Draft 60% Hydrologic and Hydraulic Technical Report

Berkeley Water Transportation Pier Ferry Project

City of Berkeley, Alameda County, California

COWI
555 12th Street, Suite 1700
Oakland, CA 94607



January 2026

NCE
1003 W. Cutting Blvd., Suite 110
Point Richmond, CA 94804

NCE Project No. 1421.01.55

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January 2026

Prepared for:

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NCE Project No. 1421.01.55

Table of Contents

1 Introduction 1

1.1 Existing Site Conditions 1

1.2 Proposed Project Improvements 1

2 Hydrologic Analysis 3

2.1 Methodology 3

2.2 Existing Conditions 3

2.3 Proposed Conditions 3

3 Hydraulic Analysis 12

4 Water Quality Design 13

5 Conclusions 15

6 References 16

List of Tables

Table 1. Permeable Parking Volume Comparison 14

Table 2. Bioretention Areas and Flow-through Planter Area Comparison 14

List of Figures

Figure 1. Project Location 2

Figure 2. Hydrologic Inputs 5

Figure 3A-C. Existing Conditions Drainage 6

Figure 4A-C. Proposed Conditions Drainage 9

List of Appendices

Appendix A

Hydrologic Analysis and References

Appendix B

Water Quality Calculations

Appendix C

Select 60% Design Plans

List of Abbreviations

Abbreviation	Definition
Bay	San Francisco Bay
ACHHM	Alameda County Hydrology & Hydraulics Manual
BWTPF	Berkeley Water Transportation Pier Ferry
District	Alameda County Flood Control & Water Conservation District
DMA	Drainage Management Area
GIS	Geographic Information System
MRP	Municipal Regional Stormwater Permit
NRCS	Natural Resources Conservation Service
STG	C.3 Stormwater Technical Guidance

1 Introduction

This Hydrologic and Hydraulic Technical Report summarizes the design of the stormwater infrastructure of the Berkeley Water Transportation Pier Ferry (BWTPF) Project. The BWTPF Project is located at Berkeley Point and includes improvements to University Avenue, Seawall Drive, and the parking lot at the terminus of Seawall Drive (Figure 1).

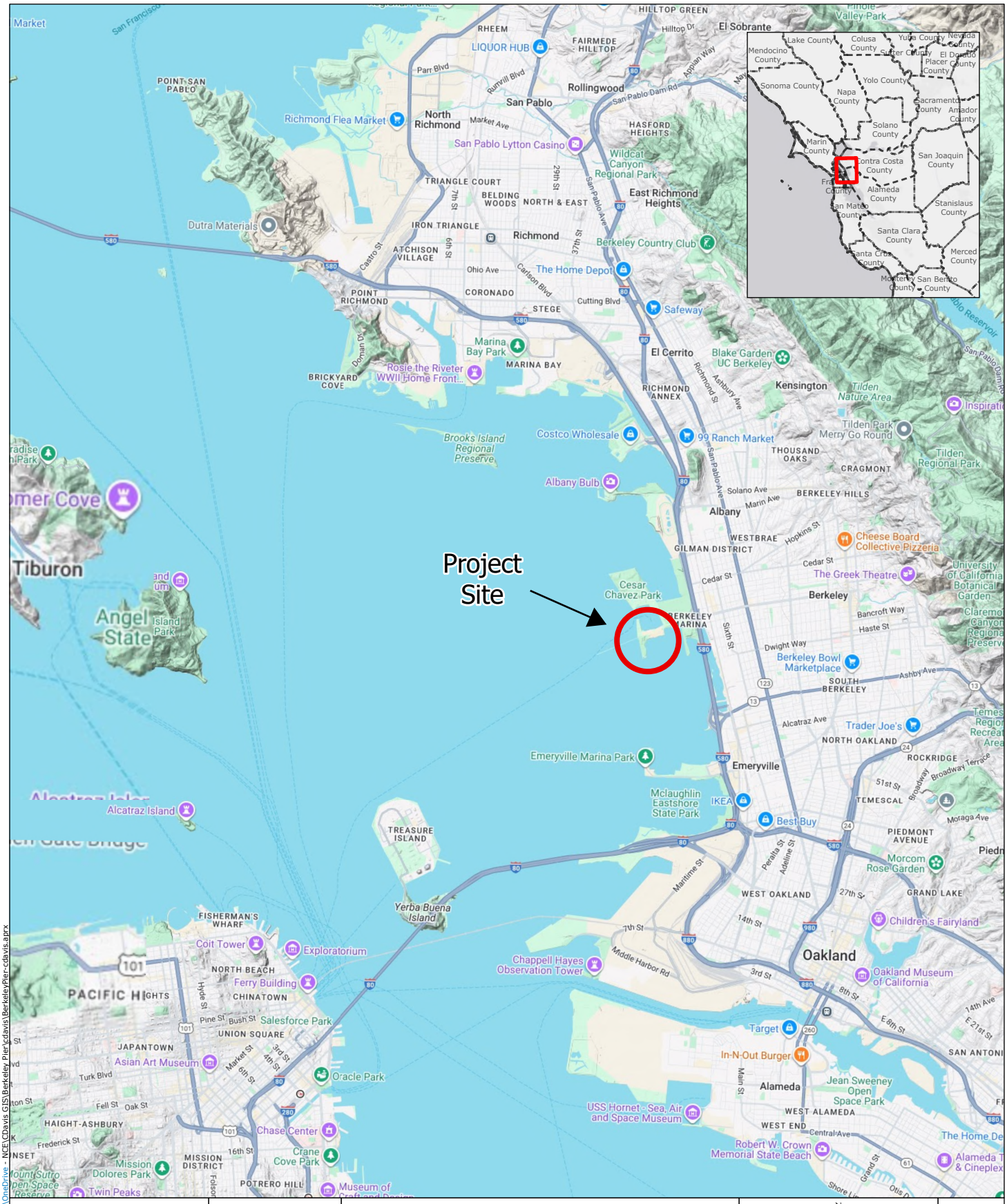
This report documents the existing drainage conditions of the site and the recommended stormwater treatment facilities as well as provide documentation of the methods, results, and assumptions of the hydrologic and hydraulic analyses.

1.1 Existing Site Conditions

The Project area, which begins to the west of the University Avenue roundabout to Seawall Drive and south to an existing parking lot, generally drains to the San Francisco Bay (Bay) either via drain inlets and storm drain pipes or by sheet flow. A couple of drainage inlets are located along the south side of the roadway near the University Avenue roundabout. Flows from the northern side of University Avenue generally flow onto adjacent parking lots, which contain drainage inlets. Runoff in the area near the intersection of University Avenue and Seawall Drive is collected by drain inlets along the western curb line. Further along Seawall Drive to the south, runoff sheet flows across the existing parking area before discharging into the Bay. The parking lot at the terminus of Seawall Drive contains a number of small, clogged, drain inlets. These inlets discharge directly to the Bay.

1.2 Proposed Project Improvements

The proposed drainage improvements as part of the BWTPF Project include construction of new bioretention areas and permeable pavers/parking with perforated underdrains. The underdrains will discharge into the bioretention areas, which will have overflow points connecting to the existing storm drain outfalls into the Bay. The proposed drainage improvements related to the BWTPF Project will not result in new storm drain outfalls to the San Francisco Bay as the proposed storm water and storm drain improvements will tie into existing outfalls.



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Berkeley Water Transportation Pier Ferry Project

Project Location

N

1 in. = 9,000 ft.

0 3,000 6,000 9,000 ft.

FIGURE 1

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
Google Map	1421.01.55	cdavis	1/11/2026	-	-

2 Hydrologic Analysis

2.1 Methodology

The hydrologic analysis of the BWTPF Project followed methodologies outlined in the Alameda County Flood Control & Water Conservation District's (District) 2025 Alameda County Hydrology & Hydraulics Manual (ACHHM). The calculation form and Geographic Information System (GIS) shapefiles provided on the District's webpage informed the inputs to the hydrologic calculations. Excerpts from the ACHHM are provided in **Appendix A**.

Given that the contributing watershed is less than 320 acres, the District's modified form of the Rational Method was applied to calculate the peak discharges associated with the 10-year and 100-year storm events. As demonstrated in **Figure 2** and **Attachment 6** in **Appendix A**, the BWTPF project is located between the 22-inch and 23-inch isohyets of mean annual precipitation. A mean annual precipitation of 22.7 inches was applied in hydrologic calculations for the BWTPF Project. The NRCS GIS soils data shown in **Figure 2** and **Attachment 9** in **Appendix A** demonstrate that the Project is underlain by a Hydrologic Soil Group Type D.

Sub-basins were delineated for both existing and proposed conditions within the Project area. Topographic data developed from a 2024 aerial survey was used to delineate the existing conditions sub-basins. The proposed conditions sub-basins were delineated based upon proposed improvements and grading with off-site areas referencing the topographic data. These same topographic sources allowed for calculation of the time of concentrations for each of the sub-basins in both existing and proposed conditions with methodology following the ACHHM.

An area weighted C-value was calculated for each sub-basin in both existing and proposed conditions. Per the ACHHM, a C-value of 0.9 was applied to the impervious areas. For pervious area and areas of proposed permeable parking, a C-value of 0.25 was used (**Appendix A**).

2.2 Existing Conditions

The Project area was delineated into 21 sub-basins based on grading and drainage outfall locations. Areas that are currently sheet flowing directly into the Bay along Seawall Drive and adjacent to the parking lot at its terminus were not delineated. **Figure 3A-3C** show the sub-basins, the flowpaths used in the time of concentration calculations, and the concentration points where flow either enters a drainage inlet or flows out of the project area. Peak flow calculations for the 10-year and 100-year storm events are provided in **Appendix A**.

2.3 Proposed Conditions

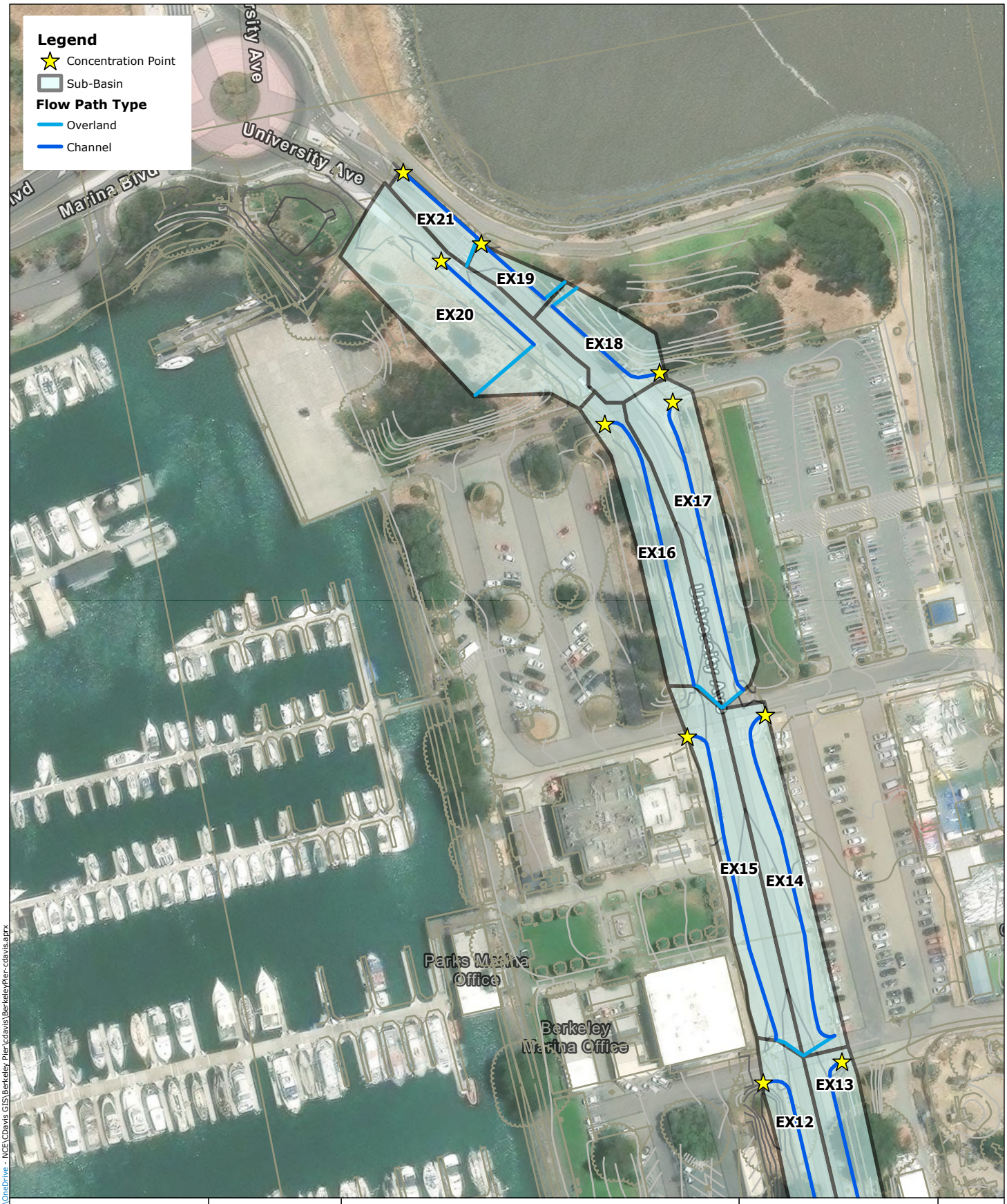
The proposed drainage improvements associated with the BWTPF Project include the construction of new bioretention areas, permeable parking with perforated underdrains, and flow-through planters. Based on the proposed grading and improvements, the Project area was delineated into 28 sub-basins. Runoff that will sheetflow from the asphalt or concrete surfaces and flow onto the permeable pavers/parking area was conveyed to the sub-basin low point in the time of concentration calculations. These calculations will be refined as the project progresses to the 90% design level. **Figures 4A-4C** demonstrate the proposed conditions sub-basins, the flowpaths used in the time of concentration calculations, and the concentration points where flows

either enter a drain inlet or a bioretention area or where flows leave the project area. Peak flow calculations for the 10-year and 100-year storm events are provided in **Appendix A**.



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CITY OF BERKELEY	NCE	Berkeley Water Transportation Pier Ferry Project Hydrologic Inputs	N 0 1,000 2,000 ft.			FIGURE 2
SOURCE		JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata		1421.01.55	cdavis	1/11/2026	-	-



Berkeley Water Transportation Pier Ferry Project

Existing Conditions Drainage

N

0 50 100 ft.

FIGURE 3A

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata	1421.01.55	cdavis	1/11/2026	-	-

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Berkeley Water Transportation Pier Ferry Project

Existing Conditions Drainage

N

0 50 100 ft.

FIGURE 3B

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata	1421.01.55	cdavis	1/11/2026	-	-

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Berkeley Water Transportation
Pier Ferry Project

Existing Conditions Drainage

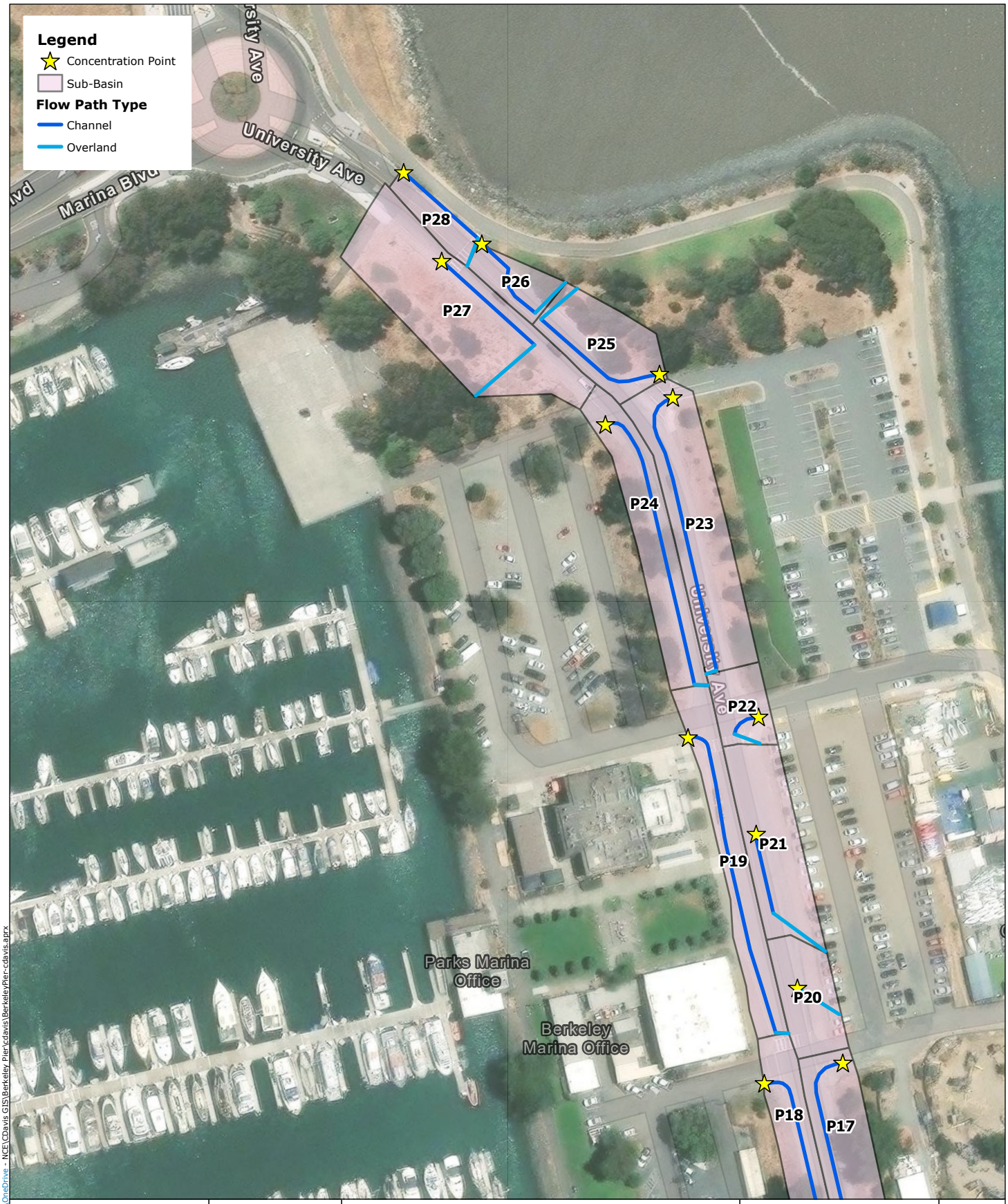
N

0 50 100 ft.

FIGURE
3C

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata	1421.01.55	cdavis	1/11/2026	-	-

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Berkeley Water Transportation
Pier Ferry Project

Proposed Conditions Drainage

N

0 50 100 ft.

FIGURE
4A

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
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Berkeley Water Transportation
Pier Ferry Project

Proposed Conditions Drainage

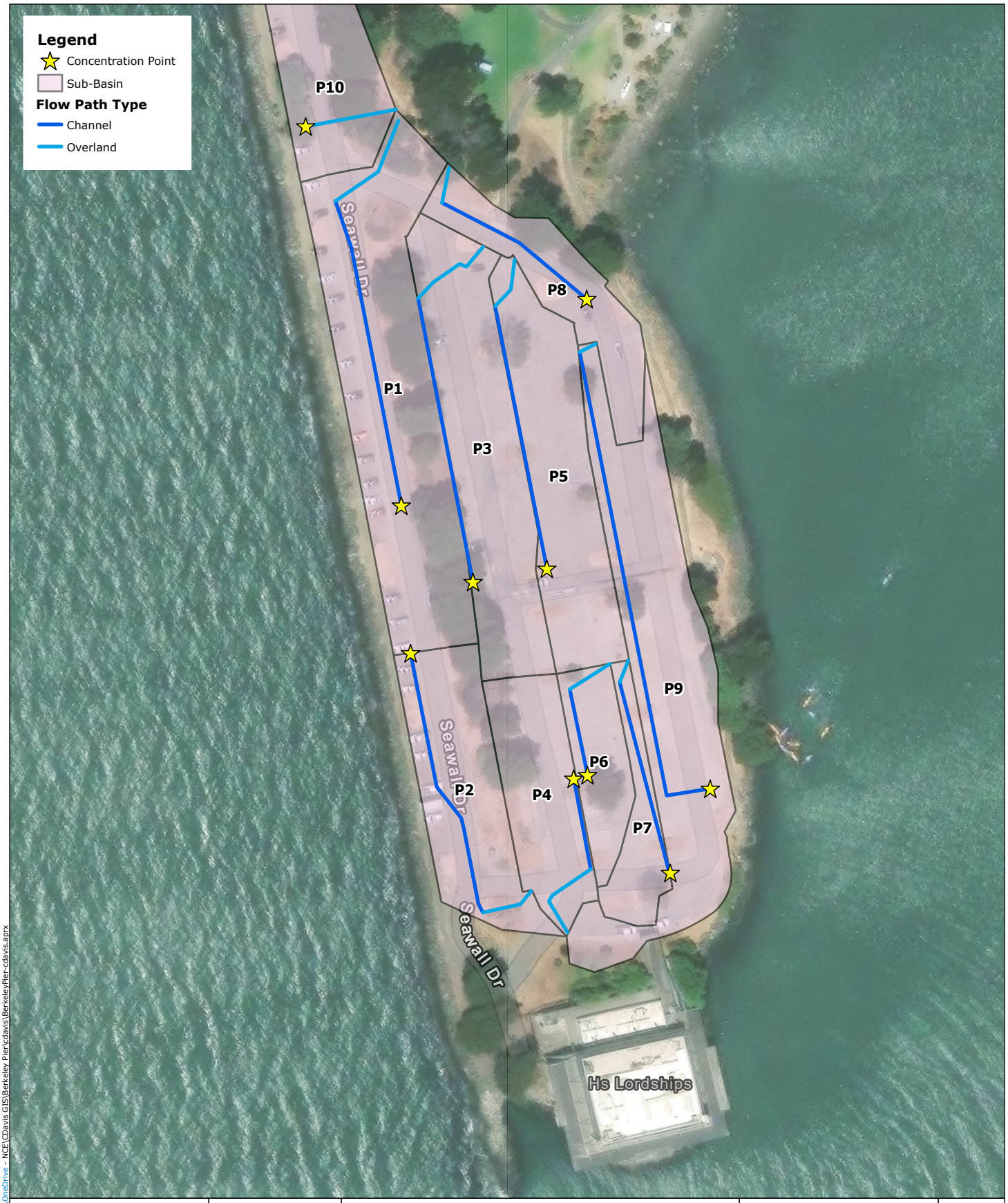
N

0 50 100 ft.

FIGURE
4B

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
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Berkeley Water Transportation Pier Ferry Project

Proposed Conditions Drainage

N

0 50 100 ft.

FIGURE 4C

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata	1421.01.55	cdavis	1/11/2026	-	-

3 Hydraulic Analysis

This section will be prepared as part of 90% design phase.

4 Water Quality Design

This project will be designed in accordance with the recent third reissuance of the San Francisco Bay Municipal Regional Stormwater Permit (MRP 3.0) and the new regulated project thresholds in Provision C.3 of the Alameda Countywide Clean Water Program. Given that the roadway, sidewalks, and parking area will be reconstructed or significantly rehabilitated to accommodate proposed geometric changes and proposed improvements, the contiguous 1-acre threshold will be exceeded, classifying the BWTPF Project as a regulated project under C.3.b. Since the BWTPF Project is not included within a susceptible area on the hydromodification susceptibility map (**Appendix B**) the project will not be required to implement hydromodification control measures. However, as a regulated project, the design of green infrastructure is being included as part of the BWTPF Project.

The proposed water quality design improvements as part of this project include permeable parking, bioretention basins, and flow-through planters. The Project area was delineated into drainage management areas (DMA) based on proposed grading and drainage improvements such that each DMA drains to a treatment facility.

Methodologies outlined in the C.3 Stormwater Technical Guidance (STG) report dated March 2023 were applied in the water quality calculations. The map provided in Appendix D of the C.3 STG document indicates that the Mean Annual Precipitation for the Project area is 20 inches. The February 2014 C.3 sizing spreadsheets were used to support this analysis. Results of the calculations are provided in **Appendix B**. The DMAs are shown in **Figures B.1** and **B.2** in **Appendix B**.

The 80% capture method is recommended in the sizing of permeable parking areas. The C.3 spreadsheet calculates the depth of materials required beneath the permeable parking given the surface area. As part of the analysis, a depth of 12-inches was applied with 35% void space to determine the volume of water that could be stored under the proposed design configuration (**Table 1**). Results demonstrate that the DMAs draining to permeable parking areas, except for DMA 10, have adequate storage capacity to meet C.3 regulations. DMA 10 will be revisited during the 90% design phase. In most locations, the storage capacity associated with 12-inches of material significantly exceeds the 80% capture volume and half of the permeable parking areas can store the full volume of a 10-year event and a portion of the 100-year event. The volumes of the 10-year, 6-hour and 100-year, 6-hour events have been conservatively estimated by applying the rainfall depth from the ACHHM with a mean annual precipitation depth of ~22.7 inches by the full DMA/sub-basin area (**Appendix B**).

A flow-based sizing criteria is recommended by the C.3 for bioretention areas and flow-through planters. A simplified approach known as the 4% method applies a runoff inflow of 0.2 inches per hour with an infiltration rate through the biotreatment soil of 5 inches per hour. This method requires the surface area of the bioretention area or flow-through planter to be at least 4% of the imperious area that drains to it. The C.3 combined flow and volume spreadsheet was used to identify whether the size of the proposed bioretention areas and flow-through planters are adequate to achieve the 4% rule (**Table 2**). Only DMA 15 appears to require a larger surface area, which will be examined in further detail during the 90% design phase.

The storage volume of the bioretention basins will be examined in further detail during the 90% design phase.

Table 1. Permeable Parking Volume Comparison

DMA	Required Capture Volume	Design Storage Volume
	(cf)	(cf)
1A	197	2,012
2A	23	1,334
2B	833	1,077
3A	876	2,417
3B	182	2,390
4A	129	1,247
4B	431	1,295
5A	709	2,284
5B	87	2,057
6	388	1,068
7	258	1,290
9A	305	3,197
9B	543	2,310
10	985	831

Table 2. Bioretention Areas and Flow-through Planter Area Comparison

DMA	Required Surface Area (4%)	Design Treatment Area
	(sf)	(sf)
1B	1,028	1,192
8	437	828
9C	355	853
11	162	400
12	876	1,010
14	361	577
15	492	228
20	179	447
21	326	502

5 Conclusions

The proposed drainage improvements related to the BWTPF Project provide a water quality benefit through reduced runoff peaks and volumes. Through the construction of permeable parking, bioretention areas, and flow-through planters the required 80 % capture method and/or 4% method of the C.3 program will be achieved. In addition, this project will not result in new storm drain outfalls to the San Francisco Bay. Storm water and storm drain improvements will tie into existing outfalls.

6 References

Alameda County Flood Control & Water Conservation District. 2025. Alameda County Hydrology & Hydraulics Manual.

Alameda County Flood Control & Water Conservation District. 2025. The Work We Do, Resources, Hydrology Manual | Alameda County Flood Control District.

Alameda Countywide Clean Water Program. 2023. C.3 Stormwater Technical Guidance, March 23, 2023.

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City of Berkeley, Alameda County, California

January 2026

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Quality Control Reviewer:

Franz Haidinger, PE
Principal Engineer

NCE Project No. 1421.01.55

Appendix A

Hydrologic Analysis and References

MAP	=	22.7	in.
Return Freq	=	10	yrs.
Initial Tc	=	5	min.

HYDROLOGY CALCULATIONS

Existing Conditions - 10-year, 6-hour

Point of Conc.	Total Area [ac]	Impervious [sf]	Pervious [sf]	C Impervious [--]	C Pervious [--]	C [--]	Overland Slope[%]	Cs [--]	C+Cs	Ci [--]	C' [--]	Tc [min]	Intensity [in/hr]	Q=C'iA [cfs]
EX1	0.592	24327	1450	0.90	0.25	0.86	2	0	0.86	0.00	0.86	5.00	3.82	**1.9**
EX2	0.460	20041	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	7.17	3.11	**1.3**
EX3	0.199	8676	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	5.66	3.56	**0.6**
EX4	0.079	3442	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.52	3.28	**0.2**
EX5	0.196	5722	2798	0.90	0.25	0.69	2	0	0.69	0.04	0.72	6.82	3.2	**0.5**
EX6	0.548	23888	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.44	3.31	**1.6**
EX7	1.220	39345	13788	0.90	0.25	0.73	2	0	0.73	0.02	0.75	10.31	2.53	**2.3**
EX8	0.235	6387	3828	0.90	0.25	0.66	2	0	0.66	0.04	0.70	7.96	2.93	**0.5**
EX9	1.177	19797	31470	0.90	0.25	0.50	2	0	0.50	0.07	0.57	11.14	2.42	**1.6**
EX10	0.807	17923	17209	0.90	0.25	0.58	2	0	0.58	0.05	0.63	12.04	2.32	**1.2**
EX11	0.135	4228	1667	0.90	0.25	0.72	2	0	0.72	0.03	0.74	7.35	3.07	**0.3**
EX12	0.294	8634	4159	0.90	0.25	0.69	2	0	0.69	0.03	0.72	8.68	2.79	**0.6**
EX13	0.429	11834	6857	0.90	0.25	0.66	2	0	0.66	0.03	0.69	11.41	2.39	**0.7**
EX14	0.325	12888	1269	0.90	0.25	0.84	2	0	0.84	0.00	0.84	11.85	2.34	**0.7**
EX15	0.285	12431	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	9.26	2.69	**0.7**
EX16	0.264	6891	4604	0.90	0.25	0.64	2	0	0.64	0.04	0.68	9.12	2.72	**0.5**
EX17	0.338	9910	4806	0.90	0.25	0.69	2	0	0.69	0.03	0.72	8.63	2.8	**0.7**
EX18	0.174	3468	4098	0.90	0.25	0.55	2	0	0.55	0.08	0.63	7.35	3.07	**0.3**
EX19	0.065	1904	924	0.90	0.25	0.69	2	0	0.69	0.04	0.73	6.32	3.34	**0.2**
EX20	0.459	7054	12944	0.90	0.25	0.48	2	0	0.48	0.10	0.58	7.46	3.04	**0.8**
EX21	0.059	2569	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.57	3.27	**0.2**

MAP	=	22.7	in.
Return Freq	=	100	yrs.
Initial Tc	=	5	min.

