Appendix N

Residential Site Preliminary Low Impact Development Plan

Preliminary Low Impact Development (LID) Plan

Prepared for:
Overton Moore Properties
19700 S. Vermont Avenue, Suite 101
Torrance, CA 90502
Contact: Montana Kanen

Property:
Azusa Greens Redevelopment Senior Housing
APN: 8617-013-001; 8684-013-014; 8684-043-002;
8617-011-001; 8684-013-030; 8617-001-013; 8617-001-005
919 Sierra Madre Avenue
Azusa, CA 91702

Prepared by:
C&V Consulting, Inc.
9830 Irvine Center Drive
Irvine, CA 92618
(949) 916-3800
Contact: Ryan Bittner, P.E.

Prepared Date: June 2023
Revised: March 2025

Receipt of WDID

REPLACE THIS SHEET

To be provided prior to final approval

Notice of Intent

REPLACE THIS SHEET

To be provided prior to final approval

Table of Contents

SECTION PAGE

List of Figures

List of Appendices

Project Owner's Certification of the Preliminary Low Impact Development (LID) Plan

Project Name: ***Azusa Greens Redevelopment Senior Housing***

Project Number: **APN 8617-013-001; 8684-013-014; 8684-043-002; 8617-011-001; 8684-013-030; 8617-001-013; 8617-001-005**

Project Address: **919 Sierra Madre Avenue**
Azusa CA 90702

This Preliminary Low Impact Development (LID) Plan for the ***Azusa Greens Redevelopment Senior Housing*** project has been prepared for Overton Moore Properties by C&V Consulting, Inc. It is intended to comply with the requirements of the City of Azusa's Conditions of Approval.

The undersigned is authorized to approve implementation of provisions of this plan as appropriate and will strive to have the plan carried out by successors consistent with the County of Los Angeles LID Manual and the intent of the NPDES storm water requirements.

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

Owner's Name:	Montana Kanen		
Owner's Title:			
Company:	Overton Moore Properties		
Address:	19700 S. Vermont Avenue, Suite 101, Torrance, CA 90502		
Email:			
Telephone No.:			
Signature:		Date:	

Engineer Certification

Engineer's Name:	Ryan Bittner		
Engineer's Title:	CEO		
Company:	C&V Consulting, Inc.		
Address:	9830 Irvine Center Drive, Irvine, CA 92618		
Email:	rbittner@cvc-inc.net		
Telephone No.	(949) 916-3800		
I hereby certify that this Low Impact Development Plan is in compliance with, and meets the requirements set forth in, Order No. R4-2021-0105, of the Los Angeles Regional Water Quality Control Board.			
Engineer's Signature		Date	
Place Stamp Here			

Section 200

A. Contact Information/List of Responsible Parties

The property contact information is:

Montana Kanen
Overton Moore Properties
19700 S. Vermont Avenue, Suite 101,
Torrance, CA 90502

The property owner shall have primary responsibility and significant authority for the implementation, maintenance, and inspection of the property BMPs. Duties of the Owner include but are not limited to:

- Implementing all elements of the LID, including but not limited to:
  - Implementation of prompt and effective erosion and sediment control measures
  - Implementing all non-storm water management, and materials and waste management activities, such as: monitoring, discharges, general site clean-up; vehicle and equipment cleaning, spill control; good construction housekeeping to ensure that no materials other than storm water are discharged which may have an adverse effect on receiving waters or storm drain systems, etc.
- Inspections and Maintenance.
- Routine inspections as described in the Low Impact Development Plan.
- Ensuring elimination of all unauthorized discharges
- The Owner shall be assigned authority to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate all of the necessary corrections/repairs are made immediately, and that the project complies with the LID at all times.
- Managing and report any Illicit Connections or Illegal Discharges.

Section 300

A. References

The following documents are made a part of this LID by reference:

- Project plans and specifications for the City of Azusa to support the project, prepared by C&V Consulting, Inc., 9830 Irvine Center Drive, Irvine, California 92618.
- Los Angeles Resources Water Quality Control Board (LARWQCB) Order R4-2021-0105 effective September 10, 2021
- State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity, adopted on September 8, 2022.
- California Stormwater BMP Handbook – Construction, November 2009.
- California Stormwater BMP Handbook – New Development and Redevelopment, January 2003.
- County of Los Angeles Department of Public Works L.I.D. Standards Manual, February 2014

Section 400 – Body of LID

A. Objectives

This Low Impact Development (LID) Plan has the following main objectives:

1) Identify all pollutant sources, including sources of sediment that may affect the quality of storm water discharges associated with daily use / activity (storm water discharges) from the property site.
2) Identify, construct, implement and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized non-storm water discharges from the property site.
3) Develop a maintenance schedule for BMPs designed to reduce or eliminate pollutants.

B. Project Background and Description

The proposed project site comprises areas of adjusted lots with a total of 21.723 acres. It is located at 919 Sierra Madre Avenue, City of Azusa, County of Los Angeles. (APN:8617-013-001; 8684-013-014; 8684-043-002; 8617-011-001; 8684-013-030; 8617-001-013; 8617-001-005). The site is bounded by Sierra Madre Avenue to the south, a water treatment facility to the north, residential Tract No. 25309 to the east, and residential areas to the west.

The site is currently a golf course and appears to have been closed for a long period of time. The perimeters of the site is bounded by chain link fence and some block walls are present along the boundary adjacent to the residential area. Vegetation within the site consists of large trees dividing the different golf holes. The vast majority of the site is covered by grass with limited types of vegetation. A few structures are present onsite with a club house located adjacent to the entrance parking lot.

The project proposes the construction of 38 one-story residential buildings and 2 three-story muti-family residential buildings with private garages, private drive aisles, sidewalks, and common landscaped areas. The project site will be accessible with an entrance/ exit along Sierra Madre Avenue. The golf course east of the site, which will not be a part of this hydrological analysis, are to be remain in-kind to preserve the perviousness of land usage and drainage pattern per existing conditions. Drive aisles and parking areas will be composed of asphalt concrete pavement. Proposed development imperviousness is assumed to be 86% per Los Angeles County Hydrology Manual recommended value based on development type.

C. Vicinity Map

The proposed project site comprises areas of adjusted lots with a total of 21.723 acres. It is located at 919 Sierra Madre Avenue, City of Azusa, County of Los Angeles. (APN:8617-013-001; 8684-013-014; 8684-043-002; 8617-011-001; 8684-013-030;

8617-001-013; 8617-001-005). The site is bounded by Sierra Madre Avenue to the south, a water treatment facility to the north, residential Tract No. 25309 to the east, and residential areas to the west.

Refer to Figure 1 for the Vicinity Map within the LID Exhibit.

D. Existing Site Drainage Condition

The existing drainage condition of the site generally flows south-westerly towards Sierra Madre Avenue with elevations ranging between approximately 650 and 665 feet above mean sea level. An existing inlet is located in Sierra Madre Avenue adjacent to the parking lot near the entrance, to intercept a portion of the flows generated onsite. The northerly portion of the site flows southerly along Ave Conejo and golf range, which ultimately routes to downstream inlets located along Sierra Madre Avenue. These inlets connect to a Los Angeles County Flood Control District's 11'-3" x 12'-0" box which runs along the Sierra Madre Avenue that intercepts all the site generated runoff. All flow ultimately discharges to the San Gabriel River which drains to the Pacific Ocean at San Pedro Bay. Water bodies downstream of the project site are listed on the most current 303(d) list as follows:

- San Gabriel River Reach 3 (Whittier Narrows to Ramona)
  - Indicator Bacteria
- San Gabriel River Reach 2 (Firestone to Whittier Narrows)
  - Coliform Bacteria
  - Cyanide
  - Lead
- San Gabriel River Reach 1 (Estuary to Firestone)
  - Coliform Bacteria
- San Gabriel River Estuary
  - Copper
  - Dioxin
  - Nickel
  - Oxygen, Dissolved
- San Pedro Bay
  - Chlordane
  - DDT (tissue & sediment)
  - PCBs (Polychlorinated biphenyls)
  - Sediment Toxicity

The MS4 facilities downstream of the project site are engineered, therefore the project is exempt from Hydromodification Control requirements per LACPW LID Manual as stated below:

"Projects that discharge directly or through a storm drain into concrete or otherwise engineered channel (i.e., channelized or armored with rip-rap, shotcrete), which, in turn, discharge into receiving water that is not susceptible to hydromodification impacts."

E. Proposed Site Drainage Conditions

Onsite residential development and the parking lot areas are analyzed as a separate drainage management area as it drains towards Sierra Madre Avenue. The golf course east of the site, which will not be a part of this hydrological analysis, is to remain in-kind to preserve the perviousness of land usage and drainage pattern per existing conditions. The onsite residential development drainage management area is further delineated into 6 subareas per proposed site grading low points with inlets. The inlets collect and direct runoffs from the drainage management area into the proposed interconnected underground infiltration / detention system. A separate infiltration / detention system is proposed for the clubhouse parking area, the outlet confluences with the overflow outlet of the proposed residential development. The proposed systems will also conform with water quality treatment standards.

During the design storm event when the infiltration/ retention system reaches full capacity, excess runoff is routed to the connection to LACFCD public storm drain via a weir system. In cases of larger storm event beyond the design storm, runoff will pond at the localized sump inlets and the site is graded to overflow towards Sierra Madre Avenue following historical drainage pattern.

Per Geotechnical Investigation, prepared by Albus & Associates, Inc. dated April 26, 2023, based on CDMG Special Report 021, the historic high groundwater is about 10-30 feet below the ground surface. Review of the California Department of Water Resources groundwater well data for well 4275 A indicates groundwater has fluctuated between 20-60 feet below ground surface between 2011-2022. Depth as measured between Well 4285H and Well 4285B indicates that depth to ground water drops off sharply to the south indicating the influence of the infiltration ponds located north of the project site.

Refer to Figure 1, BMP Exhibit for additional information.

F. LID Project Types, Characteristics, & Activities

Per the California Regional Water Quality Control Board Los Angeles Region MS4 Order R2021-0105 Part VIII.F, the proposed project is classified as a “Priority Development Project”.

Par VIII.F.1.i.(a) of the 2021 LARWQCB MS4 NPDES Permit defines “Priority Development Projects”, requiring Low Impact Development (LID) planning, to include “Projects equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet or more of impervious surface area (collectively over the entire project site).

G. Pollutant Source Identification

The following is a list of materials to be used in the daily construction activities at the project site, which will potentially contribute to pollutants, other than sediment, to storm water runoff. Control Practices for each activity are identified below:

- Vehicle fluids, including oil, grease, petroleum, and coolants from personal vehicles.

- Landscaping materials and wastes (topsoil, plant materials, herbicides, fertilizers, mulch, pesticides)
- General trash debris and litter
- Pet waste (bacteria/ fecal coliforms)

Project proponents shall implement Site Design concepts that achieve each of the following:

- Minimize Urban Runoff
- Minimize Impervious Footprint
- Conserve Natural Areas
- Minimize Directly Connected Impervious Areas (DCIAs)

The Best Management Practices (BMPs) that have been selected for implementation on this project are detailed in the following sections.

H. Non-Structural BMPs

Non-structural BMPs are generally managerial, educational, inspection and/ or maintenance oriented. These items consist of educating employees and occupants, developing, and implementing HOA guidelines, implementing BMPs and enforcing Code requirements.

Table-1: Non-Structural Source Control BMPs

BMP	TECHNIQUE	INCLUDED?		NOTES
		YES	NO	
N1	Education for Property Owners, Tenants and Occupants	X		HOA to comply
N2	Activity Restrictions	X		HOA to comply
N3	Common Area Landscape Management	X		HOA to comply
N4	BMP Maintenance	X		HOA to maintain
N5	Title 22 CCR Compliance (How development will comply)		X	HOA to comply
N6	Local Industrial Permit Compliance		X	Not Applicable
N7	Spill Contingency Plan		X	Not Applicable
N8	Underground Storage Tank Compliance		X	Not Applicable
N9	Hazardous Materials Disclosure Compliance		X	Not Applicable
N10	Uniform Fire Code Implementation		X	Not Applicable
N11	Common Area Litter Control	X		HOA to comply

BMP	TECHNIQUE	INCLUDED?		NOTES
		YES	NO	
N12	Employee Training	X		HOA to comply
N13	Housekeeping of Loading Docks		X	Not Applicable
N14	Common Area Catch Basin Inspection	X		HOA to comply
N15	Street Sweeping Private Streets and Parking Lots	X		HOA to comply
N16	Retail Gasoline Outlets		X	Not Applicable

Education for Employees and Occupants

Practical informational materials will be provided to homeowners, HOA and employees on general good housekeeping practices that contribute to protection of storm water quality. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Initially, the Owner will provide these materials. Thereafter, such materials will be available through the HOA education program.

This program must be maintained, enforced, and updated periodically by the HOA. Educational materials including, but not limited to, the materials included in the Appendix F of this plan will be made available to the employees and contractors of the HOA.

Activity Restrictions

Activities on this site will be limited to activities related to residential living. The project's Conditions, Covenants, and Restrictions (CC&Rs) will outline the activities that are restricted on the property. Such activities related to the LID include car washing, car maintenance and disposal of used motor fluids, pet waste cleanup, and trash container areas.

Community Car Wash Racks

No community car wash rack or area will be provided, therefore, vehicle washing by residents on the property will not be allowed per the CC&Rs.

Self-Contained Washing

Self-contained washing of vehicles by residents or owners on the property will not be allowed per the CC&Rs.

Outdoor Material Storage Areas

Outdoor material storage areas refer to storage areas or storage facilities solely for the storage of materials. Improper storage of materials outdoors may provide an opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the storm water conveyance system. Outdoor Storage by residents or owners on the property will not be allowed per the CC&Rs.

Common Area Landscaped Management
Identify on-going landscape maintenance requirements that are consistent with those in the County Water Conservation Resolution (or city equivalent) that include fertilizer and/or pesticide usage consistent with Management Guidelines for Use of Fertilizers

Runoff-Minimizing Landscape Design
As part of the design of all common area landscape areas, similar planting material with similar water requirements will be used in order to reduce excess irrigation runoff and promote surface filtration. Such common areas will be maintained by the HOA.

BMP Maintenance
The HOA will implement maintenance of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities.

Common Area Litter Control
The HOA must implement trash management and litter control procedures in common areas aimed at reducing pollution of drainage water. The HOA may contract a landscape maintenance company to provide this service during regularly scheduled maintenance which will consist of litter patrol and noting trash disposal violations and reporting the violations to the HOA for investigation.

Employee Training
A training program will be established as it would apply to future employees, contractors, and homeowners of the HOA to inform and train in maintenance activities regarding the impact of dumping oil, paints, solvents, or other potentially harmful chemicals into storm drains; the proper use of fertilizers and pesticides in landscaping maintenance practices; and the impacts of littering and improper water disposal.

The HOA (or a hired firm) will conduct the training program which will include targeted training sessions with specific construction disciplines (landscaping, concrete finishers, painters, etc.). See Appendix F for examples of educational materials that will be provided to the Employees.

The project's CC&Rs will include provisions for future employee training programs conducted on a yearly based prior to the rainy season.

Drainage Facility Inspection & Maintenance
The HOA will be responsible for implementing each of the BMPs detailed in this plan. The HOA will also be responsible for cleaning and maintaining the BMPs on a regular basis. Refer to Appendix G for the Operation and Maintenance Plan. Refer to Appendix C for site specific drainage BMP information.

Catch Basin Inspection
The HOA will maintain the drainage systems, including catch basins and culverts. The HOA is required to have catch basins inspected and, if necessary, cleaned prior to the storm season, no later than October 15th each year or prior to the first 24-hour storm

event, whichever occurs first. These duties may be contracted out to the landscape maintenance firm hired by the HOA. Please see Appendix E for maintenance program. Refer to Appendix G for the Operation and Maintenance Plan.

Street Sweeping in Private Streets and Parking Lots

The HOA shall have all streets and parking lots swept on a weekly basis. This procedure will be intensified around October 15th of each year prior to and throughout rain storm period.

I. Structural BMPs

Table-2 and Table-3 identifies the structural source control BMPs for Design and how each is implemented to achieve each Site Design concept. BMP fact sheets are provided by the LACDPW *Low Impact Development Standards Manual* and the California Stormwater Quality Association.

Table-2: LACDPW Source Control BMPs

BMP	TECHNIQUE	INCLUDED?		NOTES
		YES	NO	
S-1	Storm Drain Message and Signage	X		Catch basins will be appropriately marked
S-2	Outdoor Material Storage Area		X	Not Applicable
S-3	Outdoor Trash Storage and Waste Handling Area		X	Not Applicable
S-4	Outdoor Loading/Unloading Dock Area		X	No Loading Dock Areas
S-5	Outdoor Repair/Maintenance Area		X	No Maintenance Bays
S-6	Outdoor Vehicle/Equipment's/Accessory Washing Area		X	No Wash Areas
S-7	Fueling Area		X	No Fueling Areas
S-8	Landscape Irrigation Practices	X		HOA CC&Rs
S-9	Building Materials Selection	X		HOA CC&Rs
S-10	Animal Care and Handling Facilities		X	No Animal Care Facility
S-11	Outdoor Horticulture Areas		X	Not Applicable

Table-3: CASQA Source Control BMPs for Design

BMP	TECHNIQUE	INCLUDED? YES	INCLUDED? NO	NOTES
SE-7	Street Sweeping and Vacuuming	X		Pet waste collection stations, HOA
SD-10	Site Design & Landscape Planning	X		Common Landscape Area Design, HOA
SD-11	Roof Runoff Controls	X		Roof drains will be disconnected from the MS4
SD-12	Efficient Irrigation	X		Landscape design will implement efficient irrigation
SD-13	Storm Drain Signage	X		Catch basins will be appropriately marked
SD-20	Pervious Pavements		X	Site design does not allow for this BMP.
SD-21	Alternative Building Materials		X	Not Applicable
SD-30	Fueling Areas		X	Not Applicable
SD-31	Maintenance Bays & Docks		X	Not Applicable
SD-32	Trash Storage Areas		X	Not Applicable
SD-33	Vehicle Washing Areas		X	Not Applicable
SD-34	Outdoor Material Storage Areas		X	Not Applicable
SD-35	Outdoor Work Areas		X	Not Applicable
SD-36	Outdoor Processing Areas		X	Not Applicable

Storm Drain Stenciling/ Signage
Phrase "No Dumping – Drains to Ocean" or equally effective phrase to be stenciled on catch basins to alert the public to the destination of pollutants discharged into storm water. This stenciling will be inspected and re-stenciled on a periodic basis by the HOA. Refer to Table 4 for maintenance frequency.

Landscape & Irrigation System Design
As part of the design of all common area landscape irrigation shall employ water conservation principles, including, but not limited to, such provisions as water sensors, programmable irrigation times (for short cycles), etc. will be used. Such common areas will be maintained by the HOA.

Efficient Landscape System & Landscape Maintenance
Management programs will be designed and established by the HOA, who will maintain the common areas within the project site. These programs will include how to mitigate

the potential dangers of fertilizer and pesticide usage (refer to the Maintenance and Frequency Table). Ongoing maintenance will be consistent with the State of California Model- Water Efficient Landscape Ordinance. Fertilizer and pesticide usage shall be consistent with County Management Guidelines for use of Fertilizers and Pesticides.

Building Materials Selection
Material selection will minimize the use of copper, galvanized metals and other materials that could add significant amounts of harmful pollutants to stormwater runoff.

Street Sweeping and Vacuuming
The HOA shall have all streets and parking lots swept on a weekly basis. This procedure will be intensified around October 15th of each year prior to and throughout rain storm period.

J. LID and Treatment BMPs

Treatment BMPs shall be installed by the developer, through the construction and development of the project, for instance; landscaping and irrigation systems shall be designed by licensed landscape architects and installed by qualified contractors to specifications and standards of the City of Azusa. The structural BMPs used for this project are summarized below:

Expected pollutants associated with this development include vehicle discharge fluids, landscaping materials and waste, litter, and pet waste. To mitigate these pollutants, the structural best management practices are summarized below.

Table-4: Treatment BMPs

BMP	NAME	INCLUDED?		IF NOT APPLICABLE, STATE BRIEF REASON
		YES	NO	
VEG-5	Vegetated Filter Strip		X	Alternative BMP selected
VEG-4	Vegetated Swale		X	Space not available for BMP
MP-40	Media Filter		X	Alternative BMP selected
MP-52	Drain Inserts		X	Alternative BMP selected
T-3	Extended Detention Basin		X	Alternative BMP selected
T-4	Wet Pond		X	Alternative BMP selected
T-2	Constructed Wetland		X	Alternative BMP selected
T-1	Sand Filter		X	Alternative BMP selected
RET-5	Permeable Pavement without an Underdrain		X	Alternative BMP selected
RET-2	Infiltration Basin		X	Alternative BMP selected

BMP	NAME	INCLUDED?		IF NOT APPLICABLE, STATE BRIEF REASON
		YES	NO	
RET-3	Infiltration Trench	X		Proposed Infiltration BMP will be utilized in the proposed development and provide full treatment of the SWQDV.
TC-40	Media Filter		X	Alternative BMP selected
BIO-1	Biofiltration		X	Alternative BMP selected

ADS StormTech Infiltration

Storm water will enter the infiltration system per inlets throughout the site and flow via pipe directly onto specially designed isolator row. The isolator row is designed to intercept the majority of the first flows during a rain event and reduce the impact of sediment and debris on the system. As the isolator row fills up stormwater will flow into the rest of the system where it will be infiltrated. The infiltration system will also be utilized as the detention system which will overflow to the proposed parkway for flows greater than the 85th percentile storm event when the detention reach its maximum capacity.

The proposed system will treat the required volume within target drawdown duration of 96 hours. The treatment capacity of the system is determined by the drawdown duration and the design infiltration rate. The calculation is copies below for reference:

Drainage Management Area (DMA)	Size (ac)	SWQDV (cf)*	Detention Capacity (cf)	48-hr Treatment Capacity (cf)
A	19.815	45,711.6	70,977.1	172,358.6
B	1.908	6,491.0	7,202.5	15,954.8
Total	21.723	52,202.6	78,179.6	188,313.4

*Los Angeles County Department of Public Works (LACDPW) HydroCalc Software was utilized to calculate stormwater quality design volume (SWQDV). The governing flowrate per the 85th Percentile storm event was utilized for design. Refer to Appendix A for HydroCalc outputs.

The Infiltration systems will address the pollutants of concern associated with the development type. Refer to Appendix C for more information on ADS StormTech System. Treatment Volumes are to be verified with proposed perviousness per final site plan during Final Engineering.

K. BMP Maintenance, Inspection, and Repair

Inspections will be conducted as follows:

- Annually and prior to the start of the rainy season
- Every (1) month during rainy season
- At any other time(s) or intervals of time specified in the contract documents

Repairs and/ or maintenance procedures shall be carried out at the soonest possible time.

L. Inspection, Maintenance, and Responsibility for BMPs

Table-5 and Table-6 show the lists of the post-construction BMPs (routine non-structural and structural), the required ongoing maintenance, the inspection and maintenance frequency, the inspection criteria, and the entity or party responsible for implementation, maintenance, and/or inspection.

Table-5: Non-Structural BMP Maintenance Responsibility/Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Homeowner/ Business owner Education, Activity Restrictions	HOA will provide educational materials. Those materials and responsibilities must be passed onto subsequent property owners.	Continuous. CC&Rs to be provided to homeowners at the time they purchase the property and updates provided by the HOA as they occur.
Common Area Landscape Management	HOA will appoint a landscape maintenance contractor	Monthly during regular maintenance and use with management guidelines for use of fertilizers and pesticides.
Parking Areas and Drive Aisle Management	HOA	The Drives Aisles are to be swept on a routine scheduled basis to facilitate the pickup of trash and debris (plant or otherwise) and to remove excessive oil, grease and build-up. During sweeping, debris is to be removed from the parking areas and drives and then scrubbed and rinsed. This sweeping schedule will be at a minimum occurrence of once a week and as necessary to rid / reduce active pollutants from the pavement areas. This maintenance requirement will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the final Title report of these properties.
Litter Control by Sweeping	HOA	Weekly inspection of trash receptacles to ensure that lids are closed and pick up any excess trash on the ground, noting trash disposal violations to the HOA for remediation.
Employee Training	HOA	Monthly for maintenance personnel and employees to include the educational materials contained in the approved LID.
Common Area Catch Basin Inspection & Cleaning	HOA will appoint a landscape maintenance contractor for common areas and storm drain facilities.	Inspect basins once a month. Clean debris and silt in bottom of catch basins as needed. Intensified on or about October 15th each year or prior to the first 24-hour storm event, whichever occurs first. Refer to Appendix E.

