

Preliminary Water Quality Management Plan

For:

Prologis Chino Distribution Center

PL24-0008

APN : 1021-011-16&17

Prepared for:

Prologis

3546 Concours Street

Ontario, CA 91765

909-673-8721

Prepared by:

RRM Design Group

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Submittal Date: 3/26/2024

Revision Date: 1/24/2025

Approval Date: _____

FINAL APPROVED DOCUMENT WILL ADDRESS REMAINING COMMENTS PER AN EMAIL DATED 9/12/2024 FROM NATHAN M. AS DESCRIBED IN OUR RESPONSE TO COMMENTS

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Prologis by RRM Design Group. The WQMP is intended to comply with the requirements of the City of Chino and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	PL24-0008	Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1021-011-16&17
Owner's Signature			
Owner Name: DJ Arellano			
Title	VP of Development		
Company	Prologis		
Address	3546 Concours Street, Suite 100, Ontario, CA, 91764		
Email	darellano@prologis.com		
Telephone #	562-376-9233		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	PL24-0008	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	Parcel 2 and 3 of Map NO. 1371	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1021-011-16&17

“The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036.”

Engineer: Christopher Magdosku, PE		PE Stamp Below
Title	Manager of Engineering Services	
Company	RRM Design Group	
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Signature		
Date		

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Prologis Chino Distribution Center			
Project Owner Contact Name:		Prologis			
Mailing Address:	3546 Concourse Street, Suite 100, Ontario, CA, 91764	E-mail Address:	darellano@prologis.com	Telephone:	909-673-8721
Permit/Application Number(s):		PL23-0008	Tract/Parcel Map Number(s):	Parcel 2 and 3 of Map NO. 1371	
Additional Information/ Comments:					
Description of Project:		<p>The proposed improvements consist of redeveloping and existing industrial site with multiple buildings into a new distribution center with one 390,000 sf building. This will include the construction of retaining walls, concrete flatwork, landscaping, new ROW improvements, sidewalk, trash enclosures, storm water detention systems and treatment best management practices (BMPs). Runoff generated from the North, East, and West sides of the building are picked up by catch basins within the v-gutters and piped over to large detention chambers located on the East and West sides of the building. These detention chambers provide a storage space for peak flows to release to the downstream system at a slower rate. The flow from the chambers is then treated by underground modular wetland systems and discharged downstream to the existing storm drain system. On the South side of the building, runoff generated from the parking lot and driveways sheets flows and passes through curb cuts along the border of the parking lot and driveway to bioretention basins with underdrains. These basins serve to treat the runoff onsite and provide peak flow detention as well.</p>			

Water Quality Management Plan (WQMP)

<p>Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</p>	<p>N/A. This is conceptual WQMP.</p>
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Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project					
1 Development Category (Select all that apply):					
<input checked="" type="checkbox"/> Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input type="checkbox"/> New development involving the creation of 10,000 ft ² or more of impervious surface collectively over entire site	<input type="checkbox"/> Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	<input type="checkbox"/> Restaurants (with SIC code 5812) where the land area of development is 5,000 ft ² or more		
<input type="checkbox"/> Hillside developments of 5,000 ft ² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	<input type="checkbox"/> Developments of 2,500 ft ² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	<input type="checkbox"/> Parking lots of 5,000 ft ² or more exposed to storm water	<input type="checkbox"/> Retail gasoline outlets that are either 5,000 ft ² or more, or have a projected average daily traffic of 100 or more vehicles per day		
<input type="checkbox"/> Non-Priority / Non-Category Project <i>May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</i>					
2 Project Area (ft ²):	788,500	3 Number of Dwelling Units:	0	4 SIC Code:	
5 Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					
6 Does Project include roads? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)</i>					

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

Prologis, L.P. will be the owner of all portions of the site and be responsible for the maintenance of project stormwater facilities.

Stormwater features responsible for maintaining include two bioretention planters, four modular wetland systems, and two sets of underground detention chambers.

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Pathogens (Bacterial / Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Nutrients - Phosphorous	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Noxious Aquatic Plants	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Metals	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: <i>Select all that apply</i>			
<input checked="" type="checkbox"/> Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects <input type="checkbox"/> Vertical density [20%] <input type="checkbox"/> 7 units/ acre [5%]	<input type="checkbox"/> Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	<input type="checkbox"/> Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
<input type="checkbox"/> Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	<input type="checkbox"/> Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	<input type="checkbox"/> In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	<input type="checkbox"/> Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit: 8% <i>(Total all credit percentages up to a maximum allowable credit of 50 percent)</i>			
Description of Water Quality Credit Eligibility (if applicable)	The redevelopment of the site reduces the overall imperviousness 9%.		

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.***

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude 33.998973	Longitude -117.694481	Thomas Bros Map page
<p>¹ San Bernardino County climatic region: <input checked="" type="checkbox"/> Valley <input type="checkbox"/> Mountain</p>			
<p>² Does the site have more than one drainage area (DA): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached</i></p>			
<p>The project has one overall drainage area that outlets on the southwest side of the property. From there the site is broken up into multiple DMAs for water quality treatment purposes. For a more detailed description of the sites hydrologic characteristics, please see the "Prologis Distribution Center Preliminary Drainage Study", under separate cover.</p>			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 1	DMA 2	DMA 3	DMA 4
1 DMA drainage area (ft ²)	13310	26470	409650	262690
2 Existing site impervious area (ft ²)	11435	2542	400864	261657
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	AMC 1	AMC 1	AMC 1	AMC 1
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool – https://sbcountypw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc</i>	C	C	C	C
5 Longest flowpath length (ft)	230	1753	1318	1032
6 Longest flowpath slope (ft/ft)	0.03	0.01	0.01	0.005
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Industrial	Industrial	Industrial	Industrial
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Poor	Poor	Poor	Poor

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 5	DMA 6	DMA 7	DMA 8
1 DMA drainage area (ft ²)	42650	1918	26200	5729
2 Existing site impervious area (ft ²)	40337	1240	26200	3926
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	AMC 1	AMC 1	AMC 1	AMC 1
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool – https://sbcountypw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc</i>	C	C	C	C
5 Longest flowpath length (ft)	565	125	242	75
6 Longest flowpath slope (ft/ft)	0.005	0.016	0.013	.013
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Industrial	Industrial	Industrial	Industrial
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Poor	Poor	Poor	Poor

Form 3-3 Watershed Description for Drainage Area	
<p>Receiving waters</p> <p><i>Refer to Watershed Mapping Tool -</i></p> <p>https://sbcountypw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc</p> <p><i>See "Drainage Facilities" link at this website</i></p>	<p>San Antonio Channel, Prado Dam</p>
<p>Applicable TMDLs</p> <p><i>Refer to Local Implementation Plan</i></p>	<p>Nutrients</p>
<p>303(d) listed impairments</p> <p><i>Refer to Local Implementation Plan and Watershed Mapping Tool -</i></p> <p>https://sbcountypw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc and State Water Resources Control Board website -</p> <p>http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml</p>	<p>Chemical oxygen demand, indicator bacteria, nutrients.</p>
<p>Environmentally Sensitive Areas (ESA)</p> <p><i>Refer to Watershed Mapping Tool -</i></p> <p>https://sbcountypw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc</p>	<p>N/A</p>
<p>Unlined Downstream Water Bodies</p> <p><i>Refer to Watershed Mapping Tool -</i></p> <p>https://sbcountypw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc</p>	<p>San Antonio Channel</p>
<p>Hydrologic Conditions of Concern</p>	<p><input checked="" type="checkbox"/> Yes Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal</p> <p><input type="checkbox"/> No</p>
<p>Watershed-based BMP included in a RWQCB approved WAP</p>	<p><input type="checkbox"/> Yes Attach verification of regional BMP evaluation criteria in WAP</p> <ul style="list-style-type: none"> • More Effective than On-site LID • Remaining Capacity for Project DCV • Upstream of any Water of the US • Operational at Project Completion • Long-Term Maintenance Plan <p><input checked="" type="checkbox"/> No</p>

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Educational material will be provided.
N2	Activity Restrictions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Maintenance information will be provided.
N5	Title 22 CCR Compliance (How development will comply)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous waste anticipated.
N6	Local Water Quality Ordinances	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable.
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable. No material stored underground.
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous materials anticipated.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Compliance with Article 80 of the uniform Fire Code
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Litter patrol, to be scheduled as a part of onsite landscape management program.
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner/tenant to provide training to employees.
N13	Housekeeping of Loading Docks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Litter patrol, sweeping and upkeep of loading docks to be scheduled as a part of onsite maintenance program.
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Incorporate as a part of regularly scheduled maintenance. At minimum, once annually before the beginning of the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Regularly scheduled maintenance and sweeping of ground for trash/debris. At minimum, once annually before the beginning of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a public agency project.
N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Water Quality Management Plan (WQMP)

Form 4.1-2 Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage (CASQA New Development BMP Handbook SD-13)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Stenciling will be provided on all storm water catch basins.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No outdoor storage anticipated.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Paved with impervious surface and designed to not allow run-on.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No maintenance bays.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No vehicle wash areas.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Water Quality Management Plan (WQMP)

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist
<p>Site Design Practices <i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Impervious areas only used where necessary for site utilization. Landscaping maximized.</p>
<p>Maximize natural infiltration capacity: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Site has very limited infiltration per Geotech.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Existing drainage patterns kept.</p>
<p>Disconnect impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Impervious areas disconnected where possible.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input type="checkbox"/> Explanation: No existing vegetation or sensitive areas exist. Fully developed sit in current condition.</p>
<p>Re-vegetate disturbed areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Maximizing landscaping onsite. Decrease in overall impervious area.</p>
<p>Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Compaction minimized to where only necessary.</p>
<p>Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Not enough room onsite to use swales. Not enough slope across the site to successfully utilize swales.</p>
<p>Stake off areas that will be used for landscaping to minimize compaction during construction : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation:</p>

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P₆ method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 1)		
1 Project area DA 1 (ft ²): 13,310	2 Imperviousness after applying preventative site design practices (Imp%): 0	3 Runoff Coefficient (Rc): 0.04 $R_c = 0.858(Imp\%)^3 - 0.78(Imp\%)^2 + 0.774(Imp\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.87 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 76 $DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C_2]$, where C ₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) <i>Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 2)		
1 Project area DA 1 (ft ²): 26,470	2 Imperviousness after applying preventative site design practices (Imp%): 0	3 Runoff Coefficient (Rc): 0.04 <i>$R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$</i>
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.87 <i>$P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 151 <i>$DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 3)		
1 Project area DA 1 (ft ²): 409,650	2 Imperviousness after applying preventative site design practices (Imp%): 95%	3 Runoff Coefficient (Rc): 0.80 <i>$R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$</i>
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.87 <i>$P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 46,795 <i>$DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 4)		
1 Project area DA 1 (ft ²): 262,690	2 Imperviousness after applying preventative site design practices (Imp%): 95%	3 Runoff Coefficient (Rc): 0.80 $R_c = 0.858(\text{Imp}\%)^{0.3} - 0.78(\text{Imp}\%)^{0.2} + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.87 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 30,031 <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C₂], where C₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 5)		
1 Project area DA 1 (ft ²): 42,650	2 Imperviousness after applying preventative site design practices (Imp%): 51%	3 Runoff Coefficient (Rc): 0.59 $R_c = 0.858(\text{Imp}\%)^{0.3} - 0.78(\text{Imp}\%)^{0.2} + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.87 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 3,120 <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C₂], where C₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 6)		
1 Project area DA 1 (ft ²): 2,532	2 Imperviousness after applying preventative site design practices (Imp%): 0%	3 Runoff Coefficient (Rc): 0.04 $R_c = 0.858(\text{Imp}\%)^{0.3} - 0.78(\text{Imp}\%)^{0.2} + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.87 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 14 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 7)		
1 Project area DA 1 (ft ²): 12,973	2 Imperviousness after applying preventative site design practices (Imp%): 3%	3 Runoff Coefficient (Rc): 0.06 $R_c = 0.858(\text{Imp}\%)^{0.3} - 0.78(\text{Imp}\%)^{0.2} + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.59 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.87 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 111 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-2 Summary of HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes No

Go to: <http://permitrack.sbcounty.gov/wap/>

If “Yes”, then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below
(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If “No,” then proceed to Section 4.3 Project Conformance Analysis

Please see the drainage report as well as Appendix D for a summary of the existing versus post-development 2-year hydrology analysis.

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	¹ 18,915 <i>Form 4.2-3 Item 12</i>	² 14.71 <i>Form 4.2-4 Item 13</i>	³ 21.27 <i>Form 4.2-5 Item 10</i>
Post-developed	⁴ 18,807 <i>Form 4.2-3 Item 13</i>	⁵ 16.87 <i>Form 4.2-4 Item 14</i>	⁶ 18.44 <i>Form 4.2-5 Item 14</i>
Difference	⁷ -108 <i>Item 4 – Item 1</i>	⁸ -2.16 <i>Item 2 – Item 5</i>	⁹ -2.83 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	¹⁰ -0.57% <i>Item 7 / Item 1</i>	¹¹ -14.7% <i>Item 8 / Item 2</i>	¹² -13.3% <i>Item 9 / Item 3</i>

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>								
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>								
4b Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item 5}) - 10$					9 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item 7}$		
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$					10 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item 8}$		
11 Precipitation for 2 yr, 24 hr storm (in): Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html								
12 Pre-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
13 Post-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): $V_{HOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA (For projects using the Hydrology Manual complete the form below)

Variables	Pre-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>				Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
7 Cross-sectional area of channel (ft ²)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7}/\text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min):	<i>Minimum of Item 12 pre-developed DMA</i>							
14 Post-developed time of concentration (min):	<i>Minimum of Item 12 post-developed DMA</i>							
15 Additional time of concentration needed to meet HCOC requirement (min):	$T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$							

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions						
Variables	Pre-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>			Post-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 / 60)}$						
2 Drainage Area of each DMA (Acres) <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
3 Ratio of pervious area to total area <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) $F_m = Item 3 * Item 4$ <i>Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
6 Peak Flow from DMA (cfs) $Q_p = Item 2 * 0.9 * (Item 1 - Item 5)$						
7 Time of concentration adjustment factor for other DMA to site discharge point <i>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</i>	DMA A	n/a		n/a		
	DMA B		n/a		n/a	
	DMA C			n/a		n/a
8 Pre-developed Q_p at T_c for DMA A: $Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAA/2}] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAA/3}]$	9 Pre-developed Q_p at T_c for DMA B: $Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAB/1}] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAB/3}]$		10 Pre-developed Q_p at T_c for DMA C: $Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAC/1}] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAC/2}]$			
10 Peak runoff from pre-developed condition confluence analysis (cfs): <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>		13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>			
14 Peak runoff from post-developed condition confluence analysis (cfs): <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): $Q_{p-HCOC} = (Item 14 * 0.95) - Item 10$						

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS₄ Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS₄ Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.**

Form 4.3-1 Infiltration BMP Feasibility (DA 1)	
Feasibility Criterion – Complete evaluation for each DA on the Project Site	
<p>¹ Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):</p> <ul style="list-style-type: none"> • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than eight feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards. 	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>³ Would infiltration of runoff on a Project site violate downstream water rights?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>⁴ Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils?</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes, Provide basis: See infiltration study.	
<p>⁵ Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)?</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes, Provide basis: See infiltration study.	
<p>⁶ Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? <i>See Section 3.5 of the TGD for WQMP and WAP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>⁷ Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁸ Any answer from Item 4 through Item 6 is “Yes”: <i>If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.</i></p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<p>⁹ All answers to Item 1 through Item 6 are “No”: <i>Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.</i></p>	

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 2-5; If no, proceed to Item 6</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Total impervious area draining to pervious area (ft ²)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft ³) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³):		$V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; if no, proceed to Item 14</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
7 Ponding surface area (ft ²)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft ²)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$			
13 Runoff volume retention from on-lot infiltration (ft ³):		$V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$	

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)

<p>14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 15-20. If no, proceed to Item 21</i></p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type <i>(Use additional forms for more BMPs)</i></p>
<p>15 Rooftop area planned for ET BMP (ft²)</p>			
<p>16 Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i></p>			
<p>17 Daily ET demand (ft³/day) <i>Item 15 * (Item 16 / 12)</i></p>			
<p>18 Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i></p>			
<p>19 Retention Volume (ft³) <i>V_{retention} = Item 17 * (Item 18 / 24)</i></p>			
<p>20 Runoff volume retention from evapotranspiration BMPs (ft³): <i>V_{retention} = Sum of Item 19 for all BMPs</i></p>			
<p>21 Implementation of Street Trees: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 22-25. If no, proceed to Item 26</i></p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type <i>(Use additional forms for more BMPs)</i></p>
<p>22 Number of Street Trees</p>			
<p>23 Average canopy cover over impervious area (ft²)</p>			
<p>24 Runoff volume retention from street trees (ft³) <i>V_{retention} = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i></p>			
<p>25 Runoff volume retention from street tree BMPs (ft³): <i>V_{retention} = Sum of Item 24 for all BMPs</i></p>			
<p>26 Implementation of residential rain barrel/cisterns: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 27-29; If no, proceed to Item 30</i></p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type <i>(Use additional forms for more BMPs)</i></p>
<p>27 Number of rain barrels/cisterns</p>			
<p>28 Runoff volume retention from rain barrels/cisterns (ft³) <i>V_{retention} = Item 27 * 3</i></p>			
<p>29 Runoff volume retention from residential rain barrels/Cisterns (ft³): <i>V_{retention} = Sum of Item 28 for all BMPs</i></p>			
<p>30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: <i>Sum of Items 5, 13, 20, 25 and 29</i></p>			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC BMP (ft ³): $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$			
BMP Type <i>Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods</i>			
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>			
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>			
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>			
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity			
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Underground Retention Volume (ft ³) <i>Volume determined using manufacturer's specifications and calculations</i>			
16 Total Retention Volume from LID Infiltration BMPs: $(\text{Sum of Items 14 and 15 for all infiltration BMP included in plan})$			
17 Fraction of DCV achieved with infiltration BMP: $\% \text{ Retention} = \text{Item 16} / \text{Form 4.2-1 Item 7}$			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.</i>			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)			
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft ³): <i>V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 - Form 4.3-3 Item 16</i>			
BMP Type(s) <i>Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs</i>	DA BMP Type	DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft ³) <i>Volume of cistern</i>			
4 Landscaped area planned for use of harvested stormwater (ft ²)			
5 Average wet season daily irrigation demand (in/day) <i>Use local values, typical ~ 0.1 in/day</i>			
6 Daily water demand (ft ³ /day) <i>Item 4 * (Item 5 / 12)</i>			
7 Drawdown time (hrs) <i>Copy Item 6 from Form 4.2-1</i>			
8 Retention Volume (ft ³) <i>V_{retention} = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))</i>			
9 Total Retention Volume (ft ³) from Harvest and Use BMP <i>Sum of Item 8 for all harvest and use BMP included in plan</i>			
<hr style="border-top: 1px dashed black;"/> 10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.</i>			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DMA 3)		
<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 46,795 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>	<p>List pollutants of concern <i>Copy from Form 2.3-1.</i> Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input checked="" type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): 46,795 Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): 0 Item 1 – Item 3</p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</i></p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i> 		

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DMA 4)

<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 30,031 <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</i></p>	<p>List pollutants of concern <i>Copy from Form 2.3-1.</i> Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds.</p>	
<p>2 Biotreatment BMP Selected (Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p> <input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention </p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p> <input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input checked="" type="checkbox"/> Proprietary biotreatment </p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): 30,031 <i>Form 4.3-6 Item 15 + Form 4.3-7 Item 13</i></p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): 0 <i>Item 1 – Item 3</i></p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% <i>Item 4 / Item 1</i></p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</i></p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i> 		

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DMA 5)

<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 3,120 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>	<p>List pollutants of concern Copy from Form 2.3-1. Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input checked="" type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): 3,120 Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): 0 Item 1 – Item 3</p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): N/A Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP. 		

