1430 Decision Street Redevelopment Project – Planning Case No. P21-0339

Technical Reports PART 2

1. Hydrology Study – December 9, 2021
2. Storm Water Quality Management Plan – December 9, 2021

PRELIMINARY HYDROLOGY STUDY
FOR
LBA DECISION STREET

ENGINEER OF WORK

EXCEL ENGINEERING
440 State Place
Escondido, CA 92029
(760) 745-8118
Project No. 21-052

PREPARED
September 13, 2021

REVISED
December 09, 2021

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

4/12/22

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1.0 Project Description

1.1 Project Purpose

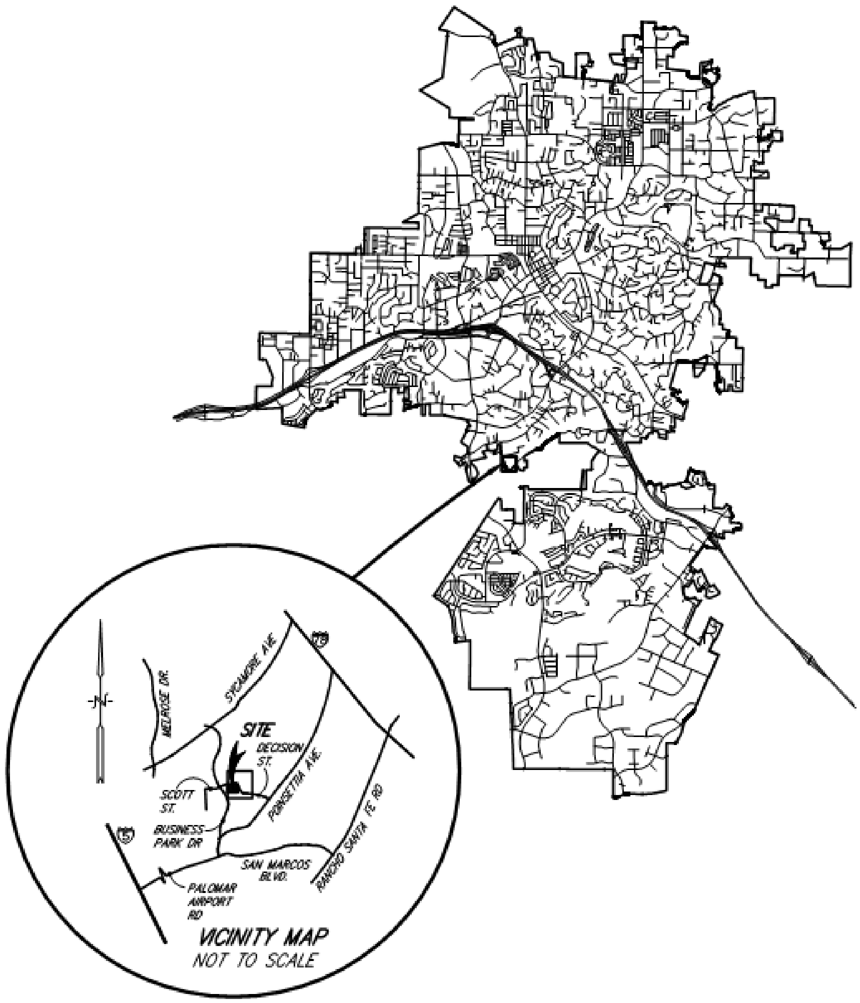
The objective of this study is to determine the amount of 100 year runoff that the existing site is generating right now and compare it to the 100 year runoff that the proposed project will be generating. We will also calculate adequacy of the proposed storm drain facilities and mitigation measures.

1.2 Project Proposed Facilities

The **8.87** acre commercial project site is located south of Scott Street in Vista, California . The site currently has a building and parking lot. The project site is face to Scott Street to the north and bordered by Business Park Drive to the west and Decision Street to the east. The present site configuration, consist of a relatively level building pad bordered by fill slopes descending to the west, north and north east. The fill slopes have a gradient of about 2:1 (horizontal:vertical). The site is bordered at the south and southeast by cut slopes with a gradient of about 2:1 (horizontal;vertical).

The project is proposing to build an approximately **5.96** acre of building and parking lot. As part of this project, associated improvements will include a biofiltration basin located at the south west corner of the project site. All necessary utilities (storm, sewer, water, etc.) will be installed as part of the project.

2.0 Vicinity Map



3.0 Site Map

Please see Attachment 1 – Site Map

4.0 Description of Watershed

4.1 Existing Conditions Topography

The site is an existing general industrial site composed of a parking lot. The project fronts onto Scott Street. The existing onsite parking lot drainage stormwater flows to the existing storm drain system located at Business Park Drive.

The site of the pre development condition is considered as empty pad. Per the soils report, all fills within the upper 15' of the pad were compacted to a minimum 95 % compaction levels. These areas cannot be considered as undisturbed natural terrain. Since Table 3-1 of the San Diego County Hydrology Manual does not have compacted pad in classification of land use, we are going to estimate the runoff coefficient C for these areas. Undisturbed soil around the project area has a natural compaction of around 80%. By ratio and proportion: 0.35/80% = C/90%, which C = 0.41.

4.2 Existing Conditions + Project Conditions Topography

This project proposed to install a building with a parking lot. At the southwest corner of the site, this project is proposed to build a biofiltration basin for storm water quality. At the east side of the biofiltration basin, five barrels of 48'' storage pipe with 242 ft long of each one is connected with the biofiltration basin to incorporate the collection of storm water from the building and the parking lot and direct the storm water through a storm water drainage pipe to POC, which is located at the west side of the study site. The tributary offsite area is located at the southeast corner of the site with approximately 1.97 acres total. The offsite with drain from the southern portion of the site, captured in an F-Type box and conveyed underground through a pipe to discharge at the POC.

The land use of the post development onsite condition is general industrial. From Table 3-1 "RUNOFF COEFFICIENTS FOR URBAN AREA", values of general industrial are used in post development onsite hydrology calculations.

The offsite of post development condition is mostly empty pad. Per the soils report, all fills within the upper 15' of the pad were compacted to a minimum 95 % compaction levels. These areas cannot be considered as undisturbed natural terrain. Since Table 3-1 of the San Diego County Hydrology Manual does not have compacted pad in classification of land use, we are going to estimate the runoff coefficient C for these areas. Undisturbed soil around the project area has a natural compaction of around 80%. By ratio and proportion: 0.35/80% = C/90%, which C = 0.41.

As calculated below and summarized further in section 6, the pre-development discharges a peak 100-year flows of 16.827 CFS. The project proposed post-development discharge a peak 100-year flows of 28.846 CFS, which need storage detention in post development. After mitigation, the peak 100-year flow of the post-development is 15.354 CFS. The baffle structure is making detention in the post mitigated development condition. The baffle is used for both hydrology and hydromodification analysis (see SWQMP report).

4.3 Hydrologic Unit Contribution
The project site is within CARLSBAD HU, Agua Hedionda HA, Los Monos HAS.

5.0 Methodology

This report is prepared in accordance with the 2003 San Diego County Hydrology Manual. Based on the overall tributary study area, calculations are based on the Rational Method.

5.1 Hydrology Software

We are using **the CivilCadd**/CivilDesign® software to analyze the runoff. The module we are using is the one for the *San Diego County Flood Control Division 2003 Hydrology Manual.* Please see the detailed hydrology calculations in Attachment 6.

5.2 Routing Software

Hydraflow Hydrographs Extension for Autodesk Civil 3D, Version 2021 is used for hydrologic routing of the entire project site. The hydrograph developed from the rational method is then manually entered into this software and routed into each detention pipe. The hydrograph report can be found in Attachment 7 in this report.

5.3 Soil Type Determination

The soil type for the proposed project was determined by mapping the project limits on the EPA Web Soil Survey website. The Web soil Survey indicate that the entire site is composed of soil type C and D. The soil report and soil index map can be found in Attachment 3 of this report.

5.4 Isopluvial Value Determination

The isopluvial values for the 100-year 6 hour and 24 hour storm events were determined by plotting the projects location on the respective exhibits from appendix B of the Hydrology Manual. The rainfall isopluvial maps can be found in Attachment 3 of this report.

6.0 Calculations

The existing 100-year peak flowrates of the site is 16.827 CFS, the intent of the post-development calculation done as part of this report is to verify the 100-year flowrates expected from the post-developed conditions are lower than the pre-developed conditions. These numbers will be used to size the proposed storm drainage pipes and to doublecheck if the existing storm drain outlet facilities are adequate.

6.1 Calculate Runoff Coefficient

The runoff coefficients for each of the drainage areas are taken from Table 3-1 of the Hydrology Manual. Based on the EPA Web Soil Survey, this project site is in type C and type D soil. The runoff coefficient C is based on the land use for this project. **General Industrial** is assumed for the post-development calculations. Table 3-1 is included in the

CIVILD software, and the values chosen based on the program input parameters. The output file was checked to ensure that the correct C values are used.

In order to not have a negative impact on the post development downstream facilities, detention structure is needed in this project. The method we are using here on how to use the resulting values of the outflow hydrograph is to recalculate the runoff coefficient c value based on the fix values of the outflow hydrograph to achieve a c_{out}. The detailed description and calculation of the c_{out} value can be found in Attachment 7 in this report.

6.2 Manning Roughness Coefficient

Manning Roughness Coefficients are taken from Table A-1, Average Manning Roughness Coefficients for Pavement and Gutters, Table A-2, Average Manning Roughness Coefficients for Closed Conduits, and Table A-5, Average Manning roughness Coefficient for Natural Channels. Values of 0.015 for Concrete Gutter, 0.016 for Asphalt Pavement Rough Texture, 0.013 for PVC Pipe, and 0.03 for Fairly Regular Section Natural Channels are used in the hydrology calculations. Table of Manning's n value can be found in Attachment 2 in this report.

6.3 Rational Method Calculation Summary

The peak runoff values for the 100-year storm are calculated according to the Hydrology Manual Rational Method. The calculations are performed using the CIVILD software. A summary of the initial calculations is summarized in the table below:

Summary of Q100 Runoff

	Outlet Node No.	Area (AC)	Tc (MIN)	Q (CFS)
Existing Condition	104	8.87	9.48	16.827
Unmitigated Developed Condition	108	8.87	10.53	28.846
Mitigated Developed Condition	108	8.87	20.57	15.354

Table 1. Q100 Analysis Results

Structures that used for detention are five barrels of 48'' pipe with 242 ft length of each one.

CIVILD data and output files can be found in Attachment 6 of this report.

By observation of the results in the summary table, the mitigated developed condition of the site will have an overall decrease in the 100 year peak flow discharge from the site.

9.0 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the engineer of work for this project. That I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions codes, and that the design is consistent with current design.

I understand that the check of the project drawings and specifications by the City of Vista is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

ENGINEER OF WORK
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Tel – (760)745-8118
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Project Number: 21-052

REGISTERED PROFESSIONAL ENGINEER
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Robert D. Dentino, RCE 45629
Registration Expire: December 31, 2022

9/16/22
Date

ATTACHMENTS

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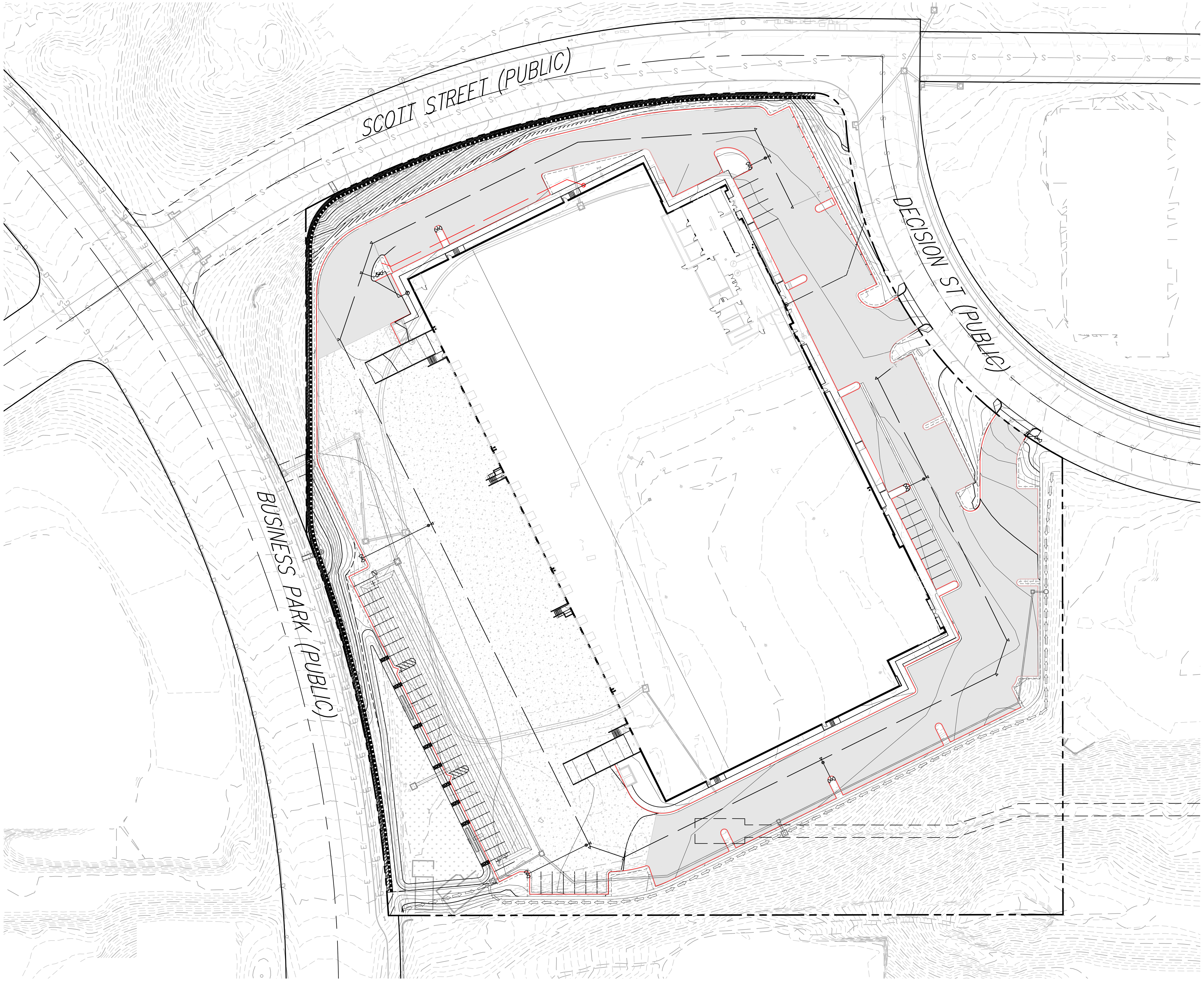
ATTACHMENT 1
SITE MAP



DECISION STREET SITE MAP

SCALE: 1:40

0 40 80 120 160

V:|21|21052|Engineering|PLOT PLAN|Storm|Working Files|Hyd|21052-Site Map.dwg 4/13/2022 11:32 AM ORIGINAL PLOT SIZE: ----

ATTACHMENT 2
FIGURES & TABLES FROM THE SAN DIEGO COUNTY HYDROLOGY MANUAL 2003

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

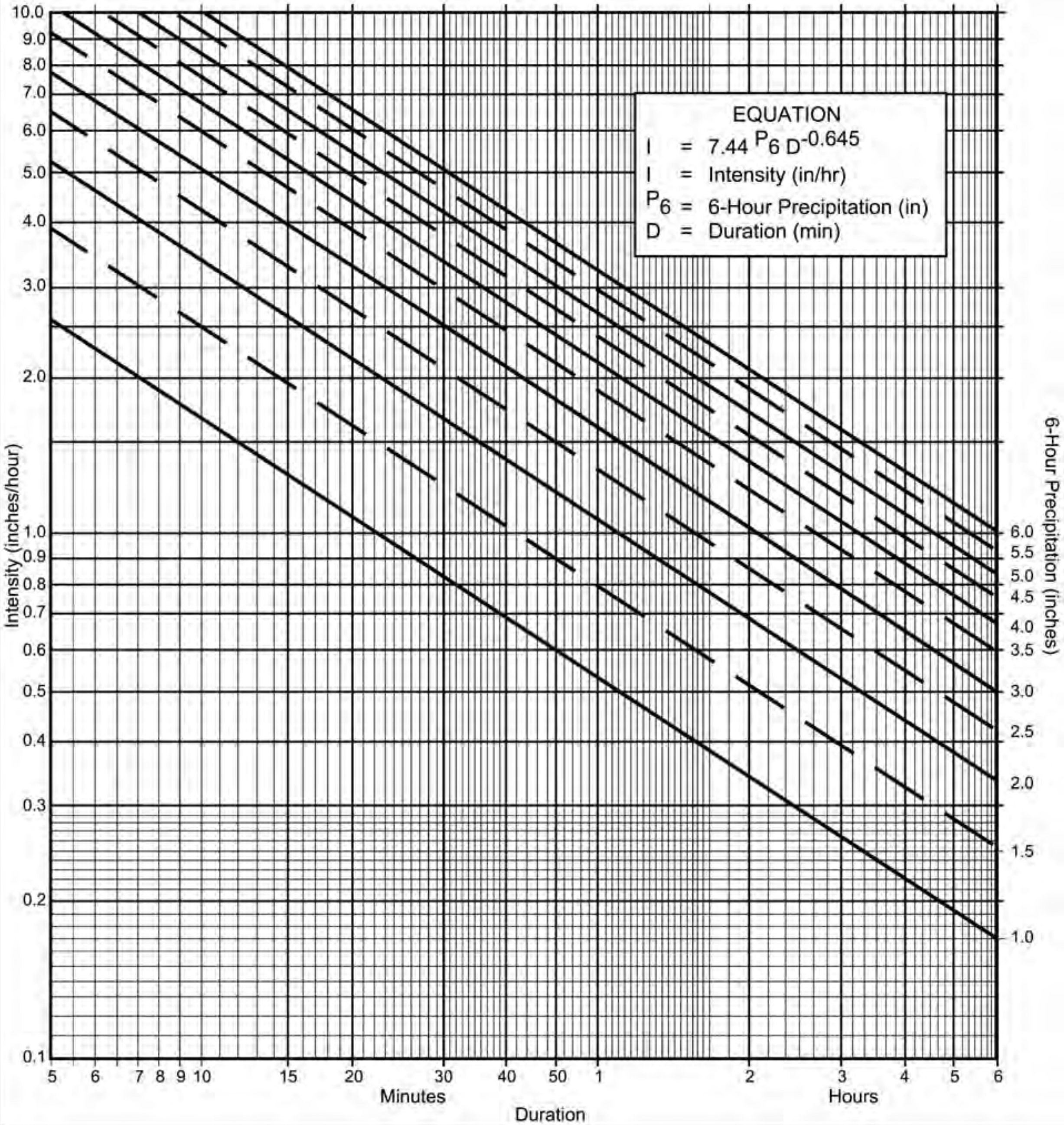
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency ______ year

(b) P_6 = ______ in., P_{24} = ______, $\frac{P_6}{P_{24}}$ = ______ %(2)

(c) Adjusted $P_6^{(2)}$ = ______ in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

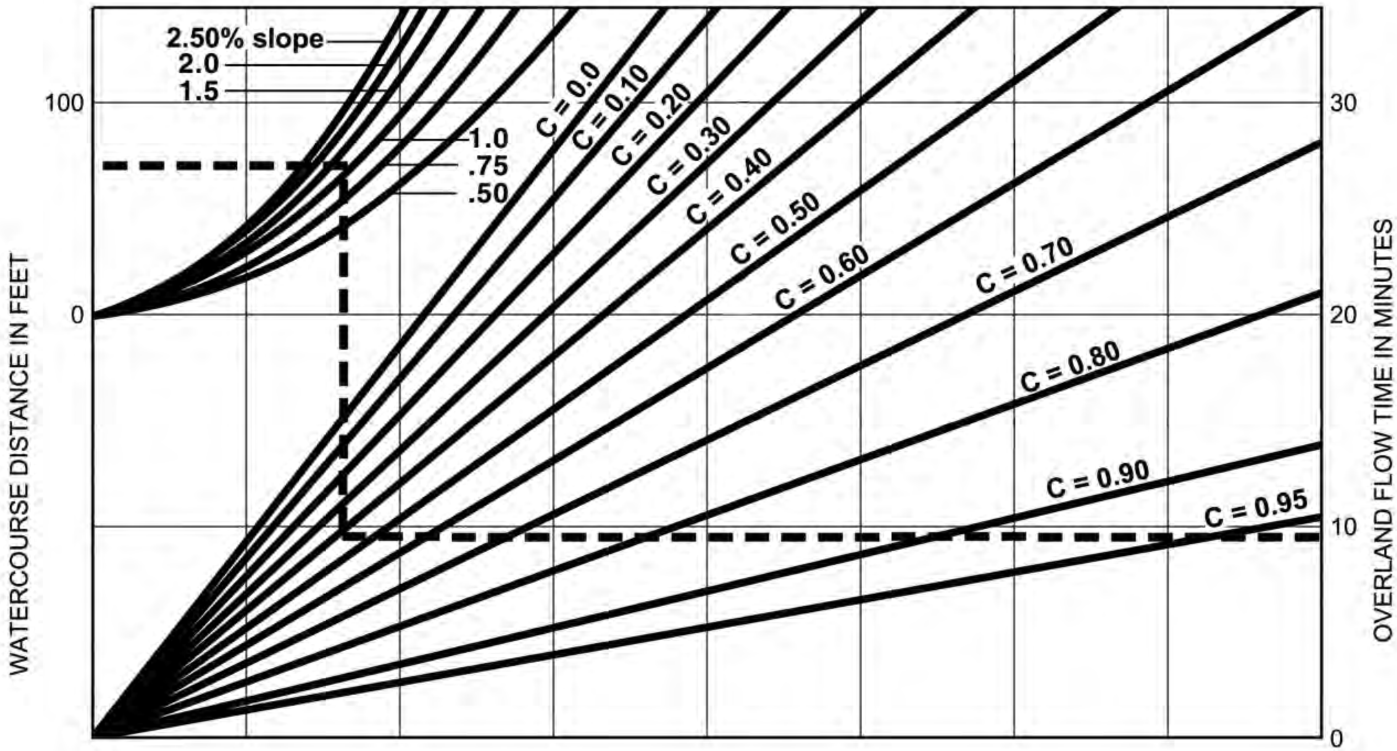
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1\text{-}C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

3-3

Rational Formula - Overland Time of Flow Nomograph

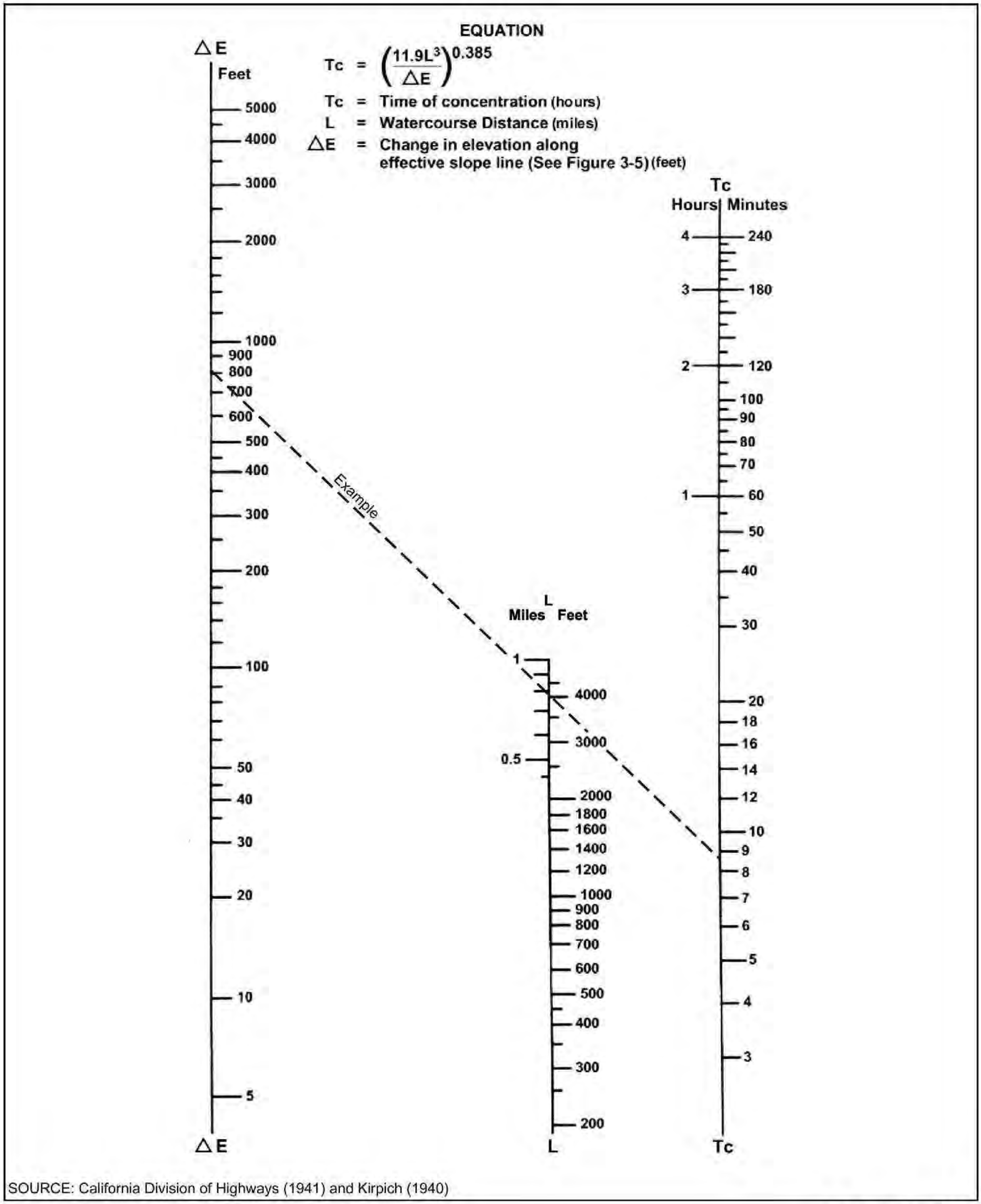
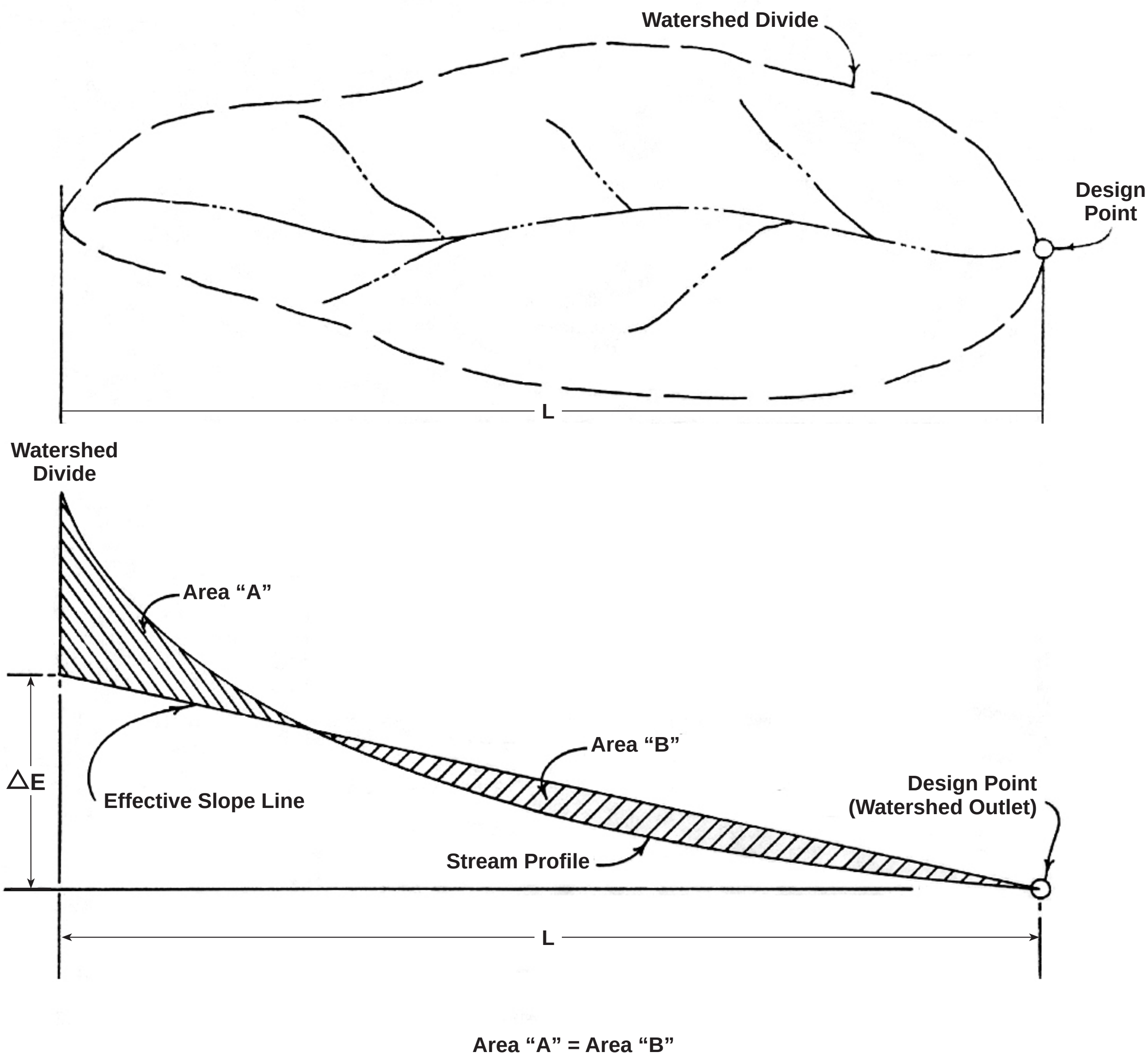


FIGURE 3-4

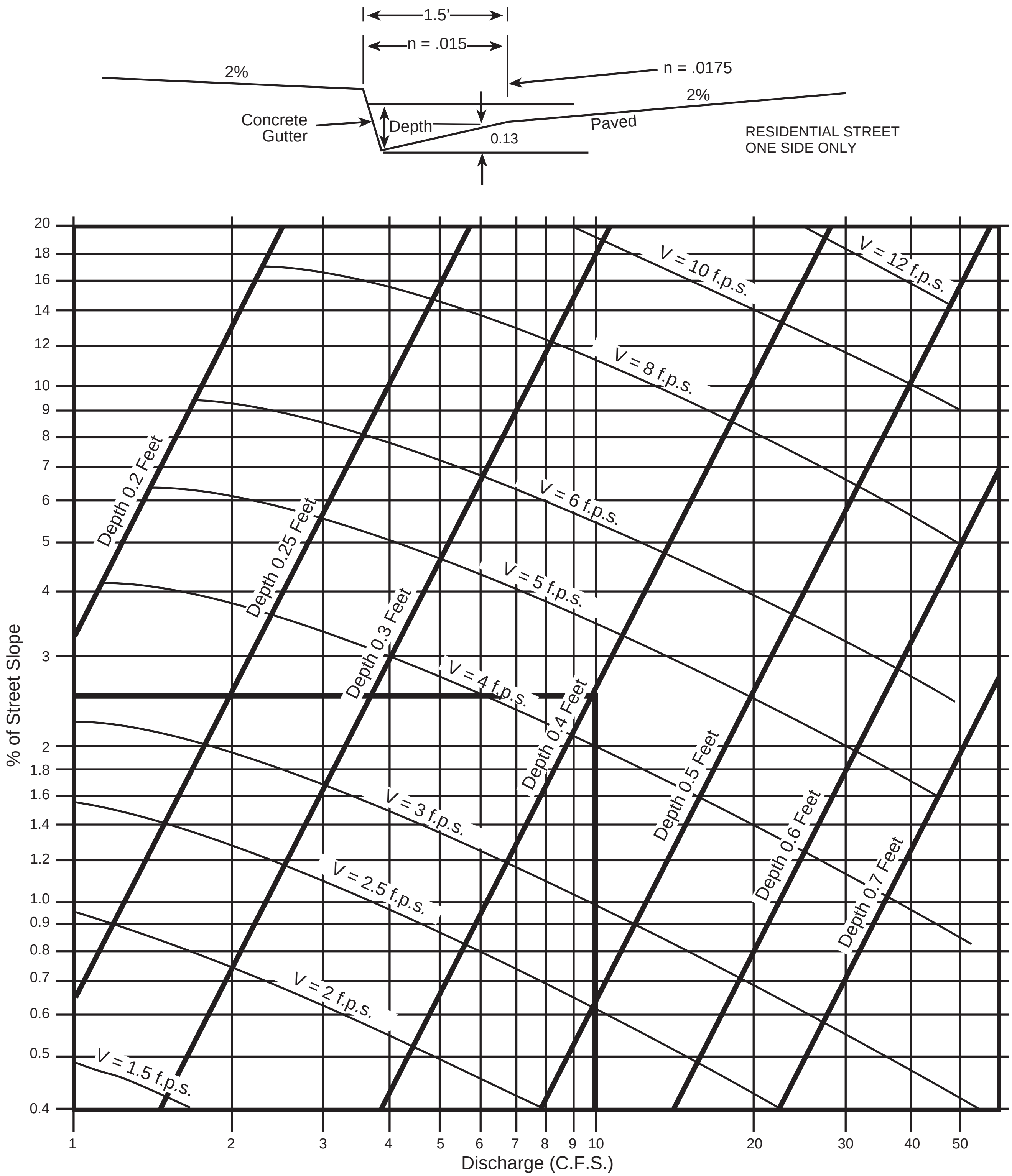
Nomograph for Determination of Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-5

Computation of Effective Slope for Natural Watersheds



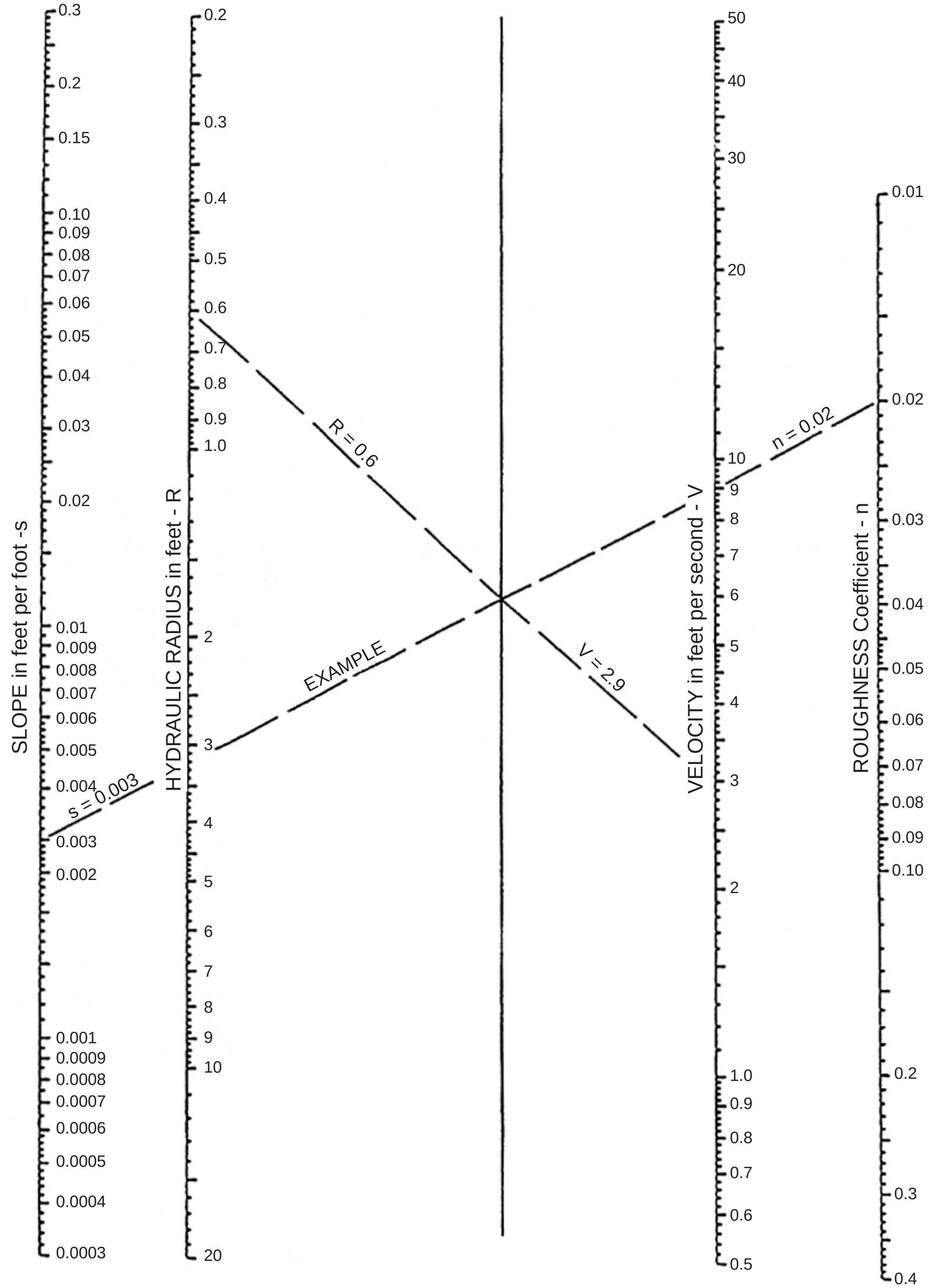
EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE: San Diego County Department of Special District Services Design Manual

FIGURE 3-6

Gutter and Roadway Discharge - Velocity Chart

EQUATION: $V = \frac{1.49}{n} R^{2/3} s^{1/2}$



GENERAL SOLUTION

SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

3-7

Manning's Equation Nomograph

Table A-1 Average Manning Roughness Coefficients for Pavement and Gutters[1]

Concrete Gutter[2]	0.015
Concrete Pavement	
Float Finish	0.014
Broom Finish	0.016
Concrete Gutter with Asphalt Pavement	
Smooth Finish	0.013
Rough Texture	0.015
Asphalt Pavement	
Smooth Finish	0.013
Rough Texture	0.016

Based on FHWA HEC-22.

[1] Based on materials and workmanship required by standard specifications.
[2] Increase roughness coefficient in gutters with mild slopes where sediment might accumulate by 0.020.

Table A-2 Average Manning Roughness Coefficients for Closed Conduits[3]

Reinforced Concrete Pipe (RCP)	0.013
Corrugated Metal Pipe and Pipe Arch	
2-3/8 x 1/2 inch Corrugations	
Unlined	0.024
Half Lined	
Full Flow	0.018
d/D>=0.60	0.016
d/D<0.60	0.013
Fully Lined	0.013
3 x 1 inch Corrugations	0.027
6 x 2 inch Corrugations	0.032
Spiral Rib Pipe	0.013
Helically Wound Pipe	
18-inch	0.015
24-inch	0.017
30-inch	0.019
36-inch	0.021
42-inch	0.022
48-inch	0.023
Plastic Pipe (HPDE and PVC)	
Smooth	0.013
Corrugated	0.024
Vitrified Clay Pipe	0.014
Cast-Iron Pipe (Uncoated)	0.013
Steel Pipe	0.011
Brick	0.017
Cast-In-Place Concrete Pipe	
Rough Wood Forms	0.017
Smooth Wood or Steel Forms	0.014

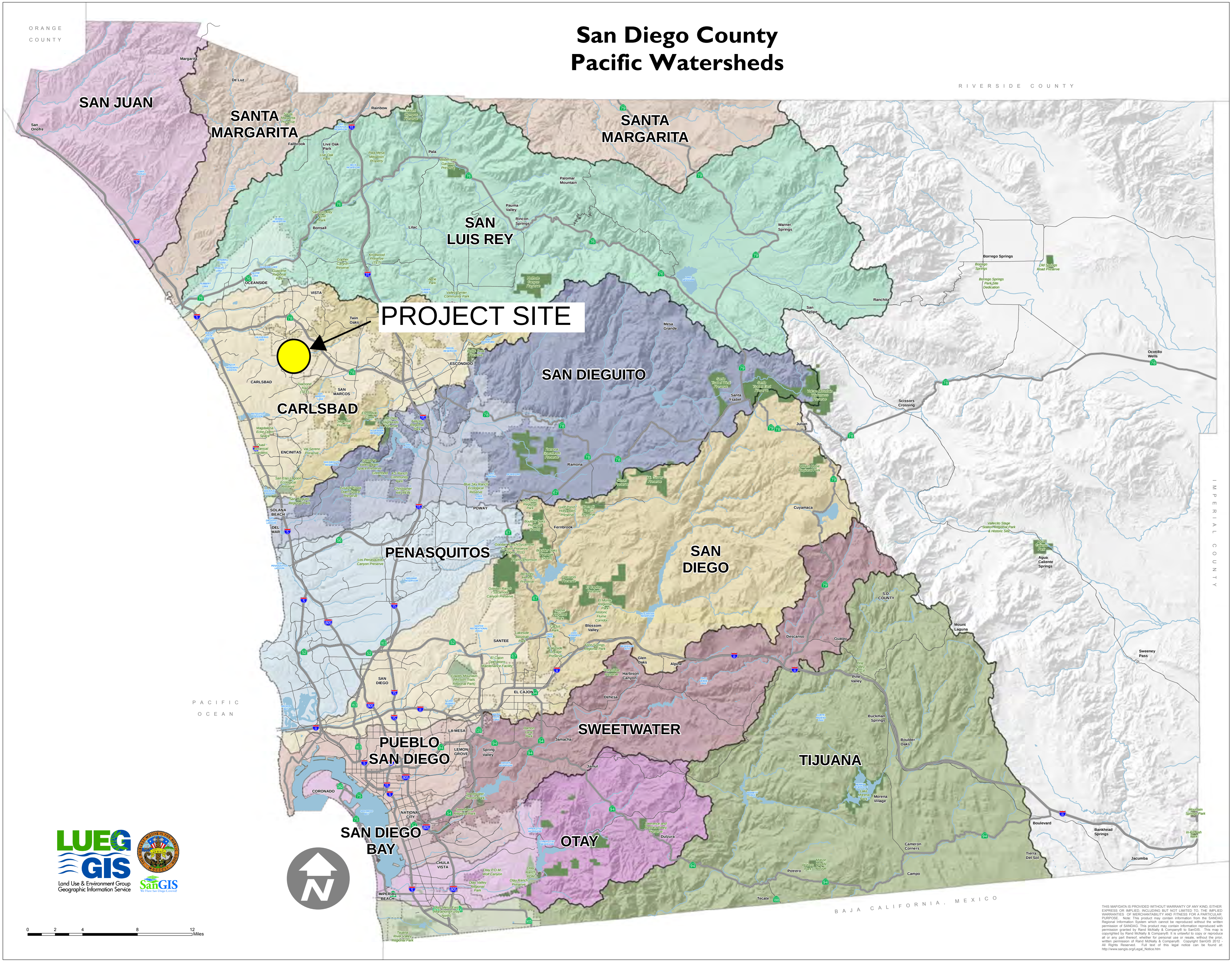
[3] Based on materials and workmanship required by standard specifications.

Table A-5 Average Manning Roughness Coefficients for Natural Channels

Minor Streams (Surface Width at Flood Stage < 100 ft)	
Fairly Regular Section	
(A) Some Grass and Weeds, Little or No Brush	0.030
(B) Dense Growth of Weeds, Depth of Flow Materially Greater Than Weed Height	0.040
(C) Some Weeds, Light Brush on Banks	0.040
(D) Some Weeds, Heavy Brush on Banks	0.060
(E) For Trees within Channel with Branches Submerged at High Stage, Increase All Above Values By	0.015
Irregular Section, with Pools, Slight Channel Meander	
Channels (A) to (E) Above, Increase All Values By	0.015
Mountain Streams; No Vegetation in Channel, Banks Usually Steep, Trees and Brush along Banks Submerged at High Stage	
(A) Bottom, Gravel, Cobbles and Few Boulders	0.050
(B) Bottom, Cobbles with Large Boulders	0.060
Flood Plains (Adjacent To Natural Streams)	
Pasture, No Brush	
(A) Short Grass	0.030
(B) High Grass	0.040
Cultivated Areas	
(A) No Crop	0.040
(B) Mature Row Crops	0.040
(C) Mature Field Crops	0.050
Heavy Weeds, Scattered Brush	0.050
Light Brush and Trees	0.060
Medium To Dense Brush	0.090
Dense Willows	0.170
Cleared Land with Tree Stumps, 100-150 Per Acre	0.060
Heavy Stand of Timber, Little Undergrowth	
(A) Flood Depth below Branches	0.110
(B) Flood Depth Reaches Branches	0.140

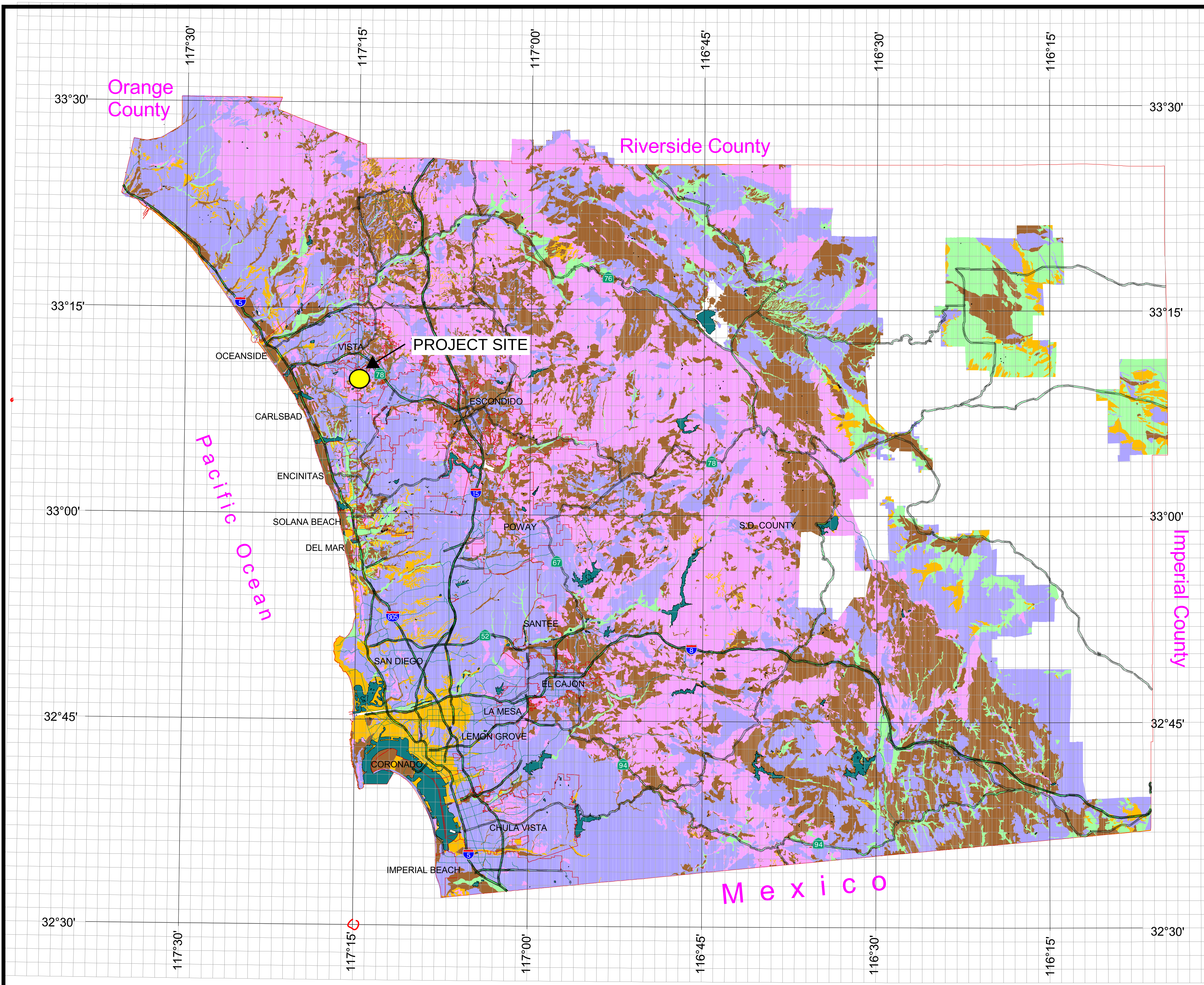
ATTACHMENT 3
WATERSHED INFORMATION

WATERSHED MAP



San Diego County
Pacific Watersheds
ORANGE COUNTY
RIVERSIDE COUNTY
IMPERIAL COUNTY
PACIFIC OCEAN
BAJA CALIFORNIA, MEXICO
SAN JUAN
SANTA MARGARITA
SANTA MARGARITA
SAN LUIS REY
PROJECT SITE
CARLSBAD
SAN DIEGUITO
PENASQUITOS
SAN DIEGO
SWEETWATER
PUEBLO SAN DIEGO
SAN DIEGO BAY
OTAY
TIJUANA
OCEANSIDE
VISTA
CARLSBAD
SAN MARCOS
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
SANTEE
EL CAJON
LA MESA
LEMON GROVE
NATIONAL CITY
CHULA VISTA
CORONADO
IMPERIAL BEACH
SAN DIEGO
Borrego Springs
LUEG GIS
Land Use & Environment Group Geographic Information Service
SanGIS
0 2 4 8 12 Miles

SOIL INDEX MAP



County of San Diego Hydrology Manual

Soil Hydrologic Groups

Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS Department of Public Works Geographic Information Services

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N S W E

3 0 3 Miles

SOIL REPORT

Hydrologic Soil Group—San Diego County Area, California

Map Scale: 1:2,020 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 25, 50, 100, 150

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 15, May 27, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 23, 2020—Feb 13, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DaE2	Diablo clay, 15 to 30 percent slopes, eroded, warm MAAT	C	3.4	35.5%
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes	D	6.1	64.5%
Totals for Area of Interest			**9.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

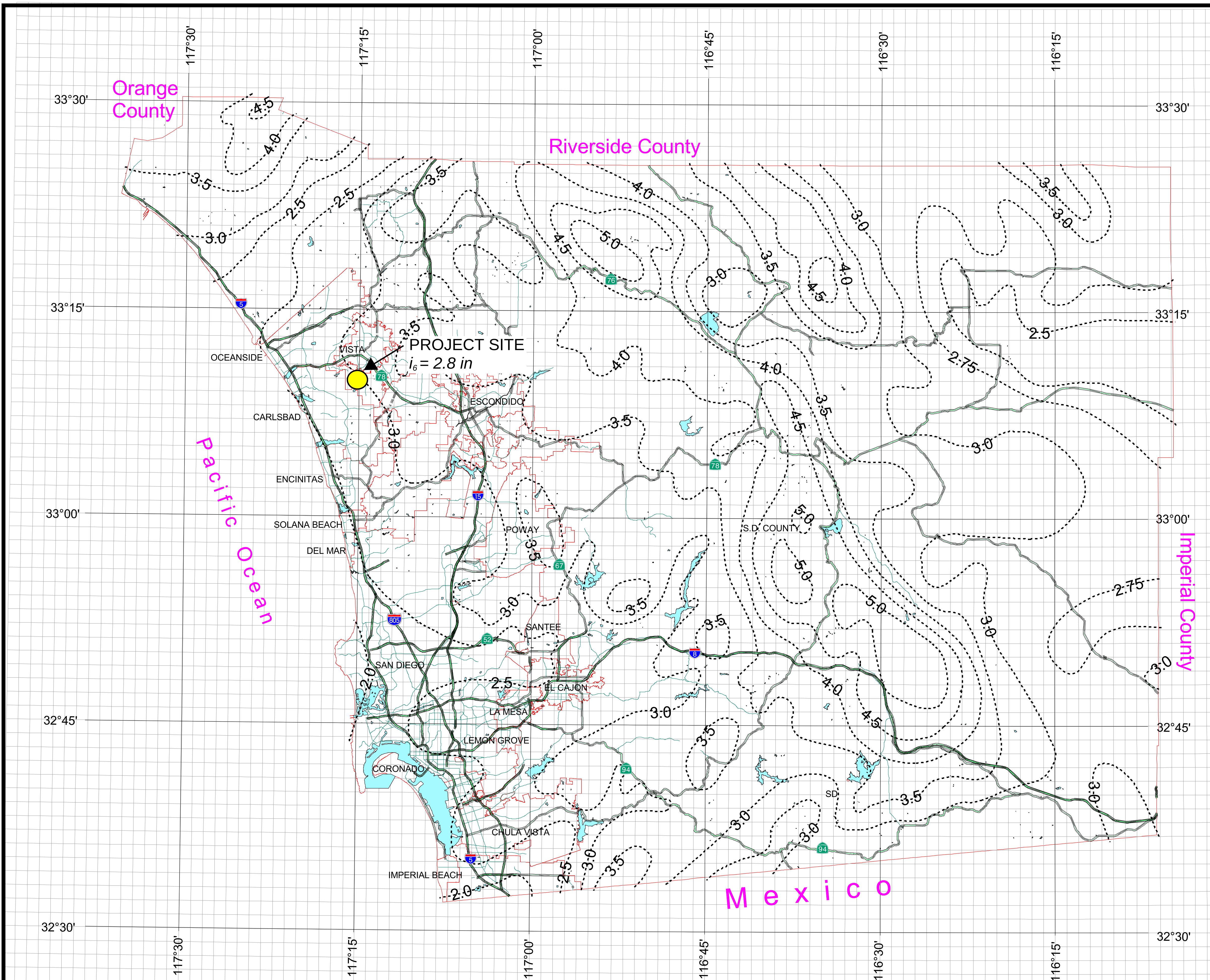
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

RAINFALL ISOPLUVIAL MAPS

County of San Diego Hydrology Manual

Rainfall Isopluvials



100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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Department of Public Works Geographic Information Services

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N
W E
S

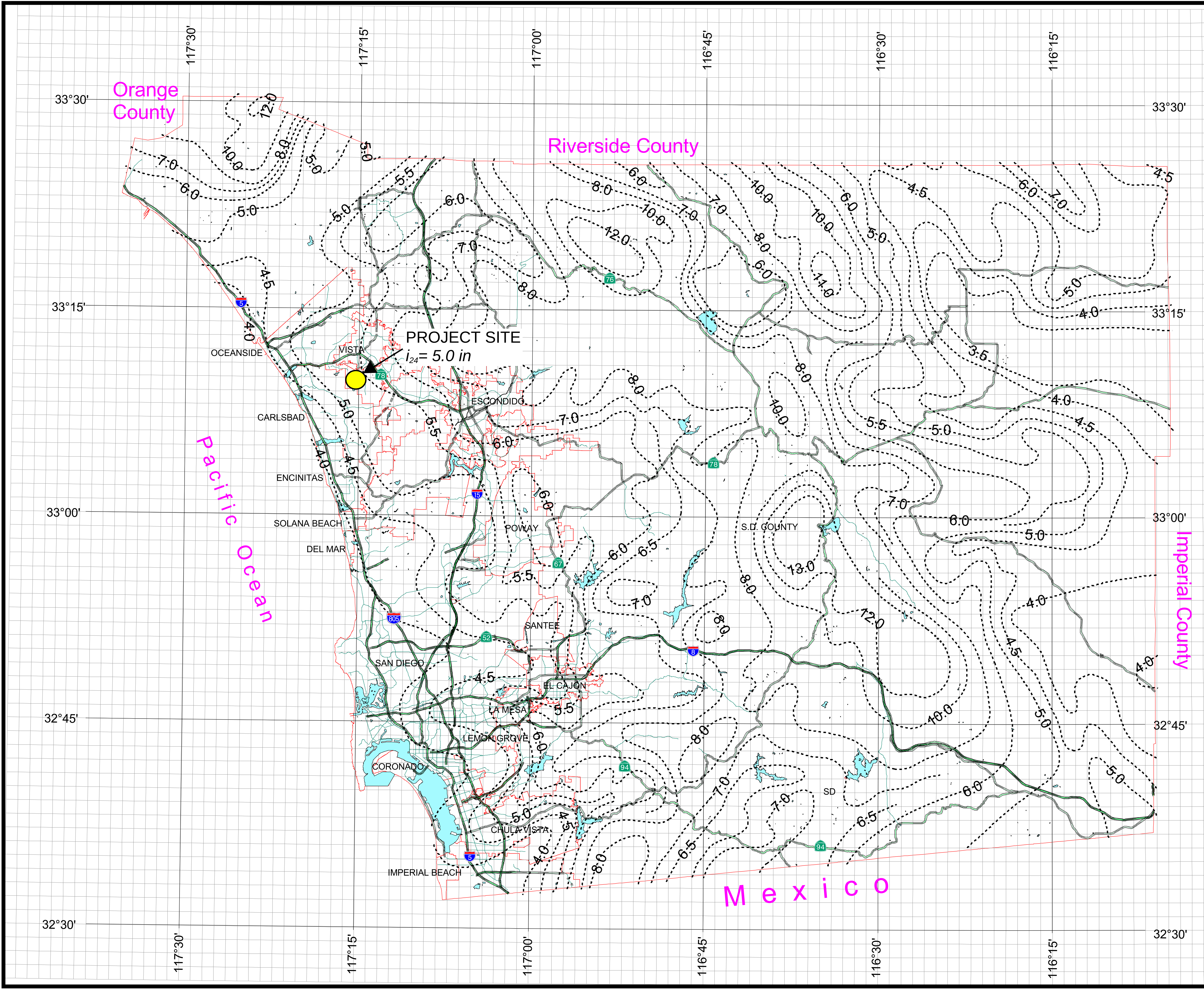
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



DPW GIS
Department of Public Works Geographic Information Services

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ATTACHMENT 4
PRE-DEVELOPMENT CONDITION EXHIBIT

DECISION STREET PRE DEVELOPMENT HYDROLOGY EXHIBIT

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

ATTACHMENT 5
POST-DEVELOPMENT CONDITION EXHIBIT

5a. Hydrology Map of Post-Development Condition Exhibit

DECISION STREET
POST DEVELOPMENT
HYDROLOGY EXHIBIT
SCOTT STREET (PUBLIC)
DECISION ST (PUBLIC)
BUSINESS PARK (PUBLIC)
AREA = 8.87 ACRES
UNMITIGATED POST Q_{100} = 28.846 CFS
T_C = 10.53 MIN
UNMITIGATED POST V_{100} = 36.23 FT/S
MITIGATED POST Q_{100} = 15.354 CFS
PRE Q_{100} = 16.827 CFS
POC
441.42 IE
BMP A
L = 640'
0.8407 ACRES
0.2491 ACRES
0.3653 ACRES
1.1389 ACRES
0.2195 ACRES
0.0868 ACRES
0.0921 ACRES
0.2402 ACRES
0.8398 ACRES
1.1173 ACRES
1.6008 ACRES
0.0688 ACRES
1.8205 ACRES
0.0807 ACRES
L = 160'
L = 285'
L = 189'
L = 169'
L = 669'
L = 703'
483.58 FS
531.72 FS
487.79 FS
488.46 FS
488.12 FS
488.27 FS
532.98 FS
532.76 FS
471.61 IE IN
471.28 IE OUT
482.81 FS
472.87 IE IN
472.83 IE OUT
480.29 FS
476.80 IE
477.00 IE
491.40 FL
483.00 IE
535.00 ES
560.00 ES
LEGEND
NODE NUMBER
SURFACE FLOW
PIPE FLOW
HYD BASIN BOUNDARY
SCALE: 1:40
0 40 80 120 160
EXCEL
ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

5b. Hydrology Map of Post-Development Mitigation Condition Exhibit


DECISION STREET POST
MITIGATION DEVELOPMENT
HYDROLOGY EXHIBIT
SCOTT STREET (PUBLIC)
DECISION ST (PUBLIC)
BUSINESS PARK (PUBLIC)
ONSITE IS MITIGATED
(SEE POST
DEVELOPMENT MAP
FOR SUB BASINS)
AREA = 8.87 ACRES
MITIGATED POST Q100 = 15.354 CFS
TC = 20.57 MIN
MITIGATED POST V100 = 30.02 FT/S
UNMITIGATED POST Q100 = 28.846 CFS
PRE Q100 = 16.827 CFS
POC
441.42 IE
471.61 IE IN
471.28 IE OUT
472.87 IE IN
472.83 IE OUT
BMP A
491.40 FL
483.00 IE
L = 703'
1.8205 ACRES
0.0807 ACRES
535.00 ES
560.00 ES
540
545
550
555
560
LEGEND
MITIGATION AREA
NODE NUMBER
SURFACE FLOW
PIPE FLOW
HYD BASIN BOUNDARY
SCALE: 1:40
0
40
80
120
160
EXCEL
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PH (760)745-8118 FX (760)745-1890

ATTACHMENT 6
MODIFIED RATIONAL METHOD RUNOFF CALCULATIONS

Steps Taken To Analyze This Condition

The Rational Method Runoff Calculations are followed here. The software that we are using is the “Rational Hydrology Method, San Diego County (2003 Manual)” module of the CIVILCADD/CIVILDESIGN Engineering Software, Version 9.1.

Please see the subsequent pages for the calculations. These calculations are for the Q100. The results are outlined/summarized in Section 6.

6a. CivilD Pre-Development Calculations

```
         San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 12/03/21
------------------------------------------------------------------------
21052 Q100 HYD PRE DEVELOPMENT
.


------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6332

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.800
24 hour precipitation(inches) =  5.000
P6/P24 =    56.0%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance  =  797.000(Ft.)
Highest elevation =  563.000(Ft.)
Lowest elevation =  486.000(Ft.)
Elevation difference =   77.000(Ft.) Slope =  9.661 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to  6.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.29 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*( 100.000^.5)/(  30.000^(1/3)]=   4.29
The initial area total distance of  797.00 (Ft.) entered leaves a
remaining distance of  697.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.57 minutes
for a distance of 697.00 (Ft.) and a slope of  6.00 %
with an elevation difference of  41.82(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.567 Minutes
Tt=[(11.9*0.1320^3)/( 41.82)]^.385=  3.57
Total initial area Ti =   4.29 minutes from Figure 3-3 formula plus
  3.57 minutes from the Figure 3-4 formula =   7.85 minutes
Rainfall intensity (I) =      5.513(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      2.560(CFS)
Total initial stream area =        1.290(Ac.)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   486.000(Ft.)
Downstream point elevation =   479.000(Ft.)
Channel length thru subarea  =   445.000(Ft.)
Channel base width  =    5.000(Ft.)
Slope or 'Z' of left channel bank =  20.000
Slope or 'Z' of right channel bank =  20.000
Estimated mean flow rate at midpoint of channel =      9.100(CFS)
Manning's 'N'    = 0.011
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      9.100(CFS)
Depth of flow =   0.211(Ft.), Average velocity =   4.671(Ft/s)
Channel flow top width =   13.448(Ft.)
Flow Velocity =    4.67(Ft/s)
Travel time  =    1.59 min.
Time of concentration =    9.44 min.
Critical depth =      0.316(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.896(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.350
Decimal fraction soil group D = 0.650
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.393
Rainfall intensity =      4.896(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.387  CA =      3.175
Subarea runoff =     12.984(CFS) for      6.906(Ac.)
Total runoff =     15.544(CFS)  Total area =       8.196(Ac.)
Depth of flow =   0.274(Ft.), Average velocity =   5.401(Ft/s)
Critical depth =      0.410(Ft.)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   471.280(Ft.)
Downstream point/station elevation =   441.420(Ft.)
Pipe length   =    63.00(Ft.) Slope =   0.4740  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.544(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    15.544(CFS)
Normal flow depth in pipe =    4.54(In.)
Flow top width inside pipe =   23.89(In.)
Critical Depth =   15.10(In.)
Pipe flow velocity =     30.13(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.48 min.


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      4.884(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =     9.48 min.
Rainfall intensity =      4.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.388  CA =      3.343
Subarea runoff =      0.784(CFS) for      0.410(Ac.)
Total runoff =     16.329(CFS)  Total area =       8.606(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      4.884(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.350
Decimal fraction soil group D = 0.650
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.393
Time of concentration =     9.48 min.
Rainfall intensity =      4.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.389  CA =      3.445
Subarea runoff =      0.498(CFS) for      0.260(Ac.)
Total runoff =     16.827(CFS)  Total area =       8.866(Ac.)
End of computations, total study area =          8.866 (Ac.)
```

6b. CivilD Post-Development Calculations

```
          San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 12/03/21
------------------------------------------------------------------------
21052 Q100 POST GROUP1



------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6332

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.800
24 hour precipitation(inches) =  5.000
P6/P24 =    56.0%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =   89.000(Ft.)
Highest elevation =  488.120(Ft.)
Lowest elevation =  487.790(Ft.)
Elevation difference =    0.330(Ft.) Slope =  0.371 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.21 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.000^(1/3)]=   3.21
Calculated TC of    3.207 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.377(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.578(CFS)
Total initial stream area =       0.090(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.100
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
```

```
Estimated mean flow rate at midpoint of channel =      2.301(CFS)
Depth of flow =   0.285(Ft.), Average velocity =   1.682(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              0.50
    2             28.75              0.12
    3             30.25              0.00
    4             30.25              0.50
Manning's 'N' friction factor =   0.015
-----------------------------------------------------------------
Sub-Channel flow  =      2.301(CFS)
  '     '    flow top width =     13.985(Ft.)
  '     '    velocity=    1.682(Ft/s)
  '     '    area =      1.368(Sq.Ft)
  '     '    Froude number =     0.948

Upstream point elevation =   487.790(Ft.)
Downstream point elevation =   483.580(Ft.)
Flow length =   640.000(Ft.)
Travel time  =    6.34 min.
Time of concentration =    9.55 min.
Depth of flow =   0.285(Ft.)
Average velocity =   1.682(Ft/s)
Total irregular channel flow =     2.301(CFS)
Irregular channel normal depth above invert elev. =   0.285(Ft.)
Average velocity of channel(s) =   1.682(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.861(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                         ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      4.861(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      0.810
Subarea runoff =      3.359(CFS) for      0.841(Ac.)
Total runoff =      3.937(CFS)  Total area =       0.931(Ac.)
Depth of flow =   0.329(Ft.), Average velocity =   1.916(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.100 to Point/Station      102.100
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.931(Ac.)
Runoff from this stream =      3.937(CFS)
Time of concentration =    9.55 min.
Rainfall intensity =     4.861(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                         ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
```

```
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  532.980(Ft.)
Lowest elevation =  532.760(Ft.)
Elevation difference =    0.220(Ft.) Slope =  0.440 %
Top of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.69 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  50.000^.5)/(   0.500^(1/3)]=   3.69
Calculated TC of    3.688 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.377(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      1.412(CFS)
Total initial stream area =        0.220(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      104.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.854(CFS)
Depth of flow =   0.138(Ft.), Average velocity =   1.008(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00               0.55
    2            110.00               0.00
    3            205.00               0.47
Manning's 'N' friction factor =   0.015
-----------------------------------------------------------------
Sub-Channel flow  =      3.854(CFS)
  '     '    flow top width =     55.304(Ft.)
  '     '    velocity=    1.008(Ft/s)
  '     '    area =      3.823(Sq.Ft)
  '     '    Froude number =     0.676

Upstream point elevation =   532.760(Ft.)
Downstream point elevation =   531.720(Ft.)
Flow length =   285.000(Ft.)
Travel time  =    4.71 min.
Time of concentration =    8.40 min.
Depth of flow =   0.138(Ft.)
Average velocity =   1.008(Ft/s)
Total irregular channel flow =     3.854(CFS)
Irregular channel normal depth above invert elev. =   0.138(Ft.)
Average velocity of channel(s) =   1.008(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.279(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      5.279(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      1.182
Subarea runoff =      4.829(CFS) for      1.139(Ac.)
Total runoff =      6.241(CFS)  Total area =       1.359(Ac.)
Depth of flow =   0.166(Ft.), Average velocity =   1.137(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      102.200
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      6.997(CFS)
Depth of flow =   0.217(Ft.), Average velocity =   7.094(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              0.50
    2              0.00              0.00
    3              1.50              0.13
    4            130.50              0.77
    5            130.50              1.27
Manning's 'N' friction factor =   0.016
-----------------------------------------------------------------
Sub-Channel flow  =      6.997(CFS)
  '     '    flow top width =     18.989(Ft.)
  '     '    velocity=    7.094(Ft/s)
  '     '    area =      0.986(Sq.Ft)
  '     '    Froude number =     5.485

Upstream point elevation =   531.720(Ft.)
Downstream point elevation =   482.810(Ft.)
Flow length =   160.000(Ft.)
Travel time  =    0.38 min.
Time of concentration =    8.78 min.
Depth of flow =   0.217(Ft.)
Average velocity =   7.094(Ft/s)
Total irregular channel flow =     6.997(CFS)
Irregular channel normal depth above invert elev. =   0.217(Ft.)
Average velocity of channel(s) =   7.094(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.132(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      5.132(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      1.500
Subarea runoff =      1.456(CFS) for      0.365(Ac.)
Total runoff =      7.697(CFS)  Total area =       1.724(Ac.)
Depth of flow =   0.221(Ft.), Average velocity =   7.253(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.100 to Point/Station      102.100
**** CONFLUENCE OF MINOR STREAMS ****

______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.724(Ac.)
Runoff from this stream =      7.697(CFS)
Time of concentration =    8.78 min.
Rainfall intensity =     5.132(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1         3.937      9.55              4.861
2         7.697      8.78              5.132
```

```
Qmax(1) =
       1.000 *    1.000 *     3.937) +
       0.947 *    1.000 *     7.697) + =      11.228
Qmax(2) =
       1.000 *    0.919 *     3.937) +
       1.000 *    1.000 *     7.697) + =      11.317

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.937       7.697
Maximum flow rates at confluence using above data:
       11.228       11.317
Area of streams before confluence:
        0.931        1.724
Results of confluence:
Total flow rate =     11.317(CFS)
Time of concentration =     8.777 min.
Effective stream area after confluence =      2.655(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.200 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =     12.922(CFS)
Depth of flow =   0.342(Ft.), Average velocity =   2.611(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00               0.50
    2              0.00               0.00
    3              1.50               0.13
    4            130.50               0.77
    5            130.50               1.27
Manning's 'N' friction factor =   0.016
-----------------------------------------------------------------
Sub-Channel flow  =     12.923(CFS)
  '     '    flow top width =     44.249(Ft.)
  '     '    velocity=    2.611(Ft/s)
  '     '    area =      4.949(Sq.Ft)
  '     '    Froude number =     1.376

Upstream point elevation =   482.810(Ft.)
Downstream point elevation =   480.290(Ft.)
Flow length =   170.000(Ft.)
Travel time  =    1.09 min.
Time of concentration =    9.86 min.
Depth of flow =   0.342(Ft.)
Average velocity =   2.611(Ft/s)
Total irregular channel flow =    12.922(CFS)
Irregular channel normal depth above invert elev. =   0.342(Ft.)
Average velocity of channel(s) =   2.611(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.760(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.200
[INDUSTRIAL area type                         ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      4.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =       3.041
Subarea runoff =      3.158(CFS) for      0.840(Ac.)
Total runoff =     14.474(CFS)  Total area =       3.495(Ac.)
Depth of flow =   0.352(Ft.), Average velocity =   2.685(Ft/s)
```

```


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.495(Ac.)
Runoff from this stream =     14.474(CFS)
Time of concentration =    9.86 min.
Rainfall intensity =     4.760(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                         ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance   =   57.000(Ft.)
Highest elevation =  488.460(Ft.)
Lowest elevation =  488.270(Ft.)
Elevation difference =    0.190(Ft.) Slope =  0.333 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.21 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.000^(1/3)]=   3.21
Calculated TC of    3.207 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.377(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.578(CFS)
Total initial stream area =        0.090(Ac.)


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Process from Point/Station      202.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel =      4.307(CFS)
Depth of flow =   0.295(Ft.), Average velocity =   2.297(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              0.41
    2             28.75              0.12
    3             30.25              0.00
    4             30.25              0.50
Manning's 'N' friction factor =   0.015
-----------------------------------------------------------------
Sub-Channel flow  =      4.307(CFS)
  '     '    flow top width =     18.875(Ft.)
  '     '    velocity=    2.297(Ft/s)
  '     '    area =     1.875(Sq.Ft)
  '     '    Froude number =     1.284

Upstream point elevation =   488.270(Ft.)
```

```
Downstream point elevation =   480.290(Ft.)
Flow length =   669.000(Ft.)
Travel time  =    4.85 min.
Time of concentration =    8.06 min.
Depth of flow =   0.295(Ft.)
Average velocity =   2.297(Ft/s)
Total irregular channel flow =     4.307(CFS)
Irregular channel normal depth above invert elev. =   0.295(Ft.)
Average velocity of channel(s) =   2.297(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.421(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.850
Decimal fraction soil group D = 0.150
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      5.421(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      1.470
Subarea runoff =      7.393(CFS) for      1.600(Ac.)
Total runoff =      7.971(CFS)  Total area =       1.690(Ac.)
Depth of flow =   0.347(Ft.), Average velocity =   2.670(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.690(Ac.)
Runoff from this stream =      7.971(CFS)
Time of concentration =    8.06 min.
Rainfall intensity =     5.421(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      115.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.500
Decimal fraction soil group D = 0.500
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  532.980(Ft.)
Lowest elevation =  532.760(Ft.)
Elevation difference =    0.220(Ft.) Slope =  0.440 %
Top of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.69 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  50.000^.5)/(   0.500^(1/3)]=   3.69
Calculated TC of    3.688 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.377(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      1.540(CFS)
Total initial stream area =       0.240(Ac.)
```

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      105.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      2.437(CFS)
Depth of flow =   0.220(Ft.), Average velocity =   0.251(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00               0.44
    2             87.00               0.00
    3            205.00               0.59
Manning's 'N' friction factor =   0.016
-----------------------------------------------------------------
Sub-Channel flow  =      2.437(CFS)
  '     '    flow top width =     88.119(Ft.)
  '     '    velocity=    0.251(Ft/s)
  '     '    area =      9.706(Sq.Ft)
  '     '    Froude number =     0.133

Upstream point elevation =   532.760(Ft.)
Downstream point elevation =   532.720(Ft.)
Flow length =   289.000(Ft.)
Travel time  =   19.18 min.
Time of concentration =   22.87 min.
Depth of flow =   0.220(Ft.)
Average velocity =   0.251(Ft/s)
Total irregular channel flow =     2.437(CFS)
Irregular channel normal depth above invert elev. =   0.220(Ft.)
Average velocity of channel(s) =   0.251(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      2.767(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.200
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      2.767(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      1.181
Subarea runoff =      1.726(CFS) for      1.117(Ac.)
Total runoff =      3.266(CFS)  Total area =       1.357(Ac.)
Depth of flow =   0.246(Ft.), Average velocity =   0.270(Ft/s)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

______________________________________________________________________
Depth of flow =   0.211(Ft.), Average velocity =   8.325(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00               0.50
    2              0.00               0.00
    3              1.50               0.13
    4            148.50               2.92
    5            148.50               3.42
Manning's 'N' friction factor =   0.016
-----------------------------------------------------------------
Sub-Channel flow  =      3.266(CFS)
  '     '    flow top width =      5.772(Ft.)
```

```
  '     '    velocity=    8.325(Ft/s)
  '     '    area =      0.392(Sq.Ft)
  '     '    Froude number =     5.628

Upstream point elevation =   531.720(Ft.)
Downstream point elevation =   480.290(Ft.)
Flow length =   169.000(Ft.)
Travel time  =    0.34 min.
Time of concentration =   23.21 min.
Depth of flow =   0.211(Ft.)
Average velocity =   8.325(Ft/s)
Total irregular channel flow =     3.266(CFS)
Irregular channel normal depth above invert elev. =   0.211(Ft.)
Average velocity of channel(s) =   8.325(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      1.357(Ac.)
Runoff from this stream =      3.266(CFS)
Time of concentration =   23.21 min.
Rainfall intensity =     2.741(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       14.474      9.86             4.760
2        7.971      8.06             5.421
3        3.266     23.21             2.741
Qmax(1) =
       1.000 *    1.000 *    14.474) +
       0.878 *    1.000 *     7.971) +
       1.000 *    0.425 *     3.266) + =      22.861
Qmax(2) =
       1.000 *    0.817 *    14.474) +
       1.000 *    1.000 *     7.971) +
       1.000 *    0.347 *     3.266) + =      20.937
Qmax(3) =
       0.576 *    1.000 *    14.474) +
       0.506 *    1.000 *     7.971) +
       1.000 *    1.000 *     3.266) + =      15.629

Total of 3 streams to confluence:
Flow rates before confluence point:
      14.474       7.971       3.266
Maximum flow rates at confluence using above data:
       22.861       20.937       15.629
Area of streams before confluence:
        3.495        1.690        1.357
Results of confluence:
Total flow rate =     22.861(CFS)
Time of concentration =     9.862 min.
Effective stream area after confluence =      6.542(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   477.000(Ft.)
Downstream point/station elevation =   476.800(Ft.)
Pipe length  =    20.00(Ft.) Slope =   0.0100  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.861(CFS)
Given pipe size =     18.00(In.)
```

```
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.645(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.947(Ft.)
 Minor friction loss =      3.898(Ft.)  K-factor =   1.50
Pipe flow velocity =     12.94(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.89 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.100
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   476.800(Ft.)
Downstream point/station elevation =   472.870(Ft.)
Pipe length  =   144.00(Ft.) Slope =   0.0273  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.861(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     6.787(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      6.818(Ft.)
 Minor friction loss =      3.898(Ft.)  K-factor =   1.50
Pipe flow velocity =     12.94(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    10.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.100 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   472.830(Ft.)
Downstream point/station elevation =   471.610(Ft.)
Pipe length  =   109.00(Ft.) Slope =   0.0112  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.861(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    22.861(CFS)
Normal flow depth in pipe =   14.10(In.)
Flow top width inside pipe =   35.14(In.)
Critical Depth =   18.48(In.)
Pipe flow velocity =      8.91(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =    10.28 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   471.280(Ft.)
Downstream point/station elevation =   441.420(Ft.)
Pipe length  =    63.00(Ft.) Slope =   0.4740  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.861(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    22.861(CFS)
Normal flow depth in pipe =    5.46(In.)
Flow top width inside pipe =   25.83(In.)
Critical Depth =   18.48(In.)
Pipe flow velocity =     33.80(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    10.31 min.


