APPENDIX J.1

Sewer and Water Study

SEWER & WATER STUDY

Fairmount Avenue Fire Station

APN 541-190-16
Parcel Map 283
47th Street
City of San Diego, CA 92105

October 28, 2024

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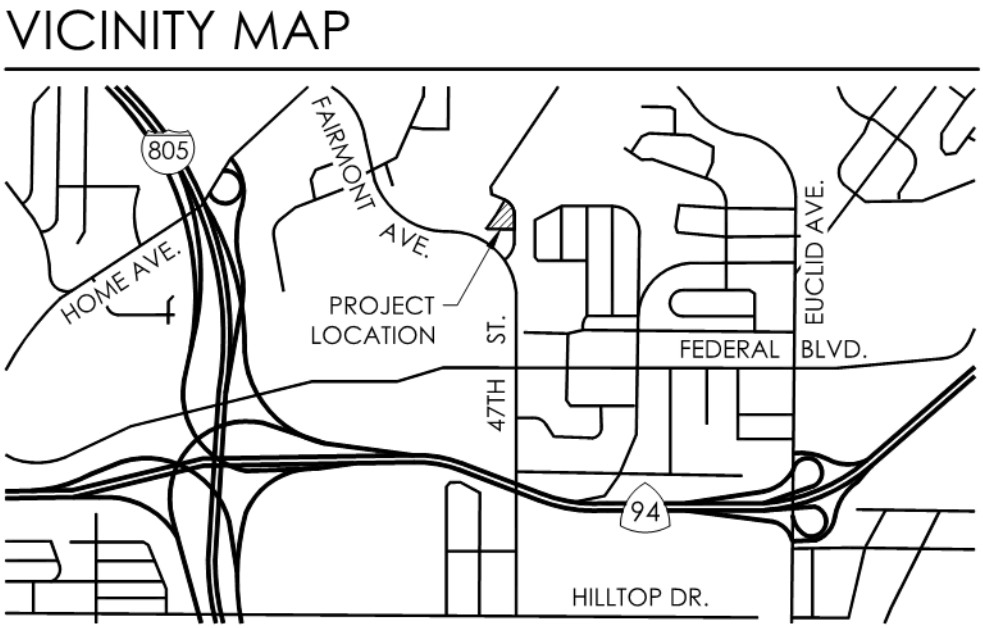
2 INTRODUCTION

The project proposed is a 1.28-acre 3-story fire station. The fire station is loaded from a single driveway. The 9-stall parking lot is accessed from a separate driveway. Only 30% of the site will be disturbed.

3 PROJECT LOCATION

The proposed project is located north of Fairmount Avenue and West of 47th Street from the intersection of Fairmont Avenue and 47th. The project is within the City of San Diego, in the R-1-7 zoning designation.

3.1 VICINITY MAP



4 PROJECT DESCRIPTION

The proposed fire station includes a 3-story station with 2 apparatus bays, exercise room, kitchen, and 10 bunk rooms. The station will also be serviced by a trash enclosure, an emergency generator, and a fuel tank.

5 TOPOGRAPHY

The site is heavily sloped. The slopes onsite generally descend from 194.0 in the southeast to 140.0 in the northwest. Over 40% of the slopes onsite have a grade over 25%. An existing storm drain from 47th St. daylights at the bottom of the site slope and drains offsite.

6 WATER AND SEWER SERVICE DESCRIPTION

The project is located within the City of San Diego water and sewer service boundary. An existing 8" water main is located in 47th Street. Per the City's Public Utilities Department, the existing pressure is 104psi.

Domestic Water Service will be provided with a 2" Water Service and Meter and a 2.5" Reduced Pressure Backflow Device and lateral.

Irrigation Service will be provided with a 2" Water Service and Meter and a 2.5" Reduced Pressure Backflow Device and lateral.

Fire Service will be provided with a 6" Water Service and a 6" Reduced Pressure Backflow Device and Lateral.

