APPENDIX F

DRAFT SUMMARY OF PRELIMINARY STORMWATER INFRASTRUCTURE SIZING FOR THE D STREET PROPERTIES, BALANCE HYDROLOGICS, INC., SEPTEMBER 2015

Balance Hydrologics, Inc.®

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September 16, 2015

Mr. Greg Miller, P.E.
Carlson, Barbee & Gibson, Inc.
2633 Camino Ramon, Suite 350
San Ramon, CA 94583

RE: DRAFT - Summary of Preliminary Stormwater Infrastructure Sizing for the D Street Properties (Tracts 8296 and 8297), Alameda County, California

Dear Mr. Miller:

Balance Hydrologics has completed analyses for the preliminary sizing of a stormwater management infrastructure for Tracts 8296 and 8297, also known as the D Street properties. This letter summarizes our design methodology, hydrologic model parameters, and results.

The project proposes to develop 31 residential lots along two new cul-de-sacs in the Fairview Specific Plan area of Alameda County. An existing developed lot (not part of the project) is located between the proposed roadways and splits the project site into two parts, herein referred to as the West Side and the East Side. Under pre-project conditions, the West Side sheet flows to the west, toward existing residential developments, and eventually drains to Sulphur Creek. The East Side is situated on a ridge, and under existing conditions roughly half of the runoff sheet flows toward D Street and the remainder sheet flows toward the Machado Court neighborhood, and eventually to San Lorenzo Creek[1]. Changes to the hydrology of the project site are evaluated in terms of flows at three analysis points, which are the outfalls of the existing watersheds for the project site shown in the attached pre-project watersheds map (Appendix A).

Development of the properties requires construction of stormwater management infrastructure that meets a range of regulatory requirements including providing runoff water-quality treatment consistent with the C.3 requirements of the Municipal Regional Permit, flow-duration control to avoid hydromodification impacts, and peak flow control to avoid flood control impacts.

Under post-project conditions all of the residential lots will have individual bioretention basins to treat runoff from impervious surfaces within each lots. Most of the lot bioretention basins will be sized to treat the required water quality volume originating from the lots only (i.e. the roofs and driveways), with the exception of the south half of the East Side, which is also sized to treat roadway runoff (described below). Sizes for lot bioretention basins will vary depending on the final architectural plans, but as an example, a

[1] The portion of the East Side draining toward D Street may actually flow to Sulphur Creek; Analysis Point E1 is situated on a high point along D Street which is the divide for the Sulphur Creek and San Lorenzo Creek watersheds. Field verification is needed to confirm which direction this portion of the project drains.

10,000 ft^2 lot having a 3,000 ft^2 building footprint and a 500 ft^2 driveway will require a 166 ft^2 bioretention basin. Lot bioretention basins will drain the water quality volume via underdrains; the underdrains for individual lots will be connected in series and routed to underground detention facilities for flood and hydromodification control. Additional details of the proposed stormwater system and drainage patterns for the East and West Sides are described as follows:

- *East Side, D Street Portion (Analysis Point E1)*: Three of the East Side post-project watersheds (Pr-E-Ex, Pr-E-Rd, and Pr-Res1) will drain toward D Street (see Appendix B for post-project watersheds map). Runoff originating from the portion of east street having frontage with Lots 1, 2, 3, 13, and 14 (and overflow from lots themselves in large events) will be directed toward a bioretention facility (Bio-A) and then into an underground 80-foot long, 6-foot diameter pipe for hydromodification and flood control. Runoff originating from the lower portion of east street (in front of Lot 15 and downhill to D Street) will drain toward a combination water quality-hydromodification-flood control basin. After passing through the required water quality and flow controls, all runoff will combine with drainage from the existing developed area between the east and west sides, and be conveyed off-site by a new storm main following D Street connecting with the existing storm drain system downslope.

- *East Side, Machado Portion (Analysis Point E2)*: The other two East Side post-project watersheds (Pr-E-Res2a and Pr-E-Res2b) will drain toward Machado Court. Runoff from the end of east street will be collected and treated by a series of bioretention features, located along the frontage of east street with Lots 4 through 12. The bioretention features for this portion of the project are not designed to overflow into the street when the water quality volume is exceeded (except for emergency overflow in the event of an outlet structure failure). Instead, runoff in bioretention features beyond the required water-quality volume will enter an outlet control structure, where it will be routed to an underground 260-foot long, 6-foot diameter detention pipe. The pipe will be outfitted with an outlet control structure to meet hydromodification and flood control requirements. From there, flow will be routed via a new storm drain line to the existing storm drain system in the Machado Court neighborhood. All of east street will be graded toward D Street for positive overland drainage release.

- *West Side (Analysis Point W1)*: The proposed storm drain system for the West Side will connect to an existing storm drain line located along the west property line. Runoff from west street will drain toward a water-quality basin (Bio-E) located between Lots 8 and 9 (the basin is also sized to treat runoff from Lots 8 and 9 themselves). The remaining lots (1 to 7 and 11 to 16) will have individual bioretention basins on each lot. When the water-quality volume is exceeded, the individual lot bioretention basins will overflow into west street, where runoff will be routed toward Bio-E. This basin will have an outlet control structure that directs runoff in excess of the water quality volume to an underground 250-foot long, 6-foot diameter detention pipe for hydromodification and flood controls. From there, runoff will exit the site through the existing storm drain to the west. A small portion of the West Side will be graded, but not developed; this strip of land along the western perimeter is considered self-treating.

Bioretention basins were sized for water-quality treatment with the combination flow and volume method described in the Clean Water Program Alameda County C.3 Technical Guidance. All sizing is based on a site mean annual precipitation (MAP) of 22.0 inches (per Appendix D of the Alameda County C.3 Technical Guidance Manual). Water quality parameters are summarized below and the complete calculation worksheets are attached (Appendix C).

Bioretention Basin ID	Effective Impervious Area *(sq ft)*	Required Capture Volume *(cu ft)*	Required Surface Area *(sq ft)*	Modeled Surface Area *(sq ft)*	Modeled Ponded Depth *(in)*
Bio-A[1]	37,947	2,540	1,138	1,154	6.3
Bio-B	6,790	455	204	325	0.0
Bio-C[1]	25,870	1,732	776	933	2.2
Bio-D[1]	27,416	822	822	980	2.4
Bio-E[2]	39,446	2,640	1,183	1,202	6.3

1. Modeled as one large basin for this preliminary analysis.
2. Sized to treat west street and Lots 8 and 9 only; the associated effective impervious area is for west street and Lots 8 and 9 only. The remainder of new impervious area in the West Side will be treated by lot bioretention basins.

Hydromodification controls were sized using the Bay Area Hydrology Model (BAHM) and the hydrologic data embedded in the BAHM software, along with a stage-storage-discharge tables developed in Excel (used to simulate the outlet control structure for the respective stormwater basins and/or detention pipes). Model parameters were estimated in ArcGIS based on the land plan in the tentative map provided by Carlson, Barbee & Gibson, lead civil engineers for the project. A BAHM model summary is attached (Appendix D), which includes input parameters, the stage-storage-discharge table, and the results showing the basin meets hydromodification requirements.

All flood control modeling was completed in conformance with the guidelines of the Alameda County Flood Control and Water Conservation District (ACFC). These guidelines require the SCS unit hydrograph method be used whenever the volume of a design storm is needed to design flood control facilities (e.g. detention basins). Design storm depths for the 10- and 100-year events were estimated as 3.5 and 5.3 inches, respectively, based on the MAP for the project site and unit values developed by the County. The Alameda County Type I storm distribution was used to transform the storm depths to a 24-hour accumulated rainfall distribution. The design storms were input to HEC-HMS, and the pre- and post- project subbasins were parameterized as follows:

		Watershed Area *(sq mi)*	Curve Number[1]	Percent Impervious *(%)*	Lag Time *(min)*
Pre-project:	Ex-E1	3.5	84.5	33.7	4.0
	Ex-E2	2.2	80.2	1.3	7.5
	Ex-W	5.1	80.8	4.3	3.4
Post-project:	Pr-E-Ex	1.1	90.4	68.9	7.5
	Pr-E-Rd	0.2	93.2	73.3	5.6
	Pr-E-Res1	2.1	86.2	34.3	6.6
	Pr-E-Res2a	1.2	87.6	42.0	7.2
	Pr-E-Res2b	1.5	86.3	36.4	7.2
	Pr-W	4.9	87.1	39.5	7.6

1. Curve numbers are for hydrologic soil group D.

Pre- and post-project hydrographs are attached (Appendix E), and model results for peak flows at each analysis point are summarized as follows:

Analysis Point	Pre-Project Peak Runoff		Post-Project Peak Runoff	
	10-Year *(cfs)*	100-Year *(cfs)*	10-Year *(cfs)*	100-Year *(cfs)*
E1	2.4	3.9	2.4	3.6
E2	1.2	2.1	1.1	2.0
W1	2.8	5.0	2.7	5.0

The same stage-storage-discharge table used for the hydromodification analysis was used in HEC-HMS to model flood control capabilities of the stormwater basin for large storms. Iterations were run for the hydromodification and flood control models with different basin sizes and outlet configurations (as represented by the stage-storage-discharge table) until all stormwater treatment, hydromodification treatment, and flood control criteria were met. For the purposes of hydromodification and flood control modeling, the only surface storage areas included in the models are the bioretention areas shown in the attached post-project watershed map (Appendix B). There will be additional storage volume from the individual lot bioretention basins, and therefore, the results are conservative from a peak flow control perspective.

The preceding discussion describes a stormwater system that meets the pertinent requirements for stormwater treatment, hydromodification management, and flood control. At this preliminary stage in planning, a final land plan that includes all impervious surfaces (roofs and driveways in particular) was not available. For this reason, we could not precisely size the individual lot bioretention basins that will ultimately contribute to the total available storage volume for the project site. In the interim, this analysis assumed a building footprint of 3,000 ft^2 and a driveway of 500 ft^2 for each lot, and directed runoff to representative aggregated-area bioretention basins. By lumping all of the required storage volume and surface area for water-quality treatment into the representative bioretention basins, the analyses demonstrate that the proposed stormwater system can meet the regulatory requirements within the spatial constraints of the project site. Of course, once a more advanced land plan is available, additional levels of detail will need to be added to the preliminary models to demonstrate that the final proposed system meets all pertinent regulatory requirements.