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Process from Point/Station      117.000 to Point/Station      108.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
```

```
Rainfall intensity (I) =      4.626(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Time of concentration =    10.31 min.
Rainfall intensity =      4.626(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.853  CA =      5.794
Subarea runoff =      3.942(CFS) for      0.249(Ac.)
Total runoff =     26.803(CFS)  Total area =       6.791(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      118.000 to Point/Station      108.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Rainfall intensity (I) =      4.626(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.500
Decimal fraction soil group D = 0.500
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.385
Time of concentration =    10.31 min.
Rainfall intensity =      4.626(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.846  CA =      5.835
Subarea runoff =      0.192(CFS) for      0.108(Ac.)
Total runoff =     26.996(CFS)  Total area =       6.899(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** 6 HOUR HYDROGRAPH ****
______________________________________________________________________
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003


Time of Concentration =  10.31
Basin Area =     6.90 Acres
6 Hour Rainfall =  2.800 Inches
Runoff Coefficient =  0.846
Peak Discharge =    27.00 CFS
     Time  (Min)     Discharge  (CFS)
       0                0.000
       10                0.978
       20                0.996
       30                1.035
       40                1.056
       50                1.102
       60                1.126
       70                1.180
       80                1.210
       90                1.276
       100                1.312
       110                1.393
       120                1.439
       130                1.543
       140                1.603
       150                1.742
       160                1.824
```

```
         170                2.023
         180                2.145
         190                2.459
         200                2.667
         210                3.259
         220                3.712
         230                5.451
         240                7.680
         250               26.996
         260                4.372
         270                2.925
         280                2.289
         290                1.917
         300                1.669
         310                1.488
         320                1.351
         330                1.242
         340                1.153
         350                1.078
         360                1.015
         370                0.960
  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                   6 - H O U R    S T O R M
              R u n o f f     H y d r o g r a p h
  --------------------------------------------------------------------
           Hydrograph in   1   Minute intervals ((CFS))

  --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft    Q(CFS)  0        6.7      13.5      20.2      27.0
 ---------------------------------------------------------------------
  0+ 0       0.0000      0.00   Q         |         |         |         |
  0+ 1       0.0001      0.10   Q         |         |         |         |
  0+ 2       0.0004      0.20   Q         |         |         |         |
  0+ 3       0.0008      0.29   Q         |         |         |         |
  0+ 4       0.0013      0.39   Q         |         |         |         |
  0+ 5       0.0020      0.49   Q         |         |         |         |
  0+ 6       0.0028      0.59   Q         |         |         |         |
  0+ 7       0.0038      0.68   VQ        |         |         |         |
  0+ 8       0.0048      0.78   VQ        |         |         |         |
  0+ 9       0.0061      0.88   VQ        |         |         |         |
  0+10       0.0074      0.98   VQ        |         |         |         |
  0+11       0.0088      0.98   VQ        |         |         |         |
  0+12       0.0101      0.98   VQ        |         |         |         |
  0+13       0.0115      0.98   VQ        |         |         |         |
  0+14       0.0128      0.98   VQ        |         |         |         |
  0+15       0.0142      0.99   VQ        |         |         |         |
  0+16       0.0155      0.99   VQ        |         |         |         |
  0+17       0.0169      0.99   VQ        |         |         |         |
  0+18       0.0183      0.99   VQ        |         |         |         |
  0+19       0.0196      0.99   VQ        |         |         |         |
  0+20       0.0210      1.00   VQ        |         |         |         |
  0+21       0.0224      1.00   VQ        |         |         |         |
  0+22       0.0238      1.00   VQ        |         |         |         |
  0+23       0.0252      1.01   VQ        |         |         |         |
  0+24       0.0265      1.01   VQ        |         |         |         |
  0+25       0.0279      1.02   VQ        |         |         |         |
  0+26       0.0294      1.02   VQ        |         |         |         |
  0+27       0.0308      1.02   VQ        |         |         |         |
  0+28       0.0322      1.03   VQ        |         |         |         |
  0+29       0.0336      1.03   VQ        |         |         |         |
  0+30       0.0350      1.03   |Q        |         |         |         |
  0+31       0.0364      1.04   |Q        |         |         |         |
  0+32       0.0379      1.04   |Q        |         |         |         |
  0+33       0.0393      1.04   |Q        |         |         |         |
  0+34       0.0408      1.04   |Q        |         |         |         |
  0+35       0.0422      1.05   |Q        |         |         |         |
  0+36       0.0436      1.05   |Q        |         |         |         |
  0+37       0.0451      1.05   |Q        |         |         |         |
  0+38       0.0465      1.05   |Q        |         |         |         |
```

0+39	0.0480	1.05	Q				
0+40	0.0494	1.06	Q				
0+41	0.0509	1.06	Q				
0+42	0.0524	1.07	Q				
0+43	0.0538	1.07	Q				
0+44	0.0553	1.07	Q				
0+45	0.0568	1.08	Q				
0+46	0.0583	1.08	Q				
0+47	0.0598	1.09	Q				
0+48	0.0613	1.09	Q				
0+49	0.0628	1.10	Q				
0+50	0.0643	1.10	Q				
0+51	0.0658	1.10	Q				
0+52	0.0674	1.11	Q				
0+53	0.0689	1.11	QV				
0+54	0.0704	1.11	QV				
0+55	0.0720	1.11	QV				
0+56	0.0735	1.12	QV				
0+57	0.0750	1.12	QV				
0+58	0.0766	1.12	QV				
0+59	0.0781	1.12	QV				
1+ 0	0.0797	1.13	QV				
1+ 1	0.0812	1.13	QV				
1+ 2	0.0828	1.14	QV				
1+ 3	0.0844	1.14	QV				
1+ 4	0.0860	1.15	QV				
1+ 5	0.0876	1.15	QV				
1+ 6	0.0891	1.16	QV				
1+ 7	0.0908	1.16	QV				
1+ 8	0.0924	1.17	QV				
1+ 9	0.0940	1.18	QV				
1+10	0.0956	1.18	QV				
1+11	0.0972	1.18	QV				
1+12	0.0989	1.19	QV				
1+13	0.1005	1.19	QV				
1+14	0.1022	1.19	Q V				
1+15	0.1038	1.20	Q V				
1+16	0.1054	1.20	Q V				
1+17	0.1071	1.20	Q V				
1+18	0.1088	1.20	Q V				
1+19	0.1104	1.21	Q V				
1+20	0.1121	1.21	Q V				
1+21	0.1138	1.22	Q V				
1+22	0.1155	1.22	Q V				
1+23	0.1171	1.23	Q V				
1+24	0.1188	1.24	Q V				
1+25	0.1206	1.24	Q V				
1+26	0.1223	1.25	Q V				
1+27	0.1240	1.26	Q V				
1+28	0.1258	1.26	Q V				
1+29	0.1275	1.27	Q V				
1+30	0.1293	1.28	Q V				
1+31	0.1310	1.28	Q V				
1+32	0.1328	1.28	Q V				
1+33	0.1346	1.29	Q V				
1+34	0.1363	1.29	Q V				
1+35	0.1381	1.29	Q V				
1+36	0.1399	1.30	Q V				
1+37	0.1417	1.30	Q V				
1+38	0.1435	1.30	Q V				
1+39	0.1453	1.31	Q V				
1+40	0.1471	1.31	Q V				
1+41	0.1489	1.32	Q V				
1+42	0.1507	1.33	Q V				
1+43	0.1526	1.34	Q V				
1+44	0.1544	1.34	Q V				
1+45	0.1563	1.35	Q V				
1+46	0.1582	1.36	Q V				
1+47	0.1601	1.37	Q V				

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1+48     0.1620     1.38  | Q V     |         |         |         |
1+49     0.1639     1.38  | Q V     |         |         |         |
1+50     0.1658     1.39  | Q V     |         |         |         |
1+51     0.1677     1.40  | Q V     |         |         |         |
1+52     0.1696     1.40  | Q  V    |         |         |         |
1+53     0.1716     1.41  | Q  V    |         |         |         |
1+54     0.1735     1.41  | Q  V    |         |         |         |
1+55     0.1755     1.42  | Q  V    |         |         |         |
1+56     0.1774     1.42  | Q  V    |         |         |         |
1+57     0.1794     1.43  | Q  V    |         |         |         |
1+58     0.1814     1.43  | Q  V    |         |         |         |
1+59     0.1833     1.43  | Q  V    |         |         |         |
2+ 0     0.1853     1.44  | Q  V    |         |         |         |
2+ 1     0.1873     1.45  | Q  V    |         |         |         |
2+ 2     0.1893     1.46  | Q  V    |         |         |         |
2+ 3     0.1914     1.47  | Q  V    |         |         |         |
2+ 4     0.1934     1.48  | Q  V    |         |         |         |
2+ 5     0.1954     1.49  | Q  V    |         |         |         |
2+ 6     0.1975     1.50  | Q  V    |         |         |         |
2+ 7     0.1996     1.51  | Q  V    |         |         |         |
2+ 8     0.2017     1.52  | Q  V    |         |         |         |
2+ 9     0.2038     1.53  | Q   V   |         |         |         |
2+10     0.2059     1.54  | Q   V   |         |         |         |
2+11     0.2081     1.55  | Q   V   |         |         |         |
2+12     0.2102     1.55  | Q   V   |         |         |         |
2+13     0.2124     1.56  | Q   V   |         |         |         |
2+14     0.2145     1.57  | Q   V   |         |         |         |
2+15     0.2167     1.57  | Q   V   |         |         |         |
2+16     0.2189     1.58  | Q   V   |         |         |         |
2+17     0.2210     1.58  | Q   V   |         |         |         |
2+18     0.2232     1.59  | Q   V   |         |         |         |
2+19     0.2254     1.60  | Q   V   |         |         |         |
2+20     0.2276     1.60  | Q   V   |         |         |         |
2+21     0.2299     1.62  | Q   V   |         |         |         |
2+22     0.2321     1.63  | Q   V   |         |         |         |
2+23     0.2344     1.64  | Q   V   |         |         |         |
2+24     0.2367     1.66  | Q   V   |         |         |         |
2+25     0.2390     1.67  | Q    V  |         |         |         |
2+26     0.2413     1.69  | Q    V  |         |         |         |
2+27     0.2436     1.70  | Q    V  |         |         |         |
2+28     0.2460     1.71  | Q    V  |         |         |         |
2+29     0.2484     1.73  | Q    V  |         |         |         |
2+30     0.2508     1.74  | Q    V  |         |         |         |
2+31     0.2532     1.75  | Q    V  |         |         |         |
2+32     0.2556     1.76  | Q    V  |         |         |         |
2+33     0.2580     1.77  | Q    V  |         |         |         |
2+34     0.2605     1.77  | Q    V  |         |         |         |
2+35     0.2629     1.78  | Q    V  |         |         |         |
2+36     0.2654     1.79  | Q    V  |         |         |         |
2+37     0.2679     1.80  | Q    V  |         |         |         |
2+38     0.2704     1.81  | Q    V  |         |         |         |
2+39     0.2729     1.82  | Q     V |         |         |         |
2+40     0.2754     1.82  | Q     V |         |         |         |
2+41     0.2779     1.84  | Q     V |         |         |         |
2+42     0.2805     1.86  | Q     V |         |         |         |
2+43     0.2831     1.88  | Q     V |         |         |         |
2+44     0.2857     1.90  | Q     V |         |         |         |
2+45     0.2884     1.92  | Q     V |         |         |         |
2+46     0.2910     1.94  | Q     V |         |         |         |
2+47     0.2937     1.96  | Q     V |         |         |         |
2+48     0.2965     1.98  | Q     V |         |         |         |
2+49     0.2992     2.00  | Q     V |         |         |         |
2+50     0.3020     2.02  | Q     V |         |         |         |
2+51     0.3048     2.04  |  Q     V|         |         |         |
2+52     0.3076     2.05  |  Q     V|         |         |         |
2+53     0.3105     2.06  |  Q     V|         |         |         |
2+54     0.3133     2.07  |  Q     V|         |         |         |
2+55     0.3162     2.08  |  Q     V|         |         |         |
2+56     0.3191     2.10  |  Q     V|         |         |         |
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 967    2+57    0.3220     2.11  |  Q     V|         |         |         |
 968    2+58    0.3249     2.12  |  Q     V|         |         |         |
 969    2+59    0.3278     2.13  |  Q     V|         |         |         |
 970    3+ 0    0.3308     2.15  |  Q     V|         |         |         |
 971    3+ 1    0.3338     2.18  |  Q     V|         |         |         |
 972    3+ 2    0.3368     2.21  |  Q     V|         |         |         |
 973    3+ 3    0.3399     2.24  |  Q      V         |         |         |
 974    3+ 4    0.3431     2.27  |  Q      V         |         |         |
 975    3+ 5    0.3462     2.30  |  Q      V         |         |         |
 976    3+ 6    0.3494     2.33  |  Q      V         |         |         |
 977    3+ 7    0.3527     2.37  |  Q      V         |         |         |
 978    3+ 8    0.3560     2.40  |  Q      V         |         |         |
 979    3+ 9    0.3593     2.43  |  Q      V         |         |         |
 980    3+10    0.3627     2.46  |  Q      V         |         |         |
 981    3+11    0.3661     2.48  |  Q      V         |         |         |
 982    3+12    0.3696     2.50  |  Q      V         |         |         |
 983    3+13    0.3731     2.52  |  Q      |V        |         |         |
 984    3+14    0.3766     2.54  |  Q      |V        |         |         |
 985    3+15    0.3801     2.56  |  Q      |V        |         |         |
 986    3+16    0.3837     2.58  |  Q      |V        |         |         |
 987    3+17    0.3872     2.60  |  Q      |V        |         |         |
 988    3+18    0.3909     2.63  |  Q      |V        |         |         |
 989    3+19    0.3945     2.65  |  Q      |V        |         |         |
 990    3+20    0.3982     2.67  |  Q      |V        |         |         |
 991    3+21    0.4019     2.73  |   Q     |V        |         |         |
 992    3+22    0.4058     2.79  |   Q     |V        |         |         |
 993    3+23    0.4097     2.84  |   Q     | V       |         |         |
 994    3+24    0.4137     2.90  |   Q     | V       |         |         |
 995    3+25    0.4178     2.96  |   Q     | V       |         |         |
 996    3+26    0.4219     3.02  |   Q     | V       |         |         |
 997    3+27    0.4262     3.08  |   Q     | V       |         |         |
 998    3+28    0.4305     3.14  |   Q     | V       |         |         |
 999    3+29    0.4349     3.20  |   Q     | V       |         |         |
1000    3+30    0.4394     3.26  |   Q     | V       |         |         |
1001    3+31    0.4439     3.30  |   Q     |  V      |         |         |
1002    3+32    0.4486     3.35  |   Q     |  V      |         |         |
1003    3+33    0.4532     3.40  |    Q    |  V      |         |         |
1004    3+34    0.4580     3.44  |    Q    |  V      |         |         |
1005    3+35    0.4628     3.49  |    Q    |  V      |         |         |
1006    3+36    0.4676     3.53  |    Q    |  V      |         |         |
1007    3+37    0.4726     3.58  |    Q    |  V      |         |         |
1008    3+38    0.4776     3.62  |    Q    |   V     |         |         |
1009    3+39    0.4826     3.67  |    Q    |   V     |         |         |
1010    3+40    0.4877     3.71  |    Q    |   V     |         |         |
1011    3+41    0.4931     3.89  |    Q    |   V     |         |         |
1012    3+42    0.4987     4.06  |     Q   |   V     |         |         |
1013    3+43    0.5045     4.23  |     Q   |   V     |         |         |
1014    3+44    0.5106     4.41  |     Q   |    V    |         |         |
1015    3+45    0.5169     4.58  |     Q   |    V    |         |         |
1016    3+46    0.5234     4.76  |      Q  |    V    |         |         |
1017    3+47    0.5302     4.93  |      Q  |    V    |         |         |
1018    3+48    0.5372     5.10  |      Q  |    V    |         |         |
1019    3+49    0.5445     5.28  |      Q  |     V   |         |         |
1020    3+50    0.5520     5.45  |       Q |     V   |         |         |
1021    3+51    0.5598     5.67  |       Q |     V   |         |         |
1022    3+52    0.5680     5.90  |       Q |     V   |         |         |
1023    3+53    0.5764     6.12  |        Q|      V  |         |         |
1024    3+54    0.5851     6.34  |        Q|      V  |         |         |
1025    3+55    0.5942     6.57  |        Q|      V  |         |         |
1026    3+56    0.6035     6.79  |         Q      V  |         |         |
1027    3+57    0.6132     7.01  |         Q       V |         |         |
1028    3+58    0.6231     7.23  |         Q       V |         |         |
1029    3+59    0.6334     7.46  |         |Q      V |         |         |
1030    4+ 0    0.6440     7.68  |         |Q       V|         |         |
1031    4+ 1    0.6572     9.61  |         |   Q    V|         |         |
1032    4+ 2    0.6731    11.54  |         |      Q V|         |         |
1033    4+ 3    0.6917    13.47  |         |        QV         |         |
1034    4+ 4    0.7129    15.41  |         |         |VQ       |         |
1035    4+ 5    0.7368    17.34  |         |         |V   Q    |         |
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1036      4+ 6      0.7633     19.27  |         |         | V     Q |         |
1037      4+ 7      0.7925     21.20  |         |         |  V      |Q        |
1038      4+ 8      0.8244     23.13  |         |         |   V     |   Q     |
1039      4+ 9      0.8589     25.06  |         |         |    V    |      Q  |
1040      4+10      0.8961     27.00  |         |         |     V   |         Q
1041      4+11      0.9302     24.73  |         |         |      V  |     Q   |
1042      4+12      0.9611     22.47  |         |         |       V |  Q      |
1043      4+13      0.9890     20.21  |         |         |        Q|         |
1044      4+14      1.0137     17.95  |         |         |     Q  V|         |
1045      4+15      1.0353     15.68  |         |         |  Q      V         |
1046      4+16      1.0538     13.42  |         |        Q|         |V        |
1047      4+17      1.0691     11.16  |         |     Q   |         |V        |
1048      4+18      1.0814      8.90  |         |  Q      |         |V        |
1049      4+19      1.0905      6.63  |        Q|         |         | V       |
1050      4+20      1.0966      4.37  |     Q   |         |         | V       |
1051      4+21      1.1024      4.23  |     Q   |         |         | V       |
1052      4+22      1.1080      4.08  |     Q   |         |         | V       |
1053      4+23      1.1134      3.94  |    Q    |         |         | V       |
1054      4+24      1.1187      3.79  |    Q    |         |         |  V      |
1055      4+25      1.1237      3.65  |    Q    |         |         |  V      |
1056      4+26      1.1285      3.50  |    Q    |         |         |  V      |
1057      4+27      1.1331      3.36  |   Q     |         |         |  V      |
1058      4+28      1.1376      3.21  |   Q     |         |         |  V      |
1059      4+29      1.1418      3.07  |   Q     |         |         |  V      |
1060      4+30      1.1458      2.93  |   Q     |         |         |  V      |
1061      4+31      1.1498      2.86  |   Q     |         |         |  V      |
1062      4+32      1.1536      2.80  |   Q     |         |         |   V     |
1063      4+33      1.1574      2.73  |   Q     |         |         |   V     |
1064      4+34      1.1611      2.67  |  Q      |         |         |   V     |
1065      4+35      1.1647      2.61  |  Q      |         |         |   V     |
1066      4+36      1.1682      2.54  |  Q      |         |         |   V     |
1067      4+37      1.1716      2.48  |  Q      |         |         |   V     |
1068      4+38      1.1749      2.42  |  Q      |         |         |   V     |
1069      4+39      1.1781      2.35  |  Q      |         |         |   V     |
1070      4+40      1.1813      2.29  |  Q      |         |         |   V     |
1071      4+41      1.1844      2.25  |  Q      |         |         |    V    |
1072      4+42      1.1874      2.21  |  Q      |         |         |    V    |
1073      4+43      1.1904      2.18  |  Q      |         |         |    V    |
1074      4+44      1.1934      2.14  |  Q      |         |         |    V    |
1075      4+45      1.1963      2.10  |  Q      |         |         |    V    |
1076      4+46      1.1991      2.07  |  Q      |         |         |    V    |
1077      4+47      1.2019      2.03  |  Q      |         |         |    V    |
1078      4+48      1.2047      1.99  | Q       |         |         |    V    |
1079      4+49      1.2074      1.95  | Q       |         |         |    V    |
1080      4+50      1.2100      1.92  | Q       |         |         |    V    |
1081      4+51      1.2126      1.89  | Q       |         |         |    V    |
1082      4+52      1.2152      1.87  | Q       |         |         |    V    |
1083      4+53      1.2177      1.84  | Q       |         |         |    V    |
1084      4+54      1.2202      1.82  | Q       |         |         |     V   |
1085      4+55      1.2227      1.79  | Q       |         |         |     V   |
1086      4+56      1.2251      1.77  | Q       |         |         |     V   |
1087      4+57      1.2275      1.74  | Q       |         |         |     V   |
1088      4+58      1.2299      1.72  | Q       |         |         |     V   |
1089      4+59      1.2322      1.69  | Q       |         |         |     V   |
1090      5+ 0      1.2345      1.67  | Q       |         |         |     V   |
1091      5+ 1      1.2368      1.65  | Q       |         |         |     V   |
1092      5+ 2      1.2390      1.63  | Q       |         |         |     V   |
1093      5+ 3      1.2413      1.61  | Q       |         |         |     V   |
1094      5+ 4      1.2435      1.60  | Q       |         |         |     V   |
1095      5+ 5      1.2456      1.58  | Q       |         |         |     V   |
1096      5+ 6      1.2478      1.56  | Q       |         |         |     V   |
1097      5+ 7      1.2499      1.54  | Q       |         |         |     V   |
1098      5+ 8      1.2520      1.52  | Q       |         |         |      V  |
1099      5+ 9      1.2541      1.51  | Q       |         |         |      V  |
1100      5+10      1.2561      1.49  | Q       |         |         |      V  |
1101      5+11      1.2582      1.47  | Q       |         |         |      V  |
1102      5+12      1.2602      1.46  | Q       |         |         |      V  |
1103      5+13      1.2622      1.45  | Q       |         |         |      V  |
1104      5+14      1.2642      1.43  | Q       |         |         |      V  |
```

```
      5+15       1.2661      1.42  | Q        |         |         |      V   |
      5+16       1.2680      1.41  | Q        |         |         |      V   |
      5+17       1.2700      1.39  | Q        |         |         |      V   |
      5+18       1.2719      1.38  | Q        |         |         |      V   |
      5+19       1.2737      1.36  | Q        |         |         |      V   |
      5+20       1.2756      1.35  | Q        |         |         |      V   |
      5+21       1.2774      1.34  |Q         |         |         |      V   |
      5+22       1.2793      1.33  |Q         |         |         |      V   |
      5+23       1.2811      1.32  |Q         |         |         |      V   |
      5+24       1.2829      1.31  |Q         |         |         |      V   |
      5+25       1.2847      1.30  |Q         |         |         |      V   |
      5+26       1.2865      1.29  |Q         |         |         |       V  |
      5+27       1.2882      1.27  |Q         |         |         |       V  |
      5+28       1.2899      1.26  |Q         |         |         |       V  |
      5+29       1.2917      1.25  |Q         |         |         |       V  |
      5+30       1.2934      1.24  |Q         |         |         |       V  |
      5+31       1.2951      1.23  |Q         |         |         |       V  |
      5+32       1.2968      1.22  |Q         |         |         |       V  |
      5+33       1.2984      1.22  |Q         |         |         |       V  |
      5+34       1.3001      1.21  |Q         |         |         |       V  |
      5+35       1.3018      1.20  |Q         |         |         |       V  |
      5+36       1.3034      1.19  |Q         |         |         |       V  |
      5+37       1.3050      1.18  |Q         |         |         |       V  |
      5+38       1.3066      1.17  |Q         |         |         |       V  |
      5+39       1.3082      1.16  |Q         |         |         |       V  |
      5+40       1.3098      1.15  |Q         |         |         |       V  |
      5+41       1.3114      1.15  |Q         |         |         |       V  |
      5+42       1.3130      1.14  |Q         |         |         |       V  |
      5+43       1.3145      1.13  |Q         |         |         |       V  |
      5+44       1.3161      1.12  |Q         |         |         |       V  |
      5+45       1.3176      1.12  |Q         |         |         |       V  |
      5+46       1.3191      1.11  |Q         |         |         |       V  |
      5+47       1.3206      1.10  |Q         |         |         |        V|
      5+48       1.3221      1.09  |Q         |         |         |        V|
      5+49       1.3236      1.09  |Q         |         |         |        V|
      5+50       1.3251      1.08  |Q         |         |         |        V|
      5+51       1.3266      1.07  |Q         |         |         |        V|
      5+52       1.3281      1.07  |Q         |         |         |        V|
      5+53       1.3295      1.06  |Q         |         |         |        V|
      5+54       1.3310      1.05  |Q         |         |         |        V|
      5+55       1.3324      1.05  |Q         |         |         |        V|
      5+56       1.3338      1.04  |Q         |         |         |        V|
      5+57       1.3353      1.03  |Q         |         |         |        V|
      5+58       1.3367      1.03  |Q         |         |         |        V|
      5+59       1.3381      1.02  |Q         |         |         |        V|
      6+ 0       1.3395      1.01  |Q         |         |         |        V|
      6+ 1       1.3409      1.01  |Q         |         |         |        V|
      6+ 2       1.3423      1.00  |Q         |         |         |        V|
      6+ 3       1.3436      1.00  |Q         |         |         |        V|
      6+ 4       1.3450      0.99  |Q         |         |         |        V|
      6+ 5       1.3464      0.99  |Q         |         |         |        V|
      6+ 6       1.3477      0.98  |Q         |         |         |        V|
      6+ 7       1.3491      0.98  |Q         |         |         |        V|
      6+ 8       1.3504      0.97  |Q         |         |         |        V|
      6+ 9       1.3517      0.97  |Q         |         |         |        V|
      6+10       1.3531      0.96  |Q         |         |         |         V
  -----------------------------------------------------------------------




      End of computations, total study area =          6.899 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 12/03/21

21052 Q100 POST GROUP2
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********* Hydrology Study Control Information **********

Program License Serial Number 6332

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.800
24 hour precipitation(inches) = 5.000
P6/P24 = 56.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 108.000 to Point/Station 108.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.846 given for subarea
Rainfall intensity (I) = 4.626(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 10.31 min. Rain intensity = 4.63(In/Hr)
Total area = 6.900(Ac.) Total runoff = 27.000(CFS)

++
Process from Point/Station 106.100 to Point/Station 106.100
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 6.900(Ac.)
Runoff from this stream = 27.000(CFS)
Time of concentration = 10.31 min.
Rainfall intensity = 4.626(In/Hr)

++
Process from Point/Station 109.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 70.000(Ft.)
Highest elevation = 560.000(Ft.)
Lowest elevation = 535.000(Ft.)

```
Elevation difference =   25.000(Ft.) Slope = 35.714 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  11.14 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*(  70.000^.5)/(   1.000^(1/3)]=  11.14
Rainfall intensity (I) =      4.399(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      0.127(CFS)
Total initial stream area =        0.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.395(CFS)
Depth of flow =   0.573(Ft.), Average velocity =   4.253(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00               1.00
    2              1.00               0.00
    3              2.00               1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      1.395(CFS)
  '     '    flow top width =      1.145(Ft.)
  '     '    velocity=    4.253(Ft/s)
  '     '    area =      0.328(Sq.Ft)
  '     '    Froude number =     1.401

Upstream point elevation =   535.000(Ft.)
Downstream point elevation =   491.400(Ft.)
Flow length =   703.000(Ft.)
Travel time  =    2.75 min.
Time of concentration =   13.90 min.
Depth of flow =   0.573(Ft.)
Average velocity =   4.253(Ft/s)
Total irregular channel flow =     1.395(CFS)
Irregular channel normal depth above invert elev. =   0.573(Ft.)
Average velocity of channel(s) =   4.253(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.815(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less        )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      3.815(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360  CA =      0.684
Subarea runoff =      2.483(CFS) for      1.820(Ac.)
Total runoff =      2.610(CFS)  Total area =       1.900(Ac.)
Depth of flow =   0.724(Ft.), Average velocity =   4.974(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****

______________________________________________________________________
```

```
Rainfall intensity (I) =       3.815(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.500
Decimal fraction soil group D = 0.500
[LOW DENSITY RESIDENTIAL                              ]
(1.0 DU/A or Less        )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.385
Time of concentration =    13.90 min.
Rainfall intensity =      3.815(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.361  CA =      0.711
Subarea runoff =      0.101(CFS) for      0.069(Ac.)
Total runoff =      2.711(CFS)  Total area =       1.969(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      106.100
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   483.000(Ft.)
Downstream point/station elevation =   472.870(Ft.)
Pipe length  =   483.00(Ft.) Slope =   0.0210  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.711(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.711(CFS)
Normal flow depth in pipe =    5.14(In.)
Flow top width inside pipe =   16.26(In.)
Critical Depth =    7.50(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    1.24 min.
Time of concentration (TC) =    15.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.100 to Point/Station      106.100
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.969(Ac.)
Runoff from this stream =      2.711(CFS)
Time of concentration =   15.14 min.
Rainfall intensity =     3.611(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.        (CFS)       (min)                   (In/Hr)


1       27.000     10.31             4.626
2        2.711     15.14             3.611
Qmax(1) =
       1.000 *    1.000 *    27.000) +
       1.000 *    0.681 *     2.711) + =      28.846
Qmax(2) =
       0.781 *    1.000 *    27.000) +
       1.000 *    1.000 *     2.711) + =      23.787

Total of 2 streams to confluence:
Flow rates before confluence point:
      27.000       2.711
Maximum flow rates at confluence using above data:
       28.846       23.787
Area of streams before confluence:
        6.900        1.969
Results of confluence:
Total flow rate =     28.846(CFS)
Time of concentration =    10.310 min.
```

```
Effective stream area after confluence =      8.869(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.100 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   472.830(Ft.)
Downstream point/station elevation =   471.610(Ft.)
Pipe length  =   109.00(Ft.) Slope =   0.0112  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    28.846(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    28.846(CFS)
Normal flow depth in pipe =   16.03(In.)
Flow top width inside pipe =   35.78(In.)
Critical Depth =   20.84(In.)
Pipe flow velocity =      9.48(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    10.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   471.280(Ft.)
Downstream point/station elevation =   441.420(Ft.)
Pipe length  =    63.00(Ft.) Slope =   0.4740  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    28.846(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    28.846(CFS)
Normal flow depth in pipe =    6.12(In.)
Flow top width inside pipe =   27.04(In.)
Critical Depth =   20.84(In.)
Pipe flow velocity =     36.23(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    10.53 min.
End of computations, total study area =          8.869 (Ac.)
```

6c. CivilD Mitigated Post-Development Calculations

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 04/06/22
------------------------------------------------------------------------
21052 Q100 POST GROUP2 DETENTION
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.
DETENTION
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 6332

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.800
24 hour precipitation(inches) =  5.000
P6/P24 =    56.0%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.636 given for subarea
Rainfall intensity (I) =      2.987(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  20.31 min.  Rain intensity =       2.99(In/Hr)
Total area =        6.900(Ac.)  Total runoff =    13.110(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.100 to Point/Station      106.100
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.900(Ac.)
Runoff from this stream =     13.110(CFS)
Time of concentration =   20.31 min.
Rainfall intensity =     2.987(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance  =   70.000(Ft.)
Highest elevation =  560.000(Ft.)
Lowest elevation =  535.000(Ft.)
```

```
Elevation difference =   25.000(Ft.) Slope = 35.714 %
Top of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  11.14 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*(  70.000^.5)/(   1.000^(1/3)]=  11.14
Rainfall intensity (I) =      4.399(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      0.127(CFS)
Total initial stream area =        0.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel =      1.395(CFS)
Depth of flow =   0.573(Ft.), Average velocity =   4.254(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00               1.00
    2              1.00               0.00
    3              2.00               1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      1.395(CFS)
  '     '    flow top width =      1.145(Ft.)
  '     '    velocity=    4.254(Ft/s)
  '     '    area =      0.328(Sq.Ft)
  '     '    Froude number =     1.401

Upstream point elevation =   535.000(Ft.)
Downstream point elevation =   491.400(Ft.)
Flow length =   703.000(Ft.)
Travel time  =    2.75 min.
Time of concentration =   13.90 min.
Depth of flow =   0.573(Ft.)
Average velocity =   4.254(Ft/s)
Total irregular channel flow =     1.395(CFS)
Irregular channel normal depth above invert elev. =   0.573(Ft.)
Average velocity of channel(s) =   4.254(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.815(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less        )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      3.815(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360  CA =      0.684
Subarea runoff =      2.484(CFS) for      1.821(Ac.)
Total runoff =      2.611(CFS)  Total area =       1.901(Ac.)
Depth of flow =   0.724(Ft.), Average velocity =   4.975(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****
```

```
Rainfall intensity (I) =      3.815(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.500
Decimal fraction soil group D = 0.500
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.385
Time of concentration =    13.90 min.
Rainfall intensity =      3.815(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.361  CA =      0.711
Subarea runoff =      0.101(CFS) for      0.069(Ac.)
Total runoff =      2.712(CFS)  Total area =       1.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      106.100
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   483.000(Ft.)
Downstream point/station elevation =   472.870(Ft.)
Pipe length  =   483.00(Ft.) Slope =   0.0210  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.712(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.712(CFS)
Normal flow depth in pipe =    5.14(In.)
Flow top width inside pipe =   16.26(In.)
Critical Depth =    7.50(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    1.24 min.
Time of concentration (TC) =    15.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.100 to Point/Station      106.100
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.970(Ac.)
Runoff from this stream =      2.712(CFS)
Time of concentration =   15.14 min.
Rainfall intensity =     3.611(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1       13.110     20.31             2.987
2        2.712     15.14             3.611
Qmax(1) =
       1.000 *    1.000 *    13.110) +
       0.827 *    1.000 *     2.712) + =      15.354
Qmax(2) =
       1.000 *    0.745 *    13.110) +
       1.000 *    1.000 *     2.712) + =      12.483

Total of 2 streams to confluence:
Flow rates before confluence point:
      13.110       2.712
Maximum flow rates at confluence using above data:
       15.354       12.483
Area of streams before confluence:
        6.900        1.970
Results of confluence:
Total flow rate =     15.354(CFS)
Time of concentration =    20.310 min.
```

```
Effective stream area after confluence =      8.870(Ac.)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.100 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   472.830(Ft.)
Downstream point/station elevation =   471.610(Ft.)
Pipe length  =   109.00(Ft.) Slope =   0.0112  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.354(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    15.354(CFS)
Normal flow depth in pipe =   11.40(In.)
Flow top width inside pipe =   33.49(In.)
Critical Depth =   14.99(In.)
Pipe flow velocity =      7.98(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =    20.54 min.

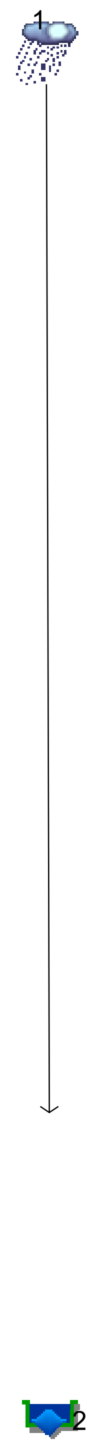

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   471.280(Ft.)
Downstream point/station elevation =   441.420(Ft.)
Pipe length  =    63.00(Ft.) Slope =   0.4740  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.354(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    15.354(CFS)
Normal flow depth in pipe =    4.51(In.)
Flow top width inside pipe =   23.83(In.)
Critical Depth =   14.99(In.)
Pipe flow velocity =     30.02(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    20.57 min.
End of computations, total study area =           8.870 (Ac.)
```

ATTACHMENT 7
HYDROGRAPH

7a. Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
1	Manual	21052hydrographupdated2
2	Reservoir	<no description>

Project: Detention Pipe.GPW

Wednesday, 12 / 8 / 2021

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	-------	-------	-------	-------	-------	-------	27.00	21052hydrographupdated2
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	13.24	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	27.00	10	250	64,920	------	------	------	21052hydrographupdated2
2	Reservoir	13.24	10	260	64,911	1	476.17	13,528	<no description>

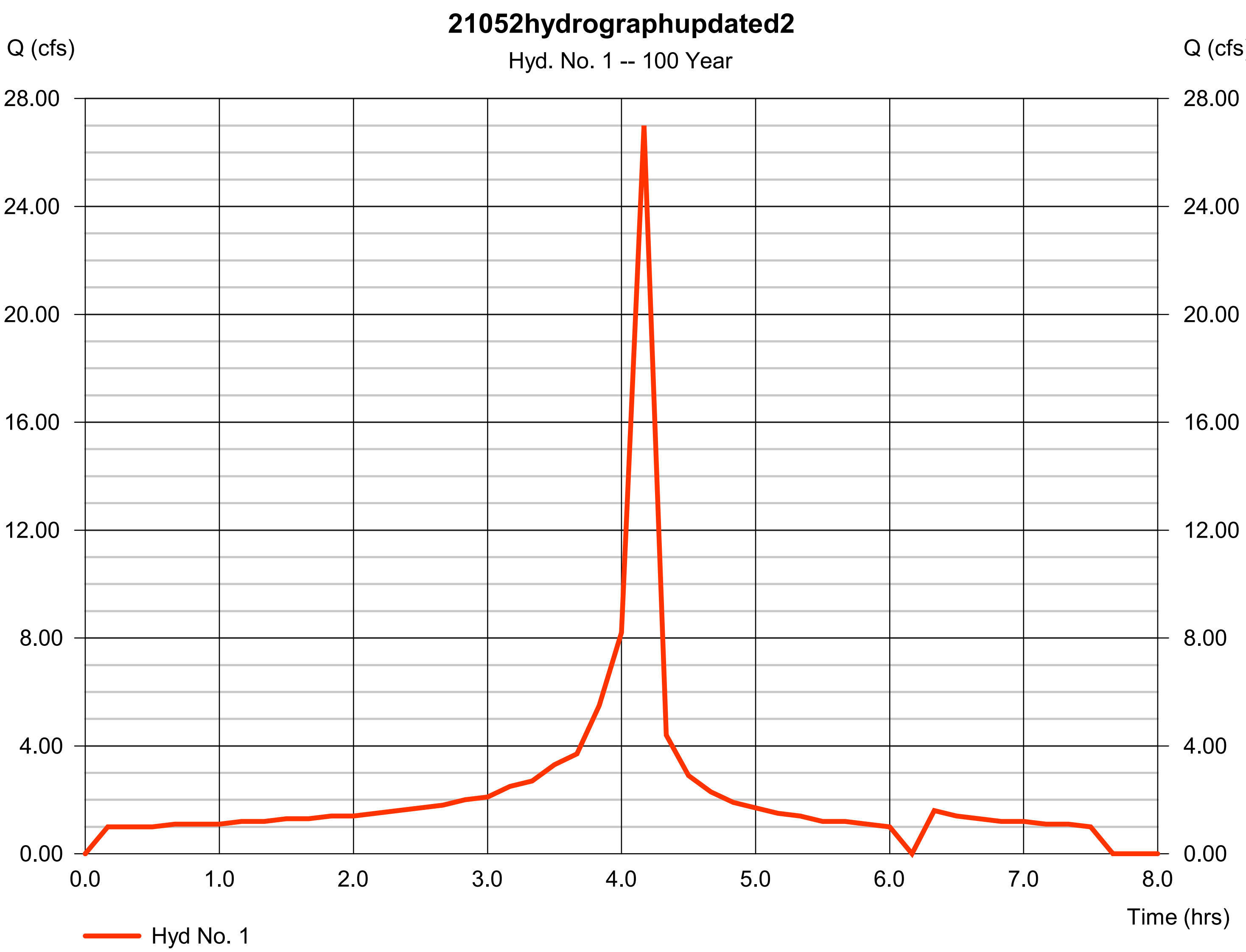
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Wednesday, 12 / 8 / 2021

Hyd. No. 1

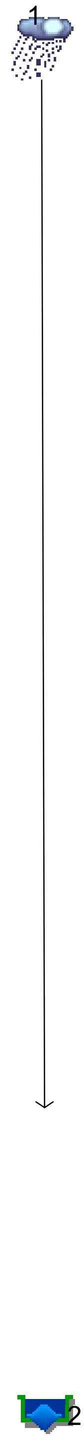
21052hydrographupdated2

Hydrograph type	= Manual	Peak discharge	= 27.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.17 hrs
Time interval	= 10 min	Hyd. volume	= 64,920 cuft



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
1	Manual	21052hydrographupdated2
2	Reservoir	<no description>

Project: Detention Pipe.GPW

Wednesday, 04 / 6 / 2022

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	-------	-------	-------	-------	-------	-------	27.00	21052hydrographupdated2
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	13.11	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	27.00	10	250	64,920	------	------	------	21052hydrographupdated2
2	Reservoir	13.11	10	260	64,911	1	476.12	13,319	<no description>

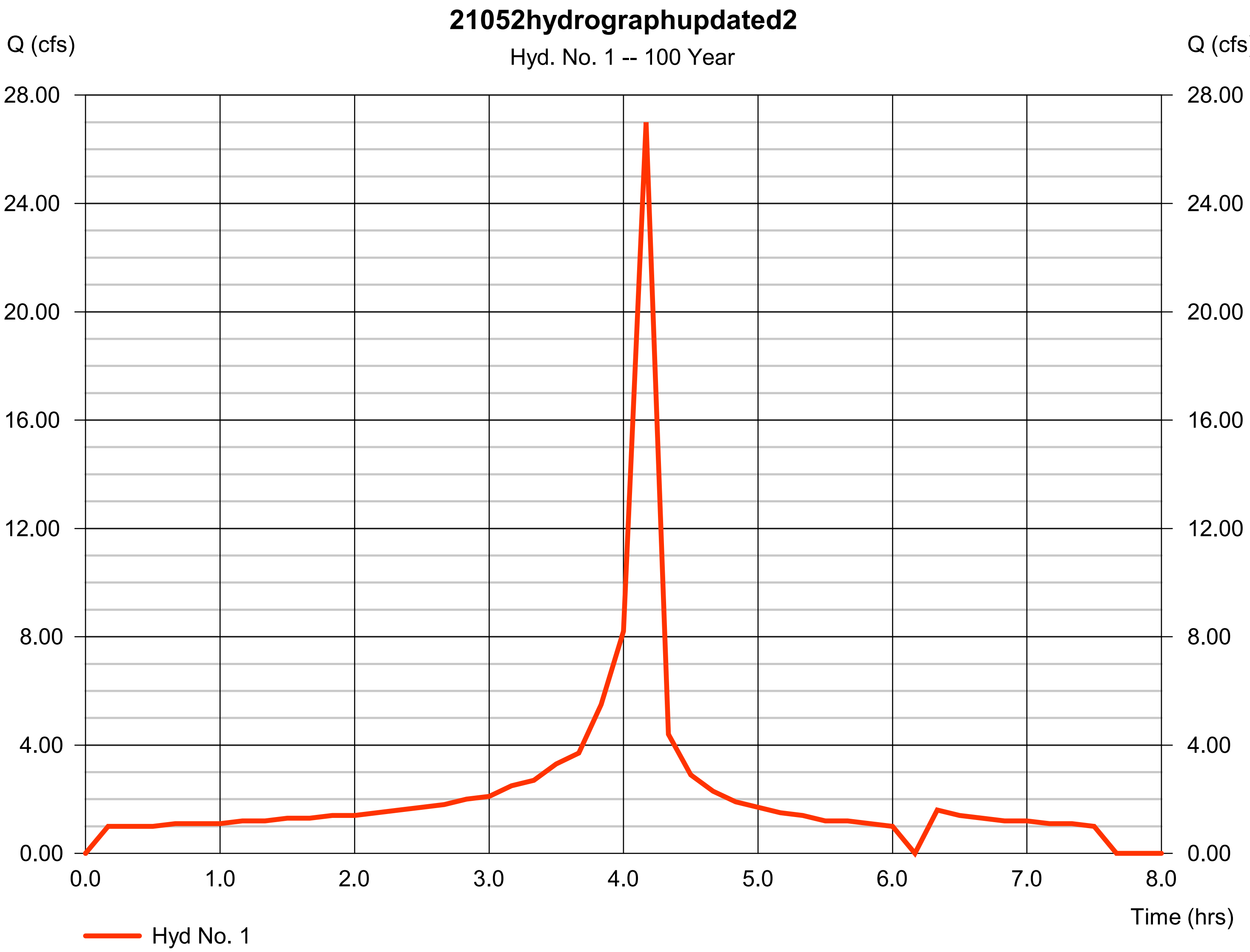
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 04 / 6 / 2022

Hyd. No. 1

21052hydrographupdated2

Hydrograph type	= Manual	Peak discharge	= 27.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.17 hrs
Time interval	= 10 min	Hyd. volume	= 64,920 cuft



Hydrograph Report

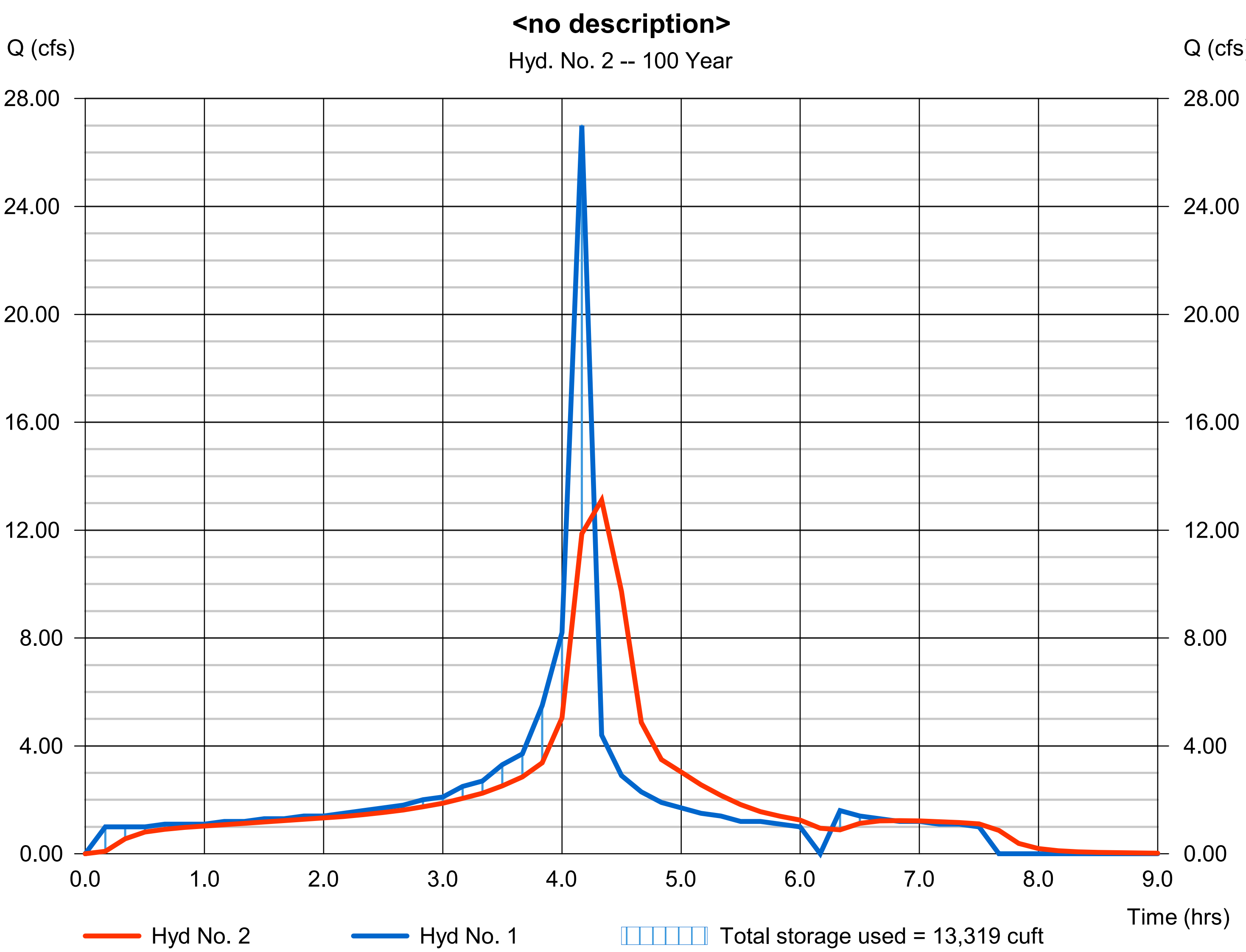
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 04 / 6 / 2022

Hyd. No. 2

<no description>

Hydrograph type	= Reservoir	Peak discharge	= 13.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.33 hrs
Time interval	= 10 min	Hyd. volume	= 64,911 cuft
Inflow hyd. No.	= 1 - 21052hydrographupdated2	Max. Elevation	= 476.12 ft
Reservoir name	= Detention Pipe-sto1	Max. Storage	= 13,319 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Pipe-sto1

Pond Data

UG Chambers -Invert elev. = 473.00 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 242.00 ft, No. Barrels = 5, Slope = 0.00%, Headers = Yes

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	473.00	n/a	0	0
0.40	473.40	n/a	828	828
0.80	473.80	n/a	1,439	2,267
1.20	474.20	n/a	1,750	4,017
1.60	474.60	n/a	1,927	5,944
2.00	475.00	n/a	2,014	7,958
2.40	475.40	n/a	2,014	9,971
2.80	475.80	n/a	1,927	11,898
3.20	476.20	n/a	1,749	13,647
3.60	476.60	n/a	1,438	15,085
4.00	477.00	n/a	827	15,912

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	0.00
Span (in)	= 18.00	0.50	1.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 473.00	473.00	473.41	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 2.20	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	Inactive	Inactive	0.00
Crest El. (ft)	= 482.50	476.00	473.75	0.00
Weir Coeff.	= 3.33	2.60	2.60	3.33
Weir Type	= 1	Broad	Broad	---
Multi-Stage	= Yes	No	Yes	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	473.00	0.00	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.000
0.04	83	473.04	0.01 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.009
0.08	166	473.08	0.04 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.035
0.12	248	473.12	0.08 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.079
0.16	331	473.16	0.14 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.138
0.20	414	473.20	0.21 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.213
0.24	497	473.24	0.31 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.306
0.28	580	473.28	0.41 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.411
0.32	663	473.32	0.53 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.533
0.36	745	473.36	0.67 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.667
0.40	828	473.40	0.78 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.779
0.44	972	473.44	0.90 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.895
0.48	1,116	473.48	1.01 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.015
0.52	1,260	473.52	1.14 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.136
0.56	1,404	473.56	1.26 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.259
0.60	1,548	473.60	1.38 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.385
0.64	1,691	473.64	1.51 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.514
0.68	1,835	473.68	1.64 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.641
0.72	1,979	473.72	1.77 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.770
0.76	2,123	473.76	1.90 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	1.899
0.80	2,267	473.80	2.03 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.028
0.84	2,442	473.84	2.16 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.156
0.88	2,617	473.88	2.28 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.282
0.92	2,792	473.92	2.41 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.410
0.96	2,967	473.96	2.53 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.534
1.00	3,142	474.00	2.66 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.657
1.04	3,317	474.04	2.78 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.776
1.08	3,492	474.08	2.89 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	2.895
1.12	3,667	474.12	3.01 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.007
1.16	3,842	474.16	3.12 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.117
1.20	4,017	474.20	3.22 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.220
1.24	4,210	474.24	3.32 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.320

Continues on next page...

Detention Pipe-sto1

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.28	4,402	474.28	3.41 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.413
1.32	4,595	474.32	3.50 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.498
1.36	4,788	474.36	3.58 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.575
1.40	4,980	474.40	3.64 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.642
1.44	5,173	474.44	3.70 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.696
1.48	5,366	474.48	3.73 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	3.730
1.52	5,559	474.52	4.06 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	4.056
1.56	5,751	474.56	4.64 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	4.637
1.60	5,944	474.60	5.15 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	5.152
1.64	6,146	474.64	5.62 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	5.622
1.68	6,347	474.68	6.05 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	6.055
1.72	6,548	474.72	6.46 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	6.459
1.76	6,750	474.76	6.84 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	6.839
1.80	6,951	474.80	7.20 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	7.199
1.84	7,152	474.84	7.54 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	7.543
1.88	7,354	474.88	7.87 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	7.871
1.92	7,555	474.92	8.19 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	8.186
1.96	7,756	474.96	8.49 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	8.490
2.00	7,958	475.00	8.78 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	8.782
2.04	8,159	475.04	9.07 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	9.065
2.08	8,361	475.08	9.34 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	9.340
2.12	8,562	475.12	9.61 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	9.607
2.16	8,763	475.16	9.87 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	9.866
2.20	8,965	475.20	10.12 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	10.12
2.24	9,166	475.24	10.37 oc	0.00	0.00	---	0.00	0.00	0.00	---	---	---	10.37
2.28	9,367	475.28	10.52 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	10.52
2.32	9,569	475.32	10.66 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	10.66
2.36	9,770	475.36	10.80 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	10.80
2.40	9,971	475.40	10.93 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	10.93
2.44	10,164	475.44	11.06 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.06
2.48	10,357	475.48	11.19 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.19
2.52	10,550	475.52	11.32 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.32
2.56	10,742	475.56	11.45 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.45
2.60	10,935	475.60	11.57 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.57
2.64	11,128	475.64	11.70 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.70
2.68	11,320	475.68	11.82 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.82
2.72	11,513	475.72	11.94 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	11.94
2.76	11,706	475.76	12.06 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.06
2.80	11,898	475.80	12.18 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.18
2.84	12,073	475.84	12.30 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.30
2.88	12,248	475.88	12.42 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.42
2.92	12,423	475.92	12.53 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.53
2.96	12,598	475.96	12.65 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.65
3.00	12,773	476.00	12.76 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.76
3.04	12,948	476.04	12.87 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.87
3.08	13,123	476.08	12.99 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	12.99
3.12	13,298	476.12	13.10 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.10
3.16	13,472	476.16	13.21 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.21
3.20	13,647	476.20	13.32 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.32
3.24	13,791	476.24	13.42 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.42
3.28	13,935	476.28	13.53 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.53
3.32	14,079	476.32	13.64 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.64
3.36	14,222	476.36	13.74 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.74
3.40	14,366	476.40	13.85 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.85
3.44	14,510	476.44	13.95 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	13.95
3.48	14,654	476.48	14.06 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.06
3.52	14,798	476.52	14.16 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.16
3.56	14,941	476.56	14.26 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.26
3.60	15,085	476.60	14.36 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.36
3.64	15,168	476.64	14.46 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.46
3.68	15,250	476.68	14.56 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.56
3.72	15,333	476.72	14.66 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.66
3.76	15,416	476.76	14.76 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.76
3.80	15,499	476.80	14.86 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.86
3.84	15,581	476.84	14.96 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	14.96
3.88	15,664	476.88	15.05 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	15.05
3.92	15,747	476.92	15.15 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	15.15
3.96	15,829	476.96	15.24 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	15.24
4.00	15,912	477.00	15.34 ic	0.00	0.00	---	0.00	0.00	0.00	---	---	---	15.34

...End

7b. Runoff Coefficient C After Detention Structure

CALCULATION AFTER THE DETENTION STRUCTURE

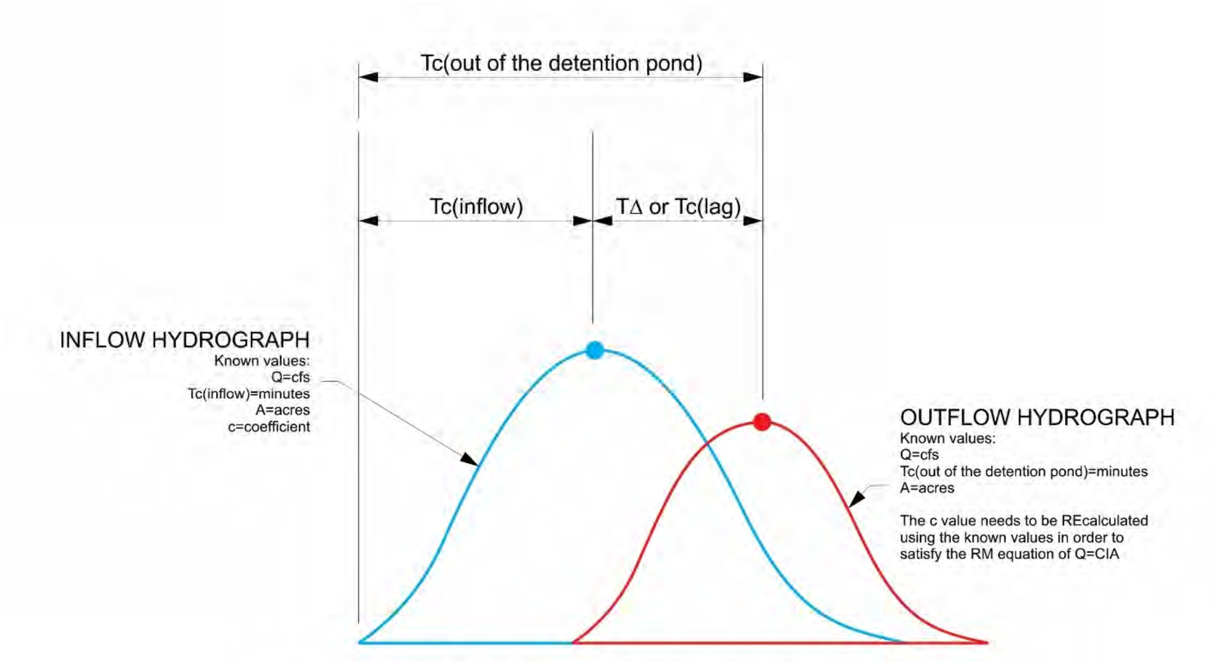
The purpose of the detention structure is to alter the peak flow and or time to peak of a given storm so it will not have a negative impact on the downstream facilities. There are different methods on how to use the resulting values of the outflow hydrograph.

For the purposes of this example there will be an association of the following values:

Q_{in} = Is equal to the inflow value that will enter the basin before storage
Q_{out} = Is equal to the outflow value that will exit the basin after storage
Tc_{in} = Is equal to the Time of Concentration flowing into the basin before detention
Tc_{out} = Is equal to the Time of Concentration exiting the basin after detention
A = Area of the tributary area being examined; (This value does not change)
c_{inflow} = The runoff coefficient going into the basin for detention
c_{out} = The runoff coefficient recalculated taking into account water stored in pond for detention

One method is to keep the value of c(inflow) and solve for the I=intensity & Tc(outflow). In this interpretation, we will get a Tc that will not match the value of the $Tc_{\text{(out of the detention structure)}}$ of the outflow hydrograph that was calculated using the detention pond. The Tc Using this method shows a disruption on the oneness & continuity of the outflow hydrograph & the formula Q=cIA.

The second method; that is the method we are using is to recalculate the c=coefficient based on the fix values of the outflow hydrograph to achieve a c_{out}. This value uses the c_{inflow} from the flow into the detention basin and then is recalculated by the output of the hydrograph software using Q=cIA; translated as c=Q/IA. This method preserves the formula Q=cIA & does not alter the $Tc_{\text{(out of the detention structure)}}$. This method shows that in order to maintain mathematical integrity of the rational equation (Q=CIA), the detention structure alters the runoff coefficient which is the only unknown in the equation. It is noted that the designer feels it is important to hold the value of Tc and the Q values that are calculated from the hydrograph.



GRAPHICAL DIAGRAM OF THE HYDROGRAPH COMING OUT OF THE DETENTION POND

The routing of the runoff through the detention structure gives us the $Q_{(\text{out of the detention structure})}$ and TΔ time lag between $Q_{(\text{inflow})}$ & $Q_{(\text{out of the detention structure})}$.

The known fix values coming out of the detention structure are:

- Q = cfs
- $Tc_{(\text{out of the detention structure})}$ = minutes
- A = acres
- *Please note that c=coefficient is not given directly from the resulting hydrograph coming out of the detention pond.*

In order to satisfy the rational equation of Q=CIA (see Section 3 of the 2003 San Diego County Hydrology Manual) coming out of the detention structure, we will calculate the only unknown value of the equation which is the outlet runoff coefficient, $C_{(\text{outlet})}$. By using the $Tc_{(\text{out of the detention structure})}$ we can solve for the intensity, I. With the intensity (I) value calculated, we can solve for the outlet runoff coefficient, $C_{(\text{outlet})}$.

The following equations are used in this stage: $Q = CIA$

$I = 7.44P_6D^{-0.645}$

Where:

$Q_{(\text{out of the detention structure})}$ = runoff (cfs), known value

$Tc_{(\text{inflow})}$ = detention structure inflow time of concentration (D) (minutes)

TΔ = time lag between $Q_{(\text{inflow})}$ & $Q_{(\text{out of the detention structure})}$

(minutes) $Tc_{(\text{out of the detention structure})} = Tc_{(\text{inflow})} + T\Delta$ (minutes)
P_6 = 6 hour precipitation (inches), known value.
I = intensity (inches/hour), calculated based on the value of $Tc_{(\text{out of the detention structure})}$
A = tributary area of the detention structure (acres),
known value $C_{(\text{outflow})}$ = runoff coefficient (unitless),
value to be solved

STORAGE PIPE			
LINE	**ITEM**	**STORAGE PIPE**	**REMARKS**
1	P6 inch	2.8	KNOWN VALUE
2	TC (inflow) mins	10.31	KNOWN VALUE
3	TC (lag) mins	10	FROM THE OUTFLOW HYDROGRAPH
4	TC (ouflow) mins	20.31	LINE 2+3
5	I inches/hour	2.987	FROM THE INTENSITY FORMULA
6	Q(outflow)	13.11	KNOWN VALUE
7	A (inflow=outflow)	6.9	KNOWN VALUE
8	c(inflow)	0.846	KNOWN VALUE FROM THE CONTRIBUTING BASIN(S)
9	c(outflow)	0.636	CALCULATED FROM C=Q/IA

The preceding highlighted data are then used to continue the calculations downstream of the detention structure.

In summary these are the steps of the calculations presented here:

1. Hydrologic methods of calculation as laid out in the 2003 San Diego Hydrology Manual was used upstream of the detention structure. These includes the methods of determining c, Tc and confluence of a junction. The c values used in the proposed conditions range from “undisturbed natural terrain” to “low & high density residential” whichever is appropriate for the contributing basin.
2. At the outflow of the detention structure, the c value was recalculated using the resulting values of the outflow hydrograph. This method preserves the values of $Tc_{(\text{out of the detention structure})}$, A & $Q_{(\text{outflow})}$. Methods and software satisfy the formula Q=cIA & the 2003 San Diego Hydrology Manual. This step shows that in order to maintain mathematical integrity of the rational equation (Q=CIA), the detention structure alters the runoff coefficient which is the only unknown in the equation.
3. The values determined in step 2 were used in the continuation of the calculations using the Hydrologic methods of calculation as laid out in the 2003 San Diego Hydrology Manual downstream of the detention structure. These includes the methods of determining c, Tc and confluence of a junction. The c values used in the proposed conditions range from “undisturbed natural terrain” to “low & high density residential” whichever is appropriate for the contributing basin.

P 18-0411

Project Number(s): PC 21-0339 LD ______ GP ______

CITY OF VISTA
CALIFORNIA

PRIORITY DEVELOPMENT PROJECT

STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)
FOR

LBA Decision Street, Vista, CA

PREPARED FOR:

LBA 1430 Decision Street, Vista, CA 92081

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

1/13/22

PREPARED
September 21th, 2021
REVISED
December 9th, 2021

NOTE: This Priority Development Project SWQMP Template and Instructions are offered as a tool to assist users in complying with RWQCB Order No. R9-2015-0001 (Permit), and is not intended to warrant or guarantee Permit compliance, which is the independent and sole responsibility of the user. This template is subject to revision without notice, at any time.

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ENGINEER OF WORK CERTIFICATION STATEMENT

Preparer's Certification

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Vista BMP Design Manual, which is a design manual for compliance with local City and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

SWQMP PREPARED BY:
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EXCEL Engineering
440 State Place
Escondido, CA 92029
(760) 745-8118
Rdentino@excelengineering.net
RCE 45629
EXP: 12/31/22

[INSERT STAMP IN SPACE BELOW]

Signature, PE License Number & Expiration Date

Robert D. Dentino
Print Name

4/13/22
Date

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

CITY OF VISTA STAFF REVIEW

Reviewed and Approved:	
City Staff Signature:	Date:

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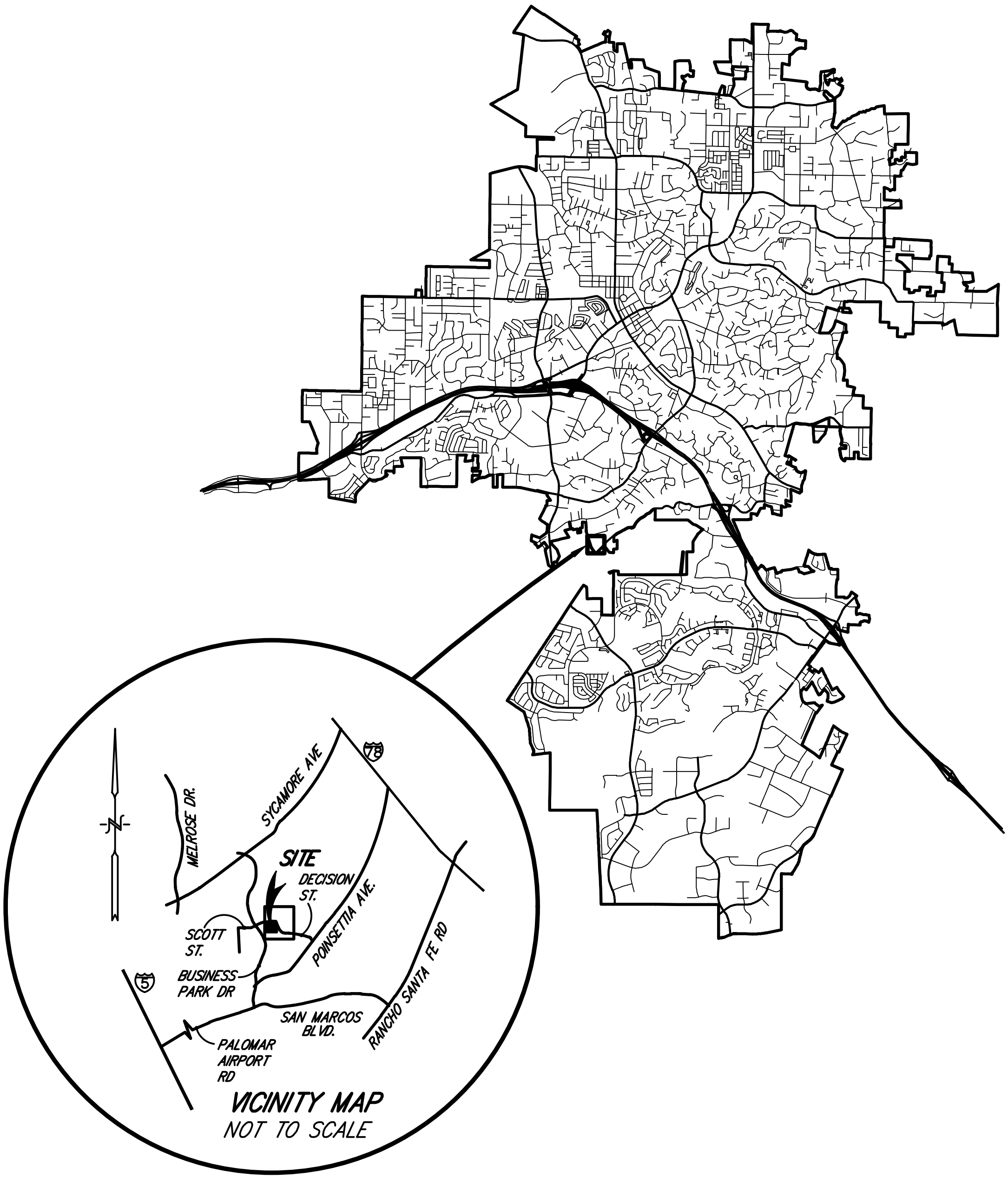
PROJECT VICINITY MAP

Project Name: LBA Decision Street

Permit Application Number: P21-0339

Insert Project Vicinity Map Below:



FORM 1 – PROJECT CATEGORY DETERMINATION CHECKLIST

This form is used to assess stormwater BMP requirements applicable to the proposed project. The form is available as a stand-alone fillable checklist on the City's website and a completed copy must be included with the final SWQMP submitted to the City. The form is available at:

http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms

CITY OF VISTA
CALIFORNIA

Project ID: P21-0339

CHECKLIST FOR DETERMINATION OF PROJECT CATEGORY

Project Name: LBA Decision Street

Project Location: 1430 Decision Street, Vista, CA 92081

APPLICABILITY OF PERMANENT, POST-CONSTRUCTION STORMWATER BMP REQUIREMENTS AND PROJECT TYPE DETERMINATION

Overview and Instructions

The City of Vista's (City's) Stormwater Management Program is regulated by the San Diego regional municipal stormwater permit (referred to as a Municipal Separate Storm Sewer System Permit). This permit requires that new development and redevelopment projects incorporate permanent stormwater Best Management Practices (BMPs) into the project design. The City of Vista's *BMP Design Manual* (formerly *SUSMP Manual*) discusses BMP requirements applicable to new development and redevelopment projects.

ALL STANDARD AND PRIORITY PROJECTS ARE REQUIRED TO INCORPORATE SITE DESIGN AND SOURCE CONTROL BMPS. Additional treatment control and hydromodification management BMP requirements apply to projects that meet specific criteria or thresholds. This checklist must be completed by the project applicant or proponent, and is used to determine if those additional BMPs are required.

Not all site improvements are considered "development projects" under the MS4 Permit.

Development projects are defined by the MS4 Permit as "construction, rehabilitation, redevelopment, or reconstruction of any public or private projects". Development projects are issued local permits to allow construction activities. To further clarify, this checklist applies only to new development or redevelopment activities and/or projects that have the potential to contact storm water and contribute an anthropogenic source of pollutants, or reduce the natural absorption and infiltration abilities of the land.

A project must be defined consistent with the California Environmental Quality Act (CEQA) definitions of "project."

CEQA requires that the project include "the whole of the action". "Whole of the Action" means the project may not be segmented or phased into small parts either onsite or offsite if the effect is to reduce the quantity of impervious area and fall below thresholds for applicability of storm water requirements. This requirement precludes "piece-mealing," which is the improper (and often artificial) separation of a project into smaller parts to avoid preparing Environmental Impact Report level documentation.

As indicated above, for the purposes of the *BMP Design Manual*, the "project" is the "whole of the action" which has the potential for adding or replacing or resulting in the addition or replacement of, roofs, pavement, or other impervious surfaces, thereby resulting in increased flows and storm water pollutants.

When defining the project, the following questions are considered:

- What are the project activities?
- Do they occur onsite or offsite?
- What are the limits of the project (project boundary)?
- What is the whole of the action associated with the project (i.e. what is the total amount of new or

replaced impervious area considering all of the collective project components through all phases of the project)?

- Are any facilities or agreements to build facilities offsite in conjunction with providing service to the project (street-widening, utilities)?

Responses to the checklist represent an initial assessment of the proposed project conditions and impacts. City staff will confirm this checklist based on assessment of the development application and/or project plans. Results of the checklist will classify a project as one of the following: Priority Development Project, Standard Project, or Non-development Project.

If additional information is needed while completing this checklist, please refer to the City's *BMP Design Manual*. Alternatively, contact City Land Development staff.

This Form is divided into 4 sections:

1. Post-Construction Stormwater Requirement Exemptions
2. Priority Development Project Determination
3. Special Consideration for Redevelopment Projects (50 Percent Rule)
4. Final Project Determination

SECTION 1 – POST CONSTRUCTION STORMWATER REQUIREMENT EXEMPTIONS	City of Vista BMP Design Manual	
This section will determine whether your project is exempt from post-construction BMP requirements and would be classified as a Non-Development Project. See section 1.3 of the City's *BMP Design Manual* for further discussion.	**YES**	**NO**
(a) Replacement of impervious surfaces that are part of a routine maintenance activity, such as (check yes if any apply): (i) Replacing roof material on an existing building (ii) Rebuilding a structure to original design after damage from earthquake, fire or similar disaster (iii) Restoring pavement or other surface materials affected by trenches from utility work (iv) Resurfacing existing roads and parking lots, including slurry, overlay and restriping (v) Routine replacement of damaged pavement, including full depth replacement, if the sole purpose is to repair the damage (vi) Constructing new sidewalk, pedestrian ramps or bike lanes on existing roads (within existing street right-of-way) (vii) Restoring a historic building to its original historic design (viii) Routine replacement of damaged pavement, such as pothole repair **Note**: Work that creates impervious surface outside of the existing impervious footprint is not considered routine maintenance.	☑	☐
(b) Repair or improvements to an existing building or structure that do not alter the size (check yes if any apply): (i) Plumbing, electrical and HVAC work (ii) Interior alterations including major interior remodels and tenant build-out within an existing commercial building (iii) Exterior alterations that do not change the general dimensions and structural framing of the building (does not include building additions or projects where the existing building is demolished)	☐	☑
If you answered **YES** to either category (a) or (b), your project is considered a Non-Development Project, and post construction BMP requirements do not apply. Please proceed to Section 4 and check the **Non-Development Project** box. If you answered **NO** to category (a) and (b), please proceed to Section 2.		

SECTION 2 – PRIORITY DEVELOPMENT PROJECT DETERMINATION	City of Vista BMP Design Manual	
This section determines whether your project is a **Priority Development Project (PDP)** or a **Standard Project.** See section 1.4 of the City's *BMP Design Manual* for further discussion. The following eight (8) types of projects are defined as **PDPs:**	**YES**	**NO**
(a) New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☐	☑
(b) Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☑	☐
(c) New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.	☑	☐

(d) New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharge directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). **Note:** ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the City. For projects adjacent to an ESA, but not discharging to an ESA, the 2,500 sq-ft threshold does not apply as long as the project does not physically disturb the ESA and the ESA is upstream of the project. There are no Areas of Special Biological Significance (ASBS) or State Water Quality Protected Areas in the City's jurisdiction. The ESAs within the City's boundaries which include 303(d)-listed impairments and RARE beneficial use designations are listed below: • Agua Hedionda Creek • Buena Creek • Buena Vista Creek • Loma Alta Creek	☑	☐
(e) New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets. This category includes Retail gasoline outlets that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic of 100 or more vehicles per day.	☐	☑
(f) New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. This means any activity that moves soils or substantially alters the pre-existing vegetated or man-made cover of any land. This includes, but is not limited to the following: (i) Grading, digging, cutting, scraping, stockpiling, pavement removal, and exterior construction; (ii) Substantial removal of vegetation where soils are disturbed including but not limited to removal by clearing or grubbing; or (iii) Any activity which bares soil or rock or involves streambed alterations or the diversion or piping of any watercourse.	☑	☐
If you answered **YES** to any of the categories above (a-f), your project is considered a PDP. Please proceed to section 3 and check the **Priority Development Project** Box in Section 4. If you answer **NO** to all categories, then your project is considered a Standard Project. Please proceed to Section 4 and check the **Standard Project Box**.		

<table>
<tr><th colspan="2">SECTION 3 – SPECIAL CONSIDERATIONS FOR REDEVELOPMENT PROJECTS (50 PERCENT RULE)</th><th>City of Vista
BMP Design Manual</th></tr>
<tr><td>This section determines additional considerations required for Redevelopment PDPs. See section 1.7 of the City’s BMP Design Manual for further discussion.</td><td>YES</td><td>NO</td></tr>
<tr><td>Will redevelopment result in the creation or replacement of impervious surface in an amount of more than 50 percent of the surface area of the previously existing development? See clarification on calculation of the ratio of impervious surface below.

These requirements for managing storm water on an entire redevelopment project site are commonly referred to as the "50 Percent Rule". For the purpose of calculating the ratio, the surface area of the previously existing development shall be the area of <u>impervious surface</u> within the previously existing development. The following steps shall be followed to estimate the area that requires treatment to satisfy the MS4 Permit requirements:
1. How much total impervious area currently exists on the site?
2. How much existing impervious area will be replaced with new impervious area?
3. How much new impervious area will be created in areas that are pervious in the existing condition?
4. Total created and/or replaced impervious surface = Step 2 + Step 3.
5. <u>50 Percent Rule Test</u>: Is step 4 more than 50 Percent of Step 1? If yes, treat all impervious surface on the site (including existing impervious surface not being replaced or added). If no, then treat only Step 4 impervious surface and any area that comingles with created and/or replaced impervious surface area.

<u>Note</u>: Step 2 and Step 3 must not overlap, as it is fundamentally not possible for a given area to be both “replaced” and “created” at the same time. Also activities that occur as routine maintenance (see Section 1 of this form) shall not be included in Step 2 and Step 3 calculation.
For example, a 10,000 square foot development proposes replacement of 4,000 square feet of impervious area. The treated area is less than 50 percent of the total development area and only the 4,000 square foot area is required to be treated.</td><td>☑</td><td>☐</td></tr>
<tr><td colspan="3">If you answered YES, then you must implement the PDP requirements for all impervious surfaces across the entire site. Please proceed to Section 4 and check the box under PDP indicating that the Project Is a Redevelopment Project Subject to the 50 Percent Rule.

If you answered NO, then you are only required to treat impervious surfaces that are replaced or created. Please proceed to section 4 and check the box under PDP indicating this is Not a Redevelopment Project Subject to the 50 Percent Rule.</td></tr>
</table>

BASED ON THE INFORMATION PROVIDED IN SECTIONS 1-3, THIS PROJECT IS DETERMINED TO BE A:

☑ **PRIORITY DEVELOPMENT PROJECT.** PRIORITY REQUIREMENTS APPLY AND A STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) MUST BE SUBMITTED AT THE TIME OF APPLICATION.

- ☑ THIS **IS** A REDEVELOPMENT PROJECT SUBJECT TO THE 50 PERCENT RULE.
- ☐ THIS **IS NOT** A REDEVELOPEMNT PROJECT SUBJECT TO THE 50 PERCENT RULE.

☐ **STANDARD PROJECT.** STANDARD REQUIREMENTS APPLY AND APPLICABLE SECTIONS OF A STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) MUST BE SUBMITTED AT THE TIME OF APPLICATION.

☐ **NON DEVELOPMENT PROJECT.**

Applicant Information and Signature Box

Address: 1430 Decision Street, Vista, CA 92081	APN(s) 219-011-88-00
Applicant Name: LBA Decision Street	Applicant Title:
Applicant Signature:	Date:

City use only

Concur:	Yes	No
By:		
Date:		
Land Dev #:		

Supporting discussion for this checklist, as well as BMP requirements for Priority Development Projects and Standard Projects, is provided in the City of Vista *BMP Design Manual*.

FORM 2 – PROJECT OVERVIEW

Page 1 of 11

Project Name	LBA Decision Street
Project Address	1430 Decision Street, Vista, CA 92081
Assessor's Parcel Number(s) (APN(s))	219-011-88-00
Permit Application Number	P21-0339
Watershed *(select one checkbox; use webpage below to determine watershed)* http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms	
San Luis Rey	☐ Lower San Luis Rey – Mission, 903.11
Carlsbad	☐ Loma Alta – Loma Alta, 904.10 ☐ Buena Vista – El Salto, 904.21 ☐ Buena Vista – Vista, 904.22 ☒ Agua Hedionda – Los Monos, 904.31 ☐ Agua Hedionda – Buena, 904.32 ☐ San Marcos – Batiquitos, 904.51
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	7.8125 Acres (340312.15 Square Feet)
Area to be Disturbed by the Project (Project Area)	6.9163 Acres (301274.03 Square Feet)
Project Proposed Impervious Area (subset of Project Area)	5.9148 Acres (257647 Square Feet)
Project Proposed Pervious Area (subset of Project Area)	0.9517 Acres (41457.83 Square Feet)
NOTE: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form 2, Page 2 of 11
DESCRIPTION OF EXISTING SITE CONDITIONS
Current Status of the Site (select all that apply and describe below): ☒ Existing development ☐ Previously graded but not built out ☐ Demolition completed without new construction ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Describe: The existing site is commercially developed containing mostly impervious surfaces such as buildings and parking lot with no apparent water quality system in place. Stormwater travels south westerly overland flow over parking and other impervious surfaces until it reaches either a grated inlet or a curb inlet. The site is developed with compacted soil and very little to virtually no pervious areas; the only visible area that are pervious is a square patch around the Power pole at the intersection of Guajome St and S Santa Fe Ave. Various plants growing throughout cracks in the existing asphalt and a bougainvillea growing in front of a small house.
Existing Land Cover Includes (select all that apply and describe below): ☒ Vegetative Cover 2.23 Acres (97027.50 Square Feet) ☐ Non-Vegetated Pervious Areas Acres (Square Feet) ☒ Impervious Areas 7.07 Acres (307919.32 Square Feet) Describe: Landcover is almost entirely impervious consisting of concrete, asphalt and buildings. The pervious surfaces include a small patch by the Utility pole, small various cracks in the asphalt and a small bougainvillea plant growing in front of a small house.
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☒ NRCS Type C ☒ NRCS Type D
Approximate Depth to Groundwater (GW): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☐ 10 feet < GW Depth < 20 feet ☒ GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply and describe in next section):

☐ Drainage ditch/Swale/Waterway
☐ Seeps
☐ Springs
☐ Wetlands
☒ None

Form 2, Page 3 of 11

DESCRIPTION OF EXISTING SITE DRAINAGE PATTERNS

How is storm water runoff conveyed from the site? At a minimum, this description should answer:

1. Is existing site drainage conveyance natural or improved storm drain (urbanized);
2. Is runoff from offsite conveyed through the site? If yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
3. Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
4. Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:

The site is an existing general industrial site composed of a parking lot. The project fronts onto Scott Street. The existing onsite parking lot drainage stormwater flows to the existing storm drain system located at Business Park Drive.

POCs are labeled on the DMA and Hydromodification exhibits.

Form 2, Page 4 of 11
DESCRIPTION OF PROPOSED SITE DEVELOPMENT
Project Description / Proposed Land Use and/or Activities: This project proposed to install a building with a parking lot. At the south west corner of the site, this project is proposed to build a biofiltration basin for stormwater; to incorporate the collection of stormwater from the building and the parking lot and direct the stormwater through a stormwater drainage pipe to POC-1, which is located at the west side of the study site. There are two driveways of the parking lot located at the east side of the study site. A part of the driveways drain stormwater through the parking lot to POC-1, another part of the driveways drain stormwater along the east project side to POC-2, which is located at the northeast corner of the study site.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): The impervious features will include buildings, parking lots, and asphalt on the existing streets.
List/describe proposed pervious features of the project (e.g., landscape areas): The pervious features will include biofiltration basins and small landscape areas.
Does the project include grading and changes to site topography? ☒ Yes ☐ No Describe: The existing project site topography is relatively flat with building and parking lot. The proposed project site is going to increase the pad size. The topography keep relatively flat in the proposed project.

Form 2, Page 5 of 11
DESCRIPTION OF PROPOSED SITE DRAINAGE PATTERNS

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☒ Yes

☐ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:

The site will include new storm drain systems to convey the water from roof drains to the biofiltration basins located at the south west corner of the project site to discharge water to POC which is located at the Business Park.

At the east side of the biofiltration basin, four barrels of 48'' storage pipe with 252 ft long of each one and one barrel of 48'' storage pipe with a length of 192 ft long are connected with the biofiltration basin to incorporate the collection of storm water from the building and the parking lot and direct the storm water through a storm water drainage pipe to POC.

The tributary offsite area is located at the southeast corner of the site. The offsite with drain from the southern portion of the site, captured in an F-Type box and conveyed underground through a pipe to discharge at the POC.

Form 2, Page 6 of 11
POTENTIAL POLLUTANT SOURCE AREAS
Identify whether any of the following features, activities, and/or pollutant source areas will be present. Select all Pollutant Source Areas that apply and include them on the DMA Exhibit. Source control BMPs must be identified for each of these areas in Form 3 of this SWQMP: ☒ On-site storm drain inlets ☒ Sump pumps or French drains ☐ Interior or sub-surface parking garages ☒ Need for future indoor & structural pest control ☒ Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, or other water features ☐ Food preparation and/or service ☒ Refuse/trash collection areas ☒ Industrial processes ☐ Outdoor storage of equipment, chemicals, or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☒ Loading docks ☒ Fire sprinkler test and relief point ☐ Miscellaneous drain or wash down areas ☒ Plazas, sidewalks, and parking lots Describe: Please see following sheets from appendix E for listed source controls and actions taken. See DMA Exhibit sheet 1 for locations of source controls

If These Sources Will Be on the Project Site …	… Then Your SWQMP Shall Consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **A.** Onsite storm drain inlets ❑ Not Applicable	☑ Locations of inlets.	☑ Mark all inlets with the words “No Dumping! Flows to Bay” or similar.	☑ Maintain and periodically repaint or replace inlet markings. ☑ Provide storm water pollution prevention information to new site owners, lessees, or operators. ☑ See applicable operational BMPs in Fact Sheet SC-44, “Drainage System Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ☑ Include the following in lease agreements: “Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains.”

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **B.** Interior floor drains and elevator shaft sump pumps ❑ Not Applicable		❑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **C.** Interior parking garages ❑ Not Applicable		❑ State that parking garage floor drains will be plumbed to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **D1.** Need for future indoor & structural pest control ❑ Not Applicable		❑ Note building design features that discourage entry of pests.	❑ Provide Integrated Pest Management information to owners, lessees, and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **D2.** Landscape/ Outdoor Pesticide Use ❑ Not Applicable	❑ Show locations of existing trees or areas of shrubs and ground cover to be undisturbed and retained. ❑ Show self-retaining landscape areas, if any. ❑ Show storm water treatment facilities.	State that final landscape plans will accomplish all of the following. ❑ Preserve existing drought tolerant trees, shrubs, and ground cover to the maximum extent possible. ❑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. ❑ Where landscaped areas are used to retain or detain storm water, specify plants that are tolerant of periodic saturated soil conditions. ❑ Consider using pest-resistant plants, especially adjacent to hardscape. ❑ To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	❑ Maintain landscaping using minimum or no pesticides. ❑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ❑ Provide IPM information to new owners, lessees and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **E.** Pools, spas, ponds, decorative fountains, and other water features. ❑ Not Applicable	❑ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	❑ If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **F.** Food service ❑ Not Applicable	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to ensure that the largest items can be accommodated.	