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DMA 7)

<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 1,502 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>		<p>List pollutants of concern Copy from Form 2.3-1. Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p>Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p>		<p>Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p>
	<p><input checked="" type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>		<p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): 1,502 Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): 0 Item 1 – Item 3</p>		<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): N/A Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</p>			
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP. 			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DMA 5 BMP Type Bioretention w/underdrain	DMA 3 BMP Type Proprietary Biofiltration	DMA 4 BMP Type Proprietary Biofiltration
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>	Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds.	Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds. See attachments for sizing info.	Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds. See attachments for sizing info.
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>	5.0		
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>	2.0		
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	2.5		
5 Pondered water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>	48		
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0.50		
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	0.50		
8 Amended soil surface area (ft ²)	2,110		
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	2		
10 Amended soil porosity, <i>n</i>	0.25		
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	1.5		
12 Gravel porosity, <i>n</i>	0.33		
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	3		
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7} / 2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	3,681	50,240	30,218
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 84,139			

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Sum of Item 14 for all volume-based BMPs included in this form

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DMA 7 BMP Type Bioretention w/underdrain		
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>	Pathogens, nutrients, noxious aquatic plants, sediment, metals, oil & grease, trash/debris, pesticides/herbicides, and organic compounds.		
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>	5.0		
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>	2.0		
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	2.5		
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>	48		
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	0.50		
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	0.50		
8 Amended soil surface area (ft ²)	890		
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	2		
10 Amended soil porosity, <i>n</i>	0.25		
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	1.5		
12 Gravel porosity, <i>n</i>	0.33		
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	3		
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7} / 2) + (\text{Item 9})$	1,553	50,240	30,218

Water Quality Management Plan (WQMP)

<i>* Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]</i>			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 1,553 + 84,139 = 85,692 <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

**Form 4.3-7 Volume Based Biotreatment (DA 1) – N/A
Constructed Wetlands and Extended Detention**

Biotreatment BMP Type <i>Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.</i>	DA DMA BMP Type		DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft ²) <i>A_{bottom} = Item 2 * Item 3</i>				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft ²) <i>A_{surface} = (Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))</i>				
8 Storage volume (ft ³) <i>For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i> <i>V = Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^{0.5}]</i>				
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>				
10 Outflow rate (cfs) <i>Q_{BMP} = (Item 8_{forebay} + Item 8_{basin}) / (Item 9 * 3600)</i>				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft ³) <i>V_{biotreated} = (Item 8_{forebay} + Item 8_{basin}) + (Item 10 * Item 11 * 3600)</i>				

Water Quality Management Plan (WQMP)

13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention :
(Sum of Item 12 for all BMP included in plan)

Form 4.3-8 Flow Based Biotreatment (DA 1) – N/			
Biotreatment BMP Type <i>Vegetated swale, vegetated filter strip, or other comparable proprietary BMP</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5</i>			
2 Flow depth for water quality treatment (ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
3 Bed slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
4 Manning's roughness coefficient			
5 Bottom width (ft) <i>$b_w = (\text{Form 4.3-5 Item 6} * \text{Item 4}) / (1.49 * \text{Item 2}^{1.67} * \text{Item 3}^{0.5})$</i>			
6 Side Slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Cross sectional area (ft ²) <i>$A = (\text{Item 5} * \text{Item 2}) + (\text{Item 6} * \text{Item 2}^2)$</i>			
8 Water quality flow velocity (ft/sec) <i>$V = \text{Form 4.3-5 Item 6} / \text{Item 7}$</i>			
9 Hydraulic residence time (min) <i>Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Length of flow based BMP (ft) <i>$L = \text{Item 8} * \text{Item 9} * 60$</i>			
11 Water surface area at water quality flow depth (ft ²) <i>$SA_{top} = (\text{Item 5} + (2 * \text{Item 2} * \text{Item 6})) * \text{Item 10}$</i>			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)	
1	Total LID DCV for the Project (ft ³): 81,448 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design hydrologic source control LID BMP (ft ³): 0 <i>Copy Item 30 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 0 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site retention with LID harvest and use BMP (ft ³): 0 <i>Copy Item 9 in Form 4.3-4</i>
5	On-site biotreatment with volume based biotreatment BMP (ft ³): 85,692 <i>Copy Item 3 in Form 4.3-5</i>
6	Flow capacity provided by flow based biotreatment BMP (cfs): <i>Copy Item 6 in Form 4.3-5</i>
7	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> • Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized</i> ▪ On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
8	<p>If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:</p> <ul style="list-style-type: none"> • Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> • An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: <input type="checkbox"/> <i>Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed</i>

4.3.6 Hydromodification Control BMP – N/A

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)	
<p>1 Volume reduction needed for HCOC performance criteria (ft³): <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i></p>	<p>2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): <i>Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i></p>
<p>3 Remaining volume for HCOC volume capture (ft³): <i>Item 1 – Item 2</i></p>	<p>4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): <i>Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</i></p>
<p>5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification <input type="checkbox"/> <i>Attach in-stream control BMP selection and evaluation to this WQMP</i></p>	
<p>6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP <input type="checkbox"/> <i>BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)</i> • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities <input type="checkbox"/> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	
<p>7 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs <input type="checkbox"/> <i>BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)</i> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	

4.4 Alternative Compliance Plan (if applicable) – N/A

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
MW-1 THRU MW-4	Prologis	Inspect for trash and sediment. Inspect media cartridges.	One time per month during wet season, and once every other month during dry season.
MW-1 THRU MW-4	Prologis	Remove sediment from pre-treatment chamber and replace pre-treatment cartridge media.	Minimum once every year for sediment, and once every two years for cartridges depending on results of inspections.
BR-1 & BR-2	Prologis	Inspect BMP inlets, outlets for structural integrity, inspect for accumulation for trash/debris, inspect for vegetation health. Remove trash/debris, repair inlets, and replant vegetation as needed.	At minimum, inspect monthly during wet season, and once during the dry season (or after a rain event of 0.5").

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements

APPENDIX A – PRELIMINARY STORMWATER CONTROL PLAN

LEGEND

- DIRECTION OF FLOW
- DRAINAGE MANAGEMENT AREAS
- DMA NUMBER
- PROPOSED IMPROVEMENTS**
 - PROPOSED CONCRETE: 293,650 sf
 - PROPOSED BUILDING AREA: 390,778
 - PERVIOUS AREA: 104,189 sf
- PROPOSED TREATMENT**
 - BIORETENTION AREA: 3,000 sf

PROJECT INFORMATION

HYDROLOGIC SOURCE CONTROLS

- STREET TREES

INFILTRATION FEASIBILITY

- INFEASIBLE PER GEOTECHNICAL REPORT

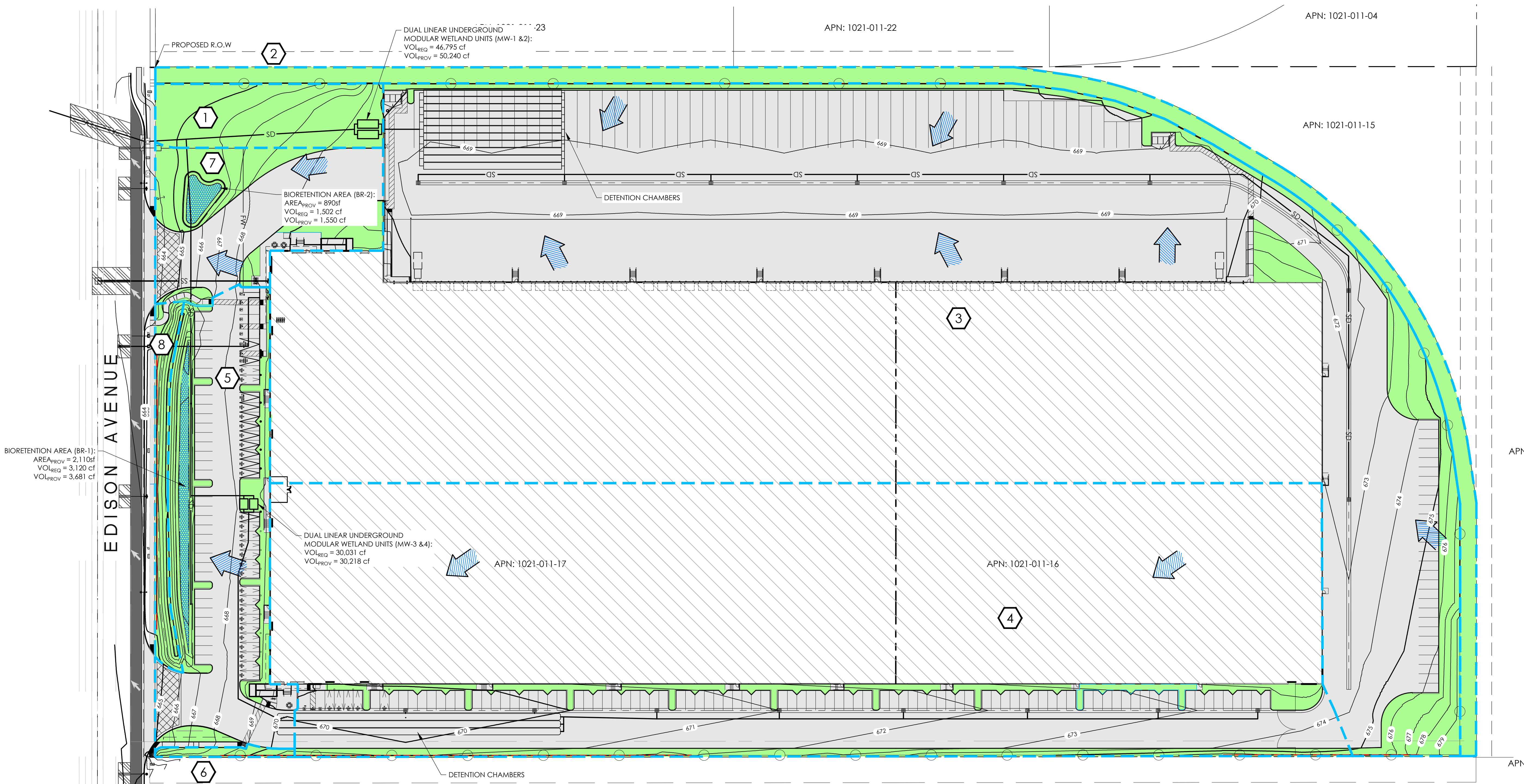
DCV CALCULATIONS

- 2 HR 1 HR PRECIPITATION = 0.59 IN PER NOAA ATLAS 14
- q1 = 1.4807 - VALLEY
- P6 = 0.87 in
- DRAWDOWN COEFFICIENT (d₂₄)
- 1.562 24-HR DRAWDOWN
- 1.963 48-HR DRAWDOWN

DCV (cf) = [P6 / 12] * C_i * A * d₂₄

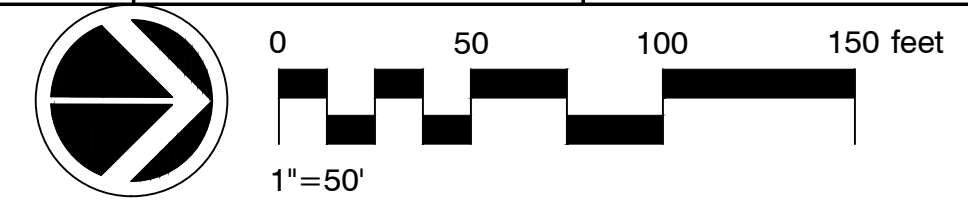
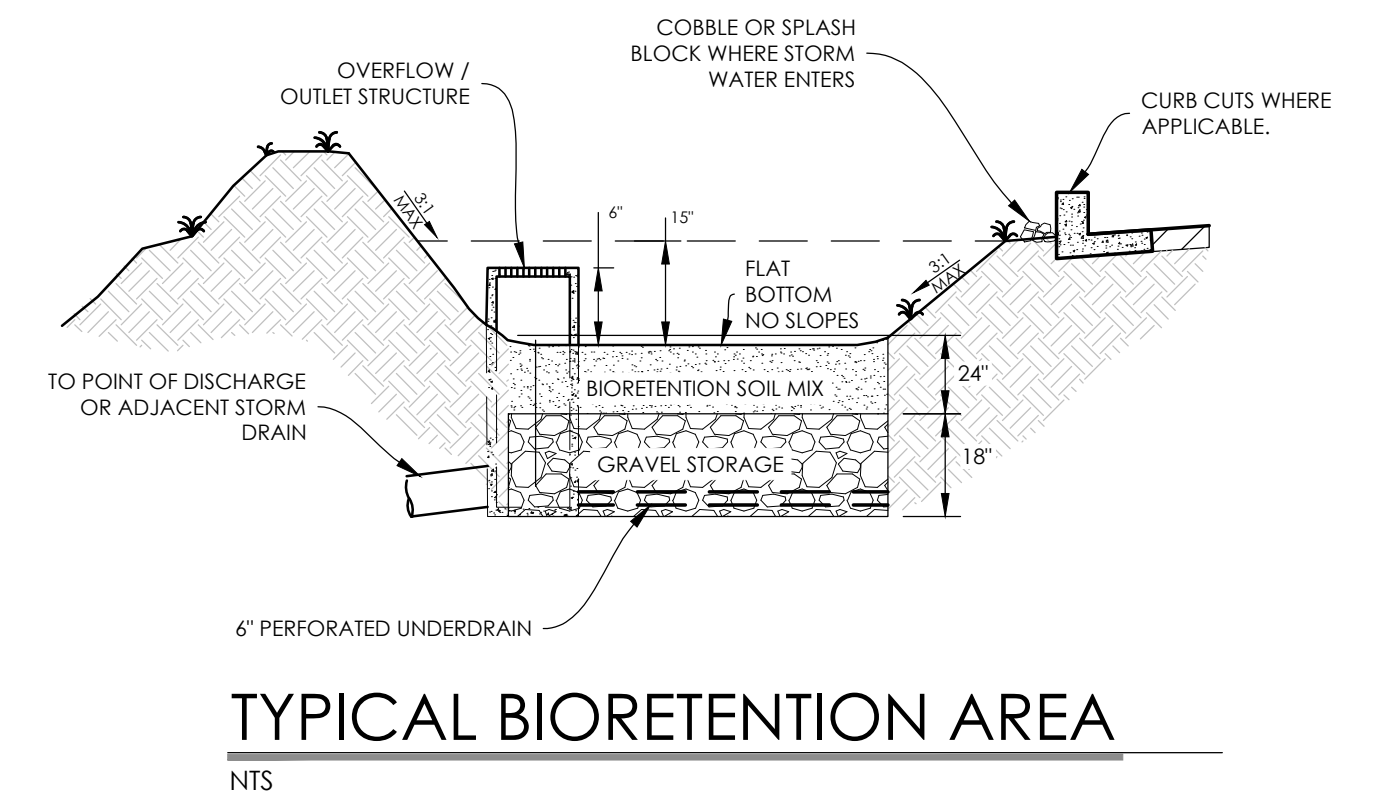
C_i = 0.858 * 1 - 0.78 * d₂₄ + 0.774 * 0.04

A = TRIBUTARY AREA (sf)



DMA SUMMARY TABLE

DMA	AREA (SF)	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	PERCENT IMPERVIOUS	RUNOFF COEFFICIENT	DCV	BMP TYPE
1	13310	13310	0	0	0.04	-	SELF-TREATING
2	26470	26470	0	0	0.04	-	SELF-TREATING
3	409,650	22,430	387,220	95	0.80	46,795	PROPRIETARY BIOFILTRATION
4	262,690	14,280	248,410	95	0.80	30,031	PROPRIETARY BIOFILTRATION
5	42,650	12,000	30,650	72	0.51	3,120	BIORETENTION W/ UNDERDRAIN
6	1,918	1,918	0	0	0.04	-	SELF-TREATING
7	26,200	10,752	15,448	59	0.40	1,502	BIORETENTION W/ UNDERDRAIN
8	5,729	5,563	166	3	0.06	-	SELF-TREATING



PRELIMINARY STORMWATER CONTROL PLAN

PROLOGIS DISTRIBUTION CENTER **C5**

January 24, 2025

A:\2025\2025-01-C022\Prologis_C5-Prologis_Distribution_Center\Drawings\DWG\Stormwater\dwg_C5_Stormwater.dwg, CS, Jan 24, 2025, 2:01pm, cmaszk

APPENDIX B – INFILTRATION REPORT

August 4, 2023

Prologis
17777 Center Court Drive North, Suite 100
Cerritos, California 90703



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**
A California Corporation

Attention: Mr. Laerte Fanucchi
Director, Development

Project No.: **23G162-2**

Subject: **Results of Infiltration Testing**
Proposed Industrial Building
5088 Edison Avenue
Chino, California

References: 1) Geotechnical Investigation, Proposed Commercial/Industrial Building, 5088 Edison Avenue, Chino, California, prepared by Southern California Geotechnical, Inc. (SCG) for ProLogis, SCG Project No. 12G120-1, dated March 29, 2012.
2) Geotechnical Investigation, Proposed Industrial Building, 5088 Edison Avenue, Chino, California, prepared by Southern California Geotechnical, Inc. (SCG) for ProLogis, SCG Project No. 23G162-1, dated August 4, 2023.

