CASC Engineering and Consulting

1470 E. Cooley Drive
Colton, CA 92324
Office: 909.783.0101
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Transmitted via Std Mail

April 21, 2021

Matt Bennett
Assistant Public Works Director
CITY OF HIGHLAND
27215 Base Line
Highland, CA 92346

Subject: Recommendation of Acceptance
Tractor Supply Co. Commercial Project C-WQMP
Project No. CWQ 021-004 (3049.31) – with Conditions

Dear Mr. Bennett:

CASC Engineering and Consulting (CASC), as a consultant to the City of Highland, has performed a review of the Conceptual Water Quality Management Plan (C-WQMP) prepared by Sitetech, Inc. (Preparer) for CWQ 021-004 (3049.31) Tractor Supply Co. Commercial Project (Project) located at the northwest corner of Church Avenue and Base Line, APN 1200-381-43 & 1200-381-05 and submitted by Woodcrest Properties (Applicant). Based on information presented in the C-WQMP, CASC has found that the C-WQMP is in conformance, at a conceptual level, with the document, "Technical Guidance Document for Water Quality Management Plans" (Guidance Document), prepared June 7, 2013 and approved by the Santa Ana Regional Water Quality Control Board. CASC's review and findings are limited to determination of a conceptual-level conformance with the Guidance Document only. The Applicant and Preparer of the C-WQMP remain responsible for all civil design elements and assertions in the C-WQMP, and the Applicant remains responsible for preparation of a Final Water Quality Management Plan (F-WQMP), submittal of the F-WQMP for approval, and implementation, maintenance, and funding of all elements of the F-WQMP and for any and all liability and damages (environmental or otherwise) arising out of the implementation or failure to implement any portion of the F-WQMP ultimately approved by the City.

The purpose of this letter is to transmit the conditions of CASC's recommendation for acceptance of the C-WQMP.

Applicant:	Woodcrest Properties
Project:	CWQ 021-004 (3049.31) Tractor Supply Co. Commercial Project
Project Location:	NWC of Church Ave. and Base Line, APN 1200-381-43 & APN 1200-381-05
Date Received:	April 15, 20210
Review Type:	Standard
Review Stage:	**Conceptual – 3rd Review – Acceptance Recommended**

Conditions of Acceptance

- The Applicant shall submit, for approval, a Final WQMP that is in substantial conformance with the Conceptual WQMP and City of Highland requirements. The Final WQMP shall be in full conformance with the Guidance Document.

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- Engineer is to provide a copy of the drainage report with the submittal of the F-WQMP. The drainage report is to include analysis to limit 100-year flows and other conditions of approval to be issued.
- Two infiltration tests using a double-ring infiltrometer shall be conducted, observed, and reported during construction once the excavation for the underground infiltration systems are complete to confirm the design infiltration rates. If the rates are less than the design infiltration rates, then the systems are to be modified to account for the lower infiltration rates. If the rates are higher than the design infiltration rates, then the system is to be constructed per plan.
- No compaction shall take place at the bottom of the excavation of the proposed underground infiltration system.
- The proposed BMP locations are not to be used for storage of equipment, vehicles, or materials during construction. The BMPs are to be protected from runoff and are not to be used as sediment traps or sediment basins during construction.
- Applicant shall include a copy of the Project's grading plans, landscape plans and utility plans with the first submittal of the Final WQMP.
- The proposed underground infiltration systems shall be registered with the EPA as Class V Injection Wells.

Please forward to the preparer and applicant after review. If there are any questions regarding this conditional acceptance, please call me at (909) 809-0035, or e-mail me at mgentile@cascinc.com at your earliest convenience.

Best regards,
CASC Engineering and Consulting

Michael J. Gentile, P.E., QSD
Senior Engineer

Enclosures: 3rd C-WQMP Submittal

Preliminary Water Quality Management Plan

For:

Tractor Supply Co. - Highland

CWQ 021-004

APN: 1200-381-43 & 1200-381-05

LOT AREA = 9.02 ACRES

GROSS WQMP AREA = 9.02 ACRES

RECEIVED
APR 15 2021
CASC ENGINEERING AND CONSULTING

Prepared for:

Woodcrest Properties

1410 Main Street, Suite C

Ramona, CA 92065

PH: (760) 789-5493

CONTACT: Wade Wylie

Prepared by:

Sitetech, Inc.

8061 Chruch Street

Mail: POX 592

Highland, CA 92346

PH: (909) 864-3180

CONTACT: Bernie Mayer

Plan Check Comments
Return With Next Submittal

Submittal Date: February 11, 2021

Revision No. and Date: #1 - March 23, 2021

Revision No. and Date: #2 - April 15, 2021

Revision No. and Date: _____

Final Approval Date:_____

8061 CHURCH STREET
PO BOX 592
HIGHLAND, CA. 92346
PHONE: (909) 864-3180
FAX: (909) 864-0850
bmayer@sitetechinc.com

SITETECH, INC

RECEIVED
APR 15 2021
CASC ENGINEERING AND CONSULTING

TRANSMITTAL

To: Melanie Sotelo
From: Bernie Mayer

Company: CASC Engineering and Consulting
1470 E. Cooley Dr.
Colton, CA. 92346

Phone: (909) 783-0101
Date: April 15, 2021

Fax: (909) 783-0108

Cell: (909) 835-0313

Re: Tractor Supply - Highland
CWQ 021-004

CC: Michael Gentile - CASC
Jay Tuttle - City of Highland

We are sending you the following items via : courier

- ☐ 1 Ea. Revised Preliminary WQMP
- ☐ 1 Ea. Preliminary WQMP Redlines (1st Submittal)
- ☐ 1 Ea. Preliminary Grading Plan

Comments:

Please contact us with any additional questions or comments.

THANKS!

Preliminary Water Quality Management Plan

For:

Tractor Supply Co. - Highland

CWQ 021-004

APN: 1200-381-43 & 1200-381-05

LOT AREA = 9.02 ACRES

GROSS WQMP AREA = 9.02 ACRES

Prepared for:

Woodcrest Properties

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PH: (760) 789-5493

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CONTACT: Bernie Mayer

Submittal Date: February 11, 2021

Revision No. and Date: #1 - March 23, 2021

Revision No. and Date: #2 - April 15, 2021

Revision No. and Date: _____

Final Approval Date:_____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for TRACTOR SUPPLY CO. by SITETECH, INC.. The WQMP is intended to comply with the requirements of the CITY OF HIGHLAND and the NPDES Areawide Stormwater Program (NPDES Order No. R8 2010-0036) 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):	CWQ 021-004	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	PTN. OF PARCEL MAP NO. 19376	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 1200-381-43 & 05

Owner's Signature			
Owner Name: WADE WYLIE			
Title			
Company	WOODCREST PROPERTIES		
Address	1410 MAIN STREET, SUITE C, RAMONA, CA 92065		
Email	wade@woodcrestrev.com		
Telephone #	(760) 789-5493		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	CWQ 021-004	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	PARCEL MAP NO. 19376	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 1200-381-43 & 05

"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: BERNIE MAYER		PE Stamp Below
Title	PRESIDENT	
Company	SITETECH INC.	
Address	8061 CHURCH STREET (Mail: PO BOX 592), HIGHLAND, CA 92346	
Email	bmayer@sitetechinc.com	
Telephone #	(909) 864-3180	
Signature		
Date	APRIL 15, 2021	

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6.3 Post Construction

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	TRACTOR SUPPLY CO. - HIGHLAND				
Project Owner Contact Name:	WADE WYLIE				
Mailing Address:	1410 MAIN STREET, SUITE C, RAMONA, CA 92065	E-mail Address:	wade@woodcrestrev.com	Telephone:	(760) 789-5493
Permit/Application Number(s):	CWQ 021-004	Tract/Parcel Map Number(s):	APN: 1200-381-43 & 05		
Additional Information/ Comments:					
Description of Project:	The project consists of the development of existing 9.02 acres. Public improvements will include the construction of driveways, sidewalks and curb drains along both Base Line (southerly property frontage) and Church Street (easterly property frontage). The on-site improvements include the construction of a Tractor Supply Retail Store, grocery store, two drive through restaurants, apartment, various hardscapes such as asphalt parking lots, v-gutters, concrete sidewalks, curb and gutters and landscaping. Drive aisles will connect to existing right-of-ways for access along Church Street, Base Line and Foster Avenue. There will be a total of five drainage areas throughout this development. Each drainage area will collect stormwater through curbs and gutters and catch basins where stormwater will be stored in underground infiltration chambers (five total). The proposed underground infiltration chambers will be sized to capture the required DCV and infiltrate/drawdown the stormwater collected in each drainage area within 48 hours. BMP sizing and drawdown calculations can be seen in Section 6.4 of this report. The combination of underground infiltration chamber BMPs are sized to include the whole site, including the proposed improvements in the public right-of-way and areas where stormwater capture is not feasible. Maximum extents practicable (MEP) principle is applied in these areas due to infeasibility of capturing stormwater.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.					

Section 2 Project Description

2.1 Project Information

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☐ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☒ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more
☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft² 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.	☒ Parking lots of 5,000 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.*

2 Project Area (ft2):	393,003	**3** Number of Dwelling Units:	20	**4** SIC Code:	5812, 5999, 5411, 6513

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

2.2 Property Ownership/Management

Form 2.2-1 Property Ownership/Management

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

The property will be maintained by TRACTOR SUPPLY CO. (hereinafter referred to as "Owner/Property Owner"). All non-structural source control BMPs and all structural source control BMPs including, but not limited to catch basins, roof drains, landscaping, underground storm drain and underground infiltration chambers for the proposed development will be maintained by the Owner. On-site sweeping will be performed as needed and all activities throughout the site will be performed in compliance with the County of San Bernardino's MS4 permit with the City of Highland as a Co-Permittee and the State's General Stormwater Permit.

Ownership of the project will be held with TRACTOR SUPPLY CO. As stated above the long term maintenance will be the responsibility of the Owner until the property is sold or transferred.

No infrastructure will transfer to any public agency after project completion.

The current owner/responsible party: TRACTOR SUPPLY CO. - HIGHLAND
WOODCREST PROPERTIES
1410 MAIN STREET, SUITE C
RAMONA, CA 92065
Phone: (760) 789-5493
Contact: WADE WYLIE

2.3 Potential Stormwater Pollutants

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Common runoff pollutant from pavement and landscape areas, including wild birds and animals together with garbage
Nutrients - Phosphorous	E ☒	N ☐	Common runoff pollutant from landscaping, including fertilizer, food waste, and garbage
Nutrients - Nitrogen	E ☒	N ☐	Common runoff polllutant from landscaping, including fertilizers, and food waste
Noxious Aquatic Plants	E ☐	N ☒	No existing landscaping present on pre-developed site
Sediment	E ☒	N ☐	Runoff from pavement, landscaping, and rooftops
Metals	E ☒	N ☐	Cars, trucks, and parking areas
Oil and Grease	E ☒	N ☐	Leaking vehicles and parking areas
Trash/Debris	E ☒	N ☐	Poorly maintained trash containers and parking areas
Pesticides / Herbicides	E ☒	N ☐	Runoff from landscaping
Organic Compounds	E ☒	N ☐	Parking areas and fertilizers
Other: Petroleum	E ☒	N ☐	Vehicles
Other: Hydrocarbons	E ☒	N ☐	Vehicles
Other: Solvents	E ☒	N ☐	Vehicles
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

Form 2.4-1 Water Quality Credits			
[1] Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ 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%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ 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%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
[2] Total Credit % 0 *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

THE PROPOSED PROJECT WILL NOT UTILIZE ANY WATER QUALITY CREDITS

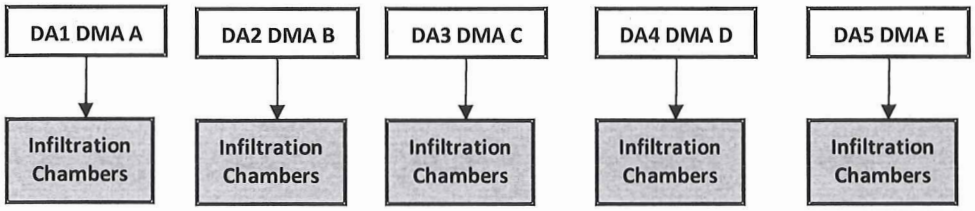
Section 3 Site and Watershed Description

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.1221°N	Longitude 117.2057°W	Thomas Bros Map page 577

[1] San Bernardino County climatic region: ☒ Valley ☐ Mountain

[2] Does the site have more than one drainage area (DA): Yes ☒ No ☐ *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*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA A to Infiltration Chambers	DA1 DMA A includes the northwesterly portion of the property where the apartments and parking for those apartments are located. Stormwater will drain southwesterly throught he parking lot and be collected at a catch basin at the southwesterly portion of this drainage area. The stormwater will be treated through direct infiltration in the chambers. Excess stormwater flows greater than the design capture volume (DCV) will be released into the public right-of-way along Foster Avenue.
DA2 DMA B to Infiltration Chambers	DA2 DMA B includes the southwesterly portion of the property where the Tractor Supply Store and parking lot for this area are located. Stormwater will drain southwesterly throught he parking lot and be collected at a catch basin at the southwesterly portion of this drainage area. The stormwater will be treated through direct infiltration in the chambers. Excess stormwater flows greater than the design capture volume (DCV) will be released into the public right-of-way along Base Line.
DA3 DMA C to Infiltration Chambers	DA3 DMA C includes the northeasterly portion of the property where the Grocery Store and parking lot for this area are located. Stormwater will drain southwesterly throught he parking lot and be collected at a catch basin at the southwesterly portion of this drainage area. The stormwater will be treated through direct infiltration in the chambers. Excess stormwater flows greater than the design capture volume (DCV) will be released into the public right-of-way along Base Line.
DA4 DMA D to Infiltration Chambers	DA4 DMA D includes a portion of the southeasterly portion of the property where one of the restraunts and parking lot are located. Stormwater will drain southwesterly throught he parking lot and be collected at a catch basin at the southwesterly portion of this drainage area. The stormwater will be treated through direct infiltration in the chambers. Excess stormwater flows greater than the design capture volume (DCV) will be released into the public right-of-way along Base Line.
DA5 DMA E to Infiltration Chambers	DA5 DMA E includes a portion of the southeasterly portion of the property where one of the restraunts and parking lot are located. Stormwater will drain southwesterly throught he parking lot and be collected at a catch basin at the southwesterly portion of this drainage area. The stormwater will be treated through direct infiltration in the chambers. Excess stormwater flows greater than the design capture volume (DCV) will be released into the public right-of-way along Base Line.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	Drainage Area 1			
1 DMA drainage area (ft^2)	393,003			
2 Existing site impervious area (ft^2)	6,153			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	B			
5 Longest flowpath length (ft)	861			
6 Longest flowpath slope (ft/ft)	0.031			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Undeveloped			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Fair			

Form 3-3 Watershed Description for Drainage Area DA 1	
Receiving waters *Refer to Watershed Mapping Tool -* *http://sbcounty.permitrack.com/WAP* *See 'Drainage Facilities" link at this website*	City Creek Channel Santa Ana River (Reach 5) Santa Ana River (Reach 4) Santa Ana River (Reach 3) Santa Ana River (Reach 2) Santa Ana River (Reach 1) Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River (Reach 4): Pathogens Santa Ana River (Reach 3): Pathogens, Nitrates
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana River (Reach 4): Pathogens Santa Ana River (Reach 3): Pathogens, Lead, Copper Santa Ana River (Reach 2): Indicator Bacteria
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	None
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	All downstream receiving waters are unlined water bodies
Hydrologic Conditions of Concern	☐ 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* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *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* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

All applicable non-structural and structural source control BMP shall be implemented in the project and are listed on Forms 4.1-1 and 4.1-2.

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	☒	☐	This Plan will be made available to the employees. Property owners will familiarize themselves with the reference material at the end of this document.
N2	Activity Restrictions	☒	☐	Owner/lease holders will comply with all restrictions per the final conditions, covenants and restrictions (CCRs). In addition, lease holder will follow restrictions per lease agreement.
N3	Landscape Management BMPs	☒	☐	Landscaped areas adjacent to curbs and sidewalks will be sumped at a minimum of 1-inch below the finished surface. Pesticides must be performed by an applicator certified by the California Department of Pesticide Regulation. Landscape will be maintained in accordance with BMP fact sheets SD-10 and SD-12 in Section 6.4 of this report in addition to all City of Highland codes and ordinances.
N4	BMP Maintenance	☒	☐	Owner to inspect and maintain infiltration chambers in accordance with specification for frequency and methods. Other BMPs will be maintained in accordance with education material found in, but not limited to, Section 6.4 of this report.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	There is no hazardous waste permitted on this site.
N6	Local Water Quality Ordinances	☒	☐	The owner will enforce all City of Highland stormwater ordinances for this site.
N7	Spill Contingency Plan	☒	☐	Owner/lease holder will produce and implement a spill contingency plan based on Title 22 CCR Compliance and site needs.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks on this site.
N9	Hazardous Materials Disclosure Compliance	☒	☐	Owner/lease holder will comply with the use, storage and clean-up of hazardous materials per Title 22 CCR Compliance and site needs.

Control Program	☒	☐	maintenance/repair to ensure leak proof receptacles and daily check of litter/debris clean up throughout site.
ining	☒	☐	Occupants will be provided a copy of this WQMP to train employees on post-construction storm water treatment management.
g of Loading Docks	☒	☐	Loading docks will be monitored for trash/debris on weekly basis. All trash/debris will be collected and disposed of in appropreate bins.
nspection Program	☒	☐	Weekly inspection by property owner's designee. Accumalated sediment or trash of 2-inches deep will be immediately removed and disposed of properly.
eping of Private Streets and	☒	☐	The parking lots will be swept monthly. Driveway entrance will be swept annually before the rainy season and periodically as necessary to remove accumulated sediment and debris.
ructural Measures for Public cts	☐	☒	No other non-structural measures proposed for public agency.
all other applicable NPDES	☒	☐	The project will acquire WDID # to demonstrate compliance with General Construction Permit.

lrain system stencilling and signage evelopment BMP Handbook SD-13)	☒	☐	Stenciling shall be blue on a white background with lettering 2" in height. A fish or similar water dependent creature silhouette may be included subject to City approval. A catch basin curb marker, circular or rectangular, at least 4" in height or diameter, may be used. Legibillity of stencils and signs must be maintained and will be inspected monthly.
struct outdoor material storage pollution introduction (CASQA ent BMP Handbook SD-34)	☐	☒	No outdoor material storage areas proposed.
struct trash and waste storage pollution introduction (CASQA ent BMP Handbook SD-32)	☒	☐	Trash enclosures are designed with impervious bottoms (portland cement concrete) to prevent infiltration into pervious surfaces. Awnings will be provided and prevent direct precipitation onto trash enclosure areas. Screen walls will be built around trash enclosure to prevent off-site transport of trash. Drainage for trash enclosure will prevent run-on from adjoining areas
igation systems & landscape onservation, smart controllers, and Statewide Model Landscape QA New Development BMP 2)	☒	☐	Landscape shall include weather-based controllers, rain shutoff devices and drip irrigation heads that will prevent over irrigation in landscaped areas. A landscaped barrier will be designed to around property lines and right-of-way lines to act as a pollutant filter for the site.
andscaped areas at a minimum of w top of curb, sidewalk, or	☒	☐	Landscaped areas adjacent to curbs and sidewalks will be sumped at a minimum of 1-inch below the finished surface. Inspection will occur before rainy season (October 1st) and after any rain event.
nd channels and provide energy QA New Development BMP 0)	☒	☐	Graded slopes to be stabilized by installing vegetation. Prior to vegetation maturity, fiber rolls to be installed at top and base of slope to prevent erosion.
reas (CASQA New Development SD-31)	☒	☐	Loading dock will be covered to prevent direct precipitation contact. No run-on or runoff will occur from loading dock to truck wells. Cleaning of loading docks will consist of sweeping activities and no cleaning with water.

MP Handbook SD-36)			
h areas with spill containment ew Development BMP Handbook	☐	☒	No equipement wash areas proposed.
CASQA New Development BMP 0)	☐	☒	No fueling areas proposed for this development.
ping (CASQA New Development SD-10)	☐	☒	No hillsides onsite
ntrol for food preparation areas	☒	☐	Indoor food-prep area will have contained area sinks that will have a sanitary sewer connection. Additional BMPs will be determined per City requirements for food waste treatment.
wash racks (CASQA New MP Handbook SD-33)	☐	☒	No wash racks proposed

4.1.2 Preventative LID Site Design Practices

- The site plan incorporates the following preventive site design practices.

Form 4.1-3 Preventative LID Site Design Practices Checklist
Site Design Practices *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*
Minimize impervious areas: Yes ☒ No ☐ Explanation: The proposed widths of hardscape are designed at minimum widths to maximize vegetation along property lines.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Planter areas will be depressed 1-inch below finished surface and intercept runoff from impervious area for infiltration as best as possible.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Existing drainage pattern will not be altered (northeast to southwest). The time of concentration will imporove due to applying an infiltration basins with controlled stormwater release of excess flows into the public storm drain system.
Disconnect impervious areas: Yes ☐ No ☒ Explanation: Most stormwater runoff will be directed from hardscape to the proposed catch basins. Buildings with adjacent landscaping will utilitize roof drain discharge into these pervious areas when possible.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: No sensitive areas within 200' of this site.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: The proposed site will re-vegetate all proposed pervious areas including landscaped buffers, planters and general landscaping.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The proposed underground infiltration chambers will be staked off during construction during the excavaction of chamber footprint to prevent construction vehicles/equipment from compacting underlying soil through traffic.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: No vegetated swales proposed for this development.
Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☒ No ☐ Explanation: Areas that will be re-vegetated with proposed landscaping will be staked off to limit the amount of unnecessary compaction. Excessive foot traffic and vehicle traffic will not be allowed in these areas to promote infiltration.

4.2 Project Performance Criteria

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 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 mi^2), 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 (DA 1 – DMA A)

1 Project area DA 1 (ft^2): 77,722	2 Imperviousness after applying preventative site design practices (Imp%): 62.8	3 Runoff Coefficient (Rc): 0.431 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.544 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.806 *P_6 = 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 *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.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 4,412 *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)* *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 (DA 2 – DMA B)

1 Project area DA 2 (ft^2): 138,988	2 Imperviousness after applying preventative site design practices (Imp%): 94.8	3 Runoff Coefficient (Rc): 0.803 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.544 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.806

*P_6 = 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 *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.*	24-hrs ☐ 48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 14,712

*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)*
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 (DA 3 – DMA C)

1 Project area DA 3 (ft^2): 118,759	2 Imperviousness after applying preventative site design practices (Imp%): 79.6	3 Runoff Coefficient (Rc): 0.595 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.544 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.806

*P_6 = 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 *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.*	24-hrs ☐ 48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 9,304

*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)*
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 (DA 4 – DMA D)

1 Project area DA 4 (ft^2): 30,188	2 Imperviousness after applying preventative site design practices (Imp%): 69.6	3 Runoff Coefficient (Rc): 0.490 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.544 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.806

*P_6 = 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 *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.*	24-hrs ☐ 48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 1,950

*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)*
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 (DA 5 – DMA E)

1 Project area DA 5 (ft^2): 34,383	2 Imperviousness after applying preventative site design practices (Imp%): 78.1	3 Runoff Coefficient (Rc): 0.577 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.544 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.806

*P_6 = 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 *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.*	24-hrs ☐ 48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 2,616

*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)*
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-DA 5)

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

Go to: http://sbcounty.permitrack.com/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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** *Item 4 – Item 1*	**8** *Item 2 – Item 5*	**9** *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** % *Item 7 / Item 1*	**11** % *Item 8 / Item 2*	**12** % *Item 9 / Item 3*

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, ft² *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
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, ft² *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): *I_a = 0.2 * 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 (ft³):
V_{pre} *=(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft³):
V_{pre} *=(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft³):
V_{HCOC} *= (Item 13 * 0.95) – 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 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o = *Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
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 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) T_t = *Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) T_c = *Item 5 + Item 11*								

13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet HCOC requirement (min): 0 $T_{C\text{-}HCOC}$ = *(Item 13 * 0.95) – 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 (*Use additional forms if more than 3 DMA*)			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA*)		
		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) *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)*							
3 Ratio of pervious area to total area *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)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *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)*							
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 *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)*	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): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): $Q_{p\text{-}HCOC}$ = *(Item 14 * 0.95) – Item 10*		

4.3 Project Conformance Analysis

The following forms for each project site DA 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).

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒

Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒

(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- 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.

If Yes, Provide basis: (attach)

3 Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

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? Yes ☐ No ☒

If Yes, Provide basis: (attach)

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)? Yes ☐ No ☒

If Yes, Provide basis: (attach)

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? Yes ☐ No ☒

See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒

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.

8 Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒

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.

9 All answers to Item 1 through Item 6 are "No":

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.

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 ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type
2 Total impervious area draining to pervious area				
3 Ratio of pervious area receiving runoff to				
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * 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): 0 *$V_{retention}$ =Sum of Item 4 for all BMPs*				
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type
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) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*				
13 Runoff volume retention from on-lot infiltration (ft^3): 0 *$V_{retention}$ =Sum of Item 12 for all BMPs* *****CALCULATION SHEET IN ATTACHMENT F*****				

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

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type
15 Rooftop area planned for ET BMP (ft^2)				
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*				
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*				
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*				
19 Retention Volume (ft^3) $V_{retention}$ = *Item 17 * (Item 18 / 24)*				
20 Runoff volume retention from evapotranspiration BMPs (ft^3): 0 $V_{retention}$ =*Sum of Item 19 for all BMPs*				
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type
22 Number of Street Trees				
23 Average canopy cover over impervious area (ft^2)				
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ = *Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*				
25 Runoff volume retention from street tree BMPs (ft^3): 0 $V_{retention}$ = *Sum of Item 24 for all BMPs*				
26 Implementation of residential rain barrel/cisterns: Yes☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type
27 Number of rain barrels/cisterns				
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ = *Item 27 * 3*				
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): 0 $V_{retention}$ =*Sum of Item 28 for all BMPs*				
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*				

4.3.2 Infiltration BMPs

Form 4.3-3 is used 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.

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): 4,412
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30

BMP Type *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*	DA 1 DMA A BMP Type Underground Chambers	DA DMA BMP Type	
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	3.2		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix 6.4.H*	3.0		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.07		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0		
7 Ponding Depth (ft) *d_{BMP} < 1/12*Item 4*Item 5) or Item 6*	6.0		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	1,123		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	---		
10 Amended soil porosity	---		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0		
12 Gravel porosity	40%		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	---		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	4,517 (per manufacturer's specifications)		

16 Total Retention Volume from LID Infiltration BMPs: 4,517 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 103% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

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.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 14,712
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30

BMP Type *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*	DA 2 DMA B BMP Type Underground Chambers	DA DMA BMP Type
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	4.2	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix 6.4.H*	3.0	
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.40	
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0	
7 Ponding Depth (ft) *d_{BMP} < 1/12*Item 4*Item 5) or Item 6*	6.0	
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	3,461	
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	---	
10 Amended soil porosity	---	
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0	
12 Gravel porosity	40%	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	---	
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	14,848 (per manufacturer's specifications)	

16 Total Retention Volume from LID Infiltration BMPs: 14,848 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 103% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

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.

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 9,304
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30

BMP Type *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*	DA 3 DMA C BMP Type Underground Chambers	DA DMA BMP Type
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	3.7	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix 6.4.H*	3.0	
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.23	
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0	
7 Ponding Depth (ft) *d_{BMP} < 1/12*Item 4*Item 5) or Item 6*	6.0	
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	3,461	
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	---	
10 Amended soil porosity	---	
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0	
12 Gravel porosity	40%	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	---	
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	9,353 (per manufacturer's specifications)	

16 Total Retention Volume from LID Infiltration BMPs: 9,353 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 101% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

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.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 4)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 1,950
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30

BMP Type *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*	DA 4 DMA D BMP Type Underground Chambers	DA DMA BMP Type	
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	3.4		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix 6.4.H*	3.0		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.13		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0		
7 Ponding Depth (ft) *d_{BMP} < 1/12*Item 4*Item 5) or Item 6*	6.0		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	2,179		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	---		
10 Amended soil porosity	---		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0		
12 Gravel porosity	40%		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	---		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	2,378 (per manufacturer's specifications)		

16 Total Retention Volume from LID Infiltration BMPs: 2,378 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 109% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

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.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 5)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 2,616
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30

BMP Type *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*	DA 1 DMA A BMP Type Underground Chambers	DA DMA BMP Type
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	6.5	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix 6.4.H*	3.0	
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.17	
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0	
7 Ponding Depth (ft) *d_{BMP} < 1/12*Item 4*Item 5) or Item 6*	6.0	
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	687	
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	---	
10 Amended soil porosity	---	
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	6.0	
12 Gravel porosity	40%	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	---	
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	2,717 (per manufacturer's specifications)	

16 Total Retention Volume from LID Infiltration BMPs: 2,717 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 108% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

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.

4.3.3 Harvest and Use BMP

Harvest and use BMPs were not considered since the full LID DCV can be met by maximizing infiltration BMPs.

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): 0 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *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*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			
9 Total Retention Volume (ft^3) from Harvest and Use BMP 0 *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest and use BMPs? Yes ☒ No ☐ *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.*			

4.3.4 Biotreatment BMP

Biotreatment BMPs were not considered since the full LID DCV can be met by maximizing retention and infiltration.

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
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)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 0 *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *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)*		
7 Metrics for MEP determination: • 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: ☐ *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 *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *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*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} = *Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} = *Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ = *Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 *Sum of Item 14 for all volume-based BMPs included in this form*			

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

Biotreatment BMP Type *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.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *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*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *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* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} = *(Item* $8_{forebay}$ + *Item* 8_{basin}*) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item* $8_{forebay}$ + *Item* 8_{basin}*) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-8 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

Form 4.3-9 demonstrates how on-site LID DCV is met with proposed infiltration BMP.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 4,412 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 4,517 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- 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 ☐ No ☒
  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
- 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 ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 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:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  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)%*
- 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: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 14,712 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 14,848 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- 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 ☐ No ☒
  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
- 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 ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 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:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  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)%*
- 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: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 3)

1 Total LID DCV for the Project DA-1 (ft^3): 9,304 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 9,353 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- 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 ☐ No ☒
  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
- 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 ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 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:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  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)%*
- 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: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 4)

1 Total LID DCV for the Project DA-1 (ft^3): 1,950 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 2,378 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- 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 ☐ No ☒
  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
- 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 ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 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:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  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)%*
- 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: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 5)

1 Total LID DCV for the Project DA-1 (ft^3): 2,616 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 2,717 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- 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 ☐ No ☒
  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
- 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 ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 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:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  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)%*
- 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: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Since no additional remaining runoff volume retention was needed for HCOC mitigation in addition to the LID BMP implemented, this form was left blank. In addition, the project is completely within the HCOC exemption area per the County's SWFMT (Stormwater Facility Mapping Tool).

Form 4.3-10 Hydromodification Control BMPs (DA 1 – DA 5)

1 Volume reduction needed for HCOC performance criteria (ft^3): *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *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*
3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *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)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  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)
- 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 ☐
- 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 ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐
  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)
- 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 ☐

THE PROPOSED PROJECT IS LOCATED WITHIN AN HCOC EXEMPTION AREA

4.4 Alternative Compliance Plan (if applicable)

Since the project was fully able to retain and infiltrate the DCV through on-site LID practices, alternative compliance plan to address remaining LID DCV is not necessary.

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

BMP	Responsible Party (s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N1-Education of Property Owners, Tenants and Occupants on Stormwater BMPs N12-Employee Training	Owner	Owner will require employees and contractors to be familiar with the property BMP practices. Available education materials will be available for employees and contractors at all times.	Within 14 days after new hiring of employee, contractor or transfer of ownership.
N2-Activity Restriction	Owner	Owner will be limited to SIC code (5541) activities. Prohibited activities include; discharge of fertilizers/ pesticides/ animal waste/ trash/ debris/ paint into infiltration basin. Employees and contractors will follow activity restrictions set forth through the employee training program upon hiring.	Restriction for property to be implemented at all times.
N3-Landscape Management BMPs S4-Efficient Irrigation System and Landscape Design S5-Finished Grade Design 1" Below Hardscape (Top of Curb, Sidewalk and Pavement)	Owner	Landscape contractor shall inspect the irrigation system and landscaping. Contractor shall report all drainage problems to the owner. All routine landscaping maintenance shall be done in conformance with City and County Ordinances.	Weekly inspections of BMPs and irrigation system, through a licensed landscape contractor.
N4-BMP Maintenance	Owner	Owner shall hire contractor to have infiltration basin and drain inlets maintained in accordance with the the Operations and Maintenance Agreement.	Inspection before wet season (October 1) and after each major rain event (> 0.5"). Repair immediately if repairs needed.
N6-Local Water Quality Ordinances	Owner	Owner shall comply with BMP site maintenance in accordance with the City of Highland stormwater ordinances for this property.	City ordinances for property to be implemented at all times.
N10-Uniform Fire Code Implementation	Owner	Employees will enforce fire code requirements regarding products storage and safety from Article 80 of the Uniform	Product storage and safety for property to be implemented at all times.

		Fire Code. Material for proper storage will be available for employees of the property.	
N11-Litter/Debris Control Program S3-Trash and Waste Storage Areas	Owner	A program shall be implemented to pick up litter and sweep and clean the trash enclosure on a daily basis. All dumpsters will have lids installed and will be inspected weekly to ensure that the dumpsters remain covered and leak-proof. The owner shall contract with a refuse company to have the dumpsters emptied on a weekly basis, at a minimum	Daily sweeping, litter disposal and inspection of trash receptacles. daily removal of garbage containers by staff.
S1-Storm Drain Stenciling/Signage	Owner	Stenciling and signage will be visually inspected for proper visibility. Faded or removed stenciling will be replaced immediately.	Inspection bi-annually. Repair immediately if repairs needed.
N15-Vacuum Sweeping of Private Streets and Parking Lots	Owner	Parking lots shall be swept weekly to prevent sediment, garden waste, trash, or other pollutants from entering on-site drains and public storm system. Sweeping will be done by a landscape contractor or other contractor provided by the owner.	Weekly sweeping of parking lots.
Underground Infiltration Chambers	Owner	Inspect, remove trash and debris. If 48 hour drawdown is not achieved, owner will remove and replace gravel and rescarify a minimum of 2" on all sides to provide fresh infiltration surface.	Inspection before wet season (October 1) and after each major rain event (> 0.5").

Section 6 WQMP Attachments

6.1. Site Plans

A – PWQMP Site Plan

B – Boundary Plat

C – Vicinity Map

6.2 Electronic Data Submittal

A – Electronic Report (CD)

6.3 Post Construction

A – Maintenance Agreement

A – Operation and Maintenance

6.4 Other Supporting Documentation

A - Design Capture Volume Calculation w/ Drawdown Calculation

B – CASQA BMP Handbook

C – Education Materials

D – HCOC Exemption Materials

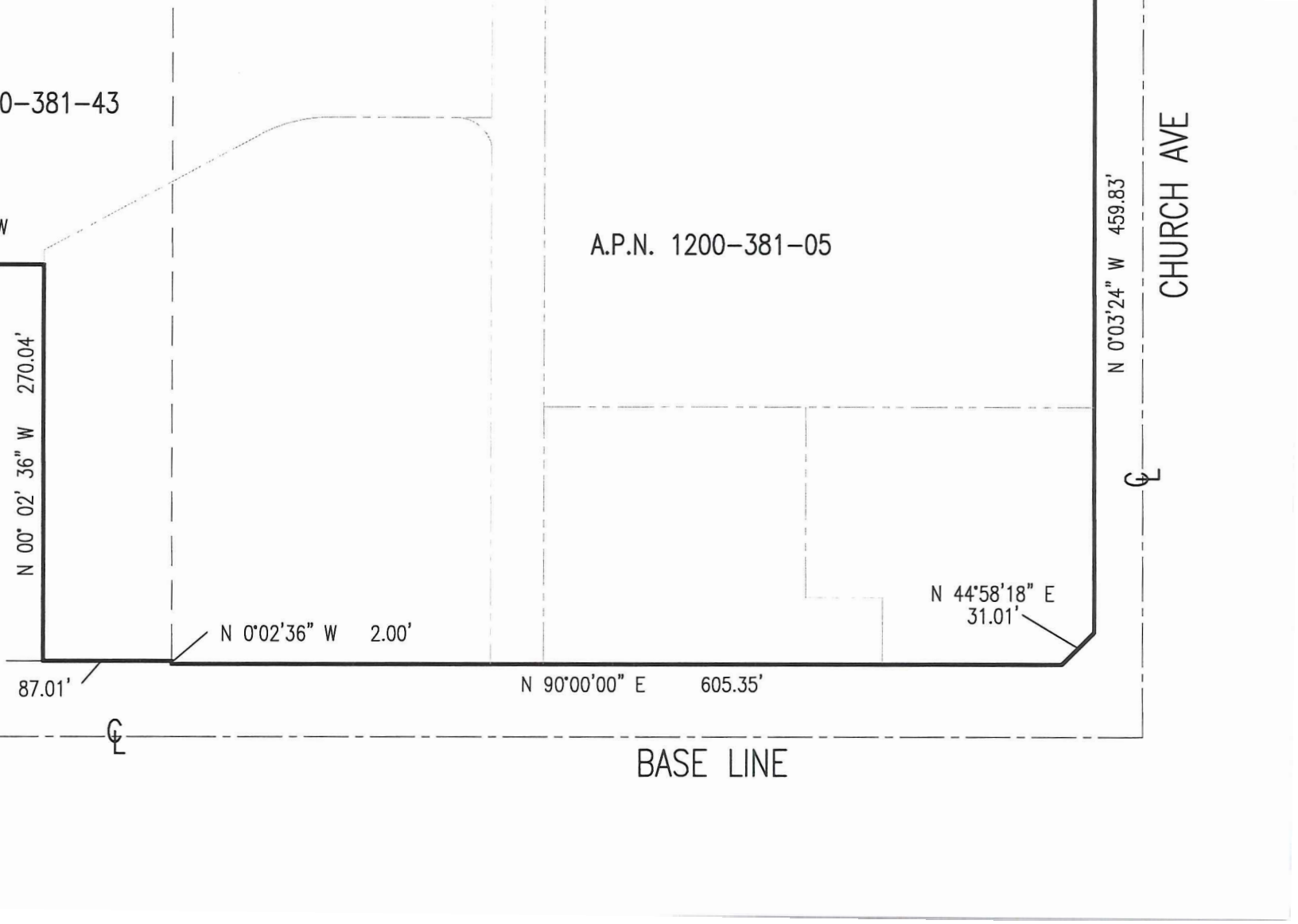
E – Receiving Waters Exhibit

F – Soils Report

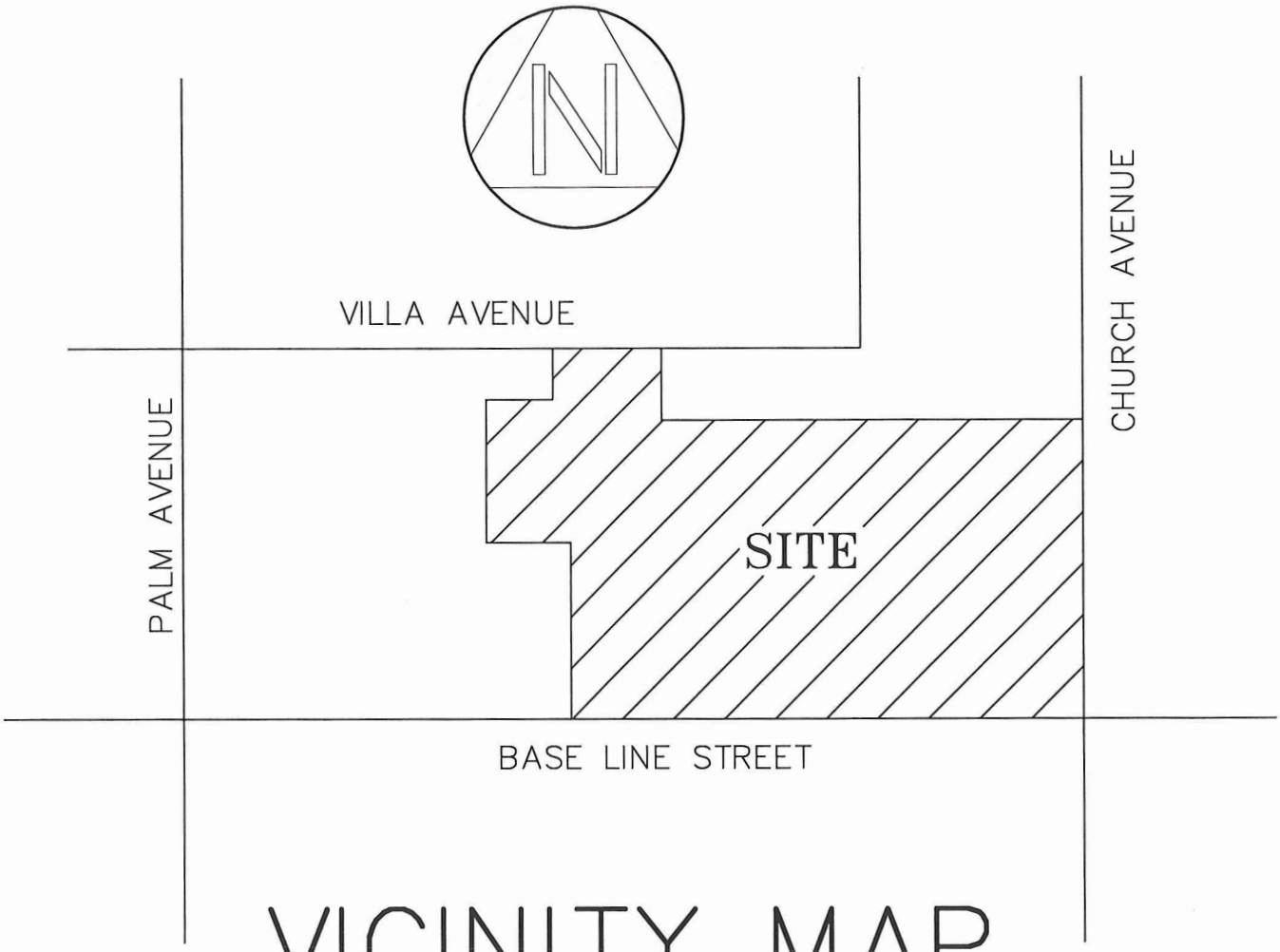
G – Factor of Safety Calculation

6.1.A – PWQMP Site Plan

6.1.B – Boundary Plat


0-381-43
A.P.N. 1200-381-05
CHURCH AVE
N 0°03'24" W 459.83'
N 00° 02' 36" W 270.04'
N 44°58'18" E
31.01'
N 0°02'36" W 2.00'
87.01'
N 90°00'00" E 605.35'
BASE LINE

6.1.C – Vicinity Map



VICINITY MAP

NO SCALE

6.2.A – Electronic Report (CD)

6.3.A – Maintenance Agreement

Will Provide for Final WQMP

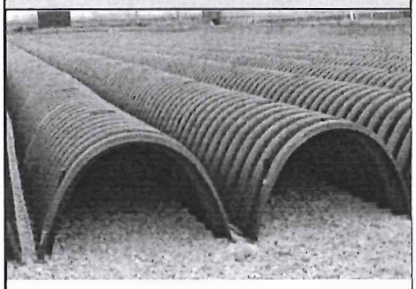
6.3.B– Operation and Maintenance

INF-7: Underground Infiltration

Underground infiltration is a vault or chamber with an open bottom that used to store runoff and percolate into the subsurface. A number of vendors offer proprietary infiltration products that allow for similar or enhanced rates of infiltration and subsurface storage while offering durable prefrabricated structures. There are many varieties of proprietary infiltration BMPs that can be used for roads and parking lots, parks and open spaces, single and multi-family residential, or mixed-use and commercial uses.