If These Sources Will Be on the Project Site …	**… Then Your SWQMP shall consider These Source Control BMPs**		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **G.** Refuse areas ❑ Not Applicable	❑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run- on and show locations of berms to prevent runoff from the area. Also show how the designated area will be protected from wind dispersal. ☑ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	❑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on- site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative Table and Narrative**
☑ **H.** Industrial processes. ❑ Not Applicable	☑ Show process area.	☑ If industrial processes are to be located onsite, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	☑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.) ☑ Not Applicable	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or runoff from area and protected from wind dispersal. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release Prevention Program ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **J.** Vehicle and Equipment Cleaning ❑ Not Applicable	❑ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle /equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited onsite and hoses are provided with an automatic shut- off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	❑ If a car wash area is not provided, describe measures taken to discourage onsite car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ❑ Wash water from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ Car dealerships and similar may rinse cars with water only. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **K.** Vehicle/Equipment Repair and Maintenance ❑ Not Applicable	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to protect from rainfall, run-on runoff, and wind dispersal. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinse water from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **L.** Fuel Dispensing Areas ❑ Not Applicable	❑ Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are (1) graded at the minimum slope necessary to prevent ponding; and (2) separated from the rest of the site by a grade break that prevents run-on of storm water to the MEP. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area1.] The canopy [or cover] shall not drain onto the fueling area.		❑ The property owner shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

1. The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
M. Loading Docks ❑ Not Applicable	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **N.** Fire Sprinkler Test Water ❑ Not Applicable		☑ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☑ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
O. Miscellaneous Drain or Wash Water ❑ Boiler drain lines ☑ Condensate drain lines ☑ Rooftop equipment ❑ Drainage sumps ❑ Roofing, gutters, and trim ❑ Not Applicable		❑ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☑ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☑ Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ❑ Any drainage sumps onsite shall feature a sediment sump to reduce the quantity of sediment in pumped water. ❑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **P.** Plazas, sidewalks, and parking lots. ☐ Not Applicable			☑ Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Wash water containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

Form 2, Page 7 of 11
IDENTIFICATION AND NARRATIVE OF RECEIVING WATER AND POLLUTANTS OF CONCERN
Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable): Project will drain to the Agua Hedionda Creek, then to the Agua Hedionda Lagoon, finally to the Pacific Ocean. The area of concern is in Agua Hedionda Creek. Agua Hedionda - Los Monos, 904.31
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
Agua Hedionda Creek	Selenium	None at this time
Agua Hedionda Creek	Total Dissolved Solids	None at this time
Agua Hedionda Creek	Toxicity	None at this time

Identification of Project Site Pollutants*

***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Expected from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☒	☐	☐
Nutrients	☒	☐	☐
Heavy Metals	☒	☐	☐
Organic Compounds	☒	☐	☐
Trash & Debris	☒	☐	☐
Oxygen Demanding Substances	☒	☐	☐
Oil & Grease	☒	☐	☐
Bacteria & Viruses	☒	☐	☐
Pesticides	☒	☐	☐

REGION NAME	WATER BODY NAME	WATER BODY TYPE	INTEGRATED REPORT CATEGORY	POLLUTANT	POLLUTANT CATEGORY	FINAL LISTING DECISION	DECISION STATUS**	TMDL REQUIREMENT STATUS**	EXPECTED TMDL COMPLETION DATE***
Regional Board 9 - San Diego Region	Agua Hedionda Creek	River & Stream	5	Selenium	Metals/Metalloids	Do Not Delist from 303(d) list (TMDL required list)	Revised	5A	7/11/1905
Regional Board 9 - San Diego Region	Agua Hedionda Creek	River & Stream	5	Total Dissolved Solids	Salinity	Do Not Delist from 303(d) list (TMDL required list)	Original	5A	7/11/1905
Regional Board 9 - San Diego Region	Agua Hedionda Creek	River & Stream	5	Toxicity	Toxicity	Do Not Delist from 303(d) list (TMDL required list)	Revised	5A	7/11/1905

Form 2, Page 8 of 11
HYDROMODIFICATION MANAGEMENT REQUIREMENTS
Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual; select one box and describe below)? ☒ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Describe:

Form 2, Page 9 of 11
CRITICAL COARSE SEDIMENT YIELD AREAS
**This section only required if hydromodification management requirements apply*
Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries (select all that apply and describe below)? Additional signed and stamped reports must be provided to document any exemption from coarse sediment yield requirements. ☒ Yes ☐ No, No critical coarse sediment yield areas to be protected based on WMAA maps If yes, have any of the optional analyses presented in Section 6.2 of the BMP Design Manual been performed? ☒ 6.2.1 Verification of Geomorphic Landscape Units (GLUs) Onsite ☐6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite ☐No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps If optional analyses were performed, what is the final result? ☒No critical coarse sediment yield areas to be protected based on verification of GLUs onsite ☐Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 2.B of the SWQMP. ☐Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit. Describe: Please see Attachment 2B for GLU analysis. The slope in the critical coarse sediment yield areas of the study site is 4.7%, which is under the slope range listed here. With the slope of 4.7%, there is **NO CRITICAL COARSE SEDIMENT IN THE PROJECT AREA.**

Form 2, Page 10 of 11
FLOW CONTROL FOR POST-PROJECT RUNOFF
**This section only required if hydromodification management requirements apply*
List and describe point(s) of compliance for hydromodification management flow control (see Section 6.3.1). Identify each point of compliance for flow control on the Hydromodification Management Exhibit in Attachment 2A. Has a geomorphic assessment been performed for the receiving channel(s)? ☒ No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide the report. Discussion / Additional Information: (optional)

Form 2, Page 11 of 11
OTHER SITE REQUIREMENTS AND CONSTRAINTS
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

FORM 3 – SOURCE CONTROL BMPS FOR ALL DEVELOPMENT PROJECTS

PROJECT IDENTIFICATION & SOURCE CONTROLS			
Project Name: LBA Decision Street			
Permit Application Number P21-0339			
All development projects must implement source control BMPs SC-1 through SC-6, unless justification is provided by qualified design professional See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following, and provide description. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. • "No" means the BMP is applicable to the project but it is not feasible to implement. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas).			
Source Control Requirement	**Applied?**		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **Use a suite of housekeeping BMPs which could include effective irrigation, dispersion of non-storm water discharges into landscaping for infiltration. No vehicle washing will be allowed onsite.**			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **Stenciling shall be provided for all storm water conveyance system inlets and catch basins within the project area. Inlet stenciling may include concrete stamping, concrete painting, placards, or other methods approved by the City.**			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No outdoor storage is anticipated at this time.**			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No outdoor storage areas anticipated at this time.**			

Form 3, Page 2 of 4			
Source Control Requirement	**Applied?**		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **• Trash container areas are deigned so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on.** **• Ensure trash container areas are screened or walled to prevent offsite transport of trash.** **• Provide roofs or awnings on all trash enclosures, to minimize exposure.** **• Locate storm drains away from the immediate vicinity of the trash storage area and vice versa.** **• Post signs on all dumpsters informing users that hazardous material are not to be disposed.**			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)	**Applied?**		
a. On-site storm drain inlets	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **Inlet will be stenciled**			
b. Sump pumps or French drains	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **French drain will convey treated water at bottom of biofiltration basins.**			
c. Interior or sub-surface parking garages	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No interior or sub-surface parking garages is anticipated at this time.**			
d. Need for future indoor & structural pest control	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **Provide integrated pest management information to owners, lessees, and operators.**			
e. Landscape/outdoor pesticide use	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **- Maintain landscaping using minimum or no pesticides.** **- See applicable operational BMPs in Fact Sheet SC-41, “Building and Grounds Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.** **- Provide IPM information to new owners, lessees and operators.**			

Form 3, Page 3 of 4			
Source Control Requirement	**Applied?**		
f. Pools, spas, ponds, decorative fountains, or other water features	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No anticipated water features at this time.**			
g. Food preparation and/or service	☐ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **No food preparation and/or service is anticipated at this time.**			
h. Refuse/trash collection areas	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **• Trash container areas are deigned so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on.** **• Ensure trash container areas are screened or walled to prevent offsite transport of trash.** **• Provide roofs or awnings on all trash enclosures, to minimize exposure.** **• Locate storm drains away from the immediate vicinity of the trash storage area and vice versa.** **• Post signs on all dumpsters informing users that hazardous material are not to be disposed.**			
i. Industrial processes	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **All source control pollutants will be minimized. All treatment will be through biofiltration basin.**			
j. Outdoor storage of equipment, chemicals, or materials	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No outdoor storage at this time**			
k. Vehicle and equipment cleaning	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No vehicle cleaning at this time.**			
l. Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No vehicle repair or maintenance at this time.**			
m. Fuel dispensing areas	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No fuel dispensing areas at this time.**			

Form 3, Page 4 of 4			
n. Loading docks	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: All source control pollutants will be minimized. All treatment will be through surface to biofiltration basin.			
o. Fire sprinkler test water and relief point	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **Any test water will drain to the sewer system.**			
p. Miscellaneous drain or wash down areas	☐ Yes	☐ No	☒ N/A
Describe how source control will be implemented, or justify if not feasible: **No wash down areas at this time.**			
q. Plaza, sidewalks, parking lots	☒ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible: **All outdoor plazas, sidewalks and parking lots will drain directly to biofiltration basins or indirectly to basins via onsite private storm drain**			
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

FORM 4 – SITE DESIGN BMPS FOR ALL DEVELOPMENT PROJECTS

Page 1 of 2

PROJECT IDENTIFICATION			
Project Name LBA Decision Street			
Permit Application Number P21-0339			
All development projects must implement site design BMPs SD-1 through SD-8, unless justification is provided by qualified design professional. See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following, and provide description. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. • "No" means the BMP is applicable to the project but it is not feasible to implement. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve).			
Site Design Requirement	**Applied?**		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☐ No	☒ N/A
Describe how site design will be implemented, or justify if not feasible: **There is no natural drainage pathways since entire site has been constructed and is impervious**			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☐ No	☒ N/A
Describe how site design will be implemented or justify if not feasible: **The site is designed to create no more disturbance than is necessary whiles being used in accordance with current zoning. The current site has no pervious areas and is proposing to add areas for vegetation. No Natural areas from pre-development to conserve.**			
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: **Landscape areas are maximized to the largest extent possible while the site is being utilized in accordance with current zoning. Walkways for access to the site are at minimum widths. The current site is 100% impervious and is proposing to put in landscape areas and decrease the impervious.**			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: **Only the areas that need to be compacted as recommended by the soils engineer will be compacted**			
Form 4, Page 2 of 2			

SD-5 Impervious Area Dispersion	☐ Yes	☒ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: The underlying soil is type C and type D soil. The project is proposing to reduce the amount of imperious surface and include pervious area (currently no pervious areas are on site); but pervious are not large enough to qualify as dispersion areas.			
SD-6 Runoff Collection	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: **Roof drains will drain to adjacent landscaped areas or directly to biofiltration basins or roof drains may drain to adjacent paved areas and then to biofiltration basins by overland flow or by onsite private storm drain. Impervious areas will drain to soft area where possible before draining to basins. Infiltration at soft areas will be limited when next to building foundations.**			
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible: **Landscape plans are being prepared in accordance with rules and guidelines published by The City of Vista.**			
SD-8 Harvest and Use of Precipitation *Note: Worksheet B.3-1, "Harvest and Use Feasibility" must be included in this section of the SWQMP.*	☐Yes	☐ No	☒ N/A
Describe how site design will be implemented, or justify if not feasible: Worksheet B.3-1 "Harvest and Use Feasibility" is included on next sheet as stated in required note.			

Worksheet B.3-1. Harvest and Use Feasibility Screening

Harvest and Use Feasibility Screening		Worksheet B.3-1
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☑ Toilet and urinal flushing ☑ Landscape irrigation ☐ Other:______________		
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. Flushing: (174 res.)x(9.3 gal/res) = 1618.2 gallons, (1618.2 gal)(1.5 days)/(7.48 gal/cuft) = 324.5 cu ft Irrigation: 36-hr Mod. Water per Table B.3-3 = (1,470 gal days/acre)*(0.9517 acres)/ 7.48 gal/ cuft = 187.03 cu ft [Provide a summary of calculations here] Total Demand = 511.53 cu ft		
3. Calculate the DCV using worksheet B-2.1. Total DCV = 12,996 0.25*12,996 = 3,249 cu ft		
3a. Is the 36-hour demand greater than or equal to the DCV? Yes ⇩ / No ⇨	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV? Yes ⇩ / No ⇨	3c. Is the 36-hour demand less than 0.25DCV? Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

FORM 5 – STRUCTURAL POLLUTANT CONTROL AND HYDROMODIFICATION MANAGEMENT BMPS

PROJECT IDENTIFICATION
Project Name LBA Decision Street
Permit Application Number P21-0339
PDP Structural BMPs
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the *BMP Design Manual*). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the *BMP Design Manual*). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the *BMP Design Manual*). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the *BMP Design Manual*). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).
Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the *BMP Design Manual* were followed, and the results (type of BMP selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate structures. **Note: Each structural pollutant control and hydromodification management BMP must be clearly identified on a site map (Attachment 1a), and described in supporting table (Attachment 1B).** **Note: Each structural pollutant control and hydromodification management BMP must be clearly identified on a site map (Attachment 1a), and described in supporting table (Attachment 1B). The project IMP selection process was accomplished in conjunction with section 5.1 of the BMP design manual.** **-Step 1, The project was divided up and evaluated at the DMA scale. Each DMA was classified as SelfTreating, De-minimis, Self-Retaining or Draining to and Integrated Management Practice (IMP).** **Step 2, For the DMA's that drain to IMP's, the appropriate runoff factors were applied to each area and the required Design Capture Volume (DCV) of each sub area calculated. For this project, Harvest and reuse is not considered feasible.** **Step 3, Due to the impermeability of the underlying soils,(soil type C&D), infiltration BMP's are not Feasible next to the building, and the building footprint covers the entire project area.** **Step 4, A&B for the infiltration condition leads to section 5.5.3 which is the Biofiltration BMP category. The various sizing methods included in Appendix B.5 were followed and the entire DCV can be treated within the proposed IMPs.**

Step 5, Each Biofiltration area is sized in accordance with the fact sheet BF-1 found in appendix E of the BMP design manual. This project requires hydromodification, so the Biofiltration units accomplish both storm water treatment and flow control mitigation in an integrated design

FORM 6 – STORMWATER BMP MAINTENANCE MECHANISM

PROJECT IDENTIFICATION
Project Name LBA Decision Street
Permit Application Number P21-0339
Maintenance Requirements
A stormwater structural BMP operations and maintenance plan must be prepared for PDPs. A template plan is available at: http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms Has a stormwater structural BMP operations and maintenance plan been prepared? ☒ Yes, included with Attachment 3A ☐ No LBA Decision Street [INSERT PLAN DATE] Robert Dentino Project Engineer/ EXCEL Engineering
All projects are required to maintain designed functionality of structural BMPs in perpetuity. Privately-owned projects must record a *Storm Drain Maintenance Agreement* with the County of San Diego Assessor's Office. A template *Storm Drain Maintenance Agreement* is available at: http://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms Has a Storm Drain Maintenance Agreement been submitted to the County? ☒ Yes, copy included with Attachment 3B ☐ No ☐ Not Applicable (e.g., city-owned property/project)

ATTACHMENT 1 – POLLUTANT CONTROLS: SUPPORT DOCUMENT AND CHECKLIST

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	Checklist
Attachment 1A	Drainage Management Area (DMA) Exhibit See DMA Exhibit Checklist on next page.	☒ Included
Attachment 1B	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, DMA Type, and BMPs* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1A	☒ Included on DMA Exhibit in Attachment 1A ☐ Included as Attachment 1B
Attachment 1C	Harvest and Use Feasibility Screening Checklist (Worksheet B.3-1) Refer to Appendix B.3-1 of the *BMP Design Manual*.	☒ Included ☐ Not included because the entire project will use Infiltration BMPs
Attachment 1D	Categorization of Infiltration Feasibility Condition (Worksheet C.4-1) Refer to Appendices C and D of the *BMP Design Manual*.	☒ Included ☐ Not included because the entire project will use Harvest and Use BMPs
Attachment 1E	Pollutant Control BMP Design Worksheets and Calculations Refer to Appendices B and E of the *BMP Design Manual* for structural pollutant control BMP design guidelines	☒ Included

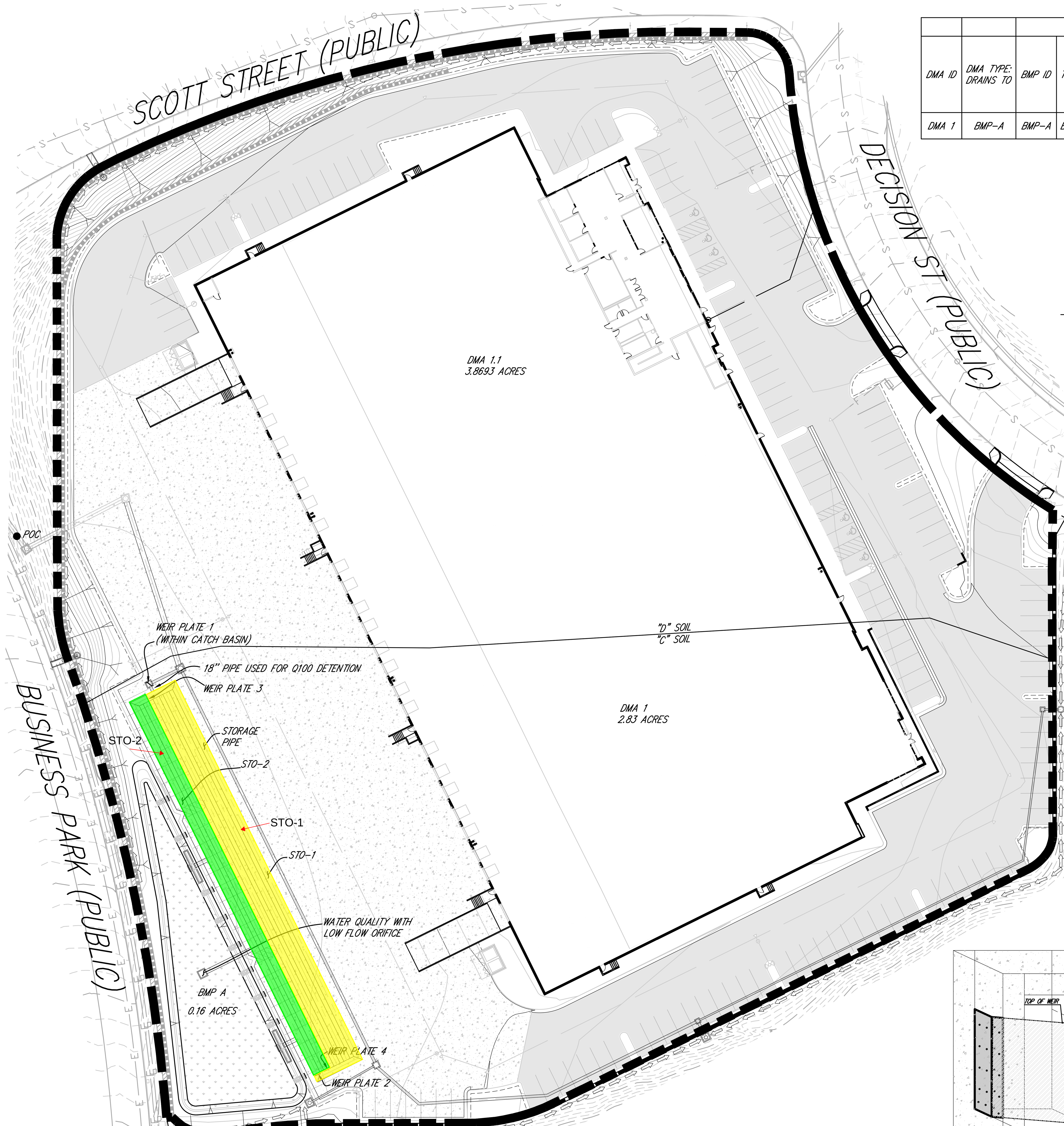
ATTACHMENT 1A – DMA EXHIBIT CHECKLIST

For Attachment 1A, provide map(s) for the project site, titled "DMA Exhibit." The checklist below identifies minimum elements that must be included with the DMA Exhibit.

- ☒ Underlying hydrologic soil group Note: C and D soil, See Hydromodification Exhibit.
- ☒ Approximate depth to groundwater Note: Approximate depth to groundwater > 50 ft.
- ☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands, etc.)
- ☐ Critical coarse sediment yield areas to be protected Note: Not Applicable
- ☐ Existing topography and impervious areas Note: Not Applicable
- ☒ Existing and proposed site drainage network and storm drain structures
- ☒ Proposed connections to offsite drainage Note: Connections will be throughout the building and connect to the existing culvert. Lines are roughly sized in hydrology report and will be precise in final engineering.
- ☒ Proposed demolition
- ☒ Proposed grading
- ☒ Proposed impervious features
- ☒ Proposed design features and surface treatments used to minimize imperviousness
- ☒ Drainage management area (DMA) boundaries
- ☒ DMA identification numbers (DMA ID)
- ☒ DMA areas (square footage or acreage)
- ☒ DMA type (Drains to BMP, Self-mitigating, De Minimis, or Self-retaining)
- ☒ Potential pollutant source areas and corresponding required source controls (see Form 2 and Form 3 of SWQMP, *BMP Design Manual* Chapter 4 and Appendix E.1)
- ☒ Proposed Structural BMPs (see Form 5 of SWQMP)

ATTACHMENT 1a

		STRUCTURAL BMP SUMMARY TABLE											
DMA ID	DMA TYPE: DRAINS TO	BMP ID	TYPE OF BMP	EFFECTIVE AREA (SQFT)	A1 (INCH)	A2 (INCH) TOP OF BASIN	C (INCH) MEDIA	D (INCH) GRAVEL	E (INCH)	BOX RISER / OVERFLOW STRUCTURE SIZE (INCHES)	ORIFICES UPPER (INCH)	ORIFICES LOWER (INCH)	IMPERMEABLE LINER?
DMA 1	BMP-A	BMP-A	BIOFILTRATION	7300	9	21	18.0	12.0	27	36x36	N/A	2.375 ø	YES



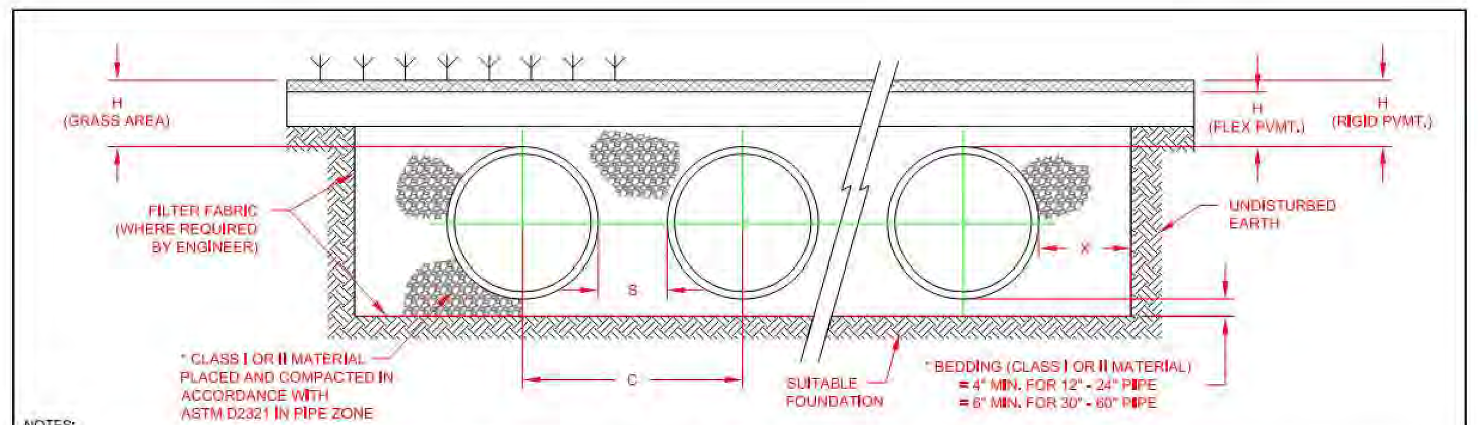
PERMANENT WATER QUALITY

TREATMENT FACILITY

KEEPING OUR WATER WAYS CLEAN
MAINTAIN WITH CARE – NO MODIFICATIONS WITHOUT AGENCY APPROVAL

DETAIL
WATER QUALITY SIGN– PLACED AT EACH BIOFILTRATION BASIN

NOTE: ALL BIOFILTRATION AREAS WILL HAVE A SIGN POSTED TO BE VISIBLE AT ALL TIMES.



NOTES:

1. ALL REFERENCES TO CLASS I OR II MATERIAL ARE PER ASTM D2321 "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST EDITION.

2. ALL RETENTION AND DETENTION SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, LATEST EDITION AND THE MANUFACTURER'S PUBLISHED INSTALLATION GUIDELINES.

3. MEASURES SHOULD BE TAKEN TO PREVENT THE MIGRATION OF NATIVE FINES INTO THE BACKFILL MATERIAL, WHEN REQUIRED. SEE ASTM D2321.

4. FILTER FABRIC: A GEOTEXTILE FABRIC MAY BE USED AS SPECIFIED BY THE ENGINEER TO PREVENT THE MIGRATION OF FINES FROM THE NATIVE SOIL INTO THE SELECT BACKFILL MATERIAL.

5. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER. AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.

6. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I OR II. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 4"-24" (100mm-600mm); 6" (150mm) FOR 30"-60" (750mm-900mm).

7. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I OR II IN THE PIPE ZONE EXTENDING NOT LESS THAN 6" ABOVE CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.

8. MINIMUM COVER: MINIMUM COVER OVER ALL RETNETION/DETENTION SYSTEMS IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" FROM TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOATATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER IS 12" UP TO 36" DIAMETER PIPE AND 24" OF COVER FOR 42" - 60" DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT.

NOMINAL DIAMETER	NOMINAL O.D.	TYPICAL SPACING "S"	TYPICAL SPACING "C"	TYPICAL SIDE WALL "X"	H (NON-TRAFFIC)	H (TRAFFIC)
12" (300 MM)	14.5" (368 MM)	11" (279 MM)	25.4" (645 MM)	8" (203 MM)	12" (292 MM)	12" (292 MM)
15" (375 MM)	18" (457 MM)	12" (292 MM)	28.9" (734 MM)	8" (203 MM)	12" (292 MM)	12" (292 MM)
18" (450 MM)	21" (533 MM)	17" (434 MM)	33.9" (862 MM)	9" (229 MM)	12" (292 MM)	12" (292 MM)
24" (600 MM)	28" (711 MM)	13" (330 MM)	40.7" (1034 MM)	10" (254 MM)	12" (292 MM)	12" (292 MM)
30" (750 MM)	36" (914 MM)	18" (457 MM)	53.1" (1347 MM)	18" (457 MM)	12" (292 MM)	12" (292 MM)
36" (900 MM)	42" 1067 MM)	22" (559 MM)	63" (1600 MM)	18" (457 MM)	12" (292 MM)	12" (292 MM)
42" (1050 MM)	48" (1219 MM)	24" (610 MM)	71.9" (1826 MM)	18" (457 MM)	12" (292 MM)	24" (610 MM)
48" (1200 MM)	54" (1372 MM)	25" (635 MM)	78.5" (1994 MM)	18" (457 MM)	12" (292 MM)	24" (610 MM)
60" (1500 MM)	67" (1702 MM)	24" (610 MM)	90" (2286 MM)	18" (457 MM)	12" (292 MM)	24" (610 MM)

* CLASS I BACKFILL REQUIRED AROUND 60" DIAMETER FITTINGS.

REV.	DESCRIPTION	BY	MM/DD/YY	CHK'D
3	REVISED 18" SPACING	TJR	01/05/09	CKS

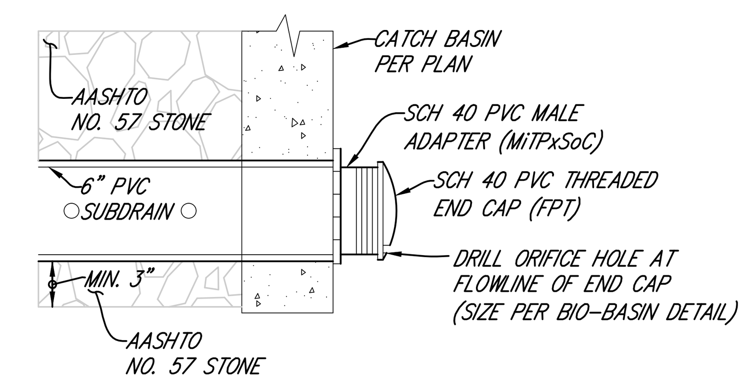
HANCOR, INC. HAS PREPARED THIS DETAIL BASED ON INFORMATION PROVIDED TO HANCOR. THIS DRAWING IS INTENDED TO DEPICT THE COMPONENTS AS REQUESTED. HANCOR HAS NOT PERFORMED ANY ENGINEERING OR DESIGN SERVICES FOR THIS PROJECT, NOR HAS HANCOR INDEPENDENTLY VERIFIED THE INFORMATION SUPPLIED. THE INSTALLATION DETAILS PROVIDED HEREIN ARE GENERAL RECOMMENDATIONS AND ARE NOT SPECIFIC FOR THIS PROJECT. THE DESIGN ENGINEER SHALL REVIEW THESE DETAILS PRIOR TO CONSTRUCTION. IT IS THE DESIGN ENGINEERS RESPONSIBILITY TO ENSURE THE DETAILS PROVIDED HEREIN MEETS OR EXCEEDS THE APPLICABLE NATIONAL, STATE, OR LOCAL REQUIREMENTS AND TO ENSURE THAT THE DETAILS PROVIDED HEREIN ARE ACCEPTABLE FOR THIS PROJECT.

TYPICAL RET/DET CROSS SECTION DETAIL

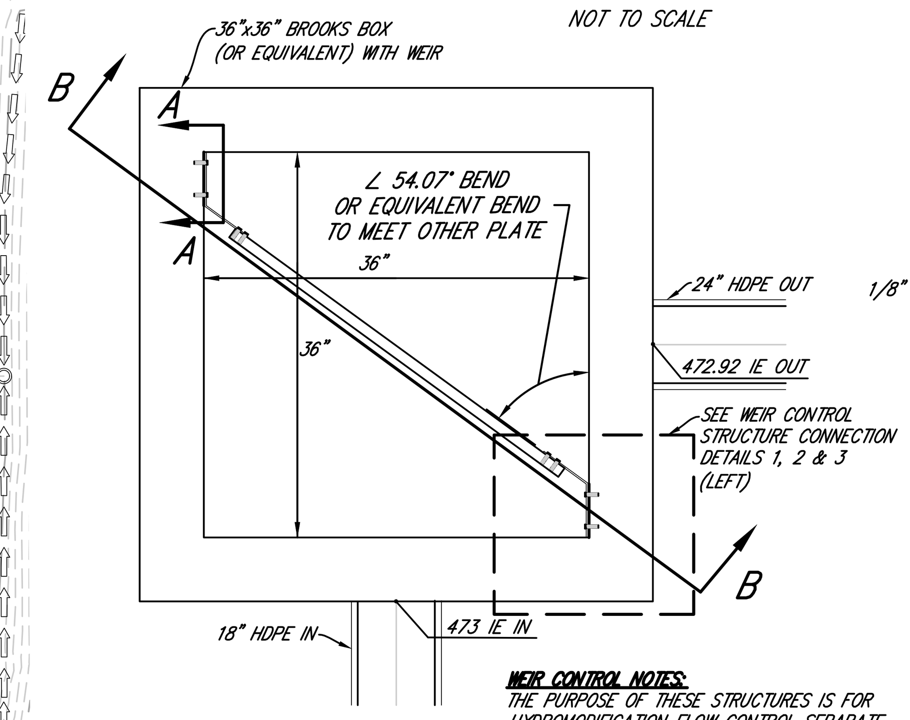
DRAWING NUMBER: STD-702

Hancor
401 OLIVE ST.
FINDLAY, OHIO 45839

DRAWN BY: AWM
DATE: 07.25.06
SCALE: NTS
SHEET: OF

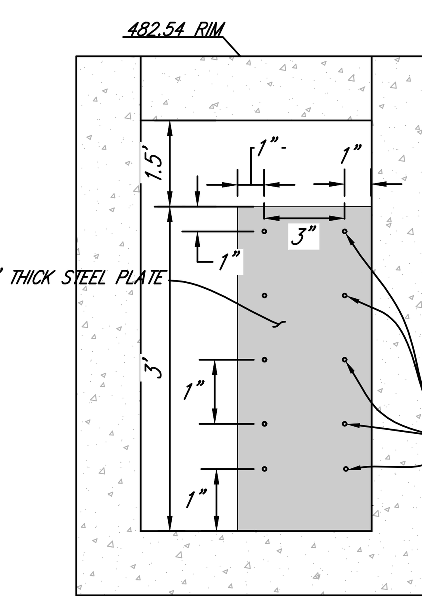


LOWER ORIFICE DETAIL
NOT TO SCALE



WEIR PLATE 1
NOT TO SCALE

WEIR CONTROL NOTES:
THE PURPOSE OF THESE STRUCTURES IS FOR HYDROMODIFICATION FLOW CONTROL SEPARATE FROM TYPICAL BIOFILTRATION FLOW MODELING.



SECTION A-A
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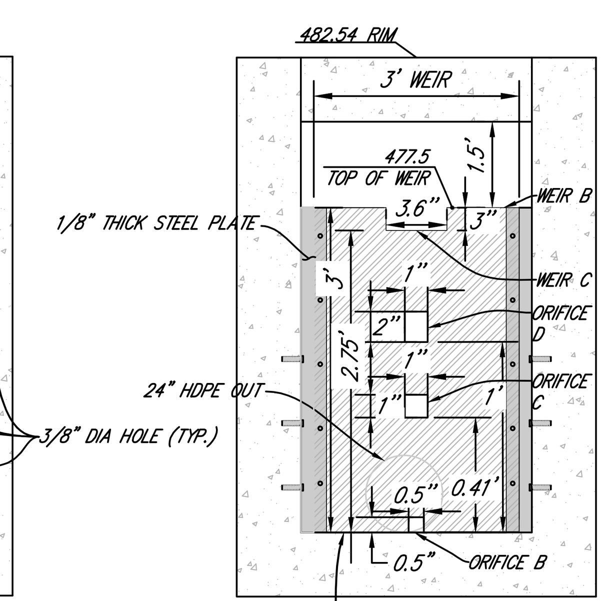
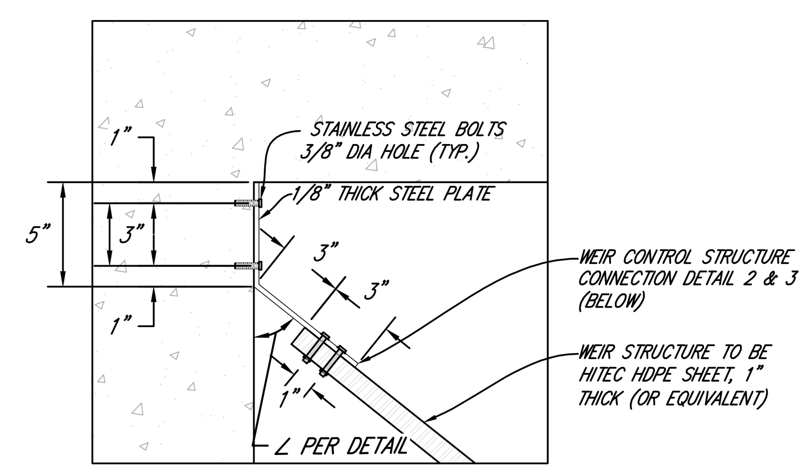


WEIR MUST BE FLUSHED WITH GROUND AND SEALED WITH "HENRY 900 CONSTRUCTION & FLASHING SEALANT" (OR EQUIVALENT)

SECTION B-B
NOT TO SCALE



WEIR CONTROL STRUCTURE CONNECTION DETAIL 1
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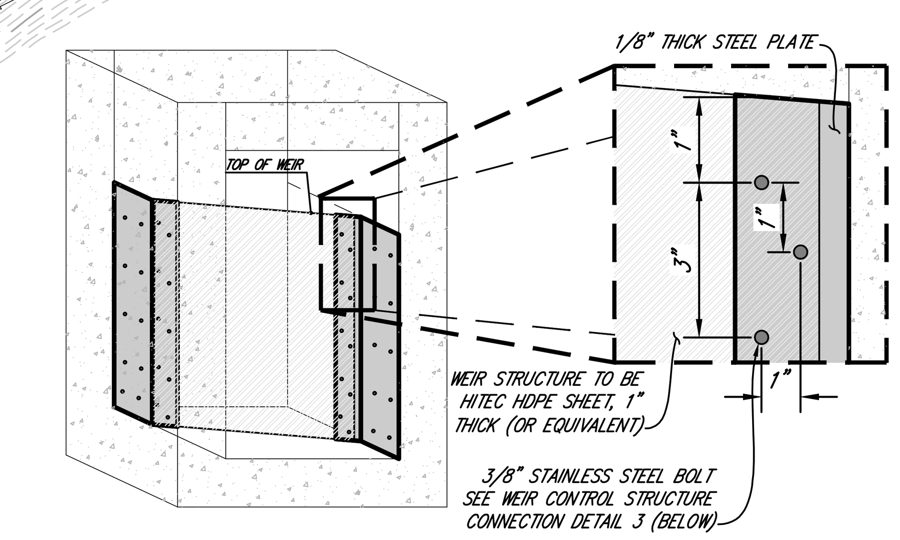

WEIR CONTROL STRUCTURE CONNECTION DETAIL 2
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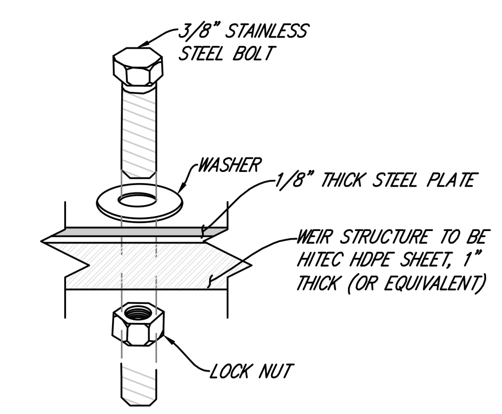

WEIR CONTROL STRUCTURE CONNECTION DETAIL 3
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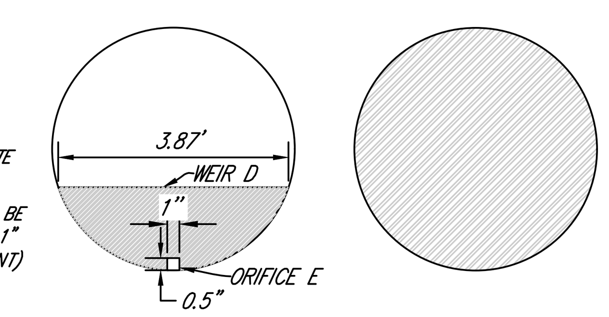
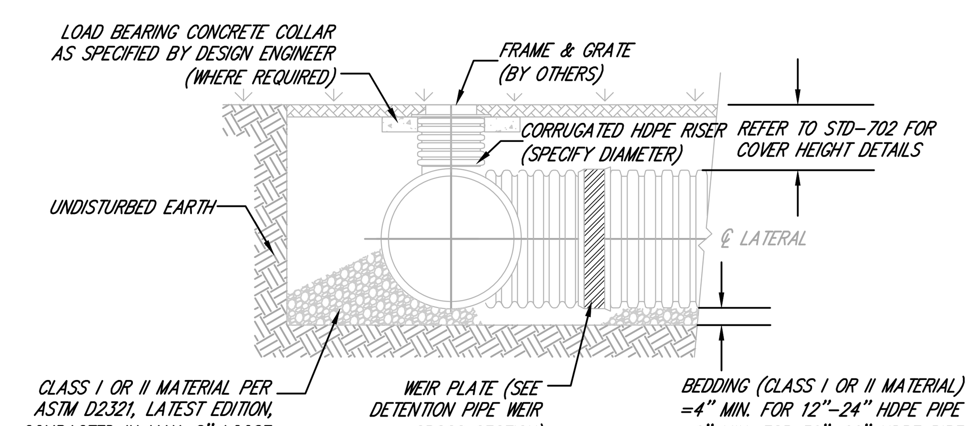


DETENTION PIPE WEIR CROSS SECTION

WEIR PLATE 2
NOT TO SCALE

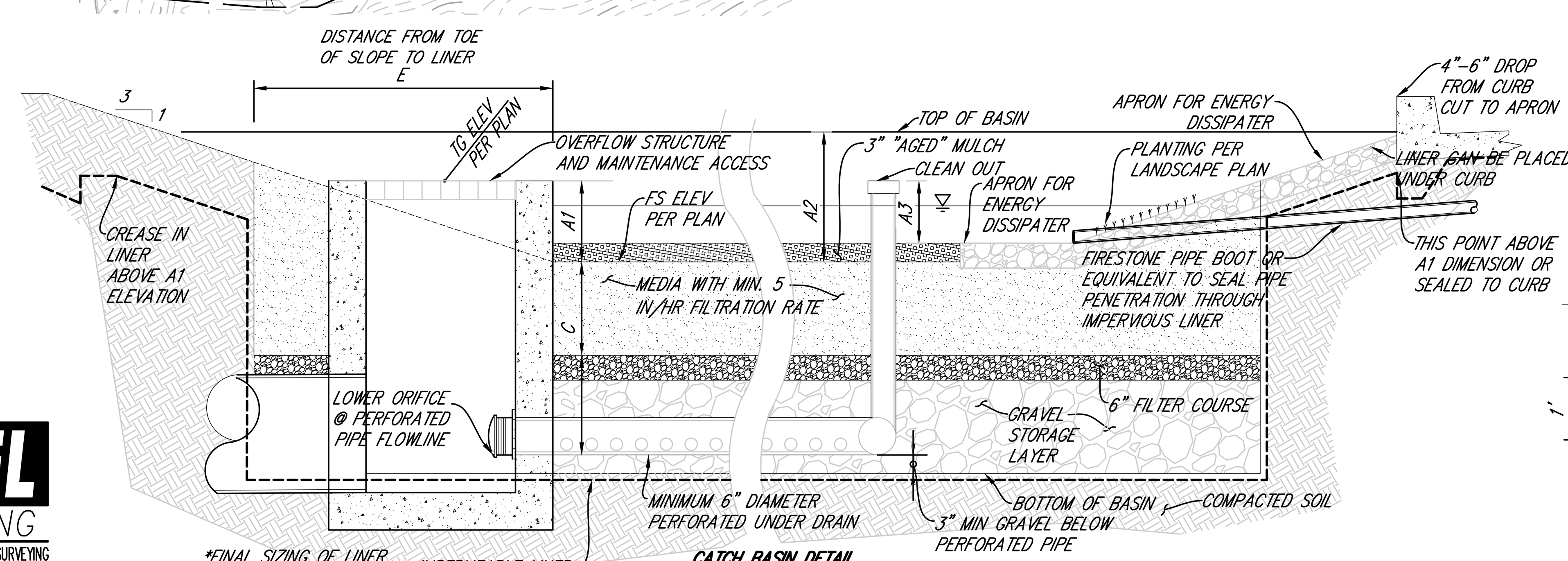
WEIR PLATE 3 AND 4
NOT TO SCALE

WEIR CONTROL NOTES:
WEIR PLATE 3 AND 4 ARE USED TO BLOCK WATER IN DETENTION PIPE.



SECTION A-A
NOT TO SCALE

Hancor
401 OLIVE ST.
FINDLAY, OHIO 45839

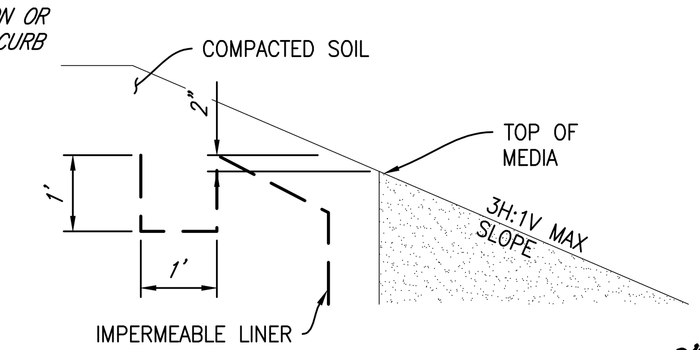


*FINAL SIZING OF LINER PER SOIL ENGINEERS RECOMMENDATIONS

CATCH BASIN DETAIL
NOT TO SCALE

DETAIL
"NO DUMPING" AT CATCH BASINS

NOTE: ALL CATCH BASINS WITH GRATES SHALL BE STENCILED WITH CITY REQUIRED ITEM PER ABOVE DETAIL (DAS MANUFACTURING #SDO OR EQUIVALENT).



IMPERMEABLE LINER EDGE ANCHOR DETAIL
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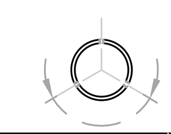


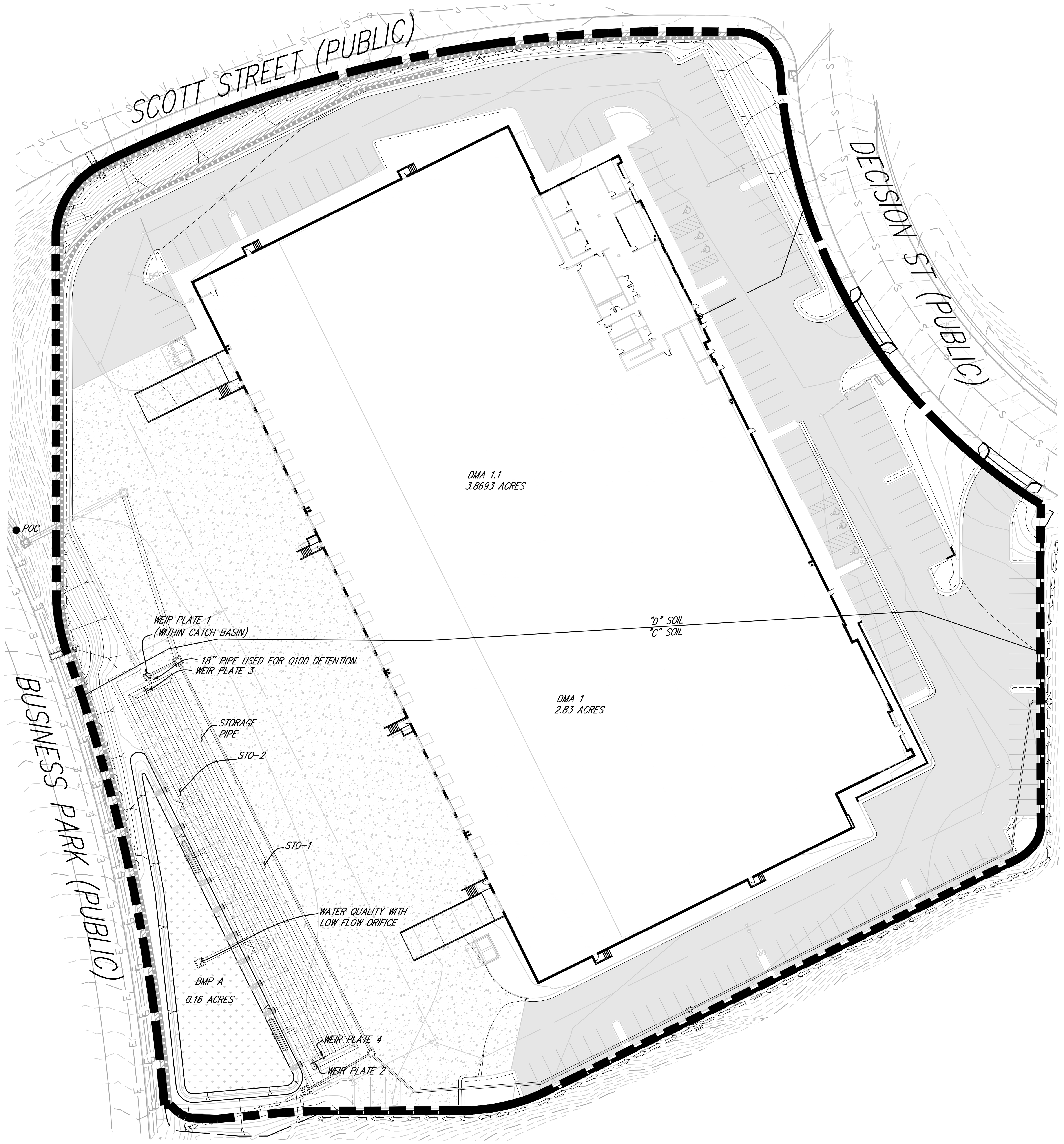
6" PVC PIPE PERFORATION LAYOUT DETAIL
NOT TO SCALE

SCALE: 1:40
0 40 80

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

DECISION STREET DMA EXHIBIT
SHEETS 1 OF 2

V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\SWQMP\21052-Post-DMA - sheets 1 of 2.dwg 4/13/2022 9:45 AM ORIGINAL PLOT SIZE: PDF 24X36



SOURCE CONTROL BMP

(1) SC-1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4

USE A SUITE OF HOUSEKEEPING BMPS WHICH COULD INCLUDE EFFECTIVE IRRIGATION, DISPERSION OF NON-STORM WATER DISCHARGES INTO LANDSCAPING FOR INFILTRATION. NO VEHICLE WASHING WILL BE ALLOWED ONSITE.

(2) SC-2 STORM DRAIN STENCILING OR SIGNAGE

STENCILING SHALL BE PROVIDED FOR ALL STORM WATER CONVEYANCE SYSTEM INLETS AND CATCH BASINS WITHIN THE PROJECT AREA. INLET STENCILING MAY INCLUDE CONCRETE STAMPING, CONCRETE PAINTING, PLACARDS, OR OTHER METHODS APPROVED BY THE CITY.

(3) SC-5 PROTECT TRASH STORAGE AREAS FROM RAINFALL, RUN-ON, RUNOFF, AND WIND DISPERSAL

- TRASH CONTAINER AREAS ARE DEIGNED SO THAT DRAINAGE FROM ADJOINING ROOFS AND PAVEMENT IS DIVERTED AROUND THE AREA(S) TO AVOID RUN-ON.
- ENSURE TRASH CONTAINER AREAS ARE SCREENED OR WALLED TO PREVENT OFFSITE TRANSPORT OF TRASH.
- PROVIDE ROOFS OR AWNINGS ON ALL TRASH ENCLOSURES, TO MINIMIZE EXPOSURE.
- LOCATE STORM DRAINS AWAY FROM THE IMMEDIATE VICINITY OF THE TRASH STORAGE AREA AND VICE VERSA.
- POST SIGNS ON ALL DUMPSTERS INFORMING USERS THAT HAZARDOUS MATERIAL ARE NOT TO BE DISPOSED.

SC-6 ADDITIONAL BMPS BASED ON POTENTIAL SOURCES OF RUNOFF POLLUTANTS

(4) A. ON-SITE STORM DRAIN INLETS

INLET WILL BE STENCILED

(5) B. FRENCH DRAINS

FRENCH DRAIN WILL CONVEY TREATED WATER AT BOTTOM OF BIOFILTRATION BASINS.

(6) C. NEED FOR FUTURE INDOOR & STRUCTURAL PEST CONTROL

PROVIDE INTEGRATED PEST MANAGEMENT INFORMATION TO OWNERS, LESSEES, AND OPERATORS.

(7) D. LANDSCAPE/OUTDOOR PESTICIDE USE

- MAINTAIN LANDSCAPING USING MINIMUM OR NO PESTICIDES.
- SEE APPLICABLE OPERATIONAL BMPS IN FACT SHEET SC-41, "BUILDING AND GROUNDS MAINTENANCE," IN THE CASQA STORMWATER QUALITY HANDBOOKS AT WWW.CABMPHANDBOOKS.COM.
- PROVIDE IPM INFORMATION TO NEW OWNERS, LESSEES AND OPERATORS.

(8) SC-43 PARKING/STORAGE AREA MAINTENANCE

ESTABLISH FREQUENCY OF PUBLIC PARKING LOT SWEEPING BASED ON USAGE AND FIELD OBSERVATIONS OF WASTE ACCUMULATION.

(9) SC-30 OUTDOOR LOADING/UNLOADING

- MOVE LOADED AND UNLOADED ITEMS INDOORS AS SOON AS POSSIBLE.
- SEE FACT SHEET SC-30, "OUTDOOR LOADING AND UNLOADING," IN THE CASQA STORMWATER QUALITY HANDBOOKS AT WWW.CABMPHANDBOOKS.COM.

SITE DESIGN BMPs

(1) SD-3 PARKING AND DRIVING AISLES WERE DESIGN TO THE MINIMUM REQUIRED TO MINIMIZE IMPERVIOUS AREAS

(3) SD-6 RUNOFF COLLECTION WAS IMPLEMENTED TO MINIMIZE THE TRANSPORT OF RUNOFF AND POLLUTANTS TO THE MS4 AND RECEIVING WATERS.

(4) SD-7 DROUGHT TOLERANT PLANTS SPECIES ARE SELECTED FOR LANDSCAPING

SCALE: 1:40

0 40 80 120 160

DECISION STREET DMA EXHIBIT
SHEETS 2 OF 2

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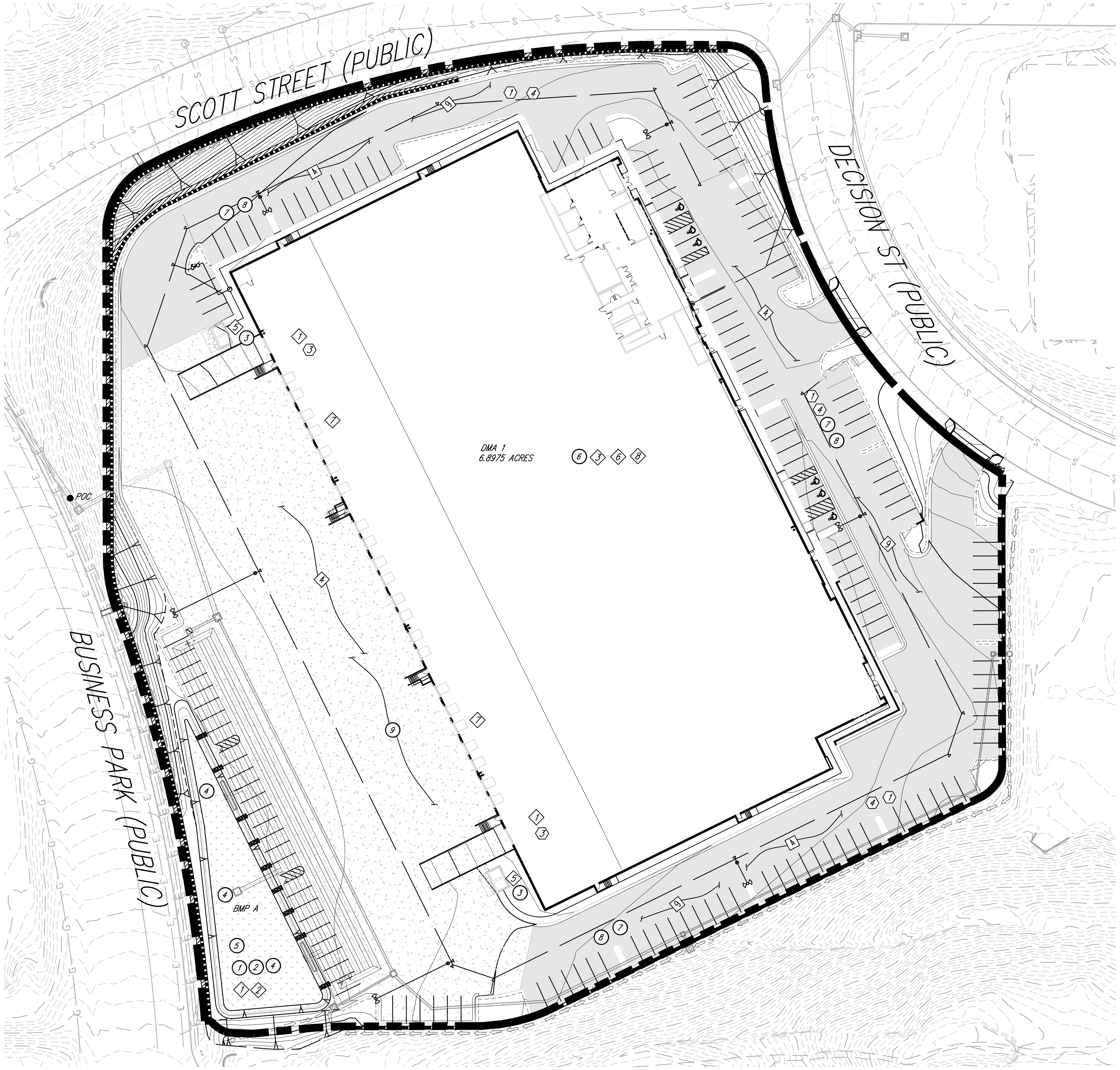

POTENTIAL POLLUTANT SOURCE AREAS

1. ON SITE STORM DRAINS
2. FRENCH DRAINS
3. NEED FOR FUTURE INDOOR AND STRUCTURAL PEST CONTROL
4. LANDSCAPE/ OUTDOOR PEST USE
5. REFUSE/ TRASH COLLECTION AREAS
6. INDUSTRIAL PROCESSES
7. LOADING DOCKS
8. FIRE SPRINKLER TEST AND RELIEF POINT
9. PLAZAS, SIDEWALKS, AND PARKING LOTS

SITE DESIGN BMPs

1 SD–3 PARKING AND DRIVING AISLES WERE DESIGN TO THE MINIMUM REQUIRED TO MINIMIZE IMPERVIOUS AREAS

3 SD–6 RUNOFF COLLECTION WAS IMPLEMENTED TO MINIMIZE THE TRANSPORT OF RUNOFF AND POLLUTANTS TO THE MS4 AND RECEIVING WATERS.

4 SD–7 DROUGHT TOLERANT PLANTS SPECIES ARE SELECTED FOR LANDSCAPING

SOURCE CONTROL BMP

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SC–6 ADDITIONAL BMPS BASED ON POTENTIAL SOURCES OF RUNOFF POLLUTANTS

4 A. ON–SITE STORM DRAIN INLETS

INLET WILL BE STENCILED

5 B. FRENCH DRAINS

FRENCH DRAIN WILL CONVEY TREATED WATER AT BOTTOM OF BIOFILTRATION BASINS.

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PROVIDE INTEGRATED PEST MANAGEMENT INFORMATION TO OWNERS, LESSEES, AND OPERATORS.

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– MAINTAIN LANDSCAPING USING MINIMUM OR NO PESTICIDES.
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SCALE: 1:40

0 40 80 120 160

DECISION STREET SOURCE CONTROL SHEET

V:|21|21052|Engineering|PLOT PLAN|Storm|Working Files|Hyd|21052–Source Control Sheet.dwg 4/13/2022 9:52 AM ORIGINAL PLOT SIZE: PDF 24X36

ATTACHMENT 1b

Please see DMA Exhibit and Attachment 1E

ATTACHMENT 1c

Worksheet B.3-1. Harvest and Use Feasibility Screening

Harvest and Use Feasibility Screening		Worksksheet B.3-1
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☑ Toilet and urinal flushing ☑ Landscape irrigation ☐ Other:______________		
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. Flushing: (174 res.)x(9.3 gal/res) = 1618.2 gallons, (1618.2 gal)(1.5 days)/(7.48 gal/cuft) = 324.5 cu ft Irrigation: 36-hr Mod. Water per Table B.3-3 = (1,470 gal days/acre)*(0.9517 acres)/ 7.48 gal/ cuft = 187.03 cu ft [Provide a summary of calculations here] Total Demand = 511.53 cu ft		
3. Calculate the DCV using worksheet B-2.1. Total DCV = 12,996 0.25*12,996 = 3,249 cu ft		
3a. Is the 36-hour demand greater than or equal to the DCV? Yes / No ⇨ ⇩	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV? Yes / No ⇨ ⇩	3c. Is the 36-hour demand less than 0.25DCV? Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

ATTACHMENT 1d

Table D.2-3: Determination of Safety Factor

Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	2	0.5
	Soil Texture Class	0.25	3	0.75
	Soil Variability	0.25	2	0.5
	Depth to Groundwater/Obstruction	0.25	1	0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.0
Design (B)	Pretreatment	0.50	2	1.0
	Resiliency	0.25	2	0.5
	Compaction	0.25	2	0.5
	Design Safety Factor, $S_B = \Sigma p$			2.0
Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)				4.0

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

Table D.2-4: Guidance for Determining Individual Factor Values

Consideration	High Concern (3 points)	Medium Concern (2 points)	Low Concern (1 point)
Infiltration Testing Method	Any	At least 2 tests of any kind within 50' of BMP.	At least 4 tests within BMP footprint, OR Large/Small Scale Pilot Infiltration Testing over at least 5% of BMP footprint.
Soil Texture Class	Unknown, Silty, or Clayey	Loamy	Granular/Slightly Loamy
Soil Variability	Unknown or High	Moderately Homogeneous	Significantly Homogeneous
Depth to Groundwater/ Obstruction	<5' below BMP	5-15' below BMP	>15' below BMP
Pretreatment	None/Minimal	Provides good pretreatment OR does not receive significant runoff from unpaved areas	Provides excellent pretreatment OR only receives runoff from rooftops and road surfaces.
Resiliency	None/Minimal	Includes underdrain/backup drainage that ensures ponding draws down in <96 hours	Includes underdrain/backup drainage AND supports easy restoration of impacted infiltration rates.
Compaction	Moderate Likelihood	Low Likelihood	Very Low Likelihood

Categorization of Infiltration Feasibility Condition				Form I-8
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**				
Criteria	**Screening Question**	Yes	**No**	
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X	
Provide basis: GPI Comment (09-01-2021): GPI performed field infiltration testing at the site at depths of 5 and 10 feet below the existing ground surface. The uncorrected field rates measured during our investigation ranged from 0.00 to 0.01 inches per hour, which is less than the 0.5 inches per hour detailed in the screening question. These rates do not include safety factor corrections for site characteristics, methodology, or potential design of the storm water system. Additional details and results of our field infiltration testing are presented in our August 3, 2021 geotechnical investigation report.				
2	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X	
Provide basis: GPI Comment (09-01-2021): Not applicable. Rates measured in the field were significantly lower than 0.5 inches per hour (see prior response to Screening Question 1).				

<table>
<tr><th colspan="4">Form I-8 Page 2 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

GPI Comment (09-01-2021):
Not applicable. Rates measured in the field were significantly lower than 0.5 inches per hour (see prior response to Screening Question 1). Groundwater is anticipated to be deeper than 50 feet below prevailing site grades.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

GPI Comment (09-01-2021):
Not applicable. Rates measured in the field were significantly lower than 0.5 inches per hour (see prior response to Screening Question 1).

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>Part 1 Result*</td><td>If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

<u>If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2</u></td><td colspan="2">NO</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Form I-8 Page 3 of 4			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria **Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?**			
Criteria	**Screening Question**	**Yes**	**No**
5	Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: GPI Comment (09-01-2021): As noted in our response to Screening Question 1, GPI measured uncorrected field infiltration rates of 0.00 and 0.01 inches per hour. These uncorrected rates are significantly lower than the recommended minimum infiltration rate of 0.5 inches per hour and also lower than the generally accepted minimum rated of 0.05 inches per hour for partial infiltration. The low rates are attributable to the presence of sedimentary bedrock and deep, fine-grained, compacted fill soils throughout the site. As such, GPI does not consider the site suitable for infiltration. Additional details and results of our field infiltration testing are presented in our August 3, 2021 geotechnical investigation report. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
6	Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X
Provide basis: GPI Comment (09-01-2021): Not applicable. Rates measured in the field were significantly lower than 0.5 inches per hour and the subsurface materials consisted of compacted fine-grained fill soils and native bedrock materials (see prior response to Screening Question 5).			

<table>
<tr><th colspan="4">Form I-8 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis: Groundwater is not located within approximately 10 feet from the bottom of the proposed basins.

GPI Comment (09-01-2021):
Not applicable. Rates measured in the field were significantly lower than 0.5 inches per hour and the subsurface materials consisted of compacted fine-grained fill soils and native bedrock materials (see prior response to Screening Question 5). Groundwater is anticipated to be deeper than 50 feet below prevailing site grades.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td>X</td></tr>
<tr><td colspan="4">Provide basis:

GPI Comment (09-01-2021):
Not applicable. Rates measured in the field were significantly lower than 0.5 inches per hour and the subsurface materials consisted of compacted fine-grained fill soils and native bedrock materials (see prior response to Screening Question 5). Groundwater is anticipated to be deeper than 50 feet below prevailing site grades.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration
If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td>NO</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings

ATTACHMENT 1e

Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	*i*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	DMA1	unitless
	2	85th Percentile 24-hr Storm Depth	0.66	inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	257,647	sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)		sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	41,458	sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)		sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)		sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)		sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)		sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)		sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)		sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)		sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)		sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)		sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)		sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)		sq-ft
	18	Number of Tree Wells Proposed per SD-A		#
	19	Average Mature Tree Canopy Diameter		ft
	20	Number of Rain Barrels Proposed per SD-E		#
	21	Average Rain Barrel Size		gal
Initial Runoff Factor Calculation	22	Total Tributary Area	299,105	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.79	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	unitless
	25	Initial Weighted Runoff Factor	0.79	unitless
	26	Initial Design Capture Volume	12,996	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	sq-ft
	28	Total Pervious Dispersion Area	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.79	unitless
	32	Design Capture Volume After Dispersion Techniques	12,996	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.79	unitless
	36	Final Effective Tributary Area	236,293	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	12,996	cubic-feet

No Warning Messages

Automated Worksheet B.2: Retention Requirements (V2.0)

Category	#	Description	*i*	Units
Basic Analysis	1	Drainage Basin ID or Name	DMA1	unitless
	2	85th Percentile Rainfall Depth	0.66	inches
	3	Predominant NRCS Soil Type Within BMP Location	D	unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted	unitless
	5	Nature of Restriction	Soil Type	unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes	yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No	yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	Yes	yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer	0.010	in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	1.5%	percentage
	12	Fraction of DCV Requiring Retention	0.01	ratio
	13	Required Retention Volume	130	cubic-feet

No Warning Messages

Automated Worksheet B.3: BMP Performance (V2.0)

Category	#	Description	i	Units
BMP Inputs	1	Drainage Basin ID or Name	DMA1	sq-ft
	2	Design Infiltration Rate Recommended	0.000	in/hr
	3	Design Capture Volume Tributary to BMP	12,996	cubic-feet
	4	Is BMP Vegetated or Unvegetated?	Vegetated	unitless
	5	Is BMP Impermeably Lined or Unlined?	Lined	unitless
	6	Does BMP Have an Underdrain?	Underdrain	unitless
	7	Does BMP Utilize Standard or Specialized Media?	Standard	unitless
	8	Provided Surface Area	7,300	sq-ft
	9	Provided Surface Ponding Depth	6	inches*
	10	Provided Soil Media Thickness	21	inches
	11	Provided Gravel Thickness (Total Thickness)	12	inches
	12	Underdrain Offset	3	inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	2.38	inches
	14	Specialized Soil Media Filtration Rate		in/hr
	15	Specialized Soil Media Pore Space for Retention		unitless
	16	Specialized Soil Media Pore Space for Biofiltration		unitless
	17	Specialized Gravel Media Pore Space		unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	cubic-feet
	19	Ponding Pore Space Available for Retention	0.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.00	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	unitless
	23	Effective Retention Depth	2.25	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.11	ratio
	25	Calculated Retention Storage Drawdown Time	120	hours
	26	Efficacy of Retention Processes	0.13	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	1,700	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	11,296	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.2523	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	1.49	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	1.49	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	8.96	inches
	34	Ponding Pore Space Available for Biofiltration	1.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	unitless
	37	Effective Depth of Biofiltration Storage	13.80	inches
	38	Drawdown Time for Surface Ponding	4	hours
	39	Drawdown Time for Effective Biofiltration Depth	9	hours
	40	Total Depth Biofiltered	22.76	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	16,944	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	13,845	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	8,472	cubic-feet
	44	Option 2 - Provided Storage Volume	8,395	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	0.99	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	1.00	ratio
	48	**Deficit of Effectively Treated Stormwater**	**0**	cubic-feet

No Warning Messages

*Note: DMA table (see DMA exhibit) has 9 inches for construction purposes. 3 inches of mulch has been added to media in this calculations due to the void space of mulch.

REGION NAME	WATER BODY NAME	WATER BODY TYPE	INTEGRATED REPORT CATEGORY	POLLUTANT	POLLUTANT CATEGORY	FINAL LISTING DECISION	DECISION STATUS**	TMDL REQUIREMENT STATUS**	EXPECTED TMDL COMPLETION DATE***
Regional Board 9 - San Diego Region	Agua Hedionda Creek	River & Stream	5	Selenium	Metals/Metalloids	Do Not Delist from 303(d) list (TMDL required list)	Revised	5A	7/11/1905
Regional Board 9 - San Diego Region	Agua Hedionda Creek	River & Stream	5	Total Dissolved Solids	Salinity	Do Not Delist from 303(d) list (TMDL required list)	Original	5A	7/11/1905
Regional Board 9 - San Diego Region	Agua Hedionda Creek	River & Stream	5	Toxicity	Toxicity	Do Not Delist from 303(d) list (TMDL required list)	Revised	5A	7/11/1905

ATTACHMENT 2 – HYDROMODIFICATION MANAGEMENT CONTROLS: SUPPORT DOCUMENTATION & CHECKLIST

☐ Check this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	Checklist
Attachment 2A	Hydromodification Management Exhibit	☒ Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2B	Management of Critical Coarse Sediment Yield Areas See Section 6.2 of the *BMP Design Manual*.	☒ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map Analyses, as applicable, for Critical Coarse Sediment Yield Area Determination, per *BMP Design Manual:* ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2C	Geomorphic Assessment of Receiving Channels See Section 6.3.4 of the *BMP Design Manual*.	☒ Not performed ☐ Included ☐ Submitted as separate stand-alone document
Attachment 2D	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary See Chapter 6 and Appendix G of the *BMP Design Manual*	☒ Included ☐ Submitted as separate stand-alone document
Attachment 2E	Vector Control Plan	☐ Included ☒ Not required because BMPs will drain in less than 96 hours

ATTACHMENT 2A – HYDROMODIFICATION MANAGEMENT EXHIBIT

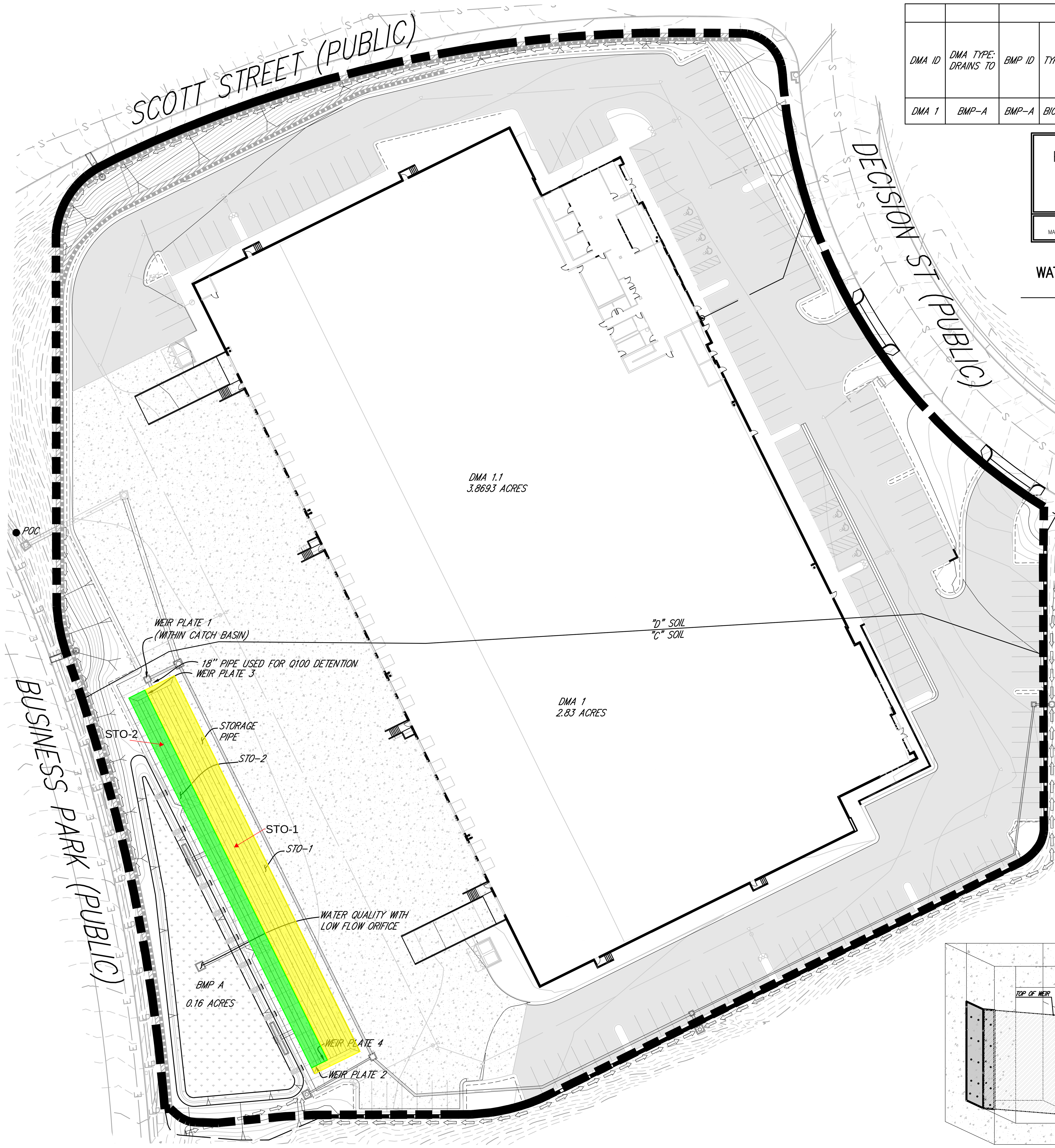
For Attachment 2A, provide map(s) for the project site, titled "Hydromodification Management Exhibit." The checklist below identifies minimum elements that must be included with the exhibit.

- ☒ Underlying hydrologic soil group Note: C and D soil. See hydromodification management exhibit.
- ☒ Approximate depth to groundwater Note: Approximate depth to groundwater is greater than 50 ft.
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands, etc.)
- ☐ Critical coarse sediment yield areas to be protected
- ☒ Existing topography and impervious areas
- ☒ Existing and proposed site drainage network and storm drain structures
- ☒ Proposed connections to offsite drainage
- ☒ Proposed demolition
- ☒ Proposed grading
- ☒ Proposed impervious features

Note: Connections will be throughout the building and connect to the existing culvert. Lines are roughly sized in hydrology report and will be precise in final engineering.

- ☒ Proposed design features and surface treatments used to minimize imperviousness
- ☒ Drainage management area (DMA) boundaries
- ☒ DMA identification numbers (DMA ID)
- ☒ DMA areas (square footage or acreage)
- ☒ DMA type (Drains to BMP, Self-mitigating, De Minimis, or Self-retaining)
- ☒ Potential pollutant source areas and corresponding required source controls (see Form 2 and Form 3 of SWQMP, *BMP Design Manual* Chapter 4 and Appendix E.1)
- ☒ Proposed Structural BMPs (see Form 5 of SWQMP)

ATTACHMENT 2a



		STRUCTURAL BMP SUMMARY TABLE											
DMA ID	DMA TYPE: DRAINS TO	BMP ID	TYPE OF BMP	EFFECTIVE AREA (SQFT)	A1 (INCH)	A2 (INCH) TOP OF BASIN	C (INCH) MEDIA	D (INCH) GRAVEL	E (INCH)	BOX RISER / OVERFLOW STRUCTURE SIZE (INCHES)	ORIFICES UPPER (INCH)	ORIFICES LOWER (INCH)	IMPERMEABLE LINER?
DMA 1	BMP-A	BMP-A	BIOFILTRATION	7300	9	21	18.0	12.0	27	36x36	N/A	2.375 ø	YES

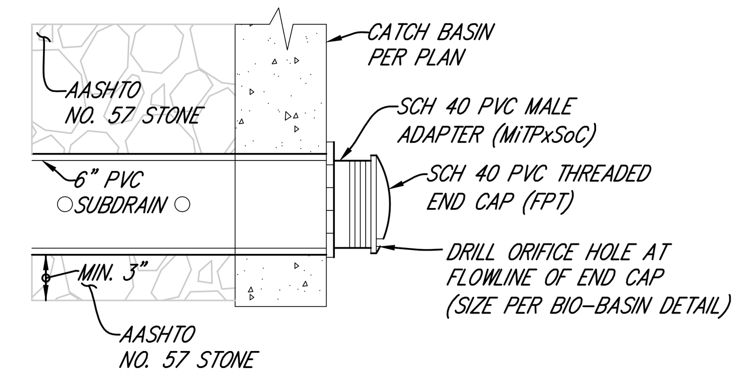
PERMANENT WATER QUALITY

TREATMENT FACILITY

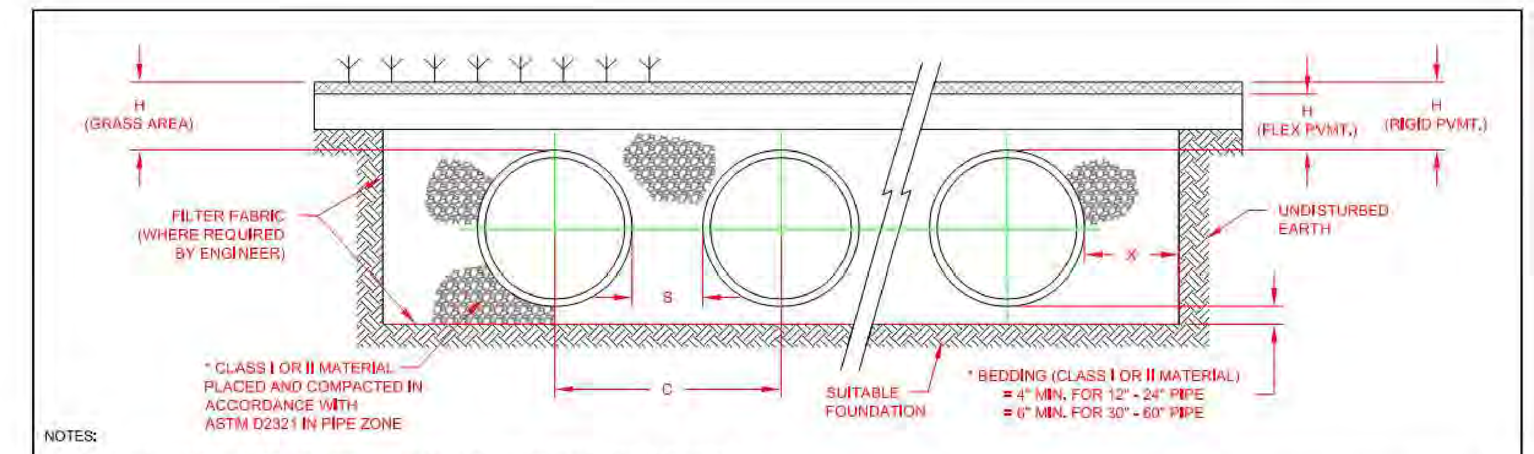
KEEPING OUR WATER WAYS CLEAN
MAINTAIN WITH CARE – NO MODIFICATIONS WITHOUT AGENCY APPROVAL

DETAIL
WATER QUALITY SIGN– PLACED AT EACH BIOFILTRATION BASIN

NOTE: ALL BIOFILTRATION AREAS WILL HAVE A SIGN POSTED TO BE VISIBLE AT ALL TIMES.



LOWER ORIFICE DETAIL
NOT TO SCALE



NOTES:

1. ALL REFERENCES TO CLASS I OR II MATERIAL ARE PER ASTM D2321 "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST EDITION.

2. ALL RETENTION AND DETENTION SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, LATEST EDITION AND THE MANUFACTURER'S PUBLISHED INSTALLATION GUIDELINES.

3. MEASURES SHOULD BE TAKEN TO PREVENT THE MIGRATION OF NATIVE FINES INTO THE BACKFILL MATERIAL, WHEN REQUIRED. SEE ASTM D2321.

4. FILTER FABRIC: A GEOTEXTILE FABRIC MAY BE USED AS SPECIFIED BY THE ENGINEER TO PREVENT THE MIGRATION OF FINES FROM THE NATIVE SOIL INTO THE SELECT BACKFILL MATERIAL.

5. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER. AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.

6. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I OR II. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 4"-24" (100mm-600mm); 6" (150mm) FOR 30"-60" (750mm-900mm).

7. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I OR II IN THE PIPE ZONE EXTENDING NOT LESS THAN 6" ABOVE CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.

8. MINIMUM COVER: MINIMUM COVER OVER ALL RETNETION/DETENTION SYSTEMS IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" FROM TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOATATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER IS 12" UP TO 36" DIAMETER PIPE AND 24" OF COVER FOR 42" - 60" DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT.

NOMINAL DIAMETER	NOMINAL O.D.	TYPICAL SPACING "S"	TYPICAL SPACING "C"	TYPICAL SIDE WALL "X"	H (NON-TRAFFIC)	H (TRAFFIC)
12" (300 MM)	14.5" (368 MM)	11" (279 MM)	25.4" (645 MM)	8" (203 MM)	12" (292 MM)	12" (292 MM)
15" (375 MM)	18" (457 MM)	12" (292 MM)	28.9" (734 MM)	8" (203 MM)	12" (292 MM)	12" (292 MM)
18" (450 MM)	21" (533 MM)	17" (434 MM)	33.9" (862 MM)	9" (229 MM)	12" (292 MM)	12" (292 MM)
24" (600 MM)	28" (711 MM)	13" (330 MM)	40.7" (1034 MM)	10" (254 MM)	12" (292 MM)	12" (292 MM)
30" (750 MM)	36" (914 MM)	18" (457 MM)	53.1" (1347 MM)	18" (457 MM)	12" (292 MM)	12" (292 MM)
36" (900 MM)	42" 1067 MM)	22" (559 MM)	63" (1600 MM)	18" (457 MM)	12" (292 MM)	12" (292 MM)
42" (1050 MM)	48" (1219 MM)	24" (610 MM)	71.9" (1826 MM)	18" (457 MM)	12" (292 MM)	24" (610 MM)
48" (1200 MM)	54" (1372 MM)	25" (635 MM)	78.5" (1994 MM)	18" (457 MM)	12" (292 MM)	24" (610 MM)
60" (1500 MM)	67" (1702 MM)	24" (610 MM)	90" (2286 MM)	18" (457 MM)	12" (292 MM)	24" (610 MM)

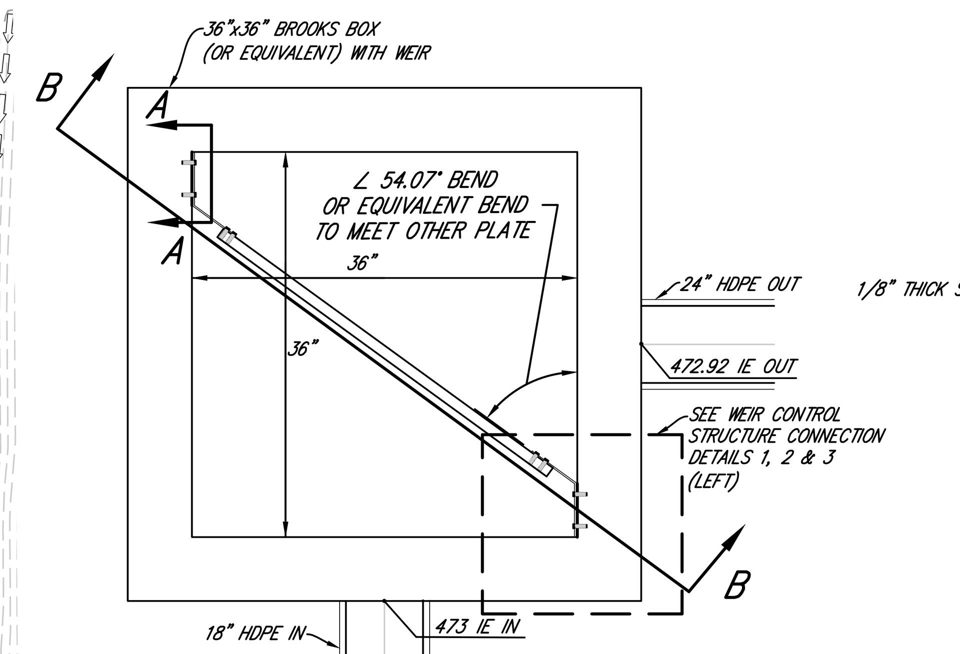
* CLASS I BACKFILL REQUIRED AROUND 60" DIAMETER FITTINGS.

3	REVISED 18" SPACING	TJR	01/05/09	CKS
REV.	DESCRIPTION	BY	MM/DD/YY	CHK'D

TYPICAL RET/DET CROSS SECTION DETAIL
DRAWING NUMBER: STD-702

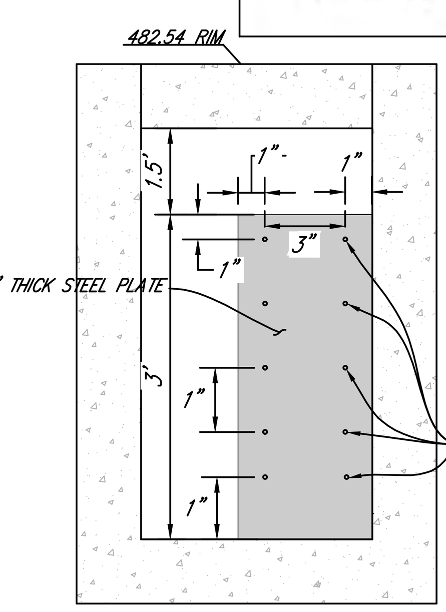
Hancor
401 OLIVE ST.
FINDLAY, OHIO 45839

DRAWN BY: AWM
DATE: 07.25.06
SCALE: NTS
SHEET: OF

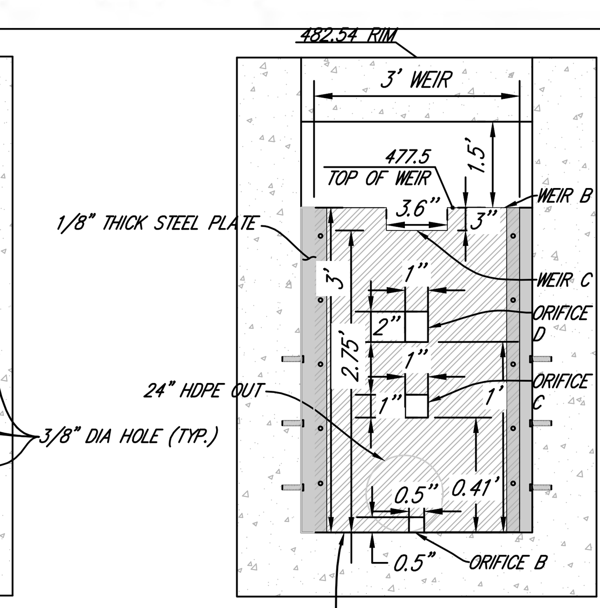


WEIR PLATE 1
NOT TO SCALE

WEIR CONTROL NOTES:
THE PURPOSE OF THESE STRUCTURES IS FOR HYDROMODIFICATION FLOW CONTROL SEPARATE FROM TYPICAL BIOFILTRATION FLOW MODELING.

