Appendix K

Preliminary Low Impact Development Plan

ESA

PRELIMINARY LOW IMPACT DEVELOPMENT PLAN (LID PLAN)

For:

CROOKED CREEK
DIAMOND BAR, CA

Prepared for:

CATHAY VIEW DEVELOPMENT, LLC

701 S San Gabriel Blvd #D
San Gabriel, CA 91766
(626) 272-2937

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June 2021

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Owner's Certification

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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I hereby certify that this Low Impact Development Plan is in compliance with, and meets the requirements set forth in, Order No. R4-2012-0175, of the Los Angeles Regional Water Quality Control Board

Signature		Date	
Place Stamp Here			

Background

On September 8, 2016, the Los Angeles Regional Water Quality Control Board (LARWQCB) adopted a National Pollutant Discharge Elimination System (NPDES) Permit (R4-2012-0175, as amended by State Water Board Order WQ 2015-0075 and Los Angeles Water Board Order R4-2012-0175-A01 NPDES No CAS004001) to regulate municipal and urban runoff stormwater discharges within the Coastal Watersheds of Los Angeles County. Under this Order, the Costal Watersheds of Los Angeles County including the City of Diamond Bar is required to ensure that all new development and redevelopment projects minimize impacts from storm water runoff and urban runoff discharges. Section VI.D.7 of the Order requires the implementation of a Planning and Land Development Program (Program) pursuant to Part VI.D.7.b for all New Development and Redevelopment projects.

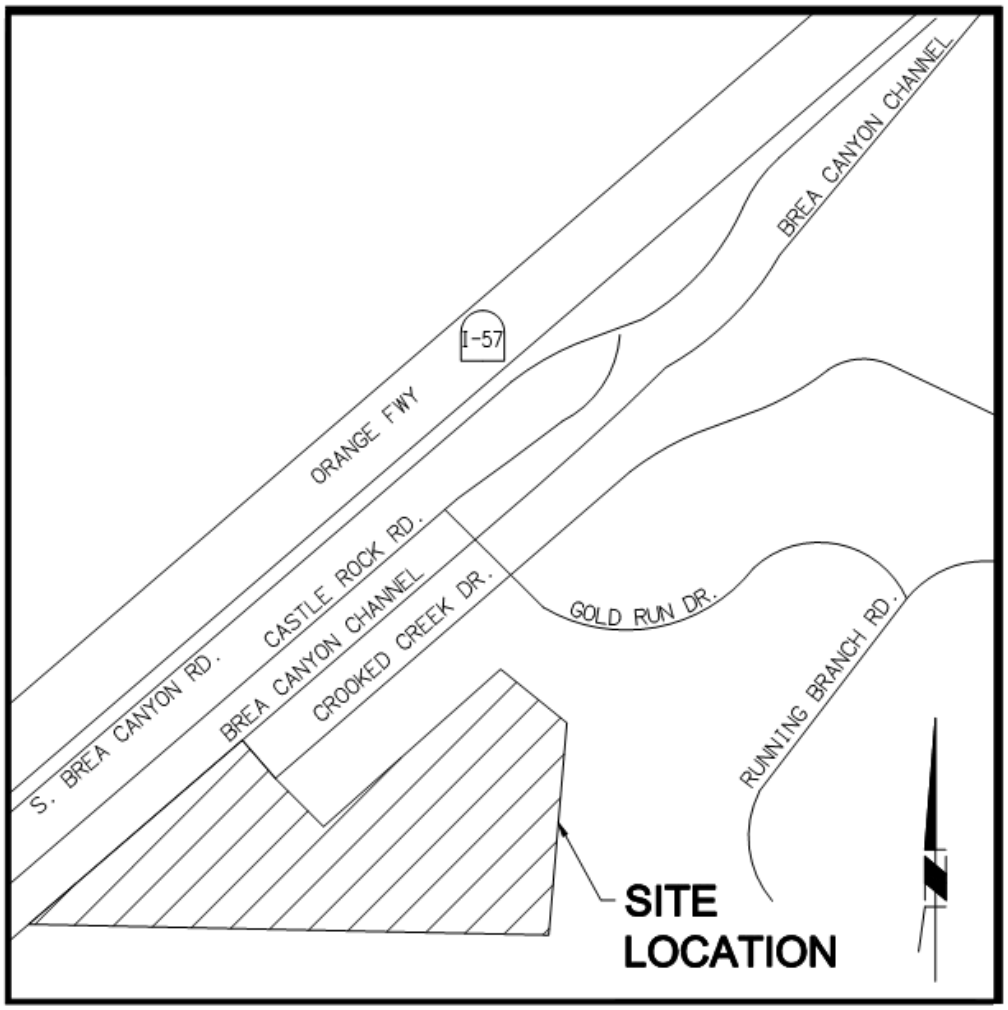
The development of this Low Impact Development Plan (LID Plan) is intended to satisfy the requirements set forth in Order No. R4-2012-0175 as amended by Order WQ 2015-0075, Part VI.D.7.a. The LID Plan also ensures that the proposed post-construction Best Management Practices (BMPs) incorporated into the project will be maintained in perpetuity to reduce the discharge of pollutants from storm water and urban runoff discharges.

Project Information

This Preliminary LID Plan was prepared for the approval of the Vesting Tentative Tract Map. A LID Plan will be prepared to satisfy requirements conditioned by the Los Angeles Regional Water Quality Control Board NPDES MS4 Permit during final engineering.

The Crooked Creek development proposes to extend the existing Crooked Creek Drive in the City of Diamond Bar and construct seven (7) detached single-family residential lots. The entire tract is comprised of 12.9 acres; however, only 2.95 acres will be disturbed. Of those 2.95 acres, 0.60 acres consist of the road extension, 1.54 acres will be the proposed home lots, and the remaining 0.81 acres will be hillside grading with terrace drains and retaining walls and manufactured slopes. The only impervious surface created in the hillside area will be for drainage conveyance and stability. All other areas will remain pervious. Therefore, treatment will not be provided for the 0.81 acres since the ΔSWQDv (Delta Stormwater Quality Design Volume) is expected to be zero. Runoff generated during larger storm events from these pervious slopes and the remaining 9.95 acres of the tract will follow its natural drainage condition as close as possible, bypassing the water quality BMPs, to discharge to Brea Canyon Channel.

The Los Angeles County Hydrology Manual recommends an impervious percentage of 21% for low density single family residential land use and 45% for high density single family residential land use. A weighted average of 35% impervious was calculated to be used as medium density for the lots and the recommended value of 91% for the street.



VICINITY MAP
NOT TO SCALE

Project Site Watershed

The project is located within the San Gabriel River Watershed which covers over 640 square miles. The San Gabriel River Watershed is in the eastern portion of Los Angeles County. It is bound by the San Gabriel Mountains to the north, most of San Bernardino/Orange County to the east, the division of the Los Angeles River from the San Gabriel River to the west, and the Pacific Ocean to the south. The watershed drains into the San Gabriel River from the San Gabriel Mountains flowing 58 miles south until its confluence with the Pacific Ocean. Major tributaries to the San Gabriel River include Walnut Creek, San Jose Creek, Coyote Creek, and numerous storm drains from 19 incorporated cities. Channel flows pass through different sections in the San Gabriel River, diverting from the riverbed into four different spreading grounds, held behind several rubber dams for controlled flow and ground water recharge, and controlled through 10 miles of concrete channel bottom from below Whittier Narrows Dam to past Coyote Creek.

The project is not located in, directly adjacent to, or directly discharging to any known Significant Ecological Area. No transfer of infrastructure to public agencies will occur as a result of this project.

Existing Drainage Patterns

The project site currently consists of steep hillside slopes that discharges directly into the Brea Canyon Channel.

Proposed Drainage Patterns

The proposed development will primarily drain in the north easterly direction. Runoff will be collected by two proposed catch basins via area drains and the curb and gutter. A proprietary biotreatment device will be used to treat runoff prior to discharging it into the storm drain system. Runoff from the manufactured slopes will be collected by the concrete v-ditches which confluence with the 24" storm drain that ultimately connects to Brea Canyon Channel

Planning and Land Development Program Purposes

The Coastal Watersheds of Los Angeles County shall implement a planning and land development program pursuant to Part VI.D.7.b for all New Development and Redevelopment projects subject to this Order to:

(1) Lessen the water quality impacts of development by using smart growth practices such as compact development, directing development towards existing communities via infill or redevelopment, and safeguarding of environmentally sensitive areas.
(2) Minimize the adverse impacts from storm water runoff on the biological integrity of Natural Drainage Systems and the beneficial uses of water bodies in accordance with requirements under CEQA (Cal. Pub. Resources Code § 21000 et seq.).
(3) Minimize the percentage of impervious surfaces on land developments by minimizing soil compaction during construction, designing projects to minimize the impervious area footprint, and employing Low Impact Development (LID) design principles to mimic predevelopment hydrology through infiltration, evapotranspiration and rainfall harvest and use.
(4) Maintain existing riparian buffers and enhance riparian buffers when possible.
(5) Minimize pollutant loadings from impervious surfaces such as roof tops, parking lots, and roadways through the use of properly designed, technically appropriate BMPs (including Source Control BMPs such as good housekeeping practices), LID Strategies, and Treatment Control BMPs.
(6) Properly select, design and maintain LID and Hydromodification Control BMPs to address pollutants that are likely to be generated, reduce changes to pre-development hydrology, assure long-term function, and avoid the breeding of vectors
(7) Prioritize the selection of BMPs to remove storm water pollutants, reduce storm water runoff volume, and beneficially use storm water to support an integrated approach to protecting water quality and managing water resources in the following order of preference:
    (a) On-site infiltration, bioretention and/or rainfall harvest and use.
    (b) On-site biofiltration, off-site ground water replenishment, and/or off-site retrofit.

The following 9 categories are intended to address the requirements set forth by the Order. The following sections address each of the required categories and address how the proposed project meets the Program requirements.

1. Identification of Designated or Non-Designated Project

Part VI.D.7.b.i of the Order states:

Development projects subject to Permittee conditioning and approval for the design and implementation of post-construction controls to mitigate storm water pollution, prior to completion of the project(s), are:

(a) All development projects equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious surface area
(b) Industrial parks 10,000 square feet or more of surface area
(c) Commercial malls 10,000 square feet or more surface area
(d) Retail gasoline outlets 5,000 square feet or more of surface area
(e) Restaurants 5,000 square feet or more of surface area
(f) Parking lots 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces
(g) Street and road construction of 10,000 square feet or more of impervious surface area shall follow USEPA guidance regarding Managing Wet Weather with Green Infrastructure: Green Streets (December 2008 EPA-833-F-08-009) to the maximum extent practicable. Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects. (h)
(h) Automotive service facilities (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) 5,000 square feet or more of surface area (i)
(i) Redevelopment projects in subject categories that meet Redevelopment thresholds identified in Part VI.D.6.b.ii (Redevelopment Projects) below
(j) Projects located in or directly adjacent to, or discharging directly to a Significant Ecological Area (SEA), where the development will:
    i. Discharge storm water runoff that is likely to impact a sensitive biological species or habitat; and
    ii. Create 2,500 square feet or more of impervious surface area
(k) Single-family hillside homes. To the extent that a Permittee may lawfully impose conditions, mitigation measures or other requirements on the development or construction of a single-family home in a hillside area as defined in the applicable Permittee's Code and Ordinances, each Permittee shall require that during the construction of a single family hillside home, the following measures are implemented:
    i. Conserve natural areas
    ii. Protect slopes and channels
    iii. Provide storm drain system stenciling and signage
    iv. Divert roof runoff to vegetated areas before discharge unless the diversion would result in slope instability
    v. Direct surface flow to vegetated areas before discharge unless the diversion would result in slope instability.

Based on Item (a), the Project is a Designated project, since the project area proposed is greater than 1 acre and will add more than 10,000 square feet of impervious surface area.

2. Feasibility of Infiltration

Geotechnical investigations indicate that the underlying soil primarily consists of clays, which are not ideal for infiltration. Surface drainage should be designed to provide drainage away from buildings and foundations. Drainage paths are minimized by incorporating area drains and pipe systems to reduce infiltration into the subgrade soils. Refer to Appendix E for the Geotechnical Report.

3. Source Control Measures

Source control measures that shall be implemented on site are storm drain message and signage.

4. Calculation of SWQDv

Except as provided in Part VI.D.7.c.ii (Technical Infeasibility or Opportunity for Regional Ground Water Replenishment), Part VI.D.7.d.i (Local Ordinance Equivalence), or Part VI.D.7.c.v (Hydromodification), below, each Permittee shall require the project to retain on-site the Stormwater Quality Design Volume (SWQDv) defined as the runoff from

(a) The 0.75-inch, 24-hour rain event or
(b) The 85th percentile, 24-hour rain event, as determined from the Los Angeles County 85th percentile precipitation isohyetal map, whichever is greater.

The project site is located in an area where the 85th percentile, 24-hour precipitation depth is 1.0 inch which will govern as the design precipitation depth.

Table 1 summarizes the SWQDv calculated using the hydrologic calculator HydroCalc that was developed by LACDPW to complete the full MODRAT calculation process. Output sheets from the calculator can be found in Appendix B.

Table 1: Stormwater Quality Design Volume

Drainage Area ID	Area (ac)	Developed Runoff Coefficient	SWQDv (cu-ft)	SWQDv (ac-ft)
A	2.14	0.5115	3,914	0.09

5. Feasibility of Harvest and Use

Harvest and use is infeasible at this site due to the lack of demand for irrigation or other feasible uses of potable water. Refer to Appendix B for demand calculation.

6. Stormwater Quality Control Measures

Stormwater quality control measures will be provided using proprietary devices (T-6). The devices will be sized according to the manufacturer's guidance to biofiltrate 1.5 times the portion of the SWQDv that is not retained. A detention volume of 7,779 cubic feet will be provided for the proprietary devices by approximately 447 feet of 54" RCP and 70 feet of the 42" RCP storm drain system.

Table 2: BMP Sizing Summary

Drainage Area ID	SWQDv (cu-ft)	Design Volume = 1.5x SWQDv (cu-ft)	WetlandMOD Configuration	Treatment Volume (cu-ft)	Storm Drain Detention Volume (cu-ft)
A	3,914	5,871	WM-6-13-V	5,900	6,779

7. Total Maximum Daily Loads (TMDLs)

Pollutants generated from developed areas are dependent upon the type of development and land use associated with the specific project. The project contains low density residential buildings. Pollutants anticipated to be generated on-site are suspended solids, total phosphorus, total nitrogen, cadmium, chromium, copper, lead, and zinc.

