Preliminary Water Quality Management Plan (PWQMP)

Project Name:

Forster Mixed Use Project
Forster and Camino Capistrano
San Juan Capistrano, CA 92675
APN: 124-160-77, -51 & -52

Prepared for:

Camino Capistrano Oz, LLC
8951 Research Drive, Suite 100
Irvine, CA 92618

Prepared by:

C3 Civil Engineering

Prepared on: 12/11/2023

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Engineer's Seal

Project Owner's Certification			
Permit/Application No.	AC23-001, CA23-001, GPM23-013, TTM23-001	Grading Permit No.	TBD
Tract/Parcel Map No.	Tract 103	Building Permit No.	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			APN 124-160-37, -51 & -52 (Lot 11)

This Preliminary Water Quality Management Plan (PWQMP) has been prepared for Camino Capistrano Oz, LLC by C3 Civil Engineering. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the San Diego Region (South Orange County). Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: Chad Brown			
Title	Vice President of Planning & Development		
Company	Camino Capistrano OZ, LLC		
Address	8951 Research Drive, Suite 100, Irvine, 92618		
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Telephone #	(949)417-6264		
Signature		Date	

Contents

Section 1 Discretionary Permit(s) and Water Quality Conditions

Project Infomation			
Permit/Application No.	AC23-001, CA23-001, GPM23-013, TTM23-001	Site Address or Tract/Parcel Map No.	SEC of Forster and El Camino Real, San Juan Capistrano, CA 92675
Additional Information/ Comments:	N/A		

Water Quality Conditions	
Water Quality Conditions from prior approvals or applicable watershed-based plans	This report is a Preliminary WQMP. The project is priority project based on the SOC TGD Section 1.2.3 classification: 2. New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and consist primarily of one or more of the following uses. 3. Restaurants. This category is defined as a facility that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (standard Industrial Classification (SIC) 6514- Multi-family housing, 5812-Resturants). 4. Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. 5. New or redevelopment projects that result in the disturbance of one or more acres of total land (impervious and pervious) and are expected to generate pollutants post-construction.

Section 2 Project Description

2.1 General Description

Description of Proposed Project		
Site Location	The project is located at the southeast corner of Camino Capistrano and Forster Street, extending to the southeast corner of Forster Street and El Camino Real in San Juan Capistrano. It is bound by Forster Street and Historic Town Center Park to the North, an O'Reilly Auto Parts store and OCFA Fire Station to the east, Camino Capistrano to the west and an office park to the south.	
Project Area (ft^2): 137,517	Number of Dwelling Units: 95 units	SIC Code: 6514- Multi-family housing; 5812-Resturants
Narrative Project Description:	The project is located within the South Orange County Permit Area. The project proposes to redevelop an existing office complex and parking lot. The existing site improvements will be demolished except for perimeter block walls along the property line(s). The proposed improvements include a mixed-use community, incorporating both commercial and residential uses. The commercial element of the project includes a free-standing 4,000 sf restaurant and 3,000 sf of commercial space attached to the residential building. The two commercial buildings sit on opposite corners of the project entrance and face a traffic circle at the main entrance. The restaurant building has a spacious courtyard for exterior seating. The residential element of the project will contain 95 multi-family homes with a mix of one- and two-bedroom apartment homes, surrounding a resort-style pool and recreational facility. A nearly 3,500 sf clubhouse building will sit at the entrance to the residences. Also included is a pool deck and partially submerged underground parking structure beneath the residential building. Two trash enclosures will serve the community and drive aisles and parking stalls will support vehicular movements throughout the project. New landscaping will be provided in all areas that are not hardscaped. The total disturbed onsite area is 137,517 sf. The total added or replaced impervious surface is 117,551 sf. In lieu of the curved roadway at Forster and El Camino Real, a four-way intersection is proposed with stop sign controls for the El Camino Real north leg and the private project entrance at the south leg. Forster Street will be fully	

	developed along the project frontage near the restaurant with a 26 ft roadway section and 5 ft sidewalks. The existing on-street parking will be removed. The curb, gutter and sidewalk along Camino Capistrano will be improved along the project frontage. A 26 ft public access easement will extend from the intersection at Forster Street and El Camino Real through the site to the southeast, across the O'Reilly property and terminating at Del Obispo. This access easement will also be assigned for public utilities. Loading docks and outdoor material storage areas are <u>not</u> included in the proposed development.			
Project Area (137,517 sf – disturbed area)	Pervious		Impervious	
	Area (sq ft)	Percentage	Area (sq ft)	Percentage
Pre-Project Conditions	23,740	17.3%	113,777	82.7%
Post-Project Conditions	24,157	17.6%	113,360	82.4%

2.2 Post Development Drainage Characteristics

The proposed development will maintain the overall drainage pattern by ultimately discharging runoff into the City of San Juan Capistrano storm drain system at Del Obispo and Camino Capistrano, tributary to San Juan Creek (an engineered channel), then ultimately into the Pacific Ocean. See the project's Drainage Study for more details.

2.3 Property Ownership/Management

The site is privately owned and long-term stormwater maintenance will be the responsibility of the owner. No storm water infrastructure will transfer to any public agencies.

Section 3 Site & Watershed Characterization

3.1 Site Conditions

3.1.1 Existing Site Conditions

Site Characteristics	
Hydrogeologic (Groundwater) Conditions	In Section 8.2 of the project's Geotechnical Engineering Investigation (soils report) prepared by Salem Engineering Group, Inc. dated July 28, 2020, groundwater was encountered during drilling for borings at a depth of approximately 29 feet below existing grade. Per the soils report, according to "the State of California Hazard Zone Report 049, Dana Point Quadrangle, Plate 1.2, historically highest groundwater is estimated to be at a depth of approximately 5 feet below ground surface."
Geotechnical Conditions (relevant to infiltration)	The soils report conducted two percolation tests at a tested depth of 5' and 10' below the existing grade. The tested infiltration rates ranged from 0.01-0.27 in/hr. After adding a factor of safety, infiltration is infeasible for this project.
Off-Site Drainage	There are no offsite areas that discharge run-on to the project. However, if the project to the north develops, there is a potential for run-on from that project. This will be evaluated at a later time.
Utility and Infrastructure Information	Water and sewer utilities are available within El Camino Real, Camino Capistrano and Forster Street. There are no public storm drain systems within the adjacent roadways. A public water main is planned as part of this project.
Topography	Moderately sloping, with slopes from 1-5%.
Drainage Patterns/Connections	The existing site drains in two general locations. The northwestern corner of the property sheet flows to the west to Camino Capistrano, where it is carried south in the street's curb and gutter. The remainder of the site is sloped towards two inlets at the southern corner of the property where it is collected in a catch basin and piped southwest in a 10" pipe to a public storm drain system in Del Obispo near the corner of Camino Capistrano.
Soil Type, Geology, and Infiltration Properties	Per the soils report, "*In general, the soils within the depth of exploration consisted of up to 4 feet of fill soils underlain by alluvium consisting of loose to very dense clayey sand with various amounts of gravel, and silty gravel with sand, and firm to hard sandy clay, clay with sand, clayey silt with sand , and silt with sand. The fill soils consisted of medium dense to very dense clayey sand with various amounts of*

	gravel, silty gravel with sand; and firm to very stiff sandy clay and clay with sand." This type of soils is not conducive to infiltration.
Existing Site Condition	The existing site improvements include a building slab, paved parking stalls and drive aisles, and mature landscaping. 100% of the site has previously been developed but the previous buildings have been demolished down to the building slabs.

Existing Land Uses

Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Commercial	3.157	2.612	0.545	82.7
Total	3.157	2.612	0.545	82.7

3.1.2 Infiltration-Related Characteristics

Per the soils report prepared for the project, along with the historically high groundwater, infiltration is infeasible for this project. See the soils report in Attachment E for more details.

3.1.2.1 Hydrogeologic Conditions

Per the soils report, groundwater was encountered at approximately 29' below surface grade during the test borings. The historic high groundwater is estimated at a depth of 5' below the existing ground surface.

3.1.2.2 Soil and Geologic Infiltration Characteristics

The soils report conducted two percolation tests at a tested depth of 5' and 10' below the existing grade. The tested infiltration rates ranged from 0.01-0.27 in/hr. After adding a factor of safety, infiltration is infeasible for this project.

3.1.2.3 Geotechnical Conditions

Per the soils report, *"In general, the soils within the depth of exploration consisted of up to 4 feet of fill soils underlain by alluvium consisting of loose to very dense clayey sand with various amounts of gravel, and silty gravel with sand, and firm to hard sandy clay, clay with sand, clayey silt with sand , and silt with sand. The fill soils consisted of medium dense to very dense clayey sand with various amounts of gravel, silty gravel with sand; and firm to very stiff sandy clay and clay with sand."* This type of soils is not conducive to infiltration.

3.1.2.4 Summary of Infiltration Opportunities and Constraints of Existing Site

As noted above, based on site characteristics, infiltration is not a feasible option for BMP's for the project's development.

3.2 Proposed Site Development Activities

Please reference the WQMP plan in the Appendix for the proposed development showing land use, topography, drainage features, and landscape areas.

3.2.1 Overview of Site Development Activities

The proposed improvements include a mixed-use community, incorporating both commercial and residential uses. The commercial element of the project includes a free-standing 4,000 sf restaurant and 3,000 sf of commercial space attached to the residential building. The two commercial buildings sit on opposite corners of the project entrance and face a traffic circle at the main entrance. The restaurant building has a spacious courtyard for exterior seating. The residential element of the project will contain 95 multi-family homes with a mix of one- and two-bedroom apartment homes, surrounding a resort-style pool and recreational facility. A nearly 3,500 sf clubhouse building will sit at the entrance to the residences. Also included is a pool deck and partially submerged underground parking structure beneath the residential building. Two trash enclosures will serve the community and drive aisles and parking stalls will support vehicular movements throughout the project. New landscaping will be provided in all areas that are not hardscaped. The total disturbed onsite area is 137,517 sf.

In lieu of the curved roadway at Forster and El Camino Real, a four-way intersection is proposed with stop sign controls for the El Camino Real north leg and the private project entrance at the south leg. Forster Street will be fully developed along the project frontage near the restaurant with a 26 ft roadway section and 5 ft sidewalks. The existing on-street parking will be removed. The curb, gutter and sidewalk along Camino Capistrano will be improved along the project frontage. A 26 ft public access easement will extend from the intersection at Forster Street and El Camino Real through the site to the southeast, across the O'Reilly property and terminating at Del Obispo. This access easement will also be assigned for public utilities.

3.2.2 Project Attributes Influencing Stormwater Management

The proposed buildings will be multi-family residential, commercial, and restaurant use, with the activity use such as food preparation, cooking and eating. (SIC Code 5812-Resturants, 6514- Multi-family housing)

There will be no truck docks, loading docks, fueling areas, and vehicle cleaning areas.

There are no outdoor food preparation areas planned for this project site.

There are no outdoor material storage areas planned for this project site.

There are no offsite areas that discharge run-on to the project site.

There are no environmentally sensitive areas within the property.

Outdoor activities include pedestrians walking, and dining at the restaurant.

The proposed development will generate waste and a SWPPP report will be in place for the site during construction. Waste management and Hazardous Waste Management procedures and precautions will be implemented per the SWPPP report. The site will generate wastes such as AC, PCC rubble, sediment, fill material, aggregate base, etc.

Construction materials will be delivered and stored per BMP WM-1 as specified in the project SWPPP report. The general material storage area will be located in the Contractor's yard as shown on the Erosion Control Plan in the project SWPPP report (with the Final WQMP). Very large items, such as light standards, framing, stockpiled lumber, will be stored in the open in the general storage area.

Proposed Land Uses

Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Restaurant	0.352	0.302	0.050	85.8
Residential	2.805	2.300	0.505	82.0
Total	3.157	2.602	0.555	82.4

3.2.3 Effects on Infiltration and Harvest and Use Feasibility

Infiltration is infeasible for the site. Based on the drought tolerant landscaping that is proposed, the DCV cannot be used for site irrigation within 48hrs of the end of precipitation, therefore, Harvest and Use BMP's are not mandatory for the project and not required.

3.3 Receiving Waterbodies

Receiving Waters	The project is located in the San Juan Creek Watershed. The proposed project will discharge runoff into the adjacent public streets and an onsite drainage system. All of the runoff from the site is eventually collected into a storm drain system at Del Obispo Street and Camino Capistrano. This public storm drain system is tributary to San Juan Creek, which is tributary to the Pacific Ocean. See Attachment C for map of downstream receiving waters.

303(d) Listed Impairments	1. San Juan Creek (mouth): Benthic Community Effects, DDE, Nitrogen, Oxygen (dissolved), Phosphorus, Selenium, Toxicity, Bifenthrin, Pyrethroids, Indicator Bacteria, 2. Pacific Ocean , San Onofre to Crystal Cove – None.
Applicable TMDLs	San Juan Creek - Benthic Community Effects, DDE, Nitrogen, Oxygen (dissolved), Phosphorus, Selenium, Toxicity, Alkalinity as CaCO3, Aluminum, Ammonia, Ammonia (unionized), Anthracene, Arsenic, Benzo(a)anthracene, Benzo(a)pyrene, Cadmium, Chlordane, Chloride, Chlorpyrifos, Chromium, Chrysene, Copper, Lead, Cyfluthrin, Cyhalothrin Lambda, Cypermethrin, DDD, DDT, Deltamethrin, Diazinon, Dieldrin, Endrin, Esfenvalerate/Fenvalerate, Fenpropathrin, Fipronil, Fipronil Sulfide, Fipronil Sulfone, Fluoranthene, Fluorene, Iron, Lead, gamma-HCH, Mercury, Methyl Parathion, Naphthalene, Nickel, PAHs, PCBs, Permethrin, Phenanthrene, Pyrene, Silver, Total DDT, Total Dissolved Solids, Turbidity, Zinc, pH, Bifenthrin, Pyrethroids, Indicator Bacteria, Malathion, Manganese, Sulfates, Temperature (water) Pacific Ocean – 2-Methylnaphthalene, Antimony, Arsenic, Benzo(a)anthracene, Benzo(a)pyrene, Cadmium, Chlordane, Chromium, Chrysene (C1-C4), Copper, Dibenz[a,h]anthracene, Lead, Mercury, PAHs, PCBs, Phenanthrene, Pyrene, Selenium, Silver, Zinc,
Pollutants of Concern for the Project	Suspended Solid/Sediments, Heavy metals, pathogens, oil & grease, toxic organic compounds, trash & debris. (Nutrients, Pesticides-Not anticipated since all landscape will be drought tolerant and landscape will be depressed)
Environmentally Sensitive and Special Biological Significant Areas	This project is not directly adjacent to or discharges directly into an ESA. San Juan Creek is listed on the 303 (d) listed, however per the WQMP TGD, the site is discharging into the City storm drain in Del Obispo Street and Camino Capistrano which comingles with downstream flows prior to discharging to the ESA. Therefore, the site is not susceptible to the requirements of discharging to an ESA.

3.4 Stormwater Pollutants or Conditions of Concern

Pollutants or Conditions of Concern				
Pollutant	Expected from Proposed Land Uses/Activities (Yes or No)	Receiving Waterbody Impaired (Yes or No)	Priority Pollutant from WQIP or other Water Quality Condition? (Yes or No)	Pollutant of Concern (Primary, Other, or No)
Suspended-Solids	Yes	No	Yes	Primary
Nutrients	Yes	Yes	Yes	No
Heavy Metals	Yes	Yes	No	Primary
Bacteria/Virus/Pathogens	Yes	Yes	Yes	Primary
Pesticides	Yes	Yes	Yes	Primary
Oil and Grease	Yes	No	No	Other
Toxic Organic Compounds	Yes	Yes	Yes	Primary
Trash and Debris	Yes	No	Yes	Primary
Dry Weather Runoff	Yes	No	Yes	Primary

3.5 Hydrologic Conditions of Concern

Does a hydrologic condition of concern exist for this project?

As provided in the attachment, and as located on the Orange County HCOC Map, the project is located within an HCOC exempt area.

