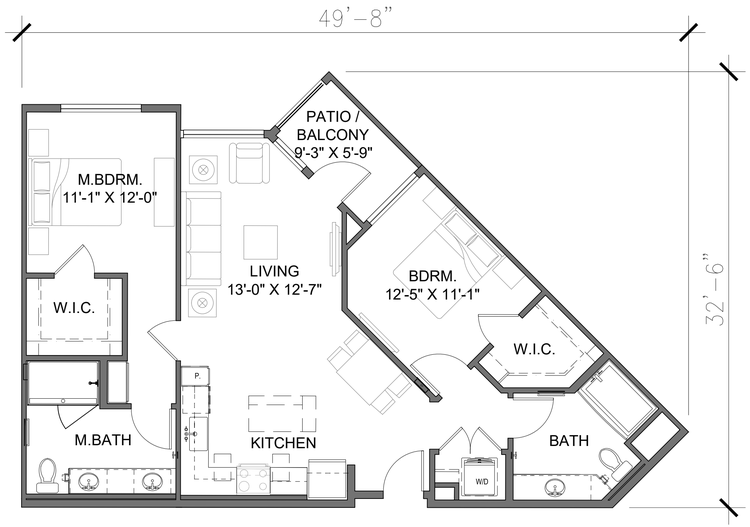
AO ARCHITECTS
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.



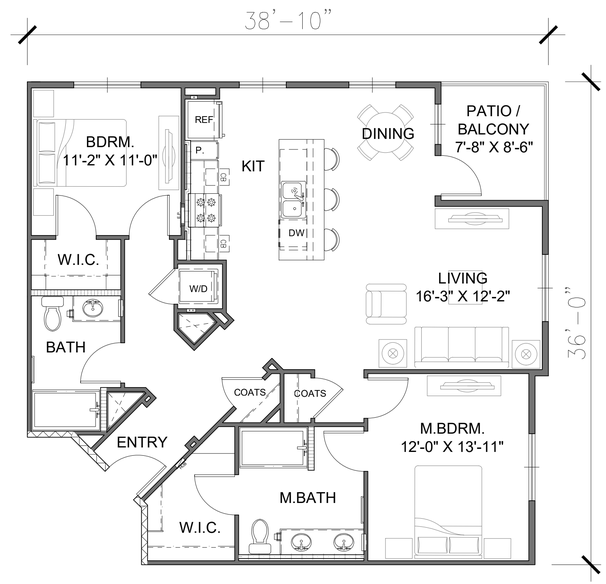
UNIT B1: 2BR/2BA

RENTABLE: 1,097 SQ.FT.
PATIO/BALCONY: 78 SQ.FT.



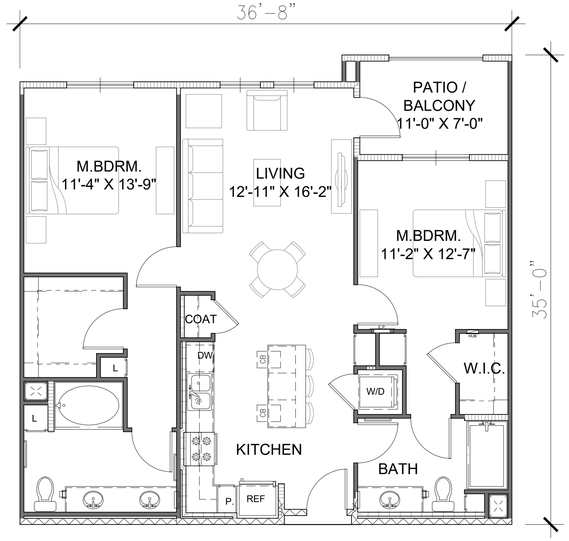
UNIT B3: 2BR/2BA

RENTABLE: 1,111 SQ.FT.
PATIO/BALCONY: 54 SQ.FT.



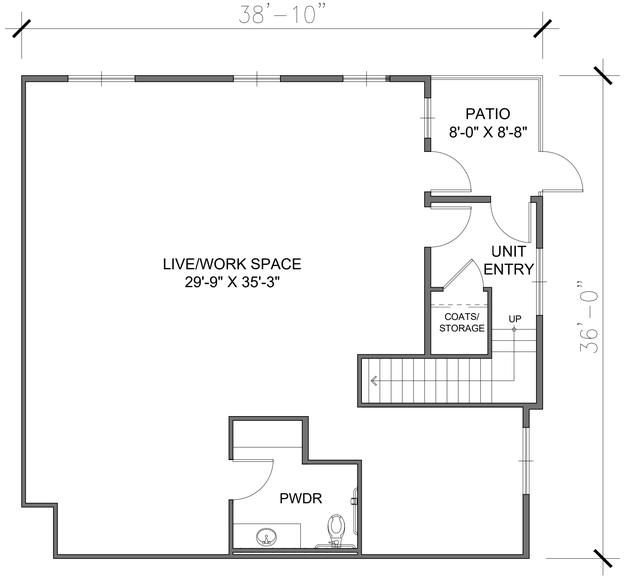
UNIT B4: 2BR/2BA

RENTABLE: 1,246 SQ.FT.
PATIO/BALCONY: 71 SQ.FT.



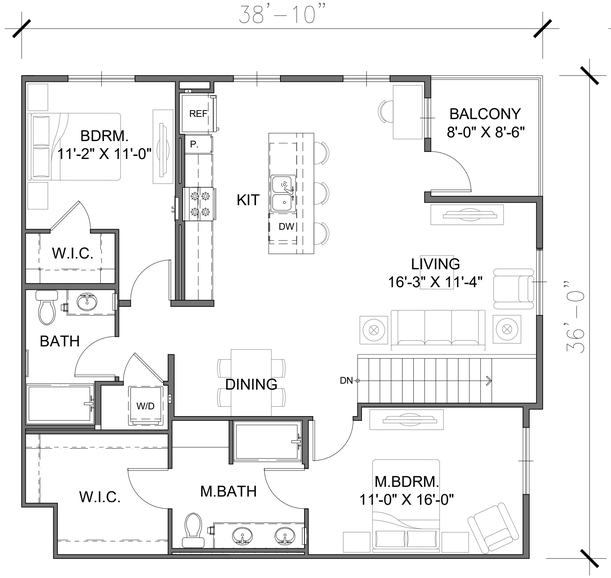
UNIT B5: 2BR/2BA

RENTABLE: 1,145 SQ.FT.
PATIO/BALCONY: 77 SQ.FT.