Table 3: Typical Pollutants of Concern [1]

Land Use	Pollutants of Concern [2]								
	Suspended Solids	Total Phosphorus	Total Nitrogen	Total Kjeldahl Nitrogen	Cadmium, Total	Chromium, Total	Copper, Total	Lead, Total	Zinc, Total
High Density Single Family Residential	X	X			X[4]	X[4]	X	X	X
Multi-Family Residential	X				X[4]	X[4]	X		X
Mixed Residential	X	X	X		X[4]	X[4]	X	X	X
Commercial	X	X	X	X	X[4]	X[4]	X	X	X
Industrial	X	X	X	X	X[4]	X[4]	X	X	X
Critical Facilities [3]	X	X[4]	X[4]	X[4]	X[4]	X[4]	X	X	X
Transportation (street, roads)	X	X	X	X	X[4]	X[4]	X	X	X
Industrial (educational facilities)	X				X [4]	X[4]	X		X

[1] Adapted from Table A-3 of the Technical Manual for Stormwater Best Management Practices in the County of Los Angeles (February 2004) and the Southern California Coastal Water Research Project Land Use Specific Storm Water Monitoring Data. X = exceedance of "standard" by observed median/average concentration; blank = no exceedance of "standard" by observed median/average concentration.
[2] Derived from Table 11 of the 2012 Los Angeles County MS4 Permit (page 104).
[3] Critical facilities include automobile dismantling (SIC 50xx), automobile repair (SIC 75xx), metal fabrication (SIC 34xx), motor freight (SIC 42xx), automobile dealerships (SIC 55xx), chemical manufacturing (SIC 28xx), and machinery manufacturing (SIC 35xx).
[4] No available data to determine if these pollutants of concern originate from this land use. Pollutant is assumed to be produced by this land use unless otherwise proven by the project applicant.

Receiving waters which are impaired for any of the pollutants of concern which are anticipated from the project need to be addressed through the proposed project BMPs.
Table 4 provides a list of downstream receiving water body impairments including both 303(d) and TMDL impairments.

Table 4: Receiving Water Body Impairments

Receiving Water Body	2014/ 2016 303(d) Impairment(s)	TMDL(s)
Coyote Creek	Copper Dissolved, Indicator Bacteria, Iron, Melathion, pH, Toxiciy	Abnormal Fish Histology (Lesions), Aluminum, Arsenic, Cadium, Chloride, Chlorpyrifos, Chromium, Chromium hexavalent, Cyanide, Diazinon, Endosulfan, Endrin, Excess Algal Growth, Fluoride, Heptachlor epoxide, Iron, Lindane/ gamma Hexachlorocyclohexane (gamma-HCH), Melathion, Mercurym Nickel, Nitrogen ammonia (Total Ammonia), Nitrogen Nitrite, Oxygen Dissolved, Pentachlorophenol (PCP), pH, Selenium, Silber, Temperature water, Toxaphene, Toxicity, Zinc
San Gabriel River Reach 1	pH, Temperature water	Abnormal Fish Histology (Lesions), Ammonia, Arsenic, Bifenthrin, Cadmium, Chlorpyrifos, Chromium, Copper, Cyfluthrin, Cyhalothrin Lambda, Cypermethrin, DDD Dichlorodiphenyldichlorethane), DDE (Dichlorodipenyldichloroenthylene), DDT (Dichlorodiphenyltrichloroethane), Deltamelthrin, Diazinon, Dieldrin, Endrin, Esfenvalerae/ Fenvalerate, Excess Algal Growth, Fenpropathrin, Indicator Bacteria, Iron, Lead, Lindane/ gamma Hexachlorocyclohexane (gamma-HCH), Mercury, Methyl Parathion, Nickel, Oxygen Dissolved, Permethrin, pH, Selenium, Silber, Temperature water, Toxicity, Zinc
San Gabriel River Estuary	Copper, Dioxin, Indicator Bacteria, Nickel, Oxygen Dissolved	Abnormal Fish Histology (Lesions), Ammonia, Arsenic, Cadmium, Chlordane, Chromium, Iron, Lead, Nickel, Oxygen Dissolved, pH, Selenium, Silver, Temperature water, Toxicity, Zinc
San Pedro Bay Near/ Off Shore Zones	Chlordane, Dieldrin, PCBs (Polychlorinated biphenyls), Total DDT, Toxicity	Arsenic, Cadmium, Chlorpyrifos, Chromium, Copper, Dieldrin, Endosulfan, Endrin, Heptachlor epoxide, Hexachlorobenzene/ HCB, Lindane/ gamma Hexchlorocyclohexane (gamma-HCH), Mercury, Mirex, Oxygen Dissolved, PAHs (Polycycli Aromatic Hydrocarbons), pH, Selenium, Zinc

Based on the Typical Pollutants of Concern and the Receiving Water Body Impairments, the selected project BMPs will focus on nitrogen, cadmium, chromium, copper, lead, and zinc.

8. Hydromodification Controls and Calculations

Projects located within natural drainage systems that have not been improved are susceptible to hydromodification. Since this project drains into a natural drainage system, hydromodification control measures need to be implemented such that the runoff flow rate, volume, velocity, and duration for the proposed condition does not exceed the existing condition for the 2-year, 24-hour rainfall event.

HydroCalc was used to compute and compare the 2-year, 24-hour peak flow for the post and pre-development conditions using the following methodology:

1. Analyze Drainage Area A (6.2 acres) for both the existing and the proposed condition.

2. Determine the peak flow rate experienced in the existing condition.

3. Find the period of the proposed condition in which the flow rate exceeds the existing condition peak.

4. Estimate the value under the hydrograph curve between the peak flow rate of the proposed condition and the existing peak flow rate within the period solved above.

5. Use this value as the volume of storage required detain to not exceed the existing flow rate and volume.

Drainage Areas B and Drainage area C has no significant development proposed from pre-development conditions and therefore will not require hydromodification measures.

Table 5: 2-year, 24-hour Comparison

Drainage Area	Area (ac)	Existing Volume (cu-ft)	Proposed Volume (cu-ft)	Existing Peak Flow (cfs)	Proposed Peak Flow (cfs)	Existing Time of Concentration (min)	Proposed Time of Concentration (min)
A-1	0.5	8,807	1,162	4.9	0.3	9	13
A-2	5.5		15,048		4.3		10
A-4	0.2		368		0.2		7
TOTAL	6.2	8,807	16,578	4.9	4.8		

Drainage Area A-2 will include approximately 447 feet of 54” RCP and 70 feet of the 42” RCP storm drain system to provide a detention volume of 7,779 cubic feet in order to meet the existing volume requirement.

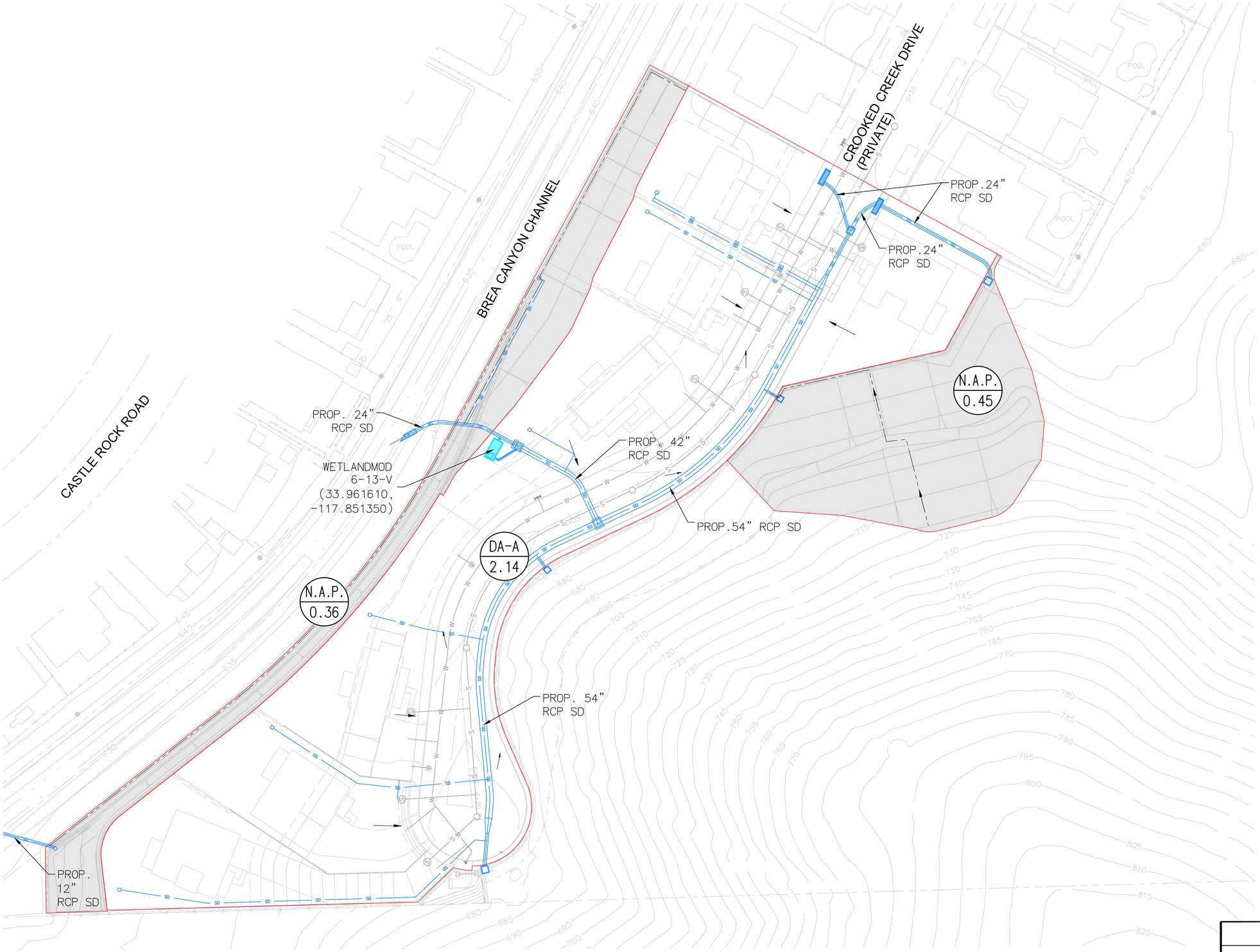
Existing and proposed hydrology exhibits can be found in Appendix D. Refer to Preliminary Hydrology and Hydraulics Report for more details.

9. Operations & Maintenance Plan

The homeowner's association (HOA) will be responsible for inspecting and maintaining the BMPs as described:

BMP Inspection/Maintenance			
BMP	**Reponsible Department / Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
WetlandMOD	HOA	Pretreatment Chamber: Pressure wash the trash screen and remove any debris and trash.	To be implemented biannually before and after the rainy seasons or as needed
		Biofiltration Chamber: Pressure wash vertical surfaces of media and remove any debris and trash. Trim overgrown vegetation and replace mulch as needed.	To be implemented at least annually before rainy seasons or as needed
Provide Storm Drain System Stencilling and Signage	HOA	Legibility of markers and signs should be maintained	To be implemented biannually before and after the rainy season or as needed
Use Efficient Irrigation Systems and Landscape Design	HOA	Design the timing and application of irrigation water to minimize runoff of excess irrigation water	Weekly visual inspections with ongoing landscape activities. Corrective actions to irrigation systems shall take place immediately as needed

APPENDIX A: Exhibits



LEGEND

- WATER QUALITY DRAINAGE AREA
- PERVIOUS SLOPES
- DA-3 / 0.62 — DA DESIGNATION / AREA (ACRE)
- PROPOSED STORM DRAIN
- FLOW DIRECTION
- PROPRIETARY BIOTREATMENT DEVICE
- CATCH BASIN STENCILING

30 15 0 30 60

SCALE: 1"=30'

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CITY OF DIAMOND BAR

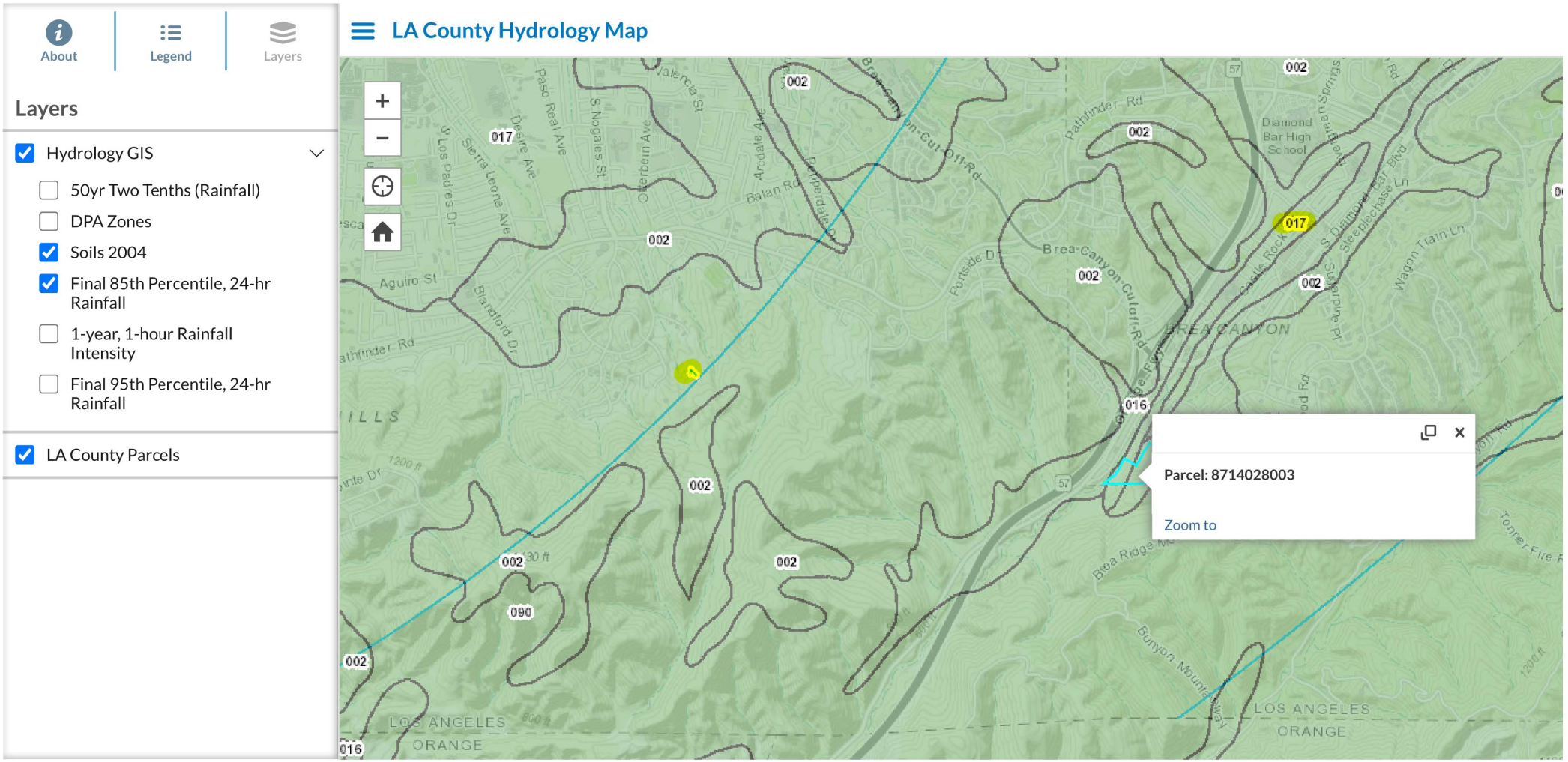
CROOKED CREEK

BMP EXHIBIT

PROJECT NO. 178757

SHEET ____ OF ____

FILE PATH: H:\pdata\178757\CADD\Strmwater\Exhibits\178757 LID Exhibit1.dwg – DATE: Jun 02, 2021, 9:36am