Mr. Fanucchi:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 23P299, dated June 22, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site and Project Description

The subject site is located on the north side of Edison Avenue, 615± feet east of Monte Vista Avenue in Chino, California. The site is also referenced by the street address 5088 Edison Avenue. The site is bounded to the north and west by railroad easements, to the south by Edison Avenue, and to the east by a commercial/industrial development. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of an irregular-shaped property, totaling 18.10± acres in size. The site is currently developed with four (4) commercial/industrial buildings. All of the buildings are single story structures of concrete tilt-up construction, presumably supported on conventional shallow foundation systems with concrete slab-on-grade floors. These buildings are utilized by RedBuilt to manufacture engineered wood products. The northern building has a footprint of 28,555± ft², the central building has a footprint of 29,560± ft², the southern building has a footprint of 36,290± ft², and the southern-most building has a footprint of 5,373± ft².

The northern portion of the site is currently being used for trailer parking. Ground surface cover consists of asphaltic concrete (AC) pavements, aggregate base, and limited areas of Portland cement concrete (PCC) pavements. AC pavements are located in the southern two-thirds of the site and were observed to be in fair to poor condition with areas of moderate to severe cracking. The aggregate base areas are located in the northern one-third of the site.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography slopes downward to the south-southwest at gradients of 1 to 1½± percent

Proposed Development

A conceptual site plan prepared by HPA, Inc., has been provided to our office by the client. Based on this plan, the subject site will be developed with a 394,230± ft² industrial building, located in the eastern area of the site. Dock-high doors will be constructed along a portion of the west side of the building. The proposed building is expected to be surrounded by AC pavements in the parking and drive areas, PCC pavements in the loading dock area, and concrete flatwork and landscaped planters throughout the site.

We understand the site will utilize an on-site storm water disposal system to dispose of storm water. The type, location, and depth of the infiltration system was not known at the time of this report. However, based on our experience with similar projects in this area, we assume the infiltration system will consist of a below-grade chamber located in the western area of the site. The bottom elevation of the proposed infiltration system is expected to be 12± feet below the existing site grades.

Previous Study

Southern California Geotechnical, Inc. (SCG) previously performed a geotechnical investigation for the previously proposed development within the overall site (Reference 1). The previously proposed development consisted of a 394,230± ft² industrial building, located in the western area of the site. As part of this investigation, eight (8) borings (identified as Boring Nos. B-1 through B-8) were advanced to depths of 5 to 50± feet below the previously existing site grades.

Most of the borings were drilled through pavements that consisted of 3½ to 5½± inches of AC with no discernible aggregate base. The remaining borings were drilled through 2± inches of aggregate base material which was exposed at the ground surface. Artificial fill soils were encountered beneath the existing pavements and aggregate base at all of the boring locations, extending to depths of 1½ to 3± feet. The fill soils generally consisted of loose to medium dense, mottled, silty sands. Native alluvial soils were encountered beneath the fill soils at all of the boring

locations. The alluvial soils consisted of loose to medium dense silty sands and sandy silts extending to depths of 8½ to 12± feet. Beneath these soils, and extending to depths of 17 to 27± feet, the alluvial soils consisted of soft to stiff silty clays. Between 27 and 37± feet, the alluvial soils generally consisted of sandy silts and clayey silts. Beneath these soils, and extending to the maximum depth explored of 50± feet, the alluvial soils generally consist of medium stiff silty clays and clayey silts.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site (Reference 2). As a part of this study, two (2) borings (identified as Boring Nos. B-9 and B-10) were advanced to depths of 50± feet below the existing site grades.

Boring No. B-9 was drilled through asphalt consisting of 3½± inches of AC, underlain by 4½± inches of aggregate base. Boring No. B-10 was drilled through 1± inch of aggregate base. Artificial fill soils were encountered beneath the existing pavements and aggregate base at both of the boring locations, extending to depths of 2½ to 4½± feet. The fill soils generally consist of loose to medium dense silty sands and sandy silts with varying clay content, and occasional very stiff sandy clays. Native alluvium was encountered beneath the artificial fill soils at both boring locations, extending to at least the maximum depth explored of 50± feet below existing site grades. The alluvial soils consist of loose to medium dense silty sands and sandy silts, with occasional medium dense sands and very stiff clayey silts, extending to depths of 8½ to 12± feet. Beneath these soils, and extending to depths of 17 to 27± feet, the alluvial soils generally consist of soft to stiff silty clays, clayey silts and sandy clays. At deeper depths and extending to at least the maximum depth explored of 50± feet, the alluvium generally consists of medium stiff to stiff sandy clays, silty clays, and clayey silts. Boring No. B-10 encountered a stratum of medium dense silty sands to sandy silts at depths of 32 to 37± feet.

Groundwater

Free water was encountered during drilling at Boring No. B-9 at a depth of 40± feet below the ground surface. Delayed groundwater level readings were taken at this boring 3 hours after the drilling was completed and the augers removed. These readings indicate that the groundwater was at a depth of 32± feet. Based on these observations and the moisture content of the recovered soil samples, the static groundwater table is considered to have been present at a depth as shallow as 32± feet below the existing grades at the time of the subsurface exploration.

As a part of our research, we reviewed available groundwater data in order to determine groundwater levels for the site. Recent water level data was obtained from the California Department of Water Resources website, <https://wdl.water.ca.gov/waterdatalibrary/>. One monitoring well is located as close as 2,770± feet south of the site. Water level readings within this monitoring well indicate a high groundwater level of 45± feet below the ground surface in April 2021.

Water level data was also obtained from the California State Water Resources Control Board, GeoTracker, website, <http://geotracker.waterboards.ca.gov/>. Several monitoring wells are located as close as 850± feet northwest of the site. Water level readings within these monitoring wells indicate a high groundwater level of 57± feet below the ground surface in June 2005.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of two (2) infiltration test borings, advanced to a depth of 12± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as I-1 and I-2) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Asphaltic concrete pavements, 3 to 5½± inches in thickness, were encountered at the ground surface of each infiltration boring location. The pavements were underlain by 0 to 7± inches of aggregate base. Artificial fill soils were encountered beneath the existing pavements at both infiltration boring locations, extending to a depth of 6± feet. The fill soils consist of loose fine sandy silts with little clay, and medium stiff fine sandy clays with little silt. Native alluvial soils were encountered beneath the fill soils at both infiltration boring locations, extending to at least the maximum depth explored of 12± feet. The alluvium generally consists of medium dense silty fine sands and fine sandy silts, and stiff to very stiff clayey silts and fine sandy clays. The Infiltration Boring Logs, which illustrate the conditions encountered at the infiltration boring locations, are included with this report.

Infiltration Testing

The infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards, both infiltration test borings were pre-soaked prior to the infiltration testing. The pre-soaking process consisted of filling test borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes or after 15 hours since initiating the pre-soak.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above

the gravel at the bottom of the test holes. In accordance with the Riverside County guidelines, since “non-sandy soils” (where 6 inches of water did not infiltrate into the surrounding soils in less than 25 minutes for two consecutive readings) were encountered at the bottom of the infiltration test borings, readings were taken at 30-minute intervals for a total of 6 hours. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

<u>Infiltration Test No.</u>	<u>Depth (feet)</u>	<u>Soil Description</u>	<u>Measured Infiltration Rate (inches/hour)</u>
I-1	12	Gray Brown Silty fine Sand to fine Sandy Silt	0.0
I-2	12	Dark Gray fine Sandy Silt, trace Clay	0.1

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 and C-2 of this report.

Design Recommendations

Two (2) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations vary from 0.0 to 0.1 inches per hour. The major factor affecting the lack of infiltration rates at the infiltration test locations is the presence of silt and clay in the soils at the tested depths. **Based on the lack of infiltration, infiltration is not considered feasible for this site, and is therefore not recommended.**

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the

contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.



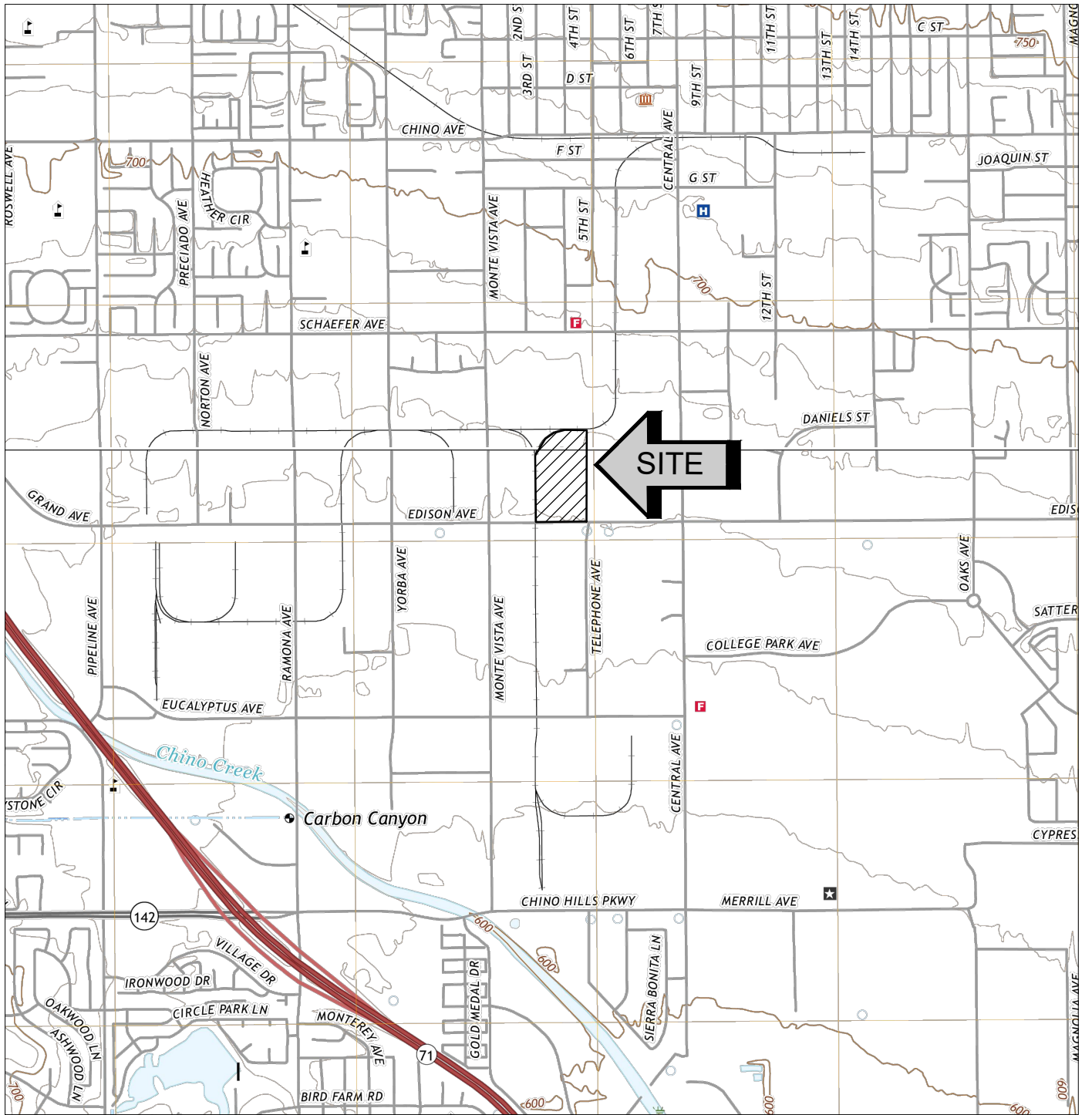
Jamie Hayward
Staff Geologist



Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

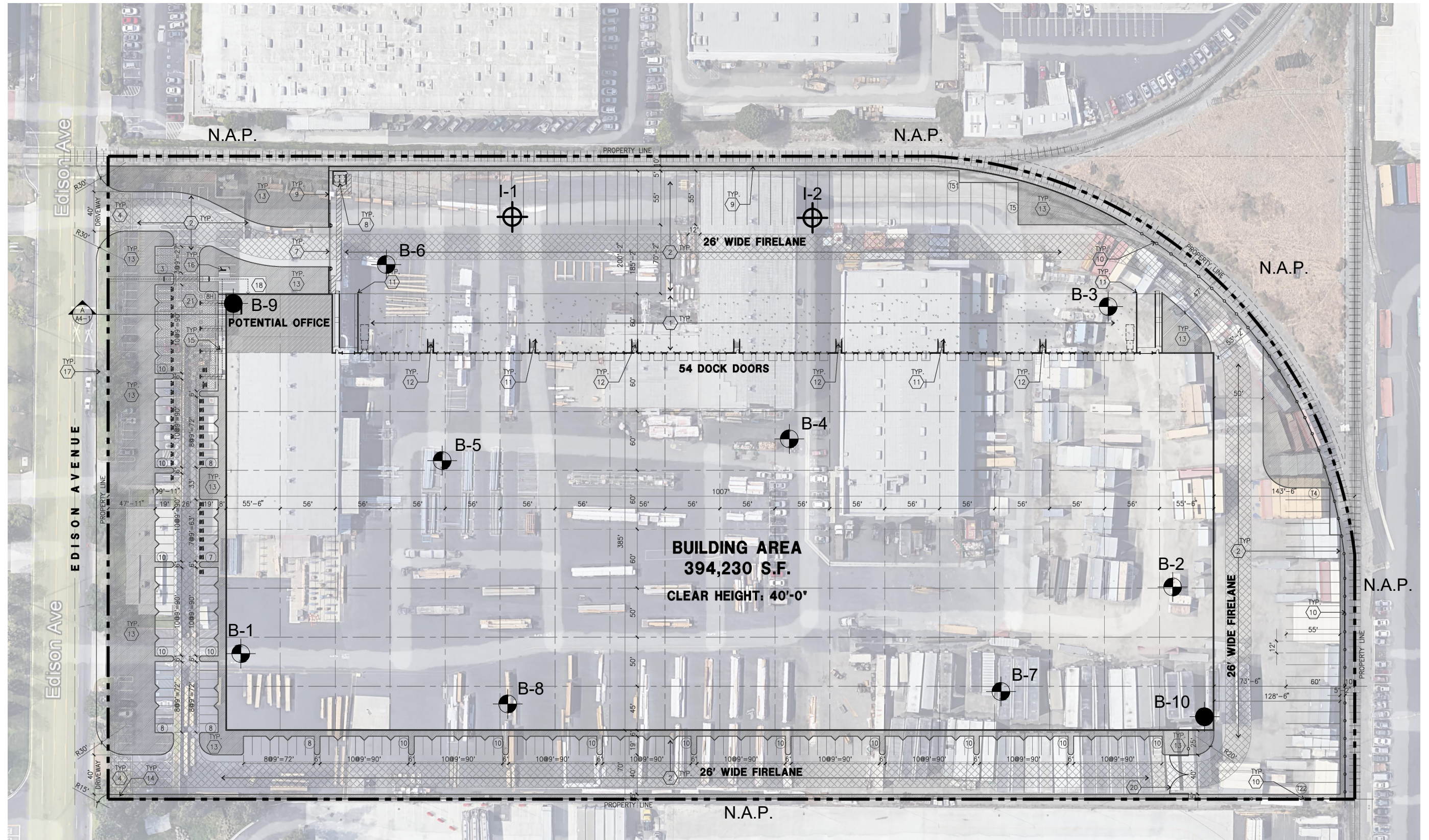
Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (4 pages)
Infiltration Test Results Spreadsheets (2 pages)
Grain Size Distribution Graphs (2 pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF THE PRADO DAM QUADRANGLE AND THE ONTARIO QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2022.



SITE LOCATION MAP	
PROPOSED INDUSTRIAL BUILDING	
CHINO, CALIFORNIA	
SCALE: 1" = 2000'	
DRAWN: JJH	
CHKD: JLL	
SCG PROJECT 23G162-2	
PLATE 1	SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO. 23G162-1)

- PREVIOUS BORING LOCATION (SCG PROJECT NO. 12G120-1)



NOTE: OVERALL SITE PLAN PREPARED BY HPA, INC.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.