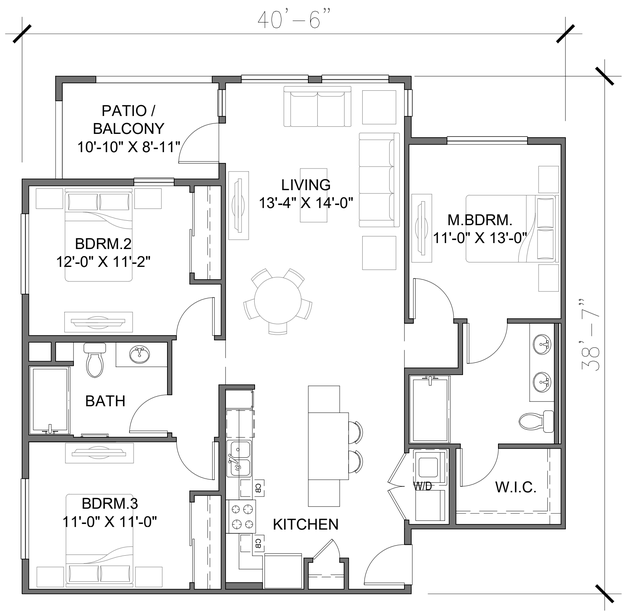
UNIT B4 LW: 2BR / 2.5BA/ LW

LEVEL 1 AREA: 1303 SQ. FT.
LEVEL 2 AREA: 1256 SQ. FT.
TOTAL AREA: 2,559 SQ. FT.
BALCONY + PATIO: 75 SQ. FT. + 75 SQ. FT. = 150 SQ. FT.



UNIT C1: 3BR/2BA

RENTABLE: 1,342 SQ.FT.
PATIO/BALCONY: 84 SQ.FT.



UNIT C1: 3BR/2BA

RENTABLE: 1,342 SQ.FT.
PATIO/BALCONY: 84 SQ.FT.

A-3.2

TENNESSEE VILLAGE

REDLANDS, CA 92374

UNIT PLANS 2

SCALE : 3/16"= 1'-0"
DATE: 10-10-2023
JOB NO.: 2020-322

DIVERSIFIED PACIFIC COMMUNITIES
10621 CIVIC CENTER DRIVE, RANCHO CUCAMONGA, CA 91730
(909) 373-2628

AO ARCHITECTS
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture.
Design.
Relationships.

LEASING / CLUBHOUSE =
+/- 21,090 SQ.FT.

A-4.1

TENNESSEE VILLAGE

REDLANDS, CA 92374

AMENITY FLOOR PLAN

DATE: 10-10-2023
JOB NO.: 2020-322

DIVERSIFIED PACIFIC COMMUNITIES
10621 CIVIC CENTER DRIVE, RANCHO CUCAMONGA, CA 91730
(909) 373-2628

AO ARCHITECTS
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture.
Design.
Relationships.

Fixture	Total Fixture Count	Equivalent DFU	Total Equivalent DFU
Sinks (Kitchen, domestic)	1384	1.5	2076
Toilets (Water Closet, 1.6 GPF Gravity Tank)	729	2.5	1822.5
Tub/Showers (Bathtub or Combination Bath/Shower (fill))	709	4	2836
Dishwasher (Dishwasher, domestic)	461	1.5	691.5
Laundry (Clothes Washer)	460	4	1840
Total	3743		9266

D. TPM 20469 (TRIBUTARY AREA C-1) FIXTURE UNIT MATRIX

TPM 20469

DFU MATRIX

Lugonia Fixture Count

	SINKS	TOILETS	TUB/SHOWERS	DISHWASHER	LAUNDRY	TOTAL UNITS	TOTAL PLANS PLOTTED	TOTAL OVERALL UNITS
PLAN 1	6	3	2	1	1	13	7	91
PLAN 2	6	3	2	1	1	13	42	546
PLAN 3	6	3	2	1	1	13	8	104
PLAN 4	6	3	4	1	1	15	13	195
POOL BLDG	2	2	1	0	0	5	1	5
TOTAL	26	14	11	4	4	59	71	**941**

Fixture	Total Fixture Count	Equivalent DFU	Total Equivalent DFU
Sinks (Kitchen, domestic)	422	1.5	633
Toilets (Water Closet, 1.6 GPF Gravity Tank)	212	2.5	530
Tub/Showers (Bathtub or Combination Bath/Shower (fill))	167	4	668
Dishwasher (Dishwasher, domestic)	70	1.5	105
Laundry (Clothes Washer)	70	4	280
Total	941		2216

E. Table A103.1 AND Chart A103.1(1)

Appendix A Recommended Rules for Sizing the Water Supply System

A101.0 General

A101.1 Applicability

This appendix provides a general procedure for sizing a water supply system. Because of the variable conditions encountered, it is impractical to lay down definite detailed rules of procedure for determining the sizes of water supply pipes in an appendix, which shall necessarily be limited in length. For a more adequate understanding of the problems involved, refer to Water-Distributing Systems for Buildings, Report BMS 79 of the National Bureau of Standards; and Plumbing Manual, Report BMS 66, also published by the National Bureau of Standards.

A102.0 Preliminary Information

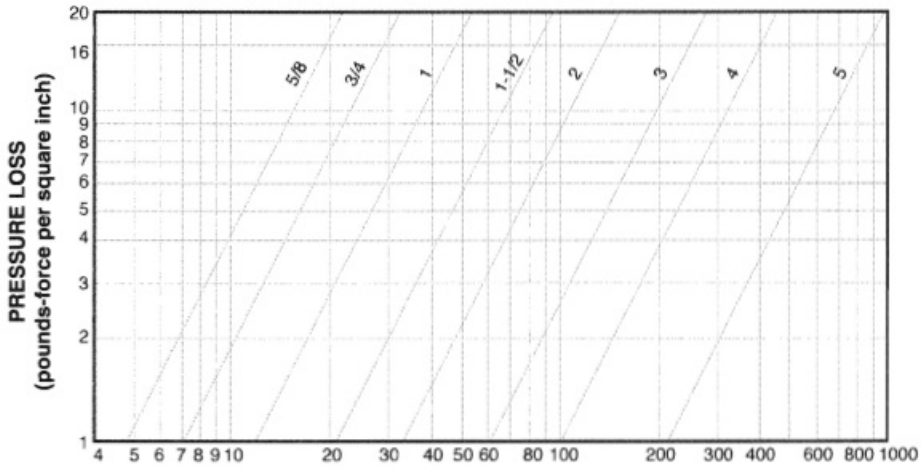
A102.1 Service Pressure

Obtain the necessary information regarding the minimum daily service pressure in the area where the building is to be located.

A102.2 Water Meter

Where the building supply is to be metered, obtain information regarding friction loss relative to the rate of flow for meters in the range of sizes likely to be used. Friction-loss data is capable of being obtained from most manufacturers of water meters. Friction losses for disk-type meters shall be permitted to be obtained from Chart A 102.2.