☒ No – An HCOC does not exist for this receiving water because:

☐ Project discharges directly to a protected conveyance (bed and bank are concrete lined the entire way from the point(s) of discharge to a receiving lake, reservoir, embayment, or the Ocean

☐ Project discharges directly to storm drains which discharge directly to a reservoir, lake, embayment, ocean or protected conveyance (as described above)

☒ The project discharges to an area identified in the WMAA as exempt from hydromodification concerns

☐ Yes – An HCOC does exist for this receiving water because none of the above are applicable.

Repeat this checklist for each different receiving water to which the project would discharge.

3.6 Critical Course Sediment Yield Areas

Critical coarse sediment provisions do not apply to projects that are HCOC exemption, per WQMP TGD Sections 2.3.1.3 & 2.3.5. San Juan Creek is not susceptible to coarse sediment yield.

Section 4 Site Plan and Drainage Plan

4.1 Drainage Management Area Delineation

The proposed development has five storm water drainage areas and two outlet discharge locations from the site.

DMA A consists of 0.197 acres which has approximately 74.7% impervious land cover. This land area includes the restaurant building and the adjacent patio and hardscape. Runoff from the building discharges directly into the biofiltration planter adjacent to the patio. Runoff in the landscape areas and patio sheet flows directly to the biofiltration planter adjacent to the patio. This biofiltration planter (BMP A) captures runoff for treatment. Lower flows infiltrate through the planter and are collected at the bottom with an underdrain pipe. Higher flows are collected at an inlet set above the ponding depth of the BMP. The underdrain and piping from the raised inlet discharge through a parkway drain to the curb and gutter in Camino Capistrano (Outlet 1). Ultimately, runoff from Camino Capistrano is conveyed south where it is collected in a public catch basin at the intersection of Camino Capistrano and Del Obispo Street. Trash capture devices will be installed where applicable.

DMA B consists of 1.400 acres which has approximately 83.5% impervious land cover. This area includes the fitness and residential building at the northern side of the site, the Forster extension from the intersection with El Camino Real, the parking lot at the northeast corner and half of the roof runoff for the southernmost residential building. It also includes landscaping and sidewalk adjacent to the buildings. Runoff from the building will be piped to an underground storm drain pipe system which will convey runoff to the east along Forster diversion manhole. Runoff from the drive aisle, parking stall areas and landscape areas will sheet flow to curb and gutter where it will be collected by a catch basin. Storm water from catch basin will be piped to the same diversion manhole. The diversion manhole will convey lower flows to a Modular Wetlands System (MWS) for treatment (BMP B) via a weir within the manhole. Stormwater will be treated within the MWS and then piped to the south to an underground storm drain detention system (System B). Higher flow rates in the diversion manhole will be confluence with the treated flow rate from the MWS and then piped to System B. Downstream of System B, storm water will be conveyed to the existing 15" storm drain pipe at the southernmost point of the project. From this connection, stormwater will be piped to the existing catch basin at the southernmost corner of the property and then to the southwest via an existing 10" outlet pipe (Outlet 2). The 10" storm drain line carries runoff to the southwest and ultimately discharges into the public storm drain system in Del Obispo Street. The storm drain main in Del Obispo St. slopes west to the intersection of Camino Capistrano and Del Obispo.

DMA C consists of 0.862 acres which has approximately 85.2% impervious land cover. This area includes the clubhouse, pool area and residential building at the southern side of the site. It also includes landscaping and sidewalk adjacent to the building. Runoff from the building and internal

walkways will be piped to a storm drain pipe system which will convey runoff to the west to the main drive aisle on the west side of the site. This pipe system conveys storm water to a catch basin at the southwest corner of the site. Runoff from the drive aisle, stall areas and landscape areas will sheet flow to curb and gutter along the west side of the drive aisle where it will be collected by a catch basin. Storm water from catch basin will be piped to a Modular Wetlands System (MWS) for treatment (BMP C). Lower flow rates will be treated, while higher flow rates will bypass internally through the system. From the MWS, storm water will be piped to the south and then east to an underground storm drain detention system (System A). Downstream of the detention system, storm water will be conveyed to the 10" outlet point of the project (Outlet 2). The 10" storm drain line carries runoff to the west and ultimately discharges into the public storm drain system in Del Obispo Street. The storm drain main in Del Obispo St. slopes southwest to the intersection of Camino Capistrano and Del Obispo.

DMA D consists of 0.581 acres which has approximately 75% impervious land cover. This land area includes the lower parking lot and drive aisle along the southern edge of the property. It also includes a large portion of the project's landscaping. Storm water in this area is collected in a MWS (BMP D) with higher flows bypassing the MWS at grade with an adjacent catch basin. From the MWS and catch basin, storm water is piped to the 10" outlet point of the project (Outlet 2). The 10" storm drain line carries runoff to the west and ultimately discharges into the public storm drain system in Del Obispo Street. The storm drain main in Del Obispo St. slopes west to the intersection of Camino Capistrano and Del Obispo.

Ultimately, storm water from our site is conveyed to the south to the public storm drain system which is tributary to San Juan Creek, which flows to the Pacific Ocean.

GPS coordinates for each BMP can be found on the WQMP Exhibit in the Appendix.

4.2 Overall Site Design BMPs

Minimize Impervious Area – The overall site plan implemented the maximum extent practical of pervious areas, provided we meet minimum parking stall, drive isle widths, walkways, etc. per building and planning code.

Maximize Natural Infiltration Capacity- Infiltration is promoted in landscape areas.

Preserve Existing Drainage Patterns and Time of Concentration -The proposed site will maintain the overall existing drainage pattern.

Disconnect Impervious Areas- Where feasible, the site will sheet flow runoff in lieu of piping.

Protect Existing Vegetation and Sensitive Areas- N/A.

Revegetate Disturbed Areas –The existing landscape onsite will be removed and new planting areas will be installed. All areas disturbed shall be revegetated within the proposed designated landscape areas.

Soil Stockpiling and Site Generated Orgaics- An erosion control plan will be provided in the Final WQMP.

Firescaping- The overall site will be completely developed and drought tolerant plants will be installed at designed landscape areas.

Water Efficient Landscaping- Drought tolerant planting will be designed for in the landscape areas and shall meet local jurisdiction requirements.

Slopes and Channel Buffers- Not required as the entire site will be completed developed. No exposed channels or slopes.

4.3 DMA Characteristics and Site Design BMPs

4.3.1 DMA A

DMA A (DA 1) consists of 0.197 acres which has approximately 74.7% impervious land cover. This land area includes the restaurant building and the adjacent patio and hardscape. Runoff from the building discharges directly into the biofiltration planter adjacent to the patio. Runoff in the landscape areas and patio sheet flows directly to the biofiltration planter adjacent to the patio. This biofiltration planter (BMP 1) captures runoff for treatment. Lower flows infiltrate through the planter and are collected at the bottom with an underdrain pipe. Higher flows are collected at an inlet set above the ponding depth of the BMP. The underdrain and piping from the raised inlet discharge through a parkway drain to the curb and gutter in Camino Capistrano (Outlet 1). Ultimately, runoff from Camino Capistrano is conveyed south where it is collected in a public catch basin at the intersection of Camino Capistrano and Del Obispo Street.

With infiltration being infeasible, biofiltration was evaluated as a potential BMP. With the landscape area adjacent to the patio, we are able to install a biofiltration planter with underdrain in the area between the two site walls. Calculations are below:

A=8,600 sf
C=0.75 (74.7% impervious cover)
Design storm depth = 0.85”
DCV = (0.75 x 0.75 +0.15) x 0.85 x 8,600 sf x 1/12 =
DCV = 434 cu-ft
Sizing with 12” ponding depth:
d_p = 1.0ft
K_{media} = 2.5 in/hr

$DD_p = (d_p / K_{media}) \times 12$ in/ft
DD_p = 4.8 hrs < 48hrs => OK

$d_{filtered}$ = minimum [{(2.5in/hr x 3hrs)/12}, d_p]= 0.625ft

$d_{filtered}$ = 0.625ft

Required Surface Area (A) = DCV / (d_p + $d_{filtered}$)
A = 434 / (1.0+0.625)
A = 267 sf

Bio-retention planter provided = 415 sf > 267 sf => OK

4.3.2 DMA B

DMA B (**DA 2, 3, 6)** consists of 1.400 acres which has approximately 83.5% impervious land cover. This area includes the fitness and residential building at the northern side of the site, the Forster extension from the intersection with El Camino Real, the parking lot at the northeast corner and half of the roof runoff for the southernmost residential building. It also includes landscaping and sidewalk adjacent to the buildings. Runoff from the building will be piped to an underground storm drain pipe system which will convey runoff to the east along Forster diversion manhole. Runoff from the drive aisle, parking stall areas and landscape areas will sheet flow to curb and gutter where it will be collected by a catch basin. Storm water from catch basin will be piped to the same diversion manhole. The diversion manhole will convey lower flows to a Modular Wetlands System (MWS) for treatment (BMP B) via a weir within the manhole. Stormwater will be treated within the MWS and then piped to the south to an underground storm drain detention system (System B). Higher flow rates in the diversion manhole will be confluence with the treated flow rate from the MWS and then piped to System B. Downstream of System B, storm water will be conveyed to the existing 15" storm drain pipe at the southernmost point of the project. From this connection, stormwater will be piped to the existing catch basin at the southernmost corner of the property and then to the southwest via an existing 10" outlet pipe (Outlet 2). The 10" storm drain line carries runoff to the southwest and ultimately discharges into the public storm drain system in Del Obispo Street. The storm drain main in Del Obispo St. slopes west to the intersection of Camino Capistrano and Del Obispo.

With infiltration being infeasible, and due to the project's limited landscape area, a Flow-Based Compact Biofiltration BMP was selected for this DA as a Proprietary Biotreatment BMP. For this project, we have selected Bioclean's Modular Wetlands System Linear (MWS). MWS's are State of Washington TAPE and GULD approved for Basic, Enhanced and Metals/Phosphorus levels of treatment. Additionally, MWS provides media and planting for the region, and satisfies the definition of a biofiltration BMP. Per Appendix J of the TGD, Section J.3.2, MWS Linear satisfies the criteria to be considered a Proprietary Biotreatment BMPs and also satisfies the criteria for full trash capture.

A MWS Linear BMP is also selected as a Proprietary Biofiltration BMP for this DMA.

Sizing: See Worksheet 9 for DMA B in the Attachments for sizing calculations.

For this DMA, the treatment flow rate is Q_{design} = 0.42 cfs

A MWS-L-8-16 unit can treat up to 0.46 cfs which is greater than Q_{design} for this DMA.

Therefore, a MWS-L-8-16 is specified for this drainage area. Also, MWS systems satisfy trash capture requirements.

4.3.3 DMA C

DMA C (**DA 4)** consists of 0.862 acres which has approximately 85.2% impervious land cover. This area includes the clubhouse, pool area and residential building at the southern side of the site. It also includes landscaping and sidewalk adjacent to the building. Runoff from the building and internal walkways will be piped to a storm drain pipe system which will convey runoff to the west to the main drive aisle on the west side of the site. This pipe system conveys storm water to a catch basin at the southwest corner of the site. Runoff from the drive aisle, stall areas and landscape areas will sheet flow to curb and gutter along the west side of the drive aisle where it will be collected by a catch basin. Storm water from catch basin will be piped to a Modular Wetlands System (MWS) for treatment (BMP C). Lower flow rates will be treated, while higher flow rates will bypass internally through the system. From the MWS, storm water will be piped to the south and then east to an underground storm drain detention system (System A). Downstream of the detention system, storm water will be conveyed to the 10" outlet point of the project (Outlet 2). The 10" storm drain line carries runoff to the west and ultimately discharges into the public storm drain system in Del Obispo Street. The storm drain main in Del Obispo St. slopes southwest to the intersection of Camino Capistrano and Del Obispo.

A MWS Linear BMP is also selected as a Proprietary Biofiltration BMP for this DMA.

Sizing: See Worksheet 9 for DMA C in the Attachments for sizing calculations.

For this DMA, the treatment flow rate is Q_{design} = 0.27 cfs

A MWS-L-8-12 unit can treat up to 0.346 cfs which is greater than Q_{design} for this DMA.

Therefore, a MWS-L-8-12 is specified for this drainage area. Also, MWS systems satisfy trash capture requirements.

4.3.4 DMA D

DMA D **(DA 5)** consists of 0.581 acres which has approximately 75% impervious land cover. This land area includes the lower parking lot and drive aisle along the southern edge of the property. It also includes a large portion of the project's landscaping. Storm water in this area is collected in a

MWS (BMP D) with higher flows bypassing the MWS at grade with an adjacent catch basin. From the MWS and catch basin, storm water is piped to the 10" outlet point of the project (Outlet 2). The 10" storm drain line carries runoff to the west and ultimately discharges into the public storm drain system in Del Obispo Street. The storm drain main in Del Obispo St. slopes west to the intersection of Camino Capistrano and Del Obispo.

A MWS Linear BMP is also selected as a Proprietary Biofiltration BMP for this DMA.

Sizing: See Worksheet 9 for DMA D in the Attachments for sizing calculations.

For this DMA, the treatment flow rate is Q_{design} = 0.16 cfs

A MWS-L-8-8 unit can treat up to 0.23 cfs which is greater than Q_{design} for this DMA.

Therefore, a MWS-L-8-8 is specified for this drainage area. Also, MWS systems satisfy trash capture requirements.

4.3.5 DMA Summary

Drainage Management Areas				
DMA (Number/Description)	Total Area (acres)	Imperviousness (%)	Infiltration Feasibility Category (Full, Partial, or No Infiltration)	Hydrologic Source Controls Used
A	0.197	74.7	No Infiltration	None
B	1.400	83.5	No Infiltration	None
C	0.862	85.2	No Infiltration	None
D	0.581	75.0	No Infiltration	None

4.4 Source Control BMPs

Non-Structural Source Control BMPs				
Identifier	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous materials will be stored or generated onsite.
N6	Local Industrial Permit Compliance	☐	☒	No
N7	Spill Contingency Plan	☐	☒	No hazardous materials will be stored or generated onsite.
N8	Underground Storage Tank Compliance	☐	☒	None onsite.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials will be stored or generated onsite.
N10	Uniform Fire Code Implementation	☐	☒	No hazardous materials will be stored or generated onsite.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks proposed.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	

N16	Retail Gasoline Outlets	☐	☒	No

Structural Source Control BMPs

Identifier	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor material storage for this project
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	None on site
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☐	
S6	Dock areas	☐	☒	None on-site
S7	Maintenance bays	☐	☒	None on site
S8	Vehicle wash areas	☐	☒	None on site
S9	Outdoor processing areas	☐	☒	None on site
S10	Equipment wash areas	☐	☒	None on site
S11	Fueling areas	☐	☒	None on site
S12	Hillside landscaping	☐	☒	None on site
S13	Wash water control for food preparation areas	☐	☒	None on site
S14	Community car wash racks	☐	☒	None on site

Section 5 Low Impact Development BMPs

5.1 LID BMPs in DMA A

As noted in Section 4, a Biofiltration with underdrain BMP will be used for this DMA. See section 4 for details and the Attachments for calculations.

5.1.1 Hydrologic Source Controls for DMA A

None applied to this area.

5.1.2 Structural LID BMP for DMA A

Biotreatment (with no infiltration) BIO-1

Bioretention successfully treats pollutants with a high removal efficiency for sediment, phosphorus, nitrogen, metals, bacteria, oil & grease, and organics.

The runoff will either sheet flow or be piped to the top of the biofiltration/biotreatment planter. The planter has been sized to mitigate the required design flow rate. An overflow outlet pipe or culvert is placed near or within the bioretention planter and will convey the high-flow storm event via parkway drain to the curb and gutter in Camino Capistrano.

Calculations are provided in Section 4.

5.2 LID BMPs in DMA B

As noted in Section 4, a Proprietary Biofiltration BMP will be used for this DMA. See section 4 for details and the Attachments for calculations.

