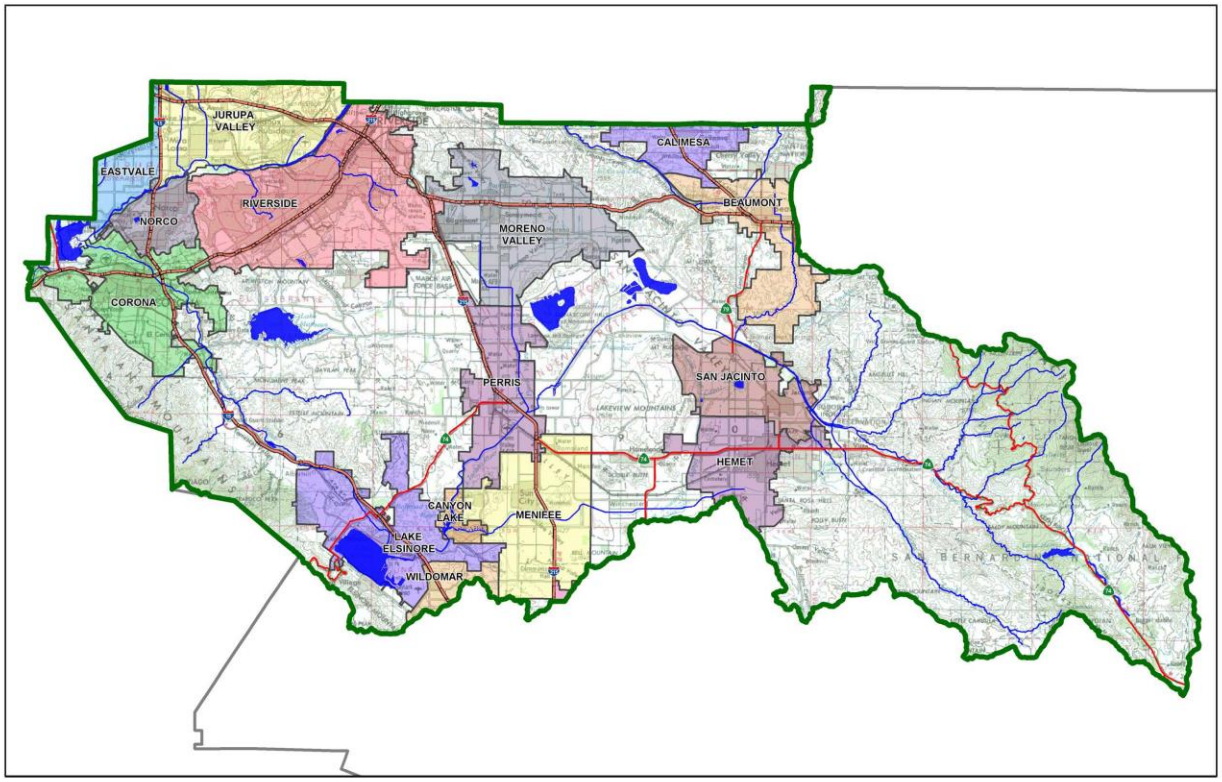
Project Specific Water Quality Management Plan

*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: Ares Spec Industrial

Development No: DEV2022-017

Design Review/Case No: TBD



☒ **Preliminary**
☐ **Final**

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Prepared for Compliance with Regional Board Order No. **R8-2010-0033**
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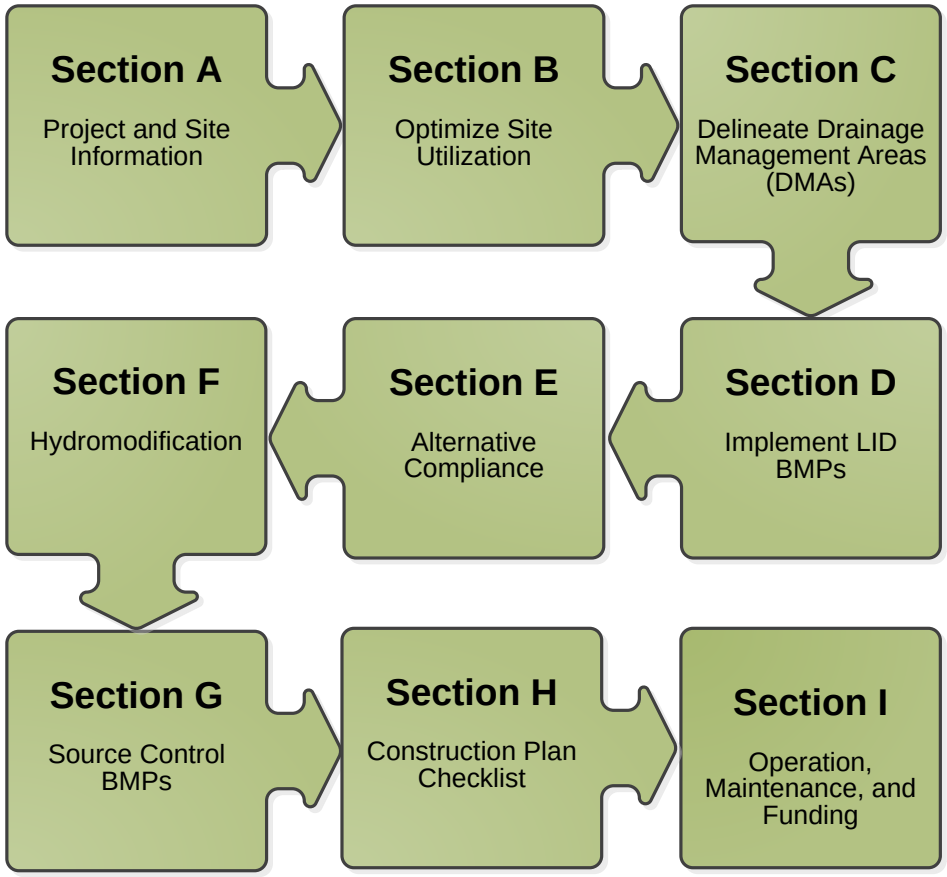
A Brief Introduction

This Project-Specific WQMP Template for the **Santa Ana Region** has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your "how-to" manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for IPT Menifee CC, LLC by Ware Malcomb for the Murrieta Road & Ethanac Road project.

This WQMP is intended to comply with the requirements of Riverside County for Ordinance No. 827 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under the Riverside County Water Quality Ordinance (Municipal Code Section 754 as amended through 754.2).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature	Date
Christopher Sanford	Principal, Western Region
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

	09-13-2023
Preparer's Signature	Date
Lucas Corsbie	Director of Civil Engineering
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure: No. C 72588

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Industrial
Planning Area:	Sun City/ Menifee Valley
Community Name:	N/A
Development Name:	Ares Spec Industrial
PROJECT LOCATION	
Latitude & Longitude (DMS): 33.738355, -117.208515	
Project Watershed and Sub-Watershed: Santa Ana Watershed, San Jacinto River Sub-Watershed	
Gross Acres: 26.579 Acres (After Dedications to Geary Street, Southern Truck Corridor & Murrieta Road)	
APN(s): 330-210-010, 330-210-011, 330-210-062, 330-560-001 through 330-560-040, 330-570-001 through 330-570-033, & 330-571-001 through 330-571-005	
Map Book and Page No.: Parcel 1 and 4 of Parcel Map No. 7285, Map Book 26, Page 56; Between Geary Street and Murrieta Road, north of McLaughlin Road and south of Floyd Avenue	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Industrial
Proposed or Potential SIC Code(s)	1541
Area of Impervious Project Footprint (SF)	1,016,028 SF
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	1,016,028 SF
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	21,831 SF
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	D
What is the Water Quality Design Storm Depth for the project?	0.60 inches

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling
- BMP Locations (Lat/Long)

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
San Jacinto River, Reach 3	None	AGR, GWR, REC1, REC2, WARM, WILD, RARE	Approximately 1.3 miles
Canyon Lake	Listed Impairments Nutrients Approved TMDLs Nutrients	MUN, AGR, GWR, REC1, REC2, COMM, WARM, WILD	Not a waterbody classified as RARE
San Jacinto River, Reach 1	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD, RARE	Approximately 6 miles
Lake Elsinore	Listed Impairments PCBs, Toxicity, DDT, Nutrients, Organic Enrichment/Low Dissolved Oxygen Approved TMDLs Nutrients, Organic Enrichment/Low Dissolved Oxygen	REC1, REC2, COMM, WARM, WILD, RARE	Approximately 9 miles

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* Building & Grading - City of Menifee	☒ Y	☐ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, **constraints** might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. **Opportunities** might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

The existing drainage pattern has been identified, with runoff draining from the southwestern corner to the northeastern corner of the site via overland flow. For on-site runoff, the existing drainage pattern will be preserved to the maximum extent practicable, with BMPs strategically located near the site's natural outfall location to the northeast. The proposed discharge point will be located near the site's outfall in the existing condition, at the northeastern corner of the proposed site boundary. Street improvements are proposed along the western, southern, and eastern borders of the site. Off-site runoff will be directed into a separate off-site BMP, also strategically located near the project's natural outfall location.

Did you identify and protect existing vegetation? If so, how? If not, why?

No, the existing site is currently vacant and barren, with minimal vegetation in the form of sparse native grasses and weed growth. The site will be developed as impervious.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

A Geotechnical Investigation conducted by SoCalGeo on November 12, 2021 revealed that the site's soils have poor infiltration rates, ranging from 0.0 inches per hour to only 0.2 inches per hour. Since the tested pre-development infiltration rates are all well below 1.6 inches per hour, infiltration BMPs are considered infeasible for this site.

Did you identify and minimize impervious area? If so, how? If not, why?

No, the existing site is over 98% pervious. The proposed site will feature an industrial building with appurtenant parking and loading areas with driveways for access and will result in a large impervious area, covering approximately 87.76% of the developed site. The site will feature landscaped areas along the perimeter of the proposed industrial building and parking areas, but the majority of the site will consist of hardscape, impervious surfaces.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

The proposed on-site drainage design features an underground storage chamber upstream of an underground modular wetlands linear system for water quality control purposes. Portions of the site feature runoff dispersion over landscaped, pervious areas separate from the proposed impervious surfaces on site, which will be self-treating.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1,2]	Area (Sq. Ft.)	DMA Type
DMA 1 – On-Site	1A – Concrete or Asphalt	505,227	D – Biotreatment BMP w/ Upstream Detention
	1B – Landscaped Areas Natural D Soil	80,197	D – Biotreatment BMP w/ Upstream Detention
	1C – Roofs	510,801	D – Biotreatment BMP w/ Upstream Detention
DMA 6 – Off-Site	6A – Concrete or Asphalt	133,944	D – Biotreatment BMP
	6B – Landscaped Areas Natural D Soil	22,574	D – Biotreatment BMP

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*
[2]*If multi-surface provide back-up*

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA 2	3,751	N/A	N/A
DMA 3	33,271	N/A	N/A
DMA 4	17,590	N/A	N/A
DMA 5	6,927	N/A	N/A

Table C.3 Type 'B', Self-Retaining Areas

Self-Retaining Area				**Type 'C' DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 =	Required Retention Depth (inches) [D]
N/A	N/A	N/A	N/A	N/A	N/A	N/A

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Impervious fraction	Product		Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]	DMA name /ID	[D]	[C]/[D]
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA 1 – ON-SITE	MWS A & B w/ BASIN A
DMA 6 – OFF-SITE	MWS C

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	X	
If Yes, list affected DMAs: All DMAs		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: 3.254 Acres (141,736 ft^2)

Type of Landscaping (Conservation Design or Active Turf): Conservation Design

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 23.325 Acres (1,016,028 ft^2)

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: 0.79

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: 18.427 Acres

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
18.427 Acres	3.254 Acres

Harvesting stormwater runoff for irrigation use is infeasible for this site.

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shutdowns or other lapses in occupancy:

Projected Number of Daily Toilet Users: 100

Project Type: Industrial

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 23.325 Acres (1,016,028 ft^2)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-2 in Chapter 2 to determine the minimum number of toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: 172

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: 4,012

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)
4,012	100

Harvesting stormwater runoff for toilet flushing uses is infeasible for this site.

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

There are no other non-potable uses for stormwater runoff on this site.

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand: N/A

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: N/A

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4: N/A

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: N/A

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
N/A	N/A

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment per Section 3.4.2 of the WQMP Guidance Document.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA 1	☐	☐	☐	☒	☐
DMA 6	☐	☐	☐	☒	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

The preliminary site design features biotreatment LID BMPs – Modular Wetland Linear Systems MWS A, B, & C – to treat on-site and off-site stormwater runoff for water quality purposes. The rationale behind the implementation of biotreatment LID BMPs as opposed to infiltration LID BMPs stems from the geotechnical investigation report performed by Southern California Geotechnical Inc., which revealed that infiltration is infeasible for the site following results of infiltration testing. As for harvest and use LID BMPs, these were also considered infeasible due to the size and scale of the proposed site, as shown in Section D.2 of this WQMP. Finally, the City of Menifee's Appendix A - Industrial Good Neighbor Policies outlines the city's design guidelines for implementation of warehouses, logistics and distribution facilities, and all industrial uses into the local community. It details the intent of the policies, which aim to maintain existing neighborhood and community characteristics when creating new industrial spaces, and protecting sensitive receptors such as residential neighborhoods, parks, hospitals, nursing homes, and other public spaces from unwanted visual disturbances in the community. Additionally, the policies clearly state that "Underground stormwater facilities are preferred over above-ground basins". Therefore, underground biotreatment LID BMPs were determined to be the best choice to handle water quality treatment for both on and off-site stormwater runoff as opposed to bioretention LID BMPs. Bioretention LID BMPs would be above ground, and would potentially serve as visual disturbances to the surrounding community in this region of the City of Menifee. The proposed biotreatment LID BMPs are underground, and they blend into the proposed industrial site while performing adequately for their intended purpose of water quality treatment.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First**,** calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3.1 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	***ON-SITE*** ***Type D – Biotreatment Modular Wetlands System with Upstream Detention (Volume Based)*** *MWS A & B*		
DMA 1	[A]	Multi-Surface	[B]	[C]	[A] x [C]			
1A	*505,227*	*Concrete or Asphalt*	*1.0*	*0.89*	*450,662.5*			
1B	*80,197*	*Landscaped Areas - Natural D Soil*	*0.4*	*0.28*	*22,432.1*			
1C	*510,801*	*Roofs*	*1.0*	*0.89*	*455,634.5*			
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	1,096,225				928,729.1	0.60	46,436.5	**50,240**

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.4.2 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	***OFF-SITE*** ***Type D – Biotreatment Modular Wetlands System (Flow Based)*** *MWS C*		
DMA 6	[A]	Multi-Surface	[B]	[C]	[A] x [C]			
6A	*133,944*	*Concrete or Asphalt*	*1.0*	*0.89*	*119,478*			
6B	*22,574*	*Landscaped Areas - Natural D Soil*	*0.4*	*0.28*	*6314.2*			
						Design Rainfall Intensity (in/hr)	*Design Flow Rate, Q_{BMP} (cfs)*	*Proposed Flow Rate on Plans (cfs)*
	156,518				125,792.2	0.20	0.600	**0.693**

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☐ Attached Residential Development	P	N	P	P	N	P	P	P[(2)]
☒ Commercial/Industrial Development	P[(3)]	P	P[(1)]	P[(1)]	P[(5)]	P[(1)]	P	P
☐ Automotive Repair Shops	N	P	N	N	P[(4, 5)]	N	P	P
☐ Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐ Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☐ Parking Lots (>5,000 ft^2)	P[(6)]	P	P[(1)]	P[(1)]	P[(4)]	P[(1)]	P	P
☐ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☒	☒	☒	☒	☒	☒	☒	☒

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
N/A	
Total Credit Percentage[1]	0%

[1]*Cannot Exceed 50%*

[2]*Obtain corresponding data from Table 3-8 in the WQMP Guidance Document*

E.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3.1 Treatment Control BMP Sizing

DMA Type /ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Imperviou s Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**		***ON-SITE*** ***Type D – Biotreatment Modular Wetlands System with Upstream Detention (Volume Based)*** *MWS A & B*		
DMA 1	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Minimum Design Capture Volume (cubic feet)*	*Total Storm Water Credit % Reduction*	*Proposed Volume on Plans (cubic feet)*
1A	*505,227*	*Concrete or Asphalt*	*1.0*	*0.89*	*450,662.5*				
1B	*80,197*	*Landscaped Areas - Natural D Soil*	*0.4*	*0.28*	*22,432.1*				
1C	*510,801*	*Roofs*	*1.0*	*0.89*	*455,634.5*				
	1,096,225				928,729.1	0.60	46,436.5	0%	**50,240**

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] is from the Total Credit Percentage as Calculated from Table E.2 above

[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

Table E.4.2 Treatment Control BMP Sizing

DMA Type /ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperviou s Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor		OFF-SITE *Type D – Biotreatment Modular Wetlands System (Flow Based)* *MWS C*		
DMA 6	[A]		[B]	[C]	[A] x [C]				
6A	*133,944*	*Concrete or Asphalt*	*1.0*	*0.89*	*119,478*				
6B	*22,574*	*Landscaped Areas - Natural D Soil*	*0.4*	*0.28*	*6,314.2*				
						Design Rainfall Intensity (in/hr)	*Minimum Design Flow Rate (cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Flow on Plans (cfs)*
	156,518				125,792.2	0.20	0.600	0%	**0.693**

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] is from the Total Credit Percentage as Calculated from Table E.2 above

[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.5 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
N/A	N/A	N/A

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.

[2] Cross Reference Table E.1 above to populate this column.

[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration (Hours)	13.5	13.5	0%
Volume (Cubic Feet)	21,306	143,156	572%

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Susceptibility Maps.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

N/A

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

HCOC Mitigation has been addressed through the implementation of the underground storage chamber system – Basin A – upstream of the proposed on-site modular wetland linear systems – MWS A & B. The site has been graded in such a way to capture the maximum amount of on-site stormwater runoff practicable. The underground storage chamber serves to detain the increase in the total runoff volume from the 2-year, 24-hour storm event as a result of the proposed development, as well as to detain all on-site runoff prior to biotreatment by the modular wetland linear systems. The underground storage chamber system has adequate storage capacity – 154,075 CF – to detain the DCV prior to biotreatment as well as detain the increase in the total runoff volume from the 2-year, 24-hour storm event. Additional information regarding HCOC Mitigation can be found in Appendix 7.

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources*:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit*:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative*:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	• Mark all inlets with the words "Only Rain Down the Storm Drain" or similar • Mark locations of all inlets	• Maintain and periodically repaint or replace inlet markings. • Provide stormwater pollution prevention information to new owners, lessees, or operators. • See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance", in the CASQA

		Stormwater Quality Handbooks at www.cabmphandbooks.com • Include the following in lease agreements: "Tenant shall not allow anything to storm drains or deposit materials so as to create a potential discharge to storm drains.
D2. Landscape/Outdoor Pesticide Use	• Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. • Design landscaping to minimize and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. • Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. • Consider using pest-resistant plants, especially adjacent to hardscape. • To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	• Maintain landscaping using minimum or no pesticides • See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com • Provide IPM information to new owners, lessees and operators.
G. Refuse areas	• Signs posted on or near the dumpsters with the words "Do not dump hazardous materials here" or similar. • Coordinate with Local Waste Management for waste pickup	• Inspect receptacles regularly • Repair or replace leaky receptacles. • Keep receptacles covered. • Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. • Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials on-site. • See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA

		Stormwater Quality Handbook at www.cabmphandbooks.com

I. Outdoor storage of equipment or materials	• Materials to be stored will be determined upon selection of tenants
	• Storage areas are located around the centralized industrial building
	• Ensure compliance with the requirements of Hazardous Materials Programs for:
	  • Hazardous Waste Generation
	  • Hazardous Materials Release Response and Inventory
	  • California Accidental Release (Cal ARP)
	  • Aboveground Storage Tank
	  • Uniform Fire Cord Article 80 Section 103(b) & (c) 1991
	  • www.cchealth.org/groups/hazmat/
		• See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

M. Loading Docks		• Move loaded and unloaded items indoors as soon as possible • See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
O. Roofing	• Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
P. Plazas, sidewalks, and parking lots		• Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect wash water containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
MWS A	On-Site: Biotreatment – Modular Wetlands Linear System	Sheet 1 – WQMP Exhibit	33.7379121, -117.206541
MWS B	On-Site: Biotreatment – Modular Wetlands Linear System	Sheet 1 – WQMP Exhibit	33.7379121, -117.206524
BASIN A	On-Site: Upstream Detention – Underground Storage Chamber System	Sheet 1 – WQMP Exhibit	33.739128, -117.207579
MWS C	Off-Site: Biotreatment – Modular Wetlands Linear System	Sheet 1 – WQMP Exhibit	33.739339, -117.206470

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: Proposed stormwater BMPs will be maintained by the owner, IPT Menifee CC, LLC.

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☐ Y ☒ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

VICINITY MAP

VICINITY MAP

SCALE: NTS

REGISTERED PROFESSIONAL ENGINEER
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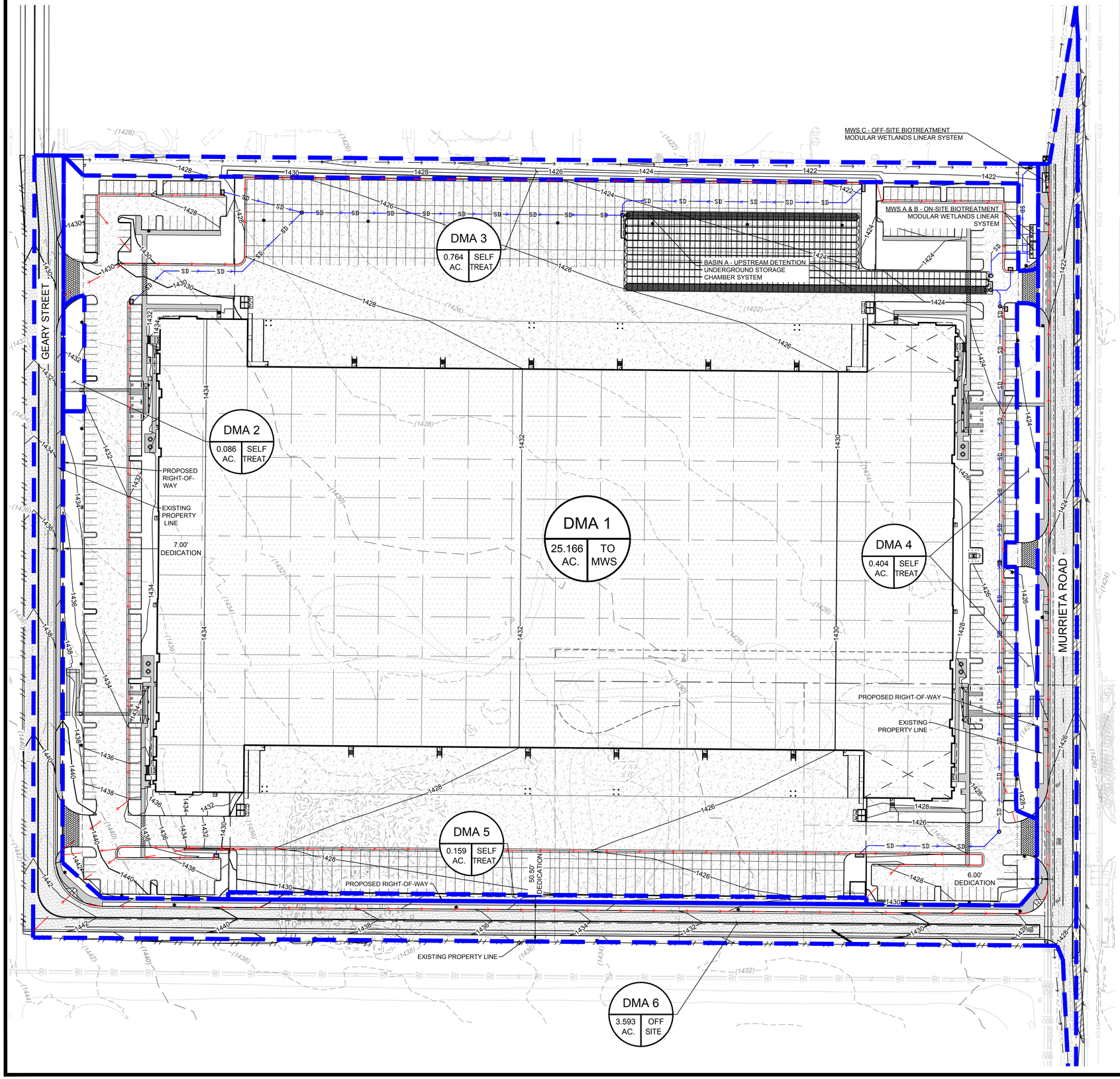
PROJECT NAME: ARES MENIFEE			SHEET
JOB NO.: IRV22-0086	DATE : 6/30/2023		1 0F 1
DRAWN: AC	PA/PM: LC	SCALE: NTS	

CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT



ON-SITE DMA TABULAR SUMMARY					
DMA	SURFACE TYPES	AREA (SF)	EFFECTIVE IMPERVIOUS FRACTION	DMA RUNOFF FACTOR	DMA TYPE / BMP TYPE
DMA 1A	CONCRETE/ASPHALT	505,227	1.0	0.89	TYPE D / BIOTREATMENT MWS
DMA 1B	LANDSCAPED AREAS NATURAL D SOILS	80,197	0.40	0.28	TYPE D / BIOTREATMENT MWS
DMA 1C	ROOFS	510,801	1.0	0.89	TYPE D / BIOTREATMENT MWS
DMA 2	LANDSCAPED AREAS NATURAL D SOILS	3,751	0.40	0.28	TYPE A / SELF-TREATING
DMA 3	LANDSCAPED AREAS NATURAL D SOILS	33,271	0.40	0.28	TYPE A / SELF-TREATING
DMA 4	LANDSCAPED AREAS NATURAL D SOILS	17,590	0.40	0.28	TYPE A / SELF-TREATING
DMA 5	LANDSCAPED AREAS NATURAL D SOILS	6,927	0.40	0.28	TYPE A / SELF-TREATING
TOTAL	N/A	1,157,764	N/A	N/A	N/A

OFF-SITE DMA TABULAR SUMMARY					
DMA	SURFACE TYPES	AREA (SF)	EFFECTIVE IMPERVIOUS FRACTION	DMA RUNOFF FACTOR	DMA TYPE / BMP TYPE
DMA 6A	CONCRETE/ASPHALT	133,944	1.0	0.89	TYPE D / BIOTREATMENT MWS
DMA 6B	LANDSCAPED AREAS - NATURAL D SOILS	22,574	0.40	0.28	TYPE D / BIOTREATMENT MWS
TOTAL	N/A	156,518	N/A	N/A	N/A

WATER QUALITY INFORMATION

HYDRAULIC SOILS GROUP D

85TH PERCENTILE 24-HR RAINFALL DEPTH: 0.60 IN

TOTAL ON-SITE AREA = 1,157,764 SF = 26.579 AC
PROPOSED IMPERVIOUS AREA: 1,016,028 SF
PROPOSED PERVIOUS AREA: 141,736 SF

TOTAL OFF-SITE AREA = 156,518 SF = 3.593 AC
PROPOSED IMPERVIOUS AREA: 133,944 SF
PROPOSED PERVIOUS AREA: 22,574 SF

ON-SITE - BIOTREATMENT MWS A & B W/ UPSTREAM DETENTION BASIN A
DESIGN CAPTURE VOLUME = 46,436.5 CF
TREATMENT CAPACITY OF MWS A & B = 50,240 CF
TOTAL UPSTREAM STORAGE CAPACITY = 154,076 CF

OFF-SITE - BIOTREATMENT MWS C
DESIGN FLOW RATE = 0.600 CFS
TREATMENT CAPACITY = 0.693 CFS

LEGEND

- DMA BOUNDARY
- PROPOSED DRAINAGE PATTERN
- STORM DRAIN — SD —

ON-SITE BMP TABULAR SUMMARY			
BMP ID	BMP LOCATION (LAT/LONG)	DCV / VBMP (CF)	TREATMENT CAPACITY (CF)
MWS A	33.7379121, -117.206541	23,218.25	25,120
MWS B	33.7379121, -177.206524	23,218.25	25,120
TOTAL	N/A	46,436.5	50,240

OFF-SITE BMP TABULAR SUMMARY			
BMP ID	BMP LOCATION (LAT/LONG)	DESIGN FLOW RATE (CFS)	TREATMENT CAPACITY (CFS)
MWS C	33.739339, -117.206470	0.600	0.693

0 30 60 120
SCALE: 1" = 60'

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE
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REGISTERED PROFESSIONAL ENGINEER
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September 13, 2023

FOR AND ON BEHALF OF WARE MALCOMB

ARES SPEC INDUSTRIAL
PRELIMINARY WQMP
MURRIETA RD. & ETHANAC RD.
MENIFEE, CA 92585

WQMP EXHIBIT

NO.	DATE	REMARKS

JOB NO.:	IRV22-0086
PA / PM:	LC
DESIGNED:	AC
DATE:	9/13/2023
PLOT DATE:	9/13/2023

SHEET 1
Sheet 1 of 3

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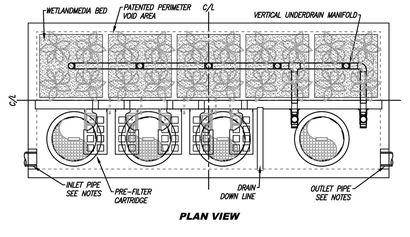
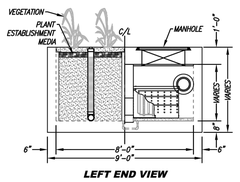
SITE SPECIFIC DATA			
PROJECT NUMBER		IRV22-0086	
PROJECT NAME		ARES MENIFEE	
PROJECT LOCATION		CITY OF MENIFEE	
STRUCTURE ID		MWS A & B - ON-SITE	
TREATMENT REQUIRED			
FLOW BASED (CFS)			
N/A			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1414.04	PVC	12
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	1413.04	PVC	12
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1422.59		
SURFACE LOAD	PEDESTRIAN		
NOTES:	UNITS WILL BE VOLUME BASED. TOTAL TREATMENT CAPACITY IS 50,240 CF.		

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



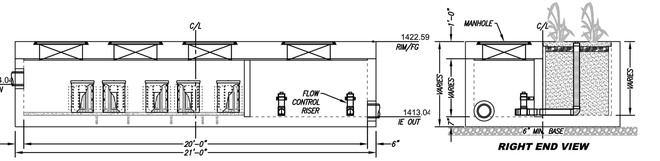
LEFT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS' SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.

GENERAL NOTES

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



ELEVATION VIEW

RIGHT END VIEW

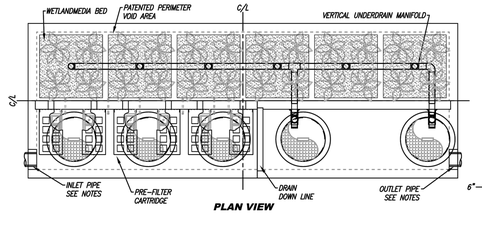
TREATMENT FLOW (CFS)	null
OPERATING HEAD (FT)	0.0
PRETREATMENT LOADING RATE (GPM/SF)	0.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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

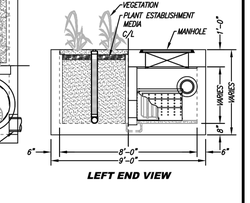
MWS A & B: CONTECH MWS-L-8-20-V STORMWATER BIOFILTRATION SYSTEM DETAIL
SCALE: NTS
ON-SITE BMP - BIOTREATMENT

SITE SPECIFIC DATA			
PROJECT NUMBER		IRV22-0086	
PROJECT NAME		ARES MENIFEE	
PROJECT LOCATION		CITY OF MENIFEE	
STRUCTURE ID		MWS C - OFF-SITE	
TREATMENT REQUIRED			
FLOW BASED (CFS)			
0.693			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1422.01		
SURFACE LOAD	PEDESTRIAN		
NOTES:	UNIT TO BE CURB-OPENING TYPE WITH OPENING AT ELEVATION 1421.92.		

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



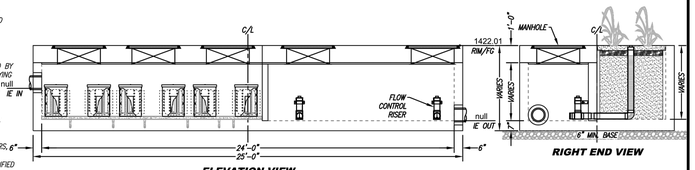
LEFT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS' SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.

GENERAL NOTES

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



ELEVATION VIEW

RIGHT END VIEW

TREATMENT FLOW (CFS)	0.693
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-24-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

MWS C: CONTECH MWS-L-8-20-V STORMWATER BIOFILTRATION SYSTEM DETAIL
SCALE: NTS
OFF-SITE BMP - BIOTREATMENT

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

ARES MENIFEE
MENIFEE, CA, USA

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-7200.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS", LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%, THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418, AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1. STORMTECH MC-7200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-7200 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-7200 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

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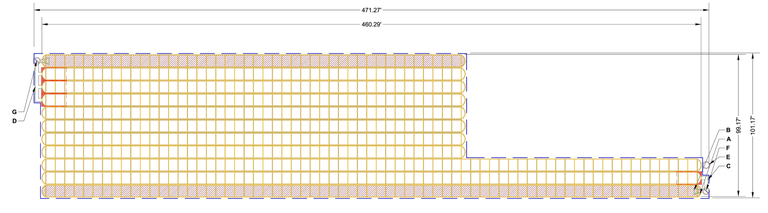
BASIN A: ADS MC-7200 STORMTECH CHAMBER SYSTEM DETAIL - SHEET 1 OF 6
SCALE: NTS
ON-SITE BMP - UPSTREAM DETENTION

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS	
559	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
22	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.33
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.13
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.13
15409	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) BASE STONE INCLUDED)	TOP OF STONE:	6.13
		TOP OF MC-7200 CHAMBER:	5.13
		24" x 24" BOTTOM MANIFOLD INVERT:	0.94
		12" x 24" BOTTOM MANIFOLD INVERT:	0.94
59021	SYSTEM AREA (SF)	24" ISOLATOR ROW PLUS INVERT:	0.94
1144.8	SYSTEM PERIMETER (ft)	24" ISOLATOR ROW PLUS INVERT:	0.94
		24" BOTTOM CONNECTION INVERT:	0.94
		BOTTOM OF MC-7200 CHAMBER:	0.13
		BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

ITEM ON LAYOUT	PART TYPE	DESCRIPTION	INVERT*	MAX FLOW
A	PREFABRICATED END CAP	24" BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
B		INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC720024RAMP (TYP 2 PLACES)		
C	MANIFOLD	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.26"	
D	MANIFOLD	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.26"	
E	CONCRETE STRUCTURE	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		7.5 CFS OUT
F	CONCRETE STRUCTURE	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		9.5 CFS IN
G	CONCRETE STRUCTURE	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		28.5 CFS IN



ISOLATOR ROW PLUS (SEE DETAIL/TYP 2 PLACES)

PLACE MINIMUM 17.50" OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

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

BASIN A: ADS MC-7200 STORMTECH CHAMBER SYSTEM DETAIL - SHEET 2 OF 6
SCALE: NTS
ON-SITE BMP - UPSTREAM DETENTION

ARES MENIFEE
MENIFEE, CA, USA
DATE: 9/13/2023
PROJECT #: IRV22-0086
CHECKED: N/A
DRAWN: JP

NO.	DATE	DESCRIPTION	DRW	CHK

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
4640 TRUEMAN BLVD HILLIARD, OH 43026 (800)733-7473

THE DRAWINGS AND DESIGNS INCLUDED ARE INFORMATION PROPRIETARY TO ADS UNDER THE LAWS OF THE STATES AND/OR COUNTRIES IN WHICH ADS DOES BUSINESS AND SHALL NOT BE USED ON ANY PROJECT WITHOUT AN EXECUTED AGREEMENT WITH ADS. THE ADS DESIGN DRAWINGS SHALL REMAIN THE EXCLUSIVE PROPERTY OF ADS AND SHALL NOT BE REPRODUCED IN ANY FORM WITHOUT THE PRIOR WRITTEN CONSENT OF ADS. ALL RIGHTS RESERVED. USE OF THESE DRAWINGS FOR ANY PROJECT CONSTRUCTED BY OTHERS WITHOUT THE EXPRESS WRITTEN CONSENT OF ADS IS STRICTLY PROHIBITED AND WILL BE SUBJECT TO LEGAL ACTION.

SHEET
2 OF 5

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE
10 edelman
irvine, ca 92618
p 949.660.9128
waremalcomb.com

REGISTERED PROFESSIONAL ENGINEER
LUCAS A. CORBETT
No. 72588
CIVIL
STATE OF CALIFORNIA
September 13, 2023

FOR AND ON BEHALF OF WARE MALCOMB

ARES SPEC INDUSTRIAL
PRELIMINARY WQMP
MURRIETA RD. & ETHANAC RD.
MENIFEE, CA 92585

BMP DETAILS

NO.	DATE	REMARKS

JOB NO.:	IRV22-0086
PA / PM:	LC
DESIGNED:	AC
DATE:	9/13/2023
PLOT DATE:	9/13/2023

SHEET
2
Sheet 2 of 3

NOT FOR CONSTRUCTION

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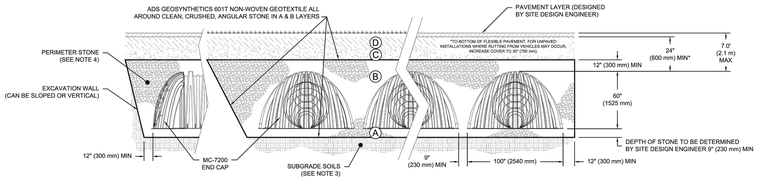
ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

	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 (18" 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[4] A-1, A-2-4, A-3 OR AASHTO M43[3] 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[3] 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[3] 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.



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 SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/% . THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. 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.

ARES MENIFEE — MENIFEE, CA, USA — DRAWN: JP — CHECKED: N/A — DATE: — PROJECT #: — DESCRIPTION — DATE — DRW — CHK

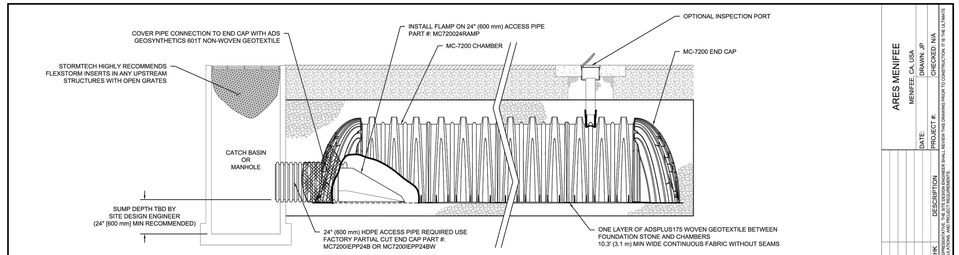
StormTech® Chamber System — 888-892-2694 | WWW.STORMTECH.COM

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

SHEET 3 OF 5

BASIN A: ADS MC-7200 STORMTECH CHAMBER SYSTEM DETAIL - SHEET 3 OF 6

SCALE: NTS
ON-SITE BMP - UPSTREAM DETENTION



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.

ARES MENIFEE — MENIFEE, CA, USA — DRAWN: JP — CHECKED: N/A — DATE: — PROJECT #: — DESCRIPTION — DATE — DRW — CHK

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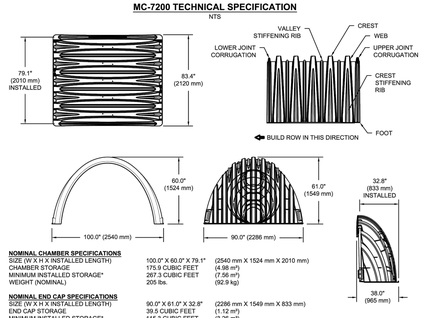
SHEET 4 OF 5

BASIN A: ADS MC-7200 STORMTECH CHAMBER SYSTEM DETAIL - SHEET 4 OF 6

SCALE: NTS
ON-SITE BMP - UPSTREAM DETENTION

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

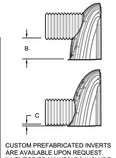
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*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)

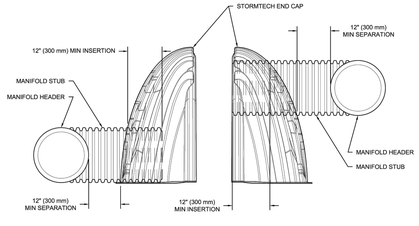
NOTE: ALL DIMENSIONS ARE NOMINAL



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-SERIES END CAP INSERTION DETAIL

NTS



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

ARES MENIFEE — MENIFEE, CA, USA — DRAWN: JP — CHECKED: N/A — DATE: — PROJECT #: — DESCRIPTION — DATE — DRW — CHK

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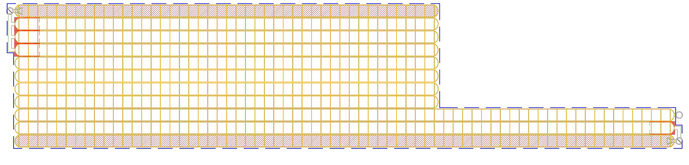
SHEET 5 OF 5

BASIN A: ADS MC-7200 STORMTECH CHAMBER SYSTEM DETAIL - SHEET 5 OF 6

SCALE: NTS
ON-SITE BMP - UPSTREAM DETENTION



BASIN A: ADS MC-7200 STORMTECH CHAMBER SYSTEM DETAIL - SHEET 6 OF 6

SCALE: NTS
ON-SITE BMP - UPSTREAM DETENTION

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE
10 edelman
irvine, ca 92618
p 949.660.9128
waremalcomb.com

REGISTERED PROFESSIONAL ENGINEER — LUCAS A. CORBETTE — No. 72588 — CIVIL — STATE OF CALIFORNIA

September 13, 2023

FOR AND ON BEHALF OF WARE MALCOMB

ARES SPEC INDUSTRIAL
PRELIMINARY WQMP
MURRIETA RD. & ETHANAC RD.
MENIFEE, CA 92585

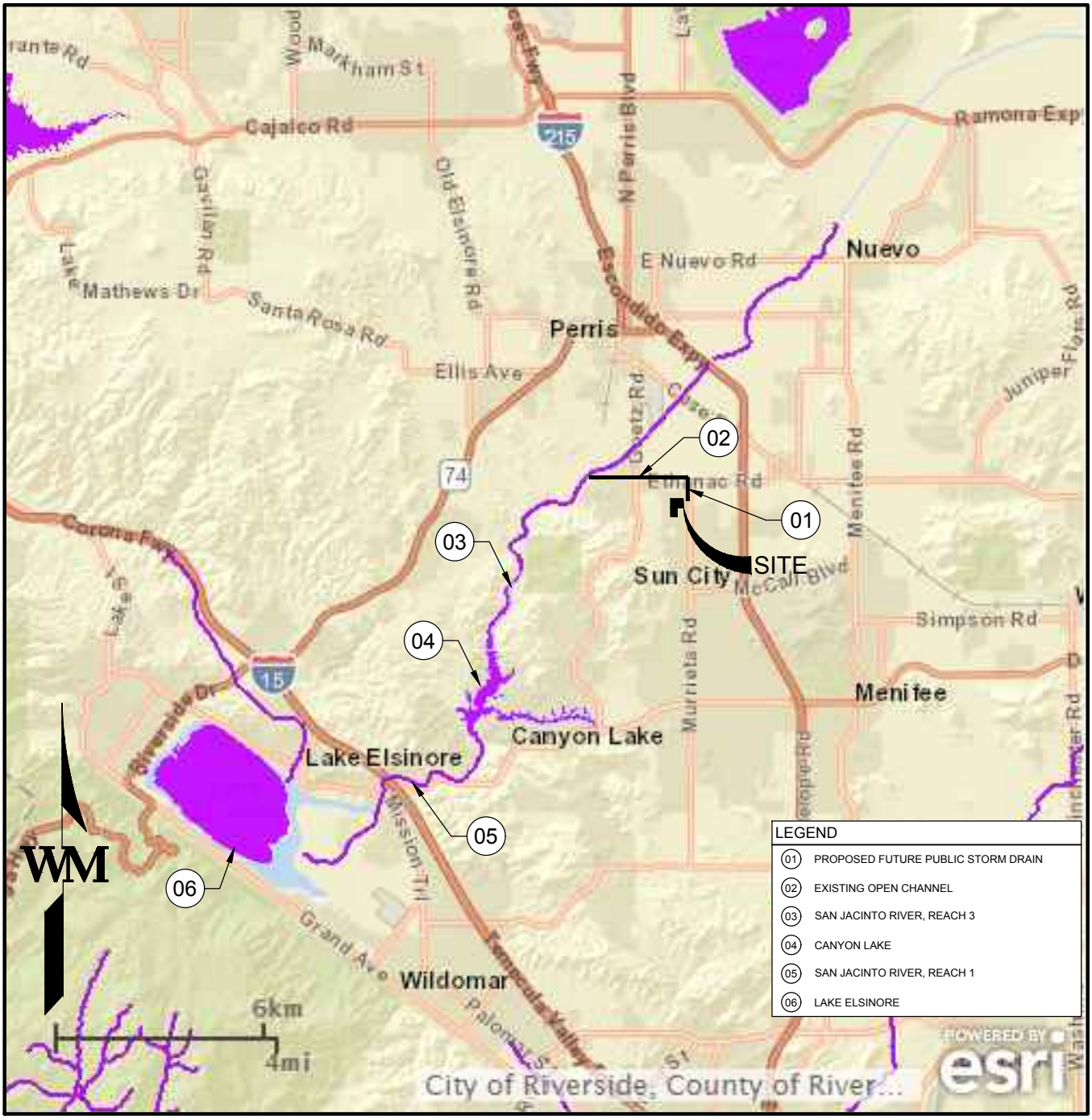
BMP DETAILS

NO.	DATE	REMARKS

JOB NO.:	IRV22-0086
PA / PM:	LC
DESIGNED:	AC
DATE:	9/13/2023
PLOT DATE:	9/13/2023

SHEET 3
Sheet 3 of 3

RECEIVING WATERS MAP



10 edelman
irvine, ca 92618
p 949.660.9128
waremalcomb.com
WARE MALCOMB
CIVIL ENGINEERING & SURVEYING

PROJECT NAME: MURRIETA ROAD & ETHANAC ROAD		
JOB NO.: IRV22-0086	DATE : 04/06/2022	
DRAWN: AC	PA/PM: LC	SCALE: N.T.S.

R 07 W | R 06 W | R 05 W | R 04 W | R 03 W | R 02 W | R 01 W | R 01 E | R 02 E | R 03 E | R 04 E | R 05 E

T 01 S | T 02 S | T 03 S | T 04 S | T 05 S | T 06 S | T 07 S | T 08 S

0.85 MiraLoma
0.61 Riverside North
0.68 PigeonPass
0.54 Riverside South
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.50 LakeMathews
0.68 PerrisReservoir
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.90 HurkeyCreek
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley

Approximate Project Site Area D85=0.60"

Santa Ana River Watershed

Santa Margarita Watershed

06	05	04	03	02	01
07	08	09	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

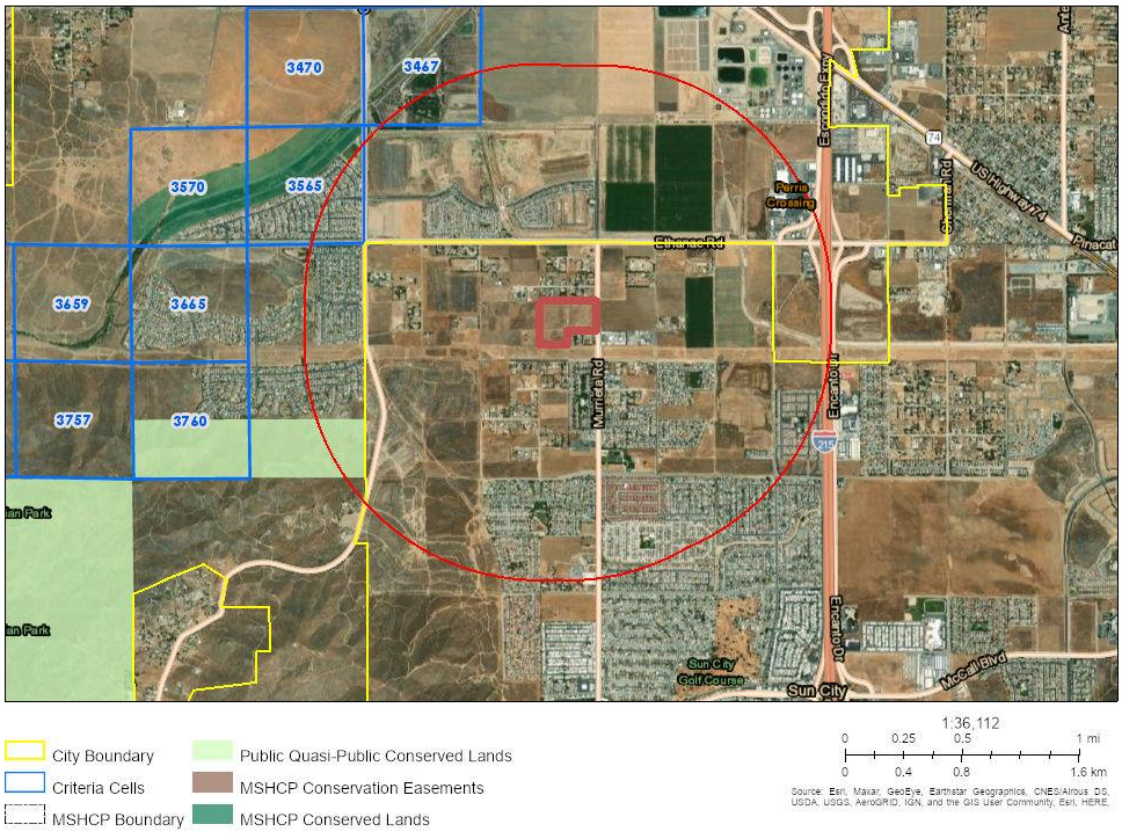
July 2011

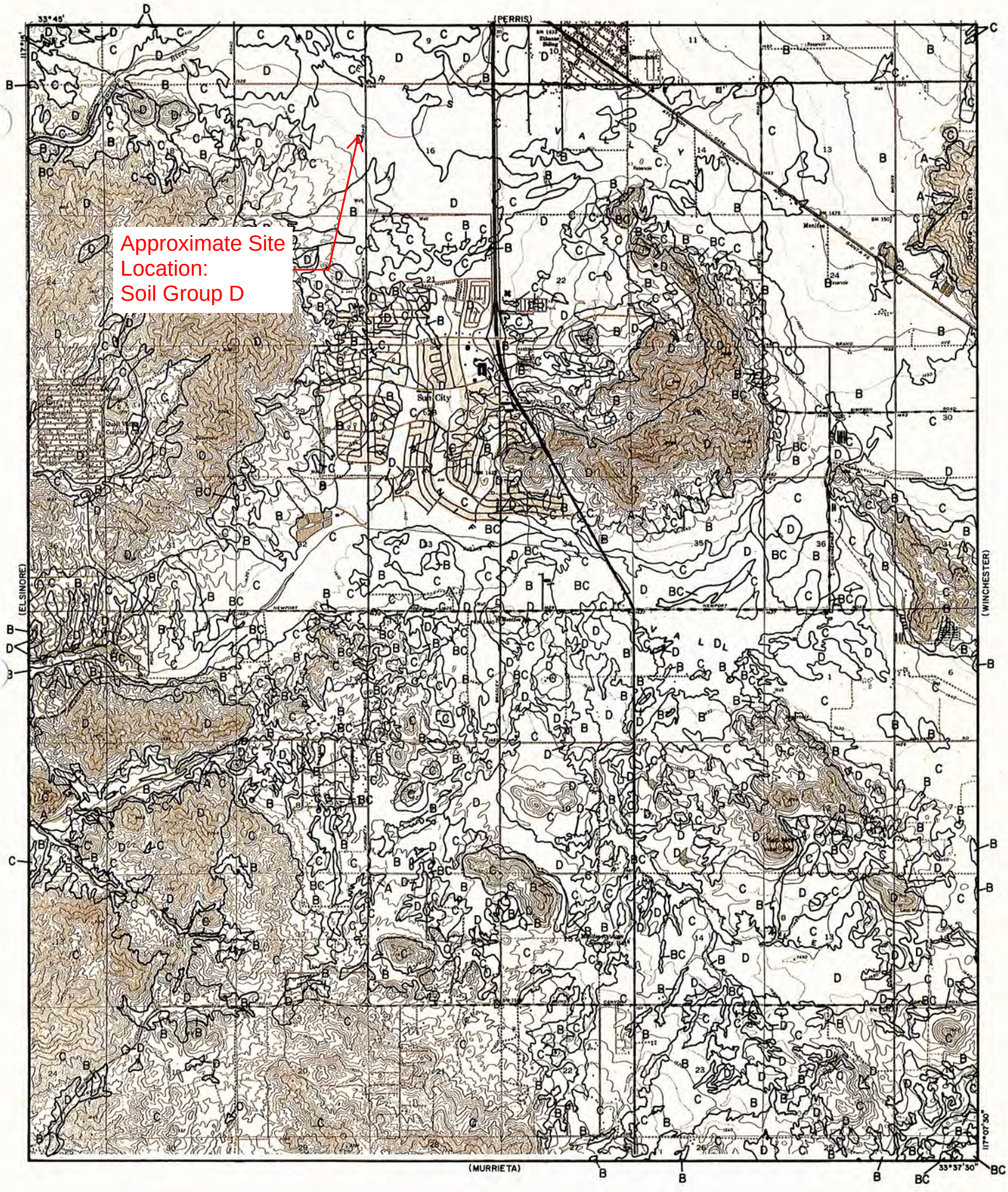
Multiple Species Habitat Conservation Plan (MSHCP) Report

Area of Interest (AOI) Information

Area : 2,560.58 acres

Apr 7 2022 9:33:21 Pacific Daylight Time





LEGEND

SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC & WCD

HYDROLOGY MANUAL

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR ROMOLAND

PLATE C-1.42

Appendix 2: Construction Plans

Grading and Drainage Plans

CAUTION: IF THIS SHEET IS NOT 24"x36" IT IS A REDUCED PRINT

ARES SPEC INDUSTRIAL - PRELIMINARY PLANS
MURRIETA RD. AND ETHANAC RD.,
MENIFEE, CA 92585

AGENCY CONTACT LIST

OWNER/DEVELOPER
IPT MENIFEE CC LLC, A DELAWARE LIMITED LIABILITY COMPANY
626.786.2112
CONTACT: JAMIE MCLAUGHLIN

CIVIL ENGINEER
WARE MALCOMB
10 EDELMAN
IRVINE, CA 92618
949.660.9128
CONTACT: LUCAS CORSBIE

CITY OF MENIFEE
COMMUNITY DEVELOPMENT DEPARTMENT
29844 HAUN ROAD
MENIFEE, CA 92586
951.672.6777

WATER & SEWER
EASTERN MUNICIPAL WATER DISTRICT
2270 TRUMBLE ROAD
PERRIS, CA 92570
951.928.3777

ELECTRIC
SOUTHERN CALIFORNIA EDISON
26100 MENIFEE ROAD
ROMOLAND, CA 92585
800.684.8123

GAS
SOCALGAS CO.
25200 TRUMBLE ROAD
PERRIS, CA 92571
909.307.7070

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE CITY OF MENIFEE GRADING ORDINANCE 8.26, CALIFORNIA BUILDING CODE APPENDIX J, THE CITY OF MENIFEE STANDARD DETAILS AND SPECIFICATIONS, POLICIES, CODES, AND PERMIT REQUIREMENTS; IN ADDITION, THE WORK SHALL CONFORM TO THE CURRENT STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (THE "GREENBOOK), THE RIVERSIDE COUNTY STREET IMPROVEMENT STANDARDS AND SPECIFICATIONS AND STANDARD PLANS; COUNTY ORDINANCE NO. 461; CALTRANS STANDARD PLANS AND SPECIFICATIONS; CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
2. A GRADING PERMIT SHALL BE OBTAINED FROM THE CITY OF MENIFEE ENGINEERING DEPARTMENT PRIOR TO START OF WORK.
3. AN ENCROACHMENT PERMIT SHALL BE OBTAINED FROM THE CITY OF MENIFEE PRIOR TO START OF WORK FOR WORK PERFORMED WITHIN THE PUBLIC RIGHT-OF-WAY.
4. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE PROSECUTED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.
5. PRIOR TO START OF WORK, THE DEVELOPER/CONTRACTOR SHALL APPLY TO THE CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) FOR AN ENCROACHMENT PERMIT FOR WORK PERFORMED WITHIN THE STATE RIGHT-OF-WAY.
6. WHEN GRADING PLANS HAVE BEEN SUBMITTED TO THE CITY FOR CHECKING AND THE CHECKING PROCESS HAS BEEN INTERRUPTED FOR A PERIOD OF ONE YEAR OR MORE, THE PLANS SHALL BE DEEMED ABANDONED. APPROVED GRADING PLANS FOR ALL SUBDIVISIONS SHALL BE DEEMED ABANDONED IF CONSTRUCTION HAS NOT COMMENCED WITHIN TWO YEARS OF THE LATEST APPROVAL DATE (ONE YEAR FOR NON-SUBDIVISIONS). IF CONSTRUCTION IS INTERRUPTED FOR A PERIOD OF ONE YEAR OR MORE, THE PLANS SHALL BE DEEMED ABANDONED. ABANDONED PLANS SHALL BE RESUBMITTED FOR REVIEW AND ALL FEES SHALL BE PAID IN ACCORDANCE WITH THE PLAN CHECK AND PROCESSING POLICY PRIOR TO ANY PERMITS BEING ISSUED.
7. NOTIFY UNDERGROUND SERVICE ALERT, (800) 227-2600, AND ALL CONCERNED UTILITY COMPANIES AT LEAST TWO WORKING DAYS IN ADVANCE OF EXCAVATION.
8. LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE DEVELOPER/CONTRACTOR SHALL DETERMINE THE EXACT LOCATIONS AND VERIFY CONDITIONS ON THE JOB SITE PRIOR TO COMMENCING WORK. THE DEVELOPER/CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR DAMAGES OCCURRED DUE TO FAILURE TO LOCATE AND PRESERVE UNDERGROUND UTILITIES. HAND DIG AS NEEDED UNTIL CLEAR OF OBSTRUCTIONS.
9. APPROVAL OF THIS PLAN BY THE CITY OF MENIFEE DOES NOT CONSTITUTE A REPRESENTATION AS TO THE ACCURACY OF, THE LOCATION OF, OR THE EXISTENCE OR NON-EXISTENCE OF, ANY UNDERGROUND UTILITY PIPE OR STRUCTURE WITHIN THE LIMITS OF THE PROJECT. THIS NOTE APPLIES TO ALL PAGES.
10. THE CONTRACTOR SHALL CONTACT THE CITY OF MENIFEE PUBLIC WORKS INSPECTOR 2 WORKING DAYS OR 48 HOURS PRIOR TO CONSTRUCTION AT (951) 672-6777.
11. A PRECONSTRUCTION MEETING WITH THE PUBLIC WORKS INSPECTOR IS REQUIRED PRIOR TO START OF WORK.
12. RIGHT OF ENTRY FOR ANY WORK PERFORMED ON ADJACENT PROPERTIES IS REQUIRED. PERMISSION FOR RIGHT OF ENTRY SHALL BE OBTAINED IN WRITING AND LETTER SHALL COMPLY WITH CITY FORMAT.
13. APPROVAL OF PLANS AND/OR PERMIT ISSUANCE DOES NOT RELIEVE THE PERMITTEE OF THEIR RESPONSIBILITY TO MAINTAIN WORK WITHIN THE PROJECT PROPERTY BOUNDARIES AND DEDICATED CITY RIGHT-OF-WAY. TRESPASSING ON PRIVATE PROPERTY IS AGAINST THE LAW AND CAUSE FOR CANCELLATION OF PERMIT AND ISSUANCE OF STOP WORK NOTICE.
14. ALL REVISIONS TO GRADING PLANS, OR MATERIAL SUBSTITUTION REQUESTS, PROPOSED DURING CONSTRUCTION SHALL BE SUBMITTED IN WRITING TO THE ENGINEERING DEPARTMENT BY THE ENGINEER OF RECORD AND SHALL FOLLOW THE PROCEDURES FOR APPROVAL OUTLINED IN THE MOST CURRENT CITY OF MENIFEE ENGINEERING DIRECTIVES.
15. IT IS THE RESPONSIBILITY OF THE PERMITTEE TO SUBMIT A REQUEST FOR PERMIT EXTENSION TO THE CITY ENGINEER IN WRITING PRIOR TO PERMIT EXPIRATION. EXTENSION AND EXPIRATION OF PERMITS SHALL BE IN ACCORDANCE WITH THE UNIFORM BUILDING CODE AND/OR THE CITY OF MENIFEE ENGINEERING DESIGN GUIDELINES POLICIES AND PROCEDURES.
16. THE DEVELOPER/CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CLEAN UP ON CITY OF MENIFEE RIGHT-OF-WAY AFFECTED BY DEVELOPER'S/CONTRACTOR'S WORK. THE DEVELOPER/CONTRACTOR SHALL KEEP CITY OF MENIFEE RIGHT-OF-WAY CLEAN OF DEBRIS, WITH DUST AND OTHER NUISANCES BEING CONTROLLED AT ALL TIMES. METHOD OF STREET CLEANING SHALL BE STREET SWEEPING OF ALL PAVED AREAS. THERE SHALL BE NO STOCKPILING OF CONSTRUCTION MATERIALS WITHIN THE CITY OF MENIFEE RIGHT-OF-WAY WITHOUT THE PERMISSION OF THE MENIFEE CITY ENGINEER.
17. ALL PROPERTY CORNERS SHALL BE CLEARLY DELINEATED IN THE FIELD PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION/GRADING.
18. THE ENGINEER OF WORK WHO PREPARED AND SIGNED THIS GRADING PLAN HAS VERIFIED THE CONSISTENCY BETWEEN THE WORK WITHIN THE RIGHT-OF-WAY AND THE ON-SITE GRADING WORK APPROVED SEPARATELY BY THE CITY OF MENIFEE ENGINEERING DEPARTMENT.
19. A GEOTECHNICAL REPORT PREPARED BY A REGISTERED PROFESSIONAL SHALL BE PROVIDED.

GRADING NOTES

1. THE CONTRACTOR SHALL TAKE ALL NECESSARY AND PROPER PRECAUTIONS TO PROTECT ADJACENT PROPERTIES FROM ANY AND ALL DAMAGE THAT MAY OCCUR FROM STORM WATER RUNOFF AND/OR DEPOSITION OF DEBRIS RESULTING FROM ANY AND ALL WORK IN CONNECTION WITH HIS PRIVATE DEVELOPMENT CONSTRUCTION.
2. PRIOR TO REMOVAL OF VEGETATION AND GRADING OF THE SITE, ALL MITIGATION MONITORING AS IDENTIFIED AND ITEMIZED IN THE PLANNING COMMISSION/COMMUNITY DEVELOPMENT CONDITIONS OF APPROVAL SHALL BE ADDRESSED TO THE SATISFACTION OF THE COMMUNITY DEVELOPMENT DIRECTOR AND THE CITY ENGINEER.
3. FILL AREAS SHALL BE CLEARED OF ALL VEGETATION AND DEBRIS, SCARIFIED, AND INSPECTED BY THE GRADING INSPECTOR AND SOILS ENGINEER PRIOR TO THE PLACING OF FILL.
4. ALL CESSPOOLS, SEPTIC TANKS, ETC., TO BE ABANDONED SHALL BE FILLED OR REMOVED IN ACCORDANCE WITH THE RIVERSIDE COUNTY HEALTH DEPARTMENT AND CERTIFIED BY THE SOILS ENGINEER AND AS APPROVED BY THE CITY ENGINEER.
5. ANY EXISTING WELLS NOT TO BE USED SHALL BE DESTROYED IN ACCORDANCE WITH RIVERSIDE COUNTY ORDINANCE 682.
6. DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL (BEST MANAGEMENT PRACTICES, BMPS) SHALL BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
7. PRIOR TO ANY CONSTRUCTION, THE DEVELOPER SHALL PROVIDE THE CITY A COPY OF THE NOI WITH A VALID WDID NUMBER.

VICINITY MAP
NOT TO SCALE

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED UPON THE CALIFORNIA COORDINATE SYSTEM OF 1983, CCS83, ZONE 6, (2017.50) IN ACCORDANCE TO THE CALIFORNIA PUBLIC RESOURCES CODE SECTIONS 8801-8819; SAID BEARINGS ARE DETERMINED LOCALLY UPON FIELD-OBSERVED TIES TO THE FOLLOWING CALIFORNIA SPATIAL REFERENCE NETWORK CONTINUOUS OPERATING REFERENCE STATIONS (C.O.R.S.):

C.S.R.C. CNPP:
NORTHING = 258382.63' EASTING = 6149110.39'

C.S.R.C. EWPP:
NORTHING = 2347787.29' EASTING = 6175506.72'

BENCHMARK

THE CALIFORNIA SPATIAL REFERENCE CENTER C.O.R.S. "CNPP", ELEVATION 1098.47 FEET (NAVD 88).