About
Legend
Layers
Layers
Hydrology GIS
50yr Two Tenths (Rainfall)
DPA Zones
Soils 2004
Final 85th Percentile, 24-hr Rainfall
1-year, 1-hour Rainfall Intensity
Final 95th Percentile, 24-hr Rainfall
LA County Parcels
LA County Hydrology Map
Parcel: 8714028003
Zoom to
BREA CANYON
LOS ANGELES
ORANGE
Brea-Canyon-Cut-Off-Rd
Pathfinder Rd
Diamond Bar High School
002
017
016
090

Appendix B: BMP Sizing and Fact Sheets

Peak Flow Hydrologic Analysis

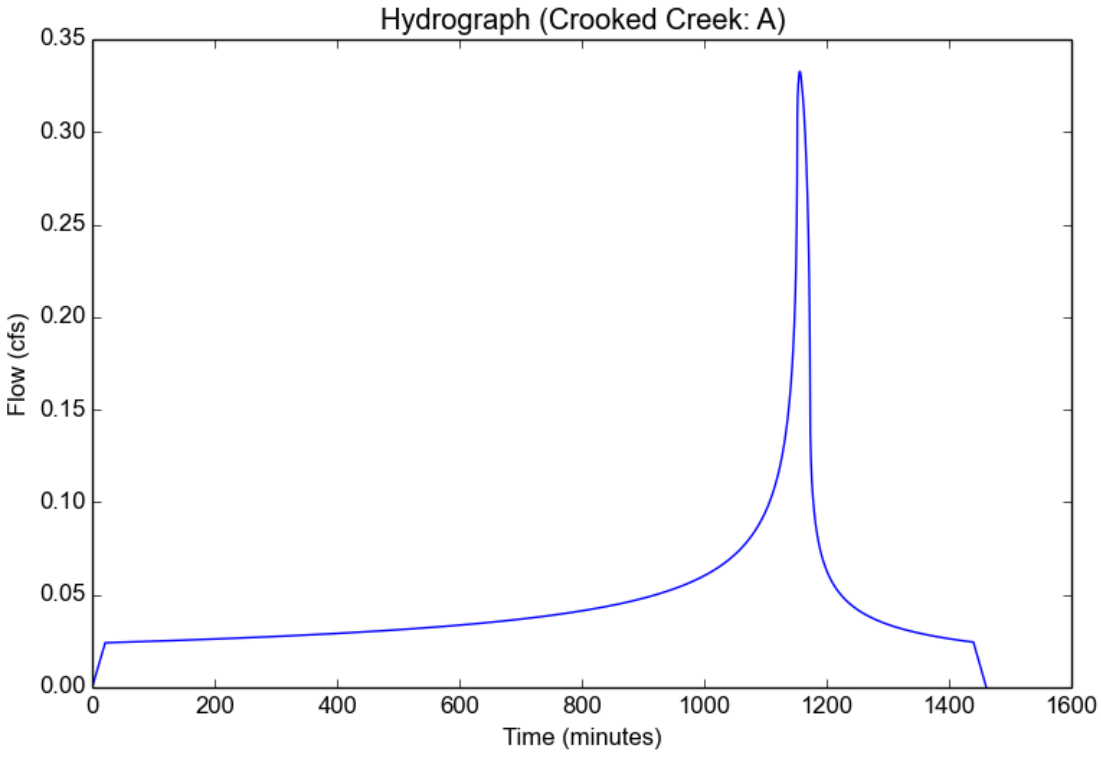
File location: H:/pdata/178757/Calcs/Strmwater/Water Quality/Crooked Creek HydroCalc.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	A
Area (ac)	2.14
Flow Path Length (ft)	360.0
Flow Path Slope (vft/hft)	0.05
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.51
Soil Type	17
Design Storm Frequency	85th percentile storm
Fire Factor	sgr
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.3039
Undeveloped Runoff Coefficient (Cu)	0.1072
Developed Runoff Coefficient (Cd)	0.5115
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	0.3327
Burned Peak Flow Rate (cfs)	0.3858
24-Hr Clear Runoff Volume (ac-ft)	0.0899
24-Hr Clear Runoff Volume (cu-ft)	3914.1427



Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		☐	
3	Landscape irrigation		☒	
4	Other:_____		☐	
5	What is the design capture storm depth? (**Figure III.1**)	d	1.0	inches
6	What is the project size?	A	2.14	ac
7	What is the acreage of impervious area?	IA	1.09	ac
	For projects with multiple types of demand (toilet flushing, indoor demand, and/or other demand)			
8	What is the minimum use required for partial capture? (**Table X.6**)			gpd
9	What is the project estimated wet season total daily use?			gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)			
	For projects with only toilet flushing demand			
11	What is the minimum TUTIA for partial capture? (**Table X.7**)			
12	What is the project estimated TUTIA?			
13	Is partial capture potentially feasible? (Line 12 > Line 11?)			
	For projects with only irrigation demand			
14	What is the minimum irrigation area required based on conservation landscape design? (**Table X.8**)		1.20	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)		1.09	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)		No	

Provide supporting assumptions and citations for controlling demand calculation:

This Worksheet from the Orange County Technical Guidance is used as a reference since an assessment like this is not readily available for LA County. A rain depth of 1.0 inches was used to match the 85th percentile, 24-hour precipitation depth in this area. The most conservative (minimum) value from Table X.8 for conservation design (K_L = 0.35) was used as the minimum required irrigated area per tributary imperious acre for potential partial capture. This analysis assumes that all pervious areas will be irrigated. It is determined that partial capture is not feasible.

Table X.8: Minimum Irrigated Area for Potential Partial Capture Feasibility

General Landscape Type	Conservation Design: K_L = 0.35			Active Turf Areas: K_L = 0.7		
Closest ET Station	*Irvine*	*Santa Ana*	*Laguna*	*Irvine*	*Santa Ana*	*Laguna*
Design Capture Storm Depth, inches	**Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac**					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.90	0.41	0.42	0.45
0.80	0.88	0.90	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.10	1.12	1.20	0.55	0.56	0.60

Bio Clean®

A Forterra Company

WetlandMod®

A Stormwater Biofiltration Solution

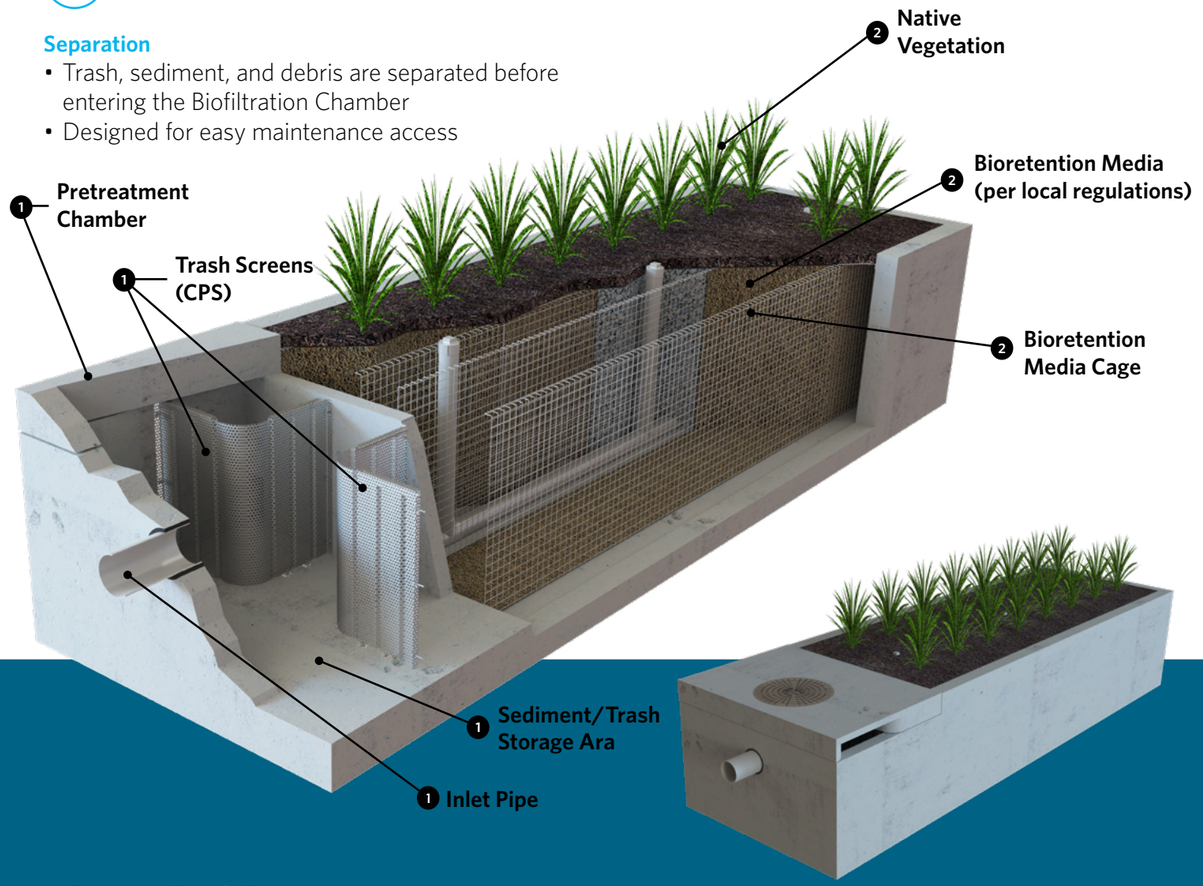
OVERVIEW

The WetlandMod® provides the ***right*** direction in stormwater bioretention/biofiltration treatment, leveraging the same horizontal flow advantages as the Modular Wetlands® System Linear to combine screening, separation, and biofiltration treatment stages.

WetlandMod is a modular compact solution, and Low Impact Development (LID) solution which is functionally equivalent to bioretention, with up to a 50% smaller footprint and the ability to reduce and control water volume in a more efficient way.

1 PRETREATMENT CHAMBER

Separation
- Trash, sediment, and debris are separated before entering the Biofiltration Chamber
- Designed for easy maintenance access



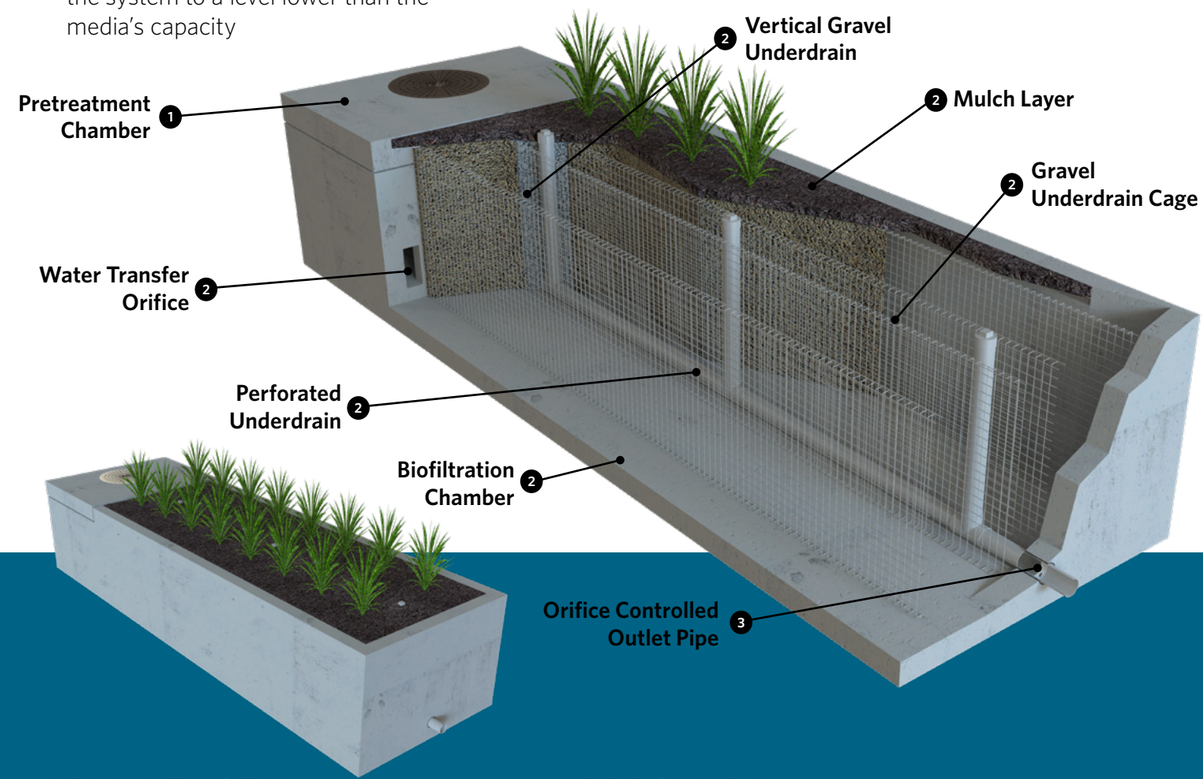
2 BIOFILTRATION CHAMBER

Horizontal Flow
- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Vertical Void Area
- Vertical ponding area between the walls and biofiltration media
- Maximizes surface area of the media for higher treatment capacity

3 DISCHARGE

Flow Control
- Orifice plate controls flow of water through the system to a level lower than the media's capacity
- Extends the life of the media and improves performance



ADVANTAGES

- REDUCES CLOGGING
- BUILT-IN PRETREATMENT
- USES AGENCY PRESCRIBED BIORETENTION SOILS
- NO DEPRESSED LANDSCAPING/ PONDING WATER
- 50% SMALLER FOOTPRINT
- LID COMPLIANT
- NO STANDING WATER / VECTOR CONTROL ISSUES