CHART A 102.2
FRICTION LOSSES FOR DISK-TYPE WATER METERS



For SI units: 1 inch = 25 mm, 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s

A102.3 Local Information

Obtain available local information regarding the use of different kinds of pipe with respect both to durability and to decrease in capacity with length of service in the particular water supply.

A103.0 Demand

Load

A103.1 Supply

Demand

Estimate the supply demand for the building main, the principal branches and risers of the system by totaling the fixture units on each, Table A 103.1, and then by reading the corresponding ordinate from Chart A103.1(1) or Chart A 103.1(2), whichever is applicable.

TABLE A 103.1
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES[3]

APPLIANCES, APPURTENANCES, OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	Private	Public	ASSEMBLY[6]

Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	-
¾ inch Bathtub Fill Valve	¾	10.0	10.0	-
Bidet	½	1.0	-	-
Clothes Washer	½	4.0	4.0	-
Dental Unit, cuspidor	½	-	1.0	-
Dishwasher, domestic	½	1.5	1.5	-
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	-
Hose Bibb, each additionat[7]	½	1.0	1.0	-
Lavatory	½	1.0	1.0	1.0
Lawn Sprinkler, each head[5]	-	1.0	1.0	-
Mobile Home, each (minimum)	-	12.0	-	-
Sinks	-	-	-	-
Bar	½	1.0	2.0	-
Clinical Faucet	½	-	3.0	-
Clinical Flushometer Valve with or without faucet	1	-	8.0	-
Kitchen, domestic	½	1.5	1.5	-
Laundry	½	1.5	1.5	-
Service or Mop Basin	½	1.5	3.0	-
Washup, each set of faucets	½	-	2.0	-
Shower per head	½	2.0	2.0	-
Urinal, 1.0 GPF Flushometer Valve	¾	3.0	4.0	5.0
Urinal, greater than 1.0 GPF Flushometer Valve	¾	4.0	5.0	6.0
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	-	4.0	-
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	5.0	5.0	8.0
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	7.0	8.0	10.0

For SI units: 1 inch = 25 mm

Notes:

[1] Size of the cold branch pipe, or both the hot and cold branch pipes.

[2] Appliances, appurtenances, or fixtures not included in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency

of use.

[3] The listed fixture unit values represent their total load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both cold and hot water connections shall be permitted to each be taken as three-quarters of the listed total value of the fixture.

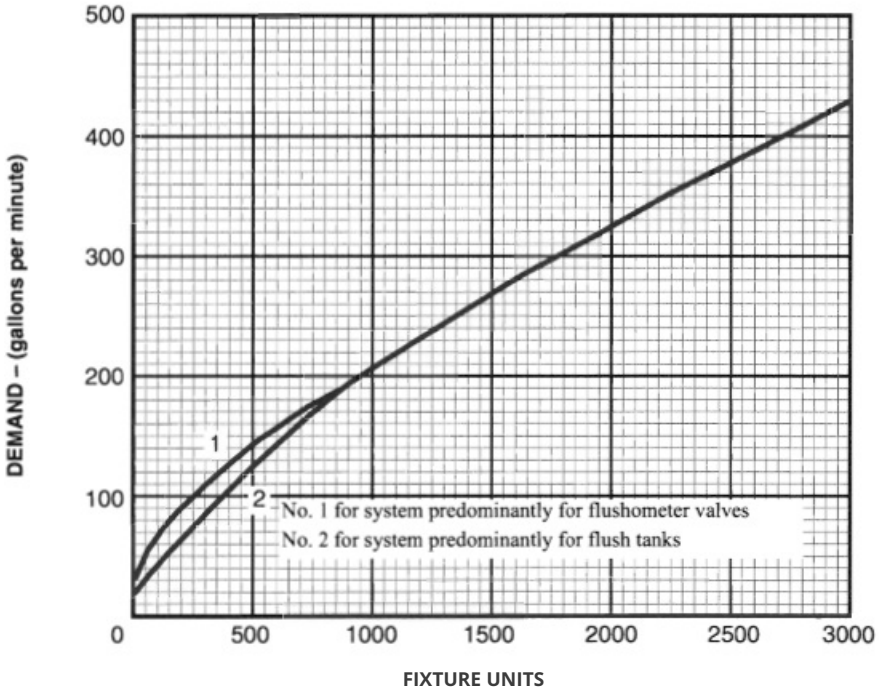
[4] The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

[5] For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s) and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.

[6] Assembly [Public Use (see Table 422.1)].

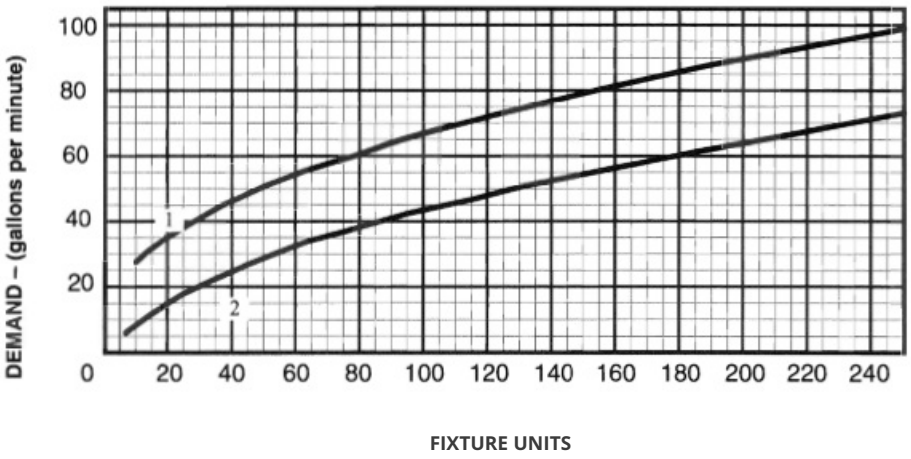
[7] Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

CHART A 103.1(1)
ESTIMATE CURVES FOR DEMAND LOAD



For SI units: 1 gallon per minute = 0.06 L/s

CHART A 103.1 (2)
ENLARGED SCALE DEMAND LOAD



For SI units: 1 gallon per minute = 0.06 L/s

A103.2 Continuous Supply

F. CITY OF REDLANDS SANITARY SEWER SYSTEMS STANDARD SPECIFICATIONS PIPE SIZING CRITERIA

CITY OF REDLANDS

MUNICIPAL UTILITIES & ENGINEERING DEPARTMENT

SANITARY SEWER SYSTEMS STANDARD SPECIFICATIONS

January 2023 Edition

CITY OF REDLANDS
35 CAJON STREET, STE 15A
P.O. BOX 3005
REDLANDS, CA 92373
WWW.CITYOFREDLANDS.ORG/MUED

Less than 2-1/2' of cover – Sewer main and/or laterals shall be Class 150 cast iron pipe with approved mechanical joints.

e. Size and Grades

The minimum pipe size shall be 8 inches. Pipe twelve inches (12") and smaller in diameter shall be designed to flow at ½ full at peak dry weather flow using n = 0.013 in the Manning Formula. Pipe 15 inches (15") and larger in diameter shall be designed to flow at ¾ full at peak dry weather flow using n = 0.013. Minimum slopes for various sizes of pipe are listed below.