Also known as:

- *Infiltration vault*
- *Recharge vault*



Underground Infiltration

Source: http://www.contech-cpi.com

Feasibility Screening Considerations

- Infiltration bains shall pass infeasible screening criteria to be considered for use.
- Underground infiltration galleries pose a potential risk of groundwater contamination; pretreatment should be used.

Opportunity Criteria

- Soils are adequate for infiltration or can be amended to provide an adequate infiltration rate.
- Appropriate for sites with limited surface space.
- Can be placed beneath roads, parking lots, parks, and athletic fields.
- Potential for groundwater contamination can be mitigated through isolation of pollutant sources, pretreatment of inflow, and/or demonstration of adequate treatment capacity of underlying soils.
- Infiltration is into native soil, or depth of engineered fill is ≤ 5 feet from the bottom of the facility to native material and infiltration into fill is approved by a geotechnical professional.
- Tributary area land uses include mixed-use and commercial, sngle-family and multi-family, roads and parking lots, and parks and open spaces. High pollutant land uses should not be tributary to infiltration BMPs.

OC-Specific Design Criteria and Considerations

- ☐ Placement of BMPs should observe geotechnical recommendations with respect to geological hazards (e.g. landslides, liquefaction zones, erosion, etc.) and set-backs (e.g., foundations, utilities, roadways, etc.)
- ☐ Minimum separation to mounded seasonally high groundwater of 10 feet shall be observed.
- ☐ Minimum pretreatment should be provided upstream of the infiltration facility, and water bypassing pretreatment should not be directed to the facility.
- ☐ Underground infiltration should not be used for drainage areas with high sediment production potential unless preceded by full treatment control with a BMP effective for sediment removal.
- ☐ Design infiltration rate should be determined as described in **Appendix VII**.
- ☐ Inspection ports or similar design features shall be provided to verify continued system performance and identify need for major maintenance.

☐ For infiltration facilities beneath roads and parking areas, structural requirements should meet H-20 load requirements.

Computing Underground Infiltration Device Size

Underground infiltration devices vary by design and by proprietary designs. The sizing method selected for use must be based on the BMP type it most strongly resembles.

- For underground infiltration devices with open pore volume (e.g., vaults, crates, pipe sections, etc), sizing will be most similar to infiltration basins.
- For underground infiltration devices with pore space (e.g., aggregate reservoirs), sizing will be most similar to permeable pavement.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 5: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**

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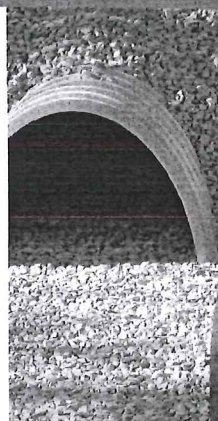


THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

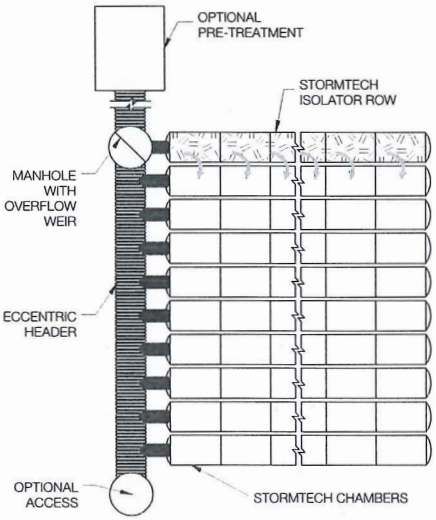
The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

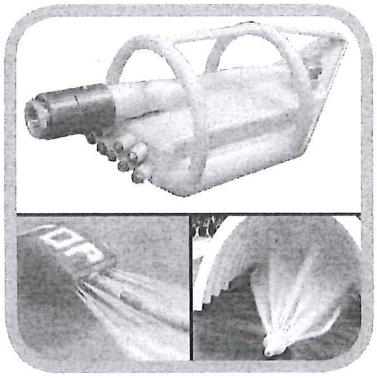
The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)





ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

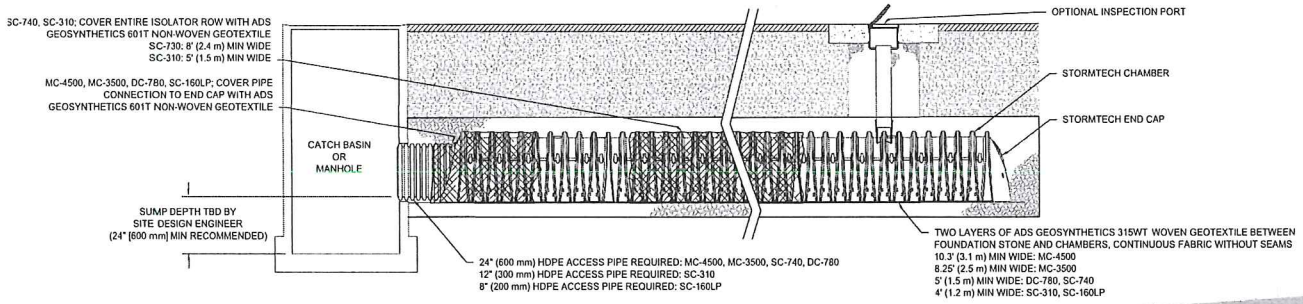
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Rows
   i. Remove cover from manhole at upstream end of Isolator Row
   ii. Using a flashlight, inspect down Isolator Row through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row using the JetVac process.

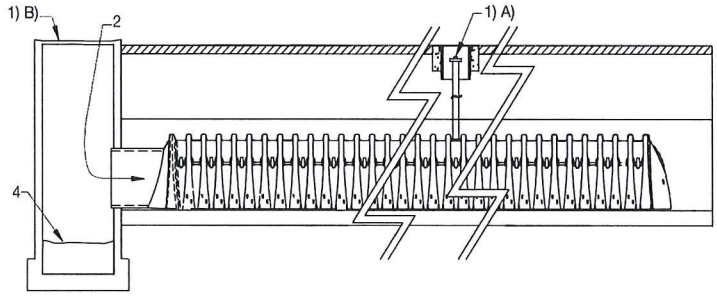
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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A division of ADS

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

StormTech Maintenance Log

Project Name:
Location:

StormTech®
www.stormtech.com

	Stadia Rod Readings				
Date	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)	Sediment Depth (1) - (2)	Observations / Actions	Inspector

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

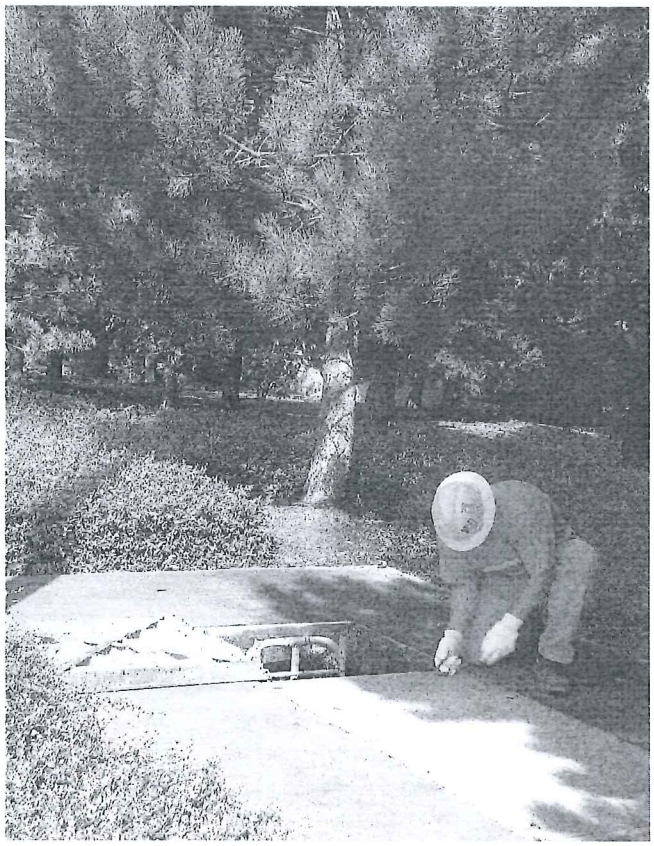
The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

CONTECH®
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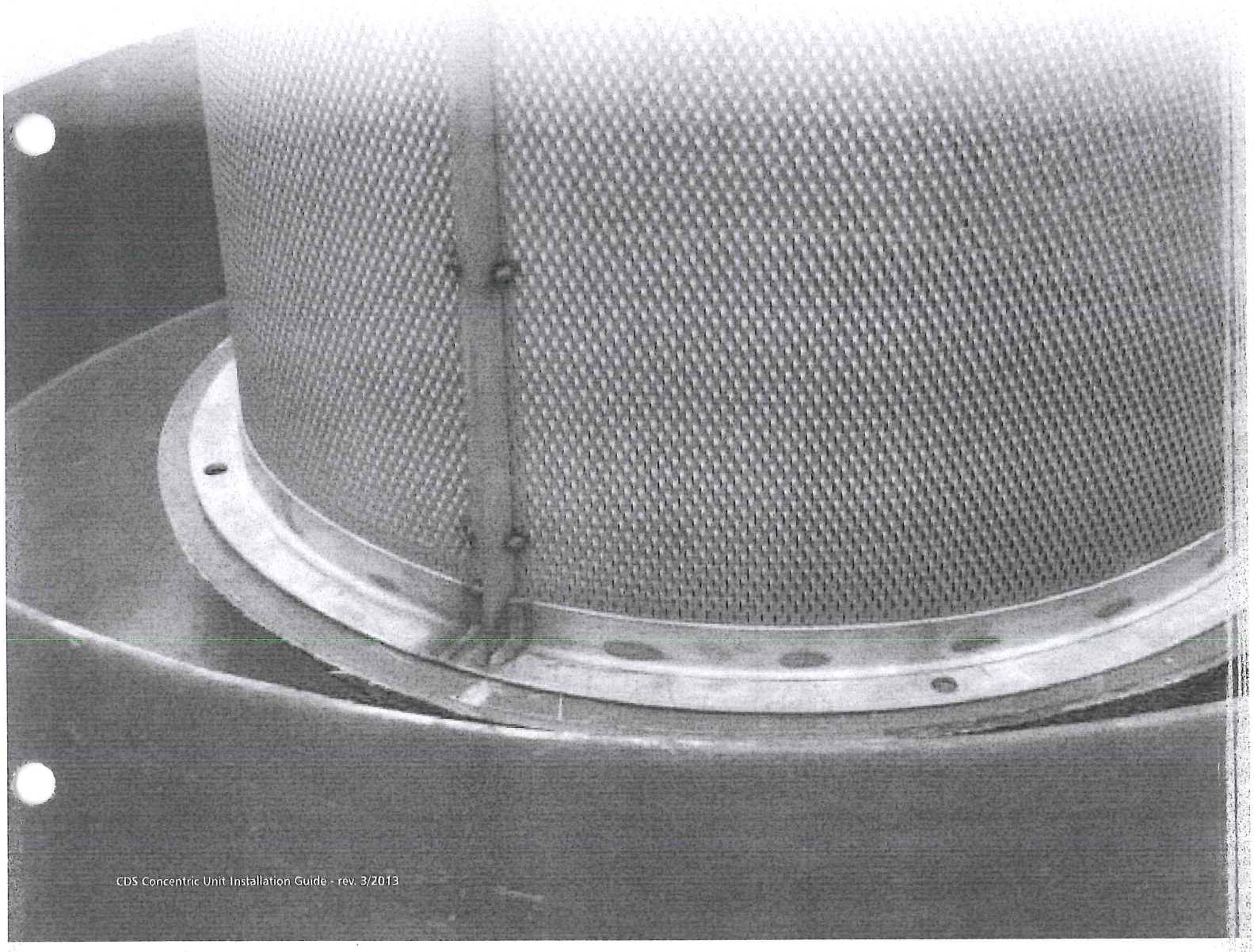
CDS® Concentric Unit

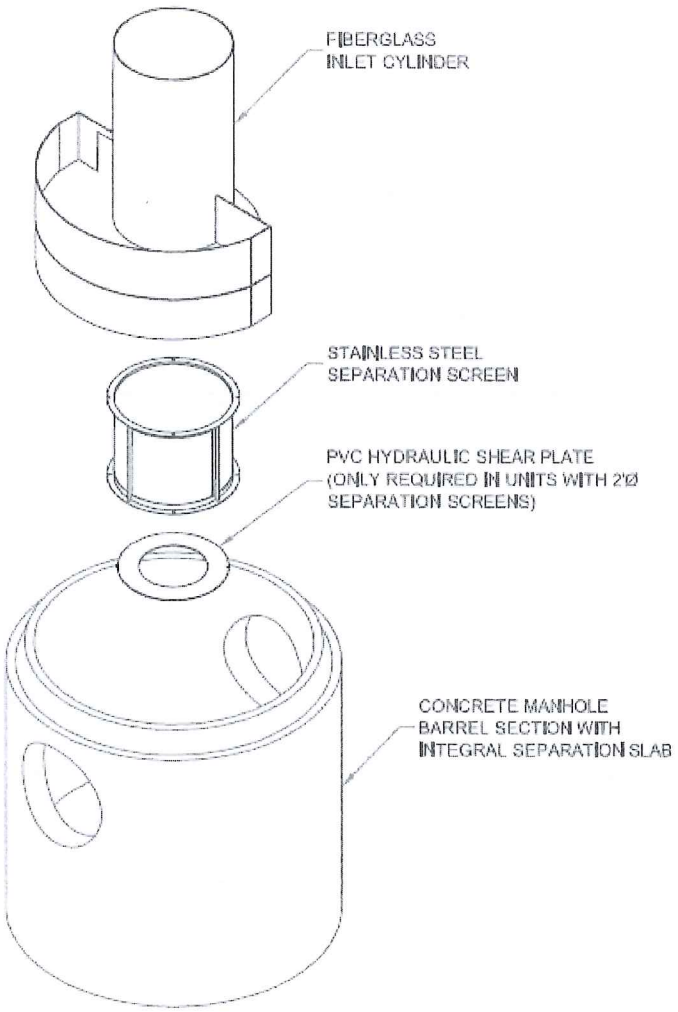
Internal Component Assembly and Installation Guide



Overview

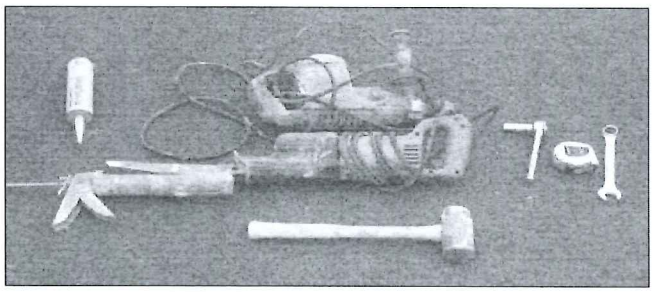
The CDS® installation will consist of three primary components, the fiberglass inlet cylinder, stainless steel separation screen, and concrete manhole barrel section with integral separation slab. If the CDS® unit has a 2' inside diameter separation screen, the unit will also have a PVC hydraulic shear plate.

Before starting installation, be sure you have all the components, tools, and supplies necessary to complete the work. Contech will ship the fiberglass inlet cylinder, SS separation screen, PVC hydraulic shear plate, and all needed hardware to you prior to the installation date. These internals will typically arrive on two shipping pallets, one with inlet cylinder and the other with the SS separation screen, box of stainless steel hardware, and PVC shear plate if required.



Tools Recommended For A Successful Installation

1. Small rotary hammer drill
2. Hand drill with ½" chuck
3. 3/8" diameter masonry bit that will drill a hole at least 3" deep
4. ½" diameter wood bit for drilling fiberglass
5. Hammer
6. Reciprocating saw
7. Long blade for saw
8. Tape measure
9. Marker or grease pencil for marking fiberglass
10. Sealant gun
11. Sealant, equivalent to Sikaflex 1a
12. 9/16" deep socket with ratchet drive for tightening 3/8" concrete anchors
13. 3/4" end wrench and 3/4" socket for tightening 1/2" bolts and nuts



Inlet Cylinder & Separation Screen Component Assembly

Remove fiberglass inlet cylinder from the shipping pallet and turn it upside down so it is standing on the cylinder with the horizontal flange facing up (Fig 1). Unbolt separation screen from shipping pallet and place it on top of the inlet cylinder with the **GREEN** painted flange facing the fiberglass flange and center screen over the cylinder opening (Fig 2).

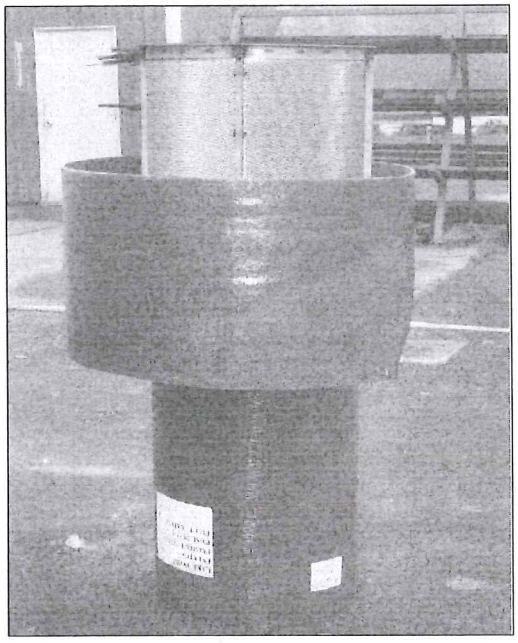


Fig 1. Upside down inlet and screen.

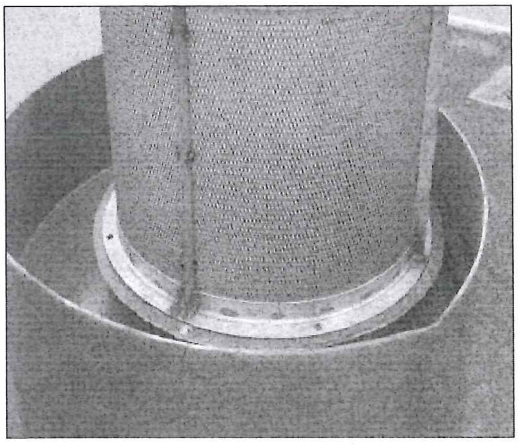


Fig 2. Screen centered over inlet cylinder opening.

Using the hand drill with 1/2" wood bit match drill the holes from the screen flange into the horizontal flange on the fiberglass inlet (Fig 3). Drill just one hole at a time and install 1/2" diameter 316 stainless steel bolts with washers to hold screen centered before moving to the next hole (Fig 4). Once all holes are drilled and bolts installed use 3/4" end wrench and 3/4" socket to tighten until split washer is flat.

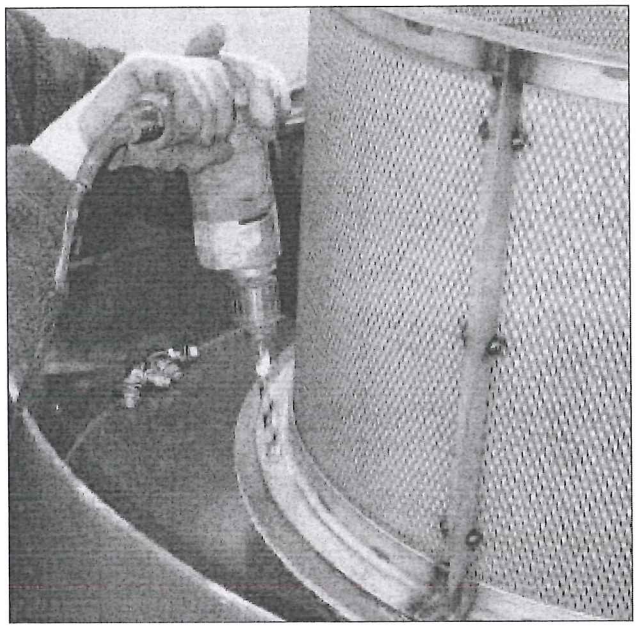


Fig 3. Match drill holes from screen flange.

Fig 4. Attach screen to inlet with 1/2" bolts

Depending on the internal height of the CDS® unit the fiberglass inlet cylinder may need to be cut down from the standard 4' height. The correct cylinder height will be located on the fabrication drawings provided by Contech (Fig 5). Using the tape measure and marker or grease pencil mark the cylinder at the height to be cut and remove top of cylinder with reciprocating saw or other cutting tool (Fig 6).

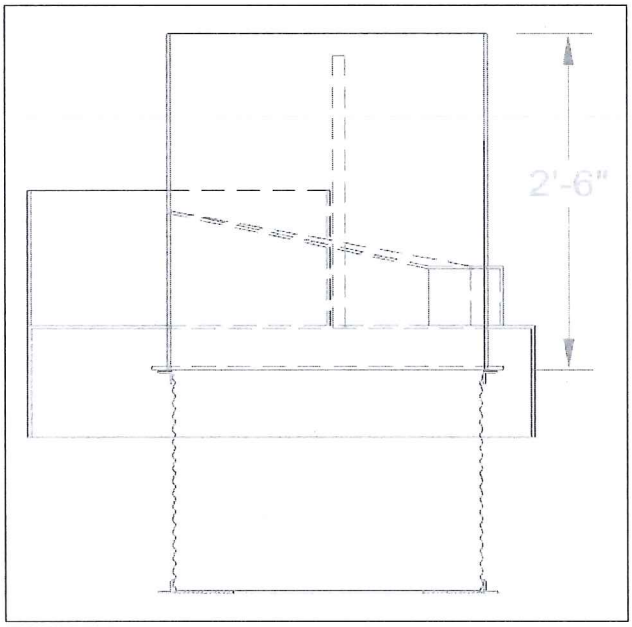


Fig 5. Cylinder height shown on fabrication drawings

Fig 6. Removing top of inlet cylinder.

Component Assembly Installation

Lift inlet and screen assembly into manhole barrel section centering the cylinder over the sump access hole in separation slab floor (Fig 7). See Contech fabrication drawings for rotation angle of the fiberglass inlet (Fig 8). Coring for inlet pipe must fall within inlet trough and coring for outlet pipe must be outside of inlet trough. If unit has multiple inlet pipes all inlet coring must fall within inlet trough.

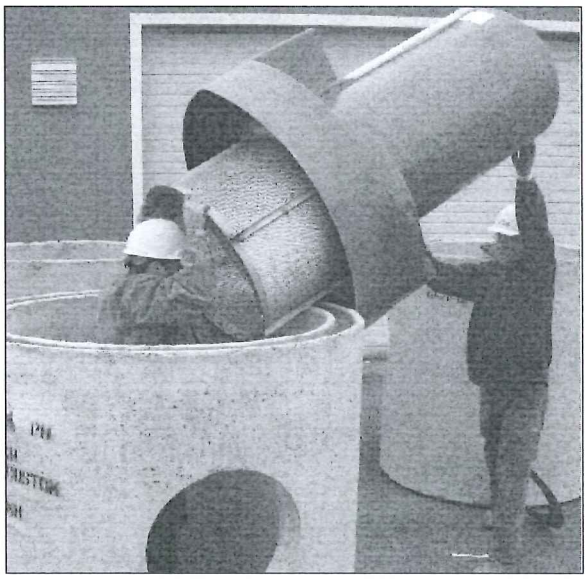


Fig 7. Lift inlet and screen assembly into manhole.

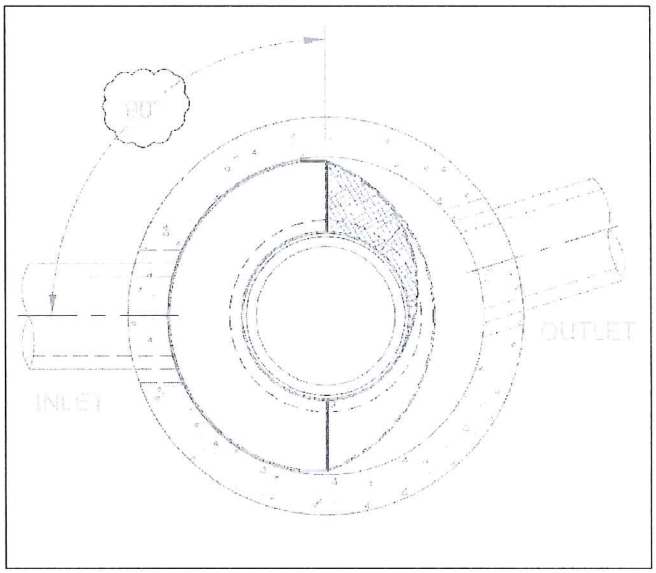


Fig 8. Inlet rotation shown on fabrication drawings.

Using marker or grease pencil, outline the sides of inlet coring down to the trough floor (Fig 9). Next rotate inlet just enough to drill two 1/2" holes on each side of the outline, about 12" apart and 4" outside of outline (Fig 10). Rotate the inlet trough and cylinder back to center so your outline mark is aligned with the inlet core.

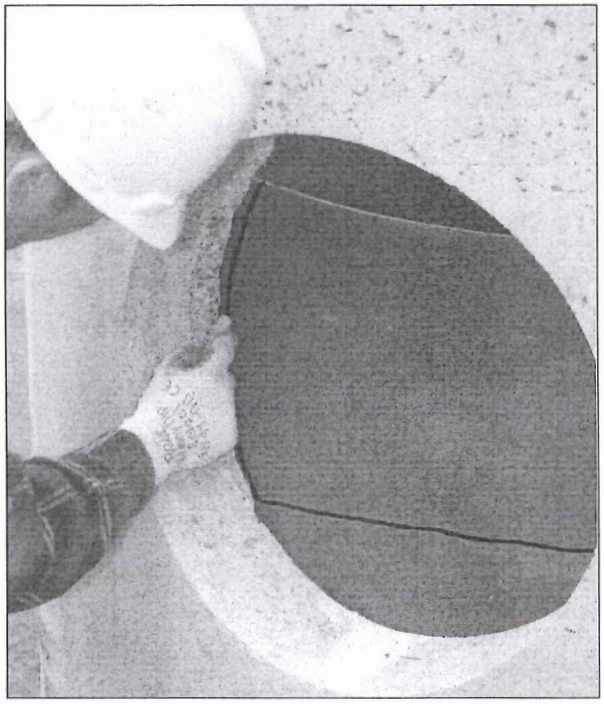


Fig 9. Outline inlet coring on inlet trough flange.

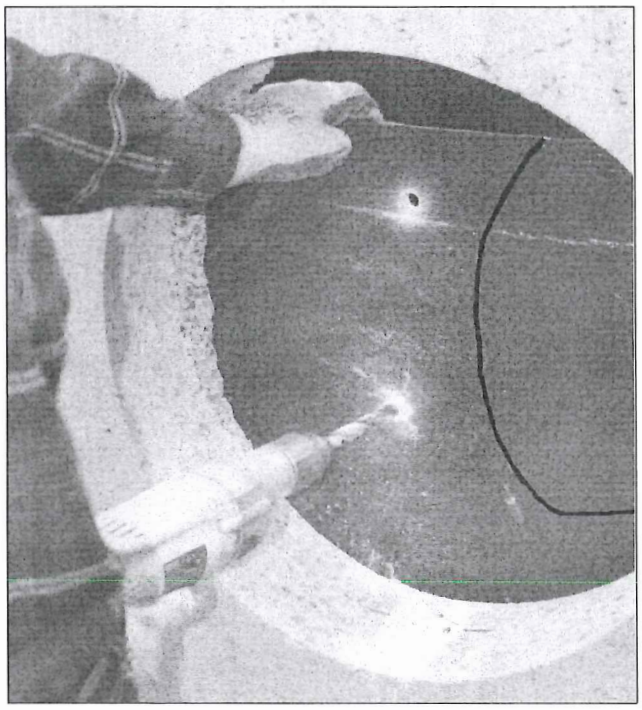


Fig 10. Drill two holes on both sides of coring outline.

Using a small rotary hammer with a 3/8" diameter masonry bit, drill a 3" deep hole into the manhole wall at one of the 1/2" holes you just drilled through the trough flange (Fig 11). You may need to angle the drill to fit between the fiberglass cylinder and the trough flange. Next place one of the provided 3/8" diameter 316 stainless steel wedge anchors into the hole and set it using a large hammer (Fig 12). Repeat steps to set anchors at all four 1/2" holes and snug down anchor nut with 9/16" deep socket.

Fig 11. Drill concrete manhole for wedge anchors.

Fig 12. Use hammer to set wedge anchors.

Using a reciprocating saw cut the trough flange to remove the fiberglass inside of the inlet outline you marked, being careful not to cut into the trough floor (Fig 13) (Fig 14).

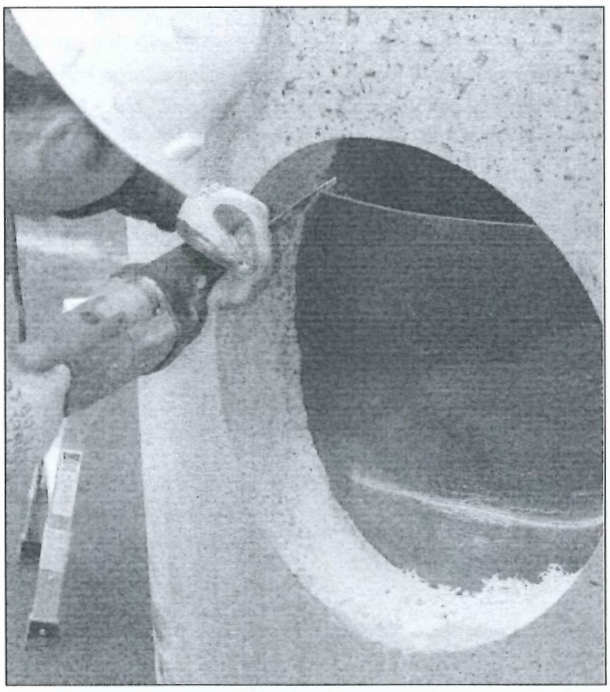


Fig 13. Remove trough flange blocking inlet coring.

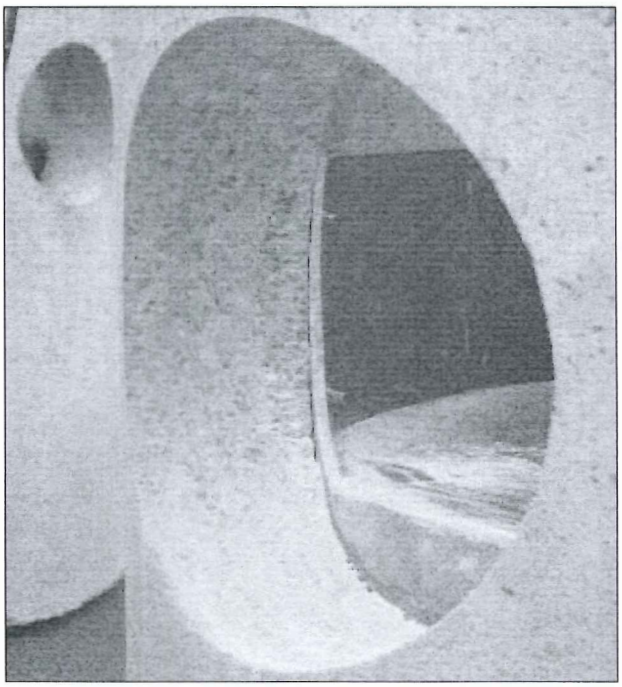


Fig 14. Inlet coring with trough flange removed.

With a sealant gun apply a bead of polyurethane elastomeric sealant, equivalent to Sikaflex 1a, down the sides and along bottom of inlet coring to seal any gap between fiberglass and manhole wall (Fig 15). If a gap exists that is to large to be filled with sealant you can fill with butyl mastic and apply sealant over the top.

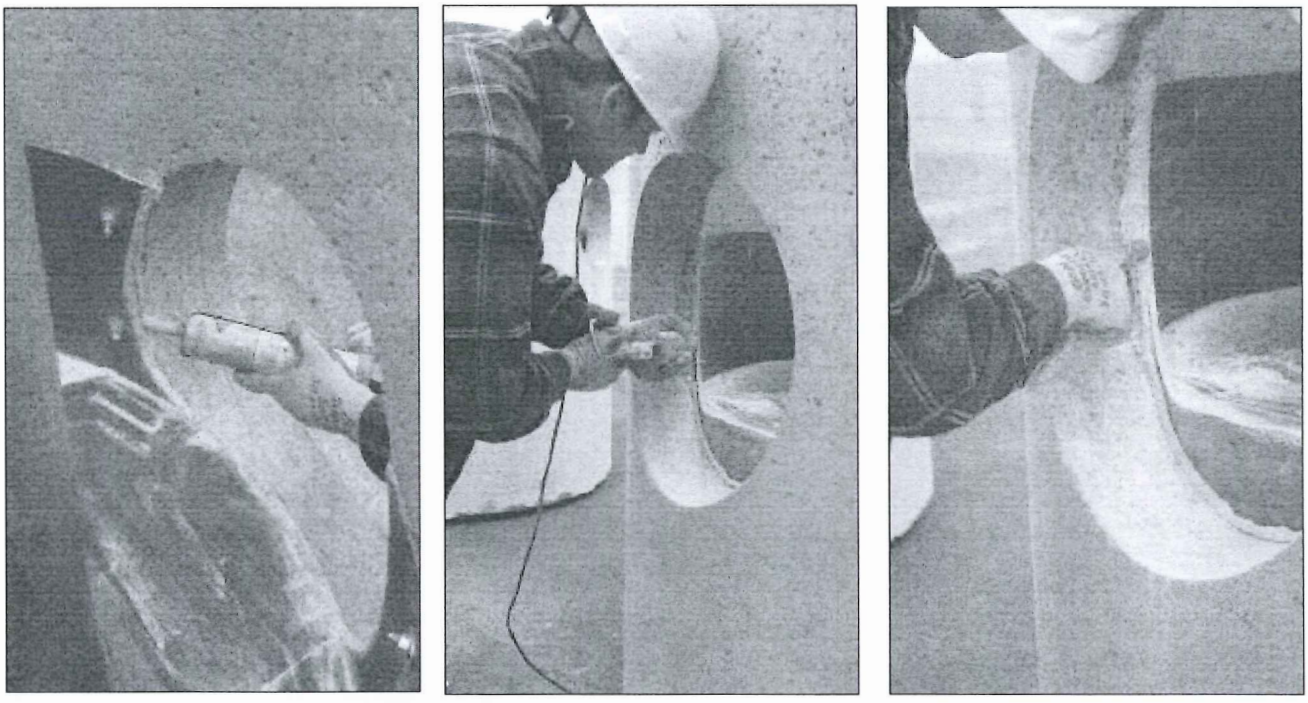


Fig 15. Seal inlet trough down the sides and along bottom of inlet coring with Sikaflex 1a sealant or equivalent.

If the unit has a 2' inside diameter separation screen Contech will provide a PVC hydraulic shear plate. This shear plate will need to be installed inside of the separation screen so that it rests on the separation slab floor. To install, drop the shear plate down through the fiberglass cylinder keeping it flat (Fig 16). Do not fasten shear plate to floor it must remain removable (Fig 17).

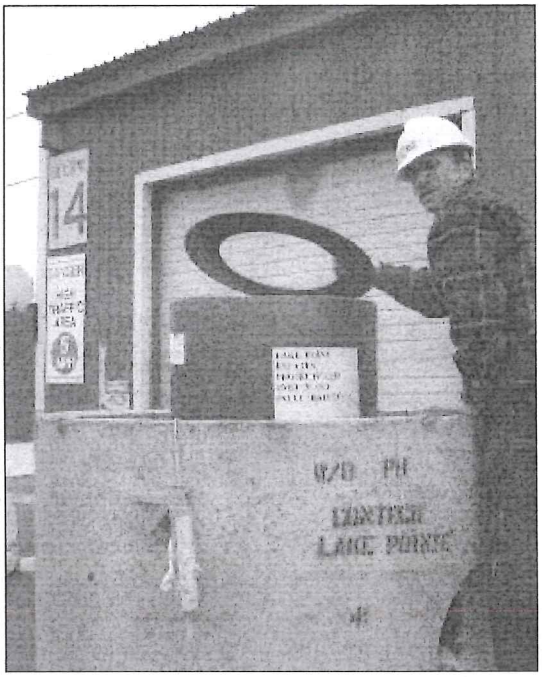


Fig 16. Installing PVC hydraulic shear plate.

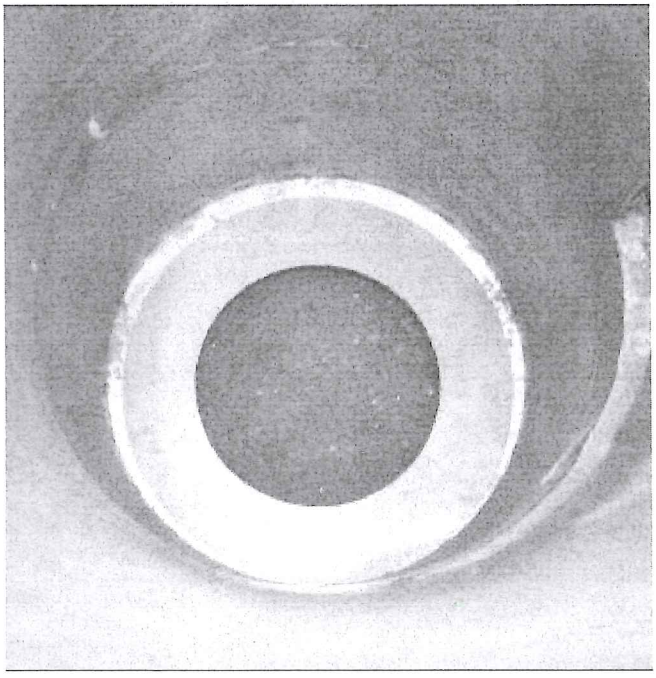
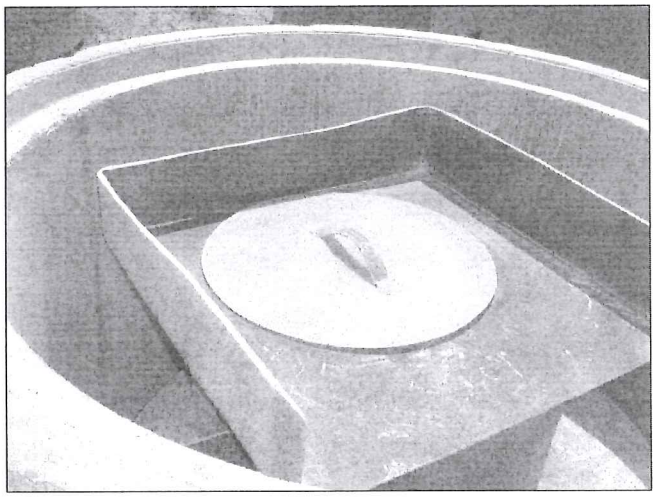


Fig 17. PVC hydraulic shear plate resting on floor.

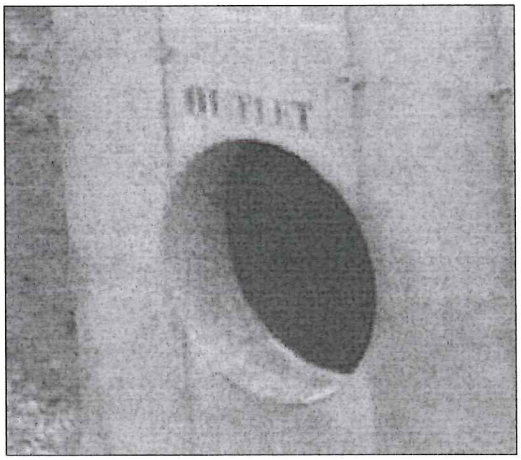
If the unit has a grated top inlet, Contech will provide a fiberglass deflector pan and cover. This deflector pan will need to be installed on top of the fiberglass cylinder with the open end over the inlet trough. See Contech fabrication drawings for correct location. Do not fasten cover to pan it must remain removable (Fig 18).

Fig 18. Deflector pan installed on top of cylinder.



Stencil manhole barrel section to mark inlet and outlet coring (Fig 18). Be sure that all manhole lifting points are accessible and not blocked by the internal components. If they are, new lift points will need to be provided.

Fig 19. Stencil inlet and outlet coring.



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Support

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- Site-specific design support is available from Contech Stormwater Design Engineers.