Table-6: Structural BMP Maintenance Responsibility/ Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Common Area Efficient Irrigation	HOA will appoint a landscape contractor after construction	Once a week, in conjunction with maintenance activities. Verify that runoff minimizing landscape design continues to function by checking that water sensors are functioning properly, that irrigation heads are adjusted properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather and day or night time temperatures.
Common Area Runoff Efficient Landscape Design	HOA will appoint a landscaping contractor	Once a week in conjunction with maintenance activities and prior to finalizing any replanting schemes. Verify that plants continue to be grouped according to similar water requirements in order to reduce excess irrigation runoff.
ADS StormTech	HOA	ADS StormTech maintenance will conform to manufacturer's specifications. Please see additional information in Appendix C

M. Operation/Maintenance Funding after Project Completion

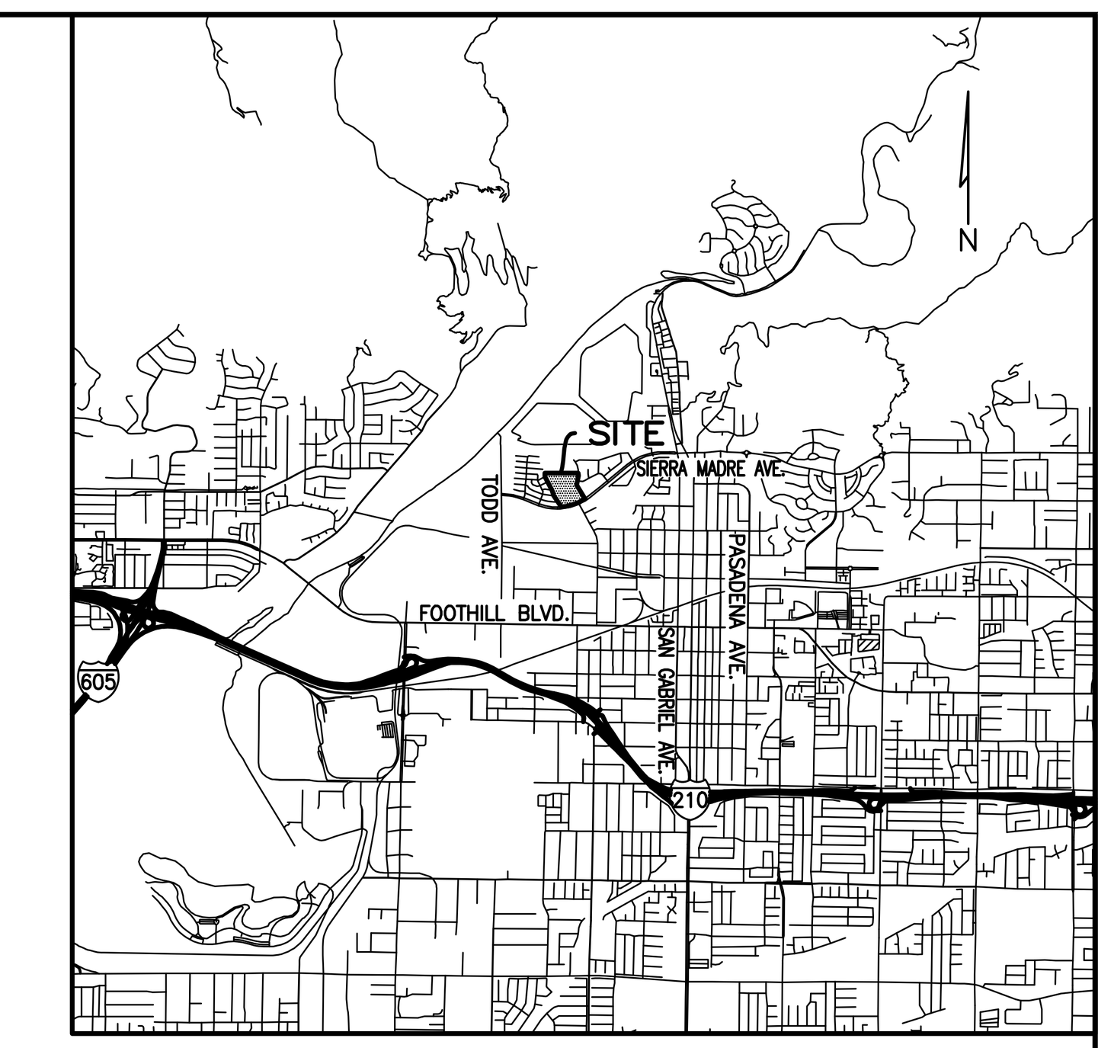
The post-construction BMPs as described above will be funded and maintained by:

Montana Kanen
Overton Moore Properties
19700 S. Vermont Avenue, Suite 101
Torrance, CA 90502

Maintenance and requirements of the maintenance for the properties will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project and will be the responsibility of the property owner at all times. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the Title report of these properties.

Figure 1:
BMP Exhibit

PRELIMINARY LID EXHIBIT



VICINITY MAP

N.T.S.

LEGEND:

- DRAINAGE MANAGEMENT AREA (DMA) BOUNDARY
- DMA SUBAREA BOUNDARY
- SITE BOUNDARY
- EXISTING RIGHT OF WAY
- EXISTING LOT LINE
- EXISTING EASEMENT LINE
- SURFACE FLOW DIRECTION
- PIPE FLOW DIRECTION
- FLOW LINE
- PERVIOUS AREA

DMA	COLOR	LANDUSE	AREA (SF)	AREA (AC)	IMPERVIOUS %
A		RESIDENTIAL	894,491.0	20.535	86%
B		PARKING	83,104.9	1.908	100%

NOTE: PROPOSED DEVELOPMENT IMPERVIOUS COVERS ARE ASSUMED PER LOS ANGELES COUNTY HYDROLOGY MANUAL BASED ON DEVELOPMENT TYPE. ALLOWABLE Q GIVEN BY LACFCD AS 3.6 CFS PER ACRE UTILIZED FOR DESIGN MITIGATION.

BEST MANAGEMENT PRACTICE (BMPs)	
IDENTIFIER	DESCRIPTION
*N1	EDUCATION FOR PROPERTY OWNERS, TENANTS, & OCCUPANTS
*N2	ACTIVITY RESTRICTIONS
*N3/SD-10	SITE DESIGN AND LANDSCAPE PLANNING
*N4	BMP MAINTAINANCE
*N11	PRIVATE STREET/ PARKING LOT SWEEPING AND VACUUMING
*N12	EMPLOYEE TRAINING
*N14	COMMON AREA CATCH BASIN INSPECTION
*N15/SE-7	PRIVATE STREET/ PARKING LOT SWEEPING AND VACUUMING
SD-11	ROOF RUNOFF CONTROLS
*S8/SD-12	EFFICIENT IRRIGATION
*S-9	BUILDING MATERIALS SELECTION
S1/SD-13	STORM DRAIN SYSTEM SIGNAGE
RET-3	ADS STORMTECH INFILTRATION SYSTEM

*NOTE: GENERALLY APPLICABLE THROUGHOUT THE SITE

PROPOSED CONDITIONS STORM EVENT PEAK RUNOFF		
DMA	REQUIRED TREATMENT VOLUME	PROPOSED DETENTION VOLUME
A	61,357.7	64,392.7
B	6,491.0	6,645.8
TOTAL OUTLET GENERATED RUNOFF	67,848.8	71,038.5

SCALE: 1" = 100'

0 50 100 200

OMP
OVERTON MOORE PROPERTIES

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

RYAN J. BITTNER | 68167 R.C.E. NO. | DATE

REGISTERED PROFESSIONAL ENGINEER RYAN J. BITTNER No. 68167 CIVIL STATE OF CALIFORNIA

PRELIMINARY LID EXHIBIT
AZUZA GREENS REDEVELOPMENT
919 SIERRA MADRE AVENUE
CITY OF AZUSA, CA 91702

PROJECT REF. NO.

SHEET 1 OF 1

CONTRACT

ACCOUNT

DWG. NO.

Figure 2:
Impaired Waters

COUNTY OF LOS ANGELES

SAN GABRIEL RIVER WATERSHED

Proposed Project Site

San Gabriel River Watershed

LEGEND

- SAN GABRIEL RIVER WATERSHED
- UNINCORPORATED AREA
- DAM / LAKE / RESERVOIR
- MAJOR RIVER
- MAJOR CHANNEL

MILES
0 0.875 1.75 3.5

Data contained in this map is produced in whole or part from the Los Angeles County Department of Public Works' digital database.

REF: \\pwgisd02\mpmgis\MPMGIS\projects\mpm\gismaps\wk_2627\SanGabrielRiver_wtrshed.mxd DATE: 08/21/07

Mapping & Property Management Division, Mapping & GIS Services Section

Appendix A:
Volume and Flowrate Calculations & Hydrologic Report

The proposed development was analyzed for the 85th Percentile storm event using the LACDPW HydroCalc software. The governing design storm event is determined to be 85th percentile as it is greater than the 0.75 in storm event in accordance with the LA County BMP Design Manual. Below is a summary of the HydroCalc outputs:

85th Percentile Storm Event
1.05 in

DMA	85th Percentile Storm ✓	
	Flowrate (cfs)	Volume (cf)
A-1	0.3299	2,912.5335
A-2	0.487	6,819.7097
A-3	0.6641	10,622.216
A-4	0.4846	3,994.1933
A-5	1.0972	13,280.9643
A-6	0.6381	8,082.025
Total (DMA-A)	3.701	45,711.6
B-7	0.5607	6,491.0489
Total (Project Site)	4.262	52,202.7

Refer to LACDPW HydroCalc Output Data within this Appendix for Volume and Flowrate Calculations.

Peak Flow Hydrologic Analysis

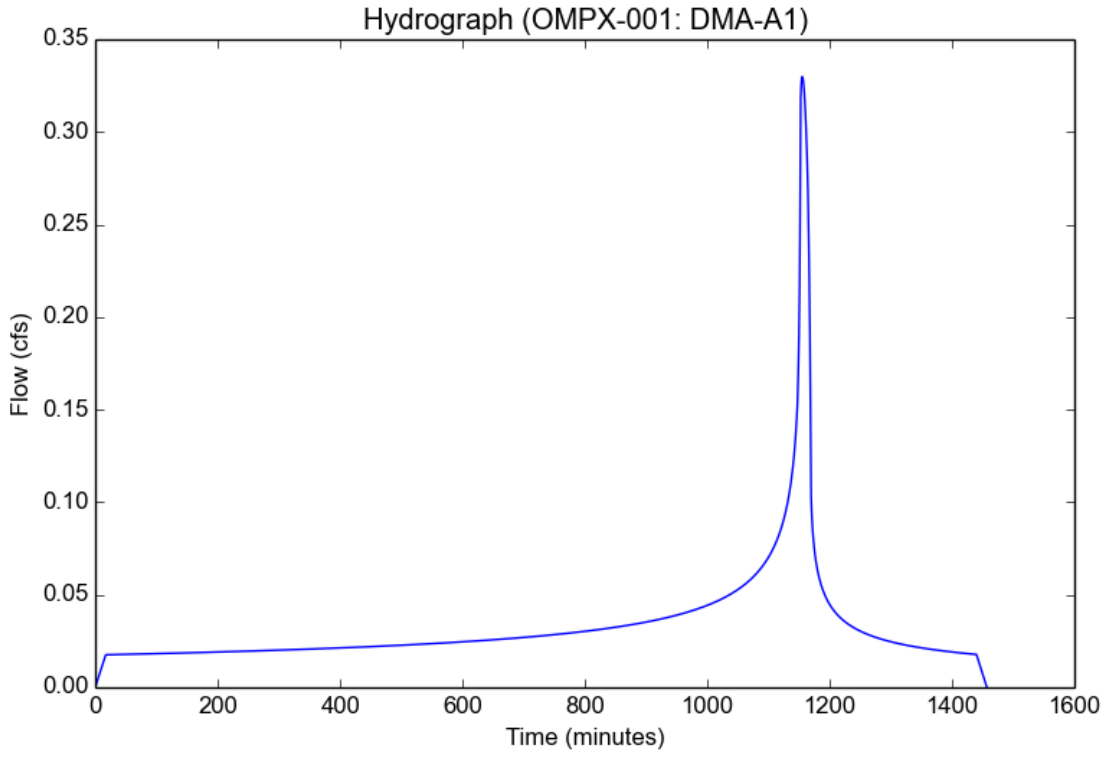
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-A1
Area (ac)	1.252
Flow Path Length (ft)	274.0
Flow Path Slope (vft/hft)	0.0102
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.63
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.3524
Undeveloped Runoff Coefficient (Cu)	0.488
Developed Runoff Coefficient (Cd)	0.7476
Time of Concentration (min)	17.0
Clear Peak Flow Rate (cfs)	0.3299
Burned Peak Flow Rate (cfs)	0.3299
24-Hr Clear Runoff Volume (ac-ft)	0.0669
24-Hr Clear Runoff Volume (cu-ft)	2912.5335



Peak Flow Hydrologic Analysis

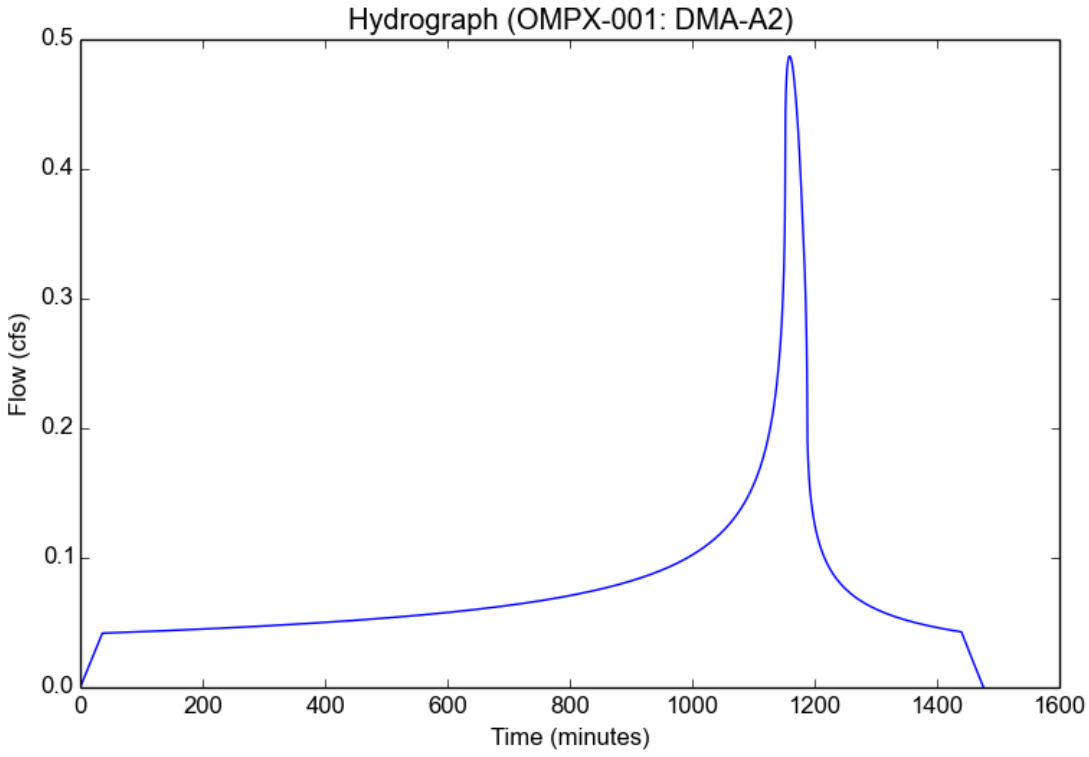
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-A2
Area (ac)	2.964
Flow Path Length (ft)	650.0
Flow Path Slope (vft/hft)	0.006
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.63
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2477
Undeveloped Runoff Coefficient (Cu)	0.2602
Developed Runoff Coefficient (Cd)	0.6633
Time of Concentration (min)	36.0
Clear Peak Flow Rate (cfs)	0.487
Burned Peak Flow Rate (cfs)	0.487
24-Hr Clear Runoff Volume (ac-ft)	0.1566
24-Hr Clear Runoff Volume (cu-ft)	6819.7097



Peak Flow Hydrologic Analysis

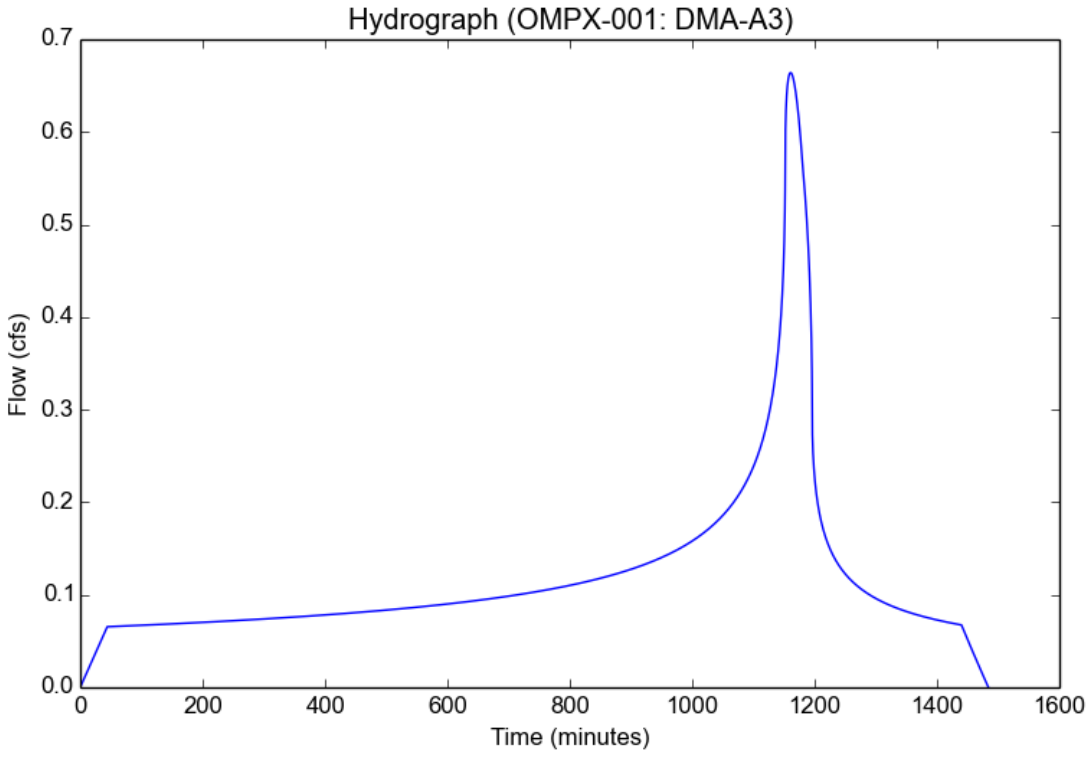
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-A3
Area (ac)	4.635
Flow Path Length (ft)	907.0
Flow Path Slope (vft/hft)	0.0073
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.63
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2254
Undeveloped Runoff Coefficient (Cu)	0.1854
Developed Runoff Coefficient (Cd)	0.6356
Time of Concentration (min)	44.0
Clear Peak Flow Rate (cfs)	0.6641
Burned Peak Flow Rate (cfs)	0.6641
24-Hr Clear Runoff Volume (ac-ft)	0.2439
24-Hr Clear Runoff Volume (cu-ft)	10622.216



Peak Flow Hydrologic Analysis

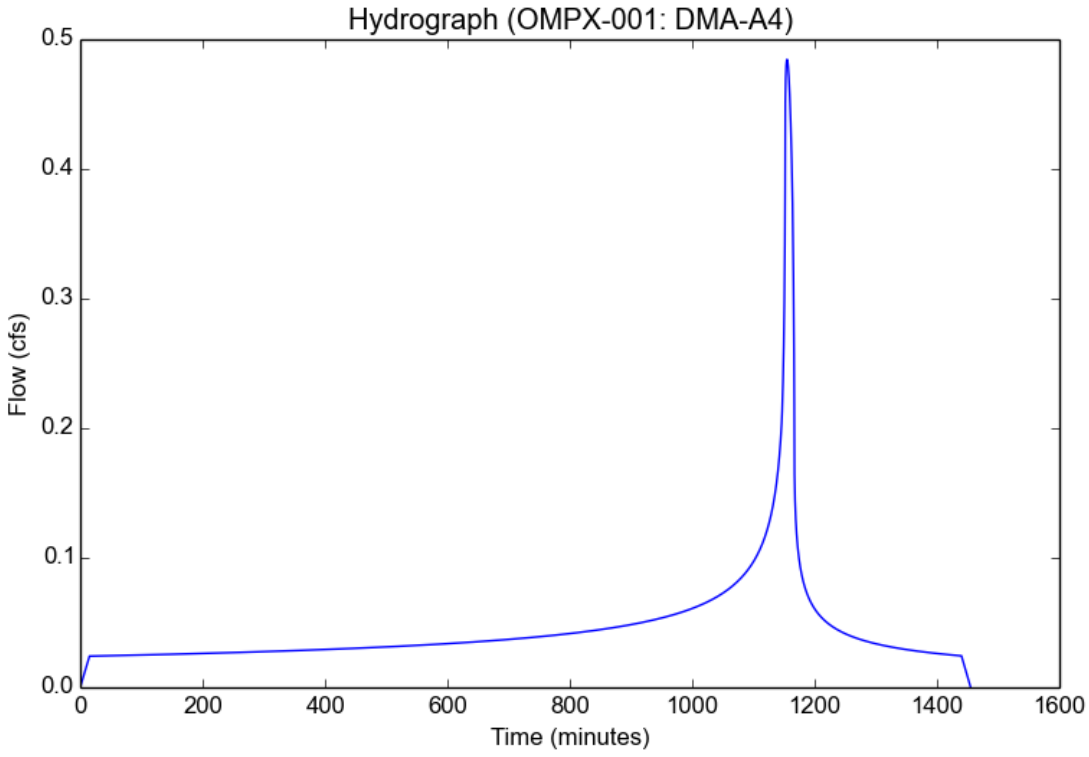
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-A4
Area (ac)	1.716
Flow Path Length (ft)	259.0
Flow Path Slope (vft/hft)	0.0181
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.63
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.3738
Undeveloped Runoff Coefficient (Cu)	0.5092
Developed Runoff Coefficient (Cd)	0.7554
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.4846
Burned Peak Flow Rate (cfs)	0.4846
24-Hr Clear Runoff Volume (ac-ft)	0.0917
24-Hr Clear Runoff Volume (cu-ft)	3994.1933



Peak Flow Hydrologic Analysis

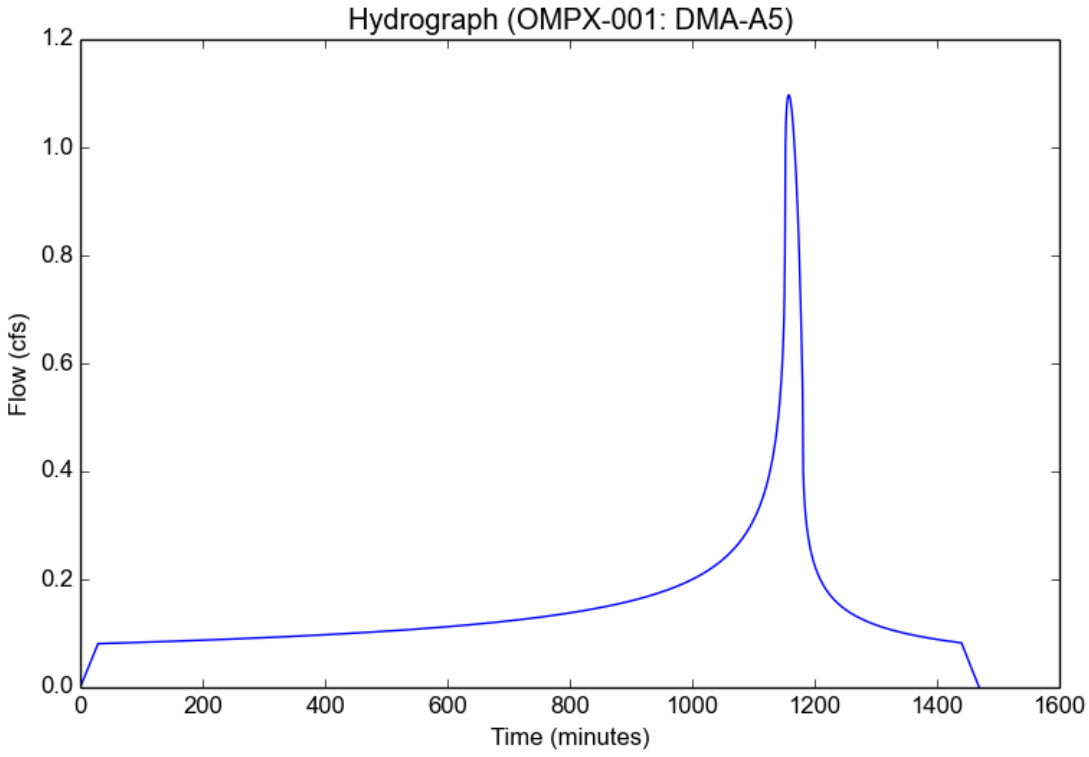
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-A5
Area (ac)	5.747
Flow Path Length (ft)	638.0
Flow Path Slope (vft/hft)	0.015
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.63
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2742
Undeveloped Runoff Coefficient (Cu)	0.3492
Developed Runoff Coefficient (Cd)	0.6962
Time of Concentration (min)	29.0
Clear Peak Flow Rate (cfs)	1.0972
Burned Peak Flow Rate (cfs)	1.0972
24-Hr Clear Runoff Volume (ac-ft)	0.3049
24-Hr Clear Runoff Volume (cu-ft)	13280.9643



Peak Flow Hydrologic Analysis

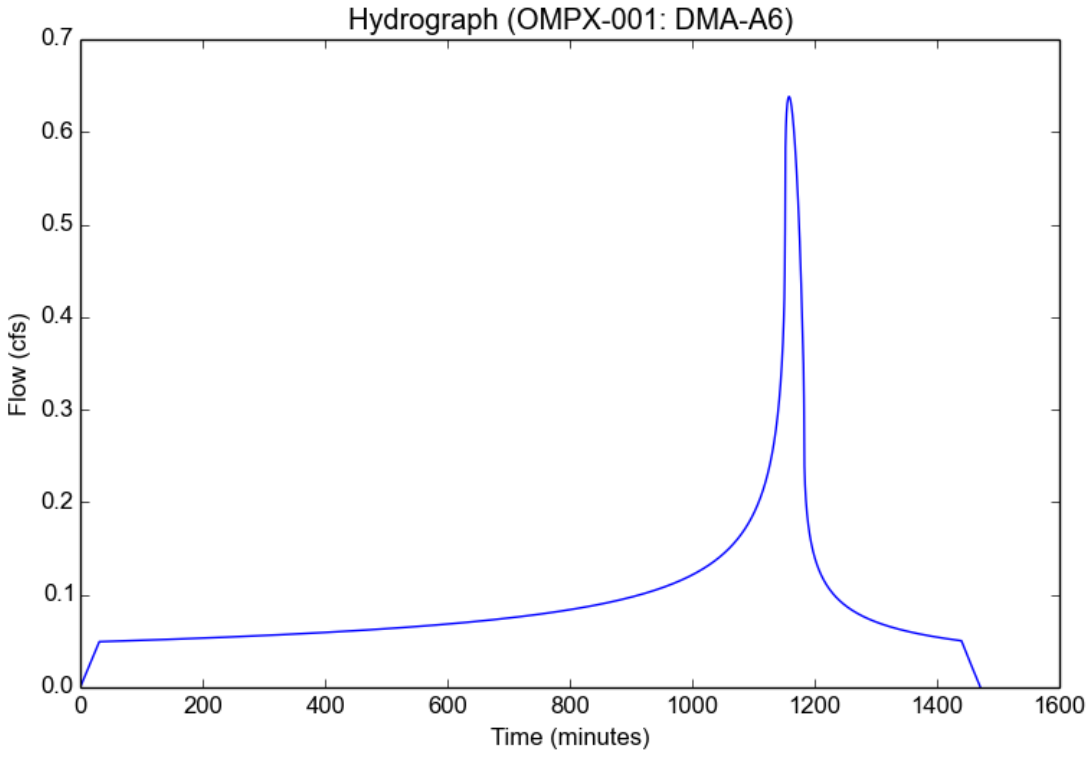
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-A6
Area (ac)	3.502
Flow Path Length (ft)	621.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	0.63
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.2657
Undeveloped Runoff Coefficient (Cu)	0.3208
Developed Runoff Coefficient (Cd)	0.6857
Time of Concentration (min)	31.0
Clear Peak Flow Rate (cfs)	0.6381
Burned Peak Flow Rate (cfs)	0.6381
24-Hr Clear Runoff Volume (ac-ft)	0.1855
24-Hr Clear Runoff Volume (cu-ft)	8082.025