8" Pipe at s = 0.0040 feet per foot
10" Pipe at s = 0.0032 feet per foot
12" Pipe at s = 0.0024 feet per foot
15" Pipe at s = 0.0016 feet per foot
18" Pipe at s = 0.0014 feet per foot
21" Pipe at s = 0.0012 feet per foot
24" Pipe at s = 0.0010 feet per foot
27" Pipe at s = 0.0008 feet per foot
30" Pipe at s = 0.0007 feet per foot

All sewers shall be designed for peak flow and using the above design criteria, however the velocity shall be not less than 2.5 feet per second nor greater than 10 feet per second at peak dry weather flow.

For determining the peak rate of flow in a main line sewer, the following tables shall be used with designated land use or persons per acre producing the greater rate of flow as the governing factor. The peak flow shall equal average flow (**Table 3**) x peak factor (**Table 4**).

TABLE 3

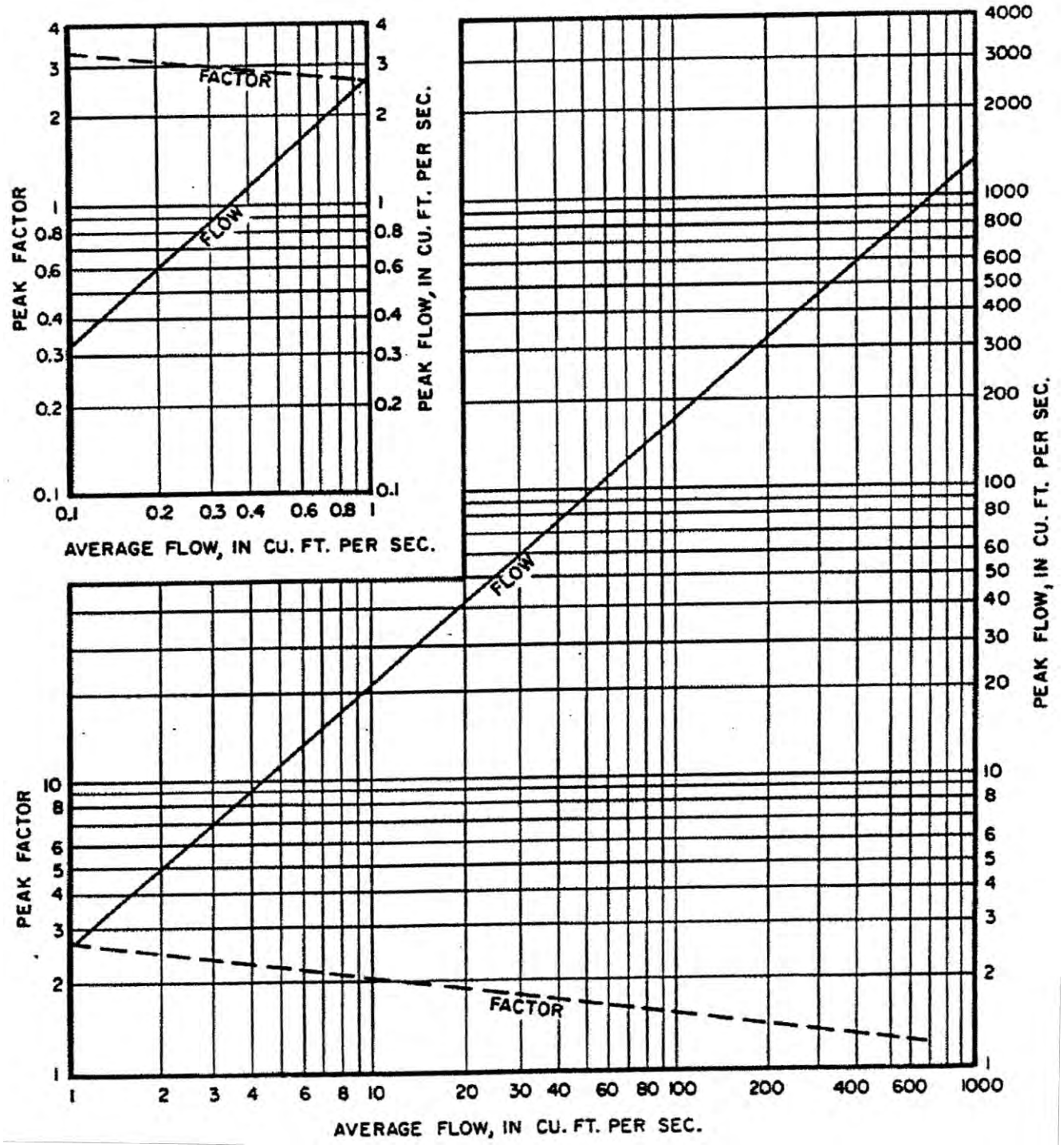
Wastewater Design Flows (Average Flow)

Land Use		**Dwelling Units Per Acre**	**Persons per Dwelling Unit**	**Average Flows (cfs/acre)**
Residential	Hillside	2	3.15	0.00083
	Low Density	4	3.15	0.0017
	Medium Density	10	2.50	0.0033
Commercial	Administrative & Professional			0.0022
	Neighborhood			0.0022
	Freeway Related			0.0022
	General			0.0022
Industrial	Urban Services			0.0022
	Light			0.0022
	General			0.0022
Public Use				0.0022

Those conditions not covered by the above table shall require special study.

TABLE 4

RATIO OF PEAK FLOW TO AVERAGE DAILY FLOW



(AVERAGE FLOW x PEAK FACTOR = PEAK FLOW – cfs)

G. SEWER AS-BUILTS

① **CONSTRUCTION NOTES FOR RAILROAD CROSSING**

1 Contractor shall install 28' of 16" O.D. Steel casing pipe 14' each side of the centerline of existing tracks of the Pacific Electric Railroad or its successers in intrest.

2 Within the Right of Way of the Pacific Electric Railroad, the contractor at his expense shall obtain the necessary permits from said railroads and shall comply with all provisions of said permits. The contractor should note that construction methods (i.e. open trench vs. boring or jacking) shall be specified by the individual railroads.