5.2.1 Hydrologic Source Controls for DMA B

None applied to this area.

5.2.2 Structural LID BMP for DMA B

Proprietary Biotreatment (with no infiltration) BIO-7

Bioretention successfully treats pollutants with a high removal efficiency for sediment, phosphorus, nitrogen, metals, bacteria, oil & grease, and organics.

The runoff will either sheet flow or be piped to the top of the Modular Wetlands biofiltration/biotreatment planter. The planter has been sized to mitigate the required design flow rate.

The 80% capture efficiency design flow rate sizing method was used based on Appendix E of the TGD and Worksheet 9 demonstrates the calculations in the appendix.

5.3 LID BMPs in DMA C

As noted in Section 4, a Proprietary Biofiltration BMP will be used for this DMA. See section 4 for details and the Attachments for calculations.

5.3.1 Hydrologic Source Controls for DMA C

None applied to this area.

5.3.2 Structural LID BMP for DMA C

Proprietary Biotreatment (with no infiltration) BIO-7

Bioretention successfully treats pollutants with a high removal efficiency for sediment, phosphorus, nitrogen, metals, bacteria, oil & grease, and organics.

The runoff will either sheet flow or be piped to the top of the Modular Wetlands biofiltration/biotreatment planter. The planter has been sized to mitigate the required design flow rate.

The 80% capture efficiency design flow rate sizing method was used based on Appendix E of the TGD and Worksheet 9 demonstrates the calculations in the appendix.

5.4 LID BMPs in DMA D

As noted in Section 4, a Proprietary Biofiltration BMP will be used for this DMA. See section 4 for details and the Attachments for calculations.

5.4.1 Hydrologic Source Controls for DMA D

Not applied to this area.

5.4.2 Structural LID BMP for DMA D

Proprietary Biotreatment (with no infiltration) BIO-7

Bioretention successfully treats pollutants with a high removal efficiency for sediment, phosphorus, nitrogen, metals, bacteria, oil & grease, and organics.

The runoff will either sheet flow or be piped to the top of the Modular Wetlands biofiltration/biotreatment planter. The planter has been sized to mitigate the required design flow rate.

The 80% capture efficiency design flow rate sizing method was used based on Appendix E of the TGD and Worksheet 9 demonstrates the calculations in the appendix.

5.5 Summary of LID BMPs

DMA	BMP	Q_{DESIGN} (cfs)	DCV (sf)	Required Area (sf)	BMP Size	$Q_{ALLOWABLE}$	Area of BMP Provided (sf)
A	Biofiltration BMP	-	434	297	415 sf	-	415
B	Proprietary Biotreatment BMP	0.42	-	-	MWS-L-8-16-V	0.46 cfs	
C	Proprietary Biotreatment BMP	0.27	-	-	MWS-L-8-12-V	0.35 cfs	
D	Proprietary Biotreatment BMP	0.16	-	-	MWS-L-8-8-V	0.23 cfs	

Section 6 Hydromodification BMPs

Project is exempt from HCOCs. See the Hydro Cmodification Exempt Map in the Appendix.

Section 7 Educational Materials Index

Educational Materials			
Residential Material (http://www.ocwatersheds.com)	Check If Applicable	Business Material (http://www.ocwatersheds.com)	Check If Applicable
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☒
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☒
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☒
Household Tips	☒	Compliance BMPs for Mobile Businesses	☐
Proper Disposal of Household Hazardous Waste	☒	Other Material	Check If Attached
Recycle at Your Local Used Oil Collection Center (North County)	☐		
Recycle at Your Local Used Oil Collection Center (Central County)	☐	Building Maintenance	☐
Recycle at Your Local Used Oil Collection Center (South County)	☐	Concrete and Asphalt Production, Application and Cutting	☐
Tips for Maintaining a Septic Tank System	☐	Parking and Storage Area Maintenance	☐
Responsible Pest Control	☒	Spill Prevention and Clean-up	☐
Sewer Spill	☐	Fire Sprinkler Maintenance	☐
Tips for the Home Improvement Projects	☐	Eating and Drinking Establishments	☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☒		☐
Tips for Projects Using Paint	☐		☐

Attachment A: Educational Materials

The Ocean Begins at Your Front Door

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door

Never allow pollutants to enter the street, gutter or storm drain!

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called “non-point source” pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

The Effect on the Ocean

Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

For More Information

Orange County Stormwater Program

California Environmental Protection Agency
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept.	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works	(949)	724-6315
La Habra Public Services	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality	(949)	497-0378
Laguna Hills Public Services	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev.	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works	(714)	379-9222 x204
Tustin Public Works/Engineering	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of household hazardous waste can lead to water pollution. Batteries, electronics, paint, oil, gardening chemicals, cleaners and other hazardous materials cannot be thrown in the trash. They also must never be poured or thrown into yards, sidewalks, driveways, gutters or streets. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

NEVER DISPOSE OF HOUSEHOLD HAZARDOUS WASTE IN THE TRASH, STREET, GUTTER, STORM DRAIN OR SEWER.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To Report Illegal Dumping of Household Hazardous Waste call 1-800-69-TOXIC

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE USED OIL

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Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

ORANGE COUNTY

Pollution Prevention

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." HHW can be found throughout your home, including the bathroom, kitchen, laundry room and garage.

WHEN POSSIBLE, USE NON-HAZARDOUS OR LESS-HAZARDOUS PRODUCTS.

Disposal of HHW down the drain, on the ground, into storm drains, or in the trash is illegal and unsafe.

Proper disposal of HHW is actually easy. Simply drop them off at a Household Hazardous Waste Collection Center (HHWCC) for free disposal and recycling. Many materials including anti-freeze, latex-based paint, motor oil and batteries can be recycled. Some centers have a "Stop & Swap" program that lets you take partially used home, garden, and automobile products free of charge. There are four HHWCCs in Orange County:

Anaheim:.....1071 N. Blue Gum St
Huntington Beach:.....17121 Nichols St
Irvine:..... 6411 Oak Canyon
San Juan Capistrano:... 32250 La Pata Ave

Centers are open Tuesday-Saturday, 9 a.m.-3 p.m. Centers are closed on rainy days and major holidays. For more information, call **(714) 834-6752** or visit **www.oclandfills.com.**

Common household hazardous wastes

- Batteries
- Paint and paint products
- Adhesives
- Drain openers
- Household cleaning products
- Wood and metal cleaners and polishes
- Pesticides
- Fungicides/wood preservatives
- Automotive products (antifreeze, motor oil, fluids)
- Grease and rust solvents
- Fluorescent lamps
- Mercury (thermometers & thermostats)
- All forms of electronic waste including computers and microwaves
- Pool & spa chemicals
- Cleaners
- Medications
- Propane (camping & BBQ)
- Mercury-containing lamps
- Television & monitors (CRTs, flatscreens)

Tips for household hazardous waste

- Never dispose of HHW in the trash, street, gutter, storm drain or sewer.
- Keep these materials in closed, labeled containers and store materials indoors or under a cover.
- When possible, use non-hazardous products.
- Reuse products whenever possible or share with family and friends.
- Purchase only as much of a product as you'll need. Empty containers may be disposed of in the trash.
- HHW can be harmful to humans, pets and the environment. Report emergencies to 911.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
Orange County 24-Hour
Water Pollution Problem
Reporting Hotline
at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

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Help Prevent Ocean Pollution:

Responsible Pest Control

Tips for Pest Control

Key Steps to Follow:

Step 1: Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.

Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: Determine how many pests are present and causing damage.

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

Step 3: If a pesticide must be used, choose the least toxic chemical.

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: Wear appropriate protective clothing.

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

Step 6: In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: Properly store and dispose of unused pesticides.

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste Collection Center
(714) 834-6752
www.oclandfills.com

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

UCCE Master Gardener Hotline:
(714) 708-1646

To report a spill,
call the
Orange County 24-Hour
Water Pollution Problem
Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Materials and excess concrete or mortar can be blown or washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never throw building materials into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

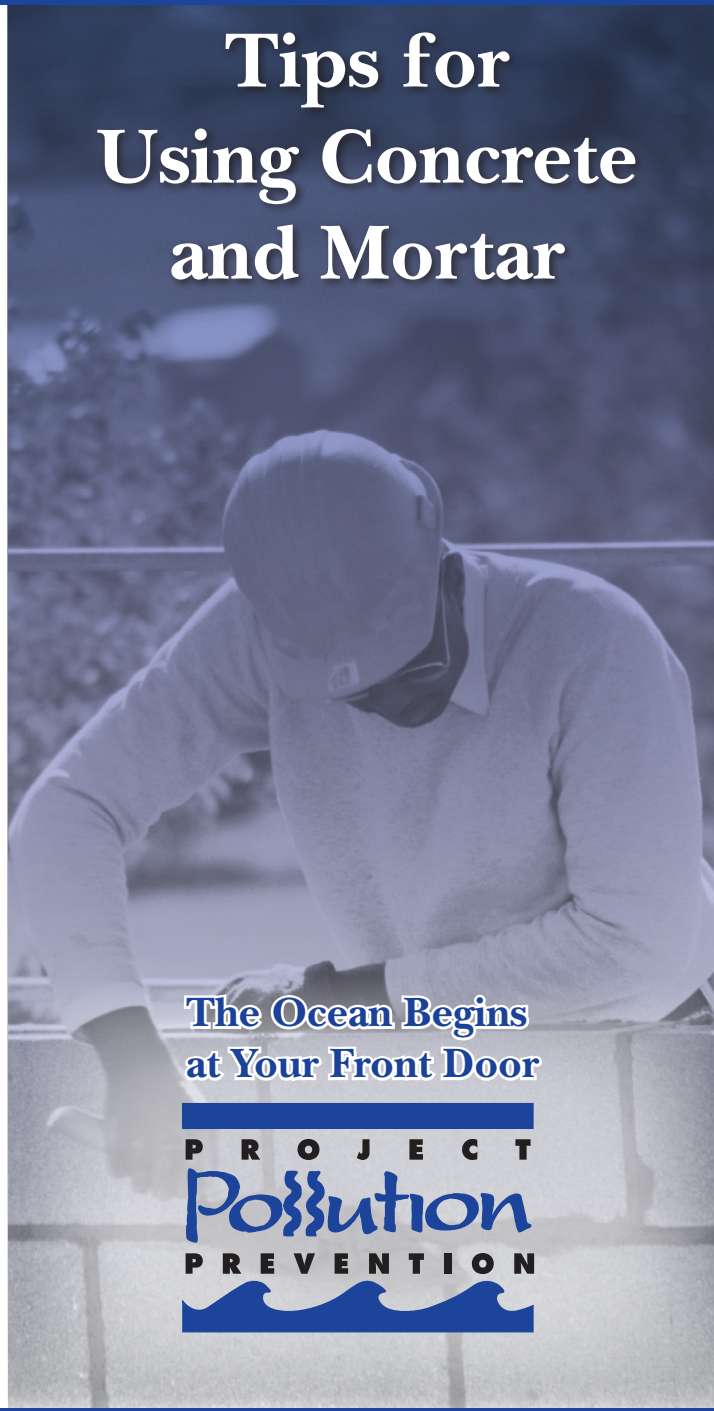
For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com.**

To report a spill, call the **Orange County 24-Hour Water Pollution Reporting Hotline** at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The Tips contained in this brochure provide useful information about how you can keep materials and washwater from entering the storm drain system. If you have other suggestions for how water and materials may be contained, please contact your city's stormwater representative or call the Orange County Stormwater Program.

Tips for Using Concrete and Mortar



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Using Concrete and Mortar

Never allow materials or washwater to enter the street or storm drain.

Before the Project

- Schedule projects for dry weather.
- Store materials under cover, with temporary roofs or plastic sheets, to eliminate or reduce the possibility that the materials can be carried from the project site to streets, storm drains or adjacent properties via rainfall, runoff or wind.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Take measures to block nearby storm drain inlets.

During the Project

- Set up and operate small mixers on tarps or heavy drop cloths.
- Do not mix more fresh concrete or cement than is needed for the job.

- When breaking up pavement, pick up all chunks and pieces and recycle them at a local construction and demolition recycling company. (See information to the right)
- When making saw cuts in pavement, protect nearby storm drain inlets during the saw-cutting operation and contain the slurry. Collect the slurry residue from the pavement or gutter and remove from the site.

Clean-Up

- Dispose of small amounts of dry concrete, grout or mortar in the trash.
- Never hose materials from exposed aggregate concrete, asphalt or similar treatments into a street, gutter, parking lot, or storm drain.
- Wash concrete mixers and equipment in designated washout areas where the water can flow into a containment area or onto dirt. Small amounts of dried material can be disposed of in the trash. Large amounts should be recycled at a local construction and demolition recycling company. (See information below)

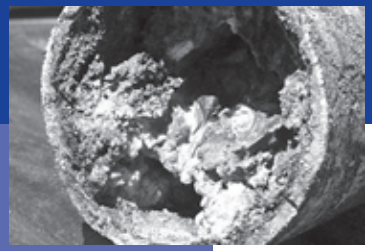
- Recycle cement wash water by pumping it back into cement mixers for reuse.

Spills

- Never hose down pavement or impermeable surfaces where fluids have spilled. Use an absorbent material such as cat litter to soak up a spill, then sweep and dispose in the trash.
- Clean spills on dirt areas by digging up and properly disposing of contaminated dry soil in trash.
- Immediately report significant spills to the County's 24-Hour Water Pollution Problem Reporting Hotline at 714-567-6363 or log onto the County's website at www.ocwatersheds.com and fill out an incident reporting form.

For a list of construction and demolition recycling locations in your area visit www.ciwmb.ca.gov/Recycle/.

For additional information on how to control, prevent, remove, and reduce pollution refer to the Stormwater Best Management Practice Handbook, available on-line at www.cabmphandbooks.com.



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. Fats, oils and grease from restaurants and food service facilities can cause sewer line blockages that may result in sewage overflow into your facility and into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways and should never contain washwater, trash, grease or other materials.

You would never dump oil and trash into the ocean, so don't let it enter the storm drains. Follow these tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

Report sewage spills and
discharges that are not
contained to your site to the
Orange County 24-Hour
Water Pollution Problem
Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455)

For emergencies, dial 911.

CALIFORNIA Restaurant ASSOCIATION SINCE 1906

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for the Food Service Industry

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Best Kitchen Practices

Food Waste Disposal

- Scrape food waste off of plates, utensils, pots, food preparation and cooking areas and dispose of it in the trash.
- Never put food waste down the drain. Food scraps often contain grease, which can clog sewer pipes and result in sewage backups and overflows.

Grease & Oil Disposal

- Never put oil or grease down the drain. Contain grease and oil by using covered grease storage containers or installing a grease interceptor.
- Never overfill your grease storage container or transport it without a cover.
- Grease control devices must be emptied and cleaned by permitted companies.
- Keep maintenance records on site.

- For a list of oil/grease recycling companies, contact the CIWMB at **www.ciwmb.ca.gov/foodwaste/render.htm** or contact your local sanitation district.

Minor Spill Cleanup

- Always use dry cleanup methods, such as a rag, damp mop or broom.
- Never hose a spill into the street, gutter or storm drain.

Major Spill Cleanup

- Have spill containment and clean-up kits readily available, and train all employees on how to use them.
- Immediately contain and clean the spill using dry methods.
- If the spill leaves your site, call **(714) 567-6363**.

Dumpster Cleanup

- Pick up all debris around the dumpster.
- Always keep the lid on the dumpster closed.

- Never pour liquids into the dumpster or hose it out.

Floor Mat Cleaning

- Sweep the floor mats regularly, discarding the debris into the trash.
- Hose off the mats in a mop sink, at a floor drain, or in an outdoor area that can contain the water.

- Never hose the mats in an area where the wastewater can flow to the street, gutter or storm drain.

Washwater Disposal

- Dispose of washwater in a mop sink or an area with a floor drain.
- Never dispose of washwater in the street, gutter or storm drain.

PROJECT Pollution PREVENTION

Preventing water pollution at your commercial/industrial site

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit: **www.swrcb.ca.gov/stormwater/industrial.html**

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline** at **1-877-89-SPILL** (1-877-897-7455).