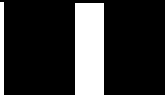



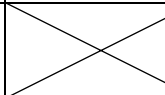
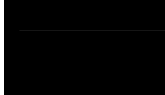

INFILTRATION TEST LOCATION PLAN
PROPOSED INDUSTRIAL BUILDING
CHINO, CALIFORNIA

SCALE: 1" = 100'
DRAWN: JAH
CHKD: JLL
SCG PROJECT
23G162-2
PLATE 2



SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
<p>COARSE GRAINED SOILS</p> <p>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</p>	<p>GRAVEL AND GRAVELLY SOILS</p>	<p>CLEAN GRAVELS</p> <p>(LITTLE OR NO FINES)</p>		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		<p>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE</p>	<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
			<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		<p>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE</p>	<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	<p>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE</p>		<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		SM	SILTY SANDS, SAND - SILT MIXTURES	
	<p>FINE GRAINED SOILS</p> <p>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE</p>	<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT LESS THAN 50</p>		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
		<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT GREATER THAN 50</p>		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY		
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
<p>HIGHLY ORGANIC SOILS</p>				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



JOB NO.: 23G162-2	DRILLING DATE: 7/17/23	WATER DEPTH: Dry
PROJECT: Proposed Industrial Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: Not Applicable
LOCATION: Chino, California	LOGGED BY: Michelle Krizek	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: ----- MSL												
				3± inches Asphaltic Concrete, no underlying Aggregate Base								
				FILL: Dark Gray to Black fine Sandy Clay, little Silt, trace medium to coarse Sand, mottled, medium stiff-moist to very moist		18						
				ALLUVIUM: Light Gray Clayey Silt, little fine Sand, trace medium to coarse Sand, stiff-moist to very moist								
				Gray Brown Silty fine Sand to fine Sandy Silt, trace Iron Oxide staining, medium dense-moist		17						
						12			49			
				Boring Terminated at 12'								

TBL 23G162-2.GPJ_SOCALGEO.GDT 8/4/23



JOB NO.: 23G162-2	DRILLING DATE: 7/17/23	WATER DEPTH: Dry
PROJECT: Proposed Industrial Building	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: Not Applicable
LOCATION: Chino, California	LOGGED BY: Michelle Krizek	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: ----- MSL												
					5½± inches Asphaltic Concrete, 7± inches Aggregate Base							
5		5			FILL: Dark Brown fine Sandy Silt, little Clay, little medium Sand, trace coarse Sand, trace Asphaltic concrete fragments, mottled, loose-very moist		20					
10		15	3.0		ALLUVIUM: Dark Brown fine Sandy Clay, little Silt, trace medium Sand, stiff to very stiff-very moist		20					
15		15			Dark Gray fine Sandy Silt, trace Clay, trace Iron Oxide staining, medium dense-very moist		22		85			
Boring Terminated at 12'												

TBL_23G162-2.GPJ_SOCALGEO.GDT_8/4/23

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Building
Project Location	Chino, California
Project Number	23G162-2
Engineer	CB

Test Hole Radius	4 (in)
Test Depth	12.10 (ft)

Infiltration Test Hole I-1

Soil Criteria Test							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	10:12 AM	25.00	10.10	0.00	NO	NON-SANDY SOILS
	Final	10:27 AM		10.10			
2	Initial	10:28 AM	25.00	10.10	0.00	NO	NON-SANDY SOILS
	Final	10:53 AM		10.10			

Test Data							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	10:54 AM	30.00	10.10	0.10	1.95	0.19
	Final	11:24 AM		10.20			
2	Initial	11:24 AM	30.00	10.10	0.00	2.00	0.00
	Final	11:54 AM		10.10			
3	Initial	11:55 AM	30.00	10.10	0.10	1.95	0.19
	Final	12:25 PM		10.20			
4	Initial	12:25 PM	30.00	10.10	0.00	2.00	0.00
	Final	12:55 PM		10.10			
5	Initial	12:56 PM	30.00	10.10	0.10	1.95	0.19
	Final	1:26 PM		10.20			
6	Initial	1:26 PM	30.00	10.10	0.00	2.00	0.00
	Final	1:56 PM		10.10			
7	Initial	1:57 PM	30.00	10.10	0.10	1.95	0.19
	Final	2:27 PM		10.20			
8	Initial	2:28 PM	30.00	10.10	0.00	2.00	0.00
	Final	2:58 PM		10.10			
9	Initial	2:59 PM	30.00	10.10	0.10	1.95	0.19
	Final	3:29 PM		10.20			
10	Initial	3:30 PM	30.00	10.10	0.00	2.00	0.00
	Final	4:00 PM		10.10			
11	Initial	4:00 PM	30.00	10.10	0.10	1.95	0.19
	Final	4:30 PM		10.20			
12	Initial	4:30 PM	30.00	10.10	0.00	2.00	0.00
	Final	5:00 PM		10.10			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

- Where:
- Q = Infiltration Rate (in inches per hour)
 - ΔH = Change in Height (Water Level) over the time interval
 - r = Test Hole (Borehole) Radius
 - Δt = Time Interval
 - H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Building
Project Location	Chino, California
Project Number	23G162-2
Engineer	CB

Test Hole Radius	4 (in)
Test Depth	12.20 (ft)

Infiltration Test Hole	I-2
------------------------	-----

Soil Criteria Test							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	7:07 AM	25.00	7.90	2.40	NO	NON-SANDY SOILS
	Final	7:32 AM		8.10			
2	Initial	7:32 AM	25.00	7.90	0.60	NO	NON-SANDY SOILS
	Final	7:57 AM		7.95			

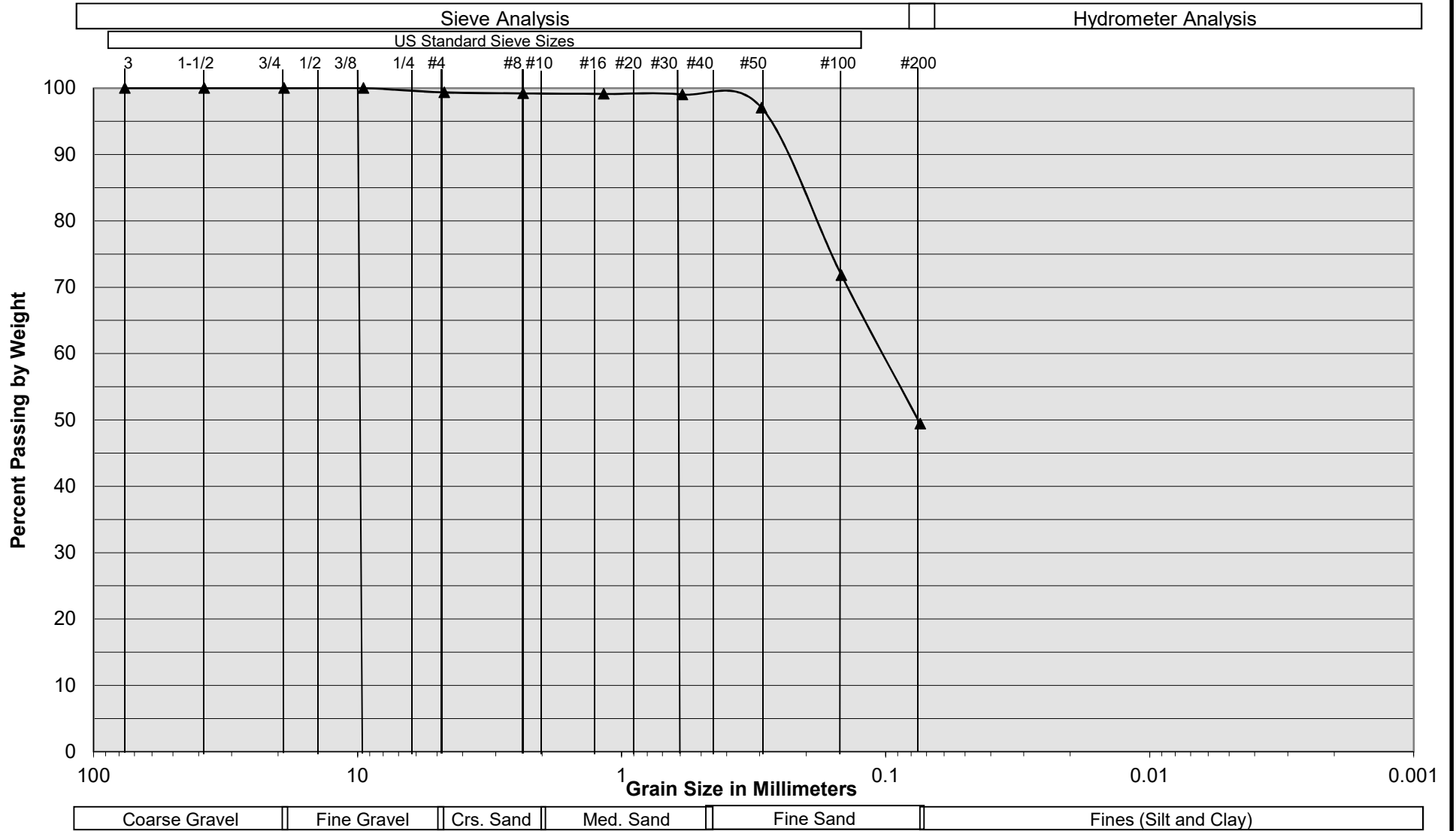
Test Data							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	7:58 AM	30.00	7.90	0.42	4.09	0.39
	Final	8:28 AM		8.32			
2	Initial	8:28 AM	30.00	7.90	0.32	4.14	0.30
	Final	8:58 AM		8.22			
3	Initial	8:59 AM	30.00	7.90	0.22	4.19	0.20
	Final	9:29 AM		8.12			
4	Initial	9:29 AM	30.00	7.90	0.21	4.20	0.19
	Final	9:59 AM		8.11			
5	Initial	10:00 AM	30.00	7.90	0.15	4.23	0.14
	Final	10:30 AM		8.05			
6	Initial	10:30 AM	30.00	7.90	0.13	4.24	0.12
	Final	11:00 AM		8.03			
7	Initial	11:01 AM	30.00	7.90	0.13	4.24	0.12
	Final	11:31 AM		8.03			
8	Initial	11:31 AM	30.00	7.90	0.13	4.24	0.12
	Final	12:01 PM		8.03			
9	Initial	12:02 PM	30.00	7.90	0.12	4.24	0.11
	Final	12:32 PM		8.02			
10	Initial	12:32 PM	30.00	7.90	0.13	4.24	0.12
	Final	1:02 PM		8.03			
11	Initial	1:03 PM	30.00	7.90	0.11	4.25	0.10
	Final	1:33 PM		8.01			
12	Initial	1:34 PM	30.00	7.90	0.11	4.25	0.10
	Final	2:04 PM		8.01			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

- Where:
- Q = Infiltration Rate (in inches per hour)
 - ΔH = Change in Height (Water Level) over the time interval
 - r = Test Hole (Borehole) Radius
 - Δt = Time Interval
 - H_{avg} = Average Head Height over the time interval

Grain Size Distribution



Sample Description	I-1 @ 10 1/2'
Soil Classification	Gray Brown Silty fine Sand to fine Sandy Silt

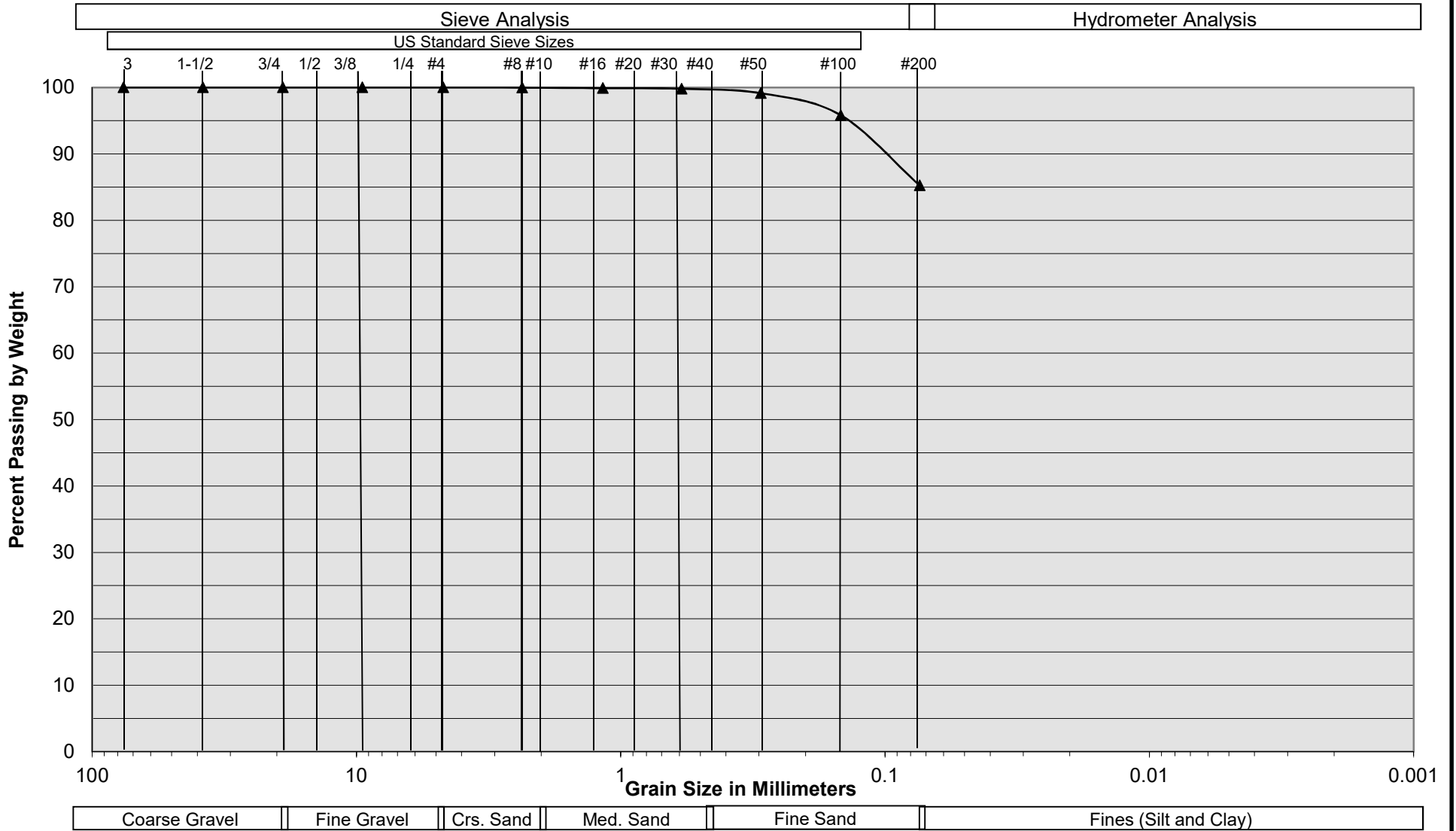
Proposed Industrial Building
 Chino, California
 Project No. 23G162-2
PLATE C- 1





SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-2 @ 10 1/2'
Soil Classification	Dark Gray fine Sandy Silt, trace Clay

Proposed Industrial Building
 Chino, California
 Project No. 23G162-2
PLATE C- 2



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX C – PROPRIETARY BIOFILTRATION – FACT SHEETS,
DESIGN GUIDE, AND O&M



Modular Wetlands[®] Linear Stormwater Biofiltration



The experts you need to solve your stormwater challenges



Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

Your Contech Team



STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.



STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.



REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.



SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions



Restoring Nature's Presence in Urban Areas – Modular Wetlands® Linear

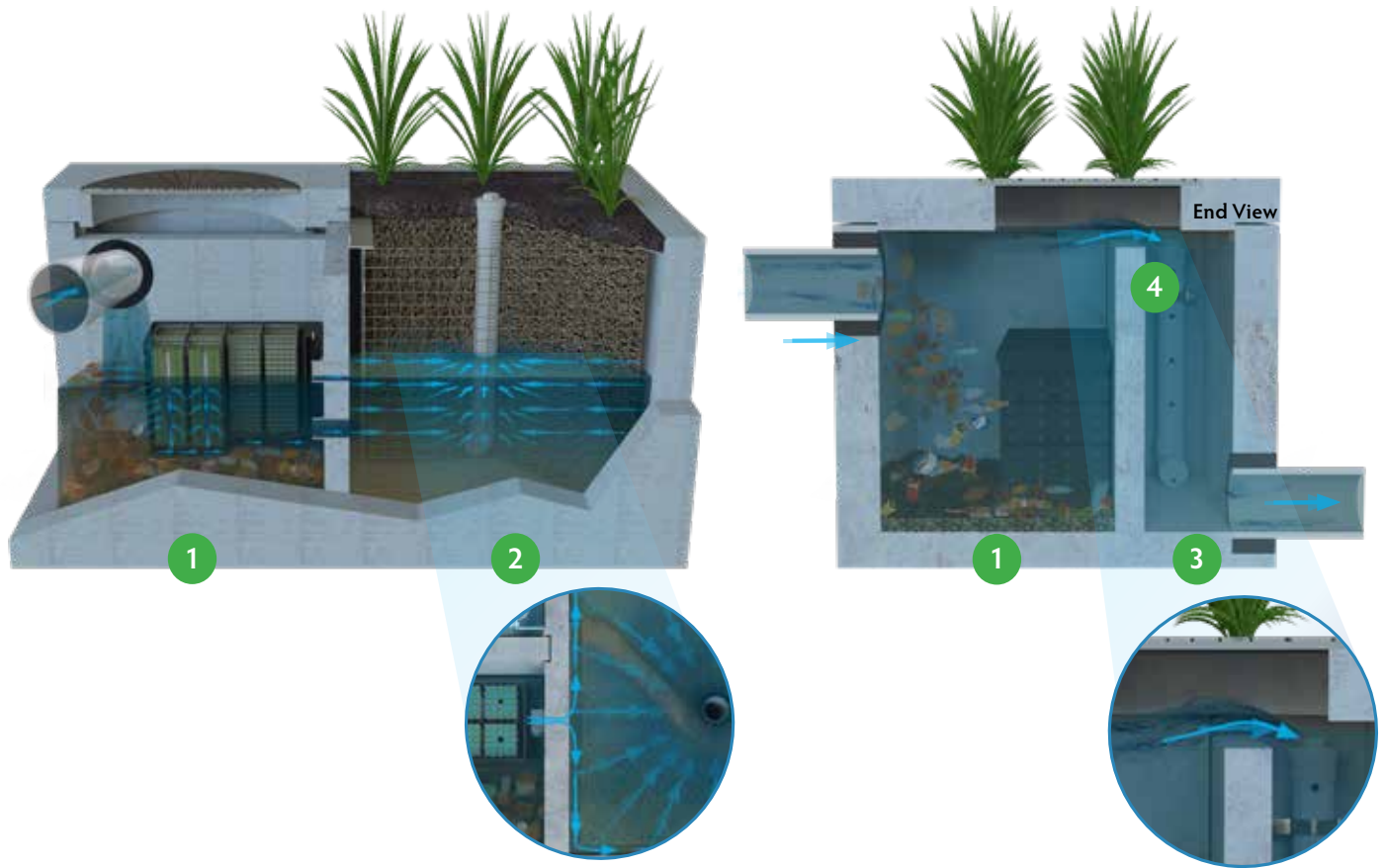
The Modular Wetlands® Linear is the only biofiltration system to utilize patented horizontal flow, allowing for a small footprint, high treatment capacity, and design versatility. It is also the only biofiltration system that can be routinely installed downstream of storage for additional volume control and treatment.