3 Steel casing shall have a minimum thickness of ¼". It shall be dipped in preservative material and thoroughly coated inside and outside.

4 Within the steel casings, the contractor shall install 8" VCP on Redwood skids banded to the pipe.

5 The contractor shall fill space completely around 8" VCP and steel casings with sand slurry.

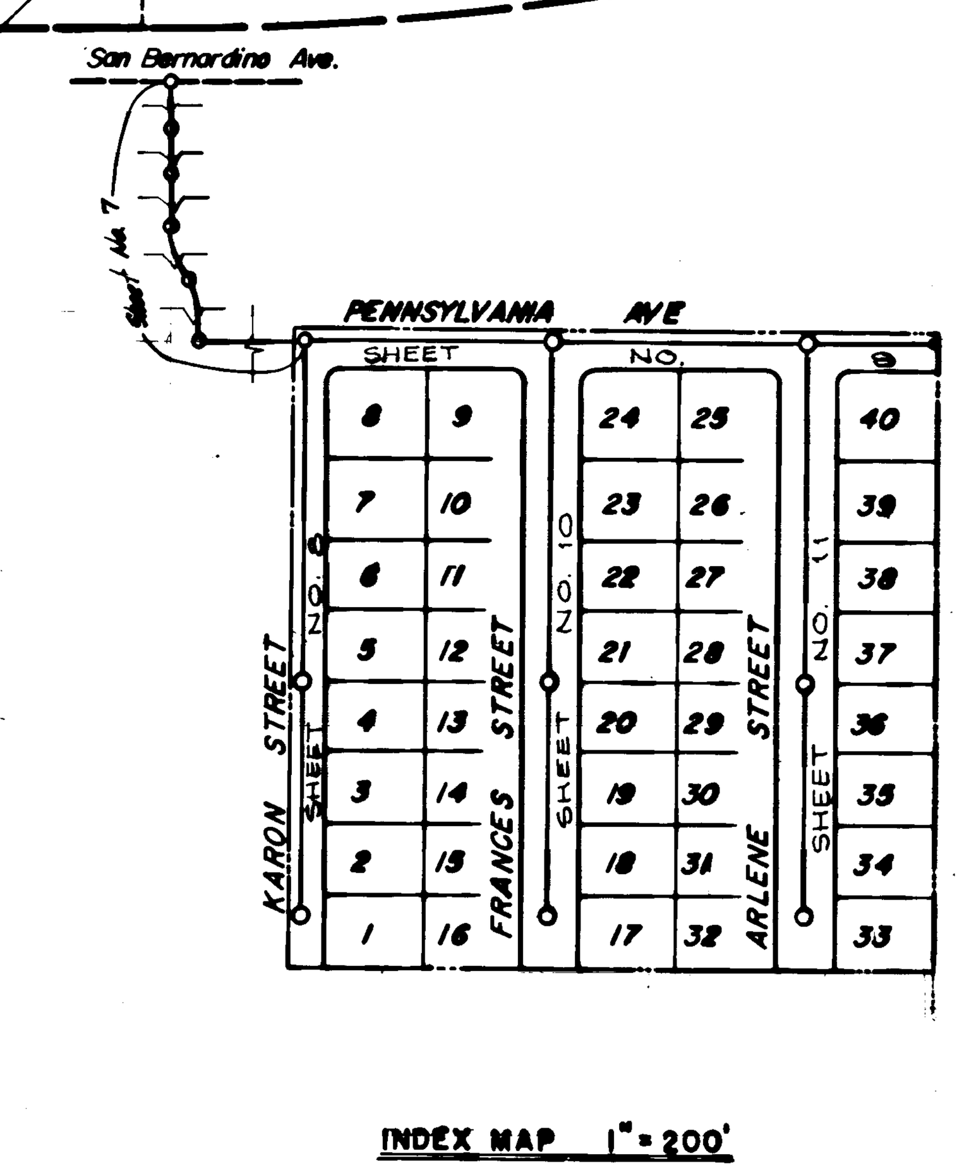
6 If the Railroad is abandoned prior to construction no casing shall be required and standard trenching and construction methods shall be allowed.

GENERAL NOTES

1. Sewer installation is to be in accordance with these plans and the Standards and Detail Drawings of the City of Redlands.
2. All sewer pipe elevations given refer to the flowline invert elevations.
3. The approximate locations of existing underground utility lines are shown on sheets 7 thru 11 of these plans. The lines are plotted from a combination of record and field data. The engineer assumes no liability as to the exact location of such lines nor for utility or irrigation lines not shown. The contractor is to notify all utility and irrigation companies prior to work or excavation to determine the exact locations of underground lines.
4. Sand bedding and backfill to a depth of 12" above pipe may be required if in the opinion of the City, the native backfill material is deemed unsuitable.
5. Sewer lateral locations shall not be changed more than 3' (Horizontal) without authorization from the City.
6. THE CONTRACTOR SHALL AIR TEST THE SEWER SYSTEM IN ACCORDANCE WITH CITY STANDARDS AFTER ALL OTHER UTILITIES HAVE BEEN INSTALLED AND COMPLETED WITHIN THE TRACT OR DEVELOPMENT. IN ADDITION, AFTER FINAL AIR TEST, THE CONTRACTOR SHALL CONNECT THE SEWER LATERALS TO THE HOUSE LATERALS AT THE PROPERTY LINES.
7. P.V.C. SEWER PIPE IS NOT PERMITTED ON ANY HORIZONTAL OR VERTICAL CURVE.

ESTIMATE OF QUANTITIES

ITEM	QUANT.	REMARKS
8" V.C.P. Sewer Main	4633 LF	EXCLUDES LENGTH THRU M.H.
4" Sewer Service Laterals	40 ea.	
Standard Manholes 4'	15 ea.	PER STD. A-95
Standard Cleanout	1 ea.	PER STD. A-102
16" O.D. ¼" steel pipe	28 L.F.	Sewer Encasement for RxR.