Sanitary Sewer Service will be provided with a 6" lateral and a clarifier.

A separate Sanitary Sewer Service will be provided for the trash enclosure drain with a 6" lateral.

7 WATER AND SEWER DESIGN CRITERIA

The City of San Diego Water Department Facility Design Guidelines (2021) and the City of San Diego Sewer Design Guide (2015) were used to develop water and sewer demands.

8 PROJECTED WATER AND SEWER DEMANDS

8.1 SEWER DEMAND

The sewer demand was calculated per the demand equations as found in the City of San Diego Sewer Design Guide Section 1.3.2. The proposed sewer demand methodologies are as follows:

8.1.1 Onsite Sewer Demand

$A_n = 0.8 \times A_g = 0.8 \times 1.28 = 1.02\ ac$

$P = D_P \times A_n = 31.5 \times 1.02 = 32.1\ persons$

$ADWF = 80 gpcpd \times P = 80 \times 32.1 = 2568\ gpd = 1.78\ gpm$

$Peaking\ Factor = 6.2945 \times P^{-0.1342} = 6.2945 \times 32.1^{-0.1342} = 3.95$

$Peak\ Dry\ Weather\ Flow = ADWF \times Peaking\ Factor = 1.78 \times 3.95 = 7.03\ gpm = 10{,}123\ gpd = 0.0156\ cfs$

Where:
$P = Residential\ Population$
$D_P = Population\ Density\ of\ Zone\ RS - 1 - 7\ in\ persons\ per\ net\ acre$
$A_n = Net\ Project\ Area\ in\ acres\ (ac)$
$A_g = Gross\ Project\ Area\ in\ acres\ (ac)$
$ADWF = Average\ Dry\ Weather\ Flow$
The proposed sewer demands are as follows:

- 1 Sanitary Sewer = 7.03 GPM
- 1 Trash Drain = 0.2 GPM
- Total = 7.23 GPM = 10,411 gpd= 0.016 cfs

8.1.2 Offsite Sewer Demand

The existing upstream sewer system has been analyzed using the projected flows from the surrounding residential areas. The existing sewer generation rates have been calculated by the number of dwelling units determined by city zoning maps. The existing downstream sewer line has been analyzed using the combined flows from the existing and proposed sewer flows. Section 1.7.1 requires that the projected peak wet weather flow from the proposed new development is less than 10% of the total flow and does not require additional sewer study as the Sewer Design Guide dictates.

Upstream Demand

$$DU = 150\ units$$

$$P = D_U \times DU = 3.5 \times 150 = 525\ persons$$

$$ADWF = 80 gpcpd \times P = 80 \times 525 = 42{,}000\ gpd$$

$$Peaking\ Factor = 6.2945 \times P^{-0.1342} = 6.2945 \times 525^{-0.1342} = 2.71$$

$$Peak\ Dry\ Weather\ Flow = ADWF \times Peaking\ Factor = 42{,}000 \times 2.71 = 114{,}068\ gpd = 0.176\ cfs$$

Where:
$P = Residential\ Population$
$D_U = Population\ Density\ of\ Zone\ RS-1-7\ in\ persons\ per\ dwelling\ unit$
$DU = Number\ of\ Dwelling\ Units$
$ADWF = Average\ Dry\ Weather\ Flow$

Downstream Demand

$$Downstream\ Peak\ Dry\ Weather\ Flow = Upstream\ Peak\ Dry\ Weather\ Flow + Proposed\ Peak\ Dry\ Weather\ Flow$$
$$= 114{,}068 + 10{,}411 = 124{,}479\ gpd = 0.192\ cfs$$

The Peak wet weather flow factor used was 1.0, so the peak wet weather flow is the same as the dry weather flow. Therefore, the proposed flow added to the downstream sewer system is 8.3% of the total flow, which meets the criteria of section 1.7.1.