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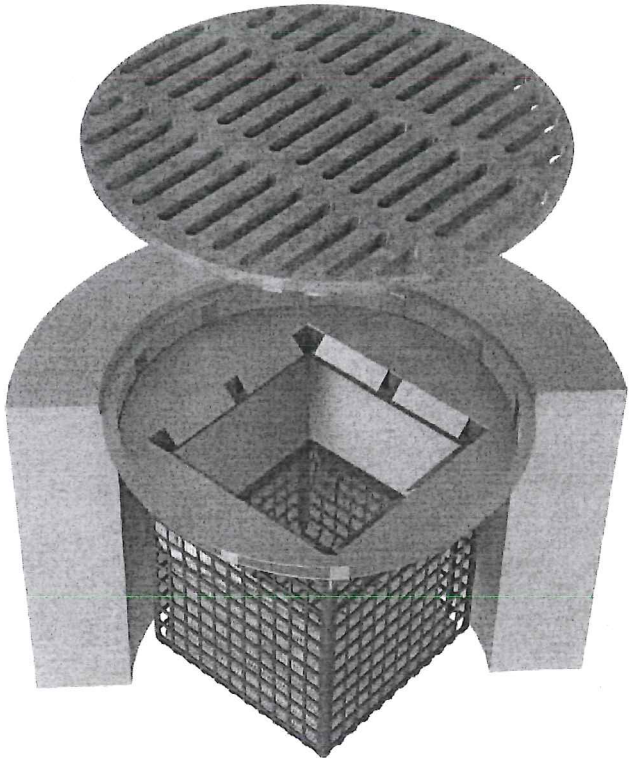
Oldcastle Infrastructure™
A CRH COMPANY

FLOGARD® CATCH BASIN INSERT FILTER

Submittal Package



Water

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1 - Submittal Drawing

2 - Features & Benefits

3 - Accessories

4 - Inspection & Maintenance

5 - Product Specifications

SECTION 1

Submittal Drawing

SECTION 2

Features & Benefits

Oldcastle Infrastructure™
A CRH COMPANY

PUT A STOP to TSS

Removes Pollutants from Runoff Prior to Entering Waterways

Efficient System
Catches pollutants where they are easiest to catch, at the inlet.

Variable Design
Able to be retrofitted or used in new projects.

Treatment Train
Can be incorporated as part of a "Treatment Train".

No Standing Water
Helps to minimize bacteria and odor problems.

Focused Treatment
Removes petroleum hydrocarbons, trash and Total Suspended Solids (TSS).

Maximum Flexibility
Available in a variety of standard sizes to fit round and square inlets.

Economical
Earn a higher return on system investment.

Two-part stainless-steel insert to filter solids and oils/grease.

Easy to install, inspect and maintain, even on small and confined sites.

By the Numbers*:
Filter will remove up to 80% of Total Suspended Solids (TSS), at least 70% of oils and grease, and up to 40% of Total Phosphorus (TP) associated with organic debris as well as Polycyclic Aromatic Hydrocarbons (PAH) from oil leaks and spills.

*Approximate for urban street application.

CATCH BASIN FILTER TEST RESULTS SUMMARY			
Testing Agency	% TSS Removal	% Oil & Grease Removal	% PAH Removal
UCLA	80	70 to 80	
U of Auckland Tonking & Taylor, Ltd (for City of Auckland)	78 to 95		
U of Hawaii (for City of Honolulu)	80		20 to 40

Oldcastle Infrastructure™
A CRH COMPANY

PUT A STOP
to TSS

Multi-Purpose Catch Basin Insert Retains Sediment, Debris, Trash and Oils/Grease

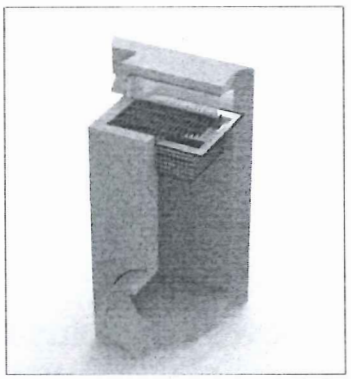
FloGard® catch basin insert filters are recommended for areas subject to silt and debris as well as low-to-moderate levels of petroleum hydrocarbons (oils and grease). Examples of such areas include vehicle parking lots, aircraft ramps, truck and bus storage yards, business parks, residential and public streets.

CATCH BASIN FILTER COMPETITIVE FEATURE COMPARISON		
Evaluation of Catch Basin Filters (Based on flow-comparable units) (Scale 1-10)	Oldcastle	Other Insert Filter Types**
Flow Rate	10	7
Removal Efficiency*	80%	45%
Capacity - Sludge & Oil	7	7
Service Life	10	3
Installation - Ease of Handling / Installation	8	6
Ease of Inspections & Maintenance	7	7
Value	10	2

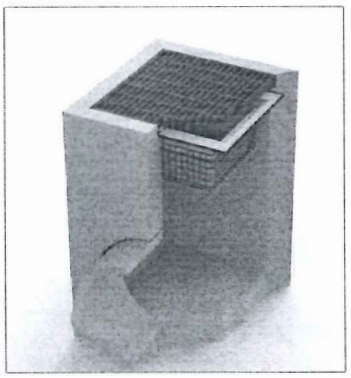
*Approximate, based on field sediment removal testing in urban street application **Average

Long-Term Value Comparison (Based on flow-comparable units) (Scale 1-10)	Oldcastle	Other Insert Filter Types**
Unit Value - Initial ($/cfs treated)	10	4
Installation Value ($/cfs treated)	10	7
Absorbent Replacement (annual avg ($/cfs treated)	10	2
Materials Replacement Value (annual avg ($/cfs treated)	10	10
Maintenance Value (annual avg ($/cfs treated)	10	7
Total First Year ROI ($/cfs treated)	10	5
Total Annual Avg Value ($/cfs treated, avg over 20 yrs)*	10	5

Captured debris from FloGard catch basin insert filter in Dana Point, California.



Combination Inlet



Flat-Grated Inlet

Circular Frame Inlet

(800) 579-8819
oldcastleinfrastructure.com

Oldcastle Infrastructure™
A CRH COMPANY

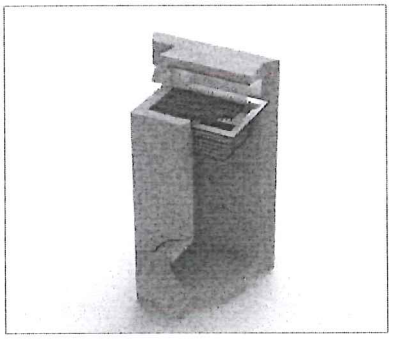
FLOGARD®
Catch Basin Insert Filter

Catch basin insert designed to capture sediment, gross solids, trash and petroleum hydrocarbons from low ("first flush") flows, even during the most extreme weather conditions

Example Types, Sizes and Capacities: Additional sizes, including regional and custom options are available.

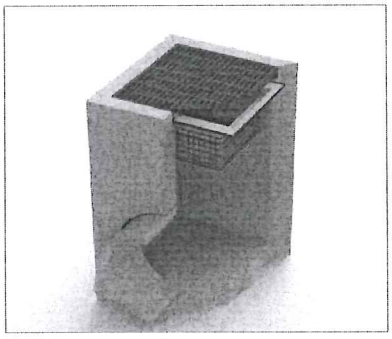
FloGard Combination Inlet
SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions) INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	STANDARD DEPTH -20 Inches- SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)	MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches- SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-1633FGO	16 X 33	19 X 36	7.0	2.5	1.7	FGP-1633FGO8	1.4	1.1
FGP-1836FGO	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836FGO8	1.3	.9
FGP-2234FGO	22 X 34	24 X 36	8.1	3.6	2.1	FGP-2234FGO8	2.1	1.4
FGP-2436FGO	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436FGO8	1.95	1.15


Combination Inlet

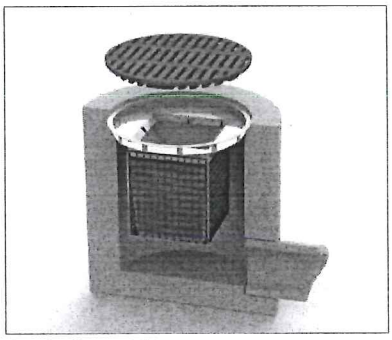
FloGard Flat Grated Inlet
SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions) INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	STANDARD DEPTH -20 Inches- SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)	MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches- SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	24 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-32F-TN	28 X 28	32 X 32	6.3	2.2	1.5	FGP-32F8-TN	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-1633F	16 X 34	18 X 36	6.9	2.3	1.6	FGP-1633F8	1.3	.9
FGP-2234F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2234F8	1.95	1.15


Flat-Grated Inlet

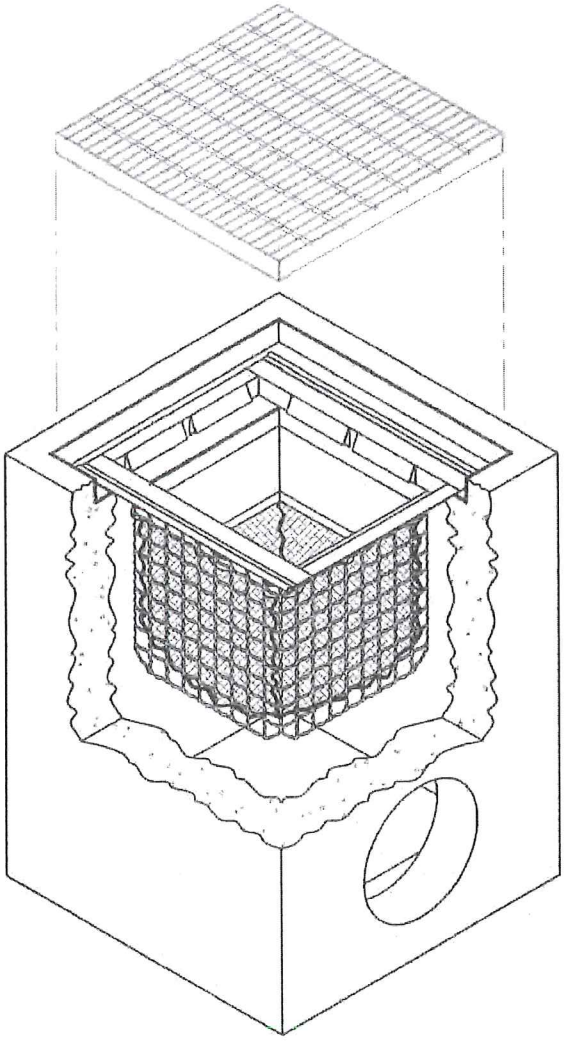
FloGard Circular Grated Inlet
SPECIFIER CHART

MODEL NUMBER	INLET ID (inches)	GRADE OD (inches)	SOLIDS STORAGE CAPACITY (CU FT)	FILTERED FLOW (CSF)	TOTAL BYPASS CAPACITY (CFS)
FGP-RF15F	15	18	0.3	0.4	2.8
FGP-RF18F	18	20	0.8	0.7	4.7
FGP-RF20F	20	23	0.8	0.7	4.7
FGP-RF21F	21	23.5	0.8	0.7	4.7
FGP-RF22F	22	24	0.8	0.7	4.7
FGP-RF24F	24	26	0.8	0.7	4.7
FGP-RF30F	30	32	2.2	1.5	6.1
FGP-RF36F	36	39	3.6	2.0	8.1

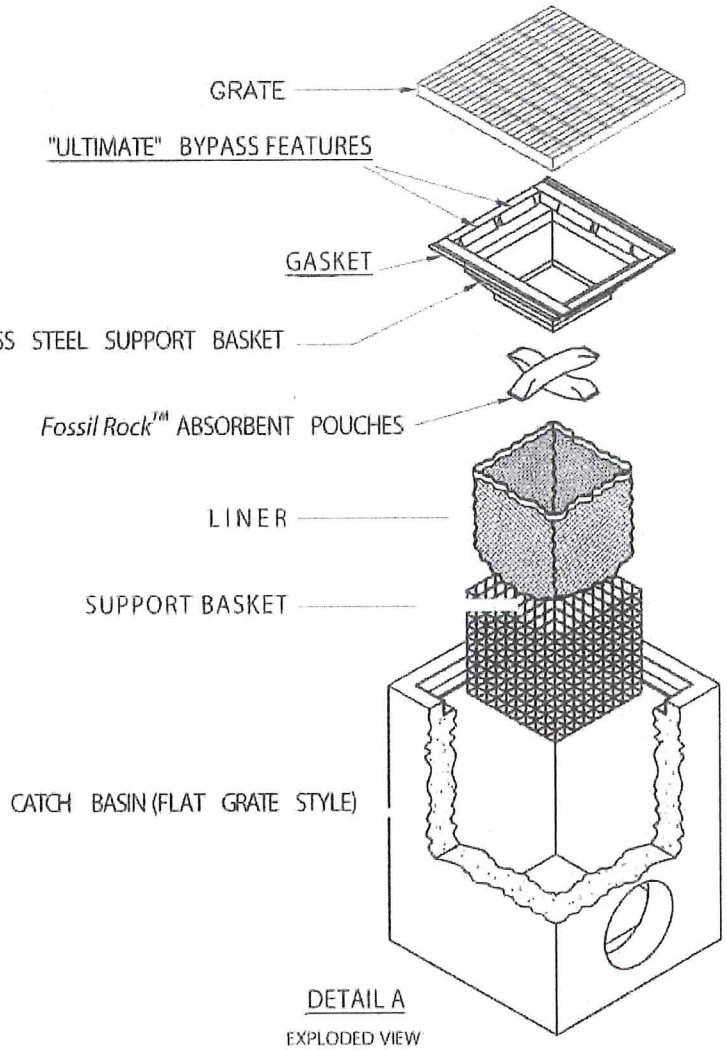

Circular Frame Inlet

SECTION 3

Accessories



FloGard® FILTER
-INSTALLED INTO CATCH BASIN-



DETAIL A
EXPLODED VIEW

NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter support frame shall be constructed from stainless steel Type 304.
3. Filter medium shall be *Fossil Rock* installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.

U.S. PATENT #6,551,023 & 6,872,029

Oldcastle Infrastructure™
A CRH COMPANY

How Rubberizer® (Fossil Rock) Products Work*

Rubberizer® transforms spilled hydrocarbons into a rubber-like solid on contact, and does not re-release when it is retrieved. The solidification process is non-chemical in nature allowing the US EPA to classify Rubberizer as a sorbent.

This product, which comes in booms, pillows or granular form, can be used to clean oil from bilges, deck spills, around hydraulic storage tanks, under hydraulic machinery, in all engineering spaces and most importantly, in any hydrocarbon fuel spill where leaking oil comes in contact with water.

Rubberizer has been used in clean-up operations around the world and is patented in 22 countries.

The key advantages of the Rubberizer product line when compared to many of the characteristics of the more conventional products include:

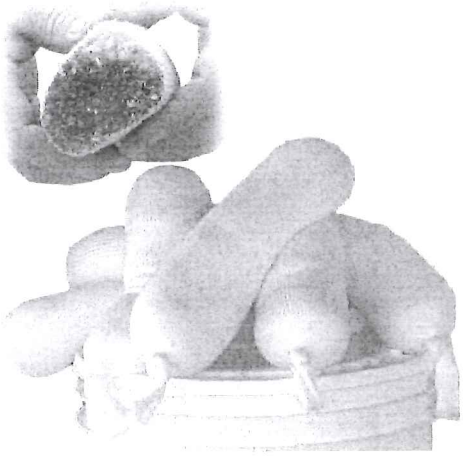
- Works on land or water borne spills
- Remains buoyant
- Solidifies and is landfill approved
- Resistant to leaching
- Does not release solidified oils under pressure
- Incinerates with less that .1% residual ash
- Reduces overall clean-up time
- Reduces overall costs

Rubberizer products sorb and transform into a rubber-like material similar to many petroleum based products like:

- Gasoline
- Jet Fuel
- Diesel Fuels
- Transformer Oils
- Hydraulic Oils
- Lube Oils
- Aromatic Solvents
- Chlorinated Solvents
- Light Crudes

Rubberizer particulate is a mixture of hydrocarbon polymers plus additives resulting in a grainy material used primarily for cleanup operations where sweeping and shoveling are involved. It can also be used for clarification of various emulsions, or solidification and removal of various petroleum based slicks from the surface of water which is in a controlled state.

This product, (and the booms and pillows) in which it is the filler, exhibit characteristics that include:



- Lightweight enabling rapid deployment and retrieval (apparent specific gravity approximately = 0.4)
- Rapid sorption and solidification (measured in minutes), hydrophobic (no affinity for water)
- Permanently buoyant (both before and after sorption)
- Will not release solidified liquids under pressure
- Resistant to leaching upon aqueous contact
- High sorbed liquid to sorbent ratios (nominally 5 parts liquid to 1 part sorbent)
- Minimal incineration residue (less than .1%)
- Little volume increase of sorbed liquids (15% in laboratory tests, nominally 25% in field applications)

One pound of this product will solidify into a rubber-like material up to 2/3 gallon of jet fuel, diesel, gasoline, transformer oil, hydraulic oils, light crude and many other liquids.

*Rubberizer® = Fossil Rock

SECTION 4

Inspection & Maintenance

Oldcastle Infrastructure™
A CRH COMPANY

FLOGARD+PLUS®
CATCH BASIN INSERT FILTER

Inspection and Maintenance Guide

DRAINAGE PROTECTION SYSTEMS
DPS
A division of
Oldcastle Infrastructure

Water

SCOPE:

Federal, State and Local Clean Water Act regulations and those of insurance carriers require that stormwater filtration systems be maintained and serviced on a recurring basis. The intent of the regulations is to ensure that the systems, on a continuing basis, efficiently remove pollutants from stormwater runoff thereby preventing pollution of the nation's water resources. These specifications apply to the FloGard+Plus® Catch Basin Insert Filter.

RECOMMENDED FREQUENCY OF SERVICE:

Drainage Protection Systems (DPS) recommends that installed FloGard+Plus Catch Basin Insert Filters be serviced on a recurring basis. Ultimately, the frequency depends on the amount of runoff, pollutant loading and interference from debris (leaves, vegetation, cans, paper, etc.); however, it is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. DPS technicians are available to do an on-site evaluation, upon request.

RECOMMENDED TIMING OF SERVICE:

DPS guidelines for the timing of service are as follows:

1. For areas with a definite rainy season: Prior to, during and following the rainy season.
2. For areas subject to year-round rainfall: On a recurring basis (at least three times per year).
3. For areas with winter snow and summer rain: Prior to and just after the snow season and during the summer rain season.
4. For installed devices not subject to the elements (wash racks, parking garages, etc.): On a recurring basis (no less than three times per year).

SERVICE PROCEDURES:

1. The catch basin grate shall be removed and set to one side. The catch basin shall be visually inspected for defects and possible illegal dumping. If illegal dumping has occurred, the proper authorities and property owner representative shall be notified as soon as practicable.
2. Using an industrial vacuum, the collected materials shall be removed from the liner. (Note: DPS uses a truck-mounted vacuum for servicing FloGard+Plus catch basin inserts).
3. When all of the collected materials have been removed, the filter medium pouches shall be removed by unsnapping the tether from the D-ring and set to one side. The filter liner, gaskets, stainless steel frame and mounting brackets, etc., shall be inspected for continued serviceability. Minor damage or defects found shall be corrected on-the-spot and a notation made on the Maintenance Record. More extensive deficiencies that affect the efficiency of the filter (torn liner, etc.), if approved by the customer representative, will be corrected and an invoice submitted to the representative along with the Maintenance Record.
4. The filter medium pouches shall be inspected for defects and continued serviceability and replaced as necessary, and the pouch tethers re-attached to the liner's D-ring.
5. The grate shall be replaced.

REPLACEMENT AND DISPOSAL OF EXPOSED FILTER MEDIUM AND COLLECTED DEBRIS

The frequency of filter medium exchange will be in accordance with the existing DPS-Customer Maintenance Contract. DPS recommends that the medium be changed at least once per year. During the appropriate service, or if so determined by the service technician during a non-scheduled service, the filter medium will be replaced with new material. Once the exposed pouches and debris have been removed, DPS has possession and must dispose of it in accordance with local, state and federal agency requirements.

DPS also has the capability of servicing all manner of storm drain filters, catch basin inserts and catch basins without inserts, underground oil/water separators, stormwater interceptors and other such devices. All DPS personnel are highly qualified technicians and are confined-space trained and certified. Call us at (888) 950-8826 for further information and assistance.

SECTION 5

Product Specifications

PART 1 — GENERAL

1.1 Section Includes

FloGard® Catch Basin Insert Filter – catch basin filtration device for stormwater treatment.

1.2 References

American Society for Testing and Materials (ASTM)

1. ASTM A240
2. ASTM D3786
3. ASTM D4355
4. ASTM D4491
5. ASTM D4533
6. ASTM D4632
7. ASTM D4751
8. ASTM D4833
9. ASTM D4991
10. ASTM D5261

PART 2 — PRODUCTS

2.1 Description

This specification describes a Catch Basin Filtration Device that removes sediment, debris, trash and petroleum hydrocarbons (oil and grease) from water flowing into the drainage inlets during low flows (first flush) without impeding the inlet's maximum design flow. Hydraulic calculations shall be supplied upon request.

The filtration device shall incorporate a sorbent capable of collecting and containing non-soluble pollutants including, but not limited to, petroleum hydrocarbons (oil and grease). Sorbent shall be contained in separate removable containers that can easily be replaced without removing the filter liner. Filtration device shall not rely on collected sediment, debris, trash or filter liner as the medium for hydrocarbon collection.

High capacity filtration devices shall incorporate a debris trap, designed to retain floatable pollutants during high flow periods and both an initial filtering bypass for moderate flows and an ultimate bypass for peak design flows. The installed device shall not impede drainage inlet's peak design flow prior to or after the device has reached its pollutant storage capacity.

2.2 Materials

Filtration device support frame and hardware shall be manufactured from Type 304 stainless steel. It shall be designed to support maximum anticipated loads from the collected pollutants and water.

Field modifications, welding or painting of the device shall not be allowed.

Device shall incorporate a removable filter liner made from a woven polypropylene monofilament geotextile with an apparent opening size less than 35 US Mesh and a clean flow rate of not less than 145 gallons per minute (gpm) per square foot, or stainless steel screen with opening size between 4 and 200 US Mesh. The use of a

non-woven geotextile filter liner shall not be allowed.

Sorbent shall be a hydrophobic material treated to attract and retain petroleum hydrocarbons and other non-soluble pollutants. It shall be non-biodegradable and non-leaching and contain no hazardous ingredients as defined by the U.S. Environmental Protection Agency (EPA).

2.3 Manufacturer

Each catch basin filter device shall be a FloGard as manufactured by Oldcastle Infrastructure, 7100 Longe St, Stockton, California 95206. Phone: (800) 579-8819.

PART 3 — EXECUTION

3.1 Installation

Installation of filtration device shall not require extensive modification of the catch basin and shall be performed by a manufacturer-approved installation contractor. Installation contractor shall be licensed and insured in accordance with agency requirements.

Filtration devices installed into grated, or combination grate with curb opening inlets shall be either supported by resting the support brackets on the grate bearing ledge (installed without the use of bolts or other anchoring devices) or mounted to the catch basin wall with easily removable separate wall mount brackets to allow for quick access to the piping system in the event of an emergency.

Devices for curb opening style inlets (no grate) shall be installed across the entire width of the curb opening and shall be secured to inlet wall, across and beneath the curb opening, using corrosion-resistant anchors (Type 304 stainless steel). The use of chains or cable to secure the device shall not be allowed.

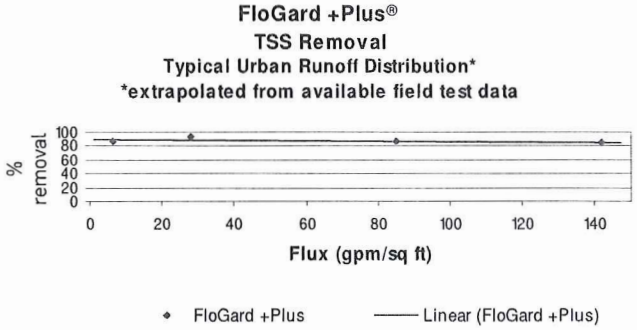
Filtration devices shall be installed in such a manner as to direct all flows into the device. Distance (gaps) between the inlet wall and the device shall not exceed one half inch. Gaps of less than one half inch shall be sealed with a flexible weatherproof sealant, as approved by agency.

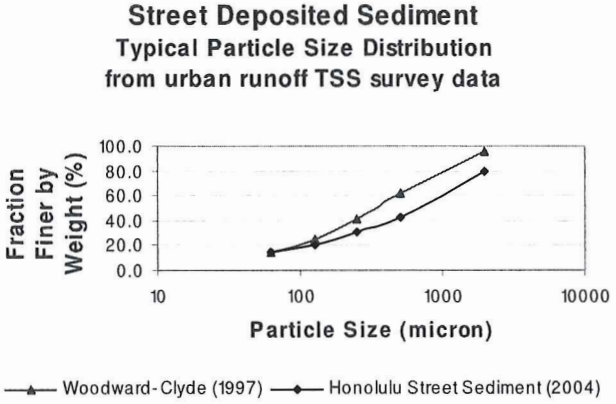
Installation contractor shall supply agency (engineer) with an installation record, denoting the date of installation, drainage inlet location, type of drainage inlet and type and/or size of filtration device.

Oldcastle Infrastructure™
A CRH COMPANY

FLOGARD +PLUS®

Independent field tests conducted in Hawaii and New Zealand on FloGard +PLUS® Catch Basin Insert Filters to determine removal efficiency of Total Suspended Solids (TSS). Results were extrapolated to a typical street deposited sediment particle size. Removal efficiencies were plotted and reflect effective TSS removal over a typical range of operating flow rates. Results are shown below as a function of unit internal surface area.





Units are sized to fit most common styles of drainage inlet grate frames or inlet widths. Rated filtered flow capacities for each model typically exceed the required "first flush" treatment flow rate, and account for reduction in capacity as the unit accumulates suspended pollutants. Rated bypass capacity for each model also typically exceeds the inlet capacity of the catch basin.

FloGard +PLUS® Catch Basin Insert Filter is an efficient inlet prefilter designed to remove suspended sediment and floatable trash and hydrocarbons from stormwater runoff in new or retrofit applications. It is ideally suited for removal of primary pollutants from paved surfaces in commercial and residential areas, or may form part of a treatment train. The device features a unique dual-bypass design, durable components, flexible installation options and easy maintenance access.

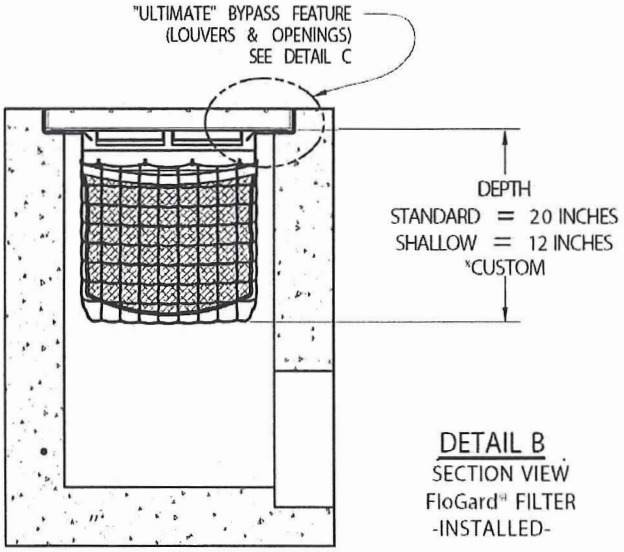
FloGard +PLUS® Test Results Summary

Testing Agency	%TSS Removal	% Oil & Grease Removal
UCLA	80*	70-80
U of Auckland Tonkin & Taylor LTD (City of Auckland)	95** 78-86***	
U of Hawaii (City of Honolulu)	80***	

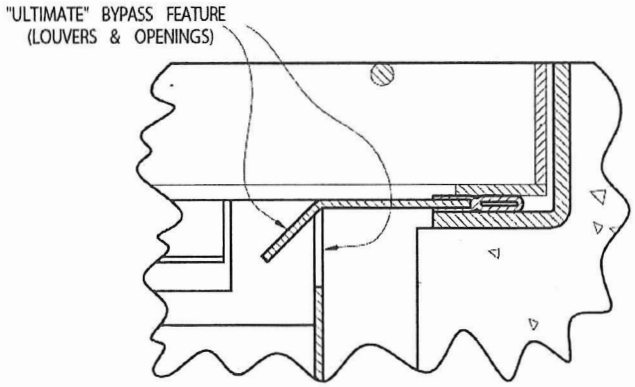
*Sand larger than ~ 575 µm
**Sand distribution ~ 100-1000 µm
***Local street sweep material (distribution consistent with NURP)

See product specifications for standard model details.

U.S. PATENT #6,551,023 & 6,872,029



DETAIL B
SECTION VIEW
FloGard™ FILTER
-INSTALLED-



DETAIL C
"ULTIMATE" BYPASS
FEATURE

* **MANY** OTHER STANDARD & CUSTOM SIZES AND DEPTHS AVAILABLE UPON REQUEST.

FloGard Flat Grated Inlet SPECIFIER CHART								
MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	24 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-32F-TN	28 X 28	32 X 32	6.3	2.2	1.5	FGP-32F8-TN	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-1633F	16 X 34	18 X 36	6.9	2.3	1.6	FGP-1633F8	1.3	.9
FGP-2234F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2234F8	1.95	1.15

FLOGARD® CATCH BASIN INSERT FILTER

OUR MARKETS

BUILDING STRUCTURES | COMMUNICATIONS | WATER | ENERGY | TRANSPORTATION

Oldcastle Infrastructure™ A CRH COMPANY | www.oldcastleinfrastructure.com 800-579-8819

Water

June 2019 v.1

6.4.A – Design Capture Volume Calculation w/ Drawdown Calculation

NOAA Atlas 14, Volume 6, Version 2
Location name: Highland, California, USA*
Latitude: 34.1221°, Longitude: -117.2057°
Elevation: 1262.35 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.109 (0.090-0.132)	0.142 (0.118-0.173)	0.188 (0.156-0.230)	0.228 (0.187-0.280)	0.283 (0.225-0.361)	0.329 (0.255-0.427)	0.377 (0.285-0.502)	0.429 (0.316-0.588)	0.503 (0.355-0.720)	0.565 (0.385-0.837)
10-min	0.156 (0.129-0.189)	0.204 (0.169-0.248)	0.270 (0.224-0.329)	0.326 (0.268-0.401)	0.406 (0.322-0.517)	0.471 (0.366-0.613)	0.540 (0.409-0.720)	0.615 (0.452-0.843)	0.721 (0.509-1.03)	0.809 (0.551-1.20)
15-min	0.188 (0.157-0.229)	0.247 (0.205-0.300)	0.327 (0.270-0.398)	0.394 (0.324-0.485)	0.491 (0.390-0.625)	0.570 (0.443-0.741)	0.653 (0.495-0.871)	0.743 (0.547-1.02)	0.872 (0.616-1.25)	0.979 (0.667-1.45)
30-min	0.283 (0.236-0.344)	0.371 (0.308-0.452)	0.491 (0.407-0.600)	0.594 (0.487-0.730)	0.739 (0.587-0.941)	0.857 (0.666-1.12)	0.983 (0.745-1.31)	1.12 (0.823-1.53)	1.31 (0.926-1.88)	1.47 (1.00-2.18)
60-min	0.415 (0.345-0.504)	0.544 (0.452-0.662)	0.720 (0.597-0.879)	0.870 (0.714-1.07)	1.08 (0.860-1.38)	1.26 (0.976-1.63)	1.44 (1.09-1.92)	1.64 (1.21-2.25)	1.92 (1.36-2.75)	2.16 (1.47-3.20)
2-hr	0.598 (0.497-0.726)	0.768 (0.637-0.934)	0.995 (0.824-1.21)	1.19 (0.973-1.46)	1.45 (1.15-1.85)	1.66 (1.29-2.16)	1.88 (1.42-2.50)	2.11 (1.55-2.89)	2.43 (1.71-3.48)	2.69 (1.83-3.98)
3-hr	0.735 (0.611-0.893)	0.936 (0.778-1.14)	1.21 (0.998-1.47)	1.43 (1.17-1.76)	1.73 (1.38-2.21)	1.98 (1.53-2.57)	2.22 (1.68-2.96)	2.48 (1.83-3.41)	2.84 (2.00-4.07)	3.12 (2.13-4.63)
6-hr	1.03 (0.856-1.25)	1.31 (1.09-1.59)	1.67 (1.38-2.04)	1.97 (1.62-2.42)	2.38 (1.89-3.03)	2.69 (2.09-3.50)	3.02 (2.29-4.02)	3.35 (2.47-4.59)	3.80 (2.68-5.44)	4.15 (2.83-6.16)
12-hr	1.36 (1.13-1.66)	1.75 (1.46-2.13)	2.26 (1.87-2.76)	2.67 (2.19-3.28)	3.22 (2.56-4.10)	3.65 (2.83-4.74)	4.08 (3.09-5.43)	4.51 (3.32-6.19)	5.11 (3.60-7.31)	5.57 (3.79-8.25)
24-hr	1.84 (1.63-2.12)	2.41 (2.13-2.78)	3.14 (2.77-3.64)	3.74 (3.27-4.36)	4.54 (3.84-5.47)	5.15 (4.27-6.33)	5.77 (4.67-7.26)	6.40 (5.04-8.28)	7.25 (5.48-9.77)	7.90 (5.78-11.0)
2-day	2.27 (2.01-2.62)	3.00 (2.65-3.46)	3.96 (3.49-4.58)	4.74 (4.15-5.53)	5.81 (4.92-7.00)	6.63 (5.51-8.16)	7.47 (6.05-9.41)	8.33 (6.57-10.8)	9.51 (7.20-12.8)	10.4 (7.62-14.5)
3-day	2.47 (2.18-2.84)	3.29 (2.91-3.79)	4.38 (3.86-5.06)	5.27 (4.61-6.15)	6.50 (5.51-7.83)	7.46 (6.19-9.17)	8.44 (6.84-10.6)	9.47 (7.46-12.3)	10.9 (8.22-14.7)	12.0 (8.76-16.7)
4-day	2.65 (2.35-3.06)	3.56 (3.15-4.11)	4.77 (4.20-5.51)	5.77 (5.05-6.72)	7.15 (6.05-8.61)	8.23 (6.83-10.1)	9.34 (7.57-11.8)	10.5 (8.28-13.6)	12.1 (9.16-16.3)	13.4 (9.78-18.6)
7-day	3.03 (2.68-3.49)	4.12 (3.65-4.75)	5.59 (4.93-6.46)	6.80 (5.95-7.93)	8.49 (7.19-10.2)	9.81 (8.14-12.1)	11.2 (9.06-14.1)	12.6 (9.95-16.3)	14.6 (11.1-19.7)	16.2 (11.8-22.6)
10-day	3.28 (2.90-3.78)	4.50 (3.98-5.20)	6.15 (5.43-7.11)	7.52 (6.58-8.77)	9.43 (7.98-11.4)	10.9 (9.07-13.4)	12.5 (10.1-15.7)	14.1 (11.1-18.3)	16.4 (12.4-22.1)	18.2 (13.3-25.4)
20-day	4.04 (3.57-4.65)	5.61 (4.96-6.47)	7.74 (6.83-8.95)	9.51 (8.33-11.1)	12.0 (10.2-14.5)	14.0 (11.6-17.2)	16.0 (13.0-20.2)	18.2 (14.3-23.5)	21.2 (16.0-28.5)	23.6 (17.2-32.9)
30-day	4.76 (4.22-5.48)	6.62 (5.85-7.63)	9.12 (8.05-10.6)	11.2 (9.82-13.1)	14.2 (12.0-17.1)	16.5 (13.7-20.3)	18.9 (15.3-23.9)	21.5 (17.0-27.9)	25.1 (19.0-33.9)	28.0 (20.5-39.0)
45-day	5.72 (5.07-6.59)	7.88 (6.97-9.09)	10.8 (9.53-12.5)	13.3 (11.6-15.5)	16.7 (14.1-20.1)	19.4 (16.1-23.9)	22.3 (18.1-28.1)	25.3 (20.0-32.8)	29.6 (22.4-39.9)	33.0 (24.1-46.0)
60-day	6.73 (5.96-7.75)	9.14 (8.09-10.5)	12.4 (11.0-14.4)	15.2 (13.3-17.7)	19.1 (16.1-23.0)	22.1 (18.4-27.2)	25.4 (20.6-32.0)	28.8 (22.7-37.3)	33.6 (25.4-45.3)	37.4 (27.4-52.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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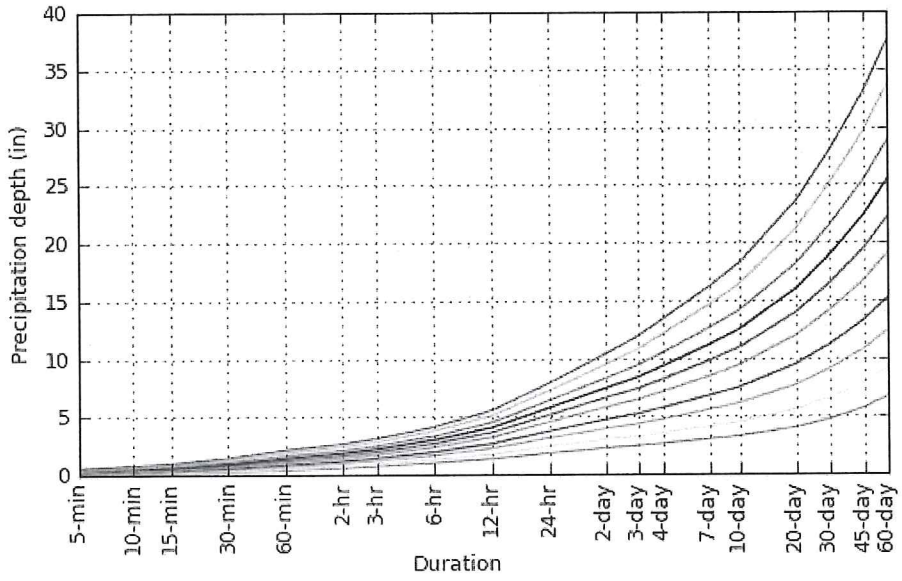
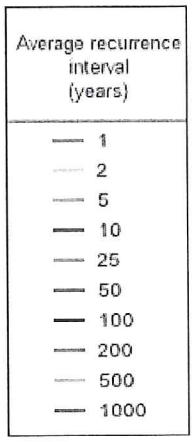
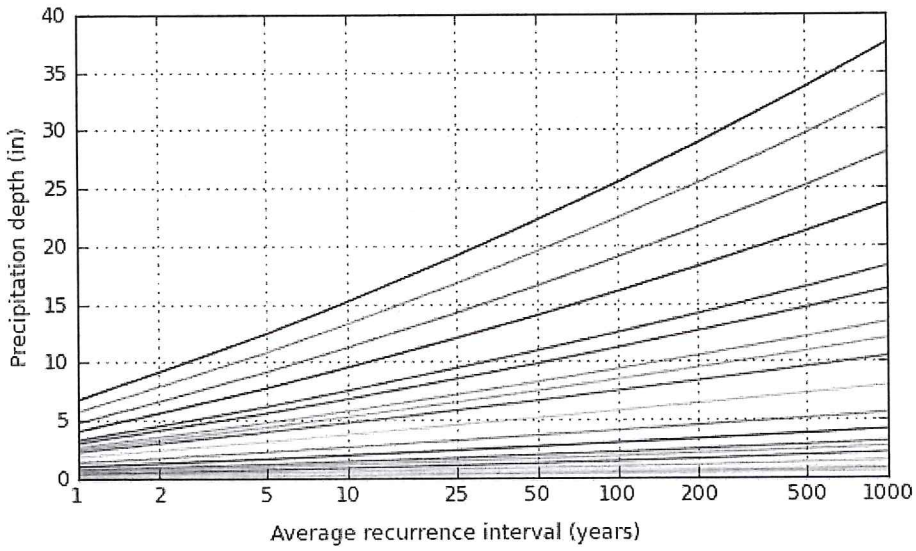
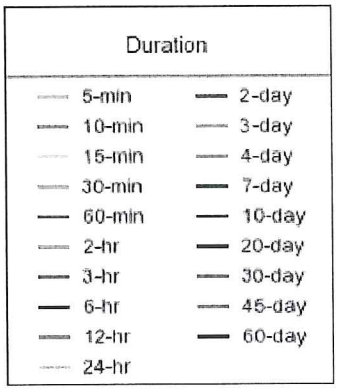
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.1221°, Longitude: -117.2057°









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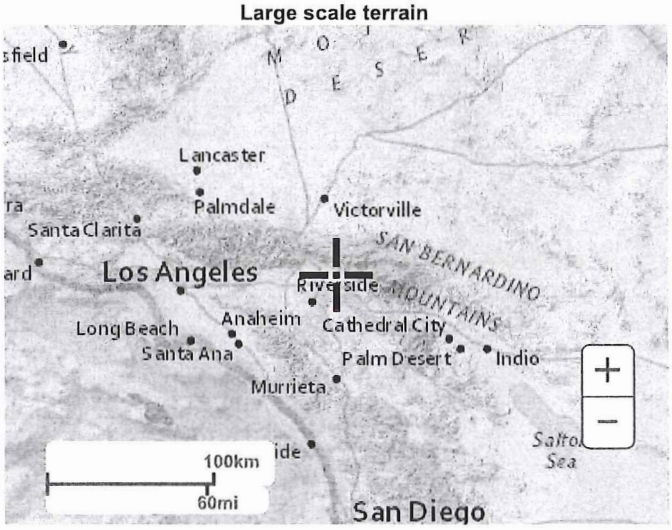
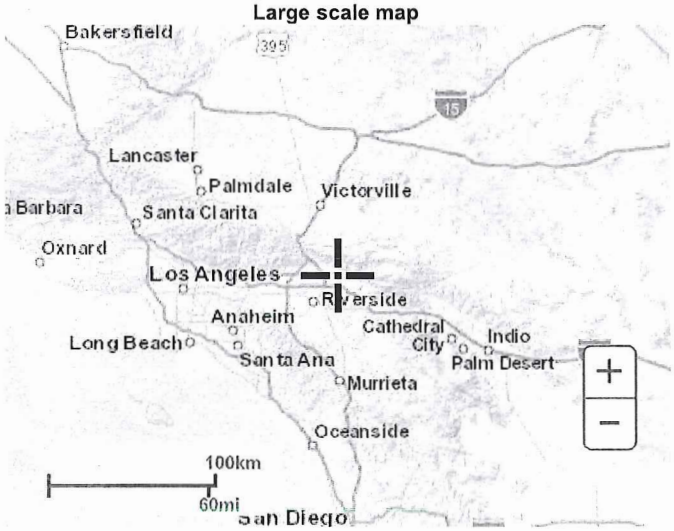
Maps & aerials

Small scale terrain

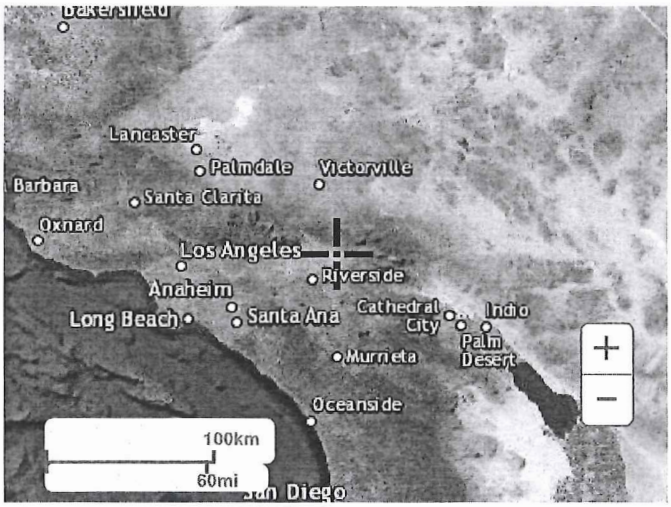
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Valley	0.544	2	48	0.490	0.279	0.303	1.481	0.806	1.963	0.775	0.045	1950
Valley	0.544	2	48	0.577	0.279	0.303	1.481	0.806	1.963	0.913	0.060	2616
											SUM=	32994

and 6-
Desert
limits
0.3250
1.2371

of safety of 2.

own time of 48 hours. (A shorter time is not feasible for all soil types. A longer time can negatively affect vector control efforts.)