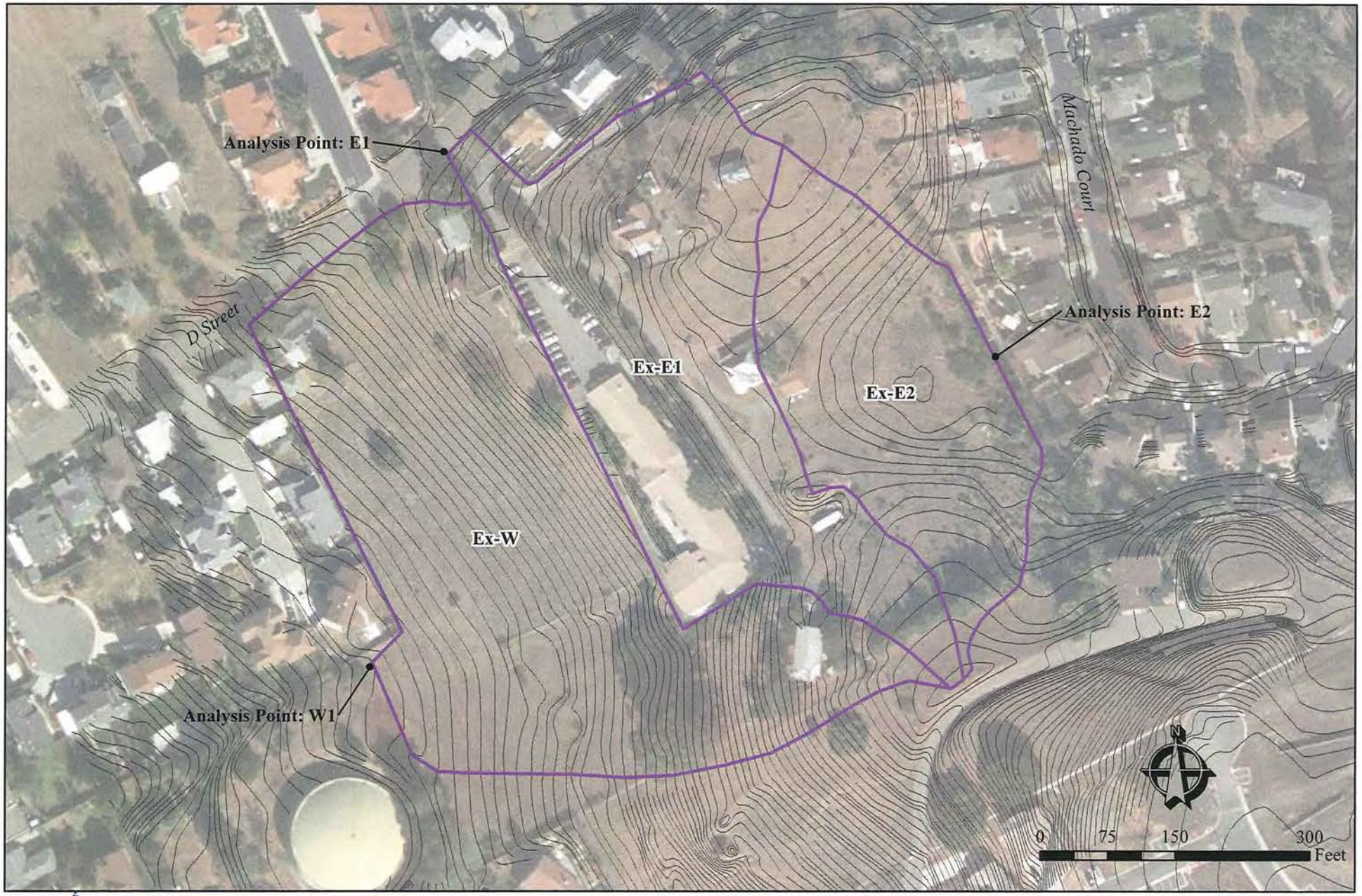
Thank you for the opportunity to participate in this project. Please do not hesitate to contact Balance Hydrologics should you have any questions on what has been presented herein.

Sincerely,

BALANCE HYDROLOGICS, Inc.

Peter Kulchawik, P.E.
Civil Engineer/Hydrologist

Enclosures: Appendix A: Pre-project watershed map
Appendix B: Post-project watershed map
Appendix C: Worksheets for calculating the combination flow and volume method
Appendix D: BAHM model summary report
Appendix E: Pre- and post-project hydrographs (HEC-HMS output)



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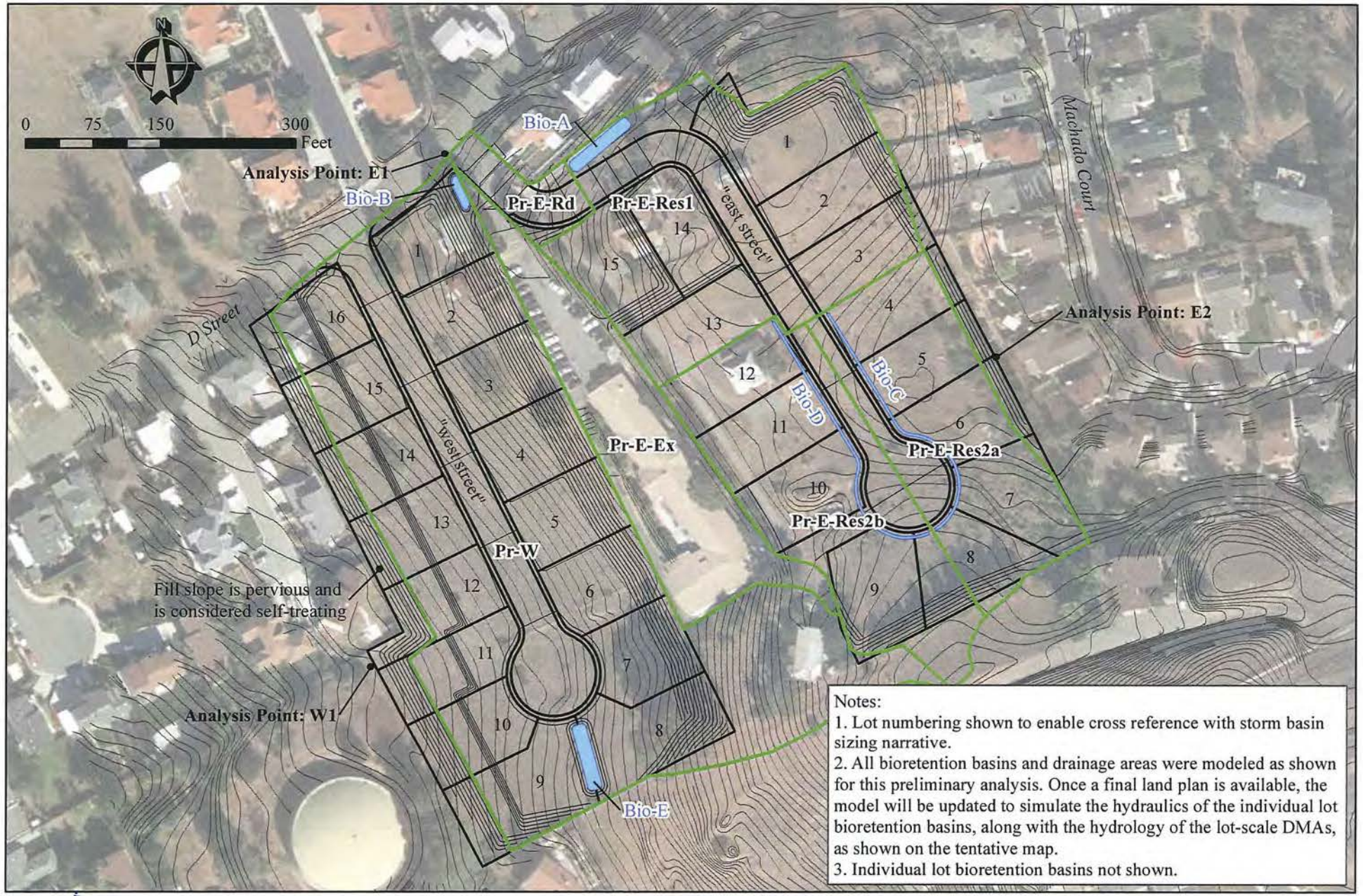
Appendix A. Pre-Project Watershed Map, D Street Project, Alameda County, California

Source: CB&G (contour data); Esri, DigitalGlobe, GeoEye, USGS, and the GIS User Community



Notes:
1. Lot numbering shown to enable cross reference with storm basin sizing narrative.
2. All bioretention basins and drainage areas were modeled as shown for this preliminary analysis. Once a final land plan is available, the model will be updated to simulate the hydraulics of the individual lot bioretention basins, along with the hydrology of the lot-scale DMAs, as shown on the tentative map.
3. Individual lot bioretention basins not shown.