8.2 SEWER CAPACITY

The City of San Diego Sewer Design Guide per section 1.3.3.1 requires that the minimum allowable velocity is 2 ft/s and the maximum allowable velocity is 10 ft/s. Section 1.3.3.3 requires that the ratio of depth of flow to pipe diameter (d_n/D) is less than 0.5 for new sewer mains that are 15 inches or smaller.

To determine velocity (V) and normal depth (D_n), Circular Channel Ratios were used.

$$R = \frac{D}{4} = 8"/4 = 2" = .166'$$

$$V_{full} = \left(\frac{1.49}{n}\right)\left(R^{\frac{2}{3}}\right)\left(\sqrt{S}\right) = \left(\frac{1.49}{.013}\right)\left((0.166)^{\frac{2}{3}}\right)\left(\sqrt{0.068}\right) = 9\ \frac{ft}{s}$$

$$Q_{full} = V_{Full} \times A = 9\ \times\ 0.35 = 3.15\ cfs$$

Based on the downstream flow $\frac{Q}{Q_{full}} = 0.061$, the corresponding values from the circular ratio chart per figure 1 are:

$$\frac{d_n}{D} = 0.2\ \ and\ \ \frac{V}{V_{full}} = 0.54$$

Therefore

$$d_n = 0.20\ \times D = 0.20\ \times 8" = 1.6"$$

$$V = 0.58\ \times V_{full} = 0.54\ \times 9 = 4.86\ ft/s$$

Where:
$R = Hydraulic\ Radius$
$S = Slope$
$D = Diameter$
$A = Area\ of\ Pipe$
$V_{full} = Velocity\ in\ a\ full\ pipe$
$Q_{full} = Flow\ in\ a\ full\ pipe$
$V = Projected\ Velocity$
$Q = Projected\ Flow$
$d_n = depth\ of\ flow\ in\ pipe$

The projected flow of the downstream sewer line has a depth to diameter ratio of 0.2 which is less than 0.50, and it has a velocity of 4.86 ft/s which is between 2 ft/s and 10 ft/s. These properties meet the requirements of section 1.3.3.1 and 1.3.3.3.