ADVANTAGES

- 5" - 12"/ HOUR INFILTRATION RATE
- LOW MAINTENANCE COSTS
- INCREASED AESTHETIC APPEAL
- NO SAFETY CONCERNS

APPROVALS

WASHINGTON ECOLOGY

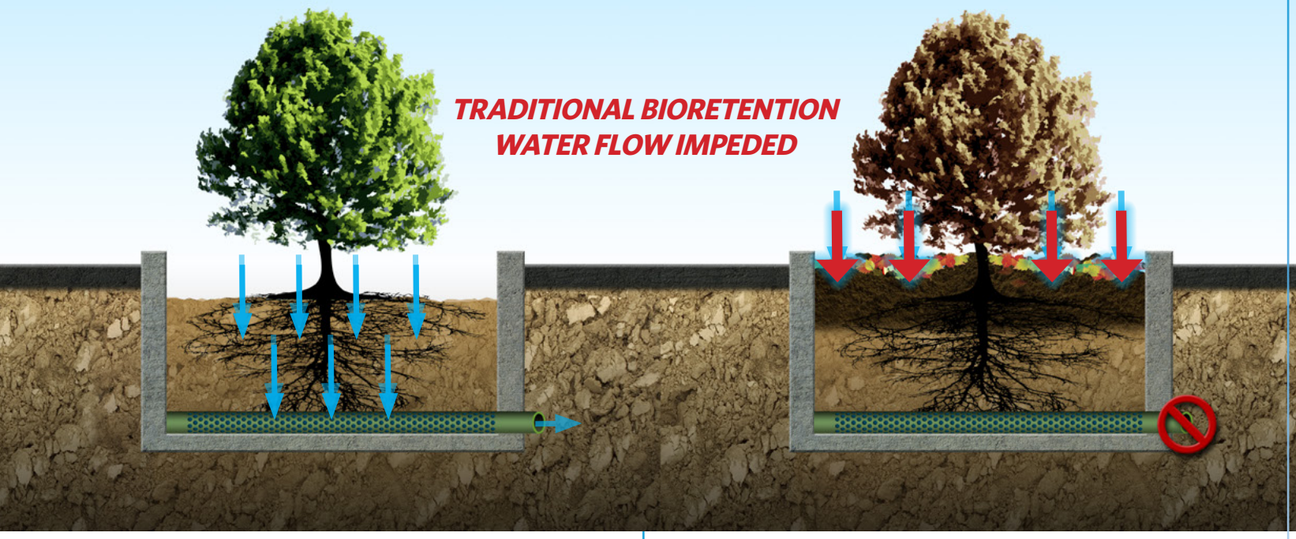
Functionally Equivalent to a Bioretention Facility for Treating Stormwater

(Bioretention examples: Planter Boxes, Rain Gardens, Biofiltration)

ALTERNATIVE DOWNWARD FLOW FLAWS

Bioretention systems have an inherent flaw — the force of gravity. As stormwater runoff carries pollutants into the system, including sediments and hydrocarbons, they are deposited on top of the bioretention media where it accumulates and quickly clogs the filter media.

It has been documented that sediment accumulation from just a few storm events can completely clog a bioretention system. This leads to drastically reduced infiltration rates, expensive maintenance burdens, and safety issues associated with standing water, depressed landscaping, and vector control.



Downward flow systems filter water in a single vertical direction, forcing polluted material to build up on the top.

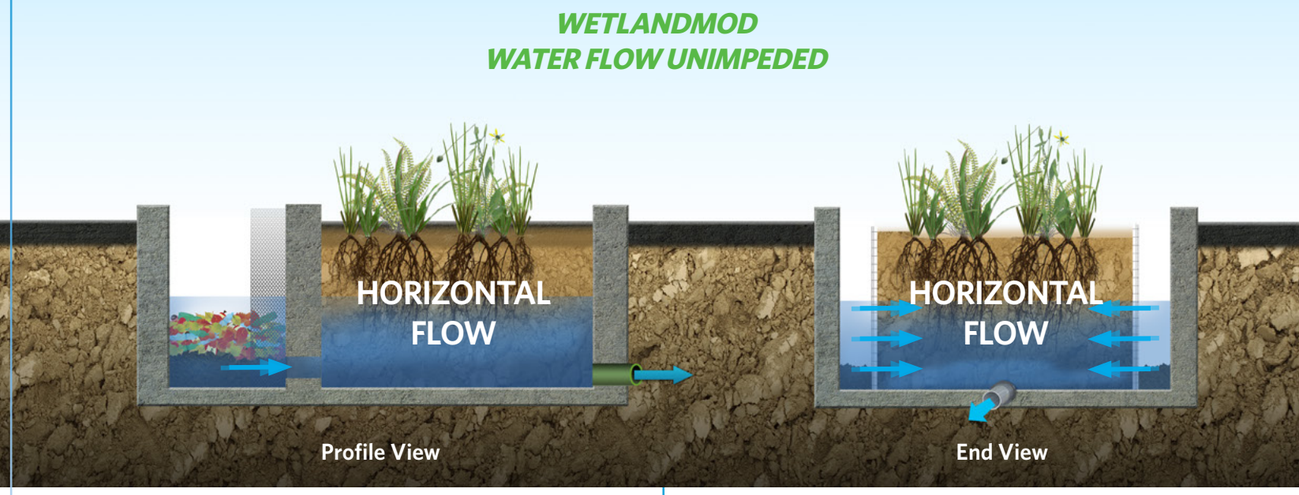
As sediment rapidly builds up on the media bed, flow is impeded and the bioretention system quickly clogs or fails.

OPERATION

WETLANDMOD FLOW DIRECTION

Horizontal flow biofiltration systems allow sediments to accumulate adjacent to the media bed, drastically reducing clogging, and focusing maintenance attention to one area; for long-term efficiency and treatment quality.

WetlandMod's horizontal design also allows water to consistently flow subsurface, clear of obstructions in a more controlled state.



Sediment, trash and debris entering the WetlandMod accumulate adjacent to vertical media surface, reducing clogging.

The vertical ponding area (void area) maximizes sedimentation and minimizes clogging issues associated with downward flow bioretention.

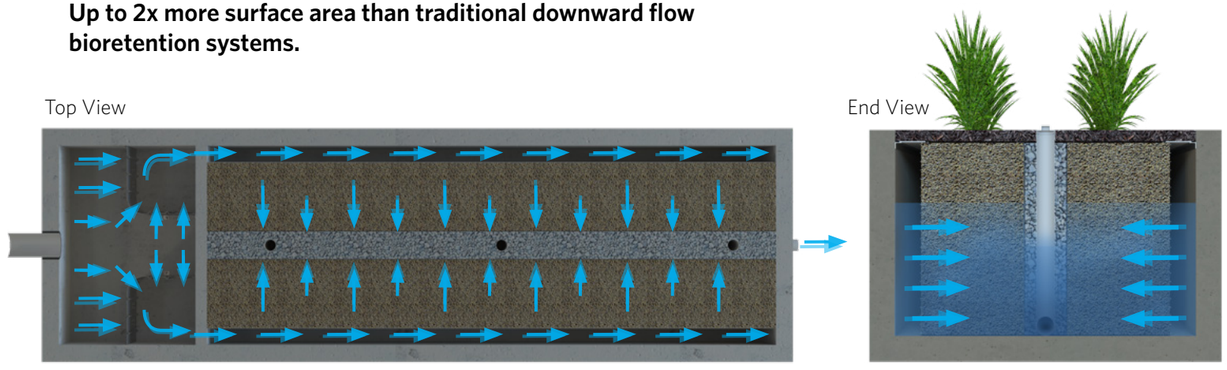
	Standard Bioretention	WetlandMod System
Total Suspended Solids (TSS) Performance Above 90%?	✓ Yes	✓ Yes
Water Volume Treated	✗ 1.074 Million Gallons	✓ 1.596 Million Gallons (33%More)
Sediment Load Treated	✗ 8,224 Pounds	✓ 11,460 Pounds (28% More)

Notes
1. Numbers scaled to a 1306 sqft bioretention system which is typical sizing for a 1 acre commercial development
2. Testing stopped once infiltration rate fell below 5 in/hr at which point the system is no longer treating the design flow rate or water quality volume.
3. Based upon independent third-party comparative testing.

BIOFILTRATION CHAMBER

The patented void area maximizes surface area and minimizes footprint, saving space and money. The unique design accomplishes this by allowing water to penetrate the media bed, not only from the top, but from each side.

Up to 2x more surface area than traditional downward flow bioretention systems.

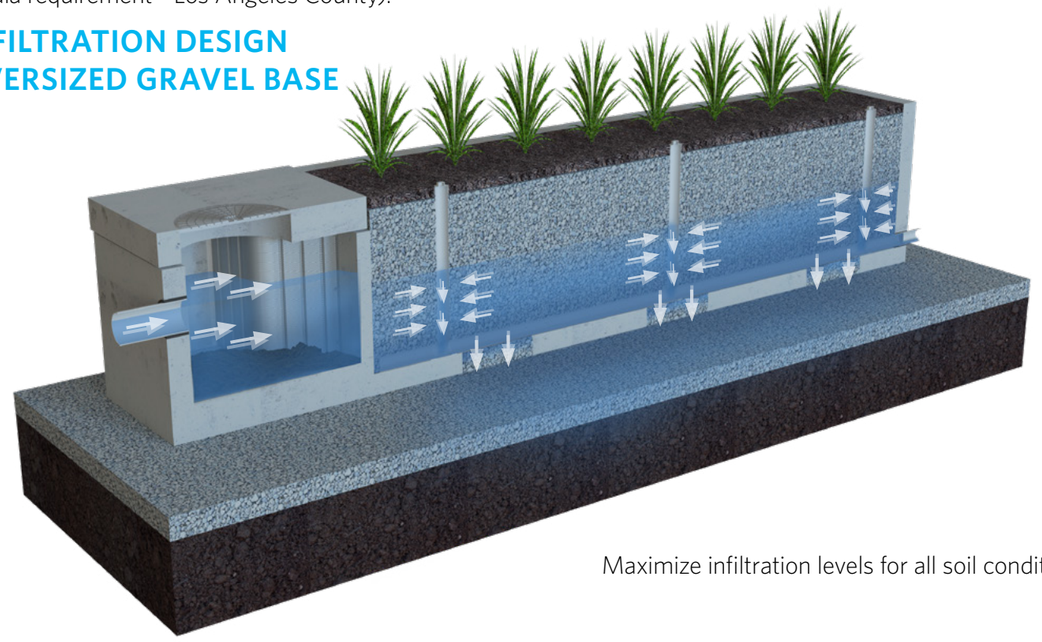


CONFIGURATIONS

The goal of the WetlandMod system is to minimize footprint and land costs associated with traditional bioretention/biofiltration systems. This is acheived by utilizing horizontal flow technology and combining it with traditional downward flow, therefore maximizing the surface area for a given footprint.

WetlandMod is constructed from modular precast concrete structures. The system can be configured as standard curb type, multiple inlet pipes, and/or grate options into the pretreatment chamber with optional internal bypass. The biofiltration chambers can be designed for various length and width combinations (shown below) to allow for easy integration with parking lot island designs. The system comes in two standard widths: 5 feet (18" minimum media requirement - San Diego County and Bay Area Region) and 6 feet (24" minimum media requirement - Los Angeles County).

INFILTRATION DESIGN
OVERSIZED GRAVEL BASE

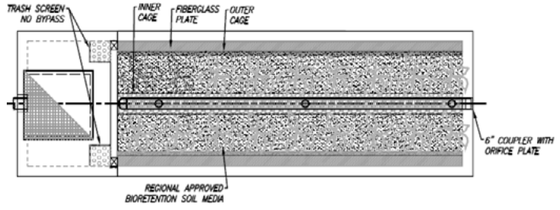


Maximize infiltration levels for all soil conditions.

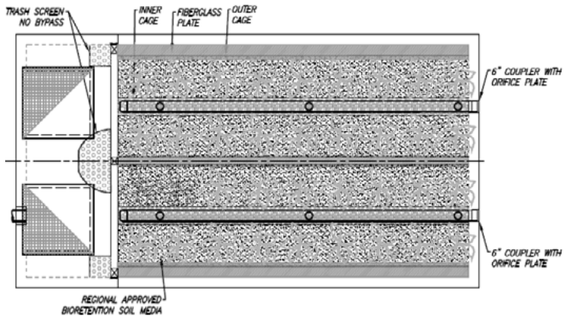
HIGHLY MODULAR

Our standard 6 foot single row and 11 foot double row models, for 24" soil media thickness, are commonly used together to meet wide design requirements and address transportation challenges.

Single Row



Double Row



INSTALLATION

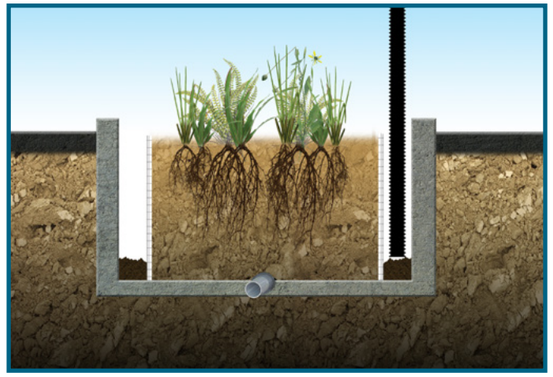
Simple vault and media installation.

All-in-one treatment train, no need for separate trash capture manhole or vault.

MAINTENANCE

A quick and easy maintenance regimen begins with a simple design, and the WetlanMod features benefits that no other bioretention system can replicate. First, the WetlandMod's pretreatment chamber can be accessed via a manhole cover or grate, providing consolidated access to most of the trash, debris, and sediment. The perimeter void areas are more easily accessible with a conventional vacuum truck, allowing plant beds to remain undisturbed.

The average maintenance time is 45 minutes using a standard vacuum truck.



The WetlandMod is designed for easy hose line access to every debris and sediment chamber.

In areas under C.3 guidance, there is no need for removal and replacement of the 6 inches or more of top soil, so there is no risk of damaging the plants and irrigation systems (if needed) that may occur during the topsoil replacement with a vertical flow planter.