REVISIONS

letter	Description	Date	Initial
△	Realigned sewer and added Casing	3/23/79	

CITY OF REDLANDS
DEPARTMENT OF PUBLIC WORKS

TRACT NO. 9877
SEWER IMPROVEMENT PLAN

HICKS & HARTWICK
ENGINEERS-SURVEYORS Date 10/30/78 R.C.E. No. 23362

Designed by: RJS
Date
Checked by:
Date
Drawn by: BWH
Date
Checked by:
Date

Approved: Date 11-3-78
Director of Public Works R.C.E. No. 13963

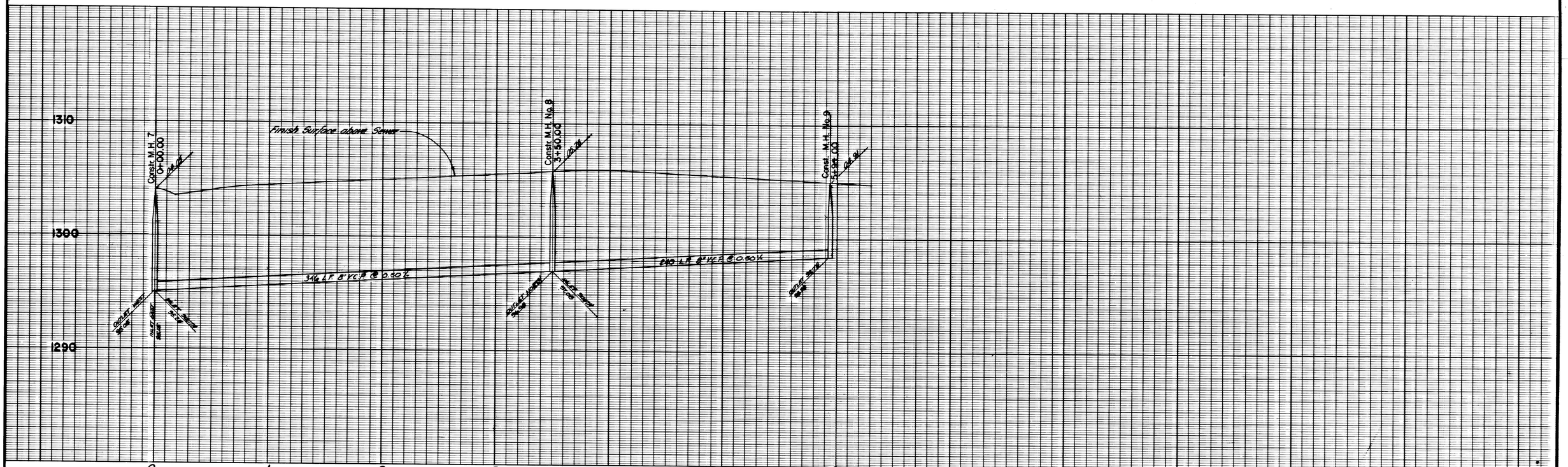
SHEET 7 OF 13 SHEETS

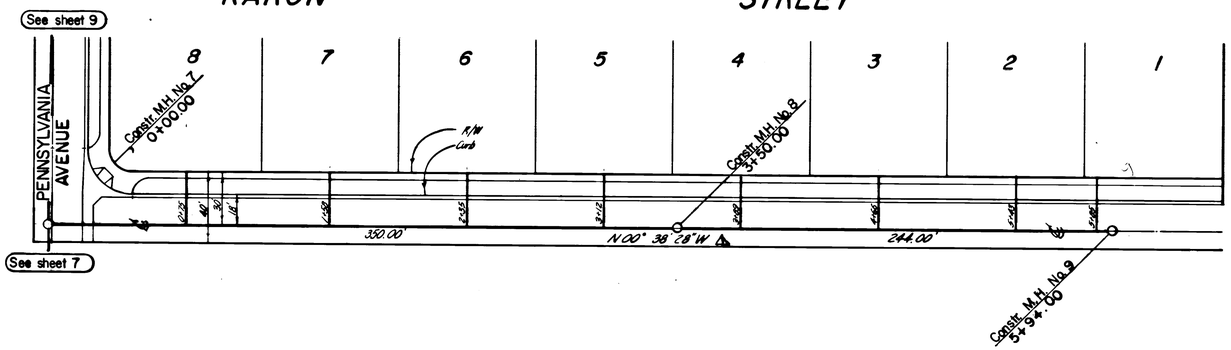
SCALE: HORIZ. 1" = 40' VERT. 1" = 4'

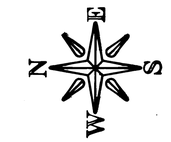
BOOK HH54/50,51 PAGE L-73/34-38

F975-7

7544







letter	Description	Date	Initial
A	Bearing Change	3/24/79	BW

REVISIONS

CITY OF REDLANDS
DEPARTMENT OF PUBLIC WORKS

TRACT NO. 9877
SEWER IMPROVEMENT PLAN
KARON STREET

HICKS & HARTWICK
ENGINEERS-SURVEYORS Date 10/30/78 R.C.E. No. 23582

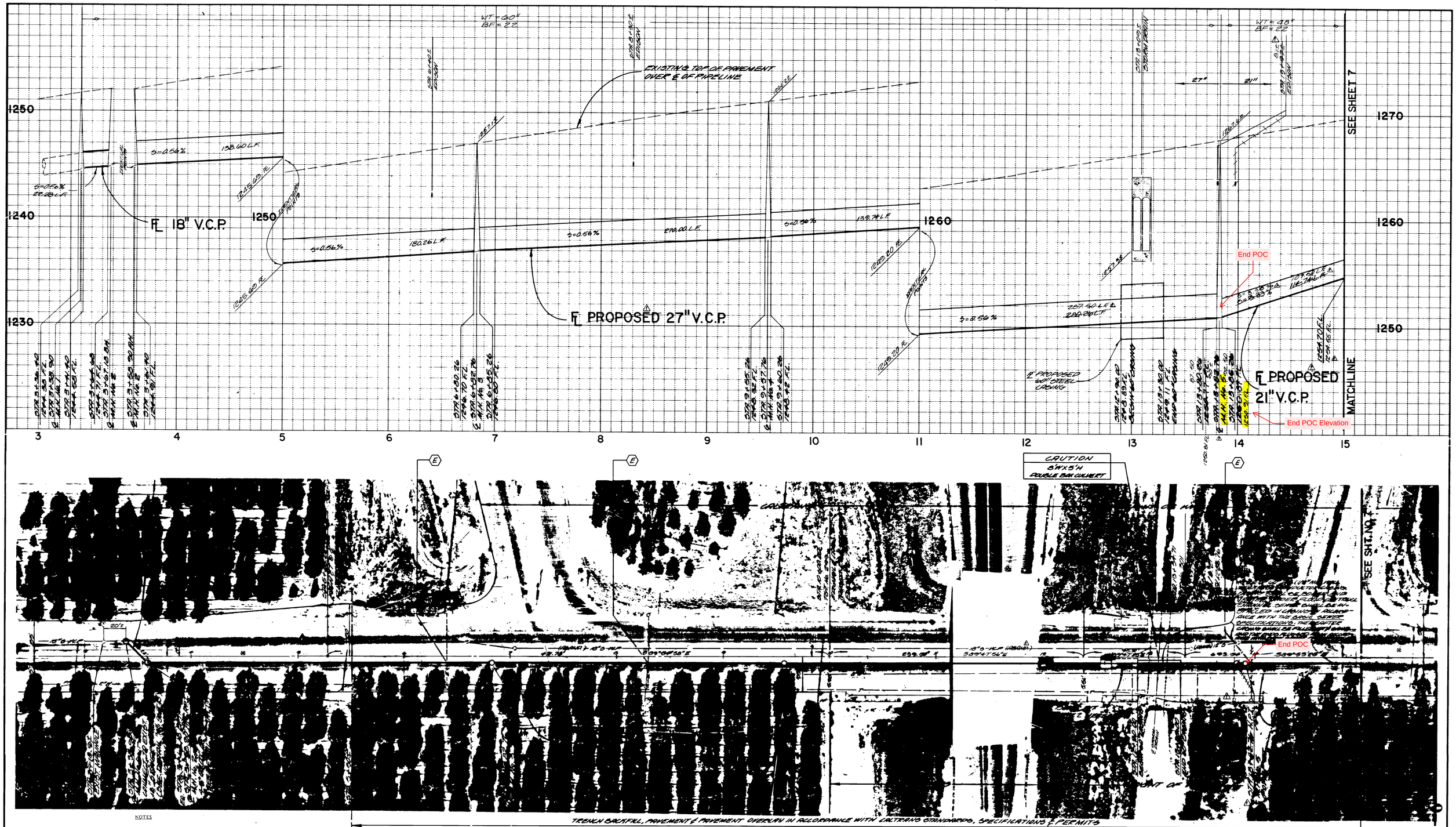
Designed by: RVB
Date
Checked by:
Date
Drawn by: BWH
Date
Checked by:
Date