With numerous regulatory approvals, the system's aesthetic appeal and superior pollutant removal make it the ideal solution for a wide range of stormwater applications, including urban development projects, commercial parking lots, residential streets, mixed-use developments, streetscapes, and more.

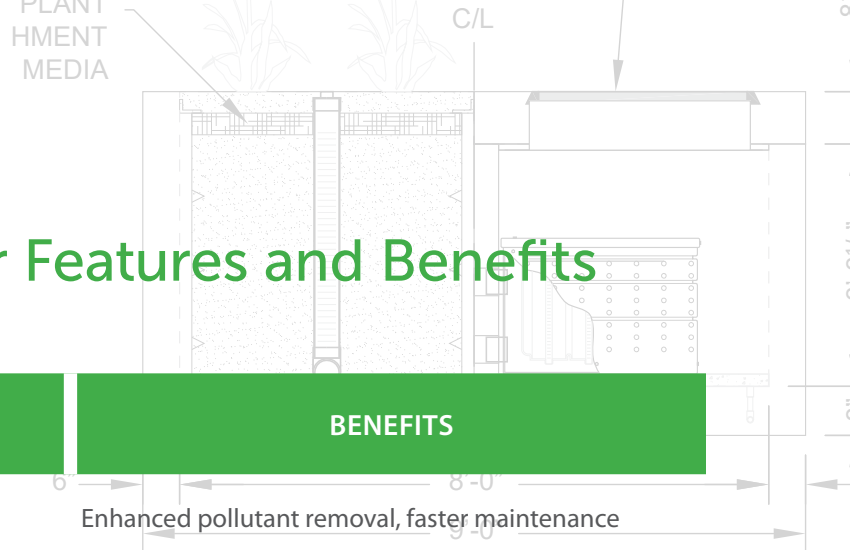
As cities grow, there is less space for natural solutions to treat stormwater. Contech understands this and is committed to providing compact, Low Impact Development (LID) solutions like the Modular Wetlands Linear to protect our nation's waterways.



How the Modular Wetlands® Linear Works




- 1** **PRETREATMENT** | Stormwater enters the pretreatment chamber where total suspended solids settle, and trash and debris are contained within the chamber. Stormwater then travels through the pretreatment filter boxes that provide additional treatment.
- 2** **BIOFILTRATION** | As water enters the biofiltration chamber, it fills the void space in the chamber's perimeter. Horizontal forces push the water inward through the biofiltration media, where nutrients and metals are captured. The water then enters the drain pipe to be discharged.
- 3** **DISCHARGE** | The specially designed vertical drain pipe and orifice control plate control the flow of water through the media to a level lower than the media's capacity, ensuring media effectiveness. The water then enters the horizontal drain pipe to be discharged.
- 4** **BYPASS** | During peak flows, an internal weir in the side-by-side configuration allows high flows to bypass treatment, eliminating flooding and the need for a separate bypass structure. Bypass is not provided in the end-to-end configuration.



Modular Wetlands[®] Linear Features and Benefits

FEATURE	BENEFITS
Pretreatment chamber	Enhanced pollutant removal, faster maintenance
Horizontal flow biofiltration	Greater filter surface area
Performance verified by both the WA DOE and NJ DEP	Superior pollutant capture with confidence
Built-in high flow bypass	Eliminates flooding and the need for a separate bypass structure
Available in multiple configurations and sizes	Flexibility to meet site-specific needs

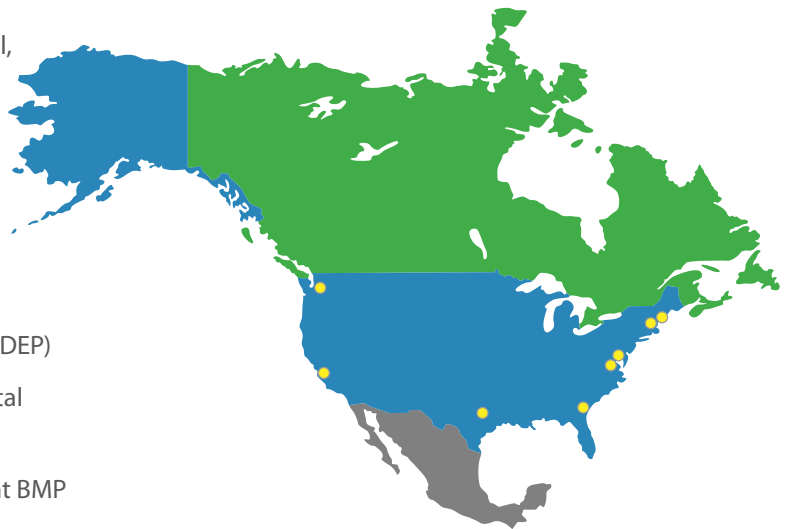


The Modular Wetlands system offers many different configurations.

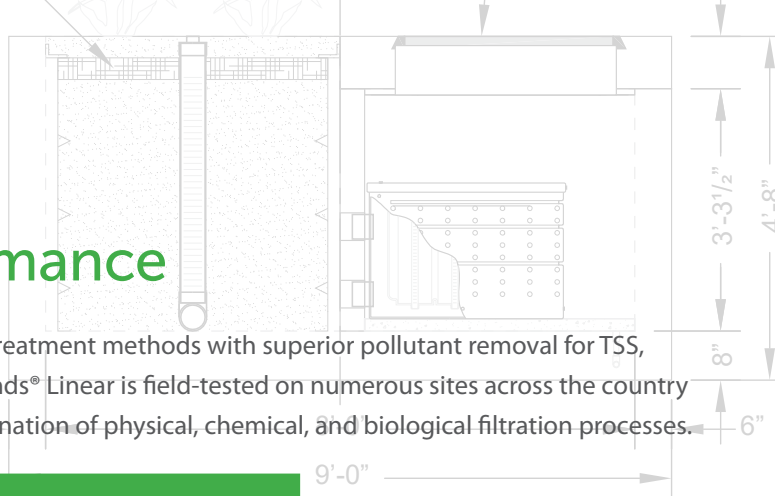
Select Modular Wetlands[®] Linear Approvals

Modular Wetlands Linear is approved through numerous local, state and federal programs, including but not limited to:

- Washington State Department of Ecology TAPE
- California Water Resources Control Board, Full Capture Certification
- Virginia Department of Environmental Quality (VA DEQ)
- New Jersey Department of Environmental Protection (NJDEP)
- Maryland Department of the Environment - Environmental Site Design (ESD)
- Rhode Island Department of Environmental Management BMP
- Texas Commission on Environmental Quality (TCEQ)
- Atlanta Regional Commission Certification



MEDIA



Modular Wetlands® Performance

The Modular Wetlands® Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, and hydrocarbons. The Modular Wetlands® Linear is field-tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes.

POLLUTANT OF CONCERN	MEDIAN REMOVAL EFFICIENCY	MEDIAN EFFLUENT CONCENTRATION (MG/L)
Total Suspended Solids (TSS)	89%	12
Total Phosphorus - TAPE (TP)	61%	0.041
Nitrogen (TN)	23%	1
Total Copper (TCu)	50%	0.006
Total Dissolved Copper	37%	0.006
Total Zinc (TZn)	66%	0.019
Dissolved Zinc	60%	0.0148
Motor Oil	79%	0.8

Sources:
 TAPE Field Study - 2012
 TAPE Field Study - 2013

Note: Some jurisdictions recognize higher removal rates. Contact your Contech Stormwater Consultant for performance expectations.

Modular Wetlands® Linear Maintenance

The Modular Wetlands® Linear is a self-contained treatment train. Maintenance requirements for the unit consist of five simple steps that can be completed using a vacuum truck. The system can also be cleaned by hand.

- Remove trash from the screening device
- Remove sediment from the separation chamber
- Periodically replace the pretreatment cartridge filter media
- Replace the drain down filter media
- Trim vegetation



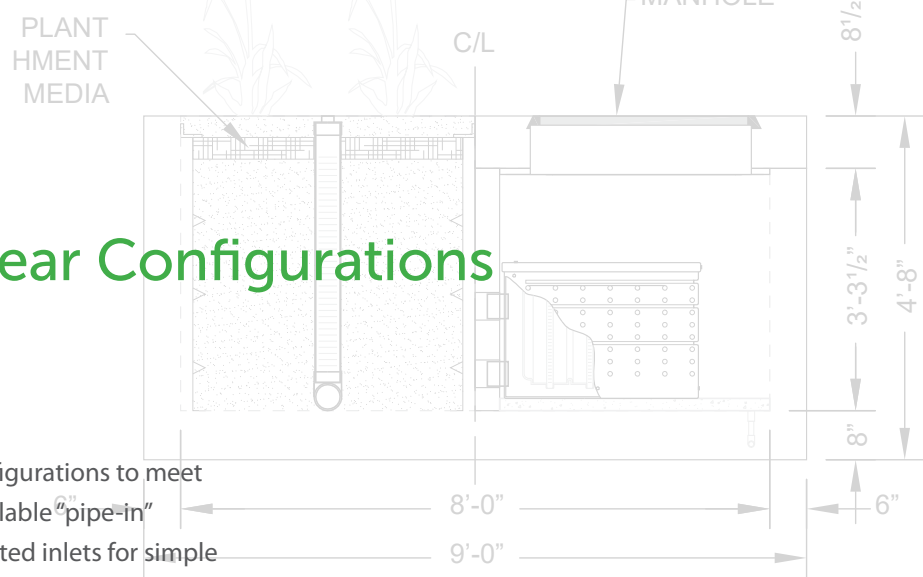
Most Modular Wetland Linear systems can be cleaned in about thirty minutes.

Multiple configurations allow for easy site integration

Modular Wetlands[®] Linear Configurations

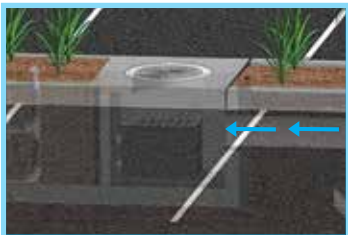
Multiple system configurations integrate with site hydraulic design and layout ...

The Modular Wetlands Linear is offered in multiple configurations to meet site specific needs. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.



Curb Inlet

The Curb Inlet configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions.



Vault

The Vault configuration can be used in end-of-the-line installations. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements, or for traffic-rated designs (no plants).



Downspout

The Downspout configuration is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

A partner you can rely on



STORMWATER
SOLUTIONS



PIPE
SOLUTIONS



STRUCTURES
SOLUTIONS

Few companies offer the wide range of high-quality stormwater resources you can find with us — state-of-the-art products, decades of expertise, and all the maintenance support you need to operate your system cost-effectively.

THE CONTECH WAY

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

TAKE THE NEXT STEP

For more information: www.ContechES.com

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SPECIFICATIONS

FLOW-BASED DESIGNS

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements. Since the Modular Wetlands® is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

MODEL #	DIMENSIONS	WETLAND MEDIA SURFACE AREA (sq. ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4' x 4'	23	0.052
MWS-L-4-6	4' x 6'	32	0.073
MWS-L-4-8	4' x 8'	50	0.115
MWS-L-4-13	4' x 13'	63	0.144
MWS-L-4-15	4' x 15'	76	0.175
MWS-L-4-17	4' x 17'	90	0.206
MWS-L-4-19	4' x 19'	103	0.237
MWS-L-4-21	4' x 21'	117	0.268
MWS-L-6-8	7' x 9'	64	0.147
MWS-L-8-8	8' x 8'	100	0.230
MWS-L-8-12	8' x 12'	151	0.346
MWS-L-8-16	8' x 16'	201	0.462
MWS-L-8-20	9' x 21'	252	0.577
MWS-L-8-24	9' x 25'	302	0.693
MWS-L-10-20	10' x 20'	302	0.693



Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

36 Hr

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 36-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	1710	2280
MWS-L-4-6	1600	2400	3200
MWS-L-4-8	2518	3777	5036
MWS-L-4-13	3131	4696	6261
MWS-L-4-15	3811	5716	7623
MWS-L-4-17	4492	6738	8984
MWS-L-4-19	5172	7758	10345
MWS-L-4-21	5853	8779	11706
MWS-L-6-8	3191	4786	6382
MWS-L-8-8	5036	7554	10072
MWS-L-8-12	7554	11331	15109
MWS-L-8-16	10073	15109	20145
MWS-L-8-20	12560	18840	25120
MWS-L-8-24	15108	22662	30216

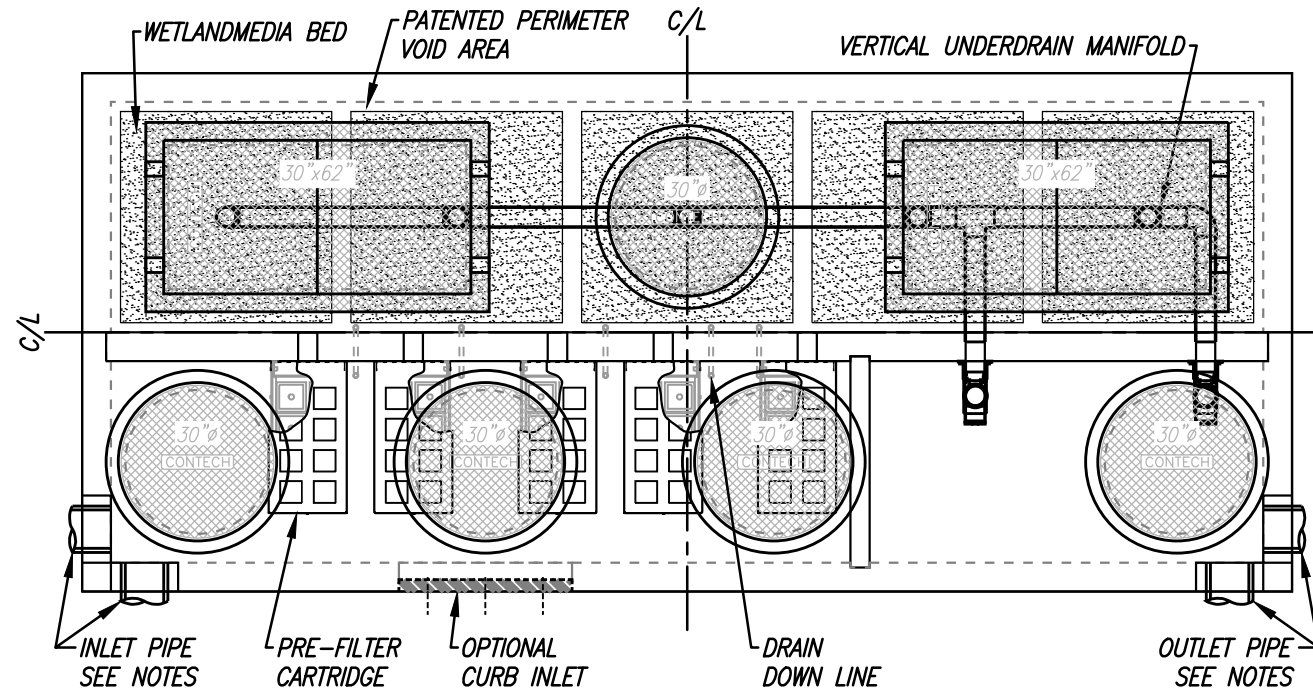
SITE SPECIFIC DATA

PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
TREATMENT FLOW (CFS)			
PRETREATMENT LOADING RATE (GPM/SF)		2.1 GPM/SF	
WETLAND MEDIA LOADING RATE (GPM/SF)		1.0	
PEAK BYPASS REQUIRED (CFS) - IF APPLICABLE		DVERT	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	HS-20		
NOTES:			

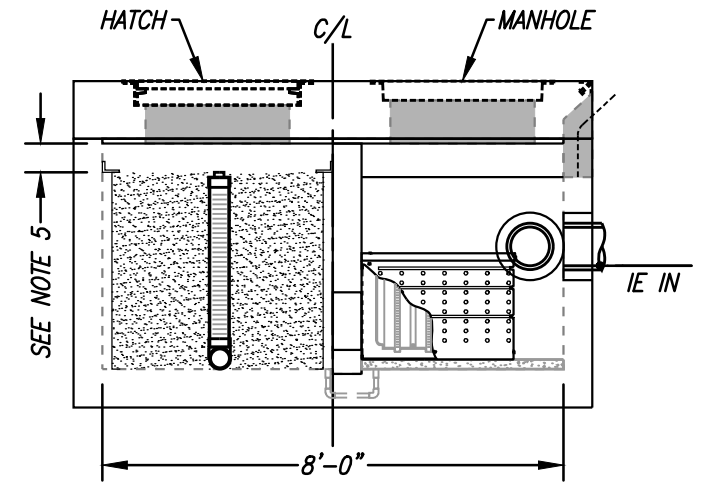
* PRELIMINARY ONLY - NOT FOR CONSTRUCTION

INSTALLATION NOTES

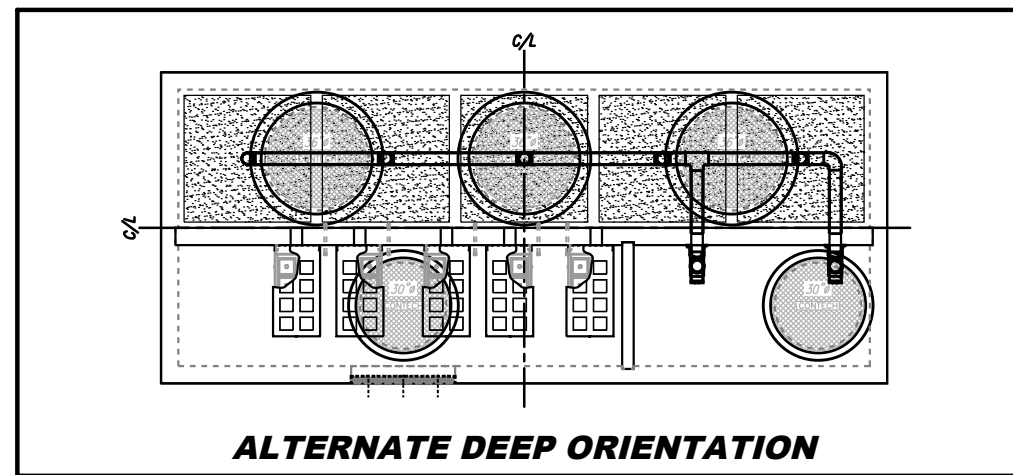
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER 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. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. ALTERNATE DEEP FRAME & COVER ORIENTATION USED WHEN CEILING TO MEDIA DISTANCE IS 2.5' OR GREATER.
6. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.