Peak Flow Hydrologic Analysis

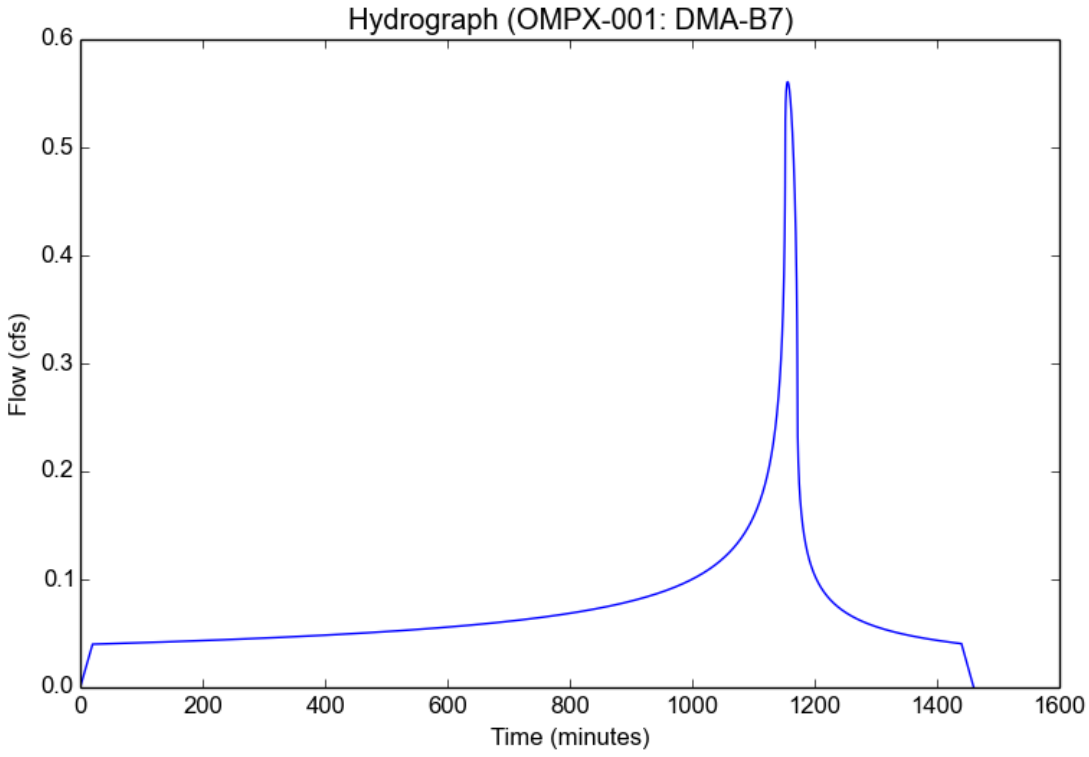
File location: P:/O/OMPX-001/Admin/Reports/Hydrology/Appendix B - Hydrology/HydroCalc/OMPX-001 HydroCalc Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	OMPX-001
Subarea ID	DMA-B7
Area (ac)	1.908
Flow Path Length (ft)	460.0
Flow Path Slope (vft/hft)	0.0137
85th Percentile Rainfall Depth (in)	1.05
Percent Impervious	1.0
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

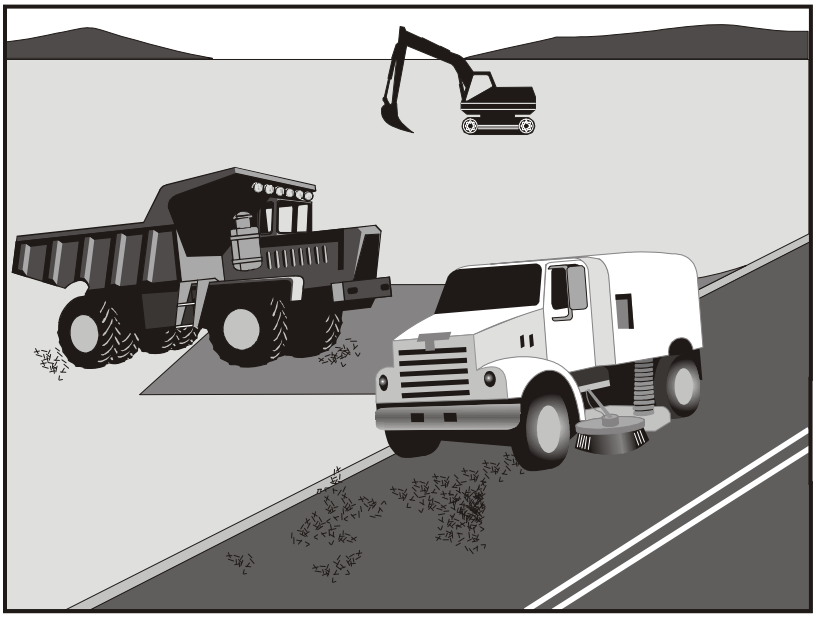
Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.05
Peak Intensity (in/hr)	0.3265
Undeveloped Runoff Coefficient (Cu)	0.4622
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	0.5607
Burned Peak Flow Rate (cfs)	0.5607
24-Hr Clear Runoff Volume (ac-ft)	0.149
24-Hr Clear Runoff Volume (cu-ft)	6491.0489



Appendix B:
Site BMPs

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

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.

CASQA
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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- 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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

– 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.

S-1: Storm Drain Message and Signage

Purpose

Waste material dumped into storm drain inlets can adversely impact surface and ground waters. In fact, any material discharged into the storm drain system has the potential to significantly impact downstream receiving waters. Storm drain messages have become a popular method of alerting and reminding the public about the effects of and the prohibitions against waste disposal into the storm drain system. The signs are typically stenciled or affixed near the storm drain inlet or catch basin. The message simply informs the public that dumping of wastes into storm drain inlets is prohibited and/or that the drain ultimately discharges into receiving waters.

General Guidance

- The signs must be placed so they are easily visible to the public.
- Be aware that signs placed on sidewalk will be worn by foot traffic.

Design Specifications

- Signs with language and/or graphical icons that prohibit illegal dumping, must be posted at designated public access points along channels and streams within the project area. Consult with Los Angeles County Department of Public Works (LACDPW) staff to determine specific signage requirements for channels and streams.
- Storm drain message markers, placards, concrete stamps, or stenciled language/icons (e.g., “No Dumping – Drains to the Ocean”) are required at all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping. Signs should be placed in clear sight facing anyone approaching the storm drain inlet or catch basin from either side (see Figure D-1 and Figure D-2). LACDPW staff should be contacted to determine specific requirements for types of signs and methods of application. A stencil can be purchased for a nominal fee from LACDPW Building and Safety Office by calling (626) 458-3171. All storm drain inlet and catch basin locations must be identified on the project site map.

Maintenance Requirements

Legibility and visibility of markers and signs should be maintained (e.g., signs should be repainted or replaced as necessary). If required by LACDPW, the owner/operator or homeowner’s association shall enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards and signs.

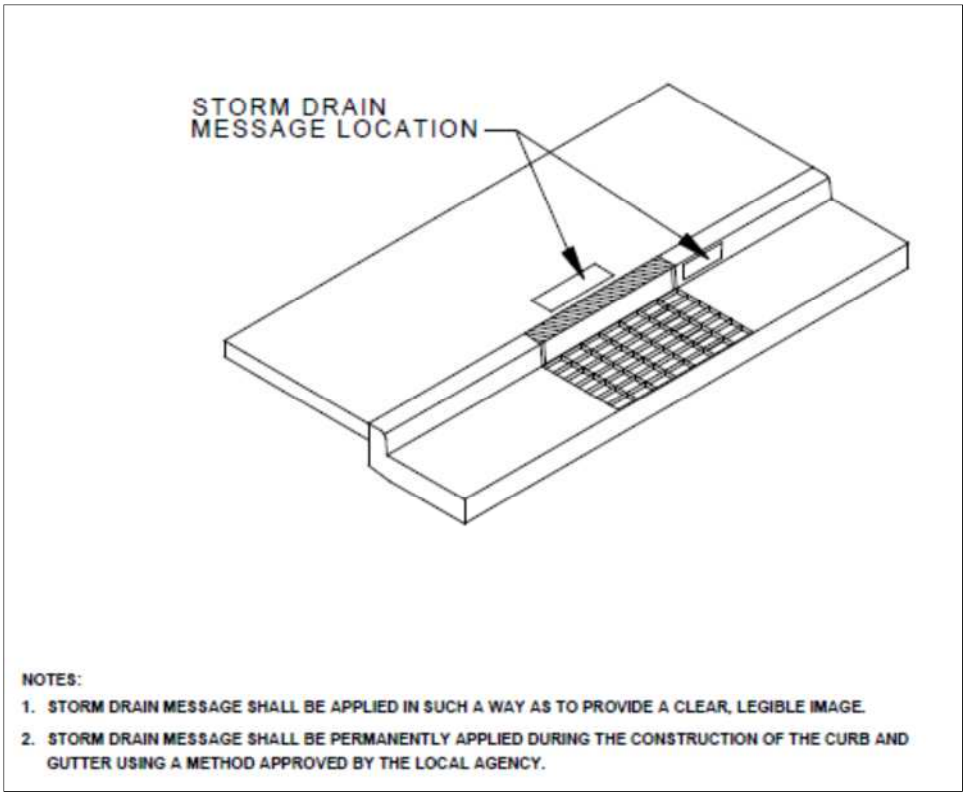


Figure D-1. Storm Drain Message Location – Curb Type Inlet

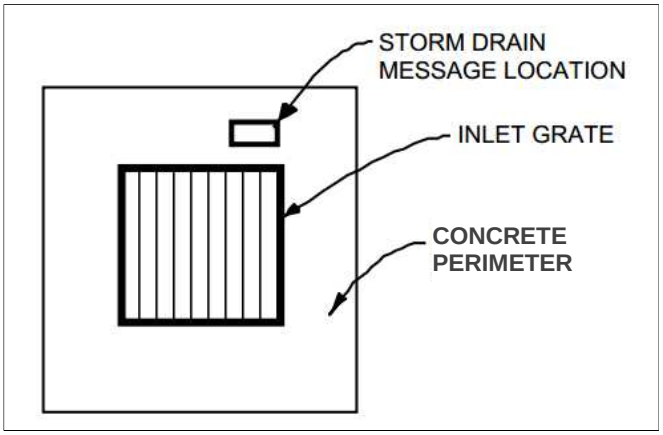


Figure D-2. Storm Drain Message Location – Catch Basin/Area Type Inlet

S-8: Landscape Irrigation Practices

Purpose

Irrigation runoff provides a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter the storm drain system. By effectively irrigating, less runoff is produced resulting in less potential for pollutants to enter the storm drain system.

General Guidance

- Do not allow irrigation runoff from the landscaped area to drain directly to storm drain system.
- Minimize use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.

Design Specifications

- Choose plants that minimize the need for fertilizer and pesticides.
- Group plants with similar water requirements and water accordingly.
- Use mulch to minimize evaporation and erosion.
- Include a vegetative boundary around project site to act as a filter.
- Design the irrigation system to only water areas that need it.
- Install an approved subsurface drip, pop-up, or other irrigation system.[1] The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).

[1] If alternative distribution systems (e.g., spray irrigation) are approved, the County will establish guidelines to implement these new systems.

- For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.[2]
- Implement Integrated Pest Management practices.

For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

Maintenance Requirements

Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

[2] As determined by the City of Los Angeles, Building and Safety Division

S-9: Building Materials Selection

Purpose

Building materials can potentially contribute pollutants of concern to stormwater runoff through leaching. For example, metal buildings, roofing, and fencing materials may be significant sources of metals in stormwater runoff, especially due to acidic precipitation. The use of alternative building materials can reduce pollutant sources in stormwater runoff by eliminating compounds that can leach into stormwater runoff. Alternative building materials may also reduce the need to perform maintenance activities (i.e., painting) that involve pollutants of concern, and may reduce the volume of stormwater runoff. Alternative materials are available to replace lumber and paving.

Design Specifications

Lumber

Decks and other house components constructed using pressure-treated wood that is typically treated using arsenate, copper, and chromium compounds are hazardous to the environment. Pressure-treated wood may be replaced with cement-fiber or vinyl.

Roofs, Fencing, and Metals

Minimizing the use of copper and galvanized (zinc-coated) metals on buildings and fencing can reduce leaching of these pollutants into stormwater runoff. The following building materials are conventionally made of galvanized metals:

- Metal roofs;
- Chain-link fencing and siding; and
- Metal downspouts, vents, flashing, and trim on roofs.

Architectural use of copper for roofs and gutters should be avoided. As an alternative to copper and galvanized materials, coated metal products are available for both roofing and gutter application. Vinyl-coated fencing is an alternative to traditional galvanized chain-link fences. These products eliminate contact of bare metal with precipitation or stormwater runoff, and reduce the potential for stormwater runoff contamination. Roofing materials are also made of recycled rubber and plastic.

Green roofs may be an option. Green roofs use vegetation such as grasses and other plants as an exterior surface. The plants reduce the velocity of stormwater runoff and absorb water to reduce the volume of stormwater runoff. One potential problem with using green roofs in the Los Angeles County area is the long, hot and dry summers, which may kill the plants if they are not watered. See the Green Roof Fact Sheet (RET-7) in Appendix E.

Pesticides

The use of pesticides around foundations can be reduced through the use of alternative barriers. Sand barriers can be applied around foundations to deter termites, as they cannot tunnel through sand. Metal shields also block termites from tunneling. Additionally, diatomaceous earth can be used to repel or kill a wide variety of other pests.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., signs) must be maintained by the owner/operator as required by local codes and ordinances. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

RET-3: Infiltration Trench

Description

An infiltration trench is a narrow trench constructed in naturally pervious soils designed for retaining and infiltrating stormwater runoff into the underlying native soils and groundwater table. Infiltration trenches are typically filled with gravel and sand, although use of manufactured percolation tank modules may be considered in place of gravel fill. Infiltration trenches provide stormwater runoff treatment through a variety of natural mechanisms (i.e., filtration, adsorption, biological degradation) as water flows through the soil profile.

Infiltration trenches differ from infiltration basins in that the former are used for small drainage areas and stores stormwater runoff out of sight underground within the void spaces of rocks or stones or percolation tank modules. Infiltration basins are used for larger drainage areas and stormwater is stored within a visible ponded surface.

Infiltration vaults and infiltration leach fields are subsurface variations of the infiltration trench concept in which stormwater runoff is distributed to the upper zone of the subsurface gravel bed by means of perforated pipes.

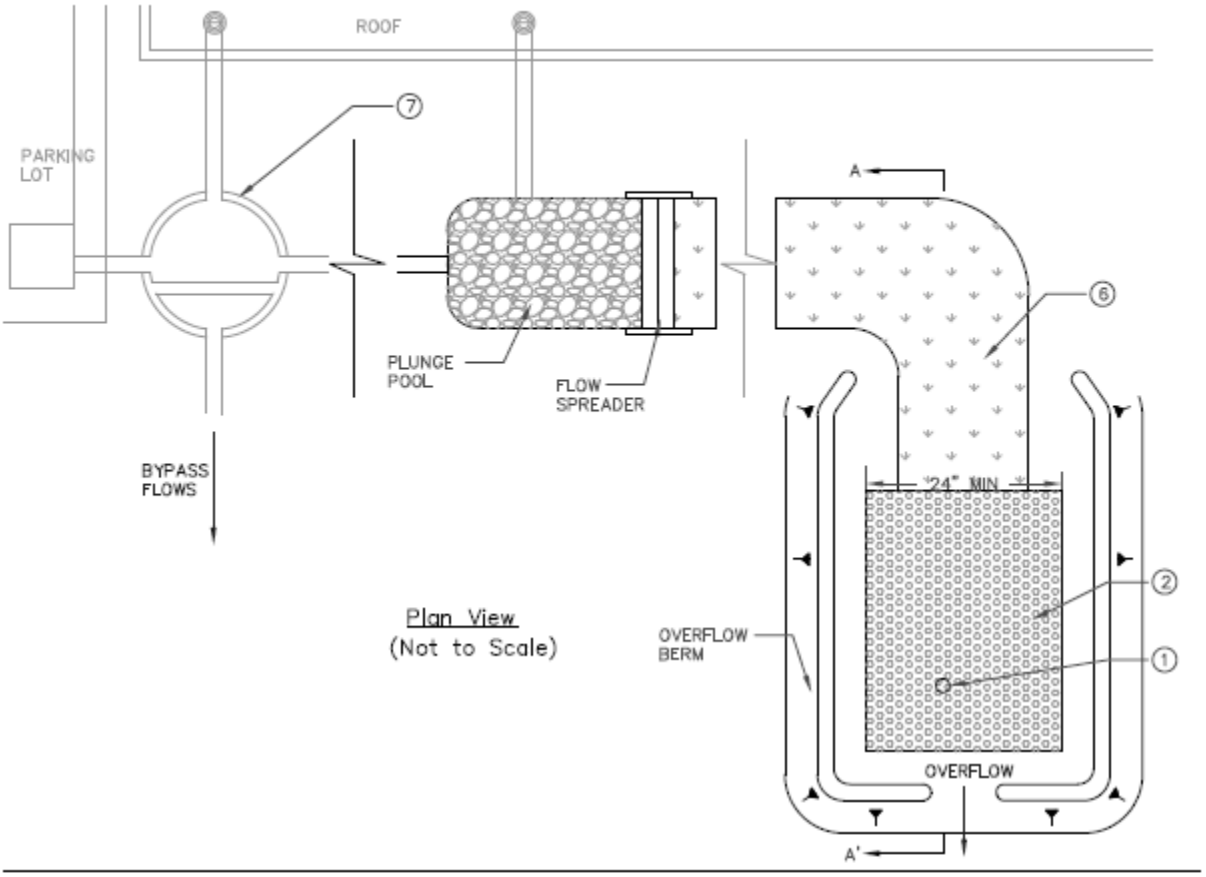
A schematic of a typical infiltration trench is presented in Figure E-3.

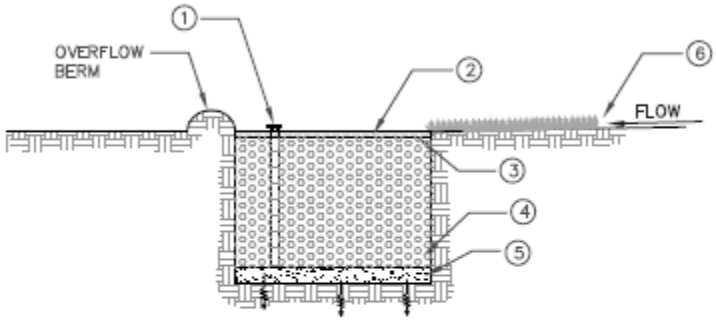
LID Ordinance Requirements

Infiltration trenches can be used to meet the on-site retention requirements of the LID Ordinance. Infiltration trenches will prevent pollutants in the SWQDv from being discharged off-site.

Advantages

- Reduces or eliminates stormwater runoff discharge to receiving water for most storm events
- Reduces peak stormwater runoff, which provides erosion control
- Provides groundwater recharge
- Provides effective treatment through settling and filtering while requiring relatively small space.
- Fits in narrow areas and unused areas of a development site.
- Is suitable for use when water is not available for irrigation or base flow.





NOTES:

1. OBSERVATION WELL WITH LOCKABLE ABOVE–GROUND CAP
2. 2" PEA GRAVEL FILTER LAYER
3. PROVIDE FILTER FABRIC IF NO PRETREATMENT IS PROVIDED
4. 3' – 5' DEEP TRENCH FILLED WITH 2" – 6" DIAMETER CLEAN STONE WITH 30% – 40% VOIDS
5. 6" DEEP SAND FILTER LAYER (OR FABRIC EQUIVALENT)
6. RUNOFF FILTERS THROUGH GRASS FILTER STRIP OR VEGETATED SWALE
7. OPTIONAL FLOW CONTROL DEVICE FOR OFF–LINE CONFIGURATIONS

Figure E-3. Infiltration Trench Schematic

Disadvantages

- Is not appropriate for areas with too low or too high permeability soils
- May not be appropriate for industrial sites or locations with contaminated soils or where spills may occur because of the potential threat to groundwater contamination
- Must be protected from high sediment loads
- May result in standing water, which may allow vector breeding
- Is not appropriate on fill or sites with steep slopes

General Constraints and Implementation Considerations

- Infiltration trenches can be integrated into open space buffers and other landscape areas.
- The potential for groundwater contamination must be carefully considered,. Infiltration trenches are not suitable for sites that:
    - Use or store chemicals or hazardous materials, unless they are prevented from entering the trench; or
    - Un-remediated “brownfield sites” where there is known groundwater or soil contamination.
- Infiltration trenches should be sited away from tree drip lines and kept free of vegetation.
- If the corrected in-situ infiltration rate exceed 2.4 in/hr, then stormwater runoff may need to be fully-treated with an upstream stormwater quality control measure prior to infiltration to protect groundwater quality.
- Infiltration trenches cannot be located on sites with a slope greater than 15 percent.
- Pretreatment to remove sediment is required to protect infiltration trench from high sediment loads.
- If possible, the entire tributary area of the infiltration trench should be stabilized before construction begins. If this is not possible, all flows should be diverted around the infiltration trench to protect it from sediment loads during construction or the top two inches of soil from the infiltration trench floor should be removed after the site has been stabilized. Excavated material should be stored such that it cannot be washed back into the infiltration trench if a storm occurs during construction.
- The equipment used to construct the infiltration trench should have extra wide low-pressure tires. Construction traffic should not enter the infiltration trench because it can compact soil, which reduces infiltration capacity. If heavy equipment is used on the base of the infiltration trench, the infiltrative capacity may be restored by tilling or aerating prior to placing the infiltrative bed.

- Clean, washed gravel should be placed in the excavated trench in lifts and lightly compacted with a plate compactor. Use of unwashed gravel can result in clogging.
- A geomembrane liner should be installed generously with overlapping seams on sides, bottom, and one foot below the surface of the infiltration trench.
- After construction is completed, the entire tributary area of the infiltration trench should be stabilized before allowing stormwater runoff to enter it.
- An observation well must be installed to check water levels, detention time, and evidence of clogging. An access road along the entire length of the infiltration trench is required unless it is located along an existing road or parking lot that can be safely used for maintenance access.

Design Specifications

The following sections provide design specifications for infiltration trenches.

Geotechnical

Due to the potential to contaminate groundwater, cause slope instability, impact surrounding structures, and potential for insufficient infiltration capacity, an extensive geotechnical site investigation must be conducted during the site planning process to verify site suitability for an infiltration trench. All geotechnical investigations must be performed according to the most recent GMED Policy GS 200.1. Soil infiltration rates and the groundwater table depth must be evaluated to ensure that conditions are satisfactory for proper operation of an infiltration trench. The project applicant must demonstrate through infiltration testing, soil logs, and the written opinion of a licensed civil engineer that sufficiently permeable soils exist on-site to allow the construction of a properly functioning infiltration trench.

Infiltration trenches are appropriate for soils with a minimum corrected in-situ infiltration rate of 0.3 in/hr. The geotechnical report must determine if the proposed project site is suitable for an infiltration trench and must recommend a design infiltration rate (see "Design Infiltration Rate" under the "Sizing" section). The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move through the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Pretreatment

Pretreatment is important for all structural stormwater quality control measures, but it is particularly important for retention facilities. Pretreatment refers to design features that provide settling of large particles before stormwater runoff enters a stormwater quality control measure in order to reduce the long-term maintenance burden. Pretreatment should be provided to reduce the sediment load entering an infiltration trench in order to maintain the infiltration rate of the infiltration trench. To ensure that infiltration trenches are effective, the project applicant must incorporate pretreatment devices that provide

sediment reduction (e.g., vegetated swales, vegetated filter strips, sedimentation manholes, and proprietary devices).

Setbacks

Infiltration trenches must be sited following the setbacks from the most recent GMED Policy GS 200.1.

Geometry

- Infiltration trenches must be designed and constructed to be at least 24 inches wide and 3 to 5 feet deep.
- The longitudinal slope of the trench should not exceed three percent.
- The filter bed media layers must have the following composition and thickness:
    - Top layer: 2 inches of pea gravel
    - Middle layer: 3 to 5 feet of washed 2- to 6-inch gravel; void spaces should be approximately 30 to 40 percent
    - Bottom layer: 6 inches of sand or geomembrane liner equivalent.

Sizing

Infiltration trenches are sized a simple sizing method where the SWQDv must be completely infiltrated within 96 hours. Infiltration trenches provide stormwater runoff storage in the voids of the rock fill or percolation tank modules.

Step 1: Determine the SWQDv

Infiltration trenches must be designed to capture and retain the SWQDv (see Section 6 for SWQDv calculation procedures).

Step 2: Determine the design infiltration rate

Determine the corrected in-situ infiltration rate (f_{design}) of the native soil using the procedures described in the most recent GMED Policy GS 200.1.

Step 3: Calculate the surface area

Determine the size of the required infiltration surface by assuming the SWQDv will fill the available void spaces of the gravel storage layer. The maximum depth of stormwater runoff that can be infiltrated within the maximum retention time (96 hrs) is calculated using the following equation:

$$d_{max} = \frac{f_{design}}{12} \times t$$

Where:

d_{max} = Maximum depth of water that can be infiltrated within the maximum retention time [ft];
f_{design} = Design infiltration rate [in/hr]; and
t = Maximum retention time (max 96 hrs) [hr].

Select the infiltration trench depth (d_t) such that:

$$d_t \leq \frac{d_{max}}{n_t}$$

Where:

d_t = Depth of infiltration trench [ft];
d_{max} = Maximum depth of water that can be infiltrated within the maximum retention time [ft]; and
n_t = Infiltration trench fill porosity.

Calculate the infiltrating surface area (bottom of the infiltration trench) required:

$$A = \frac{SWQDv}{d_t \times n_t}$$

Where:

A = Surface area of the bottom of the infiltration trench [ft^2];
SWQDv = Stormwater quality design volume [ft^3];
d_t = Depth of infiltration trench fill [ft]; and
n_t = Infiltration trench porosity.

Flow Entrance and Energy Dissipation

Energy dissipation controls, constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent flow, must be installed at the inlet to the infiltration trench. Flow velocity at the inlet must be 4 ft/s or less. Consult with LACDPW for the type and design of energy dissipation structure.

Drainage

The specifications for designing drainage systems for infiltration trenches are presented below:

- The bottom of infiltration trench must be native soil that is over-excavated at least one foot in depth with the soil replaced uniformly without compaction. Amending the excavated soil with two to four inches (~15 to 30 percent) of coarse sand is recommended.

- The use of vertical piping, either for distribution or infiltration enhancement, is prohibited. This application may be classified as a Class V Injection Well per 40 CFR Part 146.5(e)(4).
- The infiltration capacity of the subsurface layers should be sufficient to ensure a maximum detention time of 96 hours. An observation well must be installed to allow observation of detention time.