HYDROLOGY CALCULATIONS

Existing Conditions - 100-year, 6-hour

Point of Conc.	Total Area [ac]	Impervious [sf]	Pervious [sf]	C Impervious [--]	C Pervious [--]	C [--]	Overland Slope[%]	Cs [--]	C+Cs	Ci [--]	C' [--]	Tc [min]	Intensity [in/hr]	Q=C'iA [cfs]
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EX3	0.199	8676	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	5.66	5.31	**1.0**
EX4	0.079	3442	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.52	4.9	**0.4**
EX5	0.196	5722	2798	0.90	0.25	0.69	2	0	0.69	0.05	0.74	6.82	4.77	**0.7**
EX6	0.548	23888	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.44	4.93	**2.4**
EX7	1.220	39345	13788	0.90	0.25	0.73	2	0	0.73	0.03	0.76	10.31	3.78	**3.5**
EX8	0.235	6387	3828	0.90	0.25	0.66	2	0	0.66	0.06	0.72	7.96	4.37	**0.7**
EX9	1.177	19797	31470	0.90	0.25	0.50	2	0	0.50	0.11	0.61	11.14	3.61	**2.6**
EX10	0.807	17923	17209	0.90	0.25	0.58	2	0	0.58	0.08	0.66	12.04	3.46	**1.9**
EX11	0.135	4228	1667	0.90	0.25	0.72	2	0	0.72	0.04	0.75	7.35	4.57	**0.5**
EX12	0.294	8634	4159	0.90	0.25	0.69	2	0	0.69	0.04	0.73	8.68	4.16	**0.9**
EX13	0.429	11834	6857	0.90	0.25	0.66	2	0	0.66	0.05	0.71	11.41	3.56	**1.1**
EX14	0.325	12888	1269	0.90	0.25	0.84	2	0	0.84	0.00	0.84	11.85	3.49	**1.0**
EX15	0.285	12431	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	9.26	4.01	**1.1**
EX16	0.264	6891	4604	0.90	0.25	0.64	2	0	0.64	0.06	0.70	9.12	4.05	**0.7**
EX17	0.338	9910	4806	0.90	0.25	0.69	2	0	0.69	0.04	0.73	8.63	4.18	**1.0**
EX18	0.174	3468	4098	0.90	0.25	0.55	2	0	0.55	0.11	0.65	7.35	4.57	**0.5**
EX19	0.065	1904	924	0.90	0.25	0.69	2	0	0.69	0.05	0.74	6.32	4.98	**0.2**
EX20	0.459	7054	12944	0.90	0.25	0.48	2	0	0.48	0.13	0.61	7.46	4.54	**1.3**
EX21	0.059	2569	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.57	4.88	**0.3**

MAP	=	22.7	in.
Return Freq	=	10	yrs.
Initial Tc	=	5	min.

HYDROLOGY CALCULATIONS

Proposed Conditions - 10-year, 6-hour

Point of Conc.	Total Area [sf]	Total Area [ac]	Impervious [sf]	Pervious [sf]	C Impervious [--]	C Pervious [--]	C [--]	Overland Slope[%]	Cs [--]	C+Cs	Ci [--]	C' [--]	Tc [min]	Intensity [in/hr]	Q=C'iA [cfs]
P1	42870	0.984	24787	18083	0.90	0.25	0.63	2	0	0.63	0.05	0.67	9.90	2.59	**1.7**
P2	20893	0.480	11991	8902	0.90	0.25	0.62	2	0	0.62	0.05	0.67	8.57	2.81	**0.9**
P3	29751	0.683	16016	13735	0.90	0.25	0.60	2	0	0.60	0.05	0.65	9.53	2.65	**1.2**
P4	15745	0.361	8480	7265	0.90	0.25	0.60	2	0	0.60	0.07	0.67	6.21	3.38	**0.8**
P5	24259	0.557	11858	12401	0.90	0.25	0.57	2	0	0.57	0.06	0.63	9.20	2.7	**1.0**
P6	9116	0.209	6064	3052	0.90	0.25	0.68	2	0	0.68	0.04	0.72	6.26	3.36	**0.5**
P7	7563	0.174	3698	3865	0.90	0.25	0.57	2	0	0.57	0.07	0.64	7.57	3.02	**0.3**
P8	14586	0.335	8921	5665	0.90	0.25	0.65	2	0	0.65	0.05	0.69	8.00	2.92	**0.7**
P9	38521	0.884	21621	16900	0.90	0.25	0.61	2	0	0.61	0.04	0.66	12.78	2.24	**1.3**
P10	28426	0.653	15070	13356	0.90	0.25	0.59	2	0	0.59	0.08	0.67	5.00	3.81	**1.7**
P11	8695	0.200	3881	4814	0.90	0.25	0.54	2	0	0.54	0.09	0.63	6.33	3.34	**0.4**
P12	38638	0.887	20138	18500	0.90	0.25	0.59	2	0	0.59	0.08	0.66	5.58	3.59	**2.1**
P13	9817	0.225	5788	4029	0.90	0.25	0.63	2	0	0.63	0.06	0.69	5.58	3.59	**0.6**
P14	18318	0.421	8567	9751	0.90	0.25	0.55	2	0	0.55	0.08	0.64	6.36	3.33	**0.9**
P15	19827	0.455	11698	8129	0.90	0.25	0.63	2	0	0.63	0.06	0.69	5.62	3.57	**1.1**
P16	5558	0.128	3923	1635	0.90	0.25	0.71	2	0	0.71	0.03	0.74	7.08	3.13	**0.3**
P17	21809	0.501	14846	6963	0.90	0.25	0.69	2	0	0.69	0.03	0.72	11.59	2.37	**0.9**
P18	10219	0.235	6387	3832	0.90	0.25	0.66	2	0	0.66	0.04	0.70	8.60	2.81	**0.5**
P19	9058	0.208	9058	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	9.17	2.71	**0.5**
P20	5658	0.130	4351	1307	0.90	0.25	0.75	2	0	0.75	0.02	0.77	5.00	3.81	**0.4**
P21	9905	0.227	7956	1949	0.90	0.25	0.77	2	0	0.77	0.01	0.78	6.41	3.32	**0.6**
P22	3782	0.087	3303	479	0.90	0.25	0.82	2	0	0.82	0.00	0.82	5.22	3.75	**0.3**
P23	14607	0.335	10140	4467	0.90	0.25	0.70	2	0	0.70	0.03	0.73	8.25	2.87	**0.7**
P24	10476	0.240	6184	4292	0.90	0.25	0.63	2	0	0.63	0.04	0.68	9.52	2.65	**0.4**
P25	7648	0.176	4206	3442	0.90	0.25	0.61	2	0	0.61	0.06	0.67	6.88	3.19	**0.4**
P26	6238	0.143	5876	362	0.90	0.25	0.86	2	0	0.86	0.00	0.86	6.04	3.43	**0.4**
P27	19282	0.443	6338	12944	0.90	0.25	0.46	2	0	0.46	0.10	0.57	7.46	3.04	**0.8**
P28	2569	0.059	2569	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.57	3.27	**0.2**

MAP	=	22.7	in.
Return Freq	=	100	yrs.
Initial Tc	=	5	min.

HYDROLOGY CALCULATIONS

Proposed Conditions - 100-year, 6-hour

Point of	Total Area	Total Area	Impervious	Pervious	C Impervious	C Pervious	C	Overland	Cs	C+Cs	Ci	C'	Tc	Intensity	Q=C'iA
Conc.	[sf]	[ac]	[sf]	[sf]	[--]	[--]	[--]	Slope[%]	[--]		[--]	[--]	[min]	[in/hr]	[cfs]
P1	42870	0.984	24787	18083	0.90	0.25	0.63	2	0	0.63	0.07	0.69	9.90	3.86	**2.6**
P2	20893	0.480	11991	8902	0.90	0.25	0.62	2	0	0.62	0.07	0.69	8.57	4.19	**1.4**
P3	29751	0.683	16016	13735	0.90	0.25	0.60	2	0	0.60	0.08	0.68	9.53	3.95	**1.8**
P4	15745	0.361	8480	7265	0.90	0.25	0.60	2	0	0.60	0.09	0.69	6.21	5.03	**1.3**
P5	24259	0.557	11858	12401	0.90	0.25	0.57	2	0	0.57	0.09	0.66	9.20	4.03	**1.5**
P6	9116	0.209	6064	3052	0.90	0.25	0.68	2	0	0.68	0.05	0.73	6.26	5.01	**0.8**
P7	7563	0.174	3698	3865	0.90	0.25	0.57	2	0	0.57	0.10	0.66	7.57	4.5	**0.5**
P8	14586	0.335	8921	5665	0.90	0.25	0.65	2	0	0.65	0.06	0.71	8.00	4.36	**1.1**
P9	38521	0.884	21621	16900	0.90	0.25	0.61	2	0	0.61	0.06	0.68	12.78	3.34	**2.0**
P10	28426	0.653	15070	13356	0.90	0.25	0.59	2	0	0.59	0.10	0.69	5.00	5.69	**2.6**
P11	8695	0.200	3881	4814	0.90	0.25	0.54	2	0	0.54	0.12	0.66	6.33	4.98	**0.7**
P12	38638	0.887	20138	18500	0.90	0.25	0.59	2	0	0.59	0.10	0.69	5.58	5.35	**3.3**
P13	9817	0.225	5788	4029	0.90	0.25	0.63	2	0	0.63	0.08	0.71	5.58	5.35	**0.9**
P14	18318	0.421	8567	9751	0.90	0.25	0.55	2	0	0.55	0.11	0.66	6.36	4.97	**1.4**
P15	19827	0.455	11698	8129	0.90	0.25	0.63	2	0	0.63	0.08	0.71	5.62	5.33	**1.7**
P16	5558	0.128	3923	1635	0.90	0.25	0.71	2	0	0.71	0.04	0.75	7.08	4.67	**0.5**
P17	21809	0.501	14846	6963	0.90	0.25	0.69	2	0	0.69	0.04	0.73	11.59	3.53	**1.3**
P18	10219	0.235	6387	3832	0.90	0.25	0.66	2	0	0.66	0.06	0.71	8.60	4.18	**0.7**
P19	9058	0.208	9058	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	9.17	4.04	**0.8**
P20	5658	0.130	4351	1307	0.90	0.25	0.75	2	0	0.75	0.02	0.77	5.00	5.69	**0.6**
P21	9905	0.227	7956	1949	0.90	0.25	0.77	2	0	0.77	0.01	0.78	6.41	4.94	**0.9**
P22	3782	0.087	3303	479	0.90	0.25	0.82	2	0	0.82	0.00	0.82	5.22	5.55	**0.4**
P23	14607	0.335	10140	4467	0.90	0.25	0.70	2	0	0.70	0.04	0.74	8.25	4.28	**1.1**
P24	10476	0.240	6184	4292	0.90	0.25	0.63	2	0	0.63	0.06	0.70	9.52	3.95	**0.7**
P25	7648	0.176	4206	3442	0.90	0.25	0.61	2	0	0.61	0.08	0.69	6.88	4.75	**0.6**
P26	6238	0.143	5876	362	0.90	0.25	0.86	2	0	0.86	0.00	0.86	6.04	5.11	**0.6**
P27	19282	0.443	6338	12944	0.90	0.25	0.46	2	0	0.46	0.14	0.60	7.46	4.54	**1.2**
P28	2569	0.059	2569	0	0.90	0.25	0.90	2	0	0.90	0.00	0.90	6.57	4.88	**0.3**

Alameda County
Hydrology & Hydraulics Manual

Alameda County Flood Control & Water Conservation District
399 Elmhurst Street, Hayward, California 94544

Daniel Woldesenbet, Ph.D., P.E.
General Manager

2025

Disclaimer

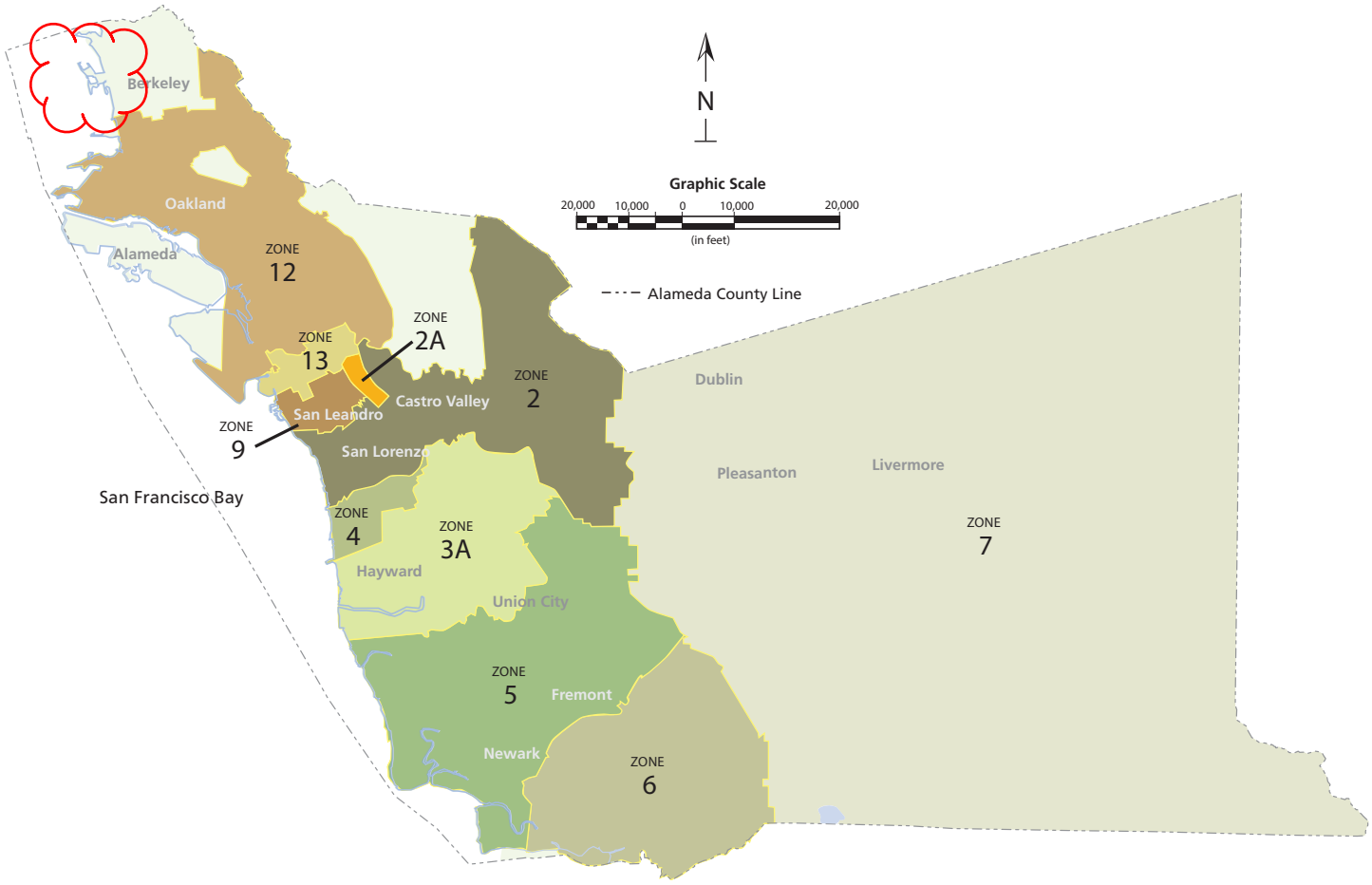
The design criteria and the hydrologic computation techniques described in this manual have been developed based upon the hydrologic and meteorological data from Alameda County and surrounding areas.

The guidelines in this manual represent minimum design requirements and do not replace sound engineering judgment for site-specific conditions that require more conservative assumptions and/or more rigorous analytic techniques.

The guidelines and the hydrologic computation techniques in this manual are applicable for hydrologic and hydraulic studies and design beginning January 1994 for the District's large open-channel projects, and for all projects effective October 2016. Studies and designs before these dates were subject to the usage and guidelines set forth in previous hydrologic and hydraulic criteria summary reports.

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FIGURE 1 **DISTRICT ZONES**



Note: Graphic for illustration purposes only. (District 2009)



CHAPTER TWO

The District's Rational Method

The District uses a modified form of the Rational Method to determine the peak discharge of a watershed for areas up to 0.5 square miles (320 acres). Calculations for the District's Rational Method can be made using ***Attachment 2*** or an equivalent method for design of drainage facilities for urban development and roadway crossings.

To use this method, the overall watershed should be broken down into smaller areas that contribute to hydraulically significant points of concentration. The subcatchment boundaries should be established based on topographic boundaries such as ridges, streets, drainage systems, etc., using good engineering judgment. The peak design discharge or flow rate should be calculated using ***Equation 1***, the District's Rational Formula.

EQUATION 1 DISTRICT'S RATIONAL FORMULA

$$Q = C'iA \tag{1}$$

where:

Q = *discharge (cfs)*
C' = *District's runoff coefficient (from **Equation 7**)*
i = *rainfall intensity (inches / hr from **Equation 5**)*
A = *drainage area (acres)*

(District 1989)

When using the District's Rational Method, it is critical to compare the peak discharge rate of a tributary area to the peak discharge in the main stem downstream of the tributary and use the greater of the two flow rates for the downstream drainage system.

TIME OF CONCENTRATION

The time of concentration (T_c) is the time required for the runoff from the most remote region of the watershed to reach the point of interest at which the flow is to be calculated. Calculate T_c using ***Equation 2.***

EQUATION 2 TIME OF CONCENTRATION

$$T_c = t_o + t_{cond} \tag{2}$$

where:

T_c = *time of concentration (min)*
t_o = *initial and/or overland time of concentration (min, from **Equation 3** or **4**)*
t_{cond} = *conduit time (min)*

(District 2015)

To design a drainage system, use a minimum time of concentration based on hydraulic conditions that maximize flow velocities.

Overland Time of Concentration

The overland time of concentration (t_o) is that time required for runoff to travel from the most remote point in the drainage area to the first point of concentration. Often, this first point of concentration is the furthest upstream inlet of the stormwater system or the upstream end of a defined ditch or swale. This time is seldom less than three minutes or more than 20 minutes. The overland time of concentration (t_o) depends on the surface conditions, i.e., whether the watershed is rural (undeveloped) or urban (developed).

For undeveloped watersheds, use *Equation 3* to determine t_o.

EQUATION 3 OVERLAND TIME OF CONCENTRATION — UNDEVELOPED WATERSHEDS

$$t_o = \frac{L_o}{60V_o} \quad (3)$$

where:

t_o = *initial and/or overland time of concentration (min)*
L_o = *overland flow length (ft)*
V_o = *overland flow velocity (ft/sec from **Attachment 3**)*

(NRCS 1986)

For urbanized watersheds, the t_o is generally the initial "roof-to-gutter" time, plus the time required for the water to flow from the street gutter at the uppermost part of the drainage basin to the furthest upstream inlet of the stormwater system. For developed watersheds, use *Equation 4* to determine t_o.

EQUATION 4 OVERLAND TIME OF CONCENTRATION — DEVELOPED WATERSHEDS

$$t_o = t_i + \frac{L_g}{60V_g} \quad (4)$$

where:

t_o = *initial and/or overland time of concentration (min)*
t_i = *initial time (min from **Attachment 4**)*
L_g = *gutter flow length (ft)*
V_g = *gutter flow velocity (ft/sec from **Attachment 5**)*

(District 1989)

Initial time is a function of ground slope and type of drainage facility, as determined from *Attachment 4*. Use sound engineering practices for other-than-typical residential areas. Then, estimate the time for the water to flow from the upstream end of the gutter to the first inlet based on the gutter flow velocity in *Attachment 5*. In other-than-typical

residential situations, use Manning's equation (***Equation 15***) to estimate velocity and travel time, or reference other charts, such as those for flow in small conduits or gullies.

Conduit Time

Conduit time (t_{cond}) is the length of time required for the water to flow from one point of concentration, or inlet, to the next. The calculated average velocity, or weighted incremental velocities, must accurately reflect the hydraulic conditions (i.e. closed conduit or open channel) within the stormwater system. Where the flow takes place in natural streams, channels, or closed conduits, use Manning's Equation to calculate the conduit time. For conduits under pressure, divide the discharge (Q) by the conduit cross-sectional area to determine the average flow velocity and conduit time.

RAINFALL INTENSITY AND DEPTH

Compute rainfall intensity for the appropriate time of concentration and storm recurrence interval using ***Equation 5***:

EQUATION 5 RAINFALL INTENSITY

$$i_{ij} = \frac{D_{ij}}{t_d} \tag{5}$$

where:

i_{ij} = *rainfall intensity (inches/hr) for recurrence interval* j *and storm duration* i

D_{ij} = *design rainfall depth (inches) for recurrence interval* j *and storm duration* i *(from* ***Equation 6****)*

t_d = *storm duration (hr)* $= T_c / 60$

T_c = *time of concentration (min)*

(District 2015)

Alternatively, in lieu of using ***Equation 5***, rainfall intensity (i) may be determined from the tables in ***Attachment 7***. Select the proper chart depending on recurrence interval, then use the time of concentration (T_c) and mean annual precipitation $(\overline{P})$ to select the rainfall intensity value from the chart.

EQUATION 6 RAINFALL DEPTH

$$D_{ij} = (0.32665 + 0.091144\overline{P})(1 + K_j CV)t_i^{0.43287} \quad (6)$$

where:

D_{ij} = *design rainfall depth (inches) for recurrence interval j and storm duration i*

$\overline{P}$ = *mean annual precipitation (inches)*

K_j = *frequency factor for recurrence interval j (from **Table 1** for storm durations up to 24 hours or **Attachment 12** for storm durations greater than 24 hours)*

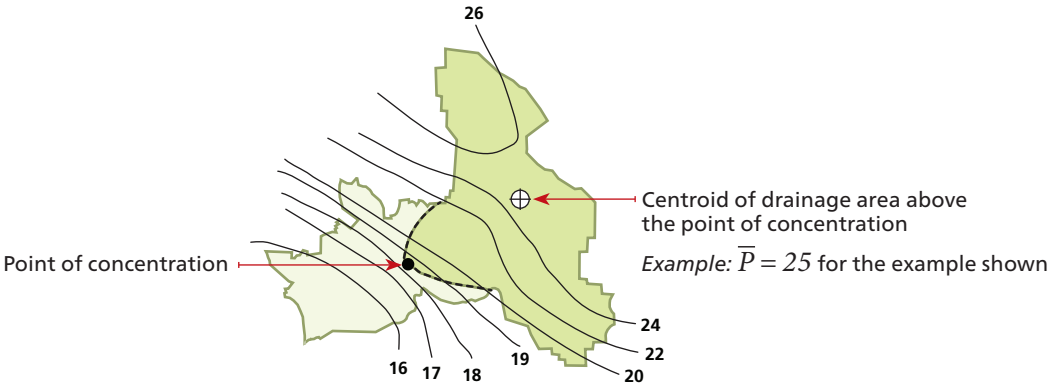
CV = *coefficient of variation (from **Attachment 12**)*

t_i = *consecutive time (days)*

(District 2015)

Determine the mean annual precipitation ($\overline{P}$) of a drainage area using the District's isohyetal map ***Attachment 6***. The $\overline{P}$ to be used is located at the centroid of the drainage area above the point of concentration at which the flow rate is being determined, as shown in *Figure 2*.

FIGURE 2 DETERMINING MEAN ANNUAL PRECIPITATION



Note: Graphic for illustration purposes only.

TABLE 1 FREQUENCY FACTORS FOR SELECT RECURRENCE INTERVALS*

Recurrence interval *(yrs)*	2	5	10	15	25	100	200	500	1000
Frequency Factor, K_j	-0.210	0.719	1.339	1.684	2.108	3.211	3.745	4.417	4.955

*Table 1 presents frequency factors (K_j) for storm durations (t_d) up to 24 hours. See ***Attachment 12*** for storm durations greater than 24 hours.

(District 2015)

Alternatively, in lieu of using ***Equation 6***, design rainfall depth (D_{ij}) may be determined from the tables in ***Attachment 8***. Select the proper chart depending on recurrence interval, then use the mean annual precipitation ($\overline{P}$) and storm duration (t_d) to select the rainfall depth from the chart.

RUNOFF COEFFICIENT

The District requires the use of the District's runoff coefficient (C') for design of flood control facilities. Calculate the runoff coefficient using ***Equation 7***. Each of the components that comprise C' is described below.

EQUATION 7 DISTRICT'S RUNOFF COEFFICIENT

$$C' = C + C_s + C_i \tag{7}$$

where:

C' = *District's runoff coefficient*
C = *basic runoff coefficient (from **Table 2**)*
C_s = *ground slope adjustment factor (from **Equation 8**)*
C_i = *rainfall intensity factor (from **Equation 9**)*

(District 1989)

Basic Runoff Coefficient

To design conveyance elements, choose the basic runoff coefficient (C) to reflect the proposed or ultimate development of the drainage area. Ultimate development is normally based on City/County general plans. If general plans are not available, make a reasonable estimate of ultimate land use.

The basic runoff coefficient (C) is a function of the percent of the watershed that is impervious and the hydrologic soil group. The percent impervious is normally based on land use category; however, it may be measured. To determine the appropriate C for any given drainage area, overlay the applicable land use onto the soil group maps provided in ***Attachment 9***. Using the area of each land use category within each soil group, determine an area-weighted average C using the information provided in ***Table 2***.

Table 2 applies to typical land use situations. For conditions not covered by ***Table 2***, calculate an appropriate runoff coefficient based on impervious area, to be determined using aerial photographs and site plans. Calculate the runoff coefficient based on an area-weighted average using $C = 0.9$ for all impervious areas, and the appropriate pervious area C value for soil groups present from the first row of ***Table 2***.

TABLE 2 BASIC RUNOFF COEFFICIENTS FOR PARTICULAR LAND USE AND SOIL TYPE

Land Use Description	Hydrologic Soil Group			
	A	B	C	D
Undeveloped land, parks, and golf courses	0.10	0.15	0.20	0.25
Rural Residential (larger than 1 ac lot)	0.13	0.18	0.23	0.28
Residential 10,000 - 1 ac lot	0.20	0.25	0.30	0.35
Residential 1/4 ac (8,000 - 10,000 sf lot)	0.25	0.30	0.35	0.40
Residential 1/8 ac (5,000 - 8,000 sf lot)	0.27	0.32	0.37	0.42
Residential (3600 - 5000 sf lot)	0.28	0.33	0.38	0.43
Residential (2700 - 3600 sf lot)	0.29	0.34	0.39	0.44
Zero Lot Line Residential & Less than 2700 sf	0.34	0.39	0.44	0.49
Townhouse	0.44	0.49	0.54	0.59
Condominium	0.51	0.56	0.61	0.66
Industrials	0.58	0.63	0.68	0.73
Apartment	0.65	0.70	0.75	0.80
Commercial	0.69	0.74	0.79	0.84
Freeway*	0.72	0.77	0.82	0.87
Mobile Home Park**	0.34	0.39	0.44	0.49
School (large open space)	0.24	0.29	0.34	0.39
School (small open space)	0.44	0.49	0.54	0.59

* For freeways, use aerial imagery to estimate percent impervious area.
** For mobile home parks, a minimum of 50% of the NCIA roof area should be counted as DCIA; for example, DCIA = 17+(37/2) = 35.5

(District 2015)

HYDROLOGIC SOIL GROUPS

Attachment 9 provides a map that shows the areas of hydrologic soil groups A, B, C, and D based on Natural Resource Conservation Service (NRCS – formerly Soil Conservation Service, SCS) mapping.

Soil Type A: Sand, loamy sand, or sandy loam. Low runoff potential and high infiltration rate even when thoroughly wetted. Primarily deep, well- to excessively-drained sand or gravel that has a high rate of water transmission.

Soil Type B: Silt loam or loam. Moderately low runoff potential and moderate infiltration rate when thoroughly wetted. Moderately deep to deep, moderately well- to well-drained soil with moderately fine to moderately coarse texture.

Soil Type C: Sandy clay loam. Moderately high runoff potential and low infiltration rate when thoroughly wetted that impedes downward movement of water. Soil with moderately fine to fine structure.

Soil Type D: Clay loam, silty clay loam, sandy clay, silty clay, or clay. High runoff potential and very low infiltration rate when thoroughly wetted. Consists chiefly of clay soil with a high swelling potential, soil with a permanent high water table, soil with a claypan or clay layer at or near the surface, and shallow soil over nearly impervious material.

Ground Slope Adjustment Factor

The ground slope adjustment factor (C_s) is used to adjust for increases in runoff as the average slope of the incremental drainage area increases. Use an area-weighted average slope (S) from the slope map provided in ***Attachment 10*** as a basis for determining C_s.

Rainfall Intensity Factor

The rainfall intensity factor (C_i) is used to account for the decrease in soil permeability that can be expected with an increase in ground slope and rainfall intensity.