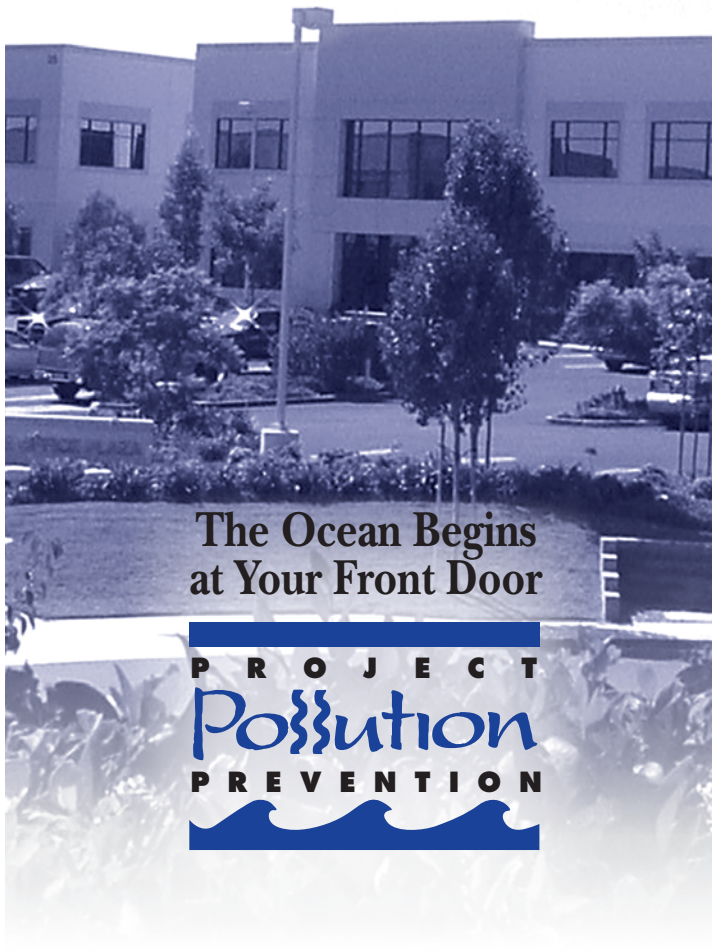
For emergencies, dial 911.

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Proper Maintenance Practices for your Business

Landscape Maintenance

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

Building Maintenance

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.
- Call your trash hauler to replace leaking dumpsters.
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.

Never Dispose of Anything in the Storm Drain.

- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit **www.oclandfills.com**.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

PROJECT Pollution PREVENTION

IC3. BUILDING MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly collect and dispose of water when pressure washing buildings, rooftops, and other large objects.
- Properly prepare work area before conducting building maintenance.
- Properly clean and dispose of equipment and wastes used and generated during building maintenance.
- Store toxic material under cover when not in use and during precipitation events.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Properly collect and dispose of water when pressure washing buildings, rooftops, and other large objects.
    - If pressure washing where the surrounding area is paved, use a water collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect the runoff and loose materials. Dispose of the collected runoff and solids properly. Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
    - If pressure washing on a landscaped area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the landscaping and not drain to pavement.
2. Properly prepare work area before conducting building maintenance.
    - Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
    - Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

3. Properly clean and dispose of equipment and wastes used and generated during building maintenance.
    - Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
    - Properly dispose of wash water, sweepings, and sediments.
    - Properly store equipment, chemicals, and wastes.
    - Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

    OPTIONAL:
    - Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable
4. Employ soil erosion and stabilization techniques when exposing large areas of soil.
    - Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.
    - Use chemical stabilization or geosynthetics to stabilize bare ground surfaces.
5. Store toxic material under cover when not in use and during precipitation events.
6. Properly dispose of fluids from air conditioning, cooling tower, and condensate drains.
7. Regularly inspect air emission control equipment under AQMD permit.
8. Switch to non-toxic chemicals for maintenance when possible.
    - If cleaning agents are used, select biodegradable products whenever feasible
    - Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).
9. Use chemicals that can be recycled.
    - Buy recycled products to the maximum extent practicable

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
4. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial Best Management Practice Handbook. Prepared by Camp Dresser& McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC7. LANDSCAPE MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly store and dispose of gardening wastes.
- Use mulch or other erosion control measures on exposed soils.
- Properly manage irrigation and runoff.
- Properly store and dispose of chemicals.
- Properly manage pesticide and herbicide use.
- Properly manage fertilizer use.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Take steps to reduce landscape maintenance requirements.
    - Where feasible, retain and/or plant native vegetation with features that are determined to be beneficial. Native vegetation usually requires less maintenance than planting new vegetation.
    - When planting or replanting consider using low water use flowers, trees, shrubs, and groundcovers.
    - Consider alternative landscaping techniques such as naturescaping and xeriscaping.
2. Properly store and dispose of gardening wastes.
    - Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage at a permitted landfill or by composting.
    - Do not dispose of gardening wastes in streets, waterways, or storm drainage systems.
    - Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm and/or cover.
3. Use mulch or other erosion control measures on exposed soils.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. Properly manage irrigation and runoff.
    - Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
    - Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
    - If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
    - If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
    - Use automatic timers to minimize runoff.
    - Use popup sprinkler heads in areas with a lot of activity or where pipes may be broken. Consider the use of mechanisms that reduce water flow to broken sprinkler heads.
5. Properly store and dispose of chemicals.
    - Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
    - Provide secondary containment for chemical storage.
    - Dispose of empty containers according to the instructions on the container label.
    - Triple rinse containers and use rinse water as product.
6. Properly manage pesticide and herbicide use.
    - Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
    - Follow manufacturers' recommendations and label directions.
    - Use pesticides only if there is an actual pest problem (not on a regular preventative schedule). When applicable use less toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible. Use the minimum amount of chemicals needed for the job.
    - Do not apply pesticides if rain is expected or if wind speeds are above 5 mph.
    - Do not mix or prepare pesticides for application near storm drains. Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the targeted pest.
    - Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
    - Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
    - Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
    - When conducting mechanical or manual weed control, avoid loosening the soil, which could lead to erosion.
    - Purchase only the amount of pesticide that you can reasonably use in a given time period.
    - Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.
7. Properly manage fertilizer use.
    - Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers.
    - Follow manufacturers' recommendations and label directions.
    - Employ techniques to minimize off-target application (e.g. spray drift) of fertilizer, including consideration of alternative application techniques. Calibrate fertilizer distributors to avoid excessive application.
    - Periodically test soils for determining proper fertilizer use.
    - Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
    - Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
    - Use slow release fertilizers whenever possible to minimize leaching

8. Incorporate the following integrated pest management techniques where appropriate:
    - Mulching can be used to prevent weeds where turf is absent.
    - Remove insects by hand and place in soapy water or vegetable oil. Alternatively, remove insects with water or vacuum them off the plants.
    - Use species-specific traps (e.g. pheromone-based traps or colored sticky cards).
    - Sprinkle the ground surface with abrasive diatomaceous earth to prevent infestations by soft-bodied insects and slugs. Slugs also can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
    - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
    - Small mammals and birds can be excluded using fences, netting, and tree trunk guards.
    - Promote beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Educate and train employees on the use of pesticides and pesticide application techniques. Only employees properly trained to use pesticides can apply them.
3. Train and encourage employees to use integrated pest management techniques.
4. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
5. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
6. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

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Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

Water Quality Handbook for Nurseries. Oklahoma Cooperative Extension Service. Division of Agricultural Sciences and Natural Resources. Oklahoma State University. E-951. September 1999.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

IC15. PARKING AND STORAGE AREA MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Conduct regular cleaning.
- Properly collect and dispose of wash water.
- Keep the parking and storage areas clean and orderly.
- Use absorbent materials and properly dispose of them when cleaning heavy oily deposits.
- When conducting surface repair work cover materials and clean paintbrushes and tools appropriately.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Conduct regular cleaning.
    - Sweeping or vacuuming the parking facility is encouraged over other methods.
    - Sweep all parking lots at least once before the onset of the wet season.
    - Establish frequency of sweeping based on usage and field observations of waste accumulation.
2. Properly collect and dispose of wash water.
    - Block the storm drain or contain runoff.
    - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains. Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
    - Dispose of parking lot sweeping debris and dirt at a landfill.
3. Consider use of source treatment BMPs to treat runoff.
    - Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
    - Utilize sand filters or oleophilic collectors for oily waste in low quantities.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. Keep the parking and storage areas clean and orderly.
    - Clean out and cover litter receptacles frequently to prevent spillage.
    - Remove debris in a timely fashion.

    OPTIONAL:
    - Post "No Littering" signs.
5. When cleaning heavy oily deposits:
    - If possible, clean oily spots with absorbent materials.
    - Do not allow discharges to the storm drain.
    - Appropriately dispose of spilled materials and absorbents.
6. When conducting surface repair work:
    - Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
    - Conduct surface repair work during dry weather to prevent contamination from contacting stormwater runoff.
    - Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and clean any debris for proper disposal.
    - To avoid runoff, use only as much water as necessary for dust control.
    - Use drip pans or absorbent material to catch drips from paving equipment that is not in use. Dispose of collected material and absorbents properly.
7. Conduct inspections on a regular basis.
    - Designate personnel to conduct inspections of the parking facilities and stormwater conveyance systems associated with them.
    - Inspect cleaning equipment/sweepers for leaks on a regular basis.
8. Keep accurate maintenance logs to evaluate materials removed/stored and improvements made.
9. Arrange rooftop drains to prevent drainage directly onto paved surfaces.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
4. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
5. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

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IC17. SPILL PREVENTION AND CLEANUP

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Develop procedures to prevent/mitigate spills to storm drain systems.
- Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal.
- Conduct routine cleaning, inspections, and maintenance.
- Properly store and handle chemical materials.
- Protect materials stored outside from stormwater runon.
- Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use.
- Identify key spill response personnel.
- Clean up leaks and spills immediately.
- Report and track spills.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

Spill Prevention

1. Develop procedures to prevent/mitigate spills to storm drain systems.
   Standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
2. Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal.
3. Conduct routine cleaning, inspections, and maintenance
   - Sweep and clean storage areas consistently at a designated frequency (e.g. weekly, monthly). DO NOT hose down areas to storm drains.
   - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Reuse, recycle, or properly dispose of any collected liquids or soiled absorbent materials.
   - Check tanks (and any containment sumps) frequently for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Check for external corrosion of material containers, structural failures, spills and overfills due to operator error, failure of piping system, etc.
- Inspect tank foundations, connections, coatings, and tank walls and piping system.

4. Properly store and handle chemical materials.
    - Designate a secure material storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
    - Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.
    - Keep chemicals in their original containers, if feasible.
    - Keep containers well labeled according to their contents (e.g., solvent, gasoline).
    - Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
    - Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
5. Utilize secondary containment systems for liquid materials.
    - Surround storage tanks with a berm or other secondary containment system.
    - Slope the area inside the berm to a drain.
    - Drain liquids to the sanitary sewer if available. DO NOT discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required
    - Pass accumulated stormwater in petroleum storage areas through an oil/water separator.
    - Use catch basin filtration inserts.
6. Protect materials stored outside from stormwater runon. Construct a berm around the perimeter of the material storage area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.
7. Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use.

Spill Control and Cleanup Activities

8. Identify key spill response personnel.
9. Adopt the Orange County Hazardous Materials Area Plan or an equivalent plan, which includes a set of planned responses to hazardous materials emergencies. The plan should include:
    - Description of the facility, owner and address, activities and chemicals present
    - Facility map
    - Notification and evacuation procedures
    - Cleanup instructions
    - Identification of responsible departments
10. Clean up leaks and spills immediately.
    - Place a stockpile of spill cleanup materials where they will be readily accessible (e.g. near storage and maintenance areas).
    - Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use brooms, shovels, sweepers, or plows.
    - Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
    - Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
    - For larger spills, a private spill cleanup company or Hazmat team may be necessary.

11. Reporting
    1. Report spills that pose an immediate threat to human health or the environment to local agencies, such as the fire department, and the Regional Water Quality Control Board.
    2. Establish a system for tracking incidents. The system should be designed to identify the following:
        - Types and quantities (in some cases) of wastes
        - Patterns in time of occurrence (time of day/night, month, or year)
        - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
        - Responsible parties
    3. Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

Training
1. Educate employees about spill prevention and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Educate employees on aboveground storage tank requirements.
    - Train all employees upon hiring and conduct annual refresher training.
2. Train employees responsible for aboveground storage tanks and liquid transfers on the Spill Prevention Control and Countermeasure Plan.

Stencil storm drains

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IC18. VEHICLE AND EQUIPMENT FUELING

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Maintain clean fuel-dispensing areas.
- Utilize fueling safeguards.
- Conduct regular inspections of fueling equipment.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	
Nutrients	
Floatable Materials	x
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	x
Pesticides	
Oxygen Demanding	

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fueling and spills.
2. Maintain clean fuel-dispensing areas.
    - Use dry cleanup methods such as sweeping for removal of litter and debris, or use of rags and absorbents for leaks and spills.
    - If cleaning by washing, place a temporary plug in the downstream storm drain and pump out the accumulated water. Properly dispose of the water. DO NOT discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required.
3. Design fueling areas to minimize stormwater exposure.
    - Cover the fuel dispensing area such that the cover's minimum dimensions are equal to or greater than the area within the grade break or fuel dispensing area. Position roof downspouts to direct water away from fueling areas.
    - Pave fuel area with Portland cement concrete or equivalent smooth impervious surface. Grade with a 2 to 4 percent slope to prevent ponding.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Use secondary containment. Construct a berm around the perimeter of the material storage area to prevent the runon of uncontaminated stormwater from adjacent areas as well as stormwater runoff.

4. Minimize pooling of water.
    - Use a perimeter drain or slope pavement inward with drainage to sump. A minimum slope of 1.5 percent is recommended.
    - Install inlet catch basin equipped with a small sedimentation basin or grit chamber to remove large particles from stormwater in impervious areas.
    - During the wet season, release accumulated stormwater frequently.
5. If conducting mobile fueling, designate mobile fueling areas and bring equipment to these areas.
    - Use secondary containment when conducting mobile fueling.
    - Cover storm drains in the vicinity during transfer.
6. Utilize fueling safeguards.
    - Use overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
    - Install protective guards around tanks and piping to prevent vehicle or forklift damage.
    - Clearly tag or label all valves to reduce human error.
    - Place spill kits at fueling areas and/or on vehicles.
    - Install vapor recovery nozzles to help control drips as well as air pollution.
    - Eliminate or post hose bibs.
    - Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
7. Conduct regular inspections of fueling equipment.
    - Check fueling equipment for external corrosion and structural failure.
    - Check for spills and overfills due to operator error.
    - Check for failure of piping system.
    - Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or visa versa.
    - Visually inspect new tank or container installation for loose fittings, poor welding, and/or improper or poorly fitting gaskets.
    - Inspect tank foundations, connections, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
    - Report leaking vehicles to fleet maintenance.
    - Periodically, have a qualified professional conduct integrity testing.
8. Use secondary containment when transferring fuel from the tank truck to the fuel tank and cover storm drains in the vicinity during transfer.
9. Fit underground storage tanks (USTs) with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
10. Equip USTs with spill and overfill protection.
11. Install required AQMD equipment and post a notice.
12. Post signs to remind employees and customers not to top off the fuel tank when filling and signs that ban customers and employees from changing engine oil or other fluids at that location.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees on proper fueling and cleanup procedures.
3. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
4. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
5. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

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IC20. VEHICLE AND EQUIPMENT WASHING AND STEAM CLEANING

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Consider using off-site commercial washing and/or steam cleaning businesses, if feasible.
- Use commercial washing and/or steam cleaning businesses capable of properly disposing of wastewater (Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wash water to the sanitary sewer).
- Designate an impervious indoor or outdoor area to be used solely for vehicle and equipment washing/steam cleaning.
- Clearly mark the vehicle and equipment washing/steam cleaning area.
- If the area is outdoors, cover the wash area when not in use to prevent contact with rainwater.
- Provide trash containers in wash area and empty on a regular basis.
- Use hoses with nozzles that automatically turn off when left unattended.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	
Metals	x
Bacteria	
Oil & Grease	x
Organics & Toxicants	
Pesticides	
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Use off-site commercial washing and/or steam cleaning businesses. These businesses are better equipped to handle and properly dispose of the wash waters.
2. Use commercial washing and/or steam cleaning businesses capable of disposing of wastewater.
    - Mobile cleaning businesses should use a leak proof cover device that will catch and contain all contaminated (i.e. chemical additives such as soaps, solvents, or degreasers are used) wastewater runoff for later disposal in a manner that complies with all city, county, state, and federal codes.
    - Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wastewater to the sanitary sewer.