SHEET INDEX

LEGEND

EXISTING		PROPOSED
	BOUNDARY	
	SECTION	
	1/4 SECTION	
	1/16 SECTION	
	LOT LINE	
	EASEMENT	
	CENTERLINE	
(5280)	MAJOR CONTOUR	5280
(5278)	MINOR CONTOUR	5278
	CURB / GUTTER	
	SIDEWALK	
X	FENCE	X
N/A	SAWCUT	
	STORM DRAIN	SD
SS	SANITARY	SS
WM	WATERLINE	WM
DW	DOMESTIC WATER	DW
FW	FIRE WATER	FW
RW	RECLAIMED WATER	RW
IRR	IRRIGATION	IRR
OH	OVERHEAD UTILITY	OH
JT	JOINT UTILITY TRENCH	JT
CATV	CABLE TV	CATV
E	BURIED ELECTRIC	E
FO	FIBER OPTIC	FO
NGAS	NATURAL GAS	NGAS
T T	TELEPHONE	T T
UKWN	UNKNOWN UTILITY	N/A

GRADING LEGEND & ABBREVIATIONS

5280.00	PROPOSED SPOT ELEVATION
(5280.0)	EXISTING SPOT ELEVATION
2.00%	PROPOSED SLOPE / GRADE
2.00%	EXISTING SLOPE / GRADE
BOS	BOTTOM OF STONE
BW	BOTTOM OF WALL
CF	CURB FACE
DOOR	ELEVATION AT DOOR
DWG	DRAWING
EL	ELEVATION
FF	FINISHED FLOOR ELEVATION
FG	FINISHED GRADE
FL	FLOWLINE
FS	FINISHED SURFACE
FW	FACE OF WALL
GB	GRADE BREAK
HP	HIGH POINT
INV	INVERT ELEVATION
LP	LOW POINT
RIM	RIM ELEVATION
RL	RIDGE LINE
R.O.W.	RIGHT OF WAY
STD	STANDARD
TC	TOP OF CURB
TG	TOP OF GRATE
TOC	TOP OF CHAMBER
TOS	TOP OF STONE
TW	TOP OF WALL

811 Know what's below. Call before you dig.

EARTHWORK QUANTITY ESTIMATE

DESCRIPTION		EXCAVATION (CY)	EMBANKMENT (CY)
RAW		47,300	81,000
BLDG. OVER EX. R&R	5' AVG. DEPTH	98,000	98,000
PAVEMENT OVER EX. R&R	12"	18,300	18,300
SUBTOTAL		163,600	197,300
SHRINKAGE	12% AVG.	-	221,000
BLDG. SLAB SECTION	6"		-9,500
CONCRETE PAVEMENT SECTION	7"		-10,700
STORAGE CHAMBER	6.75'		-8,800
GRAND TOTAL		163,600	192,000
NET (IMPORT)			28,400

NOTE: THE ESTIMATED QUANTITIES HEREON ARE ONLY FOR THE PURPOSE OF OBTAINING THE NECESSARY PERMITS. WARE MALCOMB DOES NOT GUARANTEE THE ACCURACY OF THE ESTIMATED QUANTITIES. THE CONTRACTOR SHALL PERFORM HIS OWN QUANTITY TAKEOFF BEFORE SUBMITTING A BID FOR ANY PORTION OF THE IMPROVEMENTS COVERED BY THESE PLANS.

DRAINAGE NOTES

1. EXISTING DRAINAGE COURSES ON PROJECT SITE SHALL CONTINUE TO FUNCTION. PROTECTIVE MEASURES AND TEMPORARY DRAINAGE PROVISIONS SHALL BE USED TO PROTECT ADJOINING PROPERTIES DURING GRADING OPERATIONS AND SHALL BE APPROVED BY THE APPROPRIATE REGULATORY AGENCY.
2. DRAINAGE ACROSS THE PROPERTY LINE SHALL NOT EXCEED THAT WHICH EXISTED PRIOR TO GRADING. EXCESS OR CONCENTRATED DRAINAGE SHALL BE CONTAINED ON SITE OR DIRECTED TO AN APPROVED DRAINAGE FACILITY.
3. MID SLOPE SWALES OR DITCHES ON 6 FEET AND 12 FEET WIDE TERRACES SHALL HAVE A MINIMUM GRADIENT OF FIVE (5) PERCENT AND MUST BE PAVED WITH REINFORCED CONCRETE, OR APPROVED EQUAL, NOT LESS THAN THREE (3) INCHES IN THICKNESS. A SINGLE RUN OF SWALE OR DITCH SHALL NOT COLLECT RUNOFF FROM A TRIBUTARY AREA EXCEEDING 13,500 SQUARE FEET (PROJECTED) WITHOUT DISCHARGING INTO A DOWN DRAIN.
4. INTERCEPTOR DRAINS SHALL BE INSTALLED ALONG THE TOP OF CUT SLOPES RECEIVING DRAINAGE FROM A TRIBUTARY WIDTH GREATER THAN 40 FEET MEASURED HORIZONTALLY. INTERCEPTOR DRAINS SHALL BE 3 FEET WIDE MIN. AND 1 FOOT DEEP MIN., AND SHALL HAVE A MINIMUM GRADIENT OF TWO (2) PERCENT. THE DRAIN SHALL BE PAVED WITH CONCRETE NOT LESS THAN 3 INCHES THICK.
5. PROVIDE 4 FEET WIDE BY 1 FOOT HIGH BERM ALONG THE TOP OF FILL SLOPES STEEPER THAN 3:1 (H:V) WHERE NECESSARY.
6. MINIMUM BUILDING PAD DRAINAGE GRADIENT SHALL BE = 1 PERCENT IF CUT OR FILL IS LESS THAN 10 FEET, 2 PERCENT IF CUT OF FILL IS GREATER THAN 10 FEET.
7. THE GROUND IMMEDIATELY ADJACENT TO THE BUILDING FOUNDATION SHALL BE SLOPED AWAY AT 2% MIN. TO 20% MAX. FOR THE FIRST THREE FEET, AND 1% THEREAFTER. SWALES SHALL HAVE A 1% MIN. SLOPE.
8. RESIDENTIAL LOT GRADING SHALL CONFORM TO THE CITY OF MENIFEE STANDARD PLAN NO. 300.
9. THE ENGINEER MUST SET GRADE STAKES FOR ALL DRAINAGE DEVICES AND OBTAIN CITY INSPECTION CLEARANCE BEFORE PLACING CONCRETE.
10. RIPRAP SHALL BE GRADED STONE WHERE THE AVERAGE SIZE (D50) IS THE SIZE WHERE 50% OF THE RIPRAP BY WEIGHT IS SMALLER.
11. THE FORMULA FOR THE D50 STONE SIZE IS AS FOLLOWS:
    D50 - 0.010V2.44 WHERE V = MEAN CHANNEL VELOCITY IN FPS
12. THE RIPRAP SECTION SHALL CONSIST OF GEOFABRIC PLACED ON 12" OF COMPACTED SUBGRADE TO 90% RELATIVE DENSITY, 6" AGGREGATE BASE AND THE RIPRAP PLACED TO TWICE THE THICKNESS OF THE D50 STONE SIZE TO THE HIGHER EVEN INCH.
13. RIPRAP STONE SHALL COMPLY WITH THOSE PROVISIONS OF SUBSECTION 200-1.6 OF THE STANDARD SPECIFICATIONS.
14. AGGREGATE BASE SHALL CONFORM TO NUMBER 2 GRADATION AS PROVIDED IN SUBSECTION 400-1.3.2 OF THE STANDARD SPECIFICATIONS.
15. ROCKS FOR GROUTED RIPRAP SHALL BE A GOOD QUALITY BROKEN AND/OR RIVER RUN ROCK. THE SMALLEST DIMENSIONS SHALL EXCEED 3 INCHES AND THE LARGEST DIMENSION SHALL NOT EXCEED 18 INCHES. THE LARGEST DIMENSION SHALL NOT EXCEED 4 TIMES THE SMALLEST DIMENSION.
16. THERE SHALL BE A GROUT BED OF AT LEAST 2 INCHES BENEATH THE FIRST LAYER OF ROCK. ALL THE VOIDS BETWEEN THE ROCKS SHALL BE FILLED WITH GROUT. MAXIMUM SPACING BETWEEN ROCKS SHALL BE 2 INCHES.
17. SURFACE ROCKS SHALL BE IMBEDDED FROM $\frac{1}{3}$ TO $\frac{2}{3}$ OF THEIR MAXIMUM DIMENSION.

COMPLETION OF WORK

1. A REGISTERED CIVIL ENGINEER SHALL SUBMIT TO THE CITY OF MENIFEE ENGINEERING WRITTEN ROUGH GRADING CERTIFICATION OF COMPLETION OF GRADING IN ACCORDANCE WITH THE APPROVED GRADING PLAN PRIOR TO REQUESTING INSPECTION AND ISSUANCE OF THE BUILDING PERMIT. CERTIFICATION SHALL INCLUDE LINE, GRADE, SURFACE DRAINAGE, ELEVATION, AND LOCATION OF PERMITTED GRADING ON THE LOT.
2. AFTER ALL WORK, INCLUDING THE INSTALLATION OF DRAINAGE STRUCTURES AND PROTECTIVE DEVICES, HAS BEEN COMPLETED AND REQUIRED REPORTS HAVE BEEN SUBMITTED, THE PERMITTEE SHALL REQUEST A ROUGH GRADING INSPECTION FROM THE CITY OF MENIFEE BUILDING INSPECTOR.
3. A REGISTERED CIVIL ENGINEER SHALL SUBMIT TO THE CITY OF MENIFEE ENGINEERING DEPARTMENT FOR APPROVAL WRITTEN FINAL GRADING CERTIFICATION OF COMPLETION IN ACCORDANCE WITH THE APPROVED PLANS. FINISH GRADING SHALL BE COMPLETED AND INSTALLED INCLUDING SLOPE PLANTING AND PERMANENT EROSION CONTROL AND IRRIGATION SYSTEMS PRIOR TO OCCUPANCY.

CUT/FILL NOTES

1. NO FILL SHALL BE PLACED ON EXISTING GROUND UNTIL THE GROUND HAS BEEN CLEARED OF WEEDS, DEBRIS, TOPSOIL AND OTHER DELETERIOUS MATERIAL.
2. CUT SLOPES SHALL BE NO STEEPER THAN 2 HORIZONTAL TO 1 VERTICAL, OR AS DETERMINED BY THE SOILS ENGINEER AND APPROVED BY THE CITY ENGINEER.
3. FILL SLOPES SHALL BE NO STEEPER THAN 2 HORIZONTAL TO 1 VERTICAL, OR AS DETERMINED BY THE SOILS ENGINEER AND APPROVED BY THE CITY ENGINEER.
4. MID SLOPE TERRACES AT LEAST SIX (6) FEET IN WIDTH SHALL BE ESTABLISHED AT NOT MORE THAN THIRTY (30) FOOT VERTICAL INTERVALS ON ALL CUT OR FILL SLOPES, EXCEPT THAT WHERE ONLY ONE (1) TERRACE IS REQUIRED, IT SHALL BE AT MID-HEIGHT. FOR CUT OR FILL SLOPES GREATER THAN 60 FEET AND UP TO 90 FEET IN VERTICAL HEIGHT, ONE TERRACE AT APPROXIMATELY MID-HEIGHT SHALL BE 12 FEET IN WIDTH. TERRACE WIDTHS AND SPACING FOR CUT AND FILL SLOPES GREATER THAN 90 FEET IN VERTICAL HEIGHT SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER AND APPROVED BY THE CITY ENGINEER. SUITABLE ACCESS SHALL BE PROVIDED TO PERMIT PROPER CLEANING AND MAINTENANCE.
5. THE SLOPE STABILITY FOR CUT AND FILL SLOPES OVER 30 FEET IN VERTICAL HEIGHT AND FOR SLOPES STEEPER THAN 2:1 (H:V) SHALL BE VERIFIED WITH A FACTOR OF SAFETY OF AT LEAST 1.5 BY CALCULATIONS SUBMITTED BY THE SOILS ENGINEER TO THE CITY OF MENIFEE ENGINEERING DEPARTMENT.
6. FILLS SHALL BE PLACED IN THIN LIFTS (8 INCH MAX OR AS RECOMMENDED IN SOILS REPORT), COMPACTED AND TESTED AS GRADING PROGRESSES UNTIL FINAL GRADES ARE ATTAINED. FILLS ON SLOPES STEEPER THAN 5:1 (H:V) AND HEIGHT GREATER THAN 5 FEET SHALL BE KEYED AND BENCHED INTO FIRM NATURAL SOIL FOR FULL SUPPORT. THE BENCH UNDER THE TOE SHALL BE 10 FEET WIDE MIN. AND 2' HIGH MIN.
7. NO ROCK OR SIMILAR IRREDUCIBLE MATERIAL WITH A MAXIMUM DIMENSION GREATER THAN 12 INCHES IN ANY DIMENSION SHALL BE BURIED OR PLACED IN FILLS.
8. STOCK PILE REQUIREMENTS: CASQA BEST MANAGEMENT PRACTICE, CONSTRUCTION, SECTION WM-3 - STOCKPILES WHICH HAVE NOT BEEN USED FOR 14 CALENDAR DAYS SHALL BE STABILIZED THROUGH THE APPLICATION OF SOD, SEED, AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES.
9. WHEN MATERIAL IS BEING IMPORTED FROM AN APPROVED PERMITTED BORROW SITE, THE AFTER TOPOGRAPHICAL SURVEY OF THE EXCAVATED PORTION OF THE BASIN SHALL BE SUBMITTED ALONG WITH THE ROUGH GRADING CERTIFICATE(S).
10. HAULING AND/OR STOCKPILE PERMITS MAYBE NOT BE COMBINED WITH A GRADING PERMIT.

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REGISTERED PROFESSIONAL ENGINEER LUCAS A. CORSBIE No. 72588 CIVIL STATE OF CALIFORNIA
September 13, 2023
FOR AND ON BEHALF OF WARE MALCOMB

ARES SPEC INDUSTRIAL
PRELIMINARY PLANS
MURRIETA RD. & ETHANAC RD.
MENIFEE, CA 92585

TITLE SHEET

NO.	DATE	REMARKS

JOB NO.:	IRV22-0086
PA / PM:	LC
DESIGNED:	AC
DATE:	9/13/2023
PLOT DATE:	9/13/2023

SHEET 1
Sheet 1 of 14

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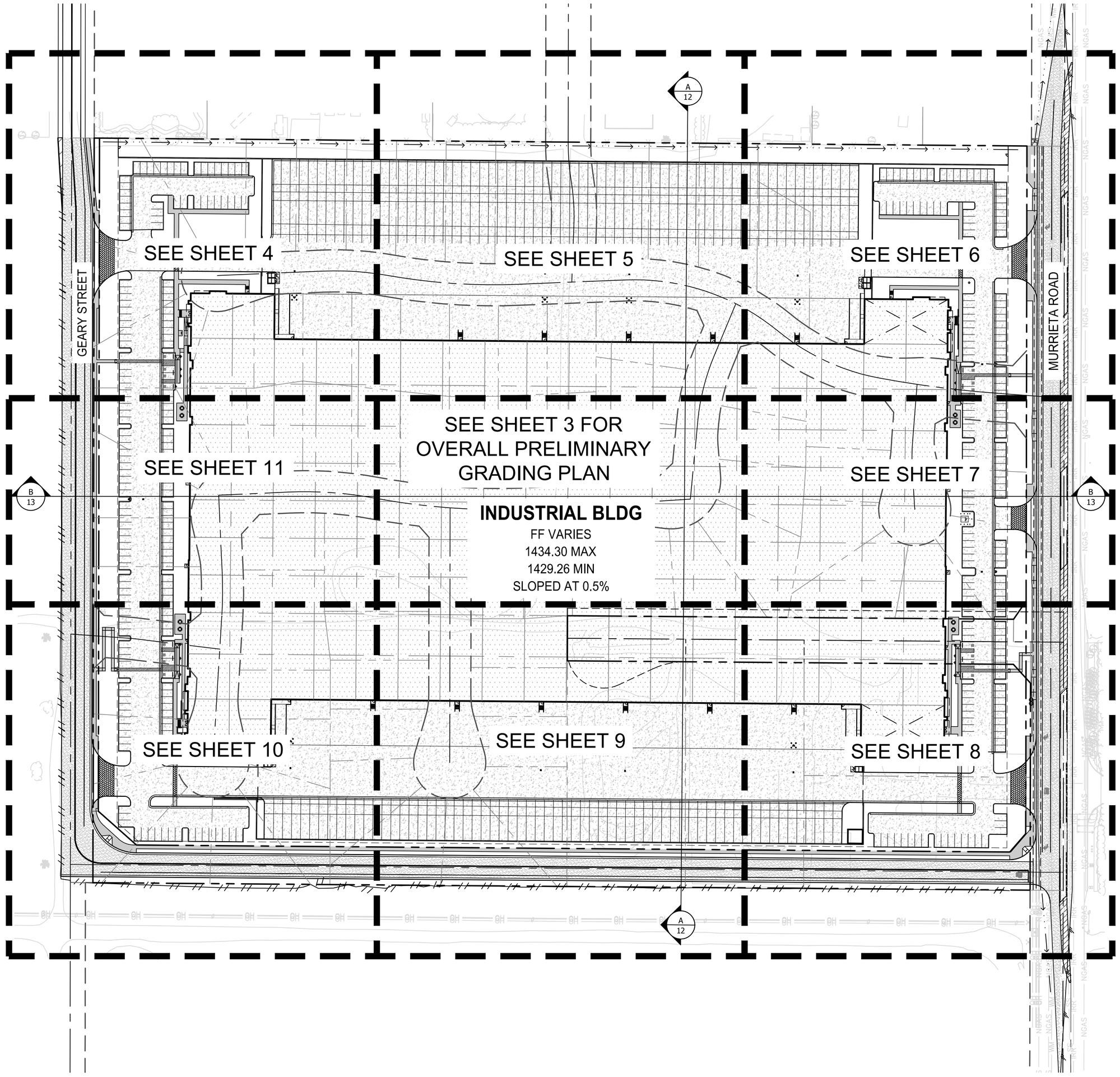

CONSTRUCTION NOTES

01 NEW COMMERCIAL DRIVEWAY APPROACH.
02 NEW 0" CURB.
03 NEW 6" CURB.
04 NEW 6" CURB AND GUTTER.
05 NEW VALLEY GUTTER.
06 NEW TRASH ENCLOSURE.
07 NEW CONCRETE PAVING PER GEOTECHNICAL REPORT.
08 NEW ADA PARKING.
09 NEW ADA CURB RAMP.
10 NEW GATE.
11 NEW BUILDING STEM WALL.
12 NEW BUILDING DEEPENED FOOTING.
13 NEW SCREEN WALL.
14 NEW RETAINING WALL.
15 NEW CONCRETE BROW DITCH.

STORM DRAINAGE NOTES

01 NEW STORM DRAIN LINE. SLOPED AT 0.5% MIN. APPROXIMATE SIZE PER PLAN.
02 NEW CURB INLET.
03 NEW GRATE INLET.
04 NEW UNDERGROUND STORAGE BASIN.
05 NEW MODULAR WETLAND SYSTEM.
06 NEW STORM DRAIN MANHOLE.
07 CONNECT TO OFFSITE STORM DRAIN CONNECTION PROVIDED BY SEPARATE PLAN.
08 NEW OVERSIDE DRAIN PER CITY OF MENIFEE STD. PLAN NO. 303.

SEWER NOTES

01 NEW SEWER LATERAL CONNECTION TO EXISTING SANITARY MANHOLE.
02 NEW SEWER LATERAL PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. SB-177.
03 NEW SEWER CLEANOUT PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. SB-52.
04 NEW 6" PVC SDR-35 SEWER LINE SLOPED AT 1%. TRENCHING PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. SB-158.
05 NEW SEWER SERVICE BUILDING POINT OF CONNECTION.

WATER NOTES

01 NEW 2" COPPER DOMESTIC AND IRRIGATION SERVICE CONNECTIONS AND METERS PER EASTERN MUNICIPAL WATER DISTRICT STD. DWGS. B-344A AND B-344.
02 NEW 2" DOMESTIC WATER AND IRRIGATION RP BACKFLOW PREVENTER ASSEMBLIES PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-597A.
03 NEW 2" COPPER DOMESTIC WATER SERVICE PIPE.
04 NEW DOMESTIC WATER SERVICE BUILDING POINT OF CONNECTION.
05 NEW IRRIGATION SERVICE POINT OF CONNECTION. REFER TO LANDSCAPE PLANS FOR CONTINUATION.
06 NEW FIRE WATER SERVICE CONNECTION AND DCDA BACKFLOW PREVENTER ASSEMBLY PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-657.
07 NEW FIRE WATER SERVICE LOOP WITH THRUST BLOCKS. PVC C900 SIZE TBD. THRUST BLOCKS PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-407. TRENCH BACKFILL PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-286B.
08 NEW FIRE HYDRANT PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-362.
09 NEW BOLLARD PROTECTION AROUND WATER APPURTENANCES.
10 NEW FIRE WATER SPRINKLER RISER.
11 NEW FIRE WATER POST INDICATOR VALVE.

WM

0 40 80 160
SCALE: 1" = 80'

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PRELIMINARY GRADING SHEET INDEX

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SHEET 2
Sheet 2 of 14

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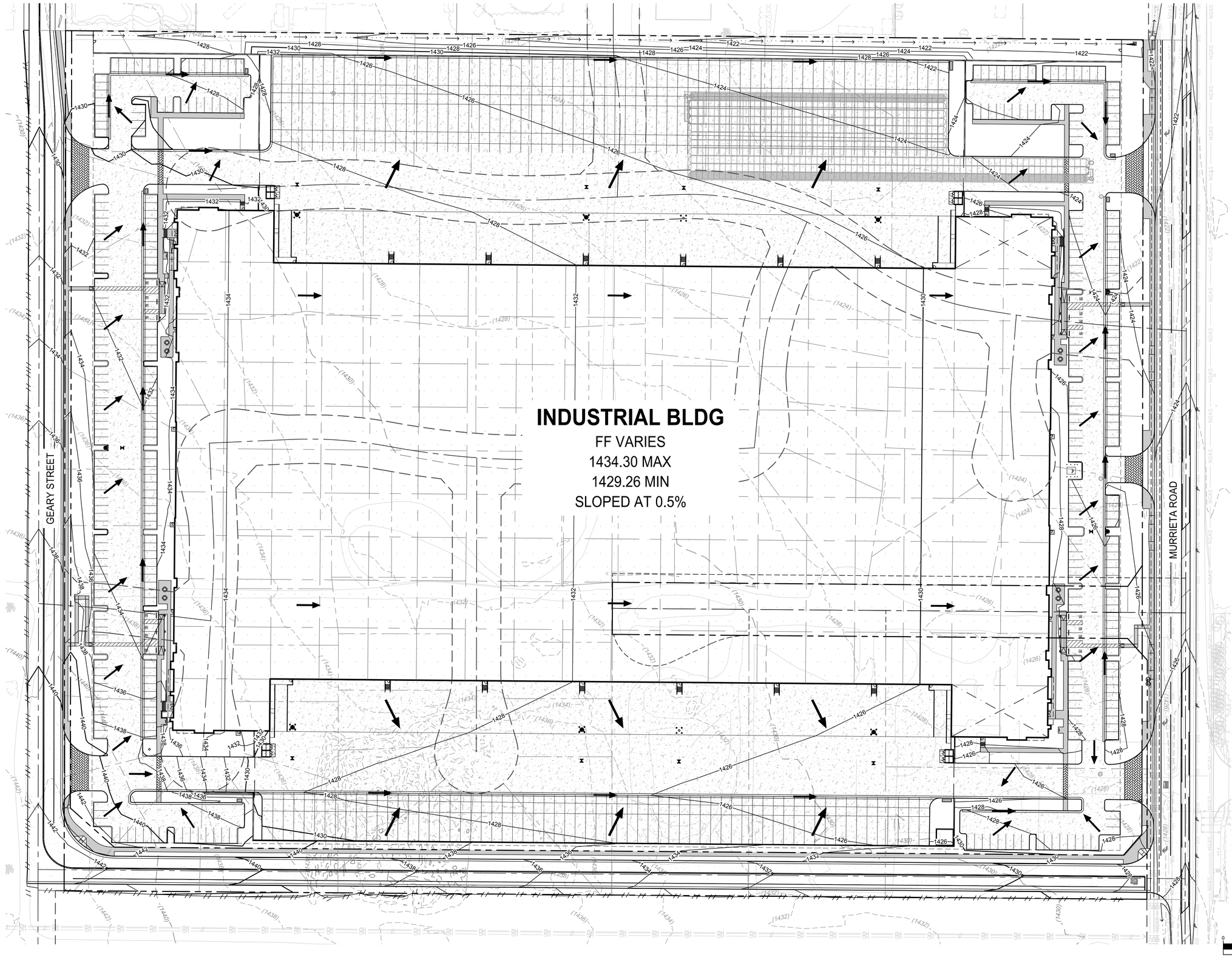

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OVERALL PRELIMINARY GRADING PLAN

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SHEET 3
Sheet 3 of 14

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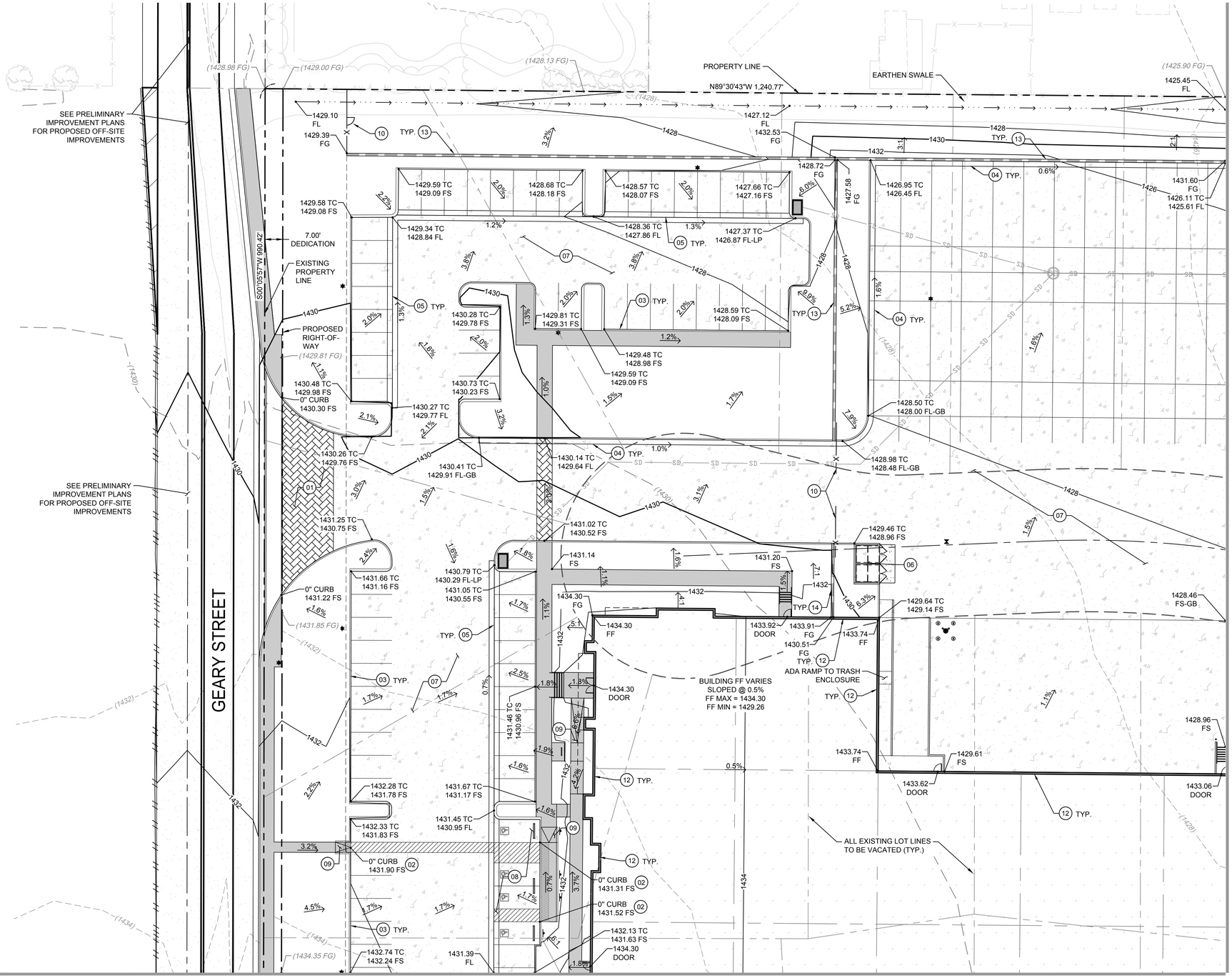

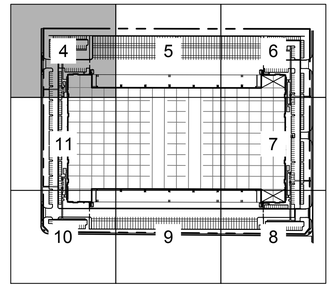

KEY MAP
SCALE: NTS

CONSTRUCTION NOTES

01. NEW COMMERCIAL DRIVEWAY APPROACH.
02. NEW 0" CURB.
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SCALE: 1" = 20'

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SHEET 4
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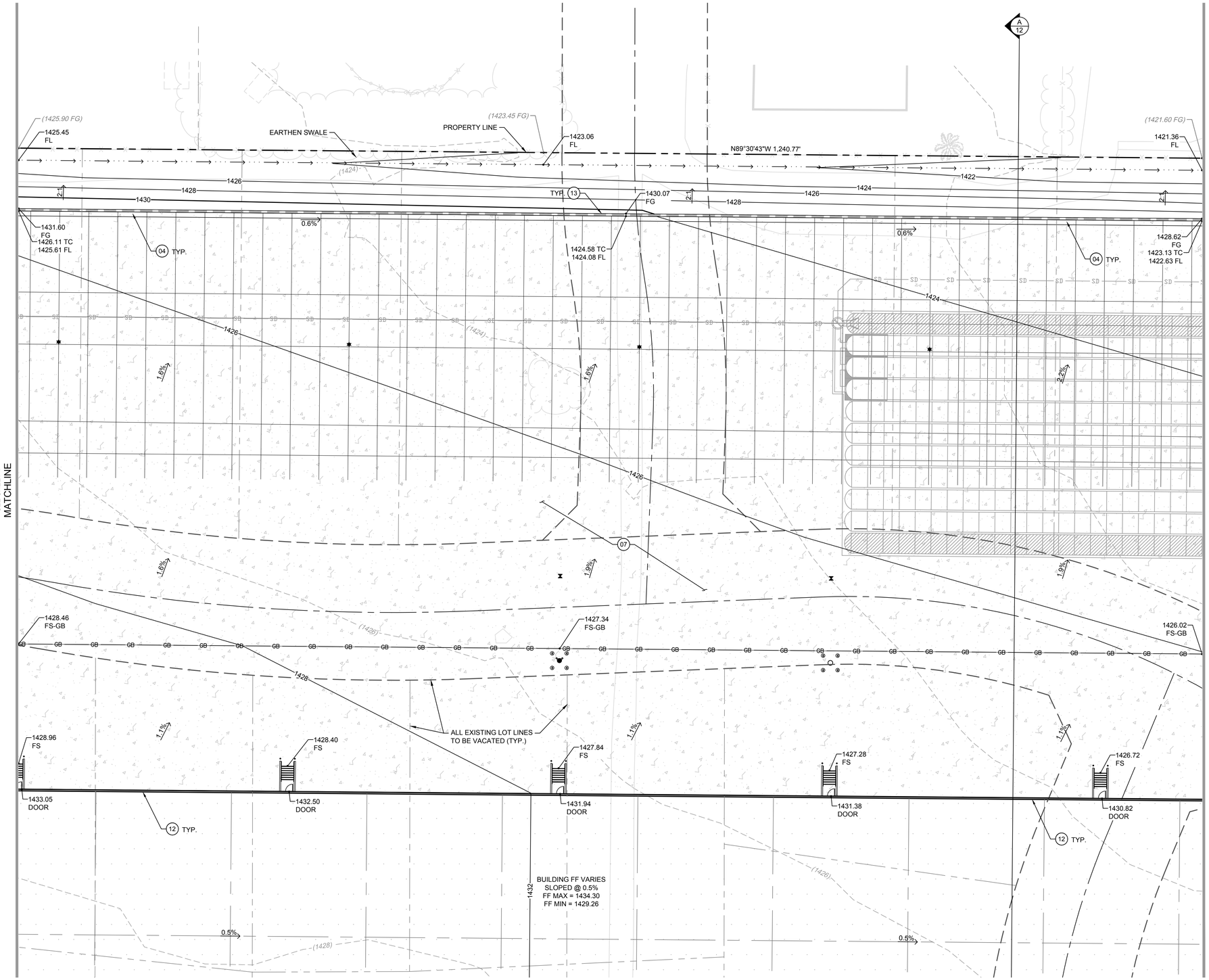

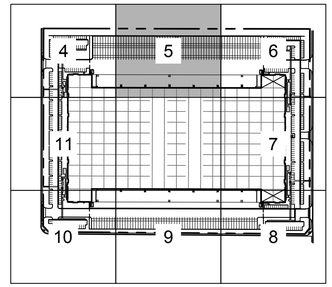

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SHEET 5
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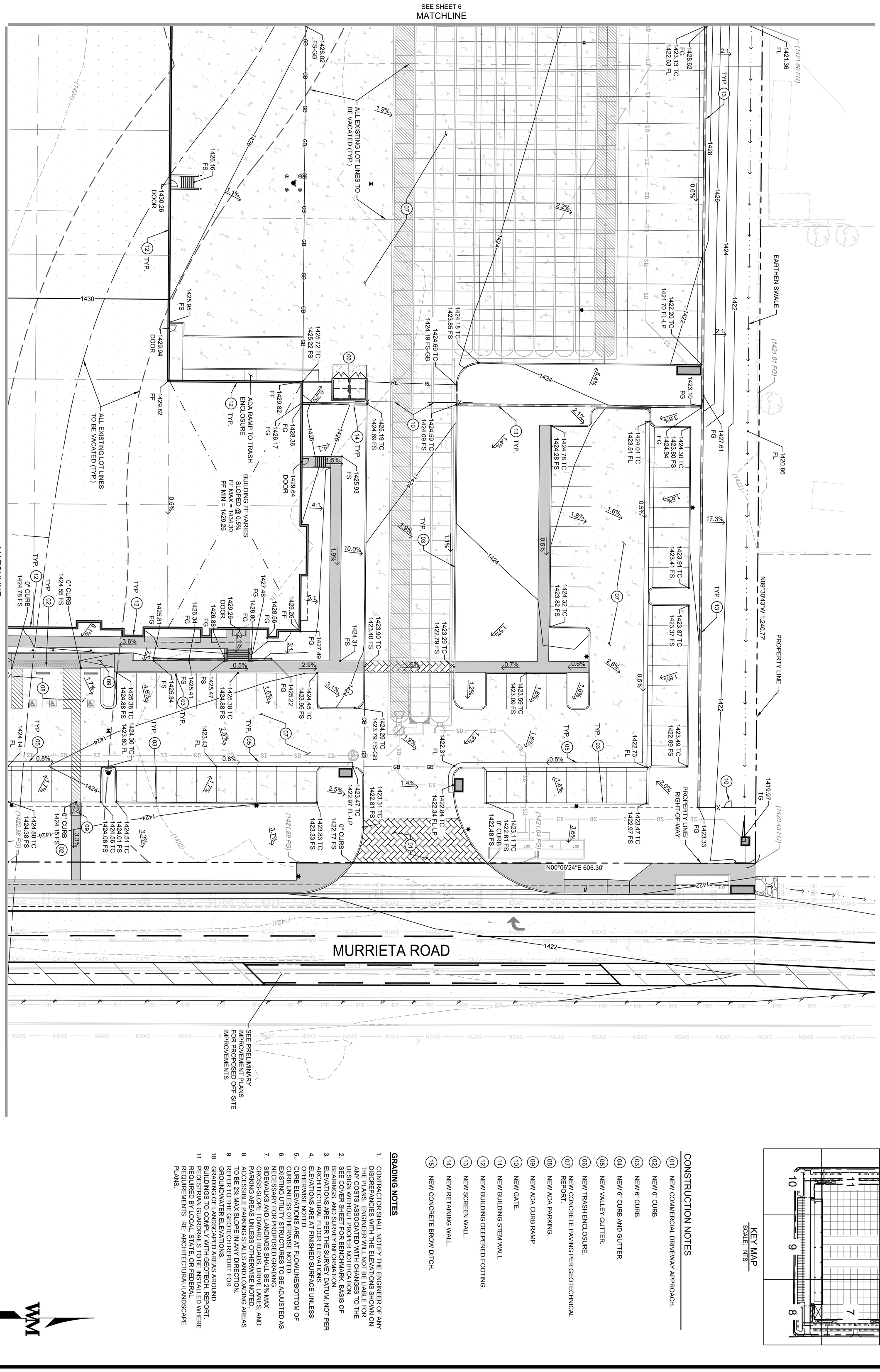

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SCALE: 1" = 20'

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PRELIMINARY GRADING PLAN

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SHEET 6 of 14

ARES SPEC INDUSTRIAL
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REGISTERED PROFESSIONAL ENGINEER
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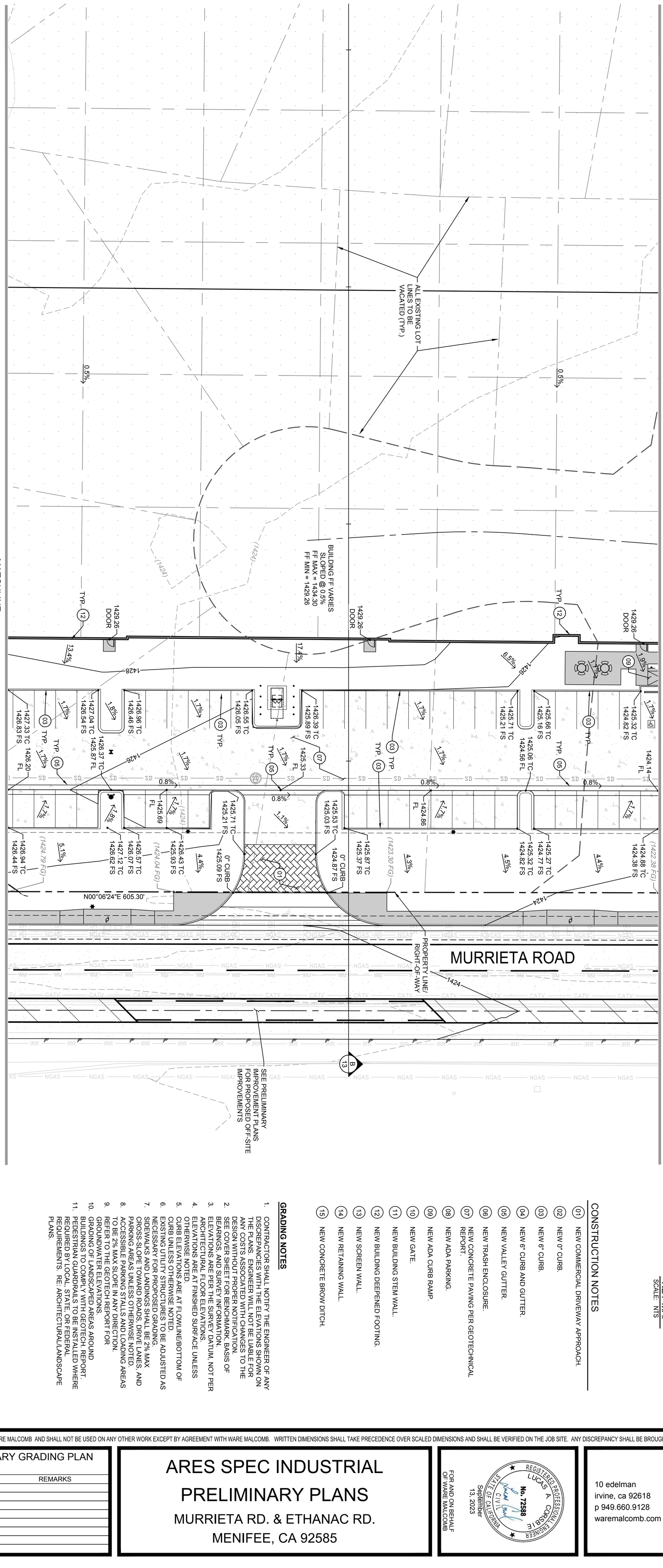

CONSTRUCTION NOTES

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(10) NEW GATE.
(11) NEW BUILDING STEM WALL.
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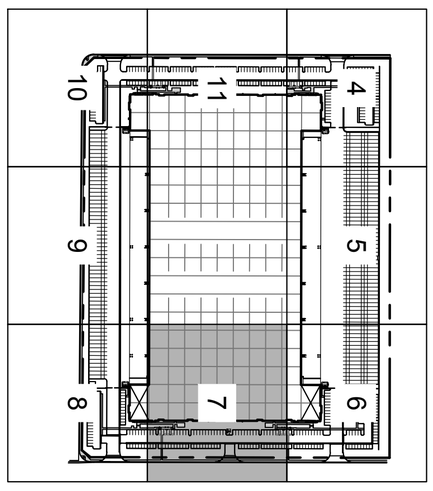
(13) NEW SCREEN WALL.
(14) NEW RETAINING WALL.
(15) NEW CONCRETE BROW DITCH.

KEY MAP
SCALE: NTS



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SCALE: 1" = 20'
0 10 20 40

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PRELIMINARY GRADING PLAN

NO.	DATE	REMARKS

ARES SPEC INDUSTRIAL
PRELIMINARY PLANS
MURRIETA RD. & ETHANAC RD.
MENIFEE, CA 92585

FOR AND ON BEHALF OF WARE MALCOMB
REGISTERED PROFESSIONAL ENGINEER LUCAS A COBBLE No. 72588 CIVIL STATE OF CALIFORNIA
September 13, 2023

10 edelman
irvine, ca 92618
p 949.660.9128
waremalcomb.com

WARE MALCOMB
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SHEET 7
Sheet 7 of 14

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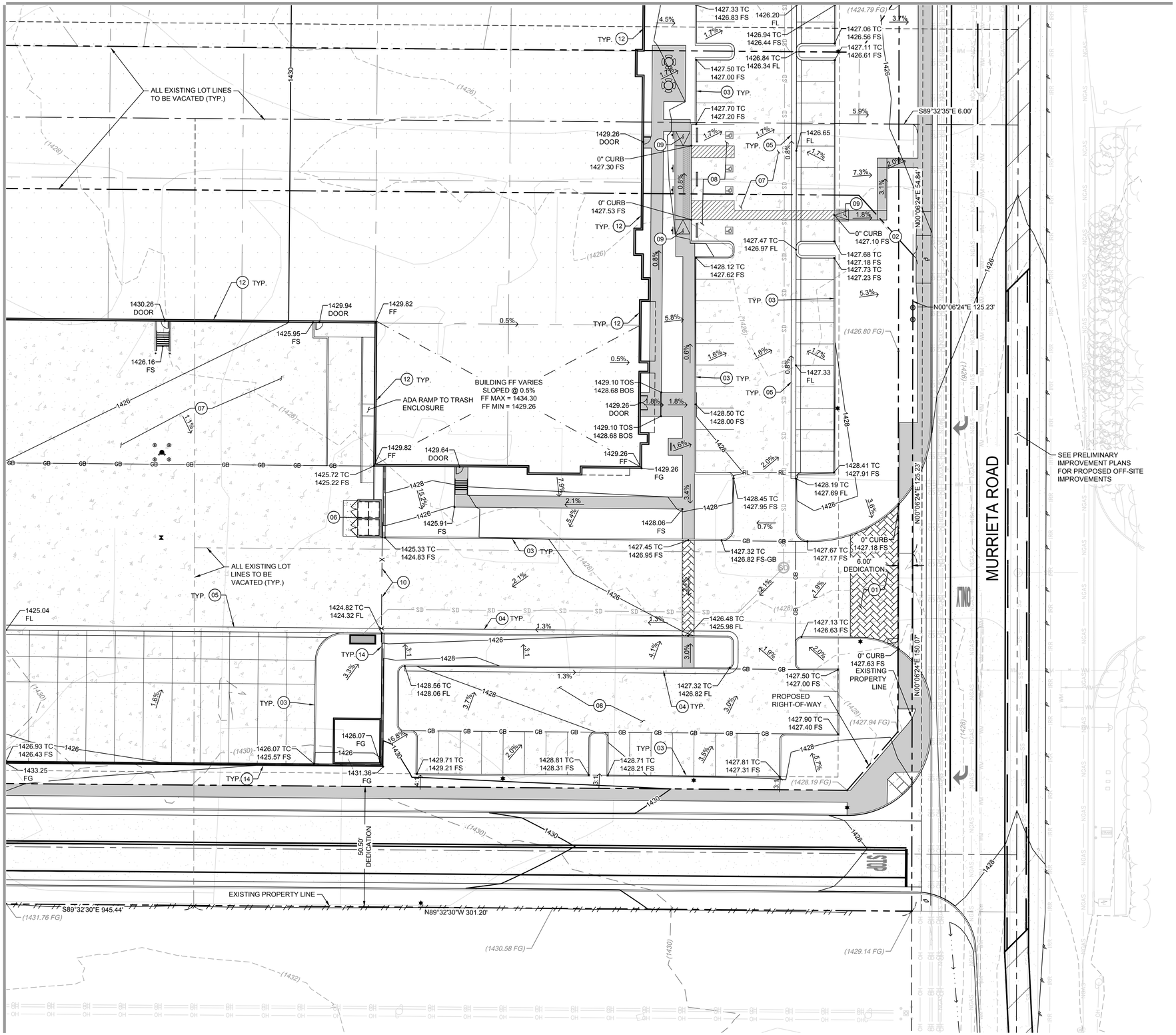
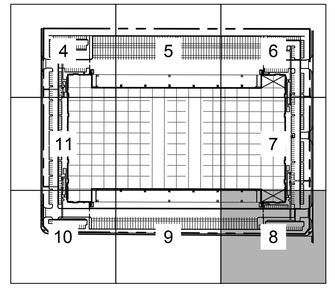
SEE SHEET 7
MATCHLINE

SEE SHEET 9
MATCHLINE





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SHEET 8
Sheet 8 of 14

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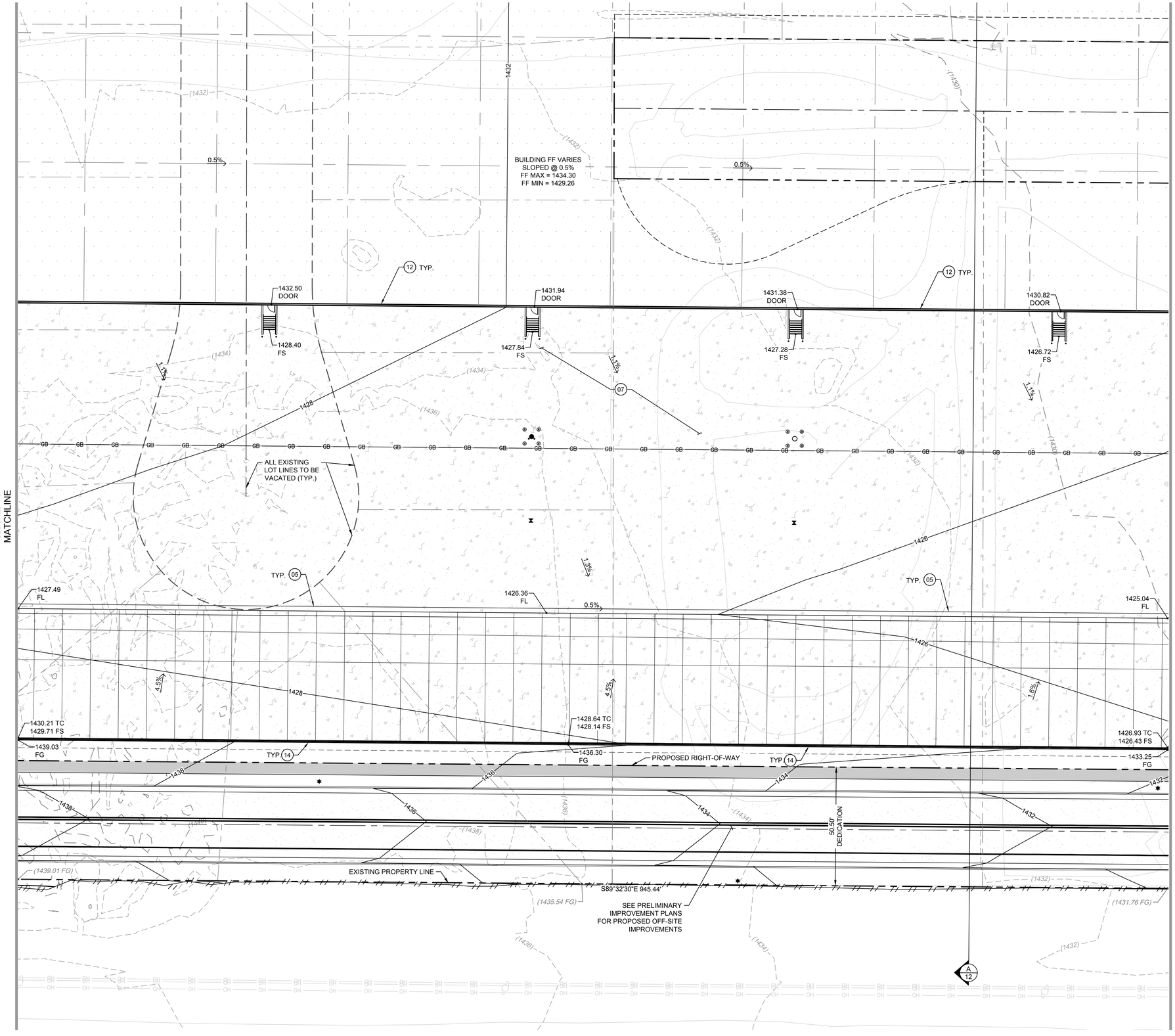

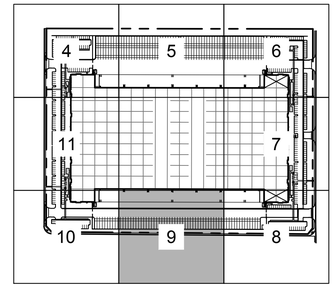

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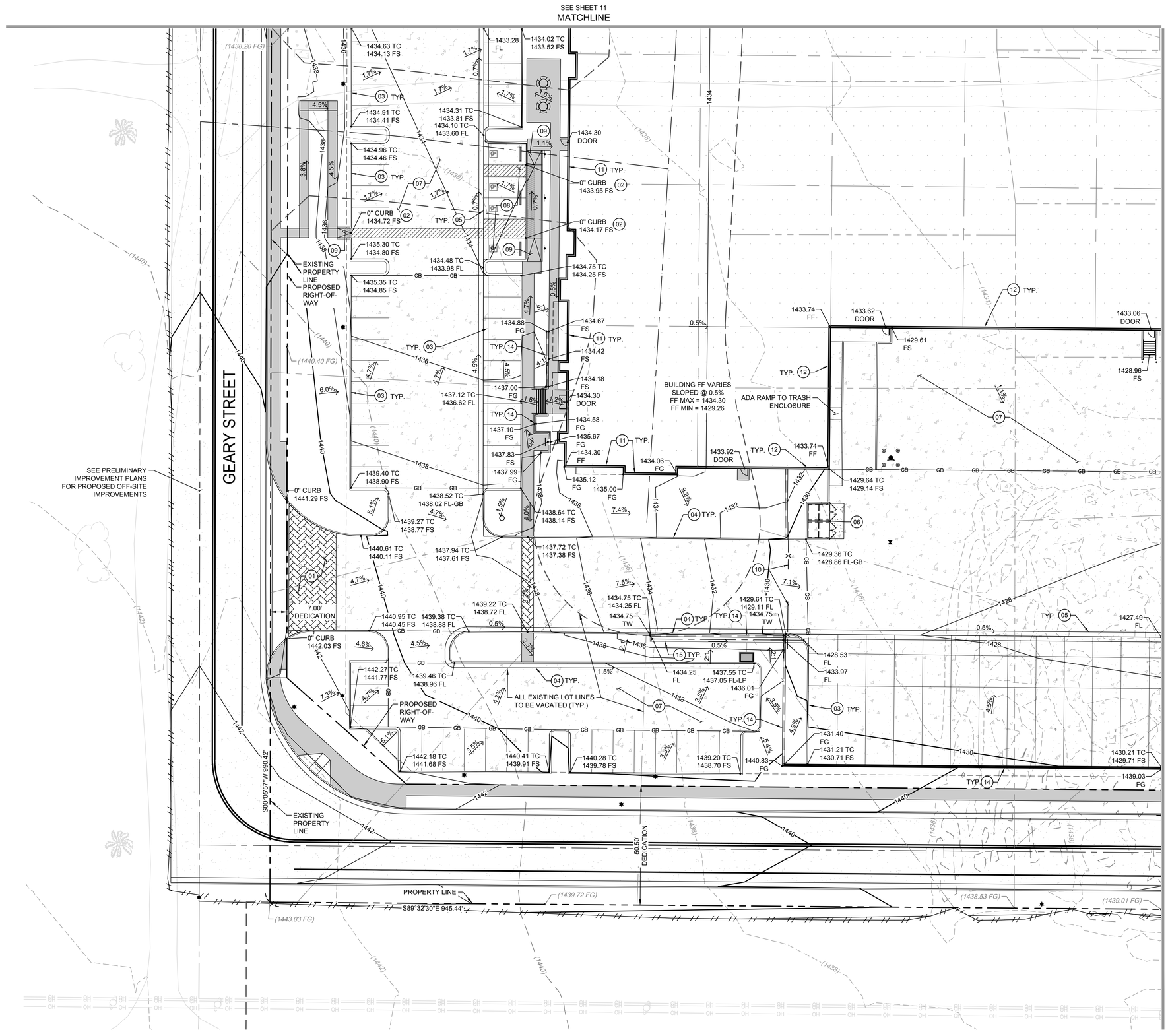

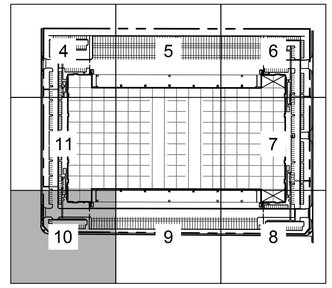

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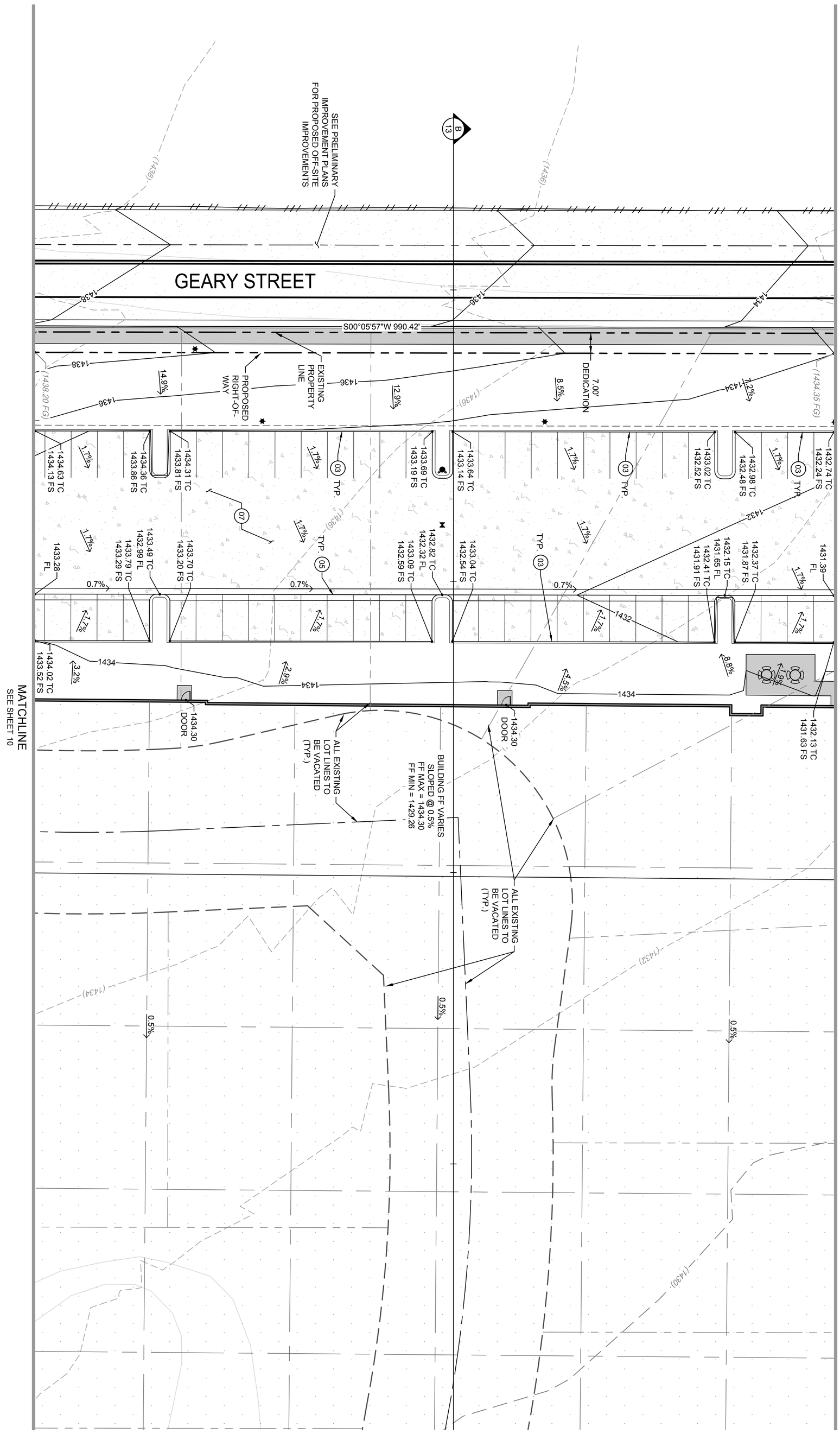

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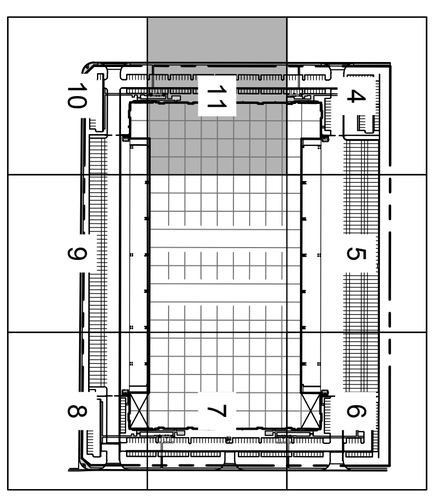

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SHEET 11
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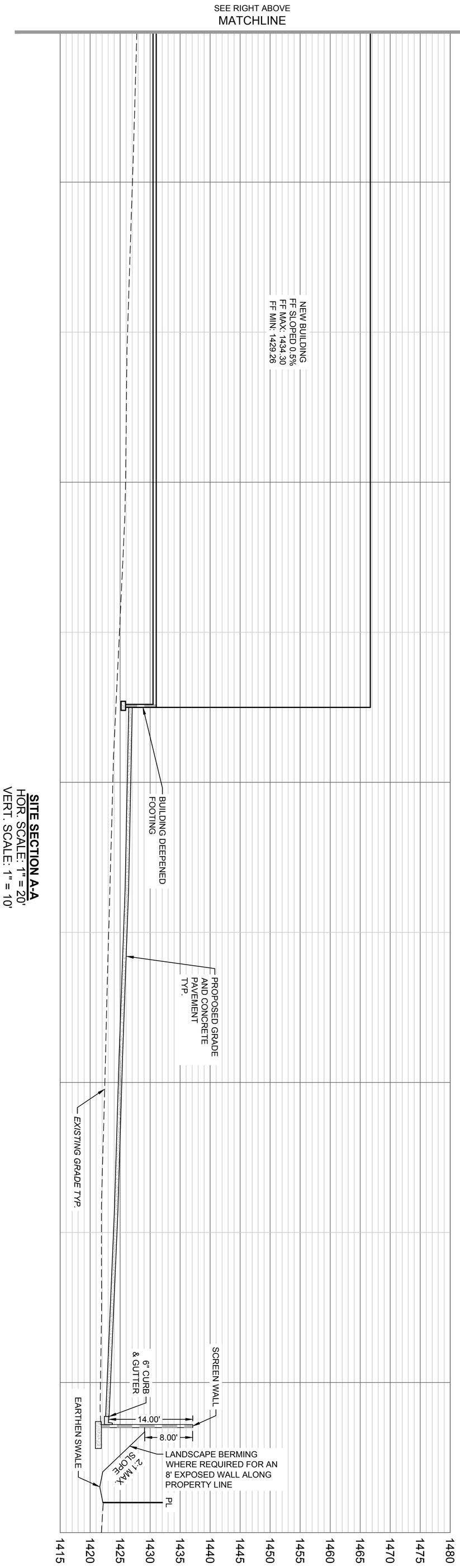

SITE SECTION A-A
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 10'

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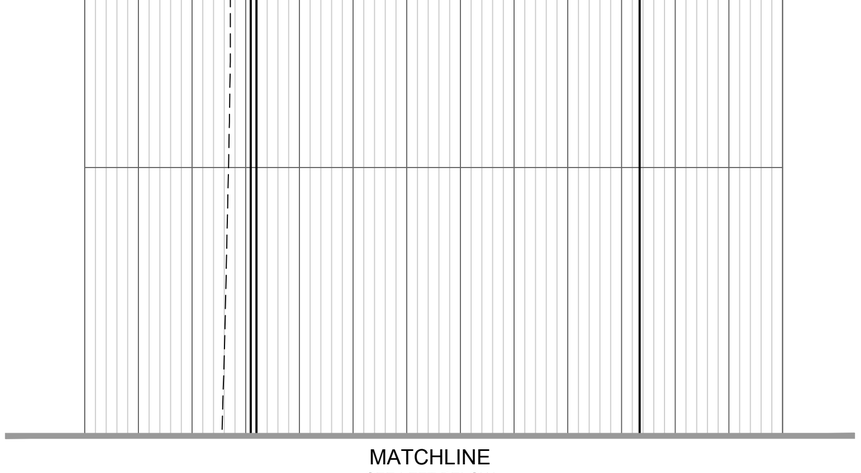

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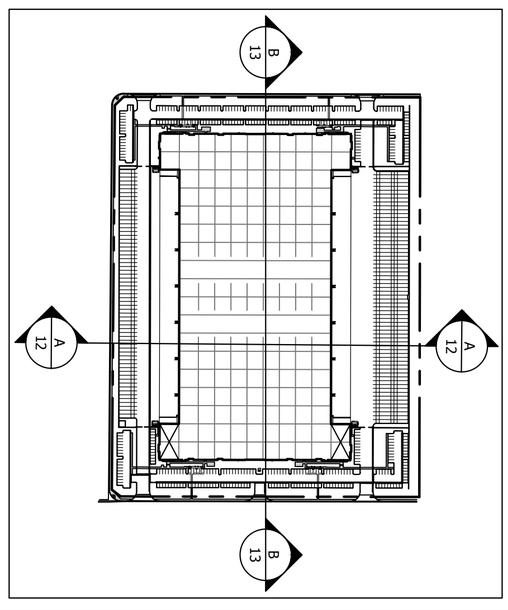

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SHEET 12
Sheet 12 of 14

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PRELIMINARY SITE SECTIONS

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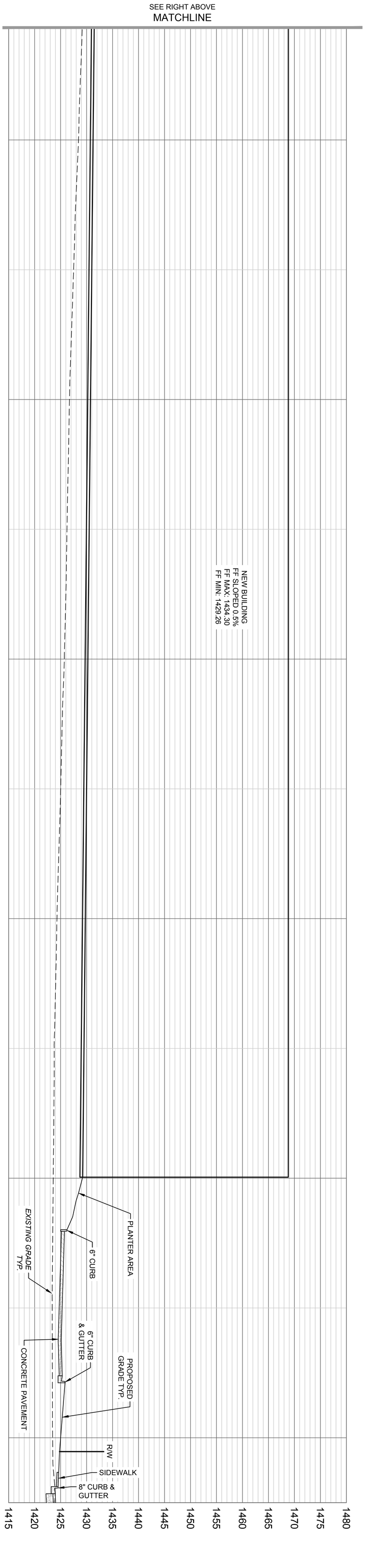

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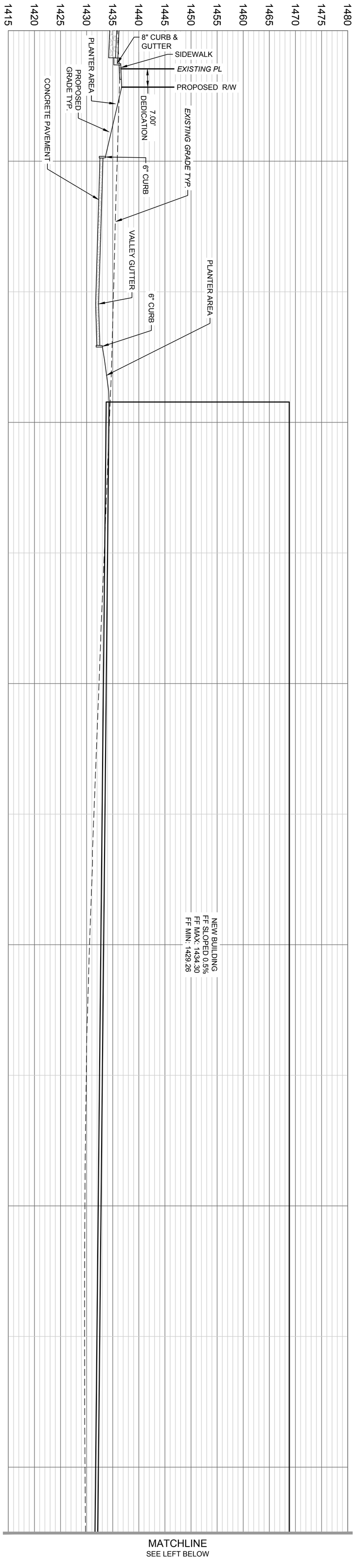

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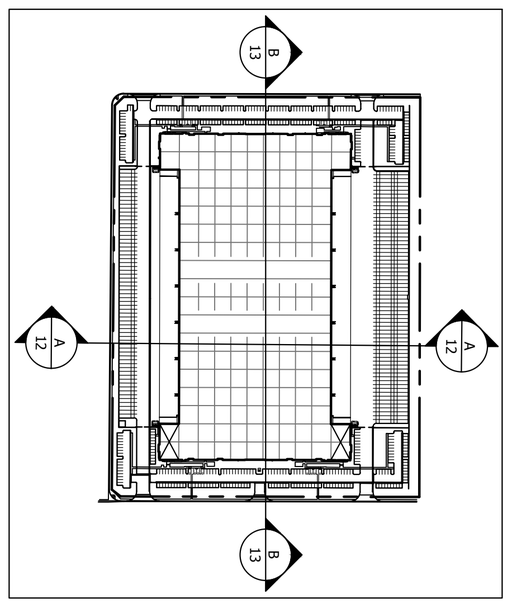

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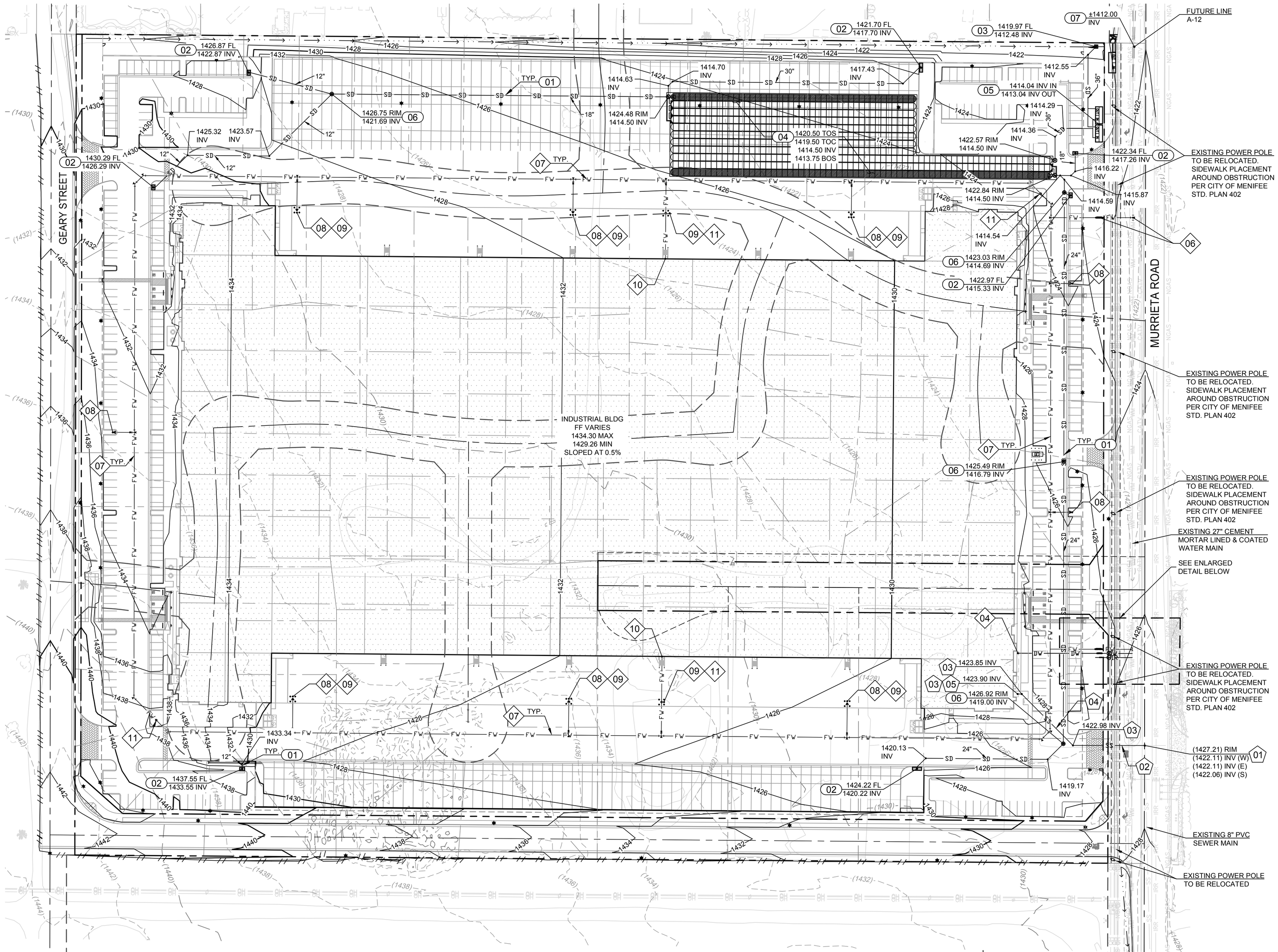


STORM DRAINAGE NOTES

01 NEW STORM DRAIN LINE. SLOPED AT 0.5% MIN. APPROXIMATE SIZE PER PLAN.

02 NEW CURB INLET.

03 NEW GRATE INLET.

04 NEW UNDERGROUND STORAGE BASIN.

05 NEW MODULAR WETLAND SYSTEM.

06 NEW STORM DRAIN MANHOLE.

07 CONNECT TO OFFSITE STORM DRAIN CONNECTION PROVIDED BY SEPARATE PLAN.

08 NEW OVERSIDE DRAIN PER CITY OF MENIFEE STD. PLAN NO. 303.

SEWER NOTES

01 NEW SEWER LATERAL CONNECTION TO EXISTING SANITARY MANHOLE.

02 NEW SEWER LATERAL PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. SB-177.

03 NEW SEWER CLEANOUT PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. SB-52.

04 NEW 6" PVC SDR-35 SEWER LINE SLOPED AT 1%. TRENCHING PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. SB-158.

05 NEW SEWER SERVICE BUILDING POINT OF CONNECTION.

WATER NOTES

01 NEW 2" COPPER DOMESTIC AND IRRIGATION SERVICE CONNECTIONS AND METERS PER EASTERN MUNICIPAL WATER DISTRICT STD. DWGS. B-344A AND B-344.