EQUATION 8 GROUND SLOPE ADJUSTMENT FACTOR

$$C_s = \frac{(0.8 - C)[ln(S-1)]S^{0.5}}{56} \qquad (8)$$

$$C_s = 0 \text{ for } C \geq 0.8$$

where:

C_s = *ground slope adjustment factor*
C = *basic runoff coefficient*
S = *slope (percent from **Attachment 10**)*

(District 1989)

EQUATION 9 RAINFALL INTENSITY FACTOR

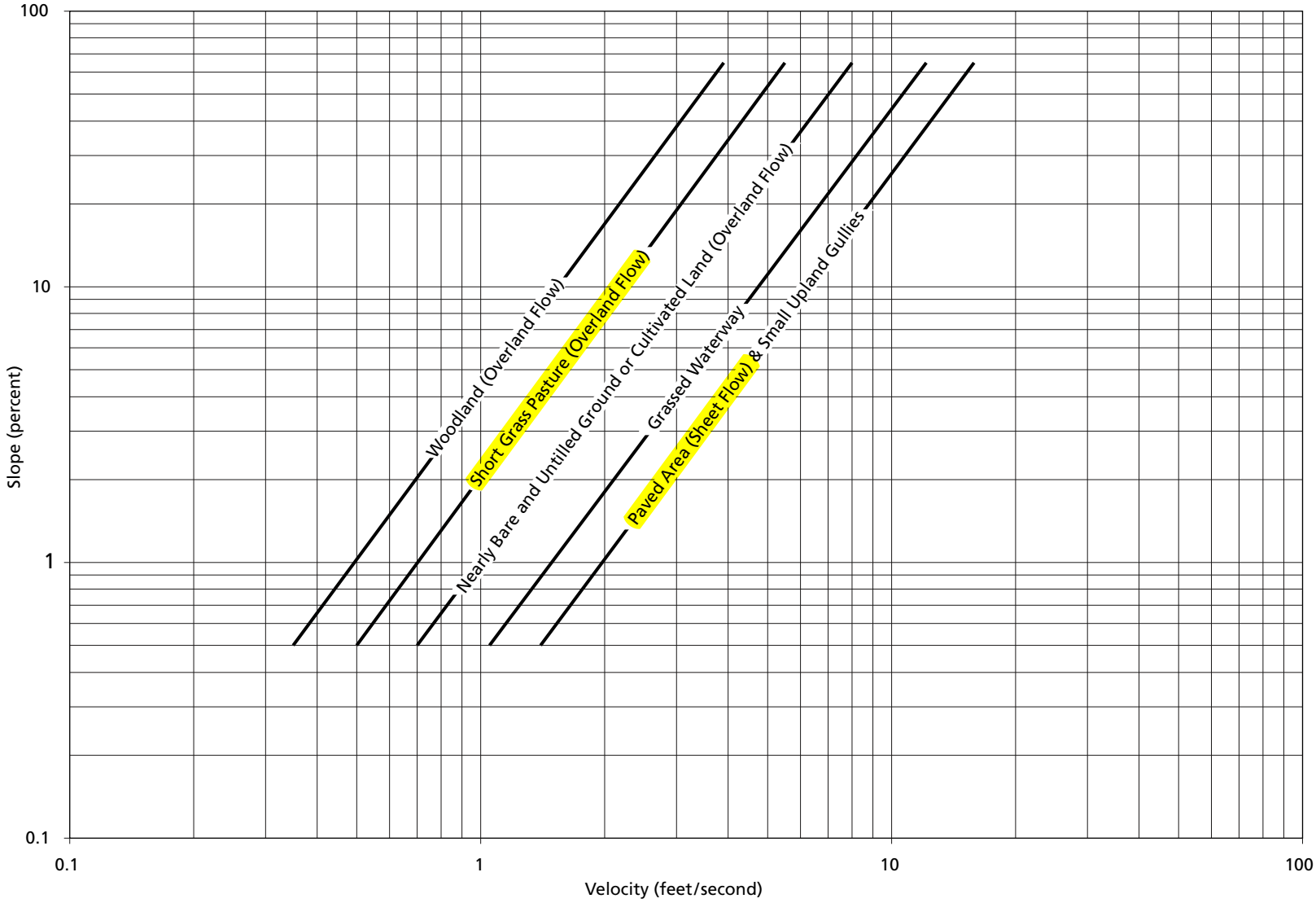
$$C_i = \left(0.8 - (C + C_s)\right)\left(1 - \frac{1}{\frac{1}{e^i} + ln(i+1)}\right) \qquad (9)$$

$$C_i = 0 \text{ for } C + C_s \geq 0.8$$

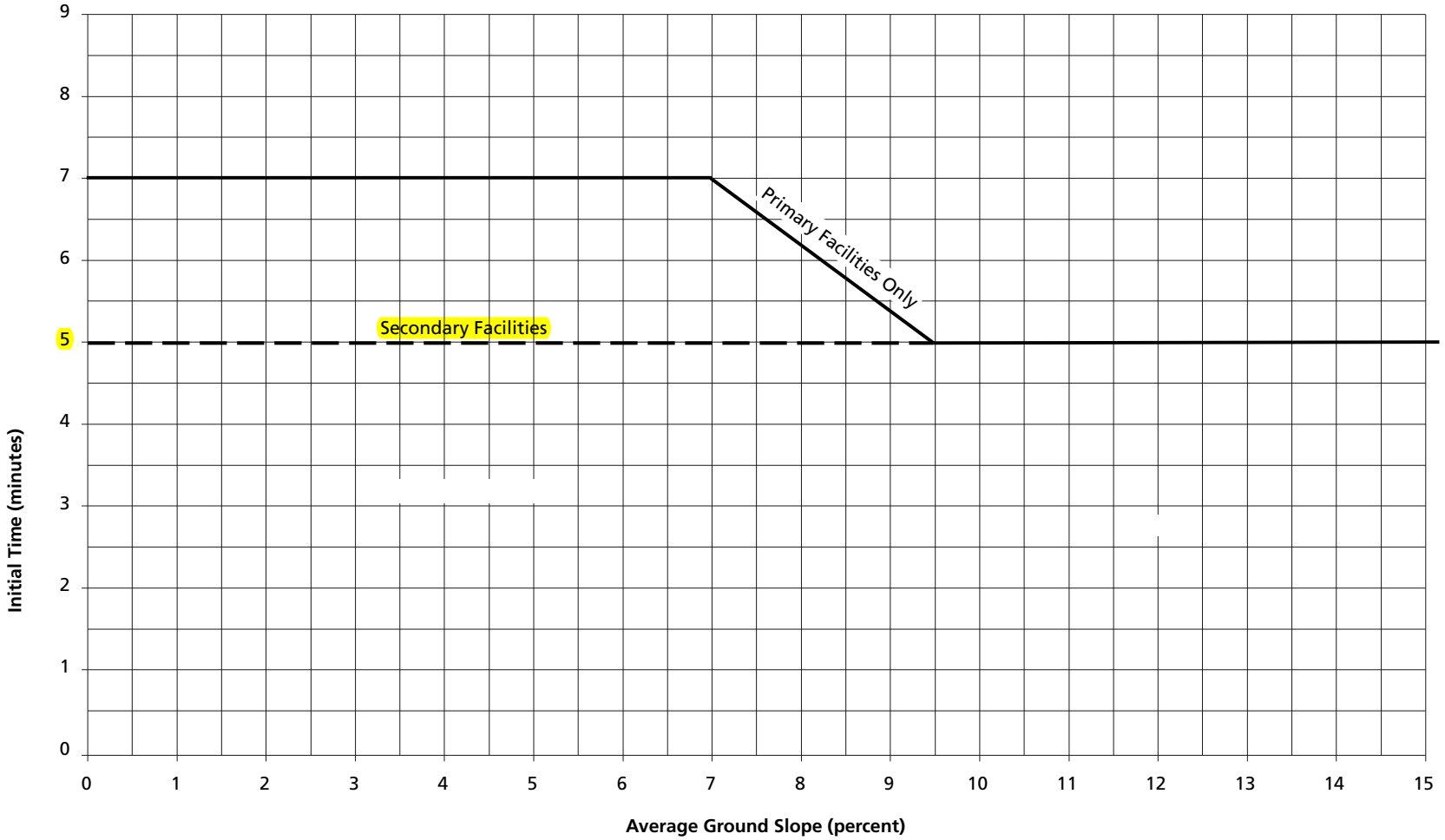
where:

C_i = *rainfall intensity factor*
C = *basic runoff coefficient*
C_s = *ground slope adjustment factor*
i = *rainfall intensity (inches / hr from **Equation 5** or **Attachment 7**)*

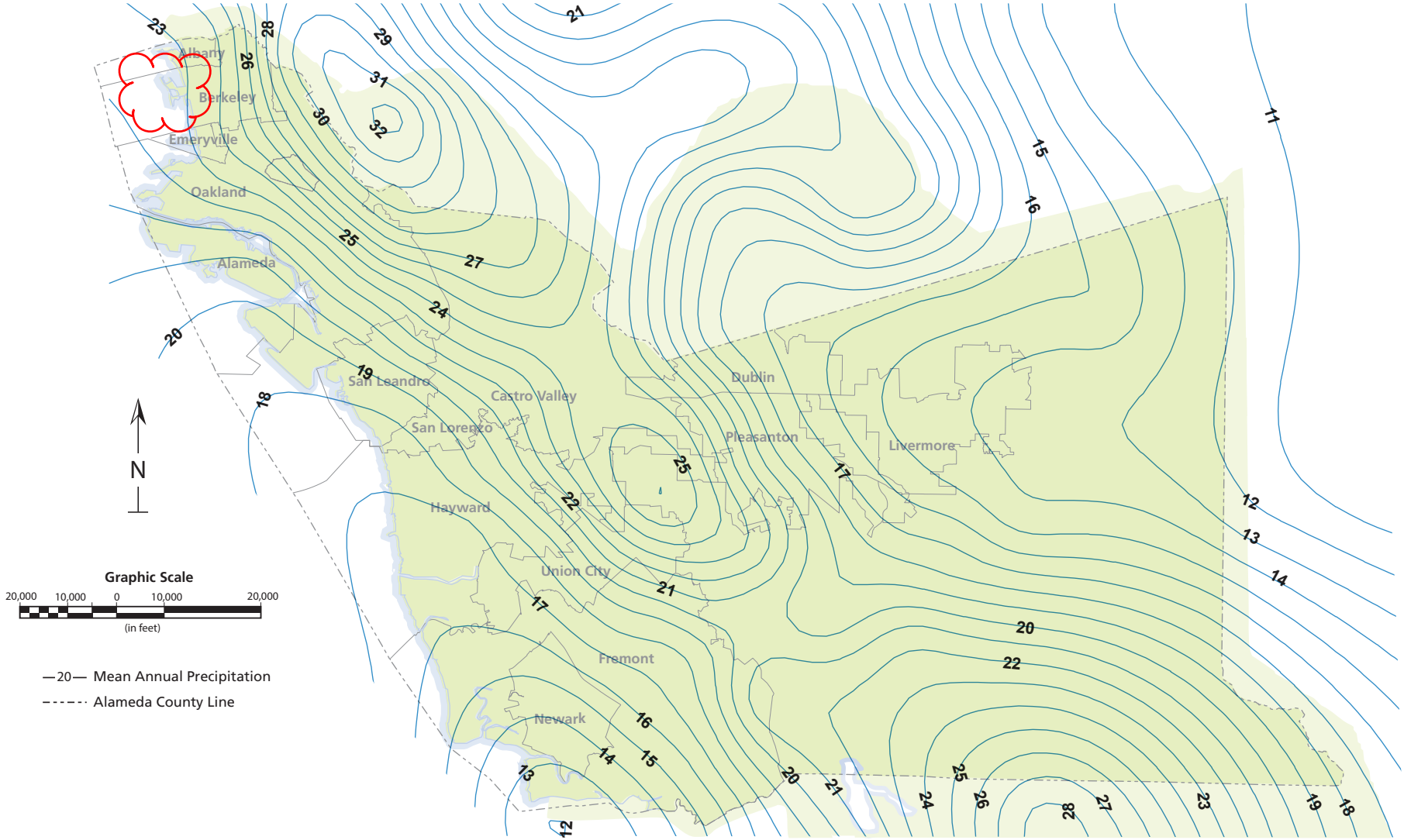
(District 1989)


100
10
1
0.1
Slope (percent)
0.1
1
10
100
Velocity (feet/second)
Woodland (Overland Flow)
Short Grass Pasture (Overland Flow)
Nearly Bare and Untilled Ground or Cultivated Land (Overland Flow)
Grassed Waterway
Paved Area (Sheet Flow) & Small Upland Gullies

(NRCS 2010)



(District 1989)

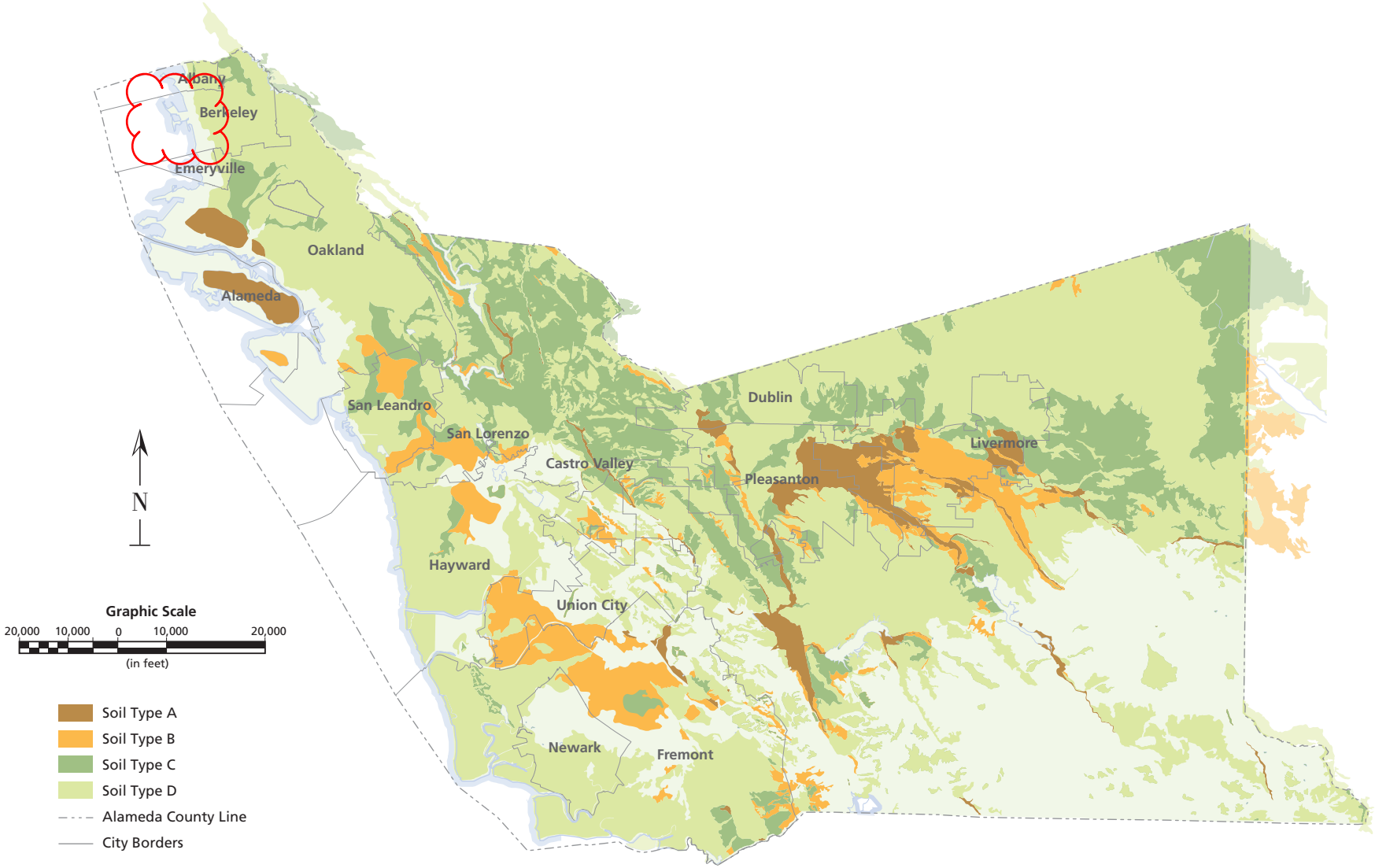


Attachment 6 available for download as a GIS file from the Alameda County Flood Control District website.

(District 2011)

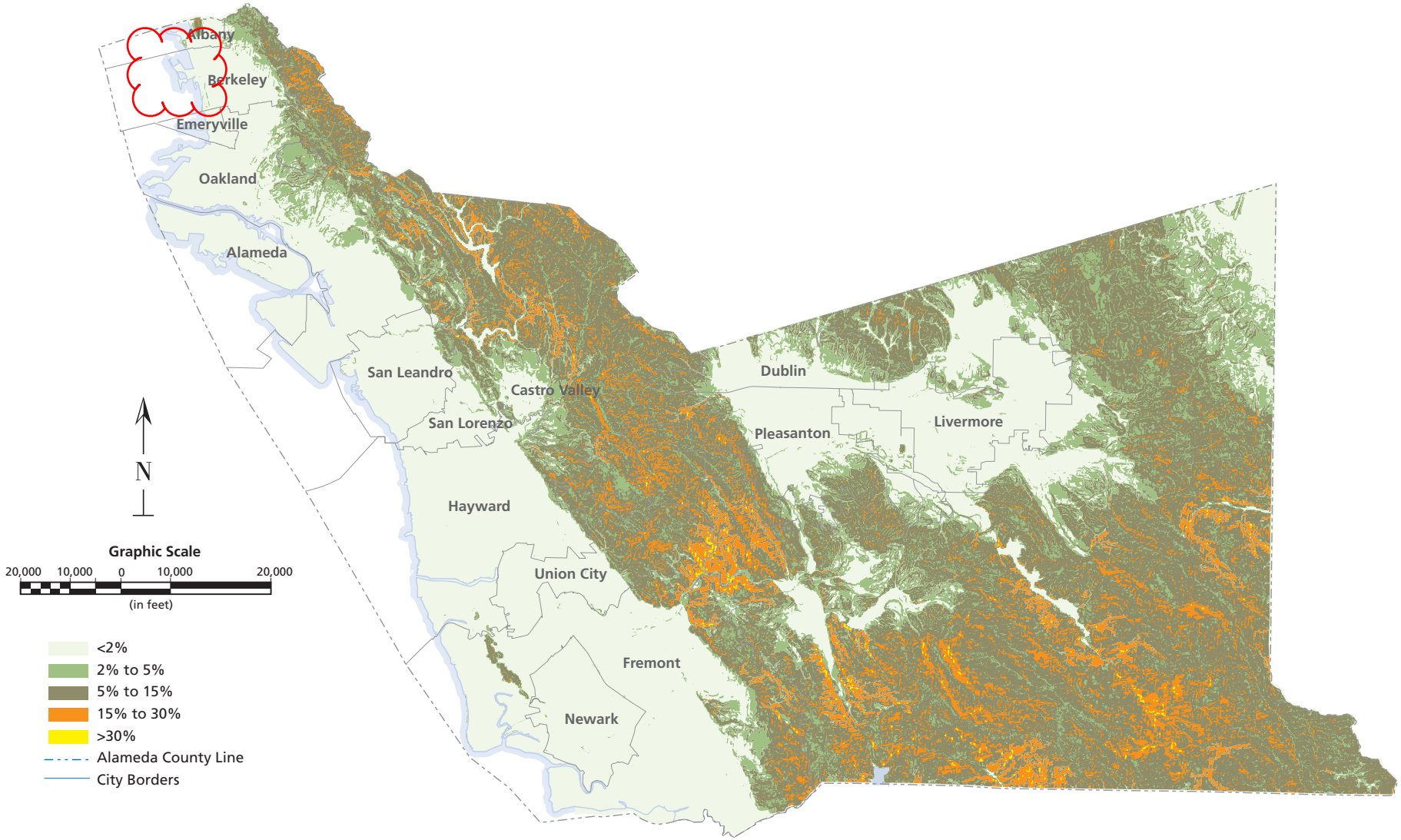
T_c (min)	Mean Annual Precipitation (in)																					
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	5.28	5.64	6.00	6.36	6.73	7.09	7.45	7.81	8.17	8.53	8.90	9.26	9.62	9.98	10.34	10.71	11.07	11.43	11.79	12.15	12.52	12.88
2	3.56	3.81	4.05	4.30	4.54	4.78	5.03	5.27	5.52	5.76	6.00	6.25	6.49	6.74	6.98	7.23	7.47	7.71	7.96	8.20	8.45	8.69
3	2.83	3.02	3.22	3.41	3.61	3.80	4.00	4.19	4.38	4.58	4.77	4.97	5.16	5.35	5.55	5.74	5.94	6.13	6.32	6.52	6.71	6.91
4	2.40	2.57	2.73	2.90	3.06	3.23	3.39	3.56	3.72	3.89	4.05	4.22	4.38	4.55	4.71	4.88	5.04	5.21	5.37	5.54	5.70	5.87
5	2.12	2.26	2.41	2.55	2.70	2.84	2.99	3.14	3.28	3.43	3.57	3.72	3.86	4.01	4.15	4.30	4.44	4.59	4.73	4.88	5.02	5.17
6	1.91	2.04	2.17	2.30	2.43	2.57	2.70	2.83	2.96	3.09	3.22	3.35	3.48	3.61	3.74	3.88	4.01	4.14	4.27	4.40	4.53	4.66
7	1.75	1.87	1.99	2.11	2.23	2.35	2.47	2.59	2.71	2.83	2.95	3.07	3.19	3.31	3.43	3.55	3.67	3.79	3.91	4.03	4.15	4.27
8	1.62	1.73	1.85	1.96	2.07	2.18	2.29	2.40	2.51	2.62	2.74	2.85	2.96	3.07	3.18	3.29	3.40	3.51	3.63	3.74	3.85	3.96
9	1.52	1.62	1.73	1.83	1.93	2.04	2.14	2.25	2.35	2.45	2.56	2.66	2.77	2.87	2.98	3.08	3.18	3.29	3.39	3.50	3.60	3.70
10	1.43	1.53	1.63	1.72	1.82	1.92	2.02	2.12	2.21	2.31	2.41	2.51	2.61	2.70	2.80	2.90	3.00	3.10	3.19	3.29	3.39	3.49
11	1.35	1.45	1.54	1.63	1.73	1.82	1.91	2.00	2.10	2.19	2.28	2.38	2.47	2.56	2.66	2.75	2.84	2.93	3.03	3.12	3.21	3.31
12	1.29	1.38	1.47	1.55	1.64	1.73	1.82	1.91	2.00	2.09	2.17	2.26	2.35	2.44	2.53	2.62	2.70	2.79	2.88	2.97	3.06	3.15
13	1.23	1.32	1.40	1.49	1.57	1.65	1.74	1.82	1.91	1.99	2.08	2.16	2.25	2.33	2.42	2.50	2.58	2.67	2.75	2.84	2.92	3.01
14	1.18	1.26	1.34	1.42	1.51	1.59	1.67	1.75	1.83	1.91	1.99	2.07	2.15	2.23	2.32	2.40	2.48	2.56	2.64	2.72	2.80	2.88
15	1.14	1.21	1.29	1.37	1.45	1.53	1.60	1.68	1.76	1.84	1.92	1.99	2.07	2.15	2.23	2.30	2.38	2.46	2.54	2.62	2.69	2.77
16	1.10	1.17	1.25	1.32	1.40	1.47	1.55	1.62	1.70	1.77	1.85	1.92	2.00	2.07	2.15	2.22	2.30	2.37	2.45	2.52	2.60	2.67
17	1.06	1.13	1.20	1.28	1.35	1.42	1.49	1.57	1.64	1.71	1.78	1.86	1.93	2.00	2.07	2.15	2.22	2.29	2.36	2.44	2.51	2.58
18	1.02	1.09	1.17	1.24	1.31	1.38	1.45	1.52	1.59	1.66	1.73	1.80	1.87	1.94	2.01	2.08	2.15	2.22	2.29	2.36	2.43	2.50
19	0.99	1.06	1.13	1.20	1.27	1.33	1.40	1.47	1.54	1.61	1.67	1.74	1.81	1.88	1.95	2.02	2.08	2.15	2.22	2.29	2.36	2.42
20	0.97	1.03	1.10	1.16	1.23	1.30	1.36	1.43	1.49	1.56	1.63	1.69	1.76	1.83	1.89	1.96	2.02	2.09	2.16	2.22	2.29	2.35
21	0.94	1.00	1.07	1.13	1.20	1.26	1.33	1.39	1.45	1.52	1.58	1.65	1.71	1.78	1.84	1.90	1.97	2.03	2.10	2.16	2.23	2.29
22	0.91	0.98	1.04	1.10	1.17	1.23	1.29	1.35	1.42	1.48	1.54	1.60	1.67	1.73	1.79	1.85	1.92	1.98	2.04	2.11	2.17	2.23
23	0.89	0.95	1.01	1.08	1.14	1.20	1.26	1.32	1.38	1.44	1.50	1.56	1.63	1.69	1.75	1.81	1.87	1.93	1.99	2.05	2.11	2.18
24	0.87	0.93	0.99	1.05	1.11	1.17	1.23	1.29	1.35	1.41	1.47	1.53	1.59	1.65	1.71	1.77	1.83	1.88	1.94	2.00	2.06	2.12
25	0.85	0.91	0.97	1.03	1.08	1.14	1.20	1.26	1.32	1.38	1.43	1.49	1.55	1.61	1.67	1.73	1.78	1.84	1.90	1.96	2.02	2.08
26	0.83	0.89	0.95	1.00	1.06	1.12	1.17	1.23	1.29	1.34	1.40	1.46	1.52	1.57	1.63	1.69	1.74	1.80	1.86	1.92	1.97	2.03
27	0.81	0.87	0.93	0.98	1.04	1.09	1.15	1.20	1.26	1.32	1.37	1.43	1.48	1.54	1.60	1.65	1.71	1.76	1.82	1.87	1.93	1.99
28	0.80	0.85	0.91	0.96	1.02	1.07	1.13	1.18	1.23	1.29	1.34	1.40	1.45	1.51	1.56	1.62	1.67	1.73	1.78	1.84	1.89	1.95
29	0.78	0.84	0.89	0.94	1.00	1.05	1.10	1.16	1.21	1.26	1.32	1.37	1.43	1.48	1.53	1.59	1.64	1.69	1.75	1.80	1.85	1.91
30	0.77	0.82	0.87	0.92	0.98	1.03	1.08	1.13	1.19	1.24	1.29	1.35	1.40	1.45	1.50	1.56	1.61	1.66	1.71	1.77	1.82	1.87
31	0.75	0.80	0.86	0.91	0.96	1.01	1.06	1.11	1.17	1.22	1.27	1.32	1.37	1.42	1.48	1.53	1.58	1.63	1.68	1.73	1.79	1.84
32	0.74	0.79	0.84	0.89	0.94	0.99	1.04	1.09	1.14	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80
33	0.73	0.78	0.83	0.88	0.93	0.98	1.03	1.08	1.13	1.17	1.22	1.27	1.32	1.37	1.42	1.47	1.52	1.57	1.62	1.67	1.72	1.77
34	0.71	0.76	0.81	0.86	0.91	0.96	1.01	1.06	1.11	1.16	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.64	1.69	1.74
35	0.70	0.75	0.80	0.85	0.90	0.94	0.99	1.04	1.09	1.14	1.18	1.23	1.28	1.33	1.38	1.43	1.47	1.52	1.57	1.62	1.67	1.71
36	0.69	0.74	0.79	0.83	0.88	0.93	0.98	1.02	1.07	1.12	1.17	1.21	1.26	1.31	1.36	1.40	1.45	1.50	1.55	1.59	1.64	1.69
37	0.68	0.73	0.77	0.82	0.87	0.91	0.96	1.01	1.05	1.10	1.15	1.19	1.24	1.29	1.33	1.38	1.43	1.47	1.52	1.57	1.61	1.66
38	0.67	0.72	0.76	0.81	0.85	0.90	0.95	0.99	1.04	1.08	1.13	1.18	1.22	1.27	1.31	1.36	1.41	1.45	1.50	1.54	1.59	1.64
39	0.66	0.71	0.75	0.80	0.84	0.89	0.93	0.98	1.02	1.07	1.11	1.16	1.20	1.25	1.30	1.34	1.39	1.43	1.48	1.52	1.57	1.61
40	0.65	0.70	0.74	0.79	0.83	0.87	0.92	0.96	1.01	1.05	1.10	1.14	1.19	1.23	1.28	1.32	1.37	1.41	1.46	1.50	1.54	1.59
41	0.64	0.69	0.73	0.77	0.82	0.86	0.91	0.95	0.99	1.04	1.08	1.13	1.17	1.22	1.26	1.30	1.35	1.39	1.44	1.48	1.52	1.57
42	0.63	0.68	0.72	0.76	0.81	0.85	0.89	0.94	0.98	1.02	1.07	1.11	1.16	1.20	1.24	1.29	1.33	1.37	1.42	1.46	1.50	1.55
43	0.63	0.67	0.71	0.75	0.80	0.84	0.88	0.93	0.97	1.01	1.05	1.10	1.14	1.18	1.23	1.27	1.31	1.35	1.40	1.44	1.48	1.53
44	0.62	0.66	0.70	0.74	0.79	0.83	0.87	0.91	0.96	1.00	1.04	1.08	1.12	1.17	1.21	1.25	1.29	1.34	1.38	1.42	1.46	1.51
45	0.61	0.65	0.69	0.73	0.78	0.82	0.86	0.90	0.94	0.99	1.03	1.07	1.11	1.15	1.19	1.24	1.28	1.32	1.36	1.40	1.44	1.49
46	0.60	0.64	0.68	0.73	0.77	0.81	0.85	0.89	0.93	0.97	1.01	1.06	1.10	1.14	1.18	1.22	1.26	1.30	1.34	1.39	1.43	1.47
47	0.59	0.64	0.68	0.72	0.76	0.80	0.84	0.88	0.92	0.96	1.00	1.04	1.08	1.12	1.17	1.21	1.25	1.29	1.33	1.37	1.41	1.45
48	0.59	0.63	0.67	0.71	0.75	0.79	0.83	0.87	0.91	0.95	0.99	1.03	1.07	1.11	1.15	1.19	1.23	1.27	1.31	1.35	1.39	1.43
49	0.58	0.62	0.66	0.70	0.74	0.78	0.82	0.86	0.90	0.94	0.98	1.02	1.06	1.10	1.14	1.18	1.22	1.26	1.30	1.34	1.38	1.42
50	0.57	0.61	0.65	0.69	0.73	0.77	0.81	0.85	0.89	0.93	0.97	1.01	1.05	1.09	1.13	1.16	1.20	1.24	1.28	1.32	1.36	1.40
51	0.57	0.61	0.65	0.68	0.72	0.76	0.80	0.84	0.88	0.92	0.96	1.00	1.03	1.07	1.11	1.15	1.19	1.23	1.27	1.31	1.35	1.38
52	0.56	0.60	0.64	0.68	0.72	0.75	0.79	0.83	0.87	0.91	0.95	0.98	1.02	1.06	1.10	1.14	1.18	1.22	1.25	1.29	1.33	1.37
53	0.56	0.59	0.63	0.67	0.71	0.75	0.78	0.82	0.86	0.90	0.94	0.97	1.01	1.05	1.09	1.13	1.16	1.20	1.24	1.28	1.32	1.36
54	0.55	0.59	0.62	0.66	0.70	0.74	0.78	0.81	0.85	0.89	0.93	0.96	1.00	1.04	1.08	1.11	1.15	1.19	1.23	1.27	1.30	1.34
55	0.54	0.58	0.62	0.66	0.69	0.73	0.77	0.80	0.84	0.88	0.92	0.95	0.99	1.03	1.07	1.10	1.14	1.18	1.21	1.25	1.29	1.33
56	0.54	0.58	0.61	0.65	0.69	0.72	0.76	0.80	0.83	0.87	0.91	0.94	0.98	1.02	1.05	1.09	1.13	1.17	1.20	1.24	1.28	1.31
57	0.53	0.57	0.61	0.64	0.68	0.72	0.75	0.79	0.83	0.86	0.90	0.93	0.97	1.01	1.04	1.08	1.12	1.15	1.19	1.23	1.26	1.30
58	0.53	0.56	0.60	0.64	0.67	0.71	0.74	0.78	0.82	0.85	0.89	0.93	0.96	1.00	1.03	1.07	1.11	1.14	1.18	1.22	1.25	1.29
59	0.52	0.56	0.59	0.63	0.67	0.70	0.74	0.77	0.81	0.85	0.88	0.92	0.95	0.99	1.02	1.06	1.10	1.13	1.17	1.20	1.24	1.28
60	0.52	0.55	0.59	0.62	0.66	0.70	0.73	0.77	0.80	0.84	0.87	0.91	0.94	0.98	1.01	1.05	1.09	1.12	1.16	1.19	1.23	1.26