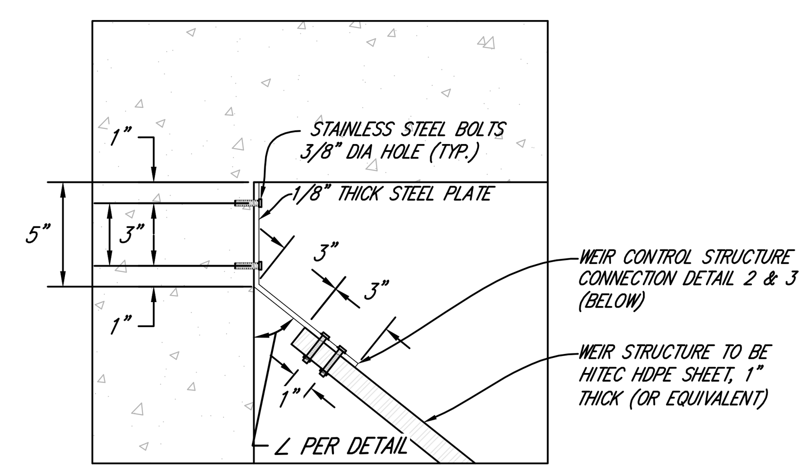


SECTION A-A
NOT TO SCALE

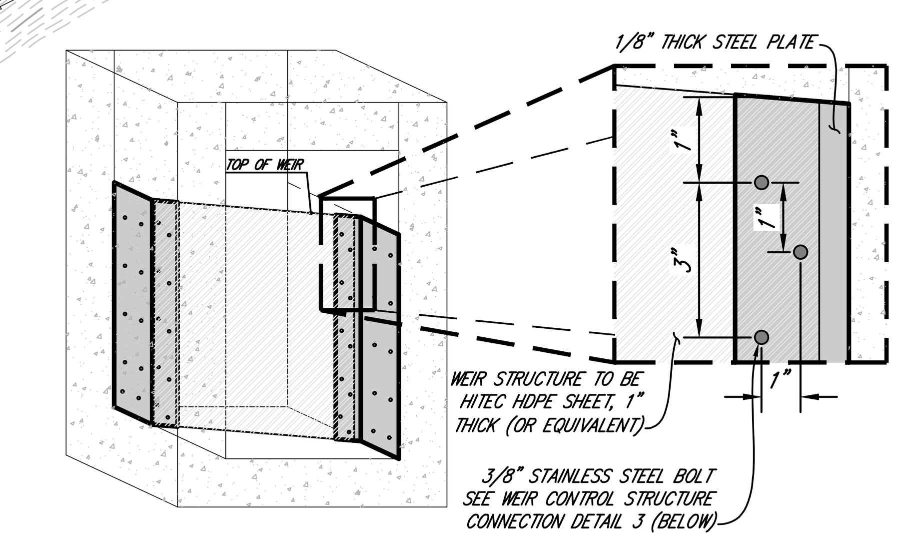


WEIR MUST BE FLUSHED WITH GROUND AND SEALED WITH "HENRY 900 CONSTRUCTION & FLASHING SEALANT" (OR EQUIVALENT)

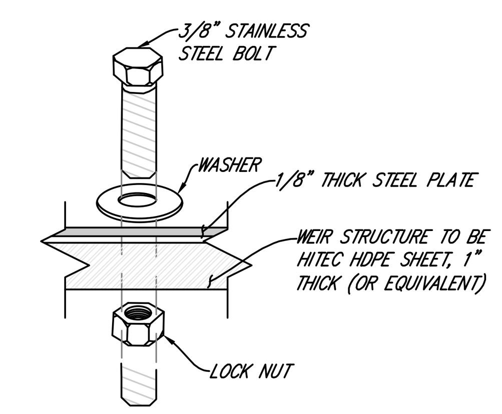
SECTION B-B
NOT TO SCALE



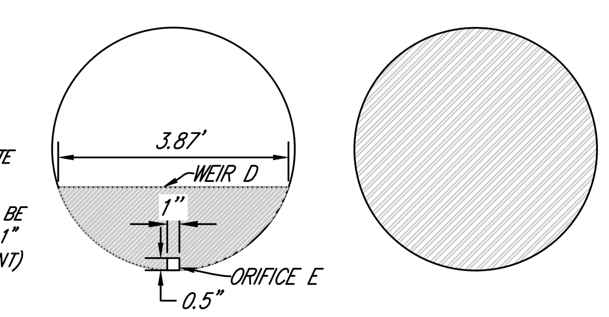
WEIR CONTROL STRUCTURE CONNECTION DETAIL 1
NOT TO SCALE



WEIR CONTROL STRUCTURE CONNECTION DETAIL 2
NOT TO SCALE



WEIR CONTROL STRUCTURE CONNECTION DETAIL 3
NOT TO SCALE

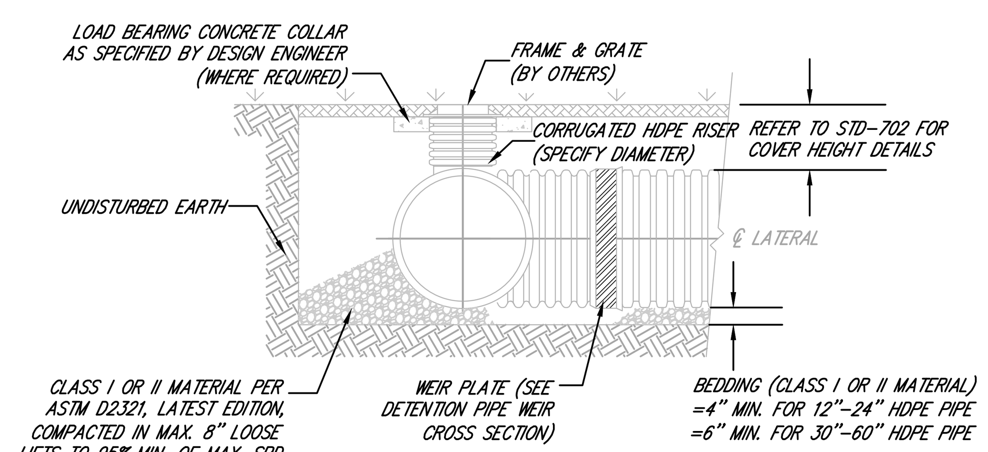


DETENTION PIPE WEIR CROSS SECTION

WEIR PLATE 2
NOT TO SCALE

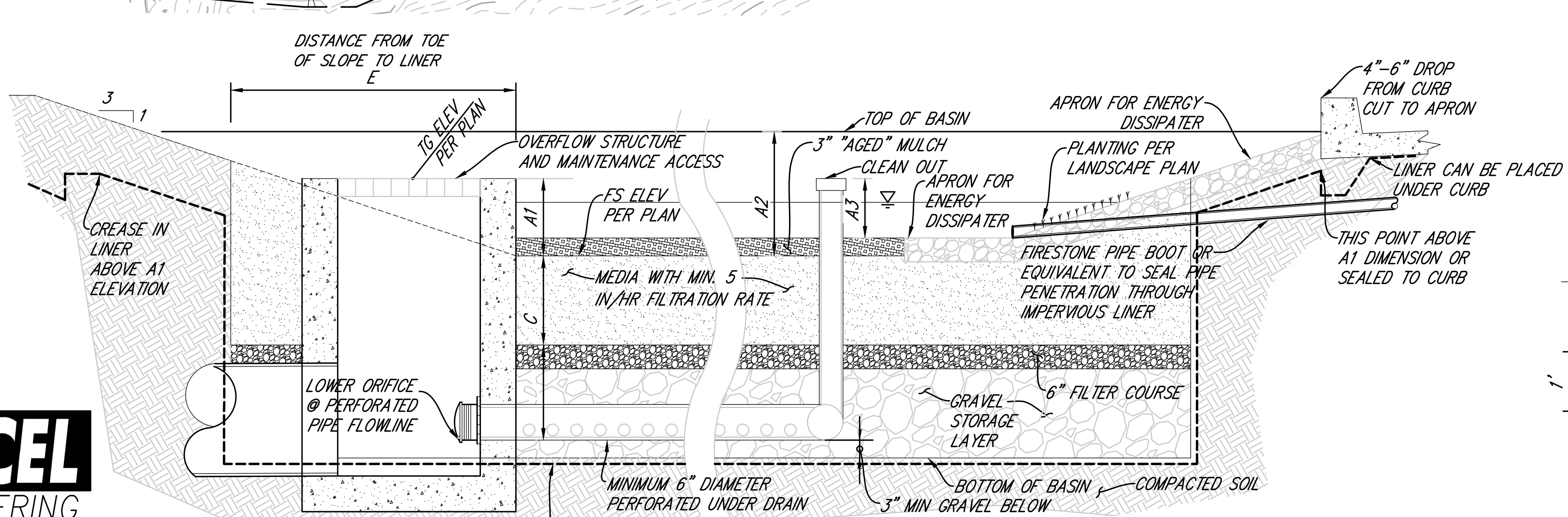
WEIR PLATE 3 AND 4
NOT TO SCALE

WEIR CONTROL NOTES:
WEIR PLATE 3 AND 4 ARE USED TO BLOCK WATER IN DETENTION PIPE.



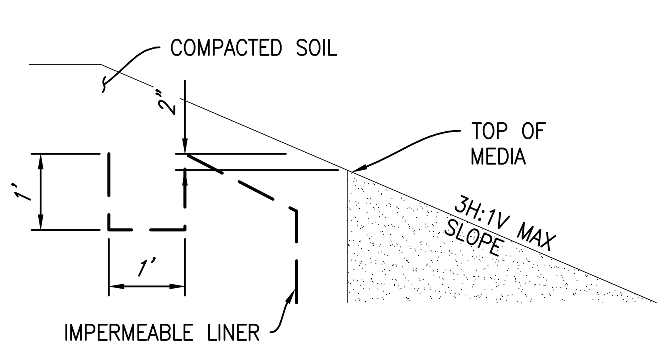
SECTION A-A
NOT TO SCALE

Hancor
401 OLIVE ST.
FINDLAY, OHIO 45839

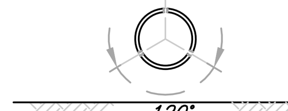


*FINAL SIZING OF LINER PER SOIL ENGINEERS RECOMMENDATIONS

CATCH BASIN DETAIL
NOT TO SCALE



IMPERMEABLE LINER EDGE ANCHOR DETAIL
NOT TO SCALE



6" PVC PIPE PERFORATION LAYOUT DETAIL
NOT TO SCALE

DETAIL
"NO DUMPING" AT CATCH BASINS

NOTE: ALL CATCH BASINS WITH GRATES SHALL BE STENCILED WITH CITY REQUIRED ITEM PER ABOVE DETAIL (DAS MANUFACTURING #SDO OR EQUIVALENT).

SCALE: 1:40
0 40 80

DECISION STREET HYDROMODIFICATION MANAGEMENT EXHIBIT

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydromod\21052 POST Hydromod.dwg 4/13/2022 10:00 AM ORIGINAL PLOT SIZE: PDF 24X36

ATTACHMENT 2b


Decision Street
Coarse Sediment Map
Legend
Potential Critical Course Sediment
San Luis Rey River
Scott St
Scott St
Project Site
Google Earth
Image Landsat / Copernicus
600 ft
N

ATTACHMENT 2C

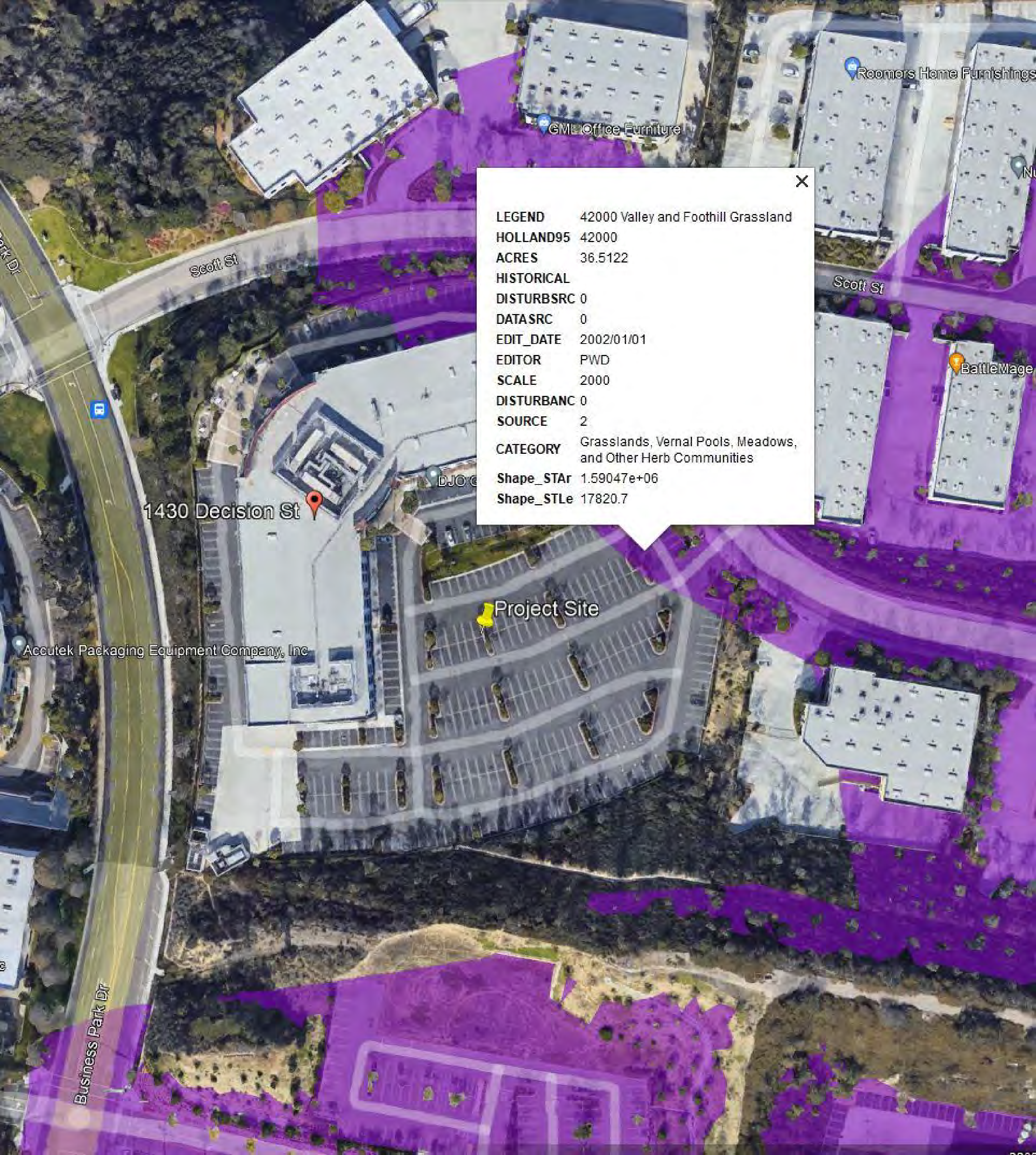
boundary to create GLUs. The GLUs listed in Table H-1.3 (also shown in Table 6-1) are considered to be potential critical coarse sediment yield areas. Note the GLU nomenclature is presented in the following format: Geology – Land Cover – Slope Category (e.g., "CB-Agricultural/Grass-3" for a GLU consisting of coarse bedrock geology, agricultural/grass land cover, and 20% to 40% slope).

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvop10	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop12	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop13	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop2	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop3	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop4	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop5	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop6	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsa	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qof	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Q	Jennings; CA	Coarse	Sedimentary	Permeable	CSP
Qa	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qd	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qmb	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP

Roomors Home Furnishings
GML Office Furniture
Scott St
Scott St
BattleMage
Decision St
DJO Global
1430 Decision St
Project Site
PTYPE Tsa
SHAPE_Leng 104986
SHAPE_Area 2.73733e+07
Accutek Packaging Equipment Company, Inc
Business Park Dr

Table H.1-2: Land Cover Grouping for SanGIS Ecology-Vegetation Data Set

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
1	42000 Valley and Foothill Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
2	42100 Native Grassland		Agricultural/Grass
3	42110 Valley Needlegrass Grassland		Agricultural/Grass
4	42120 Valley Sacaton Grassland		Agricultural/Grass
5	42200 Non-Native Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
6	42300 Wildflower Field		Agriculture/Grass
7	42400 Foothill/Mountain Perennial Grassland		Agriculture/Grass
8	42470 Transmontane Dropseed Grassland		Agriculture/Grass
9	45000 Meadow and Seep		Agriculture/Grass
10	45100 Montane Meadow		Agriculture/Grass
11	45110 Wet Montane Meadow		Agriculture/Grass
12	45120 Dry Montane Meadows		Agriculture/Grass
13	45300 Alkali Meadows and Seeps		Agriculture/Grass
14	45320 Alkali Seep		Agriculture/Grass
15	45400 Freshwater Seep		Agriculture/Grass
16	46000 Alkali Playa Community		Agriculture/Grass
17	46100 Badlands/Mudhill Forbs		Agriculture/Grass
18	Non-Native Grassland		Agriculture/Grass
19	18000 General Agriculture	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Agriculture/Grass
20	18100 Orchards and Vineyards		Agriculture/Grass
21	18200 Intensive Agriculture		Agriculture/Grass
22	18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches		Agriculture/Grass
23	18300 Extensive Agriculture - Field/Pasture, Row Crops		Agriculture/Grass
24	18310 Field/Pasture		Agriculture/Grass
25	18310 Pasture		Agriculture/Grass
26	18320 Row Crops		Agriculture/Grass
27	12000 Urban/Developed		Developed
28	12000 Urban/Developed		Developed
29	81100 Mixed Evergreen Forest	Forest	Forest
30	81300 Oak Forest		Forest
31	81310 Coast Live Oak Forest		Forest
32	81320 Canyon Live Oak Forest		Forest
33	81340 Black Oak Forest		Forest



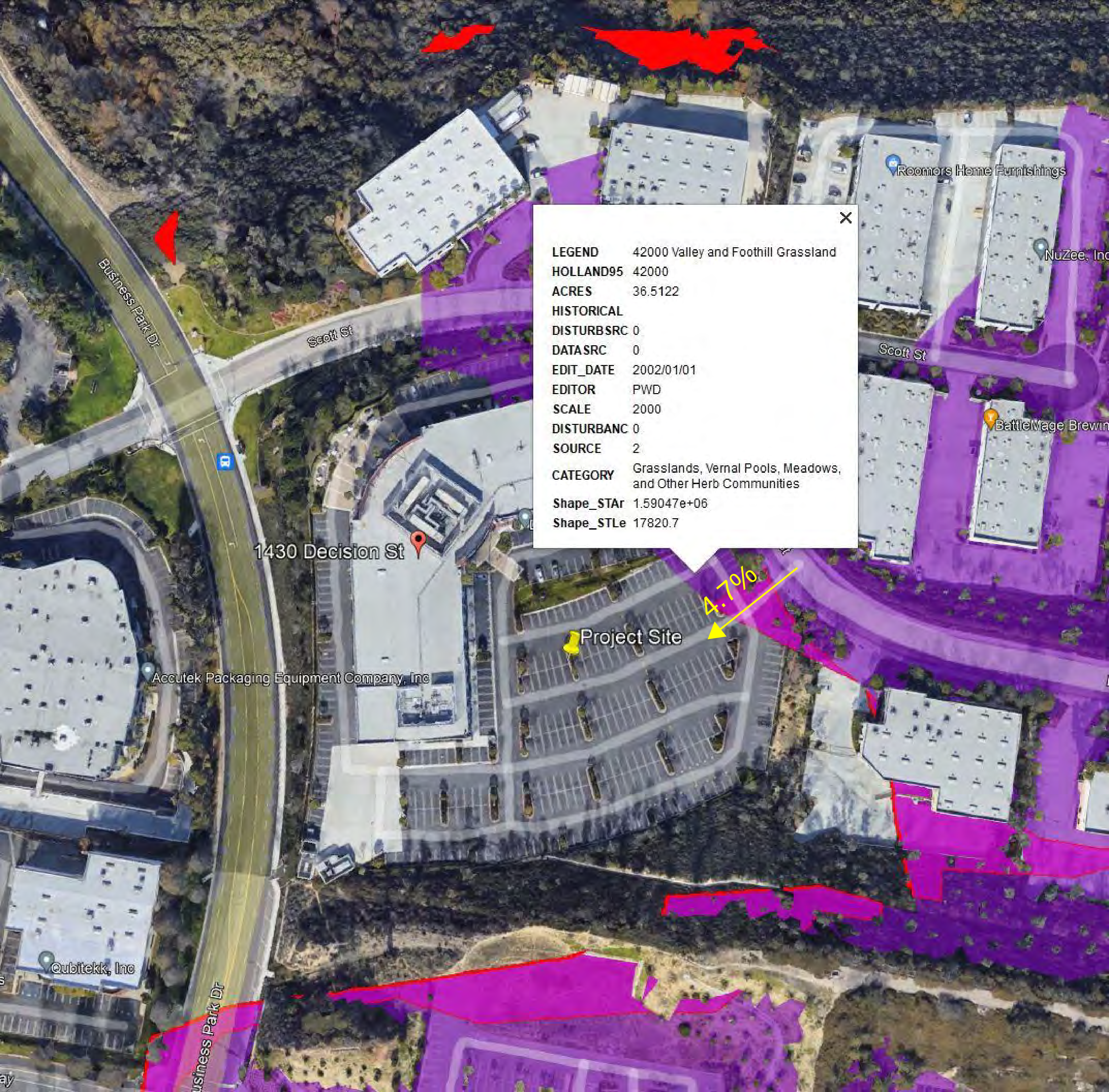
LEGEND 42000 Valley and Foothill Grassland
HOLLAND95 42000
ACRES 36.5122
HISTORICAL
DISTURBSRC 0
DATASRC 0
EDIT_DATE 2002/01/01
EDITOR PWD
SCALE 2000
DISTURBANC 0
SOURCE 2
CATEGORY Grasslands, Vernal Pools, Meadows, and Other Herb Communities
Shape_STAr 1.59047e+06
Shape_STLe 17820.7
Roomors Home Furnishings
GML Office Furniture
Scott St
Scott St
BattleMage
1430 Decision St
Project Site
Accutek Packaging Equipment Company, Inc
Business Park Dr

Table H.1-3: Potential Critical Coarse Sediment Yield Areas

GLU	Geology	Land Cover	Slope (%)
CB-Agricultural/Grass-3	Coarse Bedrock	Agricultural/Grass	20% - 40%
CB-Agricultural/Grass-4	Coarse Bedrock	Agricultural/Grass	>40%
CB-Forest-2	Coarse Bedrock	Forest	10 – 20%
CB-Forest-3	Coarse Bedrock	Forest	20% - 40%
CB-Forest-4	Coarse Bedrock	Forest	>40%
CB-Scrub/Shrub-4	Coarse Bedrock	Scrub/Shrub	>40%
CB-Unknown-4	Coarse Bedrock	Unknown	>40%
CSI-Agricultural/Grass-2	Coarse Sedimentary Impermeable	Agricultural/Grass	10 – 20%
CSI-Agricultural/Grass-3	Coarse Sedimentary Impermeable	Agricultural/Grass	20% - 40%
CSI-Agricultural/Grass-4	Coarse Sedimentary Impermeable	Agricultural/Grass	>40%
CSP-Agricultural/Grass-4	Coarse Sedimentary Permeable	Agricultural/Grass	>40%
CSP-Forest-3	Coarse Sedimentary Permeable	Forest	20% - 40%
CSP-Forest-4	Coarse Sedimentary Permeable	Forest	>40%
CSP-Scrub/Shrub-4	Coarse Sedimentary Permeable	Scrub/Shrub	>40%

The slope in the critical coarse sediment yield areas of the study site is 4.7%, which is under the slope range listed here.

With the slope of 4.7%, there is **NO CRITICAL COARSE SEDIMENT IN THE PROJECT AREA.**



LEGEND 42000 Valley and Foothill Grassland
HOLLAND95 42000
ACRES 36.5122
HISTORICAL
DISTURBSRC 0
DATASRC 0
EDIT_DATE 2002/01/01
EDITOR PWD
SCALE 2000
DISTURBANC 0
SOURCE 2
CATEGORY Grasslands, Vernal Pools, Meadows, and Other Herb Communities
Shape_STAr 1.59047e+06
Shape_STLe 17820.7
4.7%
Project Site
1430 Decision St
Business Park Dr
Scott St
Roomors Home Furnishings
NuZee, Inc
BattleMage Brewin
Accutek Packaging Equipment Company, Inc
Qubitekk, Inc

ATTACHMENT 2d

Structural BMP Drawdown Calculations

Automated Worksheet B.3: BMP Performance (V2.0)

Category	#	Description	i	Units
BMP Inputs	1	Drainage Basin ID or Name	DMA1	sq-ft
	2	Design Infiltration Rate Recommended	0.000	in/hr
	3	Design Capture Volume Tributary to BMP	12,996	cubic-feet
	4	Is BMP Vegetated or Unvegetated?	Vegetated	unitless
	5	Is BMP Impermeably Lined or Unlined?	Lined	unitless
	6	Does BMP Have an Underdrain?	Underdrain	unitless
	7	Does BMP Utilize Standard or Specialized Media?	Standard	unitless
	8	Provided Surface Area	7,300	sq-ft
	9	Provided Surface Ponding Depth	6	inches
	10	Provided Soil Media Thickness	21	inches
	11	Provided Gravel Thickness (Total Thickness)	12	inches
	12	Underdrain Offset	3	inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	2.38	inches
	14	Specialized Soil Media Filtration Rate		in/hr
	15	Specialized Soil Media Pore Space for Retention		unitless
	16	Specialized Soil Media Pore Space for Biofiltration		unitless
	17	Specialized Gravel Media Pore Space		unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	cubic-feet
	19	Ponding Pore Space Available for Retention	0.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.00	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	unitless
	23	Effective Retention Depth	2.25	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.11	ratio
	25	Calculated Retention Storage Drawdown Time	120	hours
	26	Efficacy of Retention Processes	0.13	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	1,700	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	11,296	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.2523	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	1.49	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	1.49	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	8.96	inches
	34	Ponding Pore Space Available for Biofiltration	1.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	unitless
	37	Effective Depth of Biofiltration Storage	13.80	inches
	38	Drawdown Time for Surface Ponding	4	hours *
	39	Drawdown Time for Effective Biofiltration Depth	9	hours
	40	Total Depth Biofiltered	22.76	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	16,944	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	13,845	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	8,472	cubic-feet
	44	Option 2 - Provided Storage Volume	8,395	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	0.99	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	1.00	ratio
	48	**Deficit of Effectively Treated Stormwater**	**0**	cubic-feet

*Note: Draw down is calculated per automated worksheet

No Warning Messages

Place Digital Copy of Hydromodification Files Here

STATISTICS ANALYSIS OF THE SWMM FILES FOR:

DISCHARGE NODE: POC-1

ANALYSIS DETAILS

Stream Susceptibility to Channel Erosion: High
Low Flow Threshold = (0.1)Q2 = (0.1)2.970 = Qlf = 0.2970 (cfs)
Flow Control Upper Limit = Q10 = 4.260 (cfs)
Assumed time between storms (hours): 24

PRE-DEVELOPMENT SWMM FILE

SWMM file name: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 pre hydromod.out
SWMM file time stamp: 4/7/2022 2:29:57 PM
Selected Node to Analyze: POC-1

POST-DEVELOPMENT MITIGATED SWMM FILE

SWMM file name: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 post hydromod-2.375.out
SWMM file time stamp: 4/5/2022 12:23:48 PM
Selected Node to Analyze: POC-1

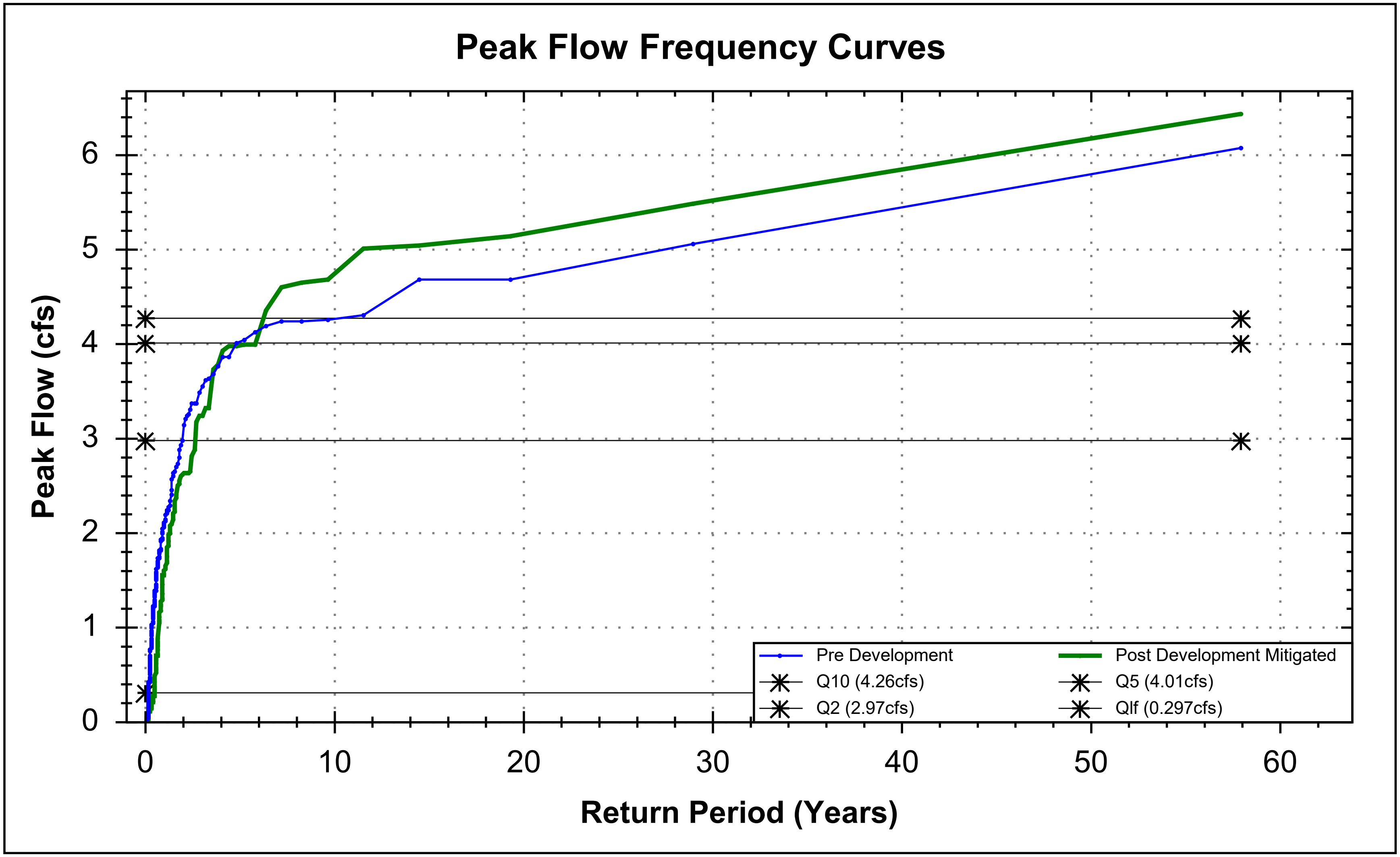
MITIGATED CONDITIONS RESULTS

For the Mitigated Conditions:

Peak Flow Conditions PASS
Flow Duration Conditions PASS

The Mitigated Conditions peak flow frequency curve is composed of 390 points. Of the points, 9 point(s) are above the flow control upper limit (Q10 = 4.26 (cfs)), 278 point(s) are below the low flow threshold value (Qlf = 0.297 (cfs)). Of the points within the flow control range (Qlf to Q10), 99 point(s) have a lower peak flow rate than pre-development conditions, and 4 point(s) have a peak flow that exceeds the pre-development by less than 10%. These points all pass. There are no points that failed, therefore the peak flow requirements have been met.

The Mitigated Conditions flow duration curve is composed of 100 flow bins (points). Each point represents the number of hours where the discharge was equal to or greater than the discharge value, but less than the next greater discharge value. Within the flow control range, comparing the post-development flow duration curve to the pre-development flow duration curve, 100 post-development curve point(s) have a lower flow duration than pre-development conditions. These points all pass. There are no points that failed, therefore the flow duration requirements have been met.



Peak Flow Frequency Curves
Peak Flow (cfs)
Return Period (Years)
0
1
2
3
4
5
6
0
10
20
30
40
50
60
Pre Development
Post Development Mitigated
Q10 (4.26cfs)
Q5 (4.01cfs)
Q2 (2.97cfs)
Qlf (0.297cfs)

Compare Post-Development Curve to Pre-Development Curve
Flow Control Upper Limit: 4.26 (cfs)
Flow Control Lower Limit: 0.297 (cfs)

post-development SWMM file: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 post hydromod-2.375.out
post-development time stamp: 4/5/2022 12:23:48 PM
Compared to:
pre-development SWMM file: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 pre hydromod.out
pre-development time stamp: 4/7/2022 2:29:57 PM

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
0	58.00	6.43	6.07	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
1	29.00	5.48	5.05	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
2	19.33	5.14	4.68	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
3	14.50	5.03	4.68	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
4	11.60	5.01	4.30	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
5	9.67	4.67	4.25	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
6	8.29	4.64	4.24	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
7	7.25	4.60	4.23	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
8	6.44	4.34	4.18	FALSE	FALSE	FALSE	Pass- Qpost Above Q10 (4.26 (cfs))
9	5.80	3.99	4.11	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
10	5.27	3.98	4.03	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
11	4.83	3.97	4.00	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
12	4.46	3.97	3.86	FALSE	TRUE	FALSE	Pass- Qpost < 110% QPre
13	4.14	3.92	3.86	FALSE	TRUE	FALSE	Pass- Qpost < 110% QPre
14	3.87	3.77	3.75	FALSE	TRUE	FALSE	Pass- Qpost < 110% QPre
15	3.63	3.72	3.68	FALSE	TRUE	FALSE	Pass- Qpost < 110% QPre
16	3.41	3.32	3.63	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
17	3.22	3.31	3.61	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
18	3.05	3.24	3.55	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
19	2.90	3.24	3.48	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
20	2.76	3.16	3.37	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
21	2.64	2.88	3.36	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
22	2.52	2.81	3.36	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
23	2.42	2.64	3.30	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
24	2.32	2.63	3.25	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
25	2.23	2.63	3.23	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
26	2.15	2.62	3.20	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
27	2.07	2.62	3.13	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
28	2.00	2.61	2.97	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
29	1.93	2.60	2.92	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
30	1.87	2.55	2.88	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
31	1.81	2.51	2.79	TRUE	FALSE	FALSE	Pass- Qpost < Qpre

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
32	1.76	2.49	2.72	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
33	1.71	2.39	2.70	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
34	1.66	2.37	2.69	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
35	1.61	2.33	2.65	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
36	1.57	2.21	2.64	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
37	1.53	2.20	2.62	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
38	1.49	2.14	2.60	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
39	1.45	2.09	2.56	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
40	1.42	2.09	2.45	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
41	1.38	2.09	2.40	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
42	1.35	2.07	2.34	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
43	1.32	1.98	2.29	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
44	1.29	1.97	2.26	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
45	1.26	1.91	2.26	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
46	1.23	1.85	2.24	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
47	1.21	1.84	2.23	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
48	1.18	1.75	2.21	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
49	1.16	1.69	2.20	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
50	1.14	1.67	2.20	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
51	1.12	1.64	2.18	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
52	1.09	1.63	2.14	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
53	1.07	1.62	2.14	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
54	1.06	1.61	2.12	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
55	1.04	1.59	2.10	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
56	1.02	1.59	2.08	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
57	1.00	1.57	2.07	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
58	0.98	1.55	2.06	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
59	0.97	1.54	2.04	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
60	0.95	1.45	2.01	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
61	0.94	1.35	2.00	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
62	0.92	1.30	1.99	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
63	0.91	1.29	1.94	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
64	0.89	1.28	1.93	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
65	0.88	1.26	1.93	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
66	0.87	1.26	1.91	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
67	0.85	1.24	1.83	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
68	0.84	1.24	1.82	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
69	0.83	1.22	1.81	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
70	0.82	1.17	1.81	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
71	0.81	1.16	1.80	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
72	0.80	1.16	1.79	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
73	0.78	1.11	1.78	TRUE	FALSE	FALSE	Pass- Qpost < Qpre

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
74	0.77	1.07	1.78	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
75	0.76	1.07	1.77	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
76	0.75	1.06	1.77	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
77	0.74	1.05	1.75	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
78	0.73	1.04	1.73	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
79	0.73	0.88	1.73	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
80	0.72	0.84	1.70	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
81	0.71	0.82	1.68	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
82	0.70	0.81	1.67	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
83	0.69	0.80	1.66	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
84	0.68	0.80	1.65	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
85	0.67	0.76	1.64	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
86	0.67	0.76	1.64	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
87	0.66	0.71	1.64	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
88	0.65	0.70	1.63	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
89	0.64	0.70	1.61	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
90	0.64	0.70	1.58	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
91	0.63	0.68	1.57	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
92	0.62	0.66	1.56	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
93	0.62	0.65	1.55	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
94	0.61	0.64	1.53	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
95	0.60	0.62	1.51	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
96	0.60	0.61	1.49	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
97	0.59	0.61	1.45	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
98	0.59	0.61	1.43	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
99	0.58	0.56	1.43	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
100	0.57	0.54	1.43	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
101	0.57	0.51	1.42	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
102	0.56	0.51	1.39	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
103	0.56	0.48	1.38	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
104	0.55	0.41	1.36	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
105	0.55	0.37	1.35	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
106	0.54	0.35	1.34	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
107	0.54	0.33	1.32	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
108	0.53	0.32	1.29	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
109	0.53	0.31	1.29	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
110	0.52	0.31	1.29	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
111	0.52	0.31	1.29	TRUE	FALSE	FALSE	Pass- Qpost < Qpre
112	0.51	0.28	1.28	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
113	0.51	0.27	1.27	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
114	0.50	0.27	1.27	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
115	0.50	0.27	1.26	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
116	0.50	0.27	1.25	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
117	0.49	0.27	1.25	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
118	0.49	0.27	1.23	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
119	0.48	0.26	1.22	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
120	0.48	0.26	1.22	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
121	0.48	0.26	1.22	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
122	0.47	0.26	1.20	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
123	0.47	0.26	1.20	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
124	0.46	0.26	1.19	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
125	0.46	0.25	1.18	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
126	0.46	0.25	1.17	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
127	0.45	0.24	1.15	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
128	0.45	0.24	1.15	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
129	0.45	0.24	1.14	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
130	0.44	0.24	1.13	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
131	0.44	0.23	1.12	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
132	0.44	0.23	1.10	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
133	0.43	0.23	1.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
134	0.43	0.23	1.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
135	0.43	0.23	1.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
136	0.42	0.23	1.08	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
137	0.42	0.23	1.05	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
138	0.42	0.22	1.05	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
139	0.41	0.22	1.05	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
140	0.41	0.22	1.05	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
141	0.41	0.22	1.04	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
142	0.41	0.21	1.04	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
143	0.40	0.21	1.03	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
144	0.40	0.21	1.03	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
145	0.40	0.21	1.02	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
146	0.40	0.21	1.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
147	0.39	0.20	0.99	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
148	0.39	0.20	0.95	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
149	0.39	0.20	0.95	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
150	0.38	0.19	0.94	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
151	0.38	0.19	0.92	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
152	0.38	0.19	0.92	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
153	0.38	0.19	0.92	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
154	0.37	0.18	0.91	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
155	0.37	0.17	0.91	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
156	0.37	0.16	0.91	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
157	0.37	0.16	0.91	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
158	0.37	0.16	0.90	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
159	0.36	0.16	0.88	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
160	0.36	0.16	0.88	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
161	0.36	0.16	0.87	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
162	0.36	0.15	0.86	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
163	0.35	0.15	0.86	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
164	0.35	0.15	0.86	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
165	0.35	0.15	0.86	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
166	0.35	0.15	0.86	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
167	0.35	0.15	0.85	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
168	0.34	0.15	0.84	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
169	0.34	0.15	0.84	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
170	0.34	0.15	0.83	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
171	0.34	0.15	0.83	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
172	0.34	0.15	0.83	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
173	0.33	0.15	0.82	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
174	0.33	0.15	0.81	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
175	0.33	0.15	0.79	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
176	0.33	0.15	0.78	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
177	0.33	0.15	0.78	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
178	0.32	0.15	0.77	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
179	0.32	0.14	0.77	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
180	0.32	0.14	0.77	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
181	0.32	0.14	0.77	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
182	0.32	0.14	0.76	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
183	0.32	0.14	0.75	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
184	0.31	0.14	0.70	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
185	0.31	0.14	0.69	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
186	0.31	0.14	0.69	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
187	0.31	0.14	0.69	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
188	0.31	0.14	0.68	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
189	0.31	0.13	0.68	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
190	0.30	0.13	0.67	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
191	0.30	0.13	0.66	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
192	0.30	0.13	0.66	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
193	0.30	0.13	0.65	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
194	0.30	0.13	0.65	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
195	0.30	0.13	0.64	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
196	0.29	0.13	0.63	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
197	0.29	0.13	0.63	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
198	0.29	0.13	0.61	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
199	0.29	0.13	0.61	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
200	0.29	0.13	0.61	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
201	0.29	0.13	0.60	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
202	0.29	0.13	0.60	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
203	0.28	0.13	0.59	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
204	0.28	0.13	0.58	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
205	0.28	0.13	0.58	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
206	0.28	0.13	0.58	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
207	0.28	0.13	0.57	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
208	0.28	0.13	0.56	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
209	0.28	0.13	0.56	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
210	0.28	0.12	0.56	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
211	0.27	0.12	0.55	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
212	0.27	0.12	0.54	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
213	0.27	0.12	0.53	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
214	0.27	0.12	0.53	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
215	0.27	0.12	0.53	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
216	0.27	0.12	0.53	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
217	0.27	0.12	0.52	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
218	0.27	0.12	0.52	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
219	0.26	0.12	0.51	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
220	0.26	0.12	0.51	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
221	0.26	0.12	0.51	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
222	0.26	0.12	0.50	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
223	0.26	0.12	0.50	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
224	0.26	0.12	0.49	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
225	0.26	0.12	0.49	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
226	0.26	0.12	0.49	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
227	0.25	0.12	0.49	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
228	0.25	0.12	0.49	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
229	0.25	0.12	0.47	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
230	0.25	0.12	0.47	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
231	0.25	0.12	0.47	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
232	0.25	0.12	0.46	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
233	0.25	0.12	0.45	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
234	0.25	0.12	0.45	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
235	0.25	0.12	0.45	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
236	0.25	0.12	0.44	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
237	0.24	0.12	0.44	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
238	0.24	0.12	0.43	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
239	0.24	0.11	0.43	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
240	0.24	0.11	0.43	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
241	0.24	0.11	0.43	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
242	0.24	0.11	0.43	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
243	0.24	0.11	0.43	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
244	0.24	0.11	0.42	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
245	0.24	0.11	0.42	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
246	0.24	0.11	0.42	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
247	0.23	0.11	0.42	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
248	0.23	0.11	0.41	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
249	0.23	0.11	0.41	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
250	0.23	0.11	0.40	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
251	0.23	0.11	0.40	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
252	0.23	0.11	0.40	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
253	0.23	0.11	0.40	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
254	0.23	0.11	0.39	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
255	0.23	0.10	0.39	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
256	0.23	0.10	0.38	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
257	0.22	0.10	0.37	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
258	0.22	0.10	0.37	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
259	0.22	0.10	0.36	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
260	0.22	0.10	0.36	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
261	0.22	0.10	0.36	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
262	0.22	0.10	0.35	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
263	0.22	0.10	0.35	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
264	0.22	0.10	0.35	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
265	0.22	0.10	0.35	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
266	0.22	0.10	0.33	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
267	0.21	0.10	0.33	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
268	0.21	0.10	0.32	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
269	0.21	0.10	0.32	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
270	0.21	0.09	0.32	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
271	0.21	0.09	0.31	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
272	0.21	0.09	0.31	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
273	0.21	0.09	0.31	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
274	0.21	0.09	0.28	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
275	0.21	0.09	0.28	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
276	0.21	0.09	0.27	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
277	0.20	0.09	0.26	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
278	0.20	0.09	0.26	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
279	0.20	0.09	0.26	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
280	0.20	0.09	0.25	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
281	0.20	0.09	0.25	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
282	0.20	0.09	0.24	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
283	0.20	0.08	0.24	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
284	0.20	0.08	0.23	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
285	0.20	0.08	0.23	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
286	0.20	0.08	0.22	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
287	0.20	0.08	0.22	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
288	0.19	0.08	0.21	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
289	0.19	0.08	0.21	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
290	0.19	0.08	0.21	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
291	0.19	0.08	0.20	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
292	0.19	0.08	0.20	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
293	0.19	0.07	0.20	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
294	0.19	0.07	0.19	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
295	0.19	0.07	0.19	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
296	0.19	0.07	0.19	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
297	0.19	0.07	0.19	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
298	0.18	0.07	0.18	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
299	0.18	0.07	0.18	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
300	0.18	0.07	0.18	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
301	0.18	0.07	0.17	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
302	0.18	0.07	0.17	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
303	0.18	0.07	0.16	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
304	0.18	0.07	0.15	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
305	0.18	0.07	0.14	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
306	0.18	0.06	0.14	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
307	0.18	0.06	0.14	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
308	0.17	0.06	0.14	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
309	0.17	0.06	0.13	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
310	0.17	0.06	0.13	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
311	0.17	0.06	0.12	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
312	0.17	0.06	0.12	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
313	0.17	0.05	0.12	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
314	0.17	0.05	0.11	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
315	0.17	0.05	0.11	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
316	0.17	0.05	0.11	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
317	0.17	0.05	0.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
318	0.17	0.04	0.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
319	0.17	0.04	0.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
320	0.16	0.04	0.09	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
321	0.16	0.04	0.08	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
322	0.16	0.04	0.08	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
323	0.16	0.04	0.07	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
324	0.16	0.04	0.07	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
325	0.16	0.04	0.06	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
326	0.16	0.03	0.06	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
327	0.16	0.03	0.06	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
328	0.16	0.03	0.05	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
329	0.16	0.03	0.04	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
330	0.15	0.03	0.04	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
331	0.15	0.03	0.03	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
332	0.15	0.03	0.03	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
333	0.15	0.03	0.02	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
334	0.15	0.03	0.02	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
335	0.15	0.03	0.02	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
336	0.15	0.03	0.02	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
337	0.15	0.03	0.01	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
338	0.15	0.03	0.01	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
339	0.15	0.03	0.01	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
340	0.14	0.03	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
341	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
342	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
343	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
344	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
345	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
346	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
347	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
348	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
349	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
350	0.14	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
351	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
352	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
353	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
354	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
355	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
356	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
357	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
358	0.13	0.02	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
359	0.13	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
360	0.13	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
361	0.13	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
362	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
363	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
364	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
365	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
366	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
367	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

Post PT #	Rtn Prd (yrs)	Post Dev Q (cfs)	Pre Dev Q (cfs)	Qpost < Qpre	Qpost > Qpre	Qpost > 110% Qpre	Pass/Fail
368	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
369	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
370	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
371	0.12	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
372	0.11	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
373	0.11	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
374	0.11	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
375	0.11	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
376	0.11	0.01	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
377	0.11	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
378	0.11	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
379	0.11	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
380	0.11	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
381	0.11	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
382	0.11	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
383	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
384	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
385	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
386	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
387	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
388	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))
389	0.10	0.00	0.00	FALSE	FALSE	FALSE	Pass- Qpost Below Qlf (0.297 (cfs))

SWMM.out file name: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 pre hydromod.out
SWMM.out time stamp: 4/7/2022 2:29:57 PM

Q10: 4.260 (cfs)
Q5: 4.010 (cfs)
Q2: 2.970 (cfs)

Peak Flow Statistics Table Values

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
1	1995/01/04 15:00:00	1995/01/04 22:00:00	8	6.07	0.24%	58
2	2003/02/25 15:00:00	2003/02/26 00:00:00	10	5.05	0.49%	29
3	1958/02/03 04:00:00	1958/02/04 14:00:00	35	4.68	0.73%	19.33
4	1969/02/23 23:00:00	1969/02/25 21:00:00	47	4.68	0.97%	14.5
5	1980/02/16 18:00:00	1980/02/21 07:00:00	110	4.3	1.22%	11.6
6	1993/01/12 19:00:00	1993/01/14 06:00:00	36	4.25	1.46%	9.67
7	2005/02/18 05:00:00	2005/02/19 01:00:00	21	4.24	1.70%	8.29
8	2000/10/29 22:00:00	2000/10/30 00:00:00	3	4.23	1.95%	7.25
9	2004/10/27 02:00:00	2004/10/27 11:00:00	10	4.18	2.19%	6.44
10	1952/01/16 07:00:00	1952/01/16 16:00:00	10	4.11	2.43%	5.8
11	1978/02/28 00:00:00	1978/03/01 09:00:00	34	4.03	2.68%	5.27
12	1958/04/01 12:00:00	1958/04/01 21:00:00	10	4	2.92%	4.83
13	1978/01/03 20:00:00	1978/01/04 21:00:00	26	3.86	3.16%	4.46
14	1982/03/17 03:00:00	1982/03/18 03:00:00	25	3.86	3.41%	4.14
15	1970/12/19 02:00:00	1970/12/19 22:00:00	21	3.75	3.65%	3.87
16	1979/01/15 13:00:00	1979/01/15 19:00:00	7	3.68	3.89%	3.63
17	1978/02/07 17:00:00	1978/02/10 06:00:00	62	3.63	4.14%	3.41
18	1998/02/03 15:00:00	1998/02/04 01:00:00	11	3.61	4.38%	3.22
19	1965/11/22 08:00:00	1965/11/23 05:00:00	22	3.55	4.62%	3.05
20	1952/11/15 13:00:00	1952/11/15 14:00:00	2	3.48	4.87%	2.9
21	1991/12/29 15:00:00	1991/12/30 03:00:00	13	3.37	5.11%	2.76
22	1998/02/22 15:00:00	1998/02/24 01:00:00	35	3.36	5.35%	2.64
23	2008/01/27 00:00:00	2008/01/27 22:00:00	23	3.36	5.60%	2.52
24	1980/03/02 20:00:00	1980/03/03 11:00:00	16	3.3	5.84%	2.42
25	1983/02/27 16:00:00	1983/02/27 19:00:00	4	3.25	6.08%	2.32
26	2004/10/20 09:00:00	2004/10/20 15:00:00	7	3.23	6.33%	2.23
27	1983/01/29 00:00:00	1983/01/29 04:00:00	5	3.2	6.57%	2.15
28	1998/02/16 17:00:00	1998/02/18 00:00:00	32	3.13	6.81%	2.07
29	1985/11/11 09:00:00	1985/11/12 05:00:00	21	2.97	7.06%	2
30	1978/01/16 17:00:00	1978/01/17 03:00:00	11	2.92	7.30%	1.93
31	2008/01/05 05:00:00	2008/01/07 01:00:00	45	2.88	7.54%	1.87
32	1980/01/28 20:00:00	1980/01/30 16:00:00	45	2.79	7.79%	1.81
33	1993/01/15 12:00:00	1993/01/18 16:00:00	77	2.72	8.03%	1.76
34	1986/03/15 21:00:00	1986/03/16 20:00:00	24	2.7	8.27%	1.71
35	1994/02/03 23:00:00	1994/02/04 11:00:00	13	2.69	8.52%	1.66
36	1961/12/02 01:00:00	1961/12/02 15:00:00	15	2.65	8.76%	1.61
37	1986/02/14 23:00:00	1986/02/15 09:00:00	11	2.64	9.00%	1.57
38	1995/03/11 02:00:00	1995/03/12 00:00:00	23	2.62	9.25%	1.53
39	1998/02/14 16:00:00	1998/02/14 21:00:00	6	2.6	9.49%	1.49

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
40	2008/02/22 02:00:00	2008/02/22 09:00:00	8	2.56	9.73%	1.45
41	1993/02/18 12:00:00	1993/02/18 13:00:00	2	2.45	9.98%	1.42
42	1992/02/12 17:00:00	1992/02/13 08:00:00	16	2.4	10.22%	1.38
43	1991/02/27 18:00:00	1991/03/01 11:00:00	42	2.34	10.46%	1.35
44	1977/08/17 01:00:00	1977/08/17 04:00:00	4	2.29	10.71%	1.32
45	1993/02/08 00:00:00	1993/02/08 12:00:00	13	2.26	10.95%	1.29
46	2005/01/11 00:00:00	2005/01/11 08:00:00	9	2.26	11.19%	1.26
47	2005/02/21 03:00:00	2005/02/23 07:00:00	53	2.24	11.44%	1.23
48	1963/03/17 00:00:00	1963/03/17 03:00:00	4	2.23	11.68%	1.21
49	2003/02/11 17:00:00	2003/02/12 19:00:00	27	2.21	11.92%	1.18
50	1963/09/18 18:00:00	1963/09/18 22:00:00	5	2.2	12.17%	1.16
51	1981/03/19 19:00:00	1981/03/19 21:00:00	3	2.2	12.41%	1.14
52	1969/02/06 08:00:00	1969/02/06 17:00:00	10	2.18	12.65%	1.12
53	1960/04/27 07:00:00	1960/04/27 11:00:00	5	2.14	12.90%	1.09
54	1978/01/14 16:00:00	1978/01/15 06:00:00	15	2.14	13.14%	1.07
55	1972/01/16 20:00:00	1972/01/16 23:00:00	4	2.12	13.38%	1.06
56	1988/12/24 20:00:00	1988/12/25 00:00:00	5	2.1	13.63%	1.04
57	1971/12/24 07:00:00	1971/12/24 23:00:00	17	2.08	13.87%	1.02
58	1952/03/15 20:00:00	1952/03/16 19:00:00	24	2.07	14.11%	1
59	1983/03/01 13:00:00	1983/03/04 06:00:00	66	2.06	14.36%	0.98
60	1979/01/05 07:00:00	1979/01/06 07:00:00	25	2.04	14.60%	0.97
61	2005/01/09 04:00:00	2005/01/09 22:00:00	19	2.01	14.84%	0.95
62	2001/02/13 17:00:00	2001/02/14 20:00:00	28	2	15.09%	0.94
63	2004/12/31 14:00:00	2004/12/31 16:00:00	3	1.99	15.33%	0.92
64	1968/03/08 05:00:00	1968/03/08 12:00:00	8	1.94	15.57%	0.91
65	1980/01/10 23:00:00	1980/01/12 13:00:00	39	1.93	15.82%	0.89
66	1997/01/12 16:00:00	1997/01/13 08:00:00	17	1.93	16.06%	0.88
67	1991/03/25 06:00:00	1991/03/27 06:00:00	49	1.91	16.30%	0.87
68	2002/11/08 17:00:00	2002/11/08 18:00:00	2	1.83	16.55%	0.85
69	1983/01/27 07:00:00	1983/01/27 14:00:00	8	1.82	16.79%	0.84
70	1977/12/28 19:00:00	1977/12/30 03:00:00	33	1.81	17.03%	0.83
71	1983/10/01 01:00:00	1983/10/01 03:00:00	3	1.81	17.27%	0.82
72	1983/12/24 18:00:00	1983/12/25 11:00:00	18	1.8	17.52%	0.81
73	1962/01/20 13:00:00	1962/01/20 20:00:00	8	1.79	17.76%	0.8
74	1975/04/08 08:00:00	1975/04/09 00:00:00	17	1.78	18.00%	0.78
75	1992/02/15 12:00:00	1992/02/15 17:00:00	6	1.78	18.25%	0.77
76	1957/01/13 04:00:00	1957/01/13 09:00:00	6	1.77	18.49%	0.76
77	1958/02/19 12:00:00	1958/02/19 15:00:00	4	1.77	18.73%	0.75
78	1965/12/10 06:00:00	1965/12/10 10:00:00	5	1.75	18.98%	0.74
79	1982/12/22 23:00:00	1982/12/23 00:00:00	2	1.73	19.22%	0.73
80	1993/02/19 19:00:00	1993/02/19 23:00:00	5	1.73	19.46%	0.73
81	1960/01/12 03:00:00	1960/01/12 08:00:00	6	1.7	19.71%	0.72
82	1995/03/05 07:00:00	1995/03/06 00:00:00	18	1.68	19.95%	0.71
83	1966/12/05 02:00:00	1966/12/05 13:00:00	12	1.67	20.19%	0.7
84	2003/04/14 13:00:00	2003/04/15 00:00:00	12	1.66	20.44%	0.69
85	2003/03/15 17:00:00	2003/03/16 17:00:00	25	1.65	20.68%	0.68
86	1983/11/24 22:00:00	1983/11/25 02:00:00	5	1.64	20.92%	0.67

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
87	1988/11/25 07:00:00	1988/11/25 10:00:00	4	1.64	21.17%	0.67
88	1994/03/24 22:00:00	1994/03/25 02:00:00	5	1.64	21.41%	0.66
89	2004/02/26 03:00:00	2004/02/26 10:00:00	8	1.63	21.65%	0.65
90	2005/01/03 06:00:00	2005/01/04 11:00:00	30	1.61	21.90%	0.64
91	1954/01/18 23:00:00	1954/01/19 22:00:00	24	1.58	22.14%	0.64
92	1959/02/11 09:00:00	1959/02/11 12:00:00	4	1.57	22.38%	0.63
93	2005/04/28 08:00:00	2005/04/28 09:00:00	2	1.56	22.63%	0.62
94	1960/02/01 22:00:00	1960/02/02 02:00:00	5	1.55	22.87%	0.62
95	1959/12/24 10:00:00	1959/12/24 16:00:00	7	1.53	23.11%	0.61
96	1999/01/26 22:00:00	1999/01/27 00:00:00	3	1.51	23.36%	0.6
97	1966/02/07 22:00:00	1966/02/08 00:00:00	3	1.49	23.60%	0.6
98	1980/01/09 04:00:00	1980/01/09 18:00:00	15	1.45	23.84%	0.59
99	1965/11/16 13:00:00	1965/11/16 18:00:00	6	1.43	24.09%	0.59
100	1973/11/22 23:00:00	1973/11/23 01:00:00	3	1.43	24.33%	0.58
101	2007/11/30 08:00:00	2007/11/30 21:00:00	14	1.43	24.57%	0.57
102	1981/11/28 03:00:00	1981/11/28 21:00:00	19	1.42	24.82%	0.57
103	1986/11/18 03:00:00	1986/11/18 07:00:00	5	1.39	25.06%	0.56
104	1958/03/15 19:00:00	1958/03/16 12:00:00	18	1.38	25.30%	0.56
105	2001/01/26 16:00:00	2001/01/27 01:00:00	10	1.36	25.55%	0.55
106	1969/01/24 07:00:00	1969/01/26 21:00:00	63	1.35	25.79%	0.55
107	2007/01/30 23:00:00	2007/01/30 23:00:00	1	1.34	26.03%	0.54
108	1963/11/20 03:00:00	1963/11/21 07:00:00	29	1.32	26.28%	0.54
109	1956/01/26 19:00:00	1956/01/27 09:00:00	15	1.29	26.52%	0.53
110	1957/01/28 03:00:00	1957/01/29 19:00:00	41	1.29	26.76%	0.53
111	1968/12/25 19:00:00	1968/12/25 21:00:00	3	1.29	27.01%	0.52
112	2002/12/20 16:00:00	2002/12/20 22:00:00	7	1.29	27.25%	0.52
113	2001/02/25 16:00:00	2001/02/27 19:00:00	52	1.28	27.49%	0.51
114	1965/04/08 14:00:00	1965/04/09 23:00:00	34	1.27	27.74%	0.51
115	1967/12/18 17:00:00	1967/12/19 12:00:00	20	1.27	27.98%	0.5
116	1985/11/29 06:00:00	1985/11/29 14:00:00	9	1.26	28.22%	0.5
117	1978/09/05 18:00:00	1978/09/05 19:00:00	2	1.25	28.47%	0.5
118	1983/04/20 03:00:00	1983/04/20 06:00:00	4	1.25	28.71%	0.49
119	1958/03/20 22:00:00	1958/03/22 07:00:00	34	1.23	28.95%	0.49
120	1952/12/02 01:00:00	1952/12/02 02:00:00	2	1.22	29.20%	0.48
121	1988/12/21 03:00:00	1988/12/21 07:00:00	5	1.22	29.44%	0.48
122	1996/11/21 16:00:00	1996/11/22 03:00:00	12	1.22	29.68%	0.48
123	1995/01/10 14:00:00	1995/01/12 15:00:00	50	1.2	29.93%	0.47
124	2004/12/28 09:00:00	2004/12/29 10:00:00	26	1.2	30.17%	0.47
125	1988/04/20 07:00:00	1988/04/21 08:00:00	26	1.19	30.41%	0.46
126	1978/02/12 17:00:00	1978/02/14 00:00:00	32	1.18	30.66%	0.46
127	1990/02/17 16:00:00	1990/02/17 19:00:00	4	1.17	30.90%	0.46
128	1964/11/17 16:00:00	1964/11/17 19:00:00	4	1.15	31.14%	0.45
129	1980/02/14 00:00:00	1980/02/15 02:00:00	27	1.15	31.39%	0.45
130	1972/11/16 11:00:00	1972/11/17 07:00:00	21	1.14	31.63%	0.45
131	2005/01/07 13:00:00	2005/01/07 21:00:00	9	1.13	31.87%	0.44
132	1977/01/02 23:00:00	1977/01/03 05:00:00	7	1.12	32.12%	0.44
133	1979/11/07 18:00:00	1979/11/07 19:00:00	2	1.1	32.36%	0.44

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
134	1960/02/29 06:00:00	1960/03/01 06:00:00	25	1.09	32.60%	0.43
135	1982/01/01 08:00:00	1982/01/01 10:00:00	3	1.09	32.85%	0.43
136	2004/02/22 07:00:00	2004/02/23 07:00:00	25	1.09	33.09%	0.43
137	1988/01/17 10:00:00	1988/01/17 12:00:00	3	1.08	33.33%	0.42
138	1952/01/17 21:00:00	1952/01/18 09:00:00	13	1.05	33.58%	0.42
139	1958/04/06 17:00:00	1958/04/07 16:00:00	24	1.05	33.82%	0.42
140	1960/01/14 17:00:00	1960/01/14 21:00:00	5	1.05	34.06%	0.41
141	1997/01/15 15:00:00	1997/01/15 19:00:00	5	1.05	34.31%	0.41
142	1992/03/20 22:00:00	1992/03/21 00:00:00	3	1.04	34.55%	0.41
143	1993/01/06 03:00:00	1993/01/08 01:00:00	47	1.04	34.79%	0.41
144	1973/02/13 00:00:00	1973/02/13 04:00:00	5	1.03	35.04%	0.4
145	2001/01/11 05:00:00	2001/01/12 12:00:00	32	1.03	35.28%	0.4
146	1998/02/07 17:00:00	1998/02/08 22:00:00	30	1.02	35.52%	0.4
147	1958/04/03 09:00:00	1958/04/03 13:00:00	5	1	35.77%	0.4
148	1987/12/16 15:00:00	1987/12/17 10:00:00	20	0.99	36.01%	0.39
149	1951/12/29 23:00:00	1951/12/30 14:00:00	16	0.95	36.25%	0.39
150	1972/11/14 14:00:00	1972/11/14 16:00:00	3	0.95	36.50%	0.39
151	1967/03/13 11:00:00	1967/03/13 22:00:00	12	0.94	36.74%	0.38
152	1954/02/13 19:00:00	1954/02/13 23:00:00	5	0.92	36.98%	0.38
153	1955/01/18 15:00:00	1955/01/18 19:00:00	5	0.92	37.23%	0.38
154	1978/01/09 16:00:00	1978/01/11 00:00:00	33	0.92	37.47%	0.38
155	1952/11/30 01:00:00	1952/11/30 05:00:00	5	0.91	37.71%	0.37
156	1957/02/28 23:00:00	1957/03/01 11:00:00	13	0.91	37.96%	0.37
157	1983/03/24 03:00:00	1983/03/24 06:00:00	4	0.91	38.20%	0.37
158	1992/01/07 19:00:00	1992/01/07 23:00:00	5	0.91	38.44%	0.37
159	1987/10/12 10:00:00	1987/10/12 17:00:00	8	0.9	38.69%	0.37
160	1977/01/05 19:00:00	1977/01/07 07:00:00	37	0.88	38.93%	0.36
161	1992/01/05 09:00:00	1992/01/06 05:00:00	21	0.88	39.17%	0.36
162	1981/01/29 18:00:00	1981/01/29 19:00:00	2	0.87	39.42%	0.36
163	1957/05/11 01:00:00	1957/05/11 03:00:00	3	0.86	39.66%	0.36
164	1967/01/22 17:00:00	1967/01/23 00:00:00	8	0.86	39.90%	0.35
165	1967/11/30 16:00:00	1967/11/30 17:00:00	2	0.86	40.15%	0.35
166	1995/01/25 08:00:00	1995/01/26 10:00:00	27	0.86	40.39%	0.35
167	2001/12/09 17:00:00	2001/12/09 21:00:00	5	0.86	40.63%	0.35
168	1980/03/05 23:00:00	1980/03/06 13:00:00	15	0.85	40.88%	0.35
169	2000/03/05 17:00:00	2000/03/05 21:00:00	5	0.84	41.12%	0.34
170	2006/10/14 01:00:00	2006/10/14 01:00:00	1	0.84	41.36%	0.34
171	1952/03/07 14:00:00	1952/03/08 10:00:00	21	0.83	41.61%	0.34
172	1976/09/10 05:00:00	1976/09/10 23:00:00	19	0.83	41.85%	0.34
173	1992/12/07 10:00:00	1992/12/07 16:00:00	7	0.83	42.09%	0.34
174	1976/02/06 04:00:00	1976/02/06 06:00:00	3	0.82	42.34%	0.33
175	1997/01/25 20:00:00	1997/01/26 07:00:00	12	0.81	42.58%	0.33
176	1985/11/25 01:00:00	1985/11/25 05:00:00	5	0.79	42.82%	0.33
177	1967/11/19 08:00:00	1967/11/19 18:00:00	11	0.78	43.07%	0.33
178	1982/12/07 22:00:00	1982/12/08 01:00:00	4	0.78	43.31%	0.33
179	1956/04/12 23:00:00	1956/04/13 17:00:00	19	0.77	43.55%	0.32
180	1978/03/30 15:00:00	1978/03/31 06:00:00	16	0.77	43.80%	0.32

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
181	1981/03/01 11:00:00	1981/03/02 13:00:00	27	0.77	44.04%	0.32
182	2006/03/11 07:00:00	2006/03/11 08:00:00	2	0.77	44.28%	0.32
183	1991/03/19 00:00:00	1991/03/19 04:00:00	5	0.76	44.53%	0.32
184	1970/12/21 08:00:00	1970/12/21 09:00:00	2	0.75	44.77%	0.32
185	1973/03/20 08:00:00	1973/03/20 11:00:00	4	0.7	45.01%	0.31
186	1970/11/30 14:00:00	1970/11/30 23:00:00	10	0.69	45.26%	0.31
187	1991/03/20 07:00:00	1991/03/21 10:00:00	28	0.69	45.50%	0.31
188	1998/01/29 17:00:00	1998/01/29 20:00:00	4	0.69	45.74%	0.31
189	1955/01/10 10:00:00	1955/01/10 11:00:00	2	0.68	45.99%	0.31
190	1967/04/11 08:00:00	1967/04/11 10:00:00	3	0.68	46.23%	0.31
191	1993/11/30 04:00:00	1993/11/30 04:00:00	1	0.67	46.47%	0.3
192	1958/01/25 04:00:00	1958/01/25 05:00:00	2	0.66	46.72%	0.3
193	1986/03/10 07:00:00	1986/03/10 20:00:00	14	0.66	46.96%	0.3
194	1966/12/06 19:00:00	1966/12/06 21:00:00	3	0.65	47.20%	0.3
195	1985/12/11 04:00:00	1985/12/11 06:00:00	3	0.65	47.45%	0.3
196	1973/03/11 12:00:00	1973/03/12 09:00:00	22	0.64	47.69%	0.3
197	1957/01/07 13:00:00	1957/01/07 20:00:00	8	0.63	47.93%	0.29
198	1990/01/17 00:00:00	1990/01/17 06:00:00	7	0.63	48.18%	0.29
199	1967/11/21 12:00:00	1967/11/21 14:00:00	3	0.61	48.42%	0.29
200	1970/02/28 16:00:00	1970/03/02 04:00:00	37	0.61	48.66%	0.29
201	1973/02/15 11:00:00	1973/02/15 13:00:00	3	0.61	48.91%	0.29
202	1979/03/17 05:00:00	1979/03/17 05:00:00	1	0.6	49.15%	0.29
203	1994/02/17 11:00:00	1994/02/17 13:00:00	3	0.6	49.39%	0.29
204	2004/10/18 07:00:00	2004/10/18 07:00:00	1	0.59	49.64%	0.28
205	1984/12/27 02:00:00	1984/12/27 21:00:00	20	0.58	49.88%	0.28
206	1986/09/25 02:00:00	1986/09/25 05:00:00	4	0.58	50.12%	0.28
207	1995/01/07 15:00:00	1995/01/08 06:00:00	16	0.58	50.36%	0.28
208	1964/01/21 07:00:00	1964/01/22 09:00:00	27	0.57	50.61%	0.28
209	1970/03/04 22:00:00	1970/03/05 02:00:00	5	0.56	50.85%	0.28
210	1975/03/08 09:00:00	1975/03/08 09:00:00	1	0.56	51.09%	0.28
211	1982/01/05 08:00:00	1982/01/05 16:00:00	9	0.56	51.34%	0.28
212	1973/03/08 12:00:00	1973/03/08 15:00:00	4	0.55	51.58%	0.27
213	1965/04/03 05:00:00	1965/04/03 06:00:00	2	0.54	51.82%	0.27
214	1979/03/19 03:00:00	1979/03/20 03:00:00	25	0.53	52.07%	0.27
215	1981/03/05 02:00:00	1981/03/05 09:00:00	8	0.53	52.31%	0.27
216	1987/02/25 01:00:00	1987/02/25 02:00:00	2	0.53	52.55%	0.27
217	1993/03/28 02:00:00	1993/03/28 04:00:00	3	0.53	52.80%	0.27
218	1976/07/22 11:00:00	1976/07/22 14:00:00	4	0.52	53.04%	0.27
219	1998/05/12 17:00:00	1998/05/12 20:00:00	4	0.52	53.28%	0.27
220	1974/12/04 09:00:00	1974/12/04 09:00:00	1	0.51	53.53%	0.26
221	1976/07/15 14:00:00	1976/07/15 16:00:00	3	0.51	53.77%	0.26
222	1978/03/11 21:00:00	1978/03/12 11:00:00	15	0.51	54.01%	0.26
223	1958/01/26 09:00:00	1958/01/26 10:00:00	2	0.5	54.26%	0.26
224	1982/04/01 09:00:00	1982/04/01 12:00:00	4	0.5	54.50%	0.26
225	1951/11/23 05:00:00	1951/11/23 06:00:00	2	0.49	54.74%	0.26
226	1978/02/05 11:00:00	1978/02/06 11:00:00	25	0.49	54.99%	0.26
227	1985/02/09 10:00:00	1985/02/09 13:00:00	4	0.49	55.23%	0.26

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
228	1988/11/14 06:00:00	1988/11/14 08:00:00	3	0.49	55.47%	0.25
229	1993/01/31 00:00:00	1993/01/31 00:00:00	1	0.49	55.72%	0.25
230	1954/11/11 02:00:00	1954/11/11 10:00:00	9	0.47	55.96%	0.25
231	1957/10/14 04:00:00	1957/10/14 06:00:00	3	0.47	56.20%	0.25
232	1969/02/22 02:00:00	1969/02/22 11:00:00	10	0.47	56.45%	0.25
233	1957/04/20 15:00:00	1957/04/20 18:00:00	4	0.46	56.69%	0.25
234	1984/11/24 17:00:00	1984/11/24 21:00:00	5	0.45	56.93%	0.25
235	1984/12/18 22:00:00	1984/12/20 04:00:00	31	0.45	57.18%	0.25
236	2003/12/25 18:00:00	2003/12/25 19:00:00	2	0.45	57.42%	0.25
237	1969/02/20 04:00:00	1969/02/20 05:00:00	2	0.44	57.66%	0.25
238	1976/07/08 13:00:00	1976/07/08 14:00:00	2	0.44	57.91%	0.24
239	1959/02/21 10:00:00	1959/02/21 17:00:00	8	0.43	58.15%	0.24
240	1962/02/08 10:00:00	1962/02/08 19:00:00	10	0.43	58.39%	0.24
241	1963/02/09 19:00:00	1963/02/11 00:00:00	30	0.43	58.64%	0.24
242	1966/12/03 07:00:00	1966/12/03 17:00:00	11	0.43	58.88%	0.24
243	1974/03/08 00:00:00	1974/03/08 11:00:00	12	0.43	59.12%	0.24
244	1979/03/28 00:00:00	1979/03/28 10:00:00	11	0.43	59.37%	0.24
245	1954/03/22 13:00:00	1954/03/23 16:00:00	28	0.42	59.61%	0.24
246	1958/02/25 08:00:00	1958/02/25 09:00:00	2	0.42	59.85%	0.24
247	2000/02/20 17:00:00	2000/02/21 20:00:00	28	0.42	60.10%	0.24
248	2005/02/11 11:00:00	2005/02/12 06:00:00	20	0.42	60.34%	0.23
249	1952/01/13 04:00:00	1952/01/13 13:00:00	10	0.41	60.58%	0.23
250	1983/03/21 04:00:00	1983/03/21 08:00:00	5	0.41	60.83%	0.23
251	1960/11/05 20:00:00	1960/11/06 12:00:00	17	0.4	61.07%	0.23
252	1977/03/24 21:00:00	1977/03/25 03:00:00	7	0.4	61.31%	0.23
253	1996/12/11 08:00:00	1996/12/11 18:00:00	11	0.4	61.56%	0.23
254	2006/04/04 20:00:00	2006/04/04 23:00:00	4	0.4	61.80%	0.23
255	1962/03/19 00:00:00	1962/03/19 03:00:00	4	0.39	62.04%	0.23
256	1966/02/06 13:00:00	1966/02/06 17:00:00	5	0.39	62.29%	0.23
257	1983/11/12 17:00:00	1983/11/12 19:00:00	3	0.39	62.53%	0.23
258	1969/02/18 08:00:00	1969/02/18 15:00:00	8	0.38	62.77%	0.23
259	1965/12/29 19:00:00	1965/12/29 20:00:00	2	0.37	63.02%	0.22
260	1974/01/07 17:00:00	1974/01/08 05:00:00	13	0.37	63.26%	0.22
261	1972/01/18 22:00:00	1972/01/19 04:00:00	7	0.36	63.50%	0.22
262	1982/01/20 06:00:00	1982/01/21 04:00:00	23	0.36	63.75%	0.22
263	1995/04/18 10:00:00	1995/04/18 12:00:00	3	0.36	63.99%	0.22
264	2001/11/24 17:00:00	2001/11/24 19:00:00	3	0.36	64.23%	0.22
265	1955/02/27 20:00:00	1955/02/27 20:00:00	1	0.35	64.48%	0.22
266	1966/01/30 07:00:00	1966/01/30 20:00:00	14	0.35	64.72%	0.22
267	1994/03/07 01:00:00	1994/03/07 06:00:00	6	0.35	64.96%	0.22
268	1996/02/27 21:00:00	1996/02/27 22:00:00	2	0.35	65.21%	0.22
269	1998/01/09 17:00:00	1998/01/10 18:00:00	26	0.35	65.45%	0.22
270	1978/01/19 08:00:00	1978/01/19 12:00:00	5	0.33	65.69%	0.22
271	1981/02/09 00:00:00	1981/02/09 07:00:00	8	0.33	65.94%	0.21
272	1965/12/16 03:00:00	1965/12/16 09:00:00	7	0.32	66.18%	0.21
273	1978/03/04 14:00:00	1978/03/04 16:00:00	3	0.32	66.42%	0.21
274	1991/01/09 14:00:00	1991/01/09 15:00:00	2	0.32	66.67%	0.21

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
275	2007/04/20 15:00:00	2007/04/20 15:00:00	1	0.32	66.91%	0.21
276	1973/02/11 07:00:00	1973/02/11 14:00:00	8	0.31	67.15%	0.21
277	1982/03/14 22:00:00	1982/03/14 23:00:00	2	0.31	67.40%	0.21
278	1994/02/07 14:00:00	1994/02/07 16:00:00	3	0.31	67.64%	0.21
279	1995/01/24 00:00:00	1995/01/24 01:00:00	2	0.31	67.88%	0.21
280	1959/02/16 03:00:00	1959/02/16 20:00:00	18	0.28	68.13%	0.21
281	1982/02/10 14:00:00	1982/02/10 19:00:00	6	0.28	68.37%	0.21
282	1987/12/04 21:00:00	1987/12/04 21:00:00	1	0.27	68.61%	0.21
283	2008/02/24 08:00:00	2008/02/24 10:00:00	3	0.27	68.86%	0.21
284	1965/02/06 21:00:00	1965/02/06 22:00:00	2	0.26	69.10%	0.2
285	1975/03/10 11:00:00	1975/03/11 00:00:00	14	0.26	69.34%	0.2
286	1994/03/19 04:00:00	1994/03/20 06:00:00	27	0.26	69.59%	0.2
287	2002/12/16 17:00:00	2002/12/16 18:00:00	2	0.26	69.83%	0.2
288	1956/01/31 09:00:00	1956/01/31 12:00:00	4	0.25	70.07%	0.2
289	1998/03/25 17:00:00	1998/03/26 19:00:00	27	0.25	70.32%	0.2
290	1998/03/31 17:00:00	1998/03/31 20:00:00	4	0.25	70.56%	0.2
291	1967/01/24 18:00:00	1967/01/24 23:00:00	6	0.24	70.80%	0.2
292	1957/03/16 09:00:00	1957/03/16 10:00:00	2	0.23	71.05%	0.2
293	1977/05/08 19:00:00	1977/05/09 04:00:00	10	0.23	71.29%	0.2
294	1978/12/17 01:00:00	1978/12/17 01:00:00	1	0.23	71.53%	0.2
295	1966/11/07 15:00:00	1966/11/07 16:00:00	2	0.22	71.78%	0.2
296	1980/01/18 03:00:00	1980/01/18 05:00:00	3	0.22	72.02%	0.2
297	1983/03/06 05:00:00	1983/03/06 06:00:00	2	0.22	72.26%	0.2
298	1998/11/08 08:00:00	1998/11/08 08:00:00	1	0.22	72.51%	0.2
299	1983/02/08 06:00:00	1983/02/08 07:00:00	2	0.21	72.75%	0.19
300	1988/12/16 10:00:00	1988/12/16 14:00:00	5	0.21	72.99%	0.19
301	1999/04/12 01:00:00	1999/04/12 04:00:00	4	0.21	73.24%	0.19
302	2006/02/28 06:00:00	2006/02/28 06:00:00	1	0.21	73.48%	0.19
303	1953/03/01 22:00:00	1953/03/01 22:00:00	1	0.2	73.72%	0.19
304	1954/03/16 22:00:00	1954/03/16 22:00:00	1	0.2	73.97%	0.19
305	1963/09/17 17:00:00	1963/09/17 17:00:00	1	0.2	74.21%	0.19
306	1976/02/10 07:00:00	1976/02/10 08:00:00	2	0.2	74.45%	0.19
307	1984/12/08 00:00:00	1984/12/08 01:00:00	2	0.2	74.70%	0.19
308	1969/03/21 13:00:00	1969/03/21 13:00:00	1	0.19	74.94%	0.19
309	1971/04/14 11:00:00	1971/04/14 11:00:00	1	0.19	75.18%	0.19
310	1976/03/01 16:00:00	1976/03/01 18:00:00	3	0.19	75.43%	0.19
311	1979/01/31 08:00:00	1979/01/31 09:00:00	2	0.19	75.67%	0.19
312	1980/03/25 23:00:00	1980/03/26 00:00:00	2	0.19	75.91%	0.19
313	1998/12/06 06:00:00	1998/12/06 07:00:00	2	0.19	76.16%	0.19
314	1958/03/06 10:00:00	1958/03/06 15:00:00	6	0.18	76.40%	0.19
315	1962/02/21 05:00:00	1962/02/21 07:00:00	3	0.18	76.64%	0.18
316	1970/01/16 17:00:00	1970/01/16 20:00:00	4	0.18	76.89%	0.18
317	1977/12/26 05:00:00	1977/12/26 16:00:00	12	0.18	77.13%	0.18
318	1980/03/10 16:00:00	1980/03/10 16:00:00	1	0.18	77.37%	0.18
319	1996/02/26 13:00:00	1996/02/26 14:00:00	2	0.18	77.62%	0.18
320	1952/12/20 11:00:00	1952/12/20 14:00:00	4	0.17	77.86%	0.18
321	1954/03/30 04:00:00	1954/03/30 04:00:00	1	0.17	78.10%	0.18