3. Designate an impervious indoor or outdoor area to be used solely for vehicle and equipment washing/steam cleaning. Do not conduct oil changes and other engine maintenance in the designated washing area.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. Clearly mark the vehicle and equipment washing/steam cleaning area. Design wash area to properly collect and dispose of wash water and/or effluent generated.
    - Install sumps or drain lines to collect wash water.
    - Construct a berm around the designated area and grade to collect wash water as well as to prevent storm water runon.
    - Use portable containment (such as ground cover devices) and vacuum collection of wastewater.
    - Inspect and maintain equipment (such as ground cover devices) regularly to ensure proper and effective functioning.
5. If the area is outdoors, cover the wash area when not in use to prevent contact with rainwater.
6. Provide trash containers in wash area and empty on a regular basis.
7. Use hoses with nozzles that automatically turn off when left unattended.
8. Use biodegradable, phosphate-free detergents if possible.
9. Recycle waste materials, whenever possible
    - Recycling is always preferable to disposal of unwanted materials.
    - Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
    - Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries).
    - Purchase recycled products to support the market for recycled materials.
12. If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:
    - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
    - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
    - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
    - Choose cleaning agents that can be recycled.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train staff on the proper maintenance of the wash area.
3. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
4. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
5. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

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IC21. WASTE HANDLING AND DISPOSAL

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Prevent waste materials from coming in direct contact with wind or rain. .
- Keep waste collection areas clean.
- Secure solid waste containers when not in use.
- Regularly inspect, repair, and/or replace waste containers.
- Use all of a product before disposing of the container.
- Label and store hazardous wastes according to hazardous waste regulations.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	x
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Prevent waste materials from coming in direct contact with wind or rain.
    - Cover the waste management area with a permanent roof.
    - If this is not feasible, cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene, or hypalon.
    - Cover dumpsters to prevent rain from washing out waste materials.
2. Design waste handling and disposal area to prevent stormwater runon.
    - Enclose the waste handling and disposal area or build a berm around it.
    - Position roof downspouts to direct stormwater away from waste handling and disposal area.
3. Design waste handling and disposal area to contain spills.
    - Place dumpsters or other waste receptacles on an impervious surface.
    - Construct a berm around the area to contain spills.
    - Install drains connected to the public sewer or the facility's process wastewater system within these contained areas. DO NOT discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

4. Keep waste collection areas clean.
    - When cleaning around waste handling and disposal areas use dry methods when possible (e.g. sweeping, use of absorbents).
    - If water must be used, collect water and discharge to the sewer if permitted to do so. DO NOT discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.
    - Post "No Littering" signs.
5. Secure solid waste containers when not in use.
6. Regularly inspect, repair, and/or replace waste containers.
7. Do not fill waste containers with washout water or any other liquid.
8. Use all of a product before disposing of the container.
9. Segregate wastes by type and label and date wastes.
    - Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
    - Ensure that only appropriate solid wastes are added to solid waste containers.
    - Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers.
10. Label and store hazardous wastes according to hazardous waste regulations.
    - Consult your local hazardous waste agency or Fire Department for details.
    - Obtain a hazardous waste generator license or permit if necessary.
12. Minimize waste.
    - Recycle materials whenever possible.
    - Modify processes or equipment to increase efficiency.
    - Identify and promote use of non-hazardous alternatives.
    - Reduction in the amount of waste generated can be accomplished using many different types of source controls such as:
        - Production planning and sequencing
        - Process or equipment modification
        - Raw material substitution or elimination
        - Loss prevention and housekeeping
        - Waste segregation and separation
        - Close loop recycling
    - Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees in proper waste handling and disposal.
3. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.

4. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
5. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read “No Dumping Drains to Ocean”.

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IC22. EATING AND DRINKING ESTABLISHMENTS

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner[1]. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Use dry cleaning methods instead of water
- Clean equipment (floor mats, grease filters, grills, garbage cans, etc.) indoors or in a covered outdoor wash area that is plumbed to the sanitary sewer or in an area that will contain the wash water (Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wash water to the sanitary sewer).
- Recycle and/or properly dispose of grease and oil.
- Block the storm drain when hosing or steam/pressure washing outside dumpster areas, sidewalks, and common areas.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	x
Organics & Toxicants	x
Pesticides	x
Oxygen Demanding	x

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Practice good housekeeping.
    - Conduct regular sweeping or vacuuming of outdoor areas: Dry sweep pavement areas including "drive-thru" areas, parking lots, sidewalks, outdoor eating areas and dumpster storage areas frequently.
    - Keep outside areas free of trash & debris.
    - Do not hose out dumpsters or fill them with liquid waste.
    - Regularly inspect, repair, and/or replace dumpsters.
2. Clean equipment (floor mats, grease filters, grills, garbage cans, etc.) indoors or in a covered outdoor wash area that is plumbed to the sanitary sewer.
    - Clean equipment in a mop sink if possible (never in a food preparation sink). If there is no mop sink, dedicate an indoor cleaning area where a drain is plumbed to the sanitary sewer.
    - Dispose mop water from cleaning floors in a mop sink, toilet or other drain that is plumbed to the sanitary sewer. Refer to fact sheet *IC24 Wastewater Disposal* for guidance on appropriate methods for disposal of wash water to the sanitary sewer.
    - Do not pour wash water outside or into a street, gutter, or storm drain.

[1] EPA " *Preliminary Data Summary of Urban Stormwater Best Management Practices"*

- Dispose of all wastewater containing oil and grease in a grease trap or interceptor.

3. Recycle and/or properly dispose of grease and oil. Collect and dispose of concentrated waste oil and grease and disposed of by a certified waste grease hauler. NEVER pour grease or oil into a sink, floor drain, storm drain or dumpster.
4. Block storm drain(s) when cleaning (hosing or steam/pressure washing) outside dumpster areas, sidewalks, and common areas with hot water, soap, or other cleaning agent. Collect water/waste and discharge to the sanitary sewer (with approval of the local sanitation district).

Training

1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
2. Train employees on proper spill containment and cleanup.
    - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
    - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
    - Fact sheet IC17 discusses Spill Prevention and Control in detail.
3. Establish a regular training schedule, train all new employees, and conduct annual refresher training.
4. Use a training log or similar method to document training.

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

Carlsbad Jurisdictional Urban Runoff Management Plan. Best Management Practices for Restaurants. City of Carlsbad. February 2002. On-line: http://www.ci.carlsbad.ca.us/cserv/jurmp.html

Orange County Stormwater Program. 2001. Water Quality Guidelines for Exterior Restaurant Cleaning Operations. Brochure. June.

Orange County Stormwater Program. Good Cleaning Practices Food & Restaurant Industry. Poster. Courtesy of the City and County of LA.

For additional information contact:

County of Orange/ OC Watersheds
Main: (714) 955-0600
24 hr Water Pollution Hotline: 1-877-89-SPILL
or visit our website at www.ocwatersheds.com

Attachment B: Operations and Maintenance Plan

Attachment C: Exhibits and Plans

PRELIM. WQMP PLAN

SUBAREA DESIGNATION

X

X.XXXac

AREA (ac)

STRUCTURAL SOURCE CONTROLS

S1 – PROVIDE STORM DRAIN SYSTEM STENCILING AND SIGNAGE
S3 – DESIGN AND CONSTRUCT TRASH AND WASTE STORAGE AREAS TO RECUE POLLUTION INTRODUCTION
S4 – USE EFFICIENT IRRIGATION SYSTEM AND DESIGN FOR CONSERVATION (TYPICAL, ALL LANDSCAPE AREAS)

N

0 20 40

SCALE: 1:20

EL CAMINO REAL

CAMINO CAPISTRANO

FORSTER STREET

BMP A
BIOFILTRATION PLANTER
W/ UNDERDRAIN PER
DETAIL SHEET 3
(415sf)

DMA A
0.197ac

DMA B
1.400ac

DMA C
0.862ac

DMA D
0.581ac

RESTAURANT
FF: 111.80

FITNESS
FF: 112.90

CLUBHOUSE
FF: 111.17

APARTMENTS
FF: 110.91

APARTMENTS
FF: 111.40

APARTMENTS
FF: 111.40

PATIO

POOL

RESTROOM

BMP B
MODULAR WETLANDS
8x16 UNIT PER
DETAIL SHEET 1

BMP C
MODULAR WETLANDS 8x12
UNIT PER DETAIL SHEET 1

BMP D
MODULAR WETLANDS 8x8 UNIT PER
DETAIL SHEET 1

ADS UNDERGROUND STORM TECH SYSTEM A
BOTTOM OF STONE=97.0, TOP OF STONE=99.0
TOTAL VOLUME=1,360CF

ADS UNDERGROUND STORM TECH SYSTEM B
BOTTOM OF STONE=97.0 TOP OF STONE=99.0
TOTAL VOLUME=1,627CF

2-STORY WOOD FRAME & STUCCO BUILDING NO. 31861

2-STORY STUCCO BUILDING NO. 31871

2-STORY MASONRY RESTAURANT

2-STORY STUCCO OFFICE & RETAIL BUILDING

1-STORY STUCCO RETAIL BUILDING

1-STORY STUCCO FIRE STATION

DEL OBISPO

EX. STORM DRAIN

OUTLET 1

OUTLET 2

WQMP CALCULATIONS (FLOW-BASED)

AREA #	IMPERVIOUS AREA (sf)	PERVIOUS AREA (sf)	TOTAL AREA (ac)	IMPERVIOUS AREA (%)	BMP FLOW RATE REQ'D (cfs)	BMP DESIGN TREATMENT FLOW RATE (cfs)	
DMA B	60,995	10,089	1.400	83.5	0.42	0.46	GPS – 33.499630, –117.660693
DMA C	31,969	5,567	0.862	85.2	0.27	0.35	GPS – 33.499346, –117.662006
DMA D	18,997	6,328	0.581	75	0.16	0.23	GPS – 33.499067, –117.661300

WQMP CALCULATIONS (VOLUME BASED)

AREA #	TOTAL AREA (ac)	PONDING DEPTH (inches)	VMP (cu ft)	BMP	MIN. AREA of BMP (sf)	AREA of BMP PROVIDED (sf)	
DMA A	0.197	12	434	BIOFILTRATION	297	415	GPS – 33.499713, –117.662347

REVISION RECORD

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www.c3civileng.com

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REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA

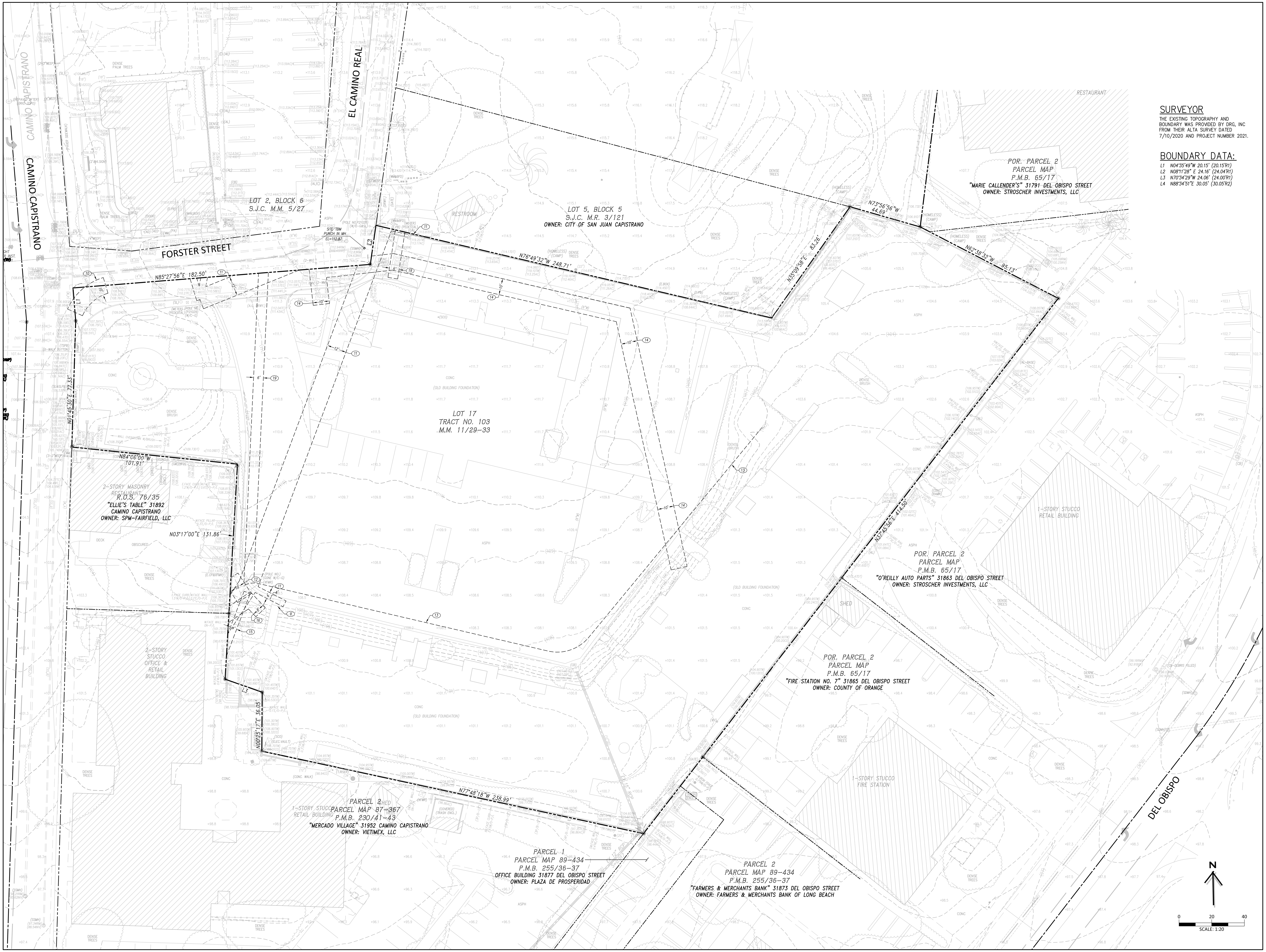
DATE: 12/11/2023
C3 JOB NO: 22-011
DRAWN BY: TH
CHECKED BY: TH

SHEET TITLE

PRELIMINARY WQMP PLAN

SHEET NUMBER

15 of 15



SURVEYOR

THE EXISTING TOPOGRAPHY AND BOUNDARY WAS PROVIDED BY DRG, INC FROM THEIR ALTA SURVEY DATED 7/10/2020 AND PROJECT NUMBER 2021.