T_c (min)	Mean Annual Precipitation (in)																				
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	7.87	8.41	8.95	9.49	10.03	10.57	11.11	11.64	12.18	12.72	13.26	13.80	14.34	14.88	15.42	15.96	16.50	17.04	17.58	18.12	18.66	19.20
2	5.31	5.67	6.04	6.40	6.77	7.13	7.50	7.86	8.22	8.59	8.95	9.32	9.68	10.04	10.41	10.77	11.14	11.50	11.87	12.23	12.59	12.96
3	4.22	4.51	4.80	5.09	5.38	5.67	5.96	6.25	6.53	6.82	7.11	7.40	7.69	7.98	8.27	8.56	8.85	9.14	9.43	9.72	10.01	10.30
4	3.58	3.83	4.08	4.32	4.57	4.81	5.06	5.31	5.55	5.80	6.04	6.29	6.53	6.78	7.03	7.27	7.52	7.76	8.01	8.25	8.50	8.75
5	3.16	3.38	3.59	3.81	4.02	4.24	4.46	4.67	4.89	5.11	5.32	5.54	5.76	5.97	6.19	6.41	6.62	6.84	7.06	7.27	7.49	7.71
6	2.85	3.04	3.24	3.43	3.63	3.82	4.02	4.22	4.41	4.61	4.80	5.00	5.19	5.39	5.58	5.78	5.97	6.17	6.36	6.56	6.75	6.95
7	2.61	2.79	2.97	3.15	3.33	3.50	3.68	3.86	4.04	4.22	4.40	4.58	4.76	4.94	5.12	5.29	5.47	5.65	5.83	6.01	6.19	6.37
8	2.42	2.59	2.75	2.92	3.08	3.25	3.41	3.58	3.75	3.91	4.08	4.24	4.41	4.58	4.74	4.91	5.07	5.24	5.41	5.57	5.74	5.90
9	2.26	2.42	2.57	2.73	2.88	3.04	3.19	3.35	3.50	3.66	3.81	3.97	4.13	4.28	4.44	4.59	4.75	4.90	5.06	5.21	5.37	5.52
10	2.13	2.28	2.42	2.57	2.72	2.86	3.01	3.16	3.30	3.45	3.59	3.74	3.89	4.03	4.18	4.32	4.47	4.62	4.76	4.91	5.06	5.20
11	2.02	2.16	2.30	2.44	2.57	2.71	2.85	2.99	3.13	3.27	3.40	3.54	3.68	3.82	3.96	4.10	4.24	4.37	4.51	4.65	4.79	4.93
12	1.92	2.05	2.19	2.32	2.45	2.58	2.71	2.85	2.98	3.11	3.24	3.37	3.50	3.64	3.77	3.90	4.03	4.16	4.30	4.43	4.56	4.69
13	1.84	1.96	2.09	2.21	2.34	2.47	2.59	2.72	2.84	2.97	3.10	3.22	3.35	3.47	3.60	3.73	3.85	3.98	4.10	4.23	4.36	4.48
14	1.76	1.88	2.00	2.12	2.24	2.37	2.49	2.61	2.73	2.85	2.97	3.09	3.21	3.33	3.45	3.57	3.69	3.81	3.94	4.06	4.18	4.30
15	1.69	1.81	1.93	2.04	2.16	2.27	2.39	2.51	2.62	2.74	2.86	2.97	3.09	3.20	3.32	3.44	3.55	3.67	3.78	3.90	4.02	4.13
16	1.63	1.74	1.86	1.97	2.08	2.19	2.30	2.42	2.53	2.64	2.75	2.86	2.98	3.09	3.20	3.31	3.42	3.54	3.65	3.76	3.87	3.98
17	1.58	1.69	1.79	1.90	2.01	2.12	2.23	2.34	2.44	2.55	2.66	2.77	2.88	2.98	3.09	3.20	3.31	3.42	3.53	3.63	3.74	3.85
18	1.53	1.63	1.74	1.84	1.95	2.05	2.16	2.26	2.37	2.47	2.57	2.68	2.78	2.89	2.99	3.10	3.20	3.31	3.41	3.52	3.62	3.73
19	1.48	1.58	1.68	1.79	1.89	1.99	2.09	2.19	2.29	2.40	2.50	2.60	2.70	2.80	2.90	3.00	3.11	3.21	3.31	3.41	3.51	3.61
20	1.44	1.54	1.64	1.73	1.83	1.93	2.03	2.13	2.23	2.33	2.43	2.52	2.62	2.72	2.82	2.92	3.02	3.12	3.21	3.31	3.41	3.51
21	1.40	1.50	1.59	1.69	1.78	1.88	1.98	2.07	2.17	2.26	2.36	2.46	2.55	2.65	2.74	2.84	2.94	3.03	3.13	3.22	3.32	3.41
22	1.36	1.46	1.55	1.64	1.74	1.83	1.92	2.02	2.11	2.20	2.30	2.39	2.48	2.58	2.67	2.77	2.86	2.95	3.05	3.14	3.23	3.33
23	1.33	1.42	1.51	1.60	1.69	1.78	1.88	1.97	2.06	2.15	2.24	2.33	2.42	2.51	2.61	2.70	2.79	2.88	2.97	3.06	3.15	3.24
24	1.30	1.39	1.48	1.56	1.65	1.74	1.83	1.92	2.01	2.10	2.19	2.28	2.37	2.45	2.54	2.63	2.72	2.81	2.90	2.99	3.08	3.17
25	1.27	1.35	1.44	1.53	1.62	1.70	1.79	1.88	1.96	2.05	2.14	2.22	2.31	2.40	2.48	2.57	2.66	2.75	2.83	2.92	3.01	3.09
26	1.24	1.32	1.41	1.50	1.58	1.67	1.75	1.84	1.92	2.01	2.09	2.18	2.26	2.35	2.43	2.52	2.60	2.69	2.77	2.86	2.94	3.03
27	1.21	1.30	1.38	1.46	1.55	1.63	1.71	1.80	1.88	1.96	2.05	2.13	2.21	2.30	2.38	2.46	2.55	2.63	2.71	2.79	2.88	2.96
28	1.19	1.27	1.35	1.43	1.52	1.60	1.68	1.76	1.84	1.92	2.00	2.09	2.17	2.25	2.33	2.41	2.49	2.57	2.66	2.74	2.82	2.90
29	1.17	1.25	1.33	1.41	1.49	1.57	1.64	1.72	1.80	1.88	1.96	2.04	2.12	2.20	2.28	2.36	2.44	2.52	2.60	2.68	2.76	2.84
30	1.14	1.22	1.30	1.38	1.46	1.54	1.61	1.69	1.77	1.85	1.93	2.01	2.08	2.16	2.24	2.32	2.40	2.48	2.55	2.63	2.71	2.79
31	1.12	1.20	1.28	1.35	1.43	1.51	1.58	1.66	1.74	1.81	1.89	1.97	2.05	2.12	2.20	2.28	2.35	2.43	2.51	2.58	2.66	2.74
32	1.10	1.18	1.25	1.33	1.40	1.48	1.56	1.63	1.71	1.78	1.86	1.93	2.01	2.08	2.16	2.24	2.31	2.39	2.46	2.54	2.61	2.69
33	1.08	1.16	1.23	1.31	1.38	1.45	1.53	1.60	1.68	1.75	1.83	1.90	1.97	2.05	2.12	2.20	2.27	2.35	2.42	2.49	2.57	2.64
34	1.06	1.14	1.21	1.28	1.36	1.43	1.50	1.58	1.65	1.72	1.80	1.87	1.94	2.01	2.09	2.16	2.23	2.31	2.38	2.45	2.53	2.60
35	1.05	1.12	1.19	1.26	1.33	1.41	1.48	1.55	1.62	1.69	1.77	1.84	1.91	1.98	2.05	2.13	2.20	2.27	2.34	2.41	2.48	2.56
36	1.03	1.10	1.17	1.24	1.31	1.38	1.46	1.53	1.60	1.67	1.74	1.81	1.88	1.95	2.02	2.09	2.16	2.23	2.30	2.37	2.44	2.52
37	1.02	1.08	1.15	1.22	1.29	1.36	1.43	1.50	1.57	1.64	1.71	1.78	1.85	1.92	1.99	2.06	2.13	2.20	2.27	2.34	2.41	2.48
38	1.00	1.07	1.14	1.21	1.27	1.34	1.41	1.48	1.55	1.62	1.69	1.75	1.82	1.89	1.96	2.03	2.10	2.17	2.23	2.30	2.37	2.44
39	0.99	1.05	1.12	1.19	1.26	1.32	1.39	1.46	1.53	1.59	1.66	1.73	1.80	1.86	1.93	2.00	2.07	2.13	2.20	2.27	2.34	2.40
40	0.97	1.04	1.10	1.17	1.24	1.30	1.37	1.44	1.50	1.57	1.64	1.70	1.77	1.84	1.90	1.97	2.04	2.10	2.17	2.24	2.30	2.37
41	0.96	1.02	1.09	1.15	1.22	1.29	1.35	1.42	1.48	1.55	1.61	1.68	1.75	1.81	1.88	1.94	2.01	2.07	2.14	2.21	2.27	2.34
42	0.94	1.01	1.07	1.14	1.20	1.27	1.33	1.40	1.46	1.53	1.59	1.66	1.72	1.79	1.85	1.92	1.98	2.05	2.11	2.18	2.24	2.30
43	0.93	1.00	1.06	1.12	1.19	1.25	1.32	1.38	1.44	1.51	1.57	1.64	1.70	1.76	1.83	1.89	1.95	2.02	2.08	2.15	2.21	2.27
44	0.92	0.98	1.05	1.11	1.17	1.24	1.30	1.36	1.42	1.49	1.55	1.61	1.68	1.74	1.80	1.87	1.93	1.99	2.06	2.12	2.18	2.24
45	0.91	0.97	1.03	1.10	1.16	1.22	1.28	1.34	1.41	1.47	1.53	1.59	1.66	1.72	1.78	1.84	1.91	1.97	2.03	2.09	2.15	2.22
46	0.90	0.96	1.02	1.08	1.14	1.20	1.27	1.33	1.39	1.45	1.51	1.57	1.64	1.70	1.76	1.82	1.88	1.94	2.00	2.07	2.13	2.19
47	0.89	0.95	1.01	1.07	1.13	1.19	1.25	1.31	1.37	1.43	1.49	1.55	1.62	1.68	1.74	1.80	1.86	1.92	1.98	2.04	2.10	2.16
48	0.88	0.94	1.00	1.06	1.12	1.18	1.24	1.30	1.36	1.42	1.48	1.54	1.60	1.66	1.72	1.78	1.84	1.90	1.96	2.02	2.08	2.14
49	0.87	0.92	0.98	1.04	1.10	1.16	1.22	1.28	1.34	1.40	1.46	1.52	1.58	1.64	1.70	1.76	1.82	1.87	1.93	1.99	2.05	2.11
50	0.86	0.91	0.97	1.03	1.09	1.15	1.21	1.27	1.33	1.38	1.44	1.50	1.56	1.62	1.68	1.74	1.79	1.85	1.91	1.97	2.03	2.09
51	0.85	0.90	0.96	1.02	1.08	1.14	1.19	1.25	1.31	1.37	1.43	1.48	1.54	1.60	1.66	1.72	1.77	1.83	1.89	1.95	2.01	2.06
52	0.84	0.89	0.95	1.01	1.07	1.12	1.18	1.24	1.30	1.35	1.41	1.47	1.53	1.58	1.64	1.70	1.76	1.81	1.87	1.93	1.98	2.04
53	0.83	0.88	0.94	1.00	1.06	1.11	1.17	1.23	1.28	1.34	1.40	1.45	1.51	1.57	1.62	1.68	1.74	1.79	1.85	1.91	1.96	2.02
54	0.82	0.88	0.93	0.99	1.04	1.10	1.16	1.21	1.27	1.32	1.38	1.44	1.49	1.55	1.61	1.66	1.72	1.77	1.83	1.89	1.94	2.00
55	0.81	0.87	0.92	0.98	1.03	1.09	1.14	1.20	1.26	1.31	1.37	1.42	1.48	1.53	1.59	1.64	1.70	1.76	1.81	1.87	1.92	1.98
56	0.80	0.86	0.91	0.97	1.02	1.08	1.13	1.19	1.24	1.30	1.35	1.41	1.46	1.52	1.57	1.63	1.68	1.74	1.79	1.85	1.90	1.96
57	0.79	0.85	0.90	0.96	1.01	1.07	1.12	1.18	1.23	1.28	1.34	1.39	1.45	1.50	1.56	1.61	1.67	1.72	1.78	1.83	1.88	1.94
58	0.79	0.84	0.89	0.95	1.00	1.06	1.11	1.16	1.22	1.27	1.33	1.38	1.43	1.49	1.54	1.60	1.65	1.70	1.76	1.81	1.87	1.92
59	0.78	0.83	0.89	0.94	0.99	1.05	1.10	1.15	1.21	1.26	1.31	1.37	1.42	1.47	1.53	1.58	1.63	1.69	1.74	1.79	1.85	1.90
60	0.77	0.82	0.88	0.93	0.98	1.04	1.09	1.14	1.19	1.25	1.30	1.35	1.41	1.46	1.51	1.57	1.62	1.67	1.72	1.78	1.83	1.88



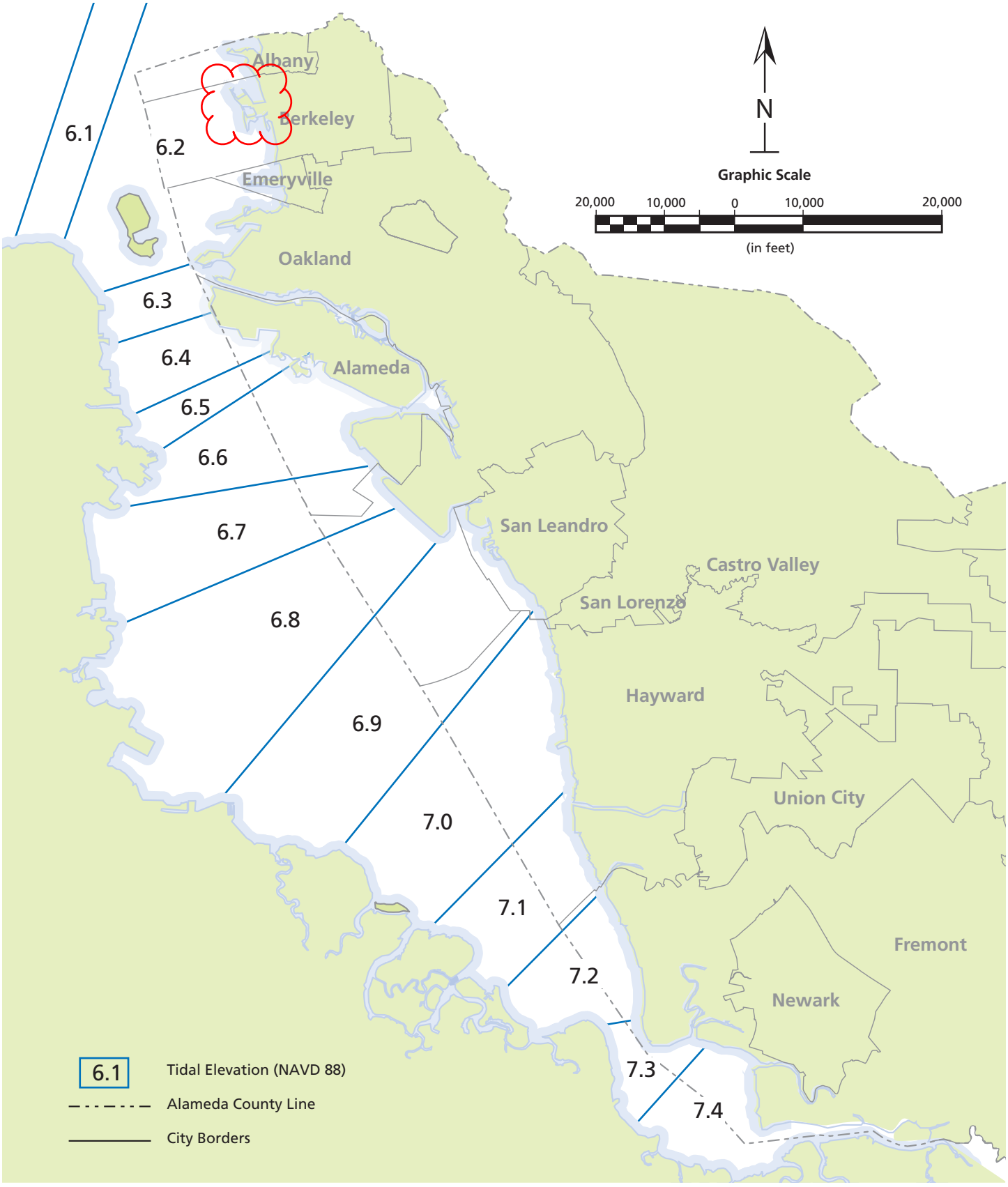
Attachment 9 available for download in GIS file from the Alameda County Flood Control District website.

(NRCS 2015) and (District 2015)



Attachment 10 available for download as a GIS file from the Alameda County Flood Control District website.

(District 2015)

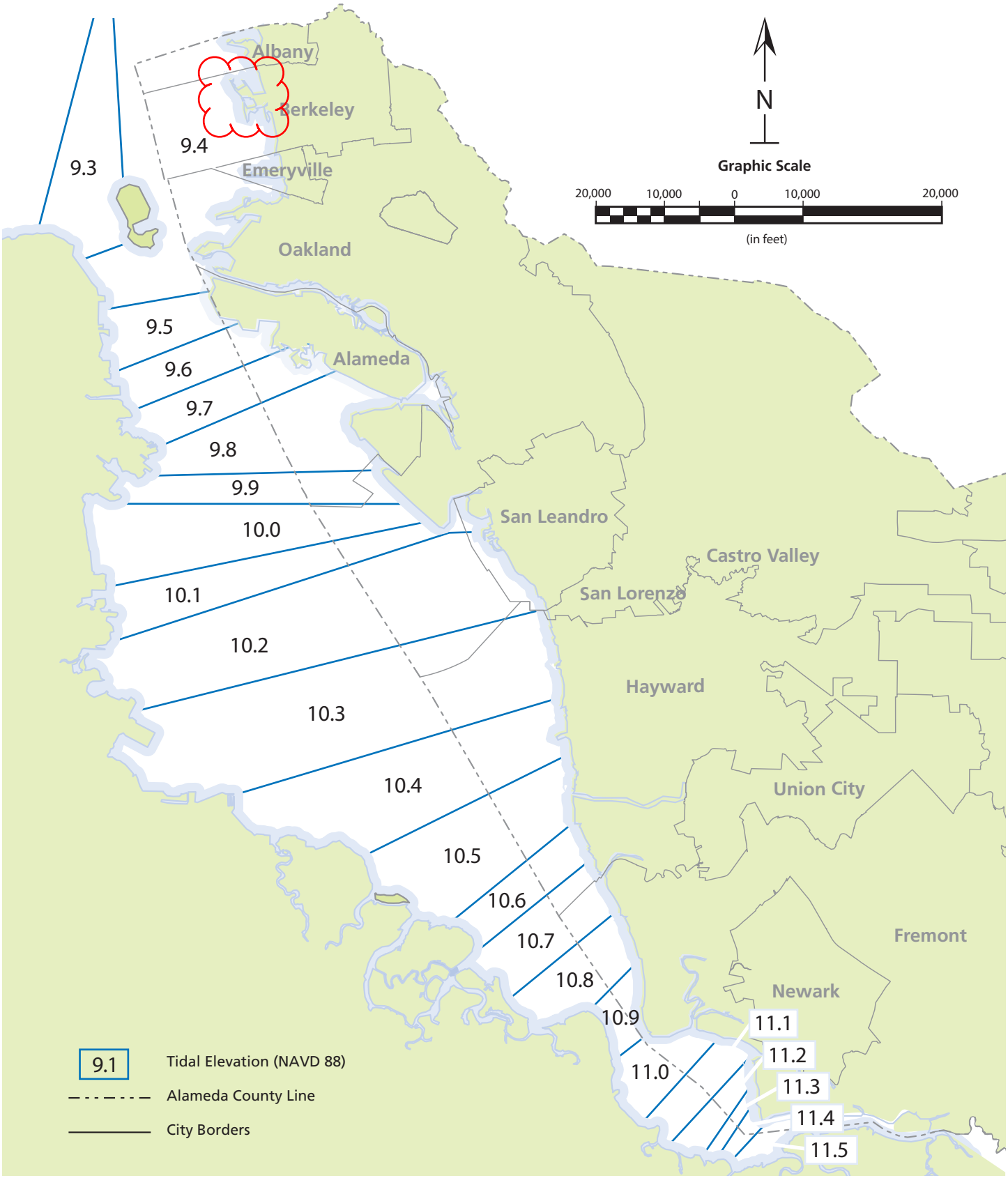


(FEMA 2016)

Alameda County Hydrology & Hydraulics Manual 2016

Tidal Summary
Adopted MHHW Tidal Elevation

Attachment 11A



(FEMA 2016)

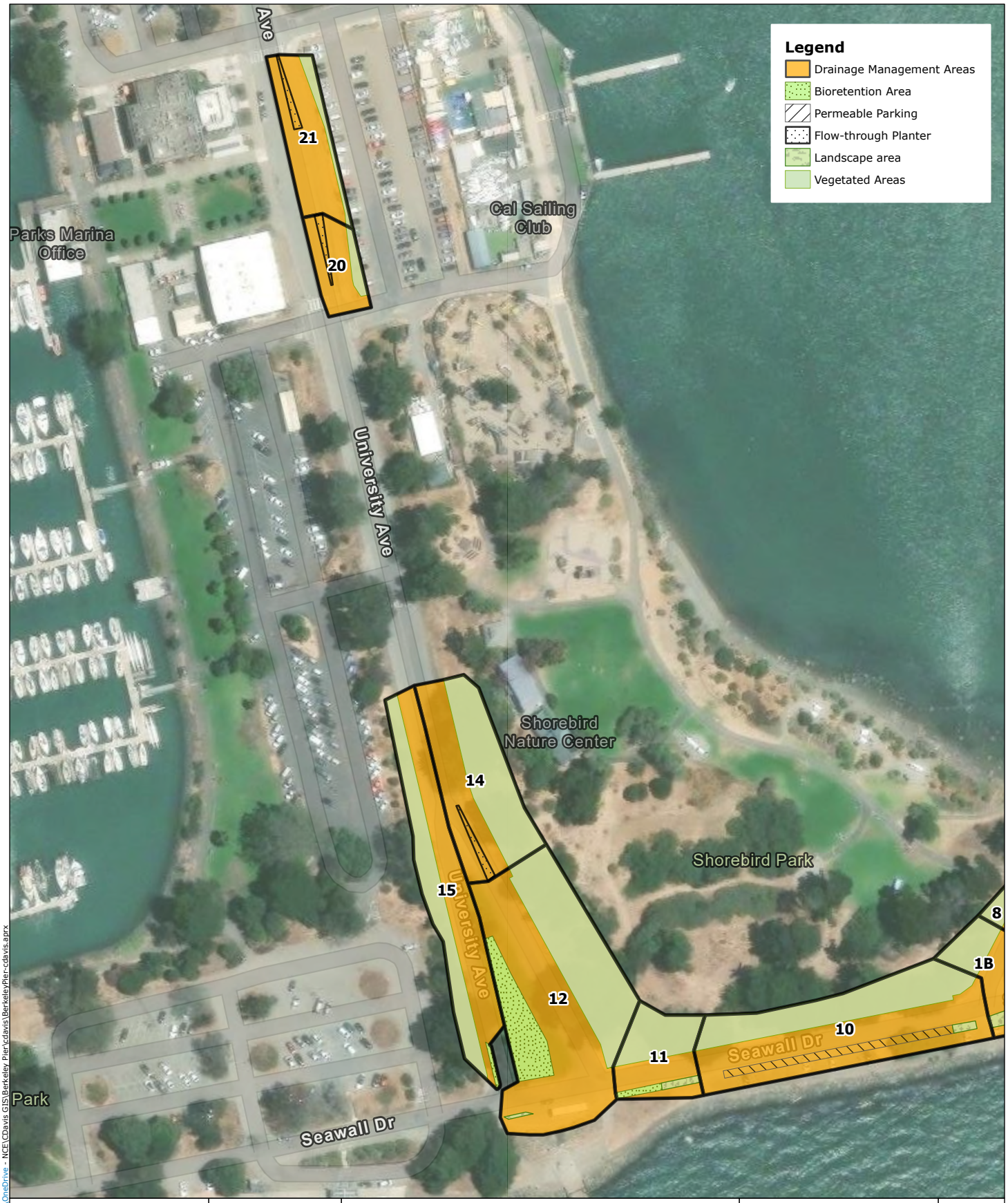
Alameda County Hydrology & Hydraulics Manual 2016

Tidal Summary
Adopted 100-yr Tidal Elevation

Attachment 11B

Appendix B

Water Quality Calculations



Document Path: C:\Users\CDavis\OneDrive - NCE\CDavis GIS\Berkeley Pier\cdavis\BerkeleyPier-cdavis.aprx

CITY OF BERKELEY

NCE

Berkeley Water Transportation Pier Ferry Project

Water Quality Drainage Areas

N

0 50 100 ft.

FIGURE B.1

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata	1421.01.55	cdavis	1/11/2026	-	-



Document Path: C:\Users\CDavis\OneDrive - NCE\CDavis GIS\Berkeley Pier\cdavis\BerkeleyPier-cdavis.aprx

CITY OF BERKELEY

NCE

Berkeley Water Transportation Pier Ferry Project

Water Quality Drainage Areas

N

0 50 100 ft.

FIGURE B.2

SOURCE	JOB NUMBER	DRAWN	DATE	REVISED	APPROVED
ESRI World Imagery with Metadata	1421.01.55	cdavis	1/11/2026	-	-

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 1A

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	2,663	1.0	2,663
2-3	Pervious surface	5,748	0.1	575
	Total DMA Area (square feet) =	8,411		

2-4 ***Total Effective Impervious Area (EIA)*** 3,238 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns		
		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 197 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 5,748 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.10 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

	Area of Permeable Parking	**5748 Square Feet**
10-year Rainfall Depth (in) 2.03	*WQ Storage in Permeable Parking*	**2012 Cubic feet**
100-year Rainfall Depth (in) 3.02	*plies 35% void space and 12 inch thickness)*	
	10-year total volume of runoff (cf)	1423 **Cubic feet**
	100-year total volume of runoff (cf)	2117 **Cubic feet**

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 1B

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	24,726	1.0	24,726
2-3	Pervious service	9,731	0.1	973
	Total DMA Area (square feet) =	34,457		

2-4 ***Total Effective Impervious Area (EIA)*** 25,699 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 1,564 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	1,028	Square feet
5-2	Area 25% smaller than item 5-1	771	Square feet
5-3	Volume of treated runoff for area in Item 5-2	1,173	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	391	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	1192	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	1,813	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(250)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.21	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-2.51	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1	Final surface area of treatment*	1,192	Square feet (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 2A

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	0	1.0	0
2-3	Pervious surface	3,810	0.1	381
	Total DMA Area (square feet) =	3,810		

2-4 ***Total Effective Impervious Area (EIA)*** 381 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 23 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 3,810 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.02 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**3810 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**1334 Cubic feet**
100-year Rainfall Depth (in)	3.02	*ıplies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	645 **Cubic feet**
		100-year total volume of runoff (cf)	959 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 2B

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	13,328	1.0	13,328
2-3	Pervious surface	3,686	0.1	369
	Total DMA Area (square feet) =	17,014		

2-4 ***Total Effective Impervious Area (EIA)*** 13,697 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 833 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 3,078 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.77 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**3078 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**1077 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	2878 **Cubic feet**
		100-year total volume of runoff (cf)	4282 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 3A

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	13,703	1.0	13,703
2-3	Pervious surface	6,906	0.1	691
	Total DMA Area (square feet) =	20,609		

2-4 ***Total Effective Impervious Area (EIA)*** 14,394 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 876 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 6,906 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.36 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**6906 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**2417 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	3486 **Cubic feet**
		100-year total volume of runoff (cf)	5187 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 3B

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	2,313	1.0	2,313
2-3	Pervious surface	6,829	0.1	683
	Total DMA Area (square feet) =	9,142		

2-4 ***Total Effective Impervious Area (EIA)*** 2,996 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 182 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 6,829 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.08 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**6829 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**2390 Cubic feet**
100-year Rainfall Depth (in)	3.02	*ıplies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	1547 **Cubic feet**
		100-year total volume of runoff (cf)	2301 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 4A

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	1,762	1.0	1,762
2-3	Pervious surface	3,564	0.1	356
	Total DMA Area (square feet) =	5,326		

2-4 ***Total Effective Impervious Area (EIA)*** 2,118 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns		
		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 129 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 3,564 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.10 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**3564 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**1247 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	901 **Cubic feet**
		100-year total volume of runoff (cf)	1340 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 4B

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	6,719	1.0	6,719
2-3	Pervious surface	3,699	0.1	370
	Total DMA Area (square feet) =	10,418		

2-4 ***Total Effective Impervious Area (EIA)*** 7,089 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 431 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 3,699 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.33 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	3699 **Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	1295 **Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	1762 **Cubic feet**
		100-year total volume of runoff (cf)	2622 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 5A

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	11,006	1.0	11,006
2-3	Pervious surface	6,525	0.1	653
	Total DMA Area (square feet) =	17,531		

2-4 ***Total Effective Impervious Area (EIA)*** 11,659 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 709 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 6,525 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.31 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**6525 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**2284 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	2966 **Cubic feet**
		100-year total volume of runoff (cf)	4412 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 5B

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	844	1.0	844
2-3	Pervious surface	5,877	0.1	588
	Total DMA Area (square feet) =	6,721		

2-4 ***Total Effective Impervious Area (EIA)*** 1,432 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 87 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 5,877 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.04 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**5877 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**2057 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	1137 **Cubic feet**
		100-year total volume of runoff (cf)	1691 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 6

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	6,064	1.0	6,064
2-3	Pervious surface	3,052	0.1	305
	Total DMA Area (square feet) =	9,116		

2-4 ***Total Effective Impervious Area (EIA)*** 6,369 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 388 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 3,052 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.36 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**3052 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**1068 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	1542 **Cubic feet**
		100-year total volume of runoff (cf)	2294 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 7

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	3,878	1.0	3,878
2-3	Pervious surface	3,685	0.1	369
	Total DMA Area (square feet) =	7,563		

2-4 ***Total Effective Impervious Area (EIA)*** 4,247 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 258 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 3,685 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.20 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**3685 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**1290 Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	1279 **Cubic feet**
		100-year total volume of runoff (cf)	1903 **Cubic feet**

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 8

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	10,768	1.0	10,768
2-3	Pervious service	1,565	0.1	157
	Total DMA Area (square feet) =	12,333		

2-4 ***Total Effective Impervious Area (EIA)*** 10,925 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 665 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	437	Square feet
5-2	Area 25% smaller than item 5-1	328	Square feet
5-3	Volume of treated runoff for area in Item 5-2	499	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	166	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	828	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	1,260	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(595)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.72	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-8.62	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1	Final surface area of treatment*	828	Square feet (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: **Oakland**

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: **1.09**

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: **DMA 9A**

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	4,106	1.0	4,106
2-3	Pervious surface	9,133	0.1	913
	Total DMA Area (square feet) =	13,239		

2-4 ***Total Effective Impervious Area (EIA)*** **5,019** **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** **0.67** **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** **0.73** **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** **305** **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** **9,133** **Square feet TO SATISI**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** **0.10** **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**9133 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**3197 Cubic feet**
100-year Rainfall Depth (in)	3.02	*ıplies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	2240 **Cubic feet**
		100-year total volume of runoff (cf)	3332 **Cubic feet**

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: Oakland

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 9B

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	8,256	1.0	8,256
2-3	Pervious surface	6,599	0.1	660
	Total DMA Area (square feet) =	14,855		

2-4 ***Total Effective Impervious Area (EIA)*** 8,916 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 543 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** 6,599 **Square feet TO SATIS**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** 0.23 **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	6599 **Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	2310 **Cubic feet**
100-year Rainfall Depth (in)	3.02	*plies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	2513 **Cubic feet**
		100-year total volume of runoff (cf)	3739 **Cubic feet**

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 9C

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	8,782	1.0	8,782
2-3	Pervious service	853	0.1	85
	Total DMA Area (square feet) =	9,635		

2-4 ***Total Effective Impervious Area (EIA)*** 8,867 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 540 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	355	Square feet
5-2	Area 25% smaller than item 5-1	266	Square feet
5-3	Volume of treated runoff for area in Item 5-2	405	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	135	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	853	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	1,298	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(758)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.89	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-10.66	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1 Final surface area of treatment* 853 **Square feet** (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	**BWTPF**	
1-2	City application ID:		
1-3	Site Address or APN:	**Berkeley Marina**	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	**20.0**	**Inches**

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	**Oakland**

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: **1.09**

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: **DMA 10**

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	**14,823**	**1.0**	**14,823**
2-3	Pervious surface	**13,603**	**0.1**	**1,360**
	Total DMA Area (square feet) =	**28,426**		

2-4 ***Total Effective Impervious Area (EIA)*** **16,183** **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** **0.67** **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** **0.73** **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** **985** **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** **2,375** **Square feet TO SATISI**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** **1.18** **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)
(Note: Infiltration trench depths are typically between 3 and 8 feet.)