Hydraulic Restriction Layer

The entire infiltrative area, including the side slopes must lined with a geomembrane liner to prevent soil from migrating into the top layer and reducing the infiltration capacity. The specifications of the geomembrane liner are presented in Table E-5. The entire trench area, including the sides, must be lined with a geomembrane liner prior to placing the media bed. Provide generous overlap at the seams.

Table E-5. Geomembrane Liner Specifications for Infiltration Trenches

Parameter	Test Method	Specifications
Material		Nonwoven geomembrane liner
Unit weight		8 oz/yd^3 (minimum)
Filtration rate		0.08 in/sec (minimum)
Puncture strength	ASTM D-751 (Modified)	125 lbs (minimum)
Mullen burst strength	ASTM D-751	400 lb/in^2 (minimum)
Tensile strength	AST D-1682	300 lbs (minimum)
Equiv. opening size	US Standard Sieve	No. 80 (minimum)

Observation Well

The observation well is a vertical section of perforated PVC pipe, four- to six-inch diameter, installed flush with the top of the infiltration trench on a footplate and with a locking, removable cap. The observation well is needed to monitor the infiltration rate in infiltration trench and is useful for marking the location of the infiltration trench.

Vegetation

- Infiltration trenches must be kept free of vegetation.
- Trees and other large vegetation should be planted away from infiltration trenches such that drip lines do not overhang the infiltration area.

Restricted Construction Materials

Use of pressure-treated wood or galvanized metal at or around an infiltration trench is prohibited.

Overflow Device

An overflow device must be provided in the event that stormwater runoff overtops the infiltration trench or if the infiltration trench becomes clogged. The overflow device must be able to convey stormwater runoff to a downstream conveyance system or other acceptable discharge point.

Maintenance Access

The infiltration trench must be safely accessible during wet and dry weather conditions if it is publicly-maintained. An access road along the entire length of the infiltration trench is required unless the trench is located along an existing road or parking lot that can be safely used for maintenance access. If the infiltration trench becomes plugged and fails, access is needed to excavate the infiltration trench and replace the filter bed media. All dimensions of the infiltration trench should also be increased by two inches to provide a fresh surface for infiltration. To prevent damage and compaction, access must able to accommodate a backhoe working at "arm's length" from the infiltration trench.

Maintenance Requirements

Maintenance and regular inspections are important for proper function of infiltration trenches. The following are general maintenance requirements:

- Conduct regular inspection and routine maintenance for pretreatment devices.
- Inspect infiltration trench and its observation well frequently to ensure that water infiltrates into the subsurface completely within the maximum detention time of 96 hours. If water is present in the observation well more than 96 hours after a major storm, the infiltration trench may be clogged. Maintenance activities triggered by a potentially clogged facility include:
    - Check for debris/sediment accumulation, rake surface and remove sediment (if any), and evaluate potential sources of sediment and vegetative or other debris (i.e., embankment erosion, channel scour, overhanging trees). If suspected upstream sources are outside of the County's jurisdiction, additional pretreatment (i.e., trash racks, vegetated swales) may be necessary.
    - Assess the condition of the top aggregate layer for sediment buildup and crusting. Remove the top layer of pea gravel and replace. If slow draining conditions persist, the entire infiltration trench may need to be excavated and replaced.
- Eliminate standing water to prevent vector breeding.
- Inspect infiltration trenches annually. Remove and dispose of trash and debris as needed, but at least prior to the beginning of the wet season.
- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.

A summary of potential problems that may need to be addressed by maintenance activities is presented in Table E-6.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater quality control measures. The property owner is responsible for compliance with the maintenance agreement. A sample maintenance agreement is presented in Appendix H.

Table E-6. Infiltration Trench Troubleshooting Summary

Problem	Conditions When Maintenance Is Needed	Maintenance Required
Trash and Debris	Trash and debris > 5 ft^3/1,000 ft^2	Remove and dispose of trash and debris.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination.
Erosion/Sediment Accumulation	Undercut or eroded areas at inlet structures	Repair eroded areas and re-grade if necessary.
	Accumulation of sediment, debris, and oil/grease in pretreatment devices	Remove sediment, debris, and/or oil/grease.
	Accumulation of sediment, debris, and oil/grease on surface, inlet or overflow structures	Remove sediment, debris, and/or oil/grease.
Water Drainage Rate	Standing water, or by inspection of observation wells	Remove the top layer of the infiltration trench bottom and replace if necessary.

Appendix C:
ADS StormTech Detention and Infiltration System

Project specific details and pre-treatment system detail to be provided prior to final approval.

Stage-Storage Table

Project: **OMPX-001**
Address: **919 Sierra Madre Avenue, City of Azusa**

ADS StormTech MC-7200 Detention

	# of chamber	# of end cap
ADS chamber/ end cap	260	34

Depth (ft)	Cumulative Volume (cf)	Cumulative Volume (cf)
0	**0**	**0**
1	8174.40	528.02
2	21928.40	1241.00
3	35066.20	1919.64
4	47195.20	2543.88
5	57657.60	3095.36
6	64825.80	3573.74
6.67	69498.00	3919.52

Syste Storage Table Conversion

43560

Depth (ft)	Volume (cf)	Volume (af)
0	0	0
1	8702.42	0.1998
2	23169.40	0.5319
3	36985.84	0.8491
4	49739.08	1.1419
5	60752.96	1.3947
6	68399.54	1.5702
6.67	73417.52	1.6854

Infiltrated Outflow

Design Infiltration rate	Infiltrated Area	Infiltrated Q
2.33 in/hr	18493.4	0.9974

Design Infiltration rate per Geotechnical Report Dated April 26, 2023.
Infitlrated Surface Area per Manufacturer's Specification.

Site Mitigated Outflow

Allowable Q	Mitigated Peak Outflow
78.2	73.94

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	No
Project Name:	OMPX-001 DMA-A
Bed Name	Bed 1
Engineer:	undefined undefined
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	500 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(20 ft. x 20 ft.)

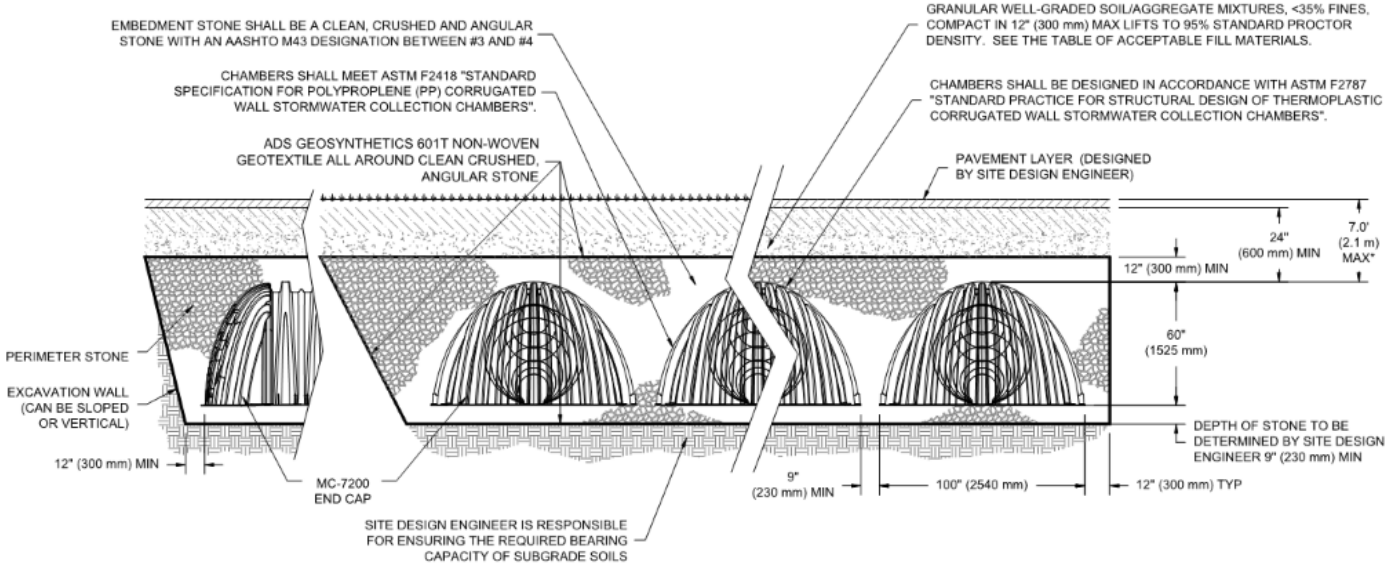
Results

System Volume and Bed Size

Installed Storage Volume:	32617.90 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	108
Number Of End Caps Required:	18
Chamber Rows:	9
Maximum Length:	92.78 ft.
Maximum Width:	83.00 ft.
Approx. Bed Size Required:	7700.88 square ft.

System Components

Amount Of Stone Required:	1196 cubic yards
Volume Of Excavation (Not Including Fill):	1926 cubic yards
Total Non-woven Geotextile Required:	2370 square yards
Woven Geotextile Required (excluding Isolator Row):	234 square yards
Woven Geotextile Required (Isolator Row):	198 square yards
Total Woven Geotextile Required:	431 square yards
Impervious Liner Required:	0 square yards



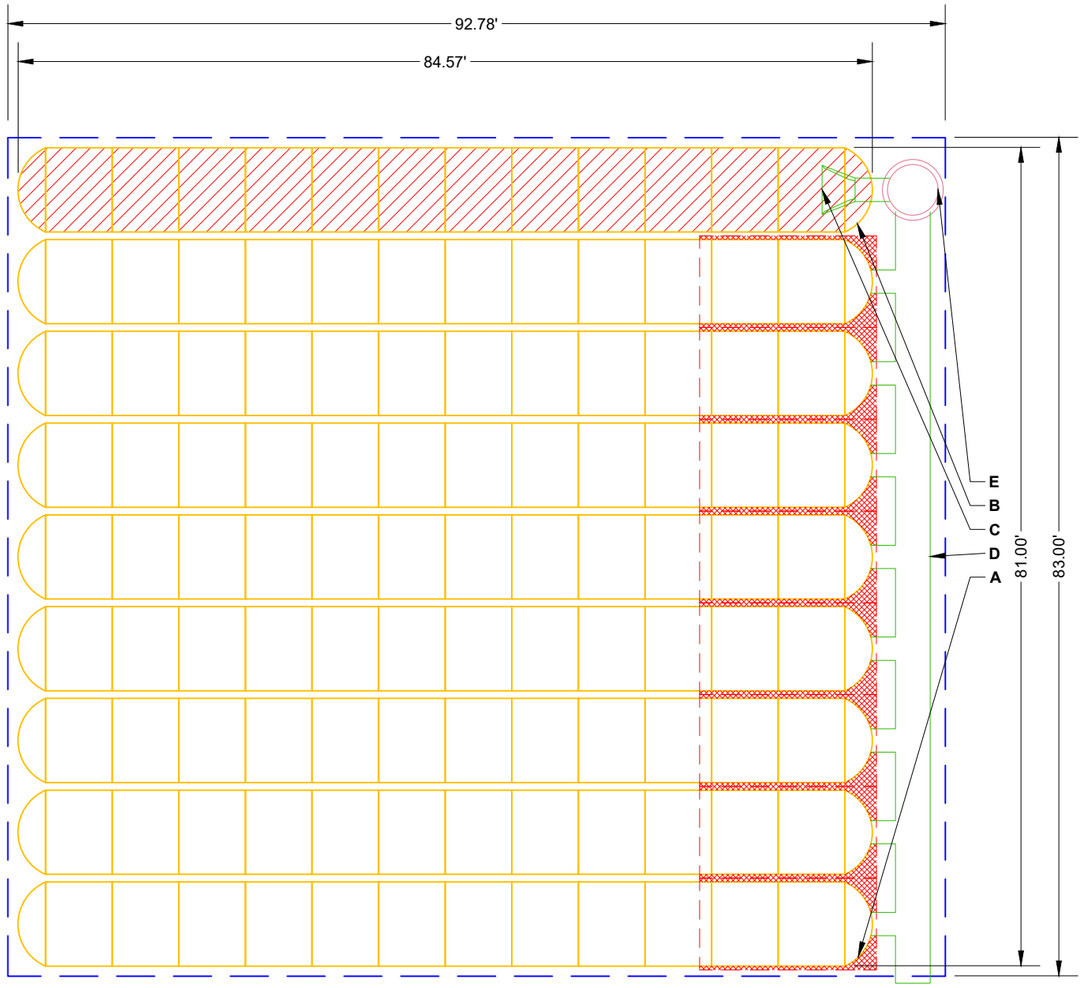
*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

PROPOSED LAYOUT: BED 1	
108	STORMTECH MC-7200 CHAMBERS
18	STORMTECH MC-7200 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
257	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (BASE STONE INCLUDED)
7701	SYSTEM AREA (SF)
351.6	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
TOP OF STONE:	6.75
TOP OF MC-7200 CHAMBER:	5.75
36" x 24" TOP MANIFOLD INVERT (24" PIPE):	2.67
36" x 24" TOP MANIFOLD INVERT (36" PIPE):	1.68
24" ISOLATOR ROW PLUS INVERT:	0.94
BOTTOM OF MC-7200 CHAMBER:	0.75
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" TOP PARTIAL CUT END CAP, PART#: MC7200IEPP24T / TYP OF ALL 24" TOP CONNECTIONS	29.13"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	36" x 24" ADS N-12 (36" PIPE) 36" x 24" ADS N-12 (24" PIPE)	11.13" 23.05"	
CONCRETE STRUCTURE	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		76.0 CFS IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

OMPX-001
AZUSA, CA, USA
DATE: 03/17/2025 | DRAWN: UU | CHECKED: N/A | PROJECT #:

DESCRIPTION	CHK	DRW	DATE

StormTech®
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

0 15 30

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	No
Project Name:	OMPX-001 DMA-A
Bed Name	Bed 2
Engineer:	undefined undefined
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	500 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(20 ft. x 20 ft.)

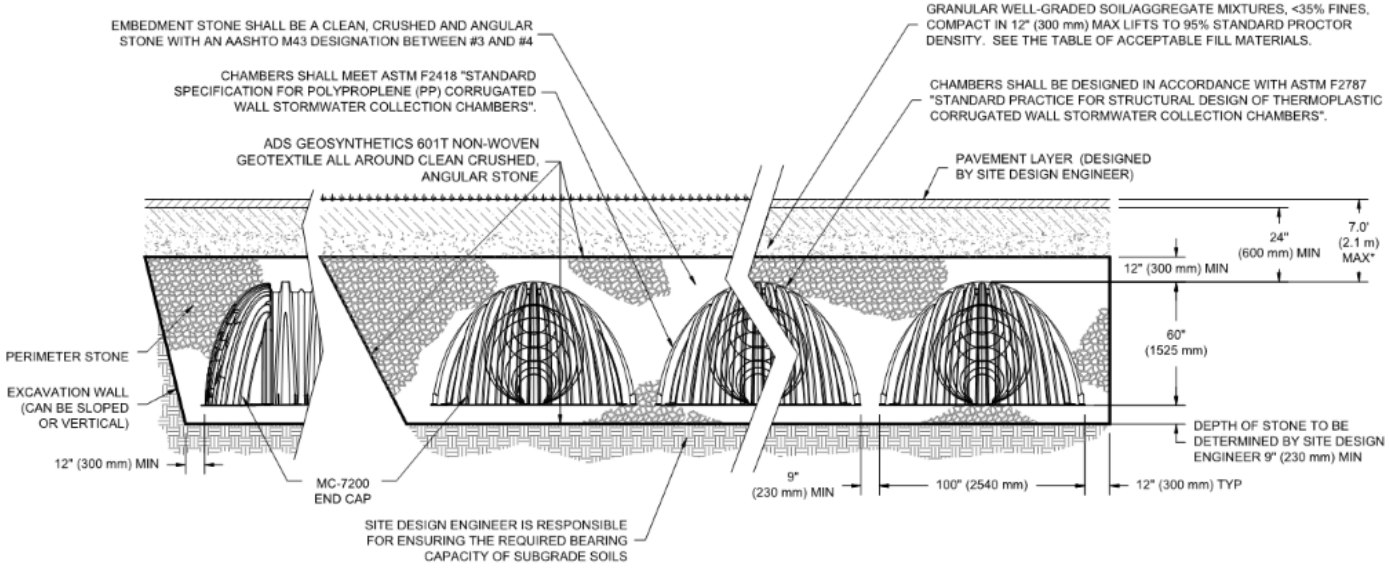
Results

System Volume and Bed Size

Installed Storage Volume:	12674.51 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	40
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	120.81 ft.
Maximum Width:	28.50 ft.
Approx. Bed Size Required:	3077.96 square ft.

System Components

Amount Of Stone Required:	501 cubic yards
Volume Of Excavation (Not Including Fill):	770 cubic yards
Total Non-woven Geotextile Required:	1090 square yards
Woven Geotextile Required (excluding Isolator Row):	88 square yards
Woven Geotextile Required (Isolator Row):	244 square yards
Total Woven Geotextile Required:	331 square yards
Impervious Liner Required:	0 square yards

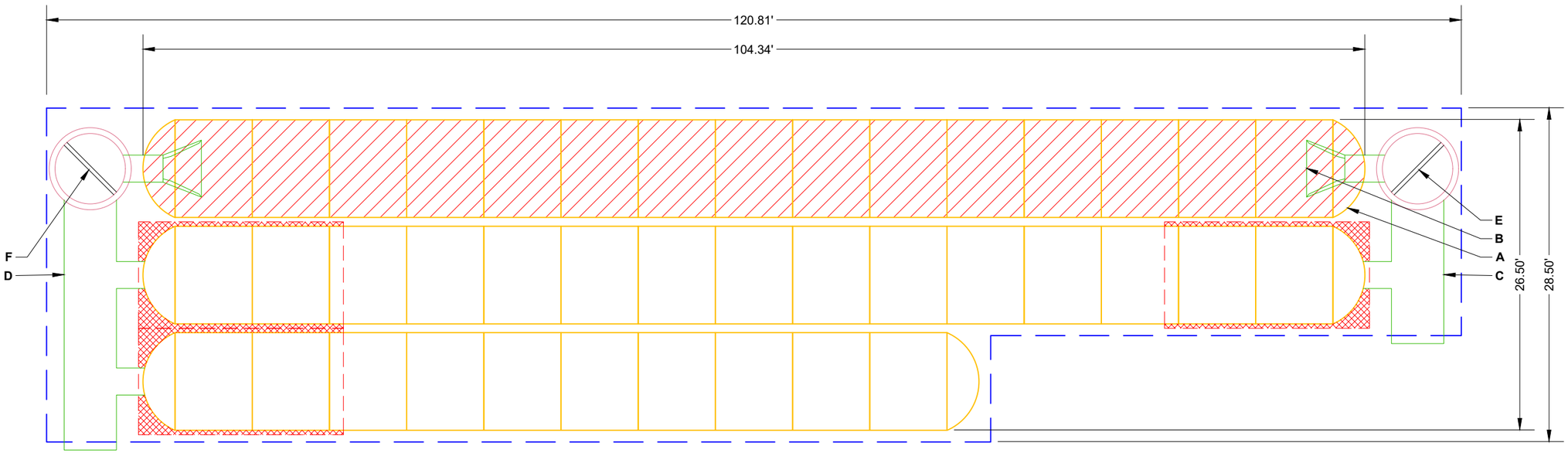


*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

PROPOSED LAYOUT: BED 2		CONCEPTUAL ELEVATIONS	
40	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
6	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
103	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-7200 CHAMBER:	5.75
		48" x 24" BOTTOM MANIFOLD INVERT (24" PIPE):	0.94
3078	SYSTEM AREA (SF)	48" x 24" BOTTOM MANIFOLD INVERT (24" PIPE):	0.94
298.6	SYSTEM PERIMETER (ft)	24" ISOLATOR ROW PLUS INVERT:	0.94
		24" ISOLATOR ROW PLUS INVERT:	0.94
		BOTTOM OF MC-7200 CHAMBER:	0.75
		BOTTOM OF STONE:	0.00
		48" x 24" BOTTOM MANIFOLD INVERT (48" PIPE):	-1.02
		48" x 24" BOTTOM MANIFOLD INVERT (48" PIPE):	-1.02

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	B	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP (TYP 2 PLACES)		
MANIFOLD	C	48" x 24" ADS N-12 (48" PIPE) 48" x 24" ADS N-12 (24" PIPE)	-21.26" 2.26"	
MANIFOLD	D	48" x 24" ADS N-12 (48" PIPE) 48" x 24" ADS N-12 (24" PIPE)	-21.26" 2.26"	
CONCRETE STRUCTURE W/WEIR	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		9.5 CFS IN
CONCRETE STRUCTURE W/WEIR	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		19.0 CFS IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

OMPX-001 DMA-A
AZUSA, CA, USA

DATE: 03/17/2025 | DRAWN: UU | CHECKED: N/A

PROJECT #:

DATE	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

0 10 20

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	No
Project Name:	OMPX-001 DMA-A
Bed Name	Bed 3
Engineer:	undefined undefined
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	500 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(20 ft. x 20 ft.)

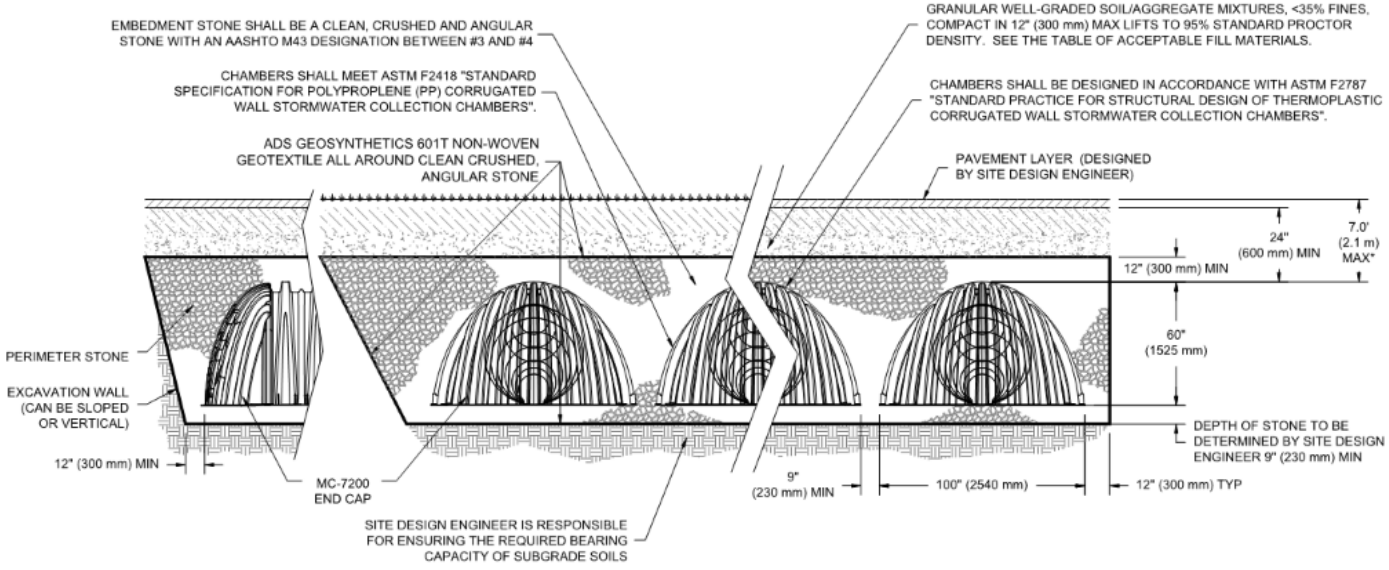
Results

System Volume and Bed Size

Installed Storage Volume:	25684.69 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	88
Number Of End Caps Required:	8
Chamber Rows:	4
Maximum Length:	159.72 ft.
Maximum Width:	37.58 ft.
Approx. Bed Size Required:	6002.68 square ft.

System Components

Amount Of Stone Required:	916 cubic yards
Volume Of Excavation (Not Including Fill):	1501 cubic yards
Total Non-woven Geotextile Required:	1956 square yards
Woven Geotextile Required (excluding Isolator Row):	88 square yards
Woven Geotextile Required (Isolator Row):	352 square yards
Total Woven Geotextile Required:	439 square yards
Impervious Liner Required:	0 square yards

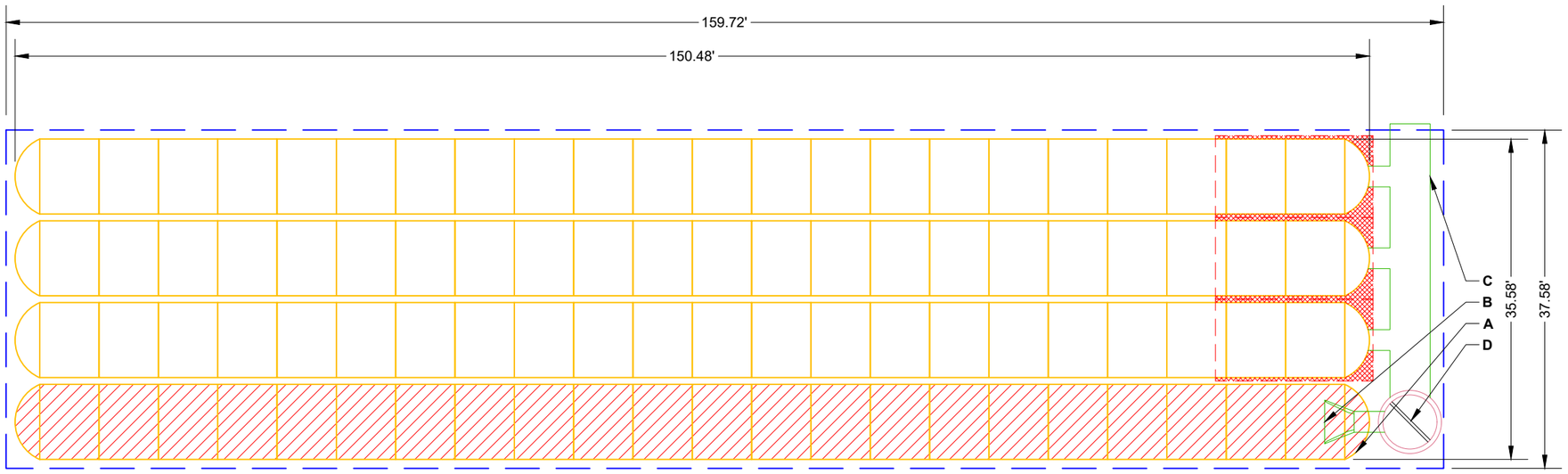


*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

PROPOSED LAYOUT: BED 3		CONCEPTUAL ELEVATIONS	
88	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
8	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
200	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-7200 CHAMBER:	5.75
		48" x 24" BOTTOM MANIFOLD INVERT (24" PIPE):	0.94
6003	SYSTEM AREA (SF)	24" ISOLATOR ROW PLUS INVERT:	0.94
394.6	SYSTEM PERIMETER (ft)	BOTTOM OF MC-7200 CHAMBER:	0.75
		BOTTOM OF STONE:	0.00
		48" x 24" BOTTOM MANIFOLD INVERT (48" PIPE):	-1.02

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	B	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	C	48" x 24" ADS N-12 (48" PIPE) 48" x 24" ADS N-12 (24" PIPE)	-21.26" 2.26"	
CONCRETE STRUCTURE W/WEIR	D	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		28.5 CFS IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

OMPX-001 DMA-A
AZUSA, CA, USA

DATE: 03/17/2025 | DRAWN: UU | CHECKED: N/A
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

StormTech®
Chamber System

1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

ADS

0 15 30

SHEET
2 OF 5

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	No
Project Name:	OMPX-001 DMA-B
Engineer:	Ka Hei Lam
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	500 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(20 ft. x 20 ft.)