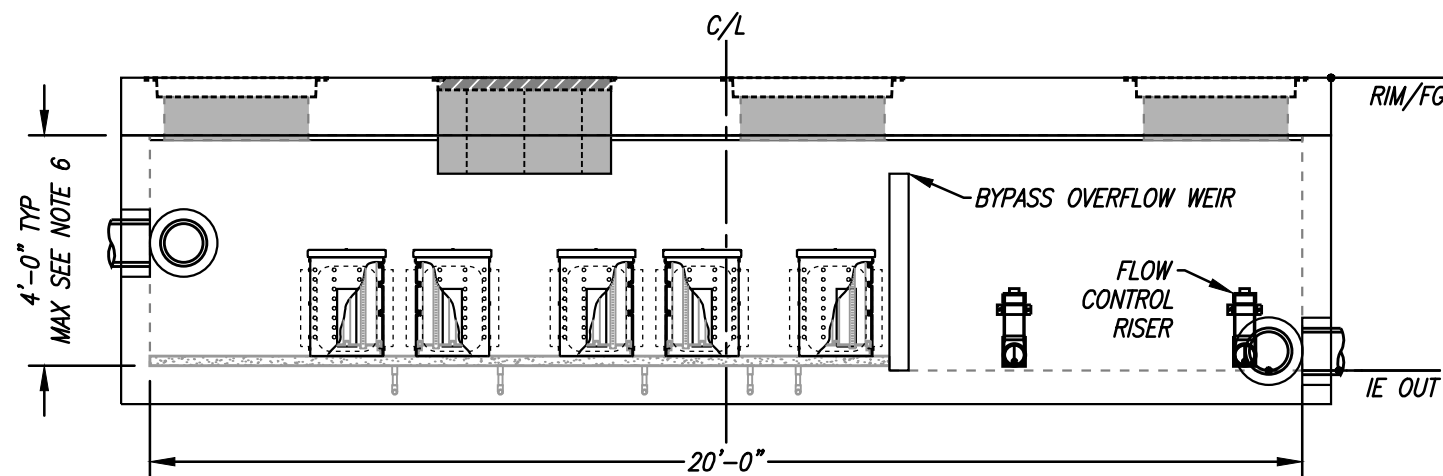
PLAN VIEW



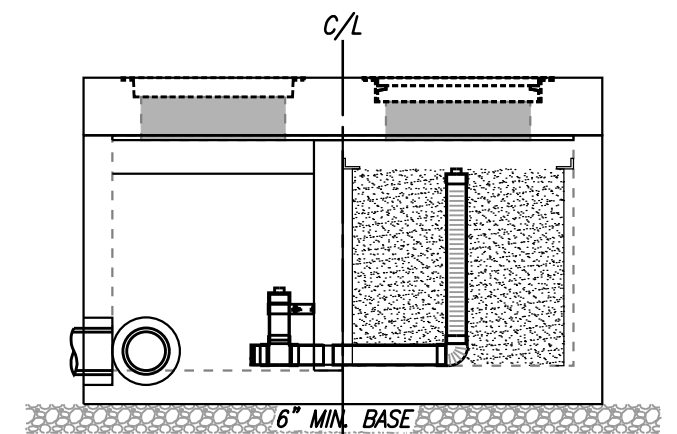
LEFT END VIEW



ALTERNATE DEEP ORIENTATION

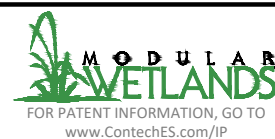


ELEVATION VIEW



RIGHT END VIEW

8/14/23 SCOTT SERTECH



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MWS-L-8-20-V-UG
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Modular Wetlands[®] Linear Operatons & Maintenance Manual



MODULAR WETLANDS LINEAR OPERATION & MAINTENANCE MANUAL

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OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.



WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.



Safety Boots



Gloves



Hard Hat



Eye Protection

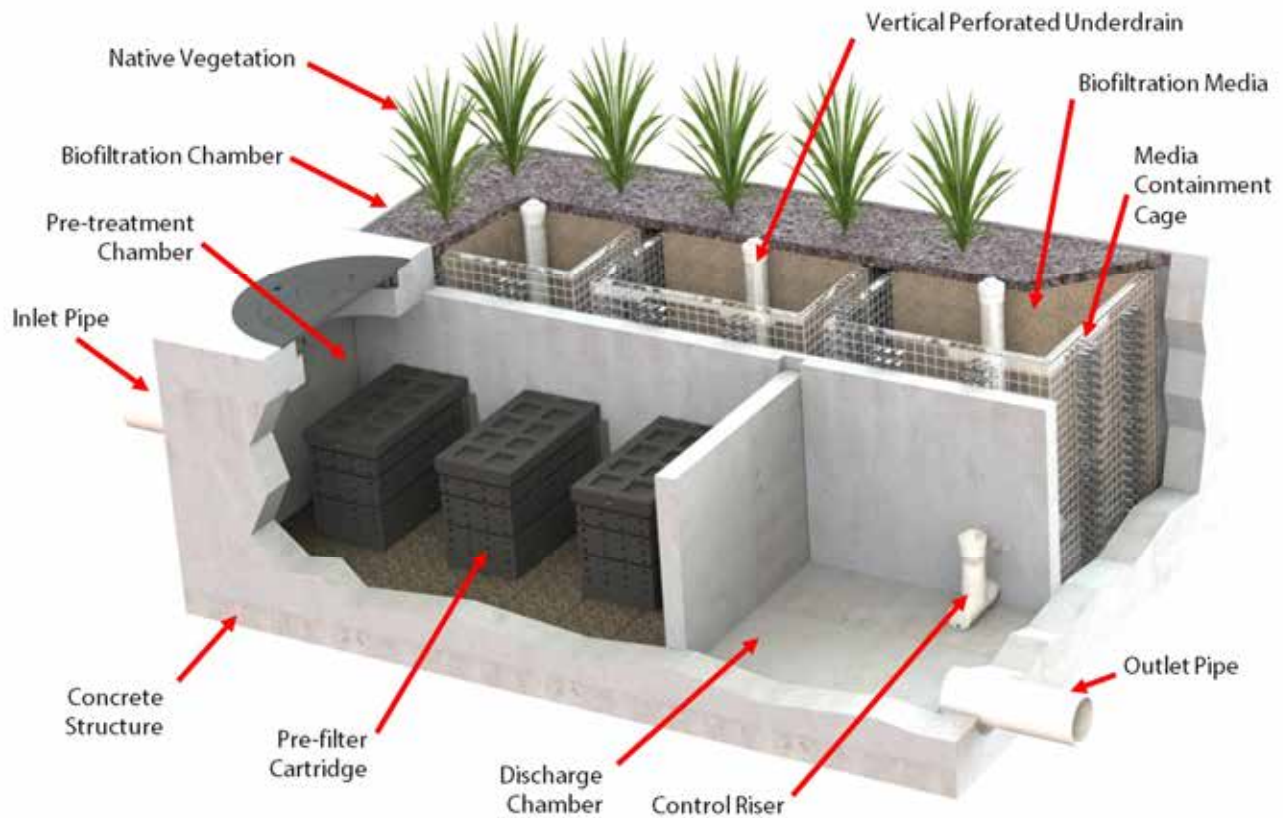


Maintenance and Protection
of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



INSPECTION SUMMARY & EQUIPMENT LIST

Stormwater regulations require 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. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:



Modular Wetlands Linear
Inspection Form



Flashlight



Tape Measure



Access Cover Hook



Ratchet
& 7/16" Socket
(if required for older pre-filter
cartridges that have two
bolts holding the lids on)

INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that 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 chamber.
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.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.



6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.
7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.
8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

MAINTENANCE INDICATORS

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

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. 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 some maintenance activities require confined space entry. 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 maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
 - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:



Modular Wetlands Linear Maintenance Form



Flashlight



Access Cover Hook



Ratchet & 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)



Vacuum Assisted Truck with Pressure Washer



Replacement BioMediaGREEN
(If Required)

(order BioMediaGREEN from Contech's Maintenance Team members at <https://www.conteches.com/maintenance>)

MAINTENANCE INSTRUCTIONS



1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



2. PRESSURE WASH SYSTEM CHAMBERS

With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).



3. VACUUM SYSTEM CHAMBERS

Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. **(MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4**. If not, replace the access cover(s) and proceed to **Step 7**.



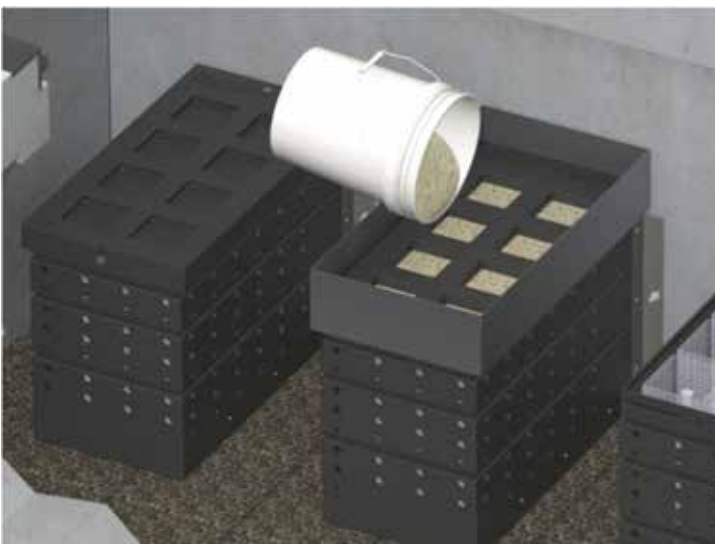
4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)



5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.



7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.



8. INSPECT UNDERDRAIN SYSTEM

Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.



9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at <https://www.conteches.com/maintenance> to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



1. VACUUM EXISTING BIOFILTRATION MEDIA

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.



2. INSTALLING NEW BIOFILTRATION MEDIA

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.

3. REPLANT VEGETATION

Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at <https://www.conteches.com/maintenance> to order new plant establishment media.



REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

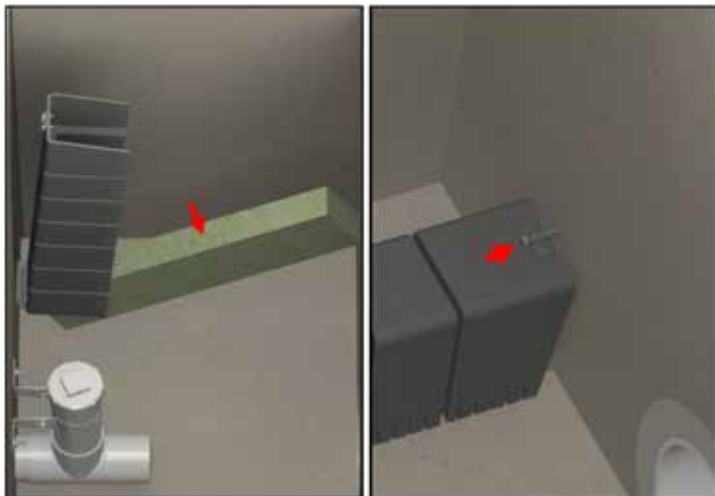
NOTE: The drain down filter is only found on units installed in California prior to 2023

If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at <https://www.conteches.com/maintenance> to order new media.



1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.



Inspection Report Modular Wetlands Linear

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

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

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: _____



Cleaning and Maintenance Report Modular Wetlands Linear

Project Name _____

For Office Use Only

(Reviewed By) _____

(Date) _____
Office personnel to complete section to the left.

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 _____

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: _____	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:



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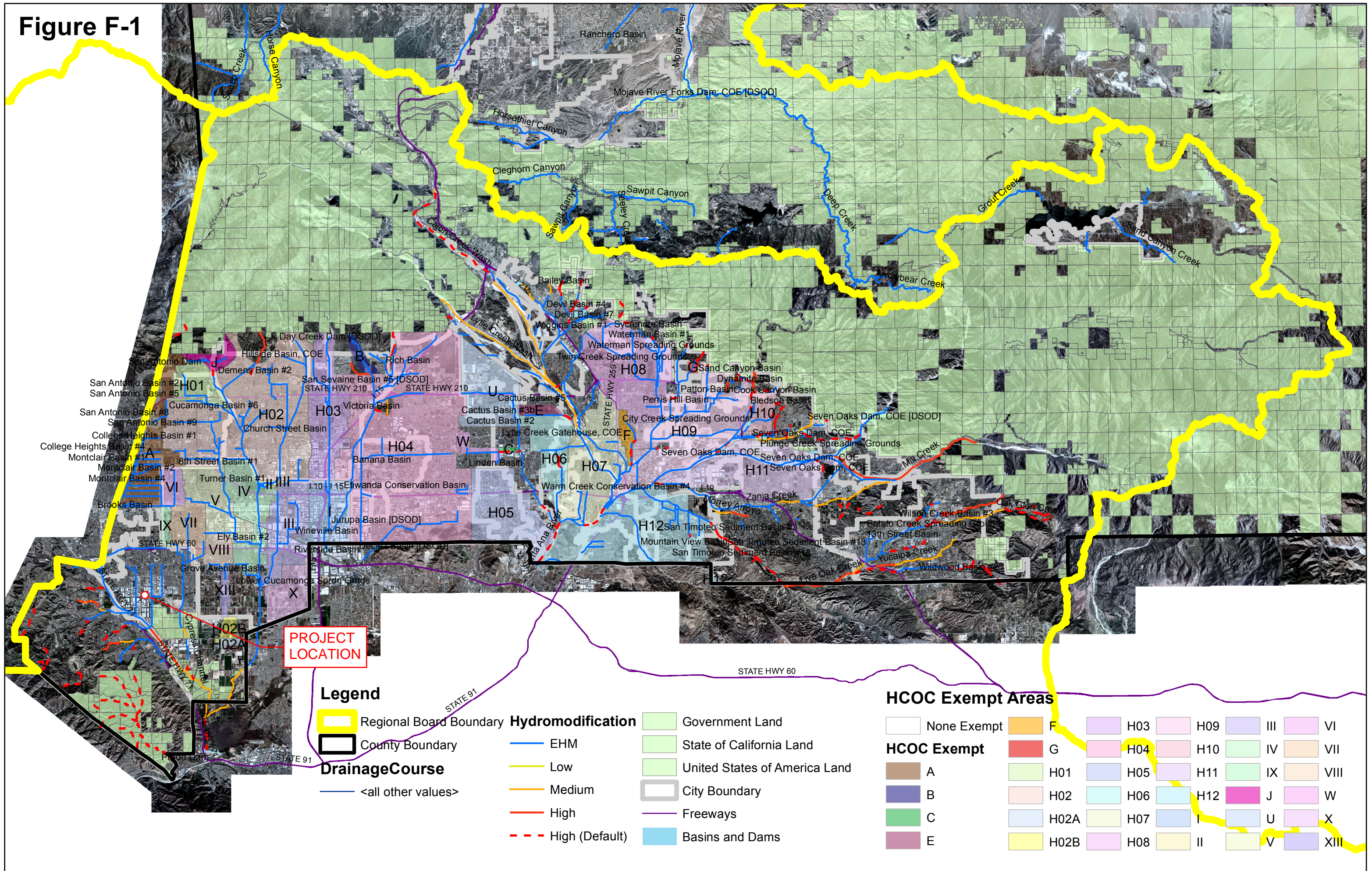
SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

ModWetLinear OM Manual 03/24

APPENDIX D – HCOC EXEMPTION MAP AND CRITERIA

Figure F-1



Hydromodification

A.1 Hydrologic Conditions of Concern (HCOC) Analysis

Project reduces impervious area and reduces the peak runoff rate as compared to the existing site conditions.

HCOC Exemption:

1. **Sump Condition**: All downstream conveyance channel to an adequate sump (for example, Prado Dam, Santa Ana River, or other Lake, Reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.
2. **Pre = Post**: The runoff flow rate, volume and velocity for the post-development condition of the Priority Development Project do not exceed the pre-development (i.e, naturally occurring condition for the 2-year, 24-hour rainfall event utilizing latest San Bernardino County Hydrology Manual.
 - a. Submit a substantiated hydrologic analysis to justify your request.
3. **Diversion to Storage Area**: The drainage areas that divert to water storage areas which are considered as control/release point and utilized for water conservation.
 - a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (<http://sbcounty.permitrack.com/wap>) for reference.
4. **Less than One Acre**: The Priority Development Project disturbs less than one acre. The Co-permittee has the discretion to require a Project Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The project disturbs less than one acre and is not part of a common plan of development.
5. **Built Out Area**: The contributing watershed area to which the project discharges has a developed area percentage greater than 90 percent.
 - a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (<http://sbcounty.permitrack.com/wap>) for reference.