02 NEW 2" DOMESTIC WATER AND IRRIGATION RP BACKFLOW PREVENTER ASSEMBLIES PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-597A.

03 NEW 2" COPPER DOMESTIC WATER SERVICE PIPE.

04 NEW DOMESTIC WATER SERVICE BUILDING POINT OF CONNECTION.

05 NEW IRRIGATION SERVICE POINT OF CONNECTION. REFER TO LANDSCAPE PLANS FOR CONTINUATION.

06 NEW FIRE WATER SERVICE CONNECTION AND DCDA BACKFLOW PREVENTER ASSEMBLY PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-657.

07 NEW FIRE WATER SERVICE LOOP WITH THRUST BLOCKS. PVC C900 SIZE TBD. THRUST BLOCKS PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-407. TRENCH BACKFILL PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-286B.

08 NEW FIRE HYDRANT PER EASTERN MUNICIPAL WATER DISTRICT STD. DWG. B-362.

09 NEW BOLLARD PROTECTION AROUND WATER APPURTENANCES.

10 NEW FIRE WATER SPRINKLER RISER.

11 NEW FIRE WATER POST INDICATOR VALVE.

UTILITY NOTES

1. CONTRACTOR SHALL VERIFY THE ELEVATION OF ALL EXISTING UTILITIES WHERE NEW GRADING OR UTILITY WORK WILL OCCUR AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES OR CONFLICTS. ENGINEER WILL NOT BE LIABLE FOR ANY COSTS ASSOCIATED WITH CHANGES TO THE DESIGN WITHOUT PROPER NOTIFICATION.
2. SEE COVER SHEET FOR BENCHMARK, BASIS OF BEARINGS, AND SURVEY INFORMATION.
3. PROPOSED DRY UTILITIES ARE SHOWN FOR REFERENCE ONLY. REFER TO PLANS BY UTILITY PROVIDERS AND/OR MEP.
4. EXISTING UTILITY STRUCTURES TO BE ADJUSTED AS NECESSARY FOR PROPOSED GRADING.
5. REFER TO THE GEOTECH REPORT FOR GROUNDWATER ELEVATIONS.
6. MANHOLES ARE CONTROLLED AT CENTER OF MANHOLE.
7. ALL RCP TO BE CLASS III OR APPROVED EQUIVALENT UNLESS OTHERWISE NOTED.
8. All STORM AND SANITARY PVC TO BE SDR35 UNLESS OTHERWISE NOTED OR REQUIRED BY THE JURISDICTION.
9. ALL WATER PVC TO BE C900 UNLESS OTHERWISE NOTED OR REQUIRED BY THE JURISDICTION.

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE
10 edelman
irvine, ca 92618
p 949.660.9128
waremalcomb.com

REGISTERED PROFESSIONAL ENGINEER
LUCAS A. CORBETE
No. 72588
CIVIL
STATE OF CALIFORNIA
September 13, 2023
FOR AND ON BEHALF OF WARE MALCOMB

ARES SPEC INDUSTRIAL
PRELIMINARY PLANS
MURRIETA RD. & ETHANAC RD.
MENIFEE, CA 92585

PRELIMINARY UTILITY PLAN

NO.	DATE	REMARKS

JOB NO.:	IRV22-0086
PA / PM:	LC
DESIGNED:	AC
DATE:	9/13/2023
PLOT DATE:	9/13/2023

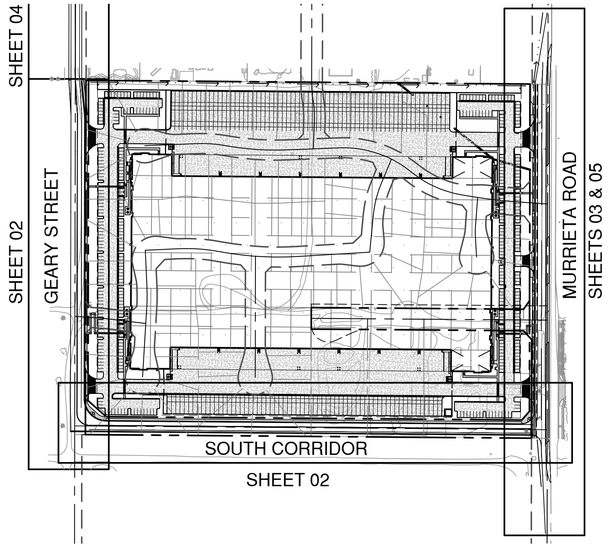
SHEET 14
Sheet 14 of 14

NOT FOR CONSTRUCTION

W:\IRV\22\0086\00\Civil\CAD\Sheets\Preliminary\IRV22-0086_UTILITY PLAN.dwg 09/DD/23 6:15 PM ACASTELLO 1:1

PRELIMINARY IMPROVEMENT PLANS FOR:

GEARY STREET, SOUTH CORRIDOR, MURRIETA ROAD, & SD LINE A-12



SHEET INDEX MAP

0' 200' 400' 600' 800'

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE CITY OF MENIFEE STANDARD DETAILS AND SPECIFICATIONS, THE CURRENT STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION(THE "GREENBOOK"), THE RIVERSIDE COUNTY STREET IMPROVEMENT STANDARDS AND SPECIFICATIONS AND STANDARD PLANS; COUNTY ORDINANCE NO. 461; CALTRANS STANDARD PLANS AND SPECIFICATIONS; CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

2. PRIOR TO START OF WORK, THE DEVELOPER/CONTRACTOR SHALL APPLY TO THE CITY OF MENIFEE ENGINEERING DEPARTMENT FOR AN ENCROACHMENT PERMIT FOR WORK PERFORMED WITHIN PUBLIC RIGHT-OF-WAY AND TO BE RESPONSIBLE FOR SATISFACTORY COMPLIANCE FOR CURRENT ENVIRONMENTAL REGULATIONS DURING THE LIFE OF CONSTRUCTION ACTIVITIES FOR THIS PROJECT. ADDITIONAL STUDIES MAY BE REQUIRED.

3. PRIOR TO START OF WORK, THE DEVELOPER/CONTRACTOR SHALL APPLY TO THE CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) FOR AN ENCROACHMENT PERMIT FOR WORK PERFORMED WITHIN THE STATE RIGHT-OF-WAY.

4. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE PROSECUTED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC. FAILURE TO COMPLY WITH THIS REQUIREMENT IS A VIOLATION OF THE CITY OF MENIFEE ENCROACHMENT PERMIT.

5. WHEN IMPROVEMENT PLANS HAVE BEEN SUBMITTED TO THE CITY FOR PLAN CHECKING AND THE PLAN CHECKING PROCESS HAS BEEN INTERRUPTED FOR A PERIOD OF ONE YEAR OR MORE, THE PLANS SHALL BE DEEMED ABANDONED. APPROVED IMPROVEMENT PLANS FOR ALL SUBDIVISIONS SHALL BE DEEMED ABANDONED IF CONSTRUCTION HAS NOT COMMENCED WITHIN TWO YEARS OF THE LATEST APPROVAL DATE (ONE YEAR FOR NON-SUBDIVISIONS). IF CONSTRUCTION IS INTERRUPTED FOR A PERIOD OF ONE YEAR OR MORE, THE PLANS SHALL BE DEEMED ABANDONED. ABANDONED PLANS SHALL BE RE-SUBMITTED FOR REVIEW AND ALL FEES SHALL BE PAID IN ACCORDANCE WITH THE PLAN CHECK AND PROCESSING POLICY PRIOR TO ANY PERMITS BEING ISSUED.

6. APPROVAL OF THIS PLAN BY THE CITY OF MENIFEE DOES NOT CONSTITUTE A REPRESENTATION AS TO THE ACCURACY OF, THE LOCATION OF, OR THE EXISTENCE OR NON-EXISTENCE OF, ANY UNDERGROUND UTILITY PIPE OR STRUCTURE WITHIN THE LIMITS OF THIS PROJECT. THIS NOTE APPLIES TO ALL PAGES.

7. ALL REVISIONS TO IMPROVEMENT PLANS, OR MATERIAL SUBSTITUTION REQUESTS, PROPOSED DURING CONSTRUCTION SHALL BE SUBMITTED IN WRITING TO THE CITY ENGINEERING DEPARTMENT BY THE ENGINEER OF RECORD AND SHALL FOLLOW THE PROCEDURES AS APPROVED BY THE CITY ENGINEER.

8. LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE DEVELOPER/CONTRACTOR SHALL DETERMINE THE EXACT LOCATIONS AND VERIFY CONDITIONS ON THE JOB SITE PRIOR TO COMMENCING WORK. THE DEVELOPER/CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR DAMAGES OCCURRED DUE TO FAILURE TO LOCATE AND PRESERVE UNDERGROUND UTILITIES. HAND DIG AS NEEDED UNTIL CLEAR OF OBSTRUCTIONS.

9. NOTIFY UNDERGROUND SERVICE ALERT, (800) 227-2600, AND ALL CONCERNED UTILITY COMPANIES AT LEAST TWO WORKING DAYS IN ADVANCE OF EXCAVATION.

10. A PRECONSTRUCTION MEETING WITH THE PUBLIC WORKS INSPECTOR IS REQUIRED PRIOR TO START OF WORK.

11. RIGHT OF ENTRY FOR ANY WORK PERFORMED ON ADJACENT PROPERTIES IS REQUIRED. PERMISSION FOR RIGHT OF ENTRY SHALL BE OBTAINED IN WRITING AND THE LETTER SHALL COMPLY WITH CITY FORMAT.

12. APPROVAL OF PLANS AND / OR PERMIT ISSUANCE DOES NOT RELIEVE THE PERMITTEE OF THEIR RESPONSIBILITY TO MAINTAIN WORK WITHIN THE PROJECT PROPERTY BOUNDARIES AND DEDICATED CITY RIGHT-OF-WAY. TRESPASSING ON PRIVATE PROPERTY IS AGAINST THE LAW AND CAUSE FOR CANCELLATION OF PERMIT AND ISSUANCE OF STOP WORK NOTICE.

13. IT IS THE RESPONSIBILITY OF THE PERMITTEE TO SUBMIT A REQUEST FOR PERMIT EXTENSION TO THE CITY ENGINEER IN WRITING PRIOR TO PERMIT EXPIRATION. EXTENSION AND EXPIRATION OF PERMITS SHALL BE IN ACCORDANCE WITH THE UNIFORM BUILDING CODE AND /OR THE CITY OF MENIFEE ENGINEERING DESIGN GUIDELINES POLICIES AND PROCEDURES.

14. THE DEVELOPER/CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CLEAN UP ON CITY OF MENIFEE RIGHT-OF-WAY AFFECTED BY DEVELOPER'S/CONTRACTOR'S WORK. THE DEVELOPER/CONTRACTOR SHALL KEEP CITY OF MENIFEE RIGHT-OF-WAY CLEAN OF DEBRIS, WITH DUST AND OTHER NUISANCES BEING CONTROLLED AT ALL TIMES. METHOD OF STREET CLEANING SHALL BE WET SWEEPING OF ALL PAVED AREAS. THERE SHALL BE NO STOCKPILING OF CONSTRUCTION MATERIALS WITHIN THE CITY OF MENIFEE RIGHT-OF-WAY WITHOUT THE PERMISSION OF THE CITY ENGINEER.

15. THE CONTRACTOR SHALL CONTACT THE CITY OF MENIFEE PUBLIC WORKS INSPECTOR 48 HOURS PRIOR TO CONSTRUCTION AT (951) 672-6777.

STREET IMPROVEMENT NOTES

1. UNDERGROUND FACILITIES, WITH LATERALS, SHALL BE IN PLACE PRIOR TO CAP PAVING THE STREET, INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING: SEWER, WATER, ELECTRIC, TELEPHONE, CABLE, GAS, STORM DRAINS.

2. STREET SECTION SHALL BE DETERMINED BY THE DEVELOPER'S SOILS ENGINEER AND SHALL BE BASED ON SUBGRADE SOILS TESTS AND THE CITY-SUPPLIED TRAFFIC INDEXES. PLANS SHALL BE REVISED TO SHOW ACTUAL PAVEMENT AND BASE SECTION TO BE CONSTRUCTED.

3. AS DETERMINED BY THE CITY ENGINEER, THE DEVELOPER/CONTRACTOR SHALL PROVIDE ROAD IMPROVEMENTS TO CENTERLINE, AND MAY BE REQUIRED TO RECONSTRUCT EXISTING PAVEMENT, INCLUDING BASE, AND MATCHING OVERLAY REQUIRED TO MEET THE STRUCTURAL STANDARDS FOR THE CURRENT ASSIGNED TRAFFIC INDEX.

4. A.C. PAVEMENT INSTALLED IN MULTIPLE LIFTS SHALL HAVE AT LEAST 2" IN THE FIRST LIFT AND AT LEAST 2" OF ASPHALT IN ALL SUCCEEDING LIFTS.

5. A.C. PAVEMENT SECTIONS 4" THICK AND GREATER SHALL BE CONSTRUCTED IN TWO LIFTS. A.C. PAVEMENT BASE COURSE SHALL BE TYPE B-PG70-10 WITH A MINIMUM 2" THICKNESS, AND THE FINAL LIFT SHALL BE TYPE C2-PG70-10 WITH A MINIMUM 2" THICKNESS.

6. APPROVED SIGNING AND STRIPING PLANS SHALL BE SUBJECT TO REVIEW AND REVISION BY THE CITY OF MENIFEE ENGINEERING DEPARTMENT IF NOT CONSTRUCTED WITHIN 12 MONTHS OF DATE OF CITY APPROVAL.

7. ANY SIGNAGE AND STRIPING DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED TO ITS ORIGINAL CONDITION.

8. PROVIDE BLUE RETROREFLECTIVE RAISED PAVEMENT MARKERS (RPMS) ON PRIVATE STREETS, PUBLIC STREETS, AND DRIVEWAYS TO INDICATE LOCATION OF FIRE HYDRANTS. RPMS SHALL BE INSTALLED PER CITY OF MENIFEE STANDARD PLAN NO. 705

9. PROVIDE ADDITIONAL SIGNS AND MARKINGS NOT INCLUDED IN THE SIGNING AND STRIPING PLAN WITHIN THE PROJECT AREA, OR ON ROADWAYS ADJACENT TO THE PROJECT BOUNDARIES, UPON THE REQUEST OF THE CITY ENGINEER, TO IMPROVE TRAFFIC SAFETY ON THE ROADS UNDER THE JURISDICTION OF THE DEVELOPER/CONTRACTOR.

10. TRAFFIC CONTROL PLANS ON EXISTING ROADWAYS SHALL BE PREPARED BY A TRAFFIC OR CIVIL ENGINEER, REGISTERED IN THE STATE OF CALIFORNIA, AND SUBMITTED FOR REVIEW AND APPROVAL BY THE CITY ENGINEERING DEPARTMENT, PRIOR TO PERMIT ISSUANCE.

11. THE CONTRACTOR SHALL TAKE ALL NECESSARY AND PROPER PRECAUTIONS TO PROTECT ADJACENT PROPERTIES FROM ANY AND ALL DAMAGE THAT MAY OCCUR FROM STORM WATER RUNOFF AND/OR DEPOSITION OF DEBRIS RESULTING FROM ANY AND ALL WORK IN CONNECTION WITH HIS PRIVATE DEVELOPMENT CONSTRUCTION.

NOTE: WORK CONTAINED WITHIN THESE PLANS SHALL NOT COMMENCE UNTIL AN ENCROACHMENT AND/OR GRADING PERMIT HAS BEEN ISSUED.

STREET IMPROVEMENT NOTES (CONTINUED)

12. EXISTING STORM DRAIN PIPES/CULVERTS (WHETHER TO BE CONNECTED TO, EXTENDED, ADJUSTED, DRAINED TO, OR JUST IN THE PROJECT VICINITY) MUST BE REPAIRED AND/OR CLEANED TO MAKE THEM FUNCTIONAL AND ACCEPTABLE TO THE CITY ENGINEER.

13. THE DEVELOPER/CONTRACTOR SHALL APPLY TO RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT (RCFC & WCD) FOR PERMITS WHEN ANY STORM DRAIN PIPE NEEDS TO BE CONNECTED WITH A RCFC & WCD FACILITY AND ADD PERMIT # _____ ON THE PLAN.

14. CONSTRUCTION PROJECTS THAT DISTURB ONE ACRE OR MORE, OR ON SITES THAT ARE PART OF A LARGER COMMON PLAN OF DEVELOPMENT THAT DISTURBS ONE ACRE OR MORE, SHALL OBTAIN A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT. DEVELOPERS/CONTRACTORS SHALL FILE A NOTICE OF INTENT (NOI) WITH THE STATE WATER RESOURCES CONTROL BOARD (SWRCB), PREPARE A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND MONITORING PLAN FOR THE SITE. THE PROJECT SHALL COMPLY WITH THE LATEST REGULATIONS SPECIFIC TO THE NPDES AT THE TIME OF PERMIT ISSUANCE. PRIOR TO CONSTRUCTION, THE DEVELOPER/CONTRACTOR SHALL PROVIDE TO THE CITY OF MENIFEE A COPY OF THE NOI WITH A VALID WASTE DISCHARGE IDENTIFICATION (WDID) NUMBER.

15. THE DEVELOPER/CONTRACTOR SHALL PROVIDE AND INSTALL STREET NAME SIGNS CONFORMING TO THE CITY OF MENIFEE STANDARD PLAN NO. 815 AND NO. 816 AS APPLIES. THE DEVELOPER/CONTRACTOR SHALL SECURE THE APPROVAL OF THE CITY ENGINEERING DEPARTMENT FOR TYPE AND LOCATION OF THE STREET NAME SIGNS AND MARKINGS PRIOR TO INSTALLATION.

16. PROVIDE AND INSTALL STREET TREES IN ACCORDANCE WITH THE APPROVED LANDSCAPING PLANS AND CITY OF MENIFEE LANDSCAPING GUIDELINES.

17. PROVIDE LANDSCAPING CONSISTING OF GRASS AND PARKWAY TREES WITHIN PARKWAYS ON LOCAL RESIDENTIAL STREETS WITHOUT SEPARATE LANDSCAPE PLANS PER THE APPROVAL OF THE CITY COMMUNITY DEVELOPMENT DEPARTMENT. OTHER TYPES OF LANDSCAPING IN THESE AREAS, AND LANDSCAPING ON OTHER STREETS, SHALL REQUIRE SEPARATE LANDSCAPE PLANS. LANDSCAPING ENCROACHMENTS SHALL CONFORM TO CITY OF MENIFEE LANDSCAPING GUIDELINES.

18. PROVIDE STREET LIGHTS IN ACCORDANCE WITH THE APPROVED STREET LIGHTING PLAN AND PROVIDE FOR THE TEMPORARY OPERATION OF THE STREET LIGHTING SYSTEM.

19. PROVIDE CURB DEPRESSIONS AND DRIVEWAY APPROACHES ACCORDING TO THE CITY OF MENIFEE STANDARD PLAN NO. 205, 206, 207 AND NO. 208 AS APPROVED BY THE CITY ENGINEER.

20. THERE SHALL BE NO ABOVE-GROUND OBSTRUCTIONS IN ANY PORTION OF THE SIDEWALK (WHERE THE WIDTH, EXCLUSIVE OF TOP OF CURB, IS 5.5 FEET OR LESS). WHERE POWER/TELEPHONE/CABLE POLES, STREET LIGHT STANDARDS, FIRE HYDRANTS, AND CONTROL BOXES OCCUR IN THE 5.5 FOOT SIDEWALK, THE SIDEWALK SHALL BE MODIFIED PER CITY OF MENIFEE STANDARD PLAN 402.

STREET IMPROVEMENT NOTES (CONTINUED)

21. "PATCHING" OF SIDEWALK DAMAGE IS PROHIBITED; REPAIRS TO SIDEWALK SHALL INCLUDE REPLACEMENT OF THE ENTIRE PANEL FROM 'JOINT-TO-JOINT'.

22. FOR DRIVEWAY RECONSTRUCTION, DEVELOPER/CONTRACTOR SHALL SUBMIT TO THE MENIFEE CITY ENGINEER PROOF OF DRIVEWAY OWNER NOTIFICATION PRIOR TO CONSTRUCTION.

23. ALL PCC CURB RAMPS SHALL INCLUDE A DETECTABLE WARNING SYSTEM, TO INCLUDE TRUNCATED DOMES, PER ADA REQUIREMENTS. THE DETECTABLE WARNING SYSTEM SHALL BE ARMOR-TILE CAST IN PLACE SYSTEM, OR APPROVED EQUAL, NO ADHESIVES SHALL BE ALLOWED. THE CONTRASTING COLOR SHALL BE YELLOW.

24. CROSS GUTTERS SHALL BE CONSTRUCTED OVER 8" MINIMUM CRUSHED AGGREGATE BASE COMPACTED TO 95% RELATIVE DENSITY.

25. MAILBOXES AND POSTS SHALL BE INSTALLED PER AN APPROVED CITY STANDARD. SUBMIT PLOT PLAN OF BUILDING ORIENTATION ON LOT AND LOCATION OF MAIL BOX AND POST TO THE U.S. POST OFFICE FOR APPROVAL PRIOR TO INSTALLATION.

26. AS-BUILT PLANS AND ASSET/ATTRIBUTE DATA SHALL BE SUBMITTED TO THE CITY PRIOR TO ACCEPTANCE OF IMPROVEMENTS AND RELEASE OF BONDS.

DECLARATION OF RESPONSIBLE CHARGE

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT. THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF MENIFEE IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

LUCAS A. CORSBIE
R.C.E. # 72588
EXP. DATE JUNE 30, 2024

SEPTEMBER 13TH, 2023

WORK TO BE DONE

THE IMPROVEMENTS CONSIST OF THE FOLLOWING WORK TO BE DONE ACCORDING TO THESE PLANS AND THE SPECIFICATIONS AND STANDARD DRAWINGS OF THE CITY OF MENIFEE.

STANDARD SPECIFICATIONS:

DESCRIPTION

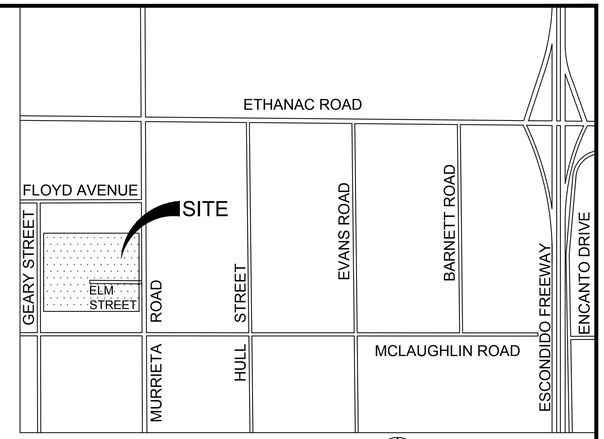
1. CITY OP MENIFEE STNADARD SPECIFICATIONS, 2014 EDITION
2. STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (GREENBOOK), 2012 EDITION
3. CALIFORNIA DEPARTMENT OF TRANSPORTATION MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, 2012 EDITION
4. CALIFORNIA DEPARTMENT OF TRANSPORTATION U.S CUSTOMARY STANDARD SPECIFICATIONS, 2010 EDITION

STANDARD DRAWINGS:

DESCRIPTION

1. CITY OF MENIFEE STANDARD DRAWINGS, 2014 EDITION
2. COUNTY OF RIVERSIDE STANDARD DRAWINGS

SHEET INDEX



VICINITY MAP
NOT TO SCALE

OWNER:

IPT MENIFEE CC LLC, A DELAWARE LIMITED LIABILITY COMPANY
626.786.2112
CONTACT: JAMIE MCLAUGHLIN

APN NO.

330-210-010 & 330-210-013, 330-210-011, 330-210-062, 330-560-001 THROUGH 330-560-040, 330-570-001 THROUGH 330-570-033, 330-571-001 THROUGH 330-571-005

TOPOGRAPHY SOURCE

CALVADA SURVEYING, INC. JOB NUMBER 21224

BENCH MARK / BASIS OF BEARING

THE CALIFORNIA SPATIAL REFERENCE CENTER C.O.R.S. "CNPP", ELEVATION 1098.47 FEET (NAVD 88).

THE BEARINGS SHOWN HEREON ARE BASED UPON THE CALIFORNIA COORDINATE SYSTEM OF 1983, CCS83, ZONE 6, (2017.50) IN ACCORDANCE TO THE CALIFORNIA PUBLIC RESOURCES CODE SECTIONS 8801-8819; SAID BEARINGS ARE DETERMINED LOCALLY UPON FIELD-OBSERVED TIES TO THE FOLLOWING CALIFORNIA SPATIAL REFERENCE NETWORK CONTINUOUS OPERATING REFERENCE STATIONS (C.O.R.S.):

C.S.R.C. CNPP:
NORTHING = 258382.63' EASTING = 6149110.39'

C.S.R.C. EWPP:
NORTHING = 2347787.29' EASTING = 6175506.72'

TOTAL DISTURBED AREA

TBD

PRELIMINARY GRADING QUANTITIES

GRADED AREA	±4.25 [ACRES]	MAX. CUT DEPTH	±2.5 [FT]
CUT QUANTITIES	2,050 [CYD]	MAX CUT SLOPE RATIO	(2:1MAX) 2:1
FILL QUANTITIES	2,850 [CYD]	MAX. FILL DEPTH	±2.0 [FT]
IMPORT	800 [CYD]	MAX FILL SLOPE RATIO	(2:1MAX) 2:1

THIS PROJECT PROPOSES TO IMPORT APPROXIMATELY 800 CUBIC YARDS OF MATERIAL FROM THIS SITE. ALL EXPORT MATERIAL SHALL BE DISCHARGED TO A LEGAL DISPOSAL SITE. THE APPROVAL OF THIS PROJECT DOES NOT ALLOW PROCESSING AND SALE OF THE MATERIAL. ALL SUCH ACTIVITIES REQUIRE A SEPARATE CONDITIONAL USE PERMIT. QUANTITIES SHOWN HEREON ARE PRELIMINARY AND REPRESENT A FINISHED TO EXISTING GRADE COMPARISON. ACCOUNTS FOR SHRINKAGE, PAVEMENT THICKNESSES, OR OTHER FACTORS WERE NOT CONSIDERED.

LEGEND

EXISTING		PROPOSED
	BOUNDARY	
	SECTION	
	1/4 SECTION	
	1/16 SECTION	
	LOT LINE	
	EASEMENT	
	CENTERLINE	
-(5280)-	MAJOR CONTOUR	5280
-(5278)-	MINOR CONTOUR	5278
	CURB / GUTTER	
	SIDEWALK	
X	FENCE	X
N/A	SAWCUT	
	STORM DRAIN	SD

SS	SANITARY	SS
WM	WATERLINE	WM
DW	DOMESTIC WATER	DW
FW	FIRE WATER	FW
RW	RECLAIMED WATER	RW
IRR	IRRIGATION	IRR
OH	OVERHEAD UTILITY	OH
JT	JOINT UTILITY TRENCH	JT
CATV	CABLE TV	CATV
E	BURIED ELECTRIC	E
FO	FIBER OPTIC	FO
NGAS	NATURAL GAS	NGAS
T	TELEPHONE	T
UKWN	UNKNOWN UTILITY	N/A

Call before you Dig
Avoid cutting underground utility lines. It's costly.
Call 811
OR
1-800-227-2600

REVISIONS

SHT.	DESCRIPTION	DATE	BY	APRD

ENGINEER LOGO

WARE MALCOMB
LEADING DESIGN FOR COMMERCIAL REAL ESTATE

10 edelman
irvine, ca 92618
p 949.660.9128
waremalcomb.com

ENGINEER SEAL
REGISTERED PROFESSIONAL ENGINEER
LUCAS A. CORSBIE
No. 72588
CIVIL
STATE OF CALIFORNIA
September 13, 2023

SCALE:	AS SHOWN
DESIGN:	AC
DRAWN:	AC
CHECKED:	LC
APPROVED:	--
DATE:	09/13/2023

CITY OF MENIFEE
ENGINEERING DEPARTMENT

YOLANDA S. MACALALAD — RCE 68190 EXP. 9/30/21 — DATE
CITY ENGINEER

RECOMMENDED BY: — DATE

SEAL
CITY OF MENIFEE
INCORPORATED 2008

CITY OF MENIFEE
ENGINEERING DEPARTMENT

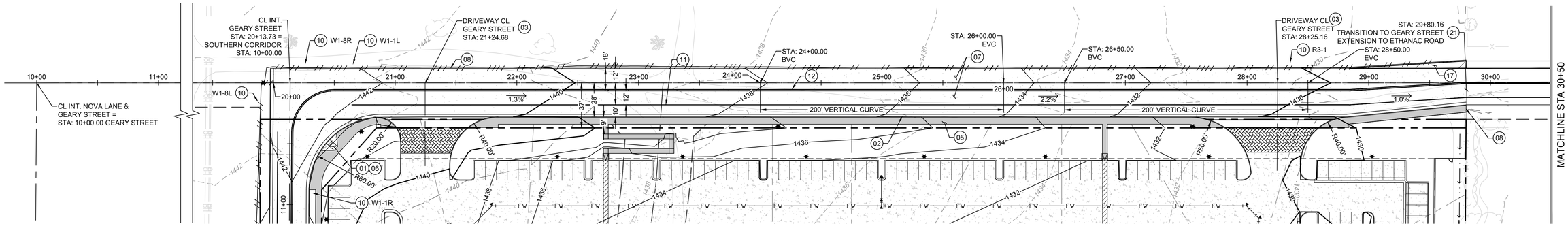
IMPROVEMENT PLANS FOR:
GEARY ST., SOUTH CORRIDOR, MURRIETA RD., & LINE A-12

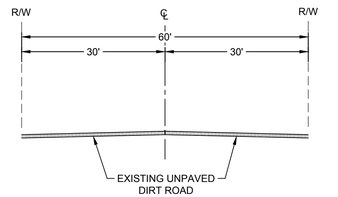
TITLE SHEET

SHEET NO.
01
01 OF 05

PROJECT NO: DEV2022-017

GEARY STREET - STA 19+50 TO 30+50





EXISTING TYPICAL SECTION

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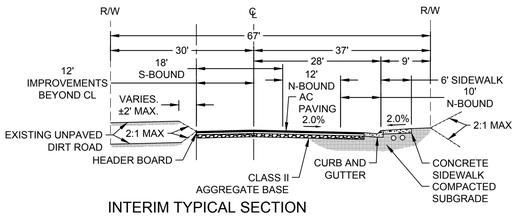
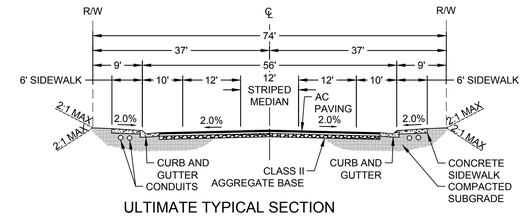


INTERIM TYPICAL SECTION

MODIFIED INDUSTRIAL COLLECTOR
SCALE: N.T.S.



ULTIMATE TYPICAL SECTION

MODIFIED INDUSTRIAL COLLECTOR
SCALE: N.T.S.

CONSTRUCTION NOTES:

01 CORNER CUT BACK PER CITY STD. NO. 82
02 TYPE 8 CURB AND GUTTER PER CITY STD. NO. 201
03 COMMERCIAL DRIVE APPROACH PER CITY STD. NO. 208
04 CROSS GUTTER AND SPANDREL PER CITY STD. NO. 209
05 SIDEWALK PER CITY STD. NO. 400
06 PEDESTRIAN RAMP TYPE I PER CITY STD. NO. 405
07 AC PAVEMENT. PRELIMINARY DESIGN PENDING
08 HEADER BOARD
09 JOIN TO EXISTING PAVEMENT
10 NEW SIGN PER PLAN
11 6" SOLID WHITE REFLECTIVE THERMOPLASTIC RIGHT EDGELINE PER CALTRANS STANDARD PLAN A20B DETAIL 27B
12 4" DOUBLE SOLID YELLOW REFLECTIVE THERMOPLASTIC LEFT EDGELINE PER FIGURE 3A-107(CA)
13 8" SOLID WHITE REFLECTIVE CHANNELIZING LINE PER FIGURE 3A-112(CA)
14 8" SOLID WHITE REFLECTIVE LANE DROP PER CALTRANS STANDARD PLAN A20C DETAIL 37B
15 4" DASHED WHITE REFLECTIVE THERMOPLASTIC LANE LINE PER CALTRANS STANDARD PLAN A20A DETAIL 9
16 12" WHITE REFLECTIVE THERMOPLASTIC LIMIT LINE (STOP LINE) PER CALTRANS STANDARD PLAN A24G LETTERING AND LOCATION PER CITY STD. 1201
17 6" DOUBLE SOLID YELLOW REFLECTIVE THERMOPLASTIC MEDIAN LINE PER CALTRANS STANDARD A20B DETAIL 29
18 6" SOLID AND DASHED YELLOW REFLECTIVE THERMOPLASTIC TWO WAY LEFT TURN LINES PER CALTRANS STANDARD A20B DETAIL 32

CONSTRUCTION NOTES (CONTINUED):

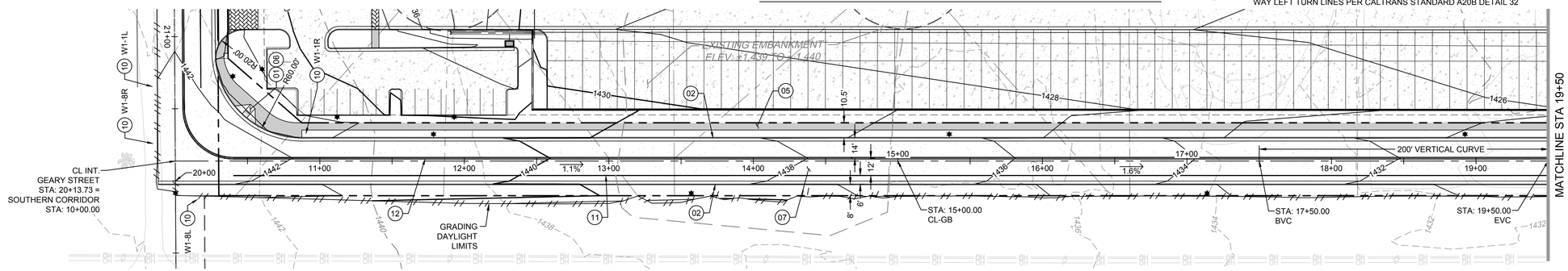
19 TYPE III (R) PAVEMENT MARKING PER CALTRANS DETAIL A24B
20 "ONLY" PAVEMENT MARKING PER CALTRANS DETAIL A24E
21 REFER TO SHEET 04 FOR CONTINUATION OF GEARY STREET IMPROVEMENTS TO ETHANAC ROAD.
22 SIDEWALK PLACEMENT AROUND OBSTRUCTION PER CITY STD. NO. 402

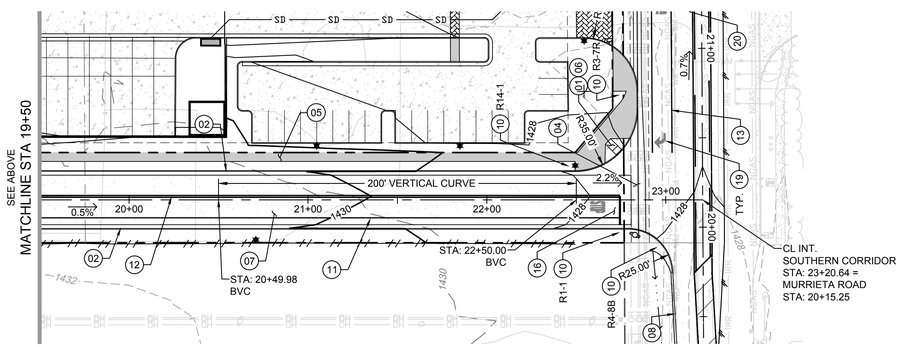
N

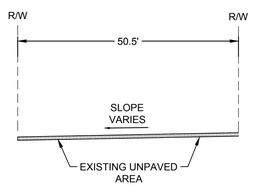
0 20 40 80

SCALE: 1" = 40'

SOUTH CORRIDOR - STA 10+00 TO 23+21

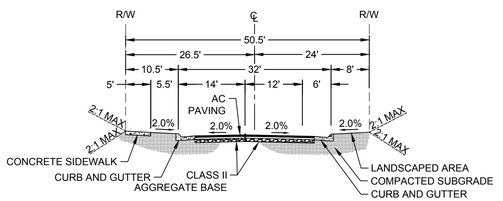






EXISTING TYPICAL SECTION

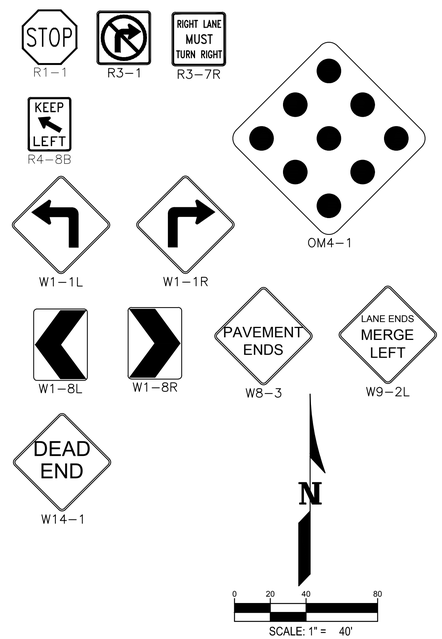
SCALE: N.T.S.



PROPOSED TYPICAL SECTION

ROADWAY R1
SCALE: N.T.S.

SIGN LEGEND:



N

0 20 40 80

SCALE: 1" = 40'

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REVISIONS

SHT.	DESCRIPTION	DATE	BY	APRD

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LEADING DESIGN FOR COMMERCIAL REAL ESTATE

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irvine, ca 92618
p 949.660.9128
waremalcomb.com

ENGINEER SEAL

REGISTERED PROFESSIONAL ENGINEER
LUCAS A. CORSETTE
No. 72588
CIVIL
STATE OF CALIFORNIA
September 13, 2023

SCALE:	AS SHOWN
DESIGN:	AC
DRAWN:	AC
CHECKED:	LC
APPROVED:	--
DATE:	09/13/2023

CITY OF MENIFEE
ENGINEERING DEPARTMENT

YOLANDA S. MACALALAD — RCE 68190 EXP. 9/30/21 — DATE
CITY ENGINEER

RECOMMENDED BY: — DATE

SEAL

CITY OF MENIFEE — OCTOBER 1, 2008

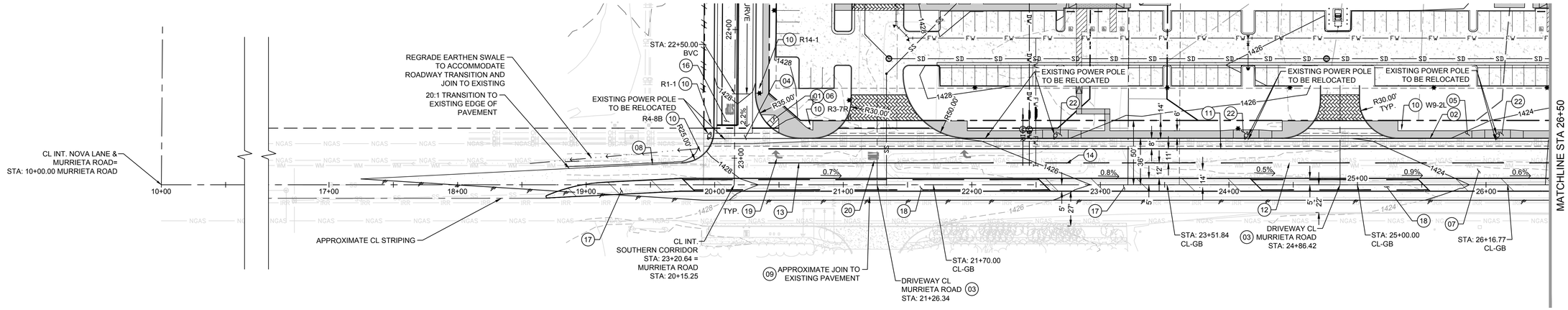
CITY OF MENIFEE
ENGINEERING DEPARTMENT

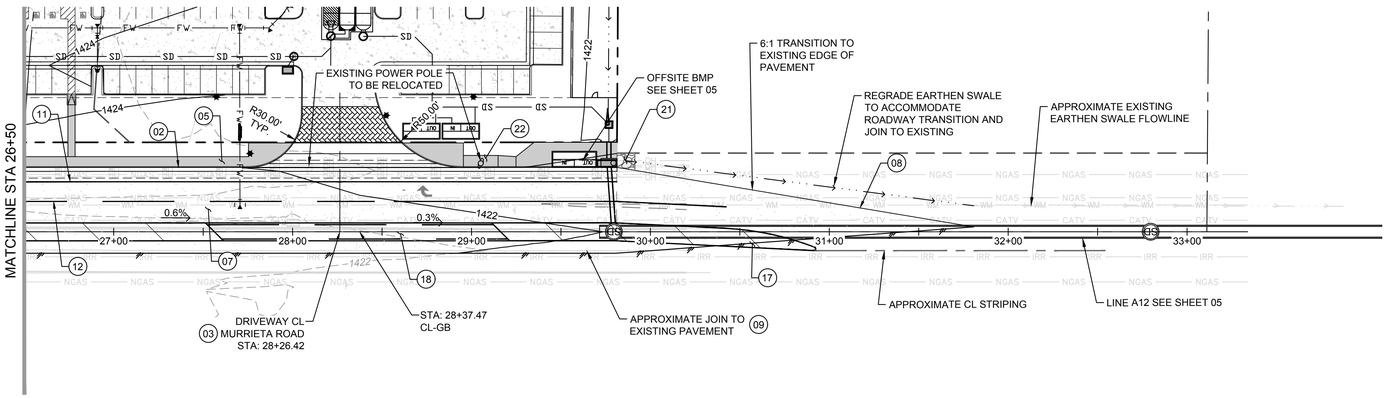
IMPROVEMENT PLANS FOR:
GEARY STREET & SOUTH CORRIDOR

PRELIMINARY STREET PLAN

SHEET NO. 02
02 OF 05

PROJECT NO: DEV2022-017





CONSTRUCTION NOTES:

01 CORNER CUT BACK PER CITY STD. NO. 82
02 TYPE 8 CURB AND GUTTER PER CITY STD. NO. 201
03 COMMERCIAL DRIVE APPROACH PER CITY STD. NO. 208
04 CROSS GUTTER AND SPANDREL PER CITY STD. NO. 209
05 SIDEWALK PER CITY STD. NO. 400
06 PEDESTRIAN RAMP TYPE I PER CITY STD. NO. 405
07 AC PAVEMENT. PRELIMINARY DESIGN PENDING
08 HEADER BOARD
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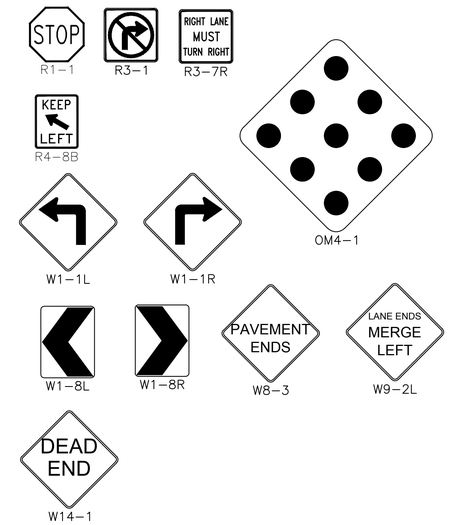
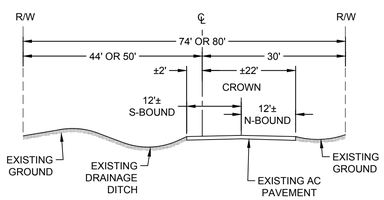
13 8" SOLID WHITE REFLECTIVE CHANNELIZING LINE PER FIGURE 3A-112(CA)
14 8" SOLID WHITE REFLECTIVE LANE DROP PER CALTRANS STANDARD PLAN A20C DETAIL 37B
15 4" DASHED WHITE REFLECTIVE THERMOPLASTIC LANE LINE PER CALTRANS STANDARD PLAN A20A DETAIL 9
16 12" WHITE REFLECTIVE THERMOPLASTIC LIMIT LINE (STOP LINE) PER CALTRANS STANDARD PLAN A24G LETTERING AND LOCATION PER CITY STD. 1201
17 6" DOUBLE SOLID YELLOW REFLECTIVE THERMOPLASTIC MEDIAN LINE PER CALTRANS STANDARD A20B DETAIL 29
18 6" SOLID AND DASHED YELLOW REFLECTIVE THERMOPLASTIC TWO WAY LEFT TURN LINES PER CALTRANS STANDARD A20B DETAIL 32
19 TYPE III (R) PAVEMENT MARKING PER CALTRANS DETAIL A24B
20 "ONLY" PAVEMENT MARKING PER CALTRANS DETAIL A24E
21 RIP RAP ENERGY DISSIPATION FOR INTERIM STREET RUNOFF OR OVERFLOW/BYPASS
22 SIDEWALK PLACEMENT AROUND OBSTRUCTION PER CITY STD. NO. 402

SIGN LEGEND:





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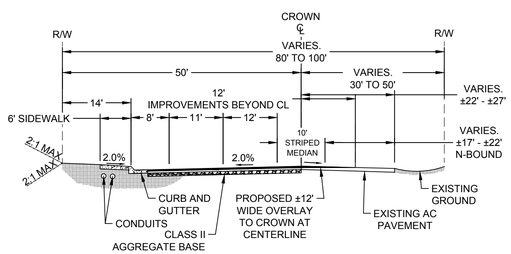
SCALE: N.T.S.



INTERIM TYPICAL SECTION
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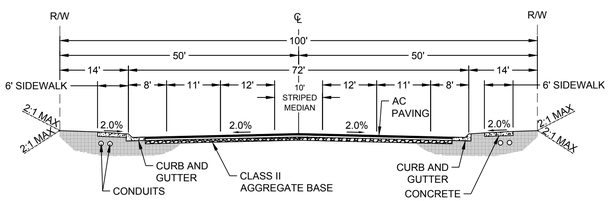

ULTIMATE TYPICAL SECTION
SECONDARY (4 LANES)
SCALE: N.T.S.

0 20 40 80
SCALE: 1" = 40'

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waremalcomb.com

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REGISTERED PROFESSIONAL ENGINEER
LUCAS A. CORBITT
No. 72588
CIVIL
STATE OF CALIFORNIA
September 13, 2023

SCALE:	AS SHOWN
DESIGN:	AC
DRAWN:	AC
CHECKED:	LC
APPROVED:	--
DATE:	09/13/2023

CITY OF MENIFEE
ENGINEERING DEPARTMENT

YOLANDA S. MACALALAD — RCE 68190 EXP. 9/30/21 — DATE
CITY ENGINEER

RECOMMENDED BY: — DATE

SEAL
CITY OF MENIFEE OCTOBER 8, 2008

CITY OF MENIFEE
ENGINEERING DEPARTMENT

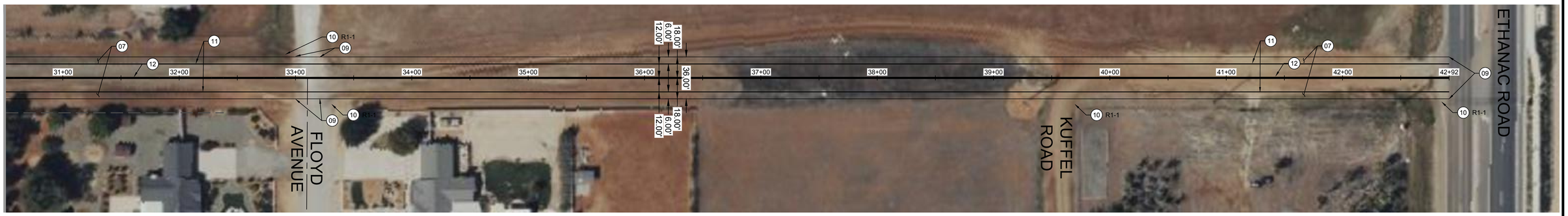
IMPROVEMENT PLANS FOR:
MURRIETA ROAD

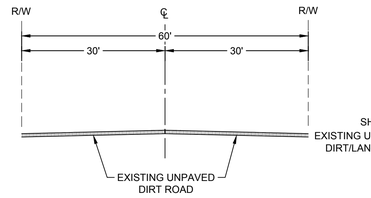
PRELIMINARY STREET PLAN

SHEET NO. 03 OF 05

PROJECT NO: DEV2022-017

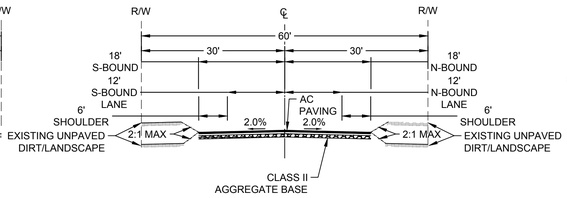
GEARY STREET - STA 30+50 TO 43+00





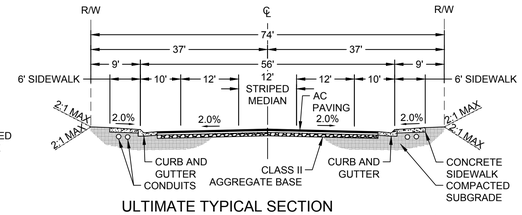
EXISTING TYPICAL SECTION

GEARY STREET EXTENSION TO ETHANAC ROAD
SCALE: N.T.S.



INTERIM TYPICAL SECTION

MODIFIED INDUSTRIAL COLLECTOR
GEARY STREET EXTENSION TO ETHANAC ROAD
SCALE: N.T.S.



ULTIMATE TYPICAL SECTION

MODIFIED INDUSTRIAL COLLECTOR
SCALE: N.T.S.

CONSTRUCTION NOTES:

01. CORNER CUT BACK PER CITY STD. NO. 82
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CONSTRUCTION NOTES (CONTINUED):

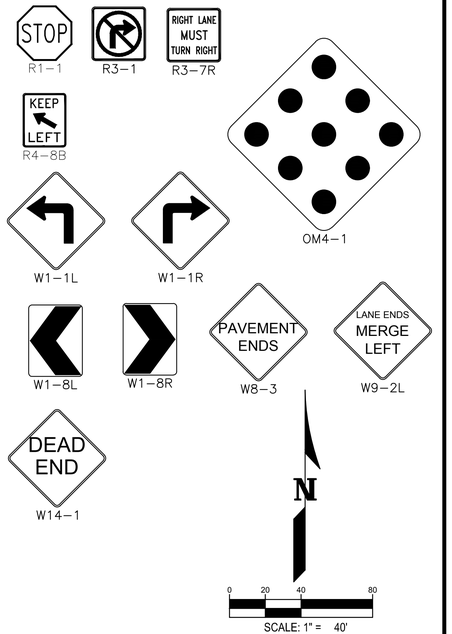
19. TYPE III (R) PAVEMENT MARKING PER CALTRANS DETAIL A24B
20. "ONLY" PAVEMENT MARKING PER CALTRANS DETAIL A24E
21. RIP RAP ENERGY DISSIPATION FOR INTERIM STREET RUNOFF OR OVERFLOW/BYPASS
22. SIDEWALK PLACEMENT AROUND OBSTRUCTION PER CITY STD. NO. 402

N

0 20 40 80

SCALE: 1" = 40'

SIGN LEGEND:



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REVISIONS

SHT.	DESCRIPTION	DATE	BY	APRD

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p 949.660.9128
waremalcomb.com

ENGINEER SEAL
REGISTERED PROFESSIONAL ENGINEER
LUCAS A. CRABBE
No. 72588
CIVIL
STATE OF CALIFORNIA
September 13, 2023

SCALE:	AS SHOWN
DESIGN:	AC
DRAWN:	AC
CHECKED:	LC
APPROVED:	--
DATE:	09/13/2023

CITY OF MENIFEE
ENGINEERING DEPARTMENT

YOLANDA S. MACALALAD — RCE 68190 — DATE
CITY ENGINEER — EXP. 9/30/21

RECOMMENDED BY: — DATE

SEAL
CITY OF MENIFEE
INCORPORATED 2008

CITY OF MENIFEE
ENGINEERING DEPARTMENT

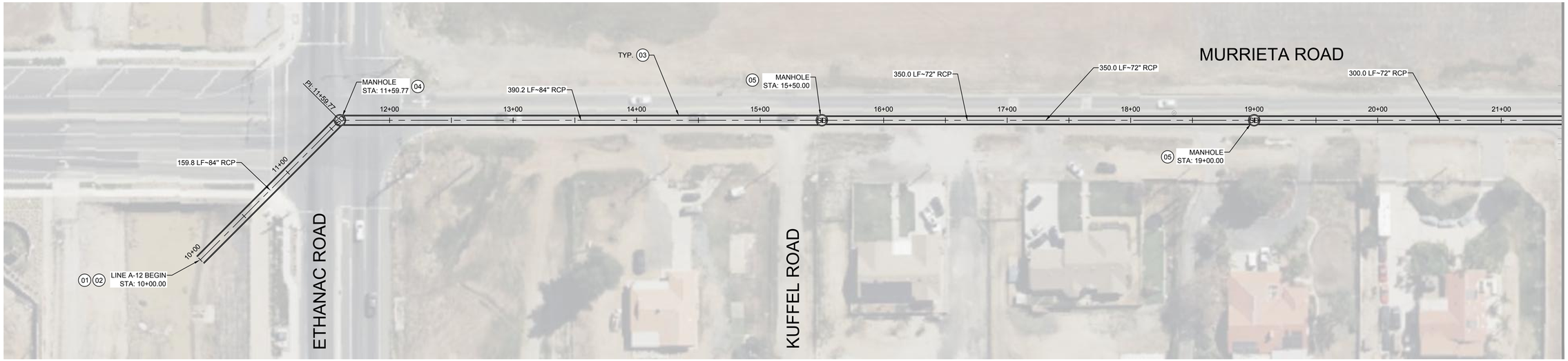
IMPROVEMENT PLANS FOR:
GEARY STREET EXTENSION TO ETHANAC ROAD

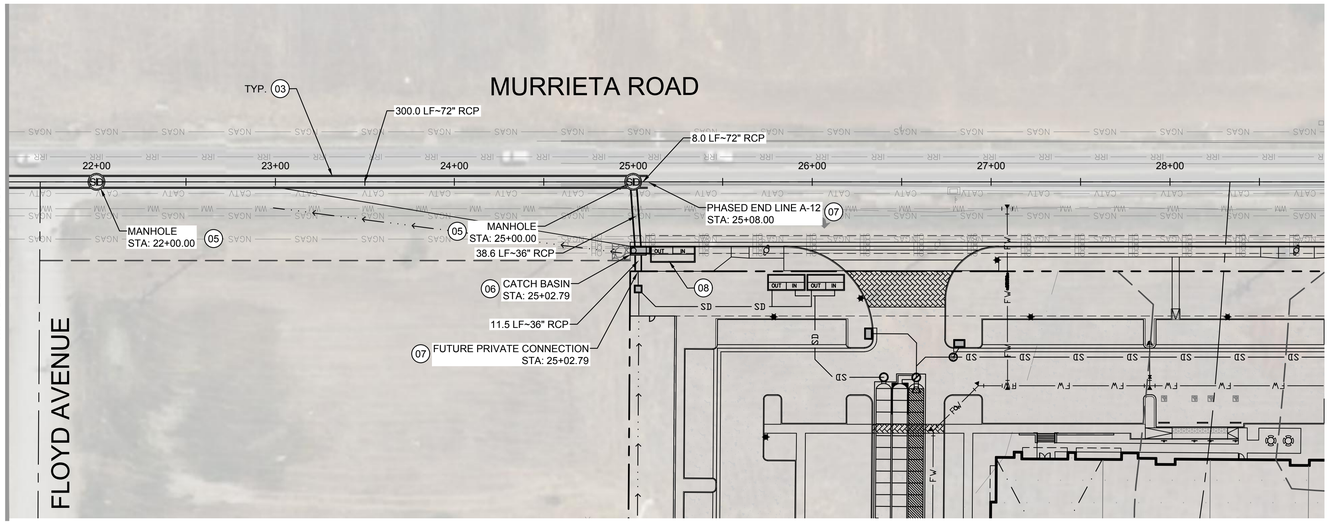
PRELIMINARY STREET PLAN

SHEET NO. 04
04 OF 05

PROJECT NO: DEV2022-017

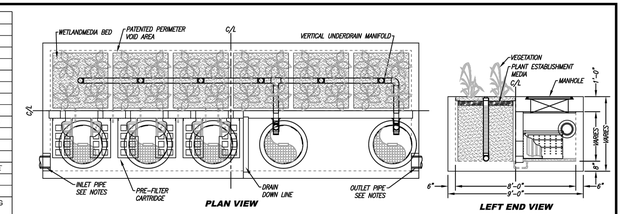
LINE A-12





SITE SPECIFIC DATA			
PROJECT NUMBER	IRV22-0086		
PROJECT NAME	ARES MENIFEE		
PROJECT LOCATION	CITY OF MENIFEE		
STRUCTURE ID	MWS C - OFF-SITE		
TREATMENT REQUIRED			
FLOW BASED (CFS)			
0.693			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE		OFFLINE	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1422.01		
SURFACE LOAD	PEDESTRIAN		
NOTES:	UNIT TO BE CURB-OPENING TYPE WITH OPENING AT ELEVATION 1421.92.		