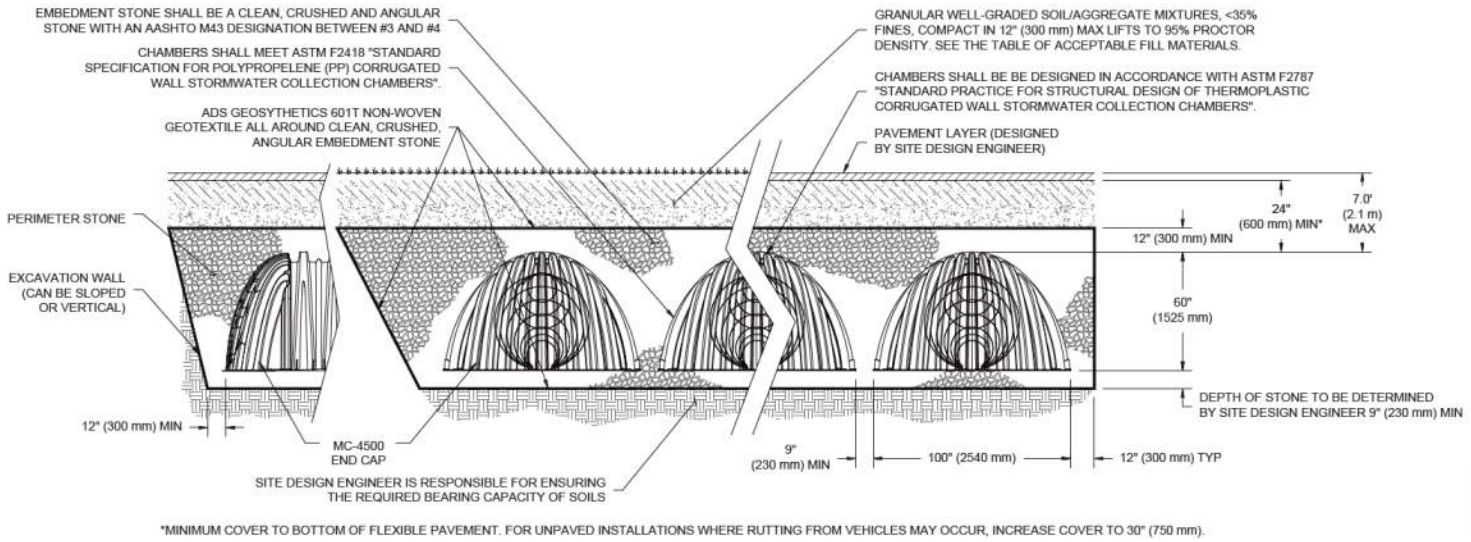
Results

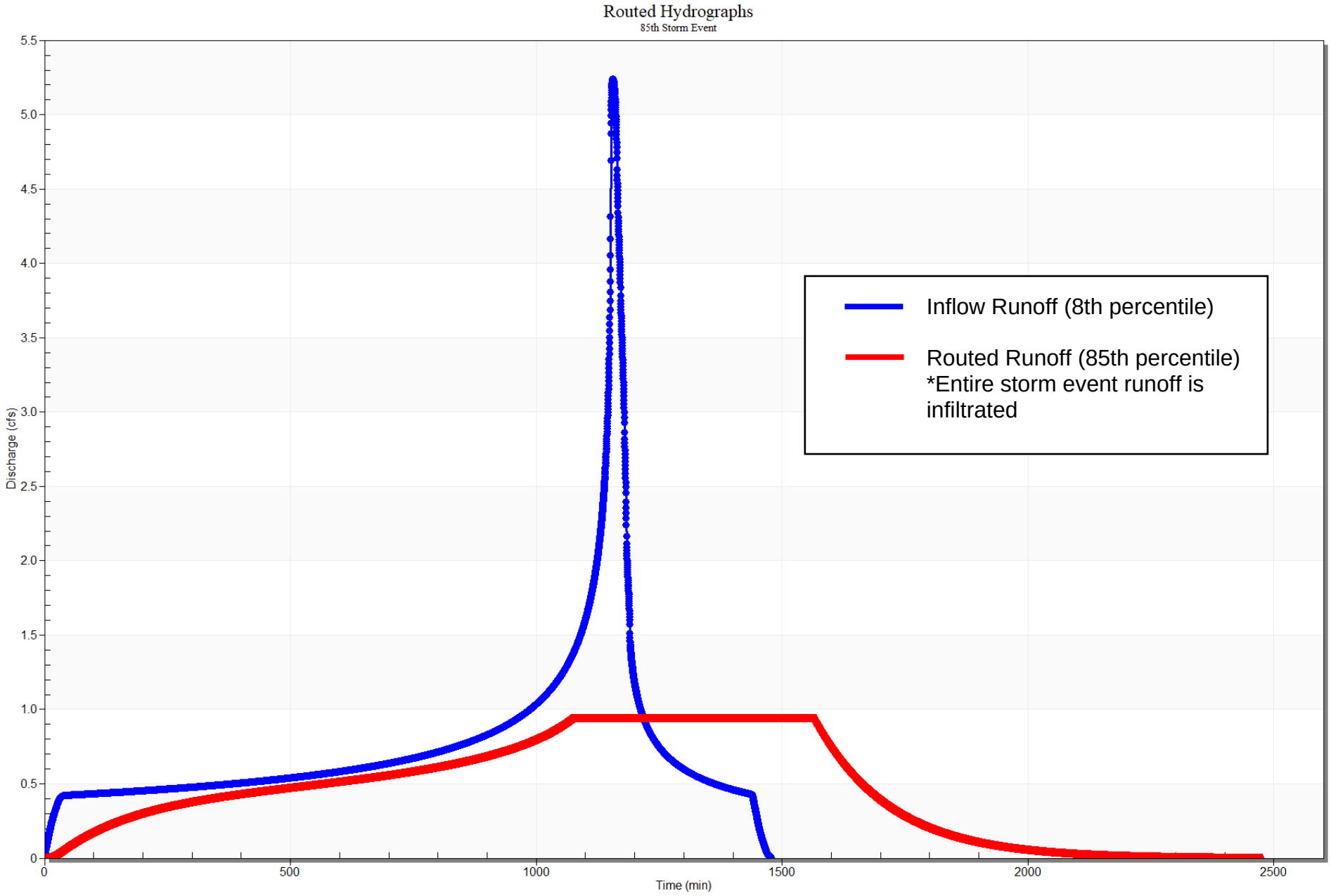
System Volume and Bed Size

Installed Storage Volume:	7202.46 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	24
Number Of End Caps Required:	2
Chamber Rows:	1
Maximum Length:	165.67 ft.
Maximum Width:	10.33 ft.
Approx. Bed Size Required:	1711.89 square ft.

System Components

Amount Of Stone Required:	269 cubic yards
Volume Of Excavation (Not Including Fill):	428 cubic yards
Total Non-woven Geotextile Required:	774 square yards
Woven Geotextile Required (excluding Isolator Row):	0 square yards
Woven Geotextile Required (Isolator Row):	382 square yards
Total Woven Geotextile Required:	382 square yards
Impervious Liner Required:	0 square yards




Routed Hydrographs
85th Storm Event
Discharge (cfs)
Time (min)
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
0
500
1000
1500
2000
2500
Inflow Runoff (8th percentile)
Routed Runoff (85th percentile)
*Entire storm event runoff is infiltrated

StormTech® MC-7200 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
83” x 100” x 60”
2108 mm x 2540 mm x 1524 mm

Chamber Storage
175.9 ft³ (4.98 m³)

Min. Installed Storage*
267.3 ft³ (7.57 m³)

Weight
202 lbs (91.6 kg)

Shipping
7 chambers/pallet
5 end caps/pallet
6 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 9” (230 mm) of stone between chambers/ end caps and 40% stone porosity.

Nominal End Cap Specifications
(not to scale)

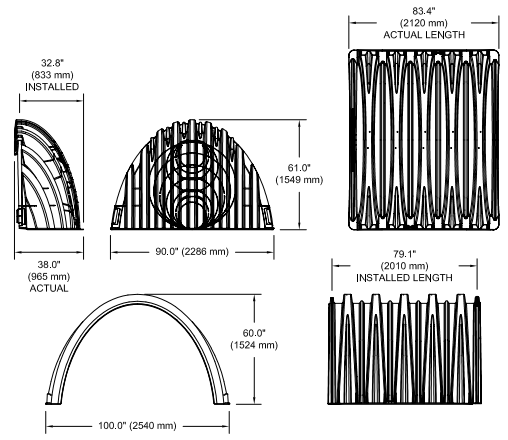
Size (L x W x H)
38” x 90” x 61”
965 mm x 2286 mm x 1549 mm

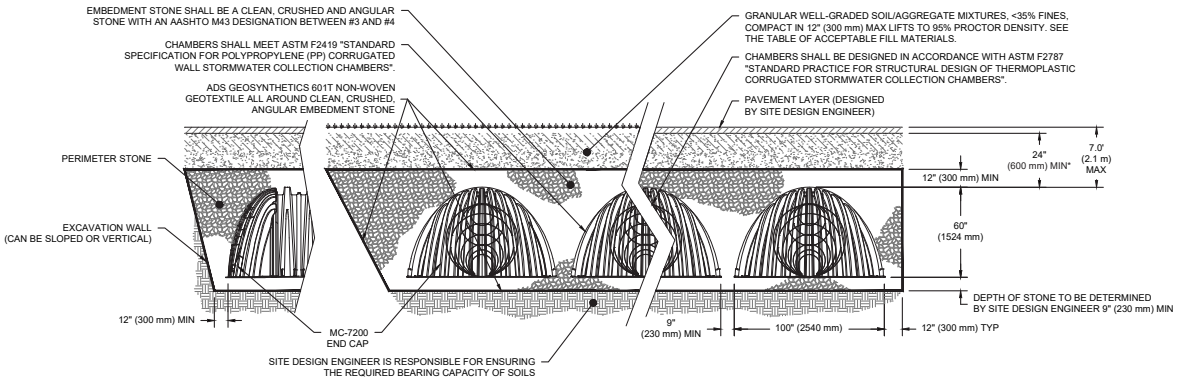
End Cap Storage
39.5 ft³ (1.12 m³)

Min. Installed Storage*
115.3 ft³ (3.26 m³)

Weight
Nominal 90.0 lbs (40.8 kg)

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 12” (300 mm) of stone perimeter, 9” (230 mm) of stone between chambers/end caps and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

ADS StormTech™

StormTech MC-7200 Specifications

Storage Volume Per Chamber

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9 in (230 mm)	12 in (300 mm)	15 in (375 mm)	18 in (450 mm)
Chamber	175.9 (4.98)	267.3 (7.57)	273.3 (7.74)	279.3 (7.91)	285.3 (8.08)
End Cap	39.5 (1.12)	115.3 (3.26)	118.6 (3.36)	121.9 (3.45)	125.2 (3.54)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter in front of end cap.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth			
	9 in	12 in	15 in	18 in
Chamber	12.1 (8.5)	12.9 (9.0)	13.6 (9.6)	14.3 (10.1)
End Cap	9.8 (7.0)	10.2 (7.3)	10.6 (7.6)	11.1 (7.9)
Metric Kilograms (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	10977 (6.5)	11703 (6.9)	12338 (7.3)	12973 (7.7)
End Cap	8890 (5.3)	9253 (5.5)	9616 (5.8)	10069 (6.0)

Note: Assumes 12" (300 mm) of stone above and 9" (230 mm) row spacing and 12" (300 mm) of perimeter stone in front of end caps. 1 yd³ = 1.42 english tons.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	9 in (230 mm)	12 in (300 mm)	15 in (375mm)	18 in (450 mm)
Chamber	17.2 (13.2)	17.7 (13.5)	18.3 (14.0)	18.8 (14.4)
End Cap	9.7 (7.4)	10.0 (7.6)	10.3 (7.9)	10.6 (8.1)

Note: Assumes 9" (230 mm) of separation between chamber rows, 12" (300 mm) of perimeter in front of the end caps, and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

Working on a project?
Visit us at adspipe.com/stormtech and utilize the Design Tool

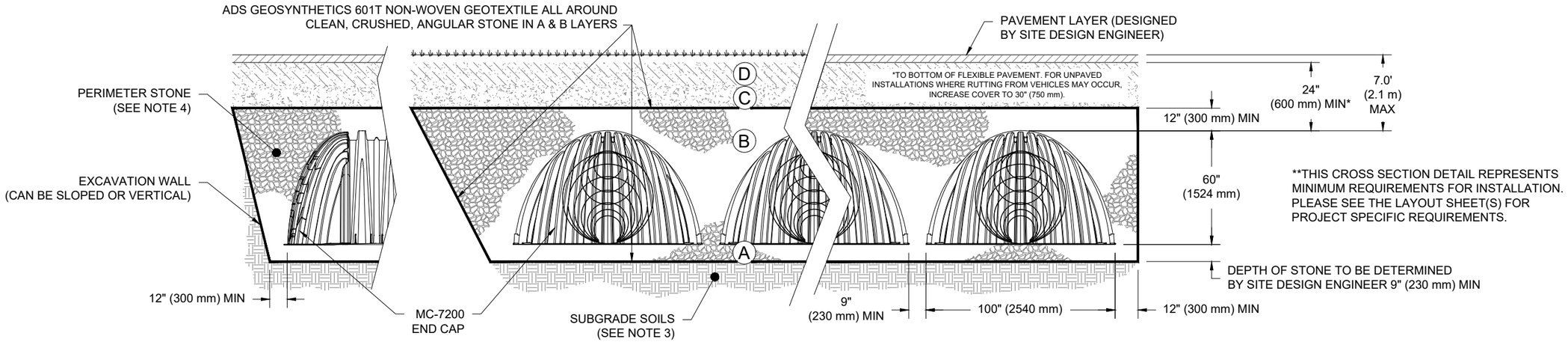
ADS StormTech™

adspipe.com
800-821-6710

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS 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".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED 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 COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED 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.



* FOR COVER DEPTHS GREATER THAN 7.0' (2.1 m) PLEASE CONTACT STORMTECH

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. 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/FT/%. 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.

MC-7200
STANDARD CROSS SECTION
DATE: 9/13/22 | DRAWN: KLJ | PROJECT #: | CHECKED: KLJ

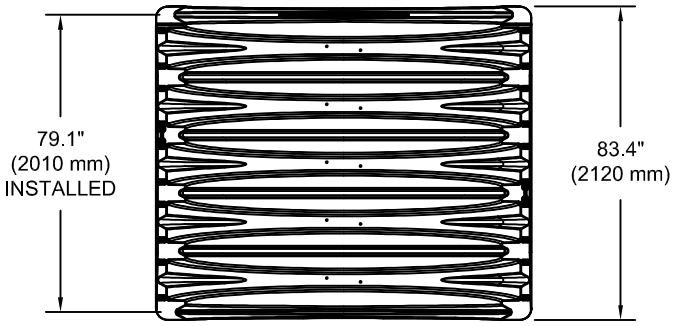
DATE	DRWN	CHKD	DESCRIPTION

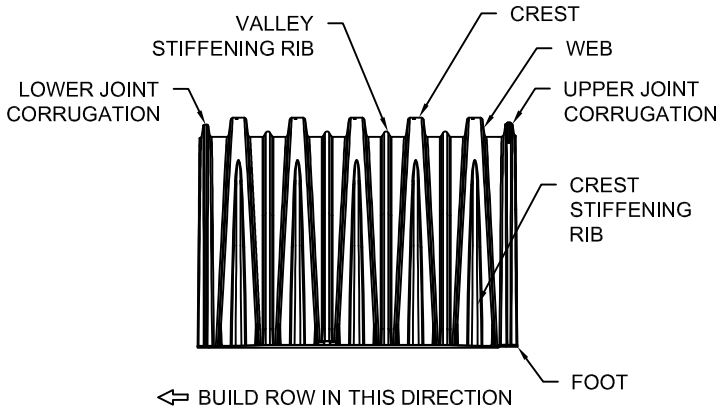
StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

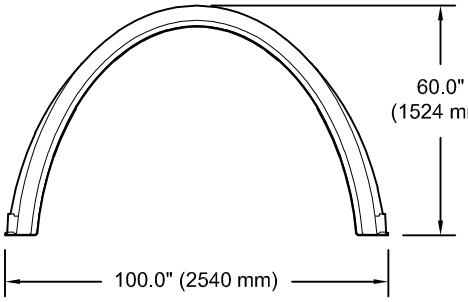
4640 TRUEMAN BLVD
HILLIARD, OH 43026

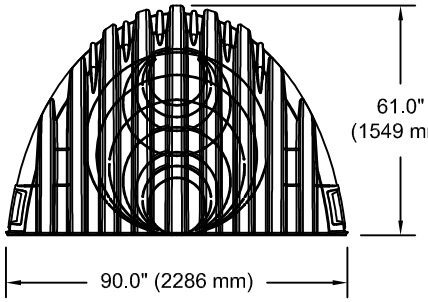
MC-7200 TECHNICAL SPECIFICATION

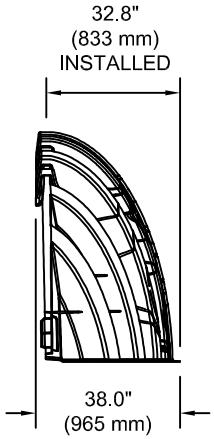
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

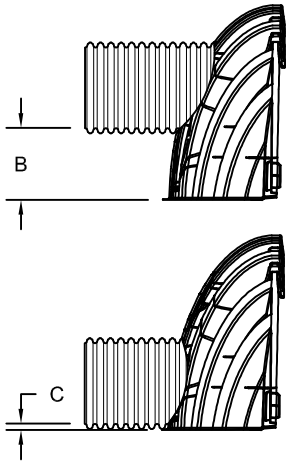
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*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.

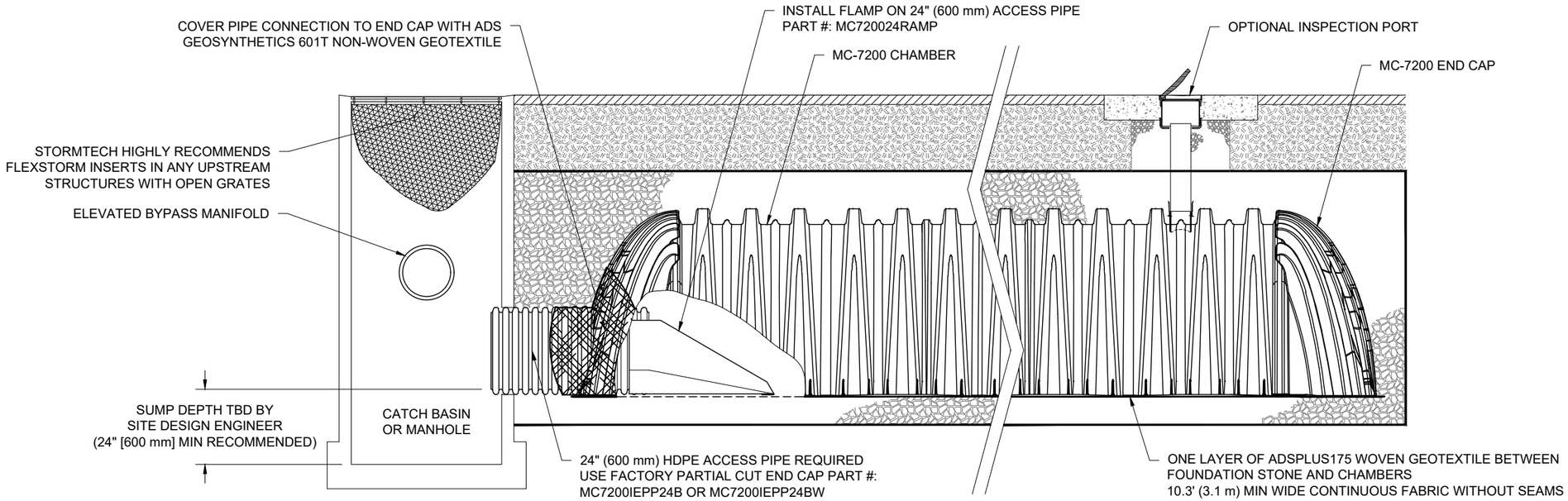
PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC7200IEPP18TW			
MC7200IEPP18B		---	1.97" (50 mm)
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW			
MC7200IEPP24B		---	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED 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-7200 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.



MC-7200 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

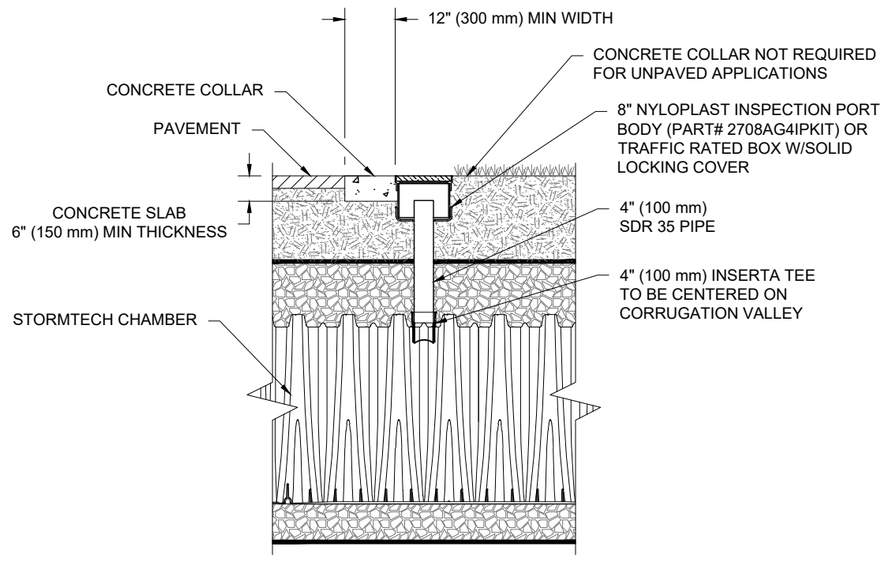
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)
NTS

MC-7200
ISOLATOR ROW PLUS DETAILS
DATE: 9/13/22 | DRAWN: KLJ | CHECKED: KLJ | PROJECT #:

DATE	DRWN	CHKD	DESCRIPTION

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 THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE 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.

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

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

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

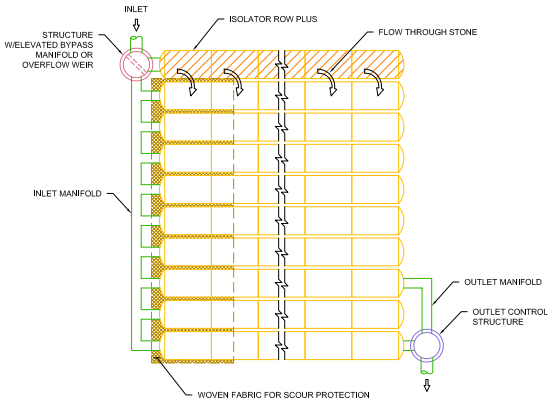
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus 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 Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus 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 Plus 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.

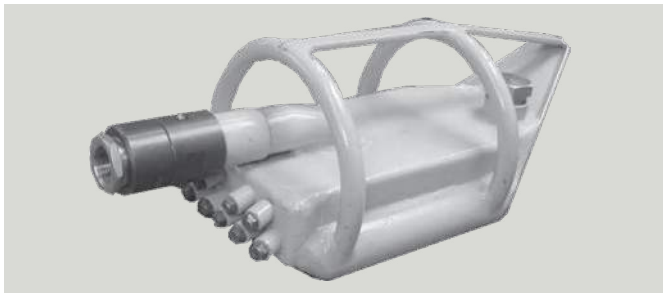
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

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 Plus, clean-out should be performed.

Maintenance

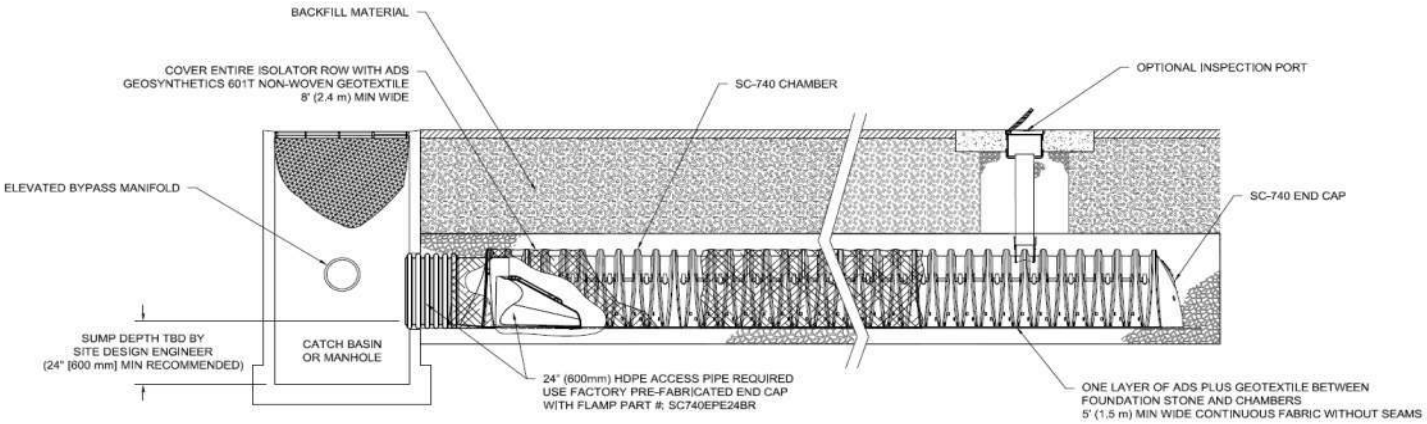
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided 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 Plus 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. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*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-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus 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 Row Plus
- i. Remove cover from manhole at upstream end of Isolator Row Plus
- ii. Using a flashlight, inspect down Isolator Row Plus 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 Plus using the JetVac process.