HIGHLAND, CA

ER SPECIFICATIONS

MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE

TM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP)
AMBERS" CHAMBER CLASSIFICATION 60x101.

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7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
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12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

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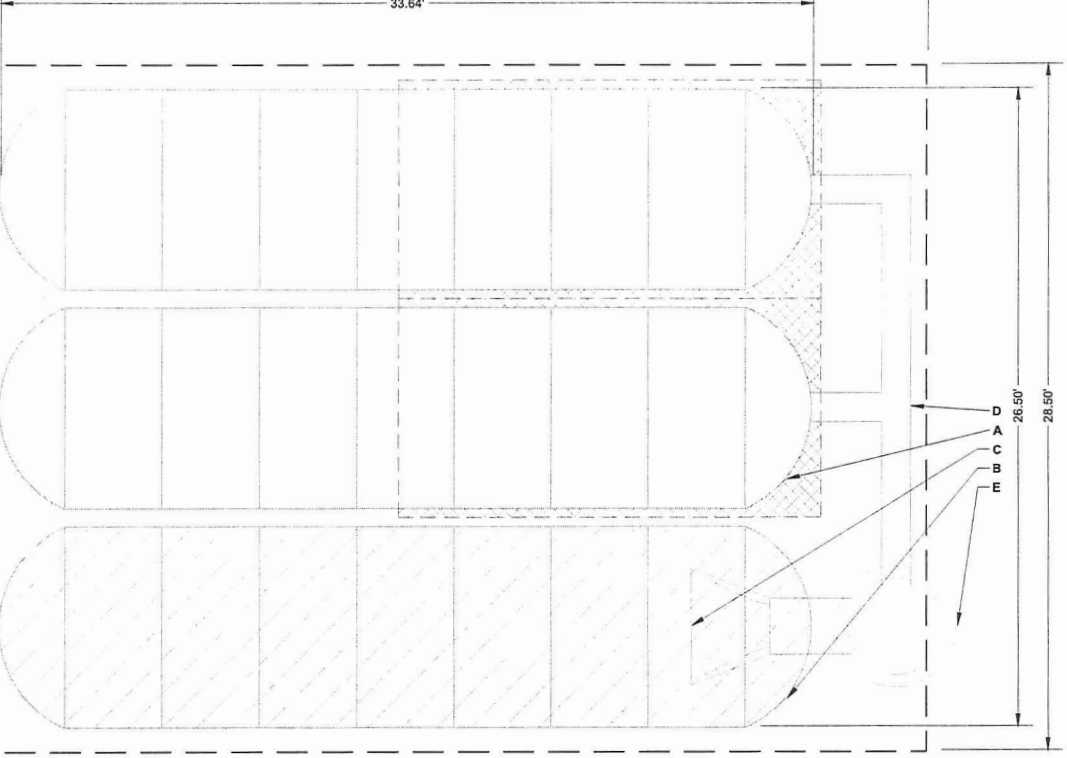

EXTILE OVER BEDDING
R PROTECTION AT ALL

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

REV	DRW	CHK	DESCRIPTION

ADS
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

0 5' 10'

StormTech
Detention|Retention|Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860 529 8188 | 888 892 2694 | WWW.STORMTECH.COM

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS

HIGHLAND, CA

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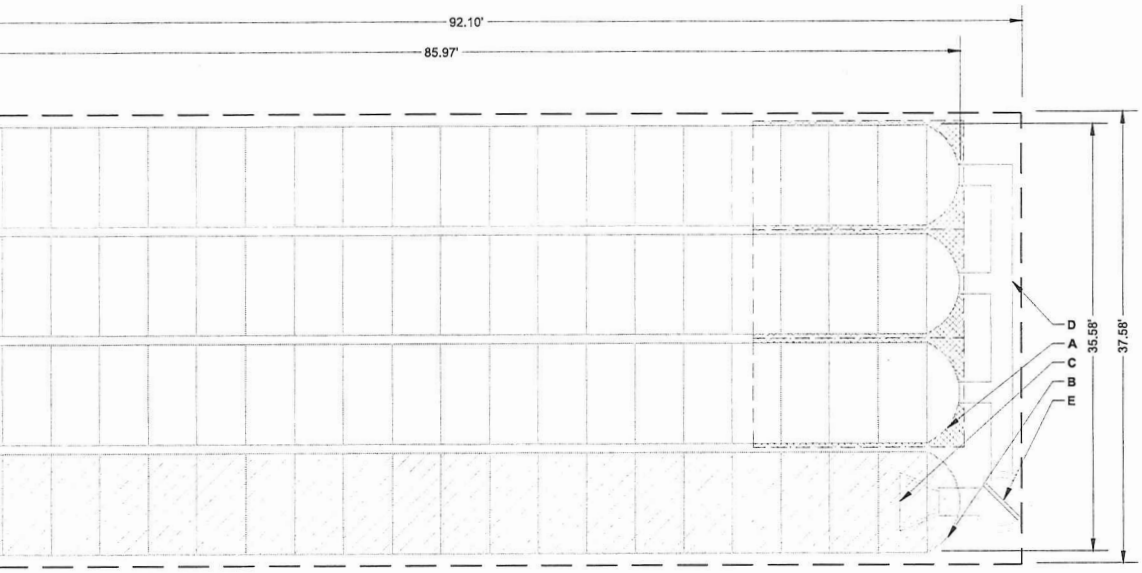

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HIGHLAND, CA

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MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE

TM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP)
AMBERS" CHAMBER CLASSIFICATION 60x101.

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LUS USED FOR DESIGN.

AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
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   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

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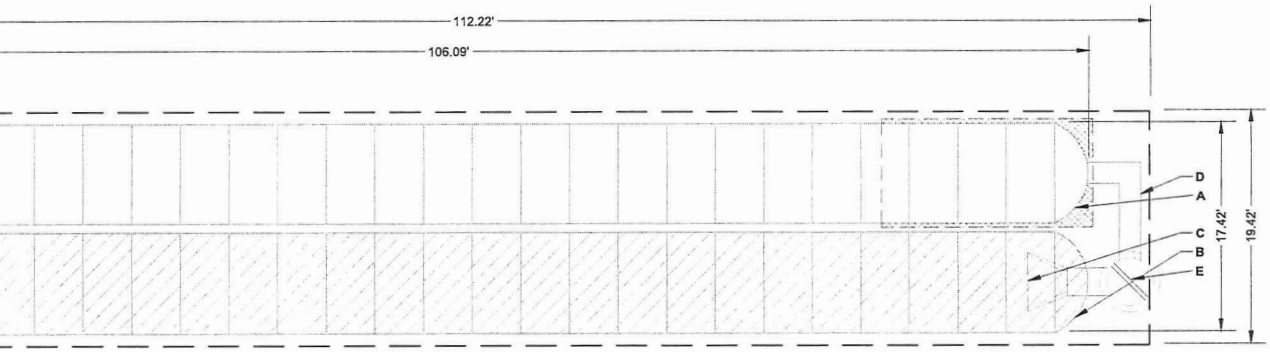

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PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADVANCED DRAINAGE SYSTEMS, INC.

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WOODCREST PROP HIGHLAND DMA D

HIGHLAND, CA

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

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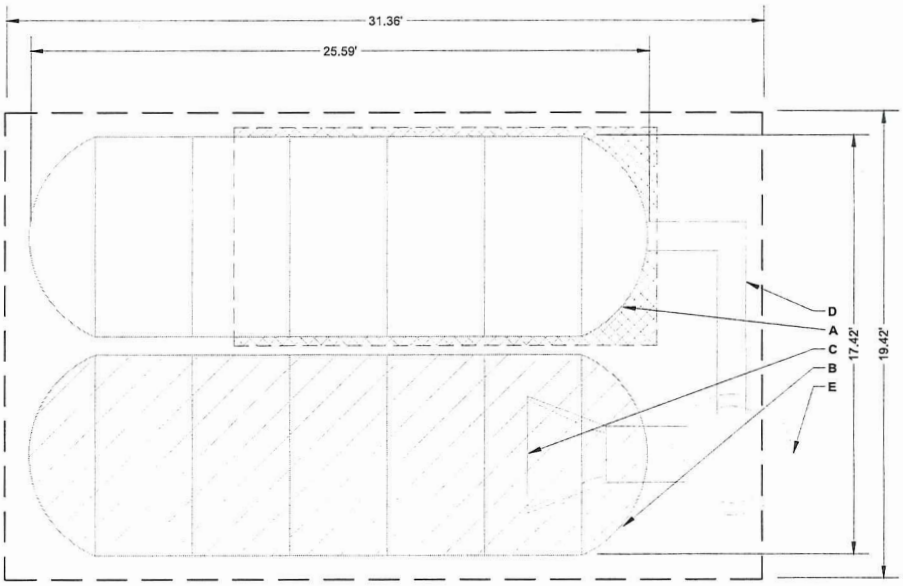

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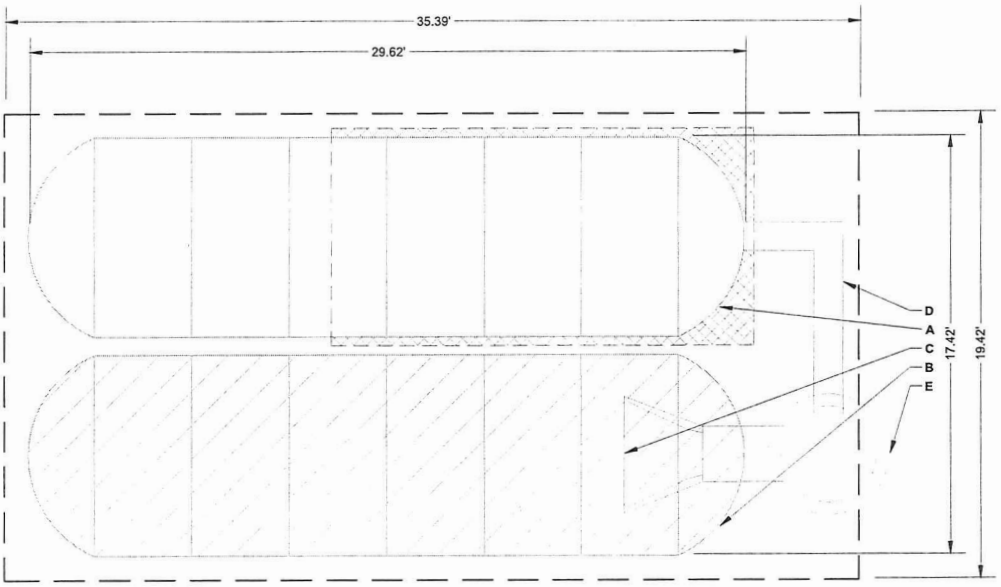

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0 5' 10'

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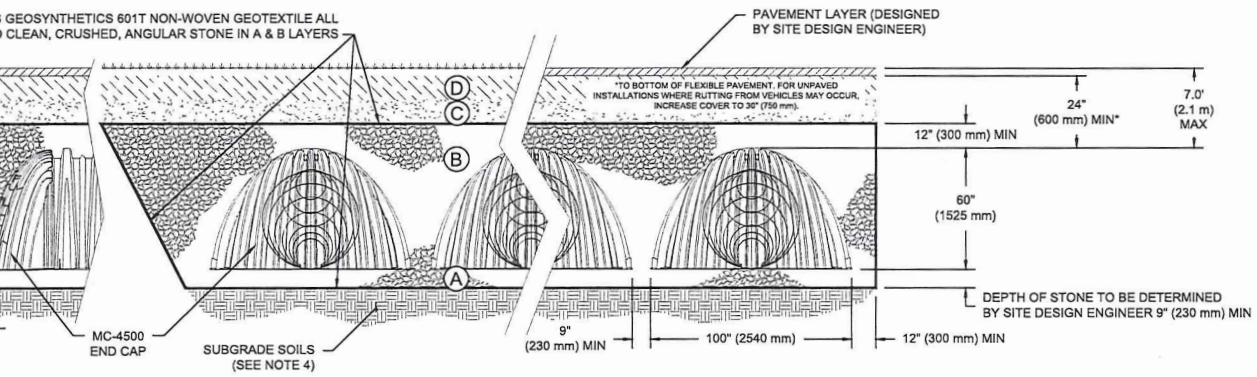
		3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	
BERS FROM THE OVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
THE SUBGRADE UP TO	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

IS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR

LACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
E WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
SING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION
NS.
O THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.

HIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
N AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
URING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN.
G INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

REV	DRW	CHK	DESCRIPTION	DATE

StormTech
Detention/Retention/Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
800-524-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
ADVANCED DRAINAGE SYSTEMS, INC
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

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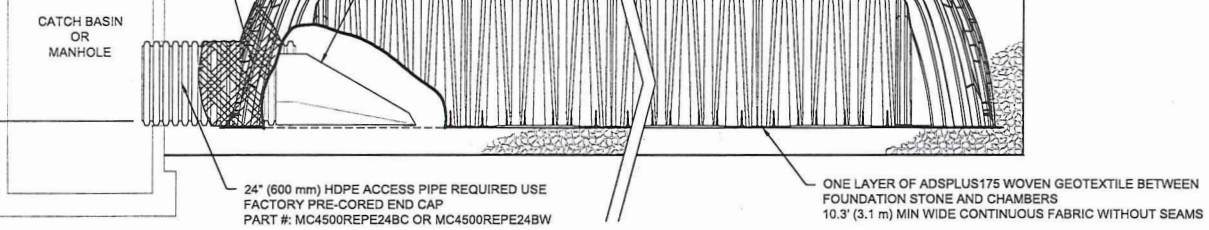

MC-4500 ISOLATOR ROW PLUS DETAIL
NTS

NE DRAIN
R IF INSTALLED
MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
' PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
a) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

UPSTREAM END OF ISOLATOR ROW PLUS
HE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
AY BE USED TO AVOID A CONFINED SPACE ENTRY
ONFINED SPACE ENTRY IF ENTERING MANHOLE
a) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

TVAC PROCESS
REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
BACKFLUSH WATER IS CLEAN

IDS; RECORD OBSERVATIONS AND ACTIONS.

STREAM OF THE STORMTECH SYSTEM.

OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS
H WATER ELEVATIONS.

EN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

REV	DRW	CHK	DESCRIPTION	DATE

StormTech
Detention|Retention|Water Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

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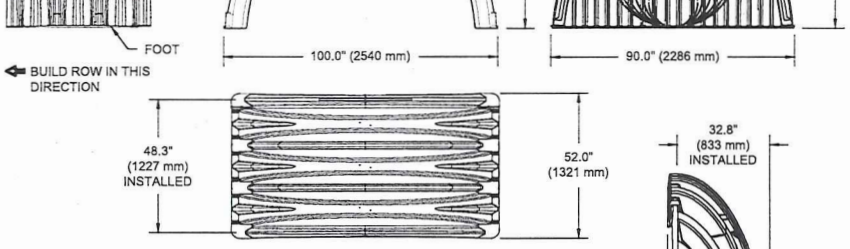


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT (NOMINAL)	125.0 lbs.	(56.7 kg)

NOMINAL END CAP SPECIFICATIONS

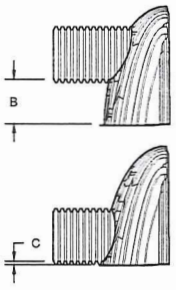
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	—
MC4500IEPP06B		—	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	—
MC4500IEPP08B		—	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	—
MC4500IEPP10B		—	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	—
MC4500IEPP12B		—	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	—
MC4500IEPP15B		—	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	—
MC4500IEPP18TW			
MC4500IEPP18B		—	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	—
MC4500IEPP24TW			
MC4500IEPP24B		—	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	—	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	—	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	—	3.55" (90 mm)

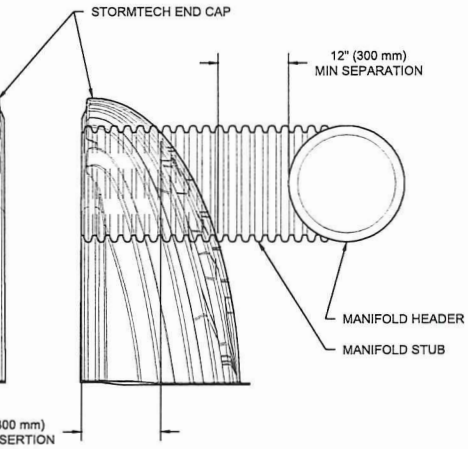
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

ND CAP INSERTION DETAIL

NTS



TUB MUST BE LAID HORIZONTAL IN END CAP OPENING.

REV	DRW	CHK	DESCRIPTION	DATE

StormTech
Dimension Protection Value Quality
520 CROMWELL AVENUE | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473
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BMP DRAWDOWN TIME

STORMTECH MC-4500 DMA A	
	DA1 DMA 'A'
$V_{storage}$ (ft^3)	4517
Infiltration Rate (in/hr)	3.2
Factory of Safety	3.00
Design Infiltration Rate (in/hr)	1.07
Infiltration Surface Area (ft^2)	1123
BMP Drawdown Time (Hr)	45.3
	Okay

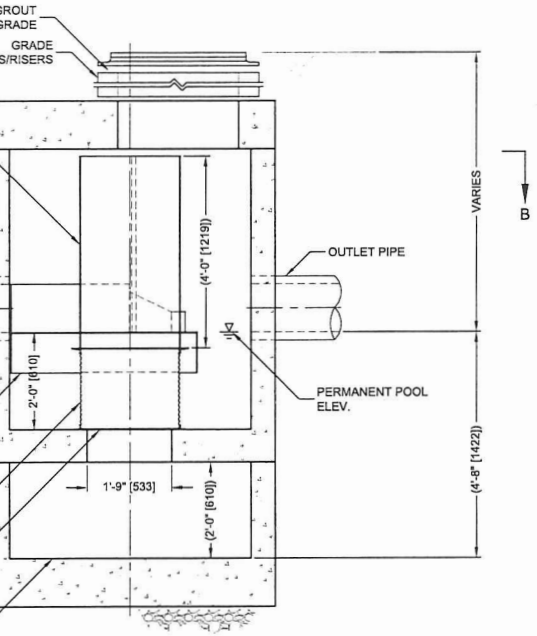
STORMTECH MC-4500 DMA B	
	DA2 DMA 'B'
$V_{storage}$ (ft^3)	14848
Infiltration Rate (in/hr)	4.2
Factory of Safety	3.00
Design Infiltration Rate (in/hr)	1.40
Infiltration Surface Area (ft^2)	3461
BMP Drawdown Time (Hr)	36.8
	Okay

STORMTECH MC-4500 DMA C	
	DA3 DMA 'C'
$V_{storage}$ (ft^3)	9353
Infiltration Rate (in/hr)	3.7
Factory of Safety	3.00
Design Infiltration Rate (in/hr)	1.23
Infiltration Surface Area (ft^2)	2179
BMP Drawdown Time (Hr)	41.8
	Okay

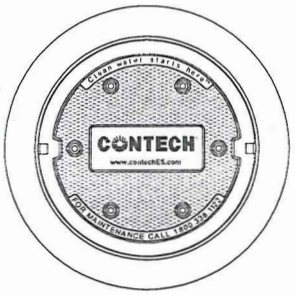
STORMTECH MC-4500 DMA D	
	DA4 DMA 'D'
$V_{storage}$ (ft^3)	2378
Infiltration Rate (in/hr)	3.4
Factory of Safety	3.00
Design Infiltration Rate (in/hr)	1.13
Infiltration Surface Area (ft^2)	609
BMP Drawdown Time (Hr)	41.3
	Okay

STORMTECH MC-4500 DMA E	
	DA5 DMA 'E'
$V_{storage}$ (ft^3)	2717
Infiltration Rate (in/hr)	6.5
Factory of Safety	3.00
Design Infiltration Rate (in/hr)	2.17
Infiltration Surface Area (ft^2)	687
BMP Drawdown Time (Hr)	21.9
	Okay

PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

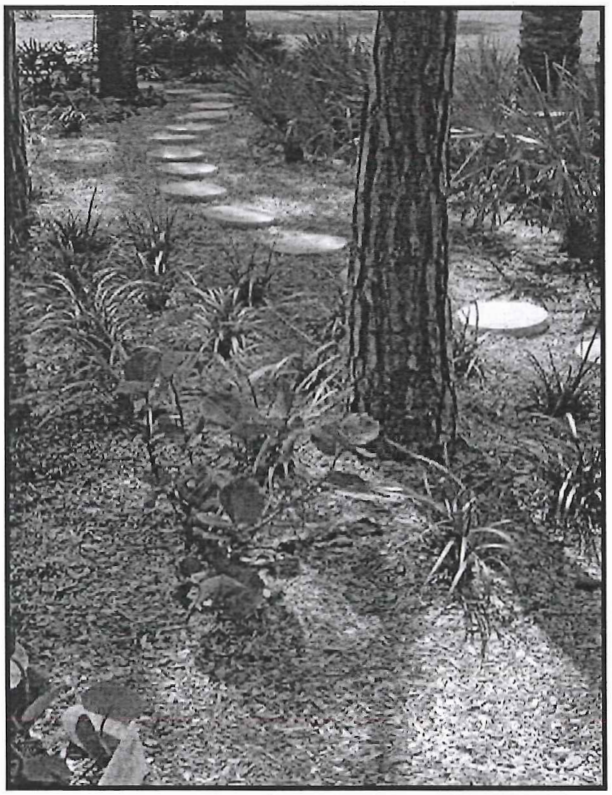
GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CDS
THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 4,985,148; 5,114,724; 5,322,629; 5,681,467; 5,759,415; 6,027,639; 6,641,720; 6,511,595; 6,649,048; 6,991,118; 7,186,337; 7,296,692; 7,297,266; 7,297,267; 7,390,410; 7,425,262; 7,470,366; 7,563,363; 7,575,668; 7,686,173; 7,708,877; 7,905,367; 8,075,781; 8,287,728; 8,557,110; 8,801,926; 8,852,436; 9,032,681; 9,199,792; 9,266,676; 9,382,703; 9,382,704; 9,388,564; 9,428,898; 9,475,623; 9,475,624; 9,481,499; 9,481,500; 9,487,340; 9,499,331; 9,505,538; 9,512,600; 9,512,601; 9,512,602; 9,512,603; 9,512,604; 9,512,605; 9,512,606; 9,512,607; 9,512,608; 9,512,609; 9,512,610; 9,512,611; 9,512,612; 9,512,613; 9,512,614; 9,512,615; 9,512,616; 9,512,617; 9,512,618; 9,512,619; 9,512,620; 9,512,621; 9,512,622; 9,512,623; 9,512,624; 9,512,625; 9,512,626; 9,512,627; 9,512,628; 9,512,629; 9,512,630; 9,512,631; 9,512,632; 9,512,633; 9,512,634; 9,512,635; 9,512,636; 9,512,637; 9,512,638; 9,512,639;

6.4.B – CASQA BMP Handbook

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

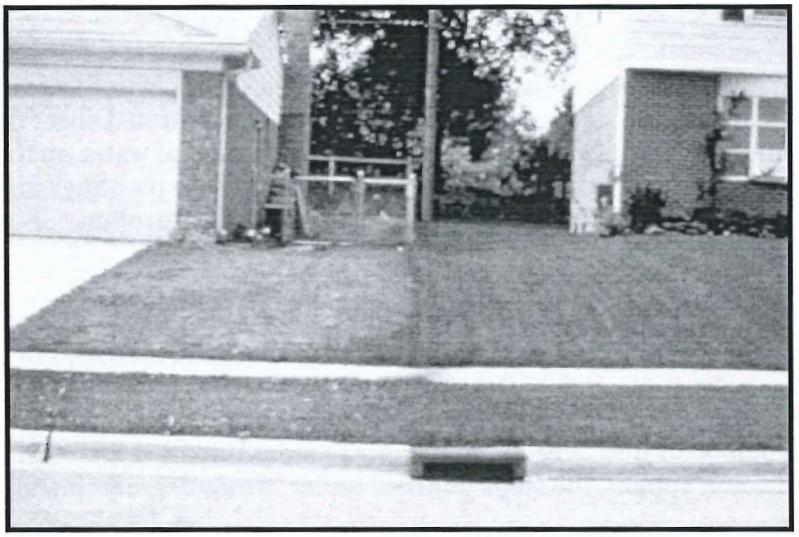
Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

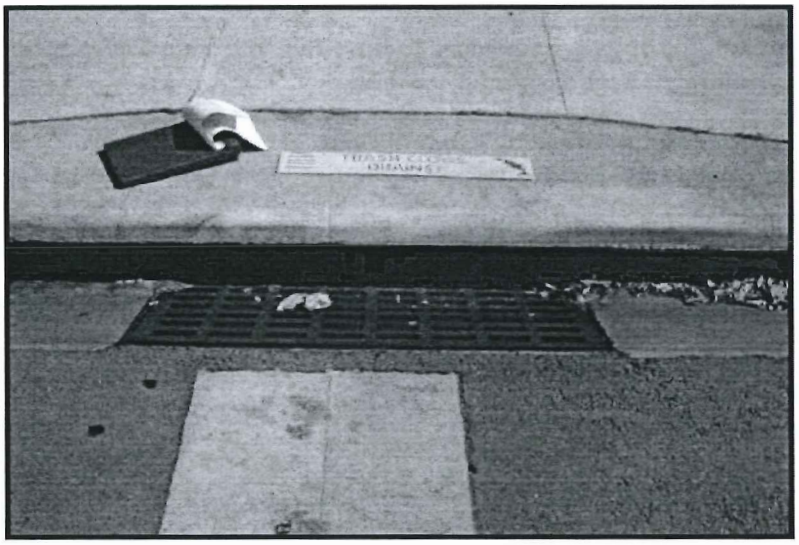
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

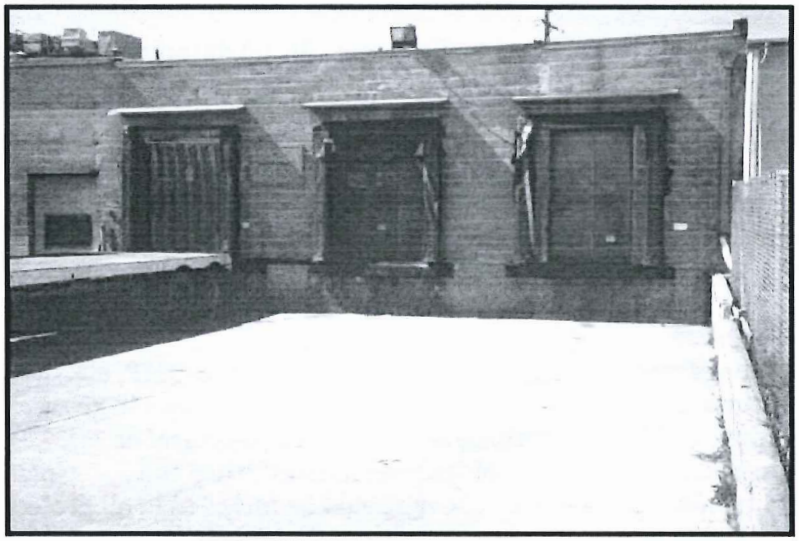
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Maintenance Bays & Docks SD-31



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.
- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.
- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.
- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.
- Other features may be comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

6.4.C – Education Materials

STORMWATER
Pollution Prevention
LANDSCAPE MAINTENANCE

San Bernardino County
STORMWATER PROGRAM

STORMWATER Pollution Prevention

Stormwater Management Practices for Commercial Landscape Maintenance

Yard waste, sediments, and toxic lawn/garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Following these best management practices will prevent pollution, comply with regulations and protect public health.

Recycle Yard Waste

Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Try grasscycling - the natural recycling of grass by leaving clippings on the lawn when mowing. Grass clippings will quickly decompose, returning valuable nutrients to the soil. Further information can be obtained at www.ciwmb.ca.gov/Organics.

Use Fertilizers, Herbicides and Pesticides Safely

Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use of natural, non-toxic alternatives to the traditional fertilizers, herbicides and pesticides is highly recommended. If you must use chemical fertilizers, herbicides, or pesticides:

- Spot apply pesticides and herbicides, rather than blanketing entire areas.
- Avoid applying near curbs and driveways, and never apply before a rain.
- Apply fertilizers as needed, when plants can best use it, and when the potential for it being carried away by runoff is low.

Recycle Hazardous Waste

Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility, which accepts these types of materials. For information on proper disposal call, (909) 386-8401.

Use Water Wisely

Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads. Plant native vegetation to reduce the need of water, fertilizers, herbicides, and pesticides.

Prevent Erosion

Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways.

- Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff.
- Avoid excavation or grading during wet weather.

Store Materials Safely

Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials must be covered with plastic sheeting to protect from rain, wind and runoff.

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

1 (800) CLEANUP

or visit our websites:

www.co.san-bernardino.ca.us/flood/npdes

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

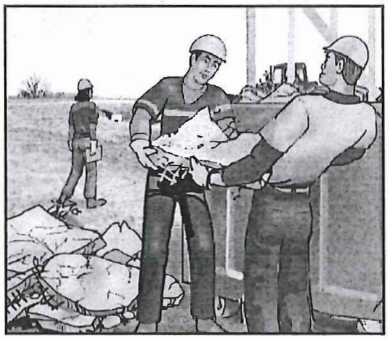
STORMWATER Pollution Prevention

FRESH CONCRETE & MORTAR APPLICATION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.

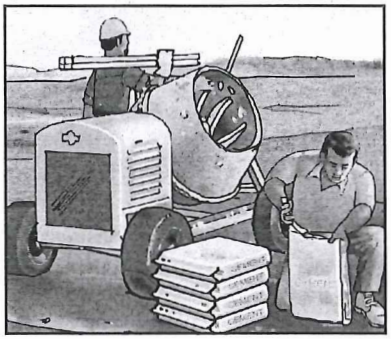
Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Secure open bags of cement and cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



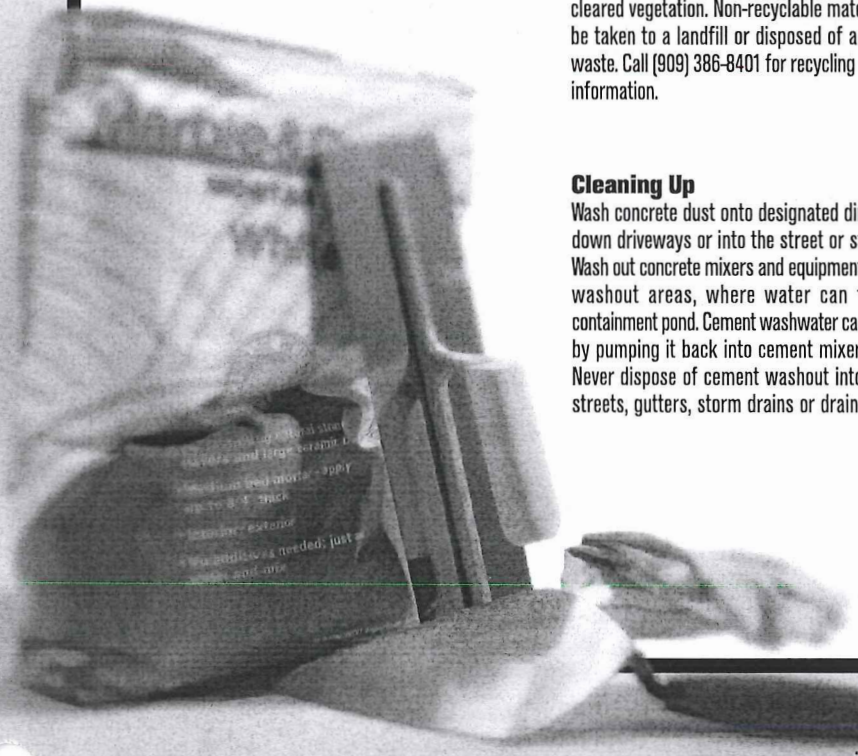
Ordering Materials & Recycling Waste

Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. When breaking up paving, recycle the pieces at a crushing company. You can also recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. Call (909) 386-8401 for recycling and disposal information.



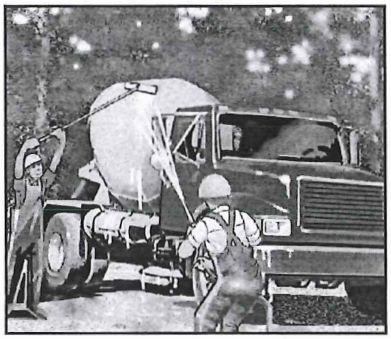
During Construction

Schedule excavation and grading during dry weather. Prevent mortar and cement from entering the street and storm drains by placing erosion controls. Setup small mixers on tarps or drop cloths, for easy cleanup of debris. Never bury waste material. Recycle or dispose of it as hazardous waste.



Cleaning Up

Wash concrete dust onto designated dirt areas, not down driveways or into the street or storm drains. Wash out concrete mixers and equipment in specified washout areas, where water can flow into a containment pond. Cement washwater can be recycled by pumping it back into cement mixers for reuse. Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



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

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

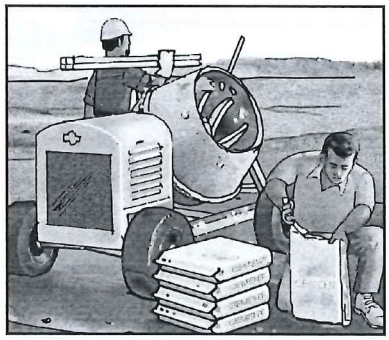
Prevención de Contaminación del Desagüe

APLICANDO CONCRETO FRESCO

Cemento, grava, asfalto y liquidos de auto, tierra y residuos peligrosos de lugares de concreto fresco por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Almacenando Materiales
Manten materiales de construcción y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y herramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.

Ordenando Materiales & Reciclando
Reduce la cantidad al ordenar el material, solo ordena lo necesario. Usa materiales recicables cuando sea posible. Cuando estes rompiendo el pavimento, recicla los pedasos en la compañia demolidora. Se puede reciclar el aspfalto, concreto, madera y la vegetacion. Materiales no reciclados se deverian llevar a lugares de desechos peligrosos. llama al (909) 386-8401 para más información.



Durante Construcción
Planea las excavaciones durante clima seco. No dejes que el cemento o la cal lleguen hasta las calles o drenajes, evita esto con plantas temporales para detener el desagüe. Cubre las maquinas de mesclar con alguna garra para que se facilite la limpieza de residuos. Nunca entierres los desechos. Recicla todos los desechos peligrosos.

Limpiando
Lava la cal en un area designada, no la eches hacia la cochera o en la calle. Lava las mescladoras y las herramientas en un lugar especifico, donde el agua llegue a un contenedor. El agua de cemento se puede reciclar volviendola a usar en las mescladoras. Nunca dejes el agua de cemento que corra hacia las calles, alcantarillas o drenajes.

Para reportar actividadas ilegales u obtener
más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

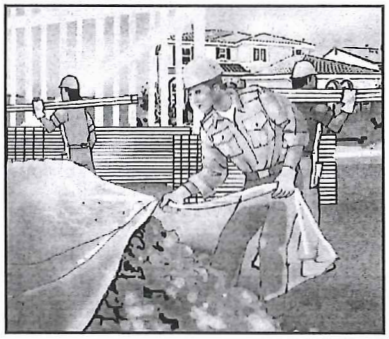
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

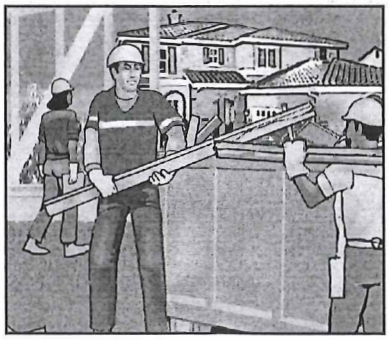
CONSTRUCTION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Store Materials Safely

Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

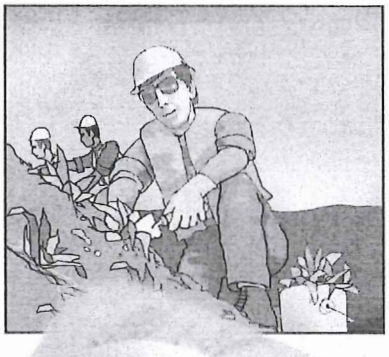


Ordering Materials & Recycling Waste

Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.

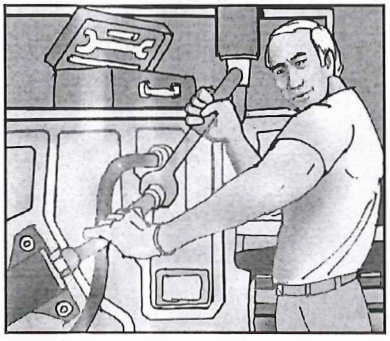
Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.



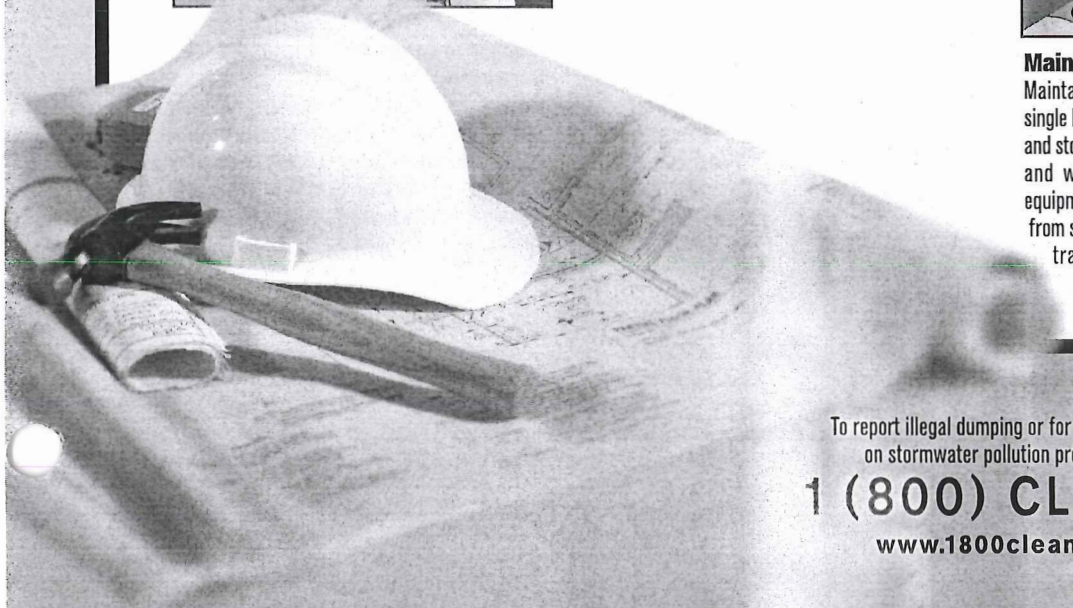
Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.



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

1 (800) CLEANUP

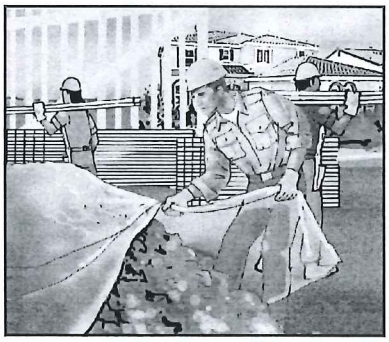
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

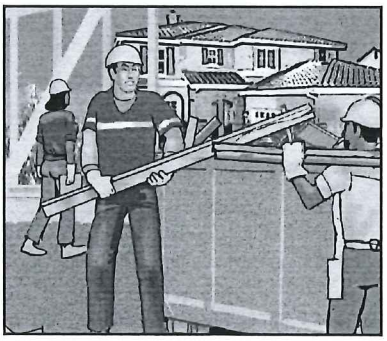
CONSTRUCCIÓN

Cemento, sedimentos, liquidos de auto, polvos y residuos peligrosos acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.



Almacenando Materiales Cuidadosamente

Manten materiales de construcción y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y herramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.



Ordenando Materiales & Reciclando Desechos

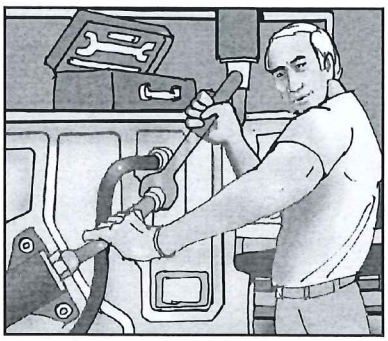
Reduce la cantidad al ordenar el material, solo ordena lo necesario. Usa materiales que se puedan reciclar cuando sea posible. Se puede reciclar el aspfalto, concreto, madera y la vegetacion. Materiales no reciclados se deven llevar a lugares de desechos peligrosos. Para mas información llama al (909) 386-8401.

Previniendo Erosiones

Evita las excavaciones durante lluvia. Planta vegetacion temporal en colinas donde aun no hay planes de construccion y planta vegetacion permanente al terminar las excavaciones. Construye algunos canales para el desagüe. Estos pueden ser creados con pasto y cemento para reducir la velocidad del desagüe.

Limpiando & Previniendo Derrames

Usa siempre un enbudo al vaciar liquidos. Barre los derrames en ves de lavarlos con la manguera. Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin. Para reportar derrames llama al 911.