Project is surrounded by industrial development as seen on HCOC map.

Summary of HCOC Exempted Area

	HCOC Exemption reasoning				
	1	2	3	4	5
Area					
A			X		X
B			X		
C					X
E			X		
F					X
G			X		X
H01	X		X		
H02	X		X		
H02A	X		X		
H02B			X		
H03			X		
H04	X		X		
H05	X				
H06			X		
H07	X				
H08	X		X		
H09	X				
H10	X		X		
H11	X		X		
H12	X				
J			X		
U			X		
W			X		
I			X		
II			X		
III					X
IV			X		X
V			X*		
VI					X
VII					X
VIII			X		
IX					X
X			X		
XIII			X		

*Detention/Conservation Basin

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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Ver. 23.0 Release Date: 07/01/2016 License ID 1734

Analysis prepared by:

***** DESCRIPTION OF STUDY *****

- * EXISTING CONDITIONS *
 - * 2-YR EVENT *
 - * PROLOGIS DISTRIBUTION CENTER *
- *****

FILE NAME: C:\AES\PROL\PROLEX2.DAT
TIME/DATE OF STUDY: 13:26 05/23/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
 10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.850
 100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.250
 COMPUTED RAINFALL INTENSITY DATA:
 STORM EVENT = 2.00 1-HOUR INTENSITY(INCH/HOUR) = 0.5704
 SLOPE OF INTENSITY DURATION CURVE = 0.6000

ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0313 0.167	0.0150
2	30.0	20.0	0.018/0.018/0.020	0.50	1.50 0.0313 0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 114.00 TO NODE 112.00 IS CODE = 21

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 73.00
 ELEVATION DATA: UPSTREAM(FEET) = 680.00 DOWNSTREAM(FEET) = 678.50

$T_c = K * [(LENGTH^{**} 3.00) / (ELEVATION CHANGE)]^{**0.20}$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.000

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.533

SUBAREA T_c AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	T_c (MIN.)
APARTMENTS	C	0.25	0.81	0.200	50	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.200

SUBAREA RUNOFF(CFS) = 0.53

TOTAL AREA(ACRES) = 0.25 PEAK FLOW RATE(CFS) = 0.53

FLOW PROCESS FROM NODE 112.00 TO NODE 110.00 IS CODE = 51

 >>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 678.50 DOWNSTREAM(FEET) = 670.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 871.00 CHANNEL SLOPE = 0.0098

CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 50.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.25

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.456

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
USER-DEFINED	-	7.03	0.27	0.050	-

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.27

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.050

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.35

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.91

AVERAGE FLOW DEPTH(FEET) = 0.11 TRAVEL TIME(MIN.) = 7.58

T_c (MIN.) = 12.58

SUBAREA AREA(ACRES) = 7.03 SUBAREA RUNOFF(CFS) = 9.12

EFFECTIVE AREA(ACRES) = 7.28 AREA-AVERAGED F_m (INCH/HR) = 0.02

AREA-AVERAGED F_p (INCH/HR) = 0.34 AREA-AVERAGED A_p = 0.06

TOTAL AREA(ACRES) = 7.3 PEAK FLOW RATE(CFS) = 9.41

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.15 FLOW VELOCITY(FEET/SEC.) = 2.33

LONGEST FLOWPATH FROM NODE 114.00 TO NODE 110.00 = 944.00 FEET.

FLOW PROCESS FROM NODE 110.00 TO NODE 102.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 660.00 DOWNSTREAM(FEET) = 654.79

FLOW LENGTH(FEET) = 600.00 MANNING'S N = 0.013

DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.6 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 6.25

ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 9.41

PIPE TRAVEL TIME(MIN.) = 1.60 Tc(MIN.) = 14.18

LONGEST FLOWPATH FROM NODE 114.00 TO NODE 102.00 = 1544.00 FEET.

FLOW PROCESS FROM NODE 102.00 TO NODE 102.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

TOTAL NUMBER OF STREAMS = 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION(MIN.) = 14.18

RAINFALL INTENSITY(INCH/HR) = 1.36

AREA-AVERAGED Fm(INCH/HR) = 0.02

AREA-AVERAGED Fp(INCH/HR) = 0.34

AREA-AVERAGED Ap = 0.06

EFFECTIVE STREAM AREA(ACRES) = 7.28

TOTAL STREAM AREA(ACRES) = 7.28

PEAK FLOW RATE(CFS) AT CONFLUENCE = 9.41

FLOW PROCESS FROM NODE 108.00 TO NODE 106.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 50.00

ELEVATION DATA: UPSTREAM(FEET) = 670.80 DOWNSTREAM(FEET) = 670.50

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.533

SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
USER-DEFINED	-	0.19	0.27	0.001	-	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.001
 SUBAREA RUNOFF(CFS) = 0.42
 TOTAL AREA(ACRES) = 0.19 PEAK FLOW RATE(CFS) = 0.42

FLOW PROCESS FROM NODE 106.00 TO NODE 104.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 670.50 DOWNSTREAM(FEET) = 664.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 459.00 CHANNEL SLOPE = 0.0142
 CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 50.000
 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.25
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.739
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
USER-DEFINED	-	2.40	0.27	0.010	-

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.010
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.34
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.75
 AVERAGE FLOW DEPTH(FEET) = 0.06 TRAVEL TIME(MIN.) = 4.36
 Tc(MIN.) = 9.36
 SUBAREA AREA(ACRES) = 2.40 SUBAREA RUNOFF(CFS) = 3.76
 EFFECTIVE AREA(ACRES) = 2.59 AREA-AVERAGED Fm(INCH/HR) = 0.00
 AREA-AVERAGED Fp(INCH/HR) = 0.27 AREA-AVERAGED Ap = 0.01
 TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 4.05

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 0.08 FLOW VELOCITY(FEET/SEC.) = 2.08
 LONGEST FLOWPATH FROM NODE 108.00 TO NODE 104.00 = 509.00 FEET.

FLOW PROCESS FROM NODE 104.00 TO NODE 102.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 655.47 DOWNSTREAM(FEET) = 654.79
 FLOW LENGTH(FEET) = 29.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.29
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 4.05

PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 9.43
 LONGEST FLOWPATH FROM NODE 108.00 TO NODE 102.00 = 538.00 FEET.

FLOW PROCESS FROM NODE 102.00 TO NODE 102.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.43
 RAINFALL INTENSITY(INCH/HR) = 1.73
 AREA-AVERAGED Fm(INCH/HR) = 0.00
 AREA-AVERAGED Fp(INCH/HR) = 0.27
 AREA-AVERAGED Ap = 0.01
 EFFECTIVE STREAM AREA(ACRES) = 2.59
 TOTAL STREAM AREA(ACRES) = 2.59
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.05

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	9.41	14.18	1.355	0.34(0.02)	0.06	7.3	114.00
2	4.05	9.43	1.731	0.27(0.00)	0.01	2.6	108.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.07	9.43	1.731	0.33(0.01)	0.04	7.4	108.00
2	12.58	14.18	1.355	0.33(0.01)	0.04	9.9	114.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 12.58 Tc(MIN.) = 14.18
 EFFECTIVE AREA(ACRES) = 9.87 AREA-AVERAGED Fm(INCH/HR) = 0.01
 AREA-AVERAGED Fp(INCH/HR) = 0.33 AREA-AVERAGED Ap = 0.04
 TOTAL AREA(ACRES) = 9.9
 LONGEST FLOWPATH FROM NODE 114.00 TO NODE 102.00 = 1544.00 FEET.

FLOW PROCESS FROM NODE 102.00 TO NODE 100.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 654.79 DOWNSTREAM(FEET) = 653.92
 FLOW LENGTH(FEET) = 172.00 MANNING'S N = 0.013

DEPTH OF FLOW IN 24.0 INCH PIPE IS 16.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.42
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 12.58
PIPE TRAVEL TIME(MIN.) = 0.53 Tc(MIN.) = 14.71
LONGEST FLOWPATH FROM NODE 114.00 TO NODE 100.00 = 1716.00 FEET.

FLOW PROCESS FROM NODE 100.00 TO NODE 100.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 14.71
RAINFALL INTENSITY(INCH/HR) = 1.33
AREA-AVERAGED Fm(INCH/HR) = 0.01
AREA-AVERAGED Fp(INCH/HR) = 0.33
AREA-AVERAGED Ap = 0.04
EFFECTIVE STREAM AREA(ACRES) = 9.87
TOTAL STREAM AREA(ACRES) = 9.87
PEAK FLOW RATE(CFS) AT CONFLUENCE = 12.58

FLOW PROCESS FROM NODE 118.00 TO NODE 116.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 263.00
ELEVATION DATA: UPSTREAM(FEET) = 676.00 DOWNSTREAM(FEET) = 674.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.493
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.987
SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
USER-DEFINED	-	0.39	0.27	0.001	-	7.49

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.001
SUBAREA RUNOFF(CFS) = 0.70
TOTAL AREA(ACRES) = 0.39 PEAK FLOW RATE(CFS) = 0.70

FLOW PROCESS FROM NODE 116.00 TO NODE 100.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 674.00 DOWNSTREAM(FEET) = 663.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 1244.00 CHANNEL SLOPE = 0.0088
 CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 50.000
 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.25
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.163

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
USER-DEFINED	-	8.83	0.27	0.090	-

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.090
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.47
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.92
 AVERAGE FLOW DEPTH(FEET) = 0.11 TRAVEL TIME(MIN.) = 10.82
 Tc(MIN.) = 18.31
 SUBAREA AREA(ACRES) = 8.83 SUBAREA RUNOFF(CFS) = 9.05
 EFFECTIVE AREA(ACRES) = 9.22 AREA-AVERAGED Fm(INCH/HR) = 0.02
 AREA-AVERAGED Fp(INCH/HR) = 0.27 AREA-AVERAGED Ap = 0.09
 TOTAL AREA(ACRES) = 9.2 PEAK FLOW RATE(CFS) = 9.46

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 0.15 FLOW VELOCITY(FEET/SEC.) = 2.30
 LONGEST FLOWPATH FROM NODE 118.00 TO NODE 100.00 = 1507.00 FEET.

FLOW PROCESS FROM NODE 100.00 TO NODE 100.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 18.31
 RAINFALL INTENSITY(INCH/HR) = 1.16
 AREA-AVERAGED Fm(INCH/HR) = 0.02
 AREA-AVERAGED Fp(INCH/HR) = 0.27
 AREA-AVERAGED Ap = 0.09
 EFFECTIVE STREAM AREA(ACRES) = 9.22
 TOTAL STREAM AREA(ACRES) = 9.22
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 9.46

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.07	9.96	1.675	0.33(0.01)	0.04	7.4	108.00
1	12.58	14.71	1.326	0.33(0.01)	0.04	9.9	114.00
2	9.46	18.31	1.163	0.27(0.02)	0.09	9.2	118.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.53	9.96	1.675	0.29(0.02)	0.06	12.4	108.00
2	21.27	14.71	1.326	0.30(0.02)	0.06	17.3	114.00
3	20.47	18.31	1.163	0.29(0.02)	0.06	19.1	118.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 21.27 Tc(MIN.) = 14.71
 EFFECTIVE AREA(ACRES) = 17.27 AREA-AVERAGED Fm(INCH/HR) = 0.02
 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.06
 TOTAL AREA(ACRES) = 19.1
 LONGEST FLOWPATH FROM NODE 114.00 TO NODE 100.00 = 1716.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 19.1 TC(MIN.) = 14.71
 EFFECTIVE AREA(ACRES) = 17.27 AREA-AVERAGED Fm(INCH/HR)= 0.02
 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.062
PEAK FLOW RATE(CFS) = 21.27

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.53	9.96	1.675	0.29(0.02)	0.06	12.4	108.00
2	21.27	14.71	1.326	0.30(0.02)	0.06	17.3	114.00
3	20.47	18.31	1.163	0.29(0.02)	0.06	19.1	118.00

=====

END OF RATIONAL METHOD ANALYSIS



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Analysis prepared by:

***** DESCRIPTION OF STUDY *****

- * POST-DEVELOPMENT CONDITIONS *
 - * 2-YR EVENT *
 - * PROLOGIS DISTRIBUTION CENTER *
- *****

FILE NAME: C:\AES\PROL\PROLPR2.DAT
TIME/DATE OF STUDY: 08:27 07/26/2024

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USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
 10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.850
 100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.250
 COMPUTED RAINFALL INTENSITY DATA:
 STORM EVENT = 2.00 1-HOUR INTENSITY(INCH/HOUR) = 0.5704
 SLOPE OF INTENSITY DURATION CURVE = 0.6000

ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0312 0.167	0.0150
2	30.0	20.0	0.018/0.018/0.020	0.50	1.50 0.0312 0.125	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 110.00 TO NODE 108.00 IS CODE = 21

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

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INITIAL SUBAREA FLOW-LENGTH(FEET) = 127.00
 ELEVATION DATA: UPSTREAM(FEET) = 679.00 DOWNSTREAM(FEET) = 674.00

$T_c = K * [(LENGTH^{**} 3.00) / (ELEVATION CHANGE)]^{**0.20}$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.462

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.402

SUBAREA T_c AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	T_c (MIN.)
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RESIDENTIAL

"3-4 DWELLINGS/ACRE"	C	0.18	0.81	0.600	50	5.46
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SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.600

SUBAREA RUNOFF(CFS) = 0.32

TOTAL AREA(ACRES) = 0.18 PEAK FLOW RATE(CFS) = 0.32

FLOW PROCESS FROM NODE 108.00 TO NODE 106.00 IS CODE = 51

 >>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 674.00 DOWNSTREAM(FEET) = 668.00

CHANNEL LENGTH THRU SUBAREA(FEET) = 613.00 CHANNEL SLOPE = 0.0098

CHANNEL BASE(FEET) = 30.00 "Z" FACTOR = 50.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.25

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.391

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
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COMMERCIAL	C	2.83	0.81	0.100	50
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SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.07

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.26

AVERAGE FLOW DEPTH(FEET) = 0.05 TRAVEL TIME(MIN.) = 8.13

T_c (MIN.) = 13.59

SUBAREA AREA(ACRES) = 2.83 SUBAREA RUNOFF(CFS) = 3.33

EFFECTIVE AREA(ACRES) = 3.01 AREA-AVERAGED F_m (INCH/HR) = 0.11

AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.13
TOTAL AREA(ACRES) = 3.0 PEAK FLOW RATE(CFS) = 3.48

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.07 FLOW VELOCITY(FEET/SEC.) = 1.59
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 106.00 = 740.00 FEET.

FLOW PROCESS FROM NODE 106.00 TO NODE 104.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM(FEET) = 664.34 DOWNSTREAM(FEET) = 661.45
FLOW LENGTH(FEET) = 578.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 15.0 INCH PIPE IS 9.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.18
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.48
PIPE TRAVEL TIME(MIN.) = 2.30 Tc(MIN.) = 15.89
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 104.00 = 1318.00 FEET.

FLOW PROCESS FROM NODE 106.00 TO NODE 104.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

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MAINLINE Tc(MIN.) = 15.89
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.266
SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	6.39	0.81	0.100	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 6.39 SUBAREA RUNOFF(CFS) = 6.82
EFFECTIVE AREA(ACRES) = 9.40 AREA-AVERAGED Fm(INCH/HR) = 0.09
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.11
TOTAL AREA(ACRES) = 9.4 PEAK FLOW RATE(CFS) = 9.96

FLOW PROCESS FROM NODE 104.00 TO NODE 102.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM(FEET) = 661.36 DOWNSTREAM(FEET) = 659.95
FLOW LENGTH(FEET) = 281.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 21.0 INCH PIPE IS 15.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.39

ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 9.96
PIPE TRAVEL TIME(MIN.) = 0.87 Tc(MIN.) = 16.76
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 102.00 = 1599.00 FEET.

FLOW PROCESS FROM NODE 102.00 TO NODE 102.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

FLOW PROCESS FROM NODE 124.00 TO NODE 122.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 95.00
ELEVATION DATA: UPSTREAM(FEET) = 675.00 DOWNSTREAM(FEET) = 673.40

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.232

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.465

SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.10	0.81	0.400	50	5.23

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400

SUBAREA RUNOFF(CFS) = 0.20

TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.20

FLOW PROCESS FROM NODE 122.00 TO NODE 120.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 673.40 DOWNSTREAM(FEET) = 669.21

CHANNEL LENGTH THRU SUBAREA(FEET) = 827.00 CHANNEL SLOPE = 0.0051

CHANNEL BASE(FEET) = 30.00 "Z" FACTOR = 40.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.25

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.244

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	5.93	0.81	0.100	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.60
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.24
AVERAGE FLOW DEPTH(FEET) = 0.09 TRAVEL TIME(MIN.) = 11.14
Tc(MIN.) = 16.37
SUBAREA AREA(ACRES) = 5.93 SUBAREA RUNOFF(CFS) = 6.20
EFFECTIVE AREA(ACRES) = 6.03 AREA-AVERAGED Fm(INCH/HR) = 0.09
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.11
TOTAL AREA(ACRES) = 6.0 PEAK FLOW RATE(CFS) = 6.29

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.12 FLOW VELOCITY(FEET/SEC.) = 1.54
LONGEST FLOWPATH FROM NODE 124.00 TO NODE 120.00 = 922.00 FEET.

FLOW PROCESS FROM NODE 120.00 TO NODE 118.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM(FEET) = 663.12 DOWNSTREAM(FEET) = 663.00
FLOW LENGTH(FEET) = 3.10 MANNING'S N = 0.012
DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 10.34
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.29
PIPE TRAVEL TIME(MIN.) = 0.00 Tc(MIN.) = 16.37
LONGEST FLOWPATH FROM NODE 124.00 TO NODE 118.00 = 925.10 FEET.

FLOW PROCESS FROM NODE 118.00 TO NODE 112.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM(FEET) = 663.00 DOWNSTREAM(FEET) = 661.36
FLOW LENGTH(FEET) = 328.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.82
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 6.29
PIPE TRAVEL TIME(MIN.) = 1.13 Tc(MIN.) = 17.51
LONGEST FLOWPATH FROM NODE 124.00 TO NODE 112.00 = 1253.10 FEET.