* PRELIMINARY NOT FOR CONSTRUCTION

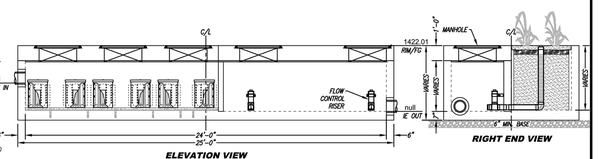


INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS' SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS. null
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL. IE IN
4. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE. 6"
5. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
6. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.

GENERAL NOTES

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



TREATMENT FLOW (CFS)	0.693
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-24-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

CONSTRUCTION NOTES:

01 JUNCTION STRUCTURE NO. 6 PER RCFC STD. NO. MH254
02 RIP RAP ENERGY DISSIPATION AT OUTFALL
03 STORM DRAIN LINE. APPROXIMATE MATERIAL, DIAMETER, AND LENGTH PER PLAN
04 MANHOLE NO. 4 PER RCFC STD. NO. MH254
05 MANHOLE NO. 2 PER RCFC STD. NO. MH252
06 CATCH BASIN NO. 1 WITH LOCAL DEPRESSION PER RCFC STD. NO. CB100
07 PLUG END FOR FUTURE CONNECTION
08 MODULAR WETLAND SYSTEM WITH CURB OPENING UPSTREAM OF CATCH BASIN. TYPICAL DETAIL HEREON

N

0 20 40 80

SCALE: 1" = 40'

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OR
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SCALE:	AS SHOWN
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CITY OF MENIFEE
ENGINEERING DEPARTMENT

YOLANDA S. MACALALAD — RCE 68190 EXP. 9/30/21 — DATE
CITY ENGINEER

RECOMMENDED BY: — DATE

SEAL
CITY OF MENIFEE
OCTOBER 1, 2008

CITY OF MENIFEE
ENGINEERING DEPARTMENT

IMPROVEMENT PLANS FOR:
STORM DRAIN LINE - A12

PRELIMINARY SD PLAN - LINE A12

SHEET NO.
05
05 OF 05

PROJECT NO: DEV2022-017

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

November 12, 2021

Mr. Alan J. Sharp
300 Spectrum Center Drive, Suite 880
Irvine, California 92618

Project No.: **21G237-2**

Subject: **Results of Infiltration Testing**
Proposed Industrial Building
Murrieta Road, North of McLaughlin Road
Menifee, California

Reference: Geotechnical Investigation, Proposed Industrial Building, Murrieta Road, North of McLaughlin Road, Menifee, California, prepared for Mr. Alan J. Sharp, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 21G237-1, dated November 3, 2021.

Mr. Sharp:

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

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 21P351, dated August 6, 2021. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The site is located on the west side of Murrieta Road, 350± feet north of McLaughlin Road in Menifee, California. The site is bounded to the north by single-family residences (SFRs), to the west by Geary Street, to the south by a vacant lot, and to the east by Murrieta Road. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of multiple contiguous parcels, which total 29.69± acres in size. The southeast area of the site is presently developed with four SFRs. Ground surface cover in this area consists of exposed soil with several medium to large trees. The remaining areas of the site are presently vacant and undeveloped. Ground surface cover in the undeveloped areas consists of exposed soil with sparse native grass and weed growth and sparse areas of trash and debris. The ground is generally uneven due to previous agricultural tilling. A stockpile that is 61,200± ft^2 in size is located in the south-central portion of the site, directly adjacent to the SFRs.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations made at the time of the subsurface investigation, the site slopes to the northeast at a gradient of 1 to 2± percent. The stockpile located in the south-central area of the site is approximately 3 to 4 feet higher than the surrounding topography.

Proposed Development

SCG was provided with a conceptual site plan prepared by Ware Malcomb. Based on this plan, the site will be developed with one (1) new industrial building. The building will be 568,080± ft² in size, located in the central area of the subject site. Dock-high doors will be constructed in a cross-dock configuration, along a portion of the north and south building walls. The building will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck court areas, and limited areas of concrete flatwork and landscape planters.

The proposed development will include on-site storm water infiltration. The infiltration system will consist of an infiltration basin located in the eastern area of the site. The bottom of the infiltration system will range from 6 to 10± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, which is referenced above. As part of this study, eight (8) borings were advanced to depths of 10 to 25± feet below existing site grades. Artificial fill soils were encountered at the ground surface at several of the boring locations extending to depths of 2½ to 8± feet below ground surface. The fill soils consist of very stiff to hard silty clay, medium dense to dense silty fine sand and silty fine to coarse sand. Native alluvium was encountered beneath the fill soils or at the ground surface at all of the boring locations, extending to at least the maximum depth explored of 25± feet below ground surface. The alluvial soils generally consist of medium dense to very dense silty fine sand, silty fine to coarse sand, fine to coarse sand and stiff to hard silty clay. Occasional layers of medium dense to very dense fine sand, clayey fine to medium sand, fine sandy silt and hard fine to medium sandy clay were encountered. Some samples are cemented and include calcareous nodules and veining.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static groundwater table is at a greater depth than 25± feet below existing site grades.

Recent water level data was obtained from the California State Water Resources Control Board, GeoTracker, website, https://geotracker.waterboards.ca.gov/. One monitoring well on record are located 0.72± miles southeast of the site. Water level readings within this monitoring well indicate a high groundwater level of 72± feet below the ground surface in February 2015.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of three (3) backhoe-excavated trenches, extending to depths of 6 to 10± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 through I-3) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Native younger alluvium was encountered at the ground surface at all three infiltration trenches extending to depths of 2½ to 4± feet below the existing site grades. The younger alluvium consists of loose to dense silty fine sands, silty fine to medium sands and stiff to very stiff fine sandy clays, fine to medium sandy clays, and fine to coarse sandy clays. Beneath the younger alluvium, older alluvium was encountered at all of the infiltration trenches extending to the maximum depth explored of 10± feet. The older alluvium generally consists of dense to very dense clayey fine to medium sands and clayey fine to coarse sands with varying fine gravel content. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are presented in this report.

Infiltration Testing

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

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

Infiltration Testing Procedure

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

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at the trench locations, the volumetric measurements were made at 20 to 30-minute increments. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

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

Infiltration Test No.	Depth (feet)	Soil Description	Infiltration Rate (inches/hour)
I-1	6	Red Brown Clayey fine to medium Sand, trace coarse Sand, trace fine Gravel	0.2
I-2	8	Red Brown Clayey fine to medium Sand, trace fine Gravel	0.0
I-3	10	Red Brown Clayey fine to coarse Sand	0.0

Design Recommendations

Three (3) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 0 to 0.2 inches per hour. The major factors affecting the lack of infiltration at these locations is the presence of dense to very dense older alluvium. **Based on the lack of infiltration at the depths tested, infiltration is not considered feasible for this site.**

Although infiltration is not considered feasible at the site, the client may desire to use storm water disposal systems that do not rely on infiltration at this site. The design of storm water disposal systems should be performed by the project civil engineer, in accordance with the City of Menifee and/or County of Riverside guidelines. It is recommended any such systems be designed and constructed to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the flow rates through the system. It should be noted that the recommended infiltration rates are based on infiltration testing at four (4) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Location of Infiltration Systems

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

given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

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

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

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

Closure

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

Respectfully Submitted,

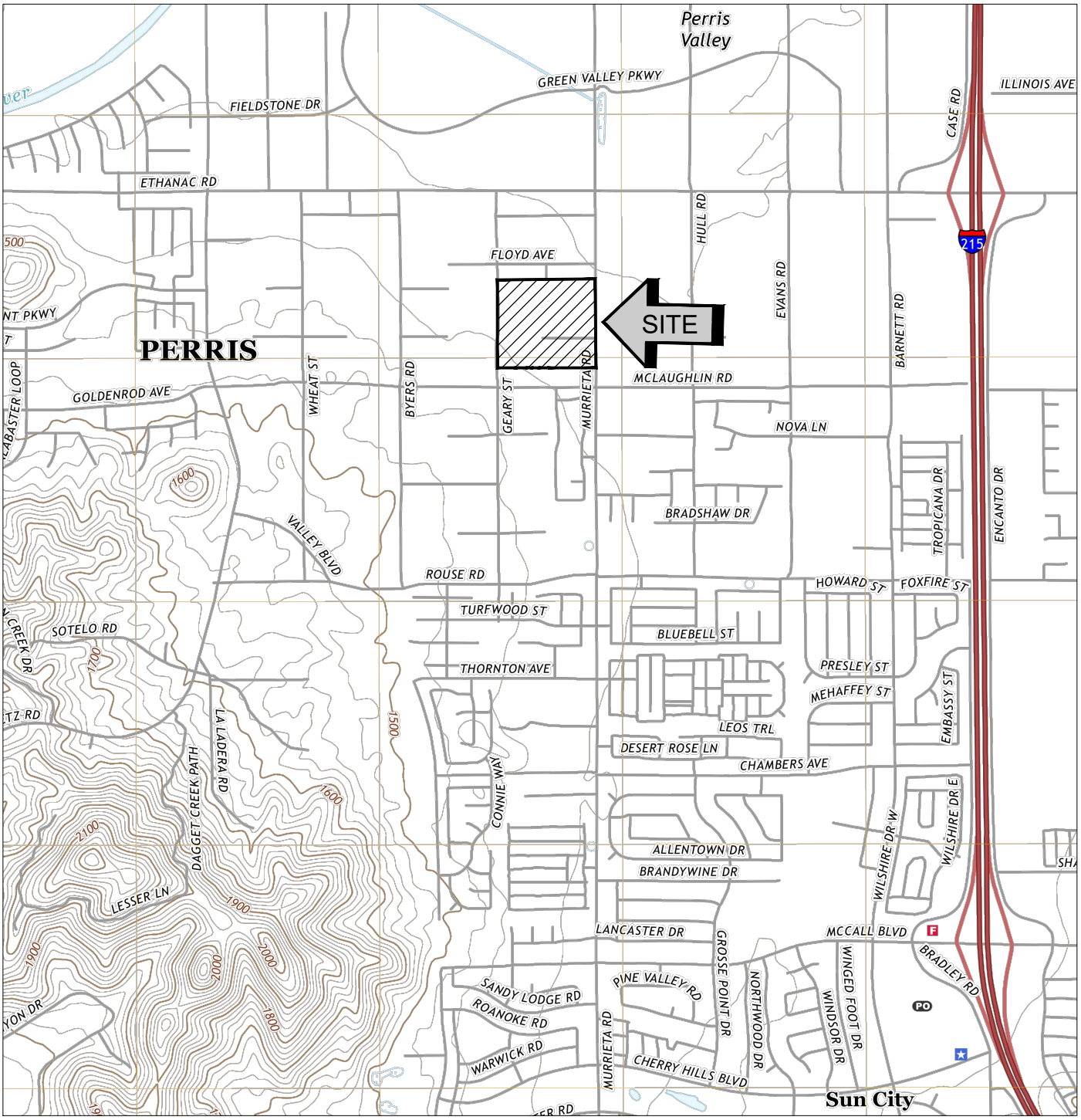
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Daryl Kas, CEG 2467
Senior Geologist

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Trench Log Legend and Logs (5 pages)
Infiltration Test Results Spreadsheets (3 pages)
Grainsize Distribution Graphs (3 pages)



SO□RCE□□SGS TOPOGRAPHIC MAP OF THE ROMOLAND □□ADRANGLE□RIVERSIDE CO□NTY□CALIFORNIA□2018

SITE LOCATION MAP

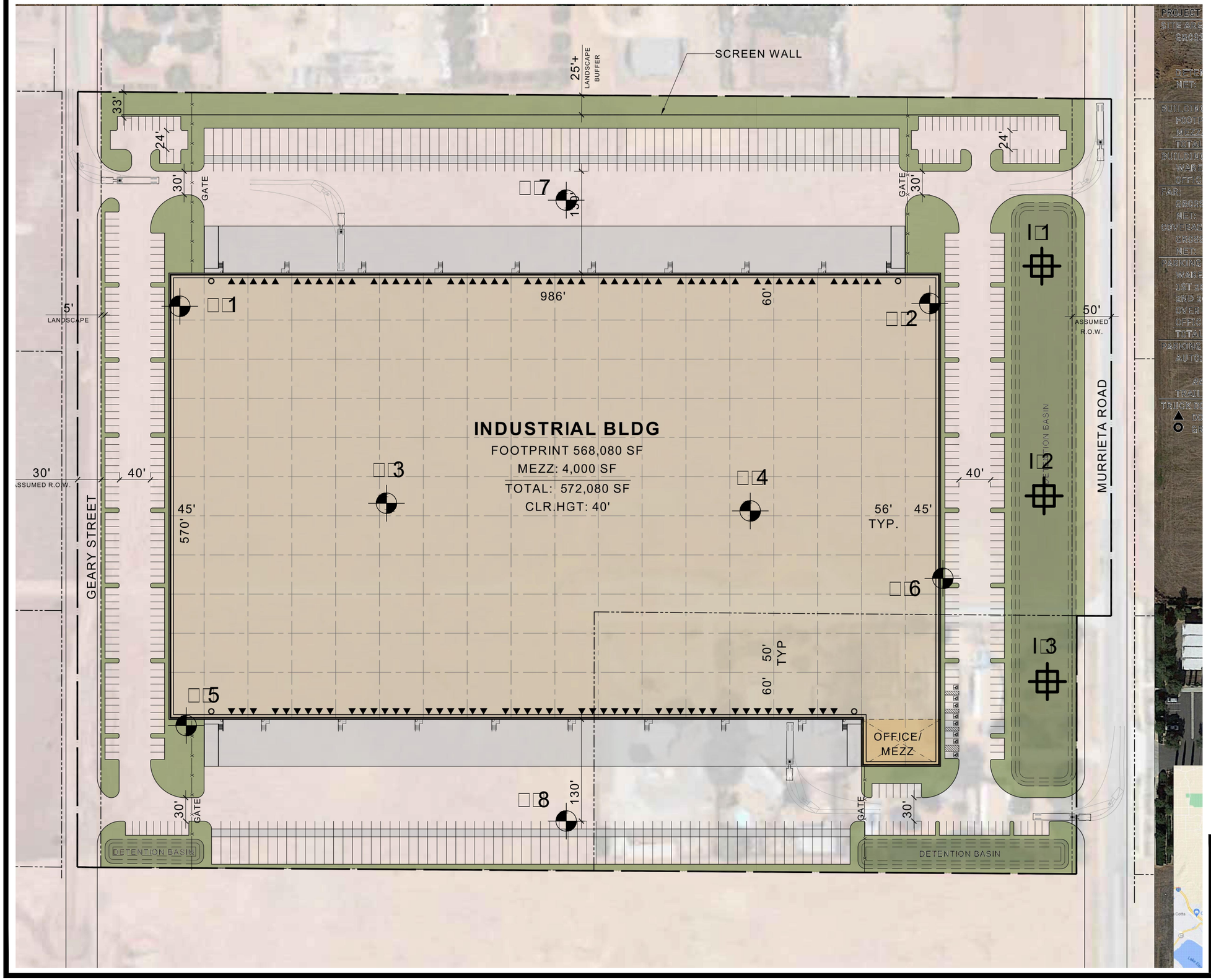
PROPOSED IND□STRIAL □□ILDING

MENIFEE□CALIFORNIA

SCALE□1" □ 2000□	
DRAWN□MD CH□D□RGT	
SCG PRO□ECT 21G237□2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



NORTH
SoCalGeo

GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE □ORING LOCATION (SCG PRO□ECT 21G237□1)

INFILTRATION TEST LOCATION PLAN

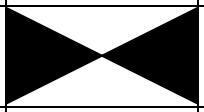
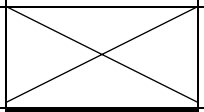
PROPOSED IND□STRIAL □□ILDING

MENIFEE□CALIFORNIA

SCALE□1" □ 120□	
DRAWN□ MD CH□D□ RGT	
SCG PRO□ECT 21G237□2	
PLATE 2	

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

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

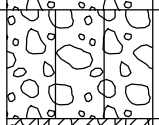
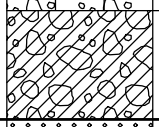
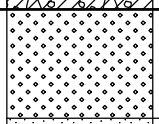
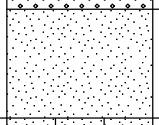
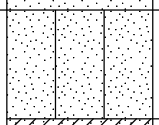
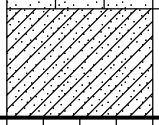
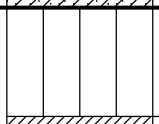
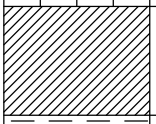
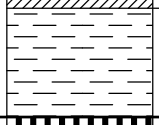
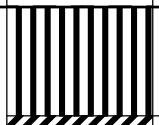
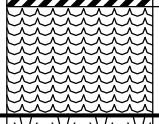
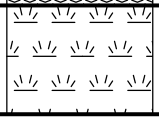
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-1

JOB NO.: 21G237-2
PROJECT: Proposed Industrial Building
LOCATION: Menifee, California

DRILLING DATE: 10/7/21
DRILLING METHOD: Backhoe
LOGGED BY: Caleb Brackett

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine Sand, trace to little Clay, trace fine Root Fibers, dense-dry							
					Dark Brown fine Sandy Clay, trace Silt, stiff-damp							
					Brown Clayey fine to medium Sand, very dense-damp							
					OLDER ALLUVIUM: Brown Clayey fine to medium Sand, very dense-dry to damp							
5												
					Trench Terminated at 6'							

TBL 21G237-2.GPJ SOCALGEO.GDT 11/12/21

TEST TRENCH LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-2

JOB NO.: 21G237-2
PROJECT: Proposed Industrial Building
LOCATION: Menifee, California

DRILLING DATE: 10/7/21
DRILLING METHOD: Backhoe
LOGGED BY: Caleb Brackett

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Dark Brown Silty fine to medium Sand, trace to little Clay, trace fine Root Fibers, loose-dry							
					Brown fine to medium Sandy Clay, trace fine Gravel, stiff to very stiff-damp							
					OLDER ALLUVIUM: Red Brown Clayey fine to medium Sand, trace fine Gravel, trace Calcareous nodules/veining, slightly cemented, porous, very dense-damp							
5												
					Trench Terminated at 8'							

TBL 21G237-2.GPJ SOCALGEO.GDT 11/12/21

TEST TRENCH LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-3

JOB NO.: 21G237-2
PROJECT: Proposed Industrial Building
LOCATION: Menifee, California

DRILLING DATE: 10/7/21
DRILLING METHOD: Backhoe
LOGGED BY: Caleb Brackett

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM Brown Silty fine to medium Sand, trace to little Clay, trace fine Root Fibers, dense-dry							
					Brown fine to coarse Sandy Clay, very stiff-dry							
5					OLDER ALLUVIUM: Red Brown fine to medium Sandy Clay, trace fine Gravel, Calcareous nodules, stiff-dry							
					Red Brown Clayey fine to coarse Sand, slightly cemented, very dense-dry to damp							
10					Trench Terminated at 10'							

TBL 21G237-2.GPJ SOCALGEO.GDT 11/12/21

TEST TRENCH LOG

PLATE B-3

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Building
Project Location	Menifee, California
Project Number	21G237-2
Engineer	Caleb Brackett

Infiltration Test No: I-1

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Space	2	2.356	2189

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

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	8:10 AM	30	0	250	0	1500	0.69	1.37	0.27	0.54
	Final	8:40 AM	**30**	250		1500					
2	Initial	8:40 AM	30	0	300	0	1000	0.82	0.91	0.32	0.36
	Final	9:10 AM	**60**	300		1000					
3	Initial	9:10 AM	30	0	300	0	1200	0.82	1.10	0.32	0.43
	Final	9:40 AM	**90**	300		1200					
4	Initial	9:40 AM	30	0	250	0	1000	0.69	0.91	0.27	0.36
	Final	10:10 AM	**120**	250		1000					
5	Initial	10:10 AM	30	0	300	0	1100	0.82	1.01	0.32	0.40
	Final	10:40 AM	**150**	300		1100					
6	Initial	10:40 AM	30	0	200	0	1000	0.55	0.91	0.22	0.36
	Final	11:10 AM	**180**	200		1000					

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Building
Project Location	Menifee, California
Project Number	21G237-2
Engineer	Caleb Brackett

Infiltration Test No: I-2

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Space	2	2.356	2189

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

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	10:23 AM	20	0	25	0	200	0.10	0.27	0.04	0.11
	Final	10:43 AM	**20**	25		200					
2	Initial	10:43 AM	20	0	25	0	200	0.10	0.27	0.04	0.11
	Final	11:03 AM	**40**	25		200					
3	Initial	11:03 AM	20	0	0	0	100	0.00	0.14	0.00	0.05
	Final	11:23 AM	**60**	0		100					
4	Initial	11:23 AM	20	0	0	0	200	0.00	0.27	0.00	0.11
	Final	11:43 AM	**80**	0		200					
5	Initial	11:43 AM	20	0	25	0	200	0.10	0.27	0.04	0.11
	Final	12:03 PM	**100**	25		200					
6	Initial	12:23 PM	20	0	0	0	100	0.00	0.14	0.00	0.05
	Final	12:43 PM	**120**	0		100					

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Building
Project Location	Menifee, California
Project Number	21G237-2
Engineer	Caleb Brackett

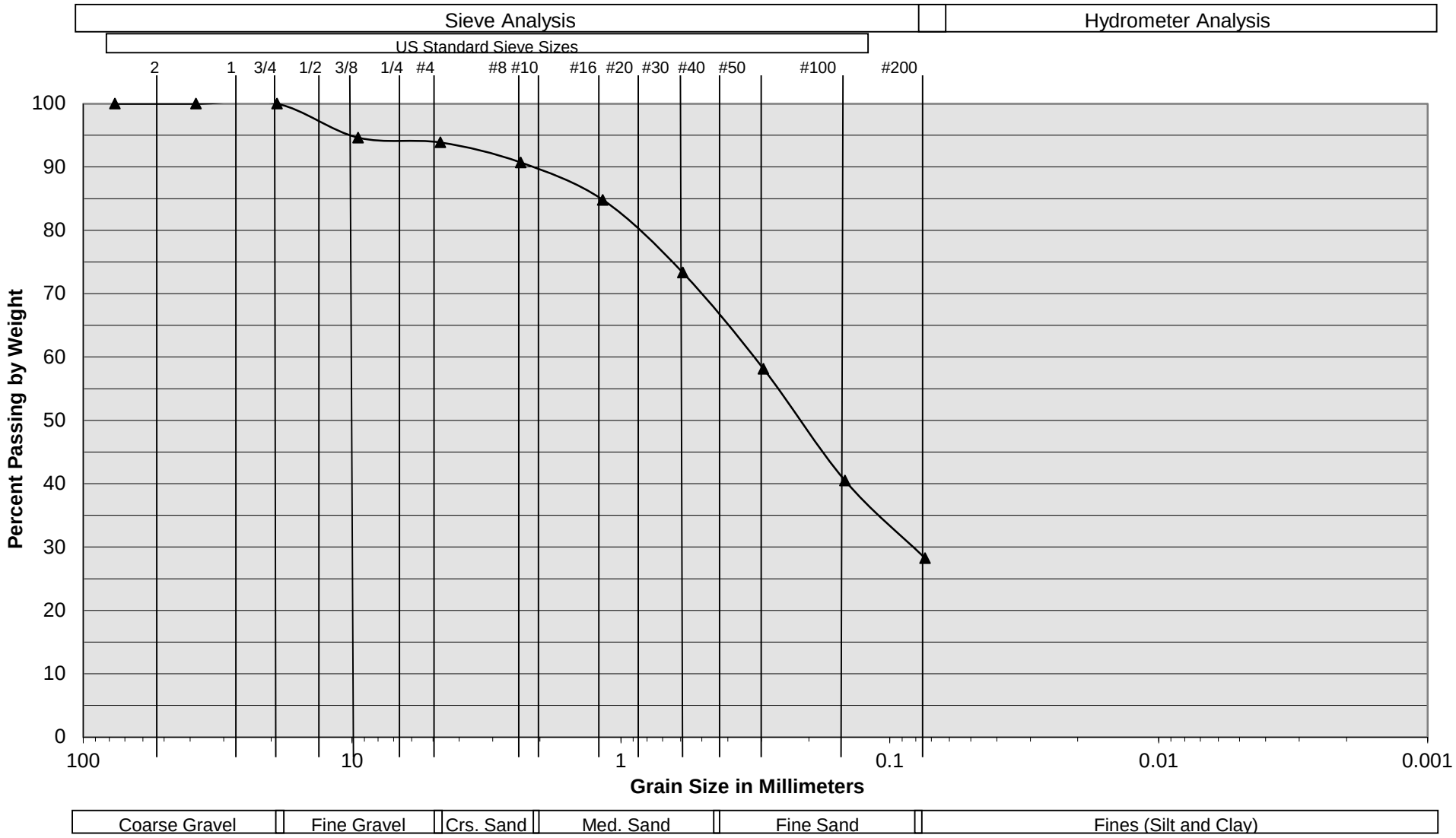
Infiltration Test No: I-3

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Space	2	2.356	2189

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

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	12:20 PM	20	0	50	0	300	0.21	0.41	0.08	0.16
	Final	12:40 PM	**20**	50		300					
2	Initial	12:40 PM	20	0	50	0	300	0.21	0.41	0.08	0.16
	Final	1:00 PM	**40**	50		300					
3	Initial	1:00 PM	20	0	25	0	200	0.10	0.27	0.04	0.11
	Final	1:20 PM	**60**	25		200					
4	Initial	1:20 PM	20	0	25	0	200	0.10	0.27	0.04	0.11
	Final	1:40 PM	**80**	25		200					
5	Initial	1:40 PM	20	0	25	0	100	0.10	0.14	0.04	0.05
	Final	2:00 PM	**100**	25		100					
6	Initial	2:00 PM	20	0	0	0	100	0.00	0.14	0.00	0.05
	Final	2:20 PM	**120**	0		100					

Grain Size Distribution



Sample Description	I-1 @6'
Soil Classification	0

Proposed Industrial Building
Menifee, California
Project No. 21G237-2
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

Sample Description	I-2 @ 8'
Soil Classification	Red Brown Clayey fine to medium Sand, trace fine Gravel

Proposed Industrial Building
Menifee, California
Project No. 21G237-2
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

Sample Description	I-3 @ 10'
Soil Classification	Red Brown Clayey fine to coarse Sand

Proposed Industrial Building
Menifee, California
Project No. 21G237-2
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

NOT APPLICABLE.

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

NOT APPLICABLE.

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Ware Malcomb	Date	6/30/2023
Designed by	Anthony Castelo	Case No	TBD
Company Project Number/Name	IRV22-0086 Ares Menifee		

BMP Identification

BMP NAME / ID: BMP On-Site - Biotreatment - MWS A & B

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA 1A	*505,227*	*Concrete or Asphalt*	*1*	*0.89*	*450662.5*			
DMA 1B	*80,197*	*Natural (D Soil)*	*0.4*	*0.28*	*22432.1*			
DMA 1C	*510,801*	*Roofs*	*1*	*0.89*	*455634.5*			
	1096225	***Total***			**928729.1**	**0.60**	***46436.5***	***50,240***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Ware Malcomb	Date	6/30/2023
Designed by	Anthony Castelo	Case No	TBD
Company Project Number/Name	IRV22-0086 Ares Menifee		

BMP Identification

BMP NAME / ID: BMP Off-Site - Biotreatment - MWS C

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

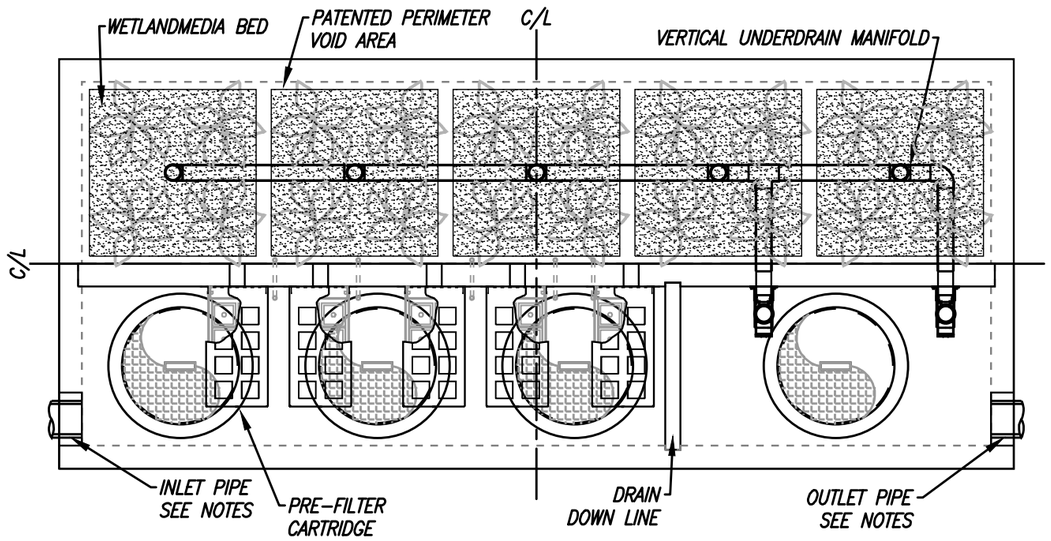
DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMA 6A	*133,944*	*Concrete or Asphalt*	*1*	*0.89*	*119478*			
DMA 6B	*22,574*	*Natural (D Soil)*	*0.4*	*0.27971*	*6314.2*			
	156518		***Total***		**125792.2**	**0.20**	***0.6***	***0.693***

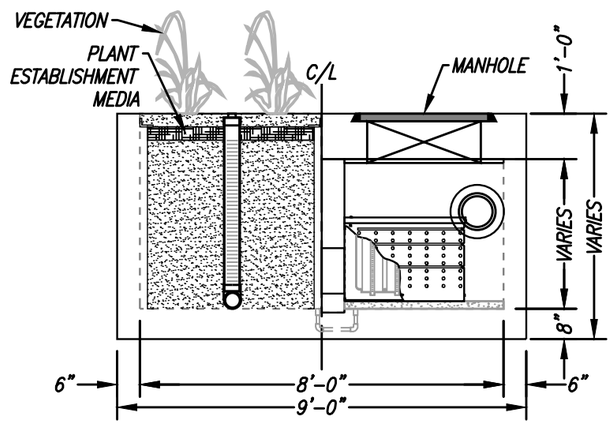
Notes:

SITE SPECIFIC DATA			
PROJECT NUMBER		IRV22-0086	
PROJECT NAME		ARES MENIFEE	
PROJECT LOCATION		CITY OF MENIFEE	
STRUCTURE ID		MWS A & B - ON-SITE	
TREATMENT REQUIRED			
FLOW BASED (CFS)			
N/A			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1414.04	PVC	12
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	1413.04	PVC	12
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1422.59		
SURFACE LOAD	PEDESTRIAN		
NOTES: UNITS WILL BE VOLUME BASED. TOTAL TREATMENT CAPACITY IS 50,240 CF.			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



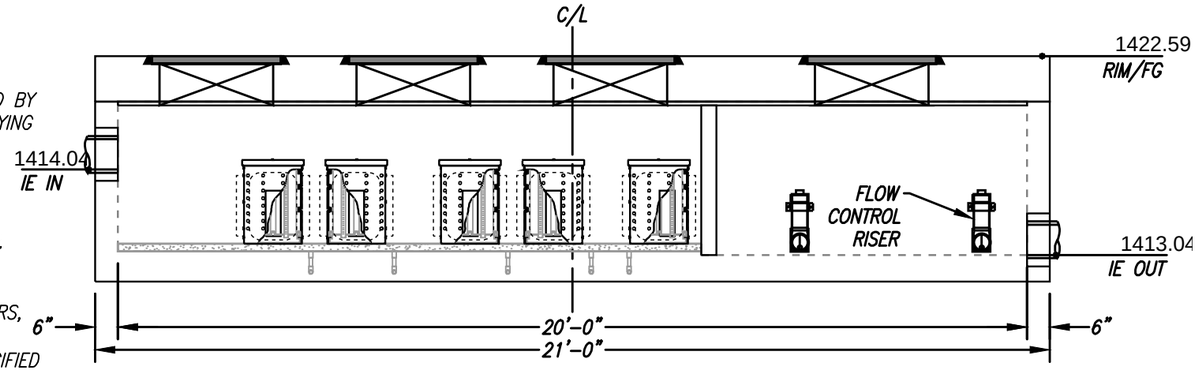
LEFT END VIEW

INSTALLATION NOTES

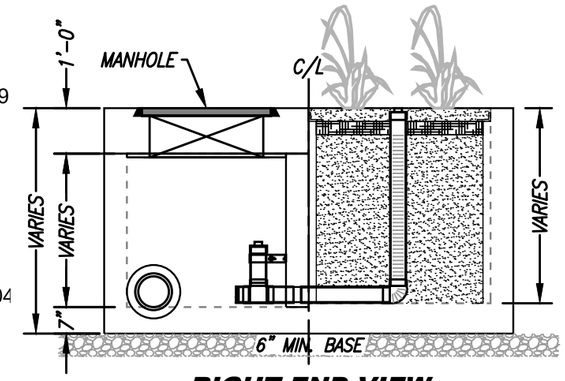
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS' SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.

GENERAL NOTES

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



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	null
OPERATING HEAD (FT)	0.0
PRETREATMENT LOADING RATE (GPM/SF)	0.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

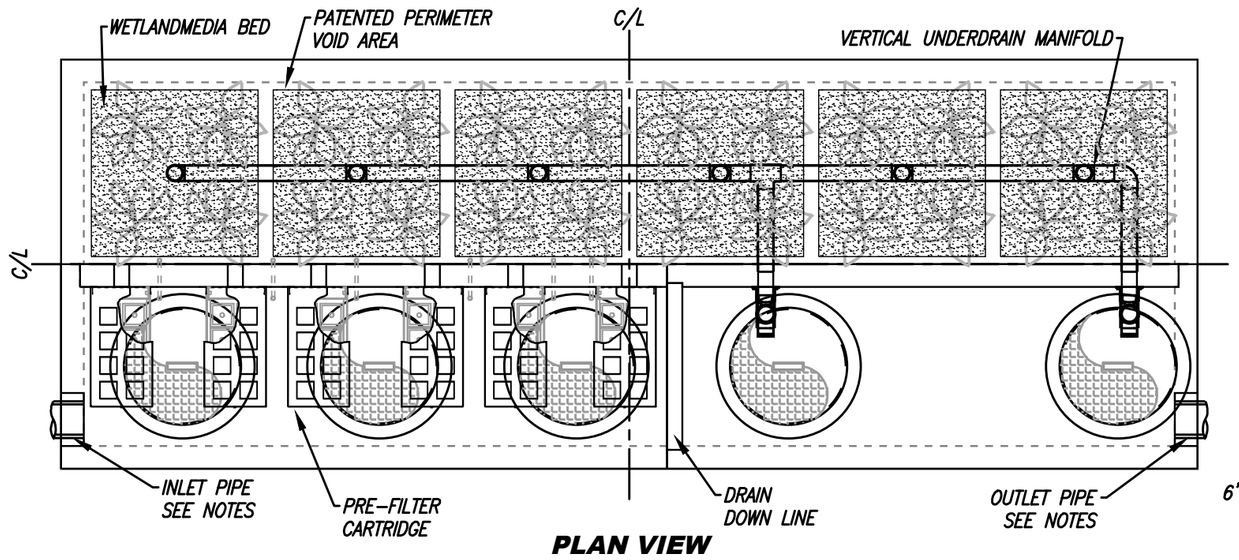
MODULAR WETLANDS
FOR PATENT INFORMATION, GO TO www.ContechES.com/IP

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

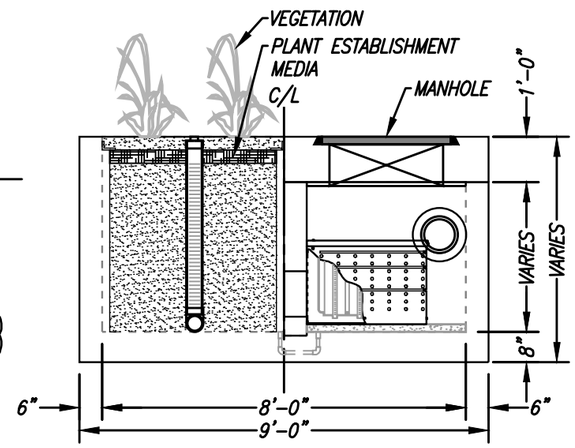
MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NUMBER		IRV22-0086	
PROJECT NAME		ARES MENIFEE	
PROJECT LOCATION		CITY OF MENIFEE	
STRUCTURE ID		MWS C - OFF-SITE	
TREATMENT REQUIRED			
FLOW BASED (CFS)			
0.693			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1422.01		
SURFACE LOAD	PEDESTRIAN		
NOTES: UNIT TO BE CURB-OPENING TYPE WITH OPENING AT ELEVATION 1421.92.			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



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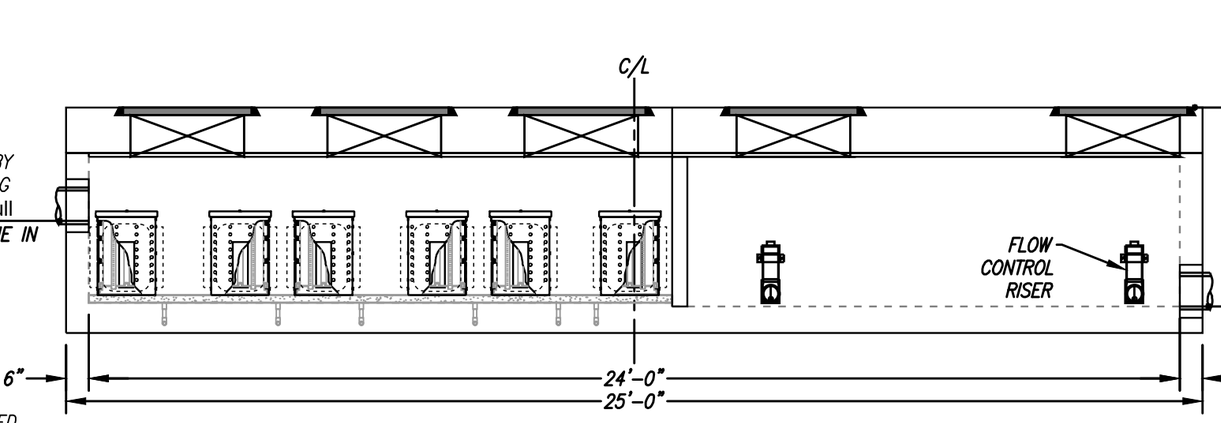
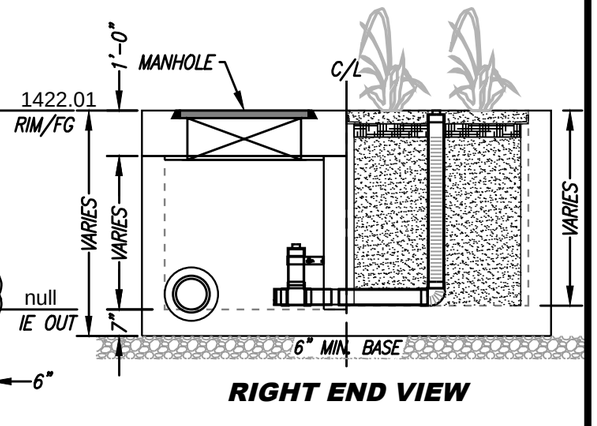


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.693
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS
FOR PATENT INFORMATION, GO TO www.ContechES.com/IP

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

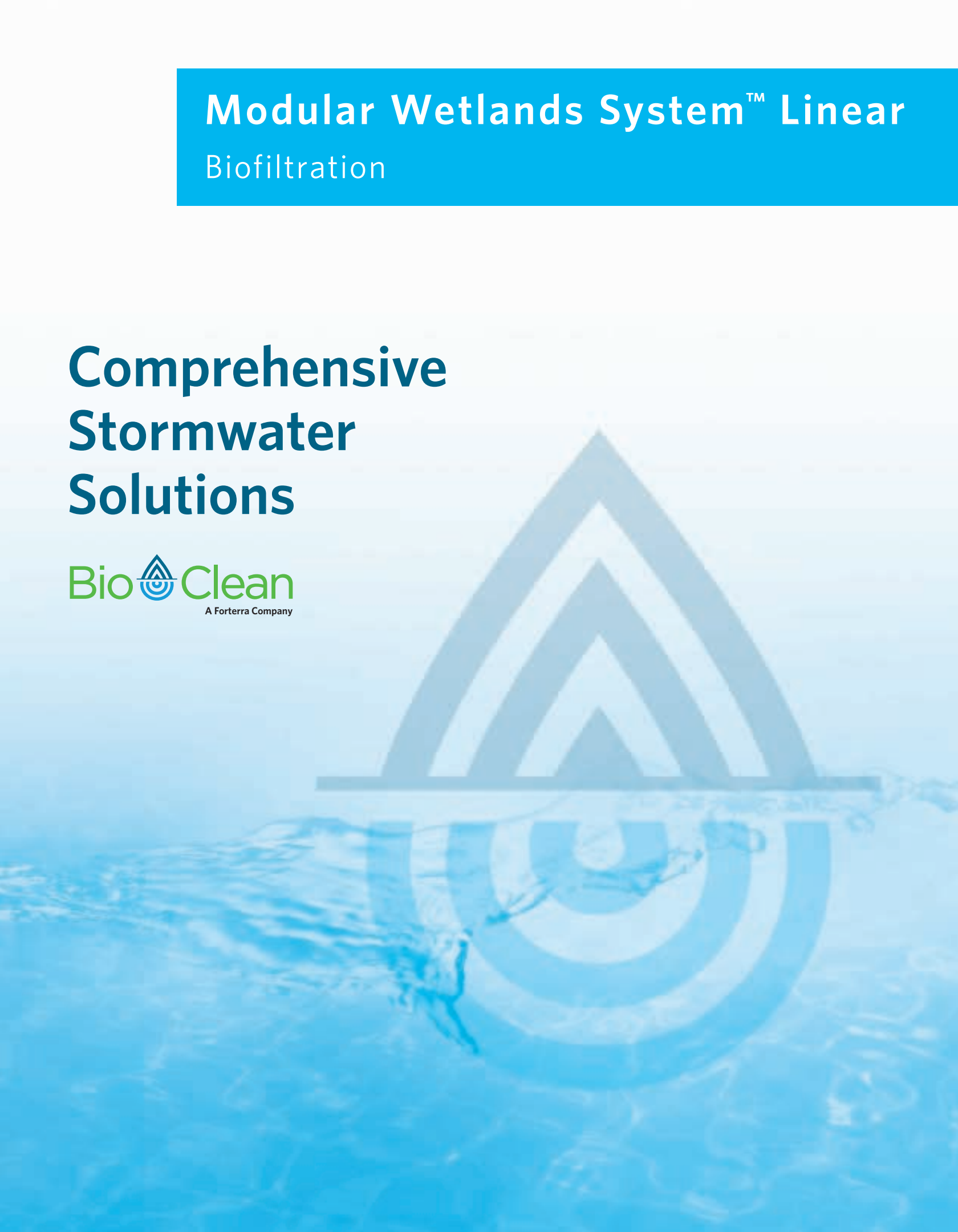
MWS-L-8-24-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Modular Wetlands System™ Linear

Biofiltration

Comprehensive Stormwater Solutions

Bio Clean
A Forterra Company



OVERVIEW

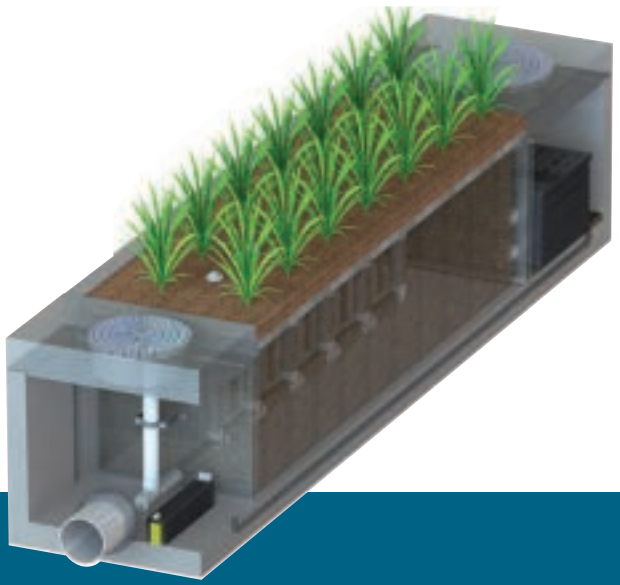
The Bio Clean Modular Wetlands System™ Linear (MWS Linear) represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pretreatment, the MWS Linear incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, in turn reducing maintenance costs and improving performance.

The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands, our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate waterways in urban areas.



PERFORMANCE

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With its advanced pretreatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses nature's ability to process, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world.

WASHINGTON STATE TAPE APPROVED

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

DEQ ASSIGNMENT

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Regulation technical criteria.

MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED

Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP EVALUATION

The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

RHODE ISLAND DEM APPROVED

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The MWS Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure 1 and Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

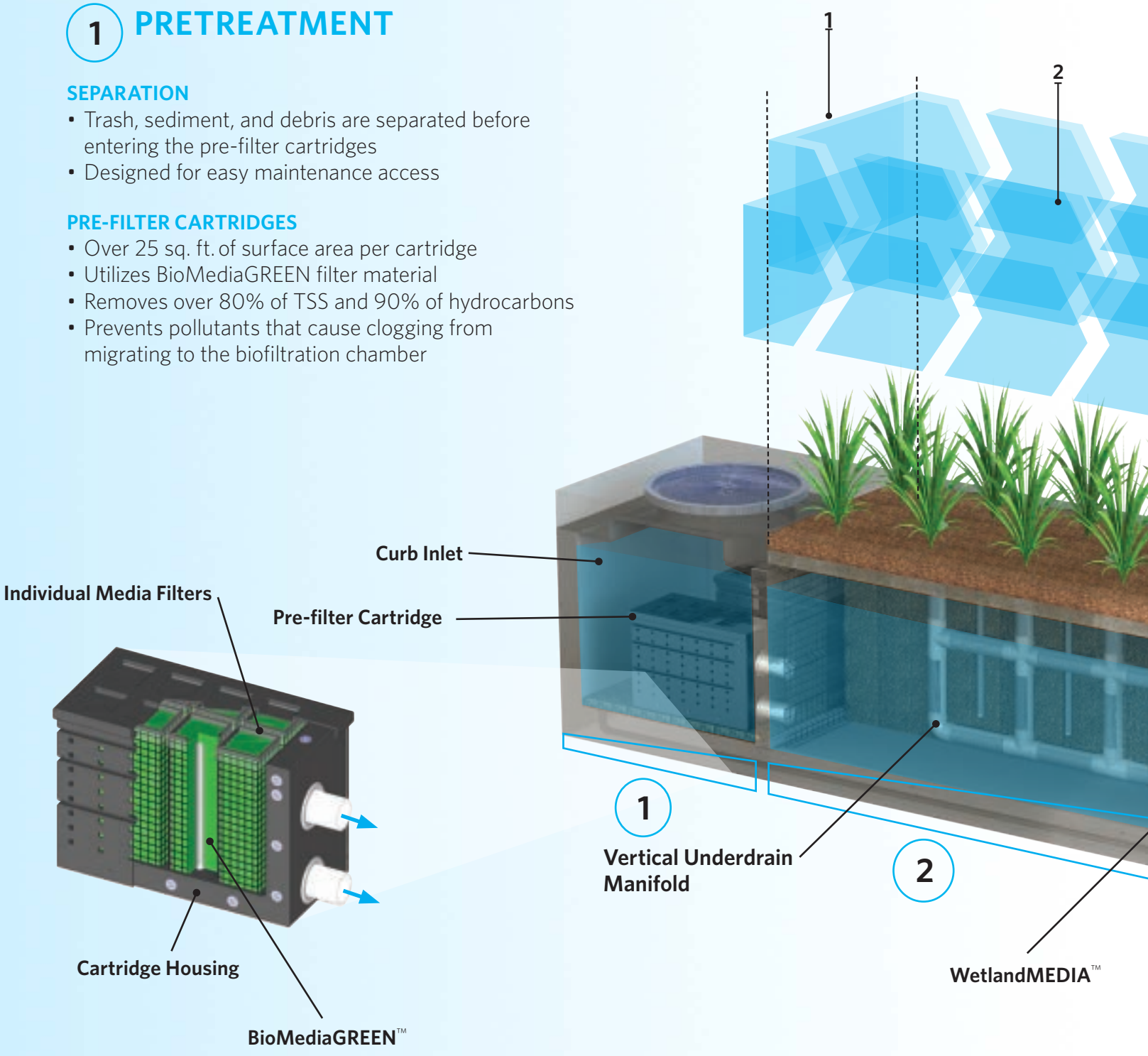
1 PRETREATMENT

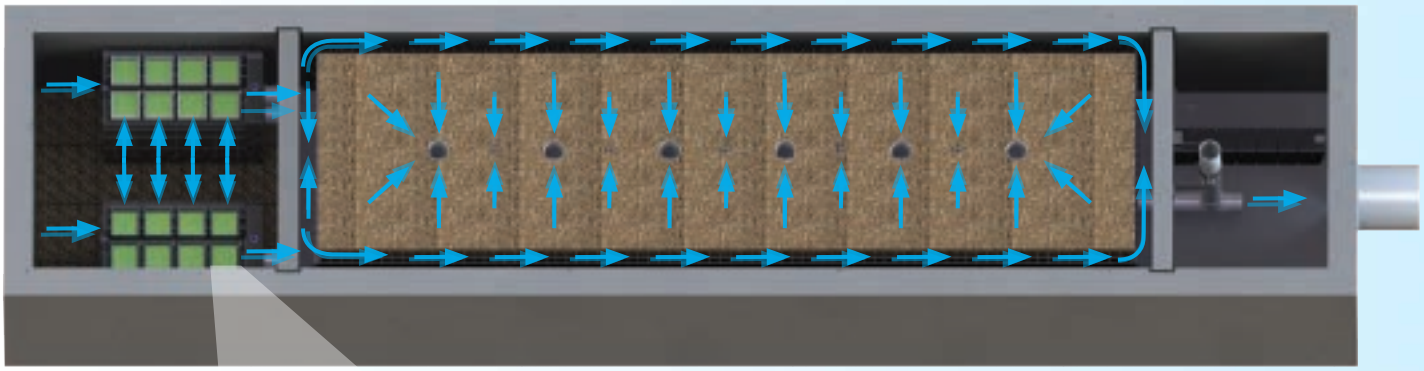
SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber





2x to 3x more surface area than traditional downward flow bioretention systems.

Figure 2, Top View

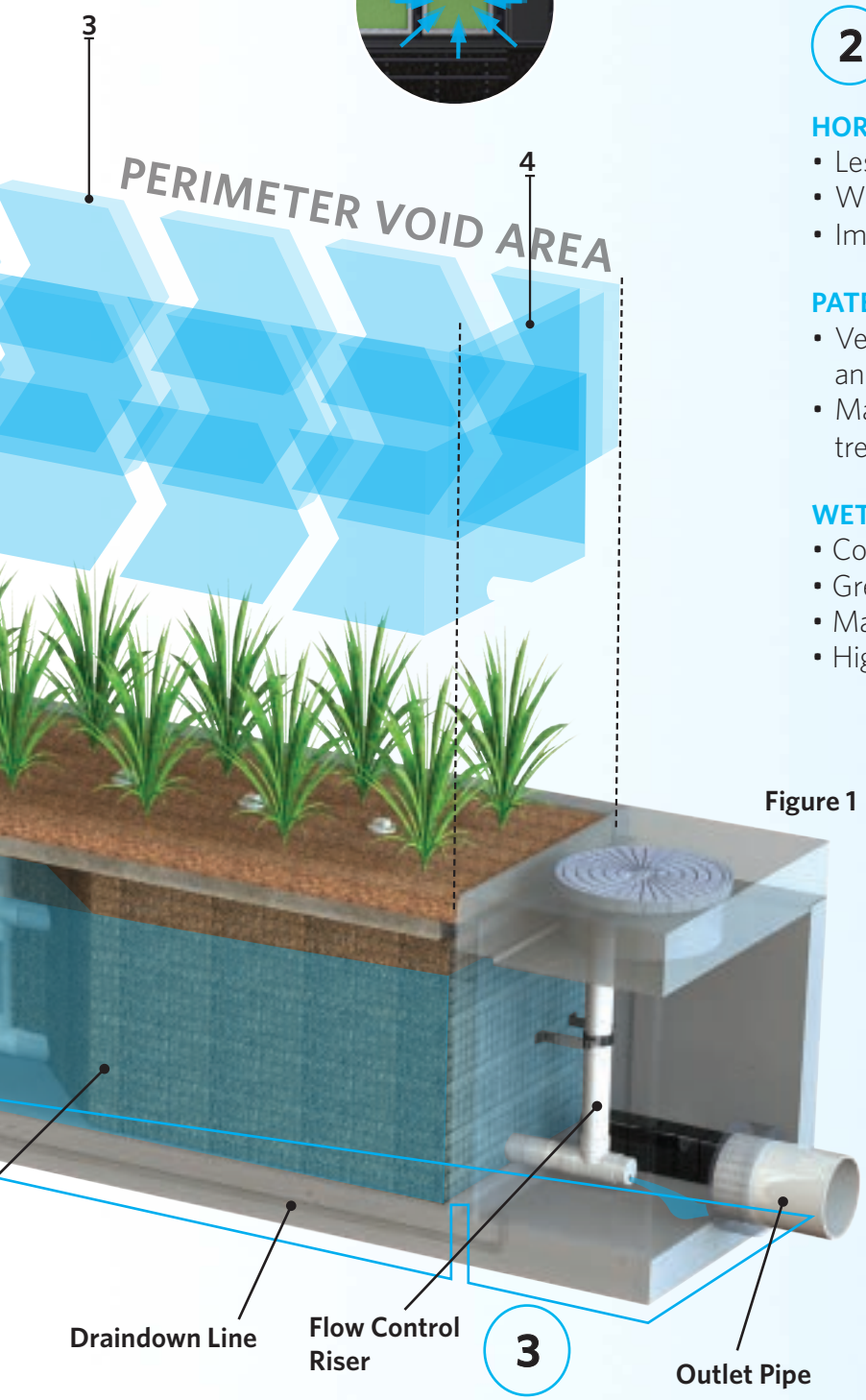


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

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

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

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

DRAINDOWN FILTER

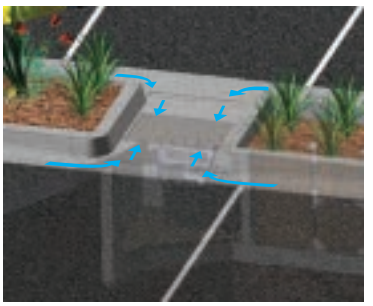
- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated

CONFIGURATIONS

The MWS Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.

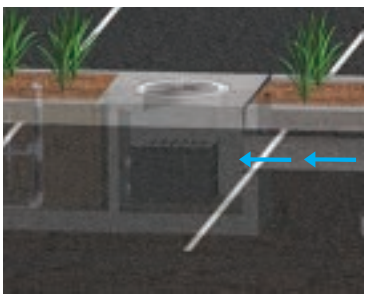
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

DOWNSPOUT TYPE

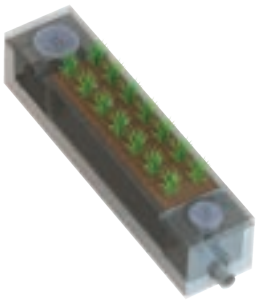
The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be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

ORIENTATIONS

SIDE-BY-SIDE

The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side.This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

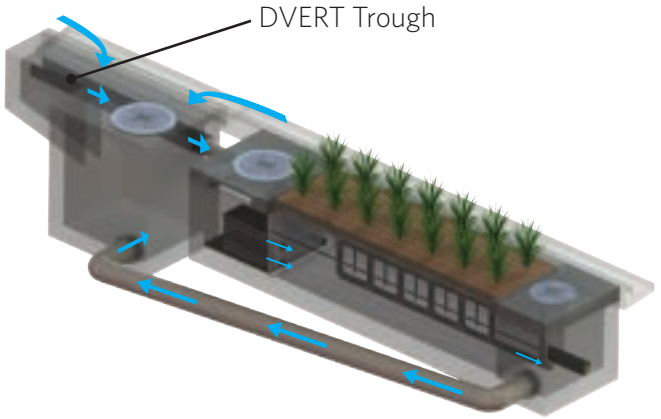
EXTERNAL DIVERSION WEIR STRUCTURE

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the MWS Linear to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED

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

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

MWS C

SPECIFICATIONS

VOLUME-BASED

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

MODEL #	TREATMENT CAPACITY (cu. ft.) @ 24-HOUR DRAINDOWN	TREATMENT CAPACITY (cu. ft.) @ 48-HOUR DRAINDOWN
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-6-8	3191	6382
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145
MWS-L-8-20	12560	25120
MWS-L-8-24	15108	30216

MWS A & B

APPLICATIONS

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.

RESIDENTIAL

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

STREETS

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

PARKING LOTS

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

COMMERCIAL

Compared to bioretention systems, the MWS Linear can treat far more area in less space, meeting treatment and volume control requirements.

MIXED USE

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION

The MWS Linear is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

MAINTENANCE

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pretreatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

Bio Clean
A Forterra Company

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biocleanenvironmental.com

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CONTECH®
ENGINEERED SOLUTIONS

Modular Wetlands® Linear Stormwater Biofiltration

The experts you need to solve your stormwater challenges

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

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

Your Contech Team

STORMWATER CONSULTANT

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

STORMWATER DESIGN ENGINEER

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

REGULATORY MANAGER

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

SALES ENGINEER

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

Contech is your partner in stormwater management solutions

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

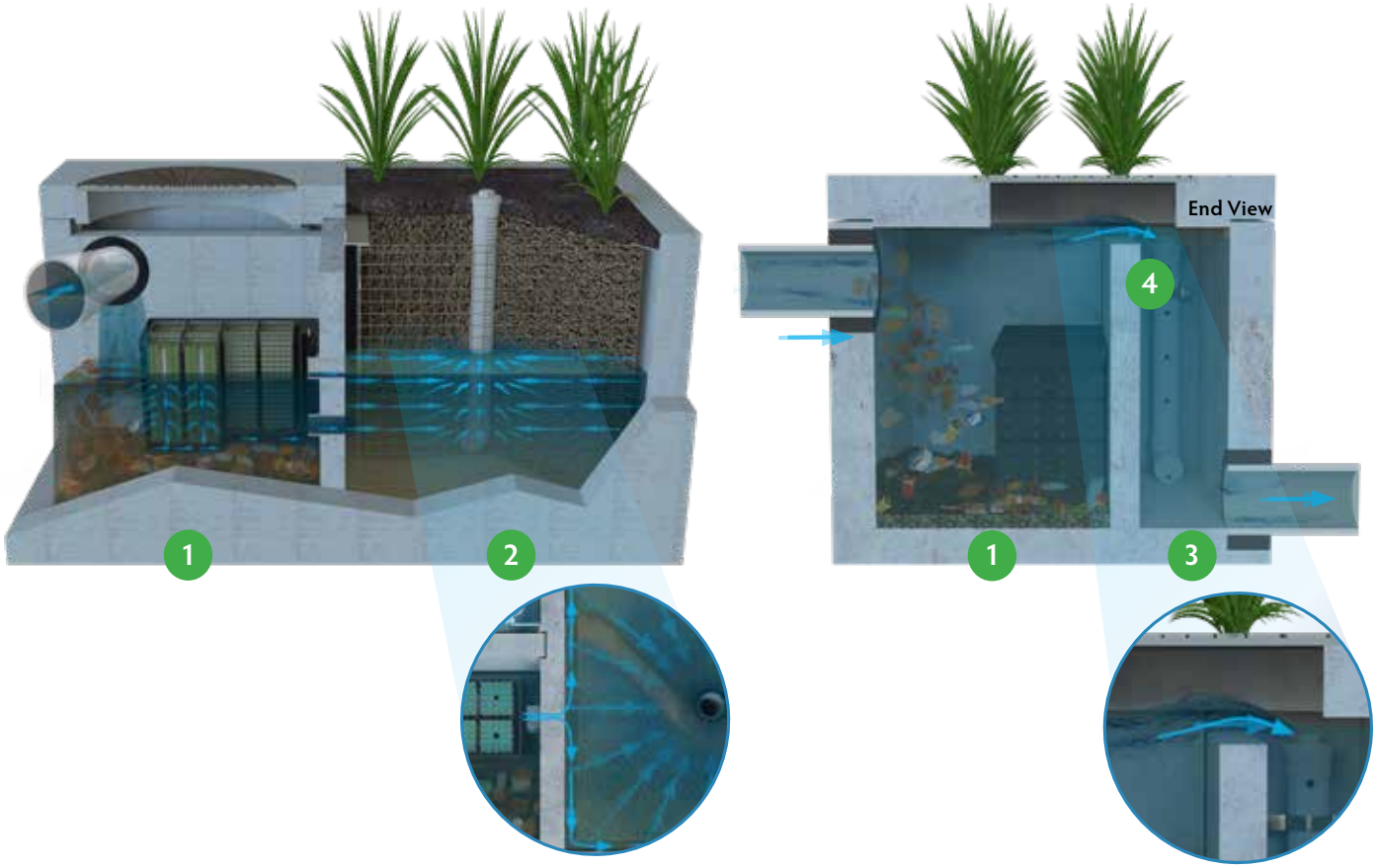
As cities grow, there is less space for natural solutions to treat stormwater. Contech understands this and is committed to providing compact, Low Impact Development (LID) solutions like the Modular Wetlands Linear to protect our nation's waterways.

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

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

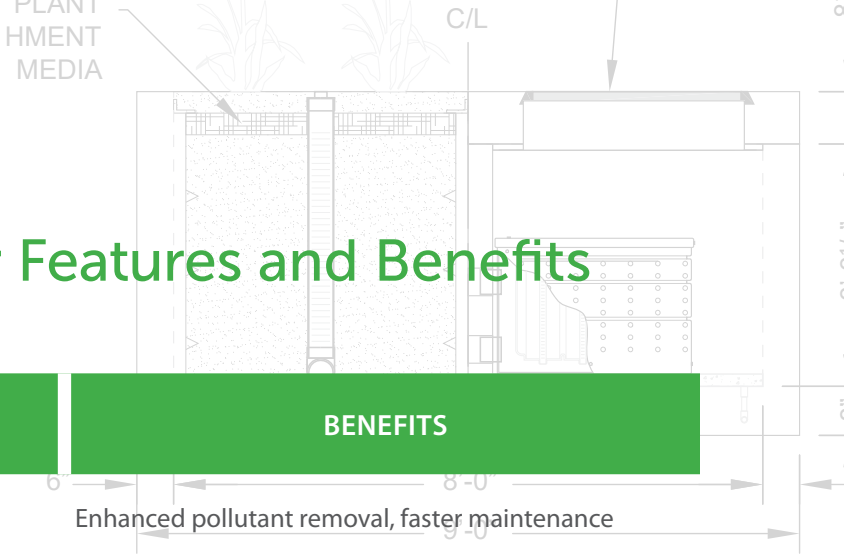
MODULAR WETLANDS®

How the Modular Wetlands® Linear Works



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

Using horizontal flow to improve performance



Modular Wetlands® Linear Features and Benefits

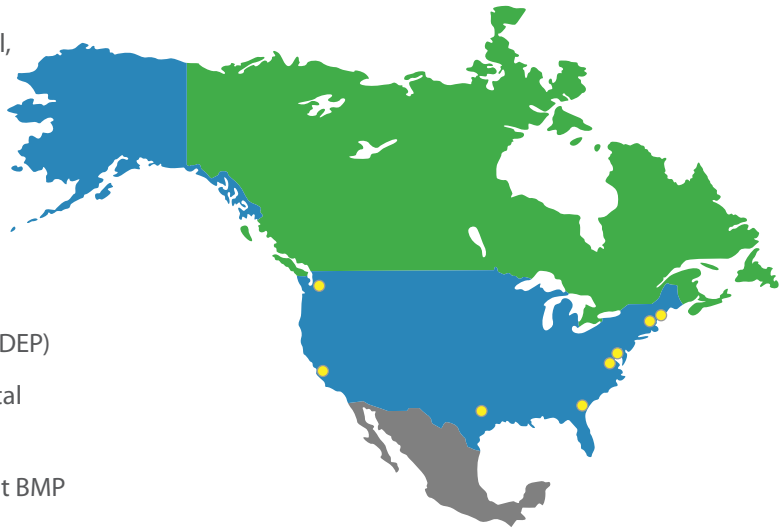
FEATURE	BENEFITS
Pretreatment chamber	Enhanced pollutant removal, faster maintenance
Horizontal flow biofiltration	Greater filter surface area
Performance verified by both the WA DOE and NJ DEP	Superior pollutant capture with confidence
Built-in high flow bypass	Eliminates flooding and the need for a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

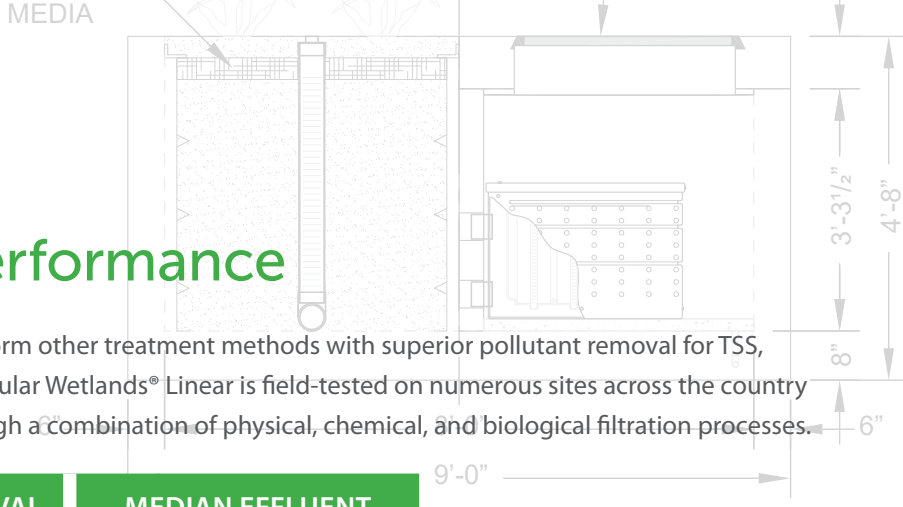
The Modular Wetlands system offers many different configurations.