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
322	1976/02/08 19:00:00	1976/02/08 23:00:00	5	0.17	78.35%	0.18
323	1954/01/24 11:00:00	1954/01/24 14:00:00	4	0.16	78.59%	0.18
324	1978/03/09 16:00:00	1978/03/09 17:00:00	2	0.16	78.83%	0.18
325	1954/03/24 19:00:00	1954/03/25 04:00:00	10	0.15	79.08%	0.18
326	1987/04/04 15:00:00	1987/04/04 16:00:00	2	0.15	79.32%	0.18
327	1951/12/11 23:00:00	1951/12/12 04:00:00	6	0.14	79.56%	0.18
328	1952/04/10 16:00:00	1952/04/10 19:00:00	4	0.14	79.81%	0.18
329	1955/04/30 21:00:00	1955/05/01 02:00:00	6	0.14	80.05%	0.18
330	1957/01/10 01:00:00	1957/01/10 08:00:00	8	0.14	80.29%	0.18
331	1963/04/17 05:00:00	1963/04/17 08:00:00	4	0.14	80.54%	0.18
332	1965/12/14 16:00:00	1965/12/14 17:00:00	2	0.14	80.78%	0.18
333	1979/03/01 10:00:00	1979/03/01 12:00:00	3	0.14	81.02%	0.17
334	1969/11/07 09:00:00	1969/11/07 09:00:00	1	0.13	81.27%	0.17
335	1983/03/18 06:00:00	1983/03/18 15:00:00	10	0.13	81.51%	0.17
336	1992/03/22 16:00:00	1992/03/23 03:00:00	12	0.13	81.75%	0.17
337	2001/04/07 17:00:00	2001/04/07 17:00:00	1	0.13	82.00%	0.17
338	1954/12/09 23:00:00	1954/12/09 23:00:00	1	0.12	82.24%	0.17
339	1965/01/24 07:00:00	1965/01/24 08:00:00	2	0.12	82.48%	0.17
340	1983/04/18 08:00:00	1983/04/18 08:00:00	1	0.12	82.73%	0.17
341	2004/04/01 21:00:00	2004/04/01 22:00:00	2	0.12	82.97%	0.17
342	1965/03/31 14:00:00	1965/03/31 17:00:00	4	0.11	83.21%	0.17
343	1969/04/05 21:00:00	1969/04/05 21:00:00	1	0.11	83.45%	0.17
344	1973/02/07 04:00:00	1973/02/07 04:00:00	1	0.11	83.70%	0.17
345	1978/12/18 12:00:00	1978/12/18 13:00:00	2	0.11	83.94%	0.17
346	1983/04/29 08:00:00	1983/04/29 09:00:00	2	0.11	84.18%	0.17
347	1988/02/02 13:00:00	1988/02/02 16:00:00	4	0.11	84.43%	0.17
348	1999/02/04 17:00:00	1999/02/04 18:00:00	2	0.1	84.67%	0.17
349	1952/01/25 08:00:00	1952/01/25 11:00:00	4	0.09	84.91%	0.17
350	1952/12/30 19:00:00	1952/12/30 23:00:00	5	0.09	85.16%	0.17
351	1975/02/09 19:00:00	1975/02/09 21:00:00	3	0.09	85.40%	0.17
352	1984/12/16 03:00:00	1984/12/16 03:00:00	1	0.09	85.64%	0.17
353	1996/01/31 20:00:00	1996/02/01 08:00:00	13	0.09	85.89%	0.16
354	1976/04/15 18:00:00	1976/04/15 18:00:00	1	0.08	86.13%	0.16
355	1980/12/07 11:00:00	1980/12/07 12:00:00	2	0.08	86.37%	0.16
356	1993/06/05 13:00:00	1993/06/05 13:00:00	1	0.08	86.62%	0.16
357	1998/04/11 17:00:00	1998/04/11 18:00:00	2	0.08	86.86%	0.16
358	2006/03/28 21:00:00	2006/03/28 22:00:00	2	0.08	87.10%	0.16
359	1962/03/06 20:00:00	1962/03/06 20:00:00	1	0.07	87.35%	0.16
360	1971/12/28 12:00:00	1971/12/28 14:00:00	3	0.07	87.59%	0.16
361	1978/03/02 11:00:00	1978/03/02 13:00:00	3	0.07	87.83%	0.16
362	1995/01/16 10:00:00	1995/01/16 10:00:00	1	0.07	88.08%	0.16
363	1957/12/17 05:00:00	1957/12/17 05:00:00	1	0.06	88.32%	0.16
364	1971/02/17 10:00:00	1971/02/17 10:00:00	1	0.06	88.56%	0.16
365	1979/02/21 05:00:00	1979/02/21 06:00:00	2	0.06	88.81%	0.16
366	1983/02/26 13:00:00	1983/02/26 13:00:00	1	0.06	89.05%	0.16
367	1985/12/02 23:00:00	1985/12/02 23:00:00	1	0.06	89.29%	0.16
368	1998/02/19 17:00:00	1998/02/19 18:00:00	2	0.06	89.54%	0.16

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
369	2001/03/06 17:00:00	2001/03/06 19:00:00	3	0.06	89.78%	0.16
370	1969/01/28 02:00:00	1969/01/28 19:00:00	18	0.05	90.02%	0.16
371	1986/03/13 22:00:00	1986/03/13 22:00:00	1	0.05	90.27%	0.16
372	1986/04/06 10:00:00	1986/04/06 10:00:00	1	0.05	90.51%	0.16
373	1957/01/26 07:00:00	1957/01/26 07:00:00	1	0.04	90.75%	0.16
374	1960/02/10 07:00:00	1960/02/10 07:00:00	1	0.04	91.00%	0.16
375	1983/12/03 16:00:00	1983/12/03 17:00:00	2	0.04	91.24%	0.16
376	1988/04/14 22:00:00	1988/04/15 00:00:00	3	0.04	91.48%	0.15
377	1993/01/10 13:00:00	1993/01/10 13:00:00	1	0.04	91.73%	0.15
378	1959/12/21 07:00:00	1959/12/21 08:00:00	2	0.03	91.97%	0.15
379	1962/02/19 11:00:00	1962/02/19 11:00:00	1	0.03	92.21%	0.15
380	1973/03/05 08:00:00	1973/03/05 08:00:00	1	0.03	92.46%	0.15
381	1983/02/07 05:00:00	1983/02/07 05:00:00	1	0.03	92.70%	0.15
382	1997/12/06 17:00:00	1997/12/06 17:00:00	1	0.03	92.94%	0.15
383	1961/11/25 19:00:00	1961/11/25 20:00:00	2	0.02	93.19%	0.15
384	1963/04/26 02:00:00	1963/04/26 02:00:00	1	0.02	93.43%	0.15
385	1982/01/29 00:00:00	1982/01/29 00:00:00	1	0.02	93.67%	0.15
386	1988/12/22 23:00:00	1988/12/22 23:00:00	1	0.02	93.92%	0.15
387	1993/02/23 20:00:00	1993/02/23 21:00:00	2	0.02	94.16%	0.15
388	1994/01/27 14:00:00	1994/01/27 14:00:00	1	0.02	94.40%	0.15
389	1996/01/22 06:00:00	1996/01/22 07:00:00	2	0.02	94.65%	0.15
390	1996/02/21 09:00:00	1996/02/21 09:00:00	1	0.02	94.89%	0.15
391	2000/02/13 17:00:00	2000/02/13 17:00:00	1	0.02	95.13%	0.15
392	1961/01/26 11:00:00	1961/01/26 11:00:00	1	0.01	95.38%	0.15
393	1962/02/16 11:00:00	1962/02/16 11:00:00	1	0.01	95.62%	0.15
394	1975/04/17 08:00:00	1975/04/17 08:00:00	1	0.01	95.86%	0.15
395	1979/02/14 03:00:00	1979/02/14 05:00:00	3	0.01	96.11%	0.15
396	1983/02/02 17:00:00	1983/02/02 17:00:00	1	0.01	96.35%	0.15
397	1983/03/17 05:00:00	1983/03/17 05:00:00	1	0.01	96.59%	0.15
398	1987/01/07 05:00:00	1987/01/07 05:00:00	1	0.01	96.84%	0.15
399	1988/04/23 10:00:00	1988/04/23 10:00:00	1	0.01	97.08%	0.15
400	1992/02/06 18:00:00	1992/02/06 19:00:00	2	0.01	97.32%	0.15
401	1996/12/09 18:00:00	1996/12/09 18:00:00	1	0.01	97.57%	0.15
402	1955/01/16 15:00:00	1955/01/16 15:00:00	1	0	97.81%	0.14
403	1959/12/10 03:00:00	1959/12/10 03:00:00	1	0	98.05%	0.14
404	1967/04/19 18:00:00	1967/04/19 18:00:00	1	0	98.30%	0.14
405	1967/04/21 23:00:00	1967/04/21 23:00:00	1	0	98.54%	0.14
406	1969/01/20 09:00:00	1969/01/20 09:00:00	1	0	98.78%	0.14
407	1983/12/27 08:00:00	1983/12/27 08:00:00	1	0	99.03%	0.14
408	1986/01/31 18:00:00	1986/01/31 18:00:00	1	0	99.27%	0.14
409	1997/01/03 06:00:00	1997/01/03 06:00:00	1	0	99.51%	0.14
410	2001/03/10 17:00:00	2001/03/10 18:00:00	2	0	99.76%	0.14
--End of Data-----------------						

SWMM.out file name: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 post hydromod-2.375.out

SWMM.out time stamp: 4/5/2022 12:23:48 PM

Peak Flow Statistics Table Values

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
1	1995/01/03 07:00:00	1995/01/30 06:00:00	648	6.43	0.17%	58
2	2003/02/25 04:00:00	2003/03/03 12:00:00	153	5.48	0.34%	29
3	1958/02/03 04:00:00	1958/02/08 14:00:00	131	5.14	0.50%	19.33
4	2004/10/27 01:00:00	2004/11/01 02:00:00	122	5.03	0.67%	14.5
5	1969/02/18 07:00:00	1969/03/02 03:00:00	285	5.01	0.84%	11.6
6	1980/02/13 12:00:00	1980/02/25 06:00:00	283	4.67	1.01%	9.67
7	1978/02/27 06:00:00	1978/03/16 09:00:00	412	4.64	1.18%	8.29
8	1952/01/13 03:00:00	1952/01/22 09:00:00	223	4.6	1.34%	7.25
9	2005/02/18 03:00:00	2005/02/27 09:00:00	223	4.34	1.51%	6.44
10	1998/01/29 08:00:00	1998/02/12 21:00:00	350	3.99	1.68%	5.8
11	1991/12/28 01:00:00	1992/01/12 03:00:00	363	3.98	1.85%	5.27
12	1978/02/05 10:00:00	1978/02/18 00:00:00	303	3.97	2.02%	4.83
13	1982/03/14 13:00:00	1982/03/22 11:00:00	191	3.97	2.18%	4.46
14	1965/11/14 18:00:00	1965/11/28 14:00:00	333	3.92	2.35%	4.14
15	1992/12/27 19:00:00	1993/01/22 17:00:00	623	3.77	2.52%	3.87
16	1998/02/14 05:00:00	1998/02/28 13:00:00	345	3.72	2.69%	3.63
17	1977/12/23 03:00:00	1978/01/23 05:00:00	747	3.32	2.86%	3.41
18	1980/01/27 23:00:00	1980/02/03 10:00:00	156	3.31	3.03%	3.22
19	1977/08/16 20:00:00	1977/08/21 20:00:00	121	3.24	3.19%	3.05
20	1991/02/27 18:00:00	1991/03/05 12:00:00	139	3.24	3.36%	2.9
21	2008/02/20 09:00:00	2008/02/28 05:00:00	189	3.16	3.53%	2.76
22	1972/01/16 18:00:00	1972/01/23 04:00:00	155	2.88	3.70%	2.64
23	2003/02/11 08:00:00	2003/02/17 13:00:00	150	2.81	3.87%	2.52
24	1986/02/07 22:00:00	1986/02/19 23:00:00	290	2.64	4.03%	2.42
25	1979/01/05 07:00:00	1979/01/13 07:00:00	193	2.63	4.20%	2.32
26	1992/02/06 08:00:00	1992/02/19 23:00:00	328	2.63	4.37%	2.23
27	1980/01/07 08:00:00	1980/01/22 17:00:00	370	2.62	4.54%	2.15
28	1997/01/12 14:00:00	1997/01/19 20:00:00	175	2.62	4.71%	2.07
29	1983/12/24 08:00:00	1983/12/31 00:00:00	161	2.61	4.87%	2
30	1968/03/07 22:00:00	1968/03/12 14:00:00	113	2.6	5.04%	1.93
31	1962/01/20 11:00:00	1962/01/26 13:00:00	147	2.55	5.21%	1.87
32	1971/12/22 06:00:00	1972/01/01 08:00:00	243	2.51	5.38%	1.81
33	1969/02/05 12:00:00	1969/02/10 18:00:00	127	2.49	5.55%	1.76
34	1961/12/01 19:00:00	1961/12/06 19:00:00	121	2.39	5.71%	1.71
35	2004/12/28 08:00:00	2005/01/15 10:00:00	435	2.37	5.88%	1.66
36	2007/11/30 07:00:00	2007/12/05 00:00:00	114	2.33	6.05%	1.61
37	1960/02/01 19:00:00	1960/02/06 03:00:00	105	2.21	6.22%	1.57
38	2001/02/13 08:00:00	2001/02/18 23:00:00	136	2.2	6.39%	1.53
39	2003/04/14 05:00:00	2003/04/19 03:00:00	119	2.14	6.55%	1.49

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
40	1966/12/03 04:00:00	1966/12/10 22:00:00	187	2.09	6.72%	1.45
41	1995/03/03 11:00:00	1995/03/16 01:00:00	303	2.09	6.89%	1.42
42	2004/02/18 17:00:00	2004/03/05 19:00:00	387	2.09	7.06%	1.38
43	1996/11/21 15:00:00	1996/11/26 05:00:00	111	2.07	7.23%	1.35
44	1958/03/27 13:00:00	1958/04/11 16:00:00	364	1.98	7.39%	1.32
45	1954/01/18 11:00:00	1954/01/29 01:00:00	255	1.97	7.56%	1.29
46	1987/12/16 11:00:00	1987/12/22 11:00:00	145	1.91	7.73%	1.26
47	1957/01/05 09:00:00	1957/01/17 10:00:00	290	1.85	7.90%	1.23
48	1958/03/06 09:00:00	1958/03/26 08:00:00	480	1.84	8.07%	1.21
49	1983/02/24 00:00:00	1983/03/10 04:00:00	341	1.75	8.24%	1.18
50	1975/04/05 22:00:00	1975/04/13 05:00:00	176	1.69	8.40%	1.16
51	1967/01/22 15:00:00	1967/01/29 00:00:00	154	1.67	8.57%	1.14
52	1969/01/13 21:00:00	1969/02/01 23:00:00	459	1.64	8.74%	1.12
53	1957/01/20 17:00:00	1957/02/02 17:00:00	313	1.63	8.91%	1.09
54	1952/03/07 07:00:00	1952/03/20 16:00:00	322	1.62	9.08%	1.07
55	1963/11/15 16:00:00	1963/11/25 08:00:00	233	1.61	9.24%	1.06
56	1954/02/13 15:00:00	1954/02/18 04:00:00	110	1.59	9.41%	1.04
57	2008/01/05 02:00:00	2008/01/11 06:00:00	149	1.59	9.58%	1.02
58	1965/03/31 13:00:00	1965/04/15 07:00:00	355	1.57	9.75%	1
59	1986/11/17 17:00:00	1986/11/22 08:00:00	112	1.55	9.92%	0.98
60	1967/03/13 10:00:00	1967/03/17 23:00:00	110	1.54	10.08%	0.97
61	2004/10/17 06:00:00	2004/10/24 17:00:00	180	1.45	10.25%	0.95
62	1951/12/28 19:00:00	1952/01/03 15:00:00	141	1.35	10.42%	0.94
63	1967/12/16 14:00:00	1967/12/23 17:00:00	172	1.3	10.59%	0.92
64	1985/11/24 15:00:00	1985/12/06 18:00:00	292	1.29	10.76%	0.91
65	1976/12/30 14:00:00	1977/01/11 05:00:00	280	1.28	10.92%	0.89
66	1987/10/11 15:00:00	1987/10/16 20:00:00	126	1.26	11.09%	0.88
67	1997/01/22 02:00:00	1997/01/30 15:00:00	206	1.26	11.26%	0.87
68	1956/04/12 21:00:00	1956/04/17 18:00:00	118	1.24	11.43%	0.85
69	1985/11/11 04:00:00	1985/11/16 05:00:00	122	1.24	11.60%	0.84
70	1977/05/07 22:00:00	1977/05/14 18:00:00	165	1.22	11.76%	0.83
71	1963/09/17 06:00:00	1963/09/22 23:00:00	138	1.17	11.93%	0.82
72	1956/01/25 16:00:00	1956/02/04 05:00:00	230	1.16	12.10%	0.81
73	1963/03/16 22:00:00	1963/03/21 07:00:00	106	1.16	12.27%	0.8
74	1960/04/27 04:00:00	1960/05/01 12:00:00	105	1.11	12.44%	0.78
75	1970/11/28 21:00:00	1970/12/05 00:00:00	148	1.07	12.61%	0.77
76	2000/10/26 09:00:00	2000/11/03 10:00:00	194	1.07	12.77%	0.76
77	2005/02/11 01:00:00	2005/02/16 14:00:00	134	1.06	12.94%	0.75
78	1960/01/10 10:00:00	1960/01/19 04:00:00	211	1.05	13.11%	0.74
79	1962/02/07 19:00:00	1962/02/14 02:00:00	152	1.04	13.28%	0.73
80	1981/11/26 21:00:00	1981/12/02 23:00:00	147	0.88	13.45%	0.73
81	1954/11/10 23:00:00	1954/11/15 15:00:00	113	0.84	13.61%	0.72
82	1994/02/03 20:00:00	1994/02/11 22:00:00	195	0.82	13.78%	0.71
83	1993/02/07 20:00:00	1993/02/12 19:00:00	120	0.81	13.95%	0.7
84	1963/02/09 17:00:00	1963/02/17 20:00:00	196	0.8	14.12%	0.69
85	1974/03/07 23:00:00	1974/03/12 12:00:00	110	0.8	14.29%	0.68
86	1994/03/19 02:00:00	1994/03/29 10:00:00	249	0.76	14.45%	0.67

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
87	2001/01/08 17:00:00	2001/01/16 09:00:00	185	0.76	14.62%	0.67
88	1980/03/02 20:00:00	1980/03/14 12:00:00	281	0.71	14.79%	0.66
89	1958/02/19 07:00:00	1958/02/23 17:00:00	107	0.7	14.96%	0.65
90	1965/12/09 07:00:00	1965/12/20 09:00:00	267	0.7	15.13%	0.64
91	1988/11/24 00:00:00	1988/11/29 11:00:00	132	0.7	15.29%	0.64
92	1990/02/17 09:00:00	1990/02/22 11:00:00	123	0.68	15.46%	0.63
93	1967/11/19 08:00:00	1967/11/25 13:00:00	150	0.66	15.63%	0.62
94	1952/11/30 01:00:00	1952/12/09 01:00:00	217	0.65	15.80%	0.62
95	1984/12/26 13:00:00	1984/12/31 21:00:00	129	0.64	15.97%	0.61
96	1970/12/16 22:00:00	1970/12/25 16:00:00	211	0.62	16.13%	0.6
97	1952/11/14 15:00:00	1952/11/20 04:00:00	134	0.61	16.30%	0.6
98	1991/03/13 19:00:00	1991/03/31 06:00:00	420	0.61	16.47%	0.59
99	1992/12/07 08:00:00	1992/12/13 00:00:00	137	0.61	16.64%	0.59
100	2008/01/22 05:00:00	2008/02/01 03:00:00	239	0.56	16.81%	0.58
101	1983/01/17 06:00:00	1983/02/11 22:00:00	617	0.54	16.97%	0.57
102	1986/09/24 01:00:00	1986/09/29 07:00:00	127	0.51	17.14%	0.57
103	1988/02/02 01:00:00	1988/02/06 17:00:00	113	0.51	17.31%	0.56
104	1974/01/07 14:00:00	1974/01/12 15:00:00	122	0.48	17.48%	0.56
105	1988/04/14 19:00:00	1988/04/26 19:00:00	289	0.41	17.65%	0.55
106	1979/01/14 18:00:00	1979/01/22 16:00:00	191	0.37	17.82%	0.55
107	1988/12/15 09:00:00	1988/12/31 11:00:00	387	0.35	17.98%	0.54
108	1970/02/28 13:00:00	1970/03/09 00:00:00	204	0.33	18.15%	0.54
109	1978/09/05 17:00:00	1978/09/10 05:00:00	109	0.32	18.32%	0.53
110	1957/05/11 00:00:00	1957/05/15 06:00:00	103	0.31	18.49%	0.53
111	1996/12/05 23:00:00	1996/12/15 20:00:00	238	0.31	18.66%	0.52
112	2002/11/08 09:00:00	2002/11/13 03:00:00	115	0.31	18.82%	0.52
113	1988/01/17 04:00:00	1988/01/21 22:00:00	115	0.28	18.99%	0.51
114	1960/02/28 18:00:00	1960/03/05 03:00:00	130	0.27	19.16%	0.51
115	1976/09/10 00:00:00	1976/09/15 01:00:00	122	0.27	19.33%	0.5
116	1981/02/08 17:00:00	1981/02/13 07:00:00	111	0.27	19.50%	0.5
117	1985/12/11 02:00:00	1985/12/15 10:00:00	105	0.27	19.66%	0.5
118	1994/03/06 12:00:00	1994/03/11 08:00:00	117	0.27	19.83%	0.49
119	2003/03/15 08:00:00	2003/03/20 16:00:00	129	0.27	20.00%	0.49
120	1966/11/07 13:00:00	1966/11/11 22:00:00	106	0.26	20.17%	0.48
121	1976/02/04 08:00:00	1976/02/14 07:00:00	240	0.26	20.34%	0.48
122	1978/12/16 23:00:00	1978/12/23 06:00:00	152	0.26	20.50%	0.48
123	1982/12/07 21:00:00	1982/12/12 02:00:00	102	0.26	20.67%	0.47
124	1983/09/29 11:00:00	1983/10/05 07:00:00	141	0.26	20.84%	0.47
125	1993/02/18 12:00:00	1993/03/01 13:00:00	266	0.26	21.01%	0.46
126	1986/03/08 15:00:00	1986/03/20 18:00:00	292	0.25	21.18%	0.46
127	2001/02/20 12:00:00	2001/03/04 07:00:00	284	0.25	21.34%	0.46
128	1959/02/08 03:00:00	1959/02/25 19:00:00	425	0.24	21.51%	0.45
129	1978/03/30 11:00:00	1978/04/05 08:00:00	142	0.24	21.68%	0.45
130	1983/11/11 21:00:00	1983/11/16 22:00:00	122	0.24	21.85%	0.45
131	1983/11/17 23:00:00	1983/11/29 02:00:00	268	0.24	22.02%	0.44
132	1958/01/25 02:00:00	1958/02/01 21:00:00	188	0.23	22.18%	0.44
133	1967/04/11 07:00:00	1967/04/15 13:00:00	103	0.23	22.35%	0.44

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
134	1974/12/04 06:00:00	1974/12/08 12:00:00	103	0.23	22.52%	0.43
135	1976/07/22 10:00:00	1976/07/30 05:00:00	188	0.23	22.69%	0.43
136	1981/03/18 16:00:00	1981/03/24 00:00:00	129	0.23	22.86%	0.43
137	1981/12/30 07:00:00	1982/01/09 16:00:00	250	0.23	23.03%	0.42
138	1982/01/20 03:00:00	1982/01/25 08:00:00	126	0.23	23.19%	0.42
139	1957/02/28 17:00:00	1957/03/05 10:00:00	114	0.22	23.36%	0.42
140	1972/11/11 07:00:00	1972/11/21 08:00:00	242	0.22	23.53%	0.41
141	1983/03/17 02:00:00	1983/03/30 18:00:00	329	0.22	23.70%	0.41
142	2006/02/27 19:00:00	2006/03/15 09:00:00	375	0.22	23.87%	0.41
143	1961/01/26 08:00:00	1961/01/30 16:00:00	105	0.21	24.03%	0.41
144	1970/02/10 03:00:00	1970/02/15 02:00:00	120	0.21	24.20%	0.4
145	1976/03/01 14:00:00	1976/03/06 13:00:00	120	0.21	24.37%	0.4
146	1982/02/08 13:00:00	1982/02/14 20:00:00	152	0.21	24.54%	0.4
147	1999/01/25 04:00:00	1999/02/11 15:00:00	420	0.21	24.71%	0.4
148	1955/01/16 08:00:00	1955/01/23 02:00:00	163	0.2	24.87%	0.39
149	1976/07/15 12:00:00	1976/07/19 17:00:00	102	0.2	25.04%	0.39
150	1992/03/02 06:00:00	1992/03/06 19:00:00	110	0.2	25.21%	0.39
151	1965/02/05 23:00:00	1965/02/10 23:00:00	121	0.19	25.38%	0.38
152	1987/01/06 18:00:00	1987/01/11 05:00:00	108	0.19	25.55%	0.38
153	2001/01/26 11:00:00	2001/01/31 11:00:00	121	0.19	25.71%	0.38
154	2006/04/04 16:00:00	2006/04/09 02:00:00	107	0.19	25.88%	0.38
155	1975/03/08 07:00:00	1975/03/16 22:00:00	208	0.18	26.05%	0.37
156	1973/11/17 07:00:00	1973/11/27 03:00:00	237	0.17	26.22%	0.37
157	1954/03/16 22:00:00	1954/03/28 22:00:00	289	0.16	26.39%	0.37
158	1959/12/20 23:00:00	1959/12/28 16:00:00	186	0.16	26.55%	0.37
159	1976/07/08 12:00:00	1976/07/12 15:00:00	100	0.16	26.72%	0.37
160	1979/03/27 04:00:00	1979/04/01 07:00:00	124	0.16	26.89%	0.36
161	1990/01/13 11:00:00	1990/01/25 00:00:00	278	0.16	27.06%	0.36
162	2002/12/16 11:00:00	2002/12/25 11:00:00	217	0.16	27.23%	0.36
163	1962/03/18 17:00:00	1962/03/25 22:00:00	174	0.15	27.39%	0.36
164	1964/01/18 19:00:00	1964/01/26 11:00:00	185	0.15	27.56%	0.35
165	1964/11/17 12:00:00	1964/11/21 19:00:00	104	0.15	27.73%	0.35
166	1966/02/06 10:00:00	1966/02/12 03:00:00	138	0.15	27.90%	0.35
167	1968/12/25 16:00:00	1968/12/30 02:00:00	107	0.15	28.07%	0.35
168	1973/03/20 07:00:00	1973/03/24 14:00:00	104	0.15	28.24%	0.35
169	1977/03/16 13:00:00	1977/03/29 07:00:00	307	0.15	28.40%	0.34
170	1979/03/17 03:00:00	1979/03/24 11:00:00	177	0.15	28.57%	0.34
171	1981/02/25 19:00:00	1981/03/09 11:00:00	281	0.15	28.74%	0.34
172	1982/12/22 09:00:00	1982/12/27 03:00:00	115	0.15	28.91%	0.34
173	1983/04/18 02:00:00	1983/04/24 23:00:00	166	0.15	29.08%	0.34
174	1985/02/09 04:00:00	1985/02/13 13:00:00	106	0.15	29.24%	0.33
175	1992/03/20 18:00:00	1992/04/03 02:00:00	321	0.15	29.41%	0.33
176	1994/02/17 09:00:00	1994/02/23 02:00:00	138	0.15	29.58%	0.33
177	1995/04/16 07:00:00	1995/04/22 16:00:00	154	0.15	29.75%	0.33
178	2005/04/28 08:00:00	2005/05/02 10:00:00	99	0.15	29.92%	0.33
179	2007/01/30 13:00:00	2007/02/04 01:00:00	109	0.15	30.08%	0.32
180	1951/12/11 21:00:00	1951/12/16 05:00:00	105	0.14	30.25%	0.32

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
181	1952/01/25 03:00:00	1952/01/29 10:00:00	104	0.14	30.42%	0.32
182	1973/02/03 21:00:00	1973/02/19 07:00:00	371	0.14	30.59%	0.32
183	1973/02/28 01:00:00	1973/03/16 01:00:00	385	0.14	30.76%	0.32
184	1974/10/28 10:00:00	1974/11/02 08:00:00	119	0.14	30.92%	0.32
185	1981/01/28 06:00:00	1981/02/03 05:00:00	144	0.14	31.09%	0.31
186	1982/11/09 15:00:00	1982/11/14 11:00:00	117	0.14	31.26%	0.31
187	1984/12/07 23:00:00	1984/12/23 23:00:00	385	0.14	31.43%	0.31
188	1993/03/26 00:00:00	1993/04/01 01:00:00	146	0.14	31.60%	0.31
189	2000/02/20 05:00:00	2000/02/27 07:00:00	171	0.14	31.76%	0.31
190	1955/01/10 03:00:00	1955/01/14 13:00:00	107	0.13	31.93%	0.31
191	1955/04/30 19:00:00	1955/05/05 07:00:00	109	0.13	32.10%	0.3
192	1964/12/27 07:00:00	1965/01/04 09:00:00	195	0.13	32.27%	0.3
193	1966/01/27 05:00:00	1966/02/03 17:00:00	181	0.13	32.44%	0.3
194	1969/03/21 12:00:00	1969/03/25 17:00:00	102	0.13	32.61%	0.3
195	1971/02/16 23:00:00	1971/02/21 11:00:00	109	0.13	32.77%	0.3
196	1979/01/30 17:00:00	1979/02/06 09:00:00	161	0.13	32.94%	0.3
197	1979/03/01 07:00:00	1979/03/05 13:00:00	103	0.13	33.11%	0.29
198	1979/10/20 03:00:00	1979/10/24 12:00:00	106	0.13	33.28%	0.29
199	1979/11/07 18:00:00	1979/11/14 23:00:00	174	0.13	33.45%	0.29
200	1982/03/25 21:00:00	1982/04/06 22:00:00	290	0.13	33.61%	0.29
201	1983/04/29 06:00:00	1983/05/04 21:00:00	136	0.13	33.78%	0.29
202	1989/03/25 11:00:00	1989/03/29 21:00:00	107	0.13	33.95%	0.29
203	1990/04/04 08:00:00	1990/04/08 13:00:00	102	0.13	34.12%	0.29
204	1994/01/24 22:00:00	1994/01/31 04:00:00	151	0.13	34.29%	0.28
205	1996/10/30 13:00:00	1996/11/03 17:00:00	101	0.13	34.45%	0.28
206	1998/11/08 08:00:00	1998/11/13 02:00:00	115	0.13	34.62%	0.28
207	1999/04/11 19:00:00	1999/04/16 02:00:00	104	0.13	34.79%	0.28
208	2000/03/04 17:00:00	2000/03/11 12:00:00	164	0.13	34.96%	0.28
209	2001/12/09 06:00:00	2001/12/16 06:00:00	169	0.13	35.13%	0.28
210	2003/12/24 23:00:00	2003/12/29 17:00:00	115	0.13	35.29%	0.28
211	1951/08/28 08:00:00	1951/09/01 12:00:00	101	0.12	35.46%	0.28
212	1952/12/17 07:00:00	1952/12/24 12:00:00	174	0.12	35.63%	0.27
213	1957/04/18 03:00:00	1957/04/25 12:00:00	178	0.12	35.80%	0.27
214	1957/10/13 21:00:00	1957/10/18 05:00:00	105	0.12	35.97%	0.27
215	1957/12/05 02:00:00	1957/12/09 10:00:00	105	0.12	36.13%	0.27
216	1958/02/25 06:00:00	1958/03/01 09:00:00	100	0.12	36.30%	0.27
217	1960/09/11 03:00:00	1960/09/15 06:00:00	100	0.12	36.47%	0.27
218	1962/02/15 18:00:00	1962/02/28 14:00:00	309	0.12	36.64%	0.27
219	1969/11/06 19:00:00	1969/11/13 19:00:00	169	0.12	36.81%	0.27
220	1971/04/14 11:00:00	1971/04/18 13:00:00	99	0.12	36.97%	0.26
221	1974/12/28 07:00:00	1975/01/02 04:00:00	118	0.12	37.14%	0.26
222	1982/11/29 11:00:00	1982/12/04 09:00:00	119	0.12	37.31%	0.26
223	1983/12/03 15:00:00	1983/12/07 18:00:00	100	0.12	37.48%	0.26
224	1984/11/23 06:00:00	1984/11/28 19:00:00	134	0.12	37.65%	0.26
225	1986/01/30 03:00:00	1986/02/04 15:00:00	133	0.12	37.82%	0.26
226	1986/04/06 01:00:00	1986/04/10 08:00:00	104	0.12	37.98%	0.26
227	1986/12/06 06:00:00	1986/12/10 22:00:00	113	0.12	38.15%	0.26

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
228	1987/02/23 14:00:00	1987/03/01 07:00:00	138	0.12	38.32%	0.25
229	1987/12/04 21:00:00	1987/12/08 23:00:00	99	0.12	38.49%	0.25
230	1988/11/14 06:00:00	1988/11/18 08:00:00	99	0.12	38.66%	0.25
231	1991/01/09 13:00:00	1991/01/13 15:00:00	99	0.12	38.82%	0.25
232	1993/01/30 23:00:00	1993/02/04 01:00:00	99	0.12	38.99%	0.25
233	1993/06/05 14:00:00	1993/06/09 15:00:00	98	0.12	39.16%	0.25
234	1995/02/13 23:00:00	1995/02/18 12:00:00	110	0.12	39.33%	0.25
235	1996/01/16 19:00:00	1996/02/06 08:00:00	494	0.12	39.50%	0.25
236	1997/12/06 13:00:00	1997/12/11 08:00:00	116	0.12	39.66%	0.25
237	2001/04/07 14:00:00	2001/04/13 19:00:00	150	0.12	39.83%	0.25
238	2001/11/24 10:00:00	2001/12/08 04:00:00	331	0.12	40.00%	0.24
239	2006/10/14 00:00:00	2006/10/18 01:00:00	98	0.12	40.17%	0.24
240	1952/02/29 21:00:00	1952/03/05 05:00:00	105	0.11	40.34%	0.24
241	1952/04/08 01:00:00	1952/04/14 16:00:00	160	0.11	40.50%	0.24
242	1953/01/06 15:00:00	1953/01/11 19:00:00	125	0.11	40.67%	0.24
243	1955/02/16 19:00:00	1955/02/21 07:00:00	109	0.11	40.84%	0.24
244	1955/02/26 11:00:00	1955/03/03 18:00:00	128	0.11	41.01%	0.24
245	1959/04/26 05:00:00	1959/04/30 06:00:00	98	0.11	41.18%	0.24
246	1965/12/29 17:00:00	1966/01/04 01:00:00	129	0.11	41.34%	0.24
247	1972/12/04 14:00:00	1972/12/11 23:00:00	178	0.11	41.51%	0.24
248	1975/01/30 15:00:00	1975/02/08 00:00:00	202	0.11	41.68%	0.23
249	1980/12/04 13:00:00	1980/12/11 09:00:00	165	0.11	41.85%	0.23
250	1986/10/09 19:00:00	1986/10/14 06:00:00	108	0.11	42.02%	0.23
251	1996/12/27 15:00:00	1997/01/07 02:00:00	252	0.11	42.18%	0.23
252	1999/03/25 14:00:00	1999/03/29 15:00:00	98	0.11	42.35%	0.23
253	2000/02/11 11:00:00	2000/02/19 04:00:00	186	0.11	42.52%	0.23
254	2004/12/04 14:00:00	2004/12/11 01:00:00	156	0.11	42.69%	0.23
255	2005/12/31 17:00:00	2006/01/06 16:00:00	144	0.11	42.86%	0.23
256	2007/04/20 15:00:00	2007/04/26 00:00:00	130	0.11	43.03%	0.23
257	1952/12/28 08:00:00	1953/01/03 22:00:00	159	0.1	43.19%	0.23
258	1957/03/16 09:00:00	1957/03/20 09:00:00	97	0.1	43.36%	0.23
259	1959/12/10 00:00:00	1959/12/14 01:00:00	98	0.1	43.53%	0.22
260	1960/01/25 20:00:00	1960/01/29 20:00:00	97	0.1	43.70%	0.22
261	1960/11/03 20:00:00	1960/11/10 05:00:00	154	0.1	43.87%	0.22
262	1960/11/26 17:00:00	1960/11/30 17:00:00	97	0.1	44.03%	0.22
263	1962/03/06 06:00:00	1962/03/10 14:00:00	105	0.1	44.20%	0.22
264	1967/11/26 18:00:00	1967/12/04 16:00:00	191	0.1	44.37%	0.22
265	1975/02/09 05:00:00	1975/02/16 09:00:00	173	0.1	44.54%	0.22
266	1975/11/27 18:00:00	1975/12/02 12:00:00	115	0.1	44.71%	0.22
267	1976/08/30 10:00:00	1976/09/03 10:00:00	97	0.1	44.87%	0.22
268	1979/02/21 01:00:00	1979/02/26 13:00:00	133	0.1	45.04%	0.22
269	1980/03/18 17:00:00	1980/03/29 22:00:00	270	0.1	45.21%	0.22
270	1993/11/30 04:00:00	1993/12/04 04:00:00	97	0.1	45.38%	0.22
271	1998/01/09 06:00:00	1998/01/15 19:00:00	158	0.1	45.55%	0.21
272	1998/03/25 13:00:00	1998/04/04 20:00:00	248	0.1	45.71%	0.21
273	2004/04/01 21:00:00	2004/04/05 20:00:00	96	0.1	45.88%	0.21
274	2006/03/28 21:00:00	2006/04/02 00:00:00	100	0.1	46.05%	0.21

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
275	1951/11/20 03:00:00	1951/11/27 02:00:00	168	0.09	46.22%	0.21
276	1954/12/09 22:00:00	1954/12/14 00:00:00	99	0.09	46.39%	0.21
277	1961/11/20 16:00:00	1961/11/29 16:00:00	217	0.09	46.55%	0.21
278	1965/01/24 05:00:00	1965/01/28 05:00:00	97	0.09	46.72%	0.21
279	1968/02/13 03:00:00	1968/02/17 03:00:00	97	0.09	46.89%	0.21
280	1970/01/09 22:00:00	1970/01/20 15:00:00	258	0.09	47.06%	0.21
281	1982/09/26 03:00:00	1982/09/30 08:00:00	102	0.09	47.23%	0.21
282	1987/04/04 06:00:00	1987/04/08 13:00:00	104	0.09	47.39%	0.21
283	1990/05/28 08:00:00	1990/06/01 08:00:00	97	0.09	47.56%	0.21
284	1996/02/20 07:00:00	1996/03/02 15:00:00	273	0.09	47.73%	0.2
285	1996/03/12 17:00:00	1996/03/17 04:00:00	108	0.09	47.90%	0.2
286	1998/05/12 14:00:00	1998/05/16 16:00:00	99	0.09	48.07%	0.2
287	2004/02/02 23:00:00	2004/02/07 11:00:00	109	0.09	48.24%	0.2
288	2005/10/16 18:00:00	2005/10/22 01:00:00	128	0.09	48.40%	0.2
289	2006/02/18 08:00:00	2006/02/23 04:00:00	117	0.09	48.57%	0.2
290	2007/12/07 04:00:00	2007/12/12 15:00:00	132	0.09	48.74%	0.2
291	2007/12/18 22:00:00	2007/12/23 04:00:00	103	0.09	48.91%	0.2
292	1952/11/23 00:00:00	1952/11/27 00:00:00	97	0.08	49.08%	0.2
293	1953/11/14 16:00:00	1953/11/18 22:00:00	103	0.08	49.24%	0.2
294	1957/12/15 08:00:00	1957/12/20 23:00:00	136	0.08	49.41%	0.2
295	1963/04/17 04:00:00	1963/04/21 04:00:00	97	0.08	49.58%	0.2
296	1965/03/12 14:00:00	1965/03/17 09:00:00	116	0.08	49.75%	0.2
297	1980/04/22 11:00:00	1980/04/27 00:00:00	110	0.08	49.92%	0.2
298	1980/10/16 05:00:00	1980/10/20 03:00:00	95	0.08	50.08%	0.2
299	1984/10/17 06:00:00	1984/10/21 04:00:00	95	0.08	50.25%	0.19
300	1988/01/05 13:00:00	1988/01/09 12:00:00	96	0.08	50.42%	0.19
301	1990/06/09 14:00:00	1990/06/14 05:00:00	112	0.08	50.59%	0.19
302	1995/03/21 11:00:00	1995/03/27 09:00:00	143	0.08	50.76%	0.19
303	2000/04/17 18:00:00	2000/04/21 22:00:00	101	0.08	50.92%	0.19
304	2006/05/22 04:00:00	2006/05/26 02:00:00	95	0.08	51.09%	0.19
305	2006/12/10 00:00:00	2006/12/14 04:00:00	101	0.08	51.26%	0.19
306	2008/02/03 07:00:00	2008/02/07 13:00:00	103	0.08	51.43%	0.19
307	1953/03/01 02:00:00	1953/03/05 18:00:00	113	0.07	51.60%	0.19
308	1954/01/12 05:00:00	1954/01/16 16:00:00	108	0.07	51.76%	0.19
309	1954/03/30 03:00:00	1954/04/03 01:00:00	95	0.07	51.93%	0.19
310	1955/04/22 05:00:00	1955/04/29 06:00:00	170	0.07	52.10%	0.19
311	1957/10/31 00:00:00	1957/11/07 05:00:00	174	0.07	52.27%	0.19
312	1963/09/04 08:00:00	1963/09/08 05:00:00	94	0.07	52.44%	0.19
313	1964/03/22 23:00:00	1964/03/27 15:00:00	113	0.07	52.61%	0.19
314	1967/04/18 20:00:00	1967/04/25 17:00:00	166	0.07	52.77%	0.19
315	1974/03/02 09:00:00	1974/03/06 13:00:00	101	0.07	52.94%	0.18
316	1976/04/13 04:00:00	1976/04/19 18:00:00	159	0.07	53.11%	0.18
317	1978/01/30 11:00:00	1978/02/03 15:00:00	101	0.07	53.28%	0.18
318	1978/11/21 16:00:00	1978/11/28 05:00:00	158	0.07	53.45%	0.18
319	1979/02/14 03:00:00	1979/02/18 01:00:00	95	0.07	53.61%	0.18
320	1982/01/10 19:00:00	1982/01/14 20:00:00	98	0.07	53.78%	0.18
321	1982/01/28 16:00:00	1982/02/01 20:00:00	101	0.07	53.95%	0.18

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
322	1982/11/19 00:00:00	1982/11/23 09:00:00	106	0.07	54.12%	0.18
323	1983/04/12 09:00:00	1983/04/16 21:00:00	109	0.07	54.29%	0.18
324	1985/01/07 11:00:00	1985/01/11 20:00:00	106	0.07	54.45%	0.18
325	1985/01/28 15:00:00	1985/02/06 16:00:00	218	0.07	54.62%	0.18
326	1987/10/28 01:00:00	1987/11/09 00:00:00	288	0.07	54.79%	0.18
327	1990/04/17 07:00:00	1990/04/21 06:00:00	96	0.07	54.96%	0.18
328	1993/12/11 16:00:00	1993/12/18 01:00:00	154	0.07	55.13%	0.18
329	1953/02/23 10:00:00	1953/02/27 09:00:00	96	0.06	55.29%	0.18
330	1953/04/27 20:00:00	1953/05/02 01:00:00	102	0.06	55.46%	0.18
331	1955/03/11 01:00:00	1955/03/14 21:00:00	93	0.06	55.63%	0.18
332	1957/02/23 06:00:00	1957/02/27 03:00:00	94	0.06	55.80%	0.18
333	1958/09/24 04:00:00	1958/09/28 00:00:00	93	0.06	55.97%	0.17
334	1959/01/06 08:00:00	1959/01/10 04:00:00	93	0.06	56.13%	0.17
335	1960/02/08 22:00:00	1960/02/14 00:00:00	123	0.06	56.30%	0.17
336	1968/04/01 20:00:00	1968/04/05 17:00:00	94	0.06	56.47%	0.17
337	1978/11/11 09:00:00	1978/11/18 00:00:00	160	0.06	56.64%	0.17
338	1989/02/09 14:00:00	1989/02/13 18:00:00	101	0.06	56.81%	0.17
339	1998/03/13 17:00:00	1998/03/18 09:00:00	113	0.06	56.97%	0.17
340	2001/03/06 12:00:00	2001/03/14 12:00:00	193	0.06	57.14%	0.17
341	2007/08/26 11:00:00	2007/08/30 07:00:00	93	0.06	57.31%	0.17
342	1963/04/26 02:00:00	1963/04/29 21:00:00	92	0.05	57.48%	0.17
343	1968/11/14 18:00:00	1968/11/18 16:00:00	95	0.05	57.65%	0.17
344	1971/01/12 19:00:00	1971/01/16 17:00:00	95	0.05	57.82%	0.17
345	1971/10/16 20:00:00	1971/10/20 19:00:00	96	0.05	57.98%	0.17
346	1975/12/20 14:00:00	1975/12/24 10:00:00	93	0.05	58.15%	0.17
347	1977/12/18 05:00:00	1977/12/22 01:00:00	93	0.05	58.32%	0.17
348	1998/04/11 14:00:00	1998/04/17 06:00:00	137	0.05	58.49%	0.17
349	2005/03/19 03:00:00	2005/03/26 15:00:00	181	0.05	58.66%	0.17
350	1951/12/04 23:00:00	1951/12/08 20:00:00	94	0.04	58.82%	0.17
351	1951/12/19 07:00:00	1951/12/23 03:00:00	93	0.04	58.99%	0.17
352	1955/01/30 23:00:00	1955/02/03 21:00:00	95	0.04	59.16%	0.17
353	1955/11/14 07:00:00	1955/11/23 19:00:00	229	0.04	59.33%	0.16
354	1957/06/10 03:00:00	1957/06/13 22:00:00	92	0.04	59.50%	0.16
355	1966/10/10 13:00:00	1966/10/14 07:00:00	91	0.04	59.66%	0.16
356	1967/03/31 10:00:00	1967/04/04 06:00:00	93	0.04	59.83%	0.16
357	1969/04/03 05:00:00	1969/04/09 15:00:00	155	0.04	60.00%	0.16
358	1975/04/17 04:00:00	1975/04/21 02:00:00	95	0.04	60.17%	0.16
359	1982/12/29 18:00:00	1983/01/02 14:00:00	93	0.04	60.34%	0.16
360	1987/02/13 20:00:00	1987/02/19 19:00:00	144	0.04	60.50%	0.16
361	1987/03/05 20:00:00	1987/03/10 02:00:00	103	0.04	60.67%	0.16
362	1987/03/22 01:00:00	1987/03/28 17:00:00	161	0.04	60.84%	0.16
363	1990/01/31 00:00:00	1990/02/08 06:00:00	199	0.04	61.01%	0.16
364	1997/12/18 12:00:00	1997/12/22 11:00:00	96	0.04	61.18%	0.16
365	1998/11/28 07:00:00	1998/12/10 00:00:00	282	0.04	61.34%	0.16
366	1953/10/22 07:00:00	1953/10/25 17:00:00	83	0.03	61.51%	0.16
367	1955/01/01 22:00:00	1955/01/07 14:00:00	137	0.03	61.68%	0.16
368	1956/02/23 18:00:00	1956/02/27 23:00:00	102	0.03	61.85%	0.16

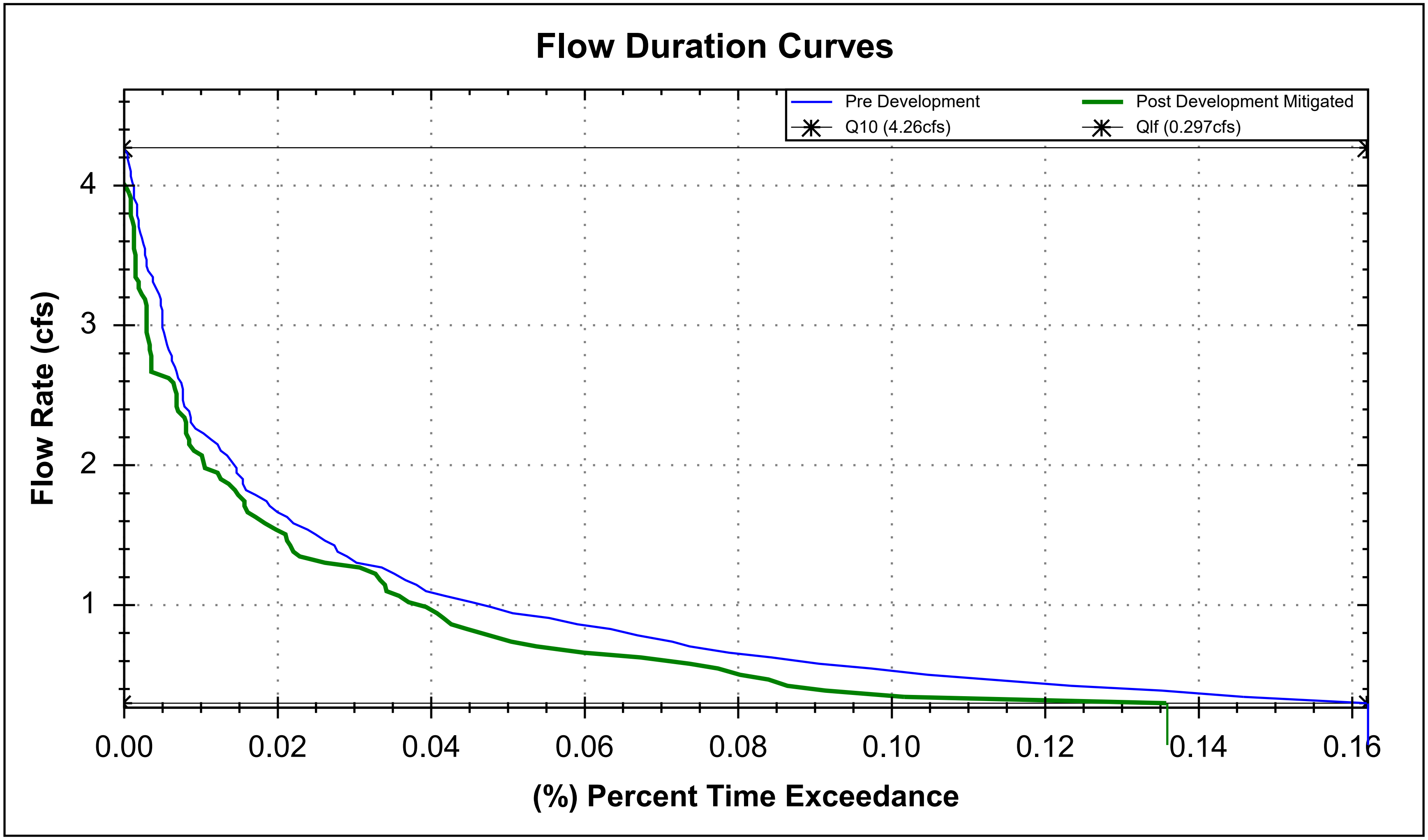
Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
369	1957/05/19 08:00:00	1957/05/24 20:00:00	133	0.03	62.02%	0.16
370	1957/10/21 03:00:00	1957/10/24 19:00:00	89	0.03	62.18%	0.16
371	1960/11/12 23:00:00	1960/11/16 15:00:00	89	0.03	62.35%	0.16
372	1961/03/28 06:00:00	1961/03/31 21:00:00	88	0.03	62.52%	0.16
373	1962/01/13 00:00:00	1962/01/16 13:00:00	86	0.03	62.69%	0.16
374	1963/03/28 10:00:00	1963/04/01 03:00:00	90	0.03	62.86%	0.16
375	1964/11/09 13:00:00	1964/11/14 09:00:00	117	0.03	63.03%	0.16
376	1971/02/23 03:00:00	1971/02/26 20:00:00	90	0.03	63.19%	0.15
377	1974/03/27 07:00:00	1974/03/30 23:00:00	89	0.03	63.36%	0.15
378	1975/03/22 09:00:00	1975/03/25 18:00:00	82	0.03	63.53%	0.15
379	1976/11/12 03:00:00	1976/11/15 15:00:00	85	0.03	63.70%	0.15
380	1977/01/29 01:00:00	1977/02/01 13:00:00	85	0.03	63.87%	0.15
381	1977/05/24 04:00:00	1977/05/27 20:00:00	89	0.03	64.03%	0.15
382	1979/12/21 06:00:00	1979/12/27 22:00:00	161	0.03	64.20%	0.15
383	1982/09/16 11:00:00	1982/09/20 17:00:00	103	0.03	64.37%	0.15
384	1983/12/09 16:00:00	1983/12/13 03:00:00	84	0.03	64.54%	0.15
385	1984/04/27 22:00:00	1984/05/01 10:00:00	85	0.03	64.71%	0.15
386	1984/11/13 08:00:00	1984/11/19 03:00:00	140	0.03	64.87%	0.15
387	1988/08/24 05:00:00	1988/08/28 00:00:00	92	0.03	65.04%	0.15
388	1989/01/05 18:00:00	1989/01/11 04:00:00	131	0.03	65.21%	0.15
389	1989/02/02 07:00:00	1989/02/08 03:00:00	141	0.03	65.38%	0.15
390	1989/03/02 10:00:00	1989/03/06 06:00:00	93	0.03	65.55%	0.15
391	1989/05/14 10:00:00	1989/05/18 16:00:00	103	0.03	65.71%	0.15
392	1991/10/27 00:00:00	1991/10/30 22:00:00	95	0.03	65.88%	0.15
393	1992/03/08 01:00:00	1992/03/11 21:00:00	93	0.03	66.05%	0.15
394	1994/11/10 12:00:00	1994/11/13 21:00:00	82	0.03	66.22%	0.15
395	1994/12/25 01:00:00	1994/12/28 16:00:00	88	0.03	66.39%	0.15
396	1996/03/04 18:00:00	1996/03/08 08:00:00	87	0.03	66.55%	0.15
397	1998/01/03 15:00:00	1998/01/07 21:00:00	103	0.03	66.72%	0.15
398	2004/11/21 06:00:00	2004/11/24 19:00:00	86	0.03	66.89%	0.15
399	2005/03/04 10:00:00	2005/03/08 08:00:00	95	0.03	67.06%	0.15
400	2006/03/20 03:00:00	2006/03/24 16:00:00	110	0.03	67.23%	0.15
401	2007/02/11 11:00:00	2007/02/16 07:00:00	117	0.03	67.39%	0.15
402	2007/02/19 02:00:00	2007/02/26 00:00:00	167	0.03	67.56%	0.14
403	2007/02/28 05:00:00	2007/03/04 02:00:00	94	0.03	67.73%	0.14
404	1953/11/05 09:00:00	1953/11/08 12:00:00	76	0.02	67.90%	0.14
405	1953/12/04 09:00:00	1953/12/07 08:00:00	72	0.02	68.07%	0.14
406	1954/12/03 23:00:00	1954/12/06 23:00:00	73	0.02	68.24%	0.14
407	1956/12/06 03:00:00	1956/12/09 10:00:00	80	0.02	68.40%	0.14
408	1957/11/14 17:00:00	1957/11/19 08:00:00	112	0.02	68.57%	0.14
409	1958/02/13 02:00:00	1958/02/16 11:00:00	82	0.02	68.74%	0.14
410	1958/05/11 10:00:00	1958/05/14 09:00:00	72	0.02	68.91%	0.14
411	1960/03/28 02:00:00	1960/03/31 07:00:00	78	0.02	69.08%	0.14
412	1964/02/29 05:00:00	1964/03/05 10:00:00	126	0.02	69.24%	0.14
413	1964/10/15 12:00:00	1964/10/18 15:00:00	76	0.02	69.41%	0.14
414	1965/09/17 02:00:00	1965/09/20 11:00:00	82	0.02	69.58%	0.14
415	1965/12/22 00:00:00	1965/12/25 11:00:00	84	0.02	69.75%	0.14

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
416	1967/01/31 01:00:00	1967/02/03 00:00:00	72	0.02	69.92%	0.14
417	1967/12/07 23:00:00	1967/12/11 10:00:00	84	0.02	70.08%	0.14
418	1969/03/09 03:00:00	1969/03/16 00:00:00	166	0.02	70.25%	0.14
419	1969/12/09 00:00:00	1969/12/12 03:00:00	76	0.02	70.42%	0.14
420	1971/03/13 07:00:00	1971/03/16 05:00:00	71	0.02	70.59%	0.14
421	1971/12/04 02:00:00	1971/12/09 14:00:00	133	0.02	70.76%	0.14
422	1972/10/19 04:00:00	1972/10/23 07:00:00	100	0.02	70.92%	0.14
423	1973/01/10 00:00:00	1973/01/13 05:00:00	78	0.02	71.09%	0.14
424	1974/01/01 06:00:00	1974/01/04 08:00:00	75	0.02	71.26%	0.14
425	1975/04/25 08:00:00	1975/04/28 05:00:00	70	0.02	71.43%	0.14
426	1975/12/12 16:00:00	1975/12/15 22:00:00	79	0.02	71.60%	0.14
427	1977/02/22 03:00:00	1977/02/28 01:00:00	143	0.02	71.76%	0.14
428	1978/03/22 15:00:00	1978/03/26 09:00:00	91	0.02	71.93%	0.14
429	1978/04/07 02:00:00	1978/04/11 18:00:00	113	0.02	72.10%	0.14
430	1978/04/15 20:00:00	1978/04/19 01:00:00	78	0.02	72.27%	0.14
431	1980/05/08 11:00:00	1980/05/13 01:00:00	111	0.02	72.44%	0.14
432	1981/04/02 05:00:00	1981/04/05 06:00:00	74	0.02	72.61%	0.13
433	1981/04/19 02:00:00	1981/04/22 12:00:00	83	0.02	72.77%	0.13
434	1983/10/07 09:00:00	1983/10/10 17:00:00	81	0.02	72.94%	0.13
435	1984/01/15 17:00:00	1984/01/19 04:00:00	84	0.02	73.11%	0.13
436	1984/12/03 08:00:00	1984/12/06 17:00:00	82	0.02	73.28%	0.13
437	1985/03/27 09:00:00	1985/03/31 06:00:00	94	0.02	73.45%	0.13
438	1985/10/21 23:00:00	1985/10/25 03:00:00	77	0.02	73.61%	0.13
439	1987/03/15 09:00:00	1987/03/18 15:00:00	79	0.02	73.78%	0.13
440	1987/12/29 12:00:00	1988/01/02 00:00:00	85	0.02	73.95%	0.13
441	1989/01/23 20:00:00	1989/01/27 04:00:00	81	0.02	74.12%	0.13
442	1990/01/02 08:00:00	1990/01/05 10:00:00	75	0.02	74.29%	0.13
443	1992/12/18 01:00:00	1992/12/21 05:00:00	77	0.02	74.45%	0.13
444	1995/06/15 22:00:00	1995/06/19 11:00:00	86	0.02	74.62%	0.13
445	1995/12/13 05:00:00	1995/12/17 03:00:00	95	0.02	74.79%	0.13
446	1995/12/23 09:00:00	1995/12/26 12:00:00	76	0.02	74.96%	0.13
447	1997/02/10 20:00:00	1997/02/14 02:00:00	79	0.02	75.13%	0.13
448	1999/01/20 09:00:00	1999/01/23 22:00:00	86	0.02	75.29%	0.13
449	1999/06/02 03:00:00	1999/06/07 00:00:00	118	0.02	75.46%	0.13
450	2000/11/10 08:00:00	2000/11/13 23:00:00	88	0.02	75.63%	0.13
451	2000/11/30 09:00:00	2000/12/03 05:00:00	69	0.02	75.80%	0.13
452	2002/02/17 17:00:00	2002/02/20 23:00:00	79	0.02	75.97%	0.13
453	2002/03/17 23:00:00	2002/03/21 05:00:00	79	0.02	76.13%	0.13
454	2003/11/12 06:00:00	2003/11/18 14:00:00	153	0.02	76.30%	0.13
455	2006/04/14 14:00:00	2006/04/17 18:00:00	77	0.02	76.47%	0.13
456	2006/12/16 21:00:00	2006/12/20 07:00:00	83	0.02	76.64%	0.13
457	2006/12/27 07:00:00	2006/12/30 11:00:00	77	0.02	76.81%	0.13
458	1951/10/10 23:00:00	1951/10/13 15:00:00	65	0.01	76.97%	0.13
459	1951/10/15 09:00:00	1951/10/17 22:00:00	62	0.01	77.14%	0.13
460	1953/01/13 19:00:00	1953/01/16 12:00:00	66	0.01	77.31%	0.13
461	1953/04/20 11:00:00	1953/04/22 19:00:00	57	0.01	77.48%	0.13
462	1955/12/01 20:00:00	1955/12/09 06:00:00	179	0.01	77.65%	0.13

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
463	1956/04/27 04:00:00	1956/04/29 05:00:00	50	0.01	77.82%	0.13
464	1959/10/01 06:00:00	1959/10/03 17:00:00	60	0.01	77.98%	0.13
465	1960/03/13 05:00:00	1960/03/15 16:00:00	60	0.01	78.15%	0.13
466	1960/03/23 10:00:00	1960/03/25 17:00:00	56	0.01	78.32%	0.12
467	1960/12/03 03:00:00	1960/12/05 13:00:00	59	0.01	78.49%	0.12
468	1962/05/14 20:00:00	1962/05/17 04:00:00	57	0.01	78.66%	0.12
469	1962/05/27 12:00:00	1962/05/29 16:00:00	53	0.01	78.82%	0.12
470	1963/11/06 16:00:00	1963/11/09 03:00:00	60	0.01	78.99%	0.12
471	1963/12/10 00:00:00	1963/12/12 11:00:00	60	0.01	79.16%	0.12
472	1964/02/15 08:00:00	1964/02/18 01:00:00	66	0.01	79.33%	0.12
473	1964/03/13 00:00:00	1964/03/14 21:00:00	46	0.01	79.50%	0.12
474	1965/01/07 09:00:00	1965/01/10 02:00:00	66	0.01	79.66%	0.12
475	1968/01/28 00:00:00	1968/01/30 08:00:00	57	0.01	79.83%	0.12
476	1968/12/20 11:00:00	1968/12/22 07:00:00	45	0.01	80.00%	0.12
477	1971/01/02 09:00:00	1971/01/04 07:00:00	47	0.01	80.17%	0.12
478	1971/04/26 05:00:00	1971/04/28 11:00:00	55	0.01	80.34%	0.12
479	1971/05/07 20:00:00	1971/05/10 12:00:00	65	0.01	80.50%	0.12
480	1971/12/13 06:00:00	1971/12/15 19:00:00	62	0.01	80.67%	0.12
481	1972/01/09 09:00:00	1972/01/11 15:00:00	55	0.01	80.84%	0.12
482	1973/03/26 07:00:00	1973/03/28 04:00:00	46	0.01	81.01%	0.12
483	1973/12/01 19:00:00	1973/12/04 02:00:00	56	0.01	81.18%	0.12
484	1977/07/20 10:00:00	1977/07/24 17:00:00	104	0.01	81.34%	0.12
485	1978/12/01 19:00:00	1978/12/04 04:00:00	58	0.01	81.51%	0.12
486	1979/01/25 14:00:00	1979/01/28 02:00:00	61	0.01	81.68%	0.12
487	1980/04/01 16:00:00	1980/04/03 13:00:00	46	0.01	81.85%	0.12
488	1980/04/28 16:00:00	1980/05/04 14:00:00	143	0.01	82.02%	0.12
489	1981/01/12 10:00:00	1981/01/15 00:00:00	63	0.01	82.18%	0.12
490	1981/03/10 18:00:00	1981/03/13 00:00:00	55	0.01	82.35%	0.12
491	1981/03/14 12:00:00	1981/03/16 21:00:00	58	0.01	82.52%	0.12
492	1981/05/01 12:00:00	1981/05/03 08:00:00	45	0.01	82.69%	0.12
493	1982/02/17 01:00:00	1982/02/19 11:00:00	59	0.01	82.86%	0.12
494	1983/01/05 08:00:00	1983/01/07 20:00:00	61	0.01	83.03%	0.12
495	1983/05/06 09:00:00	1983/05/08 06:00:00	46	0.01	83.19%	0.12
496	1983/08/18 11:00:00	1983/08/20 14:00:00	52	0.01	83.36%	0.12
497	1983/12/15 13:00:00	1983/12/18 01:00:00	61	0.01	83.53%	0.12
498	1983/12/19 14:00:00	1983/12/22 03:00:00	62	0.01	83.70%	0.12
499	1984/01/04 15:00:00	1984/01/07 02:00:00	60	0.01	83.87%	0.12
500	1985/02/20 20:00:00	1985/02/22 19:00:00	48	0.01	84.03%	0.12
501	1985/09/18 13:00:00	1985/09/21 02:00:00	62	0.01	84.20%	0.12
502	1985/10/07 10:00:00	1985/10/09 10:00:00	49	0.01	84.37%	0.12
503	1986/02/23 06:00:00	1986/02/25 16:00:00	59	0.01	84.54%	0.12
504	1986/03/01 07:00:00	1986/03/03 15:00:00	57	0.01	84.71%	0.12
505	1987/02/03 12:00:00	1987/02/08 01:00:00	110	0.01	84.87%	0.12
506	1987/07/17 12:00:00	1987/07/19 13:00:00	50	0.01	85.04%	0.12
507	1987/11/14 02:00:00	1987/11/16 06:00:00	53	0.01	85.21%	0.11
508	1987/11/17 21:00:00	1987/11/20 09:00:00	61	0.01	85.38%	0.11
509	1987/12/11 05:00:00	1987/12/13 17:00:00	61	0.01	85.55%	0.11

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
510	1991/12/18 05:00:00	1991/12/22 01:00:00	93	0.01	85.71%	0.11
511	1996/02/12 13:00:00	1996/02/15 03:00:00	63	0.01	85.88%	0.11
512	1996/04/18 03:00:00	1996/04/20 08:00:00	54	0.01	86.05%	0.11
513	1998/12/19 19:00:00	1998/12/22 09:00:00	63	0.01	86.22%	0.11
514	1999/03/11 14:00:00	1999/03/14 04:00:00	63	0.01	86.39%	0.11
515	1999/04/01 19:00:00	1999/04/04 10:00:00	64	0.01	86.55%	0.11
516	1999/04/07 04:00:00	1999/04/09 21:00:00	66	0.01	86.72%	0.11
517	2001/04/21 10:00:00	2001/04/23 17:00:00	56	0.01	86.89%	0.11
518	2001/11/12 18:00:00	2001/11/15 22:00:00	77	0.01	87.06%	0.11
519	2001/12/20 18:00:00	2001/12/24 09:00:00	88	0.01	87.23%	0.11
520	2002/12/29 17:00:00	2003/01/01 03:00:00	59	0.01	87.39%	0.11
521	2003/05/03 18:00:00	2003/05/06 07:00:00	62	0.01	87.56%	0.11
522	2004/01/02 20:00:00	2004/01/05 16:00:00	69	0.01	87.73%	0.11
523	2004/03/26 11:00:00	2004/03/28 06:00:00	44	0.01	87.90%	0.11
524	2005/09/20 05:00:00	2005/09/22 19:00:00	63	0.01	88.07%	0.11
525	2006/12/22 10:00:00	2006/12/24 07:00:00	46	0.01	88.24%	0.11
526	2007/10/13 09:00:00	2007/10/15 20:00:00	60	0.01	88.40%	0.11
527	2008/02/14 14:00:00	2008/02/16 23:00:00	58	0.01	88.57%	0.11
528	1951/10/08 08:00:00	1951/10/09 11:00:00	28	0	88.74%	0.11
529	1951/12/02 02:00:00	1951/12/03 10:00:00	33	0	88.91%	0.11
530	1952/01/07 05:00:00	1952/01/09 13:00:00	57	0	89.08%	0.11
531	1953/03/20 08:00:00	1953/03/21 14:00:00	31	0	89.24%	0.11
532	1953/11/20 07:00:00	1953/11/21 20:00:00	38	0	89.41%	0.11
533	1956/05/10 00:00:00	1956/05/11 06:00:00	31	0	89.58%	0.11
534	1957/03/09 21:00:00	1957/03/10 11:00:00	15	0	89.75%	0.11
535	1957/10/11 13:00:00	1957/10/11 21:00:00	9	0	89.92%	0.11
536	1958/03/02 20:00:00	1958/03/03 19:00:00	24	0	90.08%	0.11
537	1960/04/23 09:00:00	1960/04/25 06:00:00	46	0	90.25%	0.11
538	1960/12/08 20:00:00	1960/12/09 21:00:00	26	0	90.42%	0.11
539	1961/12/14 17:00:00	1961/12/15 18:00:00	26	0	90.59%	0.11
540	1962/03/29 09:00:00	1962/03/30 00:00:00	16	0	90.76%	0.11
541	1963/04/08 08:00:00	1963/04/09 16:00:00	33	0	90.92%	0.11
542	1963/10/16 11:00:00	1963/10/20 09:00:00	95	0	91.09%	0.11
543	1964/04/01 09:00:00	1964/04/02 09:00:00	25	0	91.26%	0.11
544	1965/01/20 07:00:00	1965/01/22 02:00:00	44	0	91.43%	0.11
545	1965/03/07 00:00:00	1965/03/08 06:00:00	31	0	91.60%	0.11
546	1966/01/20 00:00:00	1966/01/21 17:00:00	42	0	91.76%	0.11
547	1966/02/25 04:00:00	1966/02/26 04:00:00	25	0	91.93%	0.11
548	1966/03/02 08:00:00	1966/03/03 17:00:00	34	0	92.10%	0.11
549	1967/03/29 07:00:00	1967/03/29 23:00:00	17	0	92.27%	0.11
550	1968/12/11 10:00:00	1968/12/12 14:00:00	29	0	92.44%	0.11
551	1969/02/15 21:00:00	1969/02/17 03:00:00	31	0	92.61%	0.11
552	1969/11/15 19:00:00	1969/11/17 10:00:00	40	0	92.77%	0.11
553	1970/04/27 11:00:00	1970/04/28 16:00:00	30	0	92.94%	0.11
554	1974/01/20 23:00:00	1974/01/22 00:00:00	26	0	93.11%	0.11
555	1974/05/19 10:00:00	1974/05/19 22:00:00	13	0	93.28%	0.11
556	1976/04/04 04:00:00	1976/04/06 07:00:00	52	0	93.45%	0.1

Rank	Start Date	End Date	Duration (hr)	Peak (cfs)	Frequency (%)	Return Period (Yr)
557	1976/11/27 11:00:00	1976/11/28 23:00:00	37	0	93.61%	0.1
558	1977/01/26 01:00:00	1977/01/27 18:00:00	42	0	93.78%	0.1
559	1977/07/27 13:00:00	1977/07/29 00:00:00	36	0	93.95%	0.1
560	1978/04/25 17:00:00	1978/04/26 12:00:00	20	0	94.12%	0.1
561	1978/09/16 12:00:00	1978/09/17 06:00:00	19	0	94.29%	0.1
562	1979/11/04 23:00:00	1979/11/05 23:00:00	25	0	94.45%	0.1
563	1981/04/26 18:00:00	1981/04/28 02:00:00	33	0	94.62%	0.1
564	1981/12/21 02:00:00	1981/12/22 12:00:00	35	0	94.79%	0.1
565	1982/04/11 20:00:00	1982/04/13 05:00:00	34	0	94.96%	0.1
566	1984/02/10 05:00:00	1984/02/10 23:00:00	19	0	95.13%	0.1
567	1986/04/01 10:00:00	1986/04/01 16:00:00	7	0	95.29%	0.1
568	1987/01/28 08:00:00	1987/01/29 21:00:00	38	0	95.46%	0.1
569	1987/10/23 07:00:00	1987/10/24 19:00:00	37	0	95.63%	0.1
570	1988/11/11 09:00:00	1988/11/12 12:00:00	28	0	95.80%	0.1
571	1989/12/01 12:00:00	1989/12/02 13:00:00	26	0	95.97%	0.1
572	1991/03/11 03:00:00	1991/03/12 18:00:00	40	0	96.13%	0.1
573	1993/11/23 04:00:00	1993/11/24 18:00:00	39	0	96.30%	0.1
574	1993/12/19 05:00:00	1993/12/20 07:00:00	27	0	96.47%	0.1
575	1994/04/24 07:00:00	1994/04/28 06:00:00	96	0	96.64%	0.1
576	1994/11/16 09:00:00	1994/11/19 07:00:00	71	0	96.81%	0.1
577	1995/05/01 13:00:00	1995/05/02 17:00:00	29	0	96.97%	0.1
578	1996/10/02 20:00:00	1996/10/04 08:00:00	37	0	97.14%	0.1
579	1998/01/19 17:00:00	1998/01/21 05:00:00	37	0	97.31%	0.1
580	1999/03/15 11:00:00	1999/03/16 23:00:00	37	0	97.48%	0.1
581	1999/09/18 17:00:00	1999/09/20 00:00:00	32	0	97.65%	0.1
582	2000/01/26 17:00:00	2000/01/27 19:00:00	27	0	97.82%	0.1
583	2000/01/31 18:00:00	2000/02/01 19:00:00	26	0	97.98%	0.1
584	2000/02/28 17:00:00	2000/02/29 19:00:00	27	0	98.15%	0.1
585	2001/12/30 18:00:00	2001/12/31 22:00:00	29	0	98.32%	0.1
586	2002/01/29 08:00:00	2002/01/30 08:00:00	25	0	98.49%	0.1
587	2003/01/20 19:00:00	2003/01/22 03:00:00	33	0	98.66%	0.1
588	2003/03/22 18:00:00	2003/03/24 08:00:00	39	0	98.82%	0.1
589	2003/12/08 02:00:00	2003/12/08 12:00:00	11	0	98.99%	0.1
590	2004/01/28 07:00:00	2004/01/29 09:00:00	27	0	99.16%	0.1
591	2004/04/17 15:00:00	2004/04/18 02:00:00	12	0	99.33%	0.1
592	2005/01/28 16:00:00	2005/01/29 12:00:00	21	0	99.50%	0.1
593	2005/02/07 07:00:00	2005/02/08 08:00:00	26	0	99.66%	0.1
594	2006/03/17 21:00:00	2006/03/19 02:00:00	30	0	99.83%	0.1
-End of Data-----------------						


Flow Duration Curves
Pre Development
Post Development Mitigated
Q10 (4.26cfs)
Qlf (0.297cfs)
Flow Rate (cfs)
4
3
2
1
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
(%) Percent Time Exceedance

Compare Post-Development Curve to Pre-Development Curve
Flow Control Upper Limit: 4.26 (cfs)
Flow Control Lower Limit: 0.297 (cfs)

post-development SWMM file: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 post hydromod-2.375.out
post-development time stamp: 4/5/2022 12:23:48 PM
Compared to:
pre-development SWMM file: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 pre hydromod.out
pre-development time stamp: 4/7/2022 2:29:57 PM

Post PT #	Flow Rate (cfs)	Post Dev % Exceed	Pre Dev % Exceed	%Ex post < %Ex pre	%Ex post > %Ex pre	%Ex post > 110% %Ex pre	Pass/Fail
0	0.30	0.14	0.16	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
1	0.34	0.10	0.15	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
2	0.38	0.09	0.14	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
3	0.42	0.09	0.12	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
4	0.46	0.08	0.11	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
5	0.50	0.08	0.10	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
6	0.54	0.08	0.10	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
7	0.58	0.07	0.09	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
8	0.62	0.07	0.08	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
9	0.66	0.06	0.08	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
10	0.70	0.05	0.07	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
11	0.74	0.05	0.07	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
12	0.78	0.05	0.07	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
13	0.82	0.04	0.06	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
14	0.86	0.04	0.06	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
15	0.90	0.04	0.06	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
16	0.94	0.04	0.05	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
17	0.98	0.04	0.05	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
18	1.02	0.04	0.05	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
19	1.06	0.04	0.04	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
20	1.10	0.03	0.04	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
21	1.14	0.03	0.04	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
22	1.18	0.03	0.04	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
23	1.22	0.03	0.04	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
24	1.26	0.03	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
25	1.30	0.03	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
26	1.34	0.02	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
27	1.38	0.02	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
28	1.42	0.02	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
29	1.46	0.02	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration

Post PT #	Flow Rate (cfs)	Post Dev % Exceed	Pre Dev % Exceed	%Ex post < %Ex pre	%Ex post > %Ex pre	%Ex post > 110% %Ex pre	Pass/Fail
30	1.50	0.02	0.03	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
31	1.54	0.02	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
32	1.58	0.02	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
33	1.62	0.02	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
34	1.66	0.02	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
35	1.70	0.02	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
36	1.74	0.02	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
37	1.78	0.01	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
38	1.82	0.01	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
39	1.86	0.01	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
40	1.90	0.01	0.02	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
41	1.94	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
42	1.98	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
43	2.02	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
44	2.06	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
45	2.10	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
46	2.14	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
47	2.18	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
48	2.22	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
49	2.26	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
50	2.30	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
51	2.34	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
52	2.38	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
53	2.42	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
54	2.46	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
55	2.50	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
56	2.54	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
57	2.58	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
58	2.62	0.01	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
59	2.66	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
60	2.70	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
61	2.74	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
62	2.78	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
63	2.82	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
64	2.86	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
65	2.90	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
66	2.94	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
67	2.98	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
68	3.02	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
69	3.06	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration

Post PT #	Flow Rate (cfs)	Post Dev % Exceed	Pre Dev % Exceed	%Ex post < %Ex pre	%Ex post > %Ex pre	%Ex post > 110% %Ex pre	Pass/Fail
70	3.10	0.00	0.01	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
71	3.14	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
72	3.18	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
73	3.22	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
74	3.26	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
75	3.30	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
76	3.34	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
77	3.38	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
78	3.42	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
79	3.46	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
80	3.50	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
81	3.54	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
82	3.58	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
83	3.62	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
84	3.66	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
85	3.70	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
86	3.74	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
87	3.78	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
88	3.82	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
89	3.86	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
90	3.90	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
91	3.94	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
92	3.98	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
93	4.02	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
94	4.06	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
95	4.10	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
96	4.14	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
97	4.18	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
98	4.22	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration
99	4.26	0.00	0.00	TRUE	FALSE	FALSE	Pass: Post Duration <= Pre Duration

Duration Table Summary at Project Discharge Point				
file name: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 pre hydromod.out				
time stamp: 4/7/2022 2:29:57 PM				
DISCHARGE		Number of periods when discharge was equal to or greater than DISCHARGE column but less than that shown on the next line		
Bin Number	Discharge Rate (cfs)	Number of Periods	Total Periods Exceeding	Percent Time Exceeded
1	0.30	80	806	0.162
2	0.34	53	726	0.146
3	0.38	59	673	0.135
4	0.42	53	614	0.123
5	0.46	40	561	0.113
6	0.50	36	521	0.105
7	0.54	34	485	0.098
8	0.58	31	451	0.091
9	0.62	27	420	0.084
10	0.66	26	393	0.079
11	0.70	11	367	0.074
12	0.74	23	356	0.072
13	0.78	17	333	0.067
14	0.82	22	316	0.064
15	0.86	18	294	0.059
16	0.90	24	276	0.055
17	0.94	14	252	0.051
18	0.98	12	238	0.048
19	1.02	18	226	0.045
20	1.06	12	208	0.042
21	1.10	6	196	0.039
22	1.14	7	190	0.038
23	1.18	7	183	0.037
24	1.22	9	176	0.035
25	1.26	16	167	0.034
26	1.30	6	151	0.030
27	1.34	6	145	0.029
28	1.38	2	139	0.028
29	1.42	6	137	0.028
30	1.46	6	131	0.026
31	1.50	6	125	0.025
32	1.54	9	119	0.024
33	1.58	4	110	0.022
34	1.62	6	106	0.021
35	1.66	5	100	0.020
36	1.70	2	95	0.019
37	1.74	7	93	0.019
38	1.78	7	86	0.017
39	1.82	2	79	0.016
40	1.86	0	77	0.015
41	1.90	4	77	0.015
42	1.94	0	73	0.015
43	1.98	3	73	0.015
44	2.02	3	70	0.014
45	2.06	4	67	0.013
46	2.10	2	63	0.013
47	2.14	4	61	0.012
48	2.18	5	57	0.011
49	2.22	5	52	0.010
50	2.26	3	47	0.009
51	2.30	0	44	0.009

Bin Number	Discharge Rate (cfs)	Number of Periods	Total Periods Exceeding	Percent Time Exceeded
52	2.34	1	44	0.009
53	2.38	3	43	0.009
54	2.42	1	40	0.008
55	2.46	0	39	0.008
56	2.50	0	39	0.008
57	2.54	1	39	0.008
58	2.58	2	38	0.008
59	2.62	2	36	0.007
60	2.66	1	34	0.007
61	2.70	2	33	0.007
62	2.74	0	31	0.006
63	2.78	2	31	0.006
64	2.82	1	29	0.006
65	2.86	1	28	0.006
66	2.90	1	27	0.005
67	2.94	1	26	0.005
68	2.98	0	25	0.005
69	3.02	0	25	0.005
70	3.06	0	25	0.005
71	3.10	1	25	0.005
72	3.14	0	24	0.005
73	3.18	1	24	0.005
74	3.22	2	23	0.005
75	3.26	2	21	0.004
76	3.30	0	19	0.004
77	3.34	3	19	0.004
78	3.38	1	16	0.003
79	3.42	0	15	0.003
80	3.46	1	15	0.003
81	3.50	0	14	0.003
82	3.54	1	14	0.003
83	3.58	1	13	0.003
84	3.62	1	12	0.002
85	3.66	1	11	0.002
86	3.70	0	10	0.002
87	3.74	1	10	0.002
88	3.78	0	9	0.002
89	3.82	0	9	0.002
90	3.86	2	9	0.002
91	3.90	0	7	0.001
92	3.94	0	7	0.001
93	3.98	1	7	0.001
94	4.02	1	6	0.001
95	4.06	0	5	0.001
96	4.10	1	5	0.001
97	4.14	1	4	0.001
98	4.18	0	3	0.001
99	4.22	3	3	0.001
100	4.26	0	0	0.000
---------End of Data-----------------				

Duration Table Summary at Project Discharge Point

file name: V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\post 10 w new n perv - two sto\21052 post hydromod-2.375.c
time stamp: 4/5/2022 12:23:48 PM

DISCHARGE		Number of periods when discharge was equal to or greater than DISCHARGE column but less than that shown on the next line		
Bin Number	Discharge Rate (cfs)	Number of Periods	Total Periods Exceeding	Percent Time Exceeded
1	0.30	170	676	0.136
2	0.34	51	506	0.102
3	0.38	25	455	0.091
4	0.42	12	430	0.086
5	0.46	18	418	0.084
6	0.50	15	400	0.080
7	0.54	18	385	0.077
8	0.58	32	367	0.074
9	0.62	37	335	0.067
10	0.66	30	298	0.060
11	0.70	17	268	0.054
12	0.74	14	251	0.050
13	0.78	14	237	0.048
14	0.82	11	223	0.045
15	0.86	5	212	0.043
16	0.90	4	207	0.042
17	0.94	7	203	0.041
18	0.98	11	196	0.039
19	1.02	6	185	0.037
20	1.06	8	179	0.036
21	1.10	1	171	0.034
22	1.14	4	170	0.034
23	1.18	3	166	0.033
24	1.22	10	163	0.033
25	1.26	22	153	0.031
26	1.30	17	131	0.026
27	1.34	4	114	0.023
28	1.38	2	110	0.022
29	1.42	2	108	0.022
30	1.46	1	106	0.021
31	1.50	6	105	0.021
32	1.54	7	99	0.020
33	1.58	6	92	0.018
34	1.62	5	86	0.017
35	1.66	3	81	0.016
36	1.70	0	78	0.016
37	1.74	4	78	0.016
38	1.78	2	74	0.015
39	1.82	4	72	0.014
40	1.86	5	68	0.014
41	1.90	2	63	0.013
42	1.94	8	61	0.012
43	1.98	1	53	0.011
44	2.02	1	52	0.010
45	2.06	5	51	0.010
46	2.10	3	46	0.009
47	2.14	0	43	0.009
48	2.18	2	43	0.009
49	2.22	0	41	0.008
50	2.26	0	41	0.008
51	2.30	1	41	0.008

Bin Number	Discharge Rate (cfs)	Number of Periods	Total Periods Exceeding	Percent Time Exceeded
52	2.34	4	40	0.008
53	2.38	1	36	0.007
54	2.42	0	35	0.007
55	2.46	1	35	0.007
56	2.50	1	34	0.007
57	2.54	1	33	0.007
58	2.58	3	32	0.006
59	2.62	11	29	0.006
60	2.66	0	18	0.004
61	2.70	0	18	0.004
62	2.74	0	18	0.004
63	2.78	1	18	0.004
64	2.82	0	17	0.003
65	2.86	1	17	0.003
66	2.90	1	16	0.003
67	2.94	0	15	0.003
68	2.98	0	15	0.003
69	3.02	0	15	0.003
70	3.06	0	15	0.003
71	3.10	0	15	0.003
72	3.14	1	15	0.003
73	3.18	2	14	0.003
74	3.22	2	12	0.002
75	3.26	0	10	0.002
76	3.30	2	10	0.002
77	3.34	0	8	0.002
78	3.38	0	8	0.002
79	3.42	0	8	0.002
80	3.46	0	8	0.002
81	3.50	1	8	0.002
82	3.54	0	7	0.001
83	3.58	0	7	0.001
84	3.62	0	7	0.001
85	3.66	0	7	0.001
86	3.70	1	7	0.001
87	3.74	1	6	0.001
88	3.78	0	5	0.001
89	3.82	0	5	0.001
90	3.86	0	5	0.001
91	3.90	1	5	0.001
92	3.94	2	4	0.001
93	3.98	2	2	0.000
94	4.02	0	0	0.000
95	4.06	0	0	0.000
96	4.10	0	0	0.000
97	4.14	0	0	0.000
98	4.18	0	0	0.000
99	4.22	0	0	0.000
100	4.26	0	0	0.000
---------End of Data-----------------				

END OF STATISTICS ANALYSIS

21052-LBA Decision Street-Pre Development Hydromodification.inp file

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:05:00
DRY_STEP             24:00:00
ROUTING_STEP         0:01:00
RULE_STEP            01:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.566
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
Oceanside        INTENSITY 1:00     1.0      FILE       "R:\_Storm\HydMOD\Rain gauge Data\Oceanside\Oceanside ALERT Station.dat" Oceanside  IN

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-1.1          Oceanside        POC-1            3.8693   0        341      2.46     0
DMA-1            Oceanside        POC-1            2.83     0        282      2.57     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1.1          0.012      0.05       0.05       0.1        25         OUTLET
DMA-1            0.012      0.05       0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
DMA-1.1          9.0        0.01875    0.33
DMA-1            6.0        0.075      0.32
```

```
[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -2500.000 0.000 12500.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            844.028            4896.347

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1.1          4476.802           6150.049
DMA-1            4871.668           3741.362

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Oceanside        -962.488           8519.250


[BACKDROP]
FILE       "V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\21052-Post Hydmod Model for SWMM-EXCEL.jpg"
DIMENSIONS -2500.000 0.000 12500.000 10000.000
```

21052-LBA Decision Street-Pre Development Hydromodification.rpt file

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*********************
Rainfall File Summary
*********************
Station    First        Last         Recording   Periods    Periods    Periods
ID         Date         Date         Frequency  w/Precip    Missing    Malfunc.
-------------------------------------------------------------------------------
Oceanside  08/28/1951   05/23/2008      60 min      9131          0          0


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 08/28/1951 05:00:00
Ending Date .............. 05/23/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:00:00


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       374.084       670.072
Evaporation Loss .........        19.187        34.368
Infiltration Loss ........       302.049       541.039
Surface Runoff ...........        64.732       115.951
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -3.177


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......        64.732        21.094
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........        64.732        21.094
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
```

Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-1.1	670.07	0.00	53.38	490.76	0.00	161.18	161.18	16.93	3.56	0.241
DMA-1	670.07	0.00	8.37	609.78	0.00	54.12	54.12	4.16	2.51	0.081

Analysis begun on: Thu Apr 7 14:29:23 2022
Analysis ended on: Thu Apr 7 14:29:57 2022
Total elapsed time: 00:00:34

21052-LBA Decision Street-Post Development Hydromodification.inp file

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           08/28/1951
START_TIME           05:00:00
REPORT_START_DATE    08/28/1951
REPORT_START_TIME    05:00:00
END_DATE             05/23/2008
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:05:00
DRY_STEP             24:00:00
ROUTING_STEP         0:01:00
RULE_STEP            01:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.566
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          0.06   0.08   0.11   0.15   0.17   0.19   0.19   0.18   0.15   0.11   0.08   0.06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
Oceanside        INTENSITY 1:00     1.0      FILE       "R:\_Storm\HydMOD\Rain gauge Data\Oceanside\Oceanside ALERT Station.dat" Oceanside  IN

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
DMA-1.1          Oceanside        BMP-A            3.8693   91       217      2.46     0
DMA-1            Oceanside        BMP-A            2.66     91       125      2.57     0
BMP-A            Oceanside        STO-2            0.1675   0        53       0        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA-1.1          0.012      0.022      0.05       0.1        25         OUTLET
DMA-1            0.012      0.022      0.05       0.1        25         OUTLET
BMP-A            0.012      0.022      0.05       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
```

```
DMA-1.1          9          0.01875    0.33       7          0
DMA-1            6.0        0.075      0.32       7          0
BMP-A            6.0        0.075      0.32       7          0

[LID_CONTROLS]
;;Name           Type/Layer Parameters
;;-------------- ---------- ----------
BMP-A            BC
BMP-A            SURFACE    6          0.0        0          0          5
BMP-A            SOIL       21         0.4        0.2        0.1        5          5          1.5
BMP-A            STORAGE    15         0.67       0          0
BMP-A            DRAIN      0.269471386 0.5        3          6          0          0

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSat    FromImp    ToPerv     RptFile                  DrainTo          FromPerv
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- ------------------------ ---------------- ----------
BMP-A            BMP-A            1       7296.30    0          0          0          0          *                        *                0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC-1            0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------          -------- --------
STO-1            0        4          0          TABULAR    STO-1                        0        0
STO-2            0        4          0          TABULAR    STO-2                        0        0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
OrificeB         STO-1            POC-1            SIDE         0          0.61       NO       0
OrificeC         STO-1            POC-1            SIDE         0.41       0.61       NO       0
OrificeD         STO-1            POC-1            SIDE         1          0.61       NO       0
OrificeE         STO-2            STO-1            SIDE         0          0.61       NO       0

[WEIRS]
;;Name           From Node        To Node          Type         CrestHt    Qcoeff     Gated    EndCon   EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- -------- ---------- ---------- ---------- ---------- ----------------
WeirB            STO-1            POC-1            SIDEFLOW     3          3.33       NO       0        0          YES
WeirC            STO-1            POC-1            SIDEFLOW     2.75       3.33       NO       0        0          YES
WeirD            STO-2            STO-1            SIDEFLOW     1.5        3.33       NO       0        0          YES

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
OrificeB         RECT_CLOSED  0.042            0.042      0          0
OrificeC         RECT_CLOSED  0.083            0.083      0          0
OrificeD         RECT_CLOSED  0.167            0.083      0          0
OrificeE         RECT_CLOSED  0.083            0.083      0          0
WeirB            RECT_OPEN    1.5              3          0          0
WeirC            RECT_OPEN    0.25             0.3        0          0
WeirD            RECT_OPEN    2.5              3.87       0          0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
STO-1            Storage    0          0
STO-1                       0.4        2480
STO-1                       0.8        1825
STO-1                       1.2        3415
STO-1                       1.6        2355
STO-1                       2          3675
STO-1                       2.4        2355
STO-1                       2.8        3415
STO-1                       3.2        1820
STO-1                       3.6        2485
STO-1                       4          10
```

```
;
STO-2            Storage    0          0
STO-2                       0.4        1650
STO-2                       0.8        1215
STO-2                       1.2        2270
STO-2                       1.6        1565
STO-2                       2          2445
STO-2                       2.4        1565
STO-2                       2.8        2270
STO-2                       3.2        1210
STO-2                       3.6        1650
STO-2                       4          5

[REPORT]
;;Reporting Options
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -2500.000 0.000 12500.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            1248.766           5182.626
STO-1            1446.199           3366.239
STO-2            834.156            2329.714

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OrificeB         2472.853           4768.016
OrificeB         1811.451           5281.343
OrificeC         1929.911           4402.764
OrificeC         1781.836           4876.604
OrificeD         3055.281           5310.958
OrificeD         1811.451           5794.669
OrificeE         301.086            1372.162
OrificeE         -1298.124          2339.585
WeirB            646.594            3830.207
WeirB            646.594            4343.534
WeirC            1150.049           4215.202
WeirC            1406.713           4669.299
WeirD            -153.011           1934.847
WeirD            -478.776           2388.944

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA-1.1          4476.802           6150.049
DMA-1            4871.668           3741.362
BMP-A            2018.756           2546.890

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Oceanside        -962.488           8519.250


[BACKDROP]
FILE       "V:\21\21052\Engineering\PLOT PLAN\Storm\Working Files\Hydmod\21052-Post Hydmod Model for SWMM-EXCEL.jpg"
DIMENSIONS -2500.000 0.000 12500.000 10000.000
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


********************
Rainfall File Summary
********************
Station    First        Last         Recording   Periods    Periods    Periods
ID         Date         Date         Frequency  w/Precip    Missing    Malfunc.
-------------------------------------------------------------------------------
Oceanside  08/28/1951   05/23/2008      60 min      9131          0          0


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 08/28/1951 05:00:00
Ending Date .............. 05/23/2008 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:00:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Initial LID Storage ......         0.029         0.053
Total Precipitation ......       373.945       670.072
Evaporation Loss .........        71.495       128.113
Infiltration Loss ........        25.759        46.158
Surface Runoff ...........        57.084       102.288
LID Drainage .............       219.936       394.104
Final Storage ............         0.067         0.121
Continuity Error (%) .....        -0.098


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       277.023        90.272
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       276.831        90.210
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
```

Final Stored Volume	0.000	0.000
Continuity Error (%)	0.069	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA-1.1	670.07	0.00	103.22	42.59	509.14	15.83	524.97	55.16	3.72	0.783
DMA-1	670.07	0.00	102.71	54.26	508.10	5.58	513.68	37.10	2.55	0.767
BMP-A	670.07	20284.19	1106.55	0.00	0.00	0.00	19846.19	90.26	6.43	0.947

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
BMP-A	BMP-A	20954.26	1106.59	0.00	4089.73	15757.19	2.10	3.01	-0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
POC-1	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
STO-1	STORAGE	0.12	3.82	3.82	15835 16:01	3.82
STO-2	STORAGE	0.08	2.25	2.25	15835 16:01	2.25

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent

```
  ---------------------------------------------------------------------------------------------------
  POC-1                OUTFALL       0.00      6.43  15835  16:01           0        90.2       0.000
  STO-1                STORAGE       0.00      6.43  15835  16:01           0        90.2       0.031
  STO-2                STORAGE       6.43      6.43  15835  16:01        90.3        90.3       0.038


  *********************
  Node Flooding Summary
  *********************

  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************

  ----------------------------------------------------------------------------------------------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt     Occurrence    Outflow
  Storage Unit          1000 ft3    Full  Loss  Loss      1000 ft3    Full    days hr:min        CFS
  ----------------------------------------------------------------------------------------------------
  STO-1                    0.241       3     0     0         9.426      99    15835  16:01       6.43
  STO-2                    0.101       2     0     0         3.718      59    15835  16:01       6.43


  ***********************
  Outfall Loading Summary
  ***********************

  -----------------------------------------------------------
                         Flow       Avg       Max       Total
                         Freq      Flow      Flow      Volume
  Outfall Node           Pcnt       CFS       CFS    10^6 gal
  -----------------------------------------------------------
  POC-1                 14.69      0.05      6.43      90.203
  -----------------------------------------------------------
  System                14.69      0.05      6.43      90.203


  ********************
  Link Flow Summary
  ********************

  -----------------------------------------------------------------------------
                                 Maximum  Time of Max   Maximum    Max/    Max/
                                  |Flow|   Occurrence   |Veloc|    Full    Full
  Link                 Type          CFS  days hr:min    ft/sec    Flow   Depth
  -----------------------------------------------------------------------------
  OrificeB             ORIFICE      0.02  15835  16:01                     0.00
  OrificeC             ORIFICE      0.06  15835  16:01                     0.00
  OrificeD             ORIFICE      0.11  15835  16:01                     0.00
  OrificeE             ORIFICE      0.05  15835  16:01                     0.00
  WeirB                WEIR         5.91  15835  16:01                     0.00
  WeirC                WEIR         0.33  15835  16:01                     0.00
  WeirD                WEIR         6.38  15835  16:01                     0.00


  *************************
  Conduit Surcharge Summary
  *************************

  No conduits were surcharged.