Mantenimiento de Vehiculos & Herramientas

Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y preveen goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

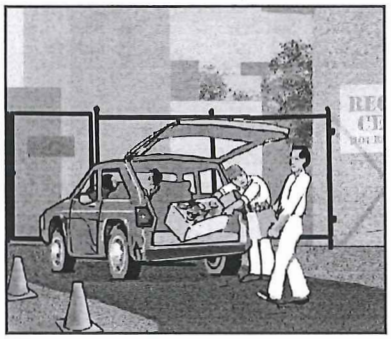
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

HOME & GARDEN

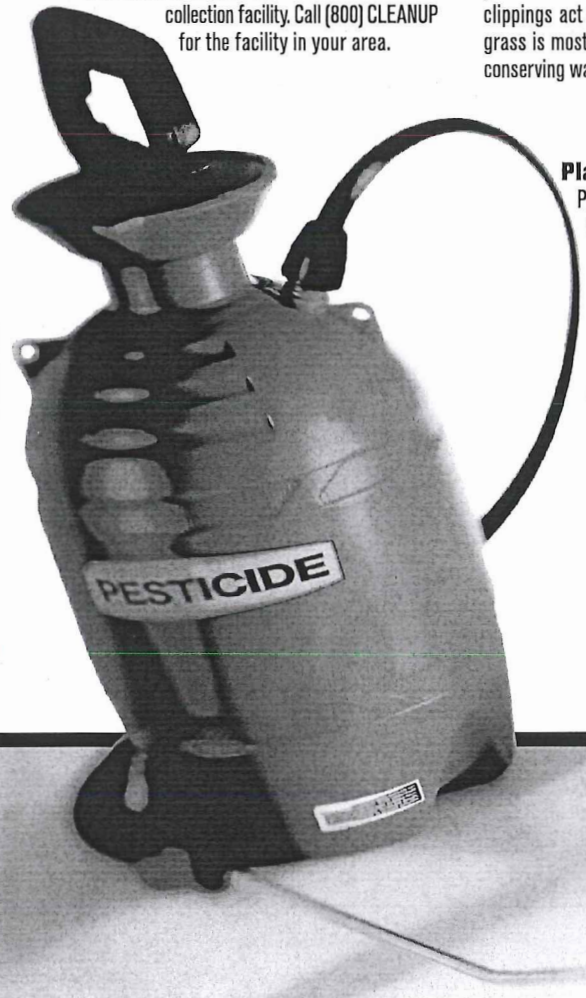
Yard waste and household toxics like paints and pesticides often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.



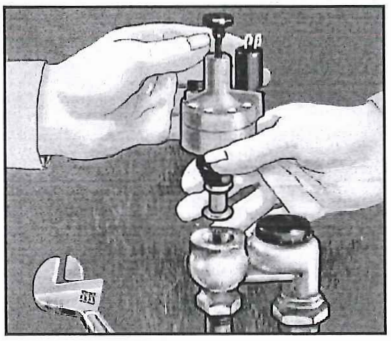
Recycle Household Hazardous Waste
Household products like paint, pesticides, solvents and cleaners are too dangerous to dump and too toxic to trash. Take them to be recycled at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.

Disposing of Yard Waste
Recycle leaves, grass clippings and other yard waste, instead of blowing, sweeping or hosing into the street. Try grasscycling, leaving grass clippings on your lawn instead of using a grass catcher. The clippings act as a natural fertilizer, and because grass is mostly water, it also irrigates your lawn, conserving water.

Use Fertilizers & Pesticides Safely
Fertilizers and pesticides are often carried into the storm drain system by sprinkler runoff. Try using organic or non-toxic alternatives. If you use chemical fertilizers or pesticides, avoid applying near curbs and driveways and never apply before a rain.



Planting in the Yard
Produce less yard waste and save water by planting low maintenance, drought-tolerant trees and shrubs. Using drip irrigation, soaker hoses or micro-spray systems for flower beds and vegetation can also help reduce your water bill and prevent runoff.



Use Water Wisely
Cut your water costs and prevent runoff by controlling the amount of water and direction of sprinklers. The average lawn needs about an inch of water a week, including rainfall, or 10 to 20 minutes of watering. A half-inch per week is enough for fall and spring. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff.

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

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

JARDIN

Basura del jardín y otros toxicos caseros como pintura, pesticidas y otros mas acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Disponiendo Desechos del Jardin

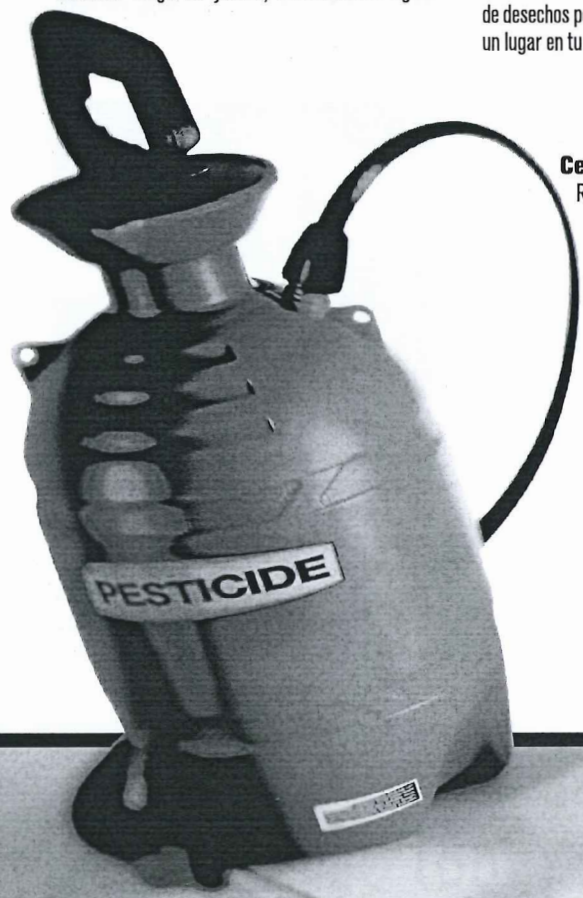
Recicla hojas, pasto y otras basuras del jardín en ves de soplarlas, barrerlas hacia la calle. El pasto sirve como fertilizante, y como el pasta es la mayoria agua tambien riega tu jardín, ahorrandote agua.

Reciclando Materiales del Hogar Peligrosos

Limpiadores del hogar como pintura, pesticidas, solventes y limpiadores son demasiado toxicos para tirarlos en la basura. Desechalos en unlugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.

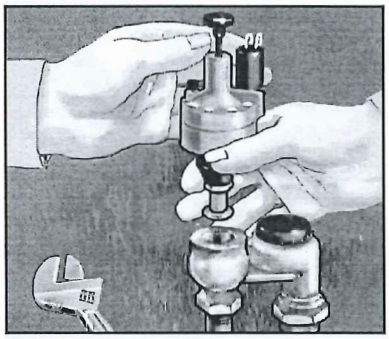
Usando Fertilizantes & Pesticidas Adecuadamente

Fertilizantes y pesticidas muchas veces terminan en los drenajes. Usa alternativas que no sean toxicas. Si tu usas fertilizantes y pesticidas con quimicos, no los uses cerca de las banquetas y cocheras y nunca los uses en tiempos de lluvia.



Cembrando en el Jardin

Reduce la basura del jardín y ahorra agua plantando arboles y plantas de bajo mantenimiento. Riega moderadamente con mangueras u otros metodos para las flores o vegetacion asi reduciras tu pago del mes y previenes el desagüe.



Usando el Agua Adecuadamente

Reduce el pago del agua y previene el desagüe controlando la cantidad y direccion de tus regaderas para el jardin. Solo necesitas regar de 10 a 20 minutos a la semana. Durante la primavera y otoño es la mitad. Las regaderas del jardin deverian estar ajustadas a que rieguen lo suficinete y evitar el desagüe.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

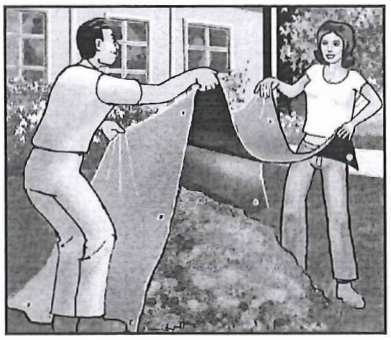
www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

STORMWATER Pollution Prevention

HOME REPAIR & REMODELING

Paints, solvents, adhesives and other toxic substances used in home repair and remodeling often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.

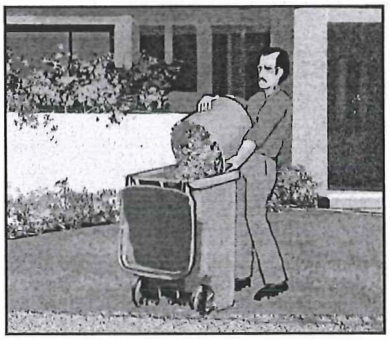


Construction Projects

Keep construction debris away from the street, gutter and storm drains. Schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of soil, sand or gravel, protected from rain, wind and runoff. Prevent erosion by planting fast-growing annual and perennial grass, which can shield and bind soil.

Recycle Household Hazardous Waste

Household cleaners, paint and other home improvement products like wallpaper and tile adhesives are too toxic to trash. Recycle them instead, at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.

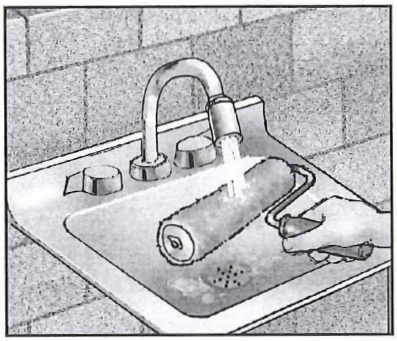


Landscaping & Gardening

Avoid applying fertilizers or pesticide near curbs and driveways, and store covered, protected from rain, wind and runoff. Try using organic or non-toxic alternatives. Reduce runoff and lower your water bill by using drip irrigation, soaker hoses or micro-spray systems. Recycle leaves instead of blowing, sweeping or raking them into the street, gutter or storm drain.

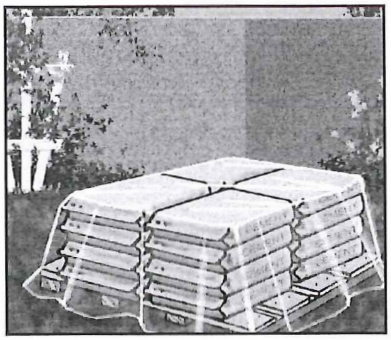
Paint Removal

Paint stripping residue, chips and dust from marine paints and paints containing lead or tributyl tin are hazardous wastes. Sweep them up instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility.



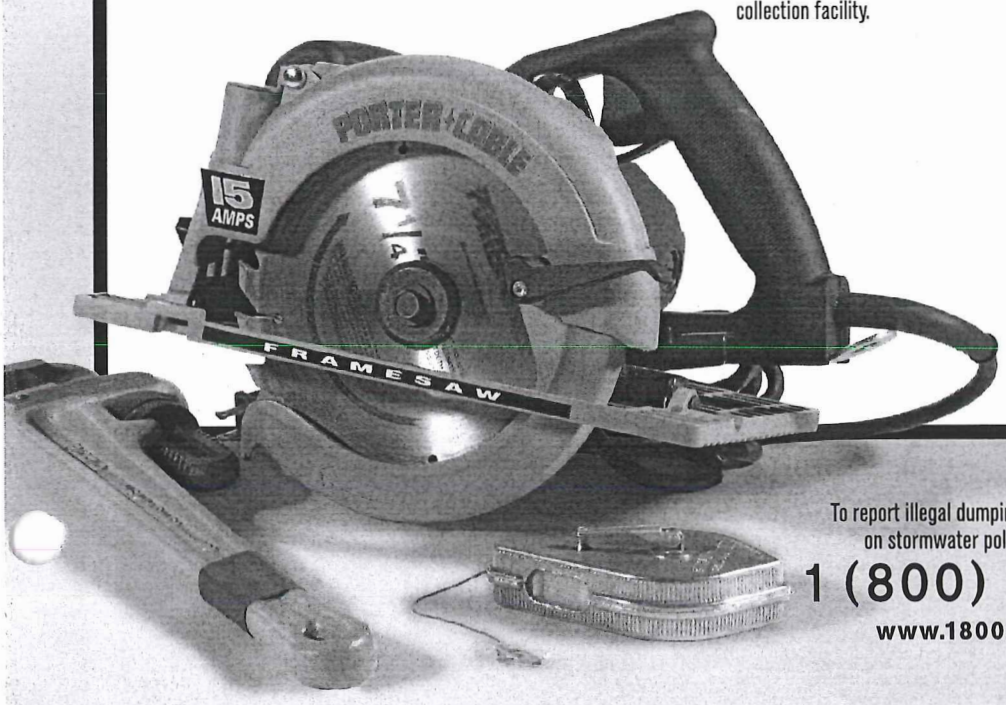
Painting Cleanup

Avoid cleaning brushes or rinsing paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which you can filter and reuse. Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.



Concrete and Masonry

Store bags of cement and plaster away from gutters and storm drains, and cover them to protect against rain, wind and runoff. Sweep or scoop up cement washout or concrete dust instead of hosing into driveways, streets, gutters or storm drains.



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

1 (800) CLEANUP

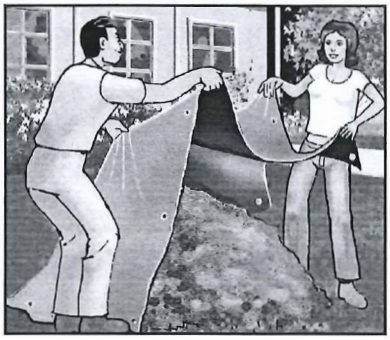
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

MEJORAS DEL HOGAR

Pintura, solventes y otros quimicos peligrosos que se usan al las mejoras del hogar acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.



Proyectos de Construcción

No dejes que los residuos de la construcción terminen en la calle, coladeras o desagües. Planea tus excavaciónes durante el clima seco. Cuvre tus materiales y tus bultos de tierra, arena, grava para protejerlos de la lluvia, el aire y el desagües. Planta pasto o plantas para evirtar las erosiones, estas pueden detener el derrame.

Jardineria

Evita usar los fertilizantes o pesticidas cerca de la banqueta o cocheras, y tapalos bien para protejerlas de la lluvia, el aire y el desagües. Usa productos no toxicos u organicos. Reduce tu pago del agua usando otros tipos de erosiones. Recicla las hojas en ves de soplarlas o barrerlas asia la calle, coladeras o alcantarillas.

Limpiando Pintura

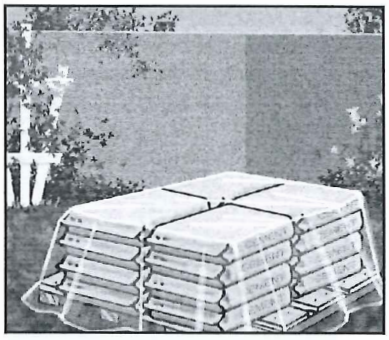
Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner, y vuelvelas a guardar en un frasco, para un uso futuro. Envuelve los residuos de pintura en un periodico y tiralos a la basura.

Reciclando Materiales del Hogar Peligrosos

Limpiadores del hogar, pintura y otros productos como la pegadura para el papel para las paredes y azulejo son demasiado toxicos para tirarlos a la basura. Desechalos en un lugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.

Removiendo Pintura

Residuos de pintura, polvo de pintura y pinturas que contienen plomo son peligrosas. Barrelos en ves de lavarlos con la manguera y desechalos en unlugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.



Concreto & Albañilería

Almacena bolsas de cemento y pegaduras lejos de las coladeras y alcantarillas, y cubrelos para protejerlos de la lluvia, viento y desagües. Barre o recoje el cemento o concreto en ves de lavarlos con la manguera hacia la cochera, calles o drenajes.

Para reportar actividades ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

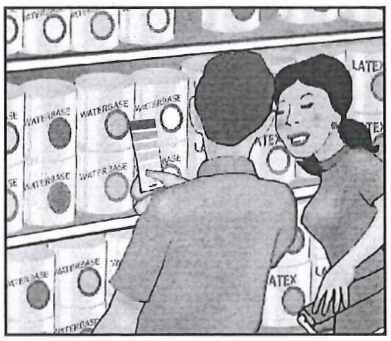
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

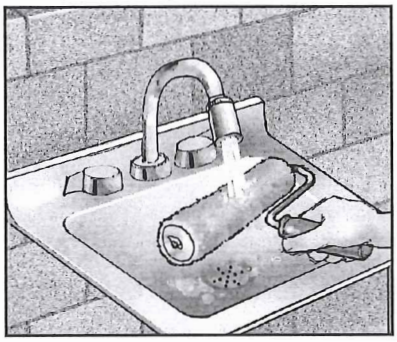
PAINTING

Paints, solvents, adhesives and other toxic chemicals used in painting often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect our health.

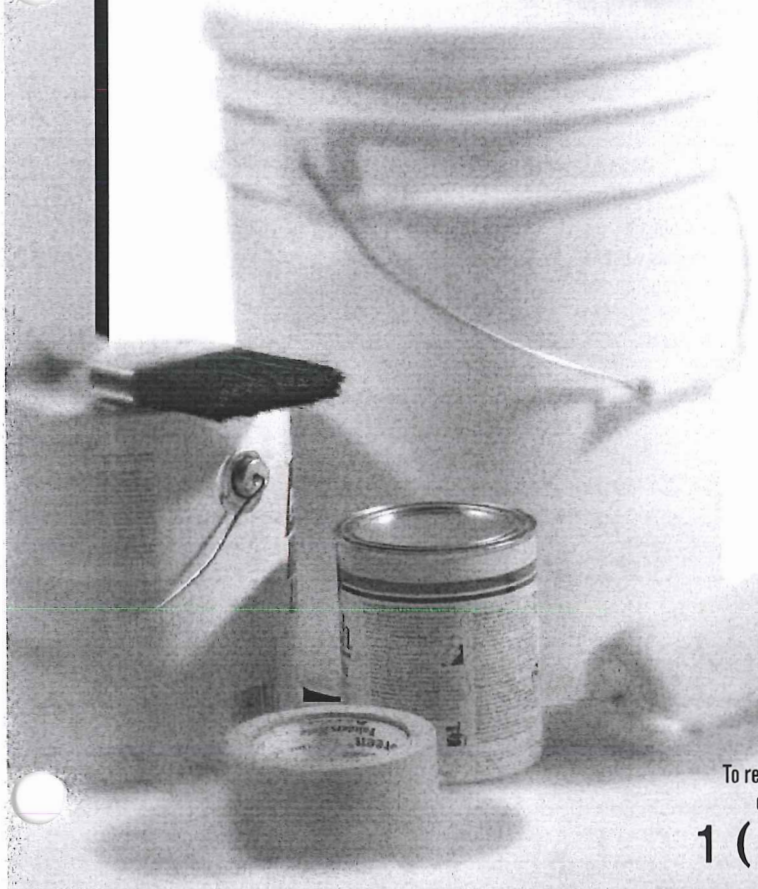


Water-Based Paints
Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or "cleans with water."

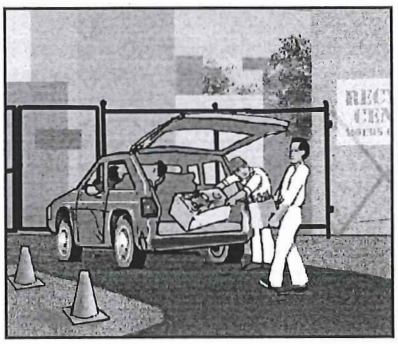
Paint Removal
Sweep up paint stripping residue, chips and dust instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



Painting Cleanup
Never clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which can be reused by putting it in a jar to settle out the paint particles and then pouring off the clear liquid for future use. Wrap dried paint residue in newspaper and dispose of it in the trash.



Exterior Paint Removal
When stripping or cleaning building exteriors with high-pressure water, block nearby storm drains and divert washwater onto a designated dirt area. Ask your local wastewater treatment authority if you can collect building cleaning water and discharge it to the sewer.



Recycling Paint
Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.

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

1 (800) CLEANUP

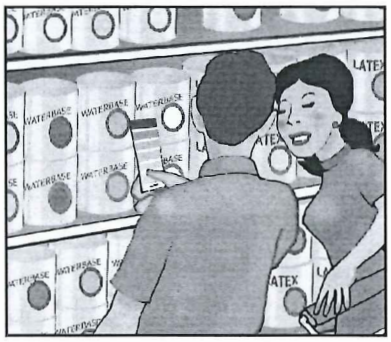
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

PINTURA

Pintura, solventes y otros quimicos peligrosos que se usan al pintar acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

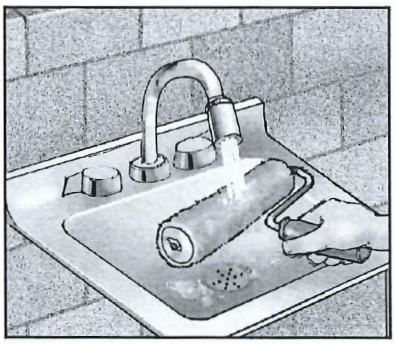


Pinturas de Agua

Usa pinturas de agua cuando sea posible. Son menos toxicas que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or 'cleans with water".

Removiendo Pintura

Residuos de pintura, polvo de pintura y pinturas que contienen plomo son peligrosas. Barrelos en ves de lavarlos con la manguera y desechalos en unlugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.

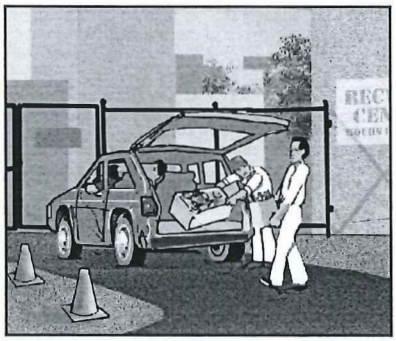


Limpiando Pintura

Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner, y vuelvelas a guardar en un frasco, para un uso futuro. Envuelve los residuos de pintura en un periodico y tiralos a la basura.

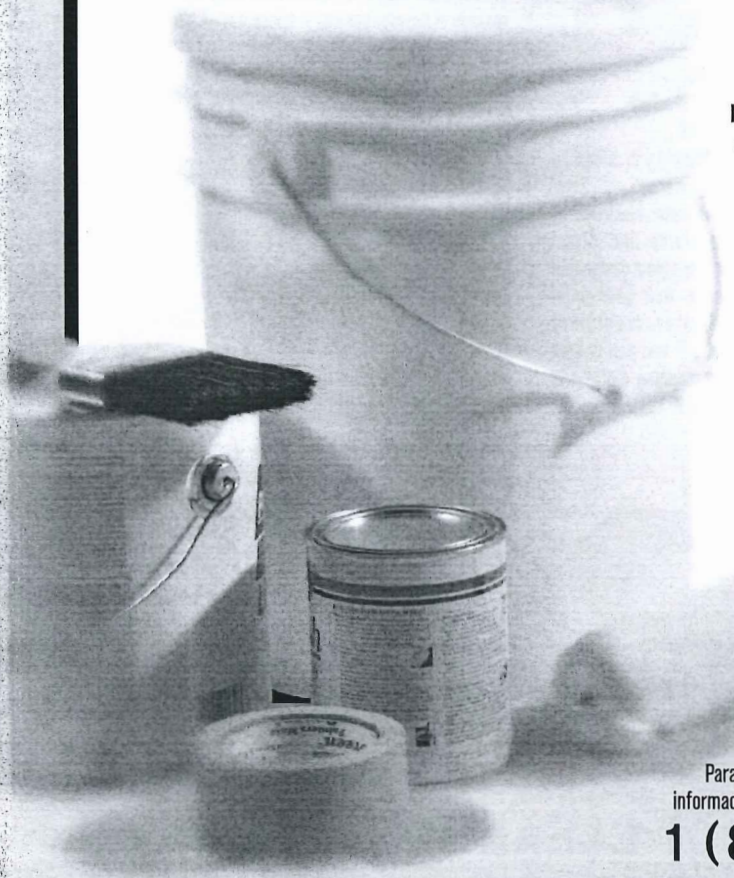
Removiendo Pintura en Exteriores

Al despintar o lavar exteriores de los edificios con agua de alta presión bloquea los drenajes cercanos y desvia el desagüe. Pregunta las autoridades si puedes desecharla en las alcantaillas.



Reciclando Pintura

Recicla la pintura que sobra en un lugar de colección de materiales peligrosos, guardala para re-toques or regalala a alguien que la use, como a un teatro, a la escuela, una oraganizacion de la ciudad o de la comunidad.



Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Fertilizer Tips to Prevent Pollution

Water that runs off your lawn and garden can carry fertilizer into the San Bernardino County storm drain system, and it does not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.

- Read the product label and follow the directions carefully, using only as directed.
- Avoid applying near driveways or gutters.
- Never apply fertilizer before a rain.
- Store fertilizers and chemicals in a covered area and in sealed, waterproof containers.
- Take unwanted lawn or garden chemicals to a household hazardous waste collection facility. Call (800) 253-2687 for the location of your city's facility.
- Use non-toxic products for your garden and lawn whenever possible.

San Bernardino County STORMWATER PROGRAM

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

1 (800) CLEANUP

www.1800cleanup.org

English side

Consejos de Prevención Para la Contaminación de Fertilizantes.

El desagüe del jardín puede llevar fertilizantes que acaben por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

- Leer las etiquetas del producto y seguir las instrucciones cuidadosamente, usarlas tal como se indica.
- Evita aplicarlos cerca de la cocheras o las alcantarillas.
- Nunca aplicar el fertilizante antes de llover.
- Guarda los fertilizantes y otros quimicos en un lugar cuvierto y en contenedores contra agua.
- Desechalos en unlugar de colección de desechos peligrosos. Llama al (800) 253-2687 para información de un centro cerca a ti.
- Trata de usar productos no-toxicos para tu jardín cada vez que sea posible.

San Bernardino County STORMWATER PROGRAM

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

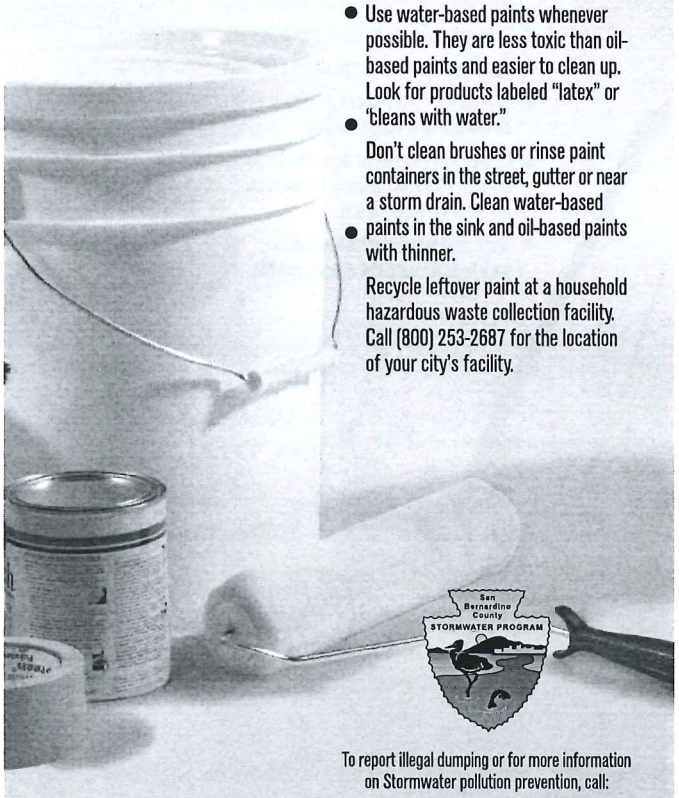
Spanish side

Item: Fertilizer bill insert **Actual size:** 3.625" x 8.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 8/29/03

Paint Tips to Prevent Pollution

Washing a paint brush or dumping rinse water in the gutter allows toxic chemicals to flow into the San Bernardino County storm drain system, and they do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.

- Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or 'cleans with water."
- Don't clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink and oil-based paints with thinner.
- Recycle leftover paint at a household hazardous waste collection facility. Call (800) 253-2687 for the location of your city's facility.



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

1 (800) CLEANUP

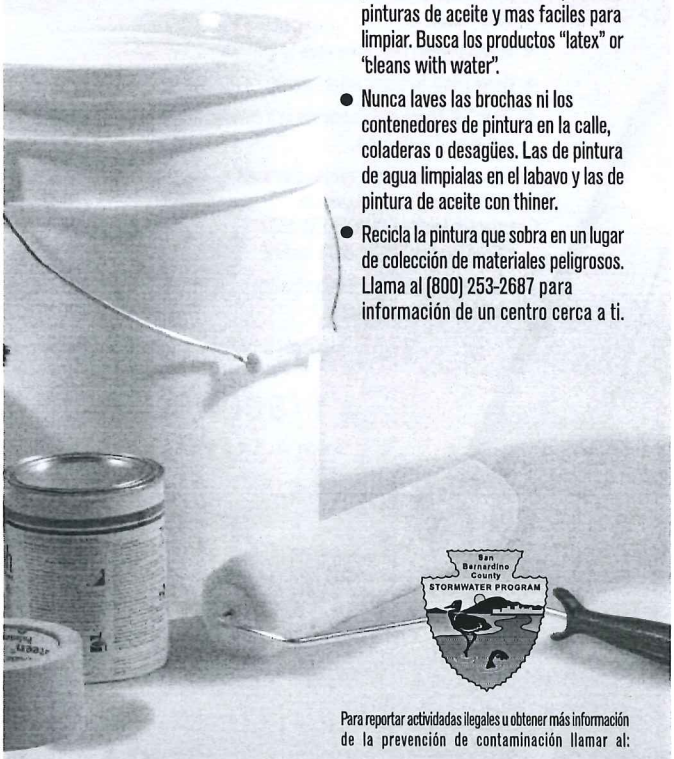
www.1800cleanup.org

English side

Consejos de Prevención Para la Contaminación de Pintura.

Lavar las brochas de pintura o arrojar agua sucia en el desagüe acaba por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

- Usa pinturas de agua cuando sea posible. Son menos toxicas que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or 'cleans with water".
- Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner.
- Recicla la pintura que sobra en un lugar de colección de materiales peligrosos. Llama al (800) 253-2687 para información de un centro cerca a ti.



Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

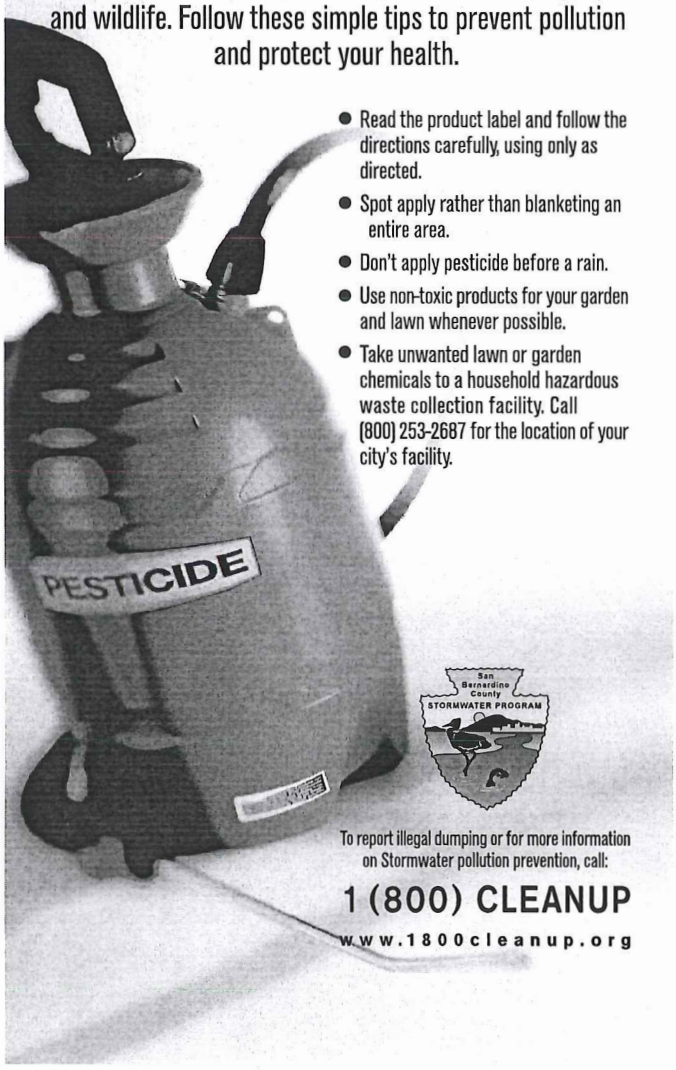
www.1800cleanup.org

Spanish side

Item: Paint bill insert **Actual size:** 3.625" x 8.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 8/29/03

Pesticide Tips to Prevent Pollution

Water that runs off your lawn and garden can carry pesticide into the San Bernardino County storm drain system, and it does not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.



- Read the product label and follow the directions carefully, using only as directed.
- Spot apply rather than blanketing an entire area.
- Don't apply pesticide before a rain.
- Use non-toxic products for your garden and lawn whenever possible.
- Take unwanted lawn or garden chemicals to a household hazardous waste collection facility. Call (800) 253-2687 for the location of your city's facility.

San Bernardino County STORMWATER PROGRAM

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

1 (800) CLEANUP

www.1800cleanup.org

English side

Consejos de Prevención Para la Contaminación de Pesticidas.

El desagüe del jardín puede llevar pesticidas que acaben por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

- Leer las etiquetas del producto y seguir las instrucciones cuidadosamente, usarlas tal como se indica.
- Apliqua solo parte por parte, no en areas grandes.
- No aplique los pesticidas antes de que llueva.
- Trata de usar productos no-toxicos para tu jardín cada vez que sea posible.
- Desechalos en unlugar de colección de desechos peligrosos. Llama al (800) 253-2687 para información de un centro cerca a ti.

San Bernardino County STORMWATER PROGRAM

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al:

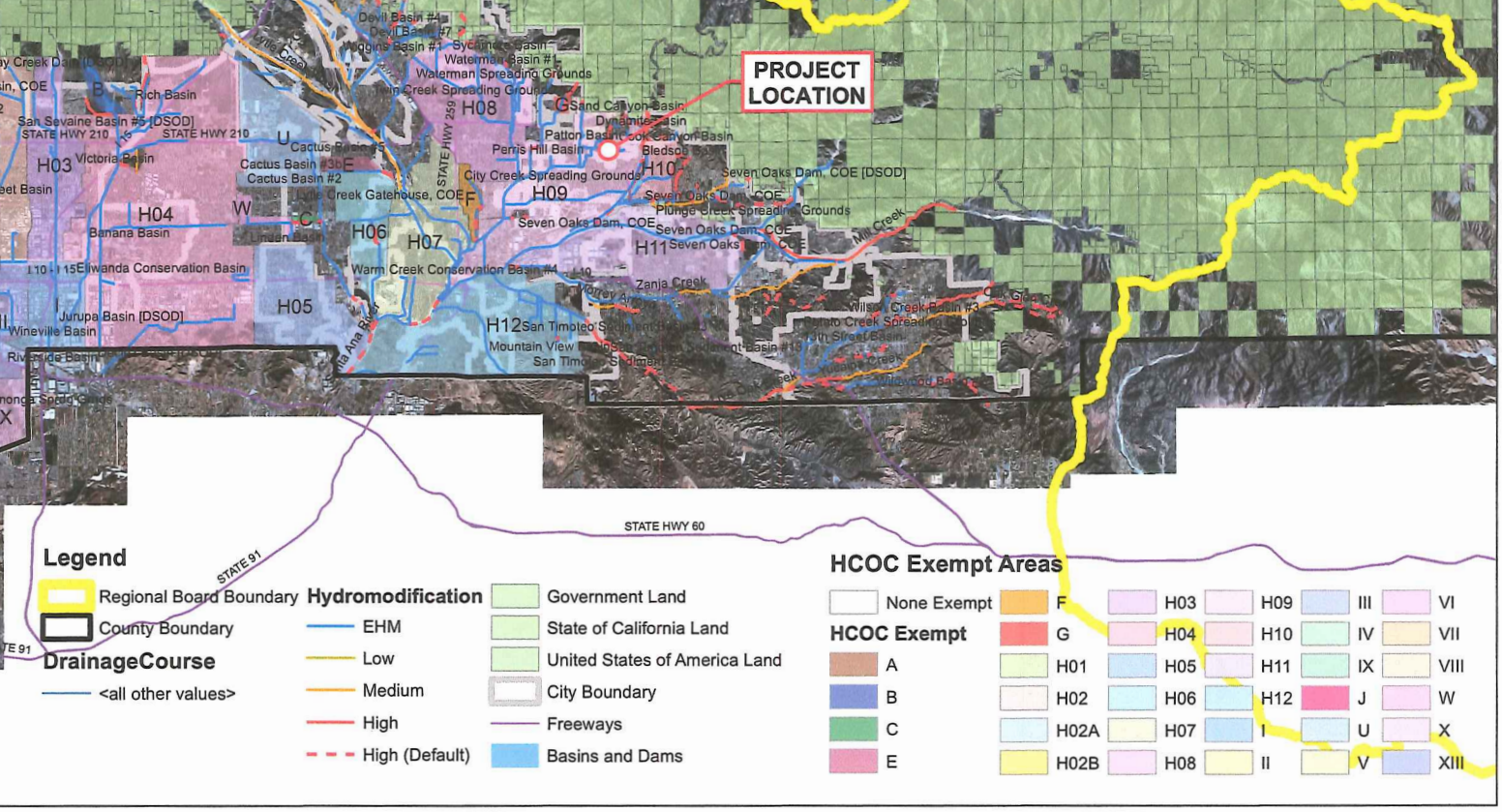
1 (800) CLEANUP

www.1800cleanup.org

Spanish side

Item: Pesticide bill insert **Actual size:** 3.625" x 8.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 8/29/03

6.4.D – HCOC Exemption Materials



Legend

- Regional Board Boundary
- County Boundary

DrainageCourse

- <all other values>

Hydromodification

- EHM
- Low
- Medium
- High
- High (Default)

- Government Land
- State of California Land
- United States of America Land
- City Boundary
- Freeways
- Basins and Dams

HCOC Exempt Areas

- None Exempt

HCOC Exempt

- A
- B
- C
- E
- F
- G
- H01
- H02
- H02A
- H02B
- H03
- H04
- H05
- H06
- H07
- H08
- H09
- H10
- H11
- H12
- I
- II
- III
- IV
- V
- VI
- VII
- VIII
- IX
- J
- U
- W
- X
- XIII

WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

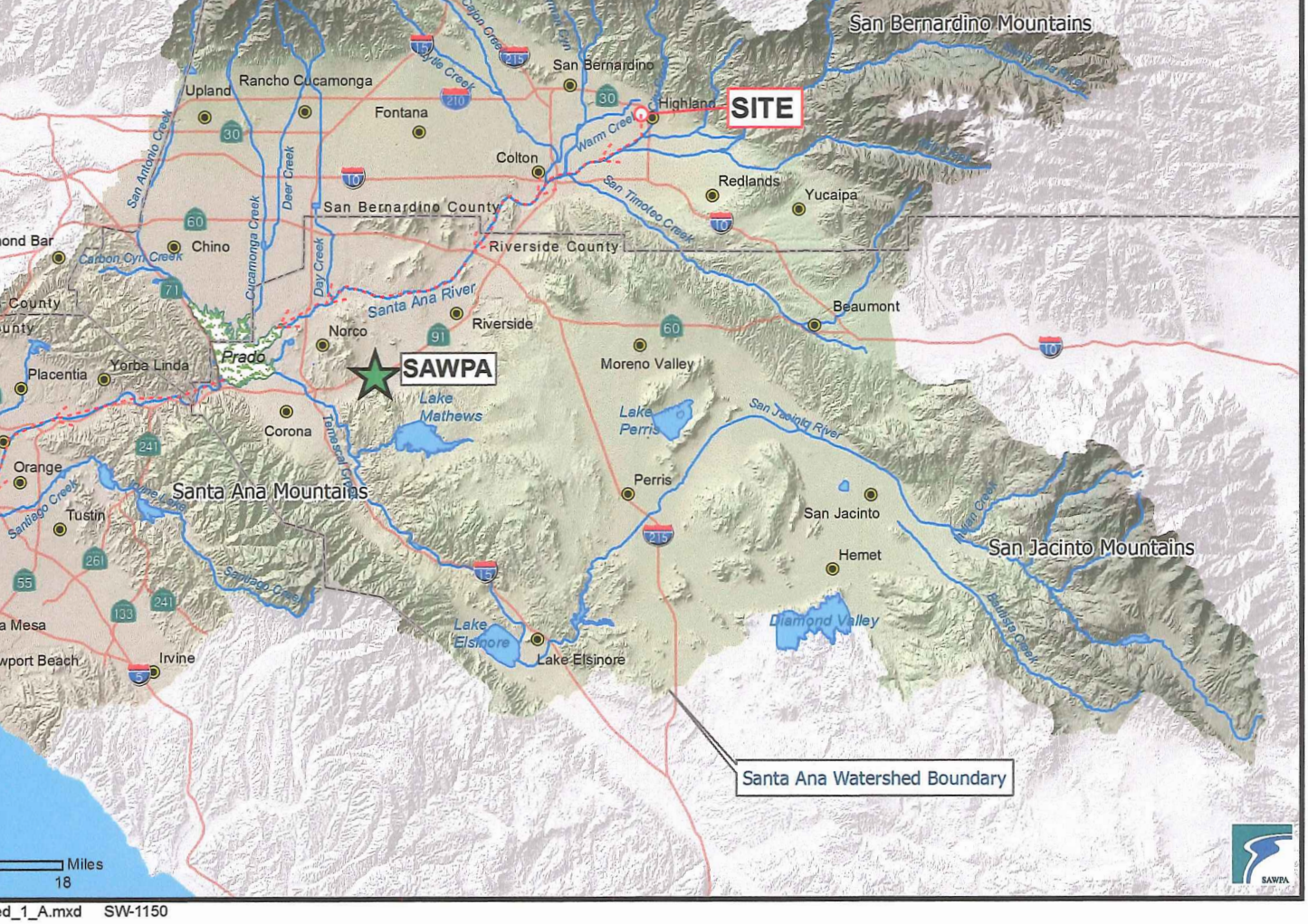
Tuesday, February 09, 2021

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	120038103, 120038137, 120038104, 120038131, 120038105, 120038135, 120038136, 120038133, 120038139, 120038134, 120038102, 120038132
Project Site Acreage:	11.393
HCOC Exempt Area:	Yes. Verify that the project is completely with the HCOC exemption area.
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - **Facility Name** - **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	High
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	Yes
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	B
Environmentally Sensitive Areas within 200':	None
Groundwater Depth (FT):	-282
Parcels with potential septic tanks within 1000':	No
Known Groundwater Contamination Plumes within 1000':	No
Studies and Reports Related to Project Site:	CSDP #6 Existing Facilities and Capacities CSDP No. 6 Volume II CSDP No. 6 Deficiency Analysis CSDP No. 6 Deficiency Analysis CSDP No. 6 Existing Facilities CSDP No. 6 Proposed Master Planned Facilities CSDP No. 6 Volume I CSDP No. 7 Storm Drain Systems CSDP No. 7 Storm Drain Systems CSDP No. 7 Storm Drain Systems CSDP No. 7 Storm Drain Hydraulic Design Data SBVMWD High Groundwater / Pressure Zone Area

TRACTOR SUPPLY HIGHLAND PWQMP - DMAs						
		FT^2	AC	%	DESCRIPTION	COMPOSITE CN VALUE
EXISTING CONDITION	A_T=	393003	9.02	---	BARREN, GRADED LAND	69
	A_{PERV}=	386850	8.88	98.4%		
	A_{IMP}=	6153	0.14	1.6%		
DA1 DMA A	A_T=	393003	9.02	---	BARREN, GRADED LAND	69
	A_{PERV}=	386850	8.88	98.4%		
	A_{IMP}=	6153	0.14	1.6%		
PROPOSED CONDITION	A_T=	400040	9.18	---	COMBINATION OF: COMMERCIAL LANDSCAPING AND PCC/AC PAVEMENT	90
	A_{PERV}=	77145	1.77	19.3%		
	A_{IMP}=	322895	7.41	80.7%		
DA1 DMA A	A_T=	77722	1.78	---	COMBINATION OF: COMMERCIAL LANDSCAPING AND PCC/AC PAVEMENT	82
	A_{PERV}=	28930	0.66	37.2%		
	A_{IMP}=	48792	1.12	62.8%		
DA2 DMA B	A_T=	138988	3.19	---	COMBINATION OF: COMMERCIAL LANDSCAPING AND PCC/AC PAVEMENT	96
	A_{PERV}=	7268	0.17	9.4%		
	A_{IMP}=	131720	3.02	94.8%		
DA3 DMA C	A_T=	118759	2.73	---	COMBINATION OF: COMMERCIAL LANDSCAPING AND PCC/AC PAVEMENT	89
	A_{PERV}=	24233	0.56	31.2%		
	A_{IMP}=	94526	2.17	79.6%		
DA4 DMA D	A_T=	30188	0.69	---	COMBINATION OF: COMMERCIAL LANDSCAPING AND PCC/AC PAVEMENT	85
	A_{PERV}=	9180	0.21	11.8%		
	A_{IMP}=	21008	0.48	69.6%		
DA 5 DMA E	A_T=	34383	0.79	---	COMBINATION OF: COMMERCIAL LANDSCAPING AND PCC/AC PAVEMENT	89
	A_{PERV}=	7534	0.17	9.7%		
	A_{IMP}=	26849	0.62	78.1%		
THE OVERALL AREA THAT WILL BE USED TO SIZE THE BMP DEVICES INCLUDE AREA BEYOND THE LIMITS OF THE PROPERTY LIMITS (LOT AREA = 393,003 SQ. FT.) ADDITIONAL WORK BEING PROPOSED IN THE PUBLIC RIGHT-OF-WAY AND WILL BE TAKEN INTO ACCOUNT FOR THE SIZING OF BMPs (GROSS PWQMP AREA = 400,040 SQ. FT.)						
EXISTING SITE (NET): 393,003 SF (9.02 ACRES), PROPOSED SITE (GROSS WQMP): 400,040 SF (9.18 ACRES), THIS SITE IS CLASSIFIED AS HYDROLOGIC SOIL GROUP B. COMMERICIAL LANDSCAPING (56), ANNUAL GRASS (FAIR COVER, 69) AND BLDG/PCC/AC PAVEMENT (98).						