Select Modular Wetlands® Linear Approvals

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

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





Modular Wetlands® Performance

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

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

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

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

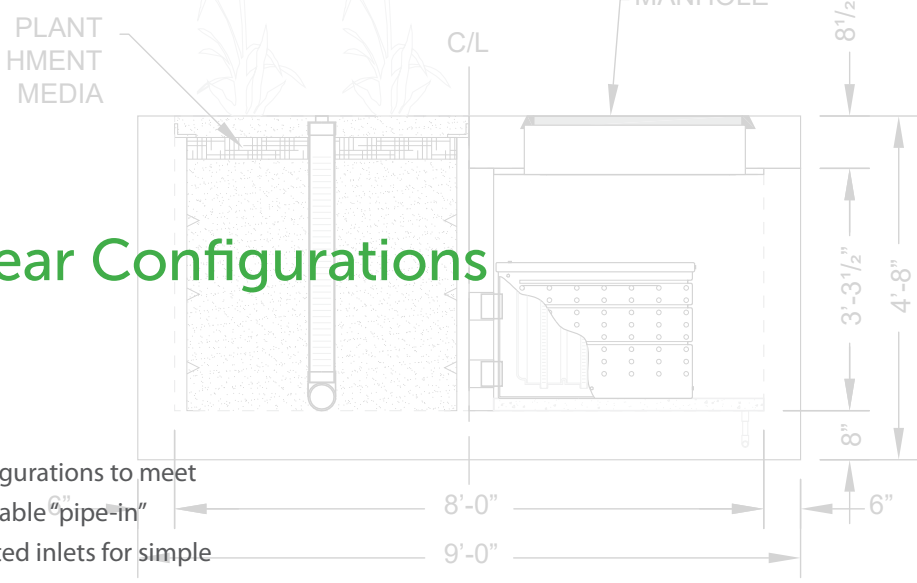
Modular Wetlands® Linear Maintenance

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

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

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

Multiple configurations allow for easy site integration



Modular Wetlands® Linear Configurations

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

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

Curb Inlet

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

Vault

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

Downspout

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

A partner you can rely on

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

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

THE CONTECH WAY

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

TAKE THE NEXT STEP

For more information: www.ContechES.com

CONTECH® ENGINEERED SOLUTIONS

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PROJECT INFORMATION	
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ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP

ARES MENIFEE

MENIFEE, CA, USA

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-7200.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1. STORMTECH MC-7200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-7200 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-7200 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

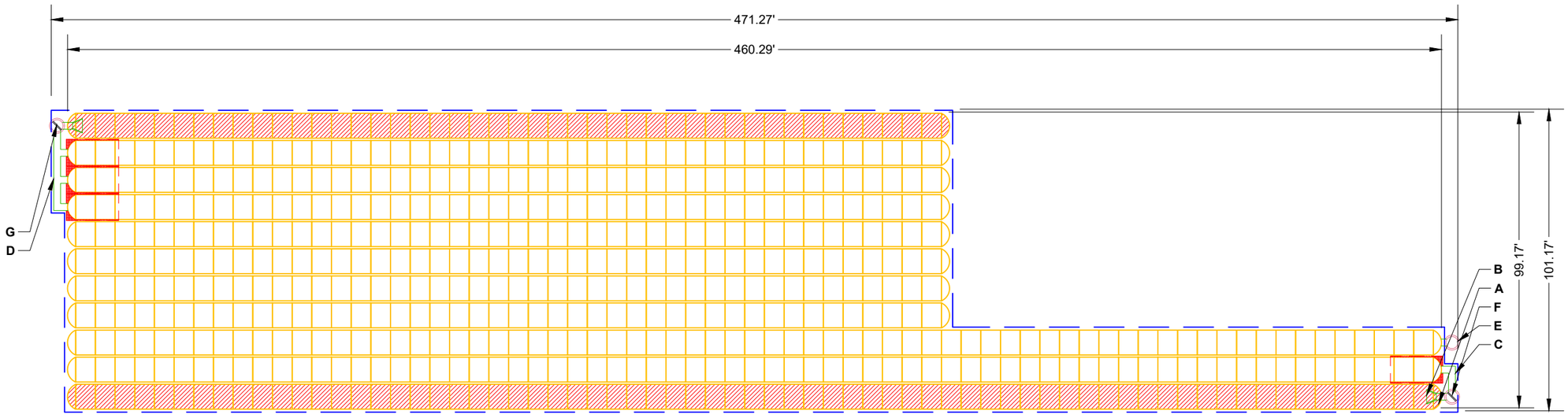
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS	
559	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
22	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
154076	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-7200 CHAMBER:	5.75
		24" x 24" BOTTOM MANIFOLD INVERT:	0.94
		24" x 24" BOTTOM MANIFOLD INVERT:	0.94
35021	SYSTEM AREA (SF)	24" ISOLATOR ROW PLUS INVERT:	0.94
1144.9	SYSTEM PERIMETER (ft)	24" ISOLATOR ROW PLUS INVERT:	0.94
		24" BOTTOM CONNECTION 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" 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#: MC720024RAMP (TYP 2 PLACES)		
MANIFOLD	C	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.26"	
MANIFOLD	D	24" x 24" BOTTOM MANIFOLD, ADS N-12	2.26"	
CONCRETE STRUCTURE	E	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		7.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		9.5 CFS IN
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		28.5 CFS IN



ISOLATOR ROW PLUS
(SEE DETAIL/TYP 2 PLACES)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

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

ARES MENIFEE
MENIFEE, CA, USA
DRAWN: JP
CHECKED: N/A
DATE:
PROJECT #:

DESCRIPTION	CHK	DRW	DATE

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

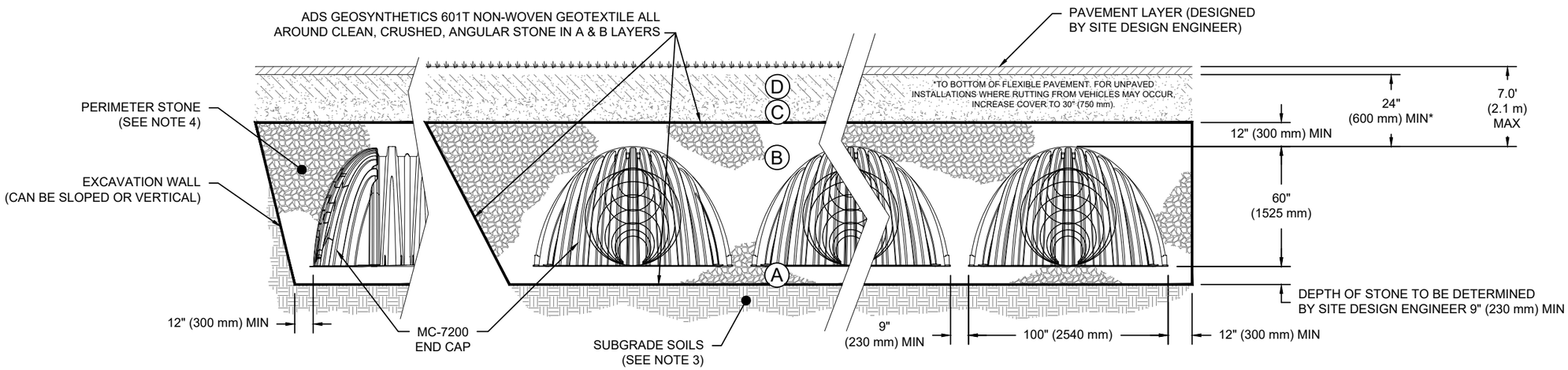
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

0 40 80

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.



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 SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. 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.

ARES MENIFEE
MENIFEE, CA, USA
DATE:
DRAWN: JP
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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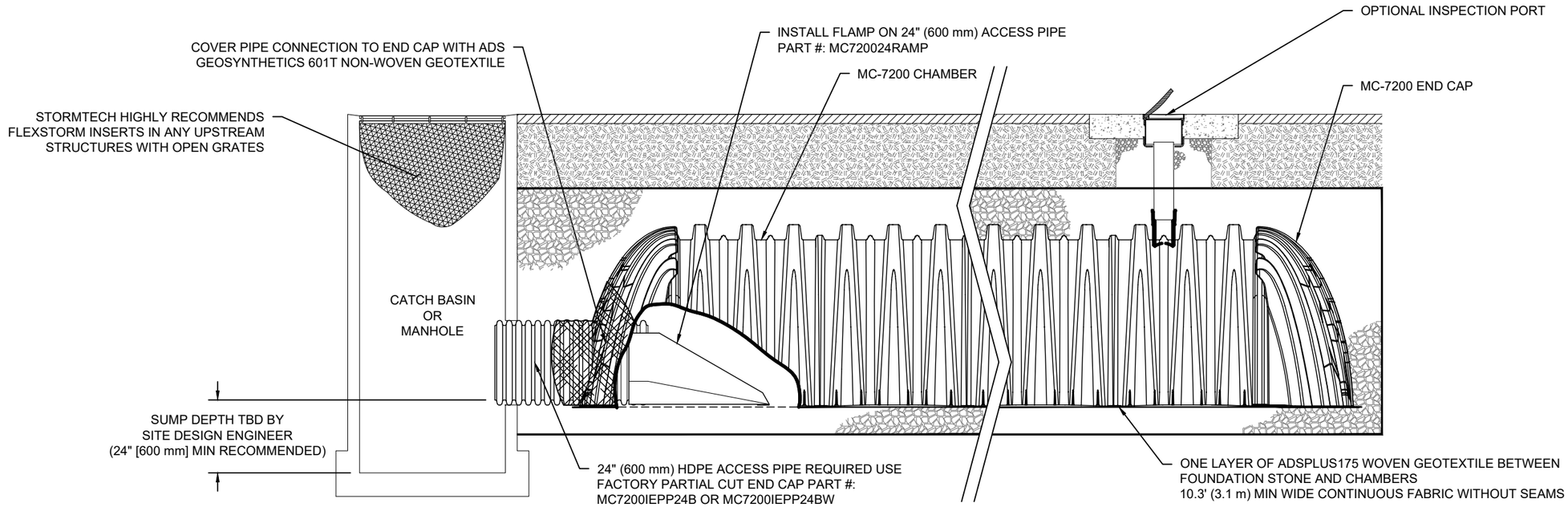
HILLIARD, OH 43026
1-800-733-7473

SHEET
3 OF 5



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.

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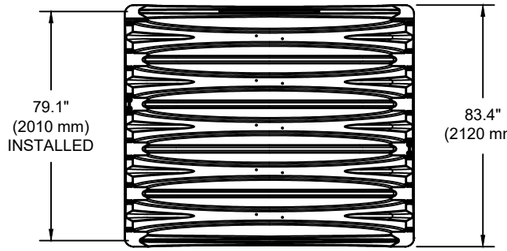
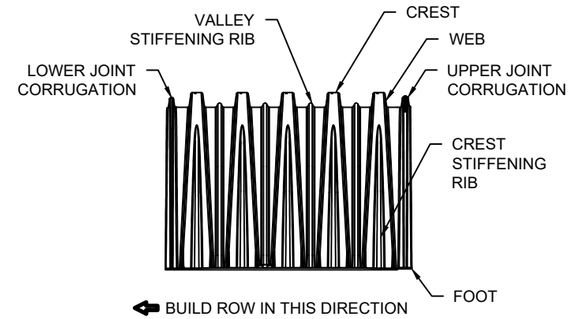
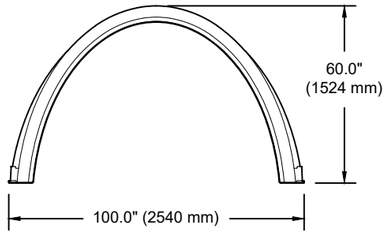
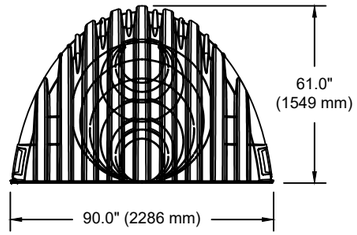
MC-7200 TECHNICAL SPECIFICATION

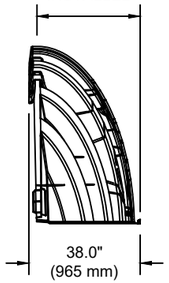
NTS











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

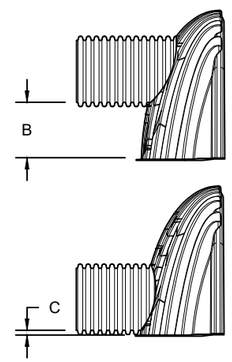
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*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)

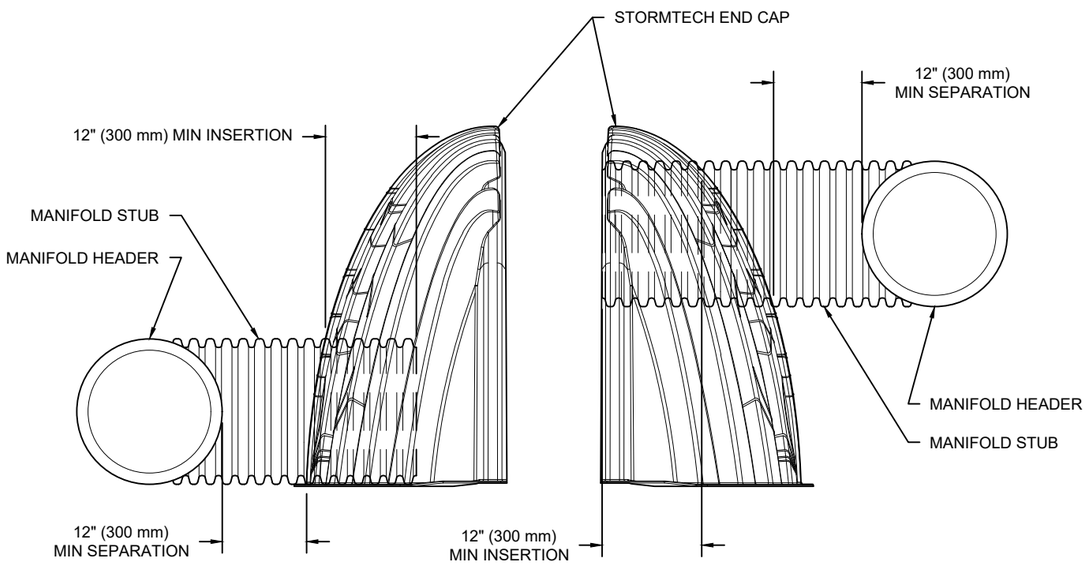
NOTE: ALL DIMENSIONS ARE NOMINAL



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-SERIES END CAP INSERTION DETAIL

NTS



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

ARES MENIFEE
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DATE	DRW	CHK	DESCRIPTION

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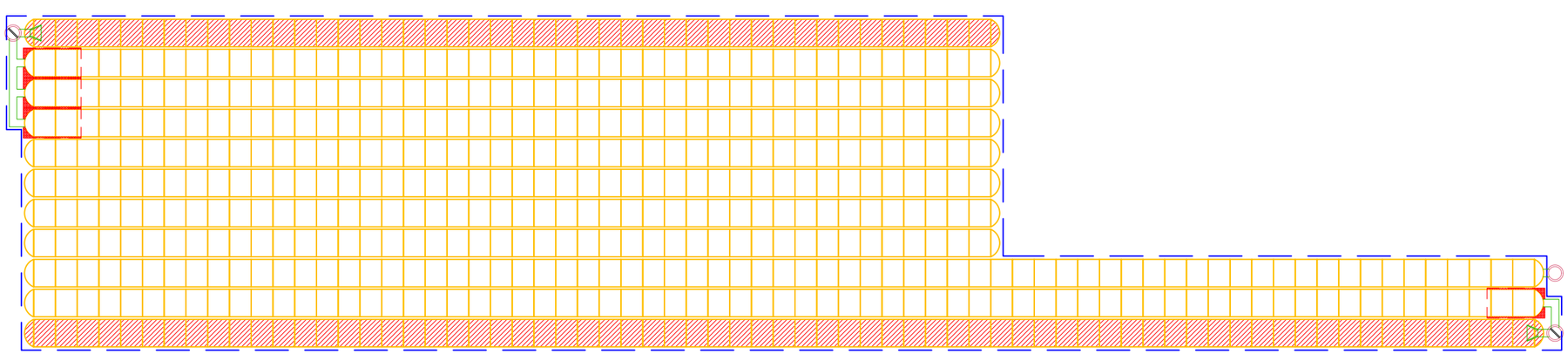
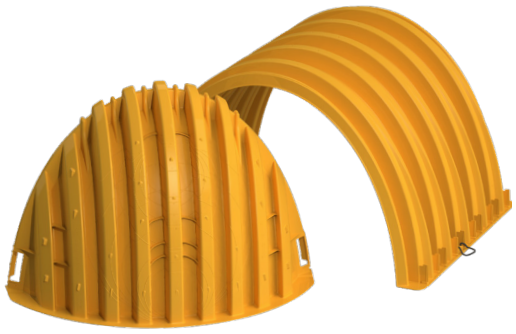


StormTech® MC-7200 Chamber

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)

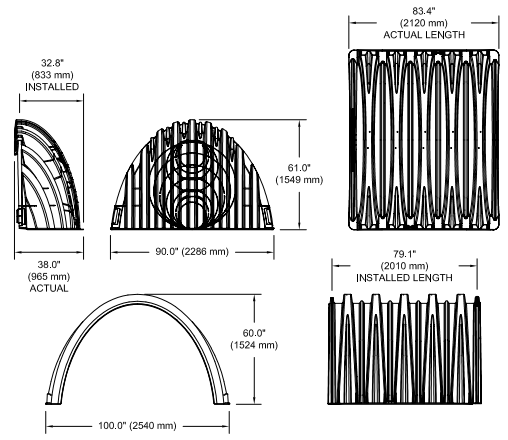
Size (L x W x H)
38” x 90” x 61”
965 mm x 2286 mm x 1549 mm

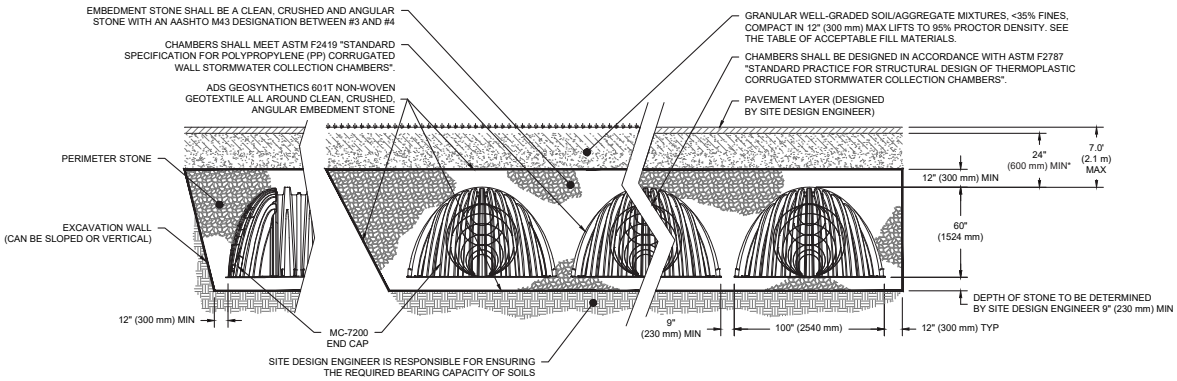
End Cap Storage
39.5 ft³ (1.12 m³)

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).

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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.

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ADS StormTech™

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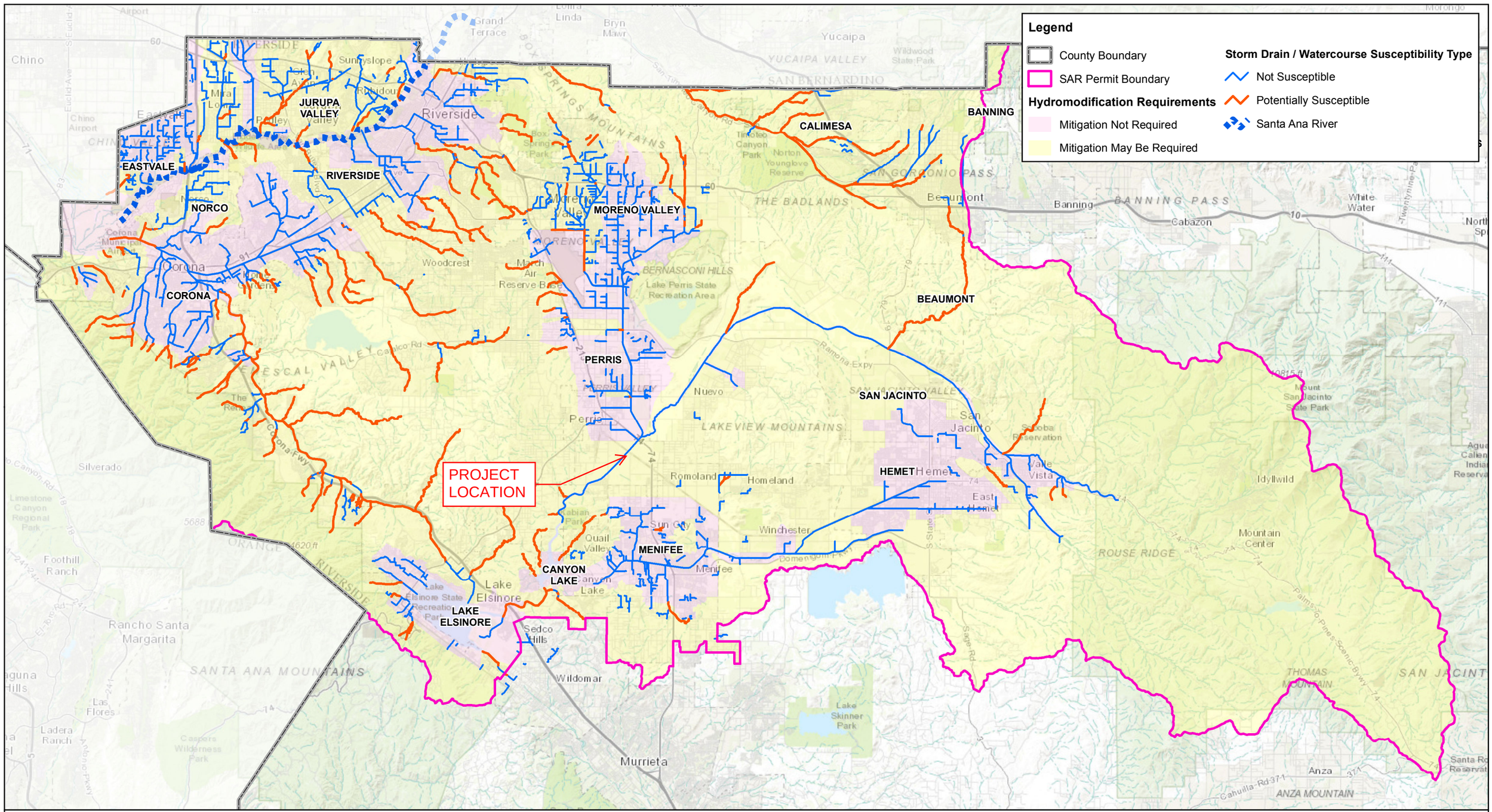
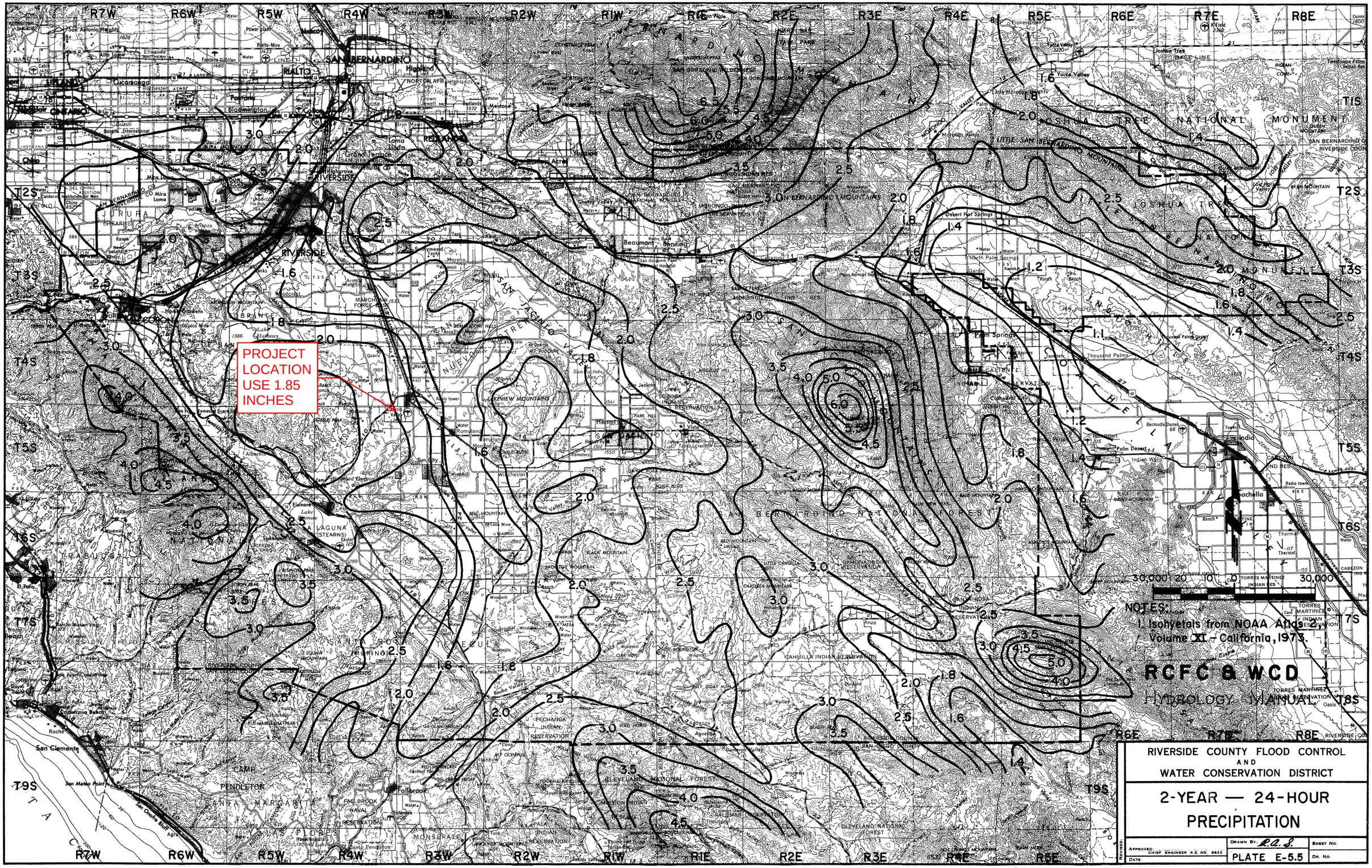
Appendix 7: Hydromodification

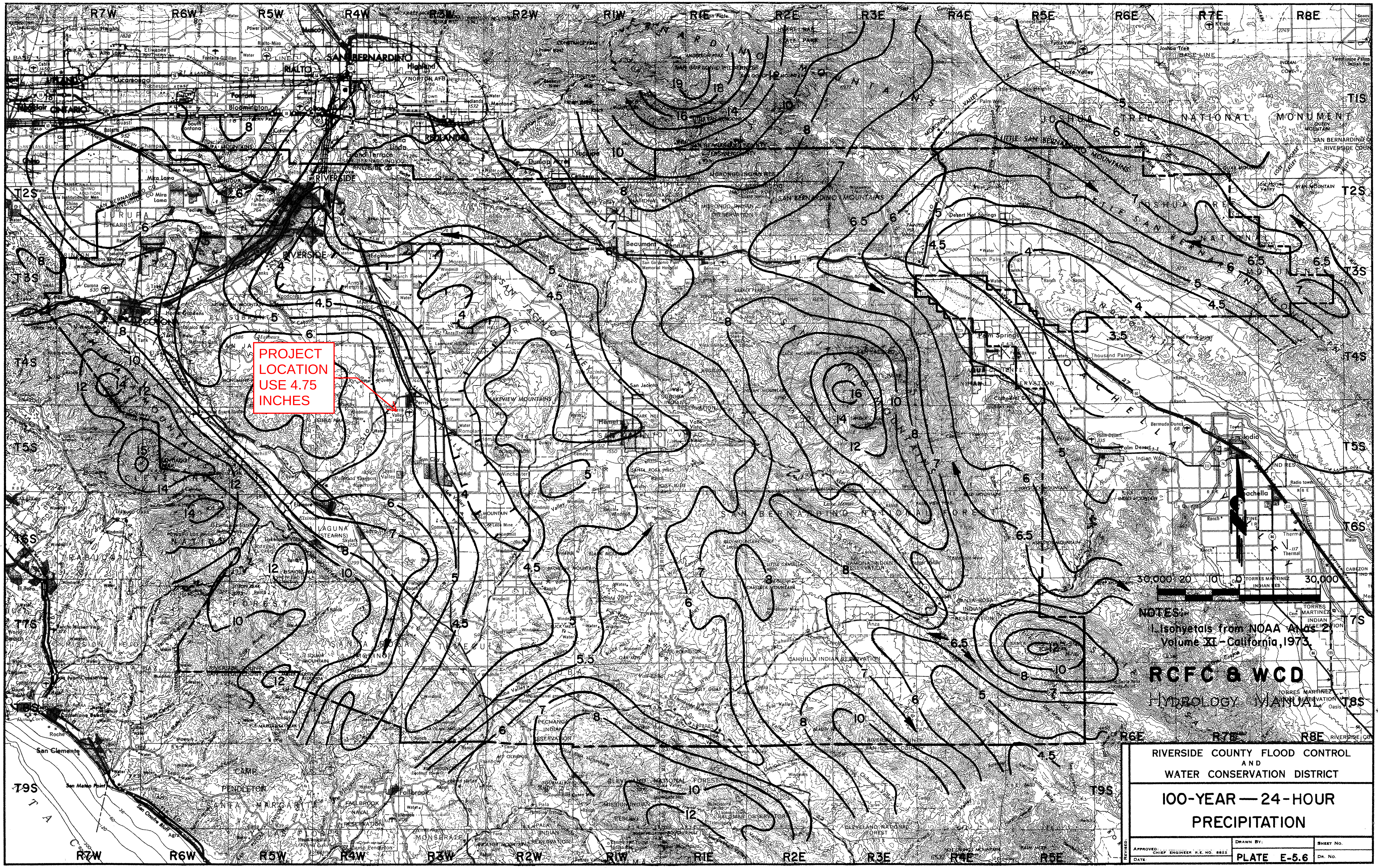
Supporting Detail Relating to Hydrologic Conditions of Concern



HCOC Applicability Map
SAR Permittees

Map 2


PROJECT LOCATION USE 1.85 INCHES
NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
2-YEAR — 24-HOUR PRECIPITATION
DRAWN BY: R.A.S.
PLATE E-5.5
SHEET NO.
DR. NO.
APPROVED, CHIEF ENGINEER R.E. NO. 6822
DATE
REVISED


PROJECT
LOCATION
USE 4.75
INCHES
NOTES:
1. Isohyetals from NOAA Atlas 2
Volume XI - California, 1973.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
100-YEAR — 24-HOUR
PRECIPITATION
PLATE E-5.6

U n i t H y d r o g r a p h A n a l y s i s

Study date 06/29/23 File: MenifeeExUH2YR24HR242.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

IRV22-0086 ARES MENIFEE - EXISTING 2 YEAR 24 HOUR UNIT HYDROGRAPH

Program License Serial Number 6350

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Drainage Area = 26.58(Ac.) = 0.042 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 26.58(Ac.) = 0.042 Sq. Mi.
Length along longest watercourse = 1818.00(Ft.)
Length along longest watercourse measured to centroid = 661.80(Ft.)
Length along longest watercourse = 0.344 Mi.
Length along longest watercourse measured to centroid = 0.125 Mi.
Difference in elevation = 21.07(Ft.)
Slope along watercourse = 61.1934 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time = 0.100 Hr.
Lag time = 5.99 Min.
25% of lag time = 1.50 Min.
40% of lag time = 2.40 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
26.58	1.85	49.17

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
26.58	4.75	126.25

STORM EVENT (YEAR) = 2.00

Area Averaged 2-Year Rainfall = 1.850(In)
Area Averaged 100-Year Rainfall = 4.750(In)

Point rain (area averaged) = 1.850(In)
Areal adjustment factor = 99.99 %
Adjusted average point rain = 1.850(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
26.579	93.00	0.000

Total Area Entered = 26.58(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
93.0	83.4	0.205	0.000	0.205	1.000	0.205
					Sum (F) =	0.205

Area averaged mean soil loss (F) (In/Hr) = 0.205
Minimum soil loss rate ((In/Hr)) = 0.103
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	83.491	14.285	3.826
2	0.167	166.982	45.525	12.195
3	0.250	250.473	18.969	5.081
4	0.333	333.964	8.021	2.149
5	0.417	417.455	4.785	1.282
6	0.500	500.946	2.979	0.798
7	0.583	584.438	2.148	0.575
8	0.667	667.929	1.442	0.386
9	0.750	751.420	0.944	0.253
10	0.833	834.911	0.903	0.242
			Sum = 100.000	Sum= 26.787

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)

1	0.08	0.07	0.015	(0.364)	0.013	0.001
2	0.17	0.07	0.015	(0.362)	0.013	0.001
3	0.25	0.07	0.015	(0.361)	0.013	0.001
4	0.33	0.10	0.022	(0.360)	0.020	0.002
5	0.42	0.10	0.022	(0.358)	0.020	0.002
6	0.50	0.10	0.022	(0.357)	0.020	0.002
7	0.58	0.10	0.022	(0.355)	0.020	0.002
8	0.67	0.10	0.022	(0.354)	0.020	0.002
9	0.75	0.10	0.022	(0.353)	0.020	0.002
10	0.83	0.13	0.030	(0.351)	0.027	0.003
11	0.92	0.13	0.030	(0.350)	0.027	0.003
12	1.00	0.13	0.030	(0.349)	0.027	0.003
13	1.08	0.10	0.022	(0.347)	0.020	0.002
14	1.17	0.10	0.022	(0.346)	0.020	0.002
15	1.25	0.10	0.022	(0.344)	0.020	0.002
16	1.33	0.10	0.022	(0.343)	0.020	0.002
17	1.42	0.10	0.022	(0.342)	0.020	0.002
18	1.50	0.10	0.022	(0.340)	0.020	0.002
19	1.58	0.10	0.022	(0.339)	0.020	0.002
20	1.67	0.10	0.022	(0.338)	0.020	0.002
21	1.75	0.10	0.022	(0.336)	0.020	0.002
22	1.83	0.13	0.030	(0.335)	0.027	0.003
23	1.92	0.13	0.030	(0.334)	0.027	0.003
24	2.00	0.13	0.030	(0.332)	0.027	0.003
25	2.08	0.13	0.030	(0.331)	0.027	0.003
26	2.17	0.13	0.030	(0.329)	0.027	0.003
27	2.25	0.13	0.030	(0.328)	0.027	0.003
28	2.33	0.13	0.030	(0.327)	0.027	0.003
29	2.42	0.13	0.030	(0.325)	0.027	0.003
30	2.50	0.13	0.030	(0.324)	0.027	0.003
31	2.58	0.17	0.037	(0.323)	0.033	0.004
32	2.67	0.17	0.037	(0.321)	0.033	0.004
33	2.75	0.17	0.037	(0.320)	0.033	0.004
34	2.83	0.17	0.037	(0.319)	0.033	0.004
35	2.92	0.17	0.037	(0.318)	0.033	0.004
36	3.00	0.17	0.037	(0.316)	0.033	0.004
37	3.08	0.17	0.037	(0.315)	0.033	0.004
38	3.17	0.17	0.037	(0.314)	0.033	0.004
39	3.25	0.17	0.037	(0.312)	0.033	0.004
40	3.33	0.17	0.037	(0.311)	0.033	0.004
41	3.42	0.17	0.037	(0.310)	0.033	0.004
42	3.50	0.17	0.037	(0.308)	0.033	0.004
43	3.58	0.17	0.037	(0.307)	0.033	0.004
44	3.67	0.17	0.037	(0.306)	0.033	0.004
45	3.75	0.17	0.037	(0.305)	0.033	0.004
46	3.83	0.20	0.044	(0.303)	0.040	0.004
47	3.92	0.20	0.044	(0.302)	0.040	0.004
48	4.00	0.20	0.044	(0.301)	0.040	0.004
49	4.08	0.20	0.044	(0.299)	0.040	0.004
50	4.17	0.20	0.044	(0.298)	0.040	0.004

51	4.25	0.20	0.044	(0.297)	0.040	0.004
52	4.33	0.23	0.052	(0.296)	0.047	0.005
53	4.42	0.23	0.052	(0.294)	0.047	0.005
54	4.50	0.23	0.052	(0.293)	0.047	0.005
55	4.58	0.23	0.052	(0.292)	0.047	0.005
56	4.67	0.23	0.052	(0.291)	0.047	0.005
57	4.75	0.23	0.052	(0.289)	0.047	0.005
58	4.83	0.27	0.059	(0.288)	0.053	0.006
59	4.92	0.27	0.059	(0.287)	0.053	0.006
60	5.00	0.27	0.059	(0.286)	0.053	0.006
61	5.08	0.20	0.044	(0.284)	0.040	0.004
62	5.17	0.20	0.044	(0.283)	0.040	0.004
63	5.25	0.20	0.044	(0.282)	0.040	0.004
64	5.33	0.23	0.052	(0.281)	0.047	0.005
65	5.42	0.23	0.052	(0.279)	0.047	0.005
66	5.50	0.23	0.052	(0.278)	0.047	0.005
67	5.58	0.27	0.059	(0.277)	0.053	0.006
68	5.67	0.27	0.059	(0.276)	0.053	0.006
69	5.75	0.27	0.059	(0.275)	0.053	0.006
70	5.83	0.27	0.059	(0.273)	0.053	0.006
71	5.92	0.27	0.059	(0.272)	0.053	0.006
72	6.00	0.27	0.059	(0.271)	0.053	0.006
73	6.08	0.30	0.067	(0.270)	0.060	0.007
74	6.17	0.30	0.067	(0.269)	0.060	0.007
75	6.25	0.30	0.067	(0.267)	0.060	0.007
76	6.33	0.30	0.067	(0.266)	0.060	0.007
77	6.42	0.30	0.067	(0.265)	0.060	0.007
78	6.50	0.30	0.067	(0.264)	0.060	0.007
79	6.58	0.33	0.074	(0.263)	0.067	0.007
80	6.67	0.33	0.074	(0.261)	0.067	0.007
81	6.75	0.33	0.074	(0.260)	0.067	0.007
82	6.83	0.33	0.074	(0.259)	0.067	0.007
83	6.92	0.33	0.074	(0.258)	0.067	0.007
84	7.00	0.33	0.074	(0.257)	0.067	0.007
85	7.08	0.33	0.074	(0.256)	0.067	0.007
86	7.17	0.33	0.074	(0.254)	0.067	0.007
87	7.25	0.33	0.074	(0.253)	0.067	0.007
88	7.33	0.37	0.081	(0.252)	0.073	0.008
89	7.42	0.37	0.081	(0.251)	0.073	0.008
90	7.50	0.37	0.081	(0.250)	0.073	0.008
91	7.58	0.40	0.089	(0.249)	0.080	0.009
92	7.67	0.40	0.089	(0.247)	0.080	0.009
93	7.75	0.40	0.089	(0.246)	0.080	0.009
94	7.83	0.43	0.096	(0.245)	0.087	0.010
95	7.92	0.43	0.096	(0.244)	0.087	0.010
96	8.00	0.43	0.096	(0.243)	0.087	0.010
97	8.08	0.50	0.111	(0.242)	0.100	0.011
98	8.17	0.50	0.111	(0.241)	0.100	0.011
99	8.25	0.50	0.111	(0.240)	0.100	0.011
100	8.33	0.50	0.111	(0.238)	0.100	0.011

101	8.42	0.50	0.111	(0.237)	0.100	0.011
102	8.50	0.50	0.111	(0.236)	0.100	0.011
103	8.58	0.53	0.118	(0.235)	0.107	0.012
104	8.67	0.53	0.118	(0.234)	0.107	0.012
105	8.75	0.53	0.118	(0.233)	0.107	0.012
106	8.83	0.57	0.126	(0.232)	0.113	0.013
107	8.92	0.57	0.126	(0.231)	0.113	0.013
108	9.00	0.57	0.126	(0.230)	0.113	0.013
109	9.08	0.63	0.141	(0.228)	0.127	0.014
110	9.17	0.63	0.141	(0.227)	0.127	0.014
111	9.25	0.63	0.141	(0.226)	0.127	0.014
112	9.33	0.67	0.148	(0.225)	0.133	0.015
113	9.42	0.67	0.148	(0.224)	0.133	0.015
114	9.50	0.67	0.148	(0.223)	0.133	0.015
115	9.58	0.70	0.155	(0.222)	0.140	0.016
116	9.67	0.70	0.155	(0.221)	0.140	0.016
117	9.75	0.70	0.155	(0.220)	0.140	0.016
118	9.83	0.73	0.163	(0.219)	0.147	0.016
119	9.92	0.73	0.163	(0.218)	0.147	0.016
120	10.00	0.73	0.163	(0.217)	0.147	0.016
121	10.08	0.50	0.111	(0.216)	0.100	0.011
122	10.17	0.50	0.111	(0.215)	0.100	0.011
123	10.25	0.50	0.111	(0.214)	0.100	0.011
124	10.33	0.50	0.111	(0.213)	0.100	0.011
125	10.42	0.50	0.111	(0.212)	0.100	0.011
126	10.50	0.50	0.111	(0.210)	0.100	0.011
127	10.58	0.67	0.148	(0.209)	0.133	0.015
128	10.67	0.67	0.148	(0.208)	0.133	0.015
129	10.75	0.67	0.148	(0.207)	0.133	0.015
130	10.83	0.67	0.148	(0.206)	0.133	0.015
131	10.92	0.67	0.148	(0.205)	0.133	0.015
132	11.00	0.67	0.148	(0.204)	0.133	0.015
133	11.08	0.63	0.141	(0.203)	0.127	0.014
134	11.17	0.63	0.141	(0.202)	0.127	0.014
135	11.25	0.63	0.141	(0.201)	0.127	0.014
136	11.33	0.63	0.141	(0.200)	0.127	0.014
137	11.42	0.63	0.141	(0.199)	0.127	0.014
138	11.50	0.63	0.141	(0.198)	0.127	0.014
139	11.58	0.57	0.126	(0.197)	0.113	0.013
140	11.67	0.57	0.126	(0.196)	0.113	0.013
141	11.75	0.57	0.126	(0.195)	0.113	0.013
142	11.83	0.60	0.133	(0.194)	0.120	0.013
143	11.92	0.60	0.133	(0.194)	0.120	0.013
144	12.00	0.60	0.133	(0.193)	0.120	0.013
145	12.08	0.83	0.185	(0.192)	0.166	0.018
146	12.17	0.83	0.185	(0.191)	0.166	0.018
147	12.25	0.83	0.185	(0.190)	0.166	0.018
148	12.33	0.87	0.192	(0.189)	0.173	0.019
149	12.42	0.87	0.192	(0.188)	0.173	0.019
150	12.50	0.87	0.192	(0.187)	0.173	0.019

151	12.58	0.93	0.207		0.186	(0.186)	0.021
152	12.67	0.93	0.207		0.185	(0.186)	0.022
153	12.75	0.93	0.207		0.184	(0.186)	0.023
154	12.83	0.97	0.215		0.183	(0.193)	0.032
155	12.92	0.97	0.215		0.182	(0.193)	0.032
156	13.00	0.97	0.215		0.181	(0.193)	0.033
157	13.08	1.13	0.252		0.180	(0.226)	0.071
158	13.17	1.13	0.252		0.179	(0.226)	0.072
159	13.25	1.13	0.252		0.178	(0.226)	0.073
160	13.33	1.13	0.252		0.178	(0.226)	0.074
161	13.42	1.13	0.252		0.177	(0.226)	0.075
162	13.50	1.13	0.252		0.176	(0.226)	0.076
163	13.58	0.77	0.170	(0.175)		0.153	0.017
164	13.67	0.77	0.170	(0.174)		0.153	0.017
165	13.75	0.77	0.170	(0.173)		0.153	0.017
166	13.83	0.77	0.170	(0.172)		0.153	0.017
167	13.92	0.77	0.170	(0.171)		0.153	0.017
168	14.00	0.77	0.170	(0.170)		0.153	0.017
169	14.08	0.90	0.200		0.170	(0.180)	0.030
170	14.17	0.90	0.200		0.169	(0.180)	0.031
171	14.25	0.90	0.200		0.168	(0.180)	0.032
172	14.33	0.87	0.192		0.167	(0.173)	0.025
173	14.42	0.87	0.192		0.166	(0.173)	0.026
174	14.50	0.87	0.192		0.165	(0.173)	0.027
175	14.58	0.87	0.192		0.164	(0.173)	0.028
176	14.67	0.87	0.192		0.164	(0.173)	0.029
177	14.75	0.87	0.192		0.163	(0.173)	0.030
178	14.83	0.83	0.185		0.162	(0.166)	0.023
179	14.92	0.83	0.185		0.161	(0.166)	0.024
180	15.00	0.83	0.185		0.160	(0.166)	0.025
181	15.08	0.80	0.178		0.159	(0.160)	0.018
182	15.17	0.80	0.178		0.159	(0.160)	0.019
183	15.25	0.80	0.178		0.158	(0.160)	0.020
184	15.33	0.77	0.170	(0.157)		0.153	0.017
185	15.42	0.77	0.170	(0.156)		0.153	0.017
186	15.50	0.77	0.170	(0.155)		0.153	0.017
187	15.58	0.63	0.141	(0.155)		0.127	0.014
188	15.67	0.63	0.141	(0.154)		0.127	0.014
189	15.75	0.63	0.141	(0.153)		0.127	0.014
190	15.83	0.63	0.141	(0.152)		0.127	0.014
191	15.92	0.63	0.141	(0.151)		0.127	0.014
192	16.00	0.63	0.141	(0.151)		0.127	0.014
193	16.08	0.13	0.030	(0.150)		0.027	0.003
194	16.17	0.13	0.030	(0.149)		0.027	0.003
195	16.25	0.13	0.030	(0.148)		0.027	0.003
196	16.33	0.13	0.030	(0.148)		0.027	0.003
197	16.42	0.13	0.030	(0.147)		0.027	0.003
198	16.50	0.13	0.030	(0.146)		0.027	0.003
199	16.58	0.10	0.022	(0.145)		0.020	0.002
200	16.67	0.10	0.022	(0.145)		0.020	0.002

201	16.75	0.10	0.022	(0.144)	0.020	0.002
202	16.83	0.10	0.022	(0.143)	0.020	0.002
203	16.92	0.10	0.022	(0.142)	0.020	0.002
204	17.00	0.10	0.022	(0.142)	0.020	0.002
205	17.08	0.17	0.037	(0.141)	0.033	0.004
206	17.17	0.17	0.037	(0.140)	0.033	0.004
207	17.25	0.17	0.037	(0.140)	0.033	0.004
208	17.33	0.17	0.037	(0.139)	0.033	0.004
209	17.42	0.17	0.037	(0.138)	0.033	0.004
210	17.50	0.17	0.037	(0.138)	0.033	0.004
211	17.58	0.17	0.037	(0.137)	0.033	0.004
212	17.67	0.17	0.037	(0.136)	0.033	0.004
213	17.75	0.17	0.037	(0.135)	0.033	0.004
214	17.83	0.13	0.030	(0.135)	0.027	0.003
215	17.92	0.13	0.030	(0.134)	0.027	0.003
216	18.00	0.13	0.030	(0.133)	0.027	0.003
217	18.08	0.13	0.030	(0.133)	0.027	0.003
218	18.17	0.13	0.030	(0.132)	0.027	0.003
219	18.25	0.13	0.030	(0.132)	0.027	0.003
220	18.33	0.13	0.030	(0.131)	0.027	0.003
221	18.42	0.13	0.030	(0.130)	0.027	0.003
222	18.50	0.13	0.030	(0.130)	0.027	0.003
223	18.58	0.10	0.022	(0.129)	0.020	0.002
224	18.67	0.10	0.022	(0.128)	0.020	0.002
225	18.75	0.10	0.022	(0.128)	0.020	0.002
226	18.83	0.07	0.015	(0.127)	0.013	0.001
227	18.92	0.07	0.015	(0.127)	0.013	0.001
228	19.00	0.07	0.015	(0.126)	0.013	0.001
229	19.08	0.10	0.022	(0.125)	0.020	0.002
230	19.17	0.10	0.022	(0.125)	0.020	0.002
231	19.25	0.10	0.022	(0.124)	0.020	0.002
232	19.33	0.13	0.030	(0.124)	0.027	0.003
233	19.42	0.13	0.030	(0.123)	0.027	0.003
234	19.50	0.13	0.030	(0.122)	0.027	0.003
235	19.58	0.10	0.022	(0.122)	0.020	0.002
236	19.67	0.10	0.022	(0.121)	0.020	0.002
237	19.75	0.10	0.022	(0.121)	0.020	0.002
238	19.83	0.07	0.015	(0.120)	0.013	0.001
239	19.92	0.07	0.015	(0.120)	0.013	0.001
240	20.00	0.07	0.015	(0.119)	0.013	0.001
241	20.08	0.10	0.022	(0.119)	0.020	0.002
242	20.17	0.10	0.022	(0.118)	0.020	0.002
243	20.25	0.10	0.022	(0.118)	0.020	0.002
244	20.33	0.10	0.022	(0.117)	0.020	0.002
245	20.42	0.10	0.022	(0.117)	0.020	0.002
246	20.50	0.10	0.022	(0.116)	0.020	0.002
247	20.58	0.10	0.022	(0.116)	0.020	0.002
248	20.67	0.10	0.022	(0.115)	0.020	0.002
249	20.75	0.10	0.022	(0.115)	0.020	0.002
250	20.83	0.07	0.015	(0.114)	0.013	0.001

251	20.92	0.07	0.015	(0.114)	0.013	0.001
252	21.00	0.07	0.015	(0.113)	0.013	0.001
253	21.08	0.10	0.022	(0.113)	0.020	0.002
254	21.17	0.10	0.022	(0.112)	0.020	0.002
255	21.25	0.10	0.022	(0.112)	0.020	0.002
256	21.33	0.07	0.015	(0.112)	0.013	0.001
257	21.42	0.07	0.015	(0.111)	0.013	0.001
258	21.50	0.07	0.015	(0.111)	0.013	0.001
259	21.58	0.10	0.022	(0.110)	0.020	0.002
260	21.67	0.10	0.022	(0.110)	0.020	0.002
261	21.75	0.10	0.022	(0.109)	0.020	0.002
262	21.83	0.07	0.015	(0.109)	0.013	0.001
263	21.92	0.07	0.015	(0.109)	0.013	0.001
264	22.00	0.07	0.015	(0.108)	0.013	0.001
265	22.08	0.10	0.022	(0.108)	0.020	0.002
266	22.17	0.10	0.022	(0.108)	0.020	0.002
267	22.25	0.10	0.022	(0.107)	0.020	0.002
268	22.33	0.07	0.015	(0.107)	0.013	0.001
269	22.42	0.07	0.015	(0.107)	0.013	0.001
270	22.50	0.07	0.015	(0.106)	0.013	0.001
271	22.58	0.07	0.015	(0.106)	0.013	0.001
272	22.67	0.07	0.015	(0.106)	0.013	0.001
273	22.75	0.07	0.015	(0.105)	0.013	0.001
274	22.83	0.07	0.015	(0.105)	0.013	0.001
275	22.92	0.07	0.015	(0.105)	0.013	0.001
276	23.00	0.07	0.015	(0.105)	0.013	0.001
277	23.08	0.07	0.015	(0.104)	0.013	0.001
278	23.17	0.07	0.015	(0.104)	0.013	0.001
279	23.25	0.07	0.015	(0.104)	0.013	0.001
280	23.33	0.07	0.015	(0.104)	0.013	0.001
281	23.42	0.07	0.015	(0.104)	0.013	0.001
282	23.50	0.07	0.015	(0.103)	0.013	0.001
283	23.58	0.07	0.015	(0.103)	0.013	0.001
284	23.67	0.07	0.015	(0.103)	0.013	0.001
285	23.75	0.07	0.015	(0.103)	0.013	0.001
286	23.83	0.07	0.015	(0.103)	0.013	0.001
287	23.92	0.07	0.015	(0.103)	0.013	0.001
288	24.00	0.07	0.015	(0.103)	0.013	0.001

(Loss Rate Not Used)

Sum = 100.0 Sum = 2.6

Flood volume = Effective rainfall 0.22(In)
times area 26.6(Ac.)/[(In)/(Ft.)] = 0.5(Ac.Ft)
Total soil loss = 1.63(In)
Total soil loss = 3.608(Ac.Ft)
Total rainfall = 1.85(In)
Flood volume = 21305.5 Cubic Feet
Total soil loss = 157176.5 Cubic Feet

Peak flow rate of this hydrograph = 1.932(CFS)

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24 - H O U R S T O R M

R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.01	Q				
0+10	0.0002	0.02	Q				
0+15	0.0004	0.03	Q				
0+20	0.0007	0.04	Q				
0+25	0.0010	0.05	Q				
0+30	0.0014	0.05	Q				
0+35	0.0018	0.06	Q				
0+40	0.0021	0.06	Q				
0+45	0.0025	0.06	Q				
0+50	0.0030	0.06	Q				
0+55	0.0035	0.07	Q				
1+ 0	0.0040	0.07	Q				
1+ 5	0.0045	0.07	Q				
1+10	0.0049	0.07	Q				
1+15	0.0054	0.06	Q				
1+20	0.0058	0.06	Q				
1+25	0.0062	0.06	Q				
1+30	0.0066	0.06	Q				
1+35	0.0070	0.06	Q				
1+40	0.0075	0.06	Q				
1+45	0.0079	0.06	Q				
1+50	0.0083	0.06	Q				
1+55	0.0088	0.07	Q				
2+ 0	0.0093	0.08	Q				
2+ 5	0.0098	0.08	Q				
2+10	0.0104	0.08	Q				
2+15	0.0109	0.08	Q				
2+20	0.0114	0.08	Q				
2+25	0.0120	0.08	Q				
2+30	0.0125	0.08	QV				
2+35	0.0131	0.08	QV				
2+40	0.0137	0.09	QV				
2+45	0.0144	0.09	QV				
2+50	0.0150	0.10	QV				
2+55	0.0157	0.10	QV				
3+ 0	0.0164	0.10	QV				
3+ 5	0.0171	0.10	QV				
3+10	0.0178	0.10	QV				
3+15	0.0184	0.10	QV				
3+20	0.0191	0.10	QV				
3+25	0.0198	0.10	QV				

3+30	0.0205	0.10	QV	|	|	|	|
3+35	0.0212	0.10	QV	|	|	|	|
3+40	0.0219	0.10	QV	|	|	|	|
3+45	0.0225	0.10	QV	|	|	|	|
3+50	0.0232	0.10	QV	|	|	|	|
3+55	0.0240	0.11	QV	|	|	|	|
4+ 0	0.0248	0.11	Q V	|	|	|	|
4+ 5	0.0256	0.12	Q V	|	|	|	|
4+10	0.0264	0.12	Q V	|	|	|	|
4+15	0.0272	0.12	Q V	|	|	|	|
4+20	0.0280	0.12	Q V	|	|	|	|
4+25	0.0289	0.13	Q V	|	|	|	|
4+30	0.0299	0.13	Q V	|	|	|	|
4+35	0.0308	0.14	Q V	|	|	|	|
4+40	0.0318	0.14	Q V	|	|	|	|
4+45	0.0327	0.14	Q V	|	|	|	|
4+50	0.0337	0.14	Q V	|	|	|	|
4+55	0.0347	0.15	Q V	|	|	|	|
5+ 0	0.0358	0.15	Q V	|	|	|	|
5+ 5	0.0368	0.15	Q V	|	|	|	|
5+10	0.0377	0.13	Q V	|	|	|	|
5+15	0.0386	0.13	Q V	|	|	|	|
5+20	0.0395	0.13	Q V	|	|	|	|
5+25	0.0404	0.13	Q V	|	|	|	|
5+30	0.0413	0.14	Q V	|	|	|	|
5+35	0.0423	0.14	Q V	|	|	|	|
5+40	0.0433	0.15	Q V	|	|	|	|
5+45	0.0444	0.15	Q V	|	|	|	|
5+50	0.0455	0.16	Q V	|	|	|	|
5+55	0.0465	0.16	Q V	|	|	|	|
6+ 0	0.0476	0.16	Q V	|	|	|	|
6+ 5	0.0487	0.16	Q V	|	|	|	|
6+10	0.0499	0.17	Q V	|	|	|	|
6+15	0.0511	0.17	Q V	|	|	|	|
6+20	0.0523	0.18	Q V	|	|	|	|
6+25	0.0535	0.18	Q V	|	|	|	|
6+30	0.0547	0.18	Q V	|	|	|	|
6+35	0.0560	0.18	Q V	|	|	|	|
6+40	0.0573	0.19	Q V	|	|	|	|
6+45	0.0586	0.19	Q V	|	|	|	|
6+50	0.0600	0.20	Q V	|	|	|	|
6+55	0.0613	0.20	Q V	|	|	|	|
7+ 0	0.0627	0.20	Q V	|	|	|	|
7+ 5	0.0641	0.20	Q V	|	|	|	|
7+10	0.0654	0.20	Q V	|	|	|	|
7+15	0.0668	0.20	Q V	|	|	|	|
7+20	0.0682	0.20	Q V	|	|	|	|
7+25	0.0696	0.21	Q V	|	|	|	|
7+30	0.0711	0.21	Q V	|	|	|	|
7+35	0.0726	0.22	Q V	|	|	|	|

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 7+40       0.0742      0.23  Q     V   |           |           |           |
 7+45       0.0758      0.23  Q     V   |           |           |           |
 7+50       0.0774      0.24  Q     V   |           |           |           |
 7+55       0.0791      0.25  Q     V   |           |           |           |
 8+ 0       0.0808      0.25  |Q    V   |           |           |           |
 8+ 5       0.0826      0.26  |Q    V   |           |           |           |
 8+10       0.0846      0.28  |Q    V   |           |           |           |
 8+15       0.0865      0.29  |Q     V  |           |           |           |
 8+20       0.0886      0.29  |Q     V  |           |           |           |
 8+25       0.0906      0.29  |Q     V  |           |           |           |
 8+30       0.0926      0.30  |Q     V  |           |           |           |
 8+35       0.0947      0.30  |Q     V  |           |           |           |
 8+40       0.0968      0.31  |Q     V  |           |           |           |
 8+45       0.0990      0.31  |Q      V |           |           |           |
 8+50       0.1011      0.32  |Q      V |           |           |           |
 8+55       0.1034      0.33  |Q      V |           |           |           |
 9+ 0       0.1057      0.33  |Q      V |           |           |           |
 9+ 5       0.1080      0.34  |Q      V |           |           |           |
 9+10       0.1105      0.36  |Q       V|           |           |           |
 9+15       0.1130      0.37  |Q       V|           |           |           |
 9+20       0.1156      0.37  |Q       V|           |           |           |
 9+25       0.1182      0.38  |Q       V|           |           |           |
 9+30       0.1209      0.39  |Q       V|           |           |           |
 9+35       0.1237      0.40  |Q        V           |           |           |
 9+40       0.1264      0.41  |Q        V           |           |           |
 9+45       0.1293      0.41  |Q        V           |           |           |
 9+50       0.1321      0.42  |Q        V           |           |           |
 9+55       0.1351      0.43  |Q        |V          |           |           |
10+ 0       0.1380      0.43  |Q        |V          |           |           |
10+ 5       0.1409      0.41  |Q        |V          |           |           |
10+10       0.1433      0.35  |Q        |V          |           |           |
10+15       0.1456      0.33  |Q        |V          |           |           |
10+20       0.1477      0.32  |Q        | V         |           |           |
10+25       0.1499      0.31  |Q        | V         |           |           |
10+30       0.1520      0.30  |Q        | V         |           |           |
10+35       0.1541      0.32  |Q        | V         |           |           |
10+40       0.1566      0.36  |Q        | V         |           |           |
10+45       0.1592      0.38  |Q        |  V        |           |           |
10+50       0.1618      0.38  |Q        |  V        |           |           |
10+55       0.1645      0.39  |Q        |  V        |           |           |
11+ 0       0.1672      0.39  |Q        |  V        |           |           |
11+ 5       0.1699      0.39  |Q        |  V        |           |           |
11+10       0.1725      0.38  |Q        |   V       |           |           |
11+15       0.1752      0.38  |Q        |   V       |           |           |
11+20       0.1778      0.38  |Q        |   V       |           |           |
11+25       0.1804      0.38  |Q        |   V       |           |           |
11+30       0.1830      0.38  |Q        |   V       |           |           |
11+35       0.1855      0.37  |Q        |    V      |           |           |
11+40       0.1880      0.35  |Q        |    V      |           |           |
11+45       0.1904      0.35  |Q        |    V      |           |           |
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11+50	0.1927	0.35	Q	V			
11+55	0.1952	0.35	Q	V			
12+ 0	0.1976	0.35	Q	V			
12+ 5	0.2002	0.38	Q	V			
12+10	0.2032	0.44	Q	V			
12+15	0.2064	0.47	Q	V			
12+20	0.2097	0.48	Q	V			
12+25	0.2131	0.50	Q	V			
12+30	0.2166	0.50	Q	V			
12+35	0.2202	0.52	Q	V			
12+40	0.2239	0.55	Q	V			
12+45	0.2279	0.58	Q	V			
12+50	0.2322	0.63	Q	V			
12+55	0.2374	0.74	Q	V			
13+ 0	0.2429	0.81	Q	V			
13+ 5	0.2497	0.99	Q	V			
13+10	0.2599	1.47	Q	V			
13+15	0.2715	1.69	Q	V			
13+20	0.2839	1.80	Q	V			
13+25	0.2969	1.88	Q	V			
13+30	0.3102	1.93	Q	V			
13+35	0.3222	1.75	Q	V			
13+40	0.3295	1.06	Q	V			
13+45	0.3348	0.77	Q	V			
13+50	0.3394	0.66	Q	V			
13+55	0.3434	0.59	Q	V			
14+ 0	0.3471	0.54	Q	V			
14+ 5	0.3510	0.56	Q	V			
14+10	0.3558	0.70	Q	V			
14+15	0.3611	0.77	Q	V			
14+20	0.3664	0.77	Q	V			
14+25	0.3713	0.72	Q	V			
14+30	0.3762	0.71	Q	V			
14+35	0.3812	0.72	Q	V			
14+40	0.3863	0.74	Q	V			
14+45	0.3915	0.76	Q	V			
14+50	0.3967	0.75	Q	V			
14+55	0.4014	0.68	Q	V			
15+ 0	0.4060	0.67	Q	V			
15+ 5	0.4104	0.64	Q	V			
15+10	0.4143	0.56	Q	V			
15+15	0.4180	0.54	Q	V			
15+20	0.4217	0.53	Q	V			
15+25	0.4251	0.49	Q	V			
15+30	0.4284	0.48	Q	V			
15+35	0.4315	0.46	Q	V			
15+40	0.4344	0.42	Q	V			
15+45	0.4371	0.40	Q	V			
15+50	0.4398	0.39	Q	V			
15+55	0.4424	0.38	Q	V			