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Appendix B. Post-Project Watershed Map, D Street Project, Alameda County, California

Source: CB&G (contour data); Esri, DigitalGlobe, GeoEye, USGS, and the GIS User Community

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:	D Street	
1-2	City application ID:		
1-3	Site Address or APN:		
1-4	Tract or Parcel Map No:	Tract 8297	
1-5	Site Mean Annual Precip. (MAP)[1]	22.0	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: 1.20

(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: Pr-E-Rd

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	6,551	1.0	6,551
2-3	Pervious service	2,388	0.1	239
	Total DMA Area (square feet) =	8,939		

2-4 ***Total Effective Impervious Area (EIA)*** 6,790 **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:*** 0.80 **Inches**

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

3-3 ***Required Capture Volume (in cubic feet):*** 455 **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	4.02	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	272	Square feet
5-2	Area 25% smaller than item 5-1	204	Square feet
5-3	Volume of treated runoff for area in Item 5-2	341	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	114	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.6	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.7	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	325	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	544	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	(89)	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	-0.28	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	-3.30	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*	325	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

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1.0 Project Information

1-1	Project Name:	D Street	
1-2	City application ID:		
1-3	Site Address or APN:		
1-4	Tract or Parcel Map No:	Tract 8297	
1-5	Site Mean Annual Precip. (MAP)[1]	22.0	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: 1.20

(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: Pr-E-Res1

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	31,841	1.0	31,841
2-3	Pervious service	61,056	0.1	6,106
	Total DMA Area (square feet) =	92,897		

2-4 ***Total Effective Impervious Area (EIA)*** 37,947 **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:*** 0.80 **Inches**

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

3-3 ***Required Capture Volume (in cubic feet):*** 2,540 **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	4.02	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	1,518	Square feet
5-2	Area 25% smaller than item 5-1	1,138	Square feet
5-3	Volume of treated runoff for area in Item 5-2	1,905	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	635	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.6	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.7	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	1154	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	1,931	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	609	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	6.33	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*	1,154	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:	D Street	
1-2	City application ID:		
1-3	Site Address or APN:		
1-4	Tract or Parcel Map No:	Tract 8297	
1-5	Site Mean Annual Precip. (MAP)[1]	22.0	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: 1.20

(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: Pr-E-Res2a

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	22,733	1.0	22,733
2-3	Pervious service	31,365	0.1	3,137
	Total DMA Area (square feet) =	54,098		

2-4 ***Total Effective Impervious Area (EIA)*** 25,870 **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:*** 0.80 **Inches**

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

3-3 ***Required Capture Volume (in cubic feet):*** 1,732 **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	4.02	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	1,035	Square feet
5-2	Area 25% smaller than item 5-1	776	Square feet
5-3	Volume of treated runoff for area in Item 5-2	1,299	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	433	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.6	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.7	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	933	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	1,561	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	170	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	0.18	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	2.19	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*	933	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:	D Street	
1-2	City application ID:		
1-3	Site Address or APN:		
1-4	Tract or Parcel Map No:	Tract 8297	
1-5	Site Mean Annual Precip. (MAP)[1]	22.0	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: 1.20

(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: Pr-E-Res2b

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	23,335	1.0	23,335
2-3	Pervious service	40,814	0.1	4,081
	Total DMA Area (square feet) =	64,149		

2-4 ***Total Effective Impervious Area (EIA)*** 27,416 **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:*** 0.80 **Inches**

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

3-3 ***Required Capture Volume (in cubic feet):*** 1,835 **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	4.02	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	1,097	Square feet
5-2	Area 25% smaller than item 5-1	822	Square feet
5-3	Volume of treated runoff for area in Item 5-2	1,376	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	459	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.6	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.7	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	980	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	1,640	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	195	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	2.39	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*	980	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:	D Street	
1-2	City application ID:		
1-3	Site Address or APN:		
1-4	Tract or Parcel Map No:	Tract 8296	
1-5	Site Mean Annual Precip. (MAP)[1]	22.0	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: 1.20

(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: Pr-W (Street B and Lots 8/9 only)

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	37,596	1.0	37,596
2-3	Pervious service	18,500	0.1	1,850
	Total DMA Area (square feet) =	56,096		

2-4 ***Total Effective Impervious Area (EIA)*** 39,446 **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:*** 0.80 **Inches**

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

3-3 ***Required Capture Volume (in cubic feet):*** 2,640 **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	4.02	Hours of Rain Event Duration

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA impervious surface	1,578	Square feet
5-2	Area 25% smaller than item 5-1	1,183	Square feet
5-3	Volume of treated runoff for area in Item 5-2	1,980	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	660	Cubic feet (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.6	Feet (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from ft to inches	6.7	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	1202	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	2,012	Cubic feet (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	629	Cubic feet (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	0.52	Feet (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from feet to inches	6.28	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*	1,202	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.*

BAHM2013
PROJECT REPORT

Project Name: 215130 D Street
Site Name: D Street
Site Address:
City :
Report Date: 9/14/2015
Gage : NRWARK
Data Start : 1959/10/01 00:00
Data End : 2003/09/30 00:00
Precip Scale: 1.62
Version : 2015/03/18

Low Flow Threshold for POC 1 : 10 Percent of the 2 Year

High Flow Threshold for POC 1: 10 year

Low Flow Threshold for POC 2 : 10 Percent of the 2 Year

High Flow Threshold for POC 2: 10 year

Low Flow Threshold for POC 3 : 10 Percent of the 2 Year

High Flow Threshold for POC 3: 10 year

Low Flow Threshold for POC 4 : 10 Percent of the 2 Year

High Flow Threshold for POC 4: 10 year

PREDEVELOPED LAND USE

Name : Ex-West
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Flat(0-5%)	.043074
C D,Grass,Mod(5-10%)	.38744
C D,Grass,Ste(10-20)	2.830043
C D,Grass,Very(>20%)	1.608424
Pervious Total	4.868981

Impervious Land Use	Acres
Roof Area	0.192659

Driveways,Flat(0-5%)	0.005789
Driveways,Mod(5-10%)	0.006431
Driveways,St(10-20%)	0.010251
Driveways,Very(>20%)	0.002216
Impervious Total	0.217346
Basin Total	5.086327

Element Flows To:
Surface Interflow Groundwater

Name : Ex-East1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Flat(0-5%)	.174485
C D,Grass,Mod(5-10%)	.539523
C D,Grass,Ste(10-20)	.623973
C D,Grass,Very(>20%)	.524886
C D,Forest,Flat(0-5)	.001302
C D,Forest,Mod(5-10)	.041788
C D,Forest,St(10-20)	.113575
C D,Forest,Very(>20)	.295524
Pervious Total	2.315056

Impervious Land Use	Acres
Roof Area	0.479421
Driveways,Flat(0-5%)	0.057996
Driveways,Mod(5-10%)	0.178546
Driveways,St(10-20%)	0.359686
Driveways,Very(>20%)	0.102217
Impervious Total	1.177866
Basin Total	3.492922

Element Flows To:
Surface Interflow Groundwater

Name : Ex-East2
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Flat(0-5%)	.407375
C D,Grass,Mod(5-10%)	.866617
C D,Grass,Ste(10-20)	.832756
C D,Grass,Very(>20%)	.094943
Pervious Total	2.201691

Impervious Land Use	Acres
Roof Area	0.028344
Impervious Total	0.028344
Basin Total	2.230035

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Pr-West
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Flat(0-5%)	1.453533
C D,Grass,Mod(5-10%)	.037545
C D,Grass,Ste(10-20)	.110873
C D,Grass,Very(>20%)	1.351083
Pervious Total	2.953034

Impervious Land Use	Acres
Roads,Flat(0-5%)	0.572409
Roads,VeryStee(>20%)	0.001897
Roof Area	1.150007
Driveways,Flat(0-5%)	0.189063
Driveways,Mod(5-10%)	0.006067
Driveways,St(10-20%)	0.007739
Driveways,Very(>20%)	0.00077
Impervious Total	1.927952
Basin Total	4.880986

Element Flows To:

Surface	Interflow	Groundwater
West WQ Basin		

Name : Pr-East-Res1
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Flat(0-5%)	.902913
C D,Grass,Mod(5-10%)	.029444
C D,Grass,Ste(10-20)	.053064
C D,Grass,Very(>20%)	.416223
Pervious Total	1.401644

Impervious Land Use	Acres
Roads,Flat(0-5%)	0.235096
Roads,Mod(5-10%)	0.066116
Roof Area	0.344355
Driveways,Flat(0-5%)	0.068699
Driveways,Mod(5-10%)	0.008415
Driveways,St(10-20%)	0.003569
Driveways,Very(>20%)	0.004729
Impervious Total	0.730979
Basin Total	2.132623

Element Flows To:

Surface	Interflow	Groundwater
WQ Basin East1		

Name : West WQ Basin
Depth: 4.5 ft.

Element Flows To:

Outlet 1	Outlet 2
UG Pipe West	

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	1202	0.000	0.000	0.000	0.000	0.000	0.000
0.250	1202	0.003	0.000	0.000	0.000	0.000	0.000

0.500	1202	0.006	0.000	0.000	0.000	0.000	0.000
0.750	1202	0.008	0.000	0.000	0.000	0.000	0.000
1.000	1202	0.011	0.000	0.000	0.000	0.000	0.000
1.250	1202	0.013	0.055	0.000	0.000	0.000	0.000
1.500	1202	0.014	0.086	0.000	0.000	0.000	0.000
1.750	1202	0.016	0.109	0.000	0.000	0.000	0.000
2.000	1202	0.018	0.128	0.000	0.000	0.000	0.000
2.250	1202	0.020	0.145	0.000	0.000	0.000	0.000
2.500	1202	0.021	0.159	0.000	0.000	0.000	0.000
2.750	1341.5	0.030	0.173	0.000	0.000	0.000	0.000
3.000	1481	0.038	0.185	0.000	0.000	0.000	0.000
3.250	1620.5	0.047	0.197	0.000	0.000	0.000	0.000
3.500	1760	0.055	0.208	0.000	0.000	0.000	0.000
3.750	1913.5	0.067	0.218	0.000	0.000	0.000	0.000
4.000	2067	0.079	0.229	0.000	0.000	0.000	0.000
4.250	2220.5	0.091	2.563	0.000	0.000	0.000	0.000

Name : UG Pipe West
Depth: 6 ft.