Bio Clean
A Forterra Company

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Carlsbad, CA 92008
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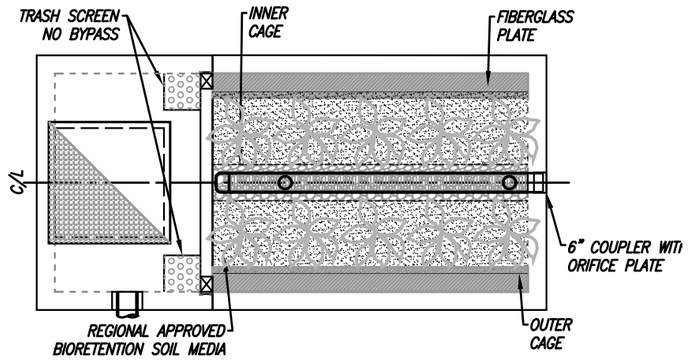
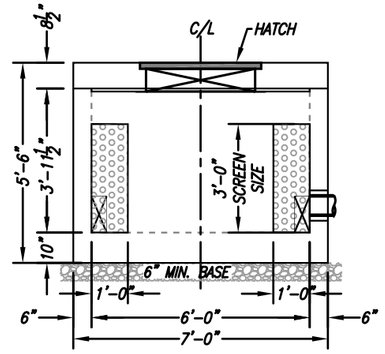
stormwater@forterrabp.com
biocleanenvironmental.com

02202020ZC

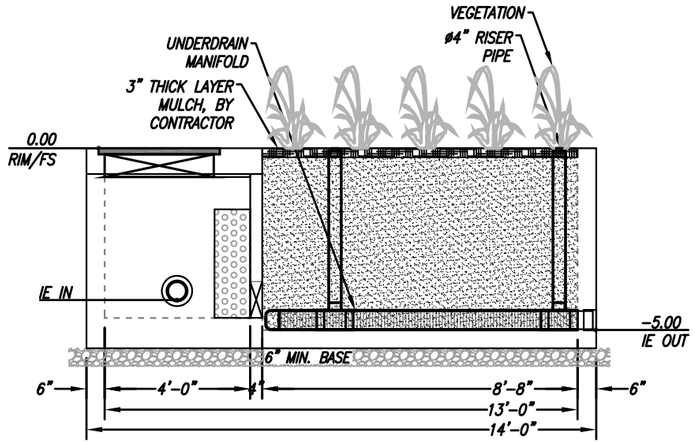
SITE SPECIFIC DATA			
PROJECT ID		12240.00	
PROJECT NAME		CROOKED CREEK	
PROJECT LOCATION		DIAMOND BAR, CA	
STRUCTURE ID		SCENARIO 2	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
5600		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE	N/K	N/K	6"
INLET PIPE	N/A	N/A	N/A
OUTLET PIPE	-5.00	PVC-SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	0.00	0.00	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	36" X 36"	N/A	N/A
LA COUNTY MEDIA MIX VOLUME (CY)			5.60
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			1.20
ORIFICE DIAMETER (IN)			ø0.57"
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.			



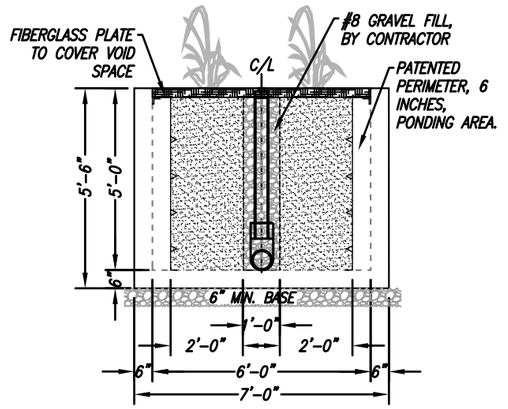
PLAN VIEW



INLET VIEW



ELEVATION VIEW



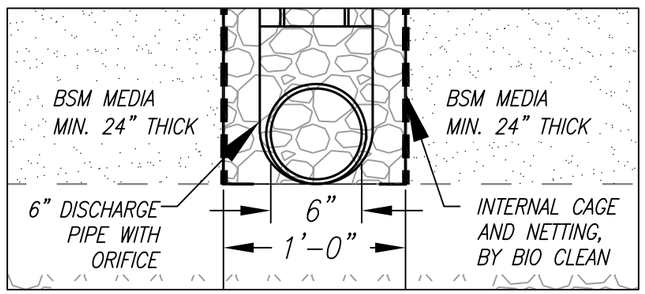
OUTLET VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURER'S STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



INTERNAL CAGE DETAILS

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)	24
TREATMENT VOLUME (CF)	5900
TARGETED DRAINDOWN DURATION (HR)	96
WETLANDMEDIA INFILTRATION RATE (IN/HR) — OR	12
WETLANDMEDIA LOADING RATE (GPM/SF)	0.12
DISCHARGE RATE (CFS)	0.016
REQUIRED TOTAL MEDIA SURFACE AREA (SF)	60.60
PROVIDED TOTAL MEDIA SURFACE AREA (SF)	71.00
NUMBER OF ROW(S)	1

Bio Clean
A Forterra Company

WetlandMOD-6-13-5'-0"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

APPENDIX C: Operation and Maintenance of BMPs

BMP Inspection Log

BMP: _____

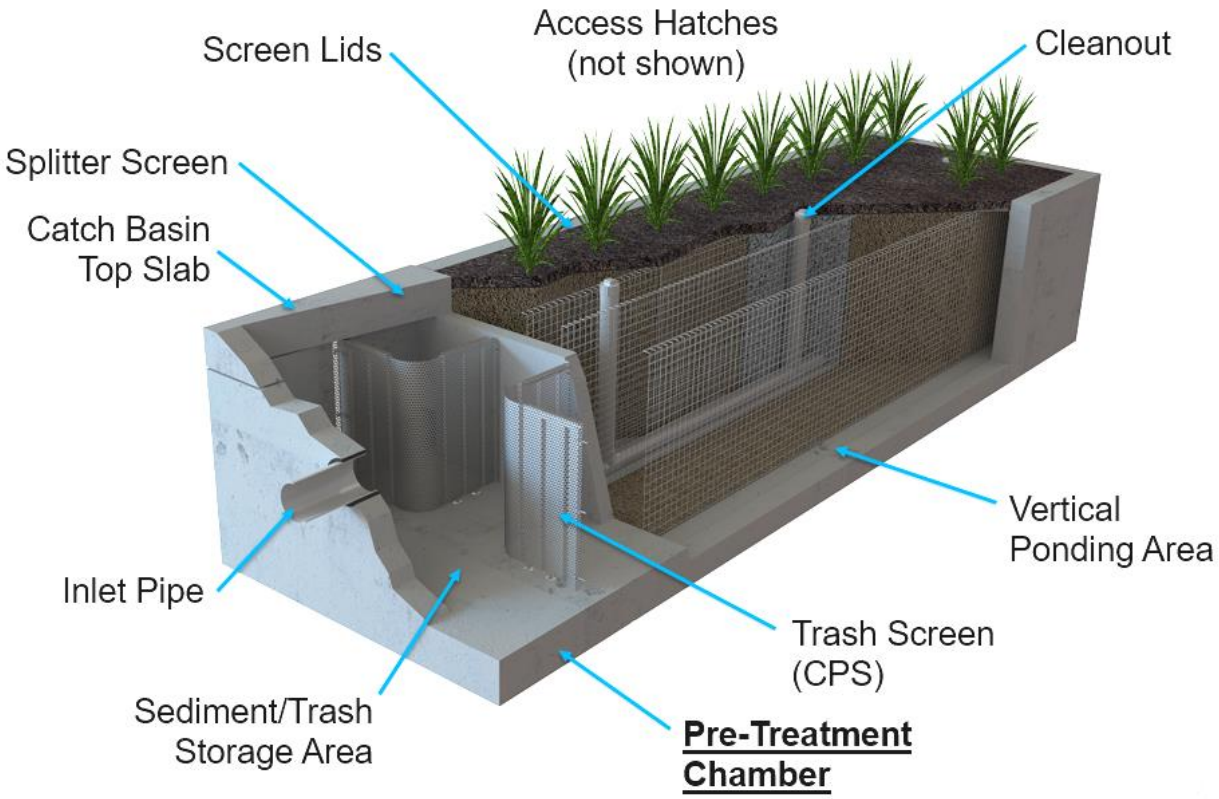
Date	Maintenance Performed	Re-Inspection Date	Comments

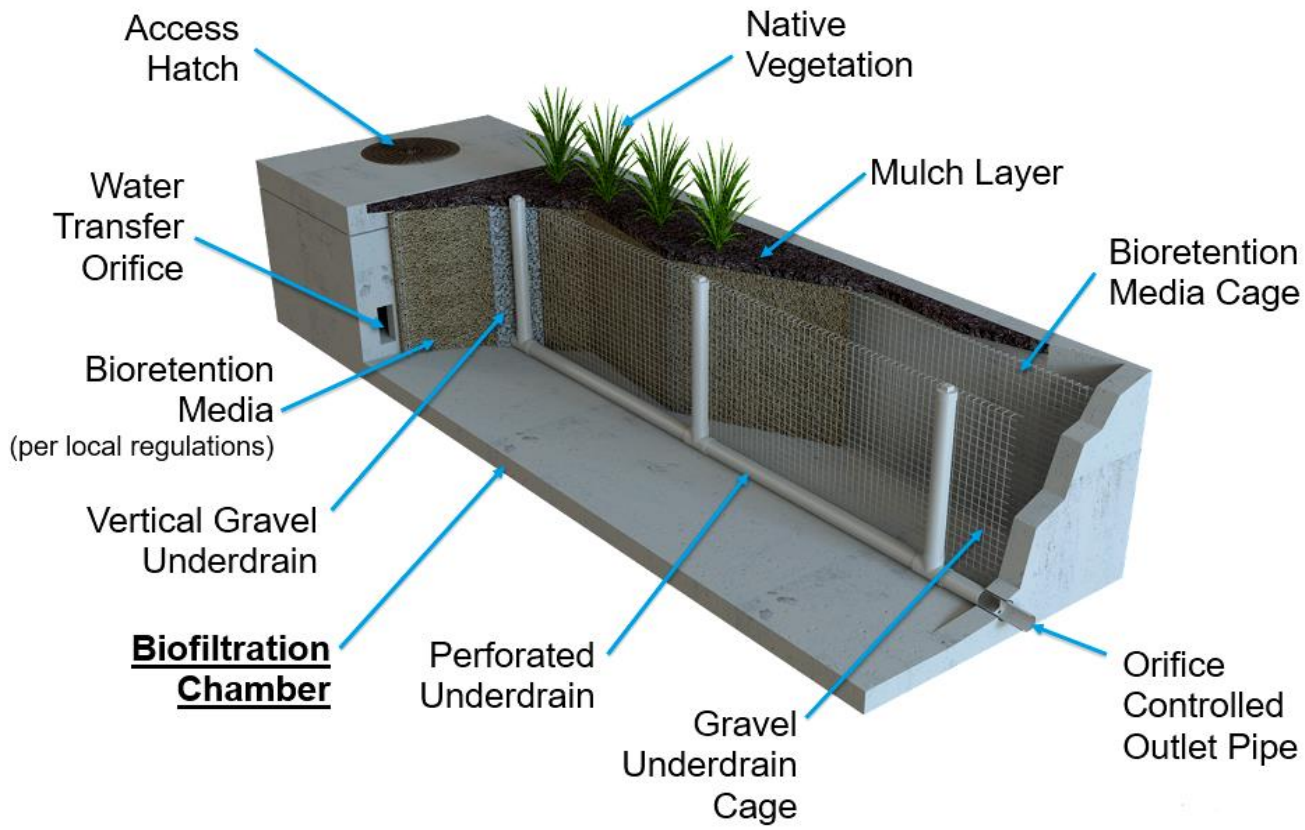
Inspection Guidelines for WetlandMOD

Inspection Summary

- Inspect Pre-Treatment Chamber – average inspection interval is 6 to 12 months.
  - (5-*minute average inspection time*).
- Inspect Biofiltration Chamber – average inspection interval is 6 to 12 months.
  - (1*0-minute average inspection time*).
- NOTE: Pollutant loading varies greatly from site to site and no two sites are the same. Therefore, the first year requires inspection monthly during the wet season and every other month during the dry season in order to observe and record the amount of pollutant loading the system is receiving.

System Diagram





Inspection Overview

As with all stormwater BMPs inspection and maintenance on the WetlandMOD is necessary. Stormwater regulations require that all BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific loading conditions. This is recommended because pollutant loading and pollutant characteristics can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding on roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided. Without appropriate maintenance a BMP will exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the WetlandMOD:

- WetlandMOD Inspection Form
- Flashlight
- Manhole hook or appropriate tools to remove access hatches and covers (if applicable)
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure.
- Protective clothing and eye protection.

- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system.

Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the WetlandMOD are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The WetlandMOD can be inspected though visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access. Once the top tray is removed the following apply:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the pre-treatment chamber and biofiltration chamber once the access hatch is removed. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the system and all of its chambers.
- Look for any out of the ordinary obstructions in the inflow pipe, around the trash screen (CPS), on the surface of the media, or in the drain down riser. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, debris and sediment accumulated in the chamber. Utilizing a tape measure or measuring stick estimate the amount of trash, debris and sediment on the floor of each chamber. Record this depth on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the system or its inlet or outlet.

- Excessive accumulation of floatables more than 12” in depth in the pre-treatment chamber.
- Excessive accumulation of sediment of more than 6” in depth in the biofiltration chamber.
- Excessive build up on the vertical surface of the biofiltration media.
- Overgrown vegetation.
- Storage area around media cage has standing water 72 hours after a storm event.

Inspection Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Media.