Approved: Date 11-3-78
Director of Public Works R.C.E. No. 13

SHEET 8 OF 13 SHEETS
SCALE: HORIZ. 1"=40'
VERT. 1"=4'
BOOK HH54/50,51 PAGE L-73/34-38

F975-8

7544



NOTES

1. CONTRACTOR SHALL VERIFY ELEVATION OF EXISTING 15" SEWER AT CONNECTION POINT PRIOR TO STARTING CONSTRUCTION. CONTRACTOR SHALL ADJUST M.H. NO. 2 ELEVATION TO ACCOMMODATE ACTUAL ELEVATION OF EXISTING 15" SEWER.
2. CONTRACTOR SHALL VERIFY ELEVATION OF EXISTING 15" SEWER AT CONNECTION POINT (STA. 3+38.90) PRIOR TO STARTING EXCAVATION OF THE BORING AND JACKING PIT. CONTRACTOR SHALL ADJUST CASING ELEVATION AS DIRECTED BY OWNER TO ACCOMMODATE ACTUAL ELEVATION OF EXISTING 15" SEWER.

BENCH MARK

A chiseled "□" on B.C.R. of the southwest curb return of Orange St. and Pennsylvania Ave.

Elevation 1364.23

RECORD DRAWING
KRIEGER & STEWART
BY: Mark E. Messersmith DATE: 11-27-89

APPROVED

C.E.NO. 30037 — DATE 10/10/88

C.E.NO. 22420 — DATE 10-21-88

SYM	REVISIONS	DATE	BY
△	RECORD DRAWING	9/7/89	MEM

• KRIEGER & STEWART •
INCORPORATED
ENGINEERING CONSULTANTS
RIVERSIDE, CALIFORNIA (714) 684-6900

APPROVED BY Mark E Messersmith
REGISTERED ENGINEER NO 22020 DATE 10-10-88

REGISTERED PROFESSIONAL ENGINEER MARK E. MESSERSMITH No. 22020 (Exp. 9-30-89) CIVIL STATE OF CALIFORNIA

SCALE	HORIZ. 1"=40' VERT. 1"=4'
FIELD BOOK	44/05-07
DESIGNED	M.E.M./M.P.T.
DRAWN	G.K.B.
CHECKED	M.E.M./J.C.R.