Element Flows To:
Outlet 1 **Outlet 2**

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.250	0.014	0.003	0.250	0.000	0.000	0.000	0.000
0.500	0.020	0.007	0.706	0.000	0.000	0.000	0.000
0.750	0.024	0.013	1.021	0.000	0.000	0.000	0.000
1.000	0.027	0.018	1.251	0.000	0.000	0.000	0.000
1.250	0.029	0.026	1.444	0.000	0.000	0.000	0.000
1.500	0.031	0.033	1.615	0.000	0.000	0.000	0.000
1.750	0.033	0.041	1.769	0.000	0.000	0.000	0.000
2.000	0.034	0.049	1.911	0.000	0.000	0.000	0.000
2.250	0.035	0.058	2.043	0.000	0.000	0.000	0.000
2.500	0.035	0.067	2.167	0.000	0.000	0.000	0.000
2.750	0.035	0.075	2.284	0.000	0.000	0.000	0.000
3.000	0.035	0.084	2.395	0.000	0.000	0.000	0.000
3.250	0.035	0.093	2.502	0.000	0.000	0.000	0.000
3.500	0.035	0.102	2.604	0.000	0.000	0.000	0.000
3.750	0.035	0.111	3.075	0.000	0.000	0.000	0.000
4.000	0.035	0.120	3.406	0.000	0.000	0.000	0.000
4.250	0.035	0.128	3.665	0.000	0.000	0.000	0.000
4.500	0.035	0.136	3.891	0.000	0.000	0.000	0.000
4.750	0.035	0.143	4.097	0.000	0.000	0.000	0.000
5.000	0.035	0.150	4.288	0.000	0.000	0.000	0.000
5.250	0.035	0.156	4.467	0.000	0.000	0.000	0.000
5.500	0.035	0.162	4.637	0.000	0.000	0.000	0.000
5.750	0.035	0.165	4.800	0.000	0.000	0.000	0.000
6.000	0.035	0.169	6.204	0.000	0.000	0.000	0.000

Name : Pr-East-Ex
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
C D,Forest,Flat(0-5)	.005729
C D,Forest,Mod(5-10)	.040282
C D,Forest,St(10-20)	.036176
C D,Forest,Very(>20)	.136953
C D,Grass,Mod(5-10%)	.014889
C D,Grass,Ste(10-20)	.051723
C D,Grass,Very(>20%)	.053387
Pervious Total	0.339139

Impervious Land Use	Acres
Roof Area	0.375994
Driveways,Flat(0-5%)	0.03671
Driveways,Mod(5-10%)	0.07591
Driveways,St(10-20%)	0.180822
Driveways,Very(>20%)	0.080831
Impervious Total	0.750267
Basin Total	1.089406

Element Flows To:
Surface Interflow Groundwater

Name : Pr-East-Rd
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Mod(5-10%)	.036383
C D,Grass,Ste(10-20)	.018371
C D,Grass,Very(>20%)	.000056
Pervious Total	0.05481

Impervious Land Use	Acres
Roads,Mod(5-10%)	0.15037
Driveways,Very(>20%)	0.000019
Impervious Total	0.150389
Basin Total	0.205199

Element Flows To:

Surface	Interflow	Groundwater
East-Mini Basin		

Name : UG Pipe East 1
Depth: 6 ft.

Element Flows To:

Outlet 1	Outlet 2

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.250	0.004	0.001	0.208	0.000	0.000	0.000	0.000
0.500	0.006	0.002	0.589	0.000	0.000	0.000	0.000
0.750	0.007	0.004	0.851	0.000	0.000	0.000	0.000
1.000	0.008	0.006	1.042	0.000	0.000	0.000	0.000
1.250	0.009	0.008	1.204	0.000	0.000	0.000	0.000
1.500	0.010	0.010	1.346	0.000	0.000	0.000	0.000
1.750	0.010	0.013	1.474	0.000	0.000	0.000	0.000
2.000	0.010	0.015	1.592	0.000	0.000	0.000	0.000
2.250	0.011	0.018	1.702	0.000	0.000	0.000	0.000
2.500	0.011	0.020	1.806	0.000	0.000	0.000	0.000
2.750	0.011	0.023	1.903	0.000	0.000	0.000	0.000
3.000	0.011	0.026	1.996	0.000	0.000	0.000	0.000
3.250	0.011	0.029	2.085	0.000	0.000	0.000	0.000
3.500	0.011	0.031	2.170	0.000	0.000	0.000	0.000
3.750	0.011	0.034	2.252	0.000	0.000	0.000	0.000
4.000	0.011	0.037	2.331	0.000	0.000	0.000	0.000
4.250	0.011	0.039	2.407	0.000	0.000	0.000	0.000
4.500	0.011	0.042	2.482	0.000	0.000	0.000	0.000
4.750	0.011	0.044	2.554	0.000	0.000	0.000	0.000
5.000	0.011	0.046	2.623	0.000	0.000	0.000	0.000
5.250	0.011	0.048	2.692	0.000	0.000	0.000	0.000
5.500	0.011	0.050	2.758	0.000	0.000	0.000	0.000
5.750	0.011	0.051	3.239	0.000	0.000	0.000	0.000

Name : East-Mini Basin
Depth: 3.5 ft.

Element Flows To:

Outlet 1	Outlet 2

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	325.0	0.000	0.000	0.000	0.000	0.000	0.000
0.250	325.0	0.001	0.000	0.000	0.000	0.000	0.000
0.500	325.0	0.001	0.000	0.000	0.000	0.000	0.000
0.750	325.0	0.002	0.000	0.000	0.000	0.000	0.000
1.000	325.0	0.003	0.000	0.000	0.000	0.000	0.000
1.250	325.0	0.003	0.055	0.000	0.000	0.000	0.000
1.500	325.0	0.004	0.086	0.000	0.000	0.000	0.000
1.750	325.0	0.004	0.109	0.000	0.000	0.000	0.000
2.000	325.0	0.005	0.128	0.000	0.000	0.000	0.000
2.250	325.0	0.005	0.145	0.000	0.000	0.000	0.000
2.500	325.0	0.006	0.159	0.000	0.000	0.000	0.000
2.750	372.3	0.008	0.173	0.000	0.000	0.000	0.000
3.000	419.5	0.011	0.185	0.000	0.000	0.000	0.000
3.250	466.8	0.013	2.522	0.000	0.000	0.000	0.000

Name : Pr-East-Res2a
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Grass,Flat(0-5%)	.672038
C D,Grass,Mod(5-10%)	.011532
C D,Grass,Ste(10-20)	.002526
C D,Grass,Very(>20%)	.033951
Pervious Total	0.720047

Impervious Land Use	Acres
Roads,Flat(0-5%)	0.14991
Roof Area	0.314568
Driveways,Flat(0-5%)	0.05739
Impervious Total	0.521868
Basin Total	1.241915

Element Flows To:

Surface	Interflow	Groundwater
WQ Basin 2a		

Name : UG Pipe East 2
Depth: 6 ft.

Element Flows To:

Outlet 1	Outlet 2

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.250	0.014	0.003	0.137	0.000	0.000	0.000	0.000
0.500	0.019	0.006	0.389	0.000	0.000	0.000	0.000
0.750	0.023	0.012	0.562	0.000	0.000	0.000	0.000
1.000	0.026	0.018	0.688	0.000	0.000	0.000	0.000
1.250	0.028	0.025	0.794	0.000	0.000	0.000	0.000
1.500	0.030	0.032	0.888	0.000	0.000	0.000	0.000
1.750	0.031	0.040	0.973	0.000	0.000	0.000	0.000
2.000	0.032	0.047	1.051	0.000	0.000	0.000	0.000
2.250	0.033	0.056	1.124	0.000	0.000	0.000	0.000
2.500	0.034	0.064	1.192	0.000	0.000	0.000	0.000
2.750	0.034	0.073	1.256	0.000	0.000	0.000	0.000
3.000	0.034	0.081	1.317	0.000	0.000	0.000	0.000
3.250	0.034	0.090	1.376	0.000	0.000	0.000	0.000
3.500	0.034	0.098	1.432	0.000	0.000	0.000	0.000
3.750	0.034	0.107	1.486	0.000	0.000	0.000	0.000
4.000	0.034	0.115	1.538	0.000	0.000	0.000	0.000
4.250	0.034	0.123	1.589	0.000	0.000	0.000	0.000
4.500	0.034	0.131	1.638	0.000	0.000	0.000	0.000
4.750	0.034	0.138	1.789	0.000	0.000	0.000	0.000
5.000	0.034	0.144	1.916	0.000	0.000	0.000	0.000
5.250	0.034	0.150	2.014	0.000	0.000	0.000	0.000
5.500	0.034	0.156	2.102	0.000	0.000	0.000	0.000
5.750	0.034	0.159	2.182	0.000	0.000	0.000	0.000
6.000	0.034	0.162	2.258	0.000	0.000	0.000	0.000

Name : WQ Basin East1
Depth: 4.5 ft.

Element Flows To:
Outlet 1 **Outlet 2**
UG Pipe East 1

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	1154	0.000	0.000	0.000	0.000	0.000	0.000
0.250	1154	0.003	0.000	0.000	0.000	0.000	0.000
0.500	1154	0.005	0.000	0.000	0.000	0.000	0.000
0.750	1154	0.008	0.000	0.000	0.000	0.000	0.000
1.000	1154	0.011	0.000	0.000	0.000	0.000	0.000
1.250	1154	0.012	0.022	0.000	0.000	0.000	0.000
1.500	1154	0.014	0.032	0.000	0.000	0.000	0.000
1.750	1154	0.016	0.040	0.000	0.000	0.000	0.000
2.000	1154	0.017	0.047	0.000	0.000	0.000	0.000
2.250	1154	0.019	0.053	0.000	0.000	0.000	0.000

2.500	1154	0.021	0.058	0.000	0.000	0.000	0.000
2.750	1250.75	0.028	0.063	0.000	0.000	0.000	0.000
3.000	1347.5	0.036	0.067	0.000	0.000	0.000	0.000
3.250	1444.25	0.044	0.071	0.000	0.000	0.000	0.000
3.500	1541	0.051	0.283	0.000	0.000	0.000	0.000
3.750	1644	0.061	0.668	0.000	0.000	0.000	0.000
4.000	1747	0.072	0.934	0.000	0.000	0.000	0.000
4.250	1850	0.082	1.710	0.000	0.000	0.000	0.000

Name : Pr-East-Res2b
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C D,Forest,Flat(0-5)	.034604
C D,Forest,Mod(5-10)	.000004
C D,Forest,Very(>20)	.000883
C D,Grass,Flat(0-5%)	.642173
C D,Grass,Mod(5-10%)	.079196
C D,Grass,Ste(10-20)	.010666
C D,Grass,Very(>20%)	.169438
Pervious Total	0.936964

Impervious Land Use	Acres
Roads,Flat(0-5%)	0.149405
Roof Area	0.305271
Driveways,Flat(0-5%)	0.079539
Driveways,Mod(5-10%)	0.000461
Driveways,St(10-20%)	0.000362
Driveways,Very(>20%)	0.000665
Impervious Total	0.535703
Basin Total	1.472667

Element Flows To:

Surface	Interflow	Groundwater
WQ Basin 2b		

Name : WQ Basin 2a
Depth: 4.5 ft.