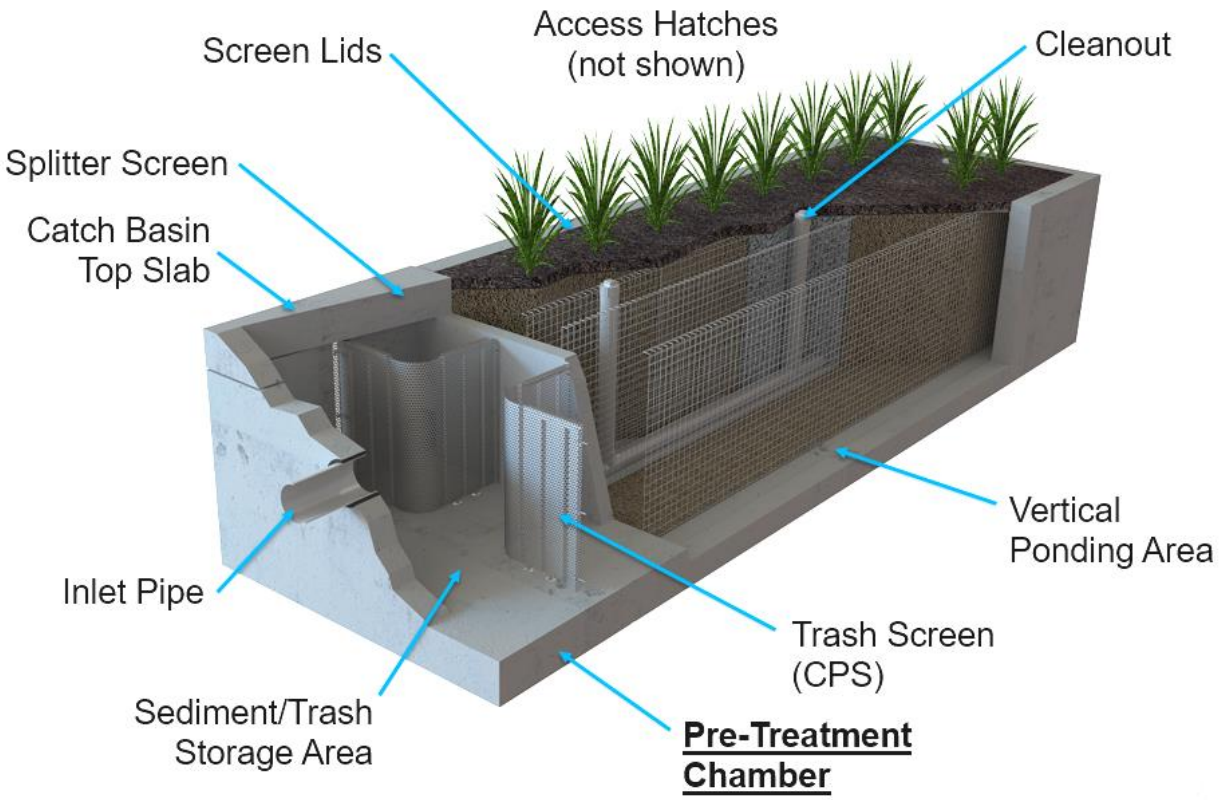
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

Maintenance Guidelines for WetlandMOD

Maintenance Summary

- Remove Sediment and Trash from Pre-Treatment Chamber – average maintenance interval is 6 to 12 months.
  - (*15 minute average service time*).
- Removed Sediment and Pressure Wash Biofiltration Media Surface – average maintenance interval 12 to 24 months.
  - (*15-60 minutes depending on size of system).*
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Overview

The time has come to maintain your WetlandMOD. To ensure successful and efficient maintenance on the system we recommend the following. The WetlandMod can be maintained by removing the access hatches. The mulch over the top tray should be removed prior to removing the top hatch over the biofiltration chamber. All necessary pre-maintenance steps must be carried out before maintenance occurs, especially traffic control and other safety measures to protect the inspector and near-by pedestrians from any dangers associated with an open access hatch or manhole. Once traffic control has been set up per local and state regulations and access covers have been safely opened the maintenance process can begin. It should be noted that no maintenance activities require confined space entry but if entry is done all confined space requirements must be strictly followed before entry into the system. In addition the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and cleaning equipment.
- Ensure traffic control is set up and properly positioned.
- Prepare a pre-checks (OSHA, safety, confined space entry) are performed.

Maintenance Equipment

Following is a list of equipment required for maintenance of the WetlandMOD:

- WetlandMOD Maintenance Form
- Manhole hook or appropriate tools to access hatches and covers (if applicable)
- Protective clothing, flashlight and eye protection.
- Vacuum assisted truck with pressure washer.
- Replacement pre-filter wraps (order from manufacturer).

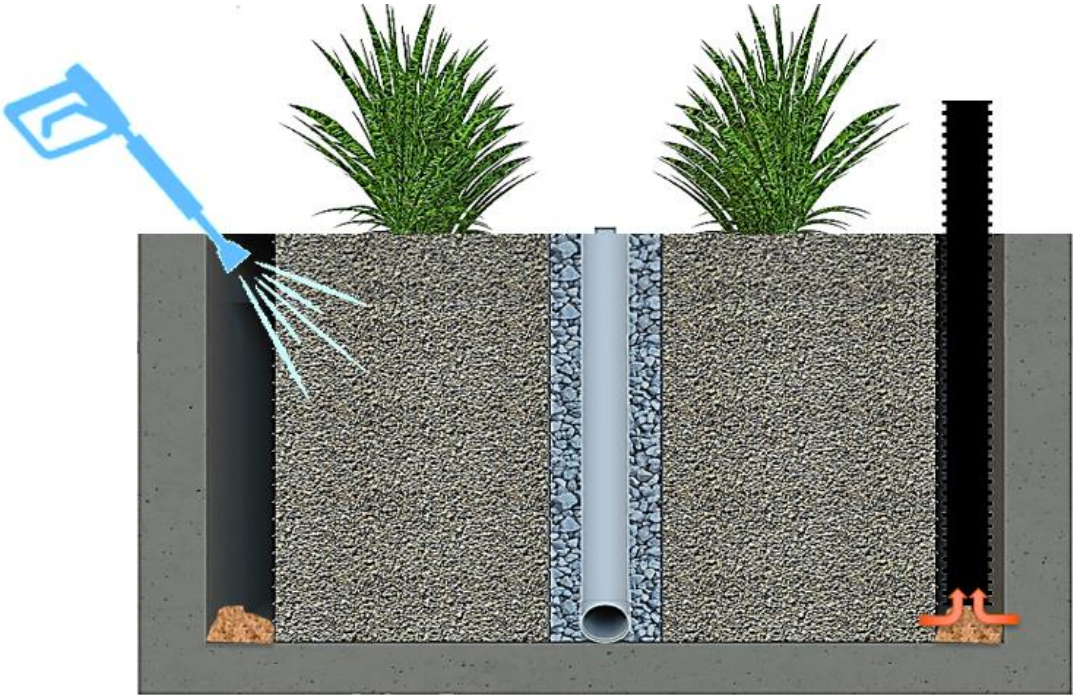
Maintenance Steps

1. Pre-Treatment Chamber (first chamber that contains trash screens)

   A. Remove access hatch and position vacuum truck accordingly.
   B. With a pressure washer spray down pollutants accumulated on trash screens.
   C. Vacuum out all accumulated pollutants including trash, debris and sediments. Be sure to vacuum the floor, screens, and walls along with outlet side of screens.

2. Biofiltration Chamber (vegetated chamber)

   A. Remove the mulch along each side of the unit. Rake away from side walls. Remove top covers to gain access to void areas.
   B. Pressure wash off the vertical surface of the media be using a pressure washer and a vacuum hose to collect and material on the floor around the cage. Pressure wash down into the media to allow accumulated sediments to flow back into the surrounding perimeter separation area for collection with the vac hose.
   C. Replace the top covers.
   D. Trim any vegetation that is overgrown.
   E. Replace the mulch to cover the top covers.



Maintenance Notes

1. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
2. Entry into chambers may require confined space training based on state and local regulations.
3. No fertilizer shall be used in the Biofiltration Chamber.
4. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment

Inspection Form

Bio Clean, A Forterra Company
P. 760.433-7640
F. 760-433-3176
E. stormwater@forterrabp.com

www.biocleanenvironmental.com

Inspection Report
WetlandMOD System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspection Checklist

WetlandMod System: _____ Size (Model): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

398 Via El Centro, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Bio Clean, A Forterra Company
P. 760.433-7640
F. 760-433-3176
E. stormwater@forterrabp.com

www.biocleanenvironmental.com

Cleaning and Maintenance Report
WetlandMOD System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	WM Catch Basins						
		WM Sedimentation Basin						
		CPS Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

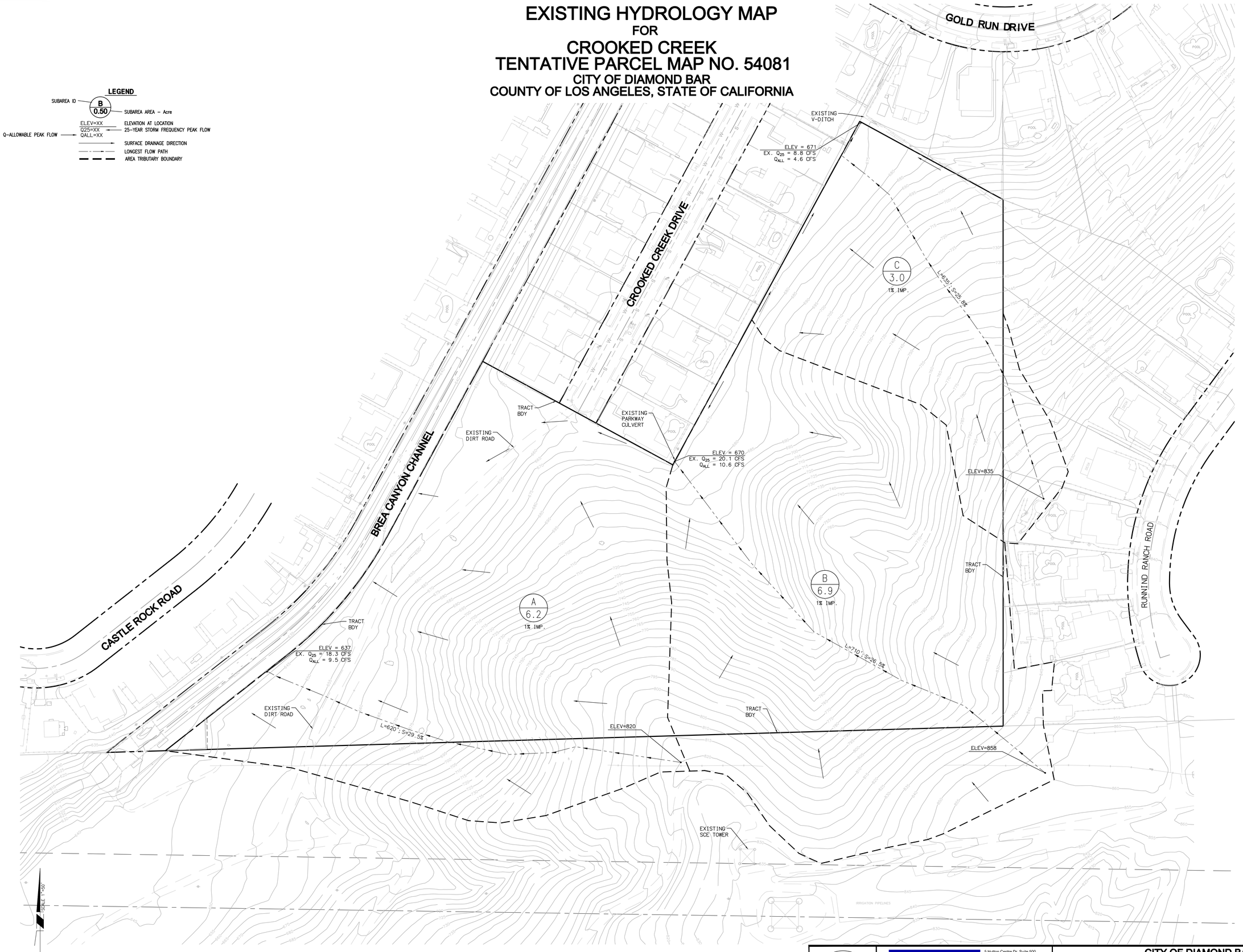
398 Via El Centro, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

APPENDIX D: Existing and Proposed 2-year, 24-hour Hydrology

EXISTING HYDROLOGY MAP
FOR
CROOKED CREEK
TENTATIVE PARCEL MAP NO. 54081
CITY OF DIAMOND BAR
COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

LEGEND

- SUBAREA ID: B / 0.50 — SUBAREA AREA – Acre
- ELEV=XX — ELEVATION AT LOCATION
- Q25=XX — 25-YEAR STORM FREQUENCY PEAK FLOW
- Q-ALLOWABLE PEAK FLOW → QALL=XX
- SURFACE DRAINAGE DIRECTION
- LONGEST FLOW PATH
- AREA TRIBUTARY BOUNDARY



REGISTERED PROFESSIONAL ENGINEER — JACQUELINE J. KIM — NO. 87503 — CIVIL — STATE OF CALIFORNIA

Michael Baker INTERNATIONAL
5 Hutton Centre Dr, Suite 500
Santa Ana, CA 92707
Phone: (949) 472-3505
MBAKERINTL.COM

JACQUELINE J. KIM R.C.E. NO. 87503 DATE

CITY OF DIAMOND BAR

HYDROLOGY MAP
EXISTING CONDITION

PROJECT NO. 178757 | SCALE: 1" = 50' | Sheet 1 of 1

Peak Flow Hydrologic Analysis

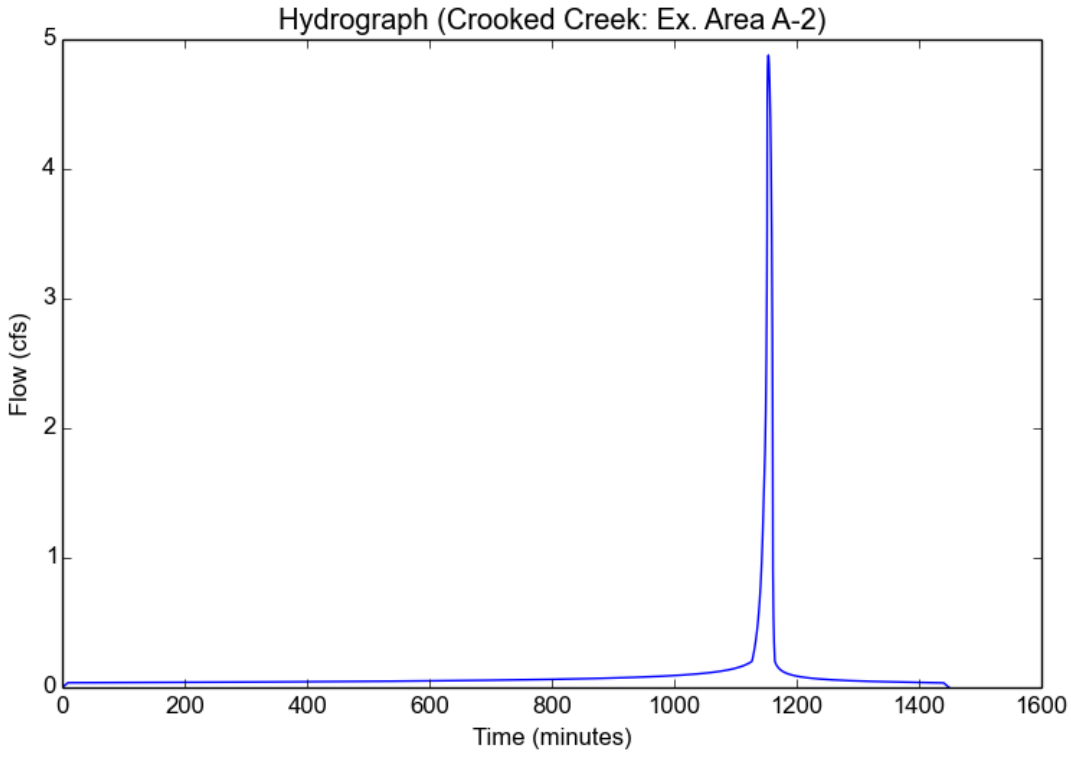
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Ex. Area A-2.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Ex. Area A-2
Area (ac)	6.2
Flow Path Length (ft)	620.0
Flow Path Slope (vft/hft)	0.295
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.01
Soil Type	17
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.0948
Undeveloped Runoff Coefficient (Cu)	0.7168
Developed Runoff Coefficient (Cd)	0.7187
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	4.8779
Burned Peak Flow Rate (cfs)	4.8779
24-Hr Clear Runoff Volume (ac-ft)	0.2022
24-Hr Clear Runoff Volume (cu-ft)	8807.0754