  Analysis begun on:  Tue Apr  5 12:22:46 2022
  Analysis ended on:  Tue Apr  5 12:23:48 2022
  Total elapsed time: 00:01:02
```

ATTACHMENT 3

ATTACHMENT 3 - BMP MAINTENANCE INFORMATION

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	Checklist
Attachment 3A	Structural BMP Operations and Maintenance Plan	☒ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3B	Draft Maintenance Agreement	☒ Included ☐ Not Applicable

If These Sources Will Be on the Project Site …	… Then Your SWQMP Shall Consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **A.** Onsite storm drain inlets ❑ Not Applicable	☑ Locations of inlets.	☑ Mark all inlets with the words "No Dumping! Flows to Bay" or similar.	☑ Maintain and periodically repaint or replace inlet markings. ☑ Provide storm water pollution prevention information to new site owners, lessees, or operators. ☑ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ☑ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on Drawings**	3 **Permanent Controls—List in Table and Narrative**	4 **Operational BMPs—Include in Table and Narrative**
☑ **B.** Interior floor drains and elevator shaft sump pumps ❑ Not Applicable		☑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	☑ Inspect and maintain drains to prevent blockages and overflow.
❑ **C.** Interior parking garages ☑ Not Applicable		❑ State that parking garage floor drains will be plumbed to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
☑ **D1.** Need for future indoor & structural pest control ❑ Not Applicable		☑ Note building design features that discourage entry of pests.	☑ Provide Integrated Pest Management information to owners, lessees, and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **D2.** Landscape/ Outdoor Pesticide Use ❑ Not Applicable	❑ Show locations of existing trees or areas of shrubs and ground cover to be undisturbed and retained. ❑ Show self-retaining landscape areas, if any. ❑ Show storm water treatment facilities.	State that final landscape plans will accomplish all of the following. ❑ Preserve existing drought tolerant trees, shrubs, and ground cover to the maximum extent possible. ❑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. ❑ Where landscaped areas are used to retain or detain storm water, specify plants that are tolerant of periodic saturated soil conditions. ❑ Consider using pest-resistant plants, especially adjacent to hardscape. ❑ To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	❑ Maintain landscaping using minimum or no pesticides. ❑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ❑ Provide IPM information to new owners, lessees and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **E.** Pools, spas, ponds, decorative fountains, and other water features. ❑ Not Applicable	❑ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	❑ If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, “Fountain and Pool Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **F.** Food service ❑ Not Applicable	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to ensure that the largest items can be accommodated.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **G.** Refuse areas ❑ Not Applicable	❑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run- on and show locations of berms to prevent runoff from the area. Also show how the designated area will be protected from wind dispersal. ☑ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	❑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on- site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative Table and Narrative**
❑ **H.** Industrial processes. ❑ Not Applicable	❑ Show process area.	❑ If industrial processes are to be located onsite, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.) ❑ Not Applicable	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or runoff from area and protected from wind dispersal. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release Prevention Program ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **J.** Vehicle and Equipment Cleaning ❑ Not Applicable	❑ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle /equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited onsite and hoses are provided with an automatic shut- off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	❑ If a car wash area is not provided, describe measures taken to discourage onsite car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ❑ Wash water from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ Car dealerships and similar may rinse cars with water only. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **K.** Vehicle/Equipment Repair and Maintenance ❑ Not Applicable	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to protect from rainfall, run-on runoff, and wind dispersal. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinse water from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **L.** Fuel Dispensing Areas ❑ Not Applicable	❑ Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are (1) graded at the minimum slope necessary to prevent ponding; and (2) separated from the rest of the site by a grade break that prevents run-on of storm water to the MEP. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area1.] The canopy [or cover] shall not drain onto the fueling area.		❑ The property owner shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

1. The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
M. Loading Docks ❑ Not Applicable	☑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☑ Move loaded and unloaded items indoors as soon as possible. ☑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **N.** Fire Sprinkler Test Water ❑ Not Applicable		☑ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☑ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
O. Miscellaneous Drain or Wash Water ❑ Boiler drain lines ☑ Condensate drain lines ☑ Rooftop equipment ❑ Drainage sumps ❑ Roofing, gutters, and trim ❑ Not Applicable		❑ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☑ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☑ Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ❑ Any drainage sumps onsite shall feature a sediment sump to reduce the quantity of sediment in pumped water. ❑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
☑ **P.** Plazas, sidewalks, and parking lots. ❑ Not Applicable			☑ Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Wash water containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

Maintain the grading buffer zone to preserve existing vegetation. Maintenance & frequency is the same as the landscaping.

4.2.3 Annual BMP Operation and Maintenance Verification

The BMP owner must verify annually that the O&M Plan is being implemented by submitting a self-certification statement to the City. The verification must include a record of inspection of the BMPs prior to the rainy season (October 1st of each year). Parties responsible for the O&M Plan shall retain records for at least 5 years. These documents shall be made available to the City for inspection upon request at any time.

BF-1
Biofiltration

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

Biofiltration facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Biofiltration facilities have limited or no infiltration. They are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Typical biofiltration components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure

Normal Expected Maintenance

Biofiltration requires routine maintenance to: remove accumulated materials such as sediment, trash or debris; maintain vegetation health; maintain infiltration capacity of the media layer; replenish mulch; and maintain integrity of side slopes, inlets, energy dissipators, and outlets. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The BMP is not drained between storm events. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.
- Sediment, trash, or debris accumulation greater than 25% of the surface ponding volume within one month. This means the load from the tributary drainage area is too high, reducing BMP function or clogging the BMP. This would require pretreatment measures within the tributary area draining to the BMP to intercept the materials. Pretreatment components, especially for sediment, will extend the life of components that are more expensive to replace such as media, filter course, and aggregate layers.
- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

Biofiltration is a vegetated structural BMP. Vegetated structural BMPs that are constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of the United States Army Corps of Engineers, SDRWQCB, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, **routine maintenance is key to preventing this scenario**.

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintenance when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintenance when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION (Continued from previous page)		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintenance when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/
California Storm Water Quality Association (CASQA). 2003. Municipal BMP Handbook.
https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook
County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html
San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet BF-1.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

RECORDING REQUESTED BY:

CITY OF VISTA

WHEN RECORDED MAIL TO:

CITY OF VISTA
200 CIVIC CENTER DRIVE
VISTA, CA 92084-6275
ATTN: CITY CLERK

Fee Exempt: Government Code Section 27383

APN: 219-011-88
DTT: $0.00; R&TC § 11922, Conveyance to Government Agency; Signed:________________________

PRIVATE STORM WATER POLLUTION CONTROL FACILITIES MAINTENANCE AGREEMENT

THIS AGREEMENT is entered into between the **CITY OF VISTA**, a chartered municipal corporation ("CITY") and **NAME,** status ("OWNER"), and dated for reference purposes as of date.

DEFINITIONS

BEST MANAGEMENT PRACTICES: Control measures ("BMPs") taken to mitigate changes to both quantity and quality of urban runoff as they may be defined or promulgated from time-to-time in the City's NPDES storm water management permit.

GOVERNING APPROVALS: C xxx; LD #xxx; GP(s) xxx; and DWG No(s). xxx

PROPERTY: Real property legally described in Exhibit A [and commonly known as][with no common street address].

FACILITIES: Those certain private storm water pollution control facilities ("SWPCFs") and appurtenances developed or installed on the PROPERTY as detailed in the GOVERNING APPROVALS as the same may be amended from time to time through changes in the governing ordinances and statutes.

WATER QUALITY TECHNICAL REPORT: The approved plan (the "WQTR") is designed to mitigate changes to both quantity and quality of urban runoff from the PROPERTY. The plan was initially approved by the City with GOVERNING APPROVALS, is on file with the City, and shall be modified from time-to-time pursuant to the City's then-current NPDES storm water management permit.

RECITALS

A. This Agreement is required as a condition of approval by the CITY.

B. The OWNER is the owner of the PROPERTY and is required to install and provide for the perpetual maintenance of the FACILITIES as a condition of being permitted to develop the PROPERTY.

C. It is the mutual desire of the parties hereto that the FACILITIES be maintained in a safe and usable condition by the OWNER.

D. It is the mutual intention of the parties that this Agreement constitutes a covenant running with the land, binding upon each successive lot owner of all or any portion of the PROPERTY.

NOW, THEREFORE, IT IS HEREBY AGREED AS FOLLOWS:

1. The cost and expense of maintaining the FACILITIES shall be paid by the OWNER or the heirs, assigns and successors in interest of the OWNER.

2. Repairs and maintenance under this Agreement shall consist of all work reasonably necessary or proper in the sole discretion of the CITY to repair and preserve FACILITIES. Repair and maintenance responsibilities for all post-construction structural FACILITIES and required BMPs associated with the project are set forth in the most current WQTR. The WQTR shall all times specify by name, title, and phone number the persons or entities responsible for maintenance and reporting activity, the persons or entities responsible for funding, schedules and procedures for inspection and maintenance of the FACILITIES and implementation of worker training requirements, and any other activities necessary to ensure BMP maintenance. The plan shall provide for servicing of all post-construction structural FACILITIES as needed and at least once annually within 60 days prior to October 1st, and for the retention of inspection and maintenance records for at least three years. Adherence to the plan shall result in effective Storm Water pollution control. The CITY shall have the right to inspect the FACILITIES and records as needed to ensure the FACILITIES are being properly maintained.

3. OWNER Indemnification.

3.1. The OWNER shall indemnify and hold the CITY harmless against any and all liability, loss, damage, fine, penalty, expense, claim, or cost (including without limitation costs and fees of litigation) of every nature (collectively, “Liability”) arising out of or in connection with this Agreement or its performance (including acts of omission) except for Liability caused by the CITY’s sole negligence or willful misconduct.

3.2 For purposes of this Section, the CITY includes CITY’s officers, officials, employees, agents, representatives, and volunteers.

3.3 It is expressly understood and agreed that the foregoing provisions will survive termination of this Agreement.

3.4 The indemnity protections provided by this Section are not intended to exceed the indemnity available under applicable law. If the indemnity protections are found by a court to be unlawful in any way, the protection shall be curtailed or adjusted, but only to the minimum extent required to conform to applicable law.

4. If in the CITY’S sole judgment the FACILITIES are not being maintained to standards set forth in this Agreement, the CITY may thereupon provide written notice to the OWNER to initiate repairs or construction within ninety (90) days. Upon failure to demonstrate good faith to make repairs or construction within ninety (90) days, the OWNER agrees that the CITY may make all needed repairs to the FACILITIES to meet the standards set forth in paragraph 3 and to then assess costs to the OWNER.

5. CITY shall have no responsibility or liability for the exercise or non-exercise of any discretionary powers it may have under this Agreement. Nothing in this Agreement, the specifications or other contract documents relating to the work required by this Agreement, or CITY approval of the plans and specifications or inspection of the work, is intended to create any contractual liability, express or implied, for the construction, maintenance or repair of the FACILITIES required by this Agreement, and the CITY, CITY’S engineer, and their consultants, and each of their officials, directors, officers, employees and agents, shall have absolutely no responsibility or liability therefor.

6. If CITY elects to make necessary repairs in accordance with paragraph 5 above, that work shall be without warranty. The repairs shall be accepted “as is” by the OWNER without any warranty of workmanship and shall be guaranteed and indemnified by it in accordance with paragraph 4. CITY will endeavor to minimize interference with OWNER’s use of the PROPERTY.

7. The foregoing covenants shall run with the land, shall be deemed to be for the direct benefit of the land, and shall be binding on the heirs, executors, administrators, successors, and assigns of the OWNER. Any subsequent purchaser of all or any portion thereof, by acceptance of delivery of a deed and/or conveyance regardless of form, shall be deemed to have consented to and become bound by these presents.

8. Nothing in this Agreement shall be construed to in any way limit or constrain CITY's exercise of its regulatory powers, police powers, or other powers of enforcement insofar as they may relate to the subject matter of this Agreement or any other matter within the power or authority of the CITY.

9. This Agreement shall be governed by the laws of the State of California. In the event that any of the provisions of this Agreement are held to be unenforceable or invalid by any court of competent jurisdiction, the validity, and enforceability of the remaining provisions shall not be affected thereby. The exclusive jurisdiction and venue of any legal action instituted in connection with this Agreement shall be San Diego County, California.

"CITY"	"OWNER"
CITY OF VISTA, a chartered municipal corporation	**South Santa Fe Housing Associates L.P.** **Community Housing Works**
By:________________________________ GREGORY D. MAYER, CITY ENGINEER	By:________________________________
	Name/Title
	By:________________________________
	Name/Title (When signing as Corporation necessary signatures are President OR Vice President AND Secretary OR Assistant Secretary.)

NOTE: A CALIFORNIA ALL PURPOSE NOTARY ACKNOWLEDGMENT MUST BE ATTACHED FOR ALL SIGNATURES ABOVE

ATTEST:
KATHY VALDEZ, CITY CLERK

By:________________________________

APPROVED AS TO FORM:
DAROLD PIEPER, CITY ATTORNEY

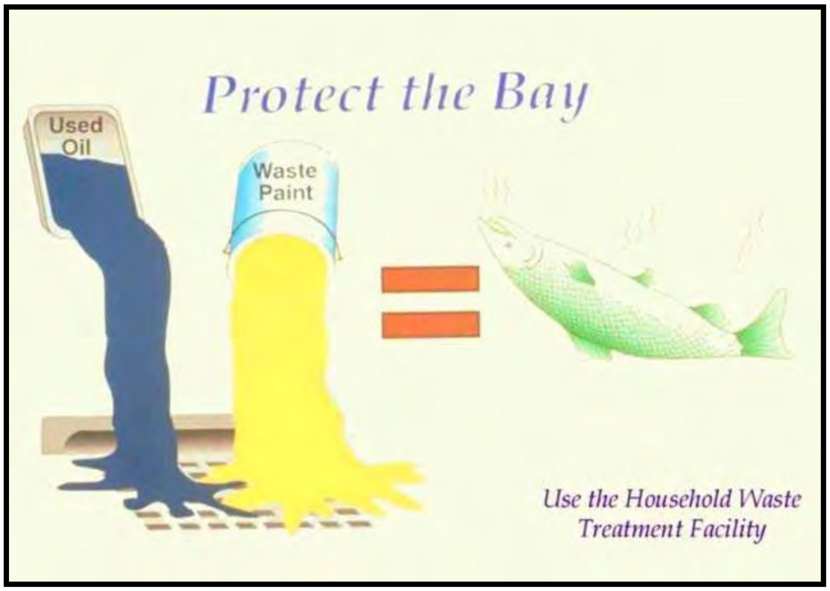
By:________________________________

ATTACHMENT 1

DMA Map

ATTACHMENT 2

BMP Fact Sheets CASQA



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

CASQA California Stormwater Quality Association

Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of “as-built” piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the “as-built” piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post “No Dumping” signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.

- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.

- Cost for containment and disposal is borne by the discharger.

- Illicit connections can be difficult to locate especially if there is groundwater infiltration.

- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.

- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes

- Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a “non-stormwater” discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State’s General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility’s SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.

- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California’s Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

Photo Credit: Geoff Brosseau

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

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Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

■ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

■ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

■ If consistent illegal dumping is observed at the facility:

- Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
- Landscaping and beautification efforts may also discourage illegal dumping.
- Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

■ Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

■ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

■ Routine maintenance:

- Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

Training

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- A Spill Prevention Control and Countermeasure Plan (SPCC) is required for facilities that are subject to the oil pollution regulations specified in Part 112 of Title 40 of the Code of Federal Regulations or if they have a storage capacity of 10,000 gallons or more of petroleum. (Health and Safety Code 6.67)

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage “topping-off’ of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Waste Handling & Disposal SC-34

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓
Oxygen Demanding	✓

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, re-use, and recycling; and preventing runon and runoff.

Approach

Pollution Prevention

- Reduction in the amount of waste generated can be accomplished using the following source controls such as:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

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Suggested Protocols

General

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater runon and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage or leaks regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Place waste containers under cover if possible.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be

disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g. sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil storm drains on the facility's property with prohibitive message regarding waste disposal.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers protected from vandalism, and in compliance with fire and hazardous waste codes.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.

Runon/Runoff Prevention

- Prevent stormwater runon from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent the waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropyleneor hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Inspection

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training
- Train staff pollution prevention measures and proper disposal methods.
- Train employees and contractors proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention
- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.
- Vehicles transporting waste should have spill prevention equipment that can prevent spills during transport. The spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

Other Considerations
- Hazardous waste cannot be re-used or recycled; it must be disposed of by a licensed hazardous waste hauler.

Requirements
Costs
- Capital and operation and maintenance costs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance
- None except for maintaining equipment for material tracking program.

Supplemental Information

Further Detail of the BMP

Land Treatment System

- Minimize the runoff of polluted stormwater from land application of municipal waste on-site by:
  - Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, there is a closed drainage system.
  - Avoiding application of waste to the site when it is raining or when the ground is saturated with water.
  - Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site.
  - Maintaining adequate barriers between the land application site and the receiving waters. Planted strips are particularly good.
  - Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins.
  - Performing routine maintenance to ensure the erosion control or site stabilization measures are working.

References and Resources

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Associations (BASMAA). On-line: http://www.basmaa.org

- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.

- Train employees and contractors in proper techniques for spill containment and cleanup.

- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.

- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.

- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.

- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.

- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building Repair and Construction SC-42

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Recycle

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

CASQA
California Stormwater Quality Association

Description

Modifications are common particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

Approach

Pollution Prevention

- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practical.

- Buy recycled products to the maximum extent practical.

- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.

- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Suggested Protocols

Repair & Remodeling

- Follow BMPs identified in Construction BMP Handbook.

- Maintain good housekeeping practices while work is underway.

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Cover materials of particular concern that must be left outside, particularly during the rainy season.

- Do not dump waste liquids down the storm drain.

- Dispose of wash water, sweepings, and sediments properly.

- Store materials properly that are normally used in repair and remodeling such as paints and solvents.

- Sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout if when repairing roofs, small particles have accumulated in the gutter. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.

- Properly store and dispose waste materials generated from construction activities. See Construction BMP Handbook.

- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.

- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.

- Develop paint handling procedures for proper use, storage, and disposal of paints.

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.

- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.

- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100% effective.

- Transfer and load paint and hot thermoplastic away from storm drain inlets.

- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is significant risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Training

Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Limitations

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more requirements for larger projects. The companion "Construction Best Management Practice Handbook" contains specific guidance and best management practices for larger-scale projects.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.

Requirements

Costs

These BMPs are generally low to modest in cost.

Maintenance

N/A

Supplemental Information

Further Detail of the BMP

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. See Treatment Control Fact Sheet TC-20 Wet Pond/Basin in Section 5 of the New Development and Redevelopment Handbook regarding design criteria. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

CASQA California Stormwater Quality Association

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

CASQA California Stormwater Quality Association

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:

  - Immediate repair of any deterioration threatening structural integrity.

  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.

- Keep accurate logs of the number of catch basins cleaned.

- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.

- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.

- Conduct routine maintenance at each pump station.

- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.

- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?

- Record locations of apparent illegal discharges/illicit connections?

- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.

- Eliminate the discharge once the origin of flow is established.

■ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

■ Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

■ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.

■ Establish a system for tracking incidents. The system should be designed to identify the following:

- Illegal dumping hot spots

- Types and quantities (in some cases) of wastes

- Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

■ Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.

■ Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

■ Train crews in proper maintenance activities, including record keeping and disposal.

■ Allow only properly trained individuals to handle hazardous materials/wastes.

■ Have staff involved in detection and removal of illicit connections trained in the following:

- OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.

- Clean up all spills and leaks using “dry” methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

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King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Vegetated Swale TC-30

Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

Targeted Constituents

	Constituent	Effectiveness
☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

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- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.

- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.

- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.

- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.

- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data

Study	Removal Efficiencies (% Removal)						Type
	TSS	TP	TN	NO_3	Metals	Bacteria	
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.

- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.

- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately \$0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately \$0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost Low	Unit Cost Moderate	Unit Cost High	Total Cost Low	Total Cost Moderate	Total Cost High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]...............	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c].............	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]...........	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]........	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]..	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]......................	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	--	–	--	–	--	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	--	–	--	–	--	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right)$ x swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	$0.85 / 1,000 ft²/ mowing	$0.14 / linear foot	$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	$9.00 / 1,000 ft²/ year	$0.18 / linear foot	$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	$0.10 / linear foot / year	$0.10 / linear foot	$0.10 / linear foot	–
Grass Reseeding with Mulch and Fertilizer	$0.30 / yd²	$0.01 / linear foot	$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	$0.15 / linear foot / year, plus $25 / inspection	$0.15 / linear foot	$0.15 / linear foot	Inspect four times per year
Total	--	**$0.58 / linear foot**	**$ 0.75 / linear foot**	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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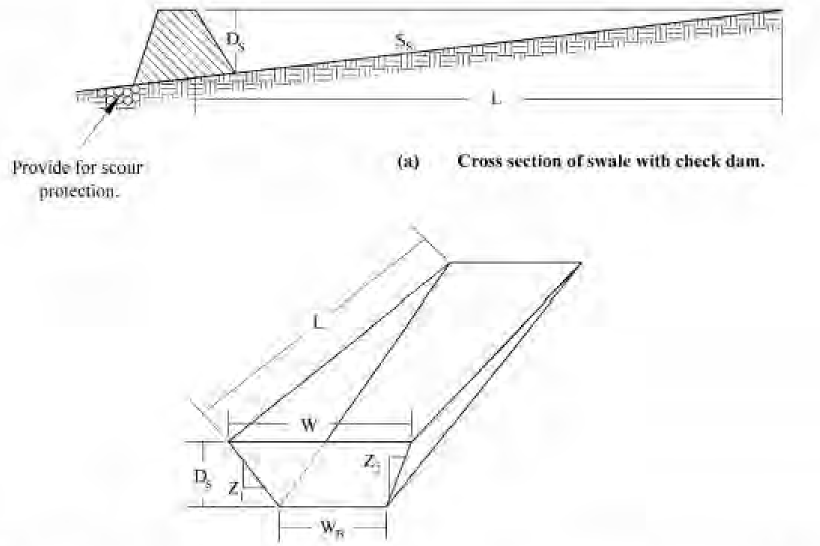

(a) Cross section of swale with check dam.

(b) Dimensional view of swale impoundment area.

Notation:

L = Length of swale impoundment area per check dam (ft)
D_S = Depth of check dam (ft)
S_S = Bottom slpe of swale (ft/ft)
W = Top width of check dam (ft)
W_B = Bottom width of check dam (ft)
$Z_{1\&2}$ = Ratio of horizontal to vertical change in swale side slope (ft/ft)

Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).

- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

Targeted Constituents

✓	Sediment	■
✓	Nutrients	▲
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

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be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretcntion is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft^2 of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

Pollutant	Removal Rate
Total Phosphorus	70-83%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-80%
Total Suspended Solids	90%
Organics	90%
Bacteria	90%

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at $111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of $24,000 (PGDER, 1993). And a new residential development spent a total of approximately $100,000 using bioretention cells on each lot instead of nearly $400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

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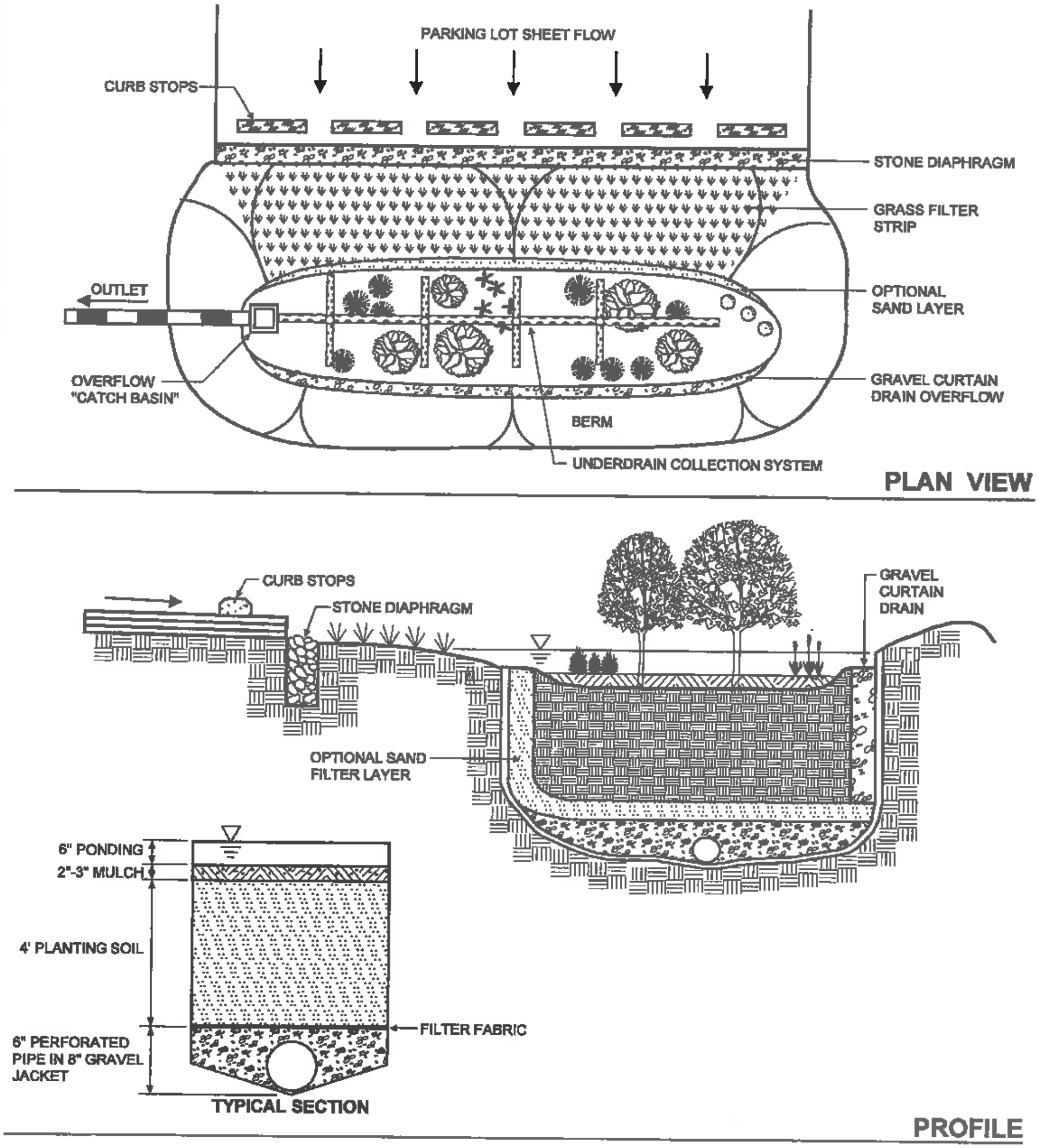

Schematic of a Bioretention Facility (MDE, 2000)

Design Considerations

- Aesthetics
- Hydraulic Head

Description

Stormwater media filters are usually two-chambered including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber. There are a number of design variations including the Austin sand filter, Delaware sand filter, and multi-chambered treatment train (MCTT).

California Experience

Caltrans constructed and monitored five Austin sand filters, two MCTTs, and one Delaware design in southern California. Pollutant removal was very similar for each of the designs; however operational and maintenance aspects were quite different. The Delaware filter and MCTT maintain permanent pools and consequently mosquito management was a critical issue, while the Austin style which is designed to empty completely between storms was less affected. Removal of the top few inches of sand was required at 3 of the Austin filters and the Delaware filter during the third year of operation; consequently, sizing of the filter bed is a critical design factor for establishing maintenance frequency.

Advantages

- Relatively high pollutant removal, especially for sediment and associated pollutants.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

Targeted Constituents

☑	Sediment	■
☑	Nutrients	●
☑	Trash	■
☑	Metals	■
☑	Bacteria	▲
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

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- More expensive to construct than many other BMPs.
- May require more maintenance that some other BMPs depending upon the sizing of the filter bed.
- Generally require more hydraulic head to operate properly (minimum 4 feet).
- High solids loads will cause the filter to clog.
- Work best for relatively small, impervious watersheds.