Element Flows To:

Outlet 1	Outlet 2
UG Pipe East 2	

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	933.0	0.000	0.000	0.000	0.000	0.000	0.000
0.250	933.0	0.002	0.000	0.000	0.000	0.000	0.000
0.500	933.0	0.004	0.000	0.000	0.000	0.000	0.000
0.750	933.0	0.006	0.000	0.000	0.000	0.000	0.000
1.000	933.0	0.009	0.000	0.000	0.000	0.000	0.000
1.250	933.0	0.010	0.014	0.000	0.000	0.000	0.000
1.500	933.0	0.011	0.021	0.000	0.000	0.000	0.000
1.750	933.0	0.013	0.026	0.000	0.000	0.000	0.000
2.000	933.0	0.014	0.030	0.000	0.000	0.000	0.000
2.250	933.0	0.015	0.034	0.000	0.000	0.000	0.000
2.500	933.0	0.017	0.037	0.000	0.000	0.000	0.000
2.750	1250.75	0.026	0.040	0.000	0.000	0.000	0.000
3.000	1568.5	0.035	0.043	0.000	0.000	0.000	0.000
3.250	1886.25	0.044	0.120	0.000	0.000	0.000	0.000
3.500	2204	0.053	0.170	0.000	0.000	0.000	0.000
3.750	2530	0.069	0.206	0.000	0.000	0.000	0.000
4.000	2856	0.085	0.236	0.000	0.000	0.000	0.000
4.250	3182	0.102	1.037	0.000	0.000	0.000	0.000

Name : WQ Basin 2b
Depth: 4.5 ft.

Element Flows To:
Outlet 1 **Outlet 2**
UG Pipe East 2

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	977.0	0.000	0.000	0.000	0.000	0.000	0.000
0.250	977.0	0.002	0.000	0.000	0.000	0.000	0.000
0.500	977.0	0.004	0.000	0.000	0.000	0.000	0.000
0.750	977.0	0.007	0.000	0.000	0.000	0.000	0.000
1.000	977.0	0.009	0.000	0.000	0.000	0.000	0.000
1.250	977.0	0.010	0.014	0.000	0.000	0.000	0.000
1.500	977.0	0.012	0.021	0.000	0.000	0.000	0.000
1.750	977.0	0.013	0.026	0.000	0.000	0.000	0.000
2.000	977.0	0.015	0.030	0.000	0.000	0.000	0.000
2.250	977.0	0.016	0.034	0.000	0.000	0.000	0.000
2.500	977.0	0.017	0.037	0.000	0.000	0.000	0.000
2.750	1309.75	0.027	0.040	0.000	0.000	0.000	0.000
3.000	1642.5	0.036	0.043	0.000	0.000	0.000	0.000
3.250	1975.25	0.046	0.120	0.000	0.000	0.000	0.000
3.500	2308	0.055	0.170	0.000	0.000	0.000	0.000
3.750	2648.75	0.072	0.206	0.000	0.000	0.000	0.000
4.000	2989.5	0.089	0.236	0.000	0.000	0.000	0.000
4.250	3330.25	0.107	1.037	0.000	0.000	0.000	0.000

ANALYSIS RESULTS

Predeveloped Landuse Totals for POC #1
Total Pervious Area:4.868981
Total Impervious Area:0.217346

Mitigated Landuse Totals for POC #1
Total Pervious Area:2.953034
Total Impervious Area:1.927952

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	2.62349
5 year	3.94256
10 year	5.159038
25 year	8.443929

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	2.06105
5 year	2.97927
10 year	4.158154
25 year	6.827254

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1960	3.392	2.122
1961	3.471	3.120
1962	4.866	3.234
1963	7.148	6.812
1964	3.873	2.890
1965	1.646	1.169
1966	3.090	1.994
1967	8.360	6.504
1968	2.593	2.003
1969	4.339	4.151
1970	1.823	1.695
1971	3.164	2.821
1972	0.841	0.451
1973	5.170	4.167
1974	2.655	2.341
1975	4.446	2.979
1976	0.231	0.321
1977	0.603	0.706
1978	3.212	2.898
1979	3.372	2.267
1980	2.525	2.124
1981	1.319	1.143
1982	5.151	3.254
1983	2.807	2.287
1984	3.112	2.139

1985	1.746	1.495
1986	1.942	1.598
1987	1.550	1.486
1988	2.001	1.642
1989	1.402	1.353
1990	1.396	1.159
1991	1.823	1.463
1992	3.943	2.936
1993	2.678	2.284
1994	1.208	1.130
1995	9.113	6.949
1996	1.966	1.668
1997	2.668	2.370
1998	3.079	2.598
1999	1.581	1.327
2000	1.779	1.743
2001	1.438	0.994
2002	1.371	1.332
2003	2.982	2.293

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	9.1126	6.9487
2	8.3603	6.8121
3	7.1479	6.5035
4	5.1696	4.1669
5	5.1506	4.1512
6	4.8663	3.2541
7	4.4462	3.2343
8	4.3388	3.1202
9	3.9426	2.9793
10	3.8728	2.9365
11	3.4708	2.8977
12	3.3924	2.8899
13	3.3716	2.8208
14	3.2120	2.5982
15	3.1643	2.3705
16	3.1124	2.3411
17	3.0900	2.2927
18	3.0790	2.2870
19	2.9822	2.2844
20	2.8075	2.2672
21	2.6777	2.1387
22	2.6679	2.1238
23	2.6555	2.1222
24	2.5929	2.0025
25	2.5254	1.9945
26	2.0006	1.7433
27	1.9661	1.6949
28	1.9423	1.6683
29	1.8227	1.6422
30	1.8226	1.5985
31	1.7795	1.4949
32	1.7458	1.4864
33	1.6459	1.4635
34	1.5811	1.3532

35	1.5495	1.3317
36	1.4380	1.3270
37	1.4021	1.1691
38	1.3957	1.1592
39	1.3711	1.1431
40	1.3188	1.1299
41	1.2075	0.9936
42	0.8411	0.7057
43	0.6031	0.4514
44	0.2306	0.3211

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2623	2259	1717	76	Pass
0.3113	2000	1488	74	Pass
0.3603	1780	1331	74	Pass
0.4092	1563	1210	77	Pass
0.4582	1390	1088	78	Pass
0.5072	1251	986	78	Pass
0.5561	1119	889	79	Pass
0.6051	1000	801	80	Pass
0.6540	900	718	79	Pass
0.7030	812	653	80	Pass
0.7520	721	592	82	Pass
0.8009	646	547	84	Pass
0.8499	590	497	84	Pass
0.8989	540	453	83	Pass
0.9478	498	410	82	Pass
0.9968	466	366	78	Pass
1.0457	431	335	77	Pass
1.0947	395	303	76	Pass
1.1437	358	273	76	Pass
1.1926	319	239	74	Pass
1.2416	292	217	74	Pass
1.2906	259	200	77	Pass
1.3395	239	185	77	Pass
1.3885	224	167	74	Pass
1.4374	209	156	74	Pass
1.4864	195	147	75	Pass
1.5354	183	130	71	Pass
1.5843	168	123	73	Pass
1.6333	152	117	76	Pass
1.6823	146	110	75	Pass
1.7312	138	104	75	Pass
1.7802	128	94	73	Pass
1.8291	115	90	78	Pass
1.8781	106	86	81	Pass
1.9271	97	80	82	Pass
1.9760	91	78	85	Pass
2.0250	87	71	81	Pass
2.0739	84	65	77	Pass
2.1229	81	58	71	Pass

2.1719	78	54	69	Pass
2.2208	74	51	68	Pass
2.2698	68	46	67	Pass
2.3188	67	42	62	Pass
2.3677	64	38	59	Pass
2.4167	60	35	58	Pass
2.4656	58	34	58	Pass
2.5146	55	29	52	Pass
2.5636	53	29	54	Pass
2.6125	48	26	54	Pass
2.6615	46	26	56	Pass
2.7105	41	25	60	Pass
2.7594	40	22	55	Pass
2.8084	39	20	51	Pass
2.8573	38	19	50	Pass
2.9063	36	17	47	Pass
2.9553	34	15	44	Pass
3.0042	33	14	42	Pass
3.0532	32	14	43	Pass
3.1022	29	14	48	Pass
3.1511	26	13	50	Pass
3.2001	25	13	52	Pass
3.2490	24	12	50	Pass
3.2980	24	11	45	Pass
3.3470	23	11	47	Pass
3.3959	21	11	52	Pass
3.4449	21	10	47	Pass
3.4938	19	9	47	Pass
3.5428	18	9	50	Pass
3.5918	18	9	50	Pass
3.6407	16	9	56	Pass
3.6897	16	9	56	Pass
3.7387	16	9	56	Pass
3.7876	16	9	56	Pass
3.8366	16	9	56	Pass
3.8855	14	8	57	Pass
3.9345	13	8	61	Pass
3.9835	11	8	72	Pass
4.0324	11	8	72	Pass
4.0814	11	8	72	Pass
4.1304	11	8	72	Pass
4.1793	10	6	60	Pass
4.2283	10	6	60	Pass
4.2772	9	6	66	Pass
4.3262	9	6	66	Pass
4.3752	8	6	75	Pass
4.4241	8	6	75	Pass
4.4731	7	6	85	Pass
4.5221	7	6	85	Pass
4.5710	7	6	85	Pass
4.6200	7	6	85	Pass
4.6689	7	6	85	Pass
4.7179	7	6	85	Pass
4.7669	7	6	85	Pass
4.8158	7	6	85	Pass
4.8648	7	6	85	Pass
4.9138	6	6	100	Pass