BOUNDARY DATA:

L1 N04°35'49"W 20.15' (20.15'R1)
L2 N08°11'28" E 24.16' (24.04'R1)
L3 N70°34'29"W 24.06' (24.00'R1)
L4 N88°34'51"E 30.05' (30.05'R2)

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THOMAS W. HAWKSWORTH
No. 68771
Exp. 09/30/2025
CIVIL
STATE OF CALIFORNIA

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C3 JOB NO: 22-011
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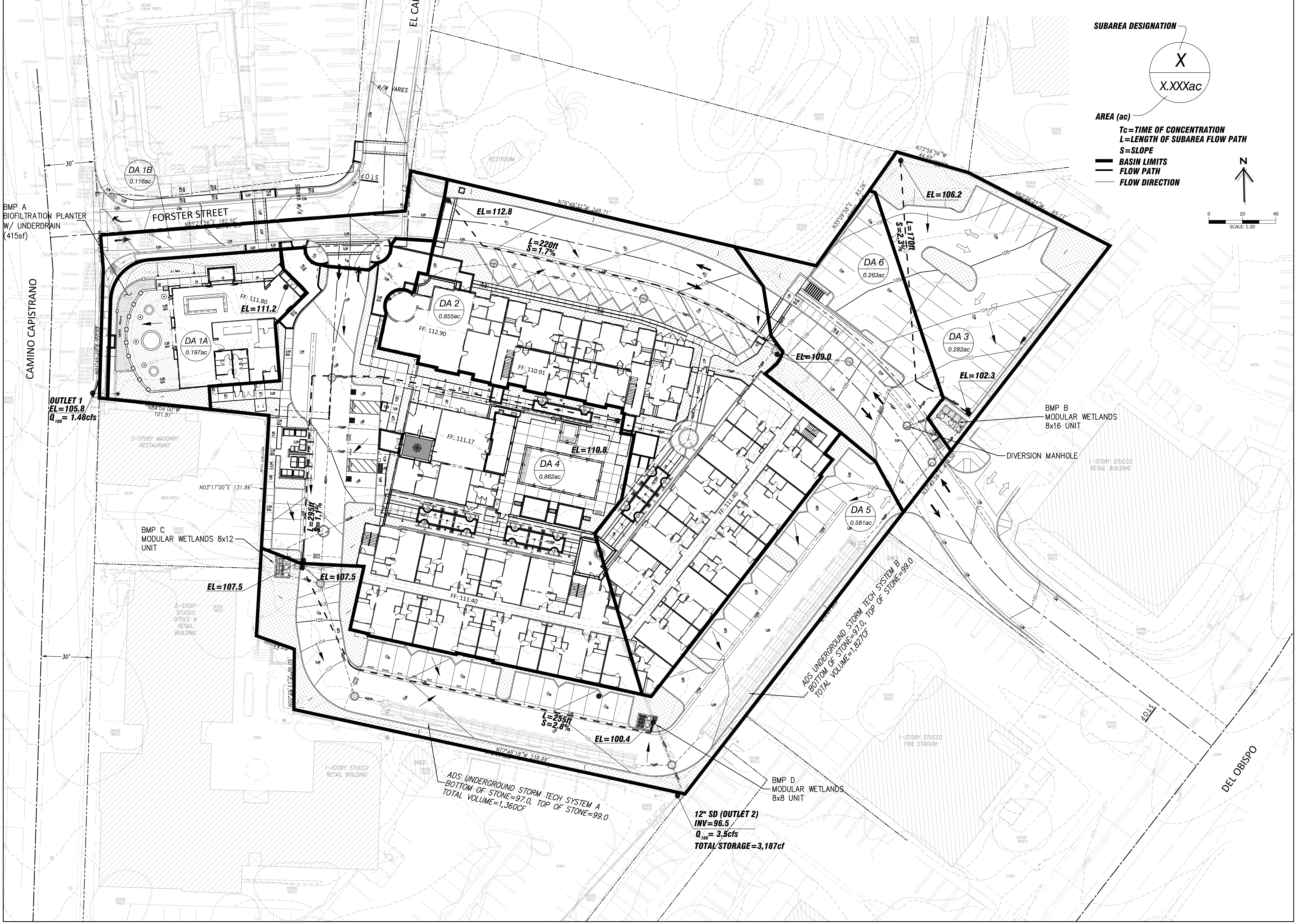
EXISTING SITE

SHEET NUMBER

PROPOSED DRAINAGE MAP



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PROPOSED DRAINAGE MAP

SHEET NUMBER

14 of 15

BENCHMARK

COUNTY OF ORANGE BENCHMARK NO. 3B-92-82

ELEVATION = 118.336 NAVD 1988 (1990)

3 3/4" OCS ALUMINUM BENCHMARK DISK STAMPED "3B-92-82" SET IN THE NORTHEASTERLY CORNER A 3.7 FEET BY 15.3 FEET CONCRETE CATCH BASIN. MONUMENT IS LOCATED ALONG THE EASTERLY SIDE OF CAMINO CAPISTRANO, 369.5 FEET NORTHERLY OF THE CENTERLINE OF ACJACHEMA STREET AND 39.6 FEET SOUTHWESTERLY OF THE NORTHWESTERLY CORNER OF A 10 FOOT HIGH CHAINLINK FENCE AROUND A TENNIS COURT. MONUMENT IS SET LEVEL WITH THE TOP OF CURB,

SITE TBM SHOWN HEREON.

BASIS OF BEARINGS:

THE BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN O.C.S. HORIZONTAL CONTROL STATIONS GPS# 7541 AND GPS# 7552 BEING **N 11°16'23" E** PER RECORDS ON FILE IN THE OFFICE OF THE ORANGE COUNTY SURVEYOR.

DATUM STATEMENT:
COORDINATES SHOWN ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM (CCS83), ZONE VI, 1983 NAD, (2017.50 EPOCH OCS GPS ADJUSTMENT).
ALL DISTANCES SHOWN ARE GROUND, UNLESS OTHERWISE NOTED. TO OBTAIN GRID DISTANCES MULTIPLY GROUND DISTANCE BY 0.99995896. COMBINATION FACTOR IS PROJECT SPECIFIC.

SURVEY:

THE EXISTING TOPOGRAPHY AND BOUNDARY WAS PROVIDED BY DAVID R. GRAY, INC FROM THEIR ALTA SURVEY DATED 7/10/20.

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CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY, AND HOLD HARMLESS THE CITY, ITS EMPLOYEES, AND AGENTS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT.

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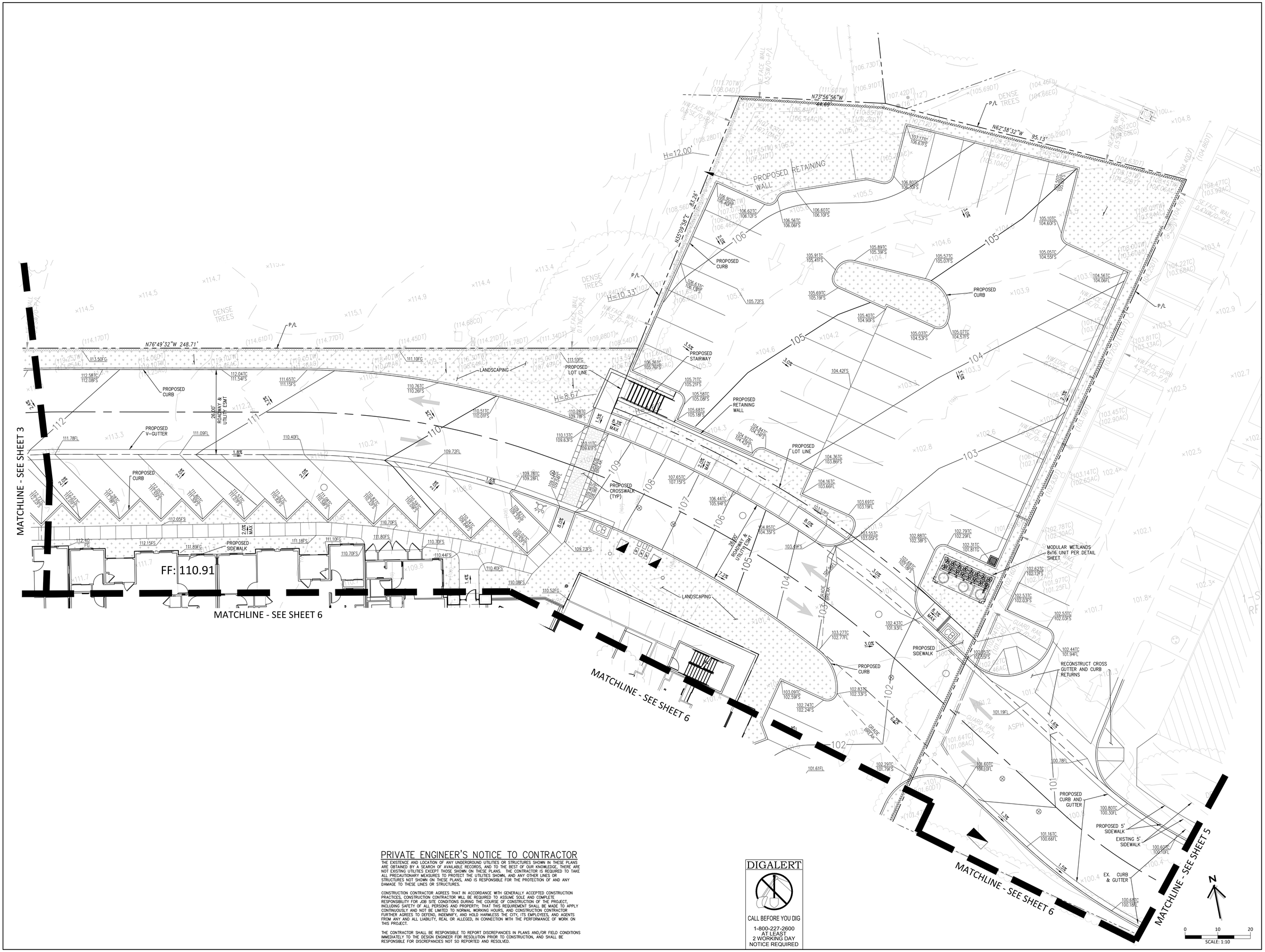

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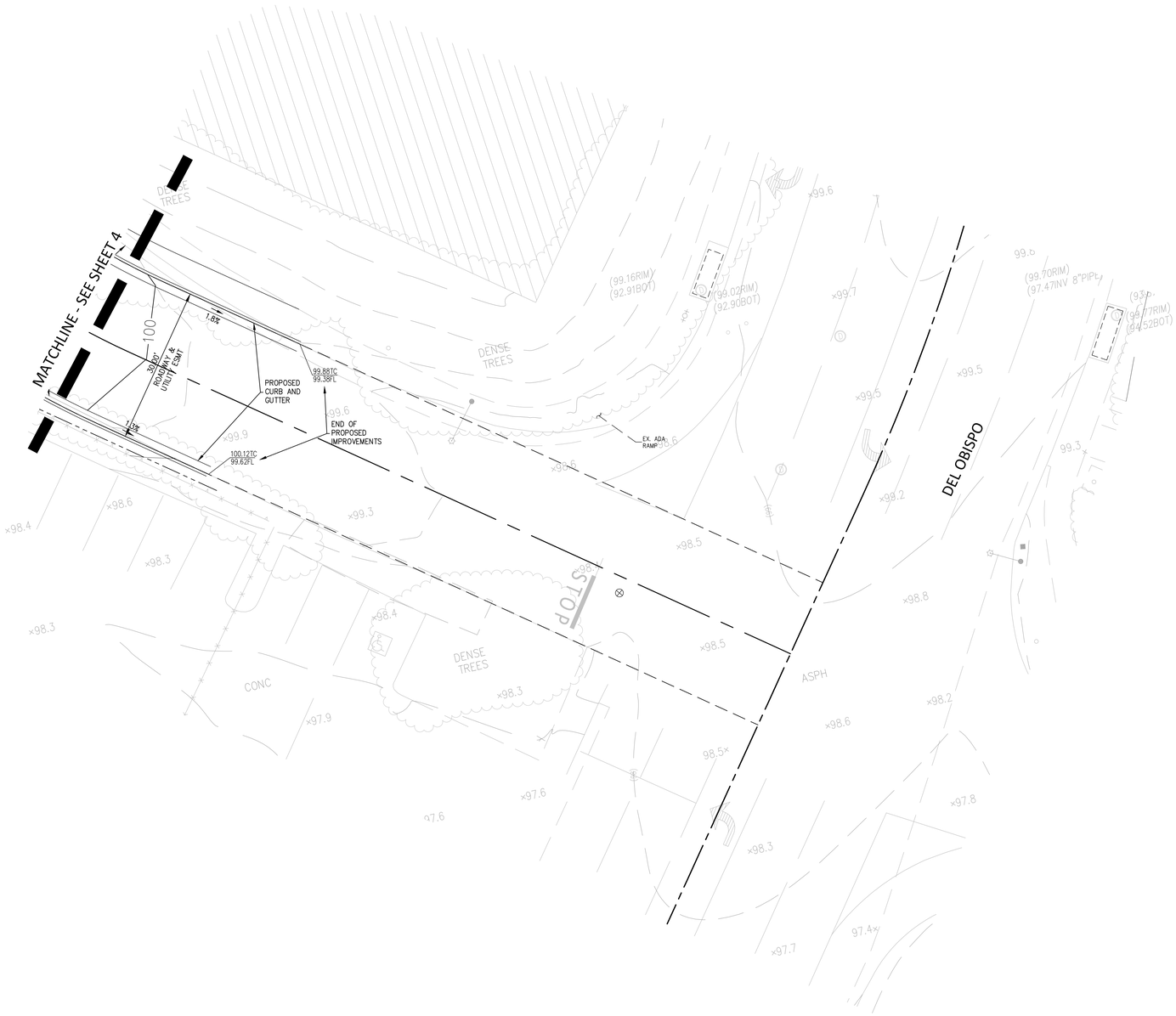

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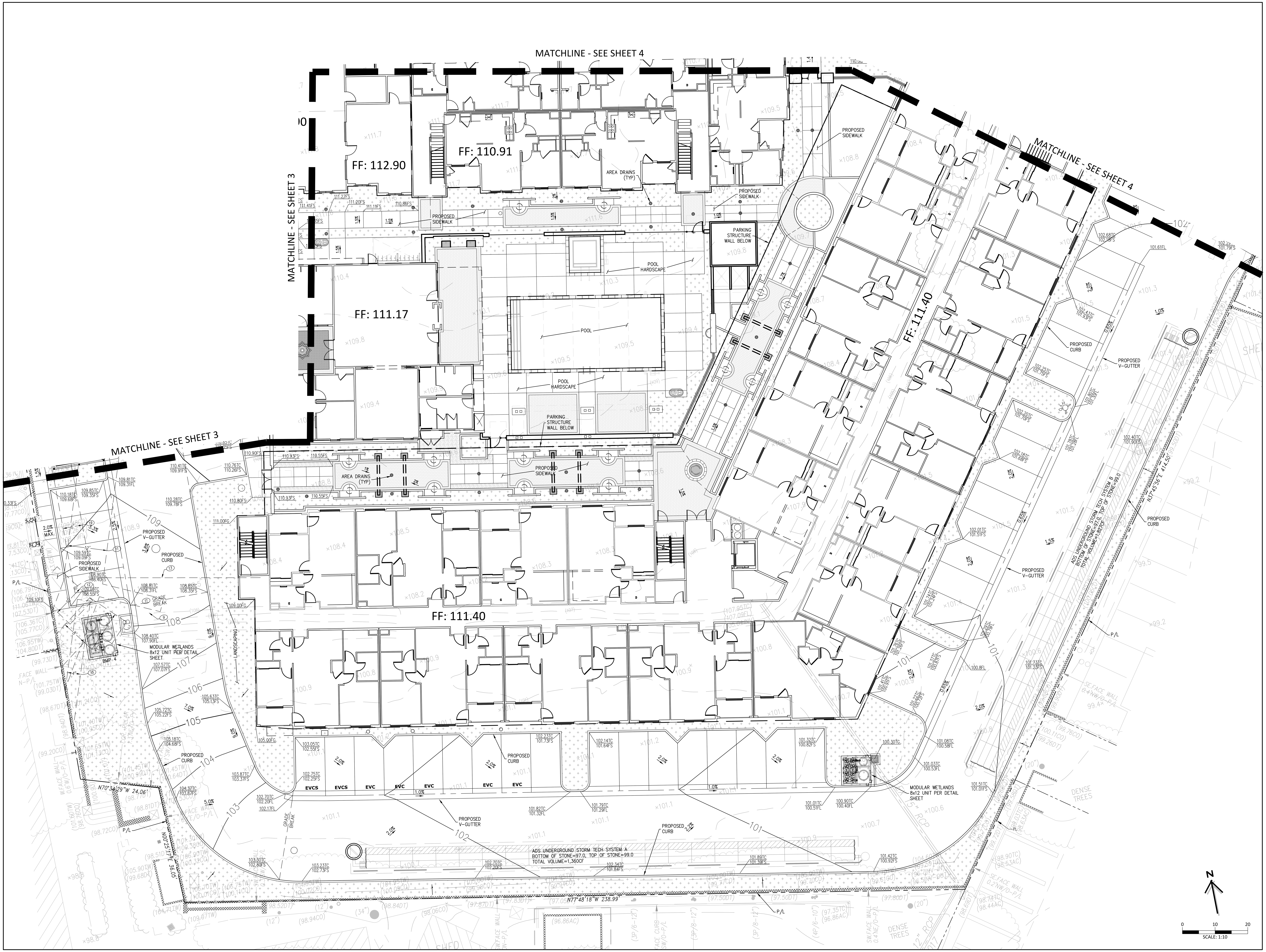