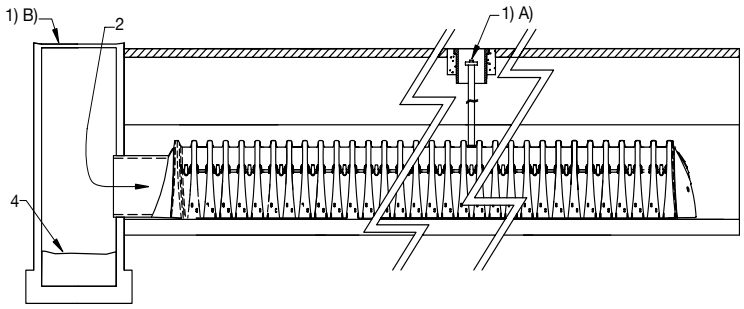
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

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		Sedi-ment 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 PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

adspipe.com
800-821-6710

StormTech® Installation Guide

MC-7200 Chamber

StormTech
Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS PLUS and non-woven geotextile fabrics
- StormTech solid end caps, pre-cored and pre-fabricated end caps
- StormTech chambers, manifolds and fittings

Note: MC-7200 chamber pallets are 100" x 84" (2.5 m x 2.1 m) and weigh about 1435 lbs. (651 kg). Unloading chambers requires 72" (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

Important Notes:

A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

C. Care should be taken in the handling of chambers and end caps. End caps must be stored standing upright. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans. Plans and specifications should include Best Management Practices (BMPs) to deter contamination of open pits during construction.

Place non-woven geotextile over prepared soils and up excavation walls.

Place clean, crushed, angular stone foundation 9" (230 mm) min. Install underdrains if required. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

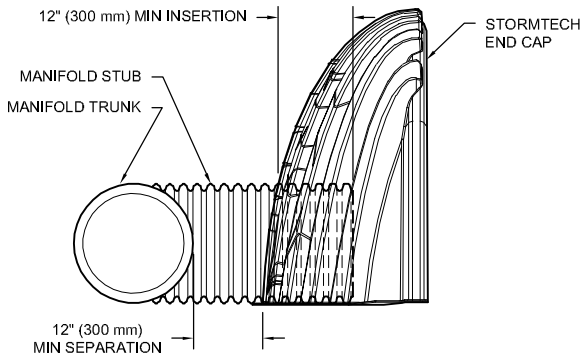
Install manifolds and lay out ADS Plus fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® Plus Row(s). Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

The MC-7200 contains built in ropes at the feet on both sides of the chambers to be used to lift and place the chambers using an excavator. No more than two chambers should be lifted at a time using the ropes. A 14' x 3/8" (10 mm) chain is recommended along with a 5/8" (16 mm) Jaw and Eye Swivel. Using this method, chambers can be placed directly on an existing row. Using too long of a chain may cause the chambers to be less stable during picking.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled "Lower Joint – Overlap Here" and "Build this direction – Upper Joint" Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 9" (230 mm) spacing between MC-7200 rows.

Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. When used on an Isolator Row Plus, a 24" FLAMP (flared end ramp) is attached to the inside of the inlet pipe with a provided threaded rod and bolt. The FLAMP then lays on top of the ADS Plus fabric.

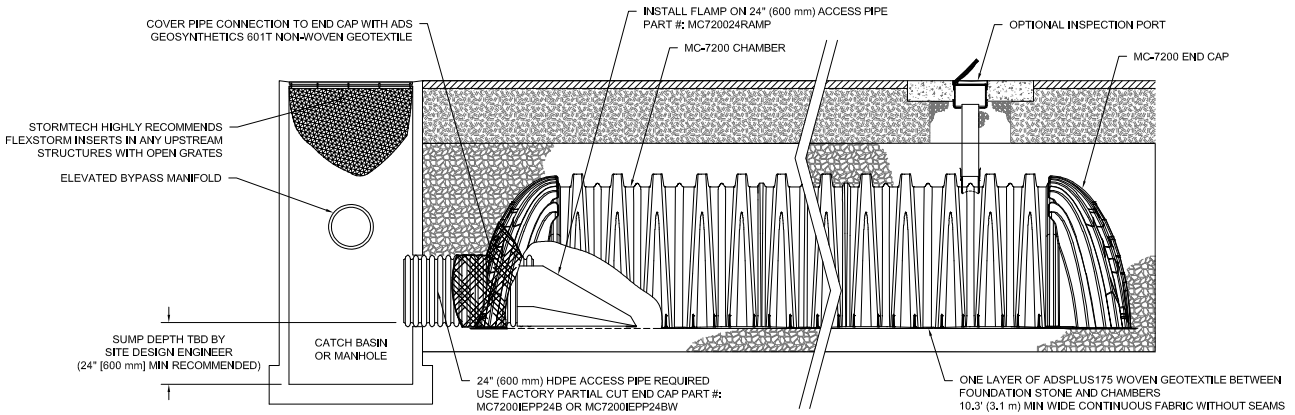
Manifold Insertion



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

Insert inlet and outlet manifolds a minimum 12" (300 mm) into chamber end caps. Manifold header should be a minimum 12" (300 mm) from base of end cap.

StormTech Isolator Row Plus Detail

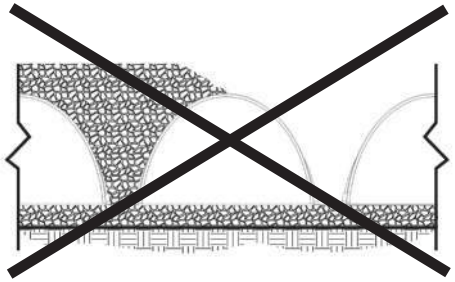


Initial Anchoring of Chambers – Embedment Stone

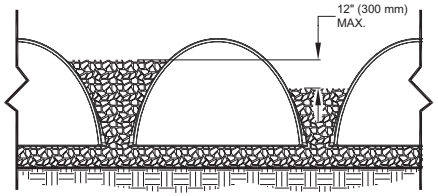
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

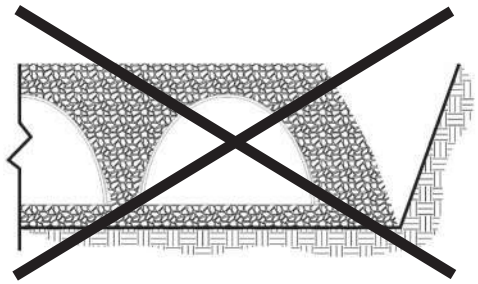


Uneven Backfill

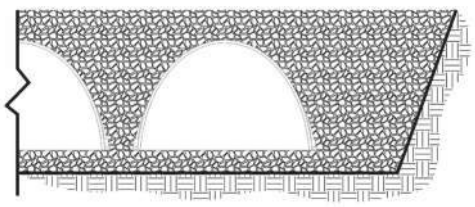


Even Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



Perimeter Not Backfilled



Perimeter Fully Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill of Chambers – Embedment Stone and Cover Stone

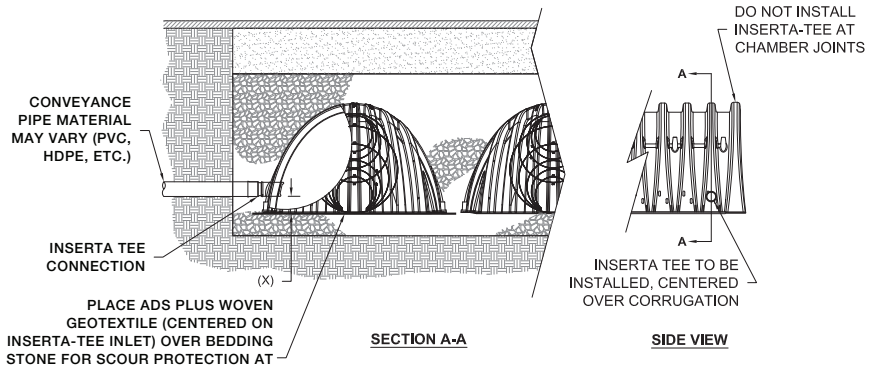
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12” (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are with a stone conveyor outside of the bed or build as you go with an excavator inside the bed reaching along the rows. Backfilling while assembling chambers rows as shown in the picture will help to ensure that equipment reach is not exceeded.

Only after chambers have been backfilled to top of chamber and with a minimum 12” (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends the contractor inspect chamber rows before placing final backfill. Any chambers damaged by construction equipment shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24” (600 mm) where edges meet. Compact at 24” (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



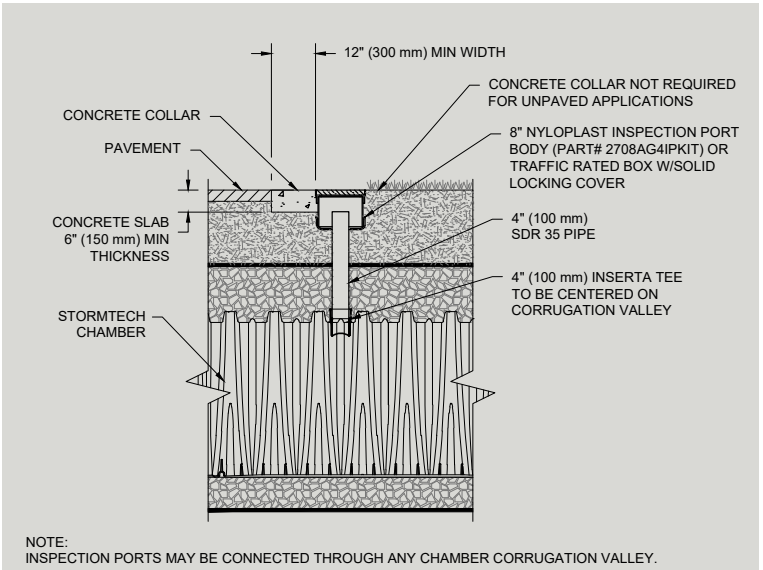
NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-7200	12" (250 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 24" (600 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M145[1] A-1, A-2-4, A-3 or AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 24" (600 mm) of material over the chambers is reached. Compact additional layers in 12" (300 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials.
(B) **Embedment Stone:** Fill the surrounding chambers from the foundation stone ('A' layer) to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 4	No compaction required.
(A) **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor.[2, 3]

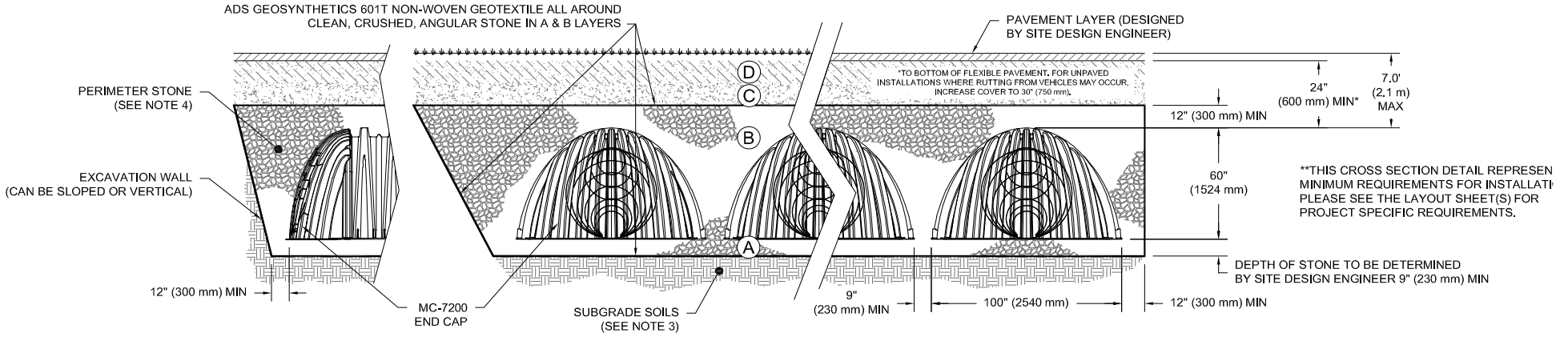
Figure 1- Inspection Port Detail



Please Note:

1. The listed AASHTO designations are for gradations 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".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 9" (230 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 2 - Fill Material Locations



Notes:

1. 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18" (450 mm) of cover for MC-7200s may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover for MC-7200s exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (<8,000 lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. StormTech does not require compaction of initial fill at 18" (450 mm) of cover. However, requirements by others for 6" (150 mm) lifts may necessitate the use of small compactors at 18" (450 mm) of cover.
6. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
7. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Call StormTech at **888.892.2694** for technical and product information or visit www.stormtech.com

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	4050 (194) 2760 (132) 2130 (102) 1770 (84) 1530 (73)	38,000 (169)
Ⓒ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2750 (131) 1920 (92) 1520 (73) 1310 (63) 1180 (56)	20,000 (89)
	24" (600) Loose/Dumped	24,000 (107)	12,000 (53)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2430 (116) 1730 (82) 1390 (66) 1210 (58) 1100 (52)	16,000 (71)
	18" (450)	24,000 (107)	12,000 (53)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2140 (102) 1530 (73) 1260 (60) 1120 (53) 1030 (49)	5,000 (22) (static loads only)[5]
Ⓑ Embedment Stone	12" (300)	Not Allowed	Not Allowed	12" (305) 18" (457) 24" (610) 30" (762)	1100 (53) 710 (34) 660 (32) 580 (28)	Not Allowed
	6" (150)	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 24" (600 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 12" (300 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 24" (600 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 12" (300 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

17.0 Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) **THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. **UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.**

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) **THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.**

StormTech®
Detention • Retention • Water Quality
An ADS company
20 Beaver Road, Suite 104 | Wethersfield | Connecticut | 06109
888.892.2694 fax 866.328.8401
www.stormtech.com

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Separation

ADS 315W WOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 315W woven geotextile.

Filter Fabric Requirements

ADS 315W is manufactured using high-tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS 315W conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Tensile Strength (Grab)	ASTM D4632	lbs (N)	315 (1400)
Elongation	ASTM D4632	%	15
CBR Puncture	ASTM D6241	lbs (N)	900 (4005)
Puncture	ASTM D4833	lbs (N)	150 (667)
Mullen Burst	ASTM D3786	psi (kPa)	600 (4134)
Trapezoidal Tear	ASTM D4533	lbs (N)	120 (533)
UV Resistance (at 500 hours)	ASTM D4355	%	70
Apparent Opening Size (AOS)*	ASTM D4751	U.S. Sieve (mm)	40 (.425)
Permittivity	ASTM D4491	sec^{-1}	.05
Water Flow Rate	ASTM D4491	gpm/ft^2 ($l/min/m^2$)	4 (163)

* Maximum average roll value.

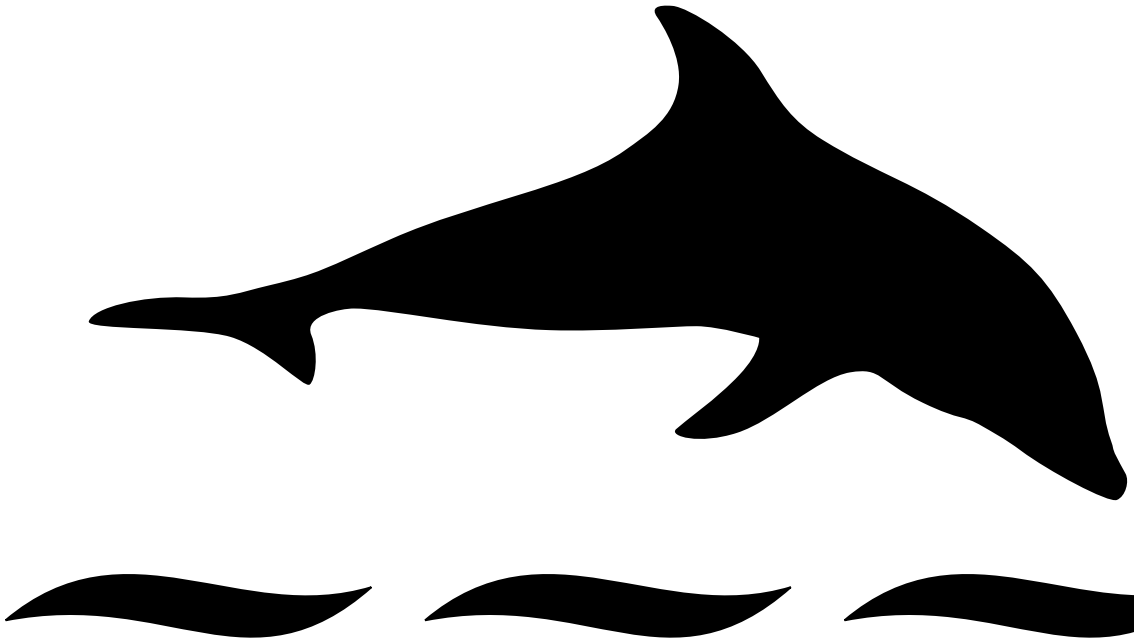
Packaging

Roll Dimensions (W x L) - ft. (m)	12.5 x 360/ 15 x 300 / 17.5 x 258 (3.81 x 109.8/ 4.57 x 91.5 / 5.33 x 78.6)

Appendix D:
"NO DUMPING – DRAINS TO OCEAN" Stencil Examples

Sample Stencil 1

NO DUMPING

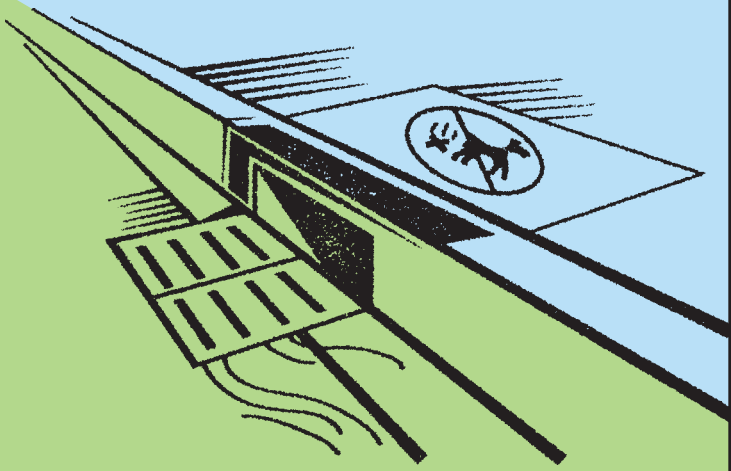


DRAINS TO OCEAN

Sample Stencil 2

Appendix E:
General Education Materials

Pick Up After Your Pooch!



Storm drains are for rain…
they're not pooper scoopers.

L.A. County residents walk a dog without picking up the droppings more than **62,000** times per month.

Disease-causing dog waste washes from the ground and streets into storm drains and flows straight to the ocean — untreated.

Remember to bring a bag and clean up after your dog.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Dog Owners:

Dog owners can help solve the stormwater pollution problem by taking these easy steps…

- Clean up after your dog every single time.
- Take advantage of the complimentary waste bags offered in dispensers at local parks.
- Ensure you always have extra bags in your car so you are prepared when you travel with your dog.
- Carry extra bags when walking your dog and make them available to other pet owners who are without.
- Teach children how to properly clean up after a pet. Encourage them to throw the used bags in the nearest trash receptacle if they are away from home.
- Put a friendly message on the bulletin board at the local dog park to remind pet owners to clean up after their dogs.
- Tell friends and neighbors about the ill effects of animal waste on the environment. Encourage them to clean up after their pets as well.

PROJECT Pollution PREVENTION

Are You a Litter Bug and Don't Know It?

Take our quiz!

Have you ever...

- Dropped a cigarette butt or trash on the ground?
- Failed to pick up after your dog while out on a walk?
- Overwatered your lawn after applying fertilizers/pesticides?
- Disposed of used motor oil in the street, gutter or garbage?

If you answered **yes** to any of these actions, then **YOU ARE A LITTER BUG**!

Each of these behaviors contribute to stormwater pollution, which contaminates our ocean and waterways, kills marine life and causes beach closures.

You can become part of the solution!
To find out how, flip this card over.

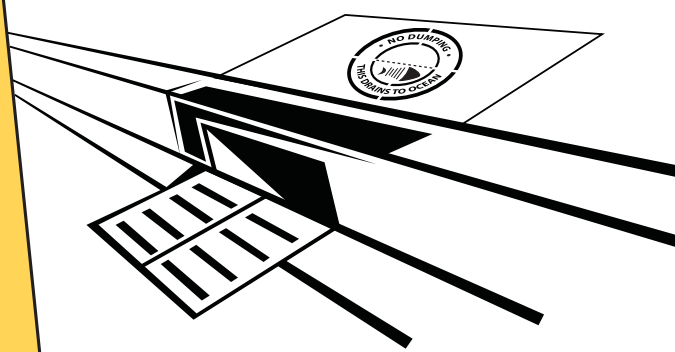
For more information, call or visit:

1 (888) CLEAN LA
www.888CleanLA.com

PROJECT Pollution PREVENTION

Follow these simple steps to prevent stormwater pollution:

- Put your garbage where it belongs — in the trash can.
- Pick up after your dog when out on a walk.
- Reduce pesticide and fertilizer use; don't overwater after application or apply if rain is forecast.
- Dispose of used motor oil at an oil recycling center or at a free Household Hazardous Waste/E-Waste collection event.



A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

Stormdrains take runoff directly to creeks and the ocean without treatment. Pool chemicals can harm our natural creeks and waterways. Anything going into our stormdrains that isn't rainwater contributes to stormwater pollution, which contaminates our creeks and ocean, kills marine life and causes beach closures.

...not pool chemicals

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Swimming Pool Tips

Follow these simple steps to prevent stormwater pollution...

- Make sure all chemicals are dissipated before draining a pool or spa
- Do not drain pools within 5 days of adding chemicals
- Never backwash a filter into the street or stormdrain
- Cleanup chemical spills with absorbent, don't wash it down the drain
- Dispose of leftover chemicals and paints through a licensed hazardous waste disposal provider

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

...they're not recycling centers.

1(888)CLEAN LA
www.888CleanLA.com

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters...

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

PROJECT Pollution PREVENTION

Printed on recycled paper

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

...they're not recycling centers.

1(888)CLEAN LA
www.888CleanLA.com

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters...

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

PROJECT Pollution PREVENTION

Printed on recycled paper

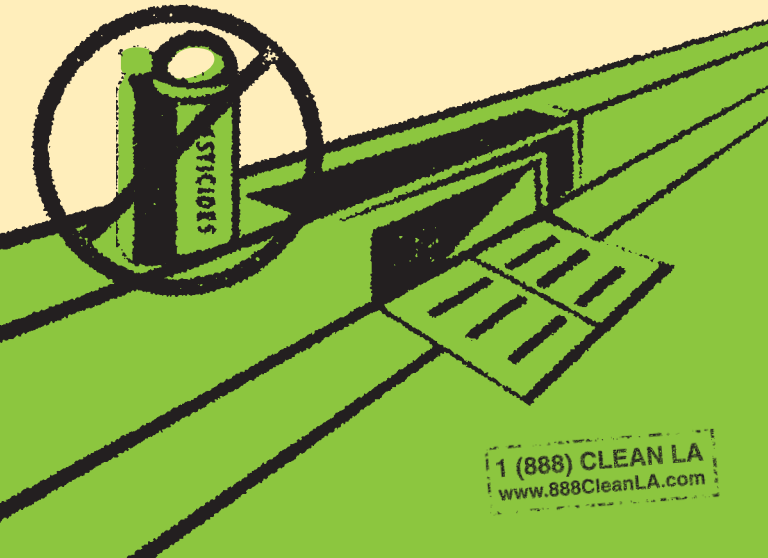
A Yard is a Terrible Thing to Waste!

Storm drains are for rain…**not yard waste.**

Residential yard waste represents about **13 percent** of the total waste generated in L.A. County.

Pesticides, fertilizer and yard waste such as leaves and mowed grass wash from the ground and streets into storm drains and flow straight to the ocean — **untreated**.

Remember to use pesticides and fertilizer wisely and pick-up yard waste.



Tips For Yard Care:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps…

- Do not over-fertilize and do not use fertilizer or pesticides near ditches, gutters or storm drains.
- Do not use fertilizer or pesticides before a rain.
- Follow the directions on the label carefully.
- Use pesticides sparingly — more is not better. "Spot" apply, rather than "blanket" apply.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street carrying pesticides and other chemicals with it.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides or fertilizer, make sure they are in a sealed, water-proof container in a covered area to prevent runoff.
- Do not blow, sweep, hose or rake leaves or other yard trimmings into the street, gutter or storm drain.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids in the street or gutter. Take them to your local auto parts store, gas station or repair shop, or a household hazardous waste Roundup for recycling.

1(888)CLEAN LA
www.888CleanLA.com

...not automotive fluids.

Car Care Tips:

You can keep your car running smoothly and efficiently, and at the same time help prevent stormwater pollution by taking these easy steps...

- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visitwww.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

PROJECT Pollution PREVENTION

Printed on recycled paper

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids in the street or gutter. Take them to your local auto parts store, gas station or repair shop, or a household hazardous waste Roundup for recycling.

1(888)CLEAN LA
www.888CleanLA.com

...not automotive fluids.

Car Care Tips:

You can keep your car running smoothly and efficiently, and at the same time help prevent stormwater pollution by taking these easy steps...

- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

PROJECT Pollution PREVENTION

Printed on recycled paper

Don't Paint the Town Red!

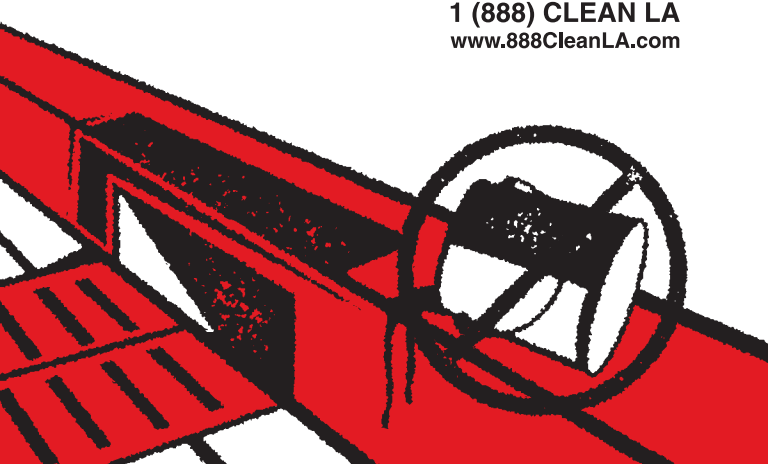
Storm drains are for rain…
they're not for paint disposal.

More than **197,000** times each month, L.A. County residents wash their dirty paint brushes under an outdoor faucet.

This dirty rinse water flows into the street, down the storm drain and straight to the ocean — **untreated**.

Remember to clean water-based paint brushes in the sink, rinse oil-based paint brushes with paint thinner, and take old paint and paint-related products to a Household Hazardous Waste/E-Waste collection event.