4.9627	6	6	100	Pass
5.0117	6	6	100	Pass
5.0606	6	6	100	Pass
5.1096	6	6	100	Pass

Drawdown Time Results

Predeveloped Landuse Totals for POC #2
Total Pervious Area:2.315056
Total Impervious Area:1.177866

Mitigated Landuse Totals for POC #2
Total Pervious Area:1.795593
Total Impervious Area:1.631635

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	Flow(cfs)
2 year	1.849142
5 year	2.81068
10 year	3.590362
25 year	6.265316

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	Flow(cfs)
2 year	1.404358
5 year	2.26552
10 year	3.009737
25 year	4.589057

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	Predeveloped	Mitigated
1960	2.448	1.466
1961	2.455	2.266
1962	3.383	2.526
1963	5.076	4.537
1964	2.710	2.154
1965	1.201	0.676
1966	2.243	1.331
1967	6.257	4.367
1968	1.856	1.403
1969	2.988	2.985
1970	1.266	1.162
1971	2.206	2.135
1972	0.697	0.400
1973	3.582	3.041
1974	1.873	1.718
1975	3.423	2.321
1976	0.333	0.293

1977	0.501	0.479
1978	2.234	2.158
1979	2.403	1.427
1980	1.776	1.447
1981	0.944	0.744
1982	3.600	2.439
1983	1.946	1.799
1984	2.251	1.406
1985	1.256	0.965
1986	1.395	1.078
1987	1.084	1.064
1988	1.401	1.085
1989	1.009	0.754
1990	1.043	0.881
1991	1.391	0.905
1992	2.811	2.047
1993	1.925	1.669
1994	0.878	0.787
1995	6.328	5.005
1996	1.399	1.060
1997	1.843	1.798
1998	2.131	1.908
1999	1.151	0.817
2000	1.245	1.216
2001	1.067	0.722
2002	1.051	0.719
2003	2.071	1.861

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	6.3282	5.0048
2	6.2575	4.5371
3	5.0764	4.3674
4	3.6004	3.0408
5	3.5823	2.9849
6	3.4229	2.5258
7	3.3828	2.4387
8	2.9884	2.3207
9	2.8107	2.2655
10	2.7105	2.1577
11	2.4554	2.1539
12	2.4483	2.1347
13	2.4027	2.0470
14	2.2505	1.9079
15	2.2432	1.8611
16	2.2339	1.7993
17	2.2063	1.7977
18	2.1306	1.7177
19	2.0712	1.6693
20	1.9463	1.4655
21	1.9245	1.4475
22	1.8729	1.4267
23	1.8557	1.4063
24	1.8429	1.4025
25	1.7761	1.3307
26	1.4010	1.2157

27	1.3991	1.1617
28	1.3953	1.0854
29	1.3907	1.0785
30	1.2662	1.0638
31	1.2558	1.0603
32	1.2446	0.9653
33	1.2012	0.9048
34	1.1510	0.8814
35	1.0845	0.8171
36	1.0674	0.7867
37	1.0508	0.7536
38	1.0430	0.7444
39	1.0088	0.7222
40	0.9442	0.7191
41	0.8783	0.6764
42	0.6969	0.4791
43	0.5010	0.4003
44	0.3327	0.2932

POC #2
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1849	2904	2550	87	Pass
0.2352	2470	2033	82	Pass
0.2854	2144	1660	77	Pass
0.3356	1898	1381	72	Pass
0.3859	1661	1161	69	Pass
0.4361	1475	1048	71	Pass
0.4864	1299	936	72	Pass
0.5366	1169	815	69	Pass
0.5869	1041	714	68	Pass
0.6371	931	634	68	Pass
0.6874	820	573	69	Pass
0.7376	729	511	70	Pass
0.7878	666	471	70	Pass
0.8381	596	433	72	Pass
0.8883	549	396	72	Pass
0.9386	513	360	70	Pass
0.9888	477	321	67	Pass
1.0391	429	284	66	Pass
1.0893	402	256	63	Pass
1.1395	365	229	62	Pass
1.1898	332	204	61	Pass
1.2400	290	191	65	Pass
1.2903	261	170	65	Pass
1.3405	245	161	65	Pass
1.3908	225	147	65	Pass
1.4410	214	135	63	Pass
1.4912	196	129	65	Pass
1.5415	184	117	63	Pass
1.5917	169	107	63	Pass
1.6420	158	99	62	Pass
1.6922	150	89	59	Pass

1.7425	140	87	62	Pass
1.7927	127	82	64	Pass
1.8430	117	76	64	Pass
1.8932	107	69	64	Pass
1.9434	103	66	64	Pass
1.9937	91	63	69	Pass
2.0439	87	60	68	Pass
2.0942	84	56	66	Pass
2.1444	82	55	67	Pass
2.1947	77	53	68	Pass
2.2449	73	50	68	Pass
2.2951	71	46	64	Pass
2.3454	70	46	65	Pass
2.3956	63	45	71	Pass
2.4459	59	44	74	Pass
2.4961	57	40	70	Pass
2.5464	53	38	71	Pass
2.5966	53	34	64	Pass
2.6469	48	34	70	Pass
2.6971	46	28	60	Pass
2.7473	43	27	62	Pass
2.7976	40	26	65	Pass
2.8478	40	26	65	Pass
2.8981	37	25	67	Pass
2.9483	34	24	70	Pass
2.9986	33	22	66	Pass
3.0488	32	21	65	Pass
3.0990	30	17	56	Pass
3.1493	29	16	55	Pass
3.1995	27	16	59	Pass
3.2498	24	15	62	Pass
3.3000	23	13	56	Pass
3.3503	23	12	52	Pass
3.4005	23	12	52	Pass
3.4508	23	12	52	Pass
3.5010	21	12	57	Pass
3.5512	19	10	52	Pass
3.6015	18	10	55	Pass
3.6517	17	9	52	Pass
3.7020	17	9	52	Pass
3.7522	17	9	52	Pass
3.8025	16	9	56	Pass
3.8527	16	9	56	Pass
3.9029	16	9	56	Pass
3.9532	15	9	60	Pass
4.0034	15	9	60	Pass
4.0537	14	9	64	Pass
4.1039	12	9	75	Pass
4.1542	12	9	75	Pass
4.2044	11	9	81	Pass
4.2547	10	9	90	Pass
4.3049	10	8	80	Pass
4.3551	9	7	77	Pass
4.4054	9	6	66	Pass
4.4556	9	6	66	Pass
4.5059	9	6	66	Pass
4.5561	9	6	66	Pass

4.6064	9	6	66	Pass
4.6566	9	6	66	Pass
4.7068	9	6	66	Pass
4.7571	9	6	66	Pass
4.8073	9	6	66	Pass
4.8576	9	6	66	Pass
4.9078	7	6	85	Pass
4.9581	7	6	85	Pass
5.0083	6	6	100	Pass
5.0586	6	6	100	Pass
5.1088	6	6	100	Pass
5.1590	6	6	100	Pass

Drawdown Time Results

Predeveloped Landuse Totals for POC #3
Total Pervious Area:2.201691
Total Impervious Area:0.028344

Mitigated Landuse Totals for POC #3
Total Pervious Area:1.657011
Total Impervious Area:1.057571

Flow Frequency Return Periods for Predeveloped. POC #3

Return Period	Flow(cfs)
2 year	1.050908
5 year	1.56222
10 year	2.109034
25 year	3.287781

Flow Frequency Return Periods for Mitigated. POC #3

Return Period	Flow(cfs)
2 year	0.483543
5 year	1.16494
10 year	1.476106
25 year	2.72572

Annual Peaks for Predeveloped and Mitigated. POC #3

Year	Predeveloped	Mitigated
1960	1.331	0.500
1961	1.289	1.146
1962	2.037	1.165
1963	2.863	2.879
1964	1.474	1.037
1965	0.633	0.229
1966	1.191	0.385
1967	3.218	2.068
1968	1.028	0.614

1969	1.883	1.476
1970	0.748	0.468
1971	1.345	1.249
1972	0.227	0.107
1973	2.199	1.477
1974	1.075	0.901
1975	1.649	0.667
1976	0.028	0.084
1977	0.115	0.214
1978	1.364	1.322
1979	1.328	0.422
1980	0.994	0.707
1981	0.488	0.358
1982	1.871	0.831
1983	1.203	1.064
1984	1.226	0.440
1985	0.660	0.357
1986	0.748	0.429
1987	0.623	0.408
1988	0.792	0.383
1989	0.570	0.334
1990	0.530	0.326
1991	0.569	0.373
1992	1.562	0.992
1993	1.090	0.657
1994	0.483	0.378
1995	3.846	2.707
1996	0.772	0.435
1997	1.145	0.848
1998	1.318	1.321
1999	0.598	0.357
2000	0.755	0.591
2001	0.461	0.227
2002	0.545	0.354
2003	1.243	0.893

Ranked Annual Peaks for Predeveloped and Mitigated. POC #3

Rank	Predeveloped	Mitigated
1	3.8464	2.8786
2	3.2180	2.7066
3	2.8629	2.0680
4	2.1990	1.4765
5	2.0370	1.4758
6	1.8826	1.3217
7	1.8713	1.3212
8	1.6491	1.2494
9	1.5622	1.1649
10	1.4743	1.1463
11	1.3636	1.0636
12	1.3454	1.0370
13	1.3311	0.9921
14	1.3281	0.9006
15	1.3180	0.8931
16	1.2889	0.8478
17	1.2429	0.8306
18	1.2263	0.7070

19	1.2032	0.6670
20	1.1910	0.6571
21	1.1454	0.6139
22	1.0904	0.5911
23	1.0747	0.4996
24	1.0281	0.4681
25	0.9936	0.4398
26	0.7920	0.4354
27	0.7718	0.4285
28	0.7550	0.4222
29	0.7484	0.4077
30	0.7477	0.3846
31	0.6602	0.3826
32	0.6333	0.3782
33	0.6227	0.3731
34	0.5978	0.3576
35	0.5698	0.3567
36	0.5686	0.3567
37	0.5446	0.3538
38	0.5295	0.3338
39	0.4881	0.3257
40	0.4830	0.2287
41	0.4606	0.2268
42	0.2269	0.2140
43	0.1155	0.1072
44	0.0285	0.0837