6.4.E – Receiving Water Exhibit



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6.4.F – Soils Report

January 22, 2021

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Woodcrest Companies
1410 Main Street, Suite C
Ramona, California 92065

Attention: Mr. Steve Powell
President

Project No.: **20G205-2**

Subject: **Results of Infiltration Testing**
Proposed Mixed Use Development
NWC Base Line Street and Church Avenue
Highland, California

Reference: Geotechnical Investigation and Infiltration Testing, Proposed Mixed Use Development, NWC Base Line Street and Church Avenue, Highland, California, prepared for Woodcrest Companies, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 20G205-1, dated January 15, 2021.

Mr. Powell:

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 the infiltration testing was in general accordance with our Proposal No. 20P329, Change Order No. 20G205-CO, and Change Order No. 20G205-CO2R dated August 26, December 22, and January 22, 2021, respectively. The scope consisted of surface reconnaissance, subsurface exploration, field testing, laboratory testing, and engineering analysis to determine the infiltration rate of the on-site soils. The infiltration testing was performed in accordance with the ASTM test method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer. Based on conversations with representatives of CASC Engineering and Consulting, the reviewer for the city of Highland, additional exploration for the infiltration testing was performed as requested.

Site and Project Description

The overall site is located at the northwest corner of Base Line Street and Church Avenue, in Highland, California. The site is bounded to the north by single-family residences (SFRs) and Villa Avenue, to the east by Church Avenue, to the south by Baseline Street and to the west by SFRs, Foster Avenue and existing commercial/industrial buildings. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The primary site consists of several irregular-shaped parcels, totaling 9.0± acres in size, located in the western area of the overall site. The secondary site consists of several rectangular-shaped

parcels, totaling 4.0± acres in size, located in the eastern area of the overall site. The primary and secondary sites are vacant and undeveloped. Several palm trees are located along the north-central property line. Ground surface cover consists of moderate to dense native grass and weed growth. Cobbles and boulders are present at the ground surface throughout both the primary and secondary sites.

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 site topography slopes downward to the southwest at a gradient of 1 to 3± percent.

Proposed Development

SCG was provided with a preliminary site plan for the proposed development, prepared by MPA Architects Inc. Based on this plan, the primary site will be developed with two (2) new buildings. These structures will consist of a Tractor Supply Company (TSC) building and an apartment building. The TSC facility will consist of a 19,097± ft^2 building with an attached food and storage building, 3,336± ft^2 in size, located at the northwest of the TSC building. A greenhouse cover, 4,445± ft^2 in size, will be constructed southwest of the TSC building, south of the proposed food and storage building. Additionally, a fenced outdoor storage area, 12,062 ft^2 in size, will be constructed west of the storage building and greenhouse cover. The apartment building will consist of one (1) two-story structure, 10,500± ft^2 in size, located in the northwest corner of the site. It is expected that the buildings will be surrounded by asphaltic concrete pavements in parking and drive areas, concrete flatwork, and landscape planter areas in various areas of the site. The proposed development will encompass the western half of the overall site.

The secondary site will be developed with a grocery store, 28,037± ft^2 in size, in the northern portion of this site and two (2) restaurant buildings with drive-thru lanes, each 3,270± ft^2 in size, in the southern portion of the site. The secondary site will be developed at a future date.

The proposed development will use on-site storm water infiltration. Based on an infiltration location plan prepared by Sitetech Inc., the project civil engineer, below-ground chamber systems will be constructed at the primary and secondary sites. The infiltration systems will be identified as follows:

Infiltration System	Site	Location	Depth (feet)
"A"	Primary	West-Central	6 to 8
"B"	Primary	Southwestern	6 to 8
"C"	Secondary	Southern	6 to 8
"D"	Secondary	Southern	6 to 8
"E"	Secondary	West-Central	6 to 8

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the primary subject site. As part of this study, three (3) borings were drilled to depths of 11 to 19± feet below the existing site grades. In addition, five (5) trenches were excavated by a backhoe to depths of 10 to 12± feet below existing site grades. Native alluvium was encountered at the ground surface at all of the boring and trench locations, extending to at least the maximum depth explored of 19± feet below ground surface. The near surface alluvial soils, within the upper 7 to 9½± feet, generally consist of silty fine sands, well-graded sands, and silty well-graded sands with varying gravel and cobble content. Alluvial soils at depths greater than 9½± feet generally consist of well graded sands with little gravel and varying cobble and boulder content. Due to the presence of the cobbles and boulders, every boring and trench encountered refusal conditions within the native alluvium.

Groundwater

Groundwater was not encountered at any of the boring locations. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 19± feet below existing site grades, at the time of the subsurface investigation.

Recent water level data was obtained from the California Department of Water Resources Water Data Library website, http://wdl.water.ca.gov/. The nearest monitoring well on record is located 2,051± feet southeast of the site. Water level readings within this monitoring well indicate a groundwater level of 292± feet below the ground surface in September 2020.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for this project consisted of ten (10) backhoe-excavated infiltration trenches extending to depths of 7 to 8± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 through I-10) are included in this report as Plate 2.

Geotechnical Conditions

Native Alluvium

Native alluvium was encountered at the ground surface of all infiltration trench locations, extending to at least the maximum explored depth of 8± feet below existing site grades. The native alluvium consisted of loose to dense silty fine to coarse sands, gravelly fine to coarse sands, and fine to coarse sandy gravel. Varying amounts of cobbles were encountered throughout the alluvium. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are presented in this report.

It should be noted that the subsurface information from the concurrent geotechnical investigation was utilized to determine the soils classifications below the proposed infiltration systems for the primary site. The subsurface soils from the concurrent geotechnical investigation and from the

infiltration study are considered to be consistent. Therefore, the infiltration rates provided below are considered to representative of the soil expected to be encountered at the bottom of the infiltration system at the primary site. Additional trenching was not performed for the secondary site as requested by the client. Therefore, additional trenching will need to be performed at a later date to determine if the soils classifications below the proposed infiltration systems for the secondary site are similar to the soil encountered at the bottom of the proposed infiltration system.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration systems that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At each test location, a trench was excavated to the proposed depth of the infiltration system and the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at both of the infiltration trench locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4± inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at the trench locations, the volumetric measurements were made at 15-minute intervals for 6 hours. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Infiltration Rate (inches/hour)
I-1	7	Brown Silty fine to coarse Sand, little fine to coarse Gravel	3.5
I-2	7	Brown Gravelly fine to coarse Sand, trace to little Silt	4.2
I-3	8	Light Brown Silty fine to coarse Sand	3.7
I-4	8	Light Brown fine to coarse Sandy Gravel, trace Silt	4.0
I-5	7	Light Brown fine to coarse Sandy Gravel	6.5
I-6	7	Light Brown Silty fine to medium Sand, trace coarse Sand	3.2
I-7	7	Light Brown Sandy fine to coarse Gravel, trace Silt	4.5
I-8	8	Light Brown Gravelly fine to coarse Sand, trace Silt	3.7
I-9	8	Light Brown Gravelly fine to coarse Sand	3.4
I-10	7	Light Brown Gravelly fine to coarse Sand, trace Silt	6.7

Laboratory Testing

Moisture Content

The moisture contents for selected soil samples within the trenches 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 Trench Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test trench has 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 the grainsize analysis are presented on Plates C-1 through C-11 of this report.

Design Recommendations

Ten (10) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 3.2 to 6.7 inches per hour. **Based on**

the results of infiltration tests, we recommend the following infiltration rates be used for the design of the proposed below-grade chamber systems.

Infiltration Test Nos.	Infiltration System	Infiltration Rate (in/hr)
I-1, I-6	"A"	3.2
I-2, I-7	"B"	4.2
I-3, I-8	"C"	3.7
I-4, I-9	"D"	3.4
I-5, I-10	"E"	6.5

As previously stated, additional trenching was not performed for the secondary site to determine the soils classifications below the proposed infiltration systems. Therefore, the infiltration results for the three infiltration systems on the secondary site should be considered preliminary. Additional exploration will need to be performed at a later date to verify if the soils beneath the proposed infiltration system is similar to the soils at the bottom of the proposed infiltration system at the secondary site.

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each chamber system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rates reported herein.

The design of the proposed storm water infiltration systems should be performed by the project civil engineer, in accordance with the City of Highland and/or County of San Bernardino guidelines. However, it is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above are based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rates are based on infiltration testing at ten (10) discrete locations, and the overall infiltration rates of the storm water infiltration systems could vary considerably.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

Infiltration versus Permeability

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. The infiltration rates presented herein were determined in accordance with the ASTM Test Method D-3385-03 standard and are considered valid for the time and place of the actual test. Changes in soil moisture content will affect these infiltration rates. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration areas could potentially be damaged due to saturation of subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any descending slopes or structures, including retaining walls.** Even with this provision of locating the infiltration systems at least 25 feet from the buildings, it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

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 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 rates 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 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 trench 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.

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.

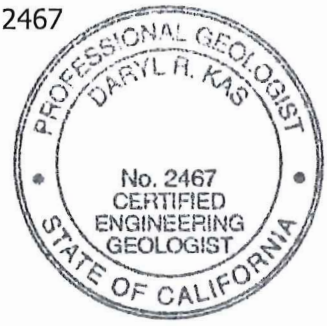
Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Ryan Bremer
Staff Geologist

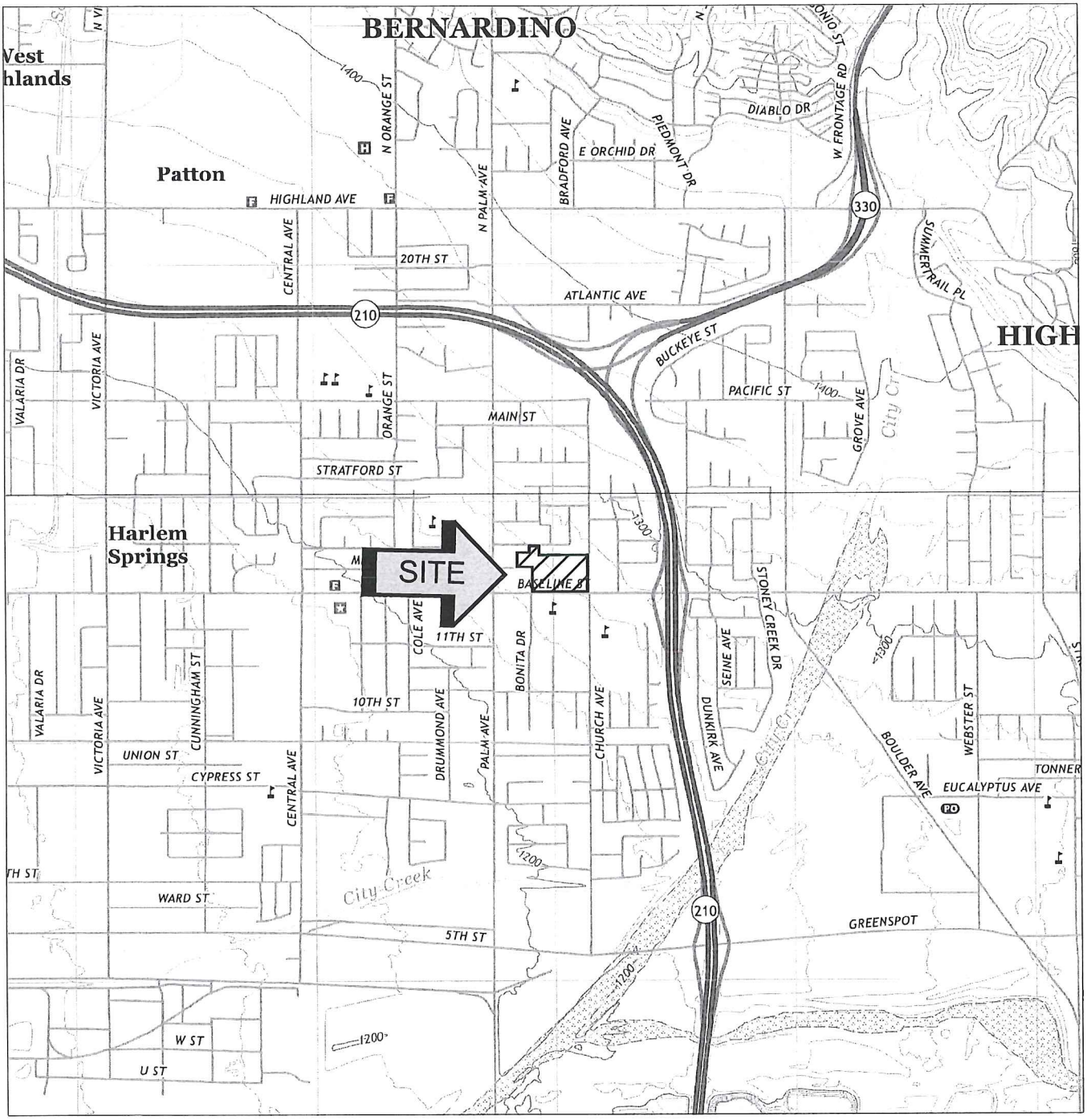
Darly R. Kas, CEG 2467
Senior Geologist

Gregory K. Mitchell, GE 2364
Principal Engineer



Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Trench Logs and Trench Log Legend (12 pages)
Infiltration Test Results Spreadsheets (20 pages)
Grain Size Distribution Graphs (11 pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF THE HARRISON MOUNTAIN AND REDLANDS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.

SITE LOCATION MAP

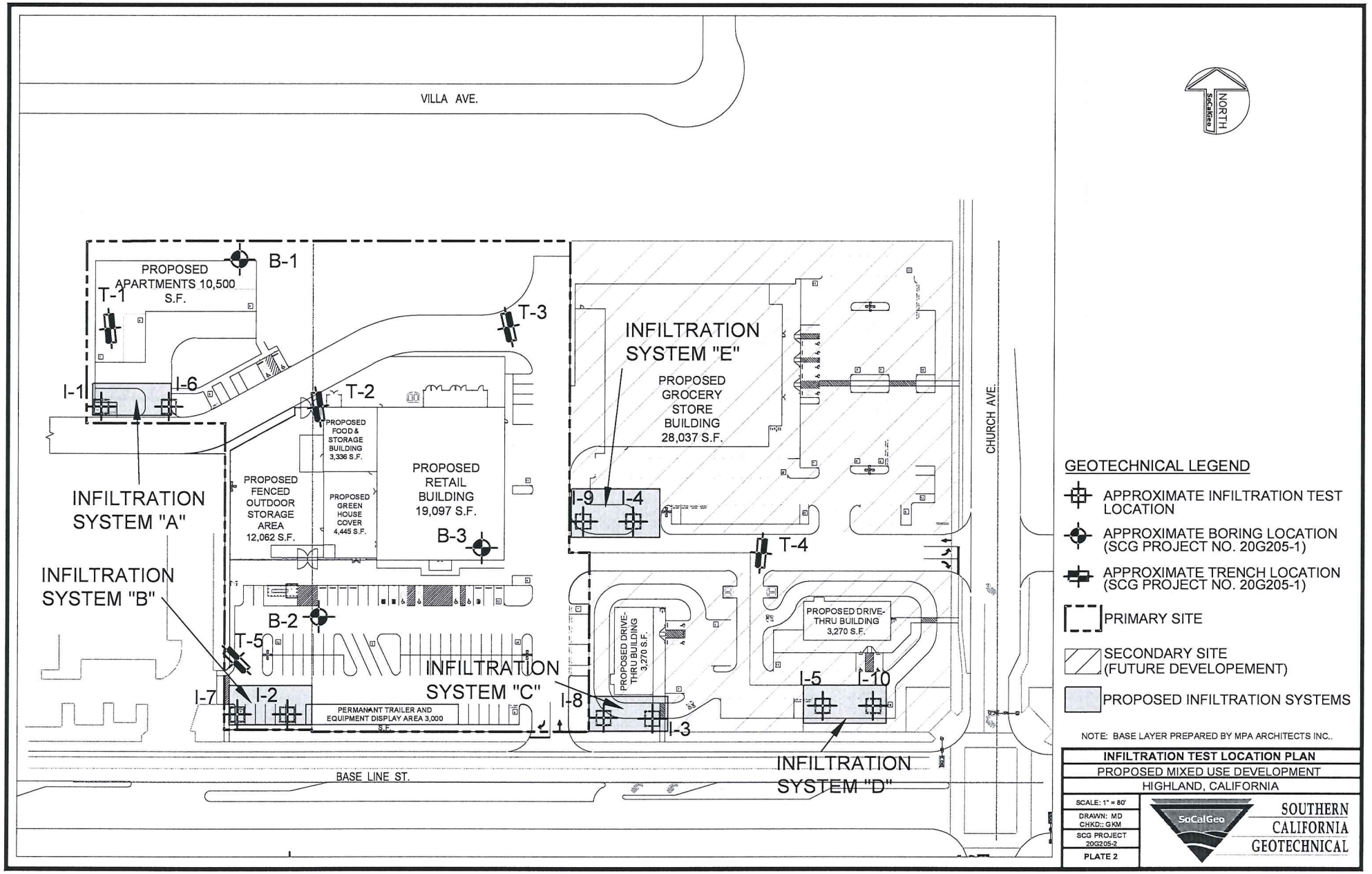
PROPOSED MIXED USE DEVELOPMENT

HIGHLAND, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: JAH CHKD: GKM	
SCG PROJECT 20G205-2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO. 20G205-1)
- APPROXIMATE TRENCH LOCATION (SCG PROJECT NO. 20G205-1)
- PRIMARY SITE
- SECONDARY SITE (FUTURE DEVELOPEMENT)
- PROPOSED INFILTRATION SYSTEMS

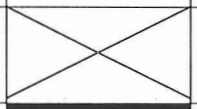
NOTE: BASE LAYER PREPARED BY MPA ARCHITECTS INC..

INFILTRATION TEST LOCATION PLAN
PROPOSED MIXED USE DEVELOPMENT
HIGHLAND, CALIFORNIA

SCALE: 1" = 80'	
DRAWN: MD CHKD:: GKM	
SCG PROJECT 20G205-2	
PLATE 2	

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH 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/ft^3.

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

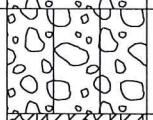
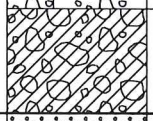
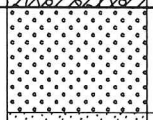
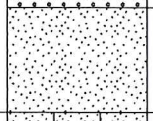
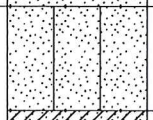
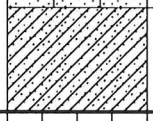
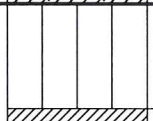
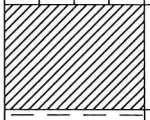
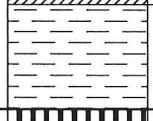
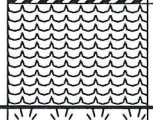
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

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	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		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
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		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
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-1

JOB NO.: 20G205-2 | DRILLING DATE: 12/29/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to coarse Sand, little fine to coarse Gravel, loose-dry							
5					Brown Silty fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, medium dense to dense-dry		3					
					Trench Terminated at 7'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG **PLATE B-1**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-2

JOB NO.: 20G205-2 | DRILLING DATE: 12/29/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5					ALLUVIUM: Brown Gravelly fine to coarse Sand, trace to little Silt, extensive Cobbles, medium dense-dry to damp		3					
					Trench Terminated at 7'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG **PLATE B-2**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-3

JOB NO.: 20G205-2 | DRILLING DATE: 12/30/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to coarse Sand, little fine to coarse Gravel, occasoinal Cobbles, dense-damp							
5												
					Light Brown Silty fine to coarse Sand, occasional Cobbles, dense-damp		4					
					Trench Terminated at 8'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-4

JOB NO.: 20G205-2
PROJECT: Proposed Mixed Use Development
LOCATION: Highland, California

DRILLING DATE: 12/30/20
DRILLING METHOD: Backhoe
LOGGED BY: Caleb Brackett

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Gray Brown Silty fine to coarse Sand, some fine to coarse Gravel, occasional Cobbles, medium dense-damp							
5					Light Brown fine to coarse Sandy Gravel, trace Silt, extensive Cobbles, dense-dry							
							3					
					Trench Terminated at 8'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG

PLATE B-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-5

JOB NO.: 20G205-2 | DRILLING DATE: 12/30/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Gravelly fine to coarse Sand, little Silt, extensive Cobbles, medium dense-damp							
5					Light Brown fine to coarse Sandy Gravel, extensive Cobbles, dense-dry to damp		3					
					Trench Terminated at 7'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG **PLATE B-5**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-6

JOB NO.: 20G205-2 | DRILLING DATE: 12/23/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5					ALLUVIUM: Light Brown Silty fine to medium Sand, trace coarse Sand, medium dense-dry		2					
					Trench Terminated at 7'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG **PLATE B-6**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-7

JOB NO.: 20G205-2 | DRILLING DATE: 12/23/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Light Brown Silty fine to coarse Sand, trace fine Gravel, loose-dry							
5					Light Brown Sandy fine to coarse Gravel, trace Silt, extensive Cobbles, medium dense-dry		1					
					Trench Terminated at 7'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG

PLATE B-7

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-8

JOB NO.: 20G205-2
PROJECT: Proposed Mixed Use Development
LOCATION: Highland, California

DRILLING DATE: 12/23/20
DRILLING METHOD: Backhoe
LOGGED BY: Caleb Brackett

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5					ALLUVIUM: Brown Silty fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense-damp							
					Light Brown Gravelly fine to coarse Sand, trace Silt, extensive Cobbles, dense-dry to damp		5					
					Trench Terminated at 8'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG

PLATE B-8

SOUTHERN CALIFORNIA GEOTECHNICAL
A Califantic Corporation

TRENCH NO. I-9

JOB NO.: 20G205-2 | DRILLING DATE: 12/30/20 | WATER DEPTH: ---
PROJECT: Proposed Mixed Use Development | DRILLING METHOD: Backhoe | CAVE DEPTH: ---
LOCATION: Highland, California | LOGGED BY: Caleb Brackett | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Gray Brown Silty fine to coarse Sand, some fine to coarse Gravel, occasional Cobbles, medium dense-damp							
5					Light Brown Gravelly fine to coarse Sand, extensive Cobbles, dense-damp							
							3					
					Trench Terminated at 8'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG **PLATE B-9**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-10

JOB NO.: 20G205-2
PROJECT: Proposed Mixed Use Development
LOCATION: Highland, California

DRILLING DATE: 12/29/20
DRILLING METHOD: Backhoe
LOGGED BY: Caleb Brackett

WATER DEPTH: ---
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Gravelly fine to coarse Sand, trace to little Silt, extensive Cobbles, medium dense-damp							
							5					
5					Light Brown Gravelly fine to coarse Sand, trace to little Silt, extensive Cobbles, dense-dry to damp							
							3					
					Trench Terminated at 7'							

TBL 20G205-2.GPJ SOCALGEO.GDT 1/19/21

TEST TRENCH LOG

PLATE B-10

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-1

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	9:17 AM	15	0	2850	0	9400	15.62	17.18	6.15	6.76
	Final	9:32 AM	**15**	2850		9400					
2	Initial	9:33 AM	15	0	2700	0	9100	14.80	16.63	5.83	6.55
	Final	9:48 AM	**31**	2700		9100					
3	Initial	9:49 AM	15	0	2500	0	8900	13.71	16.26	5.40	6.40
	Final	10:04 AM	**47**	2500		8900					
4	Initial	10:05 AM	15	0	2400	0	8800	13.16	16.08	5.18	6.33
	Final	10:20 AM	**63**	2400		8800					
5	Initial	10:21 AM	15	0	2250	0	8500	12.33	15.53	4.86	6.12
	Final	10:36 AM	**79**	2250		8500					
6	Initial	10:37 AM	15	0	2200	0	8300	12.06	15.17	4.75	5.97
	Final	10:52 AM	**95**	2200		8300					
7	Initial	10:53 AM	15	0	2050	0	8500	11.24	15.53	4.42	6.12
	Final	11:08 AM	**111**	2050		8500					
8	Initial	11:09 AM	15	0	2100	0	8200	11.51	14.98	4.53	5.90
	Final	11:24 AM	**127**	2100		8200					
9	Initial	11:25 AM	15	0	1900	0	8100	10.42	14.80	4.10	5.83
	Final	11:40 AM	**143**	1900		8100					
10	Initial	11:41 AM	15	0	1850	0	8200	10.14	14.98	3.99	5.90
	Final	11:56 AM	**159**	1850		8200					
11	Initial	11:57 AM	15	0	1800	0	8000	9.87	14.62	3.89	5.76
	Final	12:12 PM	**174**	1800		8000					
12	Initial	12:13 PM	15	0	1850	0	7900	10.14	14.44	3.99	5.68
	Final	12:28 PM	**190**	1850		7900					
13	Initial	12:29 PM	15	0	1800	0	7700	9.87	14.07	3.89	5.54
	Final	12:44 PM	**206**	1800		7700					
14	Initial	12:45 PM	15	0	1750	0	7500	9.59	13.71	3.78	5.40
	Final	1:00 PM	**222**	1750		7500					
15	Initial	1:01 PM	15	0	1750	0	7600	9.59	13.89	3.78	5.47
	Final	1:16 PM	**238**	1750		7600					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-1

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
16	Initial	1:17 PM	15	0	1700	0	7500	9.32	13.71	3.67	5.40
	Final	1:32 PM	**254**	1700		7500					
17	Initial	1:33 PM	15	0	1650	0	7500	9.05	13.71	3.56	5.40
	Final	1:48 PM	**270**	1650		7500					
18	Initial	1:49 PM	15	0	1700	0	7400	9.32	13.52	3.67	5.32
	Final	2:04 PM	**286**	1700		7400					
19	Initial	2:05 PM	15	0	1650	0	7500	9.05	13.71	3.56	5.40
	Final	2:20 PM	**302**	1650		7500					
20	Initial	2:21 PM	15	0	1650	0	7400	9.05	13.52	3.56	5.32
	Final	2:36 PM	**318**	1650		7400					
21	Initial	2:37 PM	15	0	1600	0	7400	8.77	13.52	3.45	5.32
	Final	2:52 PM	**333**	1600		7400					
22	Initial	2:53 PM	15	0	1650	0	7300	9.05	13.34	3.56	5.25
	Final	3:08 PM	**349**	1650		7300					
23	Initial	3:09 PM	15	0	1600	0	7300	8.77	13.34	3.45	5.25
	Final	3:24 PM	**365**	1600		7300					
24	Initial	3:25 PM	15	0	1600	0	7300	8.77	13.34	3.45	5.25
	Final	3:40 PM	**381**	1600		7300					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-2

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	9:40 AM	15	0	2700	0	9600	14.80	17.54	5.83	6.91
	Final	9:55 AM	**15**	2700		9600					
2	Initial	9:56 AM	15	0	2750	0	9500	15.08	17.36	5.94	6.83
	Final	10:11 AM	**31**	2750		9500					
3	Initial	10:12 AM	15	0	2700	0	9600	14.80	17.54	5.83	6.91
	Final	10:27 AM	**47**	2700		9600					
4	Initial	10:28 AM	15	0	2650	0	9500	14.53	17.36	5.72	6.83
	Final	10:43 AM	**63**	2650		9500					
5	Initial	10:44 AM	15	0	2600	0	9500	14.25	17.36	5.61	6.83
	Final	10:59 AM	**79**	2600		9500					
6	Initial	11:00 AM	15	0	2650	0	9400	14.53	17.18	5.72	6.76
	Final	11:15 AM	**95**	2650		9400					
7	Initial	11:16 AM	15	0	2600	0	9200	14.25	16.81	5.61	6.62
	Final	11:31 AM	**111**	2600		9200					
8	Initial	11:32 AM	15	0	2550	0	9000	13.98	16.45	5.50	6.48
	Final	11:47 AM	**127**	2550		9000					
9	Initial	11:48 AM	15	0	2400	0	8900	13.16	16.26	5.18	6.40
	Final	12:03 PM	**143**	2400		8900					
10	Initial	12:04 PM	15	0	2350	0	8800	12.88	16.08	5.07	6.33
	Final	12:19 PM	**159**	2350		8800					
11	Initial	12:20 PM	15	0	2250	0	8700	12.33	15.90	4.86	6.26
	Final	12:35 PM	**174**	2250		8700					
12	Initial	12:36 PM	15	0	2250	0	8500	12.33	15.53	4.86	6.12
	Final	12:51 PM	**190**	2250		8500					
13	Initial	12:52 PM	15	0	2200	0	8300	12.06	15.17	4.75	5.97
	Final	1:07 PM	**206**	2200		8300					
14	Initial	1:08 PM	15	0	2100	0	8200	11.51	14.98	4.53	5.90
	Final	1:23 PM	**222**	2100		8200					
15	Initial	1:24 PM	15	0	2150	0	8100	11.79	14.80	4.64	5.83
	Final	1:39 PM	**238**	2150		8100					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-2

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	1:40 PM	15	0	2100	0	8000	11.51	14.62	4.53	5.76
	Final	1:55 PM	**254**	2100		8000					
17	Initial	1:56 PM	15	0	2050	0	8100	11.24	14.80	4.42	5.83
	Final	2:11 PM	**270**	2050		8100					
18	Initial	2:12 PM	15	0	2000	0	8000	10.96	14.62	4.32	5.76
	Final	2:27 PM	**286**	2000		8000					
19	Initial	2:28 PM	15	0	1950	0	8000	10.69	14.62	4.21	5.76
	Final	2:43 PM	**302**	1950		8000					
20	Initial	2:44 PM	15	0	1950	0	7900	10.69	14.44	4.21	5.68
	Final	2:59 PM	**318**	1950		7900					
21	Initial	3:00 PM	15	0	2000	0	7900	10.96	14.44	4.32	5.68
	Final	3:15 PM	**333**	2000		7900					
22	Initial	3:16 PM	15	0	1950	0	7900	10.69	14.44	4.21	5.68
	Final	3:31 PM	**349**	1950		7900					
23	Initial	3:32 PM	15	0	1950	0	7900	10.69	14.44	4.21	5.68
	Final	3:47 PM	**365**	1950		7900					
24	Initial	3:48 PM	15	0	1950	0	7900	10.69	14.44	4.21	5.68
	Final	4:03 PM	**381**	1950		7900					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-3

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	7:30 AM	15	0	2100	0	8200	11.51	14.98	4.53	5.90
	Final	7:45 AM	**15**	2100		8200					
2	Initial	7:46 AM	15	0	2050	0	7900	11.24	14.44	4.42	5.68
	Final	8:01 AM	**31**	2050		7900					
3	Initial	8:16 AM	15	0	2050	0	7800	11.24	14.25	4.42	5.61
	Final	8:31 AM	**61**	2050		7800					
4	Initial	8:32 AM	15	0	1950	0	7700	10.69	14.07	4.21	5.54
	Final	8:47 AM	**77**	1950		7700					
5	Initial	8:48 AM	15	0	1950	0	7700	10.69	14.07	4.21	5.54
	Final	9:03 AM	**93**	1950		7700					
6	Initial	9:04 AM	15	0	1900	0	7600	10.42	13.89	4.10	5.47
	Final	9:19 AM	**109**	1900		7600					
7	Initial	9:20 AM	15	0	1900	0	7600	10.42	13.89	4.10	5.47
	Final	9:35 AM	**125**	1900		7600					
8	Initial	9:36 AM	15	0	1850	0	7500	10.14	13.71	3.99	5.40
	Final	9:51 AM	**141**	1850		7500					
9	Initial	9:52 AM	15	0	1850	0	7500	10.14	13.71	3.99	5.40
	Final	10:07 AM	**157**	1850		7500					
10	Initial	10:08 AM	15	0	1850	0	7400	10.14	13.52	3.99	5.32
	Final	10:23 AM	**173**	1850		7400					
11	Initial	10:24 AM	15	0	1850	0	7500	10.14	13.71	3.99	5.40
	Final	10:39 AM	**188**	1850		7500					
12	Initial	10:40 AM	15	0	1800	0	7400	9.87	13.52	3.89	5.32
	Final	10:55 AM	**204**	1800		7400					
13	Initial	10:56 AM	15	0	1750	0	7400	9.59	13.52	3.78	5.32
	Final	11:11 AM	**220**	1750		7400					
14	Initial	11:12 AM	15	0	1800	0	7300	9.87	13.34	3.89	5.25
	Final	11:27 AM	**236**	1800		7300					
15	Initial	11:28 AM	15	0	1800	0	7200	9.87	13.16	3.89	5.18
	Final	11:43 AM	**252**	1800		7200					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-3

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	11:44 AM	15	0	1750	0	7200	9.59	13.16	3.78	5.18
	Final	11:59 AM	**268**	1750		7200					
17	Initial	12:00 PM	15	0	1750	0	7300	9.59	13.34	3.78	5.25
	Final	12:15 PM	**284**	1750		7300					
18	Initial	12:16 PM	15	0	1800	0	7100	9.87	12.97	3.89	5.11
	Final	12:31 PM	**300**	1800		7100					
19	Initial	12:32 PM	15	0	1750	0	7200	9.59	13.16	3.78	5.18
	Final	12:47 PM	**316**	1750		7200					
20	Initial	12:48 PM	15	0	1750	0	7100	9.59	12.97	3.78	5.11
	Final	1:03 PM	**332**	1750		7100					
21	Initial	1:04 PM	15	0	1750	0	7200	9.59	13.16	3.78	5.18
	Final	1:19 PM	**347**	1750		7200					
22	Initial	1:20 PM	15	0	1750	0	7100	9.59	12.97	3.78	5.11
	Final	1:35 PM	**363**	1750		7100					
23	Initial	1:36 PM	15	0	1700	0	7100	9.32	12.97	3.67	5.11
	Final	1:51 PM	**379**	1700		7100					
24	Initial	1:52 PM	15	0	1700	0	7000	9.32	12.79	3.67	5.04
	Final	2:07 PM	**395**	1700		7000					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-4

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	7:55 AM	15	0	2750	0	9700	15.08	17.73	5.94	6.98
	Final	8:10 AM	**15**	2750		9700					
2	Initial	8:11 AM	15	0	2600	0	9500	14.25	17.36	5.61	6.83
	Final	8:26 AM	**31**	2600		9500					
3	Initial	8:27 AM	15	0	2550	0	9500	13.98	17.36	5.50	6.83
	Final	8:42 AM	**47**	2550		9500					
4	Initial	8:43 AM	15	0	2450	0	9400	13.43	17.18	5.29	6.76
	Final	8:58 AM	**63**	2450		9400					
5	Initial	8:59 AM	15	0	2500	0	9300	13.71	16.99	5.40	6.69
	Final	9:14 AM	**79**	2500		9300					
6	Initial	9:15 AM	15	0	2400	0	9200	13.16	16.81	5.18	6.62
	Final	9:30 AM	**95**	2400		9200					
7	Initial	9:31 AM	15	0	2350	0	9100	12.88	16.63	5.07	6.55
	Final	9:46 AM	**111**	2350		9100					
8	Initial	9:47 AM	15	0	2350	0	9100	12.88	16.63	5.07	6.55
	Final	10:02 AM	**127**	2350		9100					
9	Initial	10:03 AM	15	0	2300	0	9000	12.61	16.45	4.96	6.48
	Final	10:18 AM	**143**	2300		9000					
10	Initial	10:19 AM	15	0	2200	0	9000	12.06	16.45	4.75	6.48
	Final	10:34 AM	**159**	2200		9000					
11	Initial	10:35 AM	15	0	2150	0	8900	11.79	16.26	4.64	6.40
	Final	10:50 AM	**174**	2150		8900					
12	Initial	10:51 AM	15	0	2100	0	8800	11.51	16.08	4.53	6.33
	Final	11:06 AM	**190**	2100		8800					
13	Initial	11:07 AM	15	0	2150	0	8700	11.79	15.90	4.64	6.26
	Final	11:22 AM	**206**	2150		8700					
14	Initial	11:23 AM	15	0	2100	0	8800	11.51	16.08	4.53	6.33
	Final	11:38 AM	**222**	2100		8800					
15	Initial	11:39 AM	15	0	2000	0	8600	10.96	15.72	4.32	6.19
	Final	11:54 AM	**238**	2000		8600					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-4

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	11:55 AM	15	0	1950	0	8600	10.69	15.72	4.21	6.19
	Final	12:10 PM	**254**	1950		8600					
17	Initial	12:11 PM	15	0	2000	0	8500	10.96	15.53	4.32	6.12
	Final	12:26 PM	**270**	2000		8500					
18	Initial	12:27 PM	15	0	1950	0	8400	10.69	15.35	4.21	6.04
	Final	12:42 PM	**286**	1950		8400					
19	Initial	12:43 PM	15	0	1900	0	8400	10.42	15.35	4.10	6.04
	Final	12:58 PM	**302**	1900		8400					
20	Initial	12:59 PM	15	0	1900	0	8200	10.42	14.98	4.10	5.90
	Final	1:14 PM	**318**	1900		8200					
21	Initial	1:15 PM	15	0	1850	0	8300	10.14	15.17	3.99	5.97
	Final	1:30 PM	**333**	1850		8300					
22	Initial	1:31 PM	15	0	1850	0	8200	10.14	14.98	3.99	5.90
	Final	1:46 PM	**349**	1850		8200					
23	Initial	1:47 PM	15	0	1850	0	8200	10.14	14.98	3.99	5.90
	Final	2:02 PM	**365**	1850		8200					
24	Initial	2:03 PM	15	0	1850	0	8200	10.14	14.98	3.99	5.90
	Final	2:18 PM	**381**	1850		8200					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-5

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	8:55 AM	15	0	3900	0	12000	21.38	21.93	8.42	8.63
	Final	9:10 AM	**15**	3900		12000					
2	Initial	9:11 AM	15	0	3850	0	11900	21.11	21.75	8.31	8.56
	Final	9:26 AM	**31**	3850		11900					
3	Initial	9:27 AM	15	0	3800	0	11900	20.83	21.75	8.20	8.56
	Final	9:42 AM	**47**	3800		11900					
4	Initial	9:43 AM	15	0	3750	0	11800	20.56	21.56	8.09	8.49
	Final	9:58 AM	**63**	3750		11800					
5	Initial	9:59 AM	15	0	3700	0	11700	20.28	21.38	7.99	8.42
	Final	10:14 AM	**79**	3700		11700					
6	Initial	10:15 AM	15	0	3650	0	11600	20.01	21.20	7.88	8.35
	Final	10:30 AM	**95**	3650		11600					
7	Initial	10:31 AM	15	0	3600	0	11500	19.74	21.02	7.77	8.27
	Final	10:46 AM	**111**	3600		11500					
8	Initial	10:47 AM	15	0	3550	0	11300	19.46	20.65	7.66	8.13
	Final	11:02 AM	**127**	3550		11300					
9	Initial	11:03 AM	15	0	3500	0	11100	19.19	20.28	7.55	7.99
	Final	11:18 AM	**143**	3500		11100					
10	Initial	11:19 AM	15	0	3400	0	11000	18.64	20.10	7.34	7.91
	Final	11:34 AM	**159**	3400		11000					
11	Initial	11:35 AM	15	0	3500	0	10900	19.19	19.92	7.55	7.84
	Final	11:50 AM	**174**	3500		10900					
12	Initial	11:51 AM	15	0	3400	0	10800	18.64	19.74	7.34	7.77
	Final	12:06 PM	**190**	3400		10800					
13	Initial	12:07 PM	15	0	3400	0	10700	18.64	19.55	7.34	7.70
	Final	12:22 PM	**206**	3400		10700					
14	Initial	12:23 PM	15	0	3300	0	10600	18.09	19.37	7.12	7.63
	Final	12:38 PM	**222**	3300		10600					
15	Initial	12:39 PM	15	0	3300	0	10500	18.09	19.19	7.12	7.55
	Final	12:54 PM	**238**	3300		10500					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-5