CITY OF REDLANDS
MUNICIPAL UTILITIES DEPARTMENT

27" & 21" SAN BERNARDINO AVE. TRUNK SEWER

STA. 3+38.9 ± TO STA. 15+00

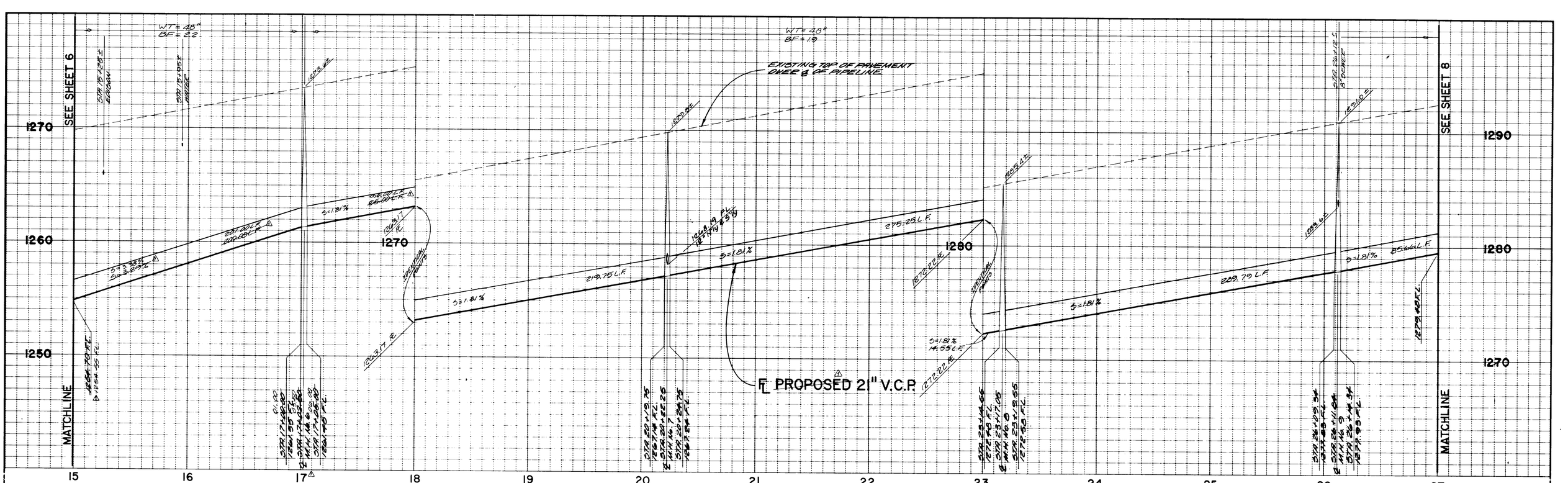
SHEET No. 6 OF 17 SHEETS

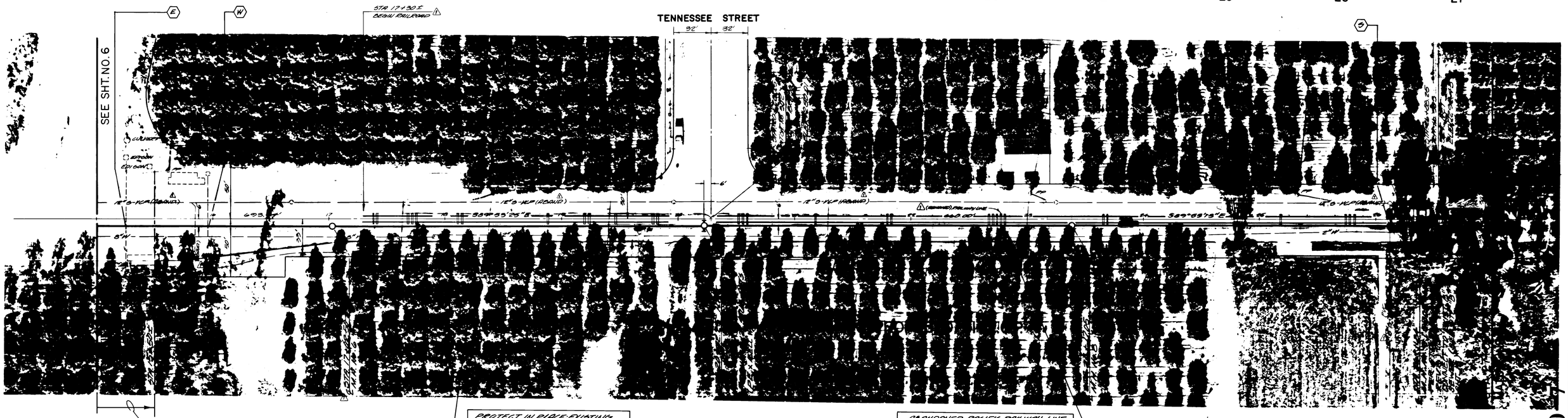
F 1276

4-7430
PROJECT No.

F 1370-D

497-4





TRENCH BACKFILL, PAVEMENT & PAVEMENT OVERLAY IN ACCORDANCE WITH CALTRANS STANDARDS, SPECIFICATIONS & PERMITS

PROTECT IN PLACE: EXISTING ROLL CURB, CONCRETE GUTTER AND TREES

SAN BERNARDINO AVENUE

ABANDONED PACIFIC RAILWAY LINE REMOVE AS REQUIRED FOR CONSTRUCTION

RECORD DRAWING
KRIEGER & STEWART
BY: Mark F. Messersmith DATE: 11-27-89

F 1370

BENCH MARK

A chiseled "□" on B.C.R. of the southwest curb return of Orange St. and Pennsylvania Ave.

Elevation 1364.23

APPROVED

C.E.NO. 30037 — DATE 10/21/88

C.E.NO. 22420 — DATE 10-21-88

SYM	REVISIONS	DATE	BY
△	RECORD DRAWING	9/7/89	MEM

• KRIEGER & STEWART •
INCORPORATED
ENGINEERING CONSULTANTS
RIVERSIDE, CALIFORNIA (714) 684-6900

APPROVED BY Mark F. Messersmith
REGISTERED ENGINEER Nº 22020 DATE 10-18-88

REGISTERED PROFESSIONAL ENGINEER MARK F. MESSERSMITH No. 22020 Exp. 9-30-89 CIVIL STATE OF CALIFORNIA

SCALE HORIZ. 1"=40' VERT 1"=4'	
FIELD BOOK	14/95-97
DESIGNED	M.E.M./M.P.T.
DRAWN	G.K.B.
CHECKED	M.E.M./J.C.R.

CITY OF REDLANDS
MUNICIPAL UTILITIES DEPARTMENT

21" SAN BERNARDINO AVE. TRUNK SEWER

STA. 15+00 TO STA. 27+00

SHEET 7 OF 17 SHEETS

F 1276

4-7430 PROJECT No.

497-4

H. BENTLEY FLOWMASTER CALCULATIONS

Worksheet for POC 1 to POC 2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.014	ft/ft
Diameter	8.0	in
Discharge	26.30	gpm

Results		
Normal Depth	1.1	in
Flow Area	0.0	ft²
Wetted Perimeter	0.5	ft
Hydraulic Radius	0.7	in
Top Width	0.46	ft
Critical Depth	1.3	in
Percent Full	13.8	%
Critical Slope	0.007	ft/ft
Velocity	2.01	ft/s
Velocity Head	0.06	ft
Specific Energy	0.15	ft
Froude Number	1.405	
Maximum Discharge	690.29	gpm
Discharge Full	641.71	gpm
Slope Full	0.000	ft/ft
Flow Type	Supercritical	

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	13.8	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.1	in
Critical Depth	1.3	in
Channel Slope	0.014	ft/ft
Critical Slope	0.007	ft/ft

Worksheet for POC 2 to POC 3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.014	ft/ft
Diameter	8.0	in
Discharge	78.40	gpm

Results		
Normal Depth	1.9	in
Flow Area	0.1	ft²
Wetted Perimeter	0.7	ft
Hydraulic Radius	1.1	in
Top Width	0.57	ft
Critical Depth	2.3	in
Percent Full	23.6	%
Critical Slope	0.006	ft/ft
Velocity	2.78	ft/s
Velocity Head	0.12	ft
Specific Energy	0.28	ft
Froude Number	1.470	
Maximum Discharge	690.29	gpm
Discharge Full	641.71	gpm
Slope Full	0.000	ft/ft
Flow Type	Supercritical	

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	23.6	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.9	in
Critical Depth	2.3	in
Channel Slope	0.014	ft/ft
Critical Slope	0.006	ft/ft

Worksheet for POC 3 to POC 4

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.014	ft/ft
Diameter	15.0	in
Discharge	1,868.00	gpm

Results		
Normal Depth	7.9	in
Flow Area	0.7	ft²
Wetted Perimeter	2.0	ft
Hydraulic Radius	3.9	in
Top Width	1.25	ft
Critical Depth	9.9	in
Percent Full	52.6	%
Critical Slope	0.007	ft/ft
Velocity	6.36	ft/s
Velocity Head	0.63	ft
Specific Energy	1.29	ft
Froude Number	1.549	
Maximum Discharge	3,690.08	gpm
Discharge Full	3,430.38	gpm
Slope Full	0.004	ft/ft
Flow Type	Supercritical	

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	52.6	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.9	in
Critical Depth	9.9	in
Channel Slope	0.014	ft/ft
Critical Slope	0.007	ft/ft