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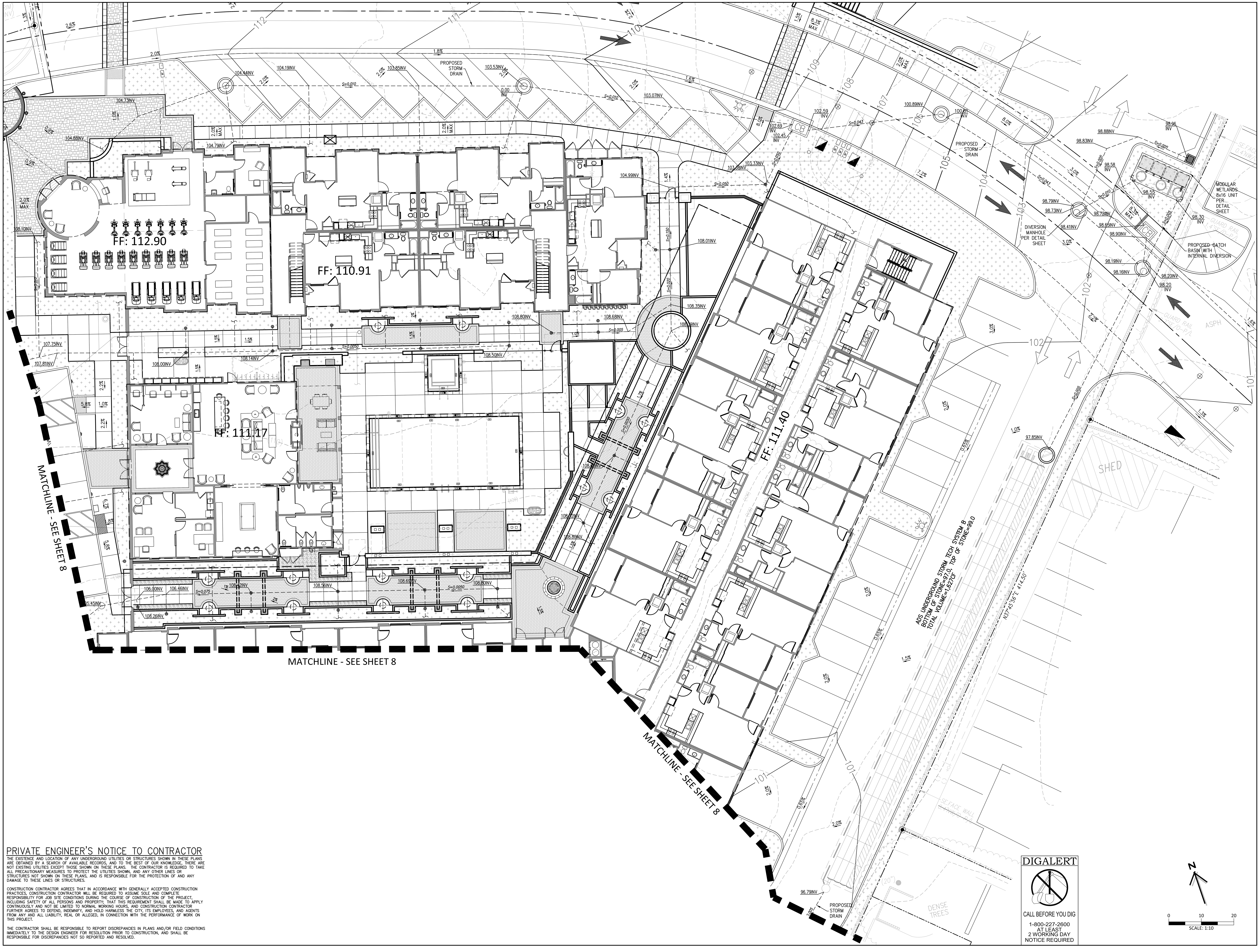

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PRELIMINARY STORM DRAIN PLAN

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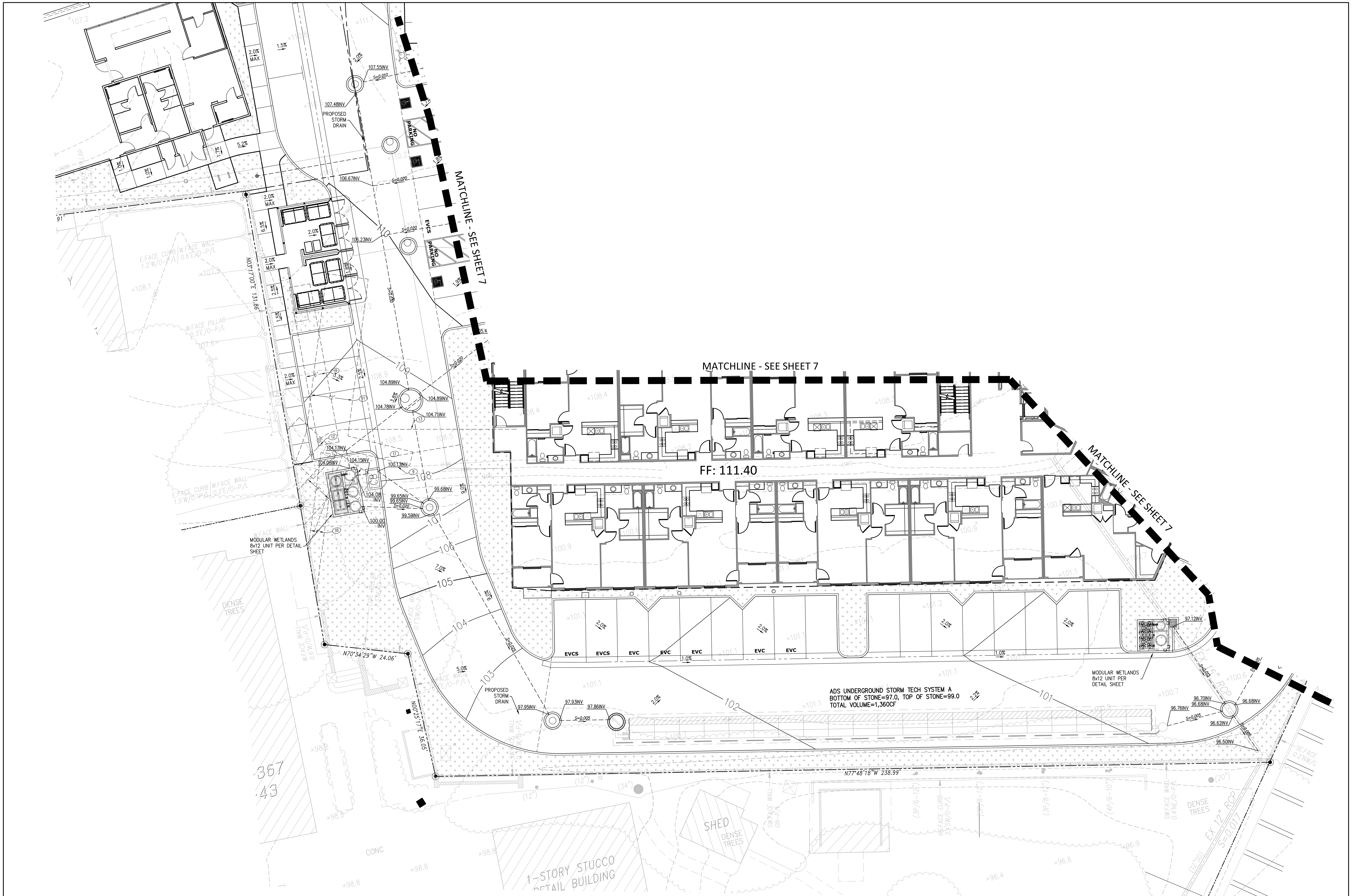

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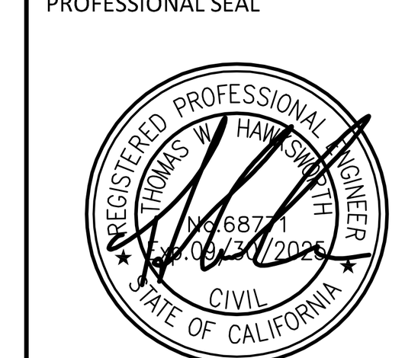

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SHEET TITLE

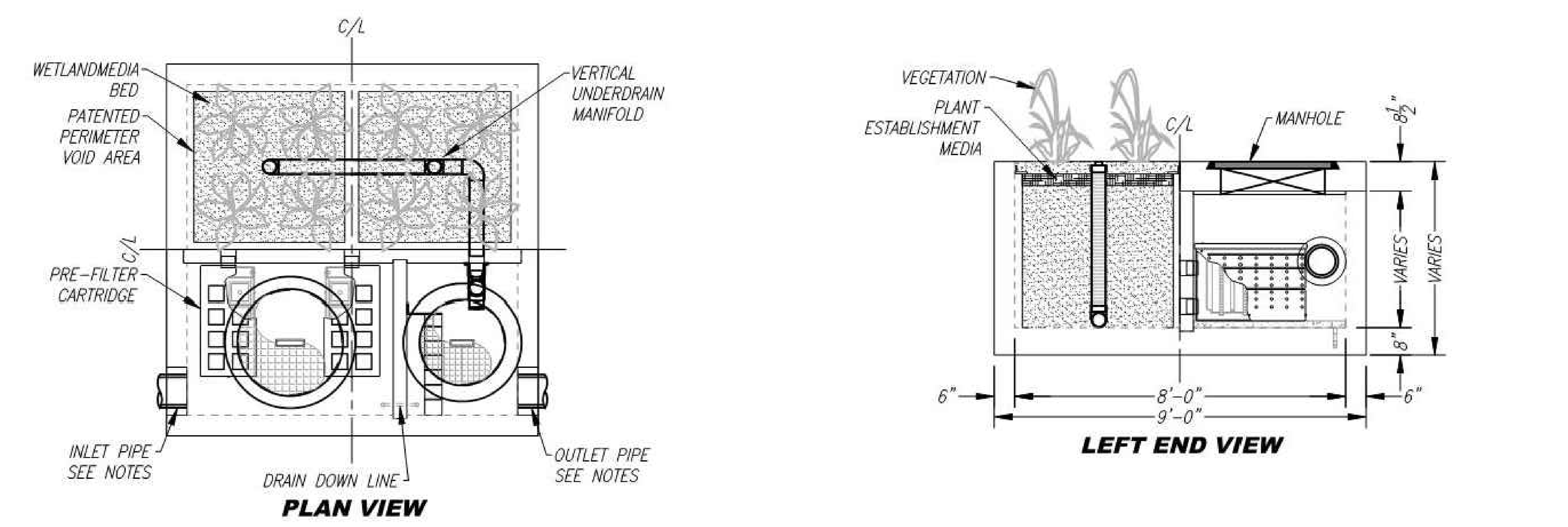
PRELIMINARY STORM DRAIN PLAN

SHEET NUMBER

SITE SPECIFIC DATA

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.231	
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			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	ø30"	OPEN PLAN	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



INSTALLATION NOTES

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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 TO VERIFY PROJECT ENGINEERS 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 WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
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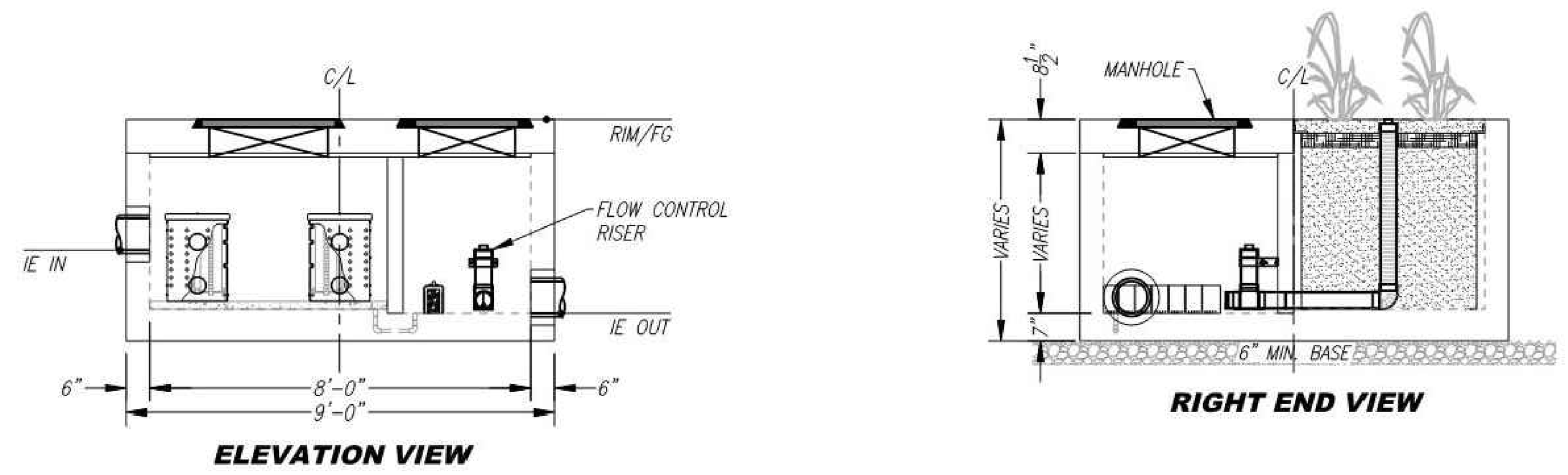
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.