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	12:55 PM	15	0	3200	0	10400	17.54	19.00	6.91	7.48
	Final	1:10 PM	**254**	3200		10400					
17	Initial	1:11 PM	15	0	3100	0	10200	16.99	18.64	6.69	7.34
	Final	1:26 PM	**270**	3100		10200					
18	Initial	1:27 PM	15	0	3050	0	10100	16.72	18.46	6.58	7.27
	Final	1:42 PM	**286**	3050		10100					
19	Initial	1:43 PM	15	0	3050	0	10000	16.72	18.27	6.58	7.19
	Final	1:58 PM	**302**	3050		10000					
20	Initial	1:59 PM	15	0	3050	0	10000	16.72	18.27	6.58	7.19
	Final	2:14 PM	**318**	3050		10000					
21	Initial	2:15 PM	15	0	3000	0	9900	16.45	18.09	6.48	7.12
	Final	2:30 PM	**333**	3000		9900					
22	Initial	2:31 PM	15	0	3000	0	9900	16.45	18.09	6.48	7.12
	Final	2:46 PM	**349**	3000		9900					
23	Initial	2:47 PM	15	0	3000	0	9900	16.45	18.09	6.48	7.12
	Final	3:02 PM	**365**	3000		9900					
24	Initial	3:03 PM	15	0	3000	0	9900	16.45	18.09	6.48	7.12
	Final	3:18 PM	**381**	3000		9900					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-6

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	7:32 AM	15	0	2200	0	8100	12.06	14.80	4.75	5.83
	Final	7:47 AM	**15**	2200		8100					
2	Initial	7:58 AM	15	0	2100	0	8000	11.51	14.62	4.53	5.76
	Final	8:13 AM	**41**	2100		8000					
3	Initial	8:14 AM	15	0	2050	0	7900	11.24	14.44	4.42	5.68
	Final	8:29 AM	**57**	2050		7900					
4	Initial	8:30 AM	15	0	2100	0	7800	11.51	14.25	4.53	5.61
	Final	8:45 AM	**73**	2100		7800					
5	Initial	8:46 AM	15	0	2000	0	7600	10.96	13.89	4.32	5.47
	Final	9:01 AM	**89**	2000		7600					
6	Initial	9:02 AM	15	0	1900	0	7600	10.42	13.89	4.10	5.47
	Final	9:17 AM	**105**	1900		7600					
7	Initial	9:18 AM	15	0	1900	0	7500	10.42	13.71	4.10	5.40
	Final	9:33 AM	**121**	1900		7500					
8	Initial	9:34 AM	15	0	1850	0	7400	10.14	13.52	3.99	5.32
	Final	9:49 AM	**137**	1850		7400					
9	Initial	9:50 AM	15	0	1800	0	7300	9.87	13.34	3.89	5.25
	Final	10:05 AM	**153**	1800		7300					
10	Initial	10:06 AM	15	0	1850	0	7400	10.14	13.52	3.99	5.32
	Final	10:21 AM	**169**	1850		7400					
11	Initial	10:22 AM	15	0	1800	0	7300	9.87	13.34	3.89	5.25
	Final	10:37 AM	**184**	1800		7300					
12	Initial	10:38 AM	15	0	1750	0	7300	9.59	13.34	3.78	5.25
	Final	10:53 AM	**200**	1750		7300					
13	Initial	10:54 AM	15	0	1750	0	7200	9.59	13.16	3.78	5.18
	Final	11:09 AM	**216**	1750		7200					
14	Initial	11:10 AM	15	0	1700	0	7200	9.32	13.16	3.67	5.18
	Final	11:25 AM	**232**	1700		7200					
15	Initial	11:26 AM	15	0	1650	0	7200	9.05	13.16	3.56	5.18
	Final	11:41 AM	**248**	1650		7200					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-6

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
16	Initial	11:42 AM	15	0	1600	0	7100	8.77	12.97	3.45	5.11
	Final	11:57 AM	**264**	1600		7100					
17	Initial	11:58 AM	15	0	1600	0	7100	8.77	12.97	3.45	5.11
	Final	12:13 PM	**280**	1600		7100					
18	Initial	12:14 PM	15	0	1550	0	7100	8.50	12.97	3.35	5.11
	Final	12:29 PM	**296**	1550		7100					
19	Initial	12:30 PM	15	0	1500	0	7000	8.22	12.79	3.24	5.04
	Final	12:45 PM	**312**	1500		7000					
20	Initial	12:46 PM	15	0	1550	0	7000	8.50	12.79	3.35	5.04
	Final	1:01 PM	**328**	1550		7000					
21	Initial	1:02 PM	15	0	1550	0	6900	8.50	12.61	3.35	4.96
	Final	1:17 PM	**343**	1550		6900					
22	Initial	1:18 PM	15	0	1500	0	6900	8.22	12.61	3.24	4.96
	Final	1:33 PM	**359**	1500		6900					
23	Initial	1:34 PM	15	0	1500	0	6900	8.22	12.61	3.24	4.96
	Final	1:49 PM	**375**	1500		6900					
24	Initial	1:50 PM	15	0	1500	0	6900	8.22	12.61	3.24	4.96
	Final	2:05 PM	**391**	1500		6900					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-7

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	8:09 AM	15	0	2850	0	8800	15.62	16.08	6.15	6.33
	Final	8:24 AM	**15**	2850		8800					
2	Initial	8:25 AM	15	0	2800	0	8600	15.35	15.72	6.04	6.19
	Final	8:40 AM	**31**	2800		8600					
3	Initial	8:41 AM	15	0	2700	0	8500	14.80	15.53	5.83	6.12
	Final	8:56 AM	**47**	2700		8500					
4	Initial	8:57 AM	15	0	2650	0	8300	14.53	15.17	5.72	5.97
	Final	9:12 AM	**63**	2650		8300					
5	Initial	9:13 AM	15	0	2600	0	8200	14.25	14.98	5.61	5.90
	Final	9:28 AM	**79**	2600		8200					
6	Initial	9:29 AM	15	0	2650	0	8100	14.53	14.80	5.72	5.83
	Final	9:44 AM	**95**	2650		8100					
7	Initial	9:45 AM	15	0	2500	0	8000	13.71	14.62	5.40	5.76
	Final	10:00 AM	**111**	2500		8000					
8	Initial	10:01 AM	15	0	2550	0	7800	13.98	14.25	5.50	5.61
	Final	10:16 AM	**127**	2550		7800					
9	Initial	10:17 AM	15	0	2500	0	7800	13.71	14.25	5.40	5.61
	Final	10:32 AM	**143**	2500		7800					
10	Initial	10:33 AM	15	0	2400	0	7700	13.16	14.07	5.18	5.54
	Final	10:48 AM	**159**	2400		7700					
11	Initial	10:49 AM	15	0	2450	0	7500	13.43	13.71	5.29	5.40
	Final	11:04 AM	**174**	2450		7500					
12	Initial	11:05 AM	15	0	2400	0	7400	13.16	13.52	5.18	5.32
	Final	11:20 AM	**190**	2400		7400					
13	Initial	11:21 AM	15	0	2400	0	7300	13.16	13.34	5.18	5.25
	Final	11:36 AM	**206**	2400		7300					
14	Initial	11:37 AM	15	0	2350	0	7100	12.88	12.97	5.07	5.11
	Final	11:52 AM	**222**	2350		7100					
15	Initial	11:53 AM	15	0	2300	0	7200	12.61	13.16	4.96	5.18
	Final	12:08 PM	**238**	2300		7200					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-7

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
16	Initial	12:09 PM	15	0	2250	0	7100	12.33	12.97	4.86	5.11
	Final	12:24 PM	**254**	2250		7100					
17	Initial	12:25 PM	15	0	2300	0	7100	12.61	12.97	4.96	5.11
	Final	12:40 PM	**270**	2300		7100					
18	Initial	12:41 PM	15	0	2250	0	7100	12.33	12.97	4.86	5.11
	Final	12:56 PM	**286**	2250		7100					
19	Initial	12:57 PM	15	0	2150	0	7000	11.79	12.79	4.64	5.04
	Final	1:12 PM	**302**	2150		7000					
20	Initial	1:13 PM	15	0	2150	0	7000	11.79	12.79	4.64	5.04
	Final	1:28 PM	**318**	2150		7000					
21	Initial	1:29 PM	15	0	2100	0	7100	11.51	12.97	4.53	5.11
	Final	1:44 PM	**333**	2100		7100					
22	Initial	1:45 PM	15	0	2100	0	7000	11.51	12.79	4.53	5.04
	Final	2:00 PM	**349**	2100		7000					
23	Initial	2:01 PM	15	0	2100	0	7000	11.51	12.79	4.53	5.04
	Final	2:16 PM	**365**	2100		7000					
24	Initial	2:17 PM	15	0	2100	0	7000	11.51	12.79	4.53	5.04
	Final	2:32 PM	**381**	2100		7000					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-8

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	10:21 AM	15	0	2450	0	7500	13.43	13.71	5.29	5.40
	Final	10:36 AM	**15**	2450		7500					
2	Initial	10:37 AM	15	0	2400	0	7300	13.16	13.34	5.18	5.25
	Final	10:52 AM	**31**	2400		7300					
3	Initial	10:53 AM	15	0	2300	0	7100	12.61	12.97	4.96	5.11
	Final	11:08 AM	**47**	2300		7100					
4	Initial	11:09 AM	15	0	2250	0	7200	12.33	13.16	4.86	5.18
	Final	11:24 AM	**63**	2250		7200					
5	Initial	11:25 AM	15	0	2200	0	7100	12.06	12.97	4.75	5.11
	Final	11:40 AM	**79**	2200		7100					
6	Initial	11:41 AM	15	0	2250	0	7000	12.33	12.79	4.86	5.04
	Final	11:56 AM	**95**	2250		7000					
7	Initial	11:57 AM	15	0	2100	0	6900	11.51	12.61	4.53	4.96
	Final	12:12 PM	**111**	2100		6900					
8	Initial	12:13 PM	15	0	2000	0	6700	10.96	12.24	4.32	4.82
	Final	12:28 PM	**127**	2000		6700					
9	Initial	12:29 PM	15	0	1950	0	6500	10.69	11.88	4.21	4.68
	Final	12:44 PM	**143**	1950		6500					
10	Initial	12:45 PM	15	0	1850	0	6600	10.14	12.06	3.99	4.75
	Final	1:00 PM	**159**	1850		6600					
11	Initial	1:01 PM	15	0	1950	0	6400	10.69	11.70	4.21	4.60
	Final	1:16 PM	**174**	1950		6400					
12	Initial	1:17 PM	15	0	1900	0	6300	10.42	11.51	4.10	4.53
	Final	1:32 PM	**190**	1900		6300					
13	Initial	1:33 PM	15	0	1800	0	6200	9.87	11.33	3.89	4.46
	Final	1:48 PM	**206**	1800		6200					
14	Initial	1:49 PM	15	0	1800	0	6300	9.87	11.51	3.89	4.53
	Final	2:04 PM	**222**	1800		6300					
15	Initial	2:05 PM	15	0	1750	0	6200	9.59	11.33	3.78	4.46
	Final	2:20 PM	**238**	1750		6200					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-8

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	2:21 PM	15	0	1750	0	6100	9.59	11.15	3.78	4.39
	Final	2:36 PM	**254**	1750		6100					
17	Initial	2:37 PM	15	0	1700	0	6100	9.32	11.15	3.67	4.39
	Final	2:52 PM	**270**	1700		6100					
18	Initial	2:53 PM	15	0	1750	0	6000	9.59	10.96	3.78	4.32
	Final	3:08 PM	**286**	1750		6000					
19	Initial	3:09 PM	15	0	1750	0	5900	9.59	10.78	3.78	4.24
	Final	3:24 PM	**302**	1750		5900					
20	Initial	3:25 PM	15	0	1700	0	6000	9.32	10.96	3.67	4.32
	Final	3:40 PM	**318**	1700		6000					
21	Initial	3:41 PM	15	0	1700	0	6000	9.32	10.96	3.67	4.32
	Final	3:56 PM	**333**	1700		6000					
22	Initial	3:57 PM	15	0	1700	0	5900	9.32	10.78	3.67	4.24
	Final	4:12 PM	**349**	1700		5900					
23	Initial	4:13 PM	15	0	1700	0	5900	9.32	10.78	3.67	4.24
	Final	4:28 PM	**365**	1700		5900					
24	Initial	4:29 PM	15	0	1700	0	5900	9.32	10.78	3.67	4.24
	Final	4:44 PM	**381**	1700		5900					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-9

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	9:38 AM	15	0	2750	0	8800	15.08	16.08	5.94	6.33
	Final	9:53 AM	**15**	2750		8800					
2	Initial	9:54 AM	15	0	2700	0	8500	14.80	15.53	5.83	6.12
	Final	10:09 AM	**31**	2700		8500					
3	Initial	10:10 AM	15	0	2650	0	8400	14.53	15.35	5.72	6.04
	Final	10:25 AM	**47**	2650		8400					
4	Initial	10:26 AM	15	0	2500	0	8200	13.71	14.98	5.40	5.90
	Final	10:41 AM	**63**	2500		8200					
5	Initial	10:42 AM	15	0	2450	0	8000	13.43	14.62	5.29	5.76
	Final	10:57 AM	**79**	2450		8000					
6	Initial	10:58 AM	15	0	2400	0	7900	13.16	14.44	5.18	5.68
	Final	11:13 AM	**95**	2400		7900					
7	Initial	11:14 AM	15	0	2300	0	7800	12.61	14.25	4.96	5.61
	Final	11:29 AM	**111**	2300		7800					
8	Initial	11:30 AM	15	0	2200	0	7900	12.06	14.44	4.75	5.68
	Final	11:45 AM	**127**	2200		7900					
9	Initial	11:46 AM	15	0	2100	0	7800	11.51	14.25	4.53	5.61
	Final	12:01 PM	**143**	2100		7800					
10	Initial	12:02 PM	15	0	2050	0	7500	11.24	13.71	4.42	5.40
	Final	12:17 PM	**159**	2050		7500					
11	Initial	12:18 PM	15	0	2000	0	7400	10.96	13.52	4.32	5.32
	Final	12:33 PM	**174**	2000		7400					
12	Initial	12:34 PM	15	0	2050	0	7300	11.24	13.34	4.42	5.25
	Final	12:49 PM	**190**	2050		7300					
13	Initial	12:50 PM	15	0	2000	0	7200	10.96	13.16	4.32	5.18
	Final	1:05 PM	**206**	2000		7200					
14	Initial	1:06 PM	15	0	1900	0	7300	10.42	13.34	4.10	5.25
	Final	1:21 PM	**222**	1900		7300					
15	Initial	1:22 PM	15	0	1850	0	7200	10.14	13.16	3.99	5.18
	Final	1:37 PM	**238**	1850		7200					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-9

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	1:38 PM	15	0	1750	0	7100	9.59	12.97	3.78	5.11
	Final	1:53 PM	**254**	1750		7100					
17	Initial	1:54 PM	15	0	1800	0	7200	9.87	13.16	3.89	5.18
	Final	2:09 PM	**270**	1800		7200					
18	Initial	2:10 PM	15	0	1700	0	7100	9.32	12.97	3.67	5.11
	Final	2:25 PM	**286**	1700		7100					
19	Initial	2:26 PM	15	0	1650	0	7000	9.05	12.79	3.56	5.04
	Final	2:41 PM	**302**	1650		7000					
20	Initial	2:42 PM	15	0	1600	0	7000	8.77	12.79	3.45	5.04
	Final	2:57 PM	**318**	1600		7000					
21	Initial	2:58 PM	15	0	1600	0	6900	8.77	12.61	3.45	4.96
	Final	3:13 PM	**333**	1600		6900					
22	Initial	3:14 PM	15	0	1550	0	6800	8.50	12.43	3.35	4.89
	Final	3:29 PM	**349**	1550		6800					
23	Initial	3:30 PM	15	0	1550	0	6800	8.50	12.43	3.35	4.89
	Final	3:45 PM	**365**	1550		6800					
24	Initial	3:46 PM	15	0	1550	0	6800	8.50	12.43	3.35	4.89
	Final	4:01 PM	**381**	1550		6800					

INFILTRATION CALCULATIONS

Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-10

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	7:23 AM	15	0	3950	0	12000	21.65	21.93	8.53	8.63
	Final	7:38 AM	**15**	3950		12000					
2	Initial	7:40 AM	15	0	3900	0	12000	21.38	21.93	8.42	8.63
	Final	7:55 AM	**32**	3900		12000					
3	Initial	7:56 AM	15	0	3950	0	11900	21.65	21.75	8.53	8.56
	Final	8:11 AM	**48**	3950		11900					
4	Initial	8:12 AM	15	0	3900	0	11900	21.38	21.75	8.42	8.56
	Final	8:27 AM	**64**	3900		11900					
5	Initial	8:28 AM	15	0	3850	0	11900	21.11	21.75	8.31	8.56
	Final	8:43 AM	**80**	3850		11900					
6	Initial	8:44 AM	15	0	3800	0	11800	20.83	21.56	8.20	8.49
	Final	8:59 AM	**96**	3800		11800					
7	Initial	9:00 AM	15	0	3700	0	11800	20.28	21.56	7.99	8.49
	Final	9:15 AM	**112**	3700		11800					
8	Initial	9:16 AM	15	0	3650	0	11700	20.01	21.38	7.88	8.42
	Final	9:31 AM	**128**	3650		11700					
9	Initial	9:32 AM	15	0	3600	0	11600	19.74	21.20	7.77	8.35
	Final	9:47 AM	**144**	3600		11600					
10	Initial	9:48 AM	15	0	3550	0	11700	19.46	21.38	7.66	8.42
	Final	10:03 AM	**160**	3550		11700					
11	Initial	10:04 AM	15	0	3500	0	11600	19.19	21.20	7.55	8.35
	Final	10:19 AM	**175**	3500		11600					
12	Initial	10:20 AM	15	0	3450	0	11500	18.91	21.02	7.45	8.27
	Final	10:35 AM	**191**	3450		11500					
13	Initial	10:36 AM	15	0	3500	0	11500	19.19	21.02	7.55	8.27
	Final	10:51 AM	**207**	3500		11500					
14	Initial	10:52 AM	15	0	3450	0	11400	18.91	20.83	7.45	8.20
	Final	11:07 AM	**223**	3450		11400					
15	Initial	11:08 AM	15	0	3450	0	11300	18.91	20.65	7.45	8.13
	Final	11:23 AM	**239**	3450		11300					

INFILTRATION CALCULATIONS

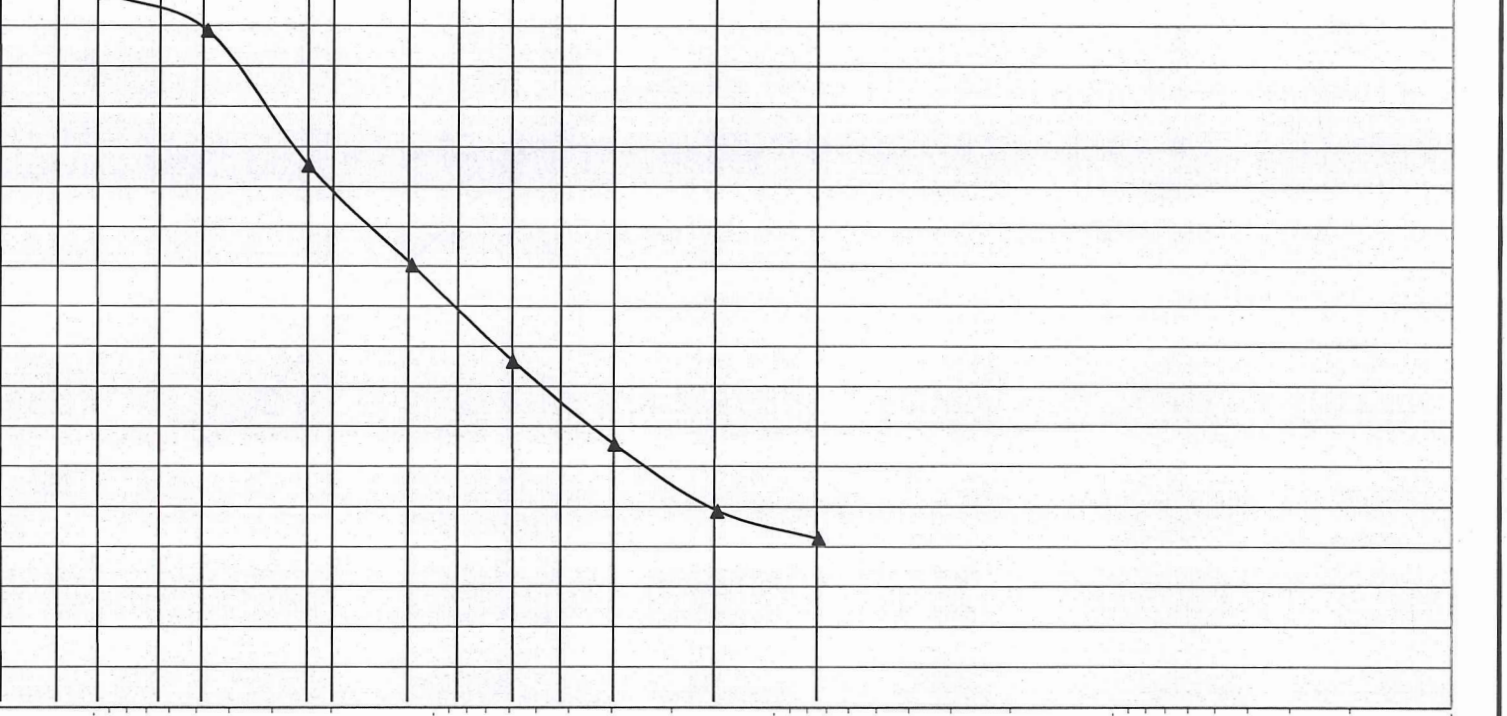
Project Name	Proposed Mixed-Use Development
Project Location	Highland, California
Project Number	20G205-2
Engineer	Caleb Brackett

Infiltration Test No: I-10

Constants			
	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
16	Initial	11:24 AM	15	0	3400	0	11200	18.64	20.47	7.34	8.06
	Final	11:39 AM	**255**	3400		11200					
17	Initial	11:40 AM	15	0	3350	0	11000	18.37	20.10	7.23	7.91
	Final	11:55 AM	**271**	3350		11000					
18	Initial	11:56 AM	15	0	3350	0	10900	18.37	19.92	7.23	7.84
	Final	12:11 PM	**287**	3350		10900					
19	Initial	12:12 PM	15	0	3300	0	10800	18.09	19.74	7.12	7.77
	Final	12:27 PM	**303**	3300		10800					
20	Initial	12:28 PM	15	0	3300	0	11700	18.09	21.38	7.12	8.42
	Final	12:43 PM	**319**	3300		11700					
21	Initial	12:44 PM	15	0	3200	0	11700	17.54	21.38	6.91	8.42
	Final	12:59 PM	**334**	3200		11700					
22	Initial	1:00 PM	15	0	3100	0	11700	16.99	21.38	6.69	8.42
	Final	1:15 PM	**350**	3100		11700					
23	Initial	1:16 PM	15	0	3100	0	11700	16.99	21.38	6.69	8.42
	Final	1:31 PM	**366**	3100		11700					
24	Initial	1:32 PM	15	0	3100	0	11700	16.99	21.38	6.69	8.42
	Final	1:47 PM	**382**	3100		11700					



Fine Gravel	Crs. Sand	Med. Sand	Fine Sand	Fines (Silt and Clay)

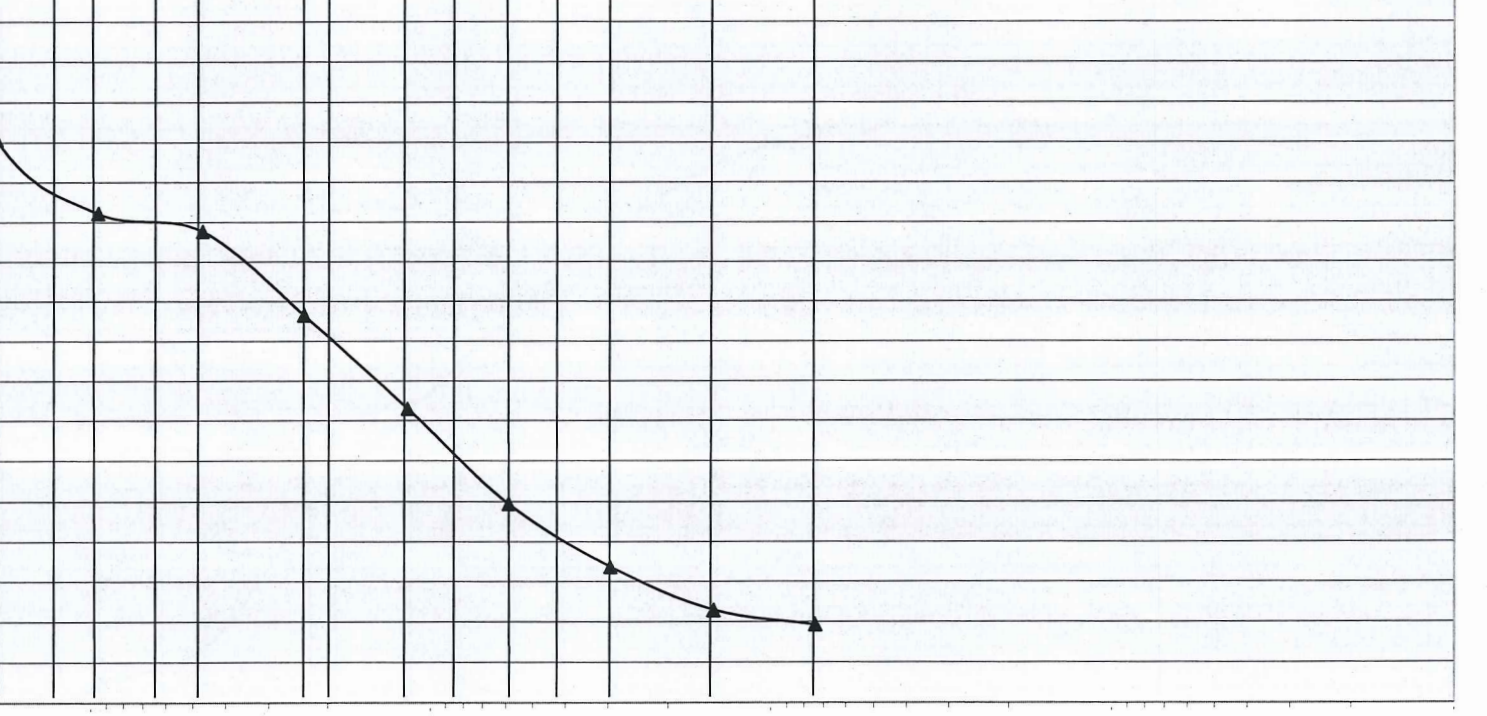
	I-1 @ 7'
	Brown Silty fine to coarse Sand, little fine to coarse Gravel

nent

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

A California Corporation



Fine Gravel	Crs. Sand	Med. Sand	Fine Sand	Fines (Silt and Clay)

	I-2 @ 7'
	Brown Gravelly fine to coarse Sand, trace to little Silt

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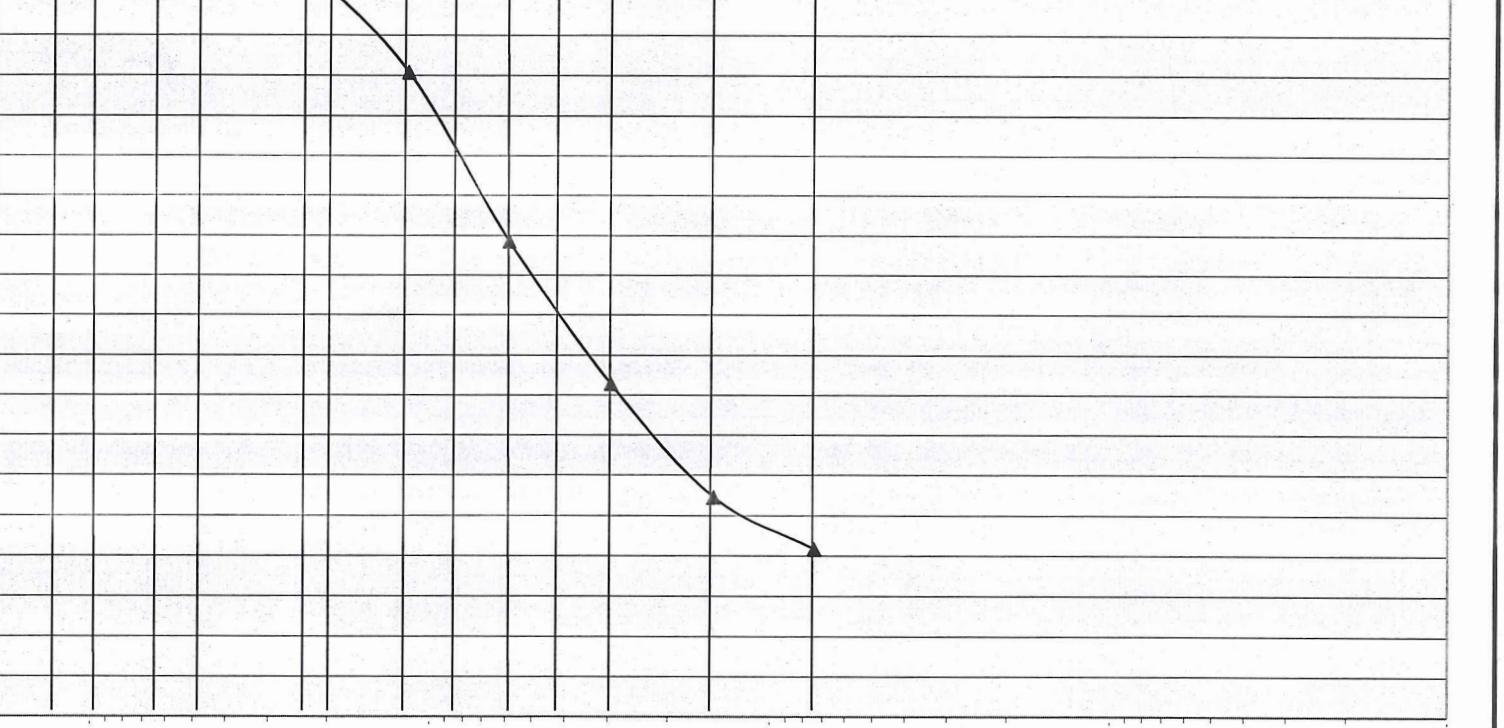
SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

A California Corporation



Fine Gravel	Crs. Sand	Med. Sand	Fine Sand	Fines (Silt and Clay)

	I-3 @ 7'
	Light Brown Silty fine to coarse Sand

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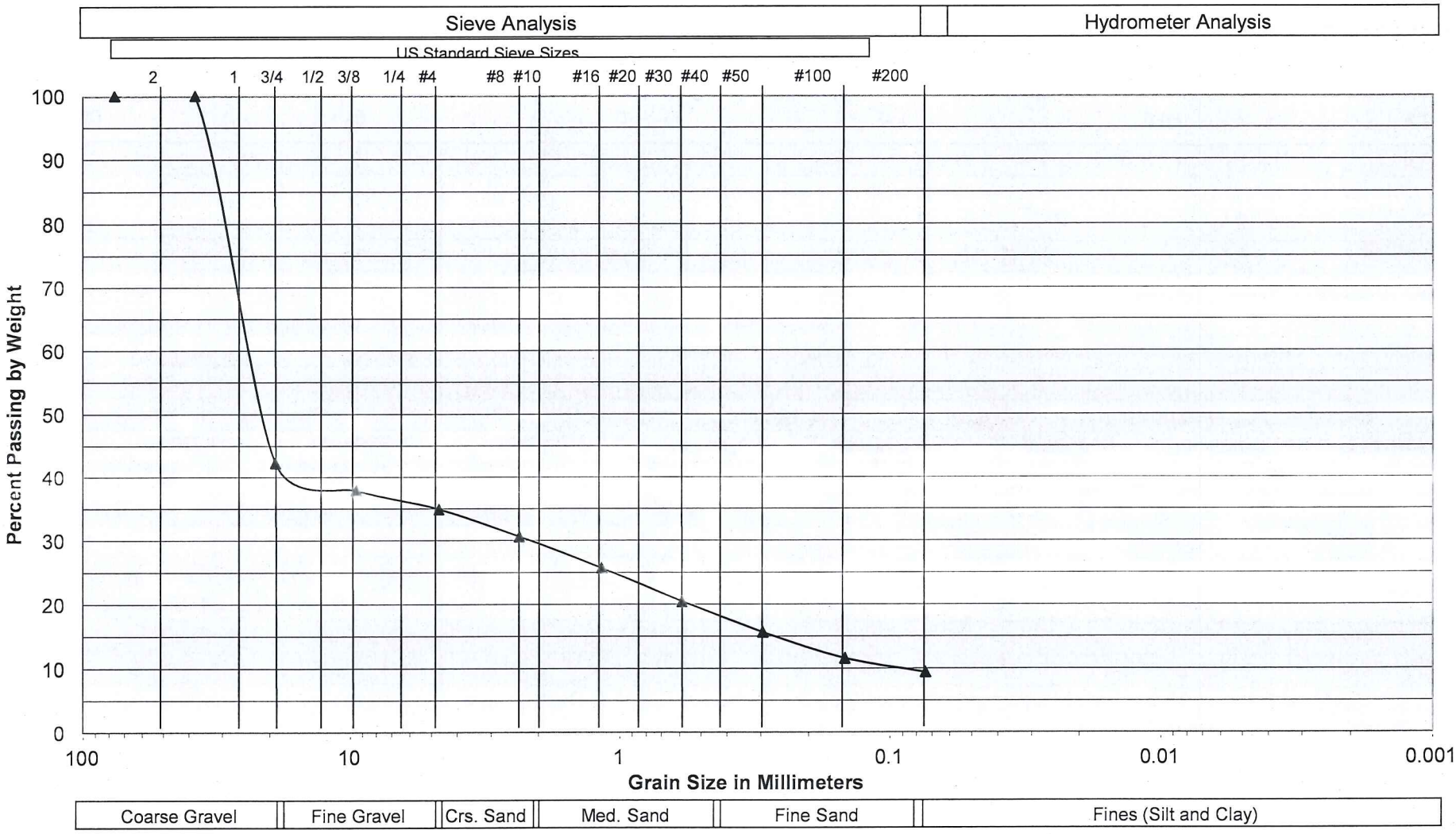
SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

A California Corporation

Grain Size Distribution



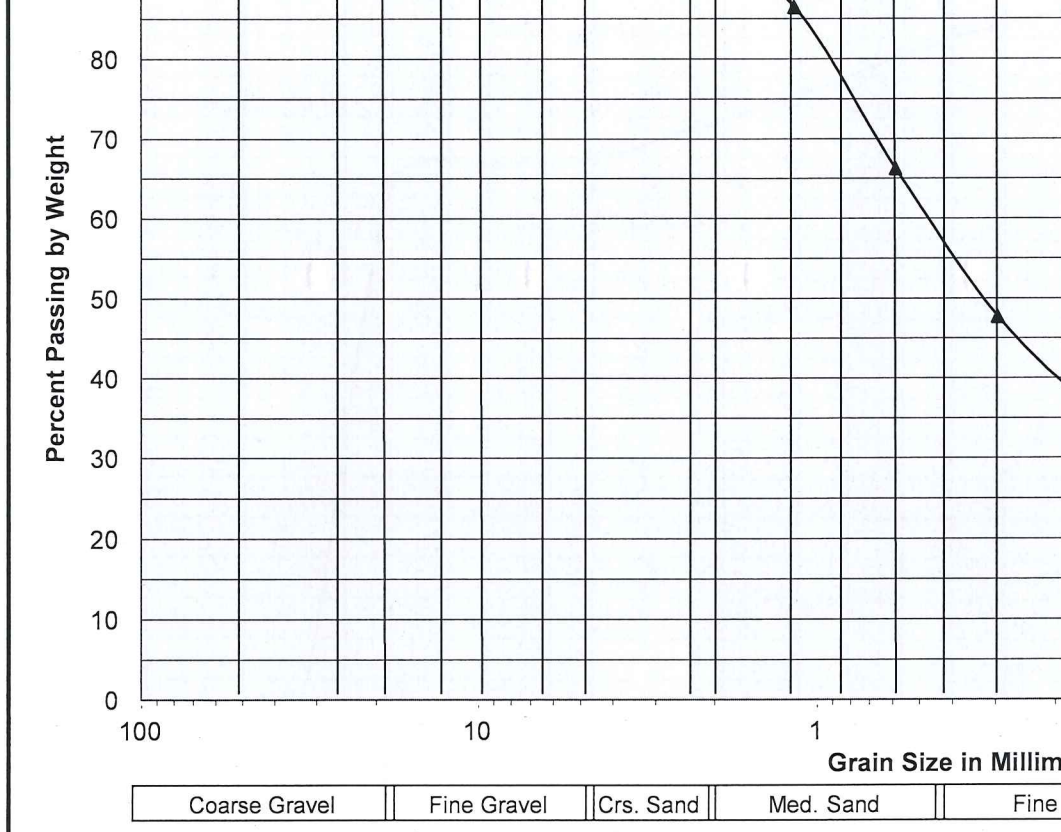
Sample Description	I-4 @ 7'
Soil Classification	Light Brown fine to coarse Sandy Gravel, trace Silt

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Sample Description	I-5 @ 7'
Soil Classification	Light Brown fine to coarse Sandy Gravel

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C



Sample Description	I-6 @ 7'
Soil Classification	Light Brown Silty fine to medium Sand, trace coa

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C- 6

Sample Description	I-7 @ 7'
Soil Classification	Light Brown Sandy fine to coarse Gravel, trace S

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C-

Sample Description	I-8 @ 8'
Soil Classification	Light Brown Gravelly fine to coarse Sand, trace S

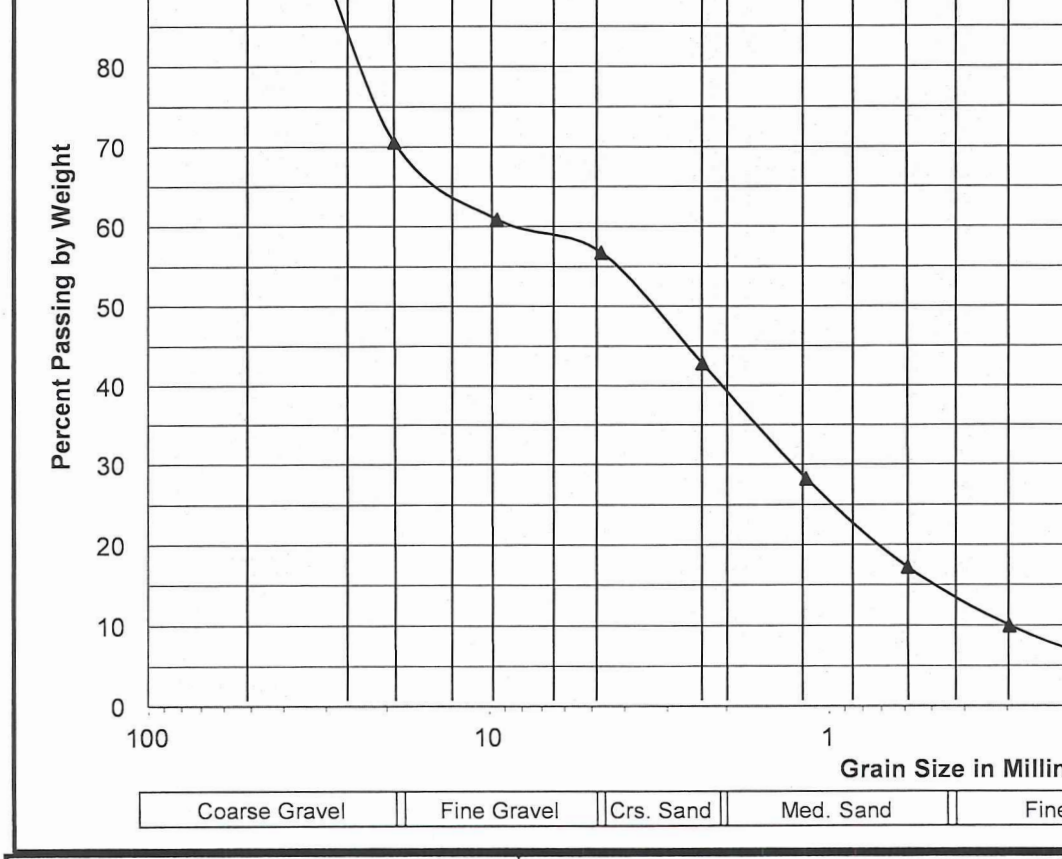
Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C- 8

Sample Description	I-9 @ 8'
Soil Classification	Light Brown Gravelly fine to coarse Sand

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C-

Sample Description	I-10 @ 5'
Soil Classification	Brown Gravelly fine to coarse Sand, trace to little

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C- 10



Sample Description	I-10 @ 7'
Soil Classification	Light Brown Gravelly fine to coarse Sand, trace

Proposed Mixed Use Development
Highland, California
Project No. 20G205-2
PLATE C-1

6.4.G – Factor of Safety Calculation

Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.25
Combined Safety Factor, $S_{TOT} = S_A \times S_B$			2.8125 ~ 3.0		
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)			DMA A = 3.2 DMA B = 4.2 DMA C = 3.7 DMA D = 3.4 DMA E = 6.5		
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} / K_M$			DMA A = 1.07 DMA B = 1.40 DMA C = 1.23 DMA D = 1.13 DMA E = 2.17		

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

***Per the provided Infiltration Testing Report found in Section 6.4.F of this report. Tests I-1 throough and I-10 were conducted throughout the site in locations of proposed infiltration systems. The maximum infiltration rate (design infiltration rate) that will be used for determining site infiltration BMPs will be 2.4 inches/hour per CASQA TC-11 "Limitations" since water is not fully treated prior to infiltration.**

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

VII.4.1. Site Suitability Considerations

Suitability assessment related considerations include (Table VII.3):

- Soil assessment methods – the site assessment extent (e.g., number of borings, test pits, etc.) and the measurement method used to estimate the short-term infiltration rate.
- Predominant soil texture/percent fines – soil texture and the percent of fines can greatly influence the potential for clogging.
- Site soil variability – site with spatially heterogeneous soils (vertically or horizontally) as determined from site investigations are more difficult to estimate average properties for resulting in a higher level of uncertainty associated with initial estimates.
- Depth to seasonal high groundwater/impervious layer – groundwater mounding may become an issue during excessively wet conditions where shallow aquifers or shallow clay lenses are present.