- Filters in residential areas can present aesthetic and safety problems if constructed with vertical concrete walls.
- Certain designs (e.g., MCTT and Delaware filter) maintain permanent sources of standing water where mosquito and midge breeding is likely to occur.

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.
- Filter bed sized to discharge the capture volume over a period of 48 hours.
- Filter bed 18 inches thick above underdrain system.
- Include energy dissipation in the inlet design to reduce resuspension of accumulated sediment.
- A maintenance ramp should be included in the design to facilitate access to the sedimentation and filter basins for maintenance activities (particularly for the Austin design).
- Designs that utilize covered sedimentation and filtration basins should be accessible to vector control personnel via access doors to facilitate vector surveillance and controlling the basins if needed.

Construction/Inspection Considerations

- Tributary area should be completely stabilized before media is installed to prevent premature clogging.

Performance

The pollutant removal performance of media filters and other stormwater BMPs is generally characterized by the percent reduction in the influent load. This method implies a relationship between influent and effluent concentrations. For instance, it would be expected that a device that is reported to achieve a 75% reduction would have an effluent concentration equal to 25% of the influent concentrations. Recent work in California (Caltrans, 2002) on various sand filter designs indicates that this model for characterizing performance is inadequate. Figure 4 presents a graph relating influent and effluent TSS concentrations for the Austin full sedimentation design.

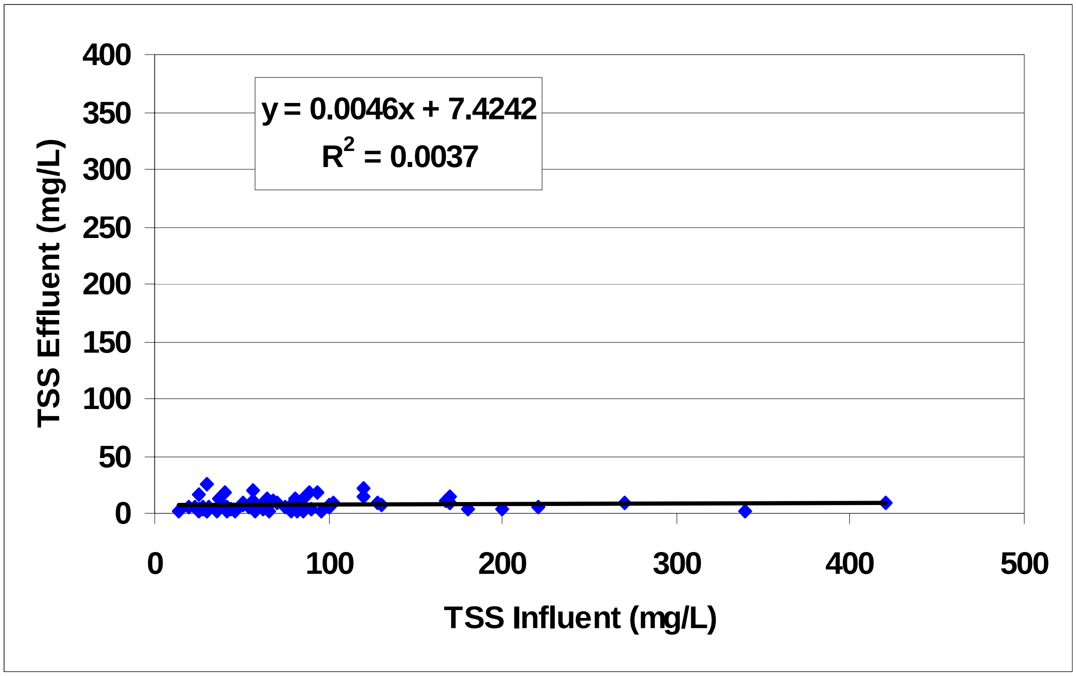

Figure 4
Comparison of Influent and Effluent Concentrations for TSS

It is clearly evident that the effluent concentration is relative constant and independent of influent concentration. Consequently, the performance is more accurately characterized by the effluent concentration, which is about 7.5 mg/L. Constant effluent concentrations also are observed for all other particle related constituents such as particulate metals (total - dissolved) and particulate phosphorus.

The small uncertainty in the estimate of the mean effluent concentration highlights the very consistent effluent quality for TSS produced by sand filters. In addition, it demonstrates that a calculated percent reduction for TSS and other constituents with similar behavior for Austin sand filters is a secondary characteristic of the device and depends primarily on the specific influent concentrations observed. The distinction between a constant effluent quality and a percent reduction is extremely important to recognize if the results are to be used to estimate effluent quality from sand filters installed at other sites with different influent concentrations or for estimating compliance with water quality standards for storms with high concentrations of particulate constituents.

If the conventionally derived removal efficiency (90%) were used to estimate the TSS concentrations in the treated runoff from storms with high influent concentrations, the estimated effluent concentration would be too high. For instance, the storm with the highest observed influent concentration (420 mg/L) would be expected to have a concentration in the treated runoff of 42 mg/L, rather than the 10 mg/L that was measured. In fact, the TSS effluent concentrations for all events with influent concentrations greater than 200 mg/L were 10 mg/L or less.

The stable effluent concentration of a sand filter under very different influent TSS concentrations implies something about the properties of the influent particle size distribution. If one assumes that only the smallest size fraction can pass through the filter, then the similarity in effluent concentrations suggests that there is little difference in the total mass of the smallest sized particles even when the total TSS concentration varies greatly. Further, the difference in TSS concentration must then be caused by changes in the relative amount of the larger size fractions. Further research is necessary to determine the range of particle size that is effectively removed in the filter and the portion of the size fraction of suspended solids that it represents in urban stormwater.

Sand filters are effective stormwater management practices for pollutant removal. Conventional removal rates for all sand filters and organic filters are presented in Table 1. With the exception of nitrates, which are always exported from filtering systems because of the conversion of ammonia and organic nitrogen to nitrate, they perform relatively well at removing pollutants.

Table 1 Sand filter removal efficiencies (percent)

	Sand Filter (Glick et al, 1998)	Compost Filter System		Multi-Chamber Treatment Train		
		Stewart, 1992	Leif, 1999	Pitt et al., 1997	Pitt, 1996	Greb et al., 1998
TSS	89	95	85	85	83	98
TP	59	41	4	80	-	84
TN	17	-	-	-	-	-
Nitrate	-76	-34	-95	-	14	-
Metals	72-86	61-88	44-75	65-90	91-100	83-89
Bacteria	65	-	-	-	-	-

From the few studies available, it is difficult to determine if organic filters necessarily have higher removal efficiencies than sand filters. The MCTT may have high pollutant removal for some constituents, although an evaluation of these devices by the California Department of Transportation indicated no significant difference for most conventional pollutants.

In addition to the relatively high pollutant removal in media filters, these devices, when sized to capture the channel forming storm volume, are highly effective at attenuating peak flow rates and reducing channel erosion.

Siting Criteria

In general, sand filters are preferred over infiltration practices, such as infiltration trenches, when contamination of groundwater with conventional pollutants is of concern. This usually occurs in areas where underlying soils alone cannot treat runoff adequately - or ground water tables are high. In most cases, sand filters can be constructed with impermeable basin or chamber bottoms, which help to collect, treat, and release runoff to a storm drainage system or directly to surface water with no contact between contaminated runoff and groundwater. In regions where evaporation exceeds rainfall and a wet pond would be unlikely to maintain the required permanent pool, a sand filtration system can be used.

The selection of a sand filter design depends largely on the drainage area's characteristics. For example, the Washington, D.C. and Delaware sand filter systems are well suited for highly impervious areas where land available for structural controls is limited, since both are installed underground. They have been used to treat runoff from parking lots, driveways, loading docks, service stations, garages, airport runways/taxiways, and storage yards. The Austin sand filtration system is more suited for large drainage areas that have both impervious and pervious surfaces. This system is located at grade and is used to treat runoff from any urban land use.

It is challenging to use most sand filters in very flat terrain because they require a significant amount of hydraulic head (about 4 feet), to allow flow through the system. One exception is the perimeter sand filter, which can be applied with as little as 2 feet of head.

Sand filters are best applied on relatively small sites (up to 25 acres for surface sand filters and closer to 2 acres for perimeter or underground filters). Filters have been used on larger drainage areas, of up to 100 acres, but these systems can clog when they treat larger drainage areas unless adequate measures are provided to prevent clogging, such as a larger sedimentation chamber or more intensive regular maintenance.

When sand filters are designed as a stand-alone practice, they can be used on almost any soil because they can be designed so that stormwater never infiltrates into the soil or interacts with the ground water. Alternatively, sand filters can be designed as pretreatment for an infiltration practice, where soils do play a role.

Additional Design Guidelines

Pretreatment is a critical component of any stormwater management practice. In sand filters, pretreatment is achieved in the sedimentation chamber that precedes the filter bed. In this chamber, the coarsest particles settle out and thus do not reach the filter bed. Pretreatment reduces the maintenance burden of sand filters by reducing the potential for these sediments to clog the filter. When pretreatment is not provided designers should increase the size of the filter area to reduce the clogging potential. In sand filters, designers should select a medium sand as the filtering medium. A fine aggregate (ASTM C-33) that is intended for use in concrete is commonly specified.

Many guidelines recommend sizing the filter bed using Darcy's Law, which relates the velocity of fluids to the hydraulic head and the coefficient of permeability of a medium. The resulting equation, as derived by the city of Austin, Texas, (1996), is

$$Af = WQV\ d/[k\ t\ (h+d)]$$

Where:

Af = area of the filter bed (ft^2);

d = depth of the filter bed (ft; usually about 1.5 feet, depending on the design);

k = coefficient of permeability of the filtering medium (ft/day);

t = time for the water quality volume to filter through the system (days; usually assumed to be 1.67 days); and

h = average water height above the sand bed (ft; assumed to be one-half of the maximum head).

Typical values for k, as assembled by CWP (1996), are shown in Table 2.

Table 2 Coefficient of permeability values for stormwater filtering practices (CWP, 1996)

Filter Medium	Coefficient of Permeability (ft/day)
Sand	3.5
Peat/Sand	2.75
Compost	8.7

The permeability of sand shown in Table 2 is extremely conservative, but is widely used since it is incorporated in the design guidelines of the City of Austin. When the sand is initially installed, the permeability is so high (over 100 ft/d) that generally only a portion of the filter area is required to infiltrate the entire volume, especially in a "full sedimentation" Austin design where the capture volume is released to the filter basin over 24 hours.

The preceding methodology results in a filter bed area that is oversized when new and the entire water quality volume is filtered in less than a day with no significant height of water on top of the sand bed. Consequently, the following simple rule of thumb is adequate for sizing the filter area. If the filter is preceded by a sedimentation basin that releases the water quality volume (WQV) to the filter over 24 hours, then

$$Af = WQV/18$$

If no pretreatment is provided then the filter area is calculated more conservatively as:

$$Af = WQV/10$$

Typically, filtering practices are designed as "off-line" systems, meaning that during larger storms all runoff greater than the water quality volume is bypassed untreated using a flow splitter, which is a structure that directs larger flows to the storm drain system or to a stabilized channel. One exception is the perimeter filter; in this design, all flows enter the system, but larger flows overflow to an outlet chamber and are not treated by the practice.

The Austin design variations are preferred where there is sufficient space, because they lack a permanent pool, which eliminates vector concerns. Design details of this variation are summarized below.

Summary of Design Recommendations

(1) Capture Volume - The facility should be sized to capture the required water quality volume, preferably in a separate pretreatment sedimentation basin.

(2) Basin Geometry – The water depth in the sedimentation basin when full should be at least 2 feet and no greater than 10 feet. A fixed vertical sediment depth marker should be installed in the sedimentation basin to indicate when 20% of the basin volume has been lost because of sediment accumulation. When a pretreatment sedimentation basin is provided the minimum average surface area for the sand filter (Af) is calculated from the following equation:

$$Af = WQV/18$$

If no pretreatment is provided then the filter area is calculated as:

$$Af = WQV/10$$

(3) Sand and Gravel Configuration - The sand filter is constructed with 18 inches of sand overlying 6 inches of gravel. The sand and gravel media are separated by permeable geotextile fabric and the gravel layer is situated on geotextile fabric. Four-inch perforated PVC pipe is used to drain captured flows from the gravel layer. A minimum of 2 inches of gravel must cover the top surface of the PVC pipe. Figure 5 presents a schematic representation of a standard sand bed profile.

(4) Sand Properties – The sand grain size distribution should be comparable to that of "washed concrete sand," as specified for fine aggregate in ASTM C-33.

(5) Underdrain Pipe Configuration – In an Austin filter, the underdrain piping should consist of a main collector pipe and two or more lateral branch pipes, each with a minimum diameter of 4 inches. The pipes should have a minimum slope of 1% (1/8 inch per foot) and the laterals should be spaced at intervals of no more than 10 feet. There should be no fewer than two lateral branch pipes. Each individual underdrain pipe should have a cleanout access location. All piping is to be Schedule 40 PVC. The maximum spacing between rows of perforations should not exceed 6 inches.

(6) Flow Splitter - The inflow structure to the sedimentation chamber should incorporate a flow-splitting device capable of isolating the capture volume and bypassing the 25-year peak flow around the facility with the sedimentation/filtration pond full.

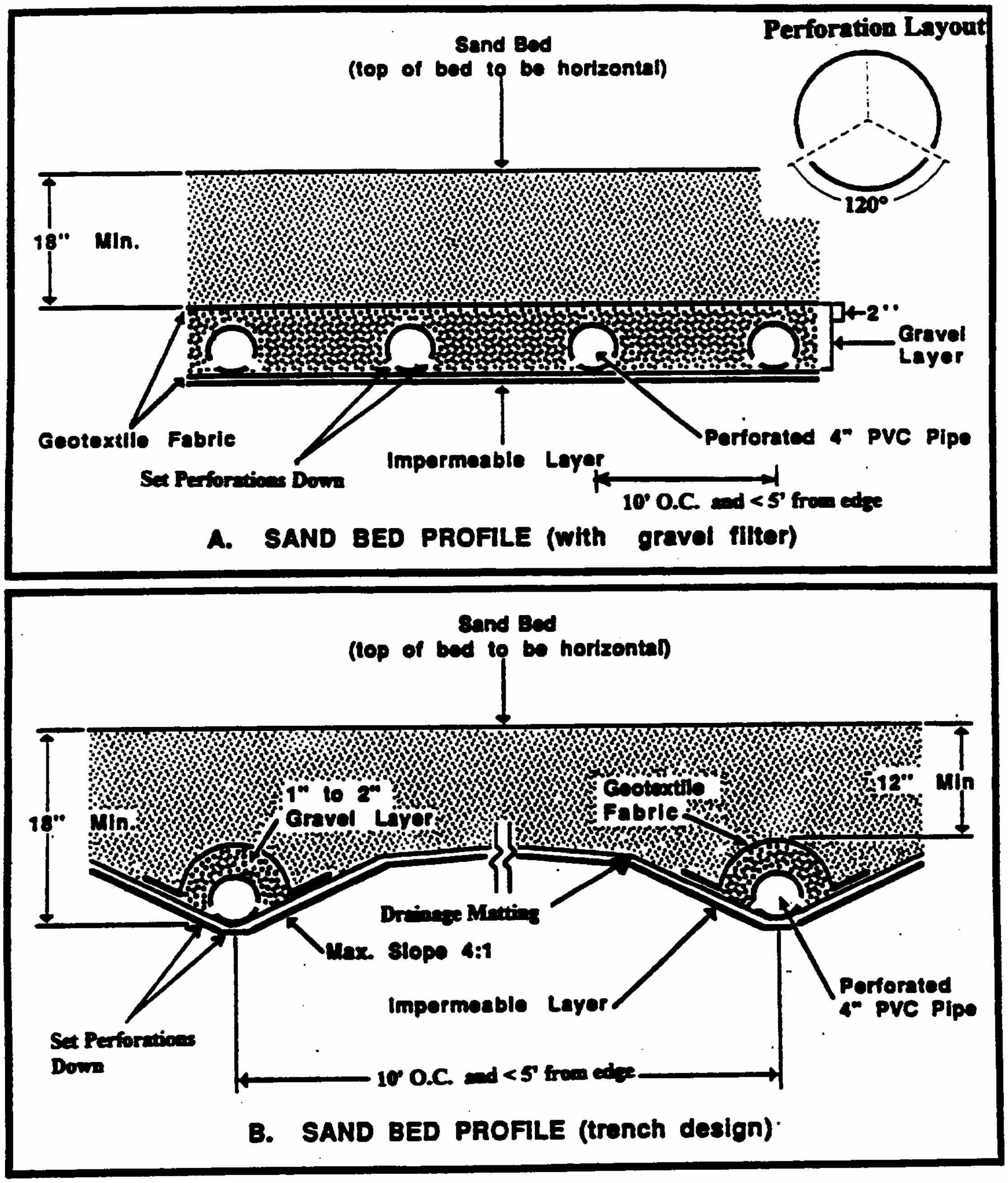

Figure 5
Schematic of Sand Bed Profile

(7) Basin Inlet – Energy dissipation is required at the sedimentation basin inlet so that flows entering the basin should be distributed uniformly and at low velocity in order to prevent resuspension and encourage quiescent conditions necessary for deposition of solids.

(8) Sedimentation Pond Outlet Structure - The outflow structure from the sedimentation chamber should be (1) an earthen berm; (2) a concrete wall; or (3) a rock gabion. Gabion outflow structures should extend across the full width of the facility such that no short-circuiting of flows can occur. The gabion rock should be 4 inches in diameter. The

receiving end of the sand filter should be protected (splash pad, riprap, etc.) such that erosion of the sand media does not occur. When a riser pipe is used to connect the sedimentation and filtration basins (example in Figure 6), a valve should be included to isolate the sedimentation basin in case of a hazardous material spill in the watershed. The control for the valve must be accessible at all times, including when the basin is full. The riser pipe should have a minimum diameter of 6 inches with four 1-inch perforations per row. The vertical spacing between rows should be 4 inches (on centers).

(9) Sand Filter Discharge – If a gabion structure is used to separate the sedimentation and filtration basins, a valve must installed so that discharge from the BMP can be stopped in case runoff from a spill of hazardous material enters the sand filter. The control for the valve must be accessible at all times, including when the basin is full.

Maintenance

Even though sand filters are generally thought of as one of the higher maintenance BMPs, in a recent California study an average of only about 49 hours a year were required for field activities. This was less maintenance than was required by extended detention basins serving comparable sized catchments. Most maintenance consists of routine removal of trash and debris, especially in Austin sand filters where the outlet riser from the sedimentation basin can become clogged.

Most data (i.e. Clark, 2001) indicate that hydraulic failure from clogging of the sand media occurs before pollutant breakthrough. Typically, only the very top of the sand becomes clogged while the rest remains in relative pristine condition as shown in Figure 7. The rate of clogging has been related to the TSS loading on the filter bed (Urbonas, 1999); however, the data are quite variable. Empirical observation of sites treating urban and highway runoff indicates that clogging of the filter occurs after 2 – 10 years of service. Presumably, this is related to differences in the type and amount of sediment in the catchment areas of the various installations. Once clogging occurs the top 2 – 3 inches of filter media is removed, which restores much, but not all, of the lost permeability. This removal of the surface layer can occur several times before the entire filter bed must be replaced. The cost of the removal of the surface layer is not prohibitive, generally ranging between $2,000 (EPA Fact Sheet) and $4,000 (Caltrans, 2002) depending on the size of the filter.

Media filters can become a nuisance due to mosquito and midge breeding in certain designs or if not regularly maintained. "Wet" designs (e.g., MCTT and Delaware filter) are more conducive to vectors than others (e.g., Austin filters) because they maintain permanent sources of standing water where breeding is likely to occur. Caltrans successfully excluded mosquitoes and midges from accessing the permanent water in the sedimentation basin of MCTT installations through use of a tight-fitting aluminum cover to seal vectors out. However, typical wet designs may require routine inspections and treatments by local mosquito and vector control agencies to suppress mosquito production. Vector habitats may also be created in "dry" designs when media filters clog, and/or when features such as level spreaders that hold water over 72 hours are included in the installation. Dry designs such as Austin filters should dewater completely (recommended 72 hour residence time or less) to prevent creating mosquito and other vector habitats. Maintenance efforts to prevent vector breeding in dry designs will need to focus on basic housekeeping practices such as removal of debris accumulations and vegetation management (in filter media) to prevent clogs and/or pools of standing water.

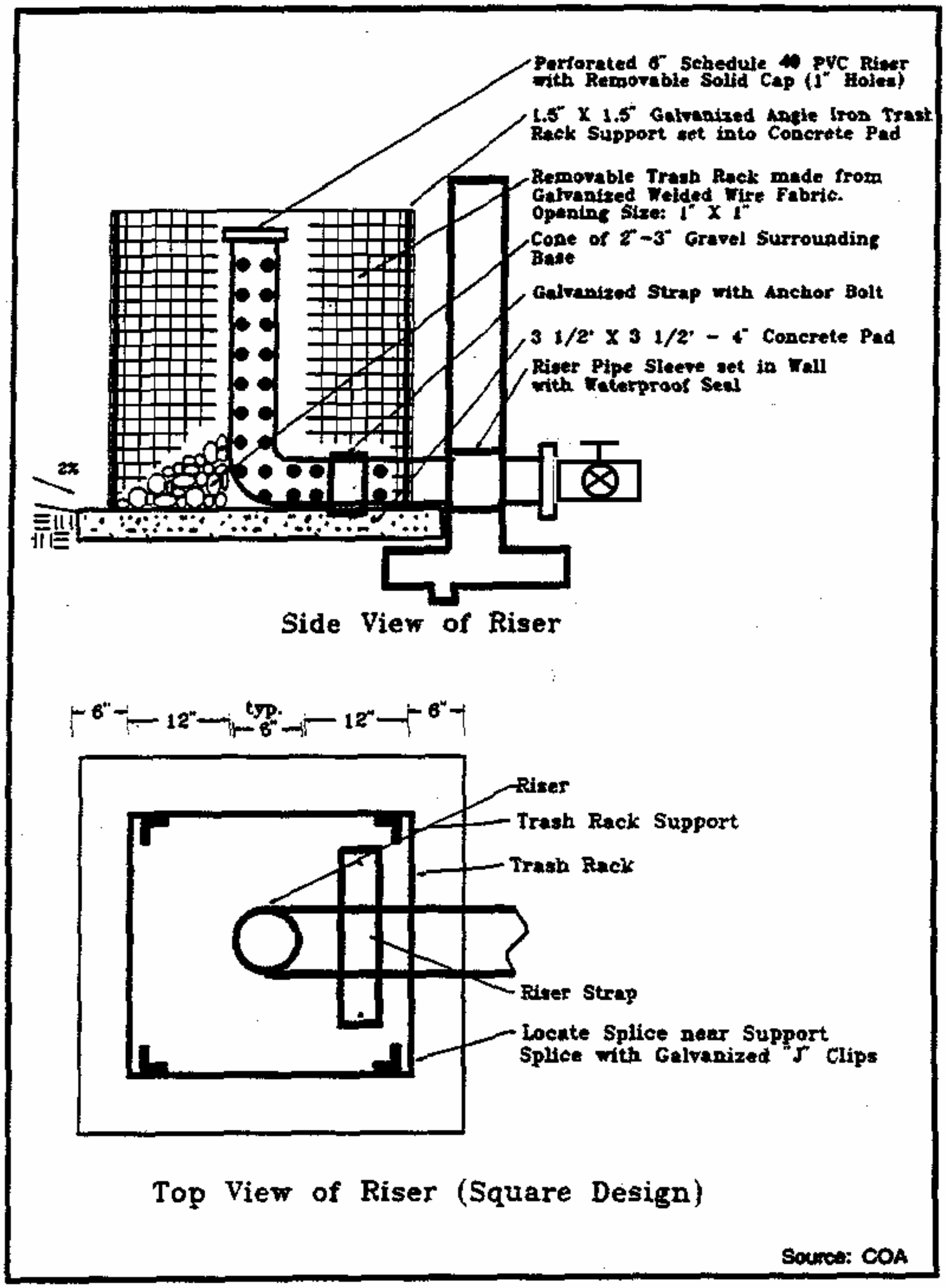

Figure 6
Detail of Sedimentation Riser Pipe

Figure 7
Formation of Clogging Crust on Filter Bed

Recommended maintenance activities and frequencies include:

- Inspections semi-annually for standing water, sediment, trash and debris, and to identify potential problems.
- Remove accumulated trash and debris in the sedimentation basin, from the riser pipe, and the filter bed during routine inspections.
- Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.
- Remove top 50 mm (2 in.) of sand and dispose of sediment if facility drain time exceeds 72 hr. Restore media depth to 450 mm (18 in.) when overall media depth drops to 300 mm (12 in.).
- Remove accumulated sediment in the sedimentation basin every 10 yr or when the sediment occupies 10 percent of the basin volume, whichever is less.

Cost

Construction Cost

There are few consistent published data on the cost of sand filters, largely because, with the exception of Austin, Texas, Alexandria, Virginia, and Washington, D.C., they have not been widely used. Furthermore, filters have such varied designs that it is difficult to assign a cost to filters in general. A study by Brown and Schueler (1997) was unable to find a statistically valid relationship between the volume of water treated in a filter and the cost of the practice. The EPA filter fact sheet indicates a cost for an Austin sand filter at $18,500 (1997 dollars) for a 0.4 hectare- (1 acre-)

drainage area. However, the same design implemented at a 1.1 ha site by the California Department of Transportation, cost $240,000. Consequently, there is a tremendous uncertainty about what the average construction cost might be.

It is important to note that, although underground and perimeter sand filters can be more expensive than surface sand filters, they consume no surface space, making them a relatively cost-effective practice in ultra-urban areas where land is at a premium.

Given the number of facilities installed in the areas that promote their use it should be possible to develop fairly accurate construction cost numbers through a more comprehensive survey of municipalities and developers that have implemented these filters.

Maintenance Cost

Annual costs for maintaining sand filter systems average about 5 percent of the initial construction cost (Schueler, 1992). Media is replaced as needed, with the frequency correlated with the solids loading on the filter bed. Currently the sand is being replaced in the D.C. filter systems about every 2 years, while an Austin design might last 3-10 years depending on the watershed characteristics. The cost to replace the gravel layer, filter fabric and top portion of the sand for D.C. sand filters is approximately $1,700 (1997 dollars).

Caltrans estimated future maintenance costs for the Austin design, assuming a device sized to treat runoff from approximately 4 acres. These estimates are presented in Table 3 and assume a fully burdened hourly rate of $44 for labor. This estimate is somewhat uncertain, since complete replacement of the filter bed was not required during the period that maintenance costs were recorded.

Table 3 Expected Annual Maintenance Costs for an Austin Sand Filter

Activity	Labor Hours	Equipment and Materials ($)	Cost
Inspections	4	0	176
Maintenance	36	125	1,706
Vector Control	0	0	0
Administration	3	0	132
Direct Costs	-	888	888
Total	43	$1,013	**$2,902**

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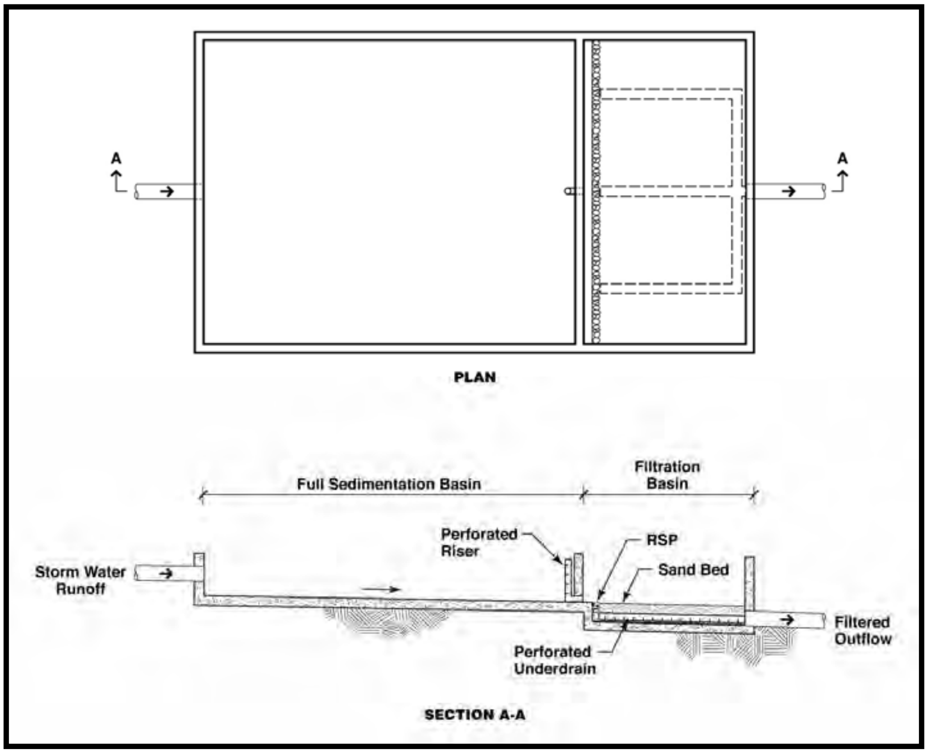
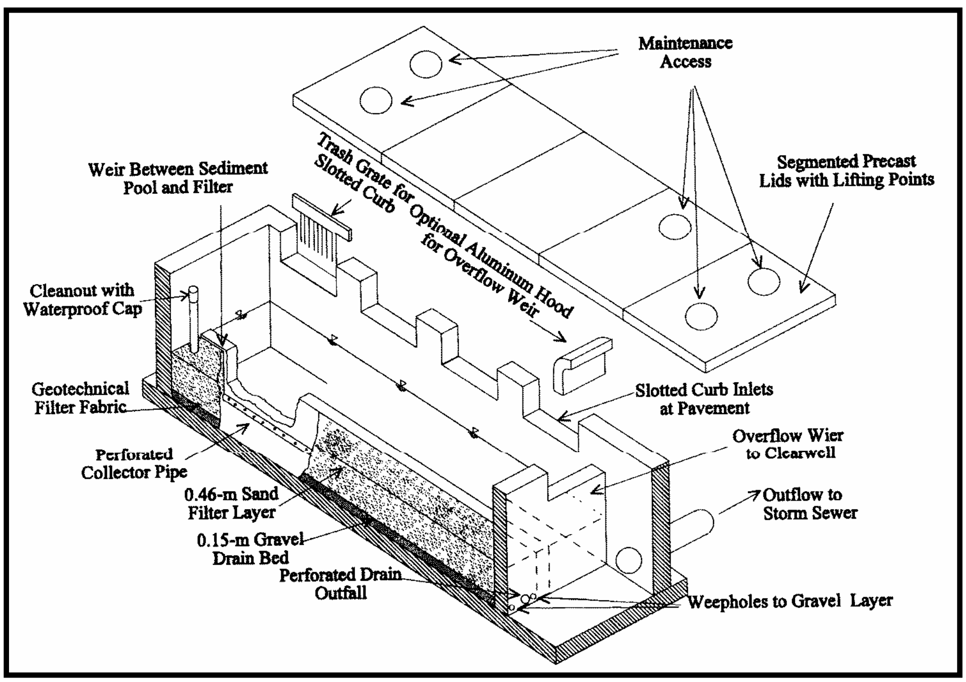
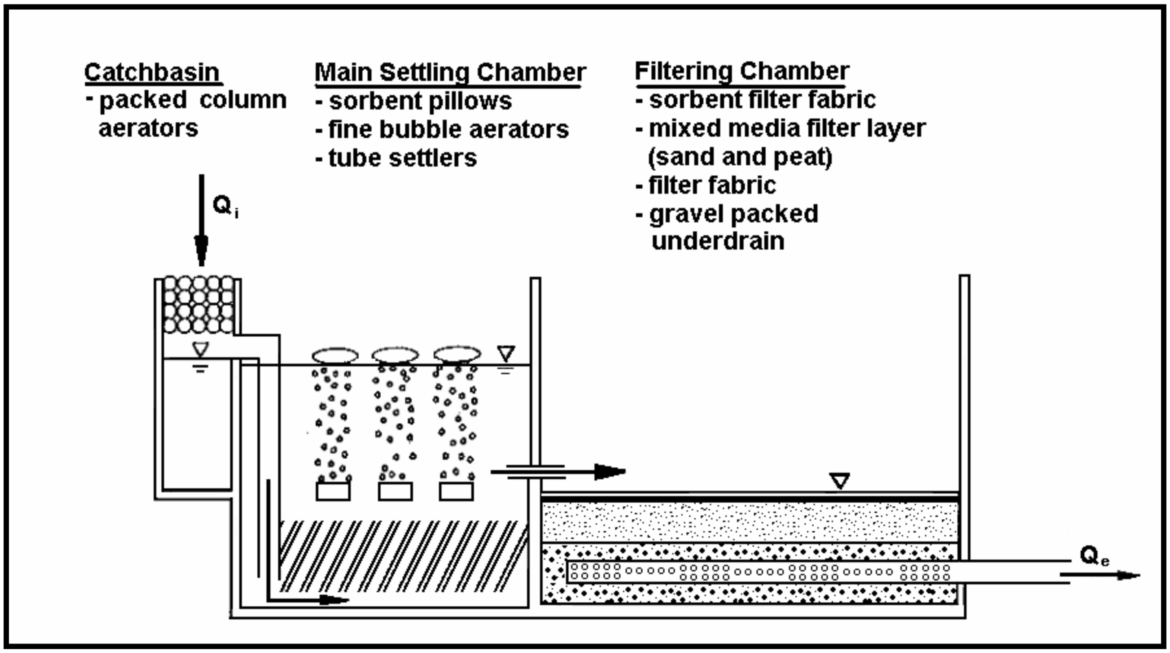


Schematic of the "Full Sedimentation" Austin Sand Filter



Schematic of a Delaware Sand Filter (Young et al., 1996)



Schematic of a MCTT (Robertson et al., 1995)

Drain Inserts

MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

- ✓ Sediment
- ✓ Nutrients
- ✓ Trash
- ✓ Metals
- Bacteria
- ✓ Oil and Grease
- ✓ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

CASQA California Stormwater Quality Association

one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations
Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance
Few products have performance data collected under field conditions.

Siting Criteria
It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines
Follow guidelines provided by individual manufacturers.

Maintenance
Likely require frequent maintenance, on the order of several times per year.

Cost
- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.

- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information
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ATTACHMENT 3

Inspection Forms

PRIVATE STRUCTURAL BMP
OPERATION AND MAINTENANCE VERIFICATION FORM
FILTRATION BMPs (MEDIA FILTERS)

1. Transcribe the information from your notification letter and complete as necessary:

Permit No.: P21-0339

BMP Location:

Responsible Party:

Phone Number: ( ) **Email:**

Responsible Party Address:

Number Street Name & Suffix City/Zip

☐ *Check here for Address Change*

2. Using the Table below, describe the inspections conducted before the start of the rainy season (i.e., October 1st) and after a storm event.

3. Under "Results of Inspection", provide the date and a description of the maintenance conducted. Examples of what to look for include: accumulation of sediment, litter, grease or standing water, erosion, poor or overgrown vegetation and structural damage (see side 2 for examples). If no maintenance was required, state "no maintenance required".

Date Inspected	Results of Inspection: Work needed? (Yes/No)	Date and Description of Maintenance Conducted

4. Attach one photo per Structural BMP (required). Include copies of service invoices, receipts, or other proof of work conducted (if available). Before submitting, please scale your photos to a small or medium size per the attached instructions. Also note that the County’s email system cannot receive emails larger than 10MB.

5. Sign and submit form to:

Signature of Responsible Party **Print Name** **Date**

PRIVATE STRUCTURAL BMP
OPERATION AND MAINTENANCE VERIFICATION FORM
MEDIA FILTERS – SIDE 2

The following list of typical maintenance indicators and activities for media filters is provided for your reference. Conduct activities in a manner that do not cause an illegal discharge. Media filters may include the following: higher rate media filters (Storm Filters, Jelly Fish or Bay Filters) or sand filters.

Filtration BMPs Inspection and Maintenance Checklist	
Typical Maintenance Indicators	**Typical Maintenance Actions**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.
Accumulation of floating oil and grease	Remove and properly dispose of oil and grease.
Clogged filter media or cartridge	Remove and properly dispose of filter media or cartridge, and replace with fresh media or cartridge.
Damage to components of the filtration system	Repair or replace as applicable.
Damaged or obstructed flow diversion components (for offline systems)	Inspect flow diversion devices for damage and obstructions. Repair damage.
Mosquito larvae present (vault-based filters)	If larvae are present and persistent, contact the San Diego County Vector Control Program at (858) 694-2888. Mosquito larvicides should be applied only when necessary and by a licensed individual or contractor. For vault-based filters, exclude vectors by sealing them out, for example, by using tight-fitting aluminum covers.
Dry designs, such as sand filters have standing water (longer than 96 hours after rainfall) and/or mosquito larvae are present	Media filters may be clogged. If clogged with a crust, remove and properly dispose of filter media and replace with fresh media.

Maintenance of filtration BMPs involves handling of potentially hazardous material (oil sorbent material), which requires special disposal. Additionally, maintenance may involve entry into the filtration BMP underground. Therefore the maintenance operator must be trained in handling and disposal of hazardous waste, and must also be certified for confined space entry if the maintenance will require entry into the filtration BMP. Therefore it is recommended that private BMP owners obtain a maintenance contract with a qualified contractor to provide inspection and maintenance. There are several cleaning service providers who are able to inspect and/or maintain filtration BMPs. Contact the manufacturer of the filtration system to find qualified service providers.

PRIVATE STRUCTURAL BMP
OPERATION AND MAINTENANCE VERIFICATION FORM

FILTRATION BMPs (MEDIA FILTERS)

1. Transcribe the information from your notification letter and complete as necessary:

Permit No.: P21-0339

BMP Location:

Responsible Party:

Phone Number: ( ) **Email:**

Responsible Party Address:

Number Street Name & Suffix City/Zip

☐ *Check here for Address Change*

2. Using the Table below, describe the inspections conducted before the start of the rainy season (i.e., October 1st) and after a storm event.

3. Under "Results of Inspection", provide the date and a description of the maintenance conducted. Examples of what to look for include: accumulation of sediment, litter, grease or standing water, erosion, poor or overgrown vegetation and structural damage (see side 2 for examples). If no maintenance was required, state "no maintenance required".

Date Inspected	Results of Inspection: Work needed? (Yes/No)	Date and Description of Maintenance Conducted

4. Attach one photo per Structural BMP (required). Include copies of service invoices, receipts, or other proof of work conducted (if available). Before submitting, please scale your photos to a small or medium size per the attached instructions. Also note that the County's email system cannot receive emails larger than 10MB.

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OPERATION AND MAINTENANCE VERIFICATION FORM
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Accumulation of floating oil and grease	Remove and properly dispose of oil and grease.
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Damage to components of the filtration system	Repair or replace as applicable.
Damaged or obstructed flow diversion components (for offline systems)	Inspect flow diversion devices for damage and obstructions. Repair damage.
Mosquito larvae present (vault-based filters)	If larvae are present and persistent, contact the San Diego County Vector Control Program at (858) 694-2888. Mosquito larvicides should be applied only when necessary and by a licensed individual or contractor. For vault-based filters, exclude vectors by sealing them out, for example, by using tight-fitting aluminum covers.
Dry designs, such as sand filters have standing water (longer than 96 hours after rainfall) and/or mosquito larvae are present	Media filters may be clogged. If clogged with a crust, remove and properly dispose of filter media and replace with fresh media.

Maintenance of filtration BMPs involves handling of potentially hazardous material (oil sorbent material), which requires special disposal. Additionally, maintenance may involve entry into the filtration BMP underground. Therefore the maintenance operator must be trained in handling and disposal of hazardous waste, and must also be certified for confined space entry if the maintenance will require entry into the filtration BMP. Therefore it is recommended that private BMP owners obtain a maintenance contract with a qualified contractor to provide inspection and maintenance. There are several cleaning service providers who are able to inspect and/or maintain filtration BMPs. Contact the manufacturer of the filtration system to find qualified service providers.

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.: BMP-A
Permit No.: P21-0339	APN(s): 219-011-88-00	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 1 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Accumulation of sediment, litter, or debris Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials, without damage to the vegetation ☐ If sediment, litter, or debris accumulation exceeds 25% of the surface ponding volume within one month (25% full*), add a forebay or other pre-treatment measures within the tributary area draining to the BMP to intercept the materials. ☐ Other / Comments:		
Poor vegetation establishment Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

Date:	Inspector:	BMP ID No.: BMP-A
Permit No.: P21-0339	APN(s): 219-011-88-00	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 2 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Dead or diseased vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		
Overgrown vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Mow or trim as appropriate ☐ Other / Comments:		
2/3 of mulch has decomposed, or mulch has been removed Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.: BMP-A
Permit No.: P21-0339	APN(s): 219-011-88-00	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 3 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Erosion due to concentrated irrigation flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas and adjust the irrigation system ☐ Other / Comments:		
Erosion due to concentrated storm water runoff flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan ☐ If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.: BMP-A
Permit No.: P21-0339	APN(s): 219-011-88-00	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 4 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Obstructed inlet or outlet structure Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Underdrain clogged (inspect underdrain if standing water is observed for longer than 24-96 hours following a storm event) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Damage to structural components such as weirs, inlet or outlet structures Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.: BMP-A
Permit No.: P21-0339	APN(s): 219-011-88-00	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 5 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Standing water in BMP for longer than 24-96 hours following a storm event* Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

*Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.

**If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.

ATTACHMENT 4

Training Forms

(Schedule/Subject/Attendance Records to be Filed Here)

ATTACHMENT 4

ATTACHMENT 4 - REQUIREMENTS FOR CONSTRUCTION PLANS

Section 8.2.2 of the *BMP Design Manual* identifies minimum requirements for storm drain construction plan sheets. Use this checklist to ensure project construction plans submitted for review include necessary information for storm drain improvements. Construction plans must include the following:

☐ All items identified in Section 8.2.2 of the *BMP Design Manual*.

P21-0339

OWNER'S CERTIFICATE

I (WE) HEREBY CERTIFY THAT I (WE) AM (ARE) THE RECORD OWNER(S) OF THE PROPERTY SHOWN ON THE TENTATIVE PARCEL MAP AND THAT SAID MAP SHOWS MY (OUR) ENTIRE CONTIGUOUS OWNERSHIP (EXCLUDING SUBDIVISION LOTS). I (WE) UNDERSTAND THAT PROPERTY IS CONSIDERED AS CONTIGUOUS EVEN IF IT IS SEPARATED BY ROAD, STREET, UTILITY EASEMENTS OR RAILROAD RIGHT-OF-WAY.

OWNER'S NAME

LBA
1430 DECISION STREET
VISTA, CA 92081

APPLICANT'S NAME

LBA
1430 DECISION STREET
VISTA, CA 92081

OWNER ____ DATE: ____ APPLICANT ____ DATE: ____

DATE PREPARED

DECEMBER 2021