POC #3
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1051	2094	2118	101	Pass
0.1253	1823	1791	98	Pass
0.1456	1593	1546	97	Pass
0.1658	1434	1363	95	Pass
0.1861	1261	1190	94	Pass
0.2063	1128	1052	93	Pass
0.2265	1019	936	91	Pass
0.2468	904	838	92	Pass
0.2670	829	745	89	Pass
0.2873	737	673	91	Pass
0.3075	660	592	89	Pass
0.3278	598	506	84	Pass
0.3480	538	434	80	Pass
0.3682	502	351	69	Pass
0.3885	473	278	58	Pass
0.4087	430	228	53	Pass
0.4290	387	194	50	Pass
0.4492	351	173	49	Pass
0.4694	325	158	48	Pass
0.4897	296	147	49	Pass
0.5099	272	129	47	Pass
0.5302	240	120	50	Pass
0.5504	216	111	51	Pass

0.5707	200	109	54	Pass
0.5909	189	100	52	Pass
0.6111	172	96	55	Pass
0.6314	161	91	56	Pass
0.6516	154	86	55	Pass
0.6719	144	83	57	Pass
0.6921	138	76	55	Pass
0.7123	128	73	57	Pass
0.7326	124	70	56	Pass
0.7528	110	70	63	Pass
0.7731	102	68	66	Pass
0.7933	93	62	66	Pass
0.8136	89	61	68	Pass
0.8338	82	59	71	Pass
0.8540	81	55	67	Pass
0.8743	79	51	64	Pass
0.8945	77	49	63	Pass
0.9148	71	46	64	Pass
0.9350	69	44	63	Pass
0.9552	67	44	65	Pass
0.9755	64	40	62	Pass
0.9957	61	39	63	Pass
1.0160	60	37	61	Pass
1.0362	54	37	68	Pass
1.0565	49	35	71	Pass
1.0767	47	32	68	Pass
1.0969	44	30	68	Pass
1.1172	43	30	69	Pass
1.1374	41	28	68	Pass
1.1577	38	26	68	Pass
1.1779	38	24	63	Pass
1.1982	36	23	63	Pass
1.2184	34	21	61	Pass
1.2386	32	20	62	Pass
1.2589	31	19	61	Pass
1.2791	28	17	60	Pass
1.2994	26	14	53	Pass
1.3196	25	14	56	Pass
1.3398	23	12	52	Pass
1.3601	22	12	54	Pass
1.3803	20	12	60	Pass
1.4006	19	11	57	Pass
1.4208	18	11	61	Pass
1.4411	17	10	58	Pass
1.4613	17	10	58	Pass
1.4815	16	8	50	Pass
1.5018	16	8	50	Pass
1.5220	15	8	53	Pass
1.5423	14	8	57	Pass
1.5625	13	8	61	Pass
1.5827	12	8	66	Pass
1.6030	12	8	66	Pass
1.6232	12	8	66	Pass
1.6435	11	7	63	Pass
1.6637	10	7	70	Pass
1.6840	10	7	70	Pass
1.7042	10	7	70	Pass

1.7244	10	7	70	Pass
1.7447	9	7	77	Pass
1.7649	9	7	77	Pass
1.7852	9	7	77	Pass
1.8054	9	7	77	Pass
1.8256	9	6	66	Pass
1.8459	9	6	66	Pass
1.8661	9	6	66	Pass
1.8864	6	6	100	Pass
1.9066	6	5	83	Pass
1.9269	6	5	83	Pass
1.9471	6	5	83	Pass
1.9673	6	5	83	Pass
1.9876	6	5	83	Pass
2.0078	6	5	83	Pass
2.0281	6	5	83	Pass
2.0483	5	5	100	Pass
2.0686	5	5	100	Pass
2.0888	5	4	80	Pass
2.1090	5	4	80	Pass

Drawdown Time Results

Predeveloped Landuse Totals for POC #4
Total Pervious Area:0
Total Impervious Area:0

Mitigated Landuse Totals for POC #4
Total Pervious Area:0
Total Impervious Area:0

Flow Frequency Return Periods for Predeveloped. POC #4

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0

Flow Frequency Return Periods for Mitigated. POC #4

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0

Annual Peaks for Predeveloped and Mitigated. POC #4

Year	Predeveloped	Mitigated

Ranked Annual Peaks for Predeveloped and Mitigated. POC #4

Rank	Predeveloped	Mitigated

POC #4
The Facility PASSED

The Facility PASSED.

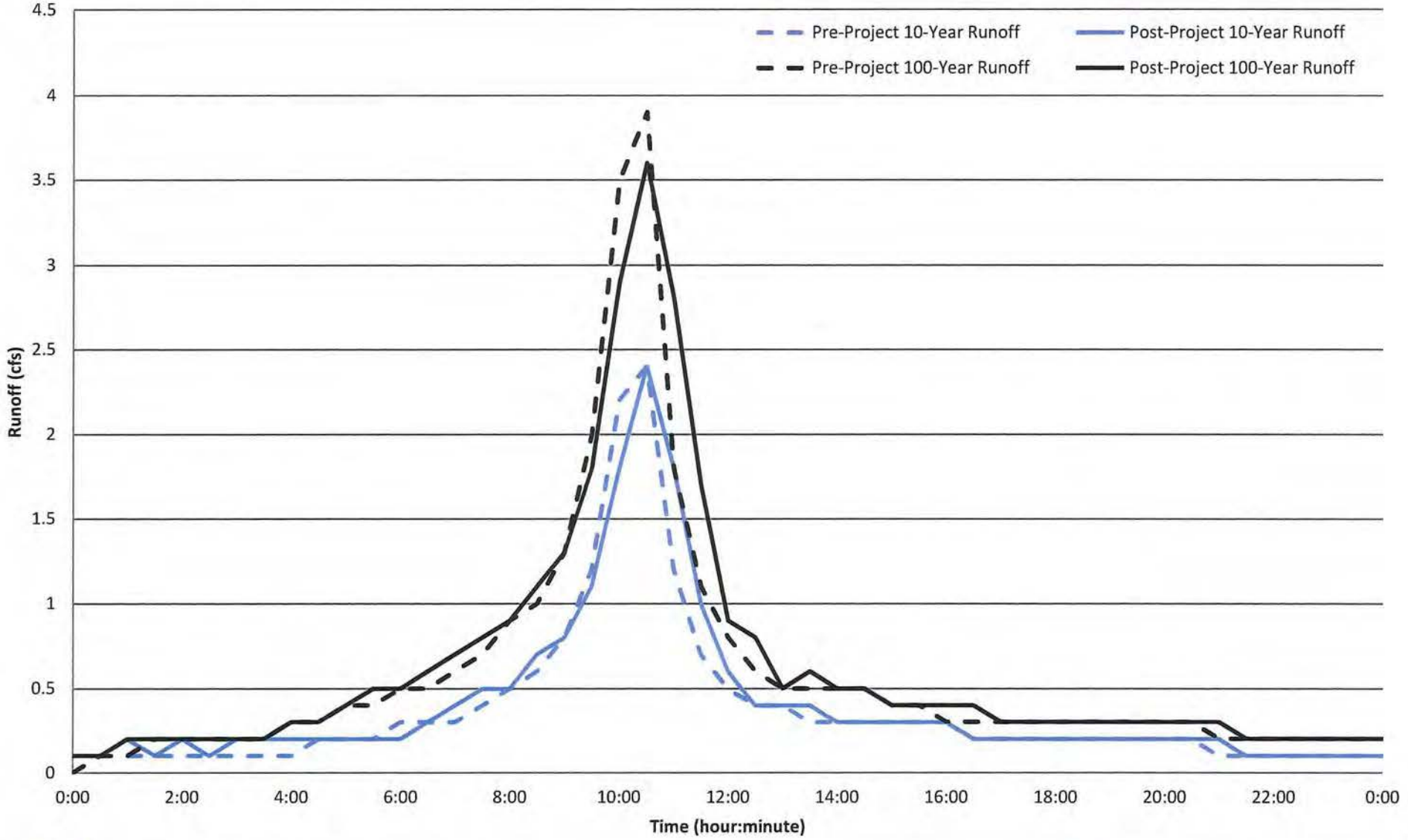
Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0000	0	0	0	Pass
0.0521	0	0	0	Pass
0.1042	0	0	0	Pass
0.1563	0	0	0	Pass
0.2084	0	0	0	Pass
0.2606	0	0	0	Pass
0.3127	0	0	0	Pass
0.3648	0	0	0	Pass
0.4169	0	0	0	Pass
0.4690	0	0	0	Pass
0.5211	0	0	0	Pass
0.5732	0	0	0	Pass
0.6253	0	0	0	Pass
0.6774	0	0	0	Pass
0.7296	0	0	0	Pass
0.7817	0	0	0	Pass
0.8338	0	0	0	Pass
0.8859	0	0	0	Pass
0.9380	0	0	0	Pass
0.9901	0	0	0	Pass
1.0422	0	0	0	Pass
1.0943	0	0	0	Pass
1.1465	0	0	0	Pass
1.1986	0	0	0	Pass
1.2507	0	0	0	Pass
1.3028	0	0	0	Pass
1.3549	0	0	0	Pass
1.4070	0	0	0	Pass
1.4591	0	0	0	Pass
1.5112	0	0	0	Pass
1.5633	0	0	0	Pass
1.6155	0	0	0	Pass
1.6676	0	0	0	Pass
1.7197	0	0	0	Pass
1.7718	0	0	0	Pass
1.8239	0	0	0	Pass
1.8760	0	0	0	Pass
1.9281	0	0	0	Pass
1.9802	0	0	0	Pass
2.0323	0	0	0	Pass
2.0845	0	0	0	Pass
2.1366	0	0	0	Pass
2.1887	0	0	0	Pass
2.2408	0	0	0	Pass
2.2929	0	0	0	Pass
2.3450	0	0	0	Pass