		Area of Permeable Parking	**2375 Square Feet**
10-year Rainfall Depth (in)	2.03	*WQ Storage in Permeable Parking*	**831 Cubic feet**
100-year Rainfall Depth (in)	3.02	*ıplies 35% void space and 12 inch thickness)*	
		10-year total volume of runoff (cf)	4809 **Cubic feet**
		100-year total volume of runoff (cf)	7154 **Cubic feet**

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 11

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	3,533	1.0	3,533
2-3	Pervious service	5,162	0.1	516
	Total DMA Area (square feet) =	8,695		

2-4 ***Total Effective Impervious Area (EIA)*** 4,049 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 246 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	162	Square feet
5-2	Area 25% smaller than item 5-1	121	Square feet
5-3	Volume of treated runoff for area in Item 5-2	185	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	62	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	400	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	609	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(362)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.91	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-10.86	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1	Final surface area of treatment*	400	Square feet (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 12

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	20,041	1.0	20,041
2-3	Pervious service	18,597	0.1	1,860
	Total DMA Area (square feet) =	38,638		

2-4 ***Total Effective Impervious Area (EIA)*** 21,901 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 1,333 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	876	Square feet
5-2	Area 25% smaller than item 5-1	657	Square feet
5-3	Volume of treated runoff for area in Item 5-2	1,000	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	333	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	1010	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	1,537	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(204)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.20	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-2.42	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1	Final surface area of treatment*	1,010	Square feet (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 14

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	7,989	1.0	7,989
2-3	Pervious service	10,329	0.1	1,033
	Total DMA Area (square feet) =	18,318		

2-4 ***Total Effective Impervious Area (EIA)*** 9,022 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 549 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	361	Square feet
5-2	Area 25% smaller than item 5-1	271	Square feet
5-3	Volume of treated runoff for area in Item 5-2	412	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	137	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	577	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	878	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(329)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.57	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-6.84	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1	Final surface area of treatment*	577	Square feet (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Water Quality Design Volume (80 percent capture method)

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF
1-2	City application ID:	
1-3	Site Address or APN:	Berkeley Marina
1-4	Tract or Parcel Map No:	
1-5	Site Mean Annual Precip. (MAP)[1]	20.0 Inches

The calculations presented here are based on the 80% capture method of sizing **volume-based treatment measures** provided in the Clean Water Program Alameda County C.3 Technical Guidance, v. 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6 Applicable Rain Gauge[2]: **Oakland**

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: **1.09**

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: **DMA 15**

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	11,470	1.0	11,470
2-3	Pervious surface	8,357	0.1	836
	Total DMA Area (square feet) =	19,827		

2-4 ***Total Effective Impervious Area (EIA)*** **12,306** **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns		
		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** **0.67** **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** **0.73** **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** **749** **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

3-4 ***To size an infiltration trench, enter the surface area available:*** **228** **Square feet TO SATISI**

3-5 ***Required depth of infiltration trench, given the surface area available (in 3-4):*** **9.38** **Feet**

(Assumes 35% void space in rectangular trench with vertical sides.)

(Note: Infiltration trench depths are typically between 3 and 8 feet.)

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 20

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	4,351	1.0	4,351
2-3	Pervious service	1,307	0.1	131
	Total DMA Area (square feet) =	5,658		

2-4 ***Total Effective Impervious Area (EIA)*** 4,482 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 273 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	179	Square feet
5-2	Area 25% smaller than item 5-1	134	Square feet
5-3	Volume of treated runoff for area in Item 5-2	205	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	68	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	447	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	680	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(407)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.91	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-10.93	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1 Final surface area of treatment* 447 **Square feet** (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	BWTPF	
1-2	City application ID:		
1-3	Site Address or APN:	Berkeley Marina	
1-4	Tract or Parcel Map No:		
1-5	Site Mean Annual Precip. (MAP)[1]	20.0	Inches

The calculations presented here are based on the **combination flow and volume hydraulic sizing method** provided in the Clean Water Program Alameda County C.3 Technical Guidance, Version 4.0. The steps presented below are explained in Chapter 5, Section 5.1 of the guidance manual, applicable portions of which are included in this file, in the tab called "Guidance from Chapter 5".

Refer to the Mean Annual Precipitation Map in Appendix D of the C.3 Technical Guidance to determine the MAP, in inches, for the site. Click here for map

1-6	Applicable Rain Gauge[2]	Oakland	

Enter "Oakland Airport" if the site MAP is 16.4 inches or greater. Enter "San Jose" if the site MAP is less than 16.4 inches.

MAP adjustment factor is automatically calculated as: 1.09

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, shown in Table 5.2, below.)

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: DMA 21

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	7,955	1.0	7,955
2-3	Pervious service	1,950	0.1	195
	Total DMA Area (square feet) =	9,905		

2-4 ***Total Effective Impervious Area (EIA)*** 8,150 **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-2: Unit Basin Storage Volumes (in inches) for 80 Percent Capture Using 48-Hour Drawdowns

		Unit Basin Storage Volume (in) for Applicable Runoff Coefficients
Applicable Rain Gauge	**Mean Annual Precipitation (in)**	**Coefficient of 1.00**
Oakland Airport	18.35	0.67
San Jose	14.4	0.56

3-1 ***Unit basin storage volume from Table 5.2:*** 0.67 **Inches**

(The coefficient for this method is 1.00, due to the conversion of any landscaping to effective impervious area)

3-2 ***Adjusted unit basin storage volume:*** 0.73 **Inches**

(The unit basin storage volume is adjusted by applying the MAP adjustment factor.)

3-3 ***Required Capture Volume (in cubic feet):*** 496 **Cubic feet**

(The adjusted unit basin sizing volume [inches] is multiplied by the size of the DMA and converted to feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	Inches per hour
4-2	Divide Item 3-2 by Item 4-1	3.65	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	326	Square feet
5-2	Area 25% smaller than item 5-1	245	Square feet
5-3	Volume of treated runoff for area in Item 5-2	372	Cubic feet (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	124	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.5	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.1	Inches (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth, skip to Item 8-1. If not, continue to Step 7-1.

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger or smaller than Item 5-2	502	Sq.ft. (enter larger area if you need less ponding depth; smaller for more depth.)
7-2	Volume of treated runoff for area in Item 7-1	764	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(268)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.53	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-6.40	Inches (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

8.0 Surface Area of Treatment Measure for DMA

8-1 Final surface area of treatment* 502 **Square feet** (Either Item 5-2 or final amount in Item 7-1)

**Note: Check with the local jurisdiction as to its policy regarding the minimum biotreatment surface area allowed.*

Attachment A:
HMP susceptibility map

Alameda Countywide
Clean Water Program
January 26, 2007

LEGEND (see text also)

- Major highways
- Major watersheds
- County boundary
- Streets

Channel type

- Natural creek or stream (susceptible)
- Earthen channel or connector
- Engineered channel - materials unknown
- Engineered channel - concrete
- Enclosed pipe or culvert

- Special consideration - San Lorenzo & Alameda Creeks
- Special consideration - Codornices Creek
- Hill or high slope region (susceptible)
- Tidally influenced / depositional - exempt
- Not included in HMP

Data sources:
Alameda County Flood Control and Water Conservation District; ACCWP;
Zone 7 Water Agency; U.S. Census Bureau; U.S. Geological Survey;
William Lettis Associates (Oakland Museum creek and watershed mapping project);
Balance Hydrologics and EIP Associates (Proposed test of the approach for the ACCWP HMM Preliminary Map, July 2003)

N W E S

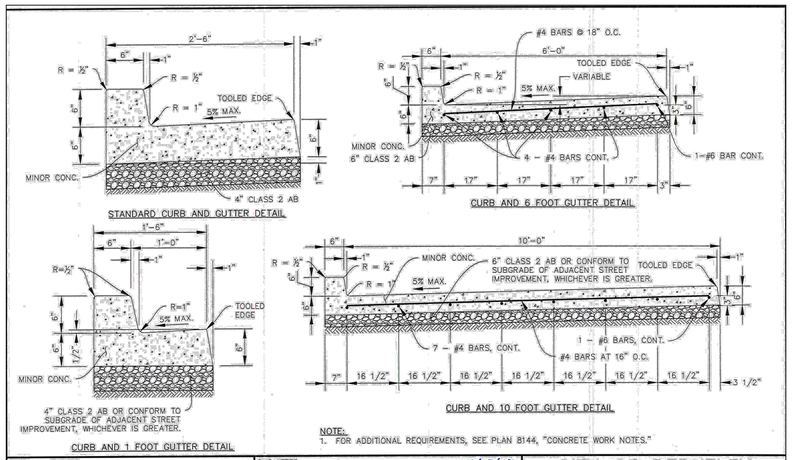
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Contra Costa County
Alameda County
Contra Costa County
Alameda County
Alameda County
San Joaquin County
Alameda County
Santa Clara County
Alameda County
Santa Clara County

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Appendix C

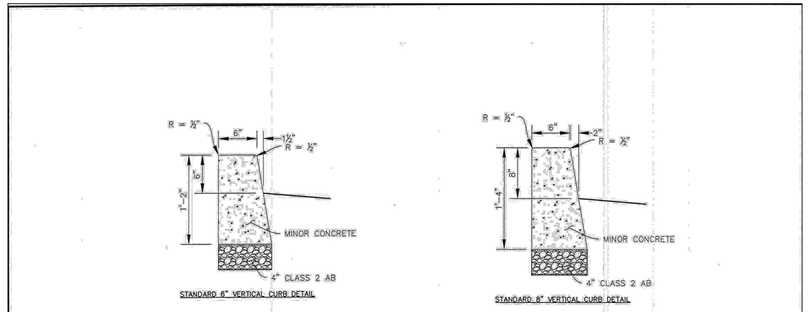
Select 60% Design Plans



NOTE:
1. FOR ADDITIONAL REQUIREMENTS, SEE PLAN 8144, "CONCRETE WORK NOTES."

STANDARD DETAIL CURB AND GUTTER	SUBMITTED: Dan Firth — SUPERVISING CIVIL ENGINEER — DATE: 2/27/17 — R.C.E. 64582 APPROVED: — MANAGER OF ENGINEERING — DATE: 2/28/17 — R.C.E. 66014	CITY OF BERKELEY DEPARTMENT OF PUBLIC WORKS	DESIGN: HEI — DRAWN: HEI — CHECK: MS — DATE: 01/26/17 — SCALE: N.T.S. — BOOK: — PLAN: 8145 — FILE: 20B-157 — SHEET: 1 OF 1

1/X STANDARD CURB AND GUTTER
N.T.S.



NOTE:
1. FOR ADDITIONAL REQUIREMENTS, SEE PLAN 8144, "CONCRETE WORK NOTES."

STANDARD DETAIL VERTICAL CONCRETE CURB	SUBMITTED: Dan Firth — SUPERVISING CIVIL ENGINEER — DATE: 2/27/17 — R.C.E. 64582 APPROVED: — MANAGER OF ENGINEERING — DATE: 2/28/17 — R.C.E. 66014	CITY OF BERKELEY DEPARTMENT OF PUBLIC WORKS	DESIGN: HEI — DRAWN: HEI — CHECK: MS — DATE: 01/26/17 — SCALE: N.T.S. — BOOK: — PLAN: 8146 — FILE: 20B-158 — SHEET: 1 OF 1

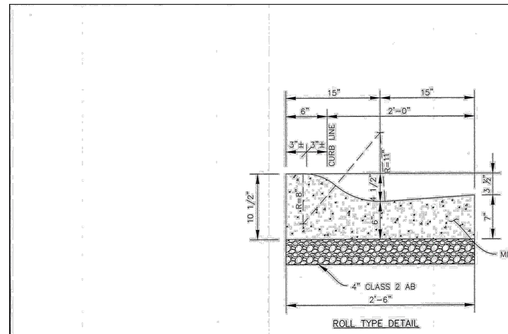
2/X STANDARD VERTICAL CONCRETE CURB
N.T.S.

GENERAL NOTES FOR CONCRETE FLAT WORK

1. CURB RAMPS SHALL CONFORM TO THE LATEST EDITION AND REVISED STANDARD PLAN (RSP) OF THE (CALIFORNIA DEPARTMENT OF TRANSPORTATION) STANDARD SPECIFICATIONS AND STANDARD PLAN A88A AND A88B.
2. PORTLAND CEMENT CONCRETE FOR SIDEWALK, CURB, DRIVEWAY, GUTTER AND VALLEY GUTTER SHALL BE MINOR CONCRETE CONFORMING TO THE REQUIREMENTS OF SECTION 90-2 'MINOR CONCRETE' OF THE (CALIFORNIA DEPARTMENT OF TRANSPORTATION) STANDARD SPECIFICATIONS. NO BAGGED MIX IS PERMITTED.
3. BUS PAD CONCRETE SHALL BE DESIGNED WITH A MINIMUM COMPRESSIVE STRENGTH OF 3,500 PSI AND SHALL BE SAMPLED (3 CYLINDERS REQ'D) AND TESTED.
4. EXISTING SUBGRADE SURFACE SHALL BE RE-GRADED (IF NECESSARY) AND RE-COMPACTED (MIN 95% RELATIVE COMPACTION) TO CONFORM TO THE GRADES SHOWN ON THE PLANS.
5. NEW CONCRETE WORK SHALL MATCH EXISTING IN FINISH, SCORE PATTERN, AND COLOR, OR AS SHOWN ON THE PLANS, OR AS DIRECTED BY THE ENGINEER.
   a) ROSE COLORED CONCRETE SHALL CONTAIN 6 POUNDS OF DAVIS #160 (ROSE) PER CUBIC YARD.
   b) ALL OTHER CONCRETE SHALL CONTAIN 1.5 POUND OF LAMPBLACK PER CUBIC YARD.
6. NO ADMIXTURES SHALL BE USED WITHOUT APPROVAL OF THE ENGINEER.
7. CURBS, SIDEWALKS, DRIVEWAYS, AND CURB RAMPS SHALL HAVE FORMS REMOVED AND BE BACKFILLED WITHIN 3 DAYS AFTER PLACING CONCRETE. CONCRETE SHALL BE ALLOWED TO CURE FOR AT LEAST 48 HOURS PRIOR TO BACKFILLING.
8. MAXIMUM SLUMP OF FRESH CONCRETE PERMITTED IN THESE ITEMS SHALL BE 4 INCHES. SLUMP SHALL BE DETERMINED BY EITHER ASTM C-143 OR CALIFORNIA TEST METHOD NO. 520 AT THE ENGINEER'S DISCRETION. CONCRETE SHALL BE TRANSPORTED IN TRUCK MIXERS OR AGITATORS AND DISCHARGED WITHIN 70 MINUTES OF LEAVING THE PLANT.
9. WEAKENED PLANE JOINTS AT LEAST 1-1/2 INCHES DEEP AND 1/8 INCHES WIDE SHALL BE PLACED AT 10 FEET MAXIMUM SPACING.
10. EXPANSION JOINT FILLER FOR CONCRETE (BITUMINOUS TYPE) MUST BE IN COMPLIANCE WITH ASTM D 994.
11. ALL NEW CURB, SIDEWALK, VALLEY GUTTER AND DRIVEWAYS CONSTRUCTED ADJACENT TO EXISTING CONCRETE CURB OR SIDEWALK SHALL BE DOWELLED TO THE EXISTING CONCRETE. THE DOWELS SHALL BE #4 REBAR, 18 INCHES LONG AT 18 INCHES MAXIMUM SPACING. DOWELS SHALL BE EMBEDDED A MINIMUM OF 9-INCHES IN A 5/8 INCH DRILLED HOLE (EXIST. CONC.).
12. SIDEWALK SHALL BE CONSTRUCTED WITH EXPANSION JOINTS AT EACH BEGINNING OF CURVE (BC) AND END OF CURVE (EC).
13. CURB AND GUTTER, SIDEWALKS AND DRIVEWAYS SHALL BE GIVEN A MEDIAN BROOM FINISH. THE SURFACE SHALL FIRST BE GIVEN A FLOATED FINISH AND FINAL TROWELING SHALL BE DONE WITH A STEEL TROWEL. THE FINISHED SURFACE SHALL BE FREE OF ALL TROWEL MARKS AND SHALL BE UNIFORM IN TEXTURE AND APPEARANCE, BROOM TEXTURE SHALL BE IN THE LONGITUDINAL DIRECTION.
14. CLASS 2 AGGREGATE BASE (CL 2 AB) SHALL CONFORM TO THE CALTRANS STANDARD SPECIFICATIONS (LATEST EDITION) AND SHALL BE COMPACTED TO A MINIMUM DENSITY OF 95% RELATIVE COMPACTION.
15. EXISTING ASPHALT CONCRETE SHALL BE SAWCUT, REMOVED AND RECONSTRUCTED FOR A MINIMUM OF 2-FEET WITHIN EDGES OF CONCRETE WORK. HOT MIX ASPHALT SHALL BE A MINIMUM THICKNESS OF 8" AND CL 2 AB SHALL MATCH EXISTING THICKNESS; AS APPROVED BY THE CITY ENGINEER. SEE PLAN 8148 "CURB AND GUTTER RETROFIT" FOR ADDITIONAL REQUIREMENTS.

CITY OF BERKELEY DEPARTMENT OF PUBLIC WORKS	STANDARD DETAIL CONCRETE WORK NOTES	
SUBMITTED: Dan Firth — SUPERVISING CIVIL ENGINEER — DATE: 2/27/17 — R.C.E. 64582 APPROVED: — MANAGER OF ENGINEERING — DATE: 2/28/17 — R.C.E. 66014	DESIGN: HEI — DRAWN: HEI — CHECK: MS — DATE: 01/26/17 — SCALE: N.T.S. — BOOK:	PLAN: 8144 — FILE: 20B-156 — SHEET: 1 OF 1

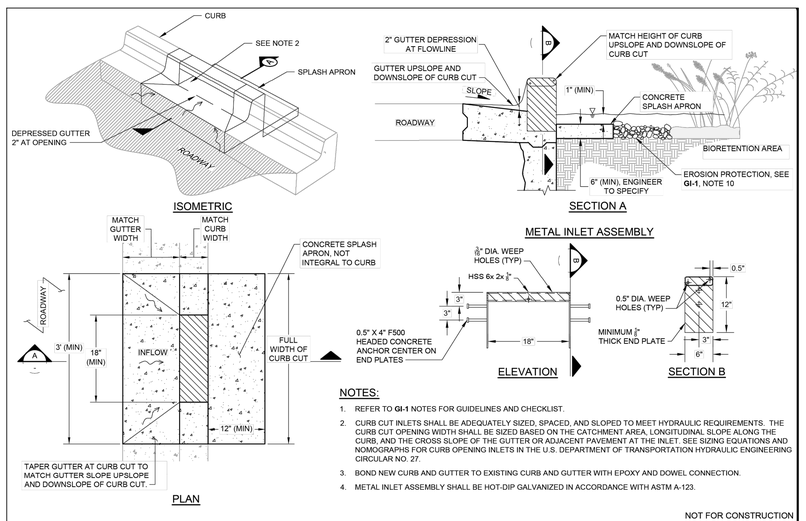
3/X CONCRETE WORK GENERAL NOTES
N.T.S.



NOTE:
1. TO BE USED ONLY WITH SPECIAL PERMISSION FROM THE CITY ENGINEER.
2. FOR ADDITIONAL REQUIREMENTS, SEE PLAN 8144, "CONCRETE WORK NOTES."

STANDARD DETAIL ROLLED CURB	SUBMITTED: Dan Firth — SUPERVISING CIVIL ENGINEER — DATE: 2/27/17 — R.C.E. 64582 APPROVED: — MANAGER OF ENGINEERING — DATE: 2/28/17 — R.C.E. 66014	CITY OF BERKELEY DEPARTMENT OF PUBLIC WORKS	DESIGN: HEI — DRAWN: HEI — CHECK: MS — DATE: 01/26/17 — SCALE: N.T.S. — BOOK: — PLAN: 8147 — FILE: 20B-159 — SHEET: 1 OF 1

4/X STANDARD ROLLED CURB
N.T.S.



NOTES:
1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. CURB CUT INLETS SHALL BE ADEQUATELY SIZED, SPACED, AND SLOPED TO MEET HYDRAULIC REQUIREMENTS. THE CURB CUT OPENING WIDTH SHALL BE SIZED BASED ON THE CATCHMENT AREA, LONGITUDINAL SLOPE ALONG THE CURB, AND THE CROSS SLOPE OF THE GUTTER OR ADJACENT PAVEMENT AT THE INLET. SEE SIZING EQUATIONS AND NOMOGRAPHS FOR CURB OPENING INLETS IN THE U.S. DEPARTMENT OF TRANSPORTATION HYDRAULIC ENGINEERING CIRCULAR NO. 27.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. METAL INLET ASSEMBLY SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A-123.

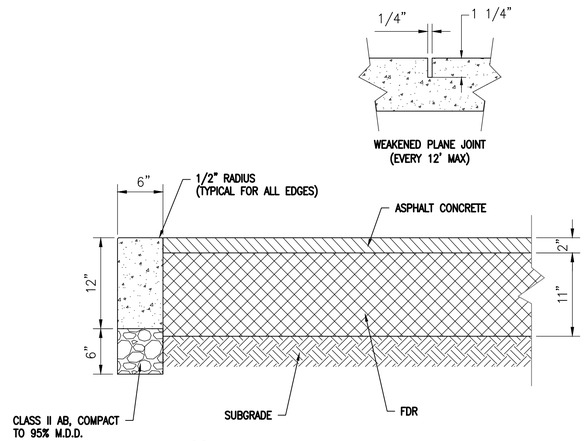
NOT FOR CONSTRUCTION

cleanwater PROGRAM

BIORETENTION COMPONENTS: GUTTER CURB CUT INLET DETAIL

GREEN INFRASTRUCTURE EXAMPLE DETAILS ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM	SCALE: NOT TO SCALE	GI-6A
	DATE: MAY 11, 2018 — REVISED: JUNE 11, 2019	
	DRAWN BY: K. K. — REVISED BY: E.F.	
	CHECKED BY: A. R.	

5/X CURB CUT TYPICAL DETAIL
N.T.S.



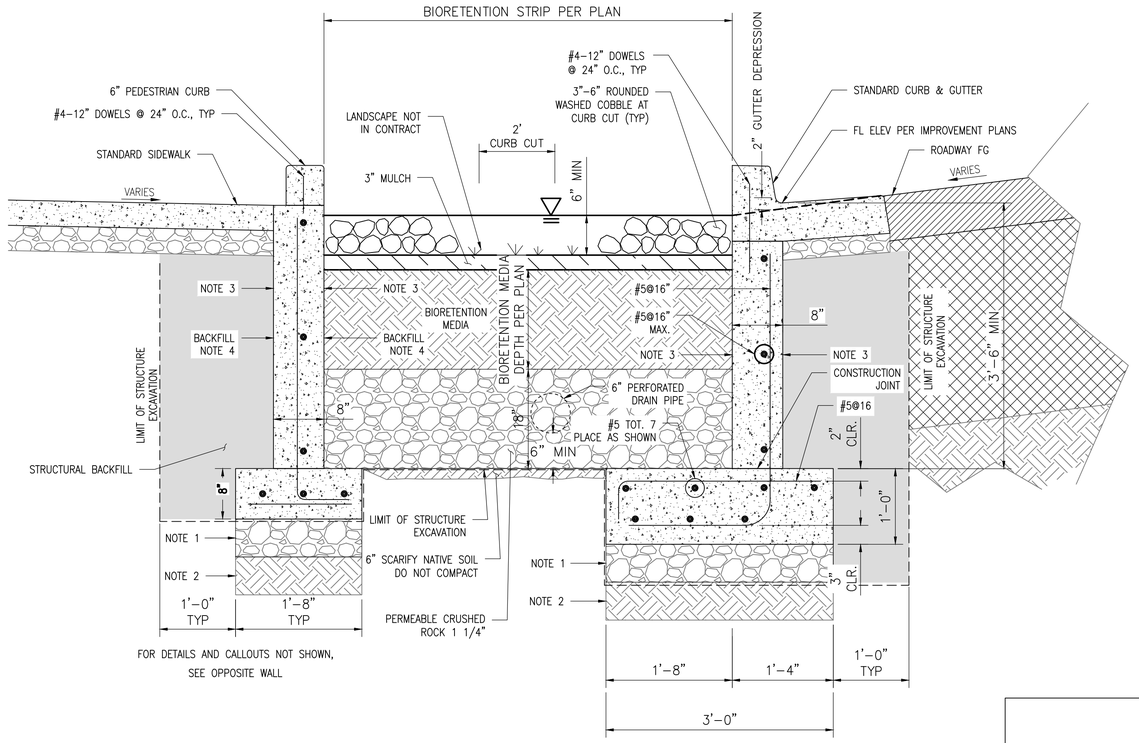
6/X FLUSH CURB
N.T.S.

60% SUBMITTAL
DECEMBER 12, 2025

PROJECT MANAGER: — DATE	DEPICTION OF MONUMENTS: — DATE SURVEY PARTY CHIEF	SUBMITTED: — DATE SUPERVISING CIVIL ENGINEER — R.C.E. — EXP.	DESIGN FH DRAWN SD CHECK AS BUILT	HORIZ. VERT. BOOK DATE 12/12/25	PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FR, BERKELEY CA94704	NCE 1003 W CUTTING BLVD., SUITE 110 POINT RICHMOND CA 94804 (510) 215-3220FAX (510) 215 2868	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA CIVIL DETAILS ROAD IMPROVEMENTS 2	PLAN FILE C-401 SHEET ___ OF ___	
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: — DATE	APPROVED: — DATE CITY ENGINEER — R.C.E. — EXP.							

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

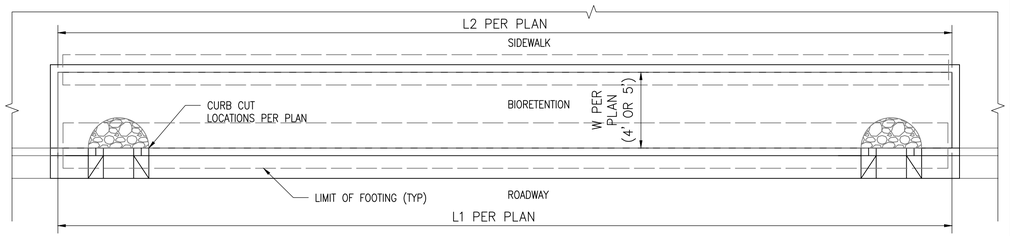
FILE NAME: P:\Active Projects\COWI – 1421\1421.01-55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\27 C102 Construction Staging Plan 3.dwg LAYOUT NAME: C-401 PLOTTED: Friday, December 12, 2025 – 6:07pm USER: JShibko



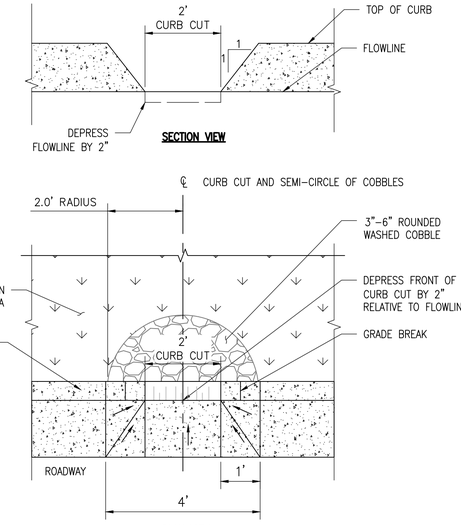
NOTES:

1. 6" THICK LAYER, CLASS 2 A.B. AT 95% COMPACTION.
2. PREPARED SUBGRADE, SCARIFY TO A MINIMUM DEPTH OF 6" AND RECOMPACT TO 90% M.D.D.
3. WEAKENED PLANES AT 24' MAXIMUM SPACING. SEE CALTRANS STANDARD PLAN B0-3, DETAIL 3-2.
4. FOR DIVIDER WALLS WITH NO FOOTINGS, AS SHOWN, BACKFILL MATERIAL AND ENGINEERED SOIL MIX SHALL BE PLACED AND COMPACTED SIMULTANEOUSLY ON BOTH SIDES OF WALL IN ORDER TO MAINTAIN EQUAL BACKFILL LEVELS ON BOTH SIDES OF DIVIDER WALL.

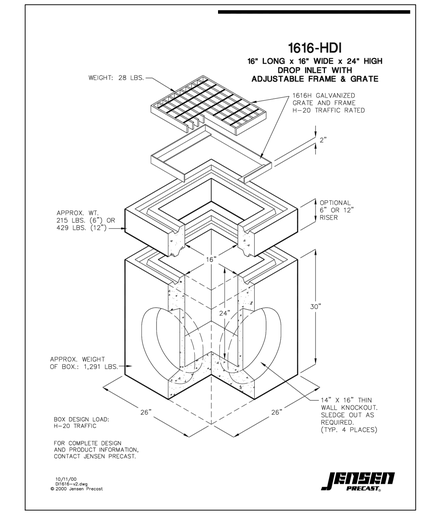
1 / X BIORETENTION TYPICAL SECTION
N.T.S.