16+ 0	0.4451	0.38	|Q	|	|	|	V |
16+ 5	0.4474	0.34	|Q	|	|	|	V |
16+10	0.4488	0.20	Q	|	|	|	V |
16+15	0.4497	0.14	Q	|	|	|	V |
16+20	0.4506	0.12	Q	|	|	|	V |
16+25	0.4513	0.10	Q	|	|	|	V |
16+30	0.4519	0.10	Q	|	|	|	V |
16+35	0.4525	0.09	Q	|	|	|	V |
16+40	0.4530	0.07	Q	|	|	|	V |
16+45	0.4535	0.07	Q	|	|	|	V |
16+50	0.4539	0.06	Q	|	|	|	V |
16+55	0.4543	0.06	Q	|	|	|	V |
17+ 0	0.4548	0.06	Q	|	|	|	V |
17+ 5	0.4552	0.07	Q	|	|	|	V |
17+10	0.4558	0.08	Q	|	|	|	V |
17+15	0.4564	0.09	Q	|	|	|	V |
17+20	0.4571	0.09	Q	|	|	|	V |
17+25	0.4577	0.10	Q	|	|	|	V |
17+30	0.4584	0.10	Q	|	|	|	V |
17+35	0.4591	0.10	Q	|	|	|	V |
17+40	0.4597	0.10	Q	|	|	|	V |
17+45	0.4604	0.10	Q	|	|	|	V |
17+50	0.4611	0.10	Q	|	|	|	V |
17+55	0.4617	0.09	Q	|	|	|	V |
18+ 0	0.4623	0.08	Q	|	|	|	V |
18+ 5	0.4628	0.08	Q	|	|	|	V |
18+10	0.4634	0.08	Q	|	|	|	V |
18+15	0.4639	0.08	Q	|	|	|	V |
18+20	0.4645	0.08	Q	|	|	|	V |
18+25	0.4650	0.08	Q	|	|	|	V |
18+30	0.4656	0.08	Q	|	|	|	V |
18+35	0.4661	0.08	Q	|	|	|	V |
18+40	0.4666	0.07	Q	|	|	|	V |
18+45	0.4670	0.06	Q	|	|	|	V |
18+50	0.4674	0.06	Q	|	|	|	V |
18+55	0.4678	0.05	Q	|	|	|	V |
19+ 0	0.4681	0.04	Q	|	|	|	V |
19+ 5	0.4684	0.05	Q	|	|	|	V |
19+10	0.4688	0.05	Q	|	|	|	V |
19+15	0.4691	0.06	Q	|	|	|	V |
19+20	0.4696	0.06	Q	|	|	|	V |
19+25	0.4700	0.07	Q	|	|	|	V |
19+30	0.4706	0.07	Q	|	|	|	V |
19+35	0.4711	0.07	Q	|	|	|	V |
19+40	0.4715	0.07	Q	|	|	|	V |
19+45	0.4719	0.06	Q	|	|	|	V |
19+50	0.4723	0.06	Q	|	|	|	V |
19+55	0.4727	0.05	Q	|	|	|	V |
20+ 0	0.4730	0.04	Q	|	|	|	V |
20+ 5	0.4733	0.05	Q	|	|	|	V |

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20+10       0.4737      0.05  Q          |          |          |        V |
20+15       0.4741      0.06  Q          |          |          |        V |
20+20       0.4745      0.06  Q          |          |          |        V |
20+25       0.4749      0.06  Q          |          |          |        V |
20+30       0.4753      0.06  Q          |          |          |        V |
20+35       0.4757      0.06  Q          |          |          |        V |
20+40       0.4761      0.06  Q          |          |          |        V |
20+45       0.4765      0.06  Q          |          |          |        V |
20+50       0.4769      0.06  Q          |          |          |        V |
20+55       0.4772      0.05  Q          |          |          |         V|
21+ 0       0.4775      0.04  Q          |          |          |         V|
21+ 5       0.4778      0.05  Q          |          |          |         V|
21+10       0.4782      0.05  Q          |          |          |         V|
21+15       0.4786      0.06  Q          |          |          |         V|
21+20       0.4789      0.05  Q          |          |          |         V|
21+25       0.4793      0.05  Q          |          |          |         V|
21+30       0.4796      0.04  Q          |          |          |         V|
21+35       0.4799      0.04  Q          |          |          |         V|
21+40       0.4802      0.05  Q          |          |          |         V|
21+45       0.4806      0.06  Q          |          |          |         V|
21+50       0.4810      0.05  Q          |          |          |         V|
21+55       0.4813      0.05  Q          |          |          |         V|
22+ 0       0.4816      0.04  Q          |          |          |         V|
22+ 5       0.4819      0.04  Q          |          |          |         V|
22+10       0.4823      0.05  Q          |          |          |         V|
22+15       0.4827      0.06  Q          |          |          |         V|
22+20       0.4830      0.05  Q          |          |          |         V|
22+25       0.4834      0.05  Q          |          |          |         V|
22+30       0.4837      0.04  Q          |          |          |         V|
22+35       0.4839      0.04  Q          |          |          |         V|
22+40       0.4842      0.04  Q          |          |          |         V|
22+45       0.4845      0.04  Q          |          |          |         V|
22+50       0.4848      0.04  Q          |          |          |         V|
22+55       0.4851      0.04  Q          |          |          |         V|
23+ 0       0.4853      0.04  Q          |          |          |         V|
23+ 5       0.4856      0.04  Q          |          |          |         V|
23+10       0.4859      0.04  Q          |          |          |         V|
23+15       0.4862      0.04  Q          |          |          |         V|
23+20       0.4864      0.04  Q          |          |          |         V|
23+25       0.4867      0.04  Q          |          |          |         V|
23+30       0.4870      0.04  Q          |          |          |         V|
23+35       0.4872      0.04  Q          |          |          |         V|
23+40       0.4875      0.04  Q          |          |          |         V|
23+45       0.4878      0.04  Q          |          |          |         V|
23+50       0.4881      0.04  Q          |          |          |         V|
23+55       0.4883      0.04  Q          |          |          |         V|
24+ 0       0.4886      0.04  Q          |          |          |         V|
24+ 5       0.4888      0.03  Q          |          |          |         V|
24+10       0.4890      0.02  Q          |          |          |         V|
24+15       0.4890      0.01  Q          |          |          |         V|
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   24+20       0.4891      0.01  Q          |          |          |         V|
   24+25       0.4891      0.00  Q          |          |          |         V|
   24+30       0.4891      0.00  Q          |          |          |         V|
   24+35       0.4891      0.00  Q          |          |          |         V|
   24+40       0.4891      0.00  Q          |          |          |         V|
   24+45       0.4891      0.00  Q          |          |          |         V|
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U n i t H y d r o g r a p h A n a l y s i s

Study date 06/29/23 File: MenifeePrUH2YR6HR242.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

IRV22-0086 ARES MENIFEE - PROPOSED 2 YEAR 24 HOUR UNIT HYDROGRAPH

Program License Serial Number 6350

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Drainage Area = 26.58(Ac.) = 0.042 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 26.58(Ac.) = 0.042 Sq. Mi.
Length along longest watercourse = 1895.80(Ft.)
Length along longest watercourse measured to centroid = 618.30(Ft.)
Length along longest watercourse = 0.359 Mi.
Length along longest watercourse measured to centroid = 0.117 Mi.
Difference in elevation = 27.77(Ft.)
Slope along watercourse = 77.3423 Ft./Mi.
Average Manning's 'N' = 0.013
Lag time = 0.041 Hr.
Lag time = 2.46 Min.
25% of lag time = 0.61 Min.
40% of lag time = 0.98 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
26.58	1.85	49.17

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
26.58	4.75	126.25

STORM EVENT (YEAR) = 2.00

Area Averaged 2-Year Rainfall = 1.850(In)
Area Averaged 100-Year Rainfall = 4.750(In)

Point rain (area averaged) = 1.850(In)
Areal adjustment factor = 99.99 %
Adjusted average point rain = 1.850(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
26.579	57.00	0.878

Total Area Entered = 26.58(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
57.0	37.0	0.697	0.878	0.146	1.000	0.146
					Sum (F) =	0.146

Area averaged mean soil loss (F) (In/Hr) = 0.146
Minimum soil loss rate ((In/Hr)) = 0.073
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.198

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	203.446	43.991	11.784
2	0.167	406.891	43.128	11.552
3	0.250	610.337	8.655	2.318
4	0.333	813.782	4.227	1.132
			Sum = 100.000	Sum= 26.787

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.015	(0.260)	0.003	0.012
2	0.17	0.07	0.015	(0.259)	0.003	0.012
3	0.25	0.07	0.015	(0.258)	0.003	0.012
4	0.33	0.10	0.022	(0.257)	0.004	0.018
5	0.42	0.10	0.022	(0.256)	0.004	0.018
6	0.50	0.10	0.022	(0.255)	0.004	0.018

7	0.58	0.10	0.022	(0.254)	0.004	0.018
8	0.67	0.10	0.022	(0.253)	0.004	0.018
9	0.75	0.10	0.022	(0.252)	0.004	0.018
10	0.83	0.13	0.030	(0.251)	0.006	0.024
11	0.92	0.13	0.030	(0.250)	0.006	0.024
12	1.00	0.13	0.030	(0.249)	0.006	0.024
13	1.08	0.10	0.022	(0.248)	0.004	0.018
14	1.17	0.10	0.022	(0.247)	0.004	0.018
15	1.25	0.10	0.022	(0.246)	0.004	0.018
16	1.33	0.10	0.022	(0.245)	0.004	0.018
17	1.42	0.10	0.022	(0.244)	0.004	0.018
18	1.50	0.10	0.022	(0.243)	0.004	0.018
19	1.58	0.10	0.022	(0.242)	0.004	0.018
20	1.67	0.10	0.022	(0.241)	0.004	0.018
21	1.75	0.10	0.022	(0.240)	0.004	0.018
22	1.83	0.13	0.030	(0.239)	0.006	0.024
23	1.92	0.13	0.030	(0.238)	0.006	0.024
24	2.00	0.13	0.030	(0.237)	0.006	0.024
25	2.08	0.13	0.030	(0.236)	0.006	0.024
26	2.17	0.13	0.030	(0.235)	0.006	0.024
27	2.25	0.13	0.030	(0.234)	0.006	0.024
28	2.33	0.13	0.030	(0.233)	0.006	0.024
29	2.42	0.13	0.030	(0.232)	0.006	0.024
30	2.50	0.13	0.030	(0.231)	0.006	0.024
31	2.58	0.17	0.037	(0.230)	0.007	0.030
32	2.67	0.17	0.037	(0.229)	0.007	0.030
33	2.75	0.17	0.037	(0.229)	0.007	0.030
34	2.83	0.17	0.037	(0.228)	0.007	0.030
35	2.92	0.17	0.037	(0.227)	0.007	0.030
36	3.00	0.17	0.037	(0.226)	0.007	0.030
37	3.08	0.17	0.037	(0.225)	0.007	0.030
38	3.17	0.17	0.037	(0.224)	0.007	0.030
39	3.25	0.17	0.037	(0.223)	0.007	0.030
40	3.33	0.17	0.037	(0.222)	0.007	0.030
41	3.42	0.17	0.037	(0.221)	0.007	0.030
42	3.50	0.17	0.037	(0.220)	0.007	0.030
43	3.58	0.17	0.037	(0.219)	0.007	0.030
44	3.67	0.17	0.037	(0.218)	0.007	0.030
45	3.75	0.17	0.037	(0.217)	0.007	0.030
46	3.83	0.20	0.044	(0.216)	0.009	0.036
47	3.92	0.20	0.044	(0.216)	0.009	0.036
48	4.00	0.20	0.044	(0.215)	0.009	0.036
49	4.08	0.20	0.044	(0.214)	0.009	0.036
50	4.17	0.20	0.044	(0.213)	0.009	0.036
51	4.25	0.20	0.044	(0.212)	0.009	0.036
52	4.33	0.23	0.052	(0.211)	0.010	0.042
53	4.42	0.23	0.052	(0.210)	0.010	0.042
54	4.50	0.23	0.052	(0.209)	0.010	0.042
55	4.58	0.23	0.052	(0.208)	0.010	0.042
56	4.67	0.23	0.052	(0.207)	0.010	0.042

57	4.75	0.23	0.052	(0.206)	0.010	0.042
58	4.83	0.27	0.059	(0.206)	0.012	0.047
59	4.92	0.27	0.059	(0.205)	0.012	0.047
60	5.00	0.27	0.059	(0.204)	0.012	0.047
61	5.08	0.20	0.044	(0.203)	0.009	0.036
62	5.17	0.20	0.044	(0.202)	0.009	0.036
63	5.25	0.20	0.044	(0.201)	0.009	0.036
64	5.33	0.23	0.052	(0.200)	0.010	0.042
65	5.42	0.23	0.052	(0.199)	0.010	0.042
66	5.50	0.23	0.052	(0.199)	0.010	0.042
67	5.58	0.27	0.059	(0.198)	0.012	0.047
68	5.67	0.27	0.059	(0.197)	0.012	0.047
69	5.75	0.27	0.059	(0.196)	0.012	0.047
70	5.83	0.27	0.059	(0.195)	0.012	0.047
71	5.92	0.27	0.059	(0.194)	0.012	0.047
72	6.00	0.27	0.059	(0.193)	0.012	0.047
73	6.08	0.30	0.067	(0.192)	0.013	0.053
74	6.17	0.30	0.067	(0.192)	0.013	0.053
75	6.25	0.30	0.067	(0.191)	0.013	0.053
76	6.33	0.30	0.067	(0.190)	0.013	0.053
77	6.42	0.30	0.067	(0.189)	0.013	0.053
78	6.50	0.30	0.067	(0.188)	0.013	0.053
79	6.58	0.33	0.074	(0.187)	0.015	0.059
80	6.67	0.33	0.074	(0.187)	0.015	0.059
81	6.75	0.33	0.074	(0.186)	0.015	0.059
82	6.83	0.33	0.074	(0.185)	0.015	0.059
83	6.92	0.33	0.074	(0.184)	0.015	0.059
84	7.00	0.33	0.074	(0.183)	0.015	0.059
85	7.08	0.33	0.074	(0.182)	0.015	0.059
86	7.17	0.33	0.074	(0.182)	0.015	0.059
87	7.25	0.33	0.074	(0.181)	0.015	0.059
88	7.33	0.37	0.081	(0.180)	0.016	0.065
89	7.42	0.37	0.081	(0.179)	0.016	0.065
90	7.50	0.37	0.081	(0.178)	0.016	0.065
91	7.58	0.40	0.089	(0.177)	0.018	0.071
92	7.67	0.40	0.089	(0.177)	0.018	0.071
93	7.75	0.40	0.089	(0.176)	0.018	0.071
94	7.83	0.43	0.096	(0.175)	0.019	0.077
95	7.92	0.43	0.096	(0.174)	0.019	0.077
96	8.00	0.43	0.096	(0.173)	0.019	0.077
97	8.08	0.50	0.111	(0.173)	0.022	0.089
98	8.17	0.50	0.111	(0.172)	0.022	0.089
99	8.25	0.50	0.111	(0.171)	0.022	0.089
100	8.33	0.50	0.111	(0.170)	0.022	0.089
101	8.42	0.50	0.111	(0.169)	0.022	0.089
102	8.50	0.50	0.111	(0.169)	0.022	0.089
103	8.58	0.53	0.118	(0.168)	0.023	0.095
104	8.67	0.53	0.118	(0.167)	0.023	0.095
105	8.75	0.53	0.118	(0.166)	0.023	0.095
106	8.83	0.57	0.126	(0.165)	0.025	0.101

107	8.92	0.57	0.126	(0.165)	0.025	0.101
108	9.00	0.57	0.126	(0.164)	0.025	0.101
109	9.08	0.63	0.141	(0.163)	0.028	0.113
110	9.17	0.63	0.141	(0.162)	0.028	0.113
111	9.25	0.63	0.141	(0.162)	0.028	0.113
112	9.33	0.67	0.148	(0.161)	0.029	0.119
113	9.42	0.67	0.148	(0.160)	0.029	0.119
114	9.50	0.67	0.148	(0.159)	0.029	0.119
115	9.58	0.70	0.155	(0.158)	0.031	0.125
116	9.67	0.70	0.155	(0.158)	0.031	0.125
117	9.75	0.70	0.155	(0.157)	0.031	0.125
118	9.83	0.73	0.163	(0.156)	0.032	0.131
119	9.92	0.73	0.163	(0.155)	0.032	0.131
120	10.00	0.73	0.163	(0.155)	0.032	0.131
121	10.08	0.50	0.111	(0.154)	0.022	0.089
122	10.17	0.50	0.111	(0.153)	0.022	0.089
123	10.25	0.50	0.111	(0.152)	0.022	0.089
124	10.33	0.50	0.111	(0.152)	0.022	0.089
125	10.42	0.50	0.111	(0.151)	0.022	0.089
126	10.50	0.50	0.111	(0.150)	0.022	0.089
127	10.58	0.67	0.148	(0.150)	0.029	0.119
128	10.67	0.67	0.148	(0.149)	0.029	0.119
129	10.75	0.67	0.148	(0.148)	0.029	0.119
130	10.83	0.67	0.148	(0.147)	0.029	0.119
131	10.92	0.67	0.148	(0.147)	0.029	0.119
132	11.00	0.67	0.148	(0.146)	0.029	0.119
133	11.08	0.63	0.141	(0.145)	0.028	0.113
134	11.17	0.63	0.141	(0.144)	0.028	0.113
135	11.25	0.63	0.141	(0.144)	0.028	0.113
136	11.33	0.63	0.141	(0.143)	0.028	0.113
137	11.42	0.63	0.141	(0.142)	0.028	0.113
138	11.50	0.63	0.141	(0.142)	0.028	0.113
139	11.58	0.57	0.126	(0.141)	0.025	0.101
140	11.67	0.57	0.126	(0.140)	0.025	0.101
141	11.75	0.57	0.126	(0.140)	0.025	0.101
142	11.83	0.60	0.133	(0.139)	0.026	0.107
143	11.92	0.60	0.133	(0.138)	0.026	0.107
144	12.00	0.60	0.133	(0.137)	0.026	0.107
145	12.08	0.83	0.185	(0.137)	0.037	0.148
146	12.17	0.83	0.185	(0.136)	0.037	0.148
147	12.25	0.83	0.185	(0.135)	0.037	0.148
148	12.33	0.87	0.192	(0.135)	0.038	0.154
149	12.42	0.87	0.192	(0.134)	0.038	0.154
150	12.50	0.87	0.192	(0.133)	0.038	0.154
151	12.58	0.93	0.207	(0.133)	0.041	0.166
152	12.67	0.93	0.207	(0.132)	0.041	0.166
153	12.75	0.93	0.207	(0.131)	0.041	0.166
154	12.83	0.97	0.215	(0.131)	0.042	0.172
155	12.92	0.97	0.215	(0.130)	0.042	0.172
156	13.00	0.97	0.215	(0.129)	0.042	0.172

157	13.08	1.13	0.252	(0.129)	0.050	0.202
158	13.17	1.13	0.252	(0.128)	0.050	0.202
159	13.25	1.13	0.252	(0.127)	0.050	0.202
160	13.33	1.13	0.252	(0.127)	0.050	0.202
161	13.42	1.13	0.252	(0.126)	0.050	0.202
162	13.50	1.13	0.252	(0.125)	0.050	0.202
163	13.58	0.77	0.170	(0.125)	0.034	0.137
164	13.67	0.77	0.170	(0.124)	0.034	0.137
165	13.75	0.77	0.170	(0.124)	0.034	0.137
166	13.83	0.77	0.170	(0.123)	0.034	0.137
167	13.92	0.77	0.170	(0.122)	0.034	0.137
168	14.00	0.77	0.170	(0.122)	0.034	0.137
169	14.08	0.90	0.200	(0.121)	0.040	0.160
170	14.17	0.90	0.200	(0.120)	0.040	0.160
171	14.25	0.90	0.200	(0.120)	0.040	0.160
172	14.33	0.87	0.192	(0.119)	0.038	0.154
173	14.42	0.87	0.192	(0.119)	0.038	0.154
174	14.50	0.87	0.192	(0.118)	0.038	0.154
175	14.58	0.87	0.192	(0.117)	0.038	0.154
176	14.67	0.87	0.192	(0.117)	0.038	0.154
177	14.75	0.87	0.192	(0.116)	0.038	0.154
178	14.83	0.83	0.185	(0.116)	0.037	0.148
179	14.92	0.83	0.185	(0.115)	0.037	0.148
180	15.00	0.83	0.185	(0.114)	0.037	0.148
181	15.08	0.80	0.178	(0.114)	0.035	0.142
182	15.17	0.80	0.178	(0.113)	0.035	0.142
183	15.25	0.80	0.178	(0.113)	0.035	0.142
184	15.33	0.77	0.170	(0.112)	0.034	0.137
185	15.42	0.77	0.170	(0.112)	0.034	0.137
186	15.50	0.77	0.170	(0.111)	0.034	0.137
187	15.58	0.63	0.141	(0.110)	0.028	0.113
188	15.67	0.63	0.141	(0.110)	0.028	0.113
189	15.75	0.63	0.141	(0.109)	0.028	0.113
190	15.83	0.63	0.141	(0.109)	0.028	0.113
191	15.92	0.63	0.141	(0.108)	0.028	0.113
192	16.00	0.63	0.141	(0.108)	0.028	0.113
193	16.08	0.13	0.030	(0.107)	0.006	0.024
194	16.17	0.13	0.030	(0.106)	0.006	0.024
195	16.25	0.13	0.030	(0.106)	0.006	0.024
196	16.33	0.13	0.030	(0.105)	0.006	0.024
197	16.42	0.13	0.030	(0.105)	0.006	0.024
198	16.50	0.13	0.030	(0.104)	0.006	0.024
199	16.58	0.10	0.022	(0.104)	0.004	0.018
200	16.67	0.10	0.022	(0.103)	0.004	0.018
201	16.75	0.10	0.022	(0.103)	0.004	0.018
202	16.83	0.10	0.022	(0.102)	0.004	0.018
203	16.92	0.10	0.022	(0.102)	0.004	0.018
204	17.00	0.10	0.022	(0.101)	0.004	0.018
205	17.08	0.17	0.037	(0.101)	0.007	0.030
206	17.17	0.17	0.037	(0.100)	0.007	0.030

207	17.25	0.17	0.037	(0.100)	0.007	0.030
208	17.33	0.17	0.037	(0.099)	0.007	0.030
209	17.42	0.17	0.037	(0.099)	0.007	0.030
210	17.50	0.17	0.037	(0.098)	0.007	0.030
211	17.58	0.17	0.037	(0.098)	0.007	0.030
212	17.67	0.17	0.037	(0.097)	0.007	0.030
213	17.75	0.17	0.037	(0.097)	0.007	0.030
214	17.83	0.13	0.030	(0.096)	0.006	0.024
215	17.92	0.13	0.030	(0.096)	0.006	0.024
216	18.00	0.13	0.030	(0.095)	0.006	0.024
217	18.08	0.13	0.030	(0.095)	0.006	0.024
218	18.17	0.13	0.030	(0.094)	0.006	0.024
219	18.25	0.13	0.030	(0.094)	0.006	0.024
220	18.33	0.13	0.030	(0.093)	0.006	0.024
221	18.42	0.13	0.030	(0.093)	0.006	0.024
222	18.50	0.13	0.030	(0.093)	0.006	0.024
223	18.58	0.10	0.022	(0.092)	0.004	0.018
224	18.67	0.10	0.022	(0.092)	0.004	0.018
225	18.75	0.10	0.022	(0.091)	0.004	0.018
226	18.83	0.07	0.015	(0.091)	0.003	0.012
227	18.92	0.07	0.015	(0.090)	0.003	0.012
228	19.00	0.07	0.015	(0.090)	0.003	0.012
229	19.08	0.10	0.022	(0.089)	0.004	0.018
230	19.17	0.10	0.022	(0.089)	0.004	0.018
231	19.25	0.10	0.022	(0.089)	0.004	0.018
232	19.33	0.13	0.030	(0.088)	0.006	0.024
233	19.42	0.13	0.030	(0.088)	0.006	0.024
234	19.50	0.13	0.030	(0.087)	0.006	0.024
235	19.58	0.10	0.022	(0.087)	0.004	0.018
236	19.67	0.10	0.022	(0.087)	0.004	0.018
237	19.75	0.10	0.022	(0.086)	0.004	0.018
238	19.83	0.07	0.015	(0.086)	0.003	0.012
239	19.92	0.07	0.015	(0.085)	0.003	0.012
240	20.00	0.07	0.015	(0.085)	0.003	0.012
241	20.08	0.10	0.022	(0.085)	0.004	0.018
242	20.17	0.10	0.022	(0.084)	0.004	0.018
243	20.25	0.10	0.022	(0.084)	0.004	0.018
244	20.33	0.10	0.022	(0.084)	0.004	0.018
245	20.42	0.10	0.022	(0.083)	0.004	0.018
246	20.50	0.10	0.022	(0.083)	0.004	0.018
247	20.58	0.10	0.022	(0.083)	0.004	0.018
248	20.67	0.10	0.022	(0.082)	0.004	0.018
249	20.75	0.10	0.022	(0.082)	0.004	0.018
250	20.83	0.07	0.015	(0.082)	0.003	0.012
251	20.92	0.07	0.015	(0.081)	0.003	0.012
252	21.00	0.07	0.015	(0.081)	0.003	0.012
253	21.08	0.10	0.022	(0.081)	0.004	0.018
254	21.17	0.10	0.022	(0.080)	0.004	0.018
255	21.25	0.10	0.022	(0.080)	0.004	0.018
256	21.33	0.07	0.015	(0.080)	0.003	0.012