2.3971	0	0	0	Pass
2.4492	0	0	0	Pass
2.5014	0	0	0	Pass
2.5535	0	0	0	Pass
2.6056	0	0	0	Pass
2.6577	0	0	0	Pass
2.7098	0	0	0	Pass
2.7619	0	0	0	Pass
2.8140	0	0	0	Pass
2.8661	0	0	0	Pass
2.9182	0	0	0	Pass
2.9704	0	0	0	Pass
3.0225	0	0	0	Pass
3.0746	0	0	0	Pass
3.1267	0	0	0	Pass
3.1788	0	0	0	Pass
3.2309	0	0	0	Pass
3.2830	0	0	0	Pass
3.3351	0	0	0	Pass
3.3872	0	0	0	Pass
3.4394	0	0	0	Pass
3.4915	0	0	0	Pass
3.5436	0	0	0	Pass
3.5957	0	0	0	Pass
3.6478	0	0	0	Pass
3.6999	0	0	0	Pass
3.7520	0	0	0	Pass
3.8041	0	0	0	Pass
3.8563	0	0	0	Pass
3.9084	0	0	0	Pass
3.9605	0	0	0	Pass
4.0126	0	0	0	Pass
4.0647	0	0	0	Pass
4.1168	0	0	0	Pass
4.1689	0	0	0	Pass
4.2210	0	0	0	Pass
4.2731	0	0	0	Pass
4.3253	0	0	0	Pass
4.3774	0	0	0	Pass
4.4295	0	0	0	Pass
4.4816	0	0	0	Pass
4.5337	0	0	0	Pass
4.5858	0	0	0	Pass
4.6379	0	0	0	Pass
4.6900	0	0	0	Pass
4.7421	0	0	0	Pass
4.7943	0	0	0	Pass
4.8464	0	0	0	Pass
4.8985	0	0	0	Pass
4.9506	0	0	0	Pass
5.0027	0	0	0	Pass
5.0548	0	0	0	Pass
5.1069	0	0	0	Pass
5.1590	0	0	0	Pass

Drawdown Time Results

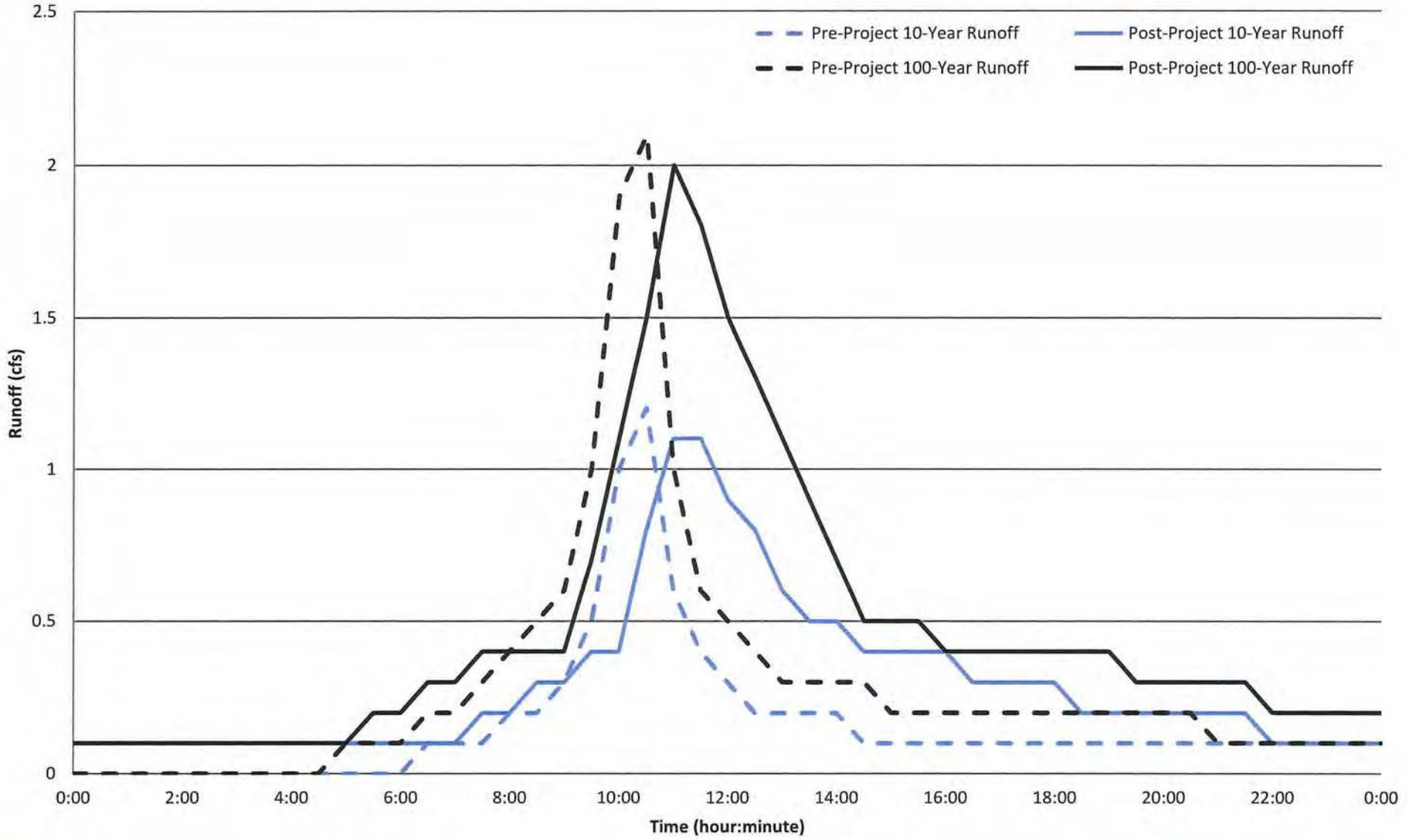
Perlnd and Implnd Changes

No changes have been made.



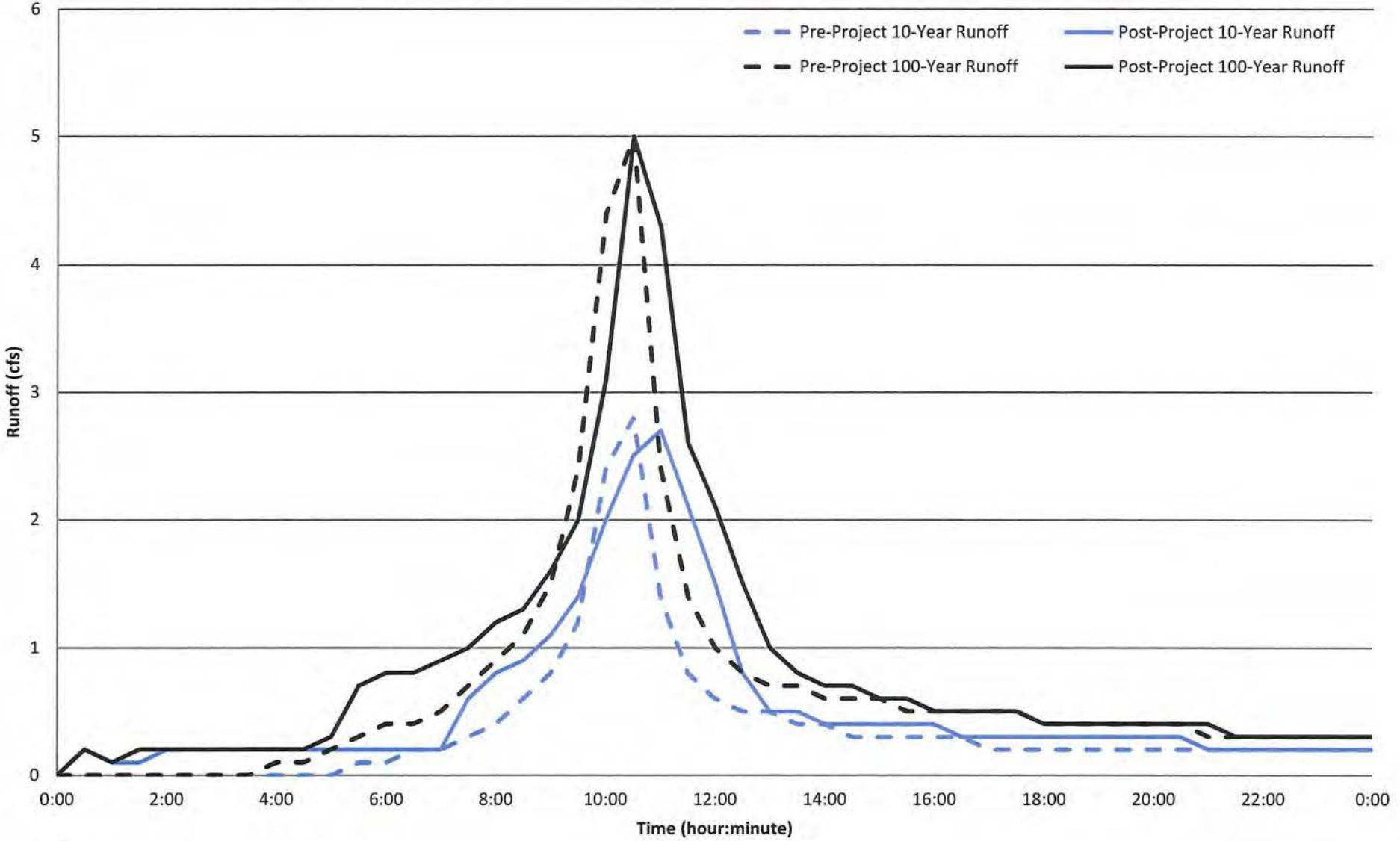
Balance Hydrologics, Inc.

Hydrographs for Analysis Point E1, D Street Project
Fairview, Alameda County, California



Balance Hydrologics, Inc.

Hydrographs for Analysis Point E2, D Street Project
Fairview, Alameda County, California



Balance Hydrologics, Inc.

Hydrographs for Analysis Point W1, D Street Project
Fairview, Alameda County, California