1 (888) CLEAN LA
www.888CleanLA.com



Tips for Paint Clean-Up:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps when working with paint and paint-related products…

- Never dispose of paint or paint-related products in the gutters or storm drains. This is called illegal dumping. Take them to a Household Hazardous Waste/E-Waste collection event. Call 1 (888) CLEAN LA or visit www.888CleanLA.com to locate an event near you.
- Buy only what you need. Reuse leftover paint for touch-ups or donate it to a local graffiti abatement program. Recycle or use excess paint.
- Clean water-based paint brushes in the sink.
- Oil-based paints should be cleaned with paint thinner. Filter and reuse paint thinner. Set the used thinner aside in a closed jar to settle-out paint particles.
- Store paints and paint-related products in rigid, durable and watertight containers with tight-fitting covers.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

Please use pesticides wisely, not before a rain, and water carefully.

...not pesticides.

1(888)CLEAN LA
www.888CleanLA.com

Pesticide Tips:

You can keep your lawn and garden green and at the same time solve the pollution problem by taking these easy steps...

- Never dispose of lawn or garden chemicals in storm drains. This is called illegal dumping. Take them to a household hazardous waste roundup. Call 1(888)CLEAN LA or visit www.888CleanLA.com to locate a roundup or collection facility near you.
- More is not better. Use pesticides sparingly. "Spot" apply, rather than "blanket" apply.
- Read labels! Use only as directed.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides, make sure they are in a sealed, water-proof container that cannot leak.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street and carry pesticide chemicals with it. Don't use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

Printed on recycled paper

Storm Drains are for Rain...

More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

Please use pesticides wisely, not before a rain, and water carefully.

...not pesticides.

1(888)CLEAN LA
www.888CleanLA.com

Pesticide Tips:

You can keep your lawn and garden green and at the same time solve the pollution problem by taking these easy steps...

- Never dispose of lawn or garden chemicals in storm drains. This is called illegal dumping. Take them to a household hazardous waste roundup. Call 1(888)CLEAN LA or visit www.888CleanLA.com to locate a roundup or collection facility near you.
- More is not better. Use pesticides sparingly. "Spot" apply, rather than "blanket" apply.
- Read labels! Use only as directed.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides, make sure they are in a sealed, water-proof container that cannot leak.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street and carry pesticide chemicals with it. Don't use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

Printed on recycled paper

Appendix F:
Operation and Maintenance Plan

(Operation and Maintenance Plan to be provided during Final Engineering)

United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-99-011 September 1999

EPA

Storm Water O&M Fact Sheet Catch Basin Cleaning

DESCRIPTION

Catch basins are chambers or sumps, usually built at the curb line, which allow surface water runoff to enter the storm water conveyance system. Many catch basins have a low area below the invert of the outlet pipe intended to retain coarse sediment. By trapping sediment, the catch basin prevents solids from clogging the storm sewer and being washed into receiving waters. Catch basins must be cleaned periodically to maintain their ability to trap sediment, and consequently their ability to prevent flooding. The removal of sediment, decaying debris, and highly polluted water from catch basins has aesthetic and water quality benefits, including reducing foul odors, reducing suspended solids, and reducing the load of oxygen-demanding substances that reach receiving waters.

APPLICABILITY

Catch basin cleaning should be performed at any facility that has an on-site storm sewer system that includes catch basins and manholes.

Although catch basin cleaning is easily implemented, it is often overlooked in an overall storm water management plan. In addition, many of the catch basin cleaning programs that have been implemented focus only on removal of debris from grate openings; full implementation of the catch basin cleaning BMP should also include removal of debris from the catch basin itself.

ADVANTAGES AND DISADVANTAGES

Catch basin cleaning is an efficient and cost-effective method for preventing the transport of sediment and pollutants to receiving water bodies. This improves both the aesthetics and the quality of the receiving water body.

Limitations associated with cleaning catch basins include:

- Catch basin debris usually contains appreciable amounts of water and offensive organic material which must be properly disposed.
- Catch basins may be difficult to clean in areas with poor accessibility and in areas with traffic congestion and parking problems.
- Cleaning is difficult during the winter when snow and ice are present.

Sediment and debris removed from catch basins can potentially be classified as hazardous waste. As a result, the materials must be disposed in a proper manner to avoid negative environmental impacts.

PERFORMANCE

Based on current data, it is not possible to quantify the water quality benefits to receiving waters resulting from catch basin cleaning. The rate at which catch basins fill with debris, as well as the total amount of material which can be removed by different frequencies of cleaning, are highly variable and cannot be readily predicted. Past studies have estimated that typical catch basins retain up to 57 percent of coarse solids and 17 percent of equivalent biological oxygen demand (BOD).

In addition, data collected as part of a Nationwide Urban Runoff Program (NURP) project in Castro Valley Creek, California, indicated that catch basins, cleaned on an average of once every year and a half, contained approximately 60 pounds of material each at the time of the cleaning.

OPERATION AND MAINTENANCE

Catch basins should be inspected at least annually to determine if they need to be cleaned. Typically, a catch basin should be cleaned if the depth of deposits is greater than or equal to one-third the depth from the basin to the invert of the lowest pipe or opening into or out of the basin. If a catch basin significantly exceeds the one-third depth standard during the annual inspection, then it should be cleaned more frequently. If woody debris or trash accumulates in a catch basin, then it should be cleaned on at least a weekly basis.

Catch basins can be cleaned either manually or by specially designed equipment. This equipment may include bucket loaders and vacuum pumps. Material removed from catch basins is usually disposed in conventional landfills. Before any materials can be disposed, it is necessary to perform a detailed chemical analysis to determine if the materials meet the EPA criteria for hazardous waste. This will help determine how the materials should be stored, treated, and disposed.

COSTS

Catch basin cleaning costs will vary depending upon the method used, the required cleaning frequency, the amount of debris removed, and debris disposal costs.

Cleaning costs for catch basins were estimated in three NURP program studies (Midwest Research Institute, 1982). These estimates are summarized in Table 1.

In communities equipped with vacuum street sweepers, a cleaning cost of $8 per basin cleaned is recommended for budgetary purposes (Southeastern Wisconsin Regional Planning Commission, 1991.) Cleaning catch basins manually costs approximately twice as much as cleaning the basins with a vacuum attached to a sweeper. Therefore, a cost estimate of $16 per catch basin cleaned may be used for manual cleaning. It should be noted that costs vary depending on local market conditions.

TABLE 1 CLEANING COST PER CATCH BASIN

Location	Method	Cost
Castro Valley, CA	Vacuum attached to street sweeper	$7.70
Salt Lake County, UT	Vacuum attached to street sweeper	$10.30
Winston-Salem, NC	Vacuum attached to street sweeper	$6.30

Source: MRI, 1982.

REFERENCES

1. Midwest Research Institute, 1982. *Collection of Economic Data from Nationwide Urban Runoff Program Projects-Final Report.* Report to U.S. Environmental Protection Agency.

2. Minnesota Pollution Control Agency, 1989. *Protecting Water Quality in Urban Areas.*

3. Southeastern Wisconsin Regional Planning Commission, 1991. *Cost of Urban Nonpoint Source Water Pollution Control Measures,* Technical Report No. 31.

4. U.S. EPA, 1983. *Final Report of the Nationwide Urban Runoff Program.* EPA 841/583109.

5. U.S. EPA, 1977. *Catch Basin Technology Overview and Assessment.* EPA-600/2-77-051.

6. Washington State Department of Ecology, 1992. *Storm Water Management Manual for Puget Sound.*

ADDITIONAL INFORMATION

Alameda County, California
Jim Scanlin
Alameda Countywide Clean Water Program
951 Turner Court, Room 300
Hayward, CA 94545

King County, Washington
Dave Hancock
Department of Natural Resources, Water and Land Resources Division, Drainage Services Section
700 5th Avenue, Suite 2200
Seattle, WA 98104

Salt Lake County, Utah
Terry Way
Salt Lake County Engineering Division
2001 South State Street, Suite N3300
Salt Lake City, UT 84190

Southeastern Wisconsin Regional Planning Commission
Bob Biebel
916 N. East Avenue, P.O. Box 1607
Waukesha, WI 53187

City of Winston Salem, North Carolina
Terry Cornett
Department of Public Works, Streets Division
P.O. Box 2511
Winston Salem, NC 27106

The mention of trade names or commercial products does not constitute endorsement or recommendation for the use by the U.S. Environmental Protection Agency.

For more information contact:

Municipal Technology Branch
U.S. EPA
Mail Code 4204
401 M St., S.W.
Washington, D.C., 20460

OWM MTB
Excellence in compliance through optimal technical solutions
MUNICIPAL TECHNOLOGY BRANCH

Appendix G:
Geotechnical Investigation

April 19, 2023
J.N.: 3138.00

Mr. Michael Johnson
Overton Moore Properties
19700 South Vermont Avenue Suite 101
Torrance, CA 90502

Subject: **Preliminary Geotechnical Investigation for Proposed Water Quality Improvements, Proposed Residential Development, North of Sierra Madre Avenue and Vernon Avenue (Azusa Greens Country Club), Azusa, California**

Dear Mr. Johnson,

Albus & Associates, Inc. has completed a geotechnical investigation of the site for evaluation of the percolation characteristics of the site soils. The scope of this investigation consisted of the following:

- Exploratory drilling, soil sampling and test well installation
- Field percolation testing
- Laboratory testing of selected soil samples
- Engineering analysis of the data
- Preparation of this report

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Site Location and Description

The site is located at 919 Sierra Madre Avenue within the city of Azusa, California. The property is bordered by Sierra Madre Avenue to the South, residential units to the south, west, and east, as well as a water treatment facility to the North. The location of the site and its relationship to the surrounding areas is shown on Figure 1, Site Location Map.

The site consists of an irregularly-shaped property containing approximately 21 acres of land. The site is relatively flat with elevations ranging from EL650 to EL665 above mean sea level (based on Google Earth) descending to the south. The site is currently a golf course and appears to not have been used for some time. The perimeters of the site are primarily bounded by chain-link fencing. Some block walls are present along portions of the residential units

Vegetation within the site consists of large trees dividing the different golf holes. The vast majority of the site is covered in grass with additional limited vegetation. A few structures are present onsite with a club house located to the south next to an associated parking lot.

N

FIGURE 1-SITE LOCATION MAP

Proposed Residential Development
919 Sierra Madre Avenue
Azusa, California

NOT TO SCALE

Proposed Development

Based on our understanding and review of the site plan by Architecture Design Relationships, site development is anticipated to consist of (38) one-story, single family residences and (2) three-story multi-family residences. Associated interior driveways, decorative hardscape, parking areas, common areas and underground utilities are also anticipated.

We anticipate demolition of existing site improvements and some minor cut and filling of the site will be required to achieve future surface configuration and we expect future foundation loads will be light. All structures are anticipated to be at grade. Part of the site development is anticipated to include subsurface infiltration chambers for treatment of storm water.

SUMMARY OF FIELD AND LABORATORY WORK

Subsurface Investigation

Subsurface exploration for this investigation was conducted on February 28 and March 9, 2023, and consisted of drilling six (6) soil borings and excavating ten (10) test pits to depths ranging from approximately 5 to 8 feet below the existing ground surface (bgs). The borings were drilled using a truck-mounted, continuous flight, hollow-stem-auger drill rig and the test pits were excavated utilizing a backhoe with a 4 foot wide bucket attachment. A representative of Albus & Associates, Inc. logged the exploratory excavations. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented in the Exploration Logs in Appendix A. The approximate locations of the exploratory excavations completed by this firm are shown on the enclosed Geotechnical Map, Plate 1.

Bulk samples were obtained at selected depths within the exploratory borings and test pits for subsequent laboratory testing. Samples were placed in plastic bags and transported to our laboratory for analyses. The exploratory excavations were backfilled with cuttings upon completion of sampling.

Upon completion of drilling, well materials were installed within each boring for subsequent percolation testing. Construction of P-1 through P-6 consisted of installing 5 to 8 feet of well materials. The bottom 5 feet for all wells utilized perforated 3-inch-diameter pipe with the remaining well utilizing solid 3-inch-diameter pipe to ground surface. The joints between pipes were reinforced with duct tape and the sections of perforated pipe were covered with filter sock. After installation of pipe, ¾" gravel was used to fill the annular space around the perforated sections. Upon completion of testing, all well materials were removed from the borings and then backfilled with soil cuttings.

Percolation Testing

Percolation testing was performed on March 3, 2023, in general conformance with the constant-head test procedures outlined in the referenced Well Permeameter Method (USBR 7300-89). A water hose attached to a water source on site was connected to an inline flowmeter to measure the water flow. The flowmeter is capable of measuring flow rates up to 10 gallons per minute and as low as 0.06 gallons per minute. A valve was connected in line with the flowmeter to control the flow rate. A filling hose was used to connect the flowmeter and the test wells. Water was introduced by the filling hose near the bottom of the test wells. A water level meter with 1/100-foot divisions was used to measure the depths to water surface from the top of well casings.

Flow to the wells was terminated upon either completion of testing of all the pre-determined water levels or the flow rate exceeded the maximum capacity of the flowmeter. Measurements obtained during the percolation testing are provided in Appendix C on Plates C-1 through C-6.

Laboratory Testing

Selected soil samples of representative earth materials were tested to assist in the formulation of conclusions and recommendations presented in this report. Tests consisted of in-situ moisture contents and sieve analyses. Results of laboratory testing relevant to percolation characteristics are presented in Appendix B and on the Exploration Logs in Appendix A.

ANALYSIS OF DATA

Subsurface Conditions

Descriptions of the earth materials encountered during our investigation are summarized below and are presented in detail on the Exploration Logs presented in Appendix A.

Review of the Dibblee Map for the Mt. Wilson and Azusa Quadrangles (Dibble 1998) indicates the site is south of the San Gabriel Mountains and is underlain by quaternary alluvial fan deposits (Qg). The materials are described by Dibble as consisting of gravel and sand of stream channels and alluvial fan outwash from major canyons. The site is located just easterly of the San Gabriel River where it flows out of the San Gabriel Mountains and falls within the overbank areas of the river.

Based on our site-specific investigation, a thin mantle of top soil is present throughout the golf course, but was observed to be generally only 0.5 feet in thickness. The topsoil generally consists of silty sand (SM) that is fine to medium grained and often contains roots and rootlets.

Underlying the topsoil or exposed at the surface in some areas are quaternary alluvial deposits (Qg). The alluvial soils were encountered to the maximum depth explored, i.e., 8 feet, but extend to more than 50 feet in depth. The materials were generally consistent with the description above by Dibblee (1998) although the site deposits tend to also contain abundant cobbles and some boulders up to about 3.5 feet in median diameter. The larger cobbles and boulders are typically oblong in shape with the maximum dimension reaching about 4 to 5 feet across. Gradationally the materials tend to become coarser grained with depth but boulders were encountered within 1.5 to 2 feet of the ground surface in some areas.

A more detailed description of the interpreted soil profile at each of the exploration locations, based upon the soil cuttings and soil samples, are presented in Appendix A. The stratigraphic descriptions in the logs represent the predominant materials encountered during investigation. Relatively thin, often discontinuous layers of different material may occur within the major divisions.

Groundwater

Groundwater was not encountered during this firm's subsurface exploration to a depth of 8 feet. The CDMG Special Report 021 suggests that historic high groundwater for the subject site is about 10-30 feet below the ground surface. Review of the California Department of Water Resources groundwater well data for well 4275A indicates groundwater has fluctuated between 20-60 feet below ground surface between 2011-2022.

Review of the Los Angeles County Public Works groundwater level data for the nearby wells 4285B and 4285H indicate that groundwater for the area has generally been below 30 feet from 1944 to 2009 with a few short-lived spikes to a depth of 10 feet. The locations of these three wells are depicted on Figure 2. The recorded depths to groundwater from these wells are plotted on Figure 3.

Depths as measured between Well 4285H and Well 4285B indicate the depth to ground water drops off sharply to the south indicating the influence of the infiltration ponds located north of the subject site.

FIGURE 2 - Groundwater Well Location Map

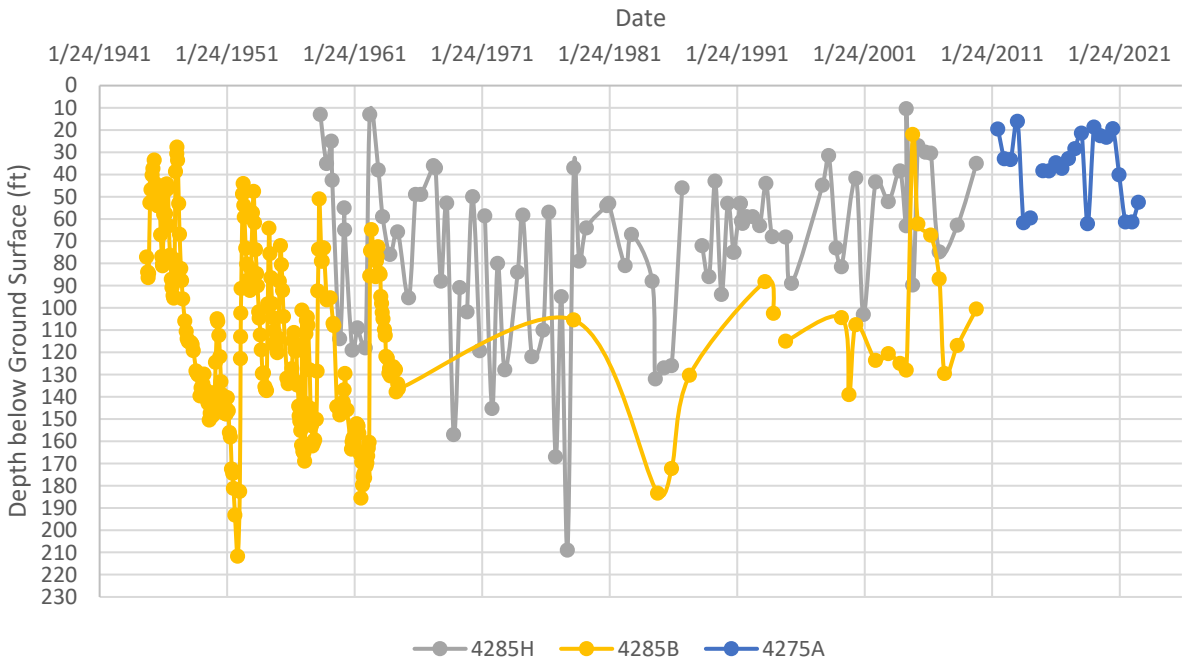


FIGURE 3 - Ground Water Data

Percolation Data

Analyses were performed to evaluate permeability using the flow rate obtained at the end of the constant-head stage of field percolation testing. These analyses were performed in accordance with the procedures provided in the referenced USBR 7300-89. The procedure essentially uses a closed-form solution to the percolation out of a small-diameter well.

Using the USBR method, we calculated a composite permeability value for the head conditions maintained in the wells. The results are summarized in Table 1 below and the supporting analyses are included in Appendix C, Plates C-7 through C-12.

TABLE 1
Summary of Back-Calculated Permeability Coefficient

Test Well	Total Depth of Well (ft)	Depth to Water in Well (ft)	Height of Water in Well (ft)	Static Flow Rate (gal./min.)	Estimated Permeability, k_s (in/hr.)
P-1	4.4	1.9	2.5	1.3	5.71
P-2	4.8	2.65	2.15	1.44	7.94
P-3	4.5	2.2	2.3	2.18	10.86
P-4	4.5	3.95	0.55	2.8	92.42
P-5	7.4	4.55	2.85	0.5	1.80
P-6	4.4	1.85	2.55	1	4.26

CONCLUSIONS AND RECOMMENDATIONS

Results of infiltration testing and exploration at the site indicate that the site is feasible for infiltration. We recommend the use of shallow chamber systems. Infiltration within the alluvial materials is not anticipated to result in adverse geotechnical conditions at the site or surrounding sites, including subsidence, landsliding, or liquefaction.

The ***infiltration rate*** is dependent upon several factors including the soil permeabilities of the various soil layers throughout the soil mass, hydraulic gradient of water pressure head in the soil mass, and depth to groundwater. We have performed the Well Permeameter tests in accordance with the test method. This test provides a means to estimate the ***Permeability Rate*** of the soils, not the infiltration rate. Therefore, the effective infiltration rate must be determined using the relationship between permeability and infiltration rate as expressed by Darcy's equation.

The infiltration rate is related to the permeability by Darcy's equation:

$V = ki$

Where:

V= water velocity (infiltration rate)
k= permeability
i=hydraulic gradient

Solution of the Darcy equation essentially requires solving a differential mass balance equation. However, when relatively uniform soil conditions are present and infiltration is accomplished using a BMP with relatively little water depth (such as a open basin or most shallow chambers) the solution to Darcy's equation is greatly simplified. The infiltration rate can be conservatively taken to be equal to the permeability.

Results of our field testing indicate a rather wide range of results. This range is due to the small scale of testing compared to the particle sizes of the soil. Some test locations may have a zone of relatively clean rock and result in high infiltration values while others may test a zone next to a large boulder that restricts flow from the test well. To obtain a reasonable value, we have discarded the highest and lowest test results then averaged the remaining four results to obtain a "measured" infiltration rate of 7 inches per hour. This value is also consistent with correlations of permeability to particle size as obtained from laboratory testing.

The design infiltration rate requires the application of a Reduction Factor in accordance with the County of Los Angeles GS200.1 guidelines, dated June 30, 2021. Based on the county requirements, the reduction factor (safety factor) is determined by summing the partial reduction factors as indicated in Table 3 below.

The RF_t value is prescribed by the test method used. The RF_v value is based on the fact that soil conditions are relatively uniform (at the scale of the infiltration system) within the anticipated infiltration zones, that several tests were performed in close proximity to the proposed infiltration

locations, and correlations with laboratory testing of site materials confirm the selected permeability rate obtained by the field test. The RF_s value is based on the infiltration system providing a chamber that traps sediments before entering the infiltration device.

TABLE 2
Reduction Factor

Factor	Value
RF_t	1.0
RF_v	1.0
RF_s	1.0
Total Reduction Factor (RF)	**3.0**

Note:
Total Reduction Factor, $RF = RF_t + RF_v + RF_s$

We recommend a "measured" infiltration rate of 7.0 in./hr. Applying the required factor of safety of 3, we obtained a **Design Infiltration Rate of 2.33 in./hr.**

The chamber systems should be embedded into the native alluvial soils at a depth no more than 7 feet below the current grades. This depth is anticipated to maintain a minimum clearance of 10 feet above the groundwater level. The chambers should be located at least 50 feet from the northern property line to maintain a safe distance from the adjacent slope. Elsewhere, the chambers should be located at least 15 feet from other property lines and residential structures. Retaining walls are generally not anticipated at the site. However, chambers should be located a horizontal distance away from retaining walls equal to 2 times the wall height.

The configuration of the chamber systems should generally be limited to a width of about 10 feet but with no limitation on length. Systems with widths greater than 10 feet will require a reduction in the design infiltration rate to account for the influence of groundwater. Specific recommendations for reduction factors can be provided once a general layout of the system is prepared.

Site materials are very friable and prone to sloughing in vertical cuts. As such, excavations for the chambers should be laid back at a maximum slope of 1 to 1 for depths of up to 7 feet. The excavations for the chamber system should be observed by the project geotechnical consultant to confirm they expose native alluvial soils at the bottom and are consistent with the conditions anticipated herein.

LIMITATIONS

This report is based on the geotechnical data as described herein. The materials encountered in our boring excavations and utilized in our laboratory testing for this investigation are believed representative of the project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil and bedrock materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observations by a geotechnical consultant during the construction phase of the storm water infiltration systems are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

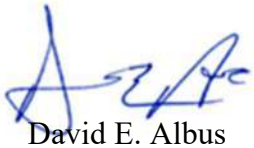
This report has been prepared for the exclusive use of **Overton Moore Properties** to assist the project consultants in the design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

This report is subject to review by the controlling governmental agency.

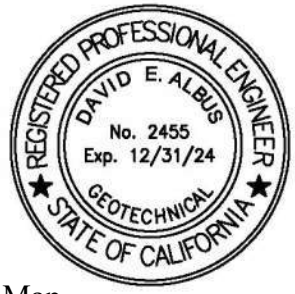
We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS & ASSOCIATES, INC.



David E. Albus
Principal Engineer
GE 2455



Enclosures: Plate 1- Geotechnical Map
Appendix A - Exploratory Logs
Appendix B – Laboratory Testing
Appendix C - Percolation Testing and Analyses

REFERENCES

Publications and Reports

California Department of Conservation, Division of Mines and Geology, Seismic Hazard Report 021, "Seismic Hazard Zone Report for the Azusa 7.5-Minute Quadrangle, Los Angeles County, California", 1998.

Californian Department of Water Resources Water Data Library (accessed 2023): http://wdl.water.ca.gov/waterdatalibrary/

Dibblee, T.W., Jr., 1998, Geologic map of the Mt. Wilson and Azusa quadrangles, Los Angeles County, California: Dibblee Geological Foundation, Map DF-67, scale 1:24,000.

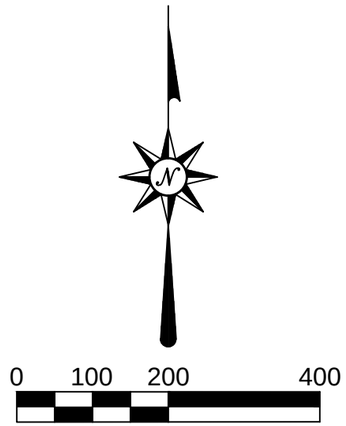
Procedure for Performing Field Permeability Testing by the Well Permeameter Method, by United States Department of The Interior, Bureau of Reclamation (USBR 7300-89).

County of Los Angeles, Department of Public Works, 2021, Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration, Geotechnical and Materials Engineering Division (GS200.1), dated June 30, 2021.