Peak Flow Hydrologic Analysis

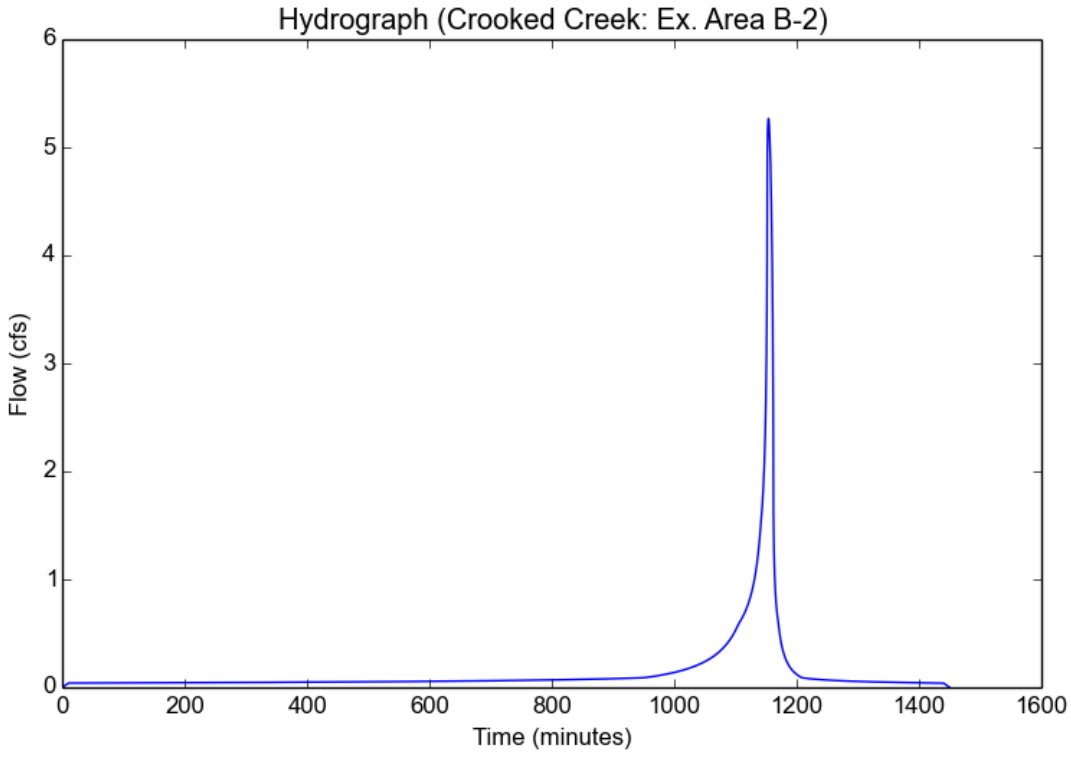
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Ex. Area B-2.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Ex. Area B-2
Area (ac)	6.9
Flow Path Length (ft)	710.0
Flow Path Slope (vft/hft)	0.265
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.0419
Undeveloped Runoff Coefficient (Cu)	0.7308
Developed Runoff Coefficient (Cd)	0.7325
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	5.2661
Burned Peak Flow Rate (cfs)	5.2661
24-Hr Clear Runoff Volume (ac-ft)	0.2988
24-Hr Clear Runoff Volume (cu-ft)	13015.907



Peak Flow Hydrologic Analysis

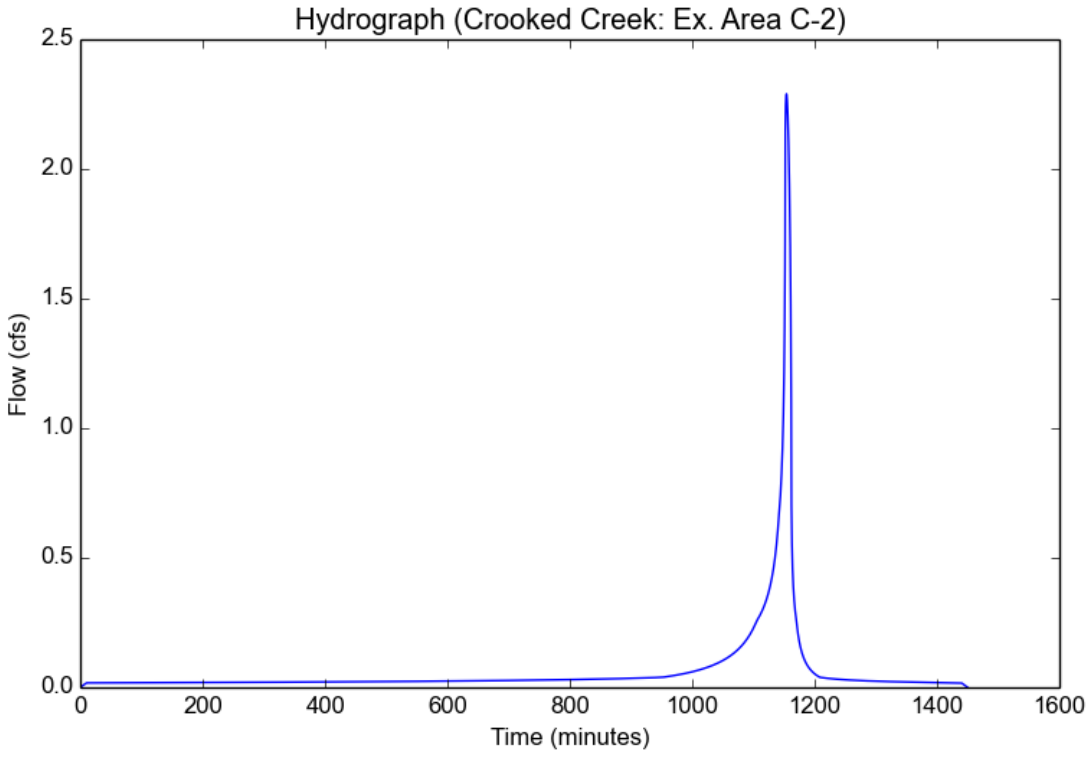
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Ex. Area C-2.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Ex. Area C-2
Area (ac)	3.0
Flow Path Length (ft)	635.0
Flow Path Slope (vft/hft)	0.258
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.0419
Undeveloped Runoff Coefficient (Cu)	0.7308
Developed Runoff Coefficient (Cd)	0.7325
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	2.2896
Burned Peak Flow Rate (cfs)	2.2896
24-Hr Clear Runoff Volume (ac-ft)	0.1299
24-Hr Clear Runoff Volume (cu-ft)	5659.09



PROPOSED HYDROLOGY MAP
FOR
CROOKED CREEK
TENTATIVE PARCEL MAP NO. 54081
CITY OF DIAMOND BAR
COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

LEGEND

- SUBAREA ID: B / 0.50 — SUBAREA AREA – Acre
- ELEV=XX — ELEVATION AT LOCATION
- Q25=XX — 25-YEAR STORM FREQUENCY PEAK FLOW (UNMITIGATED)
- Q=(MITIGATED OUTLET) PEAK FLOW — QOUT=XX
- SURFACE DRAINAGE DIRECTION
- LONGEST FLOW PATH
- AREA TRIBUTARY BOUNDARY

GOLD RUN DRIVE
EXISTING V-DITCH
ELEV = 671
EX. Q_{25} = 8.8 CFS
Q_{OUT} = 8.8 CFS
TRACT BDY
C 3.0 1% IMP.
L=935' S=25.5%
CROOKED CREEK DRIVE
ELEV=657.0
TRACT BDY
EXISTING PARKWAY CULVERT
L=280' S=5.0%
A-4 0.2 7.5% IMP.
ELEV=642.3
PROP. 24" RCP SD
PROP. 24" RCP SD
ELEV = 670
EX. Q_{25} = 20.1 CFS
Q_{OUT} = 20.1 CFS
ELEV=835
BREA CANYON CHANNEL
ELEV = 636
$Q_{25(TOT)}$ = 16.8 CFS
Q_{OUT} = 8.2 CFS
ELEV = 640.0
Q_{25} = 0.6 CFS
Q_{OUT} = 0.6 CFS
PROP. WQ DEVICE
PROP. 24" RCP SD
ELEV = 653.3
Q_{25} = 16.2 CFS
Q_{OUT} = 7.6 CFS
PROP. 42" RCP SD
PROP. 54" RCP SD
MANUFACTURED SLOPES
LOT B
LIMIT OF DISTURBED AREA
B 6.9 1% IMP.
L=710' S=26.5%
L=705' S=13.5%
RUNNING RANCH ROAD
A-2 5.5 21.3% IMP.
LOT A
CASTLE ROCK ROAD
TRACT BDY
ELEV = 631.8
Q_{25} = 1.3 CFS
Q_{OUT} = 1.3 CFS
L=495' S=26.2%
AREA "A" TO BREA CANYON
Q_{OUT}=9.5 CFS
$Q_{ALLOWABLE}$=9.5 CFS
TOTAL AREA "A" = 6.2 AC
PROP. 12" RCP SD
LIMIT OF DISTURBED AREA
PROP. 24" RCP SD
A-1 0.5 15% IMP.
ELEV=820
TRACT BDY
ELEV=858
IRRIGATION PIPELINES

SCALE 1"=50'

50 25 0 50 100 150
SCALE: 1"=50'

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JACQUELINE J. KIM R.C.E. NO. 87503 DATE

CITY OF DIAMOND BAR
HYDROLOGY MAP
PROPOSED CONDITION

PROJECT NO. 178757 | SCALE: 1" = 50' | Sheet 1 of 1

Peak Flow Hydrologic Analysis

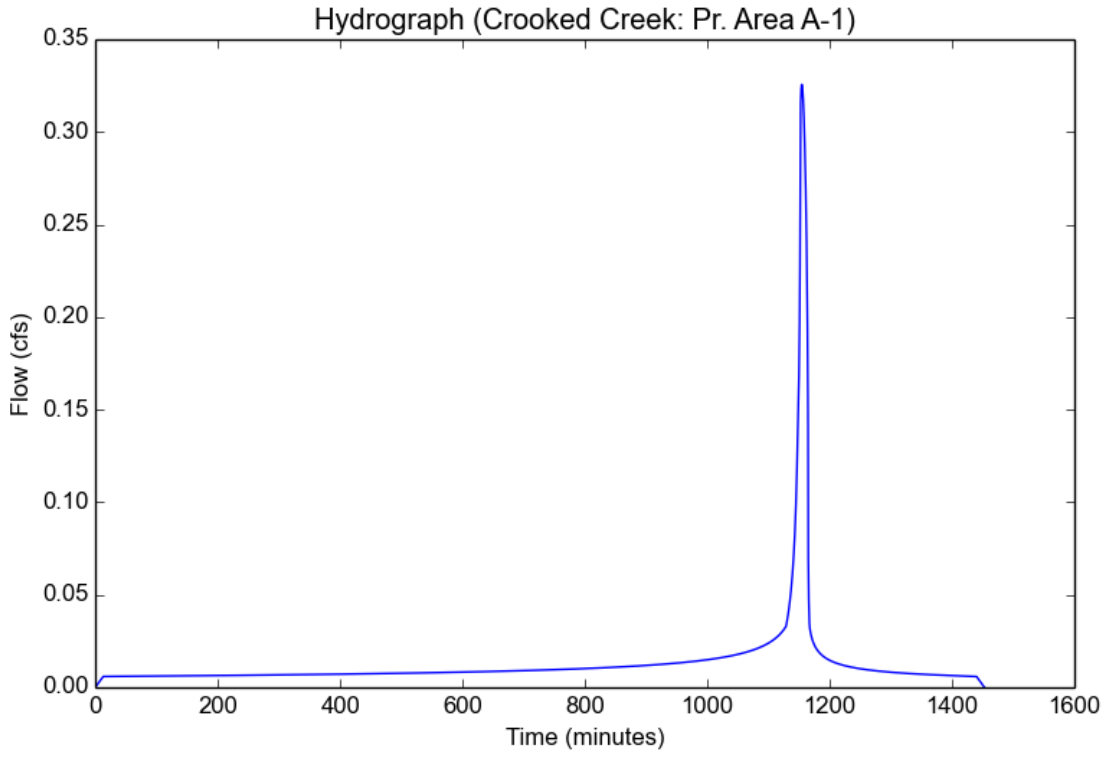
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Pr. Area A-1 - 2YR.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Pr. Area A-1
Area (ac)	0.5
Flow Path Length (ft)	495.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.15
Soil Type	17
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	0.921
Undeveloped Runoff Coefficient (Cu)	0.6732
Developed Runoff Coefficient (Cd)	0.7072
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	0.3257
Burned Peak Flow Rate (cfs)	0.3257
24-Hr Clear Runoff Volume (ac-ft)	0.0267
24-Hr Clear Runoff Volume (cu-ft)	1162.1095