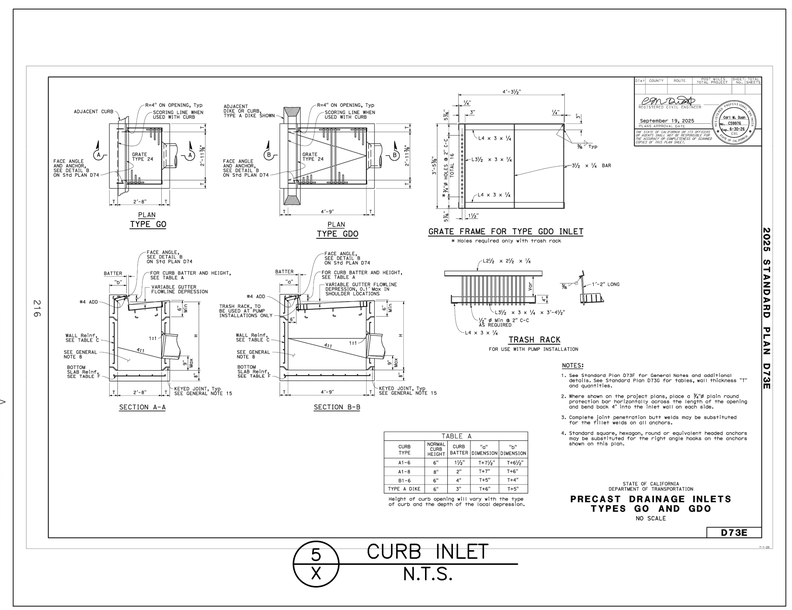
4 / X TYPICAL BIORETENTION LAYOUT
N.T.S.



2 / X BIORETENTION CURB CUT DETAIL WITH COBBLES
N.T.S.



3 / X 16" DROP INLET
N.T.S.

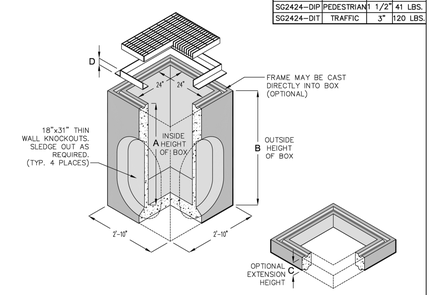


5 / X CURB INLET
N.T.S.

DROP INLET			
MODEL NO.	A	B	*WEIGHT
DI242436	36"	42"	1900 LBS.
DI242448	48"	54"	2500 LBS.

*BOX ONLY

FRAME AND GRATE			
MODEL NO.	RATING	D	WEIGHT
SG2424-DIP	PEDESTRIAN	1/2"	41 LBS.
SG2424-DIT	TRAFFIC	3"	120 LBS.



EXTENSION		
MODEL NO.	C	WEIGHT
RS242406	6"	300 LBS.
RS242412	12"	600 LBS.

- FRAME AND GRATE ASSEMBLY AVALIABLE IN TRAFFIC OR PEDESTRIAN MODELS.
- DESIGN FOR H-20-44 BRIDGE LOADING.
- ASSEMBLY TO BE PLACED ON A 6" BASE OF CRUSHER RUN FOR EASE OF INSTALLATION AND EVEN LOAD DISTRIBUTION.
- FOR COMPLETE DESIGN AND PRODUCT INFORMATION, CONTACT JENSEN PRECAST.
- ILLUSTRATION IS TYPICAL ONLY OF GENERAL SERIES CONFIGURATION. FOR SPECIFIC CONFIGURATION, CALL JENSEN PRECAST.

24" X 24" DRAIN INLET	JENSEN PRECAST
11-20-00	DI2424

6 / X 24" DROP INLET
N.T.S.

60% SUBMITTAL
DECEMBER 12, 2025

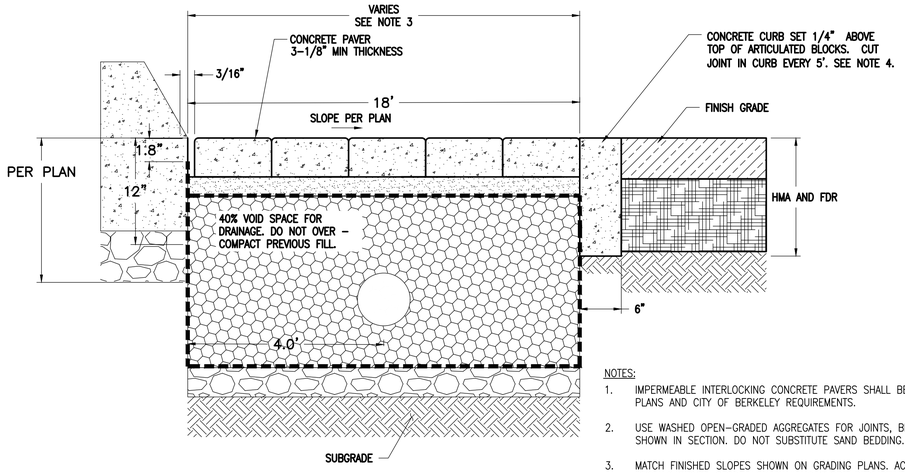
GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH	HORIZ.	BERKELEY PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FR, BERKELEY CA94704	NCE 1003 W CUTTING BLVD., SUITE 110 POINT RICHMOND CA 94804 (510) 215-3220FAX (510) 215 2898	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA CIVIL DETAILS – UTILITIES 1	PLAN
	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER R.C.E.	DRAWN SD	VERT.				FILE
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE	CHECK	BOOK				C-403
		CITY ENGINEER R.C.E.	AS BUILT	DATE 12/12/25				SHEET OF

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B	60% SUBMITTAL	12-12-2025		FH
A	30% SUBMITTAL	6-27-25		FH

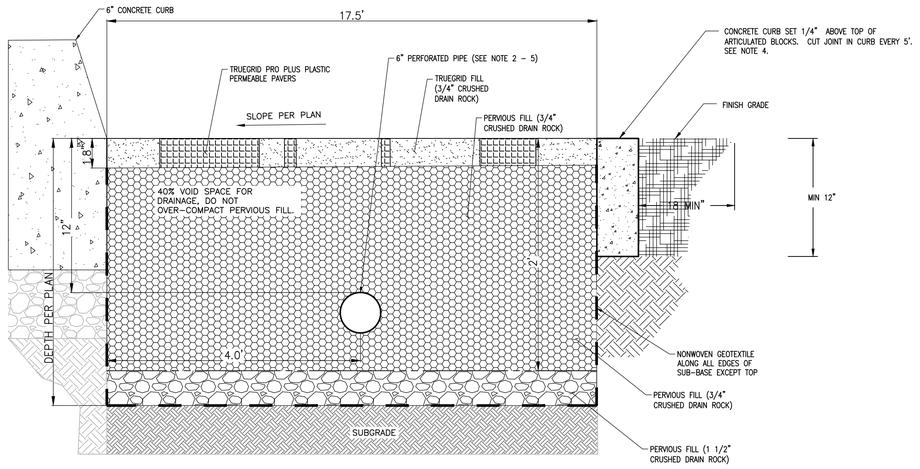
FILE NAME: P:\Active Projects\CIVIL – 1421\1421.01.55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\27 C102 Construction Staging Plan 3.dwg LAYOUT NAME: C-403 PLOTTED: Friday, December 12, 2025 – 6:07pm USER: JShibko



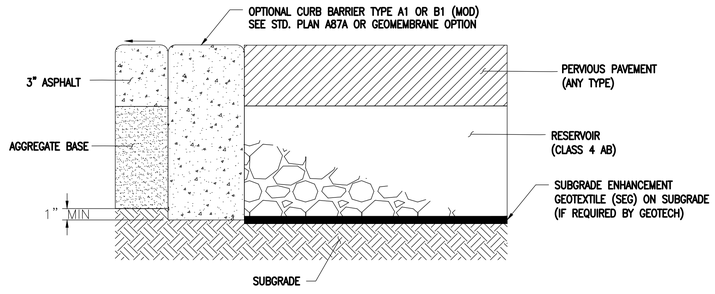
OPTION 1

NOTES:

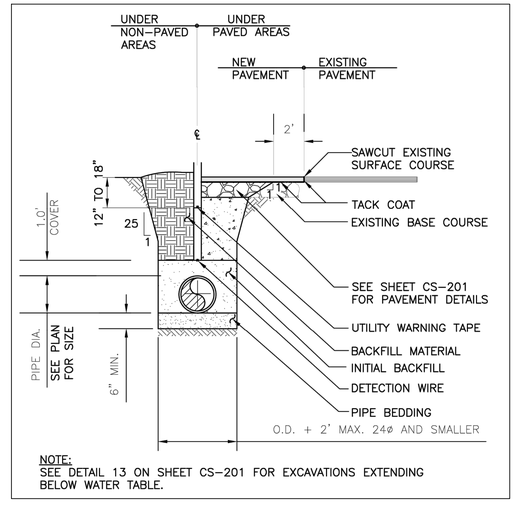
1. IMPERMEABLE INTERLOCKING CONCRETE PAVERS SHALL BE INSTALLED AND FINISHED PER PLANS AND CITY OF BERKELEY REQUIREMENTS.
2. USE WASHED OPEN-GRADED AGGREGATES FOR JOINTS, BEDDING, BASE, AND SUBBASE AS SHOWN IN SECTION. DO NOT SUBSTITUTE SAND BEDDING.
3. MATCH FINISHED SLOPES SHOWN ON GRADING PLANS. ACCESSIBLE SURFACES SHALL MEET PROWAG CROSS-SLOPE AND RUNNING SLOPE REQUIREMENTS.
4. PROVIDE CONCRETE EDGE RESTRAINT OR OTHER APPROVED LATERAL CONFINEMENT WHERE SHOWN. ALIGN EDGES STRAIGHT AND TRUE.
5. MAINTAIN SURFACE TOLERANCE WITHIN ±3/8" OVER 10 FEET. JOINT WIDTHS 1/16" TO 3/16". MAXIMUM VERTICAL LIP AT ANY TRANSITION SHALL BE 1/8".
6. DO NOT OVER-COMPACT OR OTHERWISE SEAL THE SUBGRADE. MAINTAIN A CONTINUOUS INFILTRATION PATH FROM PAVERS THROUGH BASE TO SUBGRADE.
7. PROTECT ADJACENT BAY AND STORMWATER DRAINAGE FEATURES FROM FINES DURING CONSTRUCTION. VACUUM CLEAN SURFACE AFTER INSTALLATION.
8. WHERE PAVERS TIE INTO EXISTING PAVEMENT OR CONCRETE, PROVIDE CLEAN SAWCUT EDGE AND SMOOTH GRADE TRANSITION AS DIRECTED.



OPTION 2



OPTION 3



NOTE:
SEE DETAIL 13 ON SHEET CS-201 FOR EXCAVATIONS EXTENDING BELOW WATER TABLE.

1/X PERMEABLE PAVERS OPTIONS
N.T.S.

2/X TYPICAL PIPE TRENCH
N.T.S.

60% SUBMITTAL
DECEMBER 12, 2025

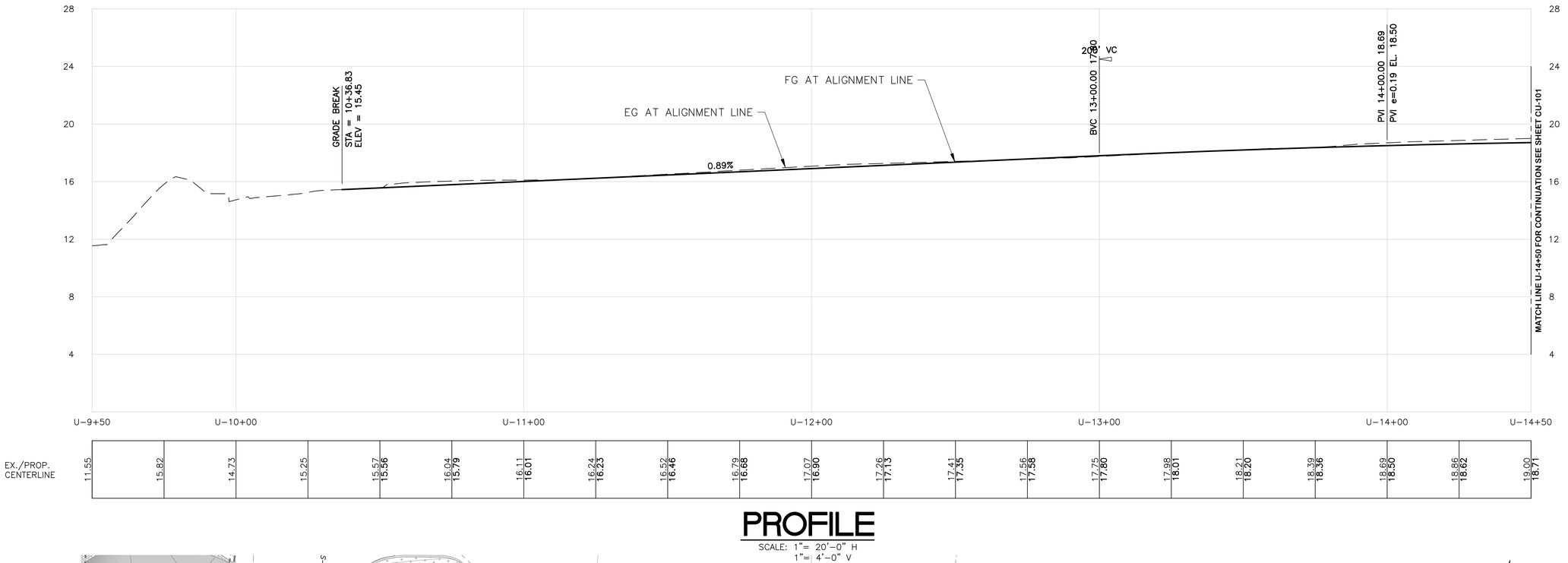
GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE R.C.E. EXP.	DESIGN FH	HORIZ.	PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FR, BERKELEY CA94704	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA
0 1 2 3 FOR REDUCED PLANS - ORIGINAL SCALE IS IN INCHES	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER	DRAWN SD	VERT.	NCE 1003 W CUTTING BLVD., SUITE 110 POINT RICHMOND CA 94804 (510) 215-3220FAX (510) 215 2868	CIVIL DETAILS - UTILITIES 3
	WATERSHED REVIEW: DATE	APPROVED: DATE R.C.E. EXP.	CHECK	BOOK		PLAN FILE C-405 SHEET OF
		CITY ENGINEER	AS BUILT	DATE 12/12/25		

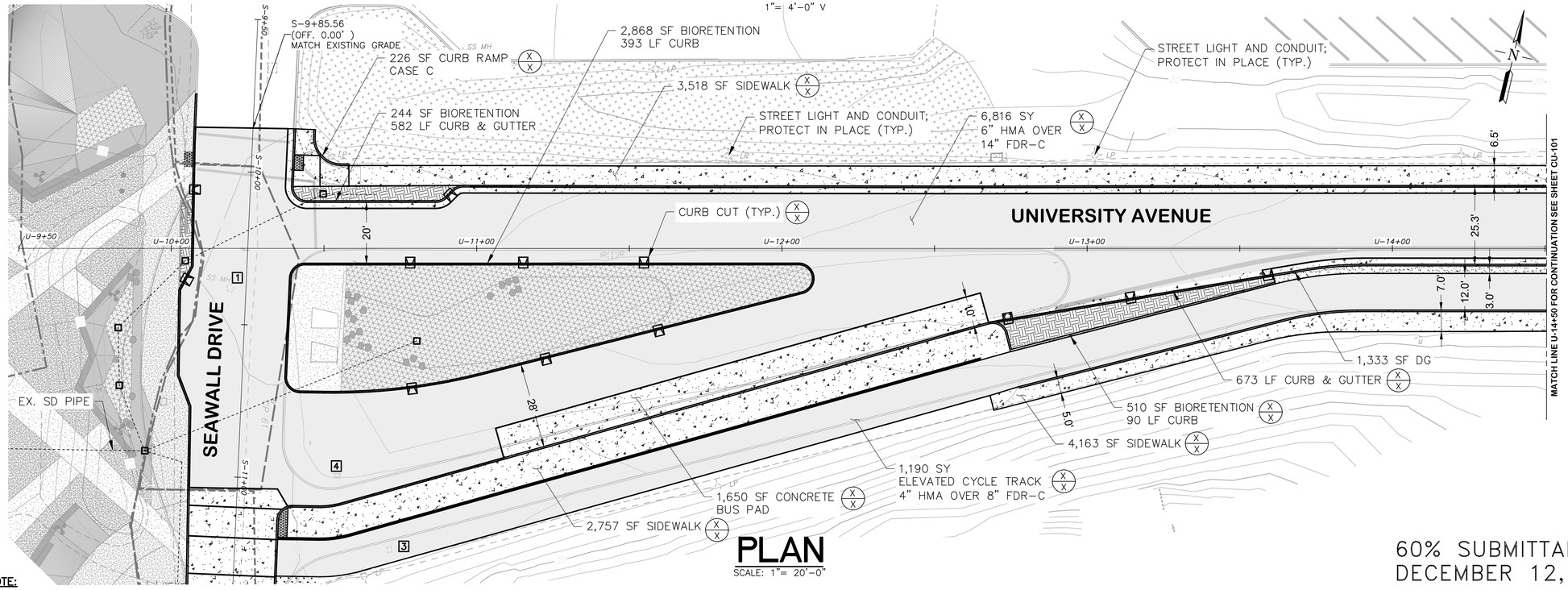
REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\CDWI - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\27 C102 Construction Staging Plan 3.dwg LAYOUT NAME: C-405 PLOTTED: Friday, December 12, 2025 - 6:08pm USER: JShibko



PROFILE

SCALE: 1"= 20'-0" H
1"= 4'-0" V



PLAN

SCALE: 1"= 20'-0"

KEYNOTES:

1. SSMH; PROTECT IN PLACE. REMOVE AND RESET SSMH RING AND COVER. SEE DETAIL 1/XX.
2. SDMH; PROTECT IN PLACE. REMOVE AND RESET SDMH RING AND COVER. SEE DETAIL 1/XX.
3. UTILITY/ELECTRICAL VAULT; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.
4. UTILITY/ELECTRICAL PULL BOX; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.

60% SUBMITTAL
DECEMBER 12, 2025

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REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

PROJECT MANAGER: _____ DATE _____
DEPICTION OF MONUMENTS: _____ DATE _____
SURVEY PARTY CHIEF
WATERSHED REVIEW: _____ DATE _____
SUBMITTED: _____ DATE _____
SUPERVISING CIVIL ENGINEER R.C.E. _____ EXP. _____
APPROVED: _____ DATE _____
CITY ENGINEER R.C.E. _____ EXP. _____

0 1 2 3
FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES

DESIGN FH
DRAWN SD
CHECK _____
AS BUILT _____
HORIZ. 1" = 20'
VERT. 1" = 4'
BOOK _____
DATE 12/12/25

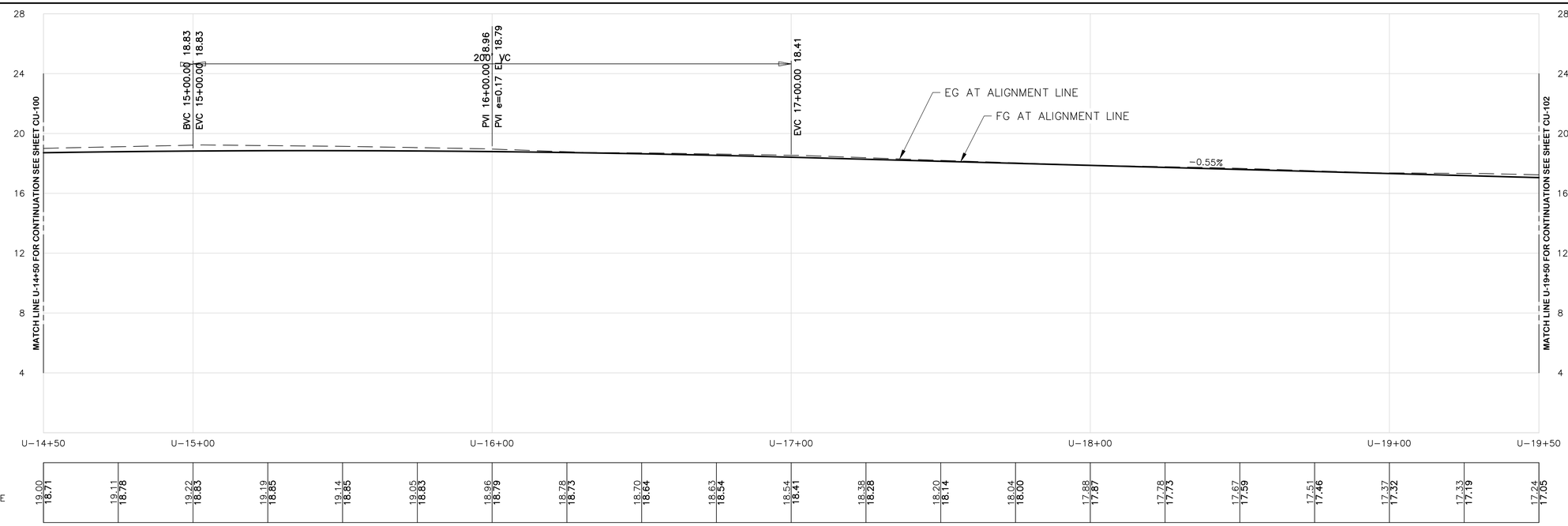
PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FL, BERKELEY CA94704

NCE
1003 W CUTTING BLVD., SUITE 110
POINT RICHMOND CA 94804
(510) 215-3020FAX (510) 215 2868

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA
UNIVERSITY AVE IMPROVEMENT PLAN
& PROFILE U-9+50 TO U-14+50

PLAN _____
FILE _____
CU-100
SHEET ___ OF ___

FILE NAME: P:\Active Projects\COW – 142\1421.01.55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\33 CU100 – University Ave 1.dwg LAYOUT NAME: CU-100 PLOTTED: Friday, December 12, 2025 – 6:39pm USER: JShibko

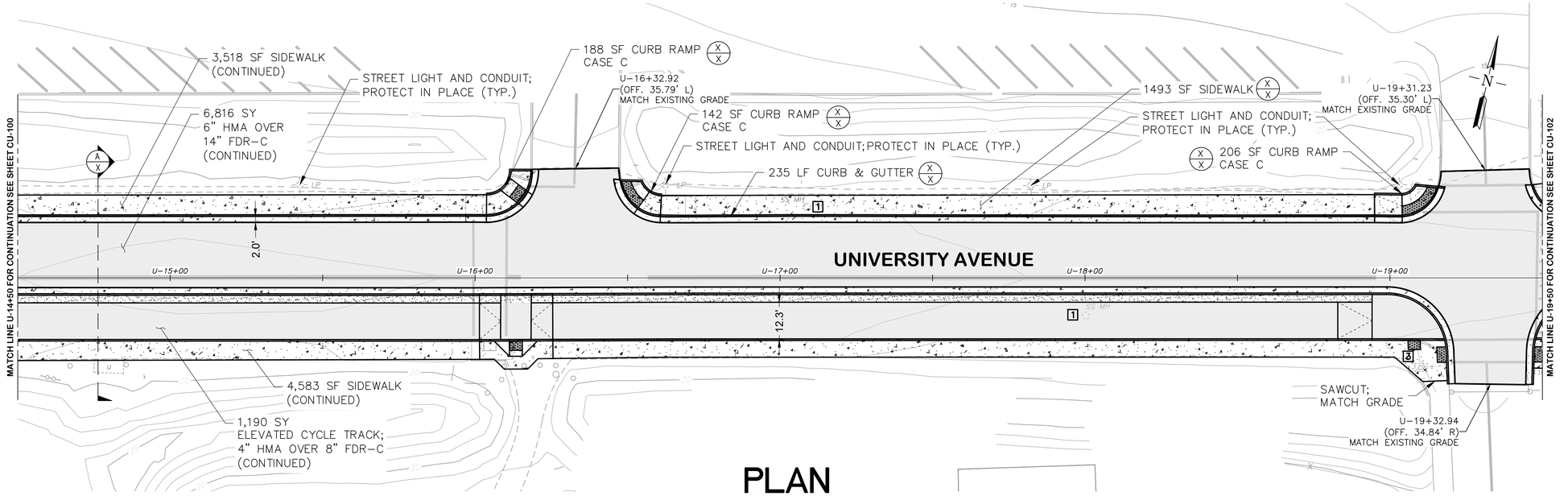


PROFILE

SCALE: 1"= 20'-0" H
1"= 4'-0" V

KEYNOTES:

1. SSMH; PROTECT IN PLACE. REMOVE AND RESET SSMH RING AND COVER. SEE DETAIL 1/XX.
2. SDMH; PROTECT IN PLACE. REMOVE AND RESET SDMH RING AND COVER. SEE DETAIL 1/XX.
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PLAN

SCALE: 1"= 20'-0"

60% SUBMITTAL
DECEMBER 12, 2025

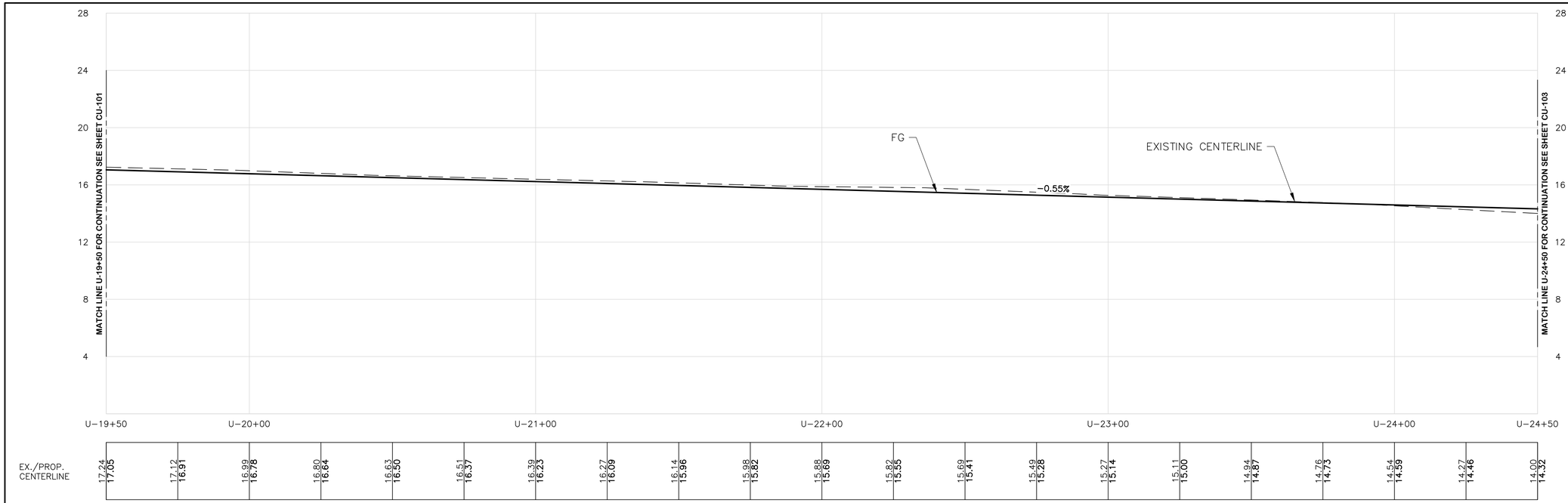
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PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE SURVEY PARTY CHIEF	SUBMITTED: DATE SUPERVISING CIVIL ENGINEER R.C.E. EXP.	DESIGN FH DRAWN SD CHECK AS BUILT	HORIZ. 1" = 20' VERT. 1" = 4' BOOK DATE 12/12/25	PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FL. BERKELEY, CA 94704	NCE 1000 W CUTTING BLVD, SUITE 110 JOINT RICHMOND, CA 94804 (510) 215-3220 FAX (510) 215 2848	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA UNIVERSITY AVE IMPROVEMENT PLAN & PROFILE U-14+50 TO U-19+50	PLAN FILE CU-101 SHEET OF
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE CITY ENGINEER R.C.E. EXP.						

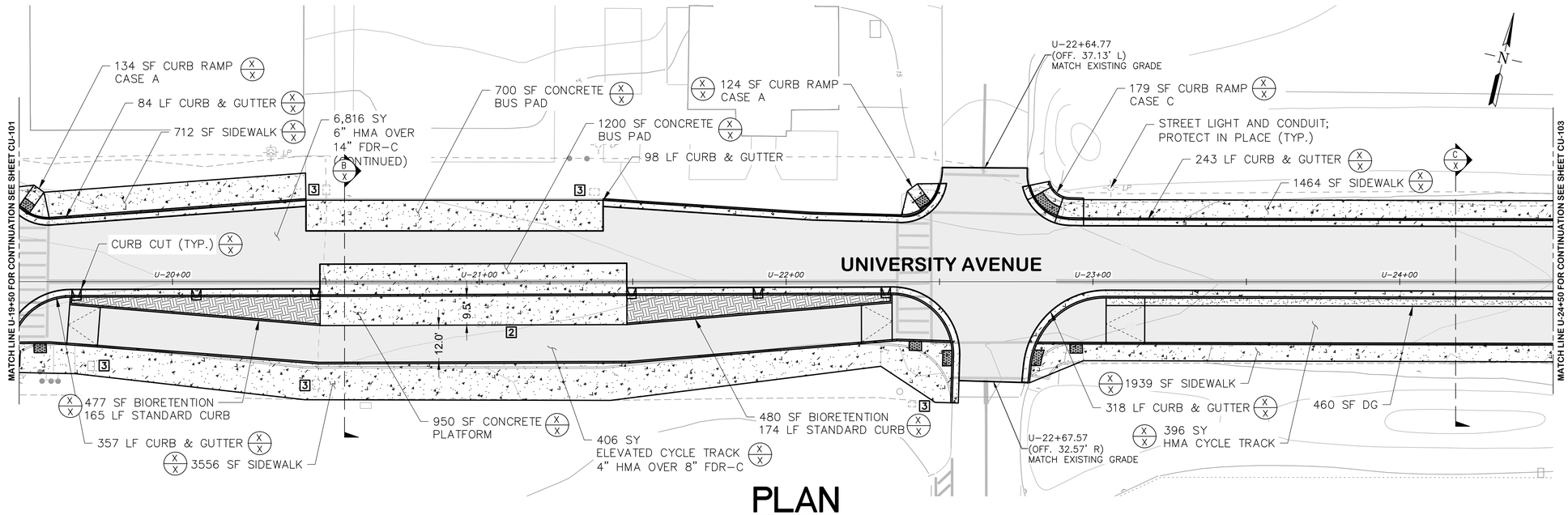
REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\CIVIL - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\33 CU100 - University Ave 1.dwg LAYOUT NAME: CU-101 PLOTTED: Friday, December 12, 2025 - 6:40pm USER: JShibko



PROFILE

SCALE: 1"= 20'-0" H
1"= 4'-0" V



PLAN

SCALE: 1"= 20'-0"

KEYNOTES:

1. SSMH; PROTECT IN PLACE. REMOVE AND RESET SSMH RING AND COVER. SEE DETAIL 1/XX.
2. SDMH; PROTECT IN PLACE. REMOVE AND RESET SDMH RING AND COVER. SEE DETAIL 1/XX.
3. UTILITY/ELECTRICAL VAULT; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.
4. UTILITY/ELECTRICAL PULL BOX; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.