FLOW PROCESS FROM NODE 112.00 TO NODE 112.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION(MIN.) = 17.51
 RAINFALL INTENSITY(INCH/HR) = 1.19
 AREA-AVERAGED Fm(INCH/HR) = 0.09
 AREA-AVERAGED Fp(INCH/HR) = 0.81
 AREA-AVERAGED Ap = 0.11
 EFFECTIVE STREAM AREA(ACRES) = 6.03
 TOTAL STREAM AREA(ACRES) = 6.03
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.29

FLOW PROCESS FROM NODE 116.00 TO NODE 114.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 125.00
 ELEVATION DATA: UPSTREAM(FEET) = 670.75 DOWNSTREAM(FEET) = 667.80

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.533

SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	C	0.15	0.81	0.100	50	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

SUBAREA RUNOFF(CFS) = 0.33

TOTAL AREA(ACRES) = 0.15 PEAK FLOW RATE(CFS) = 0.33

FLOW PROCESS FROM NODE 114.00 TO NODE 112.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<
 >>>>(STREET TABLE SECTION # 2 USED)<<<<<<

UPSTREAM ELEVATION(FEET) = 667.80 DOWNSTREAM ELEVATION(FEET) = 666.00
 STREET LENGTH(FEET) = 331.00 CURB HEIGHT(INCHES) = 6.0
 STREET HALFWIDTH(FEET) = 30.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 20.00

INSIDE STREET CROSSFALL(DECIMAL) = 0.018

OUTSIDE STREET CROSSFALL(DECIMAL) = 0.018

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0150

Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.90

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
 STREET FLOW DEPTH(FEET) = 0.27
 HALFSTREET FLOOD WIDTH(FEET) = 7.71
 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.37
 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.37
 STREET FLOW TRAVEL TIME(MIN.) = 4.03 Tc(MIN.) = 9.03
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.777
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
CONDOMINIUMS	C	0.83	0.81	0.350	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350
 SUBAREA AREA(ACRES) = 0.83 SUBAREA RUNOFF(CFS) = 1.12
 EFFECTIVE AREA(ACRES) = 0.98 AREA-AVERAGED Fm(INCH/HR) = 0.25
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.31
 TOTAL AREA(ACRES) = 1.0 PEAK FLOW RATE(CFS) = 1.34

END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.30 HALFSTREET FLOOD WIDTH(FEET) = 9.30
 FLOW VELOCITY(FEET/SEC.) = 1.49 DEPTH*VELOCITY(FT*FT/SEC.) = 0.44
 LONGEST FLOWPATH FROM NODE 116.00 TO NODE 112.00 = 456.00 FEET.

FLOW PROCESS FROM NODE 112.00 TO NODE 112.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
 =====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.03
 RAINFALL INTENSITY(INCH/HR) = 1.78
 AREA-AVERAGED Fm(INCH/HR) = 0.25
 AREA-AVERAGED Fp(INCH/HR) = 0.81
 AREA-AVERAGED Ap = 0.31
 EFFECTIVE STREAM AREA(ACRES) = 0.98
 TOTAL STREAM AREA(ACRES) = 0.98
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.34

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.29	17.51	1.194	0.81(0.09)	0.11	6.0	124.00
2	1.34	9.03	1.777	0.81(0.25)	0.31	1.0	116.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.29	9.03	1.777	0.81(0.13)	0.15	4.1	116.00
2	7.12	17.51	1.194	0.81(0.11)	0.13	7.0	124.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 7.12 Tc(MIN.) = 17.51
EFFECTIVE AREA(ACRES) = 7.01 AREA-AVERAGED Fm(INCH/HR) = 0.11
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.13
TOTAL AREA(ACRES) = 7.0
LONGEST FLOWPATH FROM NODE 124.00 TO NODE 112.00 = 1253.10 FEET.

FLOW PROCESS FROM NODE 112.00 TO NODE 130.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM(FEET) = 661.36 DOWNSTREAM(FEET) = 660.48
FLOW LENGTH(FEET) = 176.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.91
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.12
PIPE TRAVEL TIME(MIN.) = 0.60 Tc(MIN.) = 18.10
LONGEST FLOWPATH FROM NODE 124.00 TO NODE 130.00 = 1429.10 FEET.

FLOW PROCESS FROM NODE 130.00 TO NODE 130.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

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TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 18.10
RAINFALL INTENSITY(INCH/HR) = 1.17
AREA-AVERAGED Fm(INCH/HR) = 0.11
AREA-AVERAGED Fp(INCH/HR) = 0.81
AREA-AVERAGED Ap = 0.13
EFFECTIVE STREAM AREA(ACRES) = 7.01
TOTAL STREAM AREA(ACRES) = 7.01
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.12

FLOW PROCESS FROM NODE 134.00 TO NODE 132.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

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INITIAL SUBAREA FLOW-LENGTH(FEET) = 130.00

ELEVATION DATA: UPSTREAM(FEET) = 672.00 DOWNSTREAM(FEET) = 668.70

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.260

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.458

SUBAREA T_c AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
CONDOMINIUMS	C	0.12	0.81	0.350	50	5.26

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.350

SUBAREA RUNOFF(CFS) = 0.24

TOTAL AREA(ACRES) = 0.12 PEAK FLOW RATE(CFS) = 0.24

FLOW PROCESS FROM NODE 132.00 TO NODE 130.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>(STREET TABLE SECTION # 2 USED)<<<<<

UPSTREAM ELEVATION(FEET) = 668.70 DOWNSTREAM ELEVATION(FEET) = 665.40

STREET LENGTH(FEET) = 169.00 CURB HEIGHT(INCHES) = 6.0

STREET HALFWIDTH(FEET) = 30.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 20.00

INSIDE STREET CROSSFALL(DECIMAL) = 0.018

OUTSIDE STREET CROSSFALL(DECIMAL) = 0.018

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curbs) = 0.0150

Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0150

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.43

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.26

HALFSTREET FLOOD WIDTH(FEET) = 7.04

AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.53

PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.65

STREET FLOW TRAVEL TIME(MIN.) = 1.11 T_c (MIN.) = 6.37

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.190

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	C	1.31	0.81	0.200	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200

SUBAREA AREA(ACRES) = 1.31 SUBAREA RUNOFF(CFS) = 2.40

EFFECTIVE AREA(ACRES) = 1.43 AREA-AVERAGED Fm(INCH/HR) = 0.17

AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.21

TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 2.60

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.30 HALFSTREET FLOOD WIDTH(FEET) = 9.37
FLOW VELOCITY(FEET/SEC.) = 2.86 DEPTH*VELOCITY(FT*FT/SEC.) = 0.85
LONGEST FLOWPATH FROM NODE 134.00 TO NODE 130.00 = 299.00 FEET.

FLOW PROCESS FROM NODE 130.00 TO NODE 130.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.37
RAINFALL INTENSITY(INCH/HR) = 2.19
AREA-AVERAGED Fm(INCH/HR) = 0.17
AREA-AVERAGED Fp(INCH/HR) = 0.81
AREA-AVERAGED Ap = 0.21
EFFECTIVE STREAM AREA(ACRES) = 1.43
TOTAL STREAM AREA(ACRES) = 1.43
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.60

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.29	9.63	1.709	0.81(0.13)	0.15	4.1	116.00
1	7.12	18.10	1.171	0.81(0.11)	0.13	7.0	124.00
2	2.60	6.37	2.190	0.81(0.17)	0.21	1.4	134.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	8.03	6.37	2.190	0.81(0.14)	0.17	4.1	134.00
2	8.27	9.63	1.709	0.81(0.14)	0.17	5.5	116.00
3	8.40	18.10	1.171	0.81(0.12)	0.15	8.4	124.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 8.40 Tc(MIN.) = 18.10
EFFECTIVE AREA(ACRES) = 8.44 AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 8.4
LONGEST FLOWPATH FROM NODE 124.00 TO NODE 130.00 = 1429.10 FEET.

FLOW PROCESS FROM NODE 130.00 TO NODE 102.00 IS CODE = 31

 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

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ELEVATION DATA: UPSTREAM(FEET) = 660.48 DOWNSTREAM(FEET) = 659.95
 FLOW LENGTH(FEET) = 105.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 13.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.25
 ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 8.40
 PIPE TRAVEL TIME(MIN.) = 0.33 Tc(MIN.) = 18.44
 LONGEST FLOWPATH FROM NODE 124.00 TO NODE 102.00 = 1534.10 FEET.

 FLOW PROCESS FROM NODE 102.00 TO NODE 102.00 IS CODE = 11

 >>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

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** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	8.03	6.71	2.123	0.81(0.14)	0.17	4.1	134.00
2	8.27	9.97	1.674	0.81(0.14)	0.17	5.5	116.00
3	8.40	18.44	1.158	0.81(0.12)	0.15	8.4	124.00

LONGEST FLOWPATH FROM NODE 124.00 TO NODE 102.00 = 1534.10 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	9.96	16.76	1.226	0.81(0.09)	0.11	9.4	110.00

LONGEST FLOWPATH FROM NODE 110.00 TO NODE 102.00 = 1599.00 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	15.16	6.71	2.123	0.81(0.12)	0.14	7.9	134.00
2	16.53	9.97	1.674	0.81(0.11)	0.14	11.1	116.00
3	18.34	16.76	1.226	0.81(0.10)	0.13	17.3	110.00
4	17.77	18.44	1.158	0.81(0.10)	0.13	17.8	124.00

TOTAL AREA(ACRES) = 17.8

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 18.34 Tc(MIN.) = 16.759
 EFFECTIVE AREA(ACRES) = 17.27 AREA-AVERAGED Fm(INCH/HR) = 0.10
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.13
 TOTAL AREA(ACRES) = 17.8
 LONGEST FLOWPATH FROM NODE 110.00 TO NODE 102.00 = 1599.00 FEET.

FLOW PROCESS FROM NODE 102.00 TO NODE 100.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 659.95 DOWNSTREAM(FEET) = 659.70
FLOW LENGTH(FEET) = 45.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.59
ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 18.34
PIPE TRAVEL TIME(MIN.) = 0.11 Tc(MIN.) = 16.87
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 100.00 = 1644.00 FEET.

FLOW PROCESS FROM NODE 100.00 TO NODE 100.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 16.87
RAINFALL INTENSITY(INCH/HR) = 1.22
AREA-AVERAGED Fm(INCH/HR) = 0.10
AREA-AVERAGED Fp(INCH/HR) = 0.81
AREA-AVERAGED Ap = 0.13
EFFECTIVE STREAM AREA(ACRES) = 17.27
TOTAL STREAM AREA(ACRES) = 17.85
PEAK FLOW RATE(CFS) AT CONFLUENCE = 18.34

FLOW PROCESS FROM NODE 128.00 TO NODE 126.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 242.00
ELEVATION DATA: UPSTREAM(FEET) = 680.00 DOWNSTREAM(FEET) = 679.00

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.073

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.664

SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
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RESIDENTIAL "8-10 DWELLINGS/ACRE"	C	0.09	0.81	0.400	50	10.07
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SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400

SUBAREA RUNOFF(CFS) = 0.10

TOTAL AREA(ACRES) = 0.09 PEAK FLOW RATE(CFS) = 0.10

FLOW PROCESS FROM NODE 126.00 TO NODE 100.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 679.00 DOWNSTREAM(FEET) = 663.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 1521.00 CHANNEL SLOPE = 0.0105
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 50.000
MANNING'S FACTOR = 0.040 MAXIMUM DEPTH(FEET) = 0.25
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 0.469

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL ".4 DWELLING/ACRE"	C	1.15	0.81	0.900	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900

* RAINFALL INTENSITY IS LESS THAN AREA-AVERAGED Fp;
* IMPERVIOUS AREA USED FOR RUNOFF ESTIMATES.

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.14
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 0.35
AVERAGE FLOW DEPTH(FEET) = 0.03 TRAVEL TIME(MIN.) = 73.02
Tc(MIN.) = 83.10

SUBAREA AREA(ACRES) = 1.15 SUBAREA RUNOFF(CFS) = 0.05
EFFECTIVE AREA(ACRES) = 1.24 AREA-AVERAGED Fm(INCH/HR) = 0.70
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.87

* RAINFALL INTENSITY IS LESS THAN AREA-AVERAGED Fp;
* IMPERVIOUS AREA USED FOR RUNOFF ESTIMATES.

TOTAL AREA(ACRES) = 1.2 PEAK FLOW RATE(CFS) = 0.10

NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.03 FLOW VELOCITY(FEET/SEC.) = 0.33
LONGEST FLOWPATH FROM NODE 128.00 TO NODE 100.00 = 1763.00 FEET.

FLOW PROCESS FROM NODE 100.00 TO NODE 100.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 83.10
RAINFALL INTENSITY(INCH/HR) = 0.47
AREA-AVERAGED Fm(INCH/HR) = 0.70
AREA-AVERAGED Fp(INCH/HR) = 0.81

AREA-AVERAGED $A_p = 0.87$
 EFFECTIVE STREAM AREA(ACRES) = 1.24
 TOTAL STREAM AREA(ACRES) = 1.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.10

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	15.16	6.83	2.101	0.81(0.12)	0.14	7.9	134.00
1	16.53	10.09	1.663	0.81(0.11)	0.14	11.1	116.00
1	18.34	16.87	1.221	0.81(0.10)	0.13	17.3	110.00
1	17.77	18.55	1.154	0.81(0.10)	0.13	17.8	124.00
2	0.10	83.10	0.469	0.81(0.70)	0.87	1.2	128.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	15.26	6.83	2.101	0.81(0.12)	0.15	8.0	134.00
2	16.63	10.09	1.663	0.81(0.12)	0.15	11.3	116.00
3	18.44	16.87	1.221	0.81(0.11)	0.14	17.5	110.00
4	17.87	18.55	1.154	0.81(0.11)	0.14	18.1	124.00
5	7.03	83.10	0.469	0.81(0.14)	0.18	19.1	128.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 18.44 Tc(MIN.) = 16.87
 EFFECTIVE AREA(ACRES) = 17.52 AREA-AVERAGED Fm(INCH/HR) = 0.11
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED $A_p = 0.14$
 TOTAL AREA(ACRES) = 19.1
 LONGEST FLOWPATH FROM NODE 128.00 TO NODE 100.00 = 1763.00 FEET.

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END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 19.1 TC(MIN.) = 16.87
 EFFECTIVE AREA(ACRES) = 17.52 AREA-AVERAGED Fm(INCH/HR)= 0.11
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED $A_p = 0.140$
 PEAK FLOW RATE(CFS) = 18.44

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	15.26	6.83	2.101	0.81(0.12)	0.15	8.0	134.00
2	16.63	10.09	1.663	0.81(0.12)	0.15	11.3	116.00
3	18.44	16.87	1.221	0.81(0.11)	0.14	17.5	110.00
4	17.87	18.55	1.154	0.81(0.11)	0.14	18.1	124.00
5	7.03	83.10	0.469	0.81(0.14)	0.18	19.1	128.00

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END OF RATIONAL METHOD ANALYSIS



APPENDIX E – EDUCATIONAL MATERIALS

POLLUTION STORMWATER **Prevention**

Important Phone Numbers

San Bernardino County Flood Control

(909) 387-8112

County of San Bernardino

(909) 387-8109

City of Big Bear Lake

(909) 866-5831

City of Chino (909) 591-9850

City of Chino Hills (909) 364-2722

City of Colton (909) 370-6128

City of Fontana (909) 350-6772

City of Grand Terrace

(909) 824-6671 x 226

City of Highland (909) 864-8732 x 230

City of Loma Linda (909) 799-4405

City of Montclair (909) 625-9470

City of Ontario (909) 395-2025

City of Rancho Cucamonga

(909) 477-2740 x 4063

City of Redlands (909) 798-7655

City of Rialto (909) 421-4921

City of San Bernardino (909) 384-5154

City of Upland (909) 931-4370

City of Yucaipa (909) 797-2489 x 243



San Bernardino County Stormwater Program

825 East Third Street • Room 201
San Bernardino, CA 94215-0835

STORMWATER Pollution Prevention

INDUSTRIAL AND COMMERCIAL FACILITIES



Pollution ^{STORMWATER} Prevention

To reduce the amount of pollutants reaching our storm drain system, which leads to the Santa Ana River and Pacific Ocean, the San Bernardino County Stormwater Program has developed Best Management Practices (BMPs) for Industrial and Commercial Facilities. City and County ordinances require that businesses comply with these BMPs, where applicable, to protect local water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.



Prohibited Discharges

- Discontinue all non-stormwater discharges to the storm drain system. It is prohibited to discharge any chemicals, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, except when in direct use.
- Sweep outdoor areas instead of using a hose or pressure washer.

Outdoor Processes

- Move all process operations including vehicle and equipment maintenance inside of the building or into a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to city standards, then discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Ups

- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials and followed by proper disposal of materials.
 - Always have a spill kit available near chemical loading dock doors, vehicle maintenance and fueling areas.
 - Follow your Business Emergency Plan, as filed with the County Fire Department at (909) 386-8401.

Industrial and Commercial Facilities

- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator either at (800) CLEANUP or as listed at www.sbcounty.gov/stormwater.
- Report hazardous materials spills to (800) 33 TOXIC and your local Fire Department Hazmat Team at 911.

Training

Train employees in spill response procedures and prohibited discharges to the storm drain system, as prescribed in your local Stormwater Ordinance and in applicable Best Management Practices available at www.cabmphandbooks.com and www.sbcounty.gov/stormwater.

Permitting

Stormwater discharges associated with specific categories of commercial and industrial facilities are regulated by the State Water Resources Control Board (SWRCB) through an Industrial Storm Water General Permit. A copy of the General Permit and application forms are available at: www.waterboards.ca.gov/stormwtr/industrial.html

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

or visit our websites at:

www.sbcounty.gov/stormwater

www.1800cleanup.org