Los Angeles County Department of Public Works Well Data (accessed 2023): https://dpw.lacounty.gov/general/wells/

Google 2023

Base Provided By AO



APPROX SCALE : 1" = 100'

EXPLANATION

(Locations Approximate)

- Exploratory Trench
- Percolation Test Boring

ALBUS ASSOCIATES

GEOTECHNICAL MAP

Job No.: 3138.00	Date: 04/19/2023	Plate: 1

APPENDIX A

EXPLORATORY LOGS

Field Identification Sheet

Light gray

Gray

Dark gray

Gray Brown

Light brown

Brown

Dark Brown

Olive brown

Olive

Yellow

Yellowish brown

Yellowish red

Red

Reddish Brown

Tan

Description Order:

Description, Color, Moisture, Density, Grain Size, Additional Description

Description	%	Example
	0-5	Sand
trace	5-15	Sand trace Silt
with	15-30	Sand with Silt
	30+	Silty Sand

More Examples

Sand with Silt trace Clay

Sand trace Silt and Clay

Sand with Silt and Clay

Gravelly Sand with Silt trace Clay

Silty Clay with Sand trace Gravel

Moisture

Dry	absence of water
Damp	below optimum
Moist	near optimum
Very Moist	above optimum
Wet	free water visible

Density (Navfac)

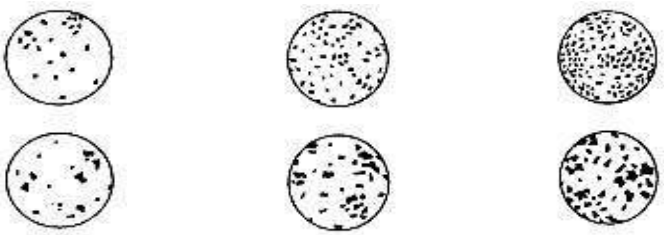
Coarse grained soils	SPT	CA
Very Loose	0-3	0-5
Loose	3-8	5-13
Medium Dense	8-14	13-22
Dense	14-25	22-40
Very Dense	25>	40>
Fine grained soils		
Very Soft	2<	0-3
Soft	2-4	3-6
Medium Stiff	4-8	6-13
Stiff	8-15	13-24
Very Stiff	15-30	24-48
Hard	30>	48>

Grain Size

Description		Sieve Size	Approx. Size
Boulders		>12"	Larger than basketball
Cobbles		3-12"	Fist to basketball
Gravel	coarse	3/4-3"	Thumb to Fist
	fine	#4-3/4"	Pea to Thumb
Sand	coarse	#10-4	Rock Salt to Pea
	medium	#40-10	Sugar to Rock Salt
	fine	#200-40	Flour to Sugar
Fines		Pass #200	Smaller than Flour

Additional Description (ie. roots, pinhole pores, debris, etc.)

Trace 5% Moderate 15% Abundant 30%



EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		EXPLANATION							
		Solid lines separate geologic units and/or material types.							
		Dashed lines indicate unknown depth of geologic unit change or material type change.							
5		**Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD).							
		Double triangle in core column represents SPT sampler.							
10		**Vertical Lines** in core column represents Shelby sampler.							
		Solid black rectangle in Bulk column respresents large bag sample.							
		Other Laboratory Tests:							
15		Max = Maximum Dry Density/Optimum Moisture Content							
		EI = Expansion Index							
		SO4 = Soluble Sulfate Content							
		DSR = Direct Shear, Remolded							
		DS = Direct Shear, Undisturbed							
		SA = Sieve Analysis (1" through #200 sieve)							
		Hydro = Particle Size Analysis (SA with Hydrometer)							
20		200 = Percent Passing #200 Sieve							
		Consol = Consolidation							
		SE = Sand Equivalent							
		Rval = R-Value							
		ATT = Atterberg Limits							

EXPLORATION LOG P-1

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Tuesday	2023-02-28

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14300	-117.91952	649.5

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, moist, fine to medium grained							
2		**Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): gray, damp to moist, fine to coarse grained							
3									
4									
5									
6		Total Depth 5 feet No Groundwater							
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG P-2

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Tuesday	2023-02-28

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14491	-117.91995	653.1

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, damp to moist, fine to medium grained							
2									
3		**Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): gray, damp to moist, fine to coarse grained							
4									
5									
6		Total Depth 5 feet No Groundwater							
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG P-3

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Tuesday	2023-02-28

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14633	-117.91993	663.2

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, damp to moist, fine to medium grained							
2		**Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): gray, damp to moist, fine to coarse grained							
3									
4									
5		Total Depth 5 feet No Groundwater							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG P-4

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Tuesday	2023-02-28

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14647	-117.92143	665.4

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, damp to moist, fine to medium grained							
2		**Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): gray, damp to moist, fine to coarse grained							
3									
4									
5		Total Depth 5 feet No Groundwater							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG P-5

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Tuesday	2023-02-28

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14696	-117.92119	665.2

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus 2	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1–8		**Topsoil** Silty Sand (SM): brown, damp to moist, fine to medium grained **Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): gray, damp to moist, fine to coarse grained							
8		Total depth 8 feet No Groundwater Refusal 8 feet							

EXPLORATION LOG P-6

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Tuesday	2023-02-28

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14709	-117.92304	662.8

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
ddalbus	2R Drilling	Hollow-Stem Auger	140 lbs / 30 in

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, damp to moist, fine to medium grained							
2		**Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): gray, damp to moist, fine to coarse grained							
3									
4									
5		Total Depth 5 feet No Groundwater							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

EXPLORATION LOG TP-1

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14362	-117.91975	650.7

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown, damp to moist, fine to medium-grained, abundant rootlets, some roots up to 3/4-inch thick							
2									
3		**Alluvium (Qg)** Sandy Gravel with Cobbles and Boulders (GP): grey brown, damp to moist, fine to coarse-grained sand, abundant cobbles and boulders up to 2 feet in diameter, clasts are subrounded							
4									
5									
6									
7		Total depth 7 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-2

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14428	-117.92037	652

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown, moist, fine to medium-grained, rootlets							
2		**Alluvium (Qg)** Sand with Gravel (SP): grey brown, damp to moist, fine to coarse-grained, gravel up to 3 inches							
3		Gravelly Sand with Cobbles (SP): grey brown, damp, fine to coarse-grained, cobbles up to 8 inches							
4									
5									
6		Gravelly Sand with Cobbles and Boulders (SP): grey brown, damp, fine to coarse-grained , boulders up to 18 inches in diameter					3.1		
7									
8		Total depth 7 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-3

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14516	-117.92034	658.4

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown, moist, fine to medium-grained, rootlets, some roots up to 1/2-inch thick, some gravel							sa
2		**Alluvium (Qg)** Gravelly Sand with Silt and Cobbles (SP): brown, damp to moist, fine to coarse-grained, cobbles up to 10 inches in diameter							
3		@ 1.5 ft, grey-brown, damp, some boulders up to 2 feet in diameter							
4									
5									
6									
7		Total depth 6.5 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-4

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14555	-117.92105	654.7

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown , moist, fine to medium-grained, rootlets, trace gravel							
2		**Alluvium (Qg)** Gravelly Sand with Cobbles and Boulders (SP): grey-brown, damp to moist, fine to coarse-grained, some boulders up to 4 feet in diameter, boulders as large as 2 feet in diameter encountered very close to the ground surface							
3									
4									
5					■		2.9		
6									
7		Total depth 7 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-5

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14616	-117.92040	663

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown, moist, fine to medium-grained, dense root zone from nearby trees with roots up to 1.5 inches thick							
2		**Alluvium (Qg)** Gravelly Sand with Cobbles and Boulders (SP): grey-brown, damp to moist, fine to coarse-grained, boulders up to 2.5 feet in diameter encountered very close to ground surface							
3									
4									
5									
6									
7		Total depth 6 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-6

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14686	-117.91964	665

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown , moist, fine-grained, roots up to 1-inch thick							
2		**Alluvium (Qg)** Gravelly Sand with Cobbles and Boulders (SP): grey-brown, moist, fine to coarse-grained, boulders 1.5 to 2 feet in diameter encountered very close to ground surface							
3									
4									
5					■		3		
6									
7		Total depth 7 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-7

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14698	-117.92131	665.5

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): dark brown, moist, fine-grained, rootlets							
2		**Alluvium (Qg)** Gravelly Sand with Cobbles and Boulders (SP): grey-brown, damp to moist, fine to coarse-grained, some boulders up to 2.5 feet in diameter encountered very close to ground surface							
3									
4									
5									
6									
7		Total depth 7 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-8

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14649	-117.92224	662.8

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, moist, fine to medium-grained, mulch and vegetation debris at surface, rootlets, roots up to 1/2-inch thick							sa
2		**Alluvium (Qg)** Gravelly Sand with Cobbles trace Boulders (SP): grey-brown, damp, fine to coarse-grained, less cobbles within the upper 2 feet							
3		@ 2 ft, boulders up to 2 foot in diameter							
4							2.7		
5		@ 4.5 ft, large boulders up to 3.5 feet in diameter							
6									
7		Total depth 6.5 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

EXPLORATION LOG TP-9

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14676	-117.92348	660.8

LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Alluvium (Qa)** Silty Sand (SM): grey-brown, moist, fine to medium-grained, rootlets, roots up to 2 inches thick, trace mica							
2									
3									
4		**Alluvium (Qg)** Gravelly Sand with Cobbles and Boulders (SP): grey-brown, damp to moist, fine to coarse-grained, boulders up to 2 feet in diameter							
5									
6									
7									
8									
9		Total depth 8 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
10									
11									
12									
13									
14									

EXPLORATION LOG TP-10

JOB NO.	CLIENT/PROJECT	DAY	DATE
3138.00	Overton Moore Properties	Thursday	2023-03-09

LOCATION	LATITUDE	LONGITUDE	ELEVATION
919 Sierra Madre Avenue, Azusa	34.14723	-117.92394	661.2

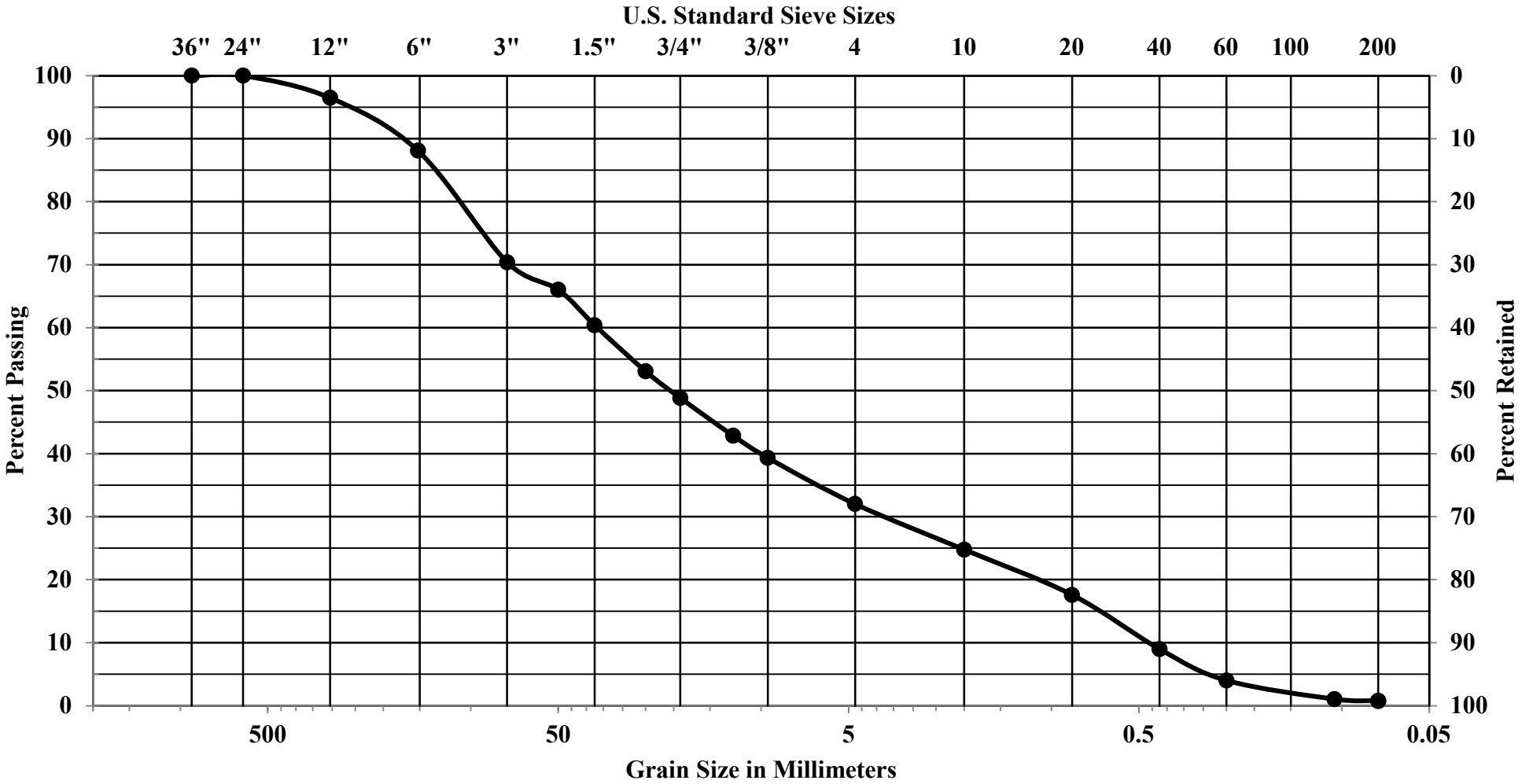
LOGGED BY	DRILLER	DRILL METHOD	DRIVING WEIGHT
dloya	other	Backhoe	other

DEPTH	LITHO	DESCRIPTION	H2O	COR	BAG	BLOW COUNT	MC (%)	DD (pcf)	LAB
1		**Topsoil** Silty Sand (SM): brown, moist, fine to medium-grained, vegetation debris at surface, rootlets, roots up to 3/4-inch thick							
2		**Alluvium (Qg)** Gravelly Sand with Cobbles and Boulders (SP): grey-brown, damp to moist, fine to coarse-grained, boulders up to 2.5 feet in diameter, some large boulders are within 2 feet from the ground surface							
3									
4									
5									
6					■		2.5		
7		Total depth 6.5 feet No groundwater Minor sidewall caving Backfilled with spoils on 3/9/2023							
8									
9									
10									
11									
12									
13									
14									

APPENDIX B

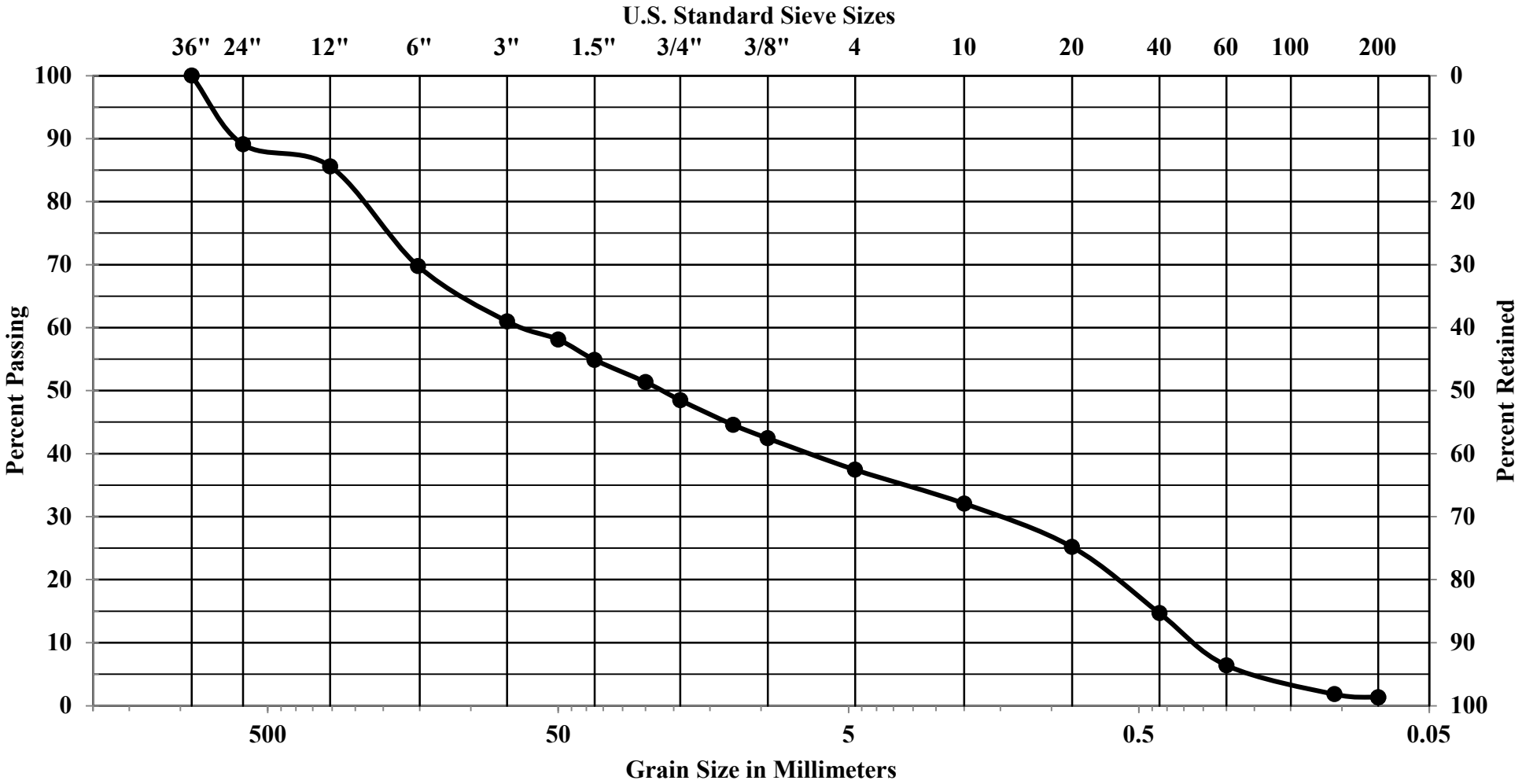
LABORATORY TEST PROGRAM

GRAIN SIZE DISTRIBUTION



Job Number	Location	Depth	Description
3138.00	TP-3	0-6.5	Sandy Gravel (GW)

GRAIN SIZE DISTRIBUTION



Job Number	Location	Depth	Description
3138.00	TP-8	0-6.5	Sandy Gravel (GW)

APPENDIX C

PERCOLATION TESTING AND ANALYSES

Field Percolation Testing - Constant Head

Client: Overton Moore Properties

Job. No.: 3138.00

Date Tested: 2/28/2023

Test by: ddalbus

Location: P-1

Top of Casing to Bottom of Well (ft): 5.1

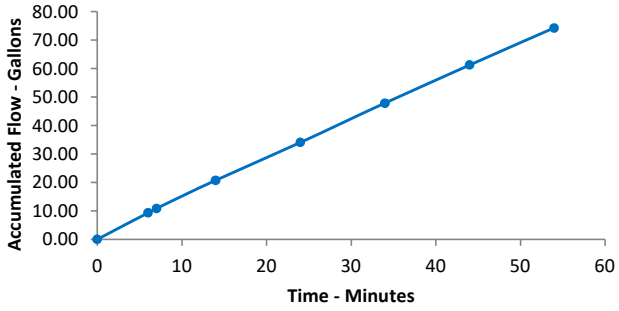
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0.7

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	10:16	2.7	1.58	0.00
6	10:22	2.6	1.54	9.36
7	10:23	2.6	1.28	10.92
14	10:30	2.65	1.38	20.79
24	10:40	2.65	1.38	34.09
34	10:50	2.6	1.30	47.89
44	11:00	2.60	1.30	61.29
54	11:10	2.60	1.30	74.29

Field Percolation Testing - Constant Head

Client: Overton Moore Properties

Job. No.: 3138.00

Date Tested: 3/3/2023

Test by: ddalbus

Location: P-2

Top of Casing to Bottom of Well (ft): 4.8

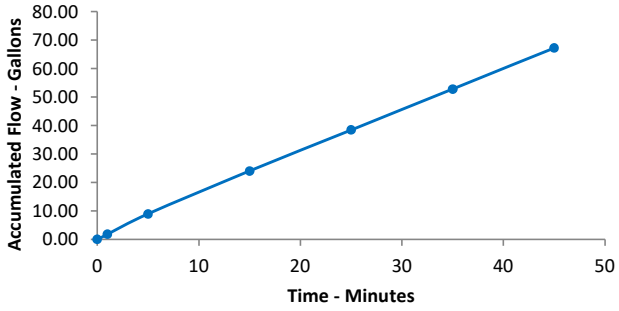
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	10:30	2.6	2.00	0.00
1	10:31	2.6	1.58	1.79
5	10:35	2.6	1.44	8.95
15	10:45	2.6	1.44	24.05
25	10:55	2.65	1.44	38.45
35	11:05	2.65	1.44	52.85
45	11:15	2.65	1.44	67.25

Field Percolation Testing - Constant Head

Client: Overton Moore Properties

Job. No.: 3138.00

Date Tested: 3/3/2023

Test by: ddalbus

Location: P-3

Top of Casing to Bottom of Well (ft): 4.9

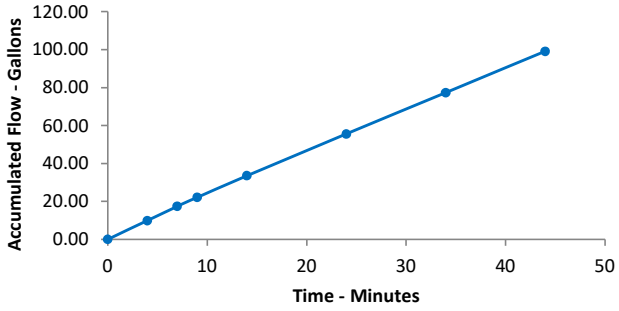
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0.4

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	11:21	2.8	2.58	0.00
4	11:25	2.6	2.40	9.96
7	11:28	2.6	2.34	17.43
9	11:30	2.6	2.22	22.17
14	11:35	2.6	2.18	33.57
24	11:45	2.6	2.18	55.57
34	11:55	2.60	2.18	77.37
44	12:05	2.60	2.18	99.17

Field Percolation Testing - Constant Head

Client: Overton Moore Properties

Job. No.: 3138.00

Date Tested: 3/3/2023

Test by: ddalbus

Location: P-4

Top of Casing to Bottom of Well (ft): 5

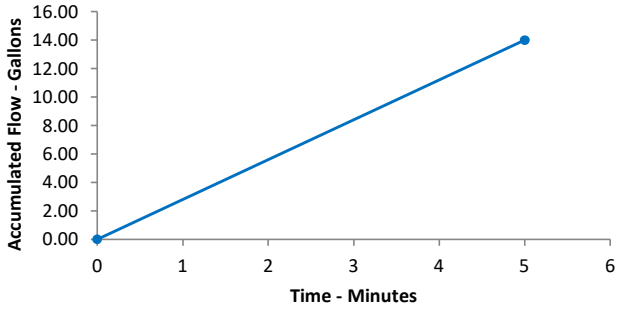
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0.5

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	12:15	4.45	2.80	0.00
5	12:20	4.45	2.80	14.00

Field Percolation Testing - Constant Head

Client: Overton Moore Properties

Job. No.: 3138.00

Date Tested: 3/3/2023

Test by: ddalbus

Location: P-5

Top of Casing to Bottom of Well (ft): 7.8

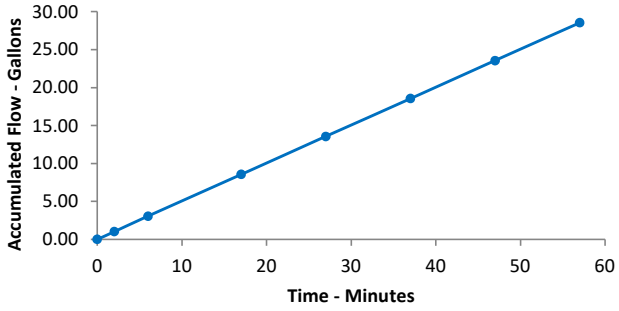
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0.4

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	12:28	4.8	0.52	0.00
2	12:30	4.9	0.50	1.02
6	12:34	4.95	0.50	3.06
17	12:45	4.95	0.50	8.56
27	12:55	4.95	0.50	13.56
37	13:05	4.95	0.50	18.56
47	13:15	4.95	0.50	23.56
57	13:25	4.95	0.50	28.56

Field Percolation Testing - Constant Head

Client: Overton Moore Properties

Job. No.: 3138.00

Date Tested: 3/3/2023

Test by: ddalbus

Location: P-6

Top of Casing to Bottom of Well (ft): 4.8

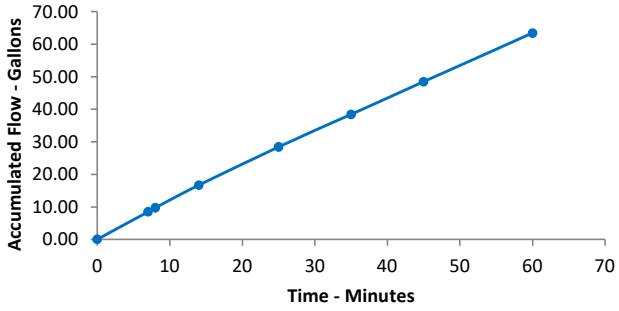
Elev. of Ground Surface (ft):

Diam. of Test Hole (in): 8

Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0.4

Water Tempurature (C°):



Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	9:00	2.25	1.25	0.00
7	9:07	2.25	1.18	8.50
8	9:08	2.3	1.14	9.72
14	9:14	2.25	1.00	16.68
25	9:25	2.25	1.00	28.45
35	9:35	2.25	1.00	38.45
45	9:45	2.25	1.00	48.45
60	10:00	2.25	1.00	63.45

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3138.00
Client: Overton Moore Properties
Well No.: P-1

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	4.4	feet
Depth to Water (**h_2**):	1.9	feet
Height of Water in the Well (h_1-h_2=**h**):	2.5	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	306.0	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	1.3	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	7.93E-03	ft/min.
Design k_{20}:	5.71	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3138.00
Client: Overton Moore Properties
Well No.: P-2

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	4.8	feet
Depth to Water (**h_2**):	2.65	feet
Height of Water in the Well (h_1-h_2=**h**):	2.15	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	223.2	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	1.44	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	1.10E-02	ft/min.
Design k_{20}:	7.94	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3138.00
Client: Overton Moore Properties
Well No.: P-3

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	4.5	feet
Depth to Water (**h_2**):	2.2	feet
Height of Water in the Well (h_1-h_2=**h**):	2.3	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	256.6	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	2.18	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	1.51E-02	ft/min.
Design k_{20}:	10.86	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3138.00
Client: Overton Moore Properties
Well No.: P-4

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	4.5	feet
Depth to Water (**h_2**):	3.95	feet
Height of Water in the Well (h_1-h_2=**h**):	0.55	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	50.6	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	2.8	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	1.37E-01	ft/min.
Design k_{20}:	98.42	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3138.00
Client: Overton Moore Properties
Well No.: P-5

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	7.4	feet
Depth to Water (**h_2**):	4.55	feet
Height of Water in the Well (h_1-h_2=**h**):	2.85	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	406.3	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	0.5	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	2.49E-03	ft/min.
Design k_{20}:	1.80	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 3138.00
Client: Overton Moore Properties
Well No.: P-6

Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	1	
Ground Surface to Bottom of Well (**h_1**):	4.4	feet
Depth to Water (**h_2**):	1.85	feet
Height of Water in the Well (h_1-h_2=**h**):	2.55	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	319.2	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	1	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (**T_u**):		Ignore T_u
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (**k_{20}**):	5.92E-03	ft/min.
Design k_{20}:	4.26	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.