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257  21.42     0.07      0.015       (  0.079)       0.003        0.012
258  21.50     0.07      0.015       (  0.079)       0.003        0.012
259  21.58     0.10      0.022       (  0.079)       0.004        0.018
260  21.67     0.10      0.022       (  0.078)       0.004        0.018
261  21.75     0.10      0.022       (  0.078)       0.004        0.018
262  21.83     0.07      0.015       (  0.078)       0.003        0.012
263  21.92     0.07      0.015       (  0.078)       0.003        0.012
264  22.00     0.07      0.015       (  0.077)       0.003        0.012
265  22.08     0.10      0.022       (  0.077)       0.004        0.018
266  22.17     0.10      0.022       (  0.077)       0.004        0.018
267  22.25     0.10      0.022       (  0.077)       0.004        0.018
268  22.33     0.07      0.015       (  0.076)       0.003        0.012
269  22.42     0.07      0.015       (  0.076)       0.003        0.012
270  22.50     0.07      0.015       (  0.076)       0.003        0.012
271  22.58     0.07      0.015       (  0.076)       0.003        0.012
272  22.67     0.07      0.015       (  0.075)       0.003        0.012
273  22.75     0.07      0.015       (  0.075)       0.003        0.012
274  22.83     0.07      0.015       (  0.075)       0.003        0.012
275  22.92     0.07      0.015       (  0.075)       0.003        0.012
276  23.00     0.07      0.015       (  0.075)       0.003        0.012
277  23.08     0.07      0.015       (  0.075)       0.003        0.012
278  23.17     0.07      0.015       (  0.074)       0.003        0.012
279  23.25     0.07      0.015       (  0.074)       0.003        0.012
280  23.33     0.07      0.015       (  0.074)       0.003        0.012
281  23.42     0.07      0.015       (  0.074)       0.003        0.012
282  23.50     0.07      0.015       (  0.074)       0.003        0.012
283  23.58     0.07      0.015       (  0.074)       0.003        0.012
284  23.67     0.07      0.015       (  0.074)       0.003        0.012
285  23.75     0.07      0.015       (  0.073)       0.003        0.012
286  23.83     0.07      0.015       (  0.073)       0.003        0.012
287  23.92     0.07      0.015       (  0.073)       0.003        0.012
288  24.00     0.07      0.015       (  0.073)       0.003        0.012
                (Loss Rate Not Used)
    Sum =     100.0                                  Sum =    17.8
       Flood volume = Effective rainfall      1.48(In)
        times area      26.6(Ac.)/[(In)/(Ft.)] =       3.3(Ac.Ft)
       Total soil loss =      0.37(In)
       Total soil loss =     0.811(Ac.Ft)
       Total rainfall =      1.85(In)
       Flood volume =      143156.8 Cubic Feet
       Total soil loss =       35325.2 Cubic Feet
       ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      5.408(CFS)
       ---------------------------------------------------------------------
       +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R    S T O R M
                      R u n o f f      H y d r o g r a p h
       ---------------------------------------------------------------------
                    Hydrograph in   5   Minute intervals ((CFS))
```

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0010	0.14	Q				
0+10	0.0029	0.28	VQ				
0+15	0.0050	0.30	VQ				
0+20	0.0076	0.39	VQ				
0+25	0.0108	0.46	VQ				
0+30	0.0140	0.47	VQ				
0+35	0.0173	0.48	VQ				
0+40	0.0206	0.48	VQ				
0+45	0.0239	0.48	VQ				
0+50	0.0277	0.55	V Q				
0+55	0.0319	0.62	V Q				
1+ 0	0.0362	0.63	V Q				
1+ 5	0.0401	0.57	V Q				
1+10	0.0436	0.50	VQ				
1+15	0.0469	0.48	VQ				
1+20	0.0502	0.48	VQ				
1+25	0.0535	0.48	VQ				
1+30	0.0568	0.48	VQ				
1+35	0.0600	0.48	VQ				
1+40	0.0633	0.48	VQ				
1+45	0.0666	0.48	VQ				
1+50	0.0704	0.55	V Q				
1+55	0.0746	0.62	V Q				
2+ 0	0.0790	0.63	V Q				
2+ 5	0.0833	0.64	|VQ				
2+10	0.0877	0.64	|VQ				
2+15	0.0921	0.64	|VQ				
2+20	0.0965	0.64	|VQ				
2+25	0.1009	0.64	|VQ				
2+30	0.1052	0.64	|VQ				
2+35	0.1101	0.71	|VQ				
2+40	0.1154	0.77	|V Q				
2+45	0.1209	0.79	|V Q				
2+50	0.1264	0.80	|V Q				
2+55	0.1318	0.80	|V Q				
3+ 0	0.1373	0.80	|V Q				
3+ 5	0.1428	0.80	|V Q				
3+10	0.1483	0.80	|V Q				
3+15	0.1537	0.80	|V Q				
3+20	0.1592	0.80	|V Q				
3+25	0.1647	0.80	| VQ				
3+30	0.1702	0.80	| VQ				
3+35	0.1757	0.80	| VQ				
3+40	0.1811	0.80	| VQ				
3+45	0.1866	0.80	| VQ				
3+50	0.1926	0.87	| VQ				
3+55	0.1990	0.93	| VQ				

4+ 0	0.2055	0.95	VQ				
4+ 5	0.2121	0.95	VQ				
4+10	0.2187	0.95	VQ				
4+15	0.2252	0.95	VQ				
4+20	0.2323	1.02	V Q				
4+25	0.2398	1.09	V Q				
4+30	0.2474	1.11	VQ				
4+35	0.2551	1.11	VQ				
4+40	0.2628	1.11	VQ				
4+45	0.2705	1.11	VQ				
4+50	0.2786	1.18	VQ				
4+55	0.2872	1.25	V Q				
5+ 0	0.2959	1.27	V Q				
5+ 5	0.3037	1.13	VQ				
5+10	0.3106	1.00	Q				
5+15	0.3173	0.97	Q				
5+20	0.3243	1.02	VQ				
5+25	0.3318	1.09	Q				
5+30	0.3395	1.11	Q				
5+35	0.3476	1.18	Q				
5+40	0.3562	1.25	VQ				
5+45	0.3650	1.27	VQ				
5+50	0.3737	1.27	VQ				
5+55	0.3825	1.27	VQ				
6+ 0	0.3913	1.27	VQ				
6+ 5	0.4005	1.34	VQ				
6+10	0.4102	1.41	VQ				
6+15	0.4200	1.42	Q				
6+20	0.4299	1.43	Q				
6+25	0.4397	1.43	Q				
6+30	0.4496	1.43	Q				
6+35	0.4599	1.50	VQ				
6+40	0.4708	1.57	VQ				
6+45	0.4817	1.58	VQ				
6+50	0.4926	1.59	VQ				
6+55	0.5036	1.59	Q				
7+ 0	0.5145	1.59	Q				
7+ 5	0.5255	1.59	Q				
7+10	0.5364	1.59	Q				
7+15	0.5474	1.59	Q				
7+20	0.5588	1.66	Q				
7+25	0.5707	1.73	Q				
7+30	0.5827	1.74	QV				
7+35	0.5953	1.82	Q				
7+40	0.6083	1.89	Q				
7+45	0.6214	1.90	Q				
7+50	0.6350	1.98	Q				
7+55	0.6491	2.05	VQ				
8+ 0	0.6633	2.06	Q				
8+ 5	0.6785	2.21	Q				

8+10	0.6947	2.34	VQ|			
8+15	0.7110	2.37	VQ|			
8+20	0.7274	2.39	VQ|			
8+25	0.7439	2.39	Q|			
8+30	0.7603	2.39	Q|			
8+35	0.7772	2.46	Q|			
8+40	0.7946	2.52	VQ			
8+45	0.8121	2.54	VQ			
8+50	0.8301	2.61	Q			
8+55	0.8486	2.68	Q			
9+ 0	0.8671	2.70	Q			
9+ 5	0.8867	2.84	VQ			
9+10	0.9073	2.98	|Q			
9+15	0.9280	3.01	|VQ			
9+20	0.9493	3.09	|VQ			
9+25	0.9711	3.16	|VQ			
9+30	0.9929	3.17	| Q			
9+35	1.0153	3.25	| VQ			
9+40	1.0382	3.32	| VQ			
9+45	1.0611	3.33	| VQ			
9+50	1.0846	3.41	| Q			
9+55	1.1086	3.48	| Q			
10+ 0	1.1326	3.49	| Q			
10+ 5	1.1534	3.01	| Q V			
10+10	1.1708	2.53	Q V			
10+15	1.1875	2.43	Q| V			
10+20	1.2040	2.39	Q| V			
10+25	1.2204	2.39	Q| V			
10+30	1.2368	2.39	Q| V			
10+35	1.2557	2.74	Q V			
10+40	1.2769	3.08	| Q V			
10+45	1.2986	3.15	| Q V			
10+50	1.3205	3.18	| Q V			
10+55	1.3424	3.18	| Q V			
11+ 0	1.3643	3.18	| Q V			
11+ 5	1.3857	3.11	| Q V			
11+10	1.4067	3.04	| Q V			
11+15	1.4275	3.03	| Q V			
11+20	1.4483	3.02	| Q V			
11+25	1.4692	3.02	| Q V			
11+30	1.4900	3.02	| Q V			
11+35	1.5098	2.88	|Q V			
11+40	1.5287	2.75	Q V			
11+45	1.5474	2.72	Q V			
11+50	1.5665	2.77	|Q V|			
11+55	1.5861	2.84	|Q V|			
12+ 0	1.6058	2.86	|Q V|			
12+ 5	1.6289	3.35	| Q V|			
12+10	1.6553	3.83	| Q V			
12+15	1.6823	3.93	| Q V			

12+20	1.7102	4.05	|	|	Q V	|	|
12+25	1.7386	4.12	|	|	Q |V	|	|
12+30	1.7670	4.13	|	|	Q |V	|	|
12+35	1.7964	4.28	|	|	Q |V	|	|
12+40	1.8268	4.41	|	|	Q | V	|	|
12+45	1.8574	4.44	|	|	Q | V	|	|
12+50	1.8886	4.52	|	|	Q | V	|	|
12+55	1.9202	4.59	|	|	Q | V	|	|
13+ 0	1.9519	4.61	|	|	Q | V	|	|
13+ 5	1.9861	4.96	|	|	Q| V	|	|
13+10	2.0226	5.31	|	|	|Q V	|	|
13+15	2.0596	5.37	|	|	|Q V	|	|
13+20	2.0969	5.41	|	|	|Q V	|	|
13+25	2.1341	5.41	|	|	|Q V	|	|
13+30	2.1714	5.41	|	|	|Q V	|	|
13+35	2.2033	4.64	|	|	Q | V	|	|
13+40	2.2301	3.88	|	|	Q | V	|	|
13+45	2.2558	3.73	|	|	Q | V	|	|
13+50	2.2810	3.66	|	|	Q | V	|	|
13+55	2.3062	3.66	|	|	Q | V	|	|
14+ 0	2.3314	3.66	|	|	Q | V	|	|
14+ 5	2.3585	3.94	|	|	Q | V	|	|
14+10	2.3875	4.21	|	|	Q | V|	|	|
14+15	2.4169	4.27	|	|	Q | V|	|	|
14+20	2.4460	4.22	|	|	Q | V|	|	|
14+25	2.4746	4.16	|	|	Q | V	|	|
14+30	2.5032	4.14	|	|	Q | V	|	|
14+35	2.5316	4.14	|	|	Q | V	|	|
14+40	2.5601	4.14	|	|	Q | |V	|	|
14+45	2.5886	4.14	|	|	Q | |V	|	|
14+50	2.6166	4.07	|	|	Q | |V	|	|
14+55	2.6441	4.00	|	|	Q | | V	|	|
15+ 0	2.6716	3.98	|	|	Q | | V	|	|
15+ 5	2.6985	3.91	|	|	Q | | V	|	|
15+10	2.7249	3.84	|	|	Q | | V	|	|
15+15	2.7512	3.82	|	|	Q | | V	|	|
15+20	2.7770	3.75	|	|	Q | | V	|	|
15+25	2.8024	3.68	|	|	Q | | V	|	|
15+30	2.8276	3.67	|	|	Q | | V	|	|
15+35	2.8509	3.38	|	|	Q | | V	|	|
15+40	2.8723	3.10	|	|	Q | | V	|	|
15+45	2.8933	3.05	|	|	Q | | V	|	|
15+50	2.9141	3.02	|	|	Q | | V	|	|
15+55	2.9349	3.02	|	|	Q | | V	|	|
16+ 0	2.9557	3.02	|	|	Q | | V	|	|
16+ 5	2.9693	1.97	|	Q |	| |	|	| V	|
16+10	2.9758	0.94	|	Q |	| |	|	| V	|
16+15	2.9809	0.74	|	Q |	| |	|	| V	|
16+20	2.9853	0.64	|	Q |	| |	|	| V	|
16+25	2.9896	0.64	|	Q |	| |	|	| V	|

16+30	2.9940	0.64	Q				V
16+35	2.9979	0.57	Q				V
16+40	3.0013	0.50	Q				V
16+45	3.0047	0.48	Q				V
16+50	3.0080	0.48	Q				V
16+55	3.0113	0.48	Q				V
17+ 0	3.0145	0.48	Q				V
17+ 5	3.0188	0.62	Q				V
17+10	3.0240	0.75	Q				V
17+15	3.0294	0.78	Q				V
17+20	3.0348	0.80	Q				V
17+25	3.0403	0.80	Q				V
17+30	3.0458	0.80	Q				V
17+35	3.0513	0.80	Q				V
17+40	3.0568	0.80	Q				V
17+45	3.0622	0.80	Q				V
17+50	3.0672	0.73	Q				V
17+55	3.0718	0.66	Q				V
18+ 0	3.0762	0.64	Q				V
18+ 5	3.0806	0.64	Q				V
18+10	3.0849	0.64	Q				V
18+15	3.0893	0.64	Q				V
18+20	3.0937	0.64	Q				V
18+25	3.0981	0.64	Q				V
18+30	3.1025	0.64	Q				V
18+35	3.1064	0.57	Q				V
18+40	3.1098	0.50	Q				V
18+45	3.1131	0.48	Q				V
18+50	3.1159	0.41	Q				V
18+55	3.1183	0.34	Q				V
19+ 0	3.1205	0.32	Q				V
19+ 5	3.1232	0.39	Q				V
19+10	3.1263	0.46	Q				V
19+15	3.1296	0.47	Q				V
19+20	3.1333	0.55	Q				V
19+25	3.1376	0.62	Q				V
19+30	3.1419	0.63	Q				V
19+35	3.1458	0.57	Q				V
19+40	3.1492	0.50	Q				V
19+45	3.1526	0.48	Q				V
19+50	3.1554	0.41	Q				V
19+55	3.1577	0.34	Q				V
20+ 0	3.1599	0.32	Q				V
20+ 5	3.1626	0.39	Q				V
20+10	3.1658	0.46	Q				V
20+15	3.1690	0.47	Q				V
20+20	3.1723	0.48	Q				V
20+25	3.1756	0.48	Q				V
20+30	3.1789	0.48	Q				V
20+35	3.1821	0.48	Q				V

20+40	3.1854	0.48	Q				V
20+45	3.1887	0.48	Q				V
20+50	3.1915	0.41	Q				V
20+55	3.1939	0.34	Q				V
21+ 0	3.1961	0.32	Q				V
21+ 5	3.1988	0.39	Q				V
21+10	3.2019	0.46	Q				V
21+15	3.2052	0.47	Q				V
21+20	3.2080	0.41	Q				V
21+25	3.2103	0.34	Q				V
21+30	3.2125	0.32	Q				V
21+35	3.2152	0.39	Q				V
21+40	3.2183	0.46	Q				V
21+45	3.2216	0.47	Q				V
21+50	3.2244	0.41	Q				V
21+55	3.2267	0.34	Q				V
22+ 0	3.2290	0.32	Q				V
22+ 5	3.2316	0.39	Q				V
22+10	3.2348	0.46	Q				V
22+15	3.2380	0.47	Q				V
22+20	3.2408	0.41	Q				V
22+25	3.2432	0.34	Q				V
22+30	3.2454	0.32	Q				V
22+35	3.2476	0.32	Q				V
22+40	3.2498	0.32	Q				V
22+45	3.2520	0.32	Q				V
22+50	3.2542	0.32	Q				V
22+55	3.2563	0.32	Q				V
23+ 0	3.2585	0.32	Q				V
23+ 5	3.2607	0.32	Q				V
23+10	3.2629	0.32	Q				V
23+15	3.2651	0.32	Q				V
23+20	3.2673	0.32	Q				V
23+25	3.2695	0.32	Q				V
23+30	3.2717	0.32	Q				V
23+35	3.2739	0.32	Q				V
23+40	3.2761	0.32	Q				V
23+45	3.2783	0.32	Q				V
23+50	3.2804	0.32	Q				V
23+55	3.2826	0.32	Q				V
24+ 0	3.2848	0.32	Q				V
24+ 5	3.2861	0.18	Q				V
24+10	3.2863	0.04	Q				V
24+15	3.2864	0.01	Q				V

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	Ares Menifee
Engineer:	Jessica Park
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	150000 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(100 ft. x 500 ft.)

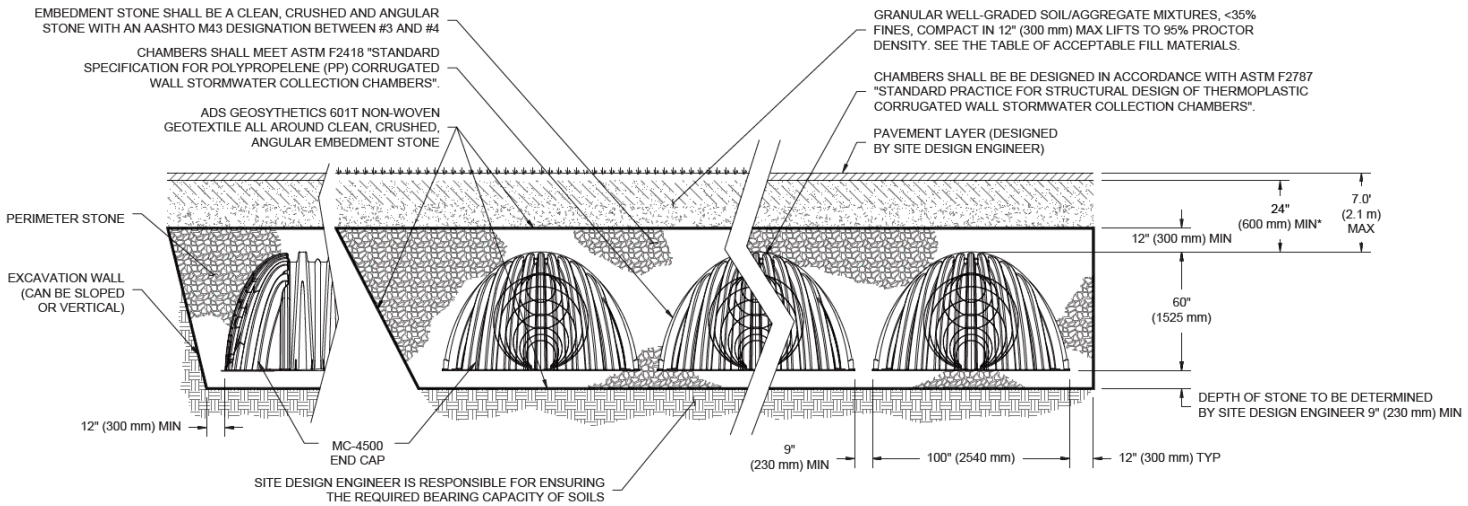
Results

System Volume and Bed Size

Installed Storage Volume:	154074.59 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	559
Number Of End Caps Required:	22
Chamber Rows:	11
Maximum Length:	471.27 ft.
Maximum Width:	101.17 ft.
Approx. Bed Size Required:	35020.86 square ft.

System Components

Amount Of Stone Required:	5082 cubic yards
Volume Of Excavation (Not Including Fill):	8756 cubic yards
Total Non-woven Geotextile Required:	10370 square yards
Woven Geotextile Required (excluding Isolator Row):	85 square yards
Woven Geotextile Required (Isolator Row):	1764 square yards
Total Woven Geotextile Required:	1849 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).

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ A. **On-site storm drain inlets**	☒ **Locations of inlets.**	☒ **Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.**	☒ **Maintain and periodically repaint or replace inlet markings.** ☒ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ☒ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ☒ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
☐ B. **Interior floor drains and elevator shaft sump pumps**		☐ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**
☐ C. **Interior parking garages**		☐ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ D1. **Need for future indoor & structural pest control**		☐ **Note building design features that discourage entry of pests.**	☐ **Provide Integrated Pest Management information to owners, lessees, and operators.**
☒ D2. **Landscape/ Outdoor Pesticide Use**	☒ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ☒ **Show self-retaining landscape areas, if any.** ☒ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** ☒ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ☒ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ☒ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ☒ **Consider using pest-resistant plants, especially adjacent to hardscape.** **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	☒ **Maintain landscaping using minimum or no pesticides.** ☒ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at http://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ☒ **Provide IPM information to new owners, lessees and operators.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ E. **Pools, spas, ponds, decorative fountains, and other water features.**	❑ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)**	**If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	❑ **See applicable operational BMPs in** "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
❑ F. **Food service**	❑ **For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.** ❑ **On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.**	❑ **Describe the location and features of the designated cleaning area.** ❑ **Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.**	❑ **See the brochure, "**The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ **Provide this brochure to new site owners, lessees, and operators.**
☒ G. **Refuse areas**	☒ **Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.** ❑ **If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.** ❑ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	☒ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** ☒ **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	☒ **State how the following will be implemented:** **Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ H. **Industrial processes.**	❑ **Show process area.**	❑ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	❑ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	☒ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ☒ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ☒ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	**Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** **www.cchealth.org/groups/hazmat/**	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ J. **Vehicle and Equipment Cleaning**	❑ **Show on drawings as appropriate:** **(1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.** **(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use).** **(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.** **(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.**	❑ **If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.**	**Describe operational measures to implement the following (if applicable):** ❑ **Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.** Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ❑ **Car dealerships and similar may rinse cars with water only.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ K. **Vehicle/Equipment Repair and Maintenance**	❑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ❑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	❑ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ❑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ❑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ❑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ❑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ❑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

[6] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ M. **Loading Docks**	☐ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ☐ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ☐ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		☐ **Move loaded and unloaded items indoors as soon as possible.** ☐ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ N. **Fire Sprinkler Test Water**		☐ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	☐ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ☐ **Boiler drain lines** ☐ **Condensate drain lines** ☒ **Rooftop equipment** ☐ **Drainage sumps** ☒ **Roofing, gutters, and trim.** ☐ **Other sources**		☐ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ☐ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ☐ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ☐ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ☒ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** **Include controls for other sources as specified by local reviewer.**	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ P. **Plazas, sidewalks, and parking lots.**			☒ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Operation and Maintenance Manual

1. Purpose of the Operation & Maintenance Manual

   The purpose of this manual is to provide maintenance instructions for the structural BMPs, modular wetland linear systems (MWS A, B, & C) and an underground storage chamber system (Basin A), located throughout the site. The modular wetland linear systems are pollution control devices designed to treat urban runoff before it enters the future storm drain main to be constructed along Murrieta Road adjacent to the project site to the east. The underground storage chamber system is an upstream detention basin for both hydromodification mitigation and water quantity control purposes, both to detain runoff prior to treatment and to reduce the peak flow of runoff from the site. Regular maintenance will help ensure that the structural BMPs will function as they have been designed.

   This manual will serve as a reference guide and filed manual to assist the property owner with:

   - An overview of the structural BMPs and how they function.
   - A description of the location of the structural BMPs.
   - An understanding of the procedures required to effectively maintain the structural BMPs on a regular basis.
   - Reproducible copies of the forms, logs, and guidance sheets necessary for recording maintenance activities associated with the structural BMPs.

2. General Description and Function of the Structural BMPs

   Modular Wetland Linear Systems

   Modular wetland linear systems are biotreatment BMPs which are designed to remove high levels of trash, debris, sediments, nutrients, metals, and hydrocarbons from stormwater runoff. Total suspended solids, trash and debris settle in the pretreatment chamber when stormwater runoff first enters the modular wetland linear system. Additional treatment is then provided by the pretreatment filter boxes that the runoff flows through, subsequently entering the biofiltration chamber. The runoff fills the voids along the biofiltration chamber's perimeter, then horizontal forces push the runoff inward through the biofiltration media. The biofiltration media is where nutrients and metals in the runoff are captured and removed. To discharge treated runoff, an internal vertical drain pipe and orifice control plate dictate runoff flow through the biofiltration media to a level manageable for the media, not exceeding its capacity. Runoff is finally discharged through the outlet drain pipe. The modular wetland linear system also features an internal weir for the purpose of runoff bypass during high-flow storm events, which prevents flooding and the need for a separate bypass structure.

   Underground Storage Chamber System

   The underground storage chamber system is a structural BMP which serves as an upstream detention basin for stormwater runoff prior to treatment by the modular wetland linear systems proposed on-site. The underground storage chamber system is designed for installation beneath impervious surfaces, typically under parking lots, for ease of implementation in sites with limited pervious space. The system features individual chambers that make up the entire system, which are embedded in a stone layer beneath fill layers and the parking lot pavement overtop. The chambers sit on top of foundation stone which rests overtop the subgrade soils on-

site. The system also features an isolator row for conveyance of stormwater runoff from the pipe network conveyance system into the chamber system. The chambers and the embedment stone provide a cumulative storage volume for the stormwater runoff that is collected in the system. This runoff is detained in the chamber system prior to being discharged into the modular wetland linear systems for treatment.

3. Maintenance Responsibility

The property owner is ultimately responsible for maintaining the structural BMPs: modular wetland linear systems and the underground storage chamber system, as well as all components of the proposed stormwater runoff conveyance network. The property owner is listed below:

IPT Menifee CC, LLC
4675 MacArthur Court, Suite 625
Newport Beach, CA 92660
Contact: Christopher Sanford
Phone: 949-788-4059

The main goals in maintaining the structural BMPs are to ensure that proper treatment is occurring, and flows are properly being discharged from the site. Regular inspection, maintenance, and repair of the structural BMPs when they are not performing as designed are the key takeaways of the maintenance program.

To achieve this, the following general procedures shall be followed:

<u>For Modular Wetland Linear Systems:</u>

- Qualified maintenance personnel should periodically inspect at a minimum four times per year during wet season, prior to October 1st through April 30th, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches. Average inspection time is approximately 15 minutes per unit. Always ensure appropriate safety protocol and procedures are followed.
- If a problem is identified, it should be rectified as soon as possible to ensure that the modular wetland linear system functions as designed in addition to reducing maintenance costs throughout the life of the modular wetland linear system. See Section 4 for more information on measures to control maintenance costs.
- Regular removal of trash, silt, and debris should occur as needed. Trash and debris, visible within the inlet pipe and within the pretreatment and biofiltration chambers, shall be promptly removed.

<u>For Underground Storage Chamber System:</u>

- Qualified maintenance personnel should periodically inspect at a minimum four times per year during wet season, prior to October 1st through April 30th, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
- If a problem is identified, it should be rectified as soon as possible to ensure that the underground storage chamber system functions as designed in addition to reducing

maintenance costs throughout the life of the underground storage chamber system. See Section 4 for more information on measures to control maintenance costs.

- Inspection ports shall be utilized as needed to assess sediment and debris buildup in the underground storage chamber system. A stadia rod shall be used to determine the average depth of sediment at each riser and cleanout location. Inspect all manifolds, laterals, and inlet/outlet pipes for any issues that may impact functionality.

Detailed maintenance procedures are outlined in section 5.

4. Measures to Control Maintenance Costs

The most effective way of reducing the maintenance costs of the modular wetland linear systems is to prevent or reduce pollutants generated on-site which are then delivered to the systems, which can be achieved through implementation of source control BMPs. The second measure is to include design features to facilitate maintenance. Access covers are provided to allow access for inspection and maintenance. The biofiltration media shall be inspected regularly along with the structural components of the system to ensure that the media is in good condition and functioning properly. Modular wetland linear systems may require excavation of the clogged biofiltration media, so it should be accessible to appropriate equipment for excavation and removal/replacement of the biofiltration media.

As for the underground storage chamber system, the most effective way of reducing maintenance costs is through proper, routine inspection and regular removal of debris and sediment buildup from the main components of the system, including the manifolds, laterals, and inlet/outlet pipes. Proper inspection and maintenance of the isolator row is also key in reducing maintenance costs. JetVac maintenance may be required to properly remove sediment from the isolator row if the average depth of sediment has reached 3".

5. Maintenance Indicators and Activities

<u>Functional Maintenance:</u>
Regular functional maintenance is required to ensure that the modular wetland linear systems and the underground storage chamber system all perform in an effective manner. Functional maintenance consists of both preventative and corrective activities. Logs and guidance sheets are contained herein to use in recording vital information while performing operation inspection and other maintenance activities for the structural BMPs. Maintenance records shall be maintained by the property owner for a minimum of five years. The proper use and subsequent storage of these records will assure Riverside County that the modular wetland linear systems and underground storage chamber system are all functioning as designed.

<u>Preventative Maintenance:</u>
Preventative maintenance shall be performed on a regular basis. Checklists are included herein to track and record preventative maintenance activities. These activities include trash and debris removal and sediment management.

Silt, trash, and debris removal shall be performed to ensure that the underground storage chamber system has adequate capacity to store the required amount of stormwater runoff, and to ensure that the modular wetland linear systems are able to treat all stormwater runoff properly without clogging or flooding, which could pose potential hazards.

Corrective Maintenance:

Corrective maintenance will be required on an emergency or non-routine basis to correct problems and restore the intended operation and safe function of the modular wetland linear systems and the underground storage chamber system.

Modular Wetland Linear System Maintenance:

- Inspect at a minimum four times per year during wet season, prior to October 1st through April 30th, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
- Remove access cover over pre-treatment chamber and observe the inside of the system. Look for obstructions in the inflow pipe or curb opening, pre-treatment chamber, biofiltration chamber, discharge chamber and outflow pipe. Inspect the media in the biofiltration chamber for any signs of disease or other negative stressors. Inspect he orifice plate and internal weir for any obstructions or debris buildup. Record all observations and determine necessary maintenance activities following inspection.
- Maintenance indicators include the following:
    - Missing or damaged internal components/cartridges
    - Obstructions in the system or its inlet and/or outlet pipes
    - Excessive accumulation of floatables in the pretreatment chamber (>18" in length and width of the chamber)
    - Excessive accumulation of sediment in the pretreatment chamber (>6" in depth)
    - Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges (>85% clogged)
    - Overgrown vegetation (for units with open planters)
    - Water level in the discharge chamber during 100% operating capacity is lower than the water mark by 20%
- Maintenance procedures include the following:
    - Spray down pollutants accumulated on walls and pre-filter cartridges in the pretreatment chamber.
    - Vacuum pretreatment chamber and remove accumulated sediment, trash, and debris.
    - Replace media in pre-filter cartridges with healthy new media as needed. Spray empty cartridges before installing new media to remove pollutants and debris.
    - Biofiltration media in the biofiltration chamber shall be replaced as needed. Contact the manufacturer to obtain new biofiltration media.
    - Remove any sediment and debris buildup in the discharge chamber.
    - Replace any broken or impaired parts of the modular wetland system as needed.
- Refer to the manufacturer's operations and maintenance manual.

Underground Storage Chamber System Maintenance:

- Inspect at a minimum four times per year during wet season, prior to October 1st through April 30th, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
- Inspect isolator row through inspection port for sediment. If upon visual inspection sediment has accumulated, insert a stadia rod to determine the average depth of sediment. If average depth of sediment exceeds 3 inches, clean-out should be performed. Measure sediment buildup at each riser and cleanout location. Inspect each manifold, all laterals, and inlet/outlet pipes for sediment buildup, obstructions, or other issues that may affect functionality of the system. Remove obstructions immediately.
- If measured sediment buildup is between 5% to 20% of the pipe diameter, cleaning should be considered. If sediment buildup exceeds 20%, cleaning should be performed at the earliest opportunity.
- A JetVac shall be utilized to properly clean the system. Apply multiple passes of the JetVac until backflush water is clean. Vacuum manhole sump as required.
- Replace all caps, lid covers, record observations and actions.
- Clean catch basins and manholes upstream of the system.
- Refer to the manufacturer's operations and maintenance manual.

Stormwater BMP Maintenance Schedule		
BMP	**Frequency**	**Procedures**
Modular Wetland Linear System	• Inspect at a minimum four times per year during wet season, prior to October 1st through April 30th, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches. • Remove sediment and debris buildup – Biannually • Replace pre-filter cartridge media – As needed • Replace biofiltration media – As needed	<u>General Inspections</u> 1. Inspect for trash, debris, and sediment. Remove promptly. 2. Inspect for floatables in pretreatment chamber. Remove promptly. 3. Inspect for sediment buildup in pretreatment chamber, biofiltration chamber, and discharge chamber. Remove promptly. 4. Identify any needed corrective maintenance that will require site-specific planning or design. <u>General Maintenance Procedures</u> 1. Spray down pollutants accumulated on walls and pre-filter cartridges in the pretreatment chamber. 2. Vacuum pretreatment chamber and remove accumulated sediment, trash, and debris. 3. Replace media in pre-filter cartridges with healthy new media if needed. Spray down empty cartridges before installing new media to remove pollutants and debris. 4. Biofiltration media in the biofiltration chamber shall be replaced as needed. Contact the manufacturer to obtain new biofiltration media. 5. Remove any sediment and debris buildup in the discharge chamber.

		6. Replace any broken or impaired parts of the modular wetland system as needed. 7. Refer to the manufacturer's operations and maintenance manual.
Underground Storage Chamber System	• Inspect at a minimum four times per year during wet season, prior to October 1st through April 30th, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches. • Remove sediment and debris buildup – Biannually • JetVac isolator row – As needed • Inspect and remove debris and sediment buildup from upstream catch basins and manholes – As needed	<u>General Inspections</u> 1. Inspect system through all inspection ports and cleanouts. 2. Identify any obstructions to the efficiency of the system. 3. Measure sediment buildup throughout the system. 4. Inspect each manifold, all laterals, and inlet/outlet pipes for sediment buildup, obstructions, or other issues that may affect functionality of the system. Remove obstructions immediately. <u>General Maintenance Procedures</u> 1. If measured sediment buildup is between 5% to 20% of the pipe diameter, cleaning should be considered. If sediment buildup exceeds 20%, cleaning should be performed at the earliest opportunity. 2. A JetVac shall be utilized to properly clean the system. Apply multiple passes of the JetVac until backflush water is clean. Vacuum manhole sump as required. 3. Replace all caps, lid covers, record observations and actions. 4. Clean catch basins and manholes upstream of the system. 5. Refer to the manufacturer's operations and maintenance manual.

Self- Treating and Self-retaining areas (Do not require specialized O&M)			
DMA	**Frequency**	**Maintenance**	**Location**
DMA 2	• As needed	<u>Landscape</u> 1. Irrigate as recommended by a landscape professional, typically for the first 3 years to establish vegetation. 2. Remove undesirable vegetation. 3. Reseed or replant areas of thin or missing vegetation.	Sloped Landscaped areas near the western border of the site.
DMA 3	• As needed	<u>Landscape</u> 1. Irrigate as recommended by a landscape professional, typically for the first 3 years to establish vegetation. 2. Remove undesirable vegetation. 3. Reseed or replant areas of thin or missing vegetation.	Sloped Landscaped areas near the northern border of the site.
DMA 4	• As needed	<u>Landscape</u> 1. Irrigate as recommended by a landscape professional, typically for the first 3 years to establish vegetation. 2. Remove undesirable vegetation. 3. Reseed or replant areas of thin or missing vegetation.	Sloped Landscaped areas near the eastern border of the site.
DMA 5	• As needed	<u>Landscape</u> 1. Irrigate as recommended by a landscape professional, typically for the first 3 years to establish vegetation. 2. Remove undesirable vegetation. 3. Reseed or replant areas of thin or missing vegetation.	Sloped Landscaped areas near the southern border of the site.

6. Inspection and Maintenance Checklist

Date of Inspection: _____

Type of Inspections: o Pre-Wet Season

- o After Heavy Runoff (0.5" or greater)
- o End of Wet Season
- o Other _____

Maintenance Indicator	**Maintenance Needed (yes/no)**	**Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)**	**Results Expected when Maintenance is Performed**
Modular Wetland Linear System			
Missing or damaged internal components/cartridges.			Missing or damaged internal components/cartridges are replaced immediately.
Obstructions in the system or its inlet and/or outlet pipes.			There should be no obstructions in the system.
Excessive accumulation of floatables in the pretreatment chamber (>18" in length and width of the chamber).			Accumulation of floatables in the pretreatment chamber should be minimal (<18" in length and width of the chamber).
Excessive accumulation of sediment in the pretreatment chamber (>6" in depth).			Accumulation of sediment in the pretreatment chamber should be minimal (<6" in depth).
Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges (>85% clogged).			Accumulation of sediment in the on the BioMediaGREEN media should be minimal (<85% clogged).
Overgrown vegetation (for units with open planters).			Vegetation should be healthy, and maintained as needed.

Water level in the discharge chamber during 100% operating capacity is lower than the water mark by 20%.			Water level in the discharge chamber should always be higher during 100% operating capacity.
Any condition not covered above that needs attention to ensure proper function of the modular wetland linear system.			Meet the design specifications.
Underground Storage Chamber System			
Missing or damaged internal components/cartridges.			Missing or damaged internal components/cartridges are replaced immediately.
Obstructions in the system, in the isolator row, manifolds, laterals, or its inlet and/or outlet pipes.			There should be no obstructions in the system.
Average depth of sediment exceeds 3 inches.			Sediment depth shall not exceed 3”.
Measured sediment buildup is between 5% to 20% of the pipe diameter.			Interior of the pipe is cleared of excessive sediment buildup.
Sediment buildup exceeds 20%.			Sediment is removed and the system is restored to full functionality.
Catch basins and manholes upstream of the system are clogged, broken, missing parts, or functioning incorrectly.			Catch basins and manholes upstream of the system are cleared of sediment and debris, broken parts are replaced, and full system is functioning properly.

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

CONTECH®
ENGINEERED SOLUTIONS

Modular Wetlands® Linear
Operation & Maintenance Manual

MODULAR WETLANDS®

MODULAR WETLANDS® LINEAR OPERATION & MAINTENANCE MANUAL

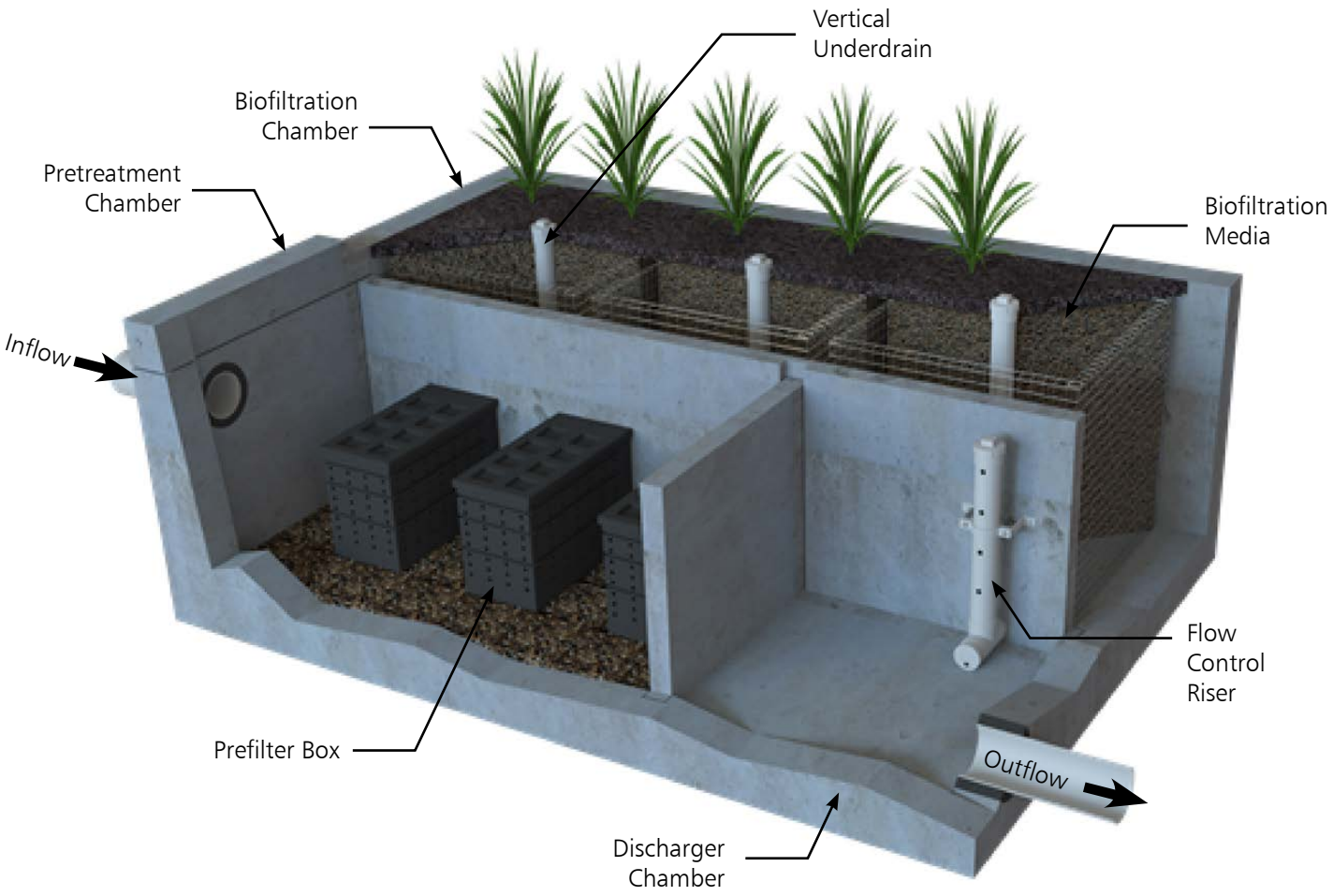
TABLE OF CONTENTS

OVERVIEW

The Modular Wetlands® Linear Biofilter is designed to remove high levels of trash, debris, sediments, nutrients, metals, and hydrocarbons. Its simple design allows for quick and easy installation. The system is housed in a standard precast structure and can be installed at various depths to meet site-specific conditions.

INTRODUCTION

This is the Modular Wetlands Linear Biofilter operation and maintenance manual. Before starting, read the instructions and equipment lists closely. It is important to follow all necessary safety procedures associated with state and local regulations. Some steps required confined space entry. Please contact Contech for more information on pre-authorized third party contractors who can provide installation services in your area. For a list of service providers in your area please visit: www.conteches.com/maintenance.



INSTRUCTIONS

INSPECTION SUMMARY

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

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

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

- Modular Wetlands Linear Inspection Form
- Flashlight
- Manhole hook or appropriate tools to remove access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- 7/16" open or closed ended wrench
- Large permanent black marker (initial inspections only - first year)

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

INSPECTION AND MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the biofiltration chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

INSPECTION PROCESS

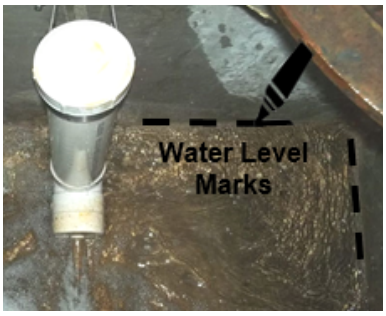
1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired,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

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.
7. The discharge chamber houses the orifice control structure, drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating conditions and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above. Generally, the discharge chamber will be clean and free of debris. Inspect the water marks on the side walls. If possible, inspect the discharge chamber during a rain event to assess the amount of flow leaving the system while it is at 100% capacity (pre-treatment chamber water level at peak HGL - top of bypass weir). The water level of the flowing water should be compared to the watermark level on the side walls, which is an indicator of the highest discharge rate the system achieved when initially installed. Record on the form if there is any difference in level from the watermark in inches.

NOTE: During the first few storms, the water level in the outflow chamber should be observed and a 6" long horizontal watermark line drawn (using a large permanent marker) at the water level in the discharge chamber while the system is operating at 100% capacity. The diagram below illustrates where the line should be drawn. This line is a reference point for future inspections of the system.

Water level in the discharge chamber is a function of flow rate and pipe size. Observation of the water level during the first few months of operation can be used as a benchmark level for future inspections. The initial mark and all future observations shall be made when the system is at 100% capacity (water level at maximum level in the pre-treatment chamber). If future water levels are below this mark when the system is at 100% capacity, this is an indicator that maintenance to the pre-filter cartridges may be needed.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.



MAINTENANCE INDICATORS

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

- Missing or damaged internal components or cartridges
- Obstructions in the system or its inlet and/or outlet pipes
- Excessive accumulation of floatables in the pretreatment chamber in which the length and width of the chamber is fully impacted more than 18". See photo below.
- Excessive accumulation of sediment in the pretreatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. The following chart shows photos of the condition of the BioMediaGREEN contained within the pre-filter cartridges. When media is more than 85% clogged, replacement is required.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.

INSPECTION PROCESS

- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models). The following photos show the condition of the BioMediaGREEN contained within the drain down filter. When media is more than 85% clogged, replacement is required.

- Overgrown vegetation.

- Water level in the discharge chamber during 100% operating capacity (pretreatment chamber water level at max height) is lower than the water mark by 20%.

MAINTENANCE SUMMARY

The time has come to maintain your Modular Wetlands® Linear. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

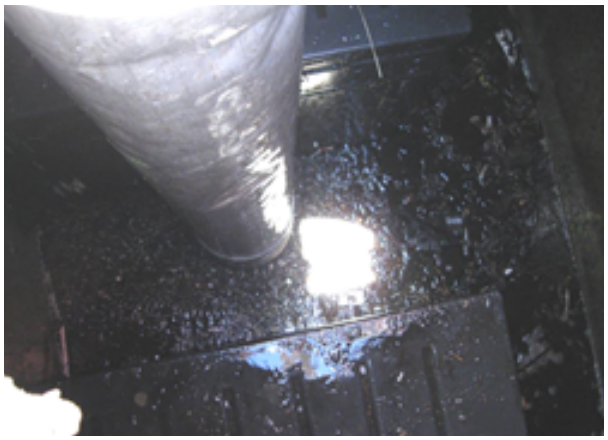
- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and cleaning equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks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

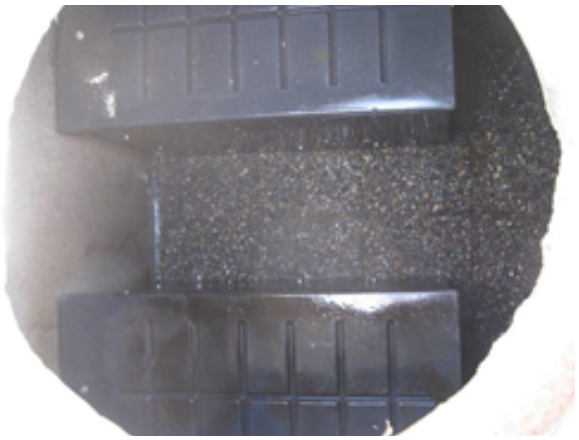
The following is a list of equipment to required for maintenance of the Modular Wetlands® Linear:

- Modular Wetlands Linear Maintenance Form
- Manhole hook or appropriate tools to access hatches and covers
- Protective clothing, flashlight, and eye protection
- 7/16" open or closed ended wrench
- Vacuum assisted truck with pressure washer
- Replacement BioMediaGREEN for pre-filter cartridges if required (order from one of Contech's Maintenance Team members at https://www.conteches.com/maintenance).

MAINTENANCE | PRETREATMENT CHAMBER

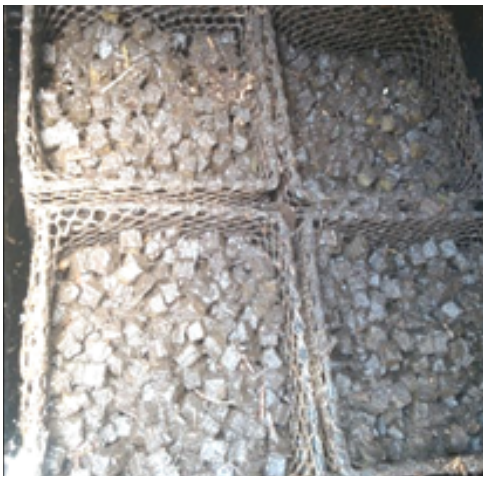
1. Remove access cover over pre-treatment chamber and position vacuum truck accordingly.
2. With a pressure washer, spray down pollutants accumulated on walls and pre-filter cartridges.
3. Vacuum out pre-treatment chamber and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the floor until the pervious pavers are visible and clean.
4. If pre-filter cartridges require media replacement, continue to step 5. If not, replace access cover and move to step 11.





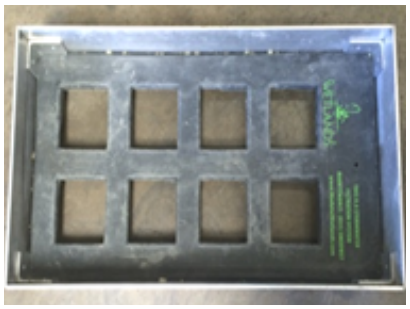
MAINTENANCE | PREFILTER CARTRIDGES

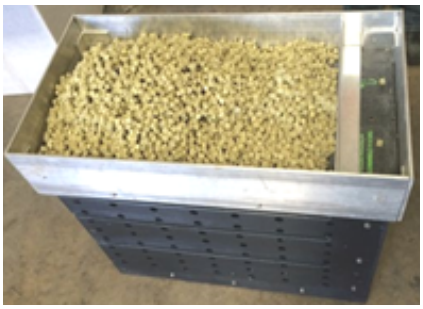
5. After successfully cleaning out the pre-treatment chamber (previous page) enter the pre-treatment chamber.
6. Unscrew the two bolts (circles shown below) holding the lid on each cartridge filter and remove lid.



7. Place the vacuum hose over each individual media filter to suck out filter media.

8. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and it's media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.
9. Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. Utilize the manufacture-provided refilling tray and place on top of the cartridge. Fill the tray with new bulk media and shake down into place. Using your hands, lightly compact the media into each filter cage. Once the cages are full, remove the refilling tray and replace the cartridge top, ensuring bolts are properly tightened.





10. Exit the pre-treatment chamber. Replace access hatch or manhole cover.

MAINTENANCE | BIOFILTRATION CHAMBER

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

12. Each vertical under drain on the biofiltration chamber has a removable (threaded cap) that can be taken off to check any blockages or root growth. Once removed, a jetting attachment can be used to clean out the under drain and orifice riser.
13. As with all biofilter systems, at some point the biofiltration media (WetlandMedia) will need to be replaced. Either because of physical clogging of sorptive exhaustion of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading. Utilize the vacuum truck to vacuum out the media by placing the hose into the chamber. Once all the media is removed use the power washer to spray down all the netting on the outer metal cage. Inspect the netting for any damage or holes. If the netting is damaged it can be repaired or replaced with guidance by the manufacturer.
14. Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new WetlandMedia. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1000 and 2000 lbs. A lifting apparatus (backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Fill the media cages up to the same level as the old media. Replant with vegetation.

MAINTENANCE | DISCHARGE CHAMBER

15. Remove access hatch or manhole cover over discharge chamber.
16. Enter chamber to gain access to the drain down filter. Unlock the locking mechanism and lift up drain down filter housing to remove used BioMediaGREEN filter block as shown below. *NOTE: Drain down filter is only found on units installed in California prior to 2023. If no drain down filter is present, skip steps 16 and 17.*

17. Insert a new BioMediaGREEN filter block and lock drain down filter housing back in place.
18. Replace access hatch or manhole cover over discharge chamber.

NOTES

CONTECH® ENGINEERED SOLUTIONS

Inspection Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

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

Weather Condition _____ Additional Notes _____

Inspection Checklist

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

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

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

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

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

CONTECH®
ENGINEERED SOLUTIONS

Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

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

Weather Condition _____ Additional Notes _____

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

Comments:

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800-338-1122

WWW.CONTECHES.COM

CONTECH ENGINEERED SOLUTIONS LLC PROVIDES SITE SOLUTIONS FOR THE CIVIL ENGINEERING INDUSTRY. CONTECH'S PORTFOLIO INCLUDES BRIDGES, DRAINAGE, SANITARY SEWER, STORMWATER AND EARTH STABILIZATION PRODUCTS. FOR INFORMATION ON OTHER CONTECH DIVISION OFFERINGS, VISIT CONTECHES.COM OR CALL 800-338-1122.

SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

Modular Wetlands Maintenance Guide 1/2023

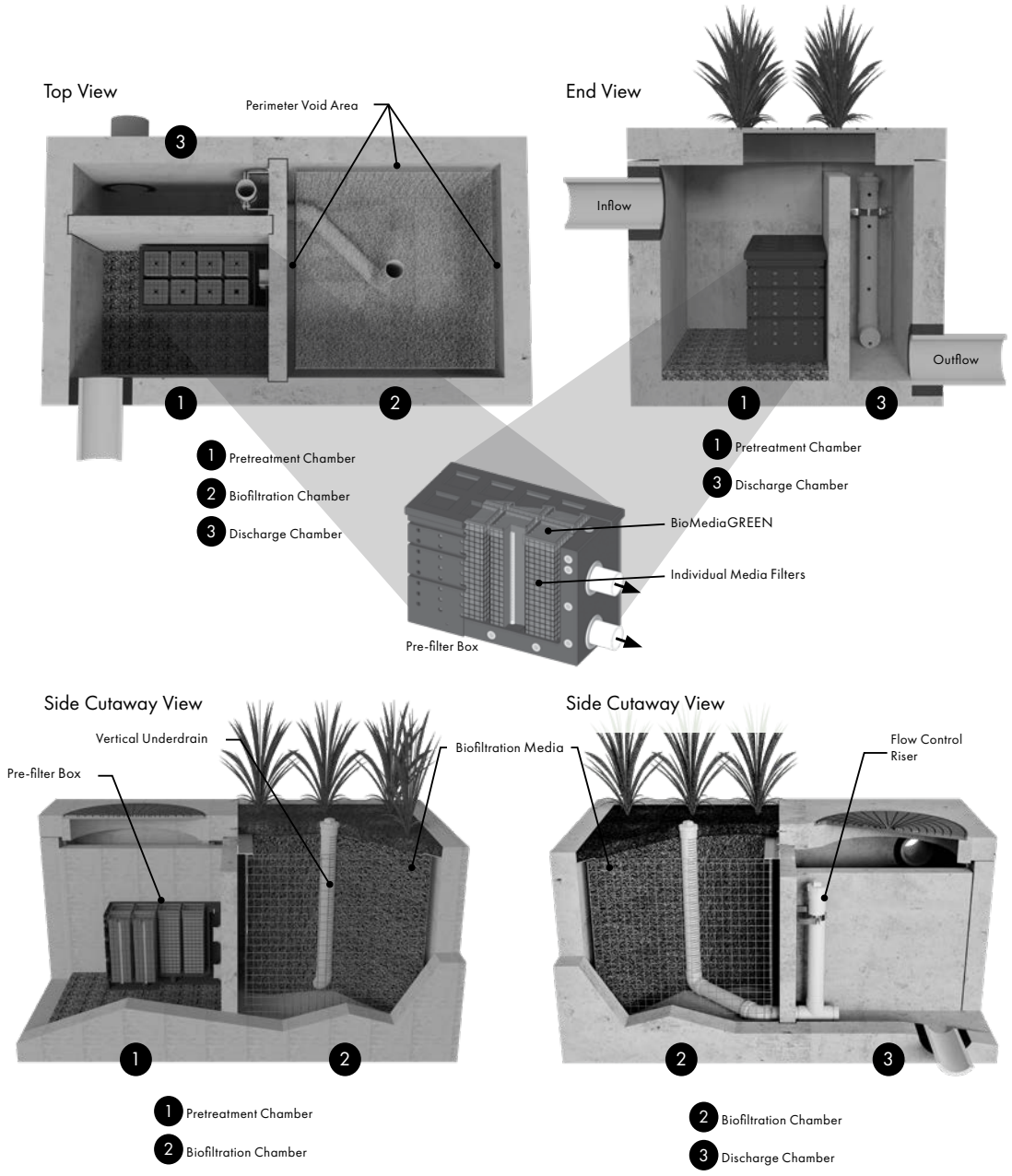
CONTECH®
ENGINEERED SOLUTIONS

Modular Wetlands® Linear Concrete Installation Manual

MODULAR WETLANDS®

Overview

The Modular Wetland® Linear Biofilter is designed to remove high levels of trash, debris, sediments, nutrients, metals, and hydrocarbons. Its simple design allows for quick and easy installation. The system is housed in a standard pre-cast structure and can be installed at various depths to meet site-specific conditions.



Introduction

This is the Modular Wetlands® Linear installation manual. Before starting, make sure there is enough room for installing and assembling the product. Inspect all materials for defects and gather the recommended tools listed on the following page. The contractor shall furnish all labor, equipment, materials, and incidentals required to conduct the installation in accordance with the contract documents.

Instructions

Delivery & Unloading / Lifting

- Contech shall deliver the unit(s) to the site in coordination with the Contractor.
- The Contractor may be required to provide spreader bars and chains/cables to safely and securely lift the base section, risers, and top section along with suitable lifting hooks, knuckles, shackles and eyebolts.
- Please see project specific drawings for weights and lifting details. Contact Contech for additional lifting details.

Inspection

Inspection of the Modular Wetlands® Linear and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any nonconformance to approved drawings or damage to any part of the system shall be documented on the Contech shipping ticket.

- Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Modular Wetlands® Linear unit shall be made to the acceptance of the Engineer/ Inspector.

Site Preparation

- The Contractor is responsible for providing adequate and complete vault protection when the Modular Wetlands® Linear unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed) to prevent construction debris or construction phase runoff from entering the unit.
- The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.
- The Contractor or Owner is responsible for appropriately barricading the Modular Wetlands® Linear unit from traffic (in accordance with local codes).

- Each Modular Wetlands® Linear unit shall be constructed based on the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.
- The Modular Wetlands® Linear unit shall be placed on level compacted sub-grade with a minimum 6-inch gravel base. Compact undisturbed sub-grade materials to be per Geotechnical/Soils report. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Place granular sub-base and compact to State and local standards as per the Engineers requirements.
- Once the base piece is set, the riser(s) and top section should be sealed onto the base section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal.
- Pipe connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct connection (inlet/outlet) will be marked on the Modular Wetlands® Linear unit.

- NOTE: The inlet and outlet pipe cannot protrude past the structures I.D. wall as it will interfere with the internal components.
- Once the Modular Wetlands® Linear unit is set, it should be protected from construction runoff entering it. Contractor will be responsible for cleaning if unit is contaminated by such construction runoff and associated pollutants and damaged (i.e. concrete wash water).
- Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6-inch lifts on all sides. Pre-cast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Modular Wetlands® Linear unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.
- If applicable, it is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetlands® Linear unit for proper stormwater flow into the system through the throat, pipe or grate opening. A standard drawing of the throat and gutter detail is available in the following section; however the plans and contract documents supersede all standard drawings. Several variations of the standard design are available. Effective bypass for an offline Modular Wetlands® Linear unit is essential for correct operation (i.e. bypass to an overflow at lower elevation).

Installation

1. Each Modular Wetlands® Linear unit shall be constructed based on the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

Position crane in a safe and optimal position for unloading. Ensure that the crane operator has the proper weights and distance to install location to allow for proper setup. The crane operator will provide instructions to the delivery driver on where to position the truck for offload.

2. The Modular Wetlands® Linear unit shall be placed on level compacted sub-grade with a minimum 6-inch gravel base and mark the base. Compact undisturbed subgrade materials to be per Geotechnical/Soils report. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Place granular sub-base and compact to State and local standards as per the Engineer's requirements.

3. Pipe material selection should be indicated on the Site Plan. Connect the pipe using a Kor-N-Seal, Press Seal, Fernco, or other approved watertight boot connection. In the case of concrete pipes, grout the connection watertight with non-shrink grout.

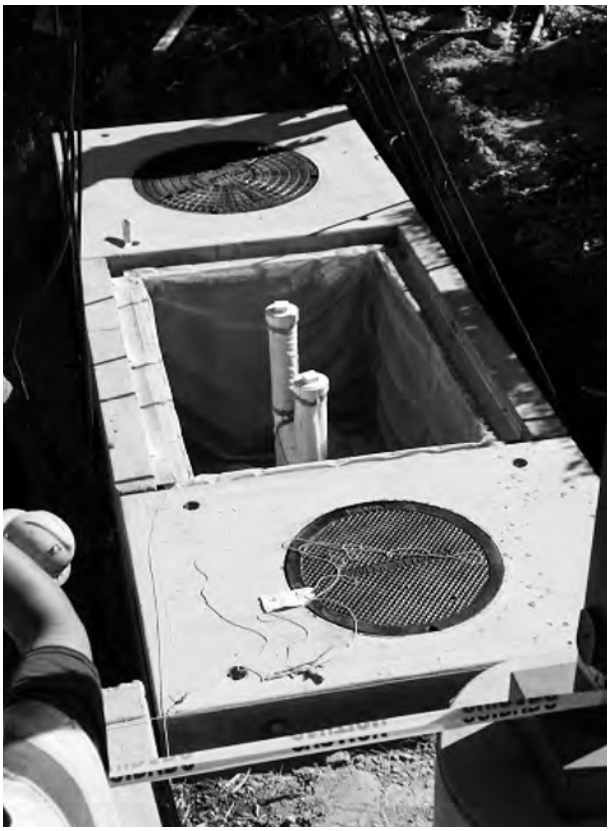
The contractor is responsible to provide the appropriate rigging and lifting connectors. Spreader bars are recommended to prevent damage to the concrete vault. All lifting points on the concrete vault must be used for safe offloading. Guide ropes can be used to stabilize the vault during offloading.

4. Lift the vault off of the delivery truck and safely move vault over the excavated area for installation. Before setting the vault ensure the hole is the right size, level, and properly sized.

5. Position the concrete vault over the excavated area and slowly lower into position. Ensure the inlet and outlet sides of the vault are in the correct position and the correct elevations are verified.

6. Once the vault is set in place, check all four corners are in the correct position. Take tension off of the rigging to ensure the vault is set properly and the compacted rock backfill below is holding the weight of the vault.

7. Use a string and or level to make sure the vault is level in both directions. The vault cannot be more than 0.5% slope off from level in any direction. If the vault slopes more than 0.5%, pick back up, move to a safe area, re-level the rock below and reset until properly level.



8. After pipe connections are completed, backfill in 12 inch increments and compact per local and state requirements. If curb type configurations, pour and connect curb and gutter system as shown in the picture to the right.

   The last step is to install the wetland media that can be delivered in super sacks or in bulk based on preference. Wetland Media must be stored in a dry, temperate environment prior to installation. Install the plant propagation blocks as shown in the drawings below. Install the vegetation and cover with decorative rock and mulch.

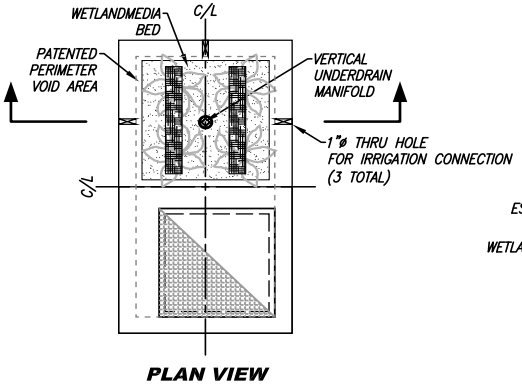
Pipe Connections

- Pipe material selection should be indicated on the Site Plan. Connect the pipe using a Kor-N-Seal, Press Seal, Fernco, or other approved watertight boot connection. In the case of concrete pipes, grout the connection watertight with non-shrink grout
- Inlet pipe(s) shall be stubbed in and connected to the precast manhole according to the Engineer's requirement or specifications. The Contractor is to grout all inlet pipes flush with the interior wall of the structure per plans and specifications.
- Outlet pipe shall be stubbed in and connected to the precast manhole according to the Engineer's requirement or specifications. The Contractor is to grout all inlet pipes flush with the interior wall of the structure per plans and specifications.
- For illustration a BAD example of a pipe installation is included below. The pipe is off-center, the pipe invert is not in the appropriate position, it is protruding beyond the inside wall, the grout is not clean and properly finished. This site was corrected by re-excavating and reconnecting the pipe properly.

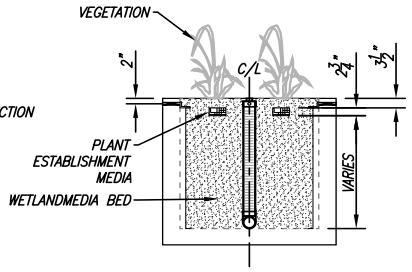
Example of a BAD pipe installation. Protruding past the internal wall of the structure, poor grouting, and wrong position.

Example of a GOOD pipe installation. Pipe flush with the internal wall of the structure, clean grouting, and proper position.

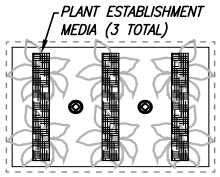
- Once the pipes are connected, carefully backfill around them, compacting in "lifts" that will not deflect, disturb or damage them.



PLAN VIEW



SECTION VIEW



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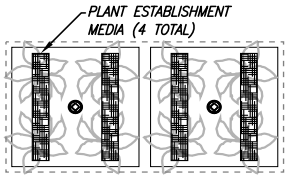

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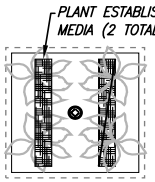

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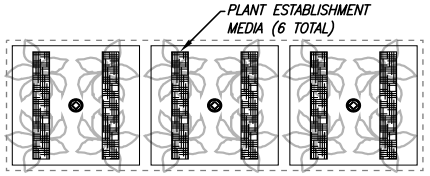

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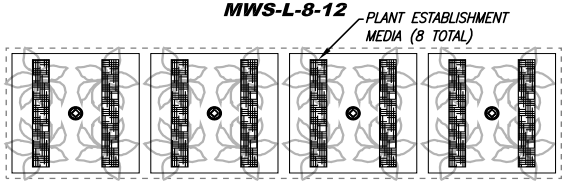

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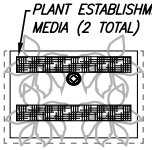

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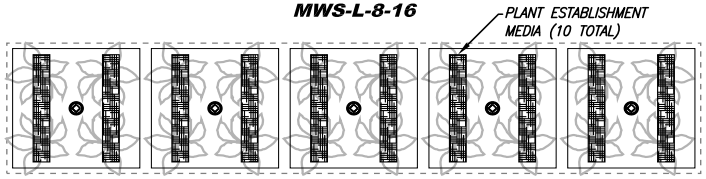

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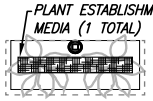
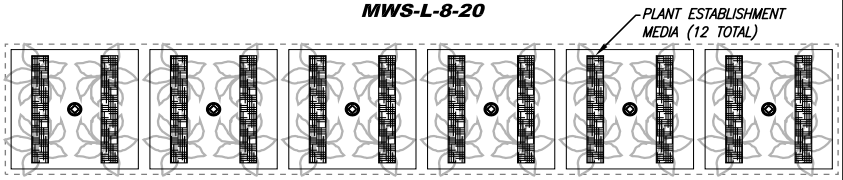


MWS-L-4-4



MWS-L-8-24

VEGETATION AND IRRIGATION NOTES:

1. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
2. BEFORE SELECTING VEGETATION SEE BIO CLEAN PLANT HARDY ZONE RECOMMENDATIONS.
3. IRRIGATION THRU HOLE IS 1"ø AND IS DESIGNED TO BE CONNECTED TO A ½"ø IRRIGATION LINE. IRRIGATION THRU HOLE IS LOCATED ON CENTER OF WETLAND CHAMBER 2" DOWN FROM THE TOP OF THE SYSTEM.
4. IRRIGATION SYSTEM FOR MODULAR WETLAND SYSTEM CAN BE PLACED ON SAME VALVE AS SURROUNDING PLANTING AREAS AND REQUIRES NO SPECIAL WATERING NEEDS.

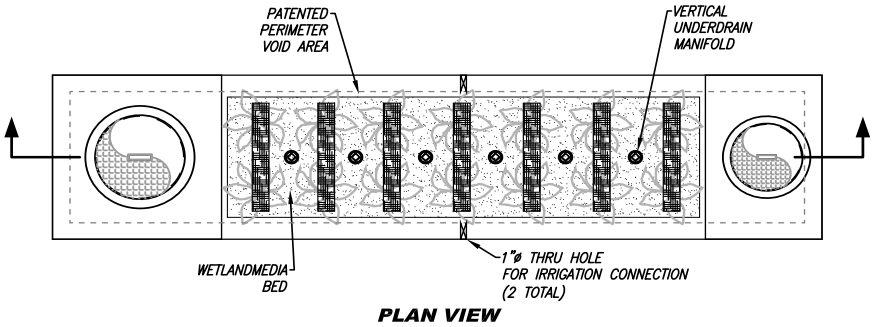
INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS' SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

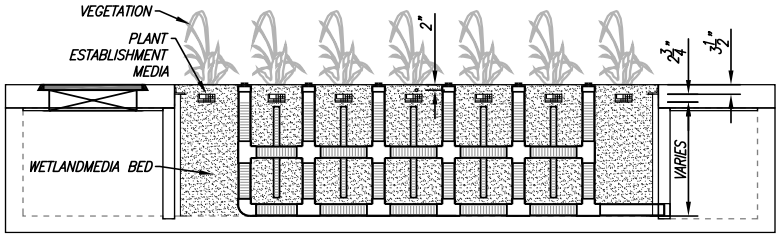
MODULAR WETLANDS

CONTECH® ENGINEERED SOLUTIONS

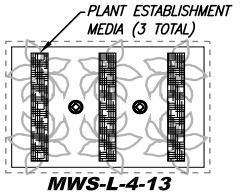
STORMWATER BIOFILTRATION SYSTEM PLANTER INSTALLATION



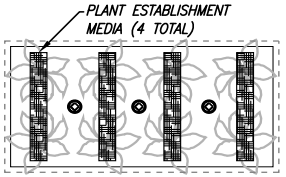
PLAN VIEW



SECTION VIEW



MWS-L-4-13



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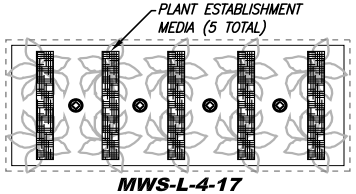

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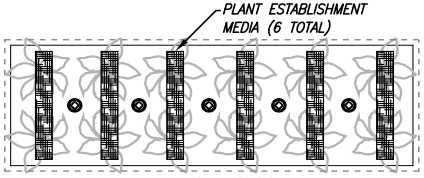

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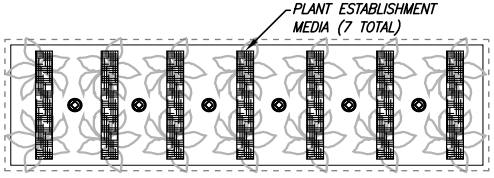

MWS-L-4-21

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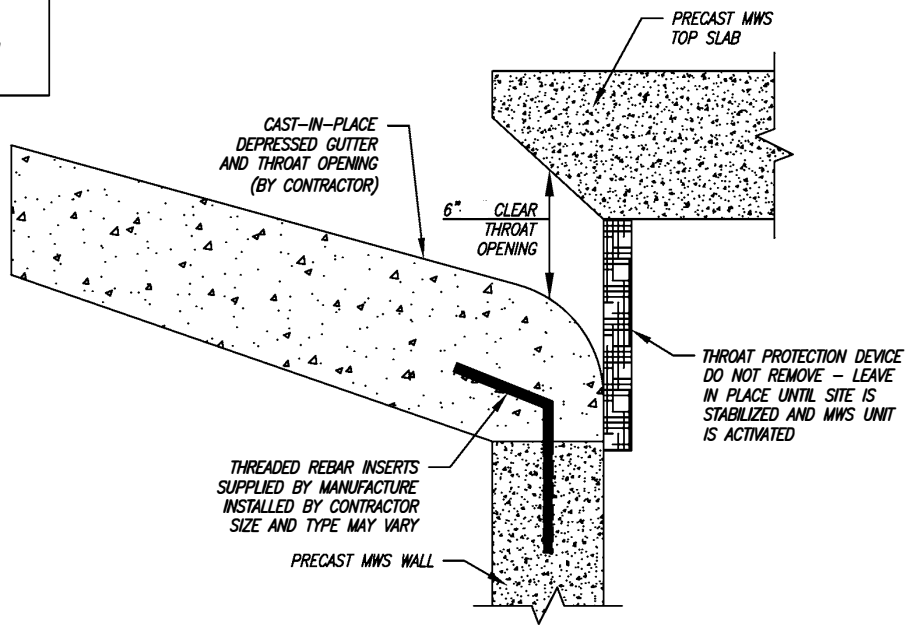
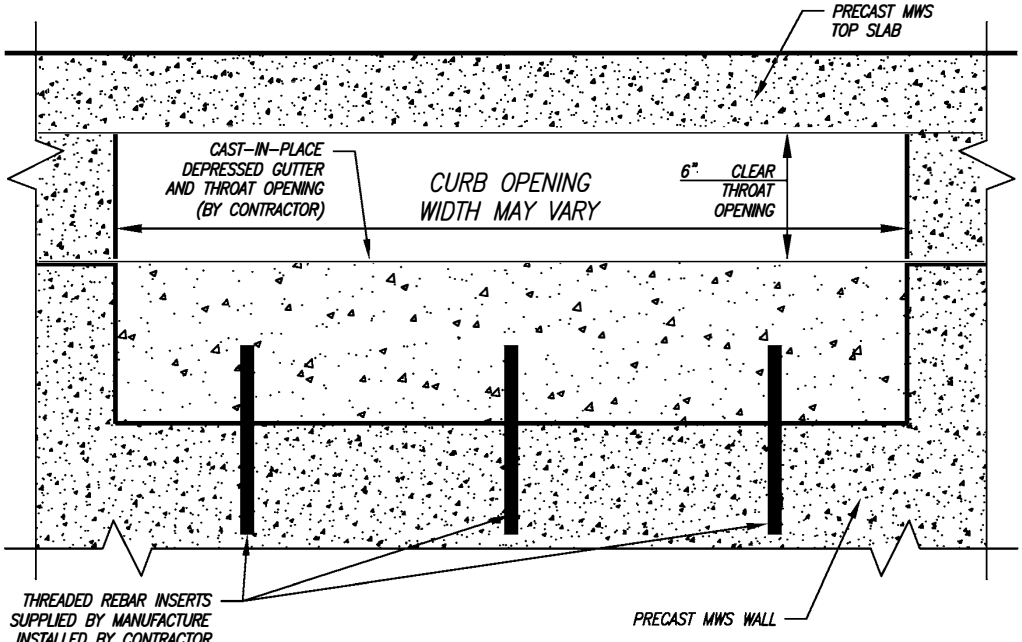
MODULAR WETLANDS

CONTECH® ENGINEERED SOLUTIONS

STORMWATER BIOFILTRATION SYSTEM
PLANTER INSTALLATION



SECTION VIEW
STANDARD MODULAR WETLAND CURB OPENING



FRONT VIEW
STANDARD MODULAR WETLAND CURB OPENING

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRWN	John	5/3/13
EDITED		

TITLE: MWS LINEAR 2.0 CURB INLET DETAILS

COMMENTS:

SIZE | DWG. NO. | REV

SCALE NTS UNITS INCHES SHEET 1 OF 1

NOTES

CONTECH®
ENGINEERED SOLUTIONS

800-338-1122

WWW.CONTECHES.COM

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SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

Modular Wetland Linear Install Guide 01/23

MC-3500 & MC-7200
Design Manual

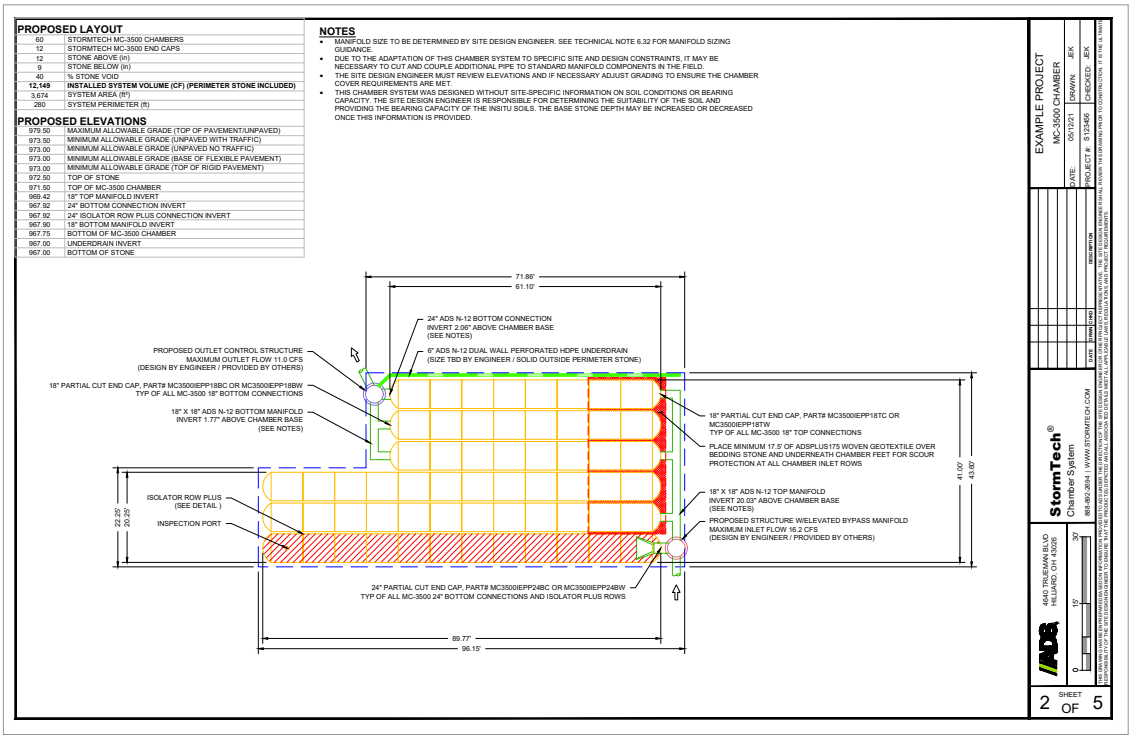
StormTech® Chamber Systems for Stormwater Management

ADS StormTech™

Table of Contents

*For SC-160LP, SC-310, SC-740 & DC-780 designs, please refer to the SC-160LP/SC-310/SC-740/DC-780 Design Manual.

StormTech Engineering Services assists design professionals in specifying StormTech stormwater systems. This assistance includes the layout of chambers to meet the engineer's volume requirements and the connections to and from the chambers. They can also assist converting and cost engineering projects currently specified with ponds, pipe, concrete vaults and other manufactured stormwater detention/ retention products. Please note that it is the responsibility of the site design engineer to ensure that the chamber bed layout meets all design requirements and is in compliance with applicable laws and regulations governing a project.



This manual is exclusively intended to assist engineers in the design of subsurface stormwater systems using StormTech chambers.

StormTech MC-3500 Chamber

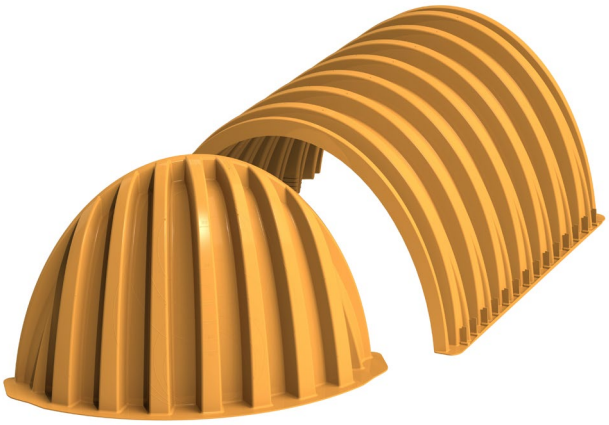
Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land 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.

MC-3500 Chamber (not to scale)

Nominal Specifications

Size (LxWxH)	90” x 77” x 45” (2286 x 1956 x 1143 mm)
Chamber Storage	109.9 ft³ (3.11 m³)
Min. Installed Storage*	175.0 ft³ (4.96 m³)
Weight	134 lbs (60.8 kg)

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 6” (150 mm) of stone between chambers/end caps and 40% stone porosity.

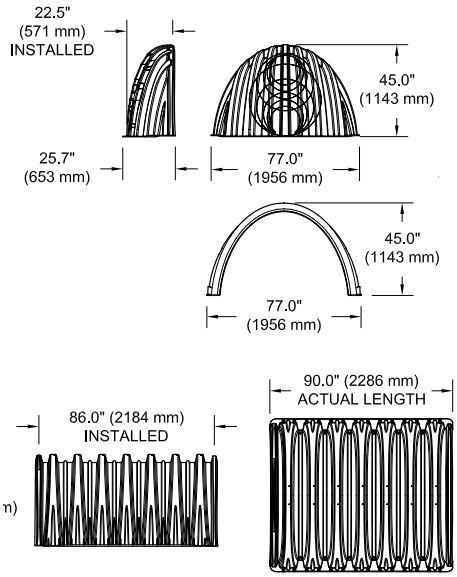


MC-3500 Chamber (not to scale)

Nominal Specifications

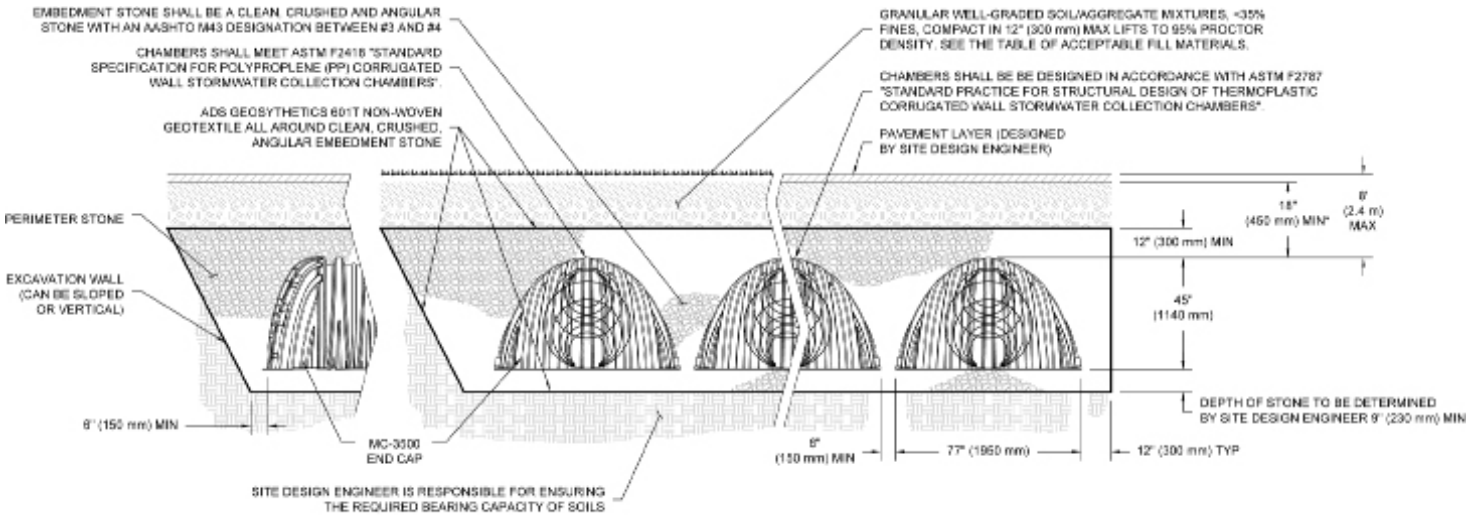
Size (LxWxH)	26.5” x 71” x 45.1” (673 x 1803 x 1145 mm)
End Cap Storage	14.9 ft³ (0.42 m³)
Min. Installed Storage*	45.1 ft³ (1.28 m³)
Weight	49 lbs (22.2 kg)

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 6” (150 mm) of stone between chambers/end caps and 40% stone porosity.



Shipping

15 chambers/pallet
7 end caps/pallet
7 pallets/truck



Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

Volume of Excavation Per Chamber/End Cap yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

StormTech MC-7200 Chamber

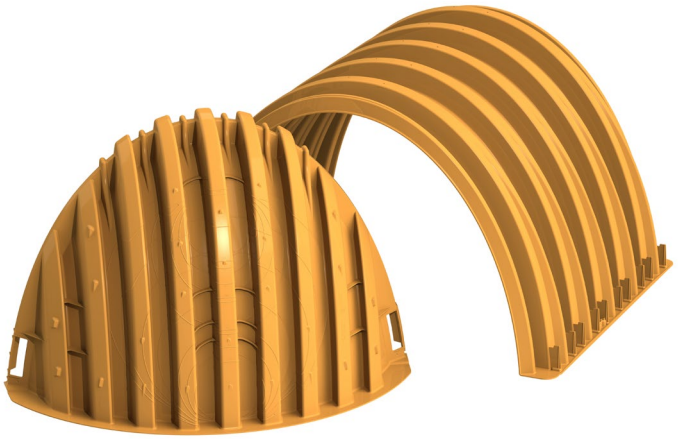
Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land 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.

MC-7200 Chamber (not to scale)

Nominal Specifications

Size (LxWxH)	83.4” x 100” x 60” (2120 x 2540 x 1524 mm)
Chamber Storage	175.9 ft³ (4.98 m³)
Min. Installed Storage*	267.3 ft³ (7.56 m³)
Weight	205 lbs (92.9 kg)

*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.

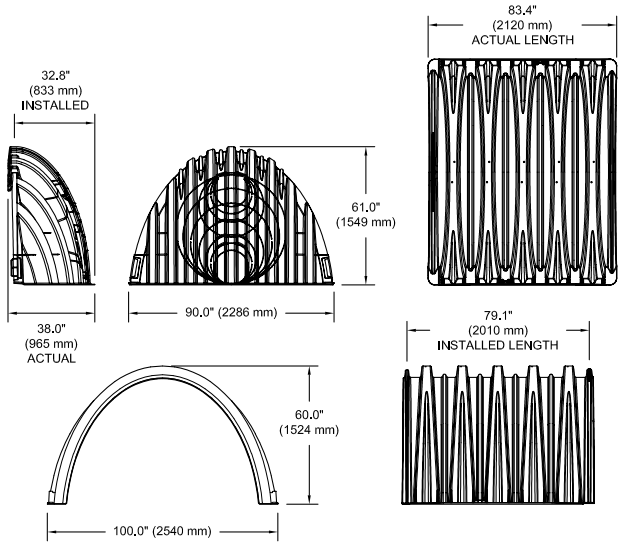


MC-7200 Chamber (not to scale)

Nominal Specifications

Size (LxWxH)	38” x 90” x 61” (965 x 2286 x 1549 mm)
End Cap Storage	39.5 ft³ (1.12 m³)
Min. Installed Storage*	115.3 ft³ (3.26 m³)
Weight	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.

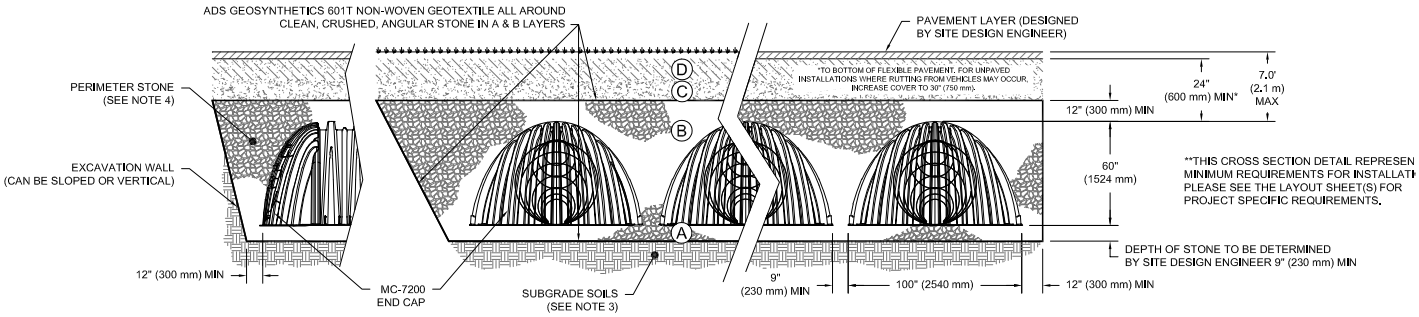


Shipping

7 chambers/pallet

5 end caps/pallet

6 pallets/truck



Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
Chamber	175.9 (4.98)	267.3 (7.57)	273.3 (7.74)	279.3 (7.91)	285.2 (8.08)
End Cap	39.5 (1.12)	115.3 (3.26)	111.9 (3.17)	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 (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
Chamber	11.9 (8.5)	12.6 (9.0)	13.4 (9.6)	14.6 (10.1)
End Cap	9.8 (7.0)	10.2 (7.3)	10.6 (7.6)	11.1 (7.9)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	10796 (6.5)	11431 (6.9)	12156 (7.3)	13245 (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.

Volume of Excavation Per Chamber/End Cap yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (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.

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

1.0 Product Information

1.1 Product Design

StormTech's commitment to thorough product testing programs, materials evaluation and adherence to national standards has resulted in two more superior products. Like other StormTech chambers, the MC-3500 and MC-7200 are designed to meet the full scope of design requirements of the American Society of Testing Materials (ASTM) International specification F2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers" and produced to the requirements of the ASTM F 2418 "Standard Specification for Polypropylene (PP) Corrugated Stormwater Collection Chambers".

The StormTech MC-3500 and MC-7200 chambers provide the full AASHTO safety factors for live loads and permanent earth loads. The ASTM F 2787 standard provides specific guidance on how to design thermoplastic chambers in accordance with AASHTO Section 12.12. of the AASHTO LRFD Bridge Design Specifications. ASTM F 2787 requires that the safety factors included in the AASHTO guidance are achieved as a prerequisite to meeting ASTM F 2418. The three standards provide both the assurance of product quality and safe structural design.

The design of larger chambers in the same tradition of our other chambers required the collaboration of experts in soil-structure interaction, plastics and manufacturing. Years of extensive research, including laboratory testing and field verification, were required to produce chambers that are ready to meet both the rigors of installation and the longevity expected by engineers and owners.

This Design Manual provides the details and specifications necessary for consulting engineers to design stormwater management systems using the MC-3500 and MC-7200 chambers. It provides specifications for storage capacities, layout dimensions as well as requirements for design to ensure a long service life. The basic design concepts for foundation and backfill materials, subgrade bearing capacities and row spacing remain equally as pertinent for the MC-3500 and MC-7200 as the SC-740, SC-310 and DC-780 chamber systems. However, since many design values and dimensional requirements are different for these larger chambers than the SC-740, SC-310 and DC-780 chambers, design manuals and installation instructions are not interchangeable.

This manual includes only those details, dimensions, cover limits, etc for the MC-3500 and MC-7200 and is intended to be a stand-alone design guide for the MC-3500 and MC-7200 chambers. A Construction Guide specifically for these two chamber models has also been published.

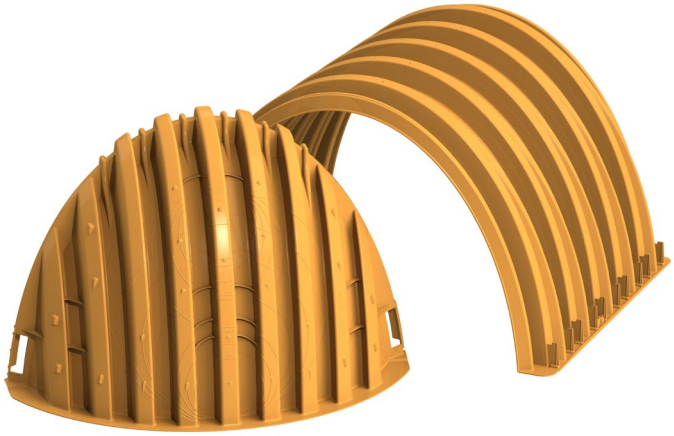
1.2 Technical Support

The StormTech Technical Services Department is available to assist the engineer with the layout of MC-3500 and MC-7200 chamber systems and answer questions regarding all the StormTech chamber models. Call the Technical Services Department, email us at info@stormtech.com or contact your local StormTech representative.

1.3 MC-3500 and MC-7200 Chambers

All StormTech chambers are designed to the full scope of AASHTO requirements without repeating end walls or other structural reinforcing. StormTech's continuously curved, elliptical arch and the surrounding angular backfill are the key components of the structural system. With the addition of patent pending integral stiffening ribs (Figure 5), the MC-3500 and MC-7200 are assured to provide a long, safe service life. Like other StormTech chambers, the MC-3500 and MC-7200 are produced from high quality, impact modified resins which are tested for short-term and long-term mechanical properties.

With all StormTech chambers, one chamber type is used for the start, middle and end of rows. Rows are formed by overlapping the upper joint corrugation of the next chamber over the lower joint corrugation of the previous chamber (Figure 6).



1.4 Chamber Joints

All StormTech chambers are designed with an optimized joining system. The height and width of the end corrugations have been designed to provide the required structural safety factors while providing an unobstructed flow path down each row.

1.0 Product Information

To assist the contractor, StormTech chambers are molded with simple assembly instructions and arrows that indicate the direction in which to build rows. The corrugation valley immediately adjacent to the lower joint corrugation is marked “Overlap Here - Lower Joint.” The corrugation valley immediately adjacent to the upper joint corrugation is marked “Build This Direction - Upper Joint.”

Two people can safely and efficiently carry and place chambers without cumbersome connectors, special tools or heavy equipment. Each row of chambers must begin and end with a joint corrugation. Since joint corrugations are of a different size than the corrugations along the body of the chamber, chambers cannot be field cut and installed. Only whole MC-3500 and MC-7200 chambers can be used. For system layout assistance contact StormTech.

1.5 MC-3500 and MC-7200 End Caps

The MC-3500 and MC-7200 end caps are easy to install. These end caps are designed with a corrugation joint that fits over the top of either end of the chamber. The end cap joint is simply set over the top of either of the upper or lower chamber joint corrugations (Figure 7).

The MC-3500 end cap has pipe cutting guides for 12”–24” (300 mm–600 mm) top inverts (Figure 9).

The MC-7200 end cap has pipe cutting guides for 12”–42” (300 mm–1050 mm) bottom inverts and 12”–24” (300 mm–600 mm) top inverts (Figure 8).

Standard and custom pre-cored end caps are available. MC-3500 pre-cored end caps, 18” in diameter and larger include a welded crown plate.

Figure 5 - Chamber and End Cap Components

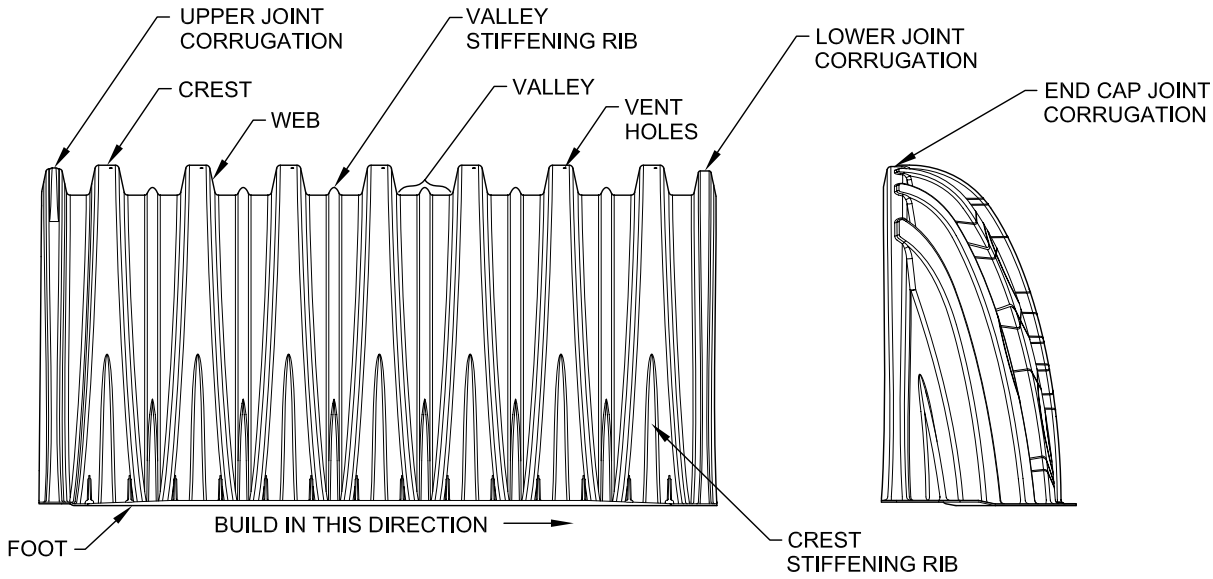


Figure 6 - Chamber Joint Overlap

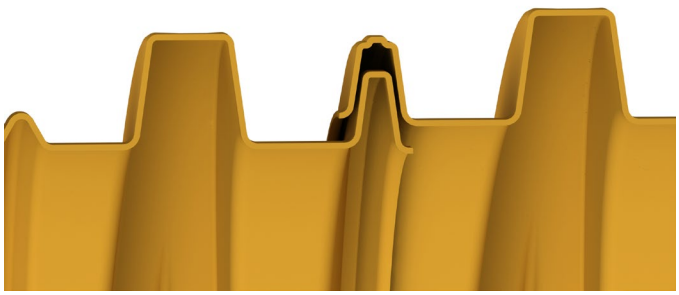


Figure 7 - End Cap Joint Overlap

1.0 Product Information

Figure 8 - MC-7200 End Cap Inverts

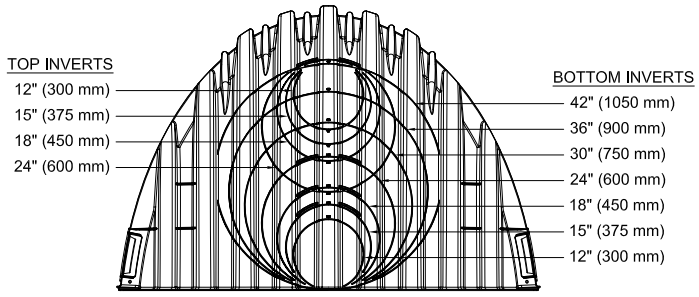
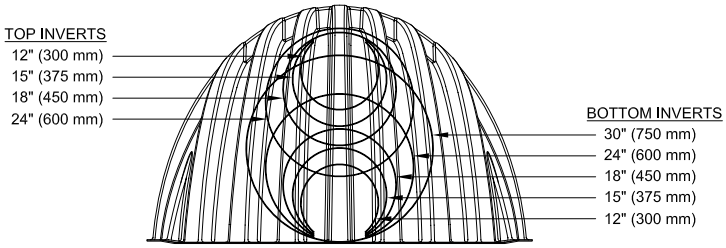


Figure 9 - MC-3500 End Cap Inverts

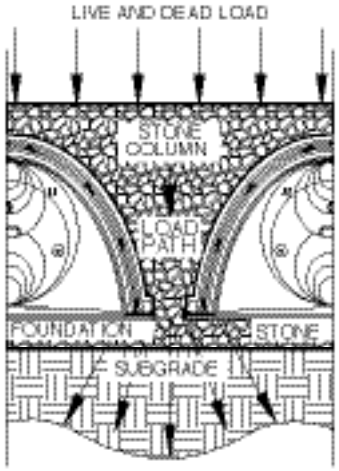


2.0 Foundations for Chambers

2.1 Foundation Requirements

StormTech chamber systems can be installed in various soil types. The subgrade bearing capacity and the cover height over the chambers determine the required depth of clean, crushed, angular foundation stone below the chambers. Foundation stone, also called bedding, is the stone between the subgrade soils and the feet of the chamber. Flexible structures are designed to transfer a significant portion of both live and dead loads through the surrounding soils. Chamber systems accomplish this by creating load paths through the columns of embedment stone between and around the rows of chambers. This creates load concentrations at the base of the columns between the rows. The foundation stone spreads out the concentrated loads to distributed loads that can be supported by the subgrade soils.

Since increasing the cover height (top of chamber to finished grade) causes increasing soil load, a greater depth of foundation stone is necessary to distribute the load to the subgrade soils. **Table 1** and **2** specify the minimum required foundation depths for varying cover heights and allowable subgrade bearing capacities. These tables are based on StormTech service loads. The minimum required foundation depth is 9” (230 mm) for both chambers.



For additional guidance on foundation stone design please see our Technical Note 6.22 - StormTech Subgrade Performance

2.2 Weaker Soils

StormTech has not provided guidance for subgrade bearing capacities less than 2000 pounds per square foot [(2.0 ksf) (96 kPa)]. These soils are often highly vari- able, may contain organic materials and could be more sensitive to moisture. A geotechnical engineer must be consulted if soils with bearing capacities less than 2000 psf (96 kPa) are present.

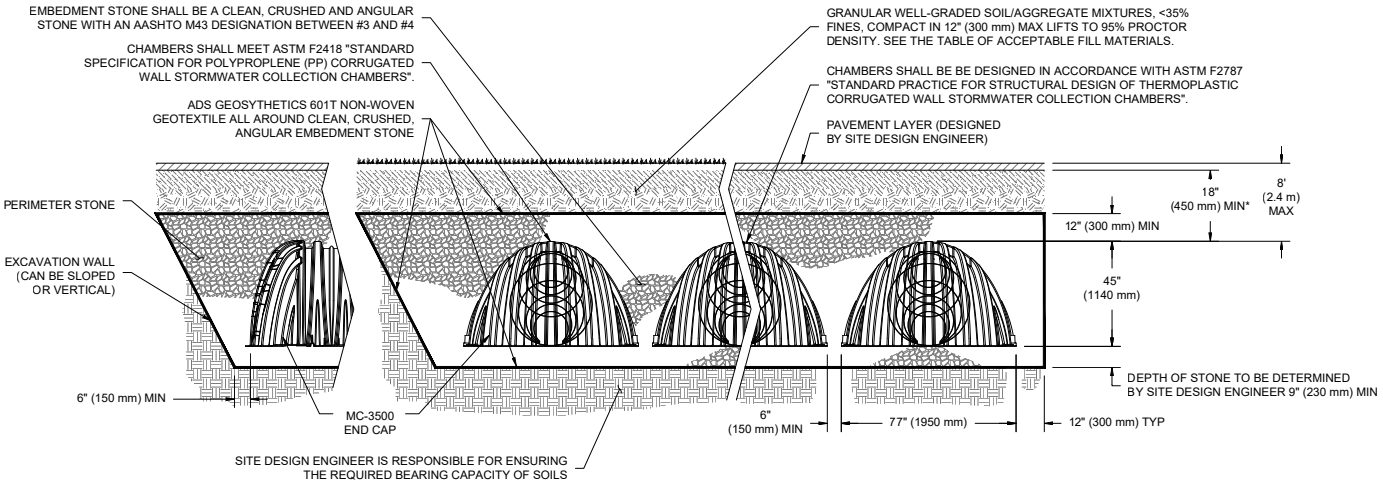
2.0 Foundations for Chambers

Table 1 - MC-3500 Minimum Required Foundation Depth in inches (millimeters)
Assumes 6" (150 mm) row spacing.

Cover Hgt. ft. (m)	Minimum Bearing Resistance for Service Loads ksf (kPa)																								
	4.4 (211)	4.3 (206)	4.2 (201)	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
1.5 (0.46)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)
2.0 (0.61)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)
2.5 (0.76)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)
3.0 (0.91)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)
3.5 (1.07)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)
4.0 (1.22)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)
4.5 (1.37)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)
5.0 (1.52)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	30 (750)
5.5 (1.68)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)
6.0 (1.83)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)
6.5 (1.98)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)
7.0 (2.13)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)	30 (750)
7.5 (2.30)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)	30 (750)
8.0 (2.44)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	30 (750)	30 (750)	30 (750)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

Figure 10A - MC-3500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Special applications will be considered on a project by project basis. Please contact our applications department should you have a unique application for our team to evaluate.

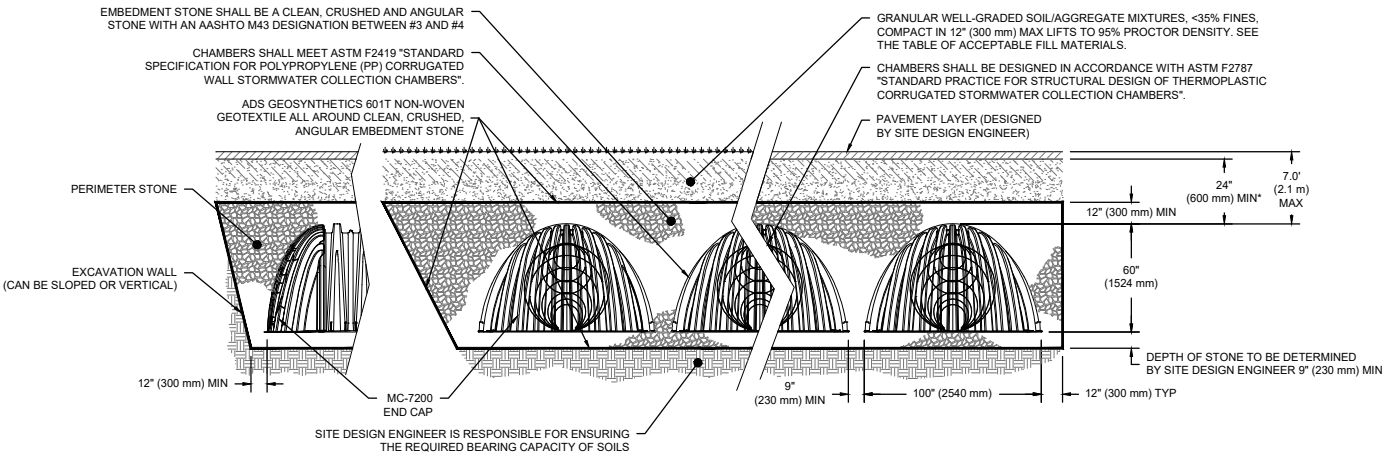
2.0 Foundations for Chambers

Table 2 - MC-7200 Minimum Required Foundation Depth in inches (millimeters)
Assumes 9” (230 mm) row spacing.

Cover Hgt. ft. (m)	Minimum Bearing Resistance for Service Loads ksf (kPa)																								
	4.4 (211)	4.3 (206)	4.2 (201)	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
2.0 (0.61)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)	21 (525)
2.5 (0.76)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)
3.0 (0.91)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)
3.5 (1.07)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	30 (750)
4.0 (1.22)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)
4.5 (1.37)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	33 (825)
5.0 (1.52)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	33 (825)	36 (900)
5.5 (1.68)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	33 (825)	33 (825)	36 (900)	36 (900)
6.0 (1.83)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	33 (825)	33 (825)	36 (900)	36 (900)	36 (900)
6.5 (1.98)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	33 (825)	33 (825)	36 (900)	36 (900)	36 (900)	36 (900)
7.0 (2.13)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	21 (525)	21 (525)	21 (525)	24 (600)	24 (600)	24 (600)	27 (675)	27 (675)	30 (750)	30 (750)	33 (825)	36 (900)	36 (900)	36 (900)	36 (900)	36 (900)	36 (900)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

Figure 10B - MC-7200 Structural Cross Section Detail (Not to Scale)



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

Special applications will be considered on a project by project basis. Please contact our applications department should you have a unique application for our team to evaluate.

3.0 Required Materials/Row Separation

3.1 Foundation and Embedment Stone

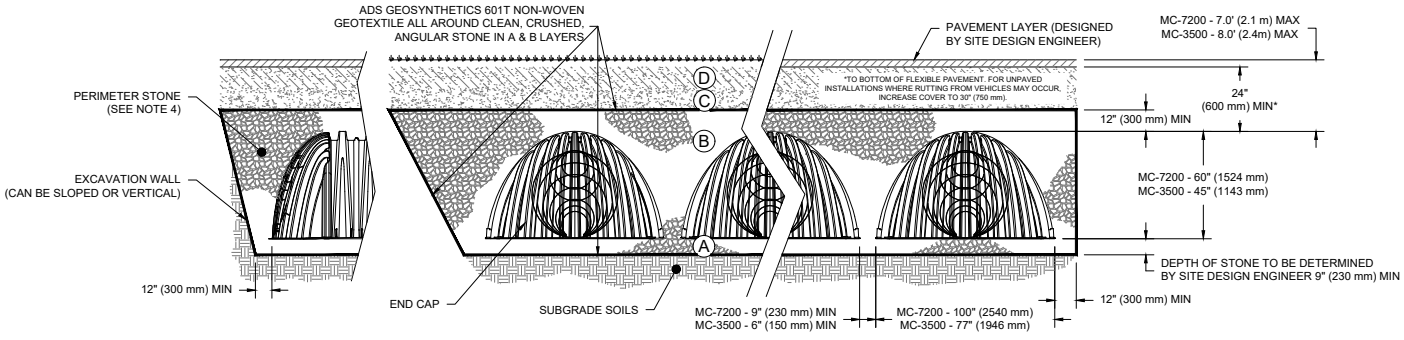
The stone surrounding the chambers consists of the foundation stone below the chambers and embedment stone surrounding the chambers. The foundation stone and embedment stone are important components of the structural system and also provide open void space for stormwater storage. Table 3 provides the stone specifications that achieve both structural requirements and a porosity of 40% for stormwater storage. Figure 11 specifies the extents of each backfill stone location.

Table 3 - Acceptable Fill Materials

	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 compactoins after 24" (600 mm) of material over the chambers is reached. compact addtional 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 form the foudation 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.

Figure 11 - Fill Material Locations



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 materials of layer 'C' or 'D' at the design engineer's discretion.

3.0 Required Materials/Row Separation

3.2 Fill Above Chambers

Refer to Table 3 and Figure 11 for acceptable fill material above the clean, crushed, angular stone. StormTech requires a minimum of 24" (600 mm) from the top of the chamber to the bottom of flexible pavement. For non-paved installations where rutting from vehicles may occur StormTech requires a minimum of 30" (750 mm) from top of chamber to finished grade.

3.3 Geotextile Separation

A non-woven geotextile meeting AASHTO M288 Class 2 separation requirements must be installed to completely envelope the system and prevent soil intrusion into the crushed, angular stone. Overlap adjacent geotextile rolls per AASHTO M288 separation guidelines. Contact StormTech for a list of acceptable geotextiles.

3.4 Parallel Row Separation/ Perpendicular Bed Separation

Parallel Row Separation

The minimum installed spacing between parallel rows after backfilling is 9" (230 mm) for the MC-7200 chambers and 6" (150mm) for the MC-3500 (measurement taken between the outside edges of the feet). Spacers may be used for layout convenience. Row spacing wider than the minimum spacing above may be specified.

Perpendicular Bed Separation

When beds are laid perpendicular to each other, a minimum installed spacing of 36" (900 mm) between beds is required.

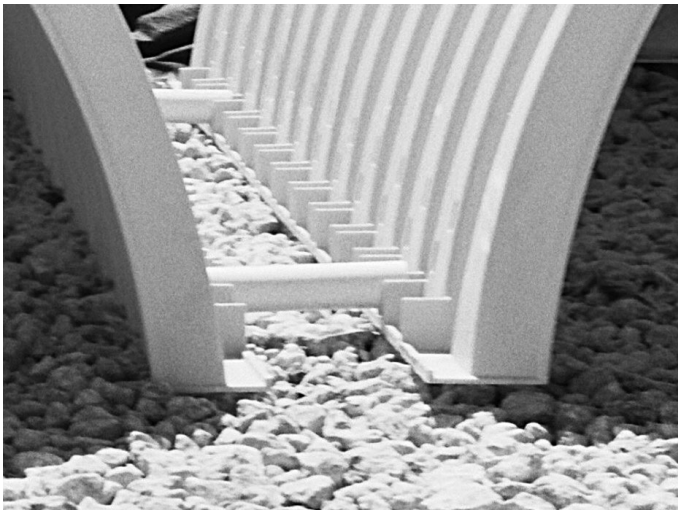
3.5 Special Structural Designs

StormTech engineers may provide special structural designs to enable deeper cover depths or increase the capacity to carry higher live loads. Special designs may utilize the additional strength that can be achieved by compaction of embedment stone or by increasing the spacing between rows.

Increasing the spacing between chamber rows may also facilitate the application of StormTech chambers with either less foundation stone or with weaker subgrade soils. This may be a good option where vertical restrictions on site prevent the use of a deeper foundation.

Contact ADS Engineering Services for more information on special structural designs.

System Cross Section



Minimum Row Spacing

4.0 Hydraulics

4.1 General

StormTech subsurface chamber systems offer the flexibility for a variety of inlet and outlet configurations. Contact the StormTech Technical Services Department or your local StormTech representative for assistance configuring inlet and outlet connections.

The open graded stone around and under the chambers provides a significant conveyance capacity ranging from approximately 0.8 cfs (23 l/s) to 13 cfs (368 l/s) per MC-3500 chamber and for the MC-7200 chamber. The actual conveyance capacity is dependent upon stone size, depth of foundation stone and head of water. Although the high conveyance capacity of the open graded stone is an important component of the flow network, StormTech recommends that a system of inlet and outlet manifolds be designed to distribute and convey the peak flow through the chamber system.

It is the responsibility of the design engineer to provide the design flow rates and storage volumes for the stormwater system and to ensure that the final design meets all conveyance and storage requirements. However, StormTech will work with the design engineer to assist with manifold and chamber layouts that meet the design objectives.

4.2 The Isolator® Row Plus

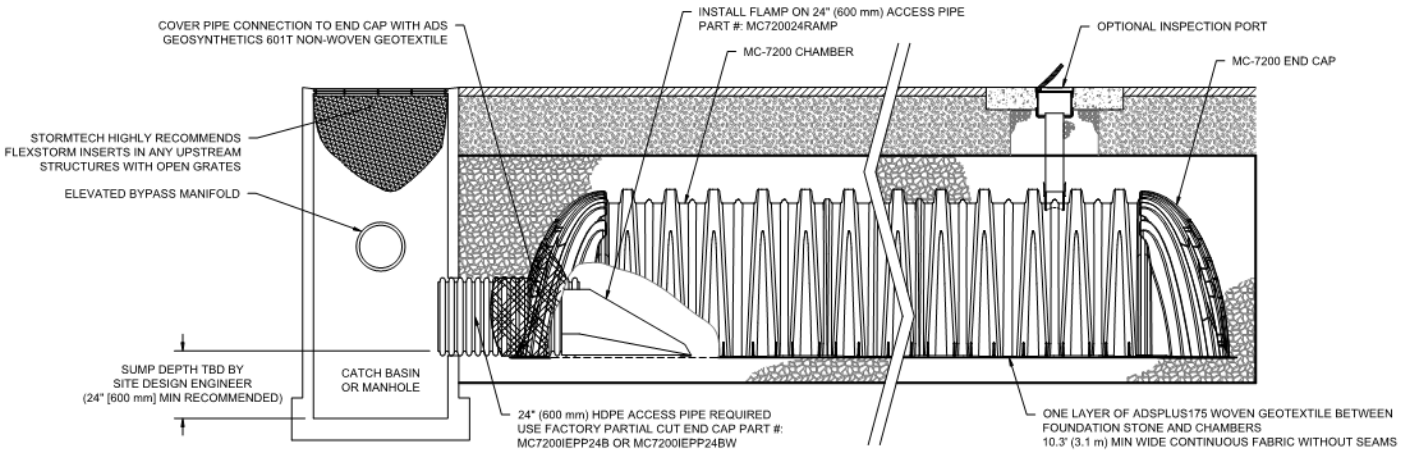
The Isolator Row Plus is a system that inexpensively captures total suspended solids (TSS) and debris and provides easy access for inspection and maintenance. In a typical configuration, a single layer of ADS Plus fabric is placed between the chambers and the stone foundations. This fabric traps and filters sediments as well as protects the stone base during cleaning and maintenance. Each installed MC-3500 chamber and MC-3500 end cap provides 42.9 ft2 (4.0 m^2) and 7.5 ft^2 (0.7 m^2) of bottom filter area respectively. Each installed MC-7200 chamber and MC-7200 end cap provides 57.9 ft^2 (5.4 m^2) and 12.8 ft^2 (1.19 m^2) of bottom filter area respectively.

The Isolator Row Plus can be configured for maintenance objectives or, in some regulatory jurisdictions, for water quality objectives. For water quality applications, the Isolator Row Plus can be sized based on water quality volume or flow rate.

All Isolator Plus Rows require: 1) a manhole for maintenance access, 2) a means of diversion of flows to the Isolator Row Plus 3) a high flow bypass and 4)FLAMP (Flared End Ramp). 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.. Flow diversion can be accomplished by either a weir in the upstream access manhole or simply by feeding the Isolator Row Plus at a lower elevation than the high flow bypass. Contact StormTech for assistance sizing Isolator Plus Rows.

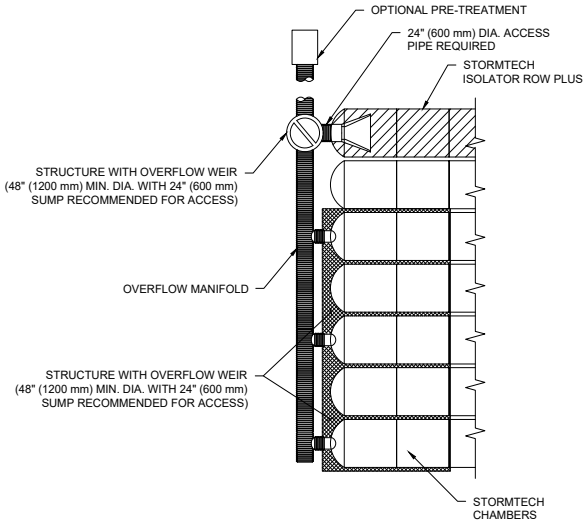
When additional stormwater treatment is required, StormTech systems can be configured using a treatment train approach where other stormwater BMPs are located in series.

Figure 12 - StormTech Isolator Row Plus Detail



4.0 Hydraulics

Figure 13 - Typical Inlet Configuration With Isolator Row Plus and Scour Protection



4.3 Inlet Manifolds

The primary function of the inlet manifold is to convey and distribute flows to a sufficient number of rows in the chamber bed such that there is ample conveyance capacity to pass the peak flows without creating an unacceptable backwater condition in upstream piping or scour the foundation stone under the chambers.

Manifolds are connected to the end caps either at the top or bottom of the end cap. Standard distances from the base of chamber to the invert of inlet and outlet manifolds connecting to StormTech end caps can be found in table 6. High inlet flow rates from either connection location produce a shear scour potential of the foundation stone. Inlet flows from top inlets also produce impingement scour potential. Scour potential is reduced when standing water is present over the foundation stone. However, for safe design across the wide range of applications, StormTech assumes minimal standing water at the time the design flow occurs.

To minimize scour potential, StormTech recommends the installation of woven scour protection fabric at each inlet row. This enables a protected transition zone from the concentrated flow coming out of the inlet pipe to a uniform flow across the entire width of the chamber for both top and bottom connections.

Allowable flow rates for design are dependent upon: the elevation of inlet pipe, foundation stone size and scour protection. With an appropriate scour protection geotextile installed from the end cap to at least 14.5 ft (4.42 m) in front of the inlet pipe for the MC-3500 and for the MC-7200, for both top and bottom feeds, the flow rates listed in Table 4 can be used for all StormTech specified foundation stone gradations.

*See StormTech's Tech Note 6.32 for manifold sizing guidance.

Table 4 - Allowable Inlet Flows*

Inlet Pipe Diameter Inches (mm)	Allowable Maximum Flow Rate cfs (l/s)
12 (300)	2.48 (70)
15 (375)	3.5 (99)
18 (450)	5.5 (156)
24 (600)	8.5 (241) [MC-3500]
24 (600)	9.5 (269) [MC-7200]

*Assumes appropriate length of scour fabric per section 4.3

Table 5 - Maximum Outlet Flow Rate Capacities From StormTech Oulet Manifolds

Pipe Diameter	Flow (CFS)	Flow (L/S)
6" (150 mm)	0.4	11.3
8" (200 mm)	0.7	19.8
10" (250 mm)	1.0	28.3
12" (300 mm)	2.0	56.6
15" (375 mm)	2.7	76.5
18" (450 mm)	4.0	113.3
24" (600 mm)	7.0	198.2
30" (750 mm)	11.0	311.5
36" (900 mm)	16.0	453.1
42" (1050 mm)	22.0	623.0
48" (1200 mm)	28.0	792.9

Table 6 - Standard Distances From Base of Chamber to Invert of Inlet and Outlet Manifolds on StormTech End Caps

MC-3500 ENDCAPS			
	Pipe Diameter	Inv. (in)	Inv. (mm)
Top	6" (150 mm)	33.21	841
	8" (200 mm)	31.16	789
	10" (250 mm)	29.04	738
	12" (300 mm)	26.36	671
	15" (375 mm)	23.39	594
	18" (450 mm)	20.03	509
	24" (600 mm)	14.48	369
Bottom	12" (750 mm)	1.35	34
	15" (900 mm)	1.5	40
	18" (1050 mm)	1.77	46
	24" (1200 mm)	2.06	52

MC-7200 ENDCAPS			
	Pipe Diameter	Inv. (in)	Inv. (mm)
Top	12" (300 mm)	35.69	907
	15" (375 mm)	32.72	831
	18" (450 mm)	29.36	746
	24" (600 mm)	23.05	585
Bottom	12" (750 mm)	1.55	34
	15" (900 mm)	1.7	43
	18" (1050 mm)	1.97	50
	24" (1200 mm)	2.26	57

5.0 Cumulative Storage Volumes

4.4 Outlet Manifolds

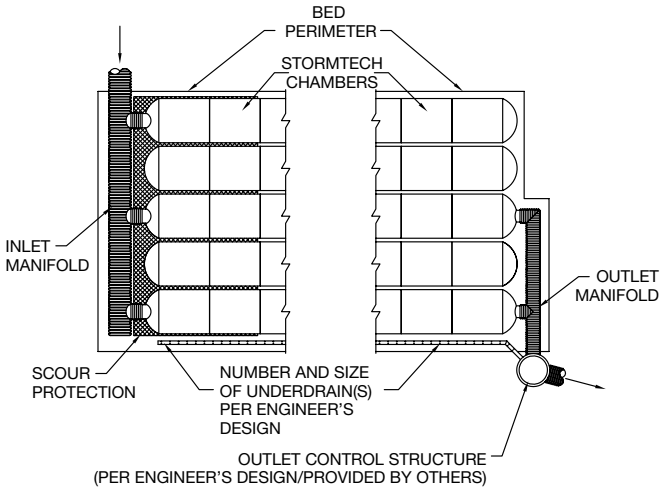
The primary function of the outlet manifold is to convey peak flows from the chamber system to the outlet control structure. Outlet manifolds are often sized for attenuated flows. They may be smaller in diameter and have fewer row connections than inlet manifolds. In some applications however, the intent of the outlet piping is to convey an unattenuated bypass flow rate and manifolds may be sized similar to inlet manifolds.

Since chambers are generally flowing at or near full at the time of the peak outlet flow rate, scour is generally not governing and outlet manifold sizing is based on pipe flow equations. In most cases, StormTech recommends that outlet manifolds connect the same rows that are connected to an inlet manifold. This provides a continuous flow path through open conduits to pass the peak flow without dependence on passing peak flows through stone.

The primary function of the underdrains is to draw down water stored in the stone below the invert of the manifold. Underdrains are generally not sized for conveyance of the peak flow.

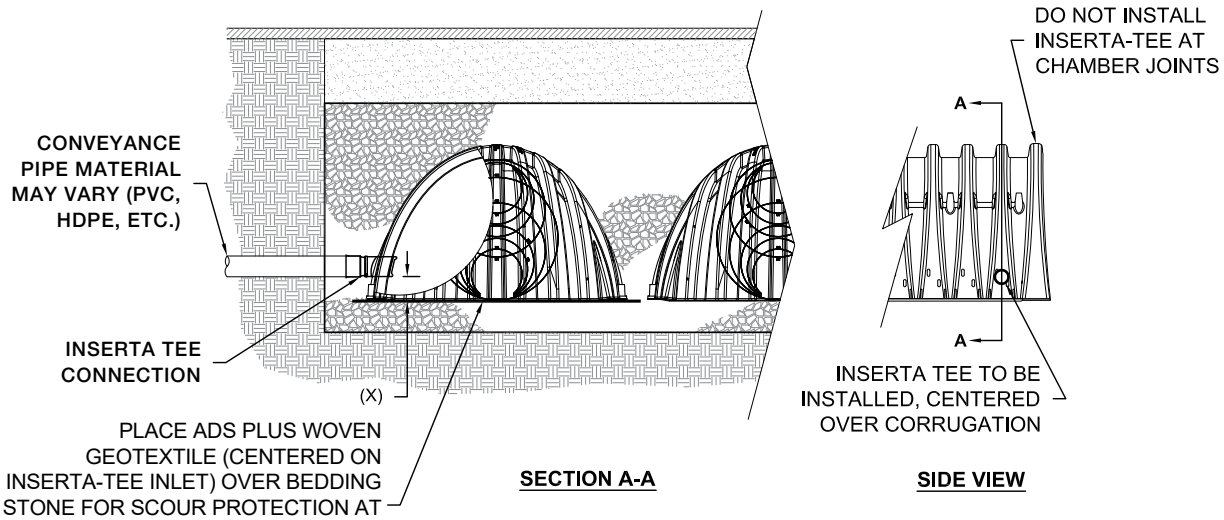
The maximum outlet flow rate capacities from StormTech outlet manifolds can be found in Table 5.

Figure 14 - Typical Inlet, Outlet and Underdrain Configuration



4.5 Inserta Tee® Inlet Connections

Figure 15 - Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-3500	12" (250 mm)	6" (150 mm)
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		

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

5.0 Cumulative Storage Volumes

Tables 7 and 8 provide cumulative storage volumes for the MC-3500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

Table 7 – MC-3500 Incremental Storage Volume Per Chamber
Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 6" (150 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
66 (1676)	0.00	175.02 (4.956)
65 (1651)	0.00	173.36 (4.909)
64 (1626)	0.00	171.71 (4.862)
63 (1600)	0.00	170.06 (4.816)
62 (1575)	0.00	168.41 (4.7.69)
61 (1549)	0.00	166.76 (4.722)
60 (1524)	0.00	165.10 (4.675)
59 (1499)	0.00	163.45 (4.628)
58 (1473)	0.00	161.80 (4.582)
57 (1448)	0.00	160.15 (4.535)
56 (1422)	0.00	158.49 (4.488)
55 (1397)	0.00	156.84 (4.441)
54 (1372)	109.95 (3.113)	155.19 (4.394)
53 (1346)	109.89 (3.112)	153.50 (4.347)
52 (1321)	109.69 (3.106)	151.73 (4.297)
51 (1295)	109.40 (3.098)	149.91 (4.245)
50 (1270)	109.00 (3.086)	148.01 (4.191)
49 (1245)	108.31 (3.067)	145.95 (4.133)
48 (1219)	107.28 (3.038)	143.68 (4.068)
47 (1194)	106.03 (3.003)	141.28 (4.000)
46 (1168)	104.61 (2.962)	138.77 (3.930)
45 (1143)	103.04 (2.918)	136.17 (3.856)
44 (1118)	101.33 (2.869)	133.50 (3.780)
43 (1092)	99.50 (2.818)	130.75 (3.702)
42 (1067)	97.56 (2.763)	127.93 (3.623)
41 (1041)	95.52 (2.705)	125.06 (3.541)
40 (1016)	93.39 (2.644)	122.12 (3.458)
39 (991)	91.16 (2.581)	119.14 (3.374)
38 (965)	88.86 (2.516)	116.10 (3.288)
37 (948)	86.47 (2.449)	113.02 (3.200)
36 (914)	84.01 (2.379)	109.89 (3.112)
35 (889)	81.49 (2.307)	106.72 (3.022)
34 (864)	78.89 (2.234)	103.51 (2.931)
33 (838)	76.24 (2.159)	100.27 (2.839)

Stone Cover

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
32 (813)	73.52 (2.082)	96.98 (2.746)
31 (787)	70.75 (2.003)	93.67 (2.652)
30 (762)	67.92 (1.923)	90.32 (2.558)
29 (737)	65.05 (1.842)	86.94 (2.462)
28 (711)	62.12 (1.759)	83.54 (2.366)
27 (686)	59.15 (1.675)	80.10 (2.268)
26 (680)	56.14 (1.590)	76.64 (2.170)
25 (635)	53.09 (1.503)	73.16 (2.072)
24 (610)	49.99 (1.416)	69.65 (1.972)
23 (584)	46.86 (1.327)	66.12 (1.872)
22 (559)	43.70 (1.237)	62.57 (1.772)
21 (533)	40.50 (1.147)	59.00 (1.671)
20 (508)	37.27 (1.055)	55.41 (1.569)
19 (483)	34.01 (0.963)	51.80 (1.467)
18 (457)	30.72 (0.870)	48.17 (1.364)
17 (432)	27.40 (0.776)	44.53 (1.261)
16 (406)	24.05 (0.681)	40.87 (1.157)
15 (381)	20.69 (0.586)	37.20 (1.053)
14 (356)	17.29 (0.490)	33.51 (0.949)
13 (330)	13.88 (0.393)	29.81 (0.844)
12 (305)	10.44 (0.296)	26.09 (0.739)
11 (279)	6.98 (0.198)	22.37 (0.633)
10 (254)	3.51 (0.099)	18.63 (0.527)
9 (229)	0.00	14.87 (0.421)
8 (203)	0.00	13.22 (0.374)
7 (178)	0.00	11.57 (0.328)
6 (152)	0.00	9.91 (0.281)
5 (127)	0.00	8.26 (0.234)
4 (102)	0.00	6.61 (0.187)
3 (76)	0.00	4.96 (0.140)
2 (51)	0.00	3.30 (0.094)
1 (25)	0.00	1.65 (0.047)

Stone Cover

NOTE: Add 1.65 ft^3 (0.047 m^3) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volume

Table 8 – MC-3500 Incremental Storage Volume Per End Cap
Assumes 40% stone porosity. Calculations are based upon a 9” (230 mm) stone base under the chambers, 12” (300 mm) of stone above end caps, and 6” (150 mm) of spacing between end caps and 6” (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
66 (1676)	0.00	45.10 (1.277)
65 (1651)	0.00	44.55 (1.262)
64 (1626)	0.00	44.00 (1.246)
63 (1600)	0.00	43.46 (1.231)
62 (1575)	0.00	42.91 (1.2.15)
61 (1549)	0.00	42.36 (1.200)
60 (1524)	0.00	41.81 (1.184)
59 (1499)	0.00	41.27 (1.169)
58 (1473)	0.00	40.72 (1.153)
57 (1448)	0.00	40.17 (1.138)
56 (1422)	0.00	39.62 (1.122)
55 (1397)	0.00	39.08 (1.107)
54 (1372)	15.64 (0.443)	38.53 (1.091)
53 (1346)	15.64 (0.443)	37.98 (1.076)
52 (1321)	15.63 (0.443)	37.42 (1.060)
51 (1295)	15.62 (0.442)	36.85 (1.043)
50 (1270)	15.60 (0.442)	36.27 (1.027)
49 (1245)	15.56 (0.441)	35.68 (1.010)
48 (1219)	15.51 (0.439)	35.08 (0.993)
47 (1194)	15.44 (0.437)	34.47 (0.976)
46 (1168)	15.35 (0.435)	33.85 (0.959)
45 (1143)	15.25 (0.432)	33.22 (0.941)
44 (1118)	15.13 (0.428)	32.57 (0.922)
43 (1092)	14.99 (0.424)	31.91 (0.904)
42 (1067)	14.83 (0.420)	31.25 (0.885)
41 (1041)	14.65 (0.415)	30.57 (0.866)
40 (1016)	14.45 (0.409)	29.88 (0.846)
39 (991)	14.24 (0.403)	29.18 (0.826)
38 (965)	14.00 (0.396)	28.48 (0.806)
37 (948)	13.74 (0.389)	27.76 (0.786)
36 (914)	13.47 (0.381)	27.04 (0.766)
35 (889)	13.18 (0.373)	26.30 (0.745)
34 (864)	12.86 (0.364)	25.56 (0.724)

Stone Cover

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
33 (838)	12.53 (0.355)	24.82 (0.703)
32 (813)	12.18 (0.345)	24.06 (0.681)
31 (787)	11.81 (0.335)	23.30 (0.660)
30 (762)	11.42 (0.323)	22.53 (0.638)
29 (737)	11.01 (0.312)	21.75 (0.616)
28 (711)	10.58 (0.300)	20.96 (0.594)
27 (686)	10.13 (0.287)	20.17 (0.571)
26 (680)	9.67 (0.274)	19.37 (0.549)
25 (635)	9.19 (0.260)	18.57 (0.526)
24 (610)	8.70 (0.246)	17.76 (0.503)
23 (584)	8.19 (0.232)	16.94 (0.480)
22 (559)	7.67 (0.217)	16.12 (0.456)
21 (533)	7.13 (0.202)	15.29 (0.433)
20 (508)	6.59 (0.187)	14.45 (0.409)
19 (483)	6.03 (0.171)	13.61 (0.385)
18 (457)	5.46 (0.155)	12.76 (0.361)
17 (432)	4.88 (0.138)	11.91 (0.337)
16 (406)	4.30 (0.122)	11.06 (0.313)
15 (381)	3.70 (0.105)	10.20 (0.289)
14 (356)	3.10 (0.088)	9.33 (0.264)
13 (330)	2.49 (0.071)	8.46 (0.240)
12 (305)	1.88 (0.053)	7.59 (0.215)
11 (279)	1.26 (0.036)	6.71 (0.190)
10 (254)	0.63 (0.018)	5.83 (0.165)
9 (229)	0.00	4.93 (0.139)
8 (203)	0.00	4.38 (0.124)
7 (178)	0.00	3.83 (0.108)
6 (152)	0.00	3.28 (0.093)
5 (127)	0.00	2.74 (0.077)
4 (102)	0.00	2.19 (0.062)
3 (76)	0.00	1.64 (0.046)
2 (51)	0.00	1.09 (0.031)
1 (25)	0.00	0.55 (0.015)

Stone Cover

NOTE: Add 0.56 ft³ (0.016 m³) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volumes

Tables 9 and **10** provide cumulative storage volumes for the MC-7200 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

Table 9 – MC-7200 Incremental Storage Volume Per Chamber
Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 9" (230 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
81 (2057)	0.00	267.30 (7.569)
80 (2032)	0.00	265.30 (7.512)
79 (2007)	0.00	263.30 (7.456)
78 (1981)	0.00	261.31 (7.399)
77 (1956)	0.00	259.31 (7.343)
76 (1930)	0.00	257.31 (7.286)
75 (1905)	0.00	255.32 (7.230)
74 (1880)	0.00	253.32 (7.173)
73 (1854)	0.00	251.32 (7.117)
72 (1829)	0.00	249.33 (7.060)
71 (1803)	0.00	247.33 (7.004)
70 (1778)	0.00	245.33 (6.947)
69 (1753)	175.90 (4.981)	243.33 (6.890)
68 (1727)	175.84 (4.979)	241.30 (6.833)
67 (1702)	175.65 (4.974)	239.19 (6.773)
66 (1676)	175.38 (4.966)	237.03 (6.712)
65 (1651)	175.02 (4.956)	234.82 (6.649)
64 (1626)	174.56 (4.943)	232.54 (6.585)
63 (1600)	173.82 (4.922)	230.10 (6.516)
62 (1575)	172.72 (4.891)	227.45 (6.441)
61 (1549)	171.41 (4.854)	224.66 (6.362)
60 (1524)	169.91 (4.811)	221.76 (6.280)
59 (1499)	168.25 (4.764)	218.77 (6.195)
58 (1473)	166.46 (4.714)	215.70 (6.108)
57 (1448)	164.53 (4.659)	212.55 (6.019)
56 (1422)	162.50 (4.602)	209.33 (5.928)
55 (1397)	160.36 (4.541)	206.05 (5.835)
54 (1372)	158.11 (4.477)	202.70 (5.740)
53 (1346)	155.77 (4.411)	199.30 (5.644)
52 (1321)	153.33 (4.342)	195.84 (5.546)
51 (1295)	150.81 (4.271)	192.33 (5.446)
50 (1270)	148.21 (4.197)	188.78 (5.346)
49 (1245)	145.53 (4.121)	185.17 (5.244)
48 (1219)	142.78 (4.043)	181.52 (5.140)
47 (1194)	139.96 (3.963)	177.83 (5.036)
46 (1168)	137.07 (3.881)	174.10 (4.930)
45 (1143)	134.11 (3.798)	170.33 (4.823)
44 (1118)	131.09 (3.712)	166.52 (4.715)
43 (1092)	128.01 (3.625)	162.68 (4.607)
42 (1067)	124.88 (3.536)	158.80 (4.497)
41 (1041)	121.68 (3.446)	154.89 (4.386)

Stone Cover

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
40 (1016)	118.44 (3.354)	150.94 (4.274)
39 (991)	115.14 (3.260)	146.97 (4.162)
38 (965)	111.80 (3.166)	142.96 (4.048)
37 (948)	108.40 (3.070)	138.93 (3.934)
36 (914)	104.97 (2.972)	134.87 (3.819)
35 (889)	101.48 (2.874)	130.78 (3.703)
34 (864)	97.96 (2.774)	126.67 (3.587)
33 (838)	94.39 (2.673)	122.54 (3.470)
32 (813)	90.79 (2.571)	118.38 (3.352)
31 (787)	87.14 (2.468)	114.19 (3.234)
30 (762)	83.46 (2.363)	109.99 (3.114)
29 (737)	79.75 (2.258)	105.76 (2.995)
28 (711)	76.00 (2.152)	101.52 (2.875)
27 (686)	72.22 (2.045)	97.25 (2.754)
26 (680)	68.41 (1.937)	92.97 (2.632)
25 (610)	64.56 (1.828)	88.66 (2.511)
24 (609)	60.69 (1.719)	84.34 (2.388)
23 (584)	56.80 (1.608)	80.01 (2.266)
22 (559)	52.87 (1.497)	75.66 (2.142)
21 (533)	48.92 (1.385)	71.29 (2.019)
20 (508)	44.95 (1.273)	66.91 (1.895)
19 (483)	40.96 (1.160)	62.52 (1.770)
18 (457)	36.94 (1.046)	58.11 (1.646)
17 (432)	32.91 (0.932)	53.69 (1.520)
16 (406)	28.85 (0.817)	49.26 (1.395)
15 (381)	24.78 (0.702)	44.82 (1.269)
14 (356)	20.69 (0.586)	40.37 (1.143)
13 (330)	16.58 (0.469)	35.91 (1.017)
12 (305)	12.46 (0.353)	31.44 (0.890)
11 (279)	8.32 (0.236)	26.96 (0.763)
10 (254)	4.17 (0.118)	22.47 (0.636)
9 (229)	0.00	17.97 (0.509)
8 (203)	0.00	15.98 (0.452)
7 (178)	0.00	13.98 (0.396)
6 (152)	0.00	11.98 (0.339)
5 (127)	0.00	9.99 (0.283)
4 (102)	0.00	7.99 (0.226)
3 (76)	0.00	5.99 (0.170)
2 (51)	0.00	3.99 (0.113)
1 (25)	0.00	2.00 (0.057)

Stone Cover

NOTE: Add 2.00 ft³ (0.057 m³) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volumes

Table 10 – MC-7200 Incremental Storage Volume Per End Cap
Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above end caps, and 9" (230 mm) of spacing between end caps and 6" (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
81 (2057)	0.00	115.28 (3.264)
80 (2032)	0.00	114.15 (3.232)
79 (2007)	0.00	113.02 (3.200)
78 (1981)	0.00	111.89 (3.168)
77 (1956)	0.00	110.76 (3.136)
76 (1930)	0.00	109.63 (3.104)
75 (1905)	0.00	108.50 (3.072)
74 (1880)	0.00	107.37 (3.040)
73 (1854)	0.00	106.24 (3.008)
72 (1829)	0.00	105.11 (2.976)
71 (1803)	0.00	103.98 (2.944)
70 (1778)	0.00	102.85 (2.912)
69 (1753)	39.54 (1.120)	101.72 (2.880)
68 (1727)	39.53 (1.119)	100.58 (2.848)
67 (1702)	39.50 (1.118)	99.43 (2.816)
66 (1676)	39.45 (1.117)	98.27 (2.783)
65 (1651)	39.38 (1.115)	97.10 (2.750)
64 (1626)	39.30 (1.113)	95.92 (2.716)
63 (1600)	39.19 (1.110)	94.73 (2.682)
62 (1575)	39.06 (1.106)	93.52 (2.648)
61 (1549)	38.90 (1.101)	92.29 (2.613)
60 (1524)	38.71 (1.096)	91.04 (2.578)
59 (1499)	38.49 (1.090)	89.78 (2.542)
58 (1473)	38.24 (1.083)	88.50 (2.506)
57 (1448)	37.97 (1.075)	87.21 (2.469)
56 (1422)	37.67 (1.067)	85.90 (2.432)
55 (1397)	37.34 (1.057)	84.57 (2.395)
54 (1372)	36.98 (1.047)	83.23 (2.357)
53 (1346)	36.60 (1.036)	81.87 (2.318)
52 (1321)	36.19 (1.025)	80.49 (2.279)
51 (1295)	35.75 (1.012)	79.10 (2.240)
50 (1270)	35.28 (0.999)	77.69 (2.200)
49 (1245)	34.79 (0.985)	76.26 (2.159)
48 (1219)	34.27 (0.970)	74.82 (2.119)
47 (1194)	33.72 (0.955)	73.36 (2.077)
46 (1168)	33.15 (0.939)	71.89 (2.036)
45 (1143)	32.57 (0.922)	70.40 (1.994)
44 (1118)	31.96 (0.905)	68.91 (1.951)
43 (1092)	31.32 (0.887)	67.40 (1.909)
42 (1067)	30.68 (0.869)	65.88 (1.866)
41 (1041)	30.00 (0.850)	64.35 (1.822)

Stone Cover

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
40 (1016)	29.30 (0.830)	62.80 (1.778)
39 (991)	28.58 (0.809)	61.23 (1.734)
38 (965)	27.84 (0.788)	59.65 (1.689)
37 (948)	27.07 (0.767)	58.07 (1.644)
36 (914)	26.29 (0.744)	56.46 (1.599)
35 (889)	25.48 (0.722)	54.85 (1.553)
34 (864)	24.66 (0.698)	53.23 (1.507)
33 (838)	23.83 (0.675)	51.60 (1.461)
32 (813)	22.98 (0.651)	49.96 (1.415)
31 (787)	22.12 (0.626)	48.31 (1.368)
30 (762)	21.23 (0.601)	46.65 (1.321)
29 (737)	20.32 (0.575)	44.97 (1.273)
28 (711)	19.40 (0.549)	43.29 (1.226)
27 (686)	18.48 (0.523)	41.61 (1.178)
26 (680)	17.54 (0.497)	39.91 (1.130)
25 (610)	16.59 (0.470)	38.21 (1.082)
24 (609)	15.62 (0.442)	36.50 (1.033)
23 (584)	14.64 (0.414)	34.78 (0.985)
22 (559)	13.66 (0.387)	33.07 (0.936)
21 (533)	12.66 (0.359)	31.33 (0.887)
20 (508)	11.65 (0.330)	29.60 (0.838)
19 (483)	10.63 (0.301)	27.85 (0.3789)
18 (457)	9.60 (0.272)	26.11 (0.739)
17 (432)	8.56 (0.242)	24.35 (0.690)
16 (406)	7.51 (0.213)	22.59 (0.640)
15 (381)	6.46 (0.183)	20.83 (0.590)
14 (356)	5.41 (0.153)	19.07 (0.540)
13 (330)	4.35 (0.123)	17.31 (0.490)
12 (305)	3.28 (0.093)	15.53 (0.440)
11 (279)	2.19 (0.062)	13.75 (0.389)
10 (254)	1.11 (0.031)	11.97 (0.339)
9 (229)	0.00	10.17 (0.288)
8 (203)	0.00	9.04 (0.256)
7 (178)	0.00	7.91 (0.224)
6 (152)	0.00	6.78 (0.192)
5 (127)	0.00	5.65 (0.160)
4 (102)	0.00	4.52 (0.128)
3 (76)	0.00	3.39 (0.096)
2 (51)	0.00	2.26 (0.064)
1 (25)	0.00	1.13 (0.032)

Stone Cover

NOTE: Add 1.08 ft^3 (0.031 m^3) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

6.0 MC-3500 Chamber System Sizing

The following steps provide the calculations necessary for preliminary sizing of an MC-3500 chamber system. For custom bed configurations to fit specific sites, contact the StormTech Technical Services Department or your local StormTech representative.

1) Determine the amount of storage volume (VS) required. It is the design engineer's sole responsibility to determine the storage volume required.

Table 11 - Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

NOTE: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 6" (150 mm) stone perimeter.

2) Determine the number of chambers (C) required. To calculate the number of chambers required for adequate storage, divide the storage volume (Vs) by the storage volume of the chamber (from **Table 11**), as follows: **C = Vs / Storage Volume per Chamber**

3) Determine the number of end caps required. The number of end caps (EC) required depends on the number of rows required by the project. Once the num- ber of chamber rows is determined, multiply the number of chamber rows by 2 to determine the number of end caps required. **EC = No. of Chamber Rows x 2**

NOTE: Additional end caps may be required for systems having inlet locations within the chamber bed.

4) Determine additional storage provided by end caps. End Caps will provide additional storage to the project. Multiply the number of end caps (EC) by the storage volume per end cap (ECS) to determine the additional storage (As) provided by the end caps. **As = EC x ECs**

5) Adjust number of chambers (C) to account for additional end cap storage (As). The original number of chambers (C) can now be reduced due to the additional storage in the end caps. Divide the additional storage (As) by the storage volume per chamber to determine the number of chambers that can be removed. **Number of chambers to remove = As/ volume per chamber**

NOTE: Additional storage exists in the stone perimeter as well as in the inlet and outlet manifold systems. Contact StormTech's Technical Services Department for assistance with determining the number of chambers and end caps required for your project.

6) Determine the required bed size (S). The size of the bed will depend on the number of chambers and end caps required:

MC-3500 area per chamber = 49.6 ft² (4.6 m²)
MC-3500 area per end cap = 16.4 ft² (1.5 m²)
S = (C x area per chamber) + (EC x area per end cap)

NOTE: It is necessary to add 12" (300 mm) of stone perimeter parallel to the chamber rows and 6" (150 mm) of stone perimeter from the base of all end caps. The additional area due to perimeter stone is not included in the area numbers above.

7) Determine the amount of stone (Vst) required. To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) and the number of end caps (EC) by the selected weight of stone from **Table 12.**

NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

Table 12 - Amount of Stone Per Chamber/End Cap

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

NOTE: Assumes 12" (300 mm) of stone above, and 6" (150 mm) row spacing, and 6" (150 mm) of perimeter stone in front of end caps.

8) Determine the volume of excavation (Ex) required. Each additional foot of cover will add a volume of excavation of 1.9 yd³ (1.5 m³) per MC-3500 chamber and 0.6 yd³ (0.5 m³) per MC-3500 end cap.

Table 13—Volume of Excavation Per Chamber/End Cap yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

NOTE: Assumes 6" (150 mm) separation between chamber rows, 6" (150 mm) of perimeter in front of end caps, and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

9) Determine the area of geotextile (F) required. The bottom, top and sides of the bed must be covered with a non-woven geotextile (filter fabric) that meets AASHTO M288 Class 2 requirements. The area of the sidewalls must be calculated and a 24" (600 mm) overlap must be included for all seams. Geotextiles typically come in 15 foot (4.57 m) wide rolls.

6.0 MC-7200 Chamber System Sizing

The following steps provide the calculations necessary for preliminary sizing of an MC-7200 chamber system. For custom bed configurations to fit specific sites, contact the StormTech Technical Services Department or your local StormTech representative.

1) Determine the amount of storage volume (VS) required. It is the design engineer's sole responsibility to determine the storage volume required.

Table 14 - Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-7200 Chamber	175.9 (4.98)	267.3 (7.57)	273.3 (7.74)	279.3 (7.91)	285.2 (8.08)
MC-7200 End Cap	39.5 (1.12)	115.3 (3.26)	118.6 (3.36)	121.9 (3.45)	125.29 (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.

2) Determine the number of chambers (C) required.
To calculate the number of chambers required for adequate storage, divide the storage volume (Vs) by the storage volume of the chamber (from **Table 14**), as follows: **C = Vs / Storage Volume per Chamber**

3) Determine the number of end caps required.
The number of end caps (EC) required depends on the number of rows required by the project. Once the number of chamber rows is determined, multiply the number of chamber rows by 2 to determine the number of end caps required. **EC = No. of Chamber Rows x 2**

NOTE: Additional end caps may be required for systems having inlet locations within the chamber bed.

4) Determine additional storage provided by end caps.
End Caps will provide additional storage to the project. Multiply the number of end caps (EC) by the storage volume per end cap (ECS) to determine the additional storage (As) provided by the end caps. **As = EC x ECs**

5) Adjust number of chambers (C) to account for additional end cap storage (As). The original number of chambers (C) can now be reduced due to the additional storage in the end caps. Divide the additional storage (As) by the storage volume per chamber to determine the number of chambers that can be removed. **Number of chambers to remove = As/ volume per chamber**

NOTE: Additional storage exists in the stone perimeter as well as in the inlet and outlet manifold systems. Contact StormTech's Technical Services Department for assistance with determining the number of chambers and end caps required for your project.

6) Determine the required bed size (S).
The size of the bed will depend on the number of chambers and end caps required:

MC-7200 area per chamber = 59.9 ft² (5.6 m²)
MC-7200 area per end cap = 33.9 ft² (3.1 m²)

S = (C x area per chamber) + (EC x area per end cap)

NOTE: It is necessary to add 12" (300 mm) of stone perimeter parallel to the chamber rows and 6" (150 mm) of stone perimeter from the base of all end caps. The additional area due to perimeter stone is not included in the area numbers above.

7) Determine the amount of stone (Vst) required.
To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) and the number of end caps (EC) by the selected weight of stone from **Table 15.**

NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

Table 15 - Amount of Stone Per Chamber/End Cap

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
Chamber	11.9 (8.5)	12.6 (9.0)	13.4 (9.6)	14.6 (10.1)
End Cap	9.8 (7.0)	10.2 (7.3)	10.6 (7.6)	11.1 (7.9)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	10796 (6.5)	11431 (6.9)	12156 (7.3)	13245 (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.

8) Determine the volume of excavation (Ex) required.
Each additional foot of cover will add a volume of excavation of 2.2 yd³ (1.7 m³) per MC-7200 chamber and 1.4 yd³ (0.8 m³) per MC-7200 end cap.

Table 13- Volume of Excavation Per Chamber/End Cap yd³ (m³)

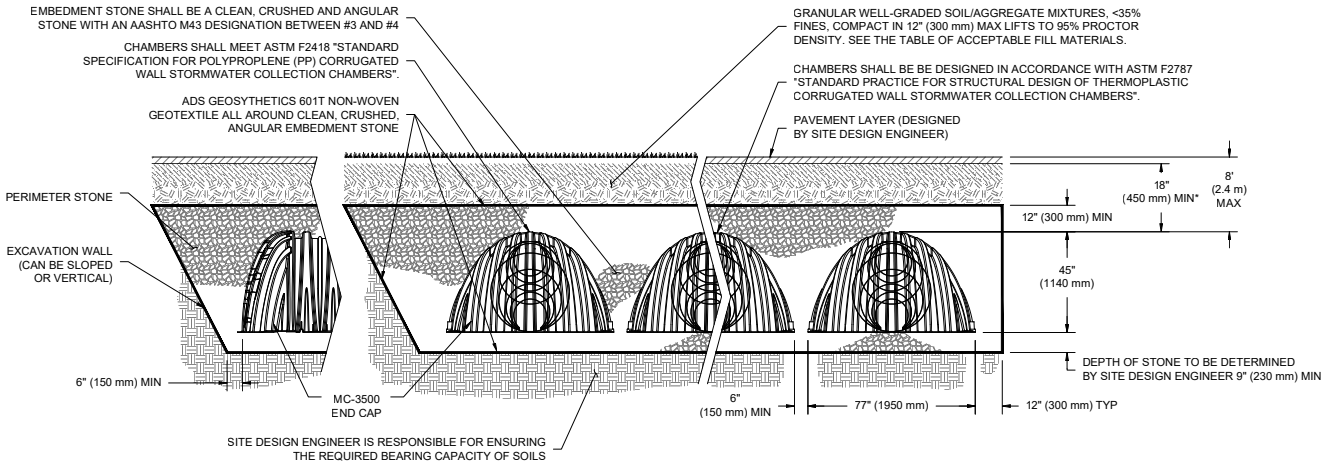
	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
Chamber	17.2 (13.2)	17.7 (13.5)	18.3 (14.0)	18.8 (14.4)
End Cap	9.7 (7.4)	10.0 (7.6)	10.3 (7.9)	10.6 (8.1)

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

9) Determine the area of geotextile (F) required.
The bottom, top and sides of the bed must be covered with a non-woven geotextile (filter fabric) that meets AASHTO M288 Class 2 requirements. The area of the sidewalls must be calculated and a 24" (600 mm) overlap must be included for all seams. Geotextiles typically come in 15 foot (4.57 m) wide rolls.

7.0 Structural Cross Sections and Specifications

Figure 16A - MC-3500 Structural Cross Section Detail (Not to Scale)



Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

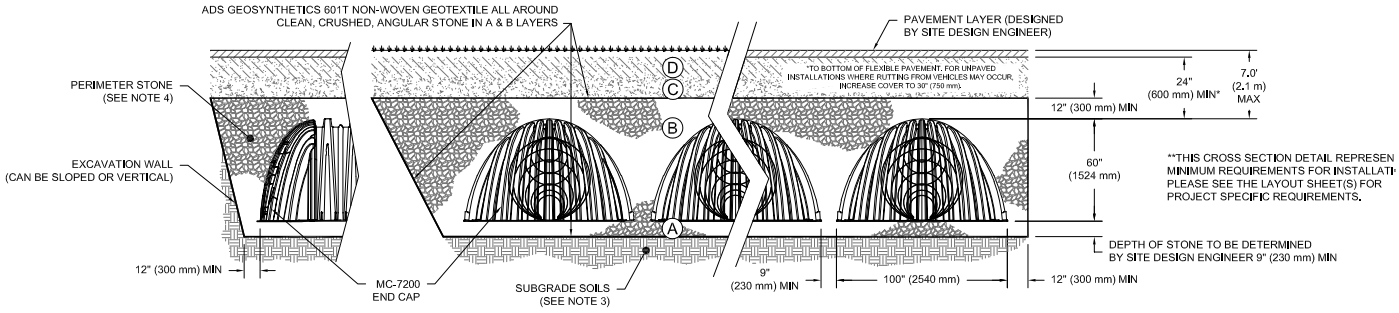
MC-3500 Stormwater Chamber Specifications

1. Chambers shall be StormTech MC-3500 or approved equal.
2. Chambers shall be made from virgin, impact-modified polypropylene copolymers.
3. Chamber rows shall provide continuous, unobstructed internal space with no internal panels that would impede flow.
4. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO Design Truck with consideration for impact and multiple vehicle presences.
5. Chambers shall meet the requirements of ASTM F 2418, “Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers.”
6. Chambers shall conform to the requirements of ASTM F 2787, “Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers.”
7. Only chambers that are approved by the engineer will be allowed. The contractor shall submit (3 sets) of the following to the engineer for approval before delivering chambers to the project site:
   - A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.
   - Structural cross section detail on which the structural cross section is based.
8. The installation of chambers shall be in accordance with the manufacturer’s latest Construction Guide.

Detail drawings available in Cad Rev. 2000 format at www.stormtech.com

7.0 Structural Cross Sections and Specifications

Figure 16B - MC-7200 Structural Cross Section Detail (Not to Scale)



Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

MC-7200 Stormwater Chamber Specifications

1. Chambers shall be StormTech MC-7200 or approved equal.
2. Chambers shall be made from virgin, impact-modified polypropylene copolymers.
3. Chamber rows shall provide continuous, unobstructed internal space with no internal panels that would impede flow.
4. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO Design Truck with consideration for impact and multiple vehicle presences.
5. Chambers shall meet the requirements of ASTM F 2418, “Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers.”
6. Chambers shall conform to the requirements of ASTM F 2787, “Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers.”
7. Only chambers that are approved by the engineer will be allowed. The contractor shall submit (3 sets) of the following to the engineer for approval before delivering chambers to the project site:
   - A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.
   - Structural cross section detail on which the structural cross section is based.
8. The installation of chambers shall be in accordance with the manufacturer’s latest Construction Guide.

Detail drawings available in Cad Rev. 2000 format at www.stormtech.com

8.0 General Notes

1. StormTech requires installing contractors to use and understand the latest StormTech **MC-3500 and MC-7200 Construction Guides** prior to beginning system installation.
2. StormTech offers installation consultations to installing contractors. Contact our Technical Service Department or local StormTech representative at least 30 days prior to system installation to arrange a pre-installation consultation. Our representatives can then answer questions or address comments on the StormTech chamber system and inform the installing contractor of the minimum installation requirements before beginning the system's construction. Call 860-529-8188 to speak to a Technical Service Representative or visit www.stormtech.com to receive a copy of our Construction Guide.
3. StormTech requirements for systems with pavement design (asphalt, concrete pavers, etc.): Minimum cover is 18" (450mm) for the MC-3500 and 24"(600mm) for the MC-7200 not including pavement; MC-3500 maximum cover is 8.0' (1.98 m) and MC-7200 maximum cover is 7.0' (2.43 m) both including pavement. For designs with cover depths deeper than these maximums, please contact Stormtech. For installations that do not include pavement, where rutting from vehicles may occur, minimum required cover is increased to 30" (762 mm).
4. The contractor must report any discrepancies with the bearing capacity of the subgrade materials to the design engineer.
5. AASHTO M288 Class 2 non-woven geotextile (ADS601 or equal) (filter fabric) must be used as indicated in the project plans.
6. Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of StormTech MC-3500 / MC-7200 Construction Guides.
7. Backfilling over the chambers must follow requirements as indicated in the most current version of StormTech MC-3500 / MC-7200 Construction Guides.
8. The contractor must refer to StormTech MC-3500 / MC-7200 Construction Guides for a Table of Acceptable Vehicle Loads at various depths of cover. This information is also available at the StormTech website: www.stormtech.com. The contractor is responsible for preventing vehicles that exceed StormTech requirements from traveling across or parking over the stormwater system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.
9. The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.
10. STORMTECH PRODUCT WARRANTY IS LIMITED. Contact StormTech for warranty information.

9.0 Inspection and Maintenance

9.1 Isolator Row Plus Inspection

Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row Plus. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a con- fined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3" (76 mm), cleanout is required.

A StormTech Isolator Row Plus should initially be inspected immediately after completion of the site's construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site's owner. Once in normal service, a StormTech Isolator Row Plus should be inspected bi-annually until an understanding of the sites characteristics is developed. The site's maintenance manager can then revise the inspection schedule based on experience or local requirements.

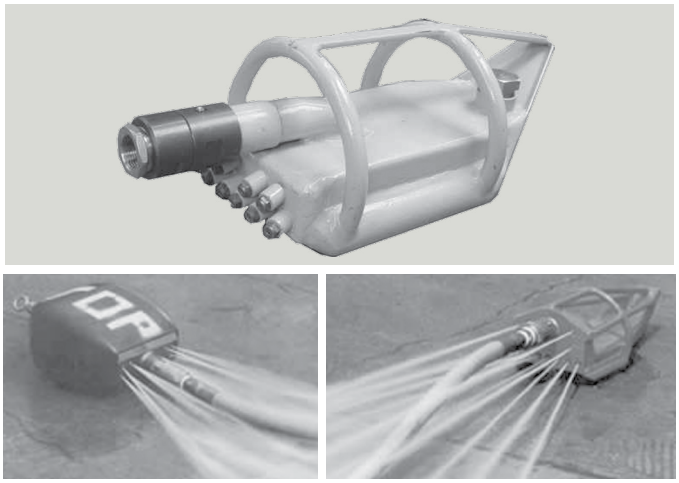
9.2 Isolator Row Plus Maintenance

JetVac maintenance is recommended if sediment has been collected to an average depth of 3" (76 mm) inside the Isolator Row Plus. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row Plus. 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, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combi- nation vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" (1143 mm) are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. The JetVac process shall only be performed on StormTech Rows that have ADS Plus fabric over the foundation stone.

A Flamp (flared end ramp) is attached to the inlet pipe on the inside of the chamber end cap to provide a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning, and to guide cleaning and inspection equipment back into the inlet pipe when complete.

Flamp (Flared End Ramp)

A typical JetVac truck (This is not a StormTech product.)



Examples of culvert cleaning nozzles appropriate for Isolator Row Plus maintenance. (These are not StormTech products).

MC-7200 MC-3500 DC-780 SC-740 SC-310 SC-160LP

A Family of Products and Services for the Stormwater Industry:

MC-3500 and MC-7200 Chambers and End Caps

SC-160LP, SC-310 and SC-740 Chambers & End Caps

DC-780 Chambers and End Caps

Fabricated End Caps

Fabricated Manifold Fittings

Patented Isolator Row PLUS for Maintenance and Water Quality

Chamber Separation Spacers

In-House System Layout Assistance

On-Site Educational Seminars

Worldwide Technical Sales Group

Centralized Product Applications Department

Research and Development Team

Technical Literature, O&M Manuals and Detailed CAD drawings all downloadable via our Website

StormTech provides state-of-the-art products and services that meet or exceed industry performance standards and expectations. We offer designers, regulators, owners and contractors the highest quality products and services for stormwater management that Saves Valuable Land and Protects Water Resources.

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ADS StormTech™

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:

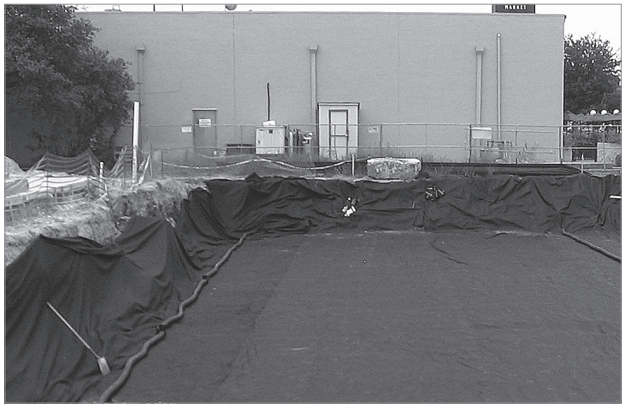
A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all 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

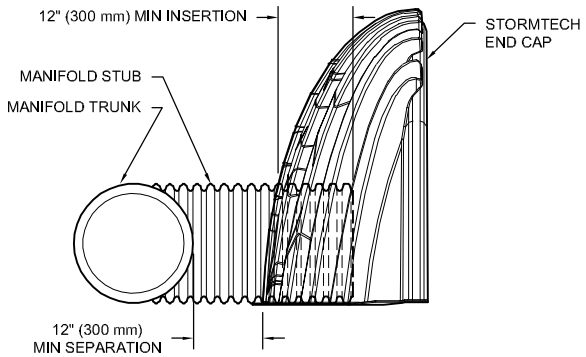
Install manifolds and lay out ADS Plus fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® Plus Row(s). Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement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

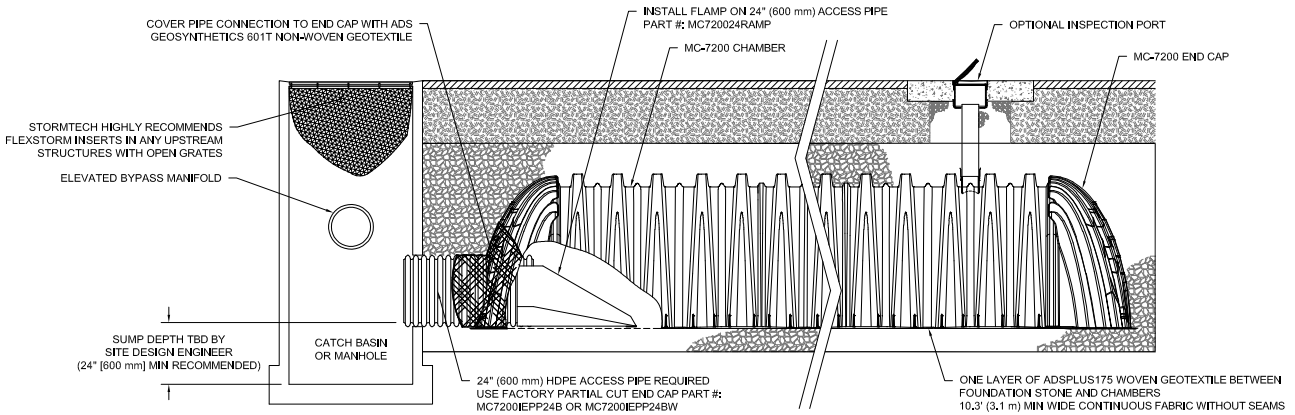
Manifold Insertion



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

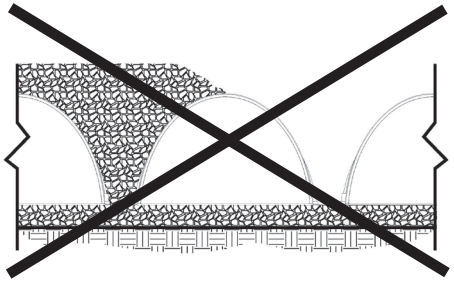


Initial Anchoring of Chambers – Embedment Stone

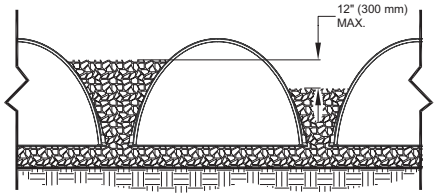
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

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

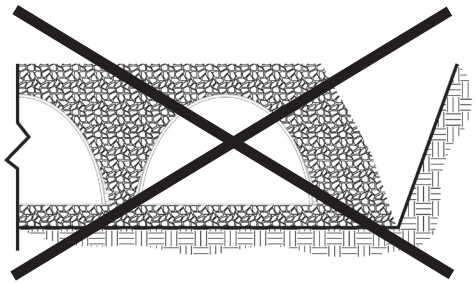


Uneven Backfill

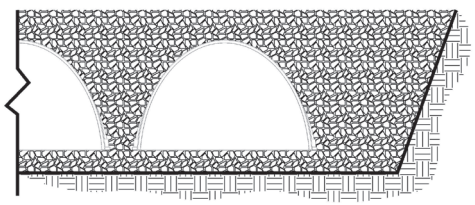


Even Backfill

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

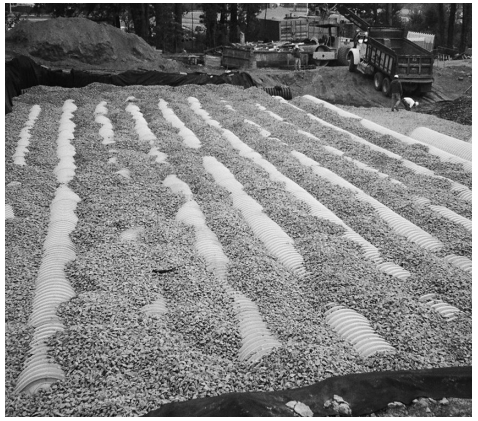


Perimeter Fully Backfilled

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.

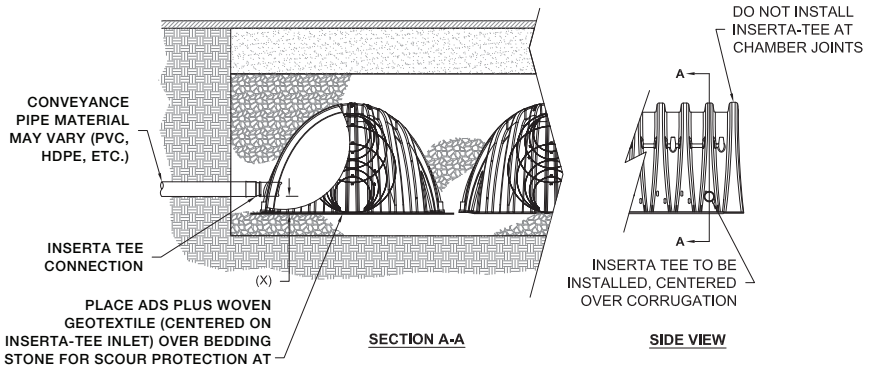


Only after chambers have been backfilled to top of chamber and with a minimum 12” (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material 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



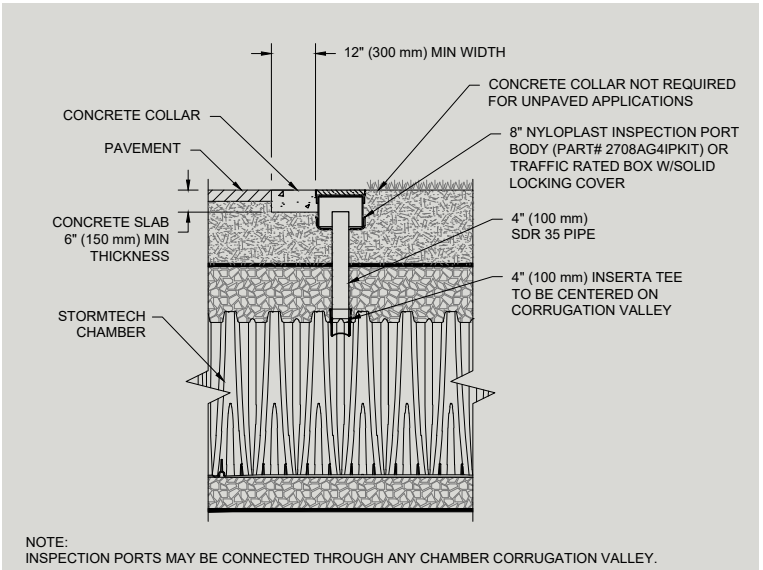
NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

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]

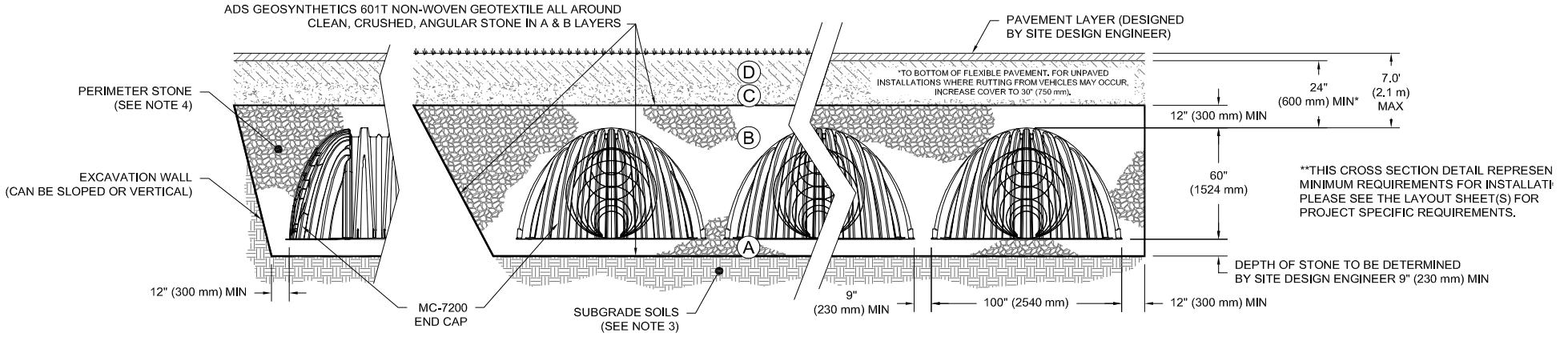
Figure 1- Inspection Port Detail



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.			