60% SUBMITTAL
DECEMBER 12, 2025

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\CIVIL - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\33 CU100 - University Ave 1.dwg LAYOUT NAME: CU-102 PLOTTED: Friday, December 12, 2025 - 6:41pm USER: JShibko

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH
	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER R.C.E. EXP.	DRAWN SD
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE	CHECK
		CITY ENGINEER R.C.E. EXP.	AS BUILT

HORIZ.	1" = 20'
VERT.	
BOOK	
DATE	12/12/25

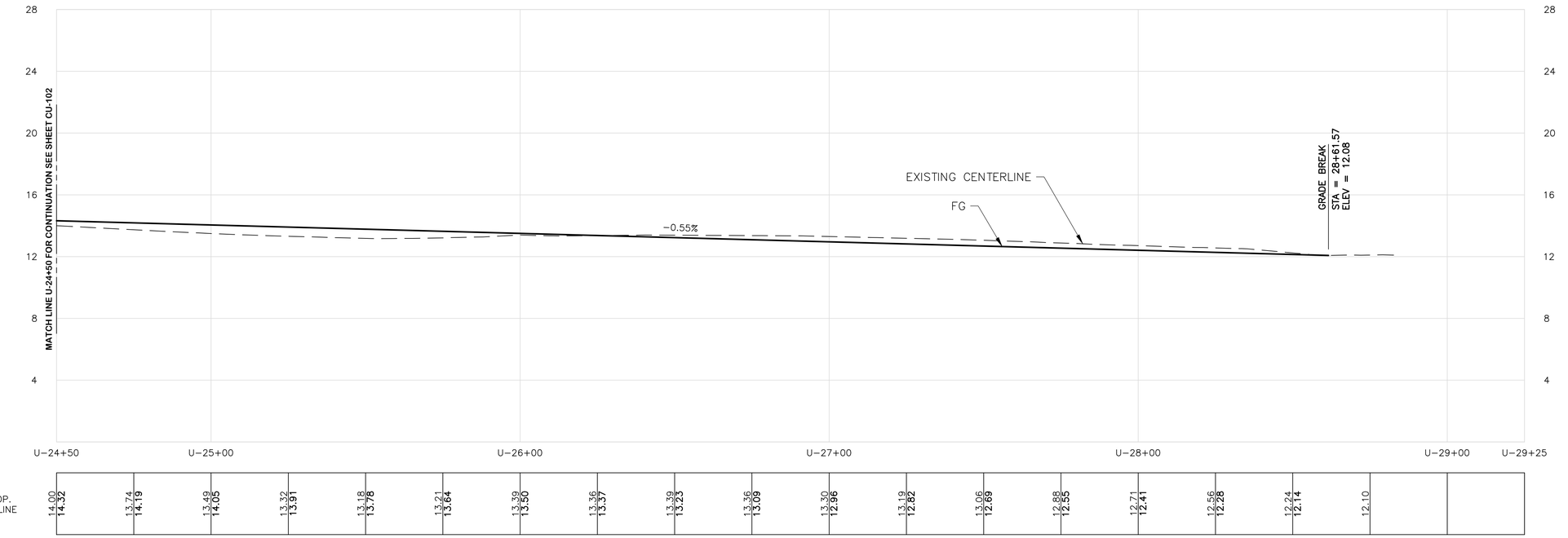
CITY OF BERKELEY
PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FL. BERKELEY, CA 94704

NCE
1003 W CUTTING BLVD., SUITE 110
POINT RICHMOND CA 94804
(510) 215-3220FAX (510) 215 2848

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA

UNIVERSITY AVE IMPROVEMENT PLAN & PROFILE U-19+50 TO U-24+50

PLAN
FILE
CU-102
SHEET ___ OF ___

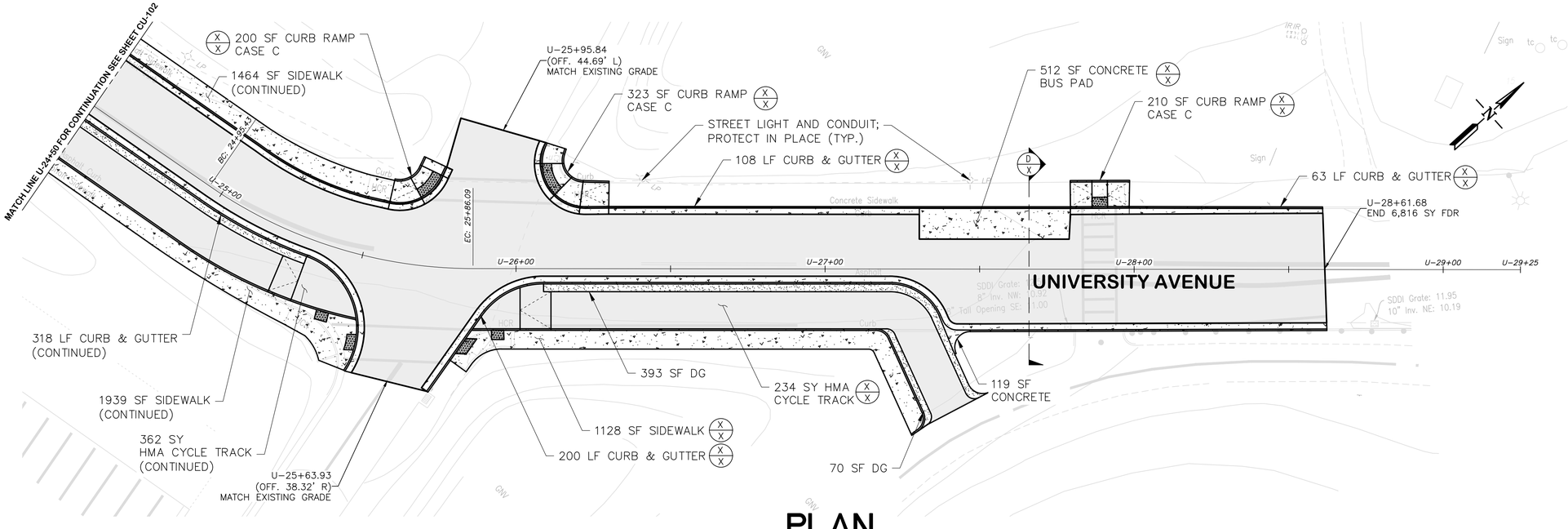


PROFILE

SCALE: 1"= 20'-0" H
1"= 4'-0" V

KEYNOTES:

1. SSMH; PROTECT IN PLACE. REMOVE AND RESET SSMH RING AND COVER. SEE DETAIL 1/XX.
2. SDMH; PROTECT IN PLACE. REMOVE AND RESET SDMH RING AND COVER. SEE DETAIL 1/XX.
3. UTILITY/ELECTRICAL VAULT; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.
4. UTILITY/ELECTRICAL PULL BOX; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.



PLAN

SCALE: 1"= 20'-0"

60% SUBMITTAL
DECEMBER 12, 2025

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE
	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER R.C.E. EXP.
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE
		CITY ENGINEER R.C.E. EXP.

DESIGN	FH	HORIZ.	1" = 20'	PLAN	
DRAWN	SD	VERT.	1" = 4'	FILE	
CHECK		BOOK			CU-103
AS BUILT		DATE	12/12/25	SHEET	OF

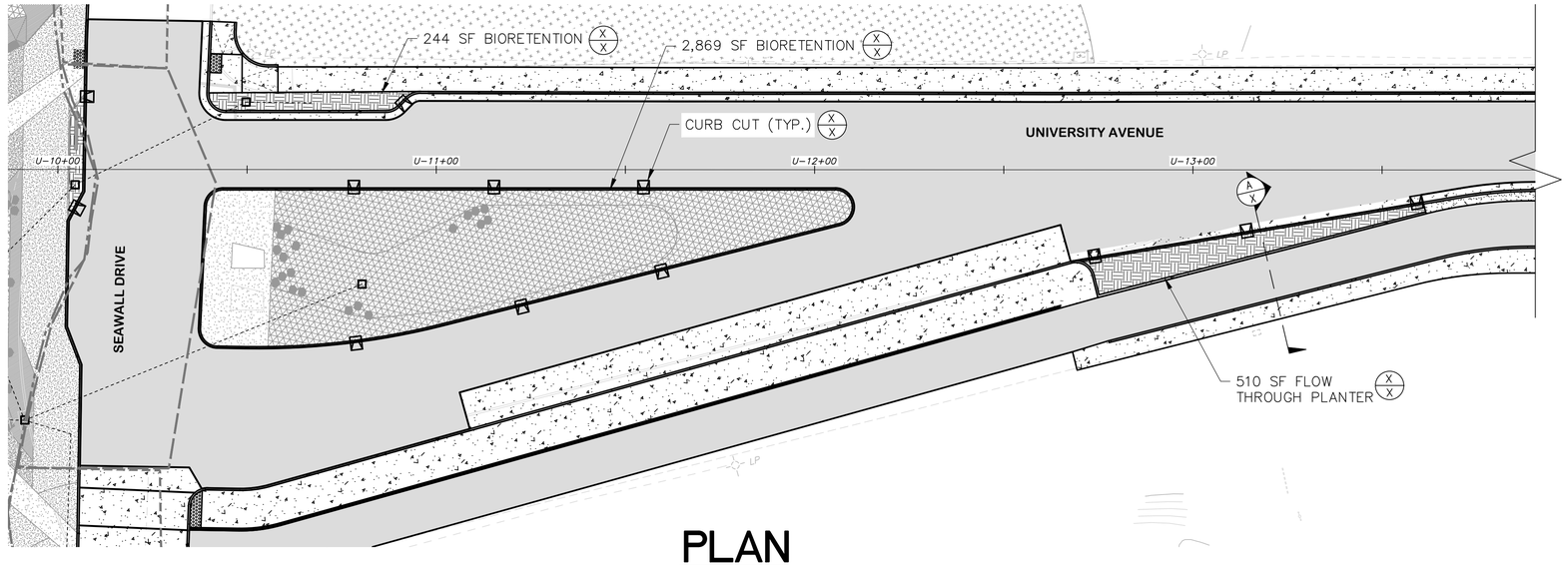
PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FL BERKELEY CA94704

NCE
1000 W CUTTING BLVD., SUITE 110
POINT RICHMOND CA 94804
(510) 215-3020FAX (510) 215 2848

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA
UNIVERSITY AVE IMPROVEMENT PLAN & PROFILE U-24+50 TO U-29+25

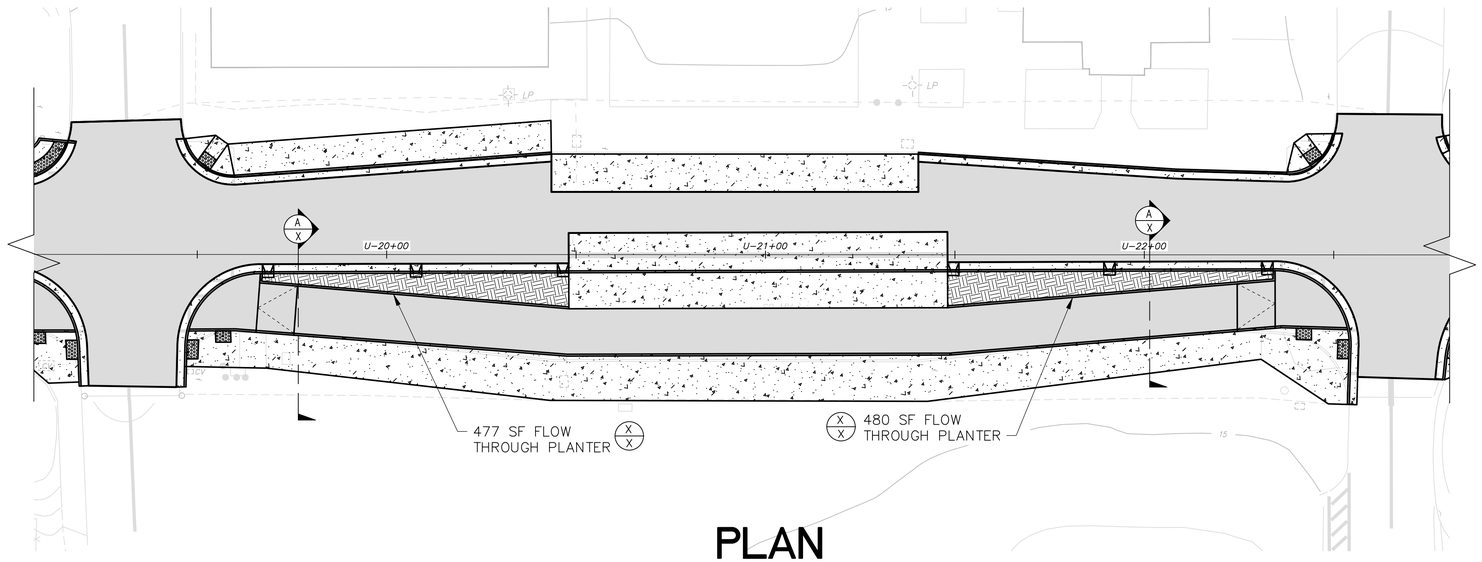
REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\CGWI – 1421\1421.01.55 – Berkeley Water transportation Pier Ferry Project\CAD\Sheets\36 CU103 – University Ave 2.dwg LAYOUT NAME: CU-103 PLOTTED: Friday, December 12, 2025 – 6:44pm USER: JShibko



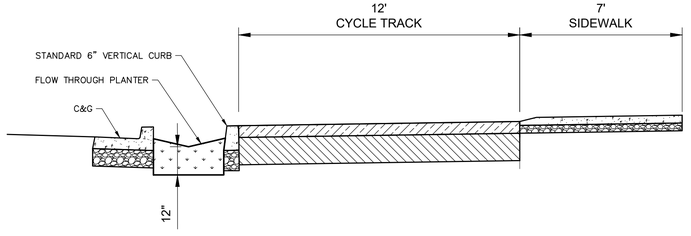
PLAN

SCALE: 1"= 20'-0"



PLAN

SCALE: 1"= 20'-0"



A/X FLOW THROUGH PLANTER SECTION

N.T.S.

60% SUBMITTAL
DECEMBER 12, 2025

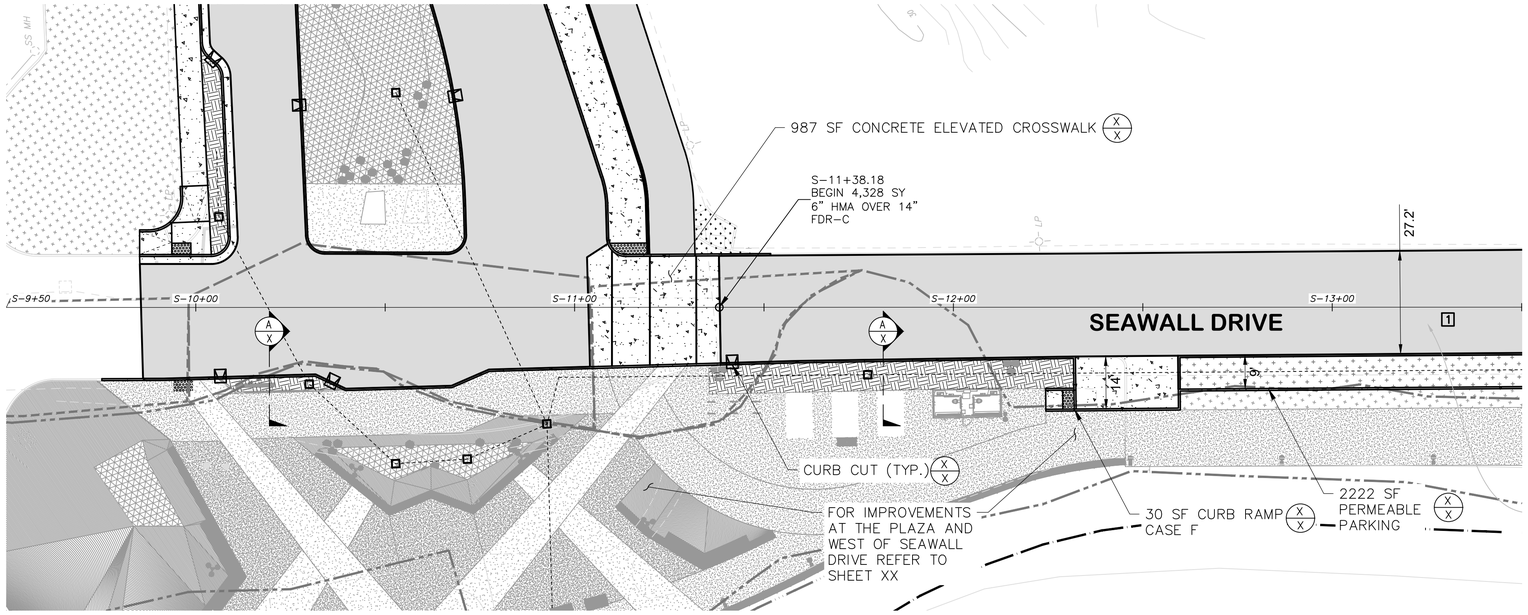
GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

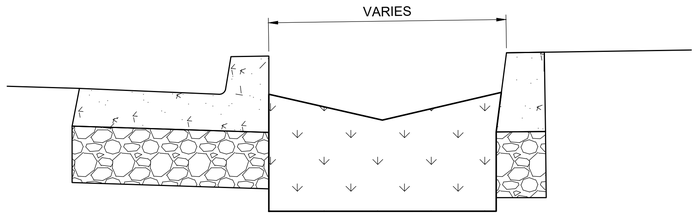
PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH	HORIZ. AS SHOWN	CITY OF BERKELEY PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FL, BERKELEY, CA 94704	NCE 1003 W CUTTING BLVD., SUITE 110 POINT RICHMOND CA 94804 (510) 215-3220FAX (510) 215 2848	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA UNIVERSITY AVENUE BIORETENTION FACILITY SECTIONS AND DETAILS	PLAN
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	SURVEY PARTY CHIEF WATERSHED REVIEW: DATE	SUPERVISING CIVIL ENGINEER R.C.E. EXP. APPROVED: DATE	DRAWN SD	VERT. AS SHOWN				FILE
		CITY ENGINEER R.C.E. EXP.	CHECK	BOOK				CU-300
			AS BUILT	DATE 12/12/25				SHEET ___ OF ___

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\COW – 1421\1421.01.55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\42 CU205 – University Ave 4.dwg LAYOUT NAME: CU-300 PLOTTED: Friday, December 12, 2025 – 6:51pm USER: JShibko



PLAN



A/X BIORETENTION SECTION
N.T.S.

SECTION

SCALE: 1"= 5'-0" H
1"= 1.25'-0" V

60% SUBMITTAL
DECEMBER 12, 2025

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

PROJECT MANAGER: DATE
DEPICTION OF MONUMENTS: DATE
SURVEY PARTY CHIEF
WATERSHED REVIEW: DATE
SUBMITTED: DATE / R.C.E. / EXP.
SUPERVISING CIVIL ENGINEER
APPROVED: DATE / R.C.E. / EXP.
CITY ENGINEER
0 1 2 3
FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES

DESIGN FH
DRAWN SD
CHECK
AS BUILT
HORIZ. 1" = 20'
VERT.
BOOK
DATE 12/12/25

CITY OF BERKELEY
PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FL. BERKELEY, CA 94704

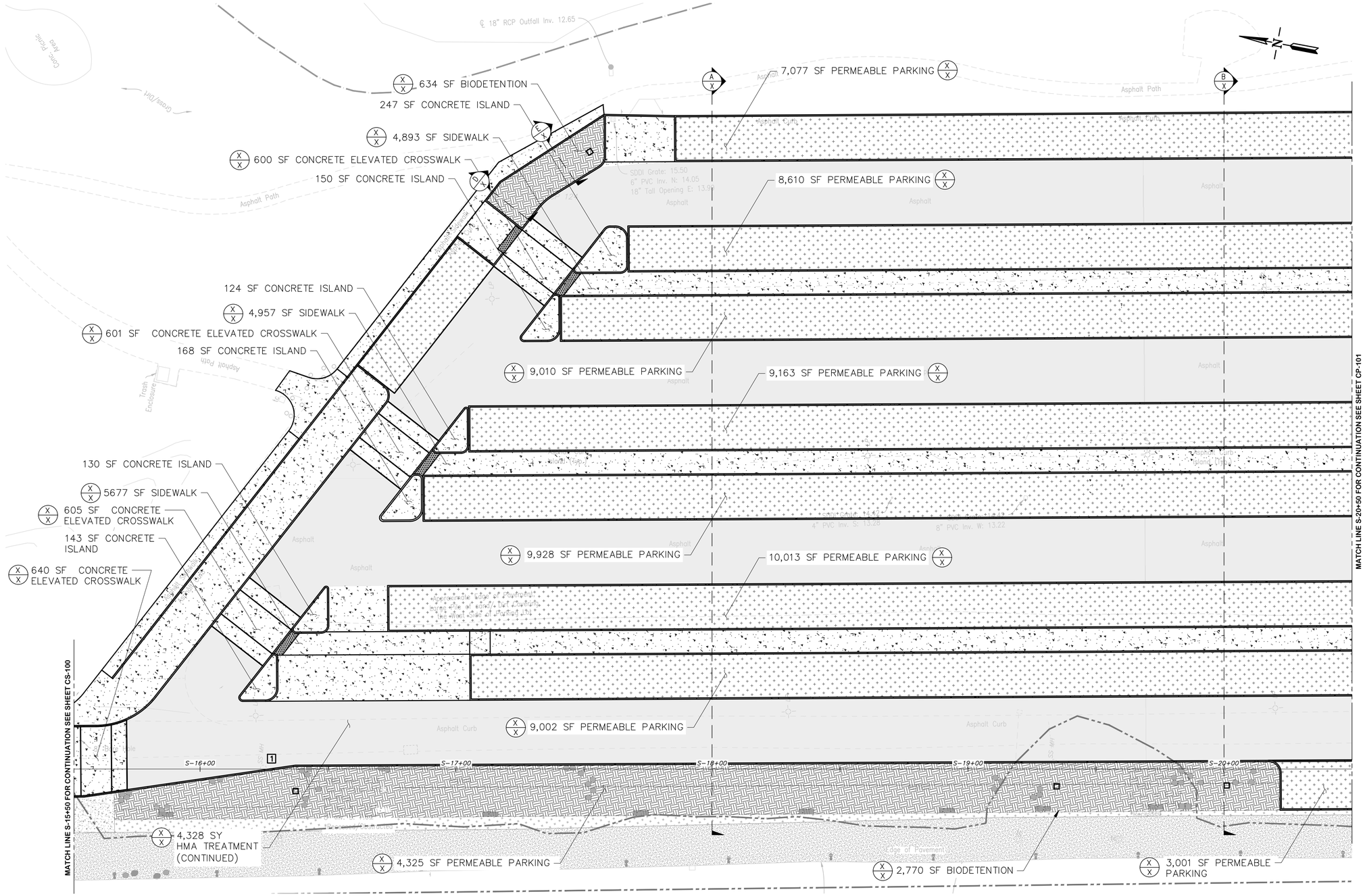
NCE
1003 W CUTTING BLVD., SUITE 110
POINT RICHMOND CA 94804
(510) 215-3220FAX (510) 215 2848

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA

SEAWALL DRIVE BIORETENTION FACILITY SECTIONS AND DETAILS

PLAN
FILE
CS-300
SHEET___OF___

FILE NAME: P:\Active Projects\COW - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\56 cs100 - seawall drive 1.dwg LAYOUT NAME: CS-300 PLOTTED: Friday, December 12, 2025 - 7:03pm USER: rShibko



KEYNOTES:

1. SSMH; PROTECT IN PLACE. REMOVE AND RESET SSMH RING AND COVER. SEE DETAIL 1/XX.
2. SDMH; PROTECT IN PLACE. REMOVE AND RESET SDMH RING AND COVER. SEE DETAIL 1/XX.
3. UTILITY/ELECTRICAL VAULT; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.
4. UTILITY/ELECTRICAL PULL BOX; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.

PLAN

SCALE: 1"= 20'-0"

60% SUBMITTAL
DECEMBER 12, 2025

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE

DEPICTION OF MONUMENTS: DATE
SURVEY PARTY CHIEF

WATERSHED REVIEW: DATE

SUBMITTED: DATE R.C.E. EXP.
SUPERVISING CIVIL ENGINEER

APPROVED: DATE R.C.E. EXP.
CITY ENGINEER

0 1 2 3
FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES

DESIGN FH
DRAWN SD
CHECK
AS BUILT
DATE 12/12/25

HORIZ. 1" = 20'
VERT.
BOOK

PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FR, BERKELEY CA94704

NCE
1003 W. CUTTING BLVD., SUITE 110
POINT RICHMOND CA 94804
(510) 215-3220FAX (510) 215 2888

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA

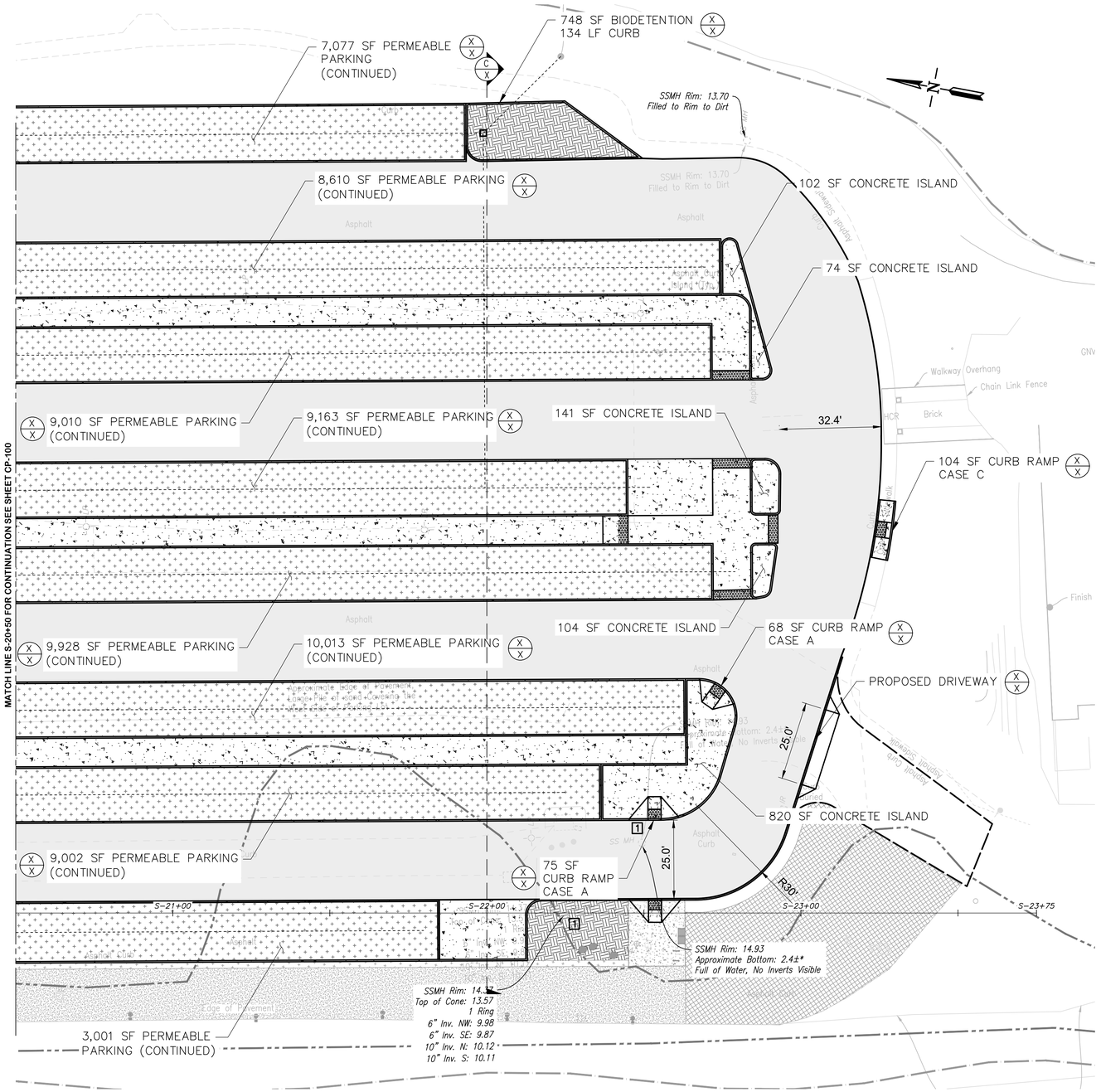
PARKING LOT IMPROVEMENT PLAN
S-15+50 TO S-20+50

PLAN
FILE
CP-100
SHEET OF

REVISION	MARK	DATE	DESCRIPTION
B	60% SUBMITTAL	12-12-2025	
A	30% SUBMITTAL	6-27-25	

APPROVAL: FH FH

FILE NAME: P:\Active Projects\CIVIL - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\62 CP100 - Parking Lot 1.dwg LAYOUT NAME: CP-100 PLOTTED: Friday, December 12, 2025 - 7:13pm USER: JShibko



PLAN

SCALE: 1"= 20'-0"

KEYNOTES:

1. SSMH; PROTECT IN PLACE. REMOVE AND RESET SSMH RING AND COVER. SEE DETAIL 1/XX.
2. SDMH; PROTECT IN PLACE. REMOVE AND RESET SDMH RING AND COVER. SEE DETAIL 1/XX.
3. UTILITY/ELECTRICAL VAULT; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.
4. UTILITY/ELECTRICAL PULL BOX; PROTECT IN PLACE. REFER TO ELECTRICAL PLANS.