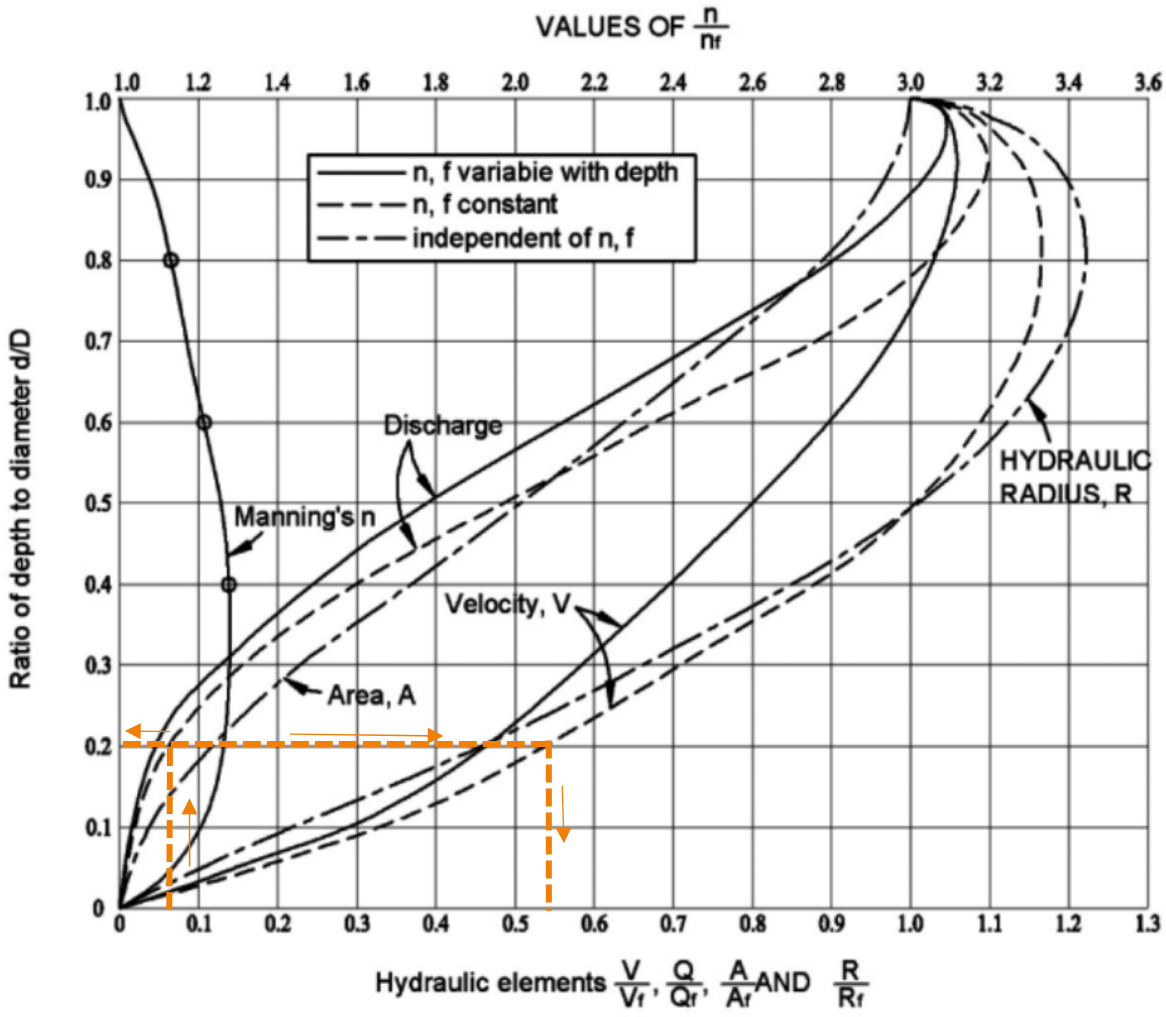


Figure 1. Circular Channel Ratio Chart

8.3 WATER DEMAND

The water demand was calculated per the demand equations as found in the City of San Diego Water Department Facility Design Guidelines Chapter 2. The proposed water demand methodologies are as follows:

$A_n = 0.8 \times A_g = 0.8 \times 1.28 = 1.02\ ac$

$P = D_P \times A = 32 \times 1.02 = 32.64\ persons$

Where:
$P = Residential\ Population$
$D_P = Population\ Density\ of\ Zone\ R-1-7\ in\ persons\ per\ net\ acre$
$A_n = Net\ Project\ Area\ in\ acres\ (ac)$
$A_g = Gross\ Project\ Area\ in\ acres\ (ac)$

$W_R = P \times w_R = 32.64 \times 150 = 4896\ gpd$

Where:
$W_R = Water\ Demand, Residential\ in\ gallons\ per\ day\ (gpd)$
$w_R = Unit\ Water\ Demand, Residential\ in\ gallons\ per\ person\ per\ day$

$W_O = A \times w_L = 1.02 \times 5000 = 5100\ gpd$

Where:
$W_O = Water\ Demand, Other\ in\ gallons\ per\ day\ (gpd)$
$w_L = Unit\ Water\ Demand\ for\ Each\ Land\ Use\ in\ gallons\ per\ acre\ per\ day$

Average Domestic Water Demand
$W_{AVG} = W_R + W_O = 4896 + 5100 = 10996\ gpd$

Peak Hour Domestic Water Demand
$W_P = W_{AVG} * Peak\ Day\ Factor * 1.5 = 10996 * 4.2 * 1.5 = 69275\ gpd$

Maximum Day Domestic Water Demand
$W_M = W_{AVG} * Peak\ Day\ Factor = 10996 * 1.5 = 16494\ gpd$

Fire Water Demand
Table 2-3: 3,000 *gpm*

Irrigation Water Demand
75 *gpm*