Peak Flow Hydrologic Analysis

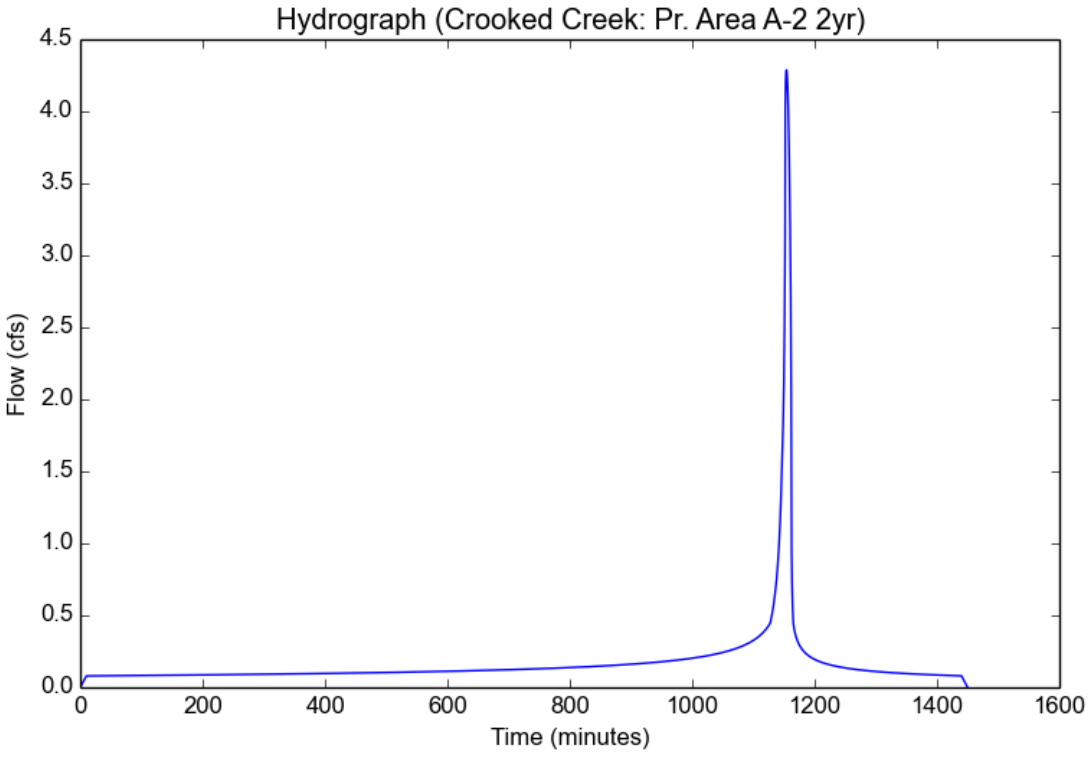
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Pr. Area A-2 - 2YR.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Pr. Area A-2 2yr
Area (ac)	5.5
Flow Path Length (ft)	705.0
Flow Path Slope (vft/hft)	0.236
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.213
Soil Type	17
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.0419
Undeveloped Runoff Coefficient (Cu)	0.7071
Developed Runoff Coefficient (Cd)	0.7482
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	4.2874
Burned Peak Flow Rate (cfs)	4.2874
24-Hr Clear Runoff Volume (ac-ft)	0.3454
24-Hr Clear Runoff Volume (cu-ft)	15047.5745



Peak Flow Hydrologic Analysis

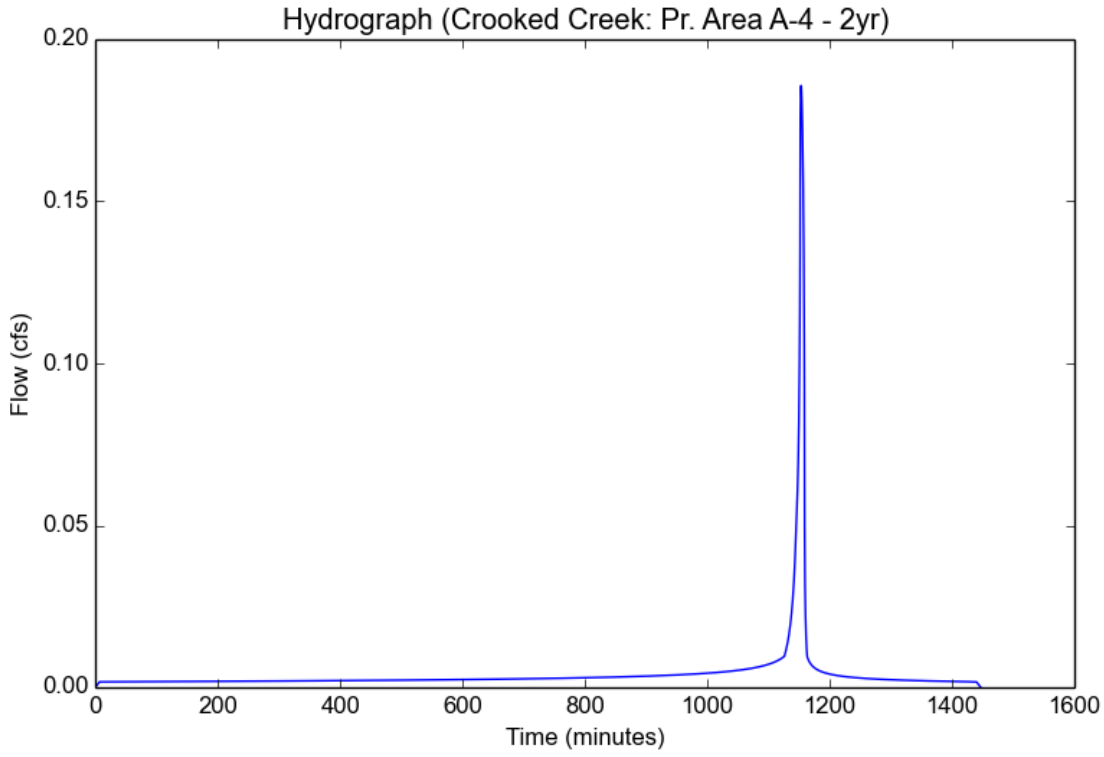
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Pr. Area A-4 - 2YR.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Pr. Area A-4 - 2yr
Area (ac)	0.2
Flow Path Length (ft)	289.0
Flow Path Slope (vft/hft)	0.059
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.075
Soil Type	17
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.232
Undeveloped Runoff Coefficient (Cu)	0.742
Developed Runoff Coefficient (Cd)	0.7539
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.1858
Burned Peak Flow Rate (cfs)	0.1858
24-Hr Clear Runoff Volume (ac-ft)	0.0085
24-Hr Clear Runoff Volume (cu-ft)	368.4972



Peak Flow Hydrologic Analysis

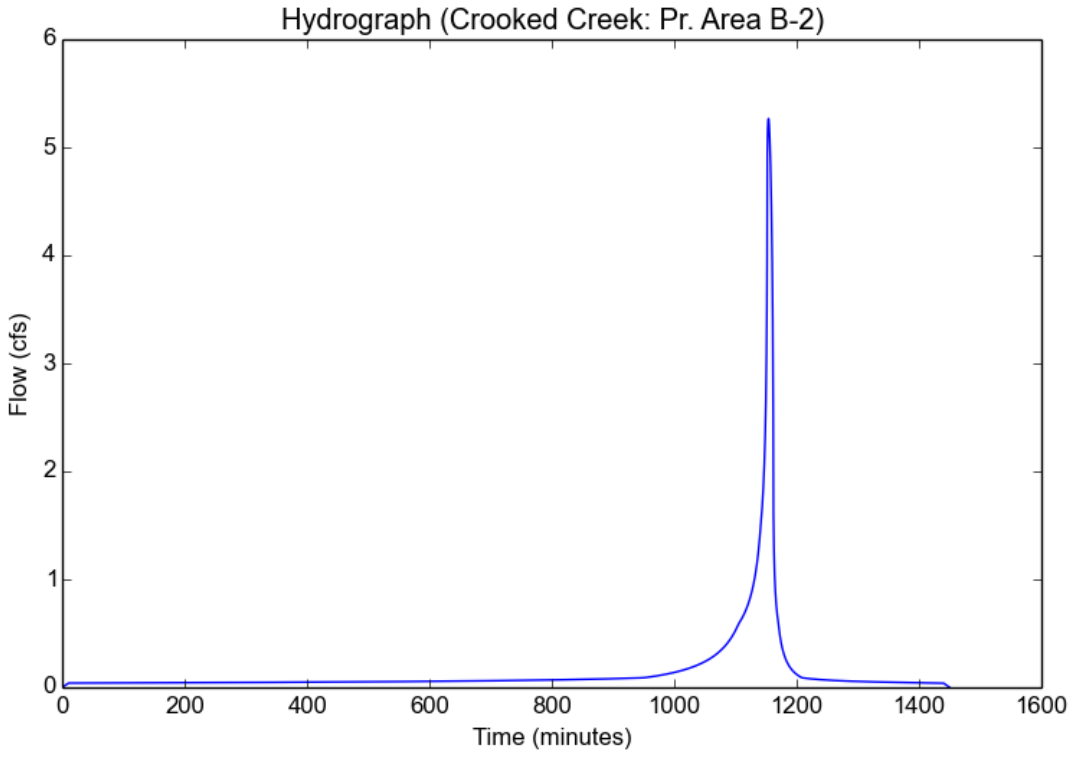
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Pr. Area B-2.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Pr. Area B-2
Area (ac)	6.9
Flow Path Length (ft)	710.0
Flow Path Slope (vft/hft)	0.265
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.0419
Undeveloped Runoff Coefficient (Cu)	0.7308
Developed Runoff Coefficient (Cd)	0.7325
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	5.2661
Burned Peak Flow Rate (cfs)	5.2661
24-Hr Clear Runoff Volume (ac-ft)	0.2988
24-Hr Clear Runoff Volume (cu-ft)	13015.907



Peak Flow Hydrologic Analysis

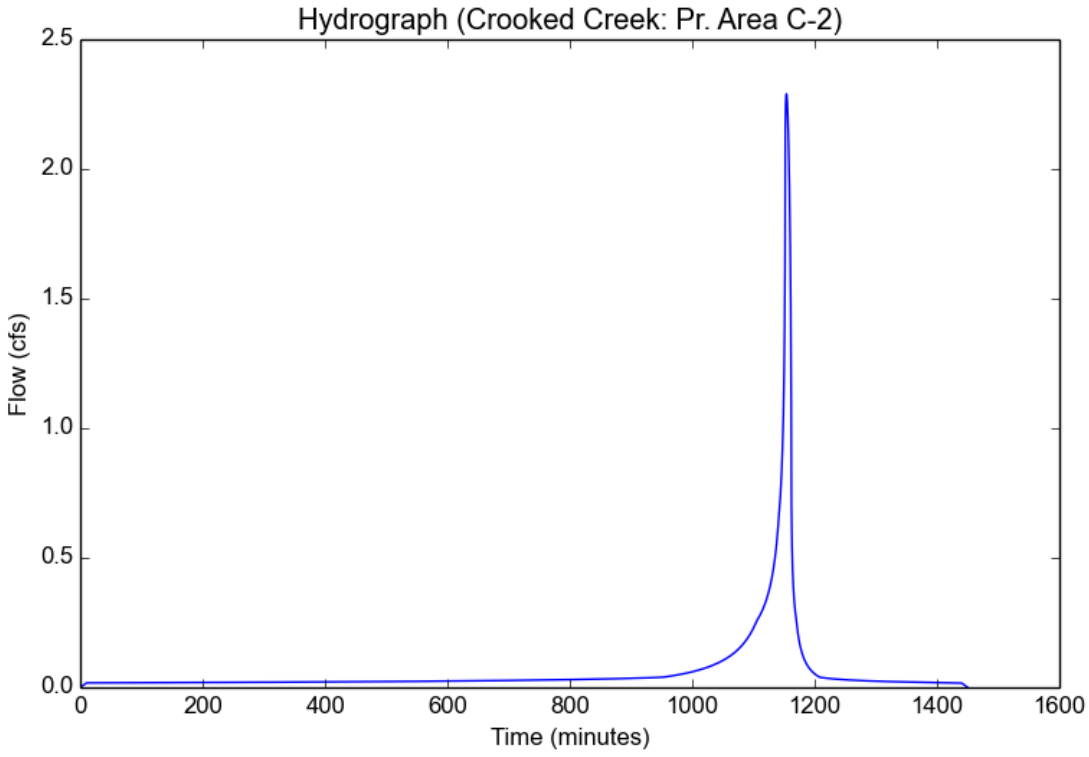
File location: H:/pdata/178757/CADD/Land/Dlv/Hydro/Report/HydroCalc/Crooked Creek - Pr. Area C-2.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Crooked Creek
Subarea ID	Pr. Area C-2
Area (ac)	3.0
Flow Path Length (ft)	635.0
Flow Path Slope (vft/hft)	0.258
50-yr Rainfall Depth (in)	6.25
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.4188
Peak Intensity (in/hr)	1.0419
Undeveloped Runoff Coefficient (Cu)	0.7308
Developed Runoff Coefficient (Cd)	0.7325
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	2.2896
Burned Peak Flow Rate (cfs)	2.2896
24-Hr Clear Runoff Volume (ac-ft)	0.1299
24-Hr Clear Runoff Volume (cu-ft)	5659.09



APPENDIX E: Infiltration Statement for LID

LGC Valley, Inc.
Geotechnical Consulting

January 21, 2021 Project No. 203008-01

Mr. Ian Harvey
NewBridge Homes
500 Newport Center Drive, Suite 570
Newport Beach, CA 92868

Subject: ***Infiltration Statement for Limited Impact Development (LID), Tract 54081, City of Diamond Bar, California.***

In accordance with your request, LGC Valley, Inc., (LGC) has prepared this letter to provide our opinion for Low Impact Development (LID) site infiltration for Tract 54081 in the City of Diamond Bar, California. Based on our assessment of the local geology, anticipated sub-surface profiles and likely water infiltration migration opportunity, it is our opinion that the introduction of water by means of infiltration would pose a potential geotechnical hazard, therefore we are not in favor of infiltration into the onsite native soils or compacted fills for one or a combination of the following reasons:

- The site is situated on hillside terrain and will be constructed with the use of multiple retaining walls and as such, water migration will be vertical and lateral, not just vertical in nature as it generally is with flat sites. Therefore, prediction of water migration is dubious and prone to a high degree of variation and uncertainty and the potential lateral migration may pose a geologic hazard to the proposed retaining walls.

- The saturation zone will be within design fill areas underlain by very clayey and relatively impermeable alluvial and landslide soils reducing/preventing vertical infiltration. Site fills were not designed with the understanding that they would be continuously saturated and as such may experience higher than normal levels of consolidation which could impact roads and home sites.

- The site and infiltration areas are situated adjacent to native/artificial fill descending slopes, we conclude there is a probability that water may migrate toward the slope face and as such pose a risk to slope failure by increasing soil weight and lowering soil strength.

All of the above factors render the site unsuitable for LID water infiltration, and the introduction of water by means of infiltration would pose a potential geotechnical hazard to the site development.

If you should have any questions, please do not hesitate to contact us. The undersigned can be reached at (661) 702-8474.

Sincerely,

LGC Valley, Inc.

Basil Hattar, GE 2734
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
BASIL HATTAR
No. 2734
Exp. 6/30/22
GEOTECHNICAL
STATE OF CALIFORNIA

Susan M. Berger, CEG 2069
Project Geologist

PROFESSIONAL GEOLOGIST
SUSAN M. BERGER
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GEOLOGIST
STATE OF CALIFORNIA

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