ENGINEER OF WORK

EXCEL ENGINEERING
440 STATE PLACE ESCONDIDO,
CA 92029 (760) 745-8118

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • GIS • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

ROBERT D. DENTINO RCE# 45629

ASSESSOR'S PARCEL NO.

219-011-88

LAND AREA

7.812 ACRES

GENERAL PLAN

RLI – RESEARCH LIGHT INDUSTRIAL

SITE ADDRESS

1430 DECISION STREET
VISTA, CA 92083

ZONING

SPI
SPECIFIC PLAN IMPLEMENTATION
VISTA BUSINESS PARK SPECIFIC PLAN

FIRE DISTRICT

CITY OF VISTA

SCHOOL DISTRICT

SAN MARCOS UNIFIED

SEWER DISTRICT

BUENA SANITATION DISTRICT

WATER DISTRICT

VISTA IRRIGATION DISTRICT

LEGAL DESCRIPTION

PARCEL C OF MAP 18692

LEGAL ACCESS

DECISION STREET

REFERENCE DRAWINGS

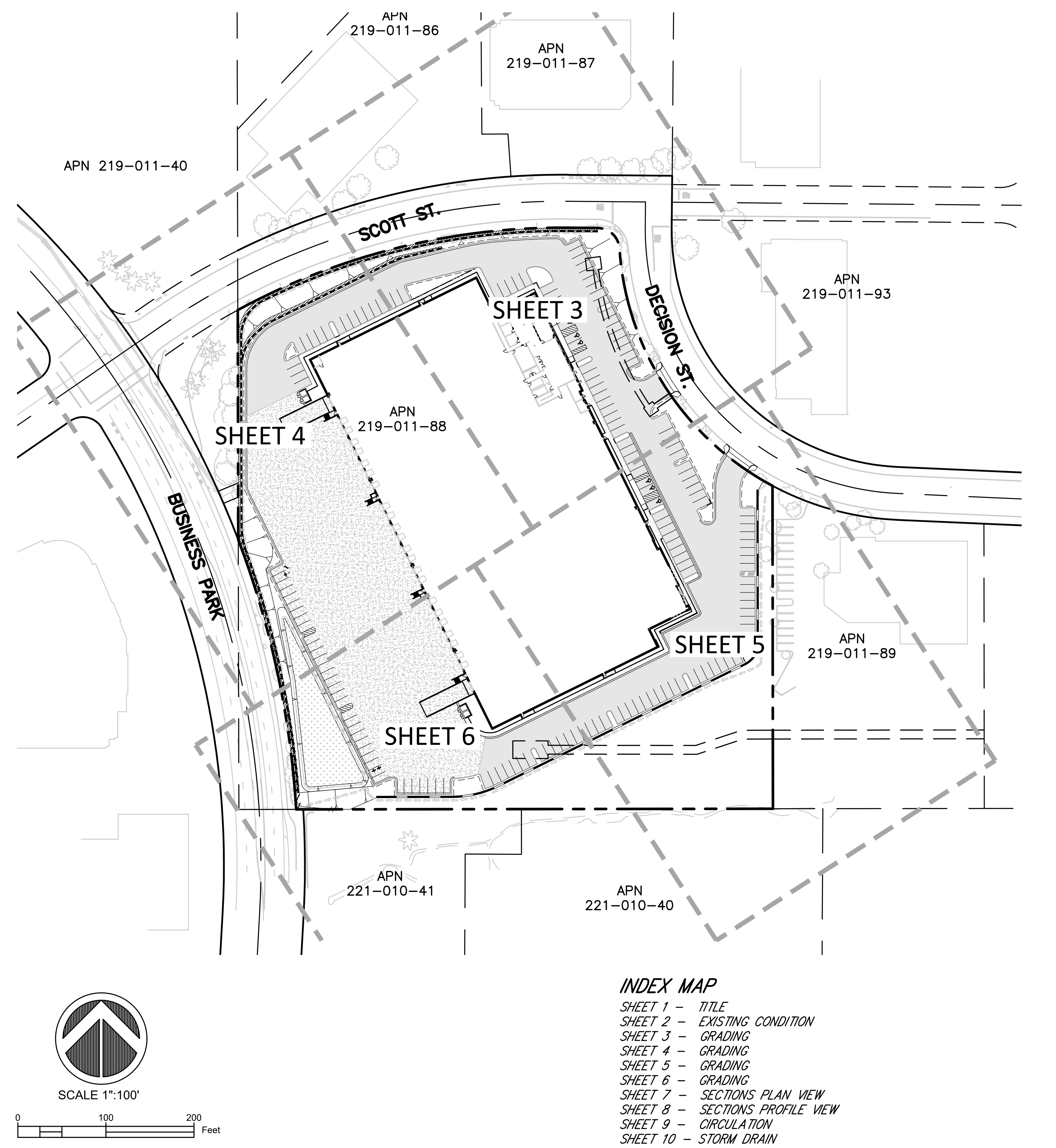
CITY OF VISTA DWGS 3590, PGP-99-30

FEMA ZONE

AS SHOWN ON FEMA PANEL 788 OF 2375; MAP 06073C0788J, DATED MAY 16, 2012, THIS PROJECT IS IN ZONE X –"AREA OF MINIMAL FLOOD HAZARD".

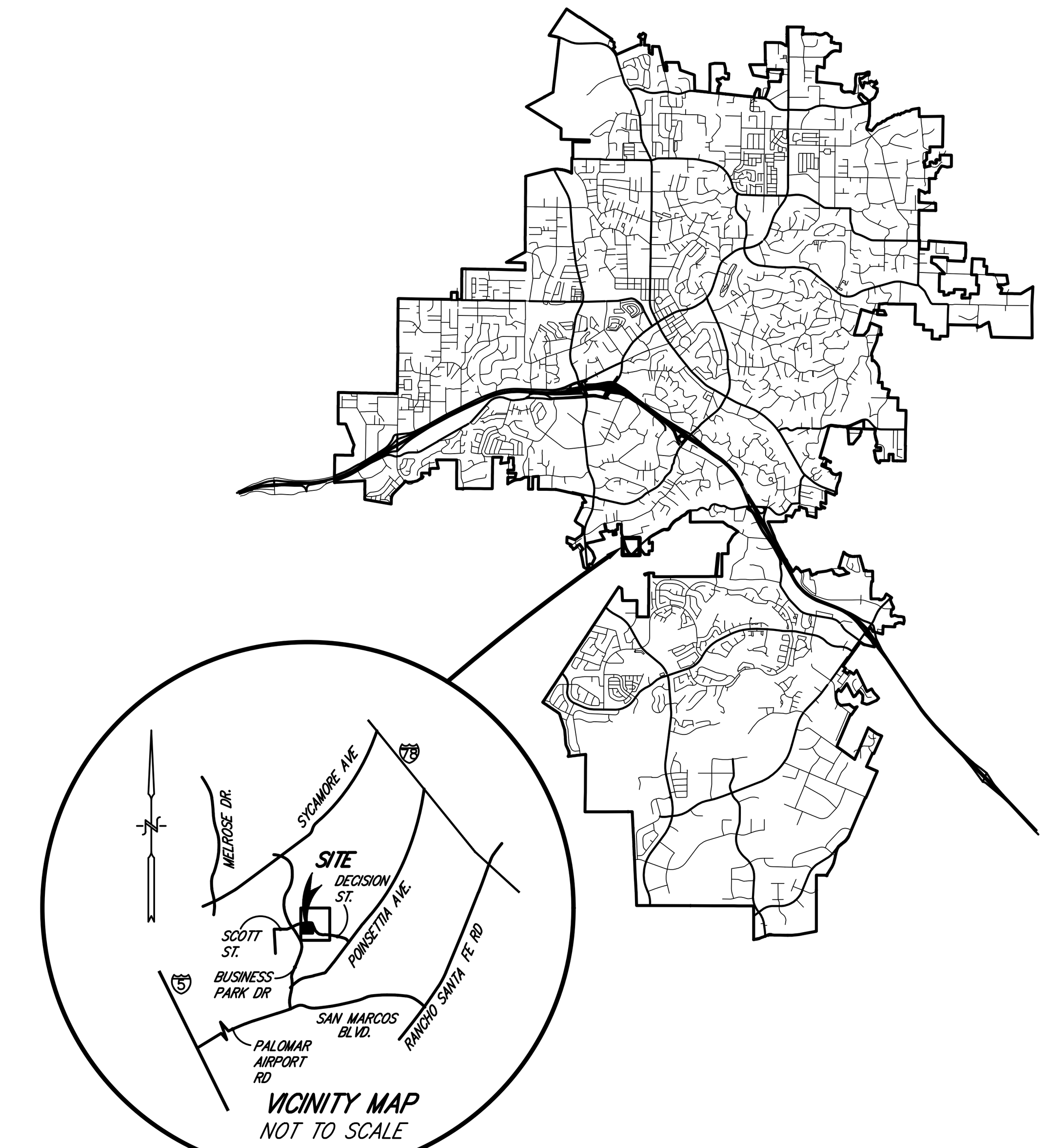
WQTR / HYDROLOGY STUDY

STUDY BY EXCEL ENGINEERING & DATED SEPTEMBER 21, 2021



INDEX MAP

SHEET 1 – TITLE
SHEET 2 – EXISTING CONDITION
SHEET 3 – GRADING
SHEET 4 – GRADING
SHEET 5 – GRADING
SHEET 6 – GRADING
SHEET 7 – SECTIONS PLAN VIEW
SHEET 8 – SECTIONS PROFILE VIEW
SHEET 9 – CIRCULATION
SHEET 10 – STORM DRAIN
SHEET 11 – DETENTION PIPE
SHEET 12 – EROSION CONTROL
SHEET 13 – EROSION CONTROL NOTES
SHEET 14 – POST DMA



VICINITY MAP
NOT TO SCALE

SOURCE OF TOPOGRAPHY

THE EXISTING TOPOGRAPHY SHOWN HEREON IS A COMBINATION OF DRONE FLIGHT TOPOGRAPHY FLOWN BY CAPTO DRONE SERVICES (DATE FLOWN: 08/10/2021), AND SUPPLEMENTAL FIELD DATA SURVEYED BY REPRESENTATIVES OF EXCEL ENGINEERING (DATE OF SITE VISIT: 08/06/2021).

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM 1983 (CCS83), ZONE 6, 2010.00 EPOCH, AND IS DETERMINED BY GPS MEASUREMENTS TAKEN ON JULY 30, 2021 AT POINTS 'A' AND 'B' (SHOWN ON SHEET 2). POINTS 'A' AND 'B' WERE ESTABLISHED FROM CONTINUOUSLY OPERATING REFERENCE STATIONS (CORS) 'P478' AND 'P474' DERIVED FROM GEODETIC VALUES PUBLISHED BY THE NATIONAL GEODETIC SURVEY (NGS).

THE BEARING BETWEEN POINTS 'A' AND 'B': NORTH 00° 04' 39" WEST

QUOTED BEARINGS FROM REFERENCE MAPS OR DEEDS MAY OR MAY NOT BE IN TERMS OF SAID SYSTEM.

THE COMBINED FACTOR AT POINT 'A': 0.99993300
GRID DISTANCE = GROUND DISTANCE x COMBINED GRID FACTOR.
ELEVATION AT POINT 'A': 562.68 (DATUM USED TO DETERMINE CGF).

CONVERGENCE ANGLE AT POINT 'A': –00° 32' 14.70"

ALL DIMENSIONS SHOWN HEREON ARE GROUND DISTANCES, UNLESS NOTED OTHERWISE.

PROJECT BENCHMARK

THE BENCHMARK FOR THIS SITE IS A CITY OF VISTA POINT, DESIGNATION "GCS6", A BRASS DISK, STAMPED "LS 6896" IN STANDARD WELL MONUMENT AT THE CENTERLINE INTERSECTION OF BUSINESS PARK DRIVE AND SCOTT STREET.

ELEVATION: 442.250 DATUM: NGVD 29

GRADING STATEMENT

PRISMOIDAL METHOD WAS USEDTO CALCULATE THE EARTHWORK VOLUME SHOWN HERE. SEE TABLE BELOW FOR DETAILS.

THE GRADING PROPOSED FOR THIS PROJECT IS AS SHOWN ON SHEETS 3 TO 6 OF THIS PLAN SET.

CUT = 25,000 CY
FILL = 25,000 CY
IMPORT = 0 CY

EARTHWORK CALCULATION DETAIL

LINE ID	ITEM DESCRIPTION	AREA (SF)	SECTION/LENGTH (FT)	VOL (CY)	ROUNDED
1	RAW CUT			4983.07	4,990.00
2	MAIN DRIVEWAY CIRCULATION (4" OVER 16") FROM SOILS	47,396.69	1.67	2,925.72	2,930.00
3	PARKING AREAS (3" OVER 7") FROM SOILS	31,534.52	0.83	973.29	980.00
4	PCC LOADING DOCK (9") FROM SOILS	55,907.49	0.75	1,552.99	1,560.00
5	BLDG FLOOR SECTION	118,305.00	0.92	4,031.13	4,040.00
6	BLDG PAD SUPPORT PER SOILS REPORT (PG. 30-31), 18" ENGINEERED FILL & 2" SAND	118,305.00	1.67	7,302.78	7,310.00
7	WQ BIO BASIN (5 FT DEEP)	7,388.77	5.00	1,368.29	1,370.00
8	DETENTION PIPES (48" RCP, 1000 LF)	12.56	1,000.00	465.19	470.00
9	TOTAL CUT			23,602.45	23,650.00
10					
11	RAW FILL			25,602.16	25,610.00
12	SHRINKAGE FROM SOILS ENGINER PG 18, 10% TO 15% (APPLIED TO RAW CUT)	4,983.07	0.15	747.46	750.00
13	TOTAL FILL			26,349.62	26,360.00
14	IMPORT (EXPECTED TO BE GENERATED FROM FOUNDATIONS & THE USE OF EXISTING ON-SITE MATERIALS)			-2,747.17	-2,710.00
15	FOR PERMITTING PURPOSES, SAY EARTHWORK IS BALANCE AT (CY)	25,000.00			

SITE DEVELOPMENT PLAN EXPIRES: ____
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ____ WDID NO. ____

DATE	REMARKS
10/08/2021	PLANNING SUBMITTAL
12/15/2021	PLANNING SUBMITTAL
	PLANNING SUBMITTAL

ENGINEER OF WORK

ENGINEER OF WORK | 45629 RCE | 12/31/2023 EXP.LIC.DATE | DATE

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

CITY of VISTA

PRELIMINARY GRADING PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER ____ RCE ____ EXPIRES ____ DATE
BENCH MARK:

SHEET 1 OF 14

P21-0339

EXCEL ENGINEERING
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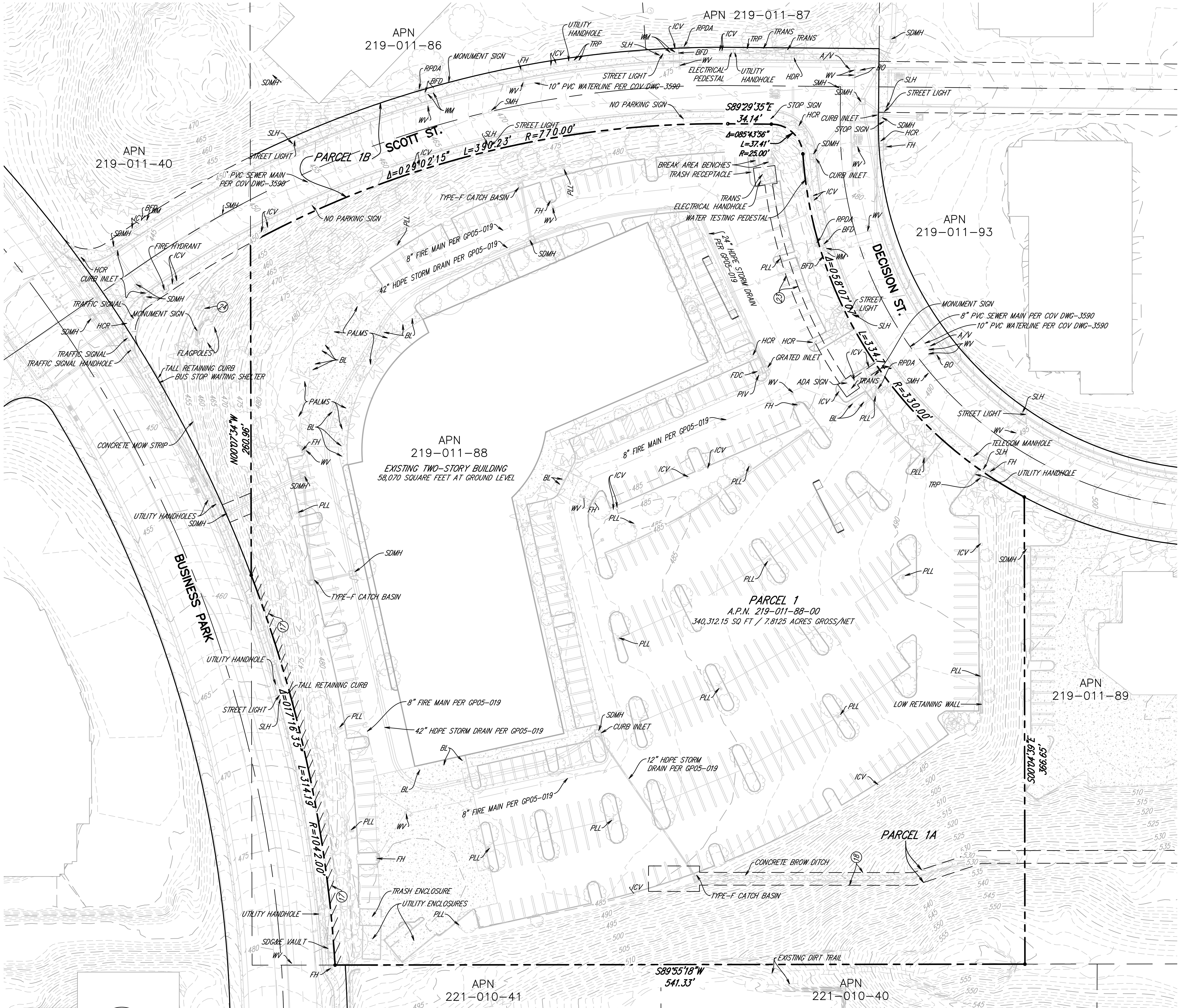
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

P21-0339



SCALE 1":40'

EXISTING EASEMENTS

(17) ABUTTER'S RIGHTS OF INGRESS AND EGRESS TO OR FROM BUSINESS PARK DRIVE HAVE BEEN DEDICATED OR RELINQUISHED ON THE MAP OF PARCEL MAP NO. 15493 OF PARCEL MAPS, RECORDED DECEMBER 13, 1988.

(18) AN EASEMENT FOR PRIVATE DRAINAGE AND INCIDENTAL PURPOSES SHOWN OR DEDICATED ON THE MAP FILED OR RECORDED MAY 03, 2001 AS PARCEL MAP NO. 18692 OF PARCEL MAPS.

(23) AN EASEMENT IN FAVOR OF SAN DIEGO GAS & ELECTRIC COMPANY FOR UNDERGROUND ELECTRIC FACILITIES, AND APPURTENANCES, UNDERGROUND COMMUNICATION FACILITIES AND APPURTENANCES, INGRESS AND EGRESS AND INCIDENTAL PURPOSES, RECORDED SEPTEMBER 16, 2005 AS INSTRUMENT NO. 2005-0802875 OF OFFICIAL RECORDS. DOCUMENT(S) DECLARING MODIFICATIONS THEREOF RECORDED JULY 07, 2006 AS INSTRUMENT NO. 2006-0480737 OF OFFICIAL RECORDS.

(24) THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "CITY OF VISTA ENCROACHMENT PERMIT – PERMIT NO. E06-0003" RECORDED JULY 07, 2006 AS INSTRUMENT NO. 0479981 OF OFFICIAL RECORDS.

(SURVEYOR'S NOTE: SAID DOCUMENT PERMITS THE INSTALLATION AND MAINTENANCE OF A MONUMENT SIGN AND FLAGPOLES WITHIN THE CITY OF VISTA'S ADJACENT PROPERTY, AS SHOWN HEREON. SAID ENCROACHMENT PERMIT IS NOT TRANSFERABLE.)

SITE DEVELOPMENT PLAN EXPIRES:

THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER

INSPECTION PRIORITY ______ WDID NO. ______

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ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

CITY of VISTA

EXISTING CONDITION FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED

FOR CITY ENGINEER ______ RCE ______ EXPIRES ______ DATE

BENCH MARK:

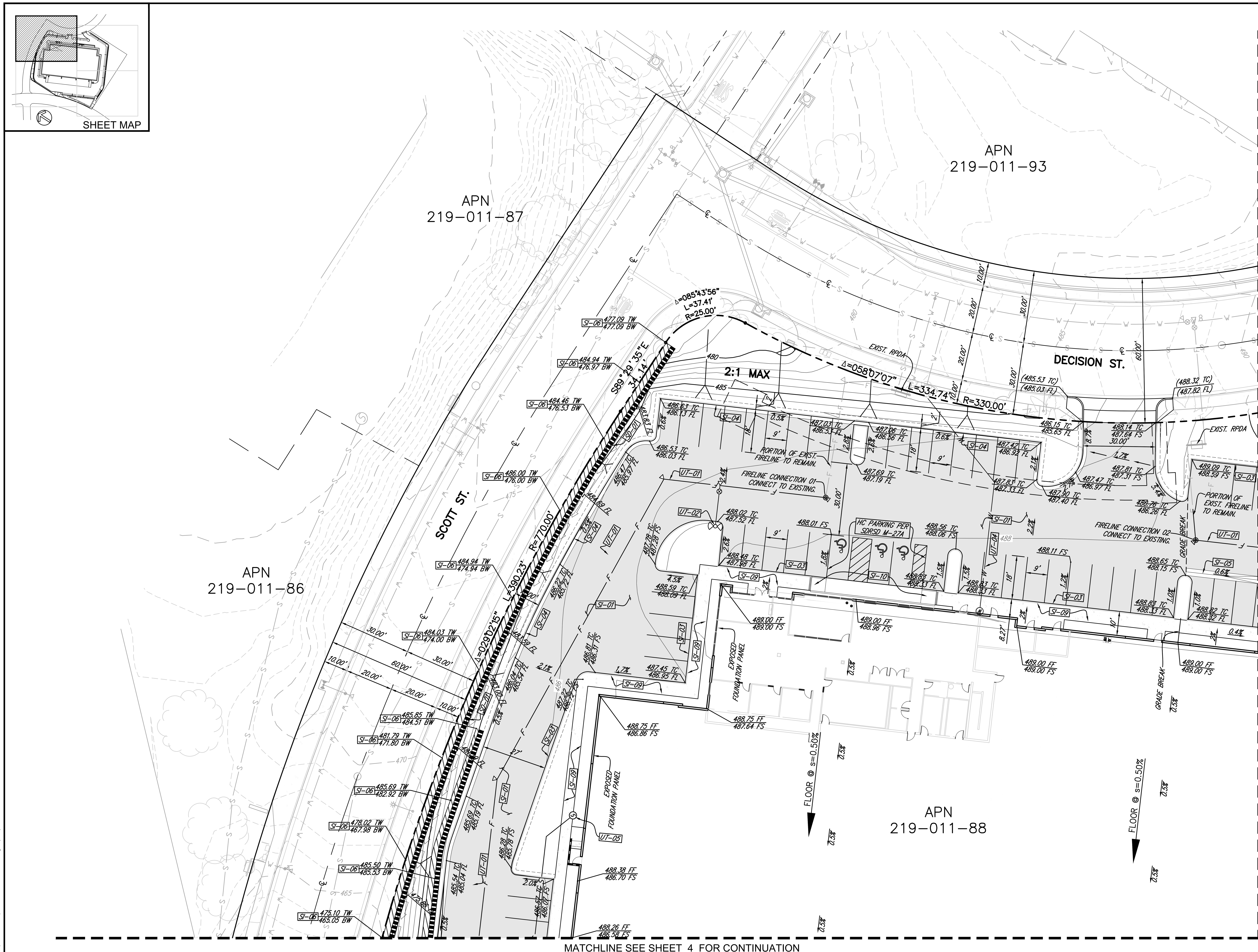
SHEET 2 OF 14

P21-0339

COV LAST REV'D: 2/10/2010 (TT)

P.C.: P21-0339 LD# ______ DWG#: ______

P21-0339



CONSTRUCTION NOTES

SURFACE IMPROVEMENTS

- SI-01 AC PAVEMENT
- SI-02 PCC PAVEMENT
- SI-03 6" PCC CURB
- SI-04 6" PCC CURB & GUTTER
- SI-05 3' WIDE PCC RIBBON GUTTER
- SI-06 NEW GEOGRID TYPE RETAINING WALL
- SI-07 SOLDIER PILE TYPE RETAINING WALL
- SI-08 3' WIDE CURB CUT @ 18' O.C. WITH RIPRAP CHUTE. RIPRAP CLASS= NO. 2 BACKING & T=1.1'.
- SI-09 PCC SIDEWALK
- SI-10 PCC RAMP
- SI-11 CMU RETAINING WALL. MAX EXPOSED HEIGHT=1.5'.

UTILITY IMPROVEMENTS

- UT-01 FIRELINE MAIN
- UT-02 FIRE HYDRANT
- UT-03 BLDG FIRE SERVICE LATERAL
- UT-04 DOMESTIC WATER SERVICE LATERAL
- UT-05 SEWER SERVICE LATERAL

STORM DRAIN / WATER QUALITY IMPROVEMENTS

SEE SHEETS 10 & 11 FOR PLAN, PROFILE & SPECS OF THE STORM DRAIN SYSTEM.

- SD-01 PCC BROW DITCH
- SD-02 STORM DRAIN INLET
- SD-03 STORM DRAIN BOX/CLEANOUT
- SD-04 STORM DRAIN PIPE
- SD-05 1,200 LF OF 48"Ø OF SD DETENTION PIPE
- SD-06 WATER QUALITY BASIN. SEE DETAILS ON SHEET 14
- SD-07 WQ BASIN OUTLET. SEE DETAILS ON SHEET 14
- SD-08 WATER QUALITY OUTLET CONTROL STRUCTURE. SEE DETAILS ON SHEET 14
- SD-09 WQ BASIN OVERFLOW INLET. TYPE C-2 CURB INLET PER SDRSD D-03A, L=20'
- SD-10 STORM DRAIN CURB OUTLET PER SDRSD D-25
- SD-11 INSTALL PVC CEANOUT AT BEND

LEGEND

- BOUNDARY LINE
- RIGHT OF WAY LINE
- PARCEL LOT LINE
- PCC CURB
- PCC CURB & GUTTER
- SEWER LINE
- WATER LINE
- FIRE LINE
- FIRE HYDRANT
- BLDG FIRE SERVICE LATERAL
- WATER SERVICE LATERAL
- SEWER SERVICE LATERAL
- STORM DRAIN INLETS / CLEANOUTS
- EXIST. TOPO MAJOR CONTOUR
- EXIST. TOPO MINOR CONTOUR
- PROPOSED TOPO MAJOR CONTOUR
- PROPOSED TOPO MINOR CONTOUR
- NEW GEOGRID TYPE RETAINING WALL
- NEW SOIL NAIL OR SOLDIER PILE TYPE RETAINING WALL

SITE DEVELOPMENT PLAN EXPIRES:
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

SCALE 1":40'
0 20 40 Feet

ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

CITY of VISTA

PRELIMINARY GRADING PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

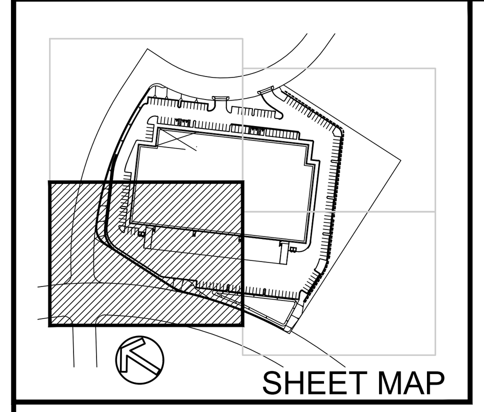
APPROVED
FOR CITY ENGINEER ______ RCE ______ EXPIRES ______ DATE ______
BENCH MARK:

SHEET 3 OF 14
P21-0339

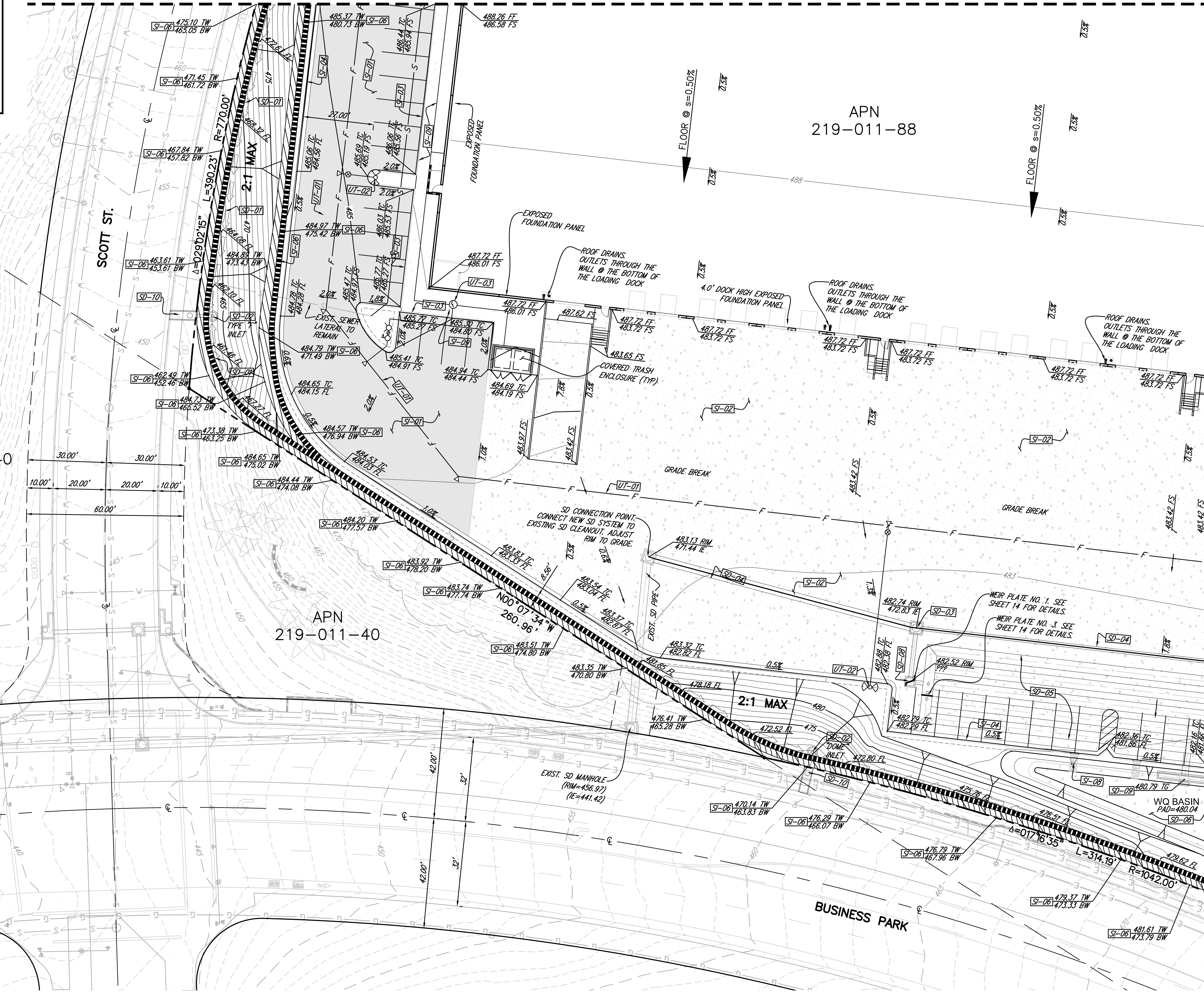
COV LAST REV'D: 2/10/2010 (TT)

P.C.: P21-0339 LD# ______ DWG#: ______

P21-0339



MATCHLINE SEE SHEET 3 FOR CONTINUATION



MATCHLINE SEE SHEET 5 FOR CONTINUATION

MATCHLINE SEE SHEET 6 FOR CONTINUATION

CONSTRUCTION NOTES

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THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ____ WDID NO. ____

CITY of VISTA

PRELIMINARY GRADING PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER ____ RCE ____ EXPIRES ____ DATE ____
BENCH MARK:

SHEET 4 OF 14
P21-0339

ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

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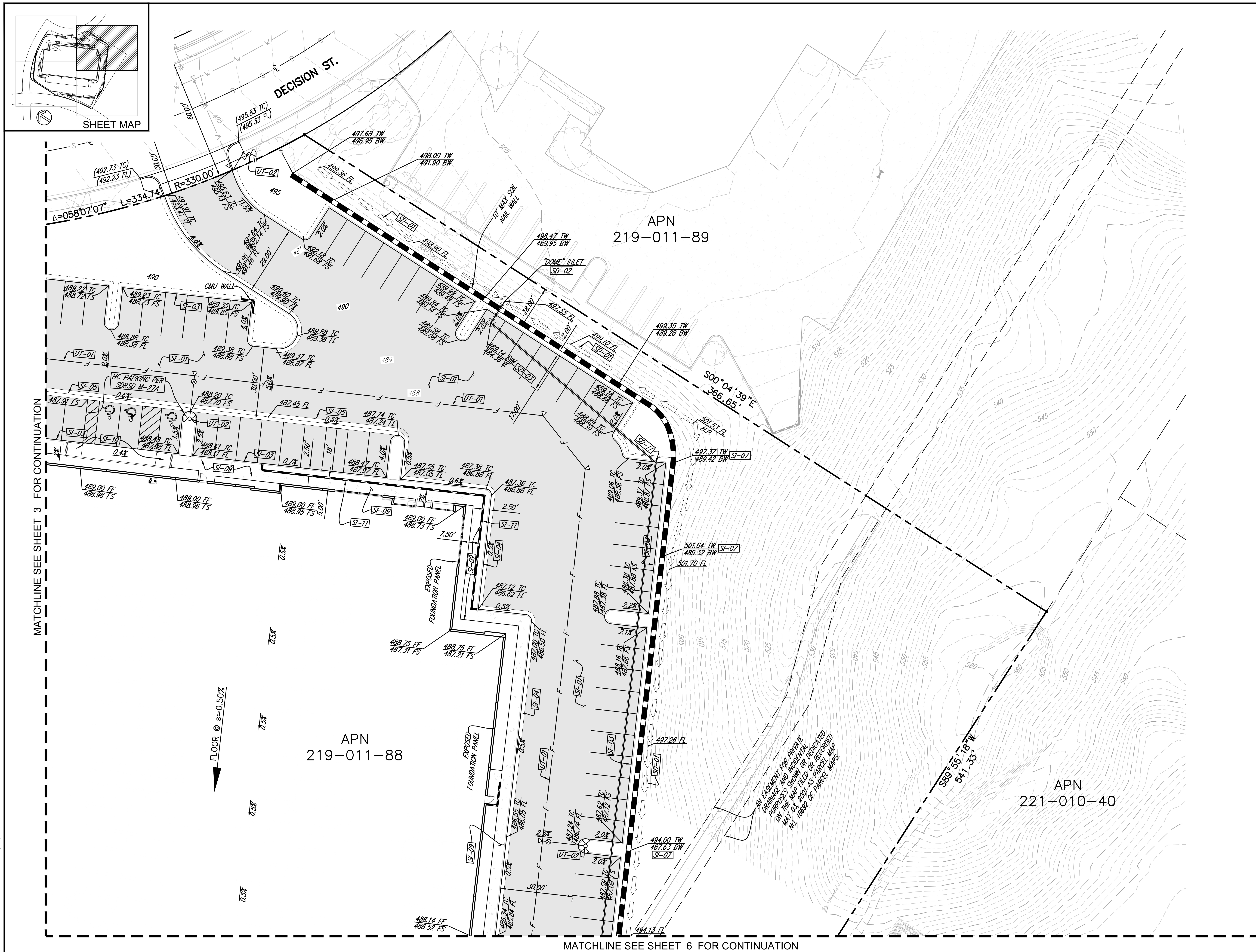
SCALE 1":40'

P21-0339



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SITE DEVELOPMENT PLAN EXPIRES:________
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

SCALE 1"=40'
0 20 40 Feet

ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

CITY of VISTA

PRELIMINARY GRADING PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER ___ RCE ___ EXPIRES ___ DATE
BENCH MARK:

SHEET 5 OF 14

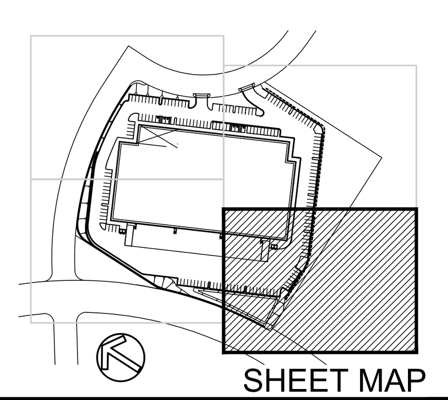
P21-0339

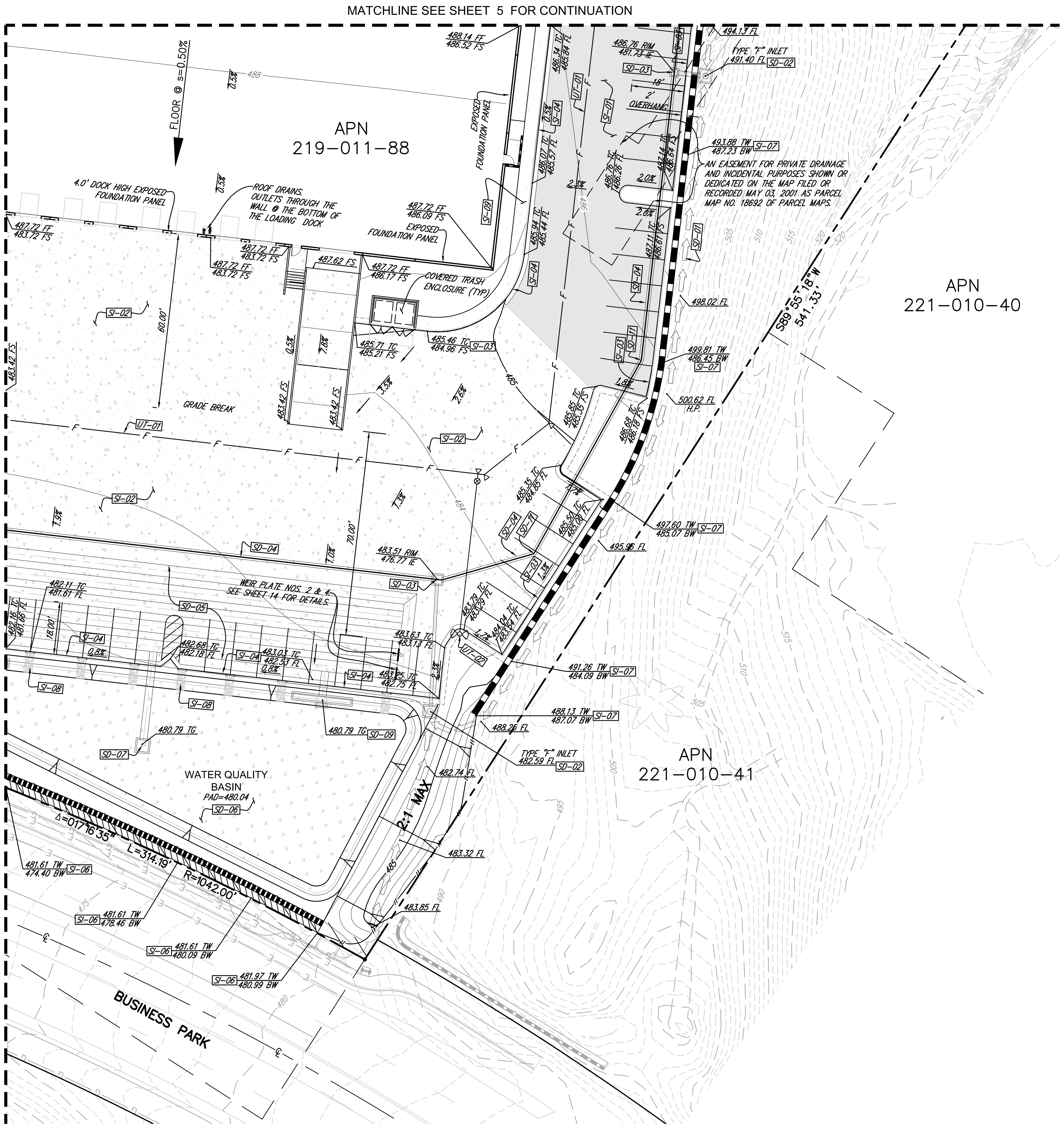
P.C.: P21-0339 LD# ______ DWG#: ______

COV LAST REV'D: 2/10/2010 (TT)

V:\21\21052\Engineering\PLOT PLAN\PRELIM GP\21052 PRELIM GP.dwg 4/13/2022 10:34 AM ORIGINAL PLOT SIZE: ----

P21-0339





CONSTRUCTION NOTES

SURFACE IMPROVEMENTS

- SI-01 AC PAVEMENT
- SI-02 PCC PAVEMENT
- SI-03 6" PCC CURB
- SI-04 6" PCC CURB & GUTTER
- SI-05 3' WIDE PCC RIBBON GUTTER
- SI-06 NEW GEOGRID TYPE RETAINING WALL
- SI-07 SOLDIER PILE TYPE RETAINING WALL
- SI-08 3' WIDE CURB CUT @ 18' O.C. WITH RIPRAP CHUTE. RIPRAP CLASS= NO. 2 BACKING & T=1.1'.
- SI-09 PCC SIDEWALK
- SI-10 PCC RAMP
- SI-11 CMU RETAINING WALL. MAX EXPOSED HEIGHT=1.5'.

UTILITY IMPROVEMENTS

- UT-01 FIRELINE MAIN
- UT-02 FIRE HYDRANT
- UT-03 BLDG FIRE SERVICE LATERAL
- UT-04 DOMESTIC WATER SERVICE LATERAL
- UT-05 SEWER SERVICE LATERAL

STORM DRAIN / WATER QUALITY IMPROVEMENTS SEE SHEETS 10 & 11 FOR PLAN, PROFILE & SPECS OF THE STORM DRAIN SYSTEM.

- SD-01 PCC BROW DITCH
- SD-02 STORM DRAIN INLET
- SD-03 STORM DRAIN BOX/CLEANOUT
- SD-04 STORM DRAIN PIPE
- SD-05 1,200 LF OF 48"Ø OF SD DETENTION PIPE
- SD-06 WATER QUALITY BASIN. SEE DETAILS ON SHEET 14
- SD-07 WQ BASIN OUTLET. SEE DETAILS ON SHEET 14
- SD-08 WATER QUALITY OUTLET CONTROL STRUCTURE. SEE DETAILS ON SHEET 14
- SD-09 WQ BASIN OVERFLOW INLET. TYPE C-2 CURB INLET PER SDRSD D-03A, L=20'
- SD-10 STORM DRAIN CURB OUTLET PER SDRSD D-25
- SD-11 INSTALL PVC CEANOUT AT BEND

LEGEND

BOUNDARY LINE
RIGHT OF WAY LINE
PARCEL LOT LINE
PCC CURB
PCC CURB & GUTTER
SEWER LINE
WATER LINE
FIRE LINE
FIRE HYDRANT
BLDG FIRE SERVICE LATERAL
WATER SERVICE LATERAL
SEWER SERVICE LATERAL
STORM DRAIN INLETS / CLEANOUTS
EXIST. TOPO MAJOR CONTOUR
EXIST. TOPO MINOR CONTOUR
PROPOSED TOPO MAJOR CONTOUR
PROPOSED TOPO MINOR CONTOUR
NEW GEOGRID TYPE RETAINING WALL
NEW SOIL NAIL OR SOLDIER PILE TYPE RETAINING WALL

SITE DEVELOPMENT PLAN EXPIRES:
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

CITY of VISTA

PRELIMINARY GRADING PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER RCE EXPIRES DATE
BENCH MARK:

SHEET 6 OF 14

P21-0339

ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

EXCEL ENGINEERING
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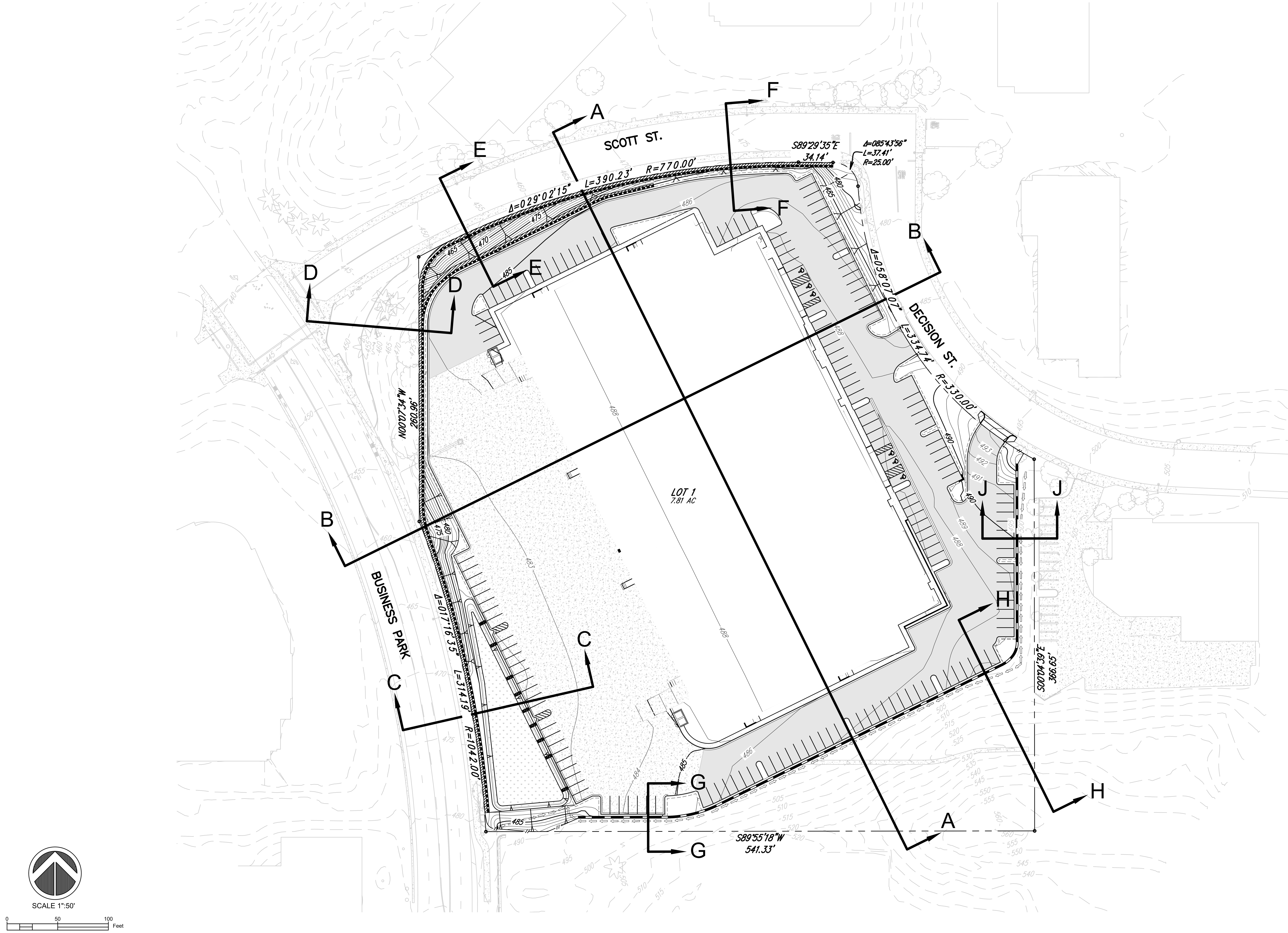
PH (760)745-8118 FX (760)745-1890

SCALE 1":40'
0 20 40 Feet

P21-0339



PLEASE SEE SHEET 8 FOR
SECTION PROFILE VIEWS

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ENGINEER OF WORK			
	45629	12/31/2023	
ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

CITY of VISTA

SECTIONS PLAN VIEW FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED

FOR CITY ENGINEER RCE EXPIRES DATE

BENCH MARK:

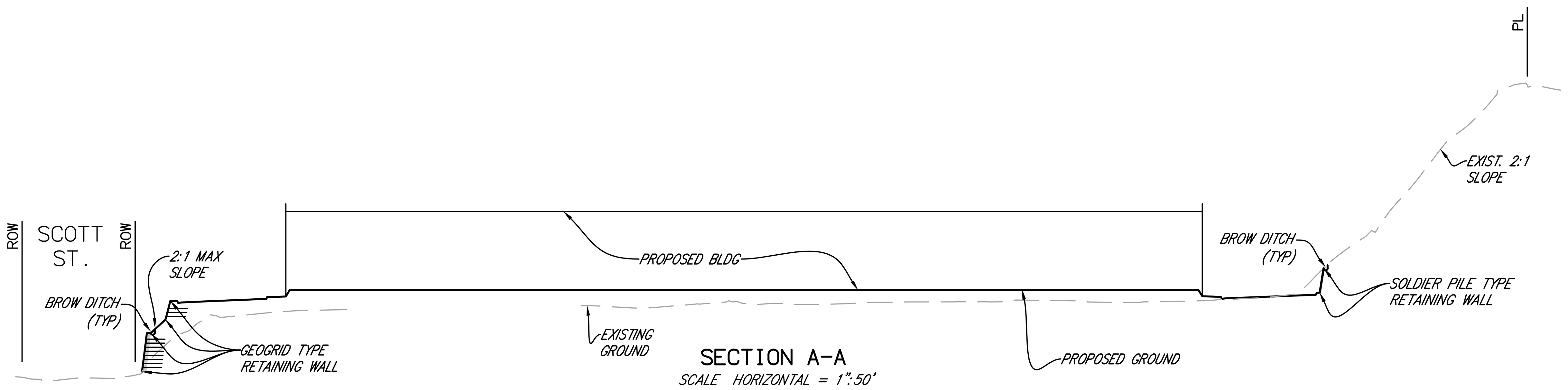
SHEET 7 OF 14

P21-0339

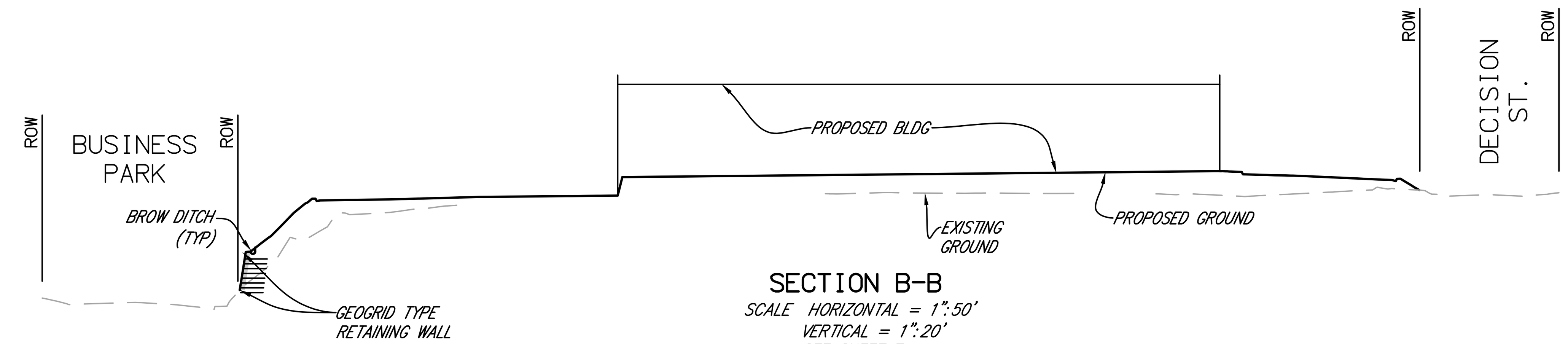
COV LAST REV'D: 2/10/2010 (TT)

P.C.: P21-0339 LD# ______ DWG#: ______

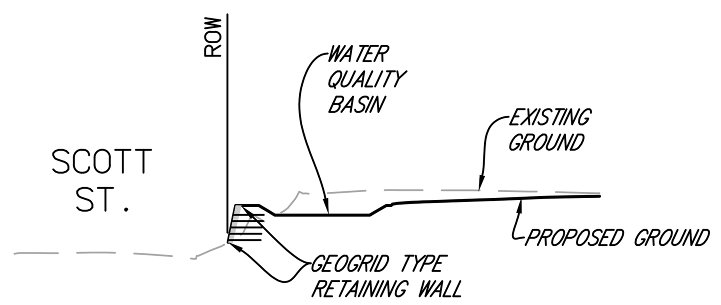
P21-0339



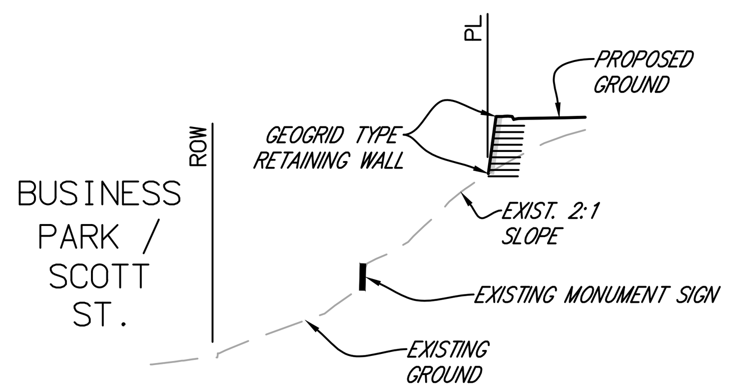
SECTION A–A
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":25'
SEE SHEET 7



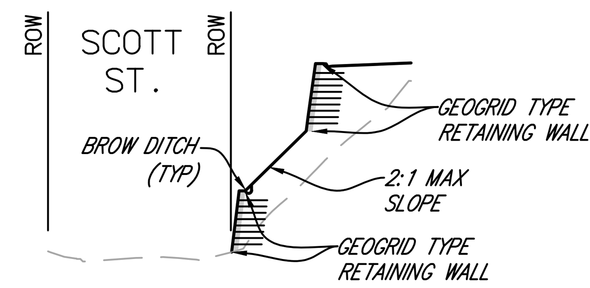
SECTION B–B
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



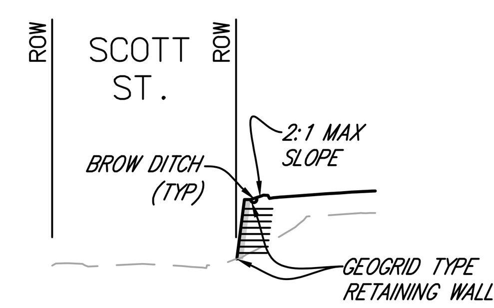
SECTION C–C
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



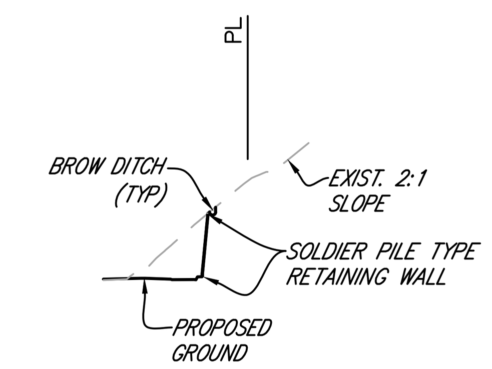
SECTION D–D
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



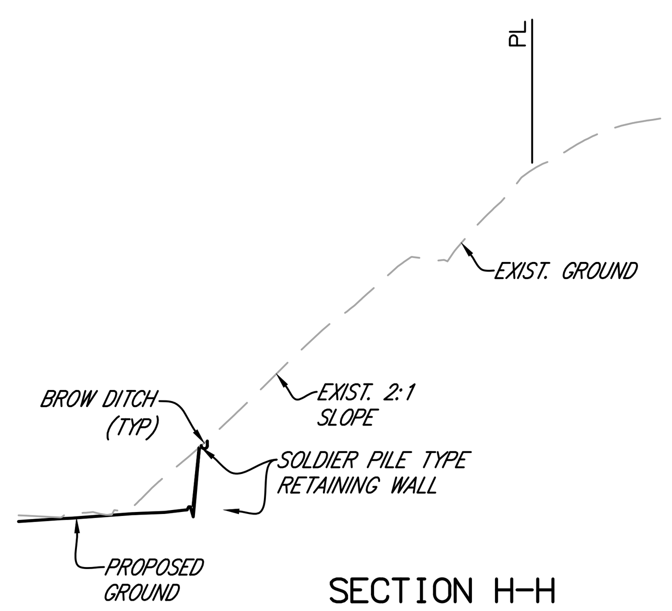
SECTION E–E
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



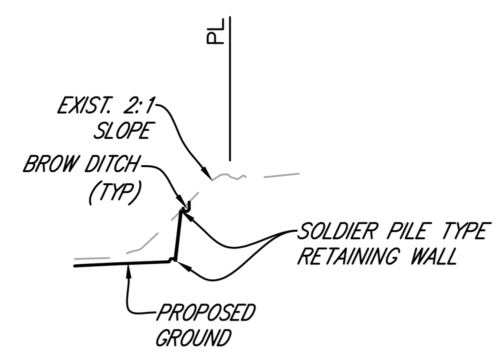
SECTION F–F
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



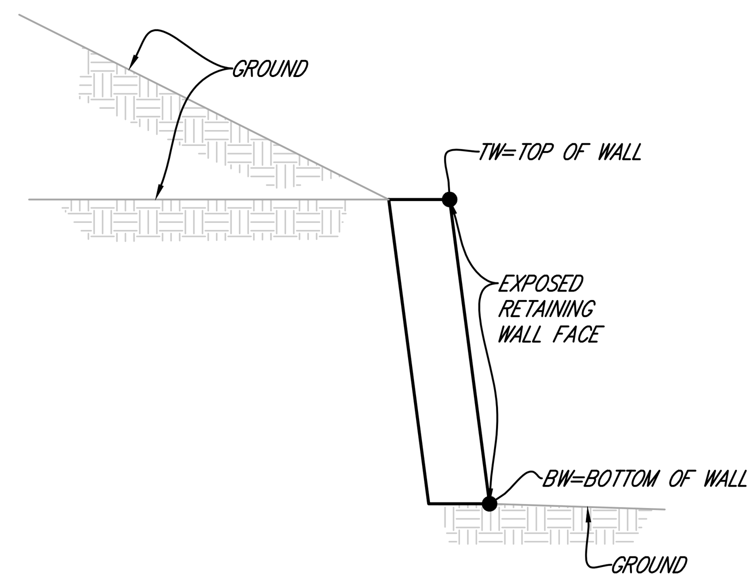
SECTION G–G
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



SECTION H–H
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



SECTION J–J
SCALE HORIZONTAL = 1":50'
VERTICAL = 1":20'
SEE SHEET 7



RETAINING WALL CALLOUT LEGEND
NOT TO SCALE

V:\21\21052\Engineering\PLOT PLAN\PRELIM\GP\21052 PRELIM GP SECTIONS.dwg 4/13/2022 10:35 AM ORIGINAL PLOT SIZE: ----

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ENGINEER OF WORK

ENGINEER OF WORK	45629 RCE	12/31/2023 EXP.LIC.DATE	DATE

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

CITY of VISTA

SECTIONS PROFILE VIEW FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED

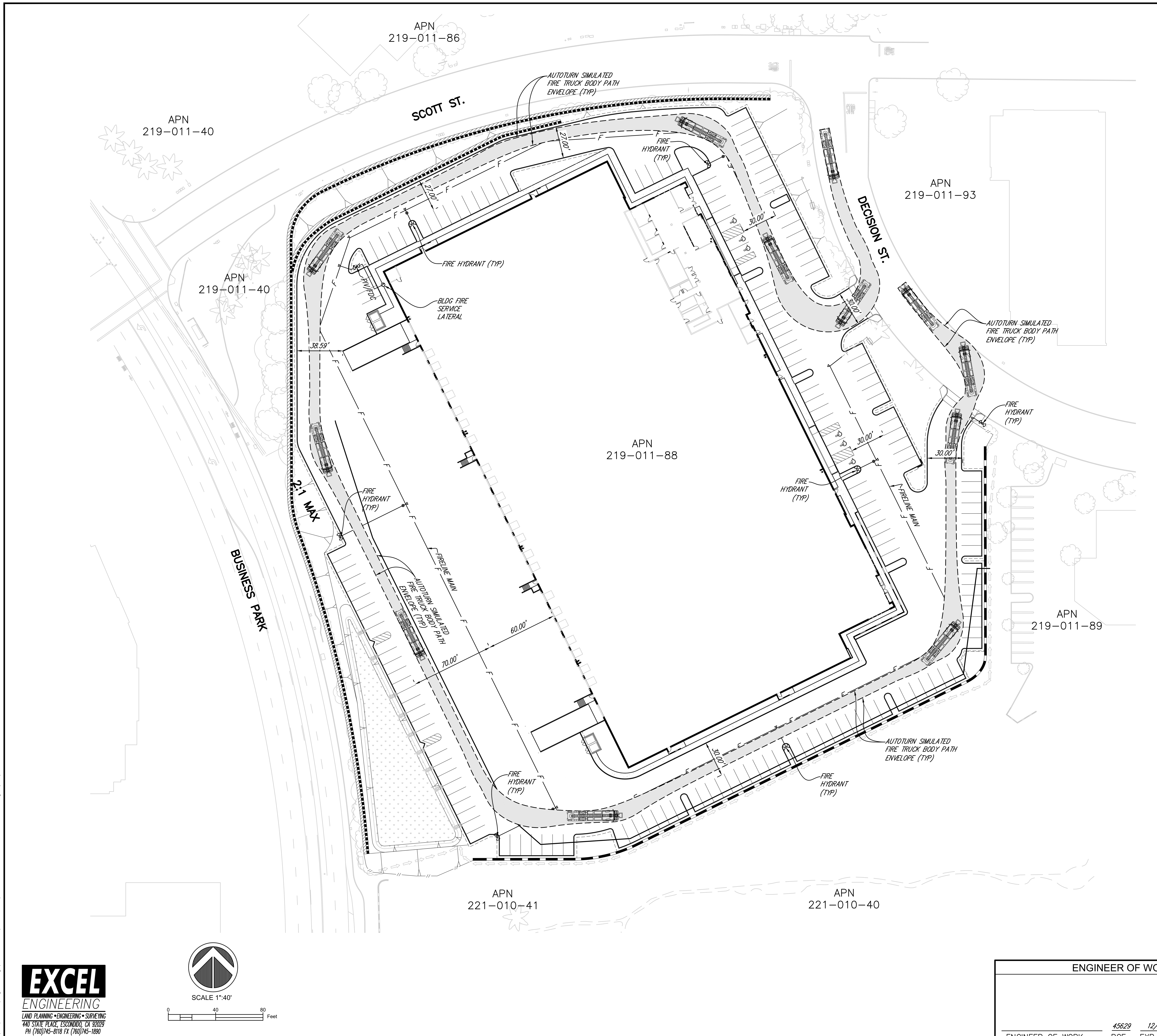
FOR CITY ENGINEER   RCE   EXPIRES   DATE

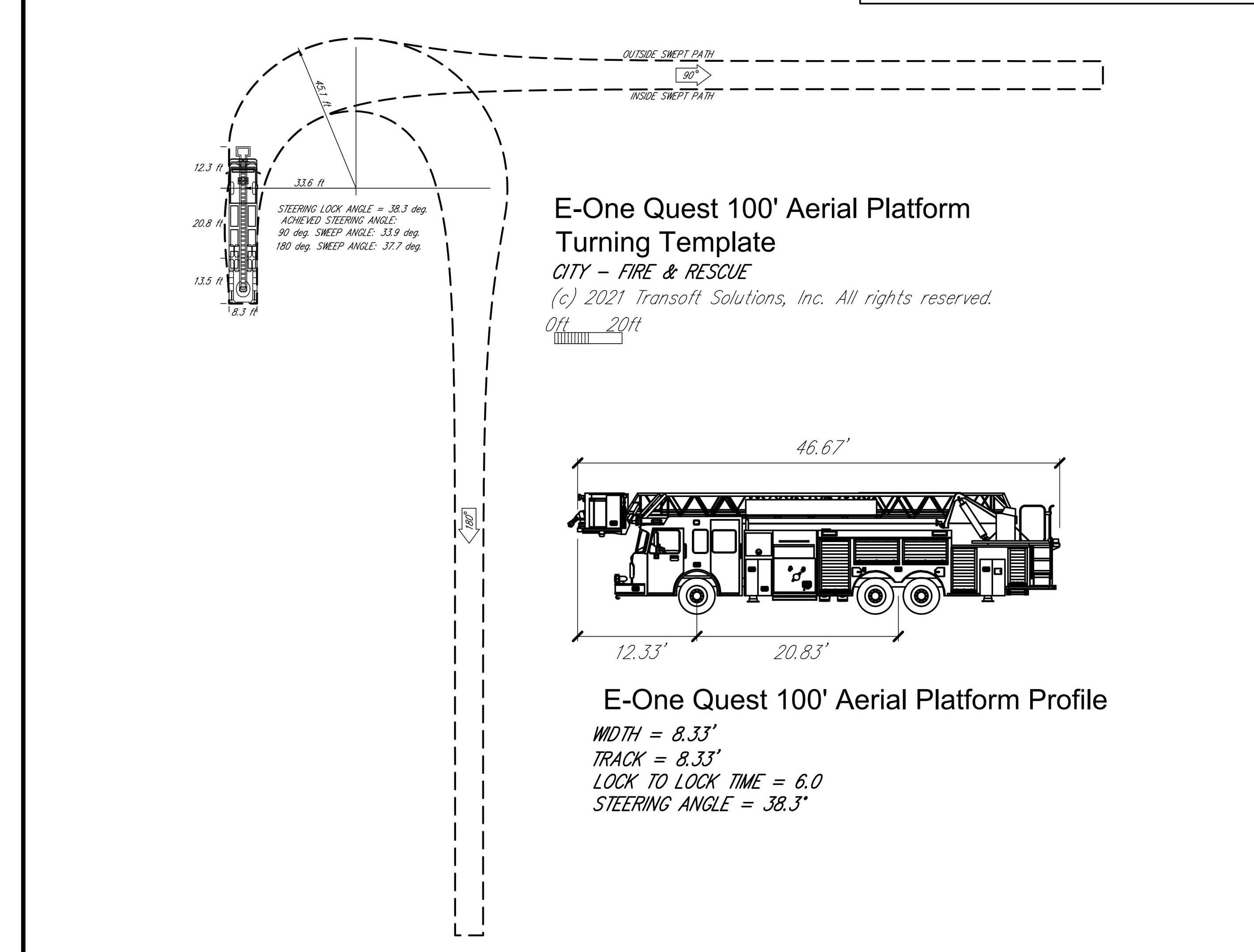
BENCH MARK:

SHEET 8 OF 14

P21-0339

P21-0339





EMERGENCY VEHICLE USED IN THE AUTOTURN SIMULATION DETAILS

SITE DEVELOPMENT PLAN EXPIRES:
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

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ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

CITY of VISTA

PRELIMINARY CIRCULATION PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER RCE EXPIRES DATE
BENCH MARK:

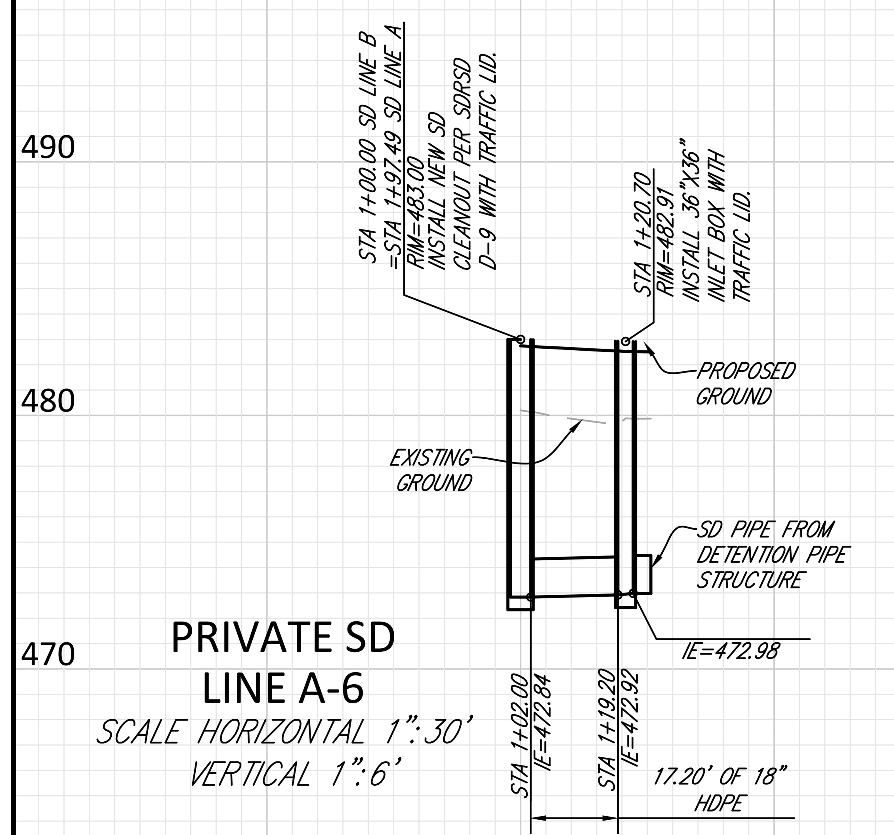
SHEET 9 OF 14
P21-0339

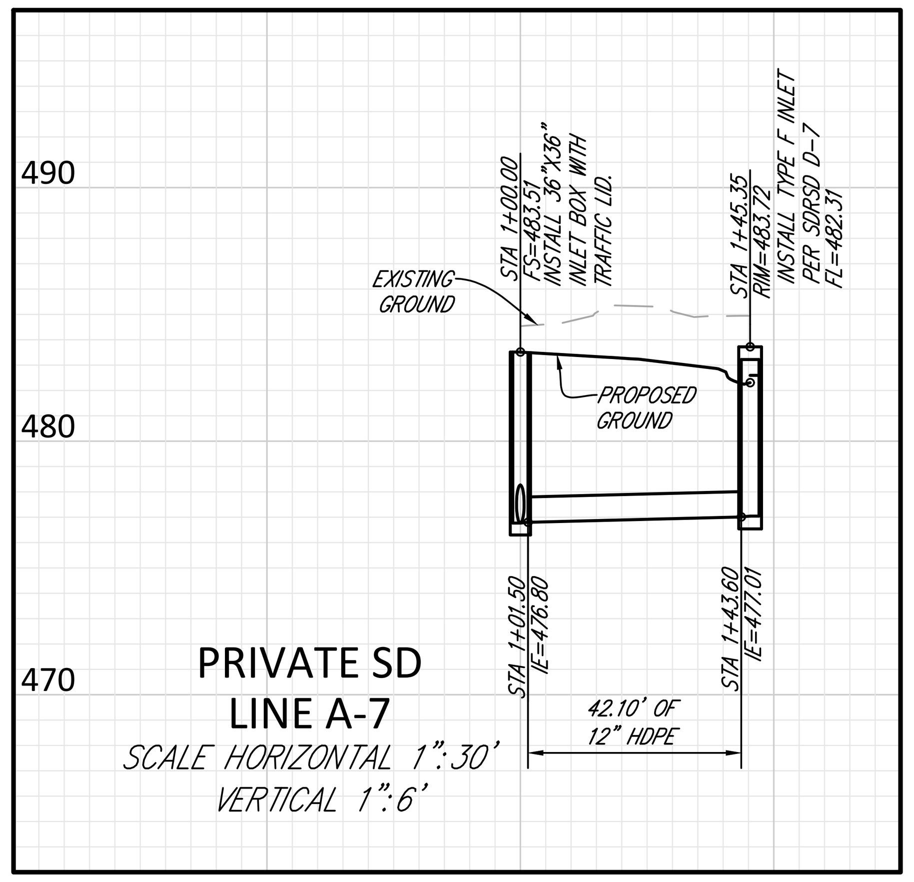
COV LAST REV'D: 2/10/2010 (TT)

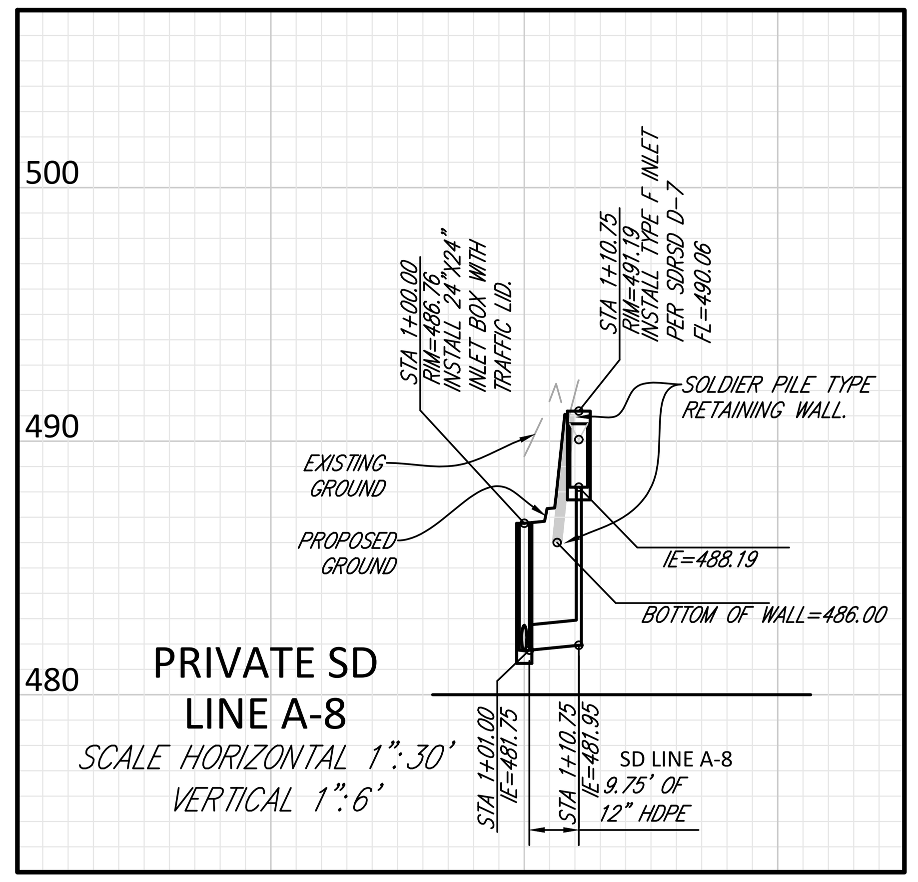
P.C.: P21-0339 LD# ______ DWG#: ______

PRIVATE STORM DRAIN LINE A-1 TO A-5

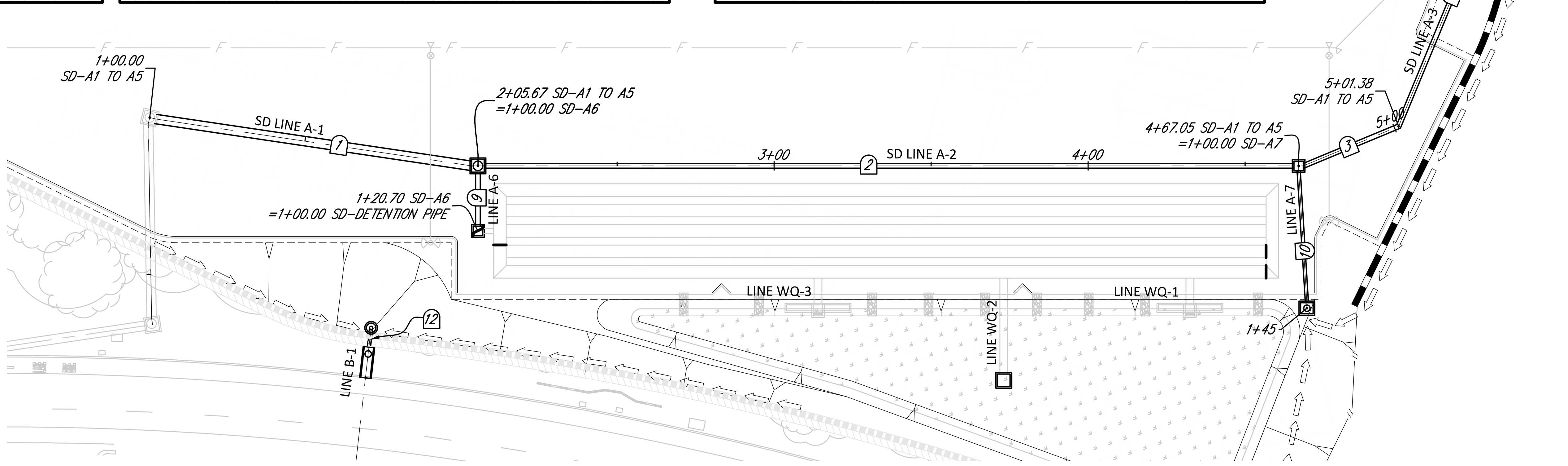
SCALE HORIZONTAL 1":30'
VERTICAL 1":6'


PRIVATE SD LINE A-6
SCALE HORIZONTAL 1":30'
VERTICAL 1":6'

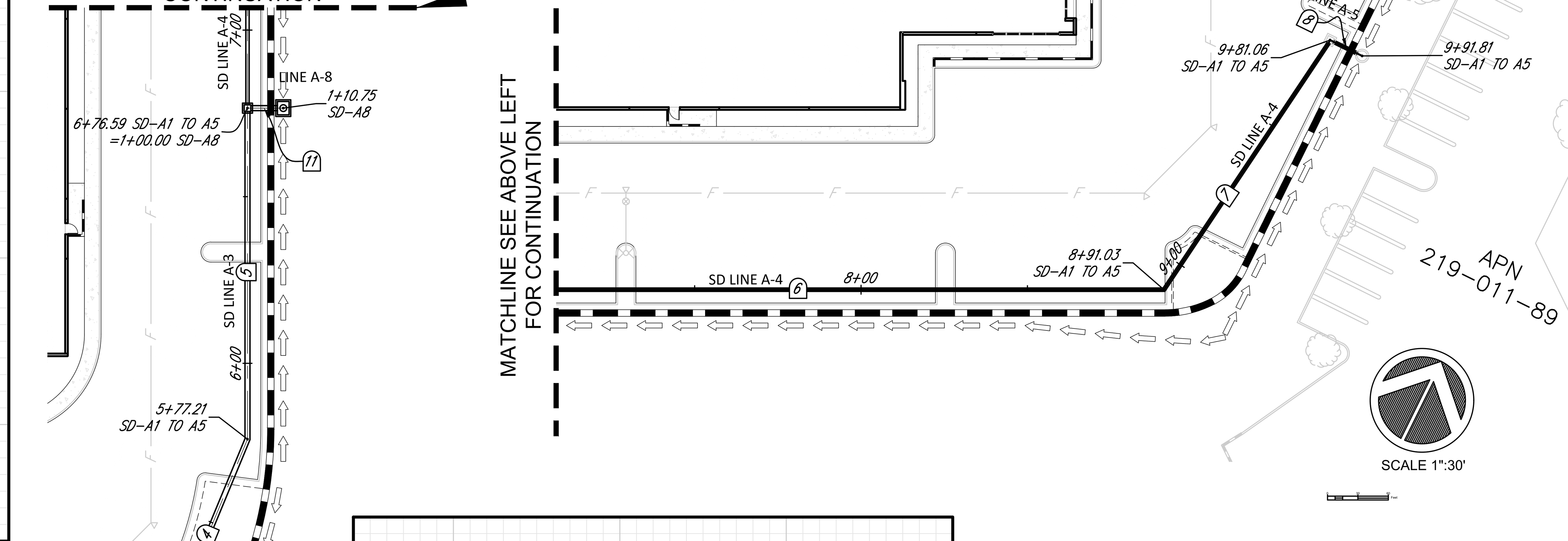

PRIVATE SD LINE A-7
SCALE HORIZONTAL 1":30'
VERTICAL 1":6'


PRIVATE SD LINE A-8
SCALE HORIZONTAL 1":30'
VERTICAL 1":6'

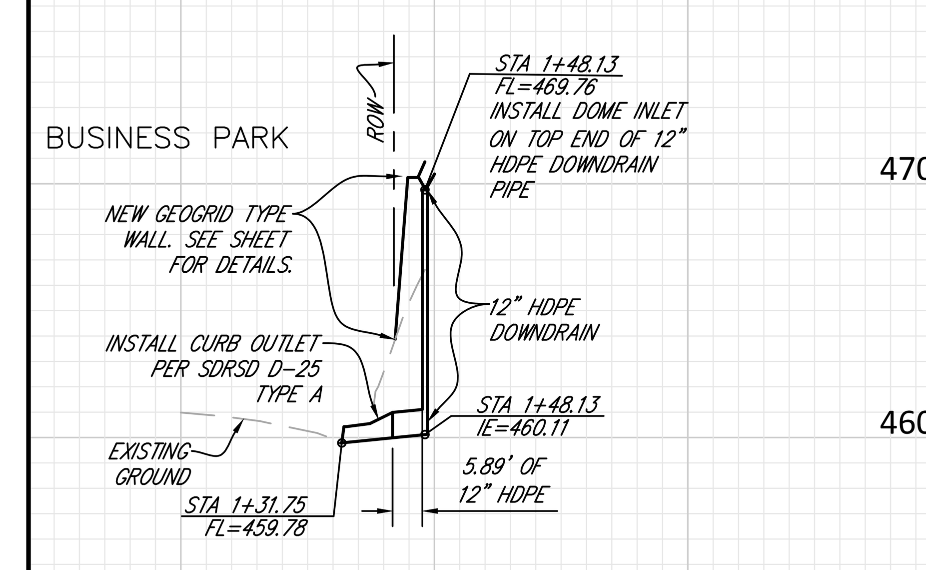
MATCHLINE SEE RIGHT FOR CONTINUATION



MATCHLINE SEE ABOVE LEFT FOR CONTINUATION



STORM DRAIN DATA			
NO.	DELTA / BEARING	RADIUS	LENGTH
1	N17° 50' 44.64"W		101.67
2	N26° 16' 21.32"W		257.88
3	S48° 46' 21.32"E		32.83
4	N86° 13' 38.68"E		75.82
5	N63° 43' 38.68"E		98.39
6	N63° 43' 38.68"E		213.44
7	N07° 28' 38.68"E		89.03
8	N89° 55' 20.78"E		8.00
9	N63° 43' 38.68"E		17.20
10	S60° 09' 08.57"W		42.10
11	S26° 16' 21.32"E		8.00
12	N70° 11' 10.99"E		6.13


PRIVATE SD LINE B-1
SCALE HORIZONTAL 1":30'
VERTICAL 1":6'

SCALE 1":30'

SITE DEVELOPMENT PLAN EXPIRES:________
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
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ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

CITY of VISTA

PRELIMINARY STORM DRAIN PLAN FOR:

1430 DECISION ST

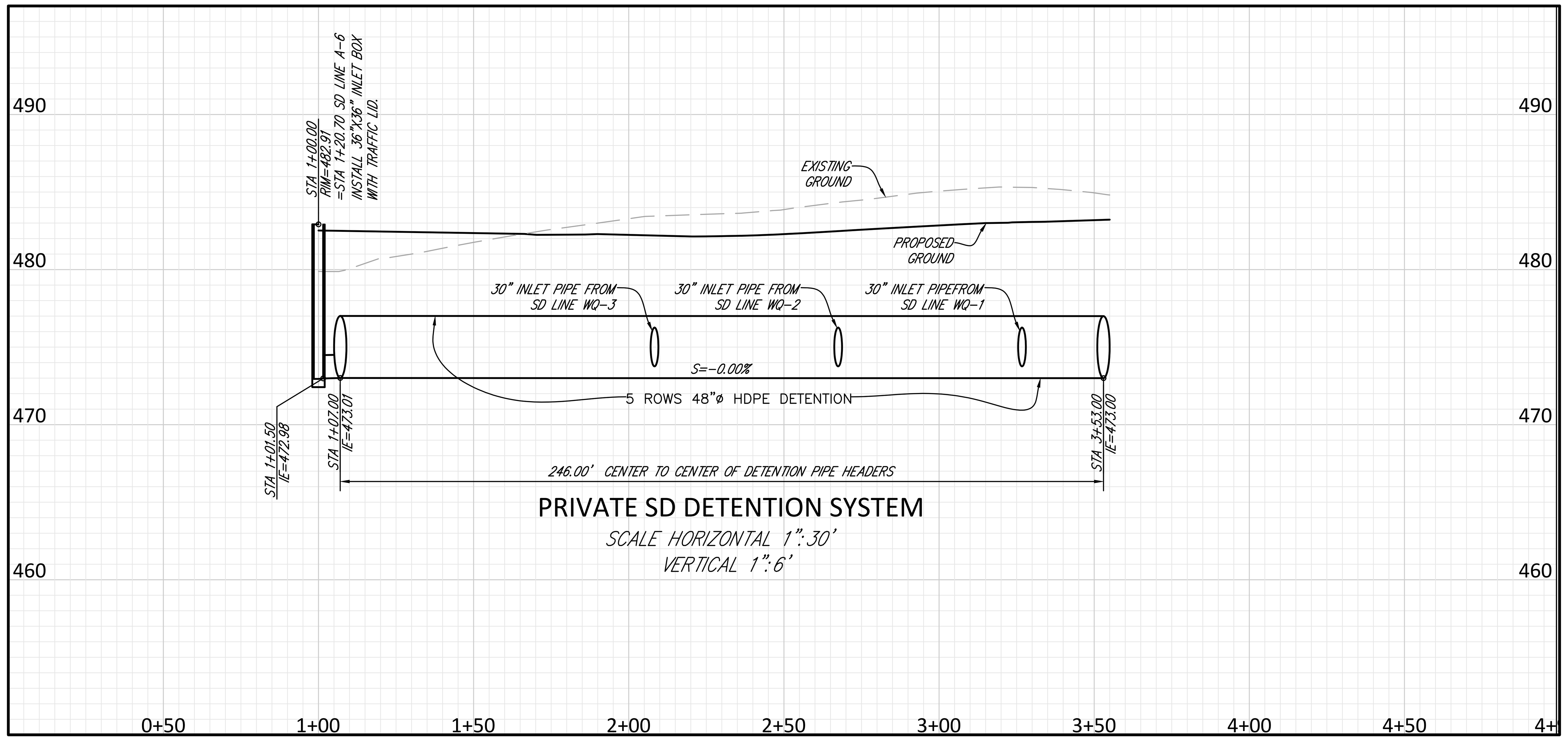
ADDRESS: 1430 DECCISION ST, VISTA CA

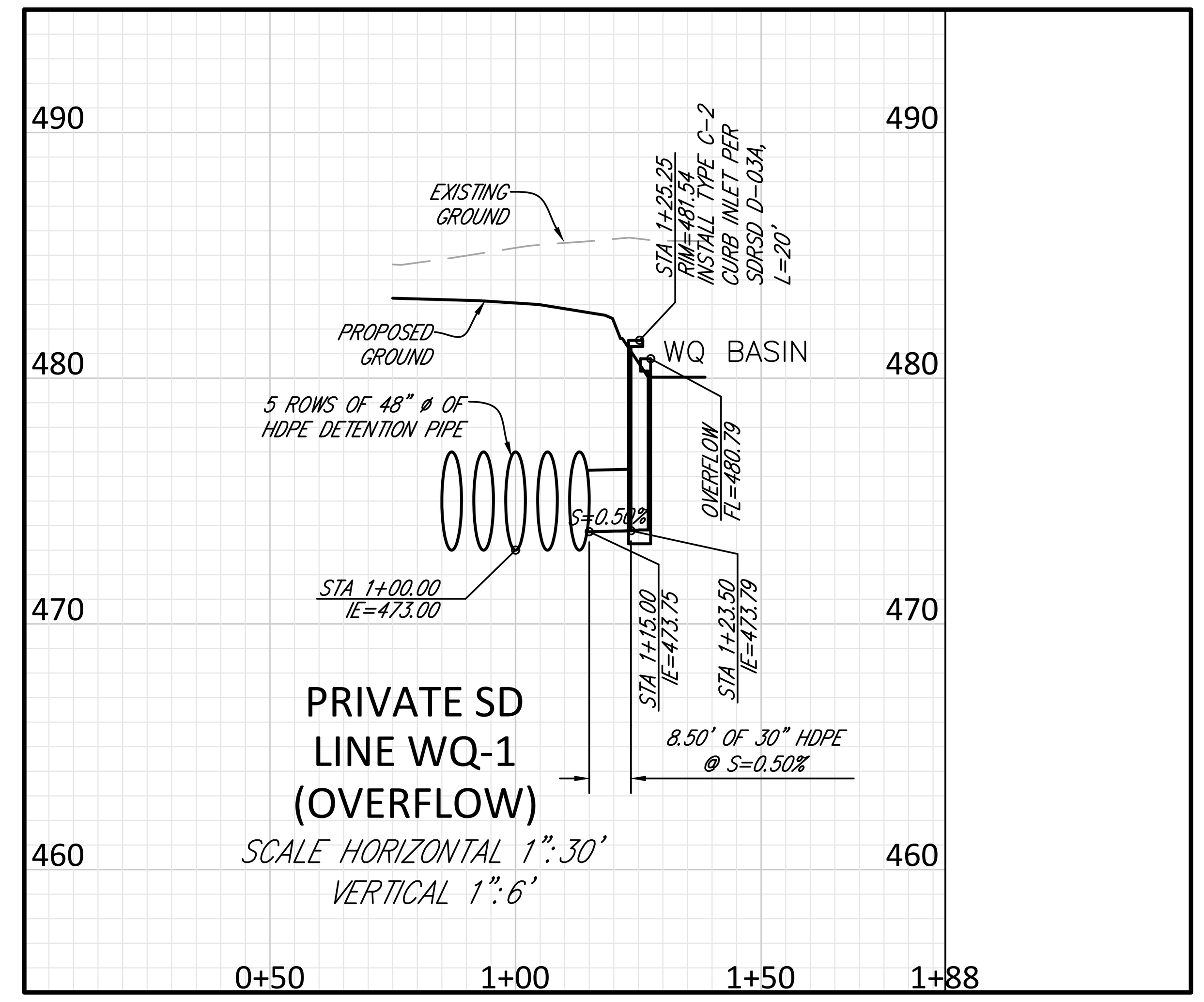
APPROVED
FOR CITY ENGINEER RCE EXPIRES DATE
BENCH MARK:

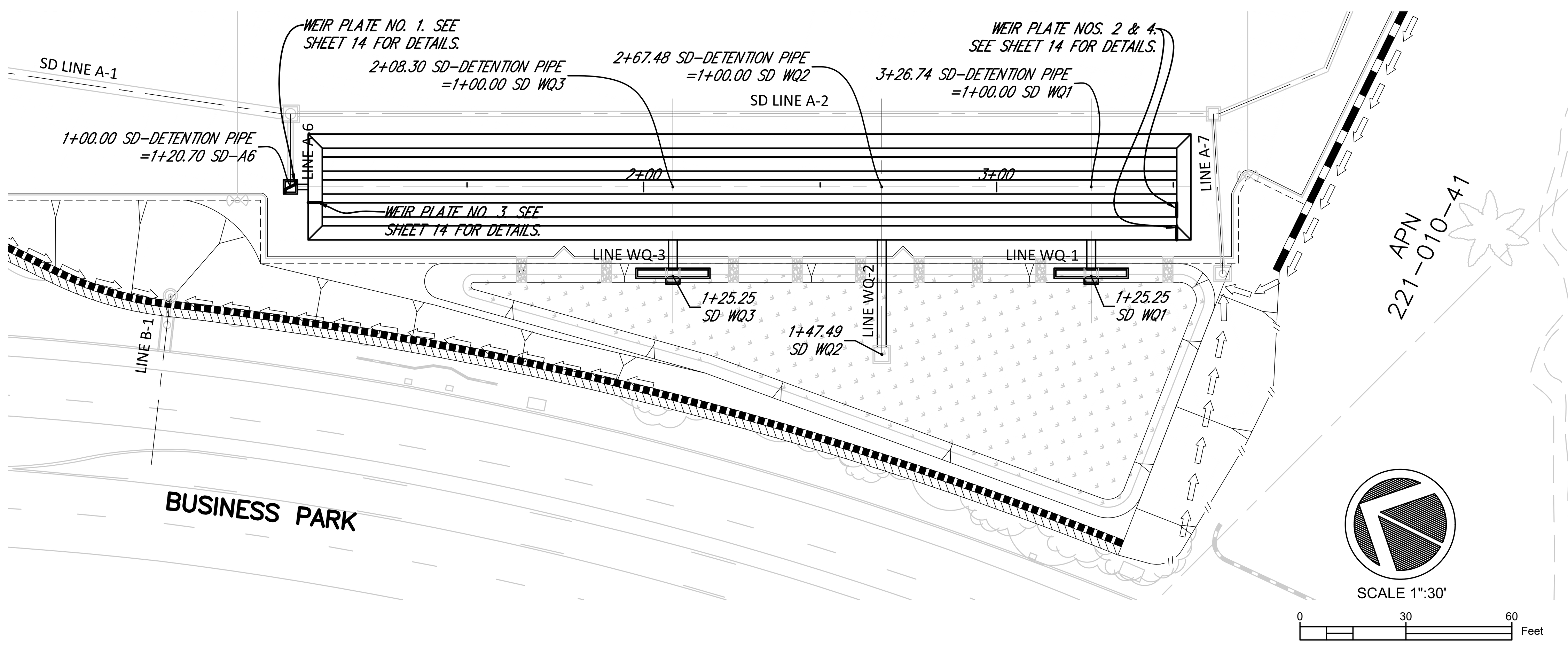
SHEET 10 OF 14

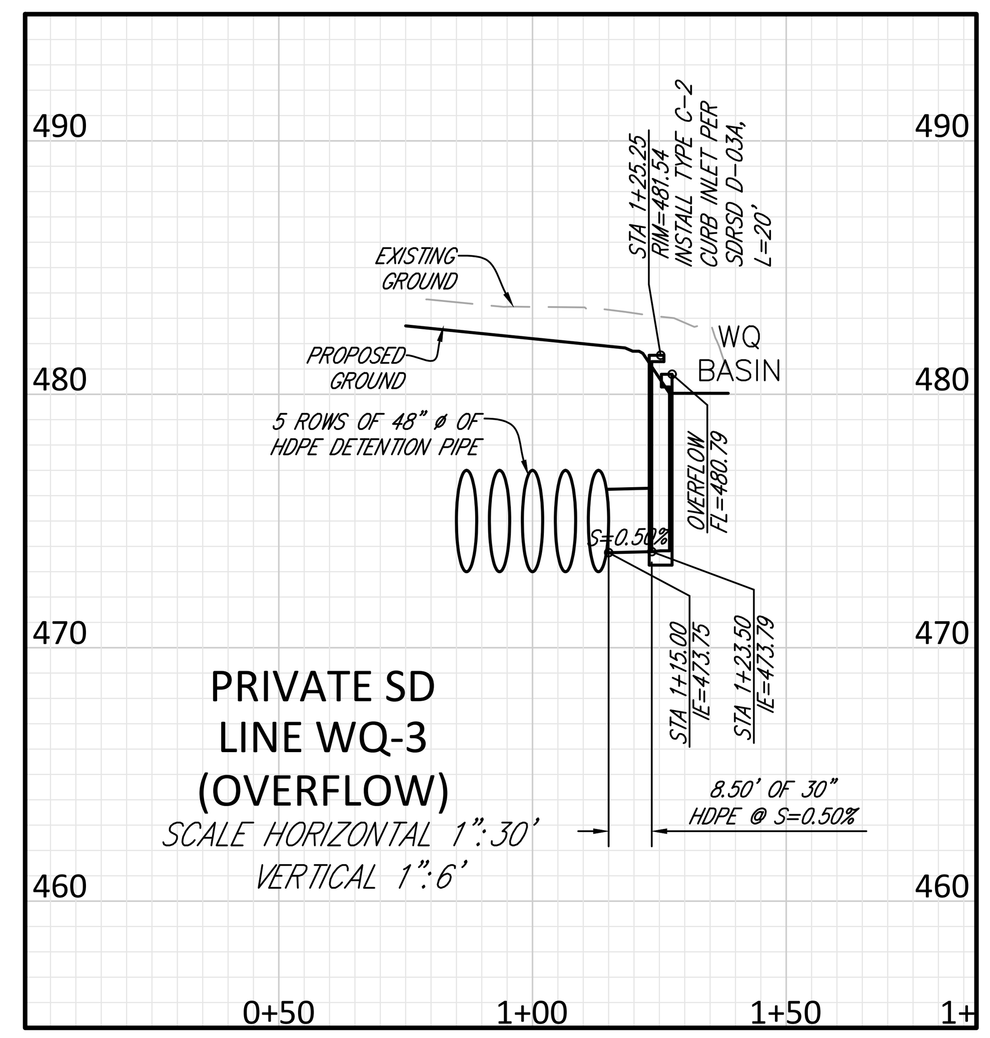
P21-0339

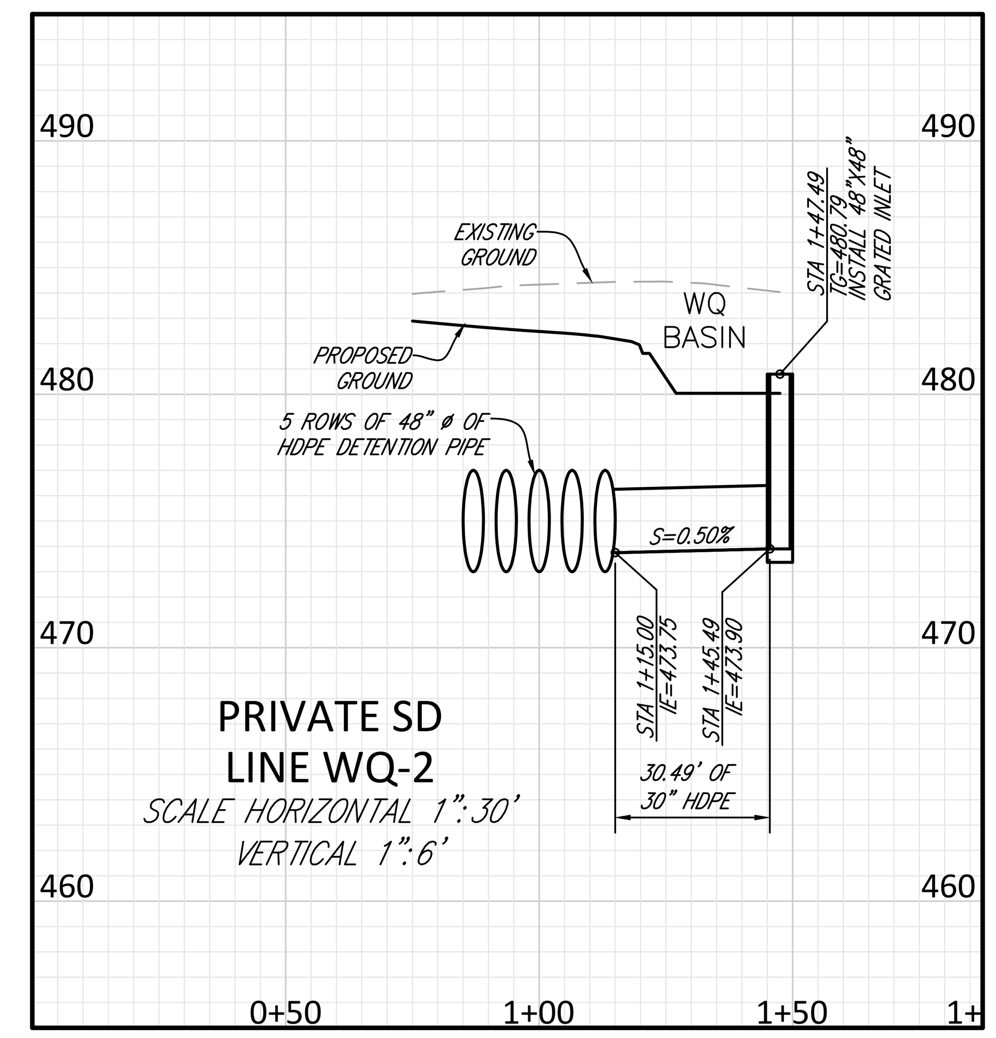
P21-0339











SITE DEVELOPMENT PLAN EXPIRES:
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

CITY of VISTA

PRELIMINARY DETENTION PIPE PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED

FOR CITY ENGINEER RCE EXPIRES DATE

BENCH MARK:

SHEET11 OF 14

P21-0339

ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER ROBERT D. DENTINO No. 45629 CIVIL STATE OF CALIFORNIA

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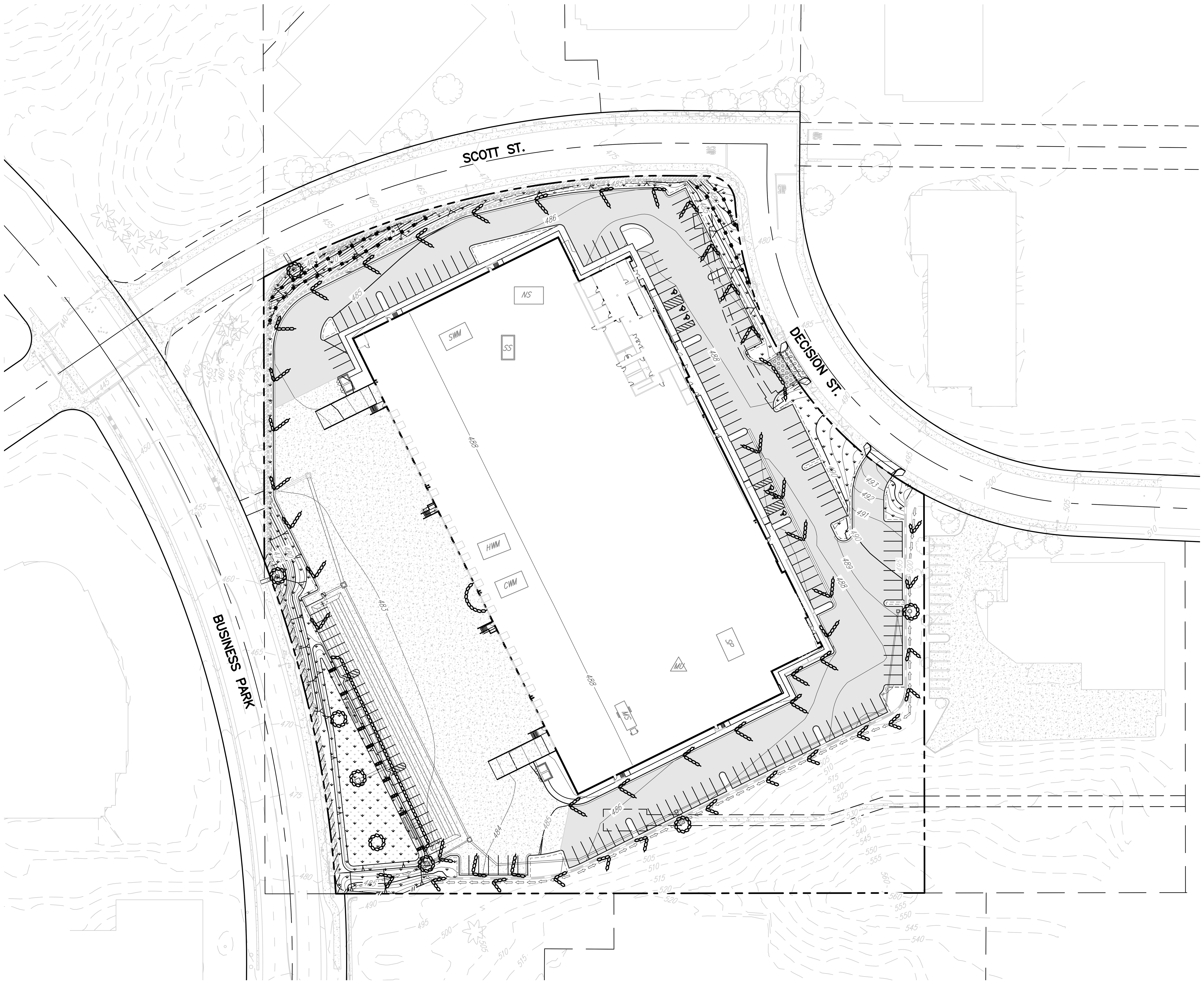
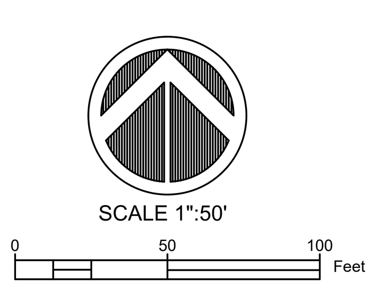
P.C.: P21-0339 LD# ______ DWG#: ______

P21-0339





EC-1 SCHEDULING
EC-2 PRESERVATION OF EXISTING VEGETATION
EC-4 HYDROSEEDING
EC-7 GEOTEXTILES AND MATS
EC-8 WOOD MULCHING
EC-9 EARTH DIKES AND DRAINAGE SWALES
EC-10 VELOCITY DISSIPATION DEVICES
EC-11 SLOPE DRAIN
SE-1 SILT FENCE
SE-2 SEDIMENT BASIN
SE-3 SEDIMENT TRAP
SE-4 CHECK DAM
SE-5 FIBER ROLLS
SE-7 STREET SWEEPING AND VACUUMING
SE-8 GRAVEL BAG BARRIER
SE-9 STRAW BALE BARRIER
SE-10 STORM DRAIN INLET PROTECTION
WE-1 WIND EROSION CONTROL
TC-1 STABILIZED CONSTRUCTION ENTRANCE/EXIT
TC-2 STABILIZED CONSTRUCTION ROADWAY
NS-2 DEWATERING OPERATIONS
NS-3 PAVING AND GRINDING OPERATIONS
NS-4 TEMPORARY STREAM CROSSING
NS-8 VEHICLE AND EQUIPMENT CLEANING
NS-9 VEHICLE AND EQUIPMENT FUELING
NS-10 VEHICLE AND EQUIPMENT MAINTENANCE
NS-12 CONCRETE CURING
NS-13 CONCRETE FINISHING
NS-14 MATERIAL AND EQUIPMENT USE
WM-1 MATERIAL DELIVERY AND STORAGE
WM-2 MATERIAL USE
WM-3 STOCKPILE MANAGEMENT
WM-4 SPILL PREVENTION AND CONTROL
WM-5 SOLID WASTE MANAGEMENT
WM-6 HAZARDOUS WASTE MANAGEMENT
WM-7 CONTAMINATED SOIL MANAGEMENT
WM-8 CONCRETE WASTE MANAGEMENT
WM-9 SANITARY/SEPTIC WASTE MANAGEMENT
WM-10 LIQUID WASTE MANAGEMENT

EROSION CONTROL LEGEND (CASQA)

BMP	TITLE	SYMBOL	QUANTITY
EC-1	SCHEDULING		
EC-4	HYDROSEEDING		29,000 SF
SE-1	SILT FENCE		700 LF
SE-4	CHECK DAMS		
SE-5	FIBER ROLL	FR	LF
SE-6	GRAVEL BAG BERM		3,200 EA
SE-7	STREET SWEEPING AND VACUUMING		
SE-10	STORM DRAIN INLET PROTECTION		
TC-1	STABILIZED CONSTRUCTION ENTRANCE/EXIT		
WE-1	WIND EROSION CONTROL		
NS-(8-10)	EQUIPMENT FUELING, CLEANING AND MAINTENANCE	NS	
WM-1	MATERIAL DELIVERY & STORAGE	MS	
WM-2	MATERIAL USE	MU	
WM-4	SPILL PREVENTION AND CONTROL	SP	
WM-5	SOLID WASTE MANAGEMENT	SWM	
WM-6	HAZARDOUS WASTE MANAGEMENT	HWM	
WM-8	CONCRETE WASTE MANAGEMENT	CWM	
WM-9	SANITARY / SEPTIC WASTE MANAGEMENT	SS	

CONSTRUCTION NOTE

SEE SWPPP, WDID NO.________________,
FOR SITE SPECIFIC EROSION CONTROL
MEASURES DURING CONSTRUCTION.

SITE DEVELOPMENT PLAN EXPIRES:____________
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

CITY of VISTA

EROSION CONTROL PLAN FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED

FOR CITY ENGINEER ____ RCE ____ EXPIRES ____ DATE ____

BENCH MARK:

SHEET 12 OF 14

P21-0339

ENGINEER OF WORK

ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE
	45629	12/31/2023	

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

EXCEL ENGINEERING
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V:\21\21052\Engineering\PLOT PLAN\PRELIMGP\21052 PRELIMGP EROSION CONTROL.dwg 4/13/2022 10:36 AM ORIGINAL PLOT SIZE:

COV LAST REV'D: 2/10/2010 (TT)

P.C.: P21-0339 LD# ______ DWG#: ______

P21-0339

EROSION CONTROL NOTES

STORM WATER AND EROSION CONTROL NOTES

1. TOTAL AREA OF LAND DISTURBANCE = 13.4 ACRES
2. THIS PROJECT IS SUBJECT TO ALL APPLICABLE GENERAL AND PROJECT SPECIFIC PROHIBITIONS AND REQUIREMENTS IN CHAPTERS 13.18 AND 17.56 OF THE VISTA MUNICIPAL CODE, AND THE CITY STORMWATER STANDARDS MANUAL.
3. BMPS AT MANNED FACILITIES MUST BE INSPECTED BY THE EROSION CONTROL CONTRACTOR BEFORE AND FOLLOWING PREDICTED RAIN EVENTS. BMPS AT UNMANNED FACILITIES MUST BE INSPECTED BY THE DISCHARGER REGULARLY DURING THE RAINY SEASON AND PERIODICALLY BETWEEN EACH RAINY SEASON. THESE BMPS MUST BE MAINTAINED SO THAT THEY CONTINUE TO FUNCTION AS DESIGNED. BMPS WHICH FAIL MUST BE REPAIRED AS SOON AS IT IS SAFE TO DO SO. IF THE FAILURE OF A BMP INDICATES THAT THE BMPS IN USE ARE INAPPROPRIATE OR INADEQUATE TO THE CIRCUMSTANCES, THE BMPS MUST BE MODIFIED OR UPGRADED TO PREVENT ANY FURTHER FAILURE IN THE SAME OR SIMILAR CIRCUMSTANCES.
4. IN THE EVENT OF FAILURE OR REFUSAL TO PROPERLY MAINTAIN SAID DEVICES, THE CITY ENGINEER MAY CAUSE EMERGENCY MAINTENANCE WORK TO BE DONE TO PROTECT ADJACENT PRIVATE AND PUBLIC PROPERTY. THE COST OF WHICH (INCLUDING AN INITIAL MOBILIZATION AMOUNT) SHALL BE CHARGED TO THE OWNER.
5. SEDIMENTATION BASINS MAY NOT BE REMOVED OR MADE INOPERATIVE WITHOUT PRIOR APPROVAL OF THE CITY ENGINEER.
6. TEMPORARY EROSION CONTROL DEVICES SHOWN ON THE EROSION CONTROL PLAN WHICH INTERFERE WITH THE WORK SHALL BE RELOCATED OR MODIFIED AS THE WORK PROGRESSES AS RECOMMENDED BY THE ENGINEER OF WORK AND AS APPROVED BY THE CITY ENGINEER.
7. ALL LOOSE SOIL AND DEBRIS SHALL BE REMOVED FROM THE STREET AREAS UPON STARTING OPERATIONS, AND PERIODICALLY THEREAFTER, AS DIRECTED BY THE INSPECTOR.
8. A 12-INCH HIGH BY 4-FOOT WIDE BERM SHALL BE MAINTAINED ALONG THE TOP OF SLOPE OF THOSE FILLS ON WHICH GRADING IS NOT IN PROGRESS. CONCENTRATED WATER SHALL NOT BE CARRIED WITHIN 10 FEET FROM THE TOP OF SLOPES.
9. STAND-BY CREWS SHALL BE ALERTED BY THE CONTRACTOR, PERMITTEE, OR OWNER FOR EMERGENCY WORK DURING RAINSTORMS.
10. ALL UTILITY TRENCHES SHALL BE BACKFILLED WITHIN 24 HOURS AND MUST BE BACKFILLED BEFORE THE END OF THE WORK DAY IF A 40 % CHANCE OF RAIN IS PREDICTED.
11. ALL BUILDING PADS SHALL BE SLOPED TOWARDS THE DRIVEWAY AND VELOCITY CHECK DAMS PROVIDED AT THE BASE OF ALL DRIVEWAYS DRAINING INTO THE STREET. VELOCITY CHECK DAMS SHALL BE PROVIDED ACROSS THE OUTLETS OF ALL LOTS DRAINING ONTO THE STREET.
12. PROVIDE VELOCITY CHECK DAMS IN ALL STREET AREAS, PAVED OR UNPAVED, AT THE INTERVALS INDICATED BELOW. VELOCITY CHECK DAMS MAY BE CONSTRUCTED OF GRAVEL BAGS, TIMBER, OR OTHER EROSION RESISTANT MATERIALS APPROVED BY THE CITY ENGINEER, AND SHALL EXTEND COMPLETELY ACROSS THE STREET OR CHANNEL AT RIGHT ANGLES TO THE CENTERLINE. EARTHEN DIKES MAY NOT BE USED AS VELOCITY CHECK DAMS.

STREET GRADE	CHECK DAM INTERVAL
LESS THAN 2%	AS REQUIRED
2% TO 4%	100 FEET
4% TO 10%	50 FEET
OVER 10%	25 FEET

13. PROVIDE VELOCITY CHECK DAMS IN ALL UNPAVED GRADED CHANNELS AT THE INTERVALS INDICATED BELOW UNLESS CHANNELS ARE LINED WITH TEMPORARY MATERIALS SUCH AS PLASTIC SHEETING.

CHANNEL GRADE	CHECK DAM INTERVAL
LESS THAN 3%	100 FEET
3% TO 6%	50 FEET
OVER 6%	25 FEET

14. A GRAVEL BAG SILT BASIN, OR SILT TRAP, SHALL BE PROVIDED AT EVERY STORM DRAIN INLET TO PREVENT SEDIMENT FROM ENTERING THE STORM DRAIN SYSTEM.
15. A GUARD SHALL BE POSTED ON SITE WHENEVER THE DEPTH OF WATER IN ANY DEVICE EXCEEDS TWO FEET.
16. ALL REMOVABLE PROTECTION DEVICES SHOWN SHALL BE IN PLACE AT THE END OF EACH WORKING DAY WHEN THE 5-DAY RAIN FORCAST PROBABLITY EXCEEDS 40 % AFTER EACH RAINSTORM EXCEEDING ¼ INCH IN A 12 HOUR PERIOD, SILT AND DEBRIS SHALL BE REMOVED FROM CHECK DAMS AND DESILTING BASINS, AND BASINS SHALL BE PUMPED DRY.
17. EFFECTIVE PLANTING SHALL BE INSTALLED, FULLY GERMINATED, AND SHALL EFFECTIVELY COVER THE REQUIRED SLOPES PRIOR TO FINAL APPROVAL. THE PLANTING MIX SHALL BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION. SPRINKLER SYSTEMS ARE REQUIRED ON ALL SLOPES OVER FIVE FEET IN HEIGHT. TEMPORARY SPRINKLER SYSTEMS WILL BE REQUIRED ON ALL SLOPES UNTIL PLANTING IS ESTABLISHED, AND MAY NOT BE REMOVED WITHOUT PRIOR APPROVAL OF THE CITY ENGINEER.
18. GRAVEL BAGS AND NECESSARY MATERIALS SHALL BE AVAILABLE ON SITE AND STOCKPILED AT CONVENIENT LOCATIONS TO FACILITATE RAPID CONSTRUCTION OF TEMPORARY DEVICES OR TO REPAIR ANY DAMAGED EROSION CONTROL MEASURES, WHEN RAIN IS IMMINENT. A STAND-BY CREW SHALL BE MADE AVAILABLE AT ALL TIMES DURING THE RAINY SEASON.
19. ANY PROPOSED ALTERNATE EROSION CONTROL MEASURES ARE TO BE RECOMMENDED BY THE ENGINEER OF WORK, FOR APPROVAL BY THE CITY ENGINEER, PRIOR TO INSTALLATION.
20. FROM OCTOBER 1ST THROUGH APRIL 30TH OF EACH YEAR, COV MUNICIPAL CODE, CHAPTER 17.56, REQUIRES THAT ALL DENUDED SLOPE FACES BE PROTECTED FROM EROSION, AND THAT ALL SEDIMENT BE KEPT ON SITE. THE USE OF INDUSTRY STANDARD SLOPE PROTECTION AND SEDIMENT CONTROL METHODS ARE REQUIRED TO BE IN PLACE AND MAINTAINED 24 HOURS A DAY/7 DAYS A WEEK.
21. MATERIALS AND WASTE WITH THE POTENTIAL TO POLLUTE URBAN RUN-OFF SHALL BE USED IN ACCORDANCE WITH LABEL DIRECTIONS AND SHALL BE STORED IN A MANNER THAT EITHER PREVENTS CONTACT WITH RAINFALL OR CONTAINS CONTAMINATED RUN-OFF FOR TREATMENT AND DISPOSAL.

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440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

EROSION CONTROL NOTES (CONT'D)

23. THE OWNER DESIGNATED 24-HOUR TELEPHONE NUMBER AND THE NAME(S) OF THE PERSON(S) RESPONSIBLE FOR EMERGENCY WORK APPEARS BELOW AND SHALL AT ALL TIMES BE POSTED IN A CONSPICUOUS PLACE ONSITE TO FACILITATE PUBLIC REPORTING OF PROBLEMS. (A TELEPHONE ANSWERING MACHINE OR ANSWERING SERVICE IS UNACCEPTABLE.)

SCOTT MERRY
NAME

760-717-0615
24 HOUR PHONE NUMBER

CONTRACTOR SHALL IMPLEMENT AND MAINTAIN ONSITE AT ALL TIMES A STORMWATER MANAGEMENT PLAN (SWMP) OR STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IN CITY APPROVED FORMAT WHICH IS HEREBY INCORPORATED WITH THESE PLANS BY REFERENCE. SAID PLAN SHALL BE KEPT CURRENT AND REFLECTIVE OF CURRENT SITE CONDITIONS.

HYDROSEED MIX ONE

CONDITION: HIGH VISIBILITY, HIGHLY ORNAMENTAL AREAS (ADJACENT TO ROADWAYS, RESIDENTIAL SLOPES, PARK AREAS, ETC.). IN ADDITION, THIS MIX IS SUITED TO ALL SLOPE HEIGHTS. HOWEVER, DUE TO THE RELATIVELY SMALLER MATURE SIZE OF THE PLANT MATERIAL, IT IS ESPECIALLY SUITED TO SLOPES LESS THAN TEN FEET IN HEIGHT. IN THESE CONDITIONS, THE PLANT MATERIAL WILL NOT EXTEND MUCH BEYOND THE LIMITS OF THE SLOPE.

APPLICATION RATE	BOTANICAL NAME
NURSE CROP	
3 LBS/ACRE	LOBULARIA MARITIMA 'CARPET OF SNOW' (1)
3 LBS/ACRE	LOBULARIA MARITIMA 'ROYAL CARPET' (2)
3 LBS/ACRE	ENCHOCHOLZIA CALIFORNICA
3 LBS/ACRE	LINUM GRANDIFLORUM 'RUBRUM'
PERENNIALS	
9 LBS/ACRE	ATRIPLEX SEMIBACCATA
5 LBS/ACRE	GAZANIA 'PIXIE DELIGHT' (3)
6 LBS/ACRE	LIMONIUM PEREZII
2 LBS/ACRE	OENOTHERA CHEIRANTHIFOLIA
SHRUBS/TREES	
2 LBS/ACRE	ACACIA SALIGNA
3 LBS/ACRE	MIMULUS PUNICEUS
4 LBS/ACRE	ENCELIA COLIFORNICA
3 LBS/ACRE	CISTUS CORSICUS
46 LBS/ACRE TOTAL	

% MINIMUM PURITY OF SEED – 95
(1) CAN BE USED WITHOUT 'ROYAL CARPET' AT THE RATE OF 5 LBS/ACRE
(2) CAN BE USED WITHOUT 'CARPET OF SNOW' AT THE RATE OF 5 LBS/ACRE
(3) CAN BE SPECIFIED IN EITHER WHITE, ORANGE OR YELLOW, OR MIXED

HYDROSEED MIX TWO

CONDITION: MODERATE VISIBILITY (INTERIOR SLOPES OF COMMERCIAL AND INDUSTRIAL DEVELOPMENTS).

APPLICATION RATE	BOTANICAL NAME
NURSE CROP	
3 LBS/ACRE	LOBULARIA MARITIMA 'CARPET OF SNOW' (4)
3 LBS/ACRE	LOBULARIA MARITIMA 'ROYAL CARPET' (5)
3 LBS/ACRE	ENCHOCHOLZIA COLIFORNICA
2 LBS/ACRE	LINUM GRANDIFLORUM 'RUBRUM'
PERENNIALS	
14 LBS/ACRE	ERIGONUM FASICULATUM
8 LBS/ACRE	LOTUS SCOPARIUS
9 LBS/ACRE	ATRIPLEX SEMIBACCATA
7 LBS/ACRE	ATRIPLEX GLAUCA
3 LBS/ACRE	ARTEMISIA PYNOCEPHALA
SHRUBS/TREES	
2 LBS/ACRE	MIMULUS PUNICEUS
3 LBS/ACRE	ENCELIA COLIFORNICA
5 LBS/ACRE	VIQUIERA LACINLATA
2 LBS/ACRE	SALVIA CLEVELANDII
2 LBS/ACRE	SALVIA MELIFERA
66 LBS/ACRE TOTAL	

NOTE: FOR NON-IRRIGATED APPLICATION, INCREASE THE APPLICATION RATE BY 20% OF THE FOLLOWING SPECIES: ERIOGONUM FASCICULATUM, ATRIPLEX GLAUCA, ATRIPLEX SEMIBACCATA, ENCELIA COLIFORNICA.

NON-IRRIGATED APPLICATION REQUIRES THE PRIOR APPROVAL OF THE PLANNING DEPARTMENT.

% MINIMUM PURITY OF SEED – 95
(4) CAN BE USED WITHOUT 'ROYAL CARPET' AT THE RATE OF 5 LBS/ACRE
(5) CAN BE USED WITHOUT 'CARPET OF SNOW' AT THE RATE OF 5 LBS/ACRE

HYDROSEED MIX THREE

CONDITION: LOW VISIBILITY, OPEN SPACE AREAS.

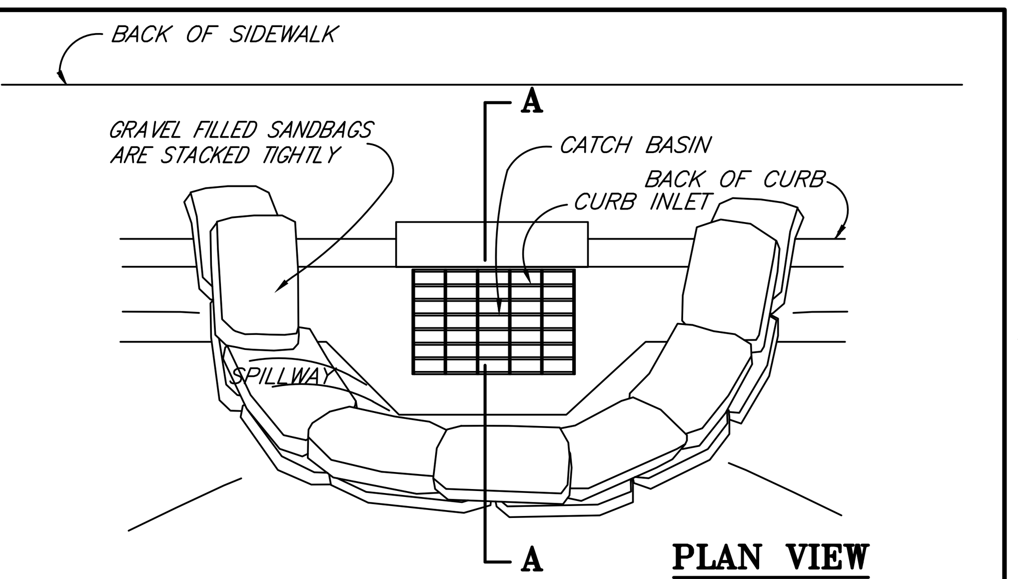
APPLICATION RATE	BOTANICAL NAME
NURSE CROP	
10 LBS/ACRE	BROMUS RUBENS
3 LBS/ACRE	ENCHOCHOLZIA COLIFORNICA
PERENNIALS	
10 LBS/ACRE	ATRIPLEX SEMIBACCATA
8 LBA/ACRE	LOTUS SCOPARIUS
10 LBS/ACRE	ATRIPLEX GLAUCA
8 LBS/ACRE	ATRIPLEX CARNASCENE
2 LBS/ACRE	HAPLOPAPPUS VENETUS
SHRUBS/TREES	
3 LBS/ACRE	MIMULUS PUNICEUS
3 LBS/ACRE	ENCELIA COLIFORNICA
5 LBS/ACRE	VIQUIERA LACINLATA
3 LBS/ACRE	BACCHARIS PILULARIS 'CONSANGUIENA'
65 LBS/ACRE TOTAL	

NOTE: FOR NON-IRRIGATED APPLICATION, INCREASE THE APPLICATION RATE BY 20% OF THE FOLLOWING SPECIES: ERIOGONUM FASICULATUM, ATRIPLEX GLAUCA, ATRIPLEX SEMIBACCATA, ENCELIA COLIFORNICA.

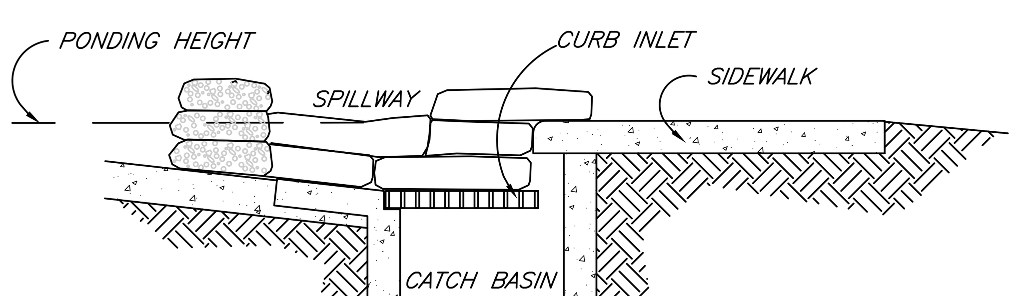
NON-IRRIGATED APPLICATION REQUIRES THE PRIOR APPROVAL OF THE PLANNING DEPARTMENT.

% MINIMUM PURITY OF SEED – 95

EROSION CONTROL DETAILS



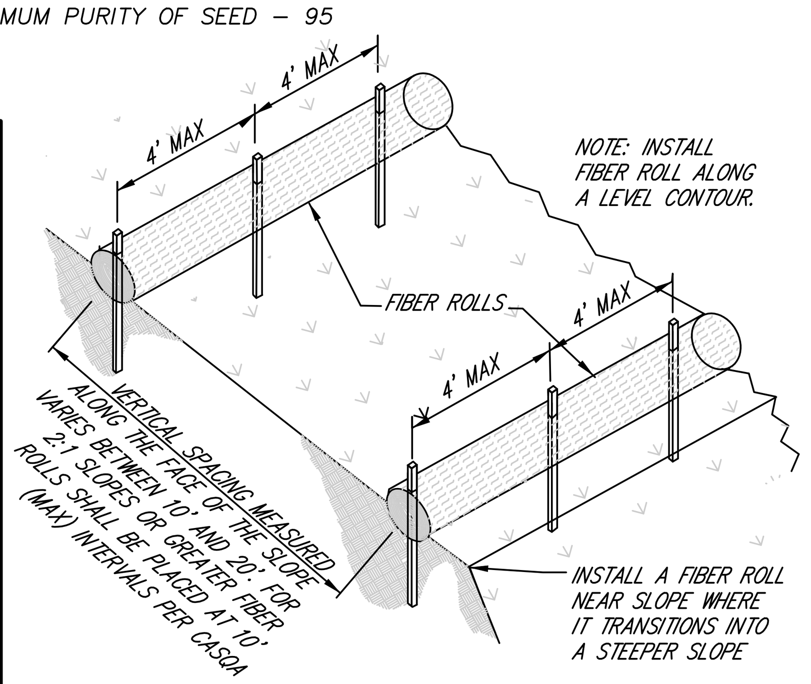
PLAN VIEW



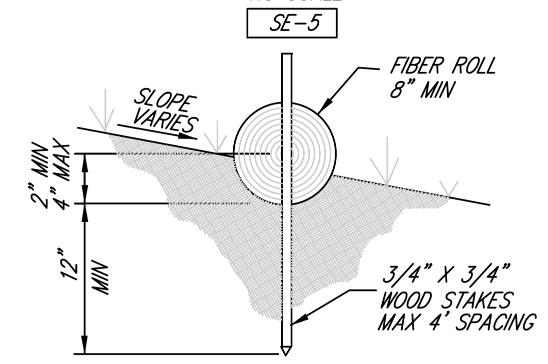
SECTION A – A

NOTES:
1. PLACE CURB TYPE SEDIMENT BARRIERS ON GENTLY SLOPING STREET SEGMENTS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. SANDBAGS, OF EITHER BURLAP OR WOVEN GEOTEXTILE FABRIC, ARE FILLED WITH GRAVEL, LAYERED AND PACKED TIGHTLY.
3. LEAVE ONE SANDBAG GAP IN THE TOP ROW TO PROVIDE A SPILLWAY FOR OVERFLOW.
4. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.

CURB INLET SEDIMENT BARRIER (SANDBAGS)

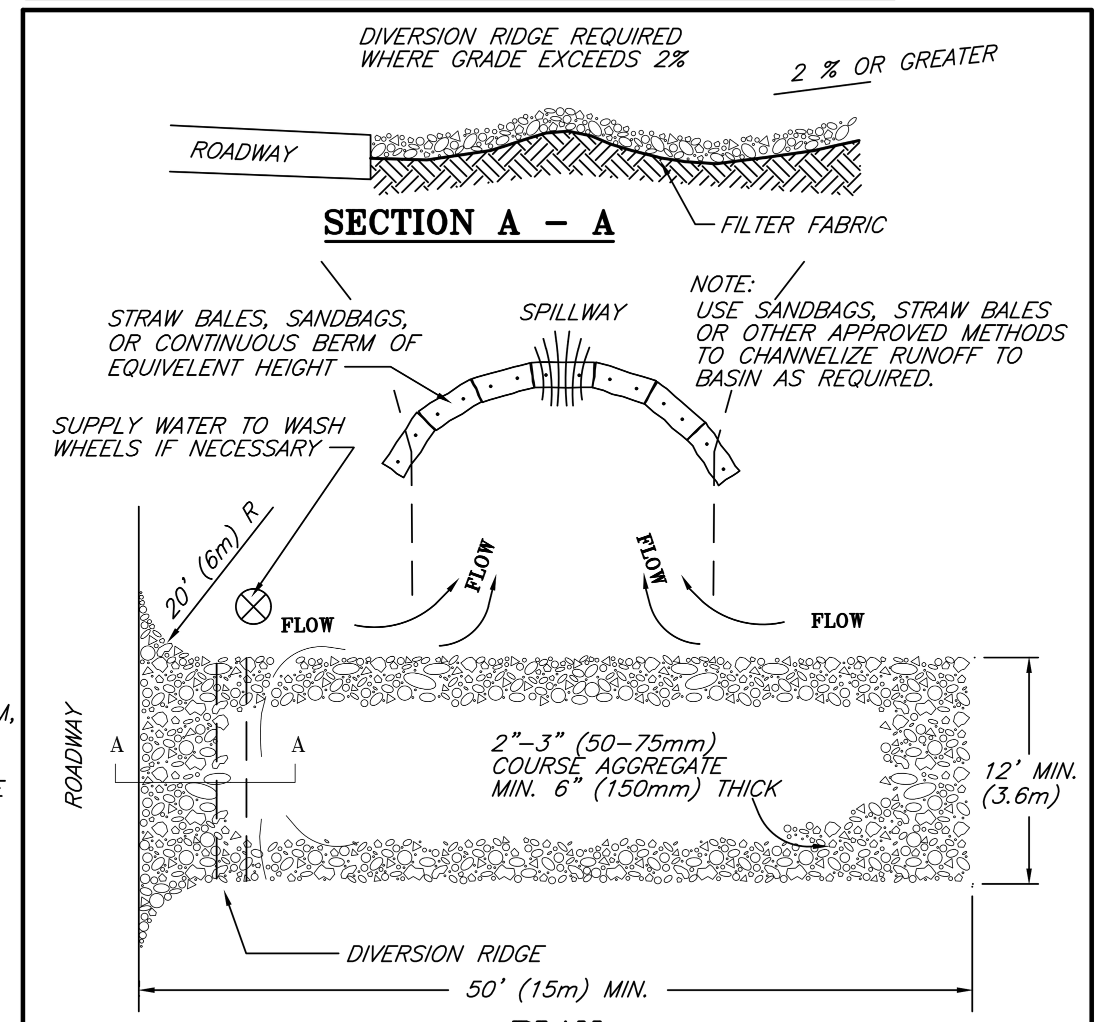


TYPICAL FIBER ROLL INSTALLATION
NO SCALE
SE-5



ENTRENCHMENT DETAIL
NO SCALE
SE-5

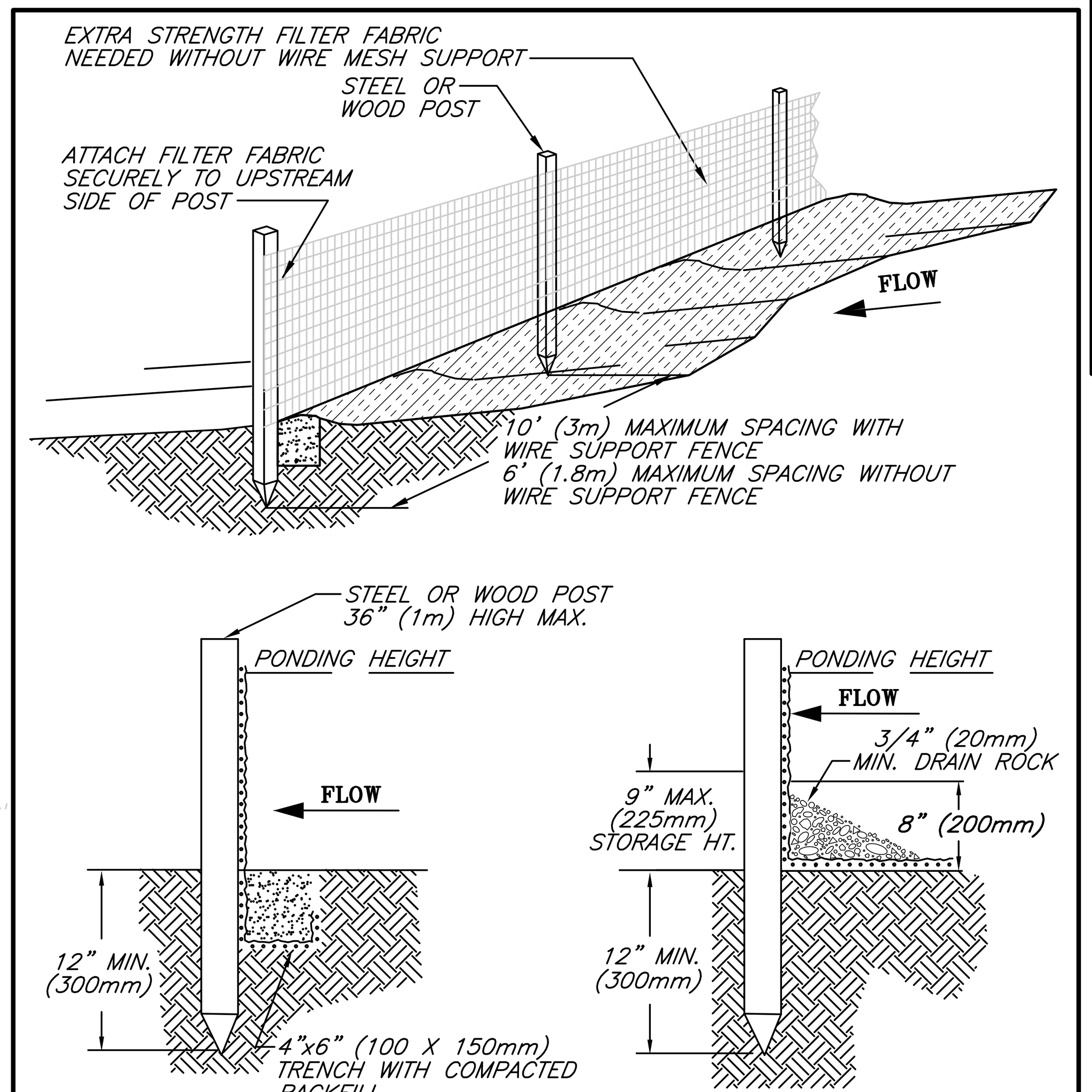
EROSION CONTROL DETAILS (CONT'D)



PLAN

NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABLIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

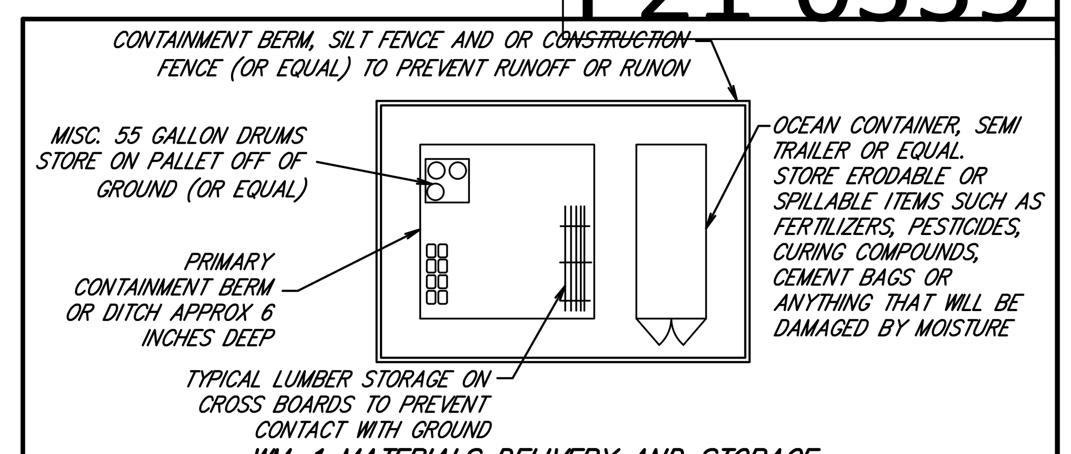
TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT



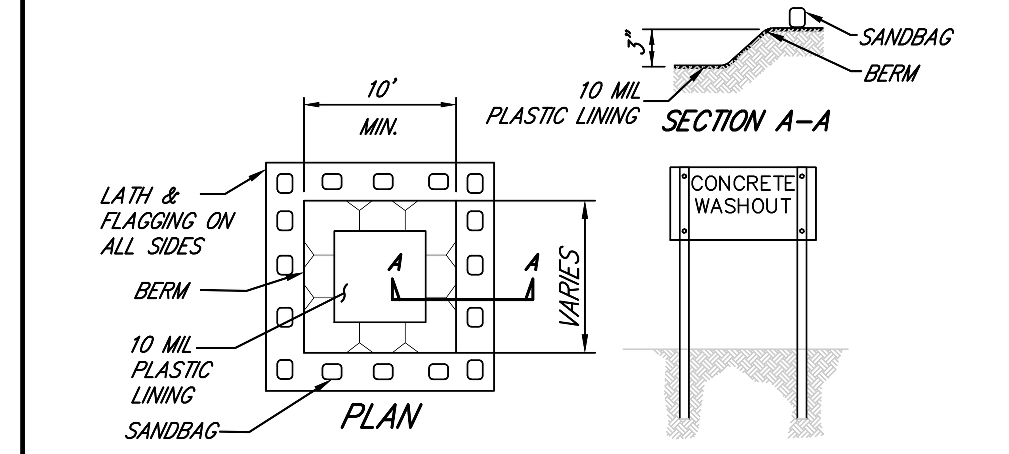
NOTES:
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" (225mm) MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE TO SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

NOT TO SCALE

SILT FENCE

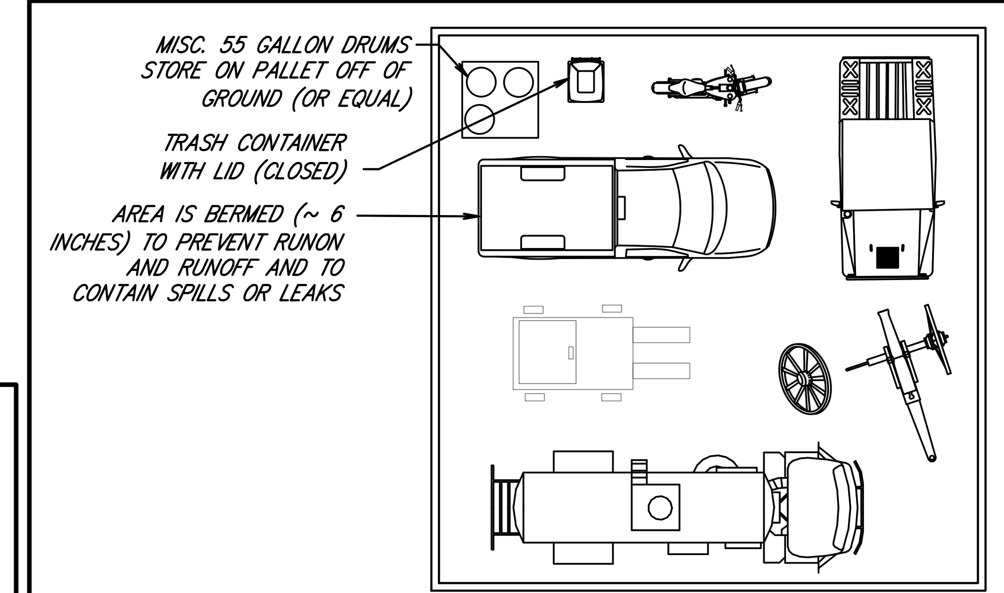


WM-1 MATERIALS DELIVERY AND STORAGE
NOT TO SCALE



NOTE: SEE CONCRETE WASTE MANAGEMENT DETAIL WM-8 PER CALIFORNIA STORMWATER BMP HANDBOOK

WM-8 CONCRETE WASTE MANAGEMENT
NOT TO SCALE



NS-8 VEHICLE AND EQUIPMENT CLEANING
NS-9 VEHICLE AND EQUIPMENT FUELING
NS-10 VEHICLE AND EQUIPMENT MAINTENANCES
NOT TO SCALE

SITE DEVELOPMENT PLAN EXPIRES:
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER	
INSPECTION PRIORITY ______	WDID NO. ______

ENGINEER OF WORK			
	45629	12/31/2023	
ENGINEER OF WORK	RCE	EXP.LIC.DATE	DATE

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

CITY of VISTA

EROSION CONTROL NOTES FOR:

1430 DECISION ST

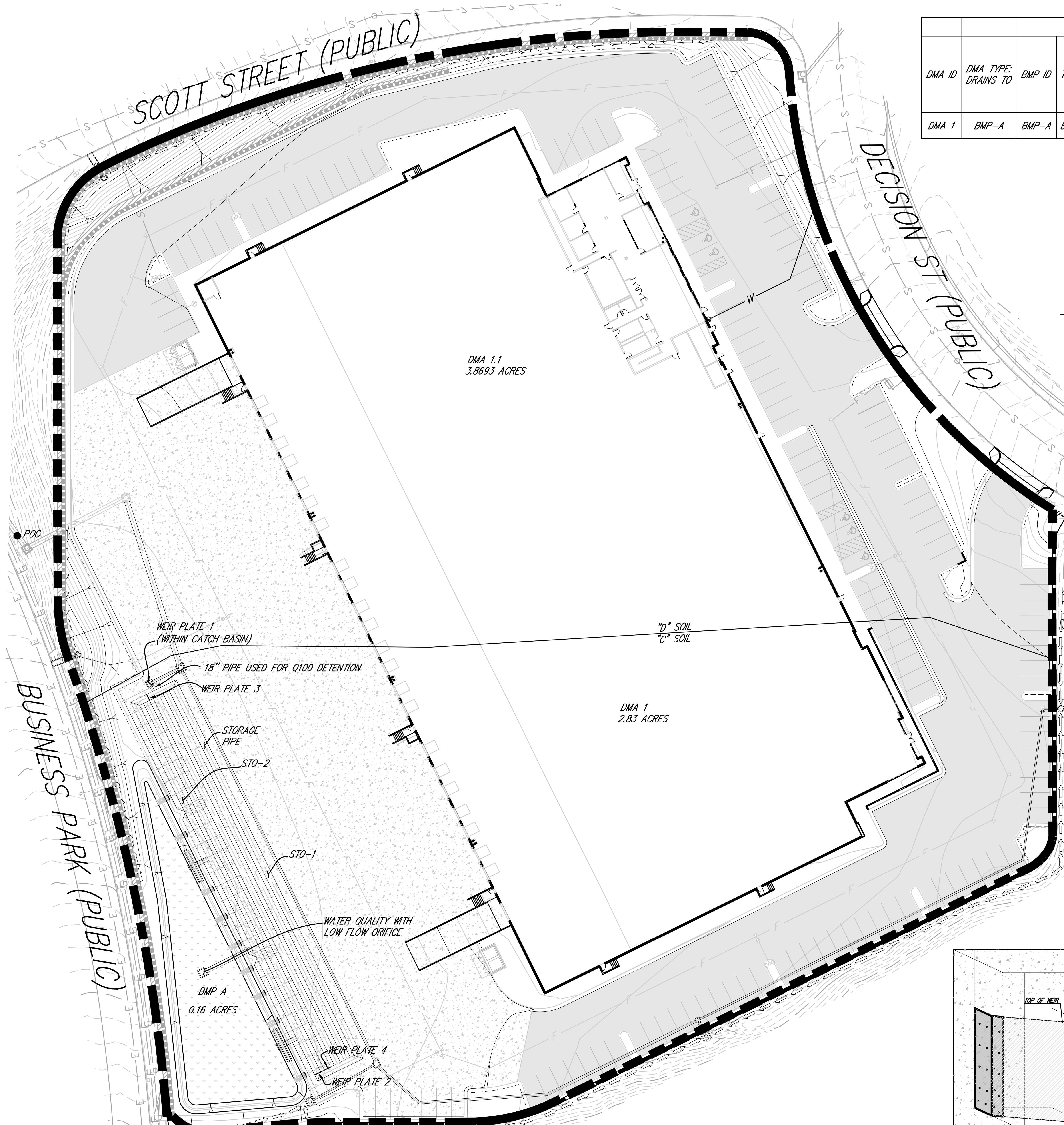
ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER ______ RCE ______ EXPIRES ______ DATE ______
BENCH MARK:

SHEET 13 OF 14

P21-0339

		STRUCTURAL BMP SUMMARY TABLE											
DMA ID	DMA TYPE: DRAINS TO	BMP ID	TYPE OF BMP	EFFECTIVE AREA (SQFT)	A1 (INCH)	A2 (INCH) TOP OF BASIN	C (INCH) MEDIA	D (INCH) GRAVEL	E (INCH)	BOX RISER / OVERFLOW STRUCTURE SIZE (INCHES)	ORIFICES		IMPERMEABLE LINER?
											UPPER (INCH)	LOWER (INCH)	
DMA 1	BMP-A	BMP-A	BIOFILTRATION	7300	9	21	18.0	12.0	27	36x36	N/A	2.375 ø	YES



PERMANENT WATER QUALITY

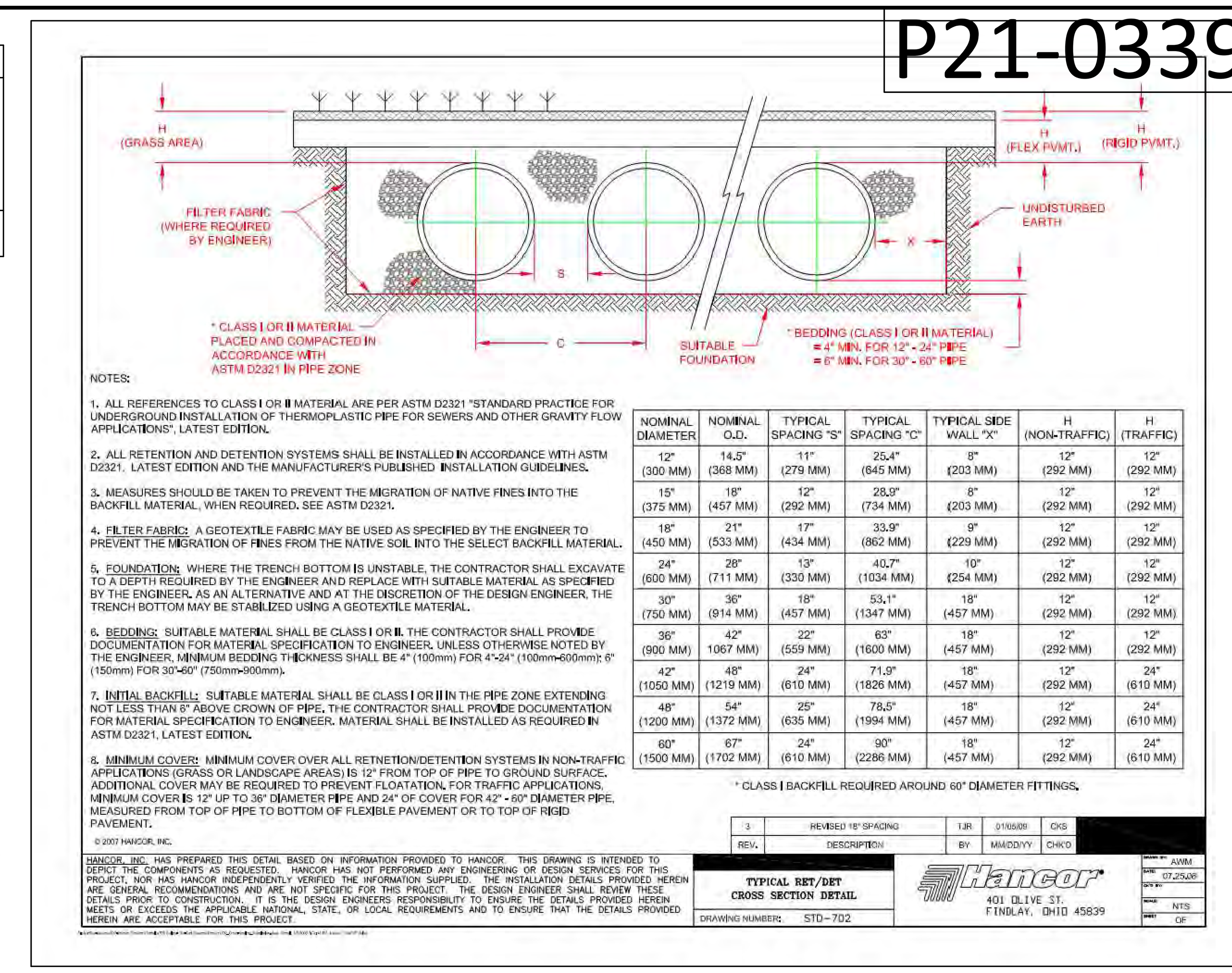
TREATMENT FACILITY

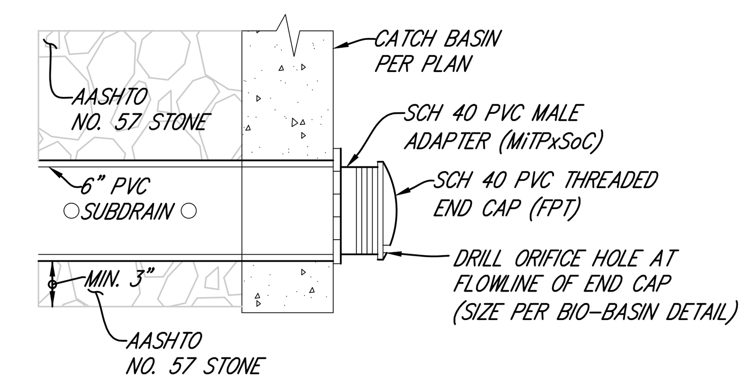
KEEPING OUR WATER WAYS CLEAN

MAINTAIN WITH CARE – NO MODIFICATIONS WITHOUT AGENCY APPROVAL

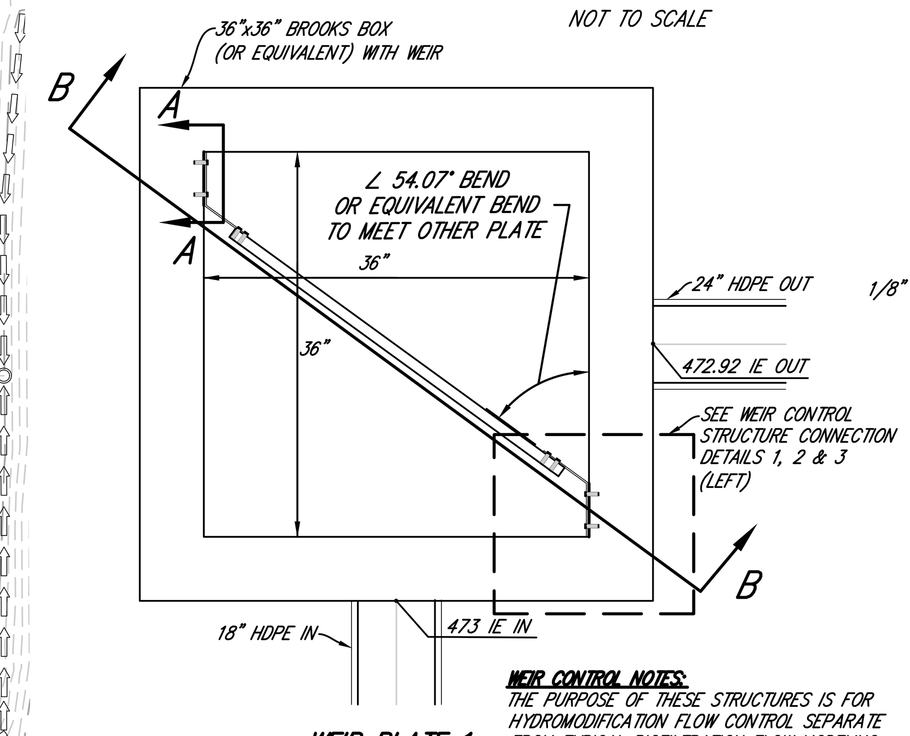
DETAIL
WATER QUALITY SIGN– PLACED AT EACH BIOFILTRATION BASIN

NOTE: ALL BIOFILTRATION AREAS WILL HAVE A SIGN POSTED TO BE VISIBLE AT ALL TIMES.



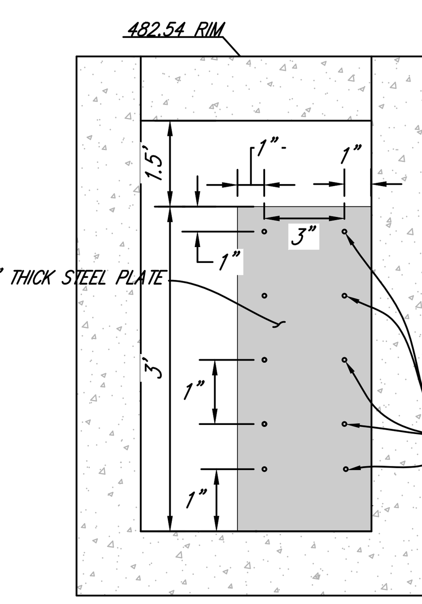


LOWER ORIFICE DETAIL
NOT TO SCALE



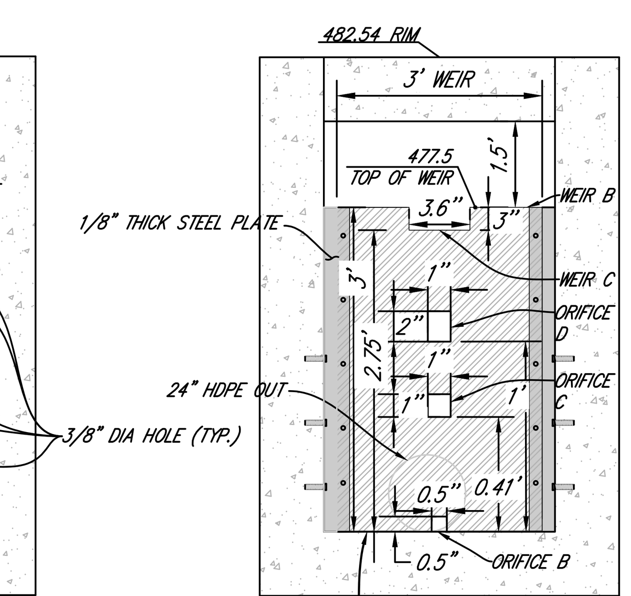
WEIR CONTROL NOTES:
THE PURPOSE OF THESE STRUCTURES IS FOR HYDROMODIFICATION FLOW CONTROL SEPARATE FROM TYPICAL BIOFILTRATION FLOW MODELING.

WEIR PLATE 1
NOT TO SCALE

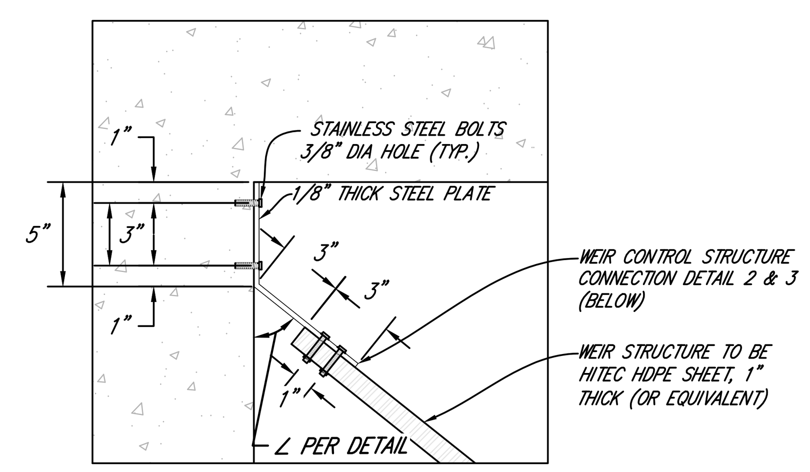


SECTION A-A
NOT TO SCALE

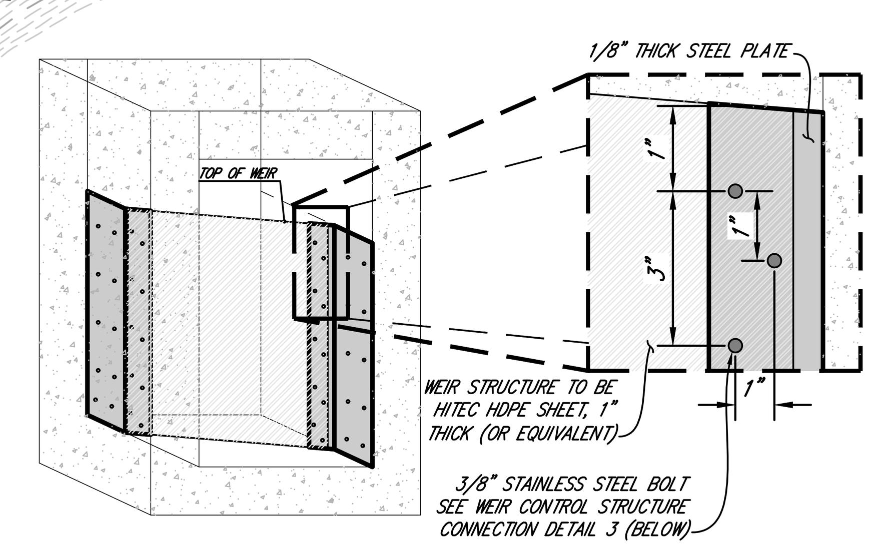
WEIR MUST BE FLUSHED WITH GROUND AND SEALED WITH "HENRY 900 CONSTRUCTION & FLASHING SEALANT" (OR EQUIVALENT)



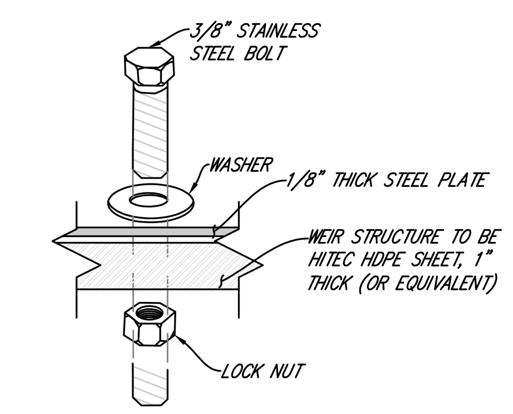
SECTION B-B
NOT TO SCALE



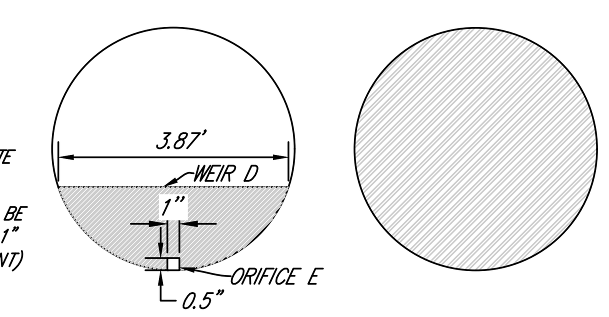
WEIR CONTROL STRUCTURE CONNECTION DETAIL 1
NOT TO SCALE



WEIR CONTROL STRUCTURE CONNECTION DETAIL 2
NOT TO SCALE



WEIR CONTROL STRUCTURE CONNECTION DETAIL 3
NOT TO SCALE

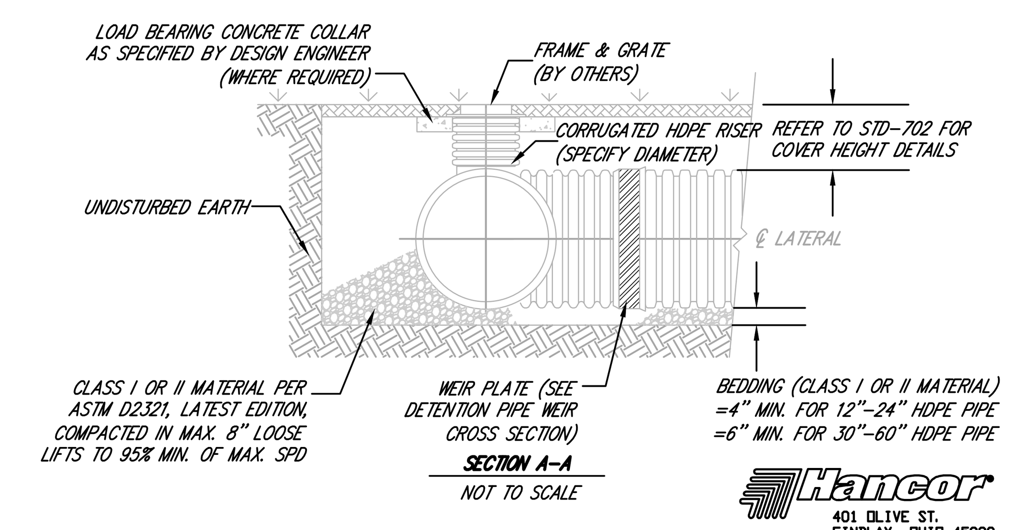


DETENTION PIPE WEIR CROSS SECTION

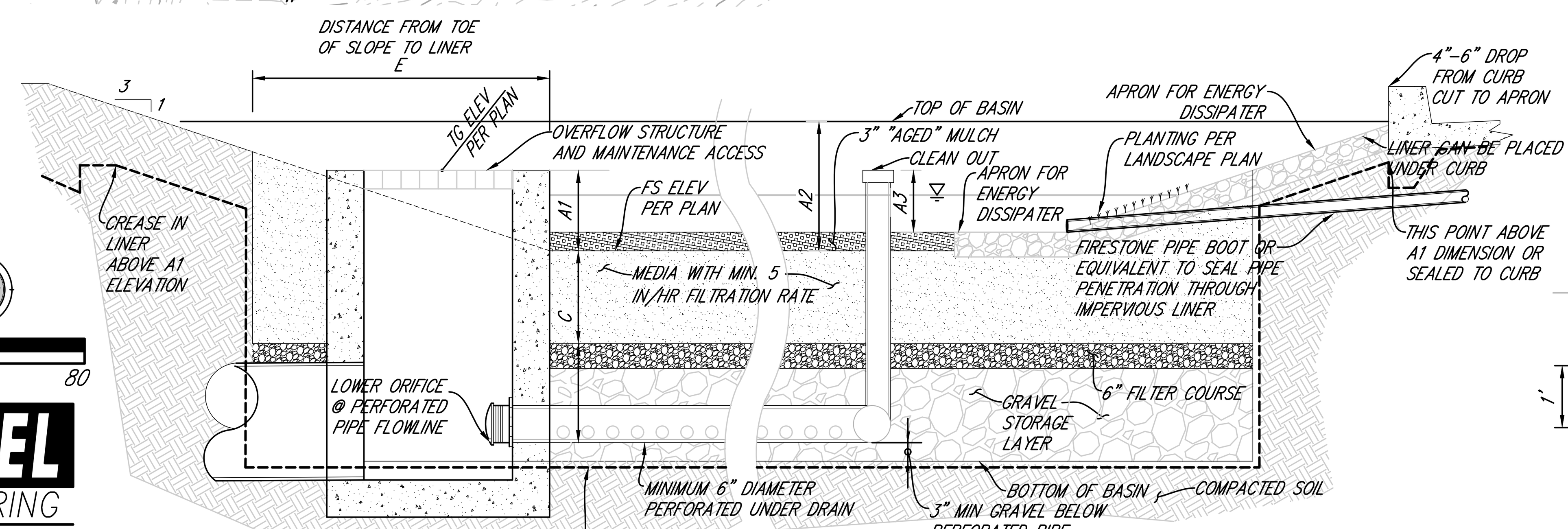
WEIR PLATE 2
NOT TO SCALE

WEIR PLATE 3 AND 4
NOT TO SCALE

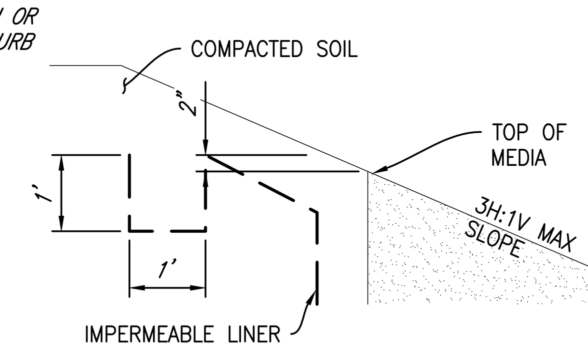
WEIR CONTROL NOTES:
WEIR PLATE 3 AND 4 ARE USED TO BLOCK WATER IN DETENTION PIPE.



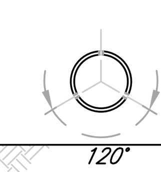
SECTION A-A
NOT TO SCALE



CATCH BASIN DETAIL
NOT TO SCALE



IMPERMEABLE LINER EDGE ANCHOR DETAIL
NOT TO SCALE



6" PVC PIPE PERFORATION LAYOUT DETAIL
NOT TO SCALE

DETAIL
"NO DUMPING" AT CATCH BASINS

NOTE: ALL CATCH BASINS WITH GRATES SHALL BE STENCILED WITH CITY REQUIRED ITEM PER ABOVE DETAIL (DAS MANUFACTURING #SDO OR EQUIVALENT).

SCALE: 1:40
0 40 80

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

ENGINEER OF WORK

ENGINEER OF WORK	45629 RCE	12/31/2023 EXP.LIC.DATE	DATE

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
CIVIL
STATE OF CALIFORNIA

SITE DEVELOPMENT PLAN EXPIRES: ______
THIS PLAN IS VALID FOR 2 YEARS FROM APPROVAL

STORMWATER
INSPECTION PRIORITY ______ WDID NO. ______

CITY of VISTA

DMA EXHIBIT FOR:

1430 DECISION ST

ADDRESS: 1430 DECCISION ST, VISTA CA

APPROVED
FOR CITY ENGINEER ___ RCE ___ EXPIRES ___ DATE
BENCH MARK:

SHEET 14 OF 14

P21-0339

V:\21\21052\Engineering\PLOT PLAN\PRELIMSP\POST DMA.dwg 4/13/2022 10:36 AM ORIGINAL PLOT SIZE: ----