60% SUBMITTAL
DECEMBER 12, 2025

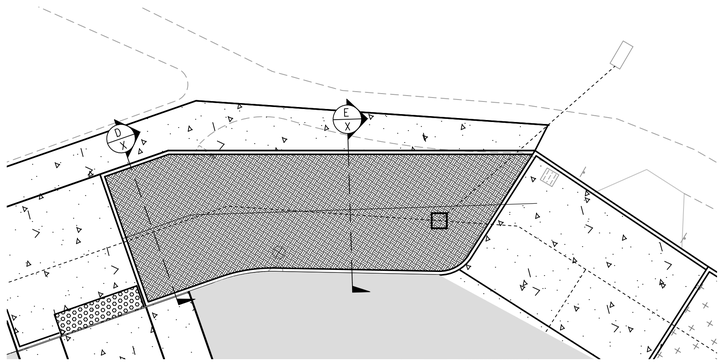
GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH	HORIZ. 1" = 20'	BERKELEY	NCE	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER R.C.E. EXP.	DRAWN SD	VERT.	PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FR, BERKELEY CA94704	1003 W. CUTTING BLVD., SUITE 110 POINT RICHMOND, CA 94804 (510) 215-3220FAX (510) 215 2888	CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE CITY ENGINEER R.C.E. EXP.	CHECK	BOOK			PARKING LOT IMPROVEMENT PLAN S-20+50 TO S-23+75
			AS BUILT	DATE 12/12/25			PLAN FILE CP-101 SHEET OF

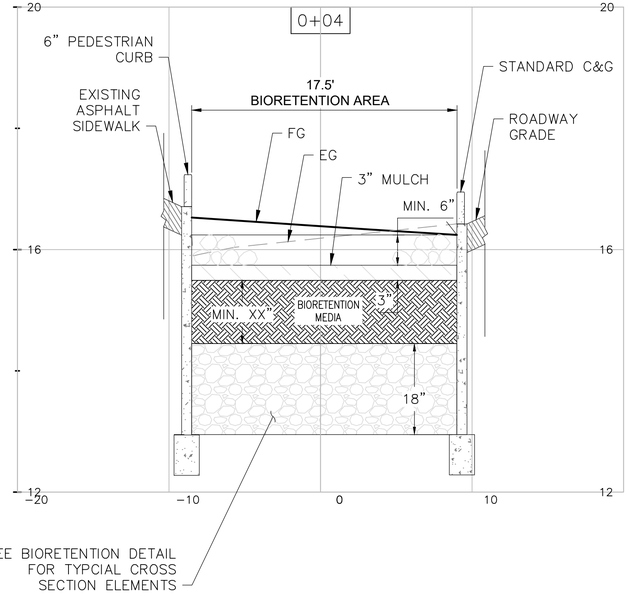
REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B	60% SUBMITTAL	12-12-2025		FH
A	30% SUBMITTAL	6-27-25		FH

FILE NAME: P:\Active Projects\CIVIL – 1421\1421.01.55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\62 CP100 – Parking Lot 1.dwg LAYOUT NAME: CP–101 PLOTTED: Friday, December 12, 2025 – 7:14pm USER: JShibko

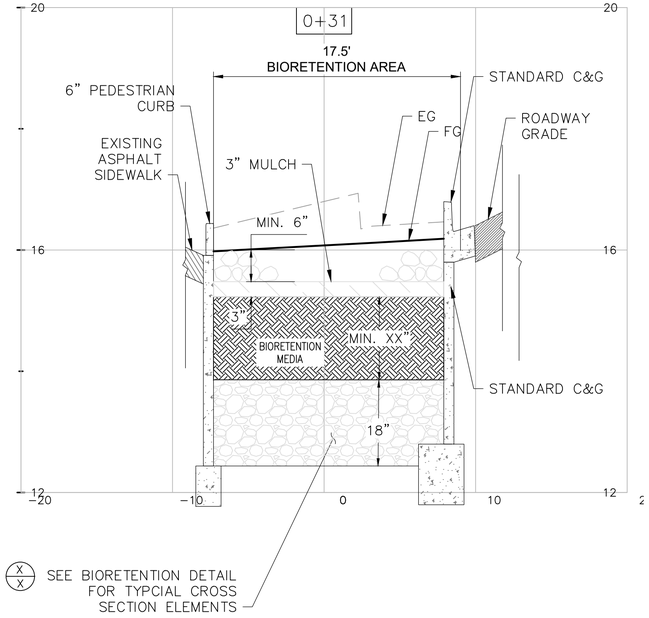


PLAN

SCALE: 1"= 10'-0"



D/X PARKING LOT BIORETENTION SECTION



E/X PARKING LOT BIORETENTION SECTION

SECTION

SCALE: 1"= 5'-0" H
1"= 1.25'-0" V

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

60% SUBMITTAL
DECEMBER 12, 2025

B	60% SUBMITTAL	12-12-2025	FH	FH									
A	30% SUBMITTAL	6-27-25											
REVISION	DESCRIPTION	DATE	MARK	APPROVAL									

FILE NAME: P:\Active Projects\CCWI - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\68 CP203 - Parking Lot 3.dwg LAYOUT NAME: CP-300 PLOTTED: Friday, December 12, 2025 - 7:21pm USER: JShibko

PROJECT MANAGER: DATE
DEPICTION OF MONUMENTS: DATE
SURVEY PARTY CHIEF
WATERSHED REVIEW: DATE
SUBMITTED: DATE
SUPERVISING CIVIL ENGINEER R.C.E. EXP.
APPROVED: DATE
CITY ENGINEER R.C.E. EXP.

0 1 2 3
FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES

DESIGN FH
DRAWN SD
CHECK
AS BUILT
HORIZ. AS SHOWN
VERT. AS SHOWN
BOOK
DATE 12/12/25

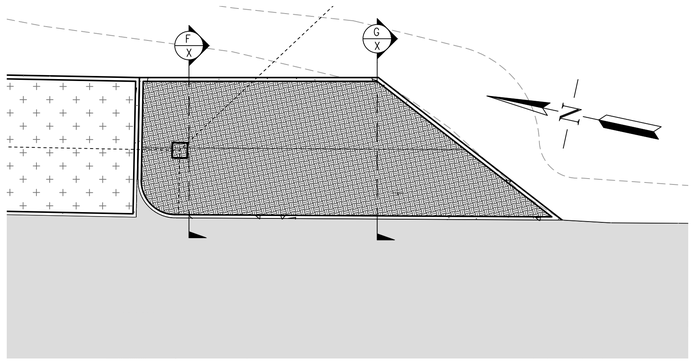
CITY OF BERKELEY
PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FL, BERKELEY, CA 94704

NCE
1093 W CUTTING BLVD., SUITE 110
POINT RICHMOND, CA 94804
(510) 215-3220FAX (510) 215 2848

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA

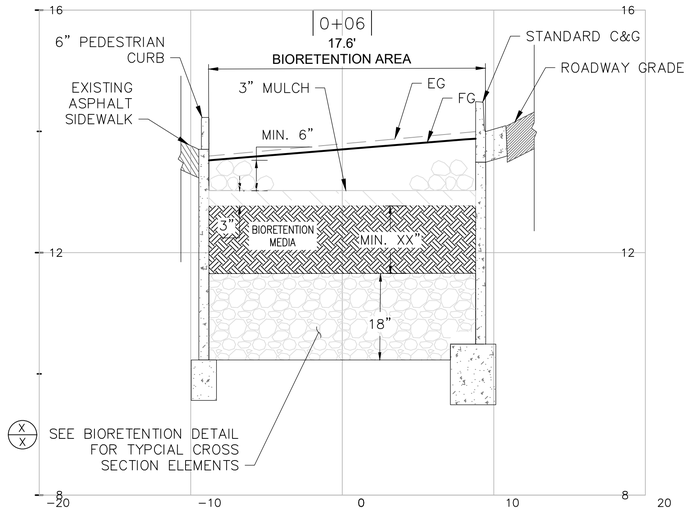
PARKING LOT BIORETENTION FACILITY SECTIONS AND DETAILS 1

PLAN
FILE
CP-300-A
SHEET OF

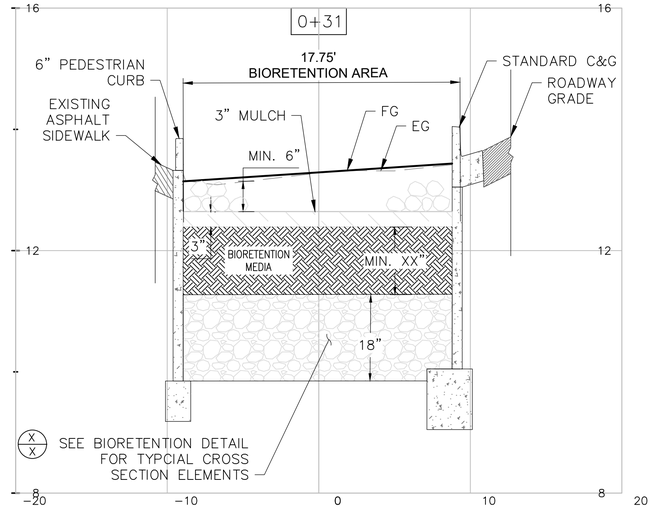


PLAN

SCALE: 1"= 10'-0"



F/X PARKING LOT BIORETENTION SECTION



G/X PARKING LOT BIORETENTION SECTION

SECTION

SCALE: 1"= 5'-0" H
1"= 1.25'-0" V

60% SUBMITTAL
DECEMBER 12, 2025

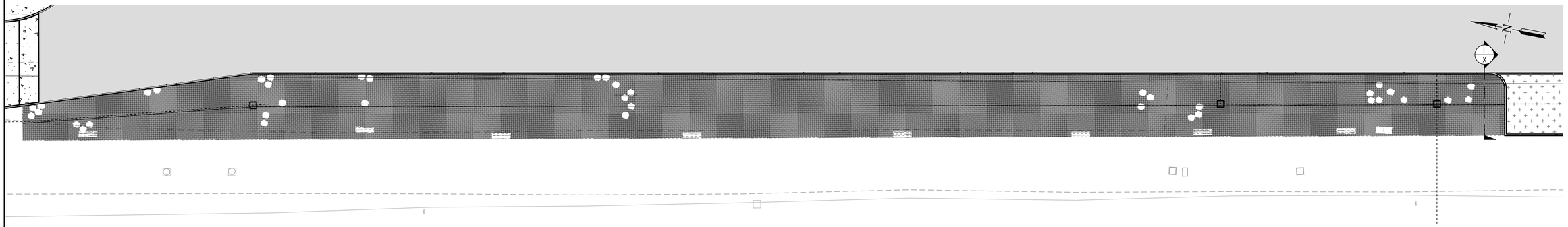
GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

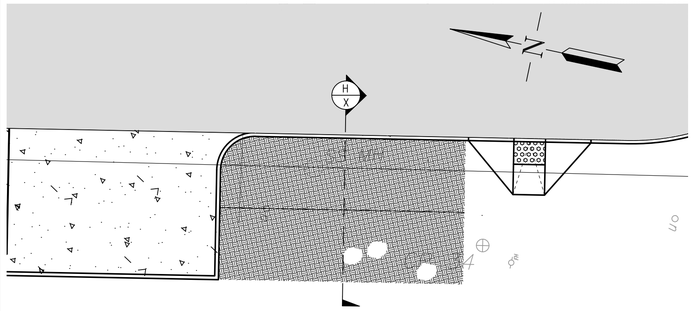
PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH	HORIZ. AS SHOWN	CITY OF BERKELEY PARKS, RECREATION & WATERFRONT 1947 CENTER ST., 5th FL, BERKELEY, CA 94704	NCE 1003 W CUTTING BLVD., SUITE 110 POINT RICHMOND, CA 94804 (510) 215-3220FAX (510) 215 2888	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA PARKING LOT BIORETENTION FACILITY SECTIONS AND DETAILS 2	PLAN
	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER R.C.E. EXP.	DRAWN SD	VERT. AS SHOWN				FILE
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE	CHECK	BOOK				CP-300-B
		CITY ENGINEER R.C.E. EXP.	AS BUILT	DATE 12/12/25				SHEET OF

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

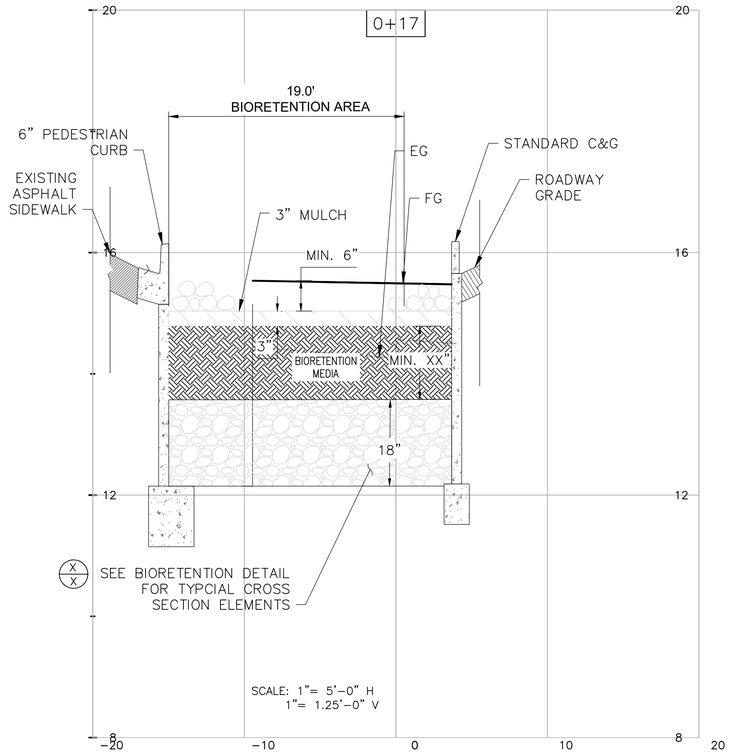
FILE NAME: P:\Active Projects\CDWI - 1421\1421.01.55 - Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\68 CP203 - Parking Lot 3.dwg LAYOUT NAME: CP-301 PLOTTED: Friday, December 12, 2025 - 7:22pm USER: JShibko



PLAN
SCALE: 1"= 10'-0"

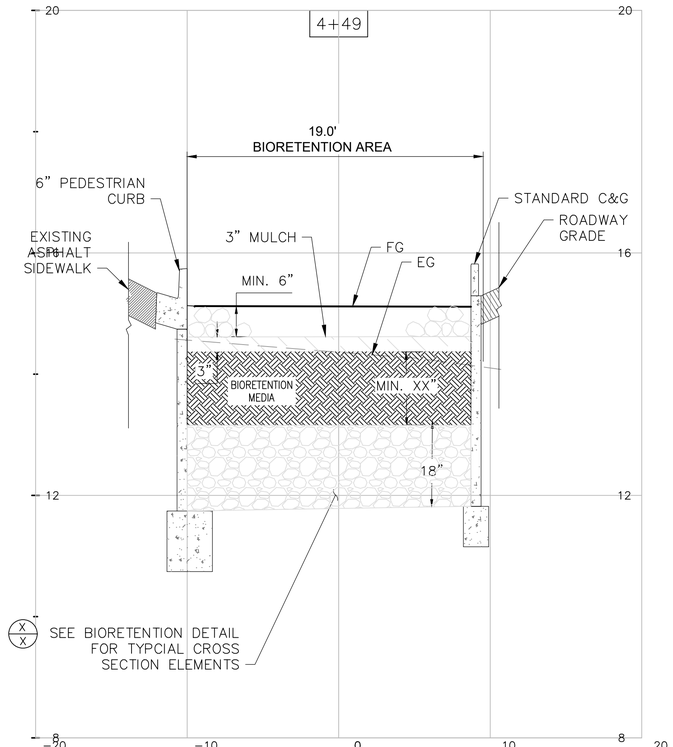


PLAN
SCALE: 1"= 10'-0"



H/X PARKING LOT BIORETENTION SECTION

PROFILE
SCALE: 1"= 5'-0" H
1"= 1.25'-0" V



I/X PARKING LOT BIORETENTION SECTION

PROFILE
SCALE: 1"= 5'-0" H
1"= 1.25'-0" V

60% SUBMITTAL
DECEMBER 12, 2025

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B	60% SUBMITTAL	12-12-2025		FH
A	30% SUBMITTAL	6-27-25		FH

PROJECT MANAGER: _____ DATE _____

DEPICTION OF MONUMENTS: _____ DATE _____
SURVEY PARTY CHIEF

WATERSHED REVIEW: _____ DATE _____

SUBMITTED: _____ DATE _____
SUPERVISING CIVIL ENGINEER R.C.E. _____ EXP. _____

APPROVED: _____ DATE _____
CITY ENGINEER R.C.E. _____ EXP. _____

0 1 2 3
FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES

DESIGN	FH
DRAWN	SD
CHECK	
AS BUILT	
HORIZ.	AS SHOWN
VERT.	AS SHOWN
BOOK	
DATE	12/12/25

PARKS RECREATION & WATERFRONT
1947 CENTER ST., 5th FL. BERKELEY, CA 94704

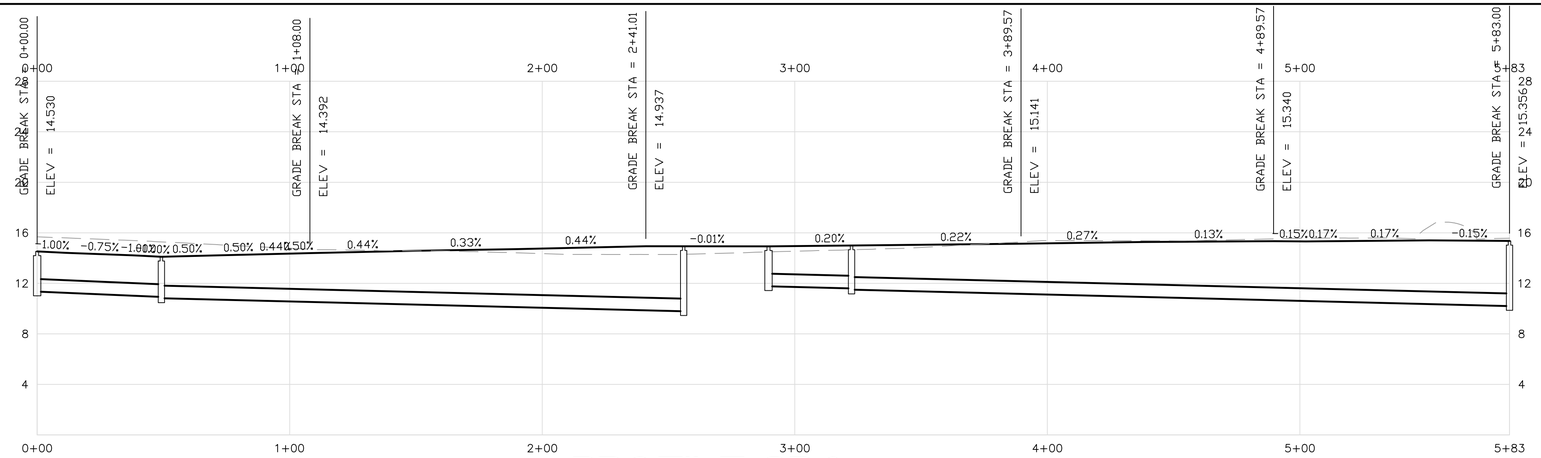
NCE
1000 W CUTTING BLVD., SUITE 110
POINT RICHMOND, CA 94804
(510) 215-3020 FAX (510) 215 2848

BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT
CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA

PARKING LOT BIORETENTION
FACILITY SECTIONS AND DETAILS 3

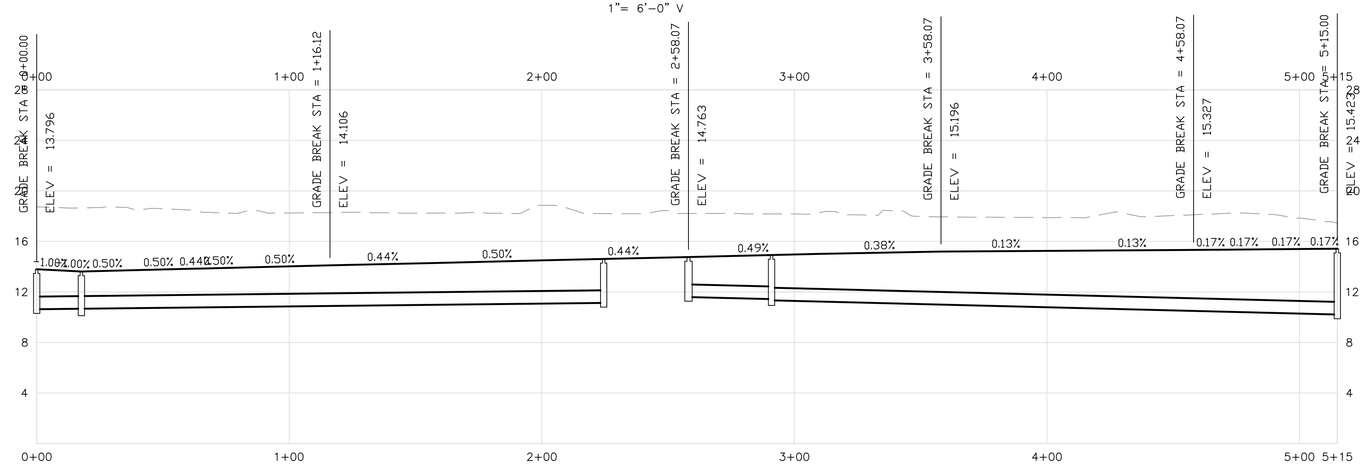
PLAN _____
FILE _____
CP-300-C
SHEET ___ OF ___

FILE NAME: P:\Active Projects\CIVil – 1421\1421.01.55 – Berkeley Water transportation Pier Ferry Project\CAD\Sheets\68 CP203 – Parking Lot 3.dwg LAYOUT NAME: CP-302 PLOTTED: Friday, December 12, 2025 – 7:23pm USER: JShibko



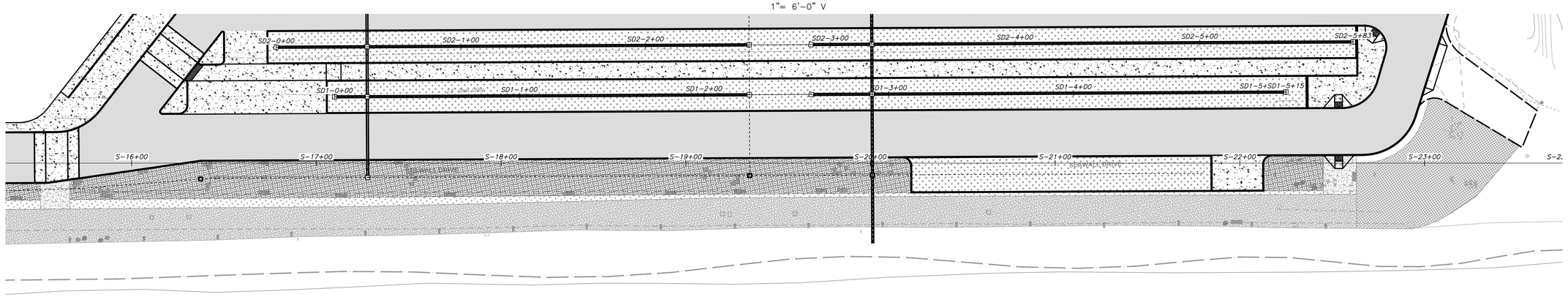
PROFILE SD2

SCALE: 1"= 30'-0" H
1"= 6'-0" V



PROFILE SD1

SCALE: 1"= 30'-0" H
1"= 6'-0" V



PLAN

SCALE: 1"= 30'-0"

60% SUBMITTAL
DECEMBER 12, 2025

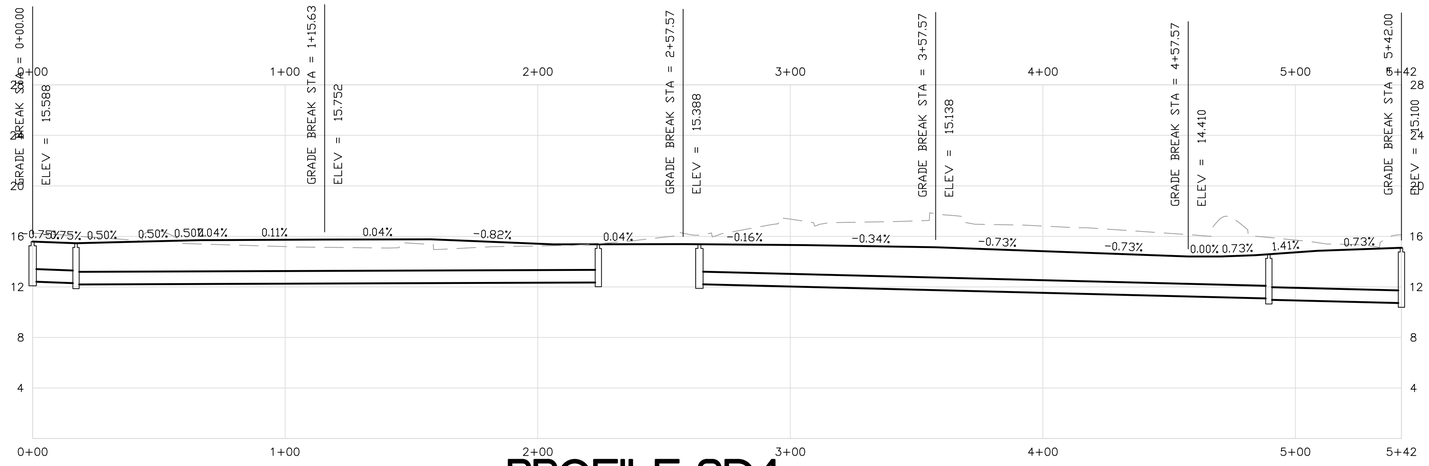
GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH	HORIZ. 1" = 20'	PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FR, BERKELEY CA94704	1003 W CUTTING BLVD, SUITE 110 PT. RICHMOND, CA 94804 (510) 215-3520FAX (510) 215 2868	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA PARKING LOT SUBDRAIN AND DRAINAGE SYSTEM PLAN & PROFILE 1	PLAN
	SURVEY PARTY CHIEF	SUPERVISING CIVIL ENGINEER DATE R.C.E. EXP.	DRAWN SD	VERT.				FILE
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE R.C.E.	CHECK	BOOK				CP-301
		CITY ENGINEER EXP.	AS BUILT	DATE 12/12/25				SHEET OF

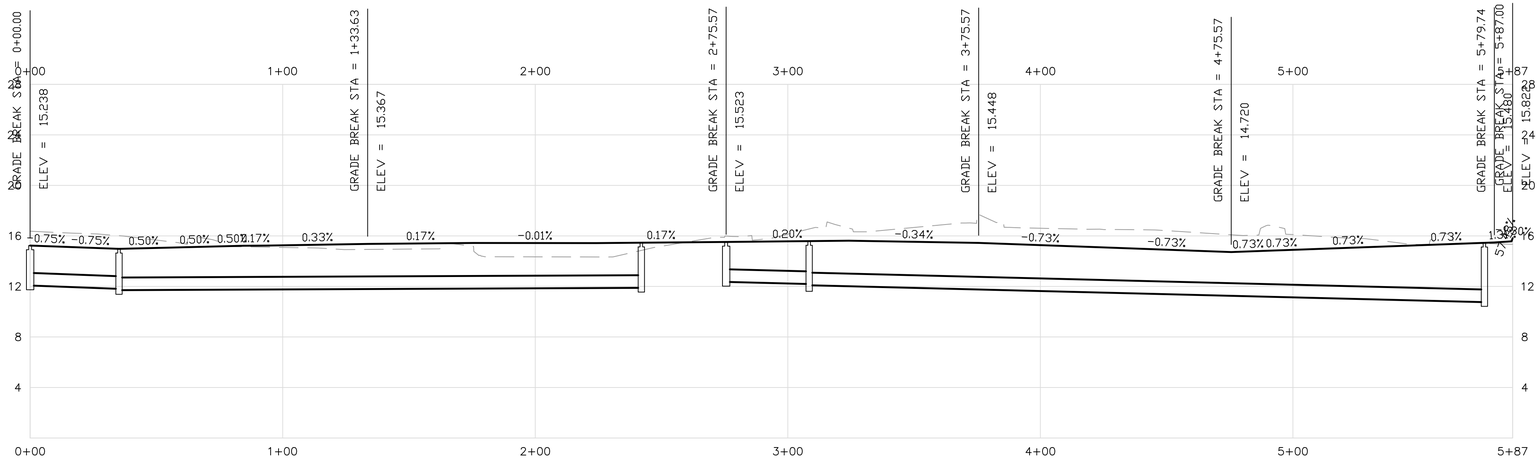
MARK	DATE	DESCRIPTION	APPROVAL
B	12-12-2025	60% SUBMITTAL	FH
A	6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\CDWI – 1421\1421.01.55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\Y1 CP-301 – Parking Lot 4.dwg LAYOUT NAME: CP-301 PLOTTED: Friday, December 12, 2025 – 7:26pm USER: JShibko



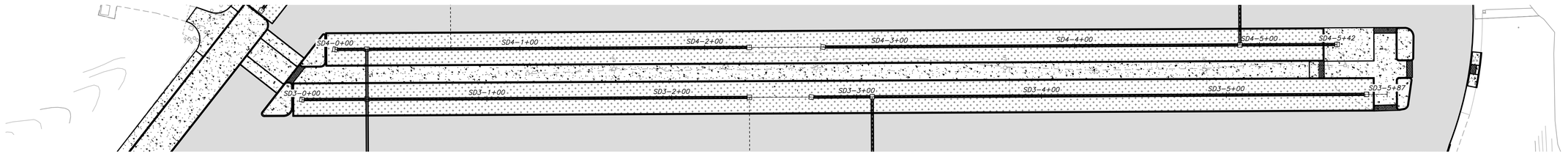
PROFILE SD4

SCALE: 1"= 30'-0" H
1"= 6'-0" V



PROFILE SD3

SCALE: 1"= 30'-0" H
1"= 6'-0" V



PLAN

SCALE: 1"= 30'-0"

60% SUBMITTAL
DECEMBER 12, 2025

GENERAL NOTE:

THE CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT (USA) AT 811 AT LEAST TWO WORKING DAYS BEFORE EXCAVATING. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING EXISTING UTILITIES IN ACCORDANCE WITH THE SPECIFICATIONS.

PROJECT MANAGER: DATE	DEPICTION OF MONUMENTS: DATE	SUBMITTED: DATE	DESIGN FH	HORIZ. 1" = 20'	PARKS RECREATION & WATERFRONT 1947 CENTER ST., 5th FR, BERKELEY CA94704	NCE 1003 W CUTTING BLVD., SUITE 110 POINT RICHMOND CA 94804 (510) 215-3220FAX (510) 215 2868	BERKELEY WATER TRANSPORTATION PIER FERRY (BWTPF) PROJECT CITY OF BERKELEY, ALAMEDA COUNTY, CALIFORNIA PARKING LOT SUBDRAIN AND DRAINAGE SYSTEM PLAN & PROFILE 2	PLAN
	SURVEY PARTY CHIEF	R.C.E.	DRAWN SD	VERT.				FILE
0 1 2 3 FOR REDUCED PLANS – ORIGINAL SCALE IS IN INCHES	WATERSHED REVIEW: DATE	APPROVED: DATE	CHECK	BOOK				CP-302
		CITY ENGINEER R.C.E. EXP.	AS BUILT	DATE 12/12/25				SHEET OF

REVISION	MARK	DATE	DESCRIPTION	APPROVAL
B		12-12-2025	60% SUBMITTAL	FH
A		6-27-25	30% SUBMITTAL	FH

FILE NAME: P:\Active Projects\CIVIL – 1421\1421.01.55 – Berkeley Water Transportation Pier Ferry Project\CAD\Sheets\71 CP302 – Parking Lot 4.dwg LAYOUT NAME: CP-302 PLOTTED: Friday, December 12, 2025 – 7:27pm USER: JShibko