Table VII.3: Suitability Assessment Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern	Medium Concern	Low Concern
Assessment methods (see explanation below)	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates	Direct measurement of ≥ 20 percent of infiltration area with localized infiltration measurement methods (e.g., infiltrometer)	Direct measurement of ≥ 50 percent of infiltration area with localized infiltration measurement methods or Use of extensive test pit infiltration measurement methods
Texture Class	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site soil variability	Highly variable soils indicated from site assessment or limited soil borings collected during site assessment	Soil borings/test pits indicate moderately homogeneous soils	Multiple soil borings/test pits indicate relatively homogeneous soils
Depth to groundwater/ impervious layer	<5 ft below facility bottom	5-10 ft below facility bottom	>10 below facility bottom

Localized infiltration testing refers to methods such as the double ring infiltrometer test (ASTM D3385-88) which measure infiltration rates over an area less than 10 sq-ft, may include lateral

Table VII.4: Design Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern	Medium Concern	Low Concern
Tributary area size	Greater than 10 acres.	Greater than 2 acres but less than 10 acres.	2 acres or less.
Level of pretreatment/ expected influent sediment loads	Pretreatment from gross solids removal devices only, such as hydrodynamic separators, racks and screens AND tributary area includes landscaped areas, steep slopes, high traffic areas, or any other areas expected to produce high sediment, trash, or debris loads.	Good pretreatment with BMPs that mitigate coarse sediments such as vegetated swales AND influent sediment loads from the tributary area are expected to be relatively low (e.g., low traffic, mild slopes, disconnected impervious areas, etc.).	Excellent pretreatment with BMPs that mitigate fine sediments such as bioretention or media filtration OR sedimentation or facility only treats runoff from relatively clean surfaces, such as rooftops.
Redundancy of treatment	No redundancy in BMP treatment train.	Medium redundancy, other BMPs available in treatment train to maintain at least 50% of function of facility in event of failure.	High redundancy, multiple components capable of operating independently and in parallel, maintaining at least 90% of facility functionality in event of failure.
Compaction during construction	Construction of facility on a compacted site or elevated probability of unintended/ indirect compaction.	Medium probability of unintended/ indirect compaction.	Heavy equipment actively prohibited from infiltration areas during construction and low probability of unintended/ indirect compaction.

IN THE CITY OF HIGHLAND, CALIFORNIA
PRELIMINARY WATER QUALITY MANAGEMENT PLAN
TRACTOR SUPPLY CO. - HIGHLAND

IN THE CITY OF HIGHLAND, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

SITETECH, INC. APRIL 2021

AREA OF PROPOSED WQMP:

TOTAL AREA (GROSS WQMP)	400,040 S.F. (9.18 ACRES)
EXISTING IMPERVIOUS AREA	6,153 S.F. (0.14 ACRES)
EXISTING PERVIOUS AREA	386,850 S.F. (8.88 ACRES)
PROPOSED IMPERVIOUS AREA	322,895 S.F. (7.41 ACRES)
PROPOSED PERVIOUS AREA	77,145 S.F. (1.77 ACRES)

OWNER/APPLICANT:

WOODCREST PROPERTIES
1410 MAIN STREET, SUITE C
RAMONA, CA 92065
CONTACT: WADE WYLIE
PH: (760) 789-5493

ENGINEER/MAP PREPARER:

SITETECH, INC.
8061 CHURCH STREET
P.O. BOX 592
HIGHLAND, CA 92346
CONTACT: BERNIE MAYER
PH: (909) 864-3180

NOTE: [1]-[5]
BASIN ROUTING CALCULATIONS WILL BE PROVIDED DURING FINAL ENGINEERING TO VERIFY RELEASED STORM FLOWS IN PROPOSED CONDITION WILL BE EQUAL OR LESS THAN THE EXISTING CONDITION FOR A 100-YEAR STORM EVENT. IN EVENT OF ADDITIONAL CAPTURE/TREATMENT NEEDED DUE TO FINAL ENGINEERING ANALYSIS THE SIZE OF BMPs, INCLUDING, BUT NOT LIMITED TO CATCH BASINS, UNDERGROUND STORM DRAIN PIPE, UNDERGROUND CHAMBERS AND CDS UNIT WILL REFLECT FINAL ENGINEERING CALCULATIONS.

NOTE: [1]-[5]
UNDERGROUND INFILTRATION CHAMBERS TO BE REGISTERED WITH THE ENVIRONMENTAL PROTECTION AGENCY (EPA), DURING FINAL ENGINEERING AND PRIOR TO APPROVAL OF FINAL WQMP.

NOTE:
HYDRAULIC CALCULATIONS WILL BE PROVIDED DEMONSTRATING THE CAPACITIES OF CATCH BASINS AND STORM DRAIN CAPACITIES CAN HANDLE LOW FLOW STORM WATER RUNOFF DURING FINAL ENGINEERING AND PRIOR TO APPROVAL OF FINAL WQMP.

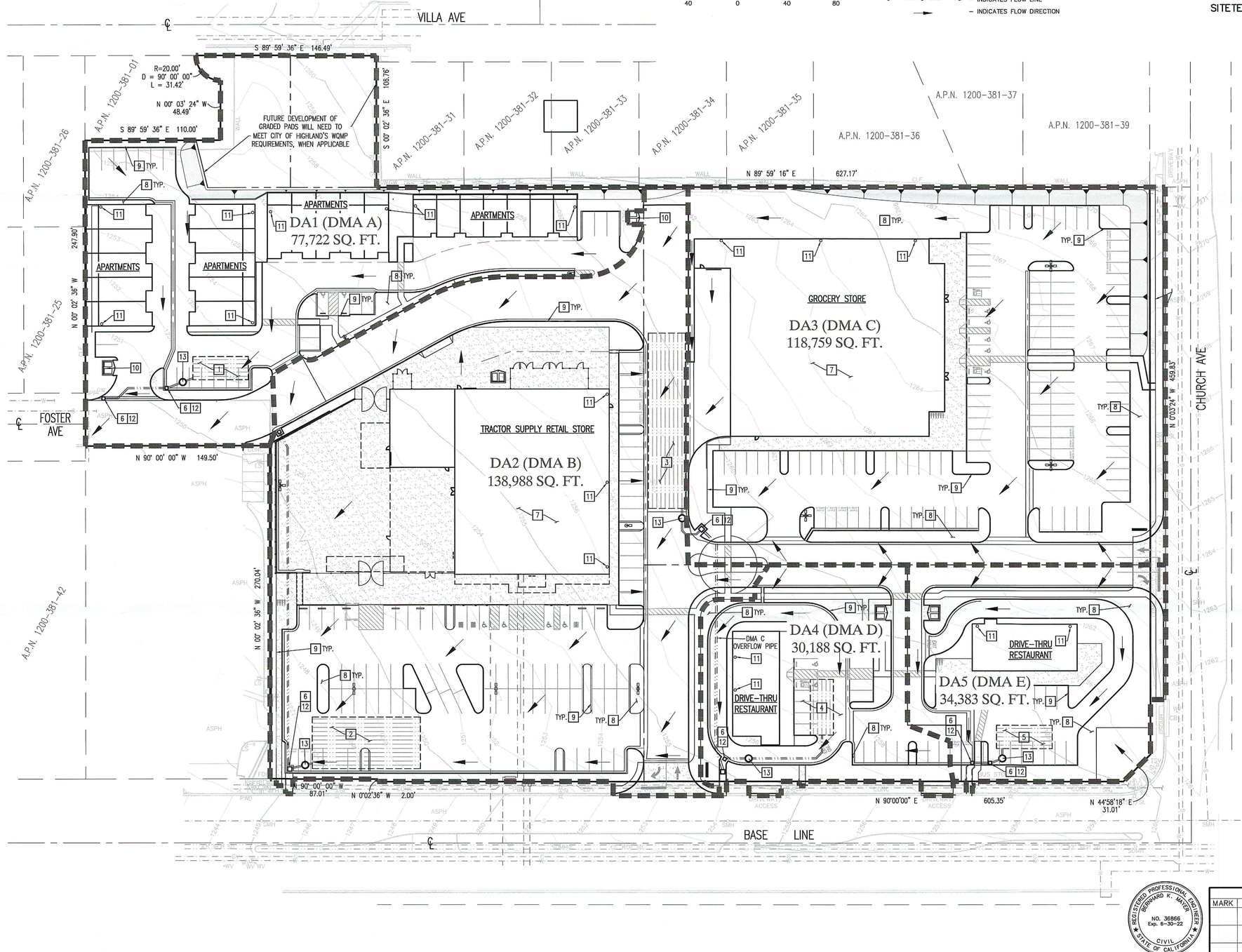
N

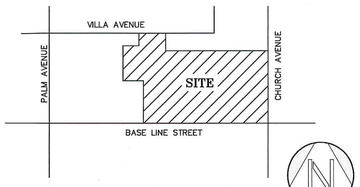
SCALE: 1"=40'

40 0 40 80

LEGEND:

- INDICATES EXISTING CONTOUR
- INDICATES STREET CENTERLINE
- INDICATES CURB LINE
- INDICATES BOUNDARY LINE
- INDICATES CONCRETE PAVEMENT
- INDICATES INFILTRATION BASIN BOTTOM
- INDICATES EXISTING CHAIN LINK FENCE
- INDICATES DRAINAGE AREA LIMITS
- INDICATES FLOW LINE
- INDICATES FLOW DIRECTION





VICINITY MAP
NO SCALE

STRUCTURAL WATER QUALITY MANAGMENT DEVICES:

1. INSTALL 4,517 C.F. STORMTECH MC-4500 INFILTRATION CHAMBERS, DA1 (4,412 C.F. REQUIRED).
2. INSTALL 14,848 C.F. STORMTECH MC-4500 INFILTRATION CHAMBERS, DA2 (14,712 C.F. REQUIRED).
3. INSTALL 9,353 C.F. STORMTECH MC-4500 INFILTRATION CHAMBERS, DA3 (9,304 C.F. REQUIRED).
4. INSTALL 2,378 C.F. STORMTECH MC-4500 INFILTRATION CHAMBERS, DA4 (1,950 C.F. REQUIRED).
5. INSTALL 2,717 C.F. STORMTECH MC-4500 INFILTRATION CHAMBERS, DA5 (2,616 C.F. REQUIRED).
6. INSTALL "NO DUMPING – DRAINS TO RIVER" SIGN ON RISER FOR BASIN OVERFLOW OUTLET AND TOP OF CURB AT INLETS TO BASIN (S1).
7. PREPARE SPILL CONTAINMENT PLAN PER CASQA BMP SD-36 (S9).
8. INSTALL AND MAINTAIN IRRIGATION OF LANDSCAPED AREAS PER CASQA BMP SD-12 (S5).
9. GRADE AND INSTALL LANDSCAPE ADJACENT TO HARDSCAPE AT 1" MINIMUM SUMP (S5).
10. COVERED TRASH ENCLOSURE TO BE MAINTAINED PER CASQA BMP SD-32 (S3).
11. CONSTRUCT ROOF DRAIN DOWNSPOUTS TO OUTLET ONTO RIP-RAP/CONCRETE SPLASH PAD.
12. INSTALL FLO-GARD CATCH BASIN INSERT FILTER FOR PRE-TREATMENT, OR APPROVED EQUAL.
13. INSTALL HYDRODYNAMIC SEPARATOR UNIT (CDS) BY CONTECH MODEL NO. CDS2015-5-C, OR APPROVED EQUAL.

NON-STRUCTURAL WATER QUALITY MANAGMENT DEVICES:

- N1 – EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPS
- N2 – ACTIVITY RESTRICTIONS – OWNER/LEASE HOLDERS WILL COMPLY WITH ALL RESTRICTIONS PER THE FINAL CONDITIONS, COVENANTS AND RESTRICTIONS (CCRS). IN ADDITION, LEASE HOLDER WILL FOLLOW RESTRICTIONS PER LEASE AGREEMENT.
- N3 – LANDSCAPE MANAGEMENT BMPS
- N4 – BMP MAINTENANCE
- N5 – TITLE 22 CCR COMPLIANCE
- N6 – LOCAL WATER QUALITY ORDINANCES
- N7 – SPILL CONTINGENCY PLAN
- N10 – UNIFORM FIRE CODE IMPLEMENTATION
- N11 – LITTER/DEBRIS CONTROL PROGRAM
- N12 – EMPLOYEE TRAINING
- N14 – CATCH BASIN INSPECTION PROGRAM
- N15 – VACUUM SWEEPING OF PRIVATE PARKING LOT

GENERAL NOTES:

1. ASSESOR'S PARCEL NUMBER: 1200-381-43 & 05.
2. EXISTING ZONING IS M.U. (MIXED USE).
3. EXISTING AND PROPOSED LAND USE IS DESIGNATED M.U.
4. GENERAL PLAN DESIGNATION IS M.U. (MIXED USE).
5. THERE IS ONE TRACTOR SUPPLY RETAIL STORE, ONE GROCERY STORE, 22 APARTMENT UNITS AND TWO DRIVE THROUGH RESTAURANTS WITHIN THIS DEVELOPMENT, SHOWN ON THE EXHIBIT, WHICH CONTAINS APPROXIMATELY 9.02 ACRES.
6. THERE ARE NO NEW STREETS PROPOSED WITHIN THIS DEVELOPMENT.
7. THERE ARE NO EXISTING TREES BEING REMOVED AS PART OF THIS DEVELOPMENT.
8. THERE ARE NO EXISTING STRUCTURES BEING REMOVED AS PART OF THIS DEVELOPMENT.

SHEET 1 OF 1

REGISTERED PROFESSIONAL ENGINEER BERNARD K. MAYER NO. 36866 Exp. 6-30-22 CIVIL STATE OF CALIFORNIA

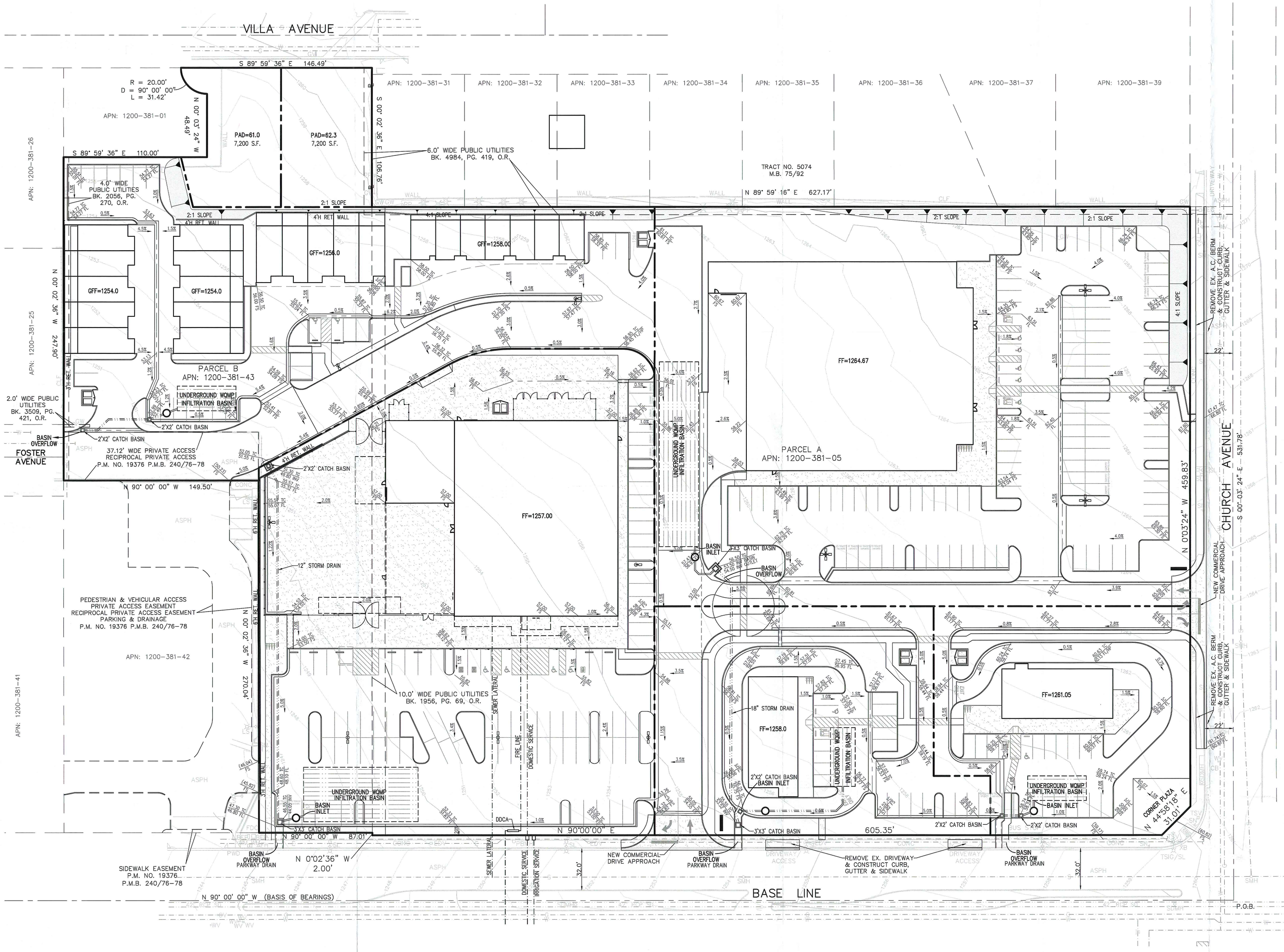
REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

SITETECH INC.

8061 CHURCH ST. HIGHLAND CA 92346 PO BOX 592
PH: (909) 864-3180, FAX: (909) 864-0850

APRIL 15, 2021

BERNHARD K. MAYER R.C.E. 36866 L.S. 7319 DATE



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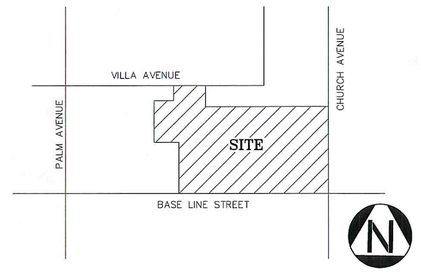

VICINITY MAP

LEGAL DESCRIPTION

FOR APN/PARCEL ID(S): 1200-381-05 AND 1200-381-43

PARCEL A:

ALL THAT PORTION OF THE SOUTHEAST 1/4 OF THE SOUTHWEST 1/4 OF SECTION 33, TOWNSHIP 1 NORTH, RANGE 3 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE CITY OF HIGHLAND, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF, DESCRIBED AS FOLLOWS:

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PARCEL B:

PARCEL 2 OF PARCEL MAP NO. 19376, IN THE CITY OF HIGHLAND, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER MAP FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, DECEMBER 17, 2012, IN BOOK 240, PAGES 76-78 OF PARCEL MAPS.

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CENTERLINE OF BASE LINE AS DEPICTED ON PARCEL MAP NO. 19376 FILED IN PARCEL MAP BOOK 240, PAGES 76-78, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

BEARING SHOWN AS N 90° 00' 00" W

LEGEND:

- INDICATES EXISTING CONTOUR
- INDICATES STREET CENTERLINE
- INDICATES ADJACENT PROPERTY LINE
- INDICATES PARCEL BOUNDARY
- INDICATES 3:1 MAX SLOPE FACE
- INDICATES FLOW LINE
- PAD=50.0 – INDICATES PAD ELEVATION
- F.F.=50.5 – INDICATES FINISH FLOOR ELEVATION
- TC – INDICATES TOP OF CURB
- FL – INDICATES FLOW LINE
- FS – INDICATES FINISH SURFACE
- FG – INDICATES FINISH GRADE
- TG – INDICATES TOP OF GRATE
- INV – INDICATES PIPE INVERT ELEVATION
- NG – INDICATES NATURAL GROUND

PLAN PREPARED UNDER THE SUPERVISION OF:

BERNHARD K. MAYER R.C.E. 36866 — 04/15/2021 DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — BERNHARD K. MAYER — NO. 36866 Exp. 6-30-22 — CIVIL — STATE OF CALIFORNIA

SITETECH INC.
8061 CHURCH ST. HIGHLAND CA 92346 PO BOX 592
PH: (909) 864-3180, FAX: (909) 864-0850

BENCH MARK:
CITY OF HIGHLAND BENCHMARK NO.: 00585

DESIGNATION/STAMPING/DATUM: 00585 14-2 NAVD29

DESCRIPTION: SAN BERNARDINO COUNTY BENCH MARK RESET 1992 IN T.C. 1 FOOT WEST OF ECR: NORTHWEST CORNER OF BASE LINE AND PALM AVENUE
ELEVATION=1,231.407

REVISIONS

CITY OF HIGHLAND

DRAWN: B.A.M. DESIGNED: J.B.M. CHECKED: B.K.M.

RECOMMENDED BY:

MATTHEW S. BENNETT DATE
RCE 85100, EXP. 9/30/22

APPROVED BY:

PLANNING DEPARTMENT DATE

BUILDING & SAFETY DATE

ERNEST WONG, CITY ENGINEER DATE
RCE 37413, EXP. 6/30/22

PRELIMINARY GRADING PLAN

A.P.N. 1200-381-05 & 43

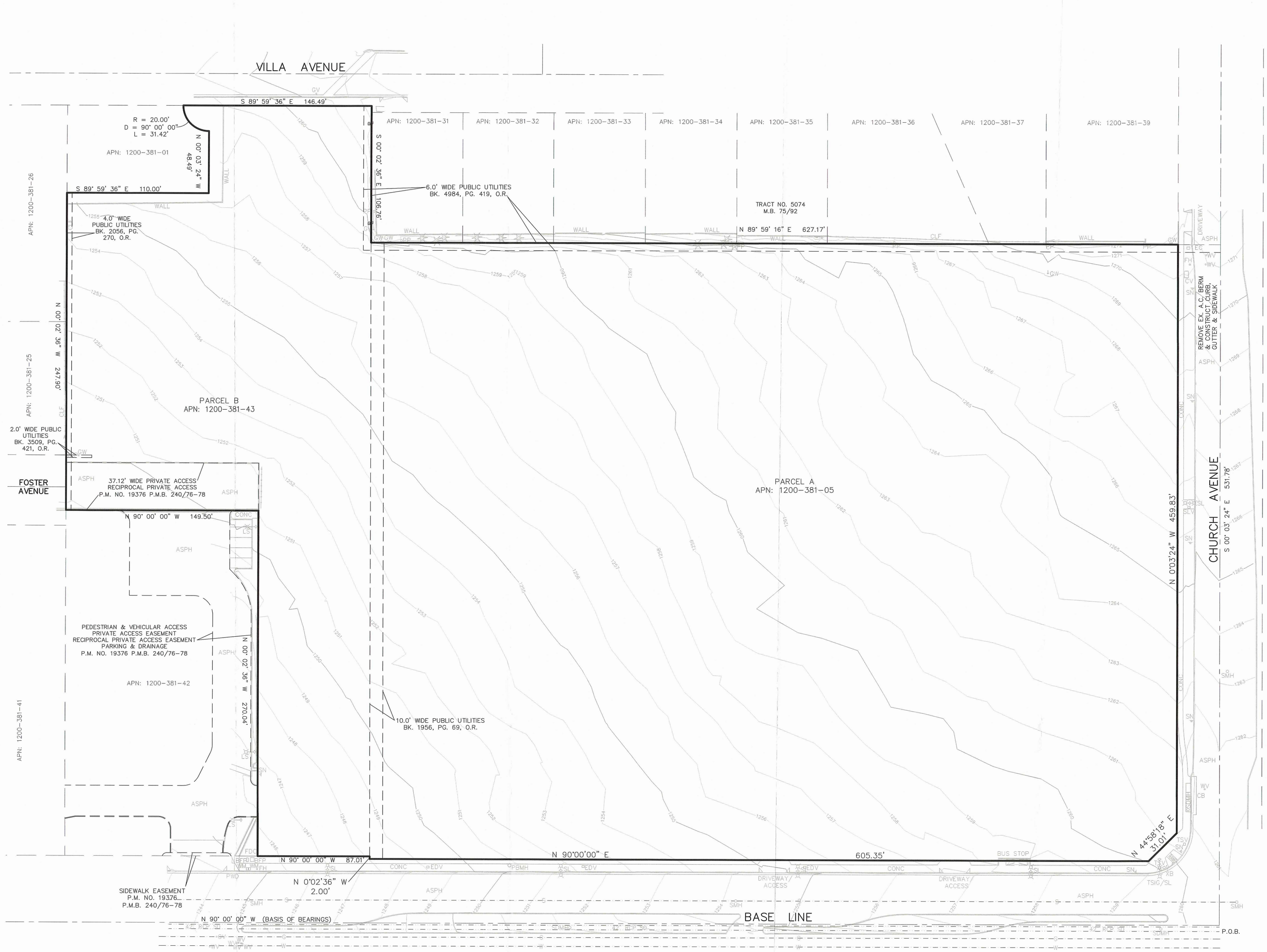
BASE LINE AT CHURCH AVE.
HIGHLAND, CA. 92346

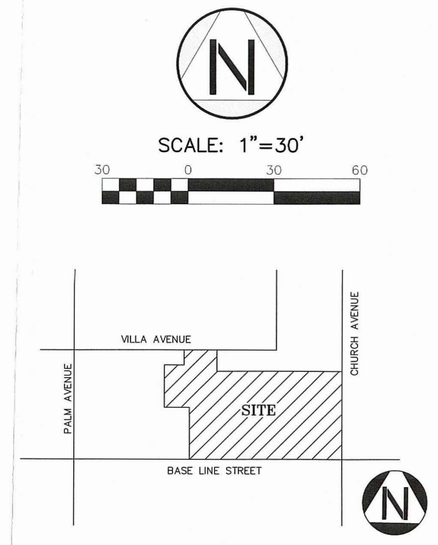
W.O.

SCALE:

FILE NO.

SHEET 1 OF 1





VICINITY MAP

LEGAL DESCRIPTION

FOR APN/PARCEL ID(S): 1200-381-05 AND 1200-381-43

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LEGEND

	APN	ASSESSOR'S PARCEL NUMBER
	ASPH	ASPHALT
▭	BFP	BACK FLOW PREVENTOR
	BK.	BOOK
	CONC	CONCRETE
□	CV	COMMUNICATIONS UTILITY VAULT
	D	DELTA ANGLE OF CURVE
□	EC	ELECTRIC UTILITY CABINET
□	EDV	EDISON UTILITY VAULT
●	FD	FOUND MONUMENT – AS NOTED
⍺	FH	FIRE HYDRANT
□	GR	GRATE
⋈	GV	GAS UTILITY VALVE
⟵	GW	GUYWIRE
	L	LENGTH OF CURVE
◇	LS	LIGHT STANDARD
	NO.	NUMBER
OHU	OHU	OVERHEAD UTILITY LINE
	O.R.	OFFICIAL RECORDS
□	P.M.	PARCEL MAP
	P.M.B.	PARCEL MAP BOOK
	PA	PLANTER AREA
○	PBMH	PACIFIC BELL UTILITY MANHOLE
	PG.	PAGE
PL	PL	PROPERTY LINE
⊸	PP	POWER POLE
	PWD	PARKWAY DRAIN
	R	RADIUS OF CURVE
⊖	SDMH	STORM DRAIN MANHOLE
◇	SL	STREET LIGHT
▭	SLV	STREET LIGHT VAULT
○	SMH	SEWER MANHOLE
⊧	SN	SIGN
▭	TSV	TRAFFIC SIGNAL VAULT
	TSIG	TRAFFIC SIGNAL
□	UC	UTILITY CABINET
▭	WM	WATER METER
	WV	WATER VALVE
	XB	CROSS WALK BUTTON
1111		CONTOURS
		BLOCK WALL – TYPICAL
		FENCE WOOD – TYPICAL
		FENCE CHAIN LINK – TYPICAL
		TREE – DECIDUOUS
		TREE – PALM

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CENTERLINE OF BASE LINE AS DEPICTED ON PARCEL MAP NO. 19376 FILED IN PARCEL MAP BOOK 240, PAGES 76-78, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

BEARING SHOWN AS N 90° 00' 00" W

PLAN PREPARED UNDER THE SUPERVISION OF:

BERNHARD K. MAYER R.C.E. 36866 03/23/2021 DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER BERNHARD K. MAYER NO. 36866 Exp. 6-30-22 CIVIL STATE OF CALIFORNIA

SITETECH INC.
8061 CHURCH ST. HIGHLAND CA 92346 PO BOX 592
PH: (909) 864-3180, FAX: (909) 864-0850

BENCH MARK:
CITY OF HIGHLAND BENCHMARK NO.: 00585
DESIGNATION/STAMPING/DATUM: 00585 14-2 NAVD29
DESCRIPTION: SAN BERNARDINO COUNTY
BENCH MARK RESET 1992 IN T.C. 1 FOOT
WEST OF ECR: NORTHWEST CORNER OF BASE LINE AND PALM AVENUE
ELEVATION=1,231.407

TOPOGRAPHIC MAP

A.P.N. 1200-381-05 & 43

BASE LINE AT CHURCH AVE.
HIGHLAND, CA. 92346

W.O.
SCALE:
FILE NO.
SHEET 1 OF 1

Bernie Mayer

From: Jay Tuttle [jtuttle@cityofhighland.org]
Sent: Thursday, April 08, 2021 4:56 PM
To: Bernie Mayer
Cc: Wade Wylie
Subject: RE: Conceptual WQMP for "Tractor Supply Co." Project, NWC Base Line/Church Ave., City of Highland; CWQ 021-004/3049.31

Hi Bernie:

The 2nd PC comments of the subject CWQMP are available for pick-up here at the front counter of Highland City Hall. City Hall is closed Friday.

Thanks,

Jay Tuttle IV
Assistant Engineer
City of Highland
Engineering Department
Ph.: (909) 864-6861, ext. 240
Email: jtuttle@cityofhighland.org

From: Jay Tuttle
Sent: Wednesday, March 17, 2021 3:48 PM
To: 'Bernie Mayer' <bmayer@sitetechinc.com>
Cc: 'Wade Wylie' <wade@woodcrestrev.com>
Subject: RE: Conceptual WQMP for "Tractor Supply Co." Project, NWC Base Line/Church Ave., City of Highland; CWQ 021-004/3049.31

Hi Bernie:

Just a reminder, City Hall is closed Friday.

Thanks,

Jay Tuttle IV
Assistant Engineer
City of Highland
Engineering Department
Ph.: (909) 864-6861, ext. 240
Email: jtuttle@cityofhighland.org

From: Jay Tuttle
Sent: Tuesday, March 16, 2021 2:11 PM
To: 'Wade Wylie' <wade@woodcrestrev.com>; 'Bernie Mayer' <bmayer@sitetechinc.com>
Cc: Salvador Quintanilla <squintanilla@cityofhighland.org>; Kim Stater <kstater@cityofhighland.org>; Matt Bennett <mbennett@cityofhighland.org>

City of Highland
Engineering Department
27215 Base Line
Highland, CA 92346
(909) 864-6861 (909) 862-3180 FAX

DATE: April 8, 2021

JOB NO. 3049.31
(CWQ 021-004)

TO: Sitetech, Inc.

Attn.: Bernie Mayer

PH#: (909) 864-3180

SUBJ.: **DRA 021-004; "Tractor Supply Co." Commercial Project**
NEC Base Line/Church Ave., in the City of Highland

The included report, for the subject development, in the City of Highland, has been reviewed and is returned to your firm for corrections and/or comment.

__X__ **Conceptual WQMP Report** **Plan Check No.** __2__

Please refer to the redlined comments on the enclosed report, and the attached letter from CASC, to assist in making the requested corrections. Please include **one copy** of the revised report and return the enclosed redlined copy, **and submit directly to the City's consultant:**

Michael Gentile
CASC Engineering and Consulting
1470 Cooley Drive
Colton, CA 92324.

If you have any questions, please call **Michael Gentile**, with CASC at (909) 783-0101, ext. 1610, or email at mgentile@cascinc.com

Thank you,

Jay Tuttle IV
Engineering Department

CASC
Engineering and Consulting

1470 E. Cooley Drive
Colton, CA 92324
Office: 909.783.0101
Fax: 909.783.0108

April 6, 2021

Transmitted via email and Std Mail

Matt Bennett
Assistant Public Works Director
CITY OF HIGHLAND
ENGINEERING DEPARTMENT
27215 Base Line
Highland, CA 92346

Subject: **Second Review Comments - Conceptual Water Quality Management Plan (C-WQMP) for Tractor Supply Co. Commercial Project**
Project No. CWQ 021-004 (3049.31)

Dear Mr. Bennett:

CASC Engineering and Consulting (CASC), as a consultant to the City of Highland, has performed a second review of the Conceptual Water Quality Management Plan (C-WQMP) prepared by Sitetech, Inc. (Preparer) for CWQ 021-004 (3049.31) Tractor Supply Co. Commercial Project (Project) located at the northwest corner of Church Avenue and Base Line, APN 1200-381-43 & 1200-381-05, and submitted by Woodcrest Properties (Applicant). The C-WQMP is not ready to be recommended for acceptance based on the findings enumerated herein:

1. Confirm that there are no improvements to Foster Avenue. If so, then disregard the redline comment regarding treatment of runoff from the existing extension of Foster Avenue. Confirm that the DCV calculation and BMP capacity for DMA-A includes this area, however. - EXPLAINED ON REDLINE SITEPLAN, AREA INCLUDED IN DCV CALCS
2. Confirm the areas and delineations. The drainage areas do not match the report. - FIXED SITE PLAN AREAS TO CORRECT AREAS SHOWN IN REPORT.
3. The preparer notes that hydrologic analysis to limit 100-year flows will be performed at final engineering. Please note that this may increase the size of the proposed storm drain facilities, including the underground chamber systems and CDS units. - NOTED, ADDED CLARIFICATION
4. Although it is impractical to capture and infiltrate runoff from the proposed curb-adjacent sidewalk on Church Avenue, confirm that the DCV calculations and BMP capacities for the delineated areas shown include the proposed sidewalks. - DCV CALCULATIONS INCLUDE PUBLIC IMPROVEMENT AREAS TO SEE THE DMAS.
5. Address all redline comments. - ADDRESSED

These findings and the redlined comments within the document are to be addressed in the next submittal.

Please review and arrange with the preparer for pickup. If there are any questions regarding these second review comments, please call me at (909) 809-0035 or e-mail me at mgentile@cascinc.com at your earliest convenience.

Best regards,
CASC Engineering and Consulting

Digitally signed by Michael J. Gentile, PE
Date: 2021.04.06 14:42:17 -07'00'

Michael J. Gentile, P.E., QSD
Senior Engineer

RECEIVED
APR 08 2021
ENGINEERING DEPT

Copy: Jay Tuttle IV, City of Highland
Enclosures: Second Review Conceptual WQMP

Preliminary Water Quality Management Plan

For:

Tractor Supply Co. - Highland

CWQ 021-004

APN: 1200-381-43 & 1200-381-05

LOT AREA = 9.02 ACRES

GROSS WQMP AREA = 9.02 ACRES

CWQ 21-004
RECEIVED
2nd
MAR 25 2021
3049.31
CASC ENGINEERING
AND CONSULTING

Prepared for:

Woodcrest Properties

1410 Main Street, Suite C

Ramona, CA 92065

PH: (760) 789-5493

CONTACT: Wade Wylie

Prepared by:

Sitetech, Inc.

8061 Chruch Street

Mail: POX 592

Highland, CA 92346

PH: (909) 864-3180

CONTACT: Bernie Mayer

Submittal Date: February 11, 2021

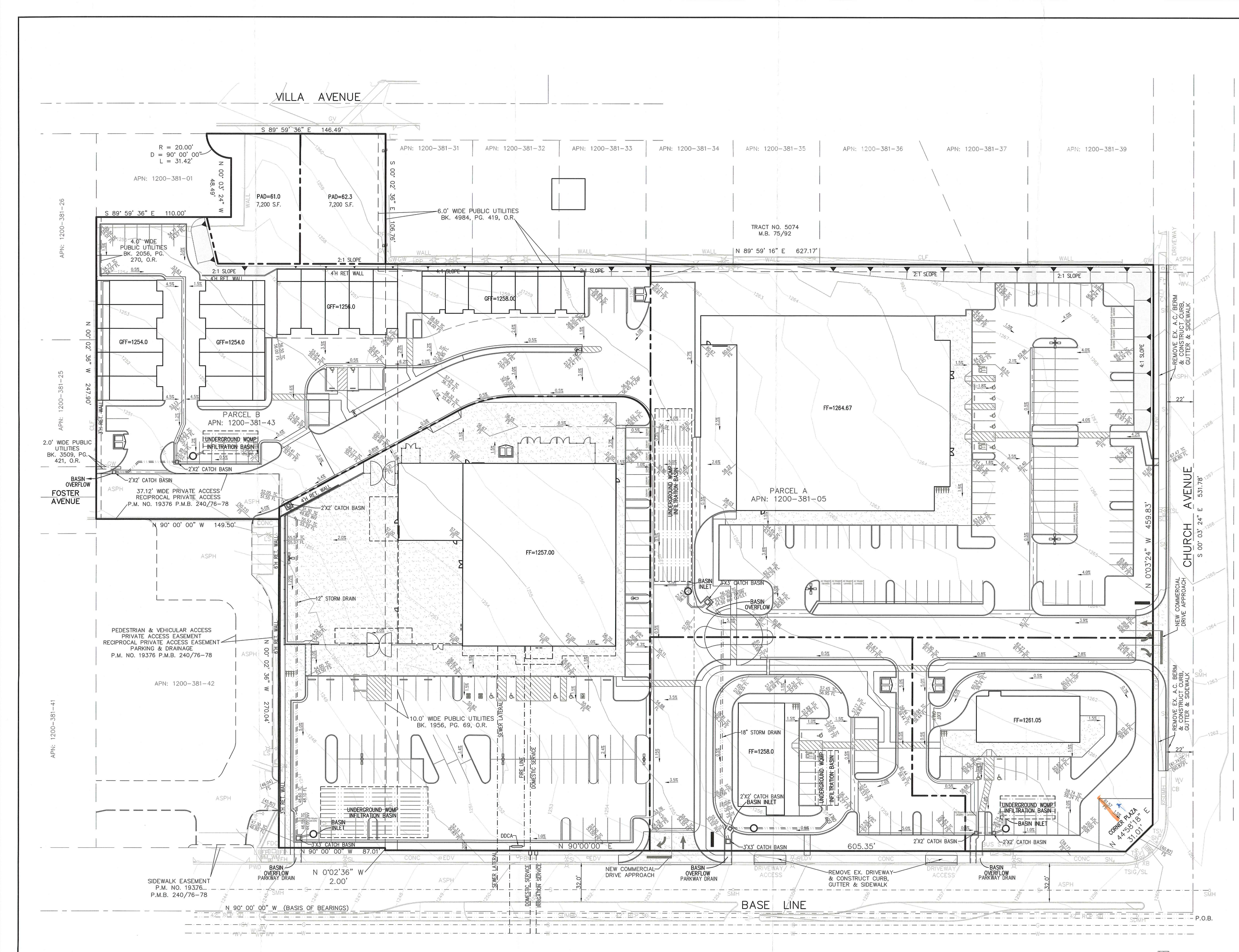
Revision No. and Date: #1 - March 23, 2021

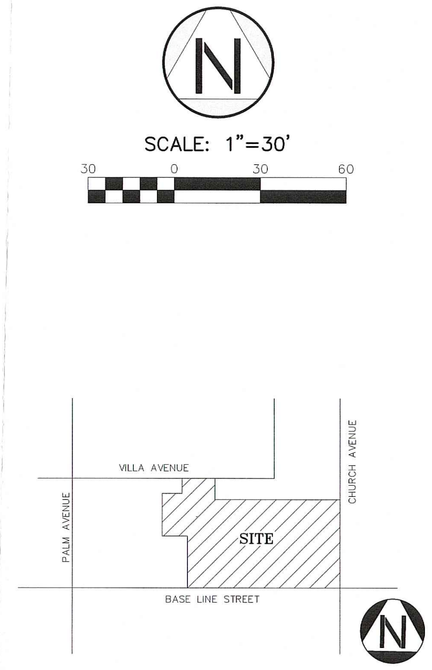
Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:_____

Plan Check Comments
Return With Next Submittal





VICINITY MAP

LEGAL DESCRIPTION

FOR APN/PARCEL ID(S): 1200-381-05 AND 1200-381-43

PARCEL A:

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BEARING SHOWN AS N 90° 00' 00" W

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PLAN PREPARED UNDER THE SUPERVISION OF:

BERNHARD K. MAYER R.C.E. 36866 — 03/23/2021 DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER BERNHARD K. MAYER NO. 36866 Exp. 6-30-22 CIVIL STATE OF CALIFORNIA

SITETECH INC.
8061 CHURCH ST. HIGHLAND CA 92346 PO BOX 592
PH: (909) 864-3180, FAX: (909) 864-0850

BENCH MARK:

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DESIGNATION/STAMPING/DATUM: 00585 14-2 NAVD29

DESCRIPTION: SAN BERNARDINO COUNTY BENCH MARK RESET 1992 IN T.C. 1 FOOT WEST OF ECR: NORTHWEST CORNER OF BASE LINE AND PALM AVENUE ELEVATION=1,231.407

REVISIONS

CITY OF HIGHLAND

DRAWN: B.A.M. DESIGNED: J.B.M. CHECKED: B.K.M.

RECOMMENDED BY:

MATTHEW S. BENNETT DATE
RCE 65100, EXP. 9/30/22

APPROVED BY:

PLANNING DEPARTMENT DATE

BUILDING & SAFETY DATE

ERNEST WONG, CITY ENGINEER DATE
RCE 37413, EXP. 6/30/22

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A.P.N. 1200-381-05 & 43
BASE LINE AT CHURCH AVE.
HIGHLAND, CA. 92346

W.O.

SCALE:

FILE NO.

SHEET 1 OF 1