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5/23/19TOLEE

TREATMENT FLOW (CFS)	0.231
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS — THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

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Bio Clean — A Forterra Company

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

SITE SPECIFIC DATA

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.346	
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			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLAN	ø24"
NOTES:			

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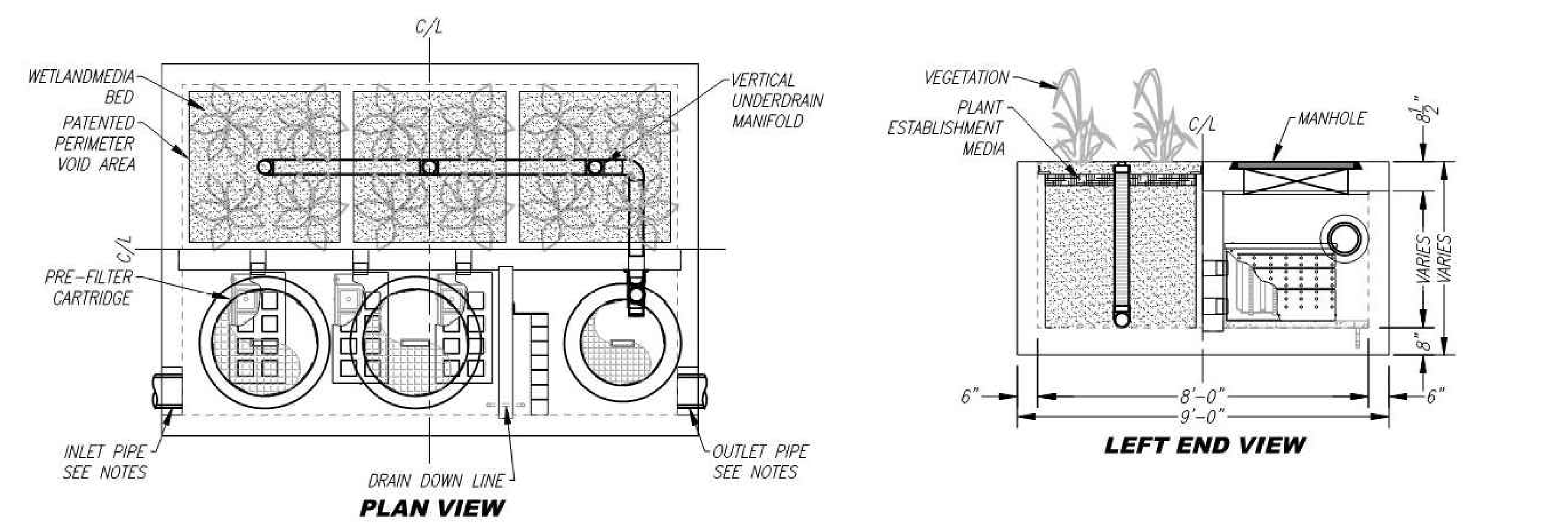

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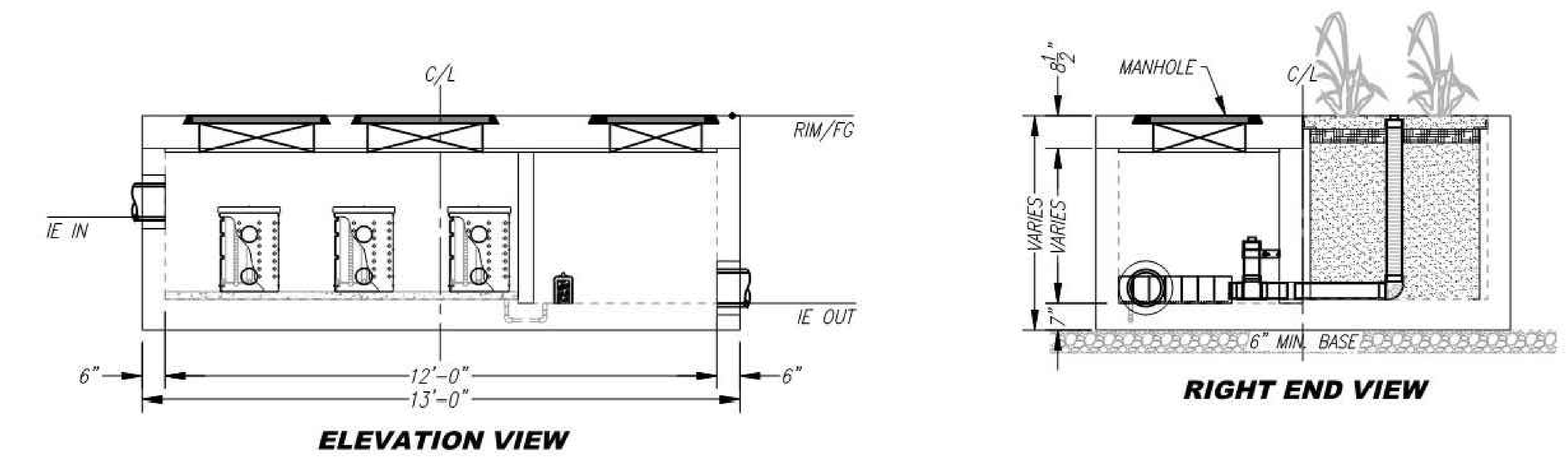

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5/23/19TOLEE

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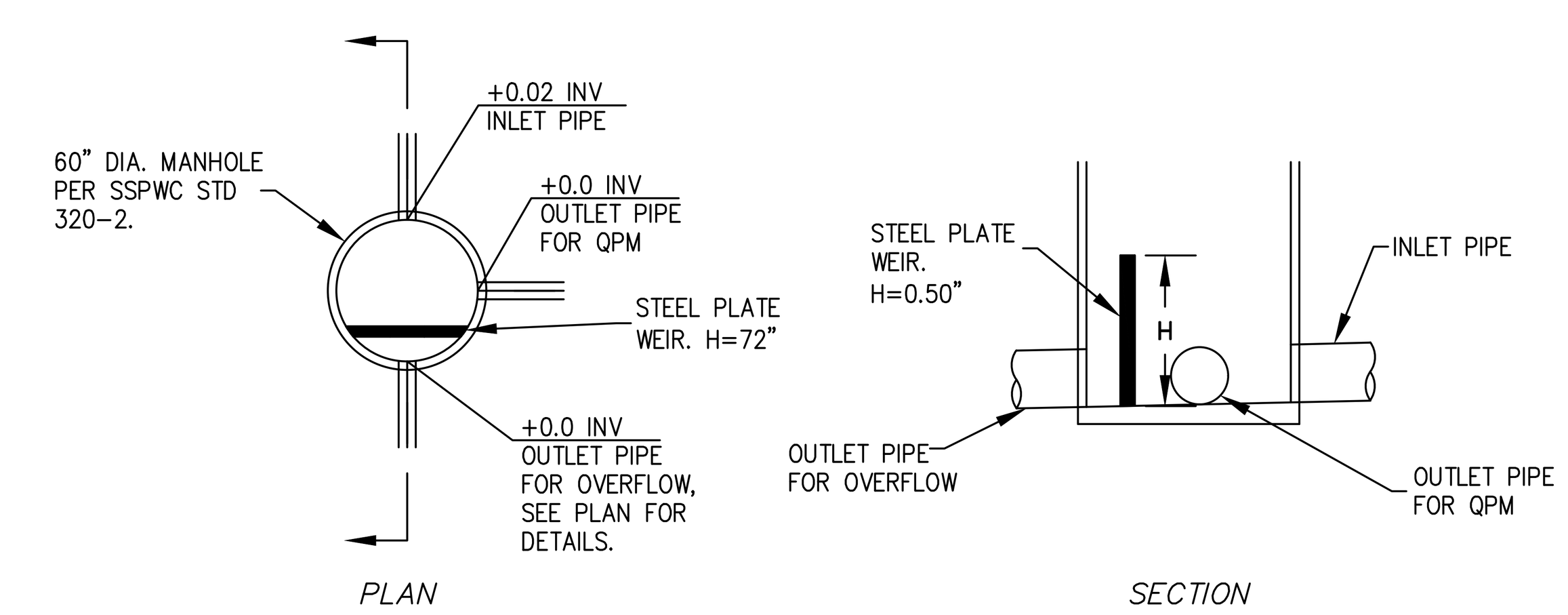
Bio Clean — A Forterra Company

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL



DIVERSION MANHOLE
N.T.S.

SITE SPECIFIC DATA

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
FLOW BASED (CFS)			
0.462			
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			
SURFACE LOAD	PEDESTRIAN		
NOTES:			

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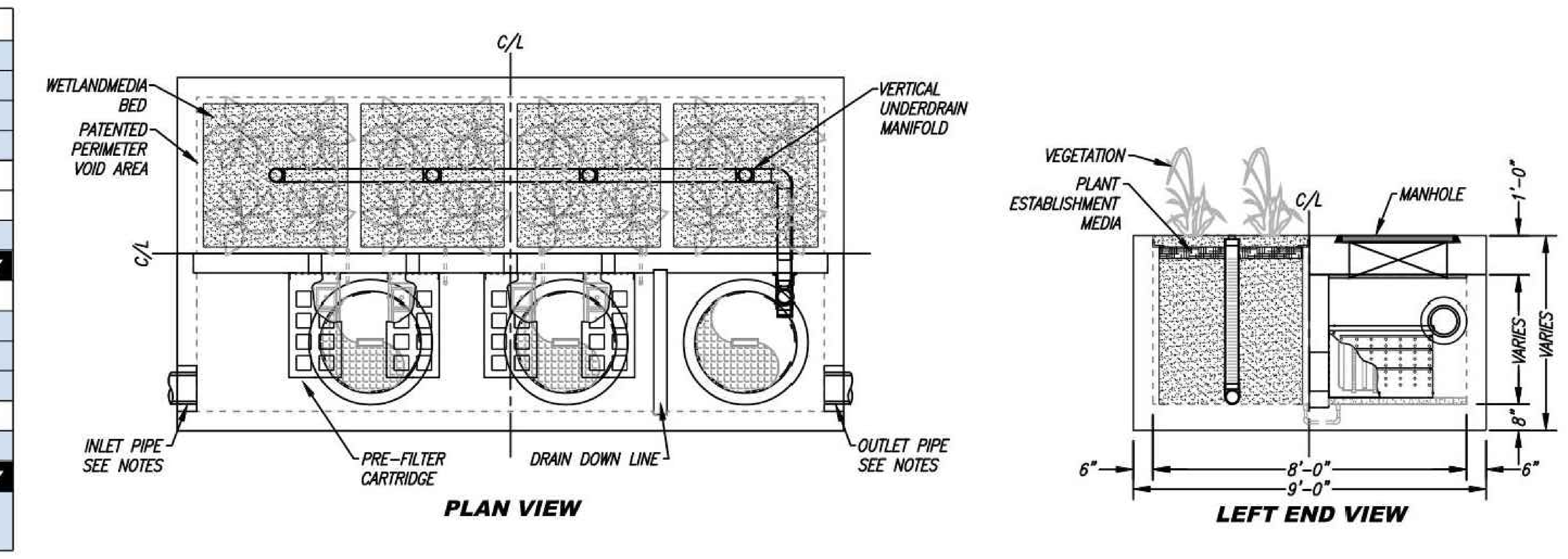

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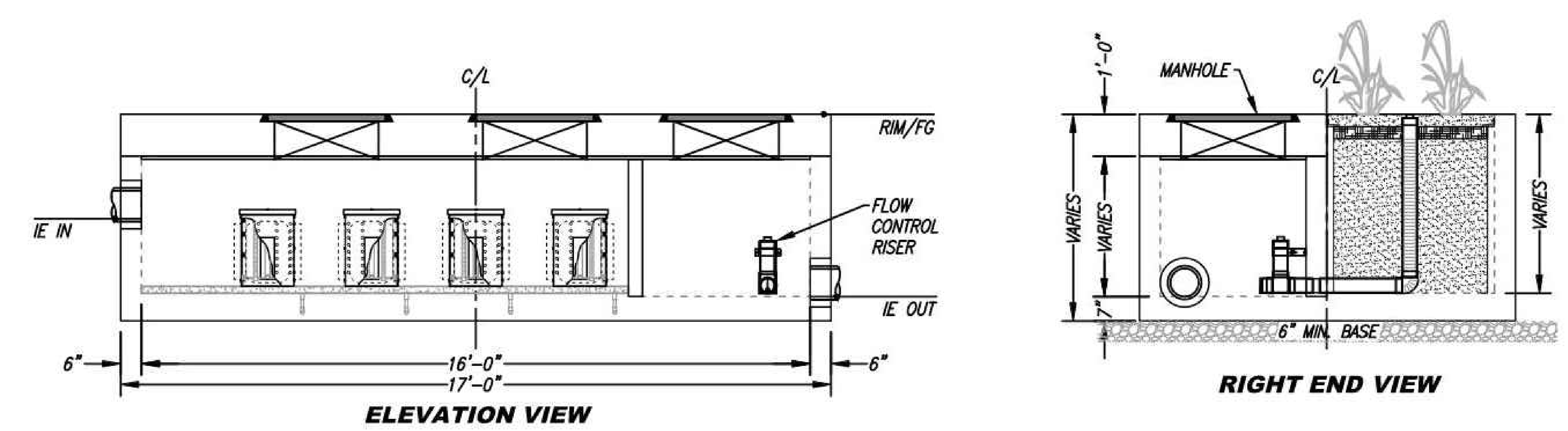

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MODULAR WETLANDS — FOR PATENT INFORMATION, GO TO www.ContechES.com/IP

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

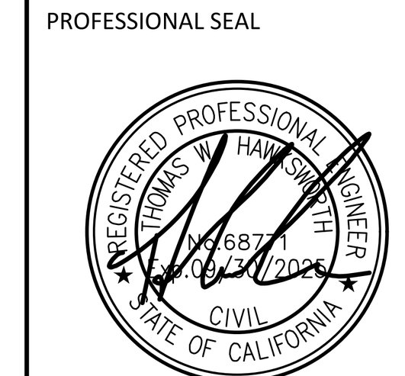
MWS-L-8-16-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

REVISION RECORD		
#	DATE	DESCRIPTION

FORSTER MIXED USE
FORSTER STREET
SAN JUAN CAPISTRANO, CA

C3 CIVIL ENGINEERING
10870 W. FAIRVIEW DR
STE 102-1187
BOISE, ID 83713
(208) 918-0928
thomas@c3civileng.com
www.c3civileng.com

PROFESSIONAL SEAL



DATE: 12/11/2023
C3 JOB NO: 22-011
DRAWN BY: TH
CHECKED BY: TH

SHEET TITLE

DETAIL
SHEET 1

SHEET NUMBER

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteASSIST® FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

FORSTER

SAN JUAN CAPISTRANO, CA

SC-160LP STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-160LP.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
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 1.5".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-160LP SYSTEM

1. STORMTECH SC-160LP CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-160LP CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-160LP CONSTRUCTION GUIDE".
3. FOUNDATION STONE AND EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE; AASHTO M43 #3,357, 4, 467, 5, 56, OR 57.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. THE DEPTH OF FOUNDATION STONE SHALL BE DETERMINED BASED ON THE SUBGRADE BEARING CAPACITY PROVIDED BY THE SITE DESIGN ENGINEER.
6. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES CONCERNING CHAMBER FOUNDATION DESIGN AND SUBGRADE BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
7. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
8. CHAMBERS SHALL BE INSTALLED "TOE TO TOE". NO ADDITIONAL SPACING BETWEEN ROWS IS REQUIRED.
9. 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.
10. 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

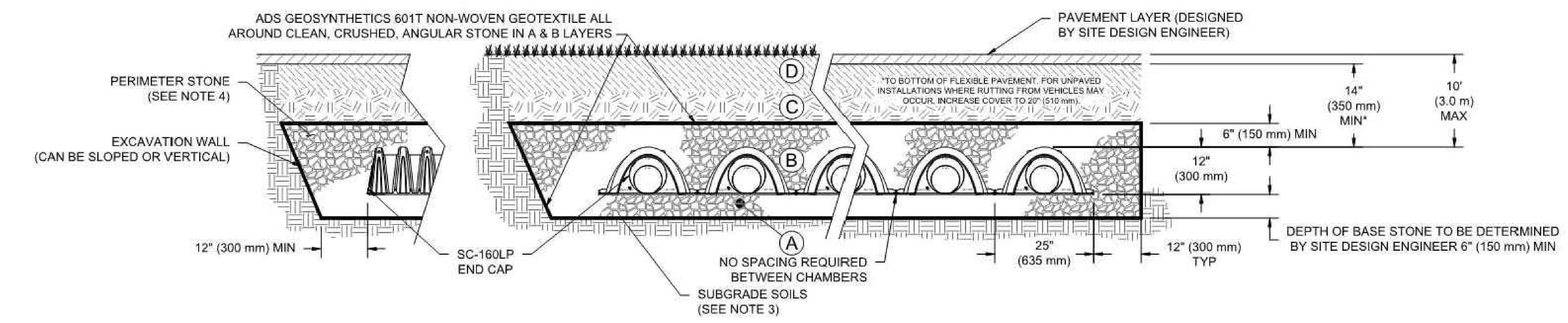
1. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-160LP CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-160LP CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-106LP CONSTRUCTION GUIDE".
2. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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

ACCEPTABLE FILL MATERIALS: STORMTECH SC-160LP 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 14" (355 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 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
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, 357, 4, 467, 5, 56, 57	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, 357, 4, 467, 5, 56, 57	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 6" (150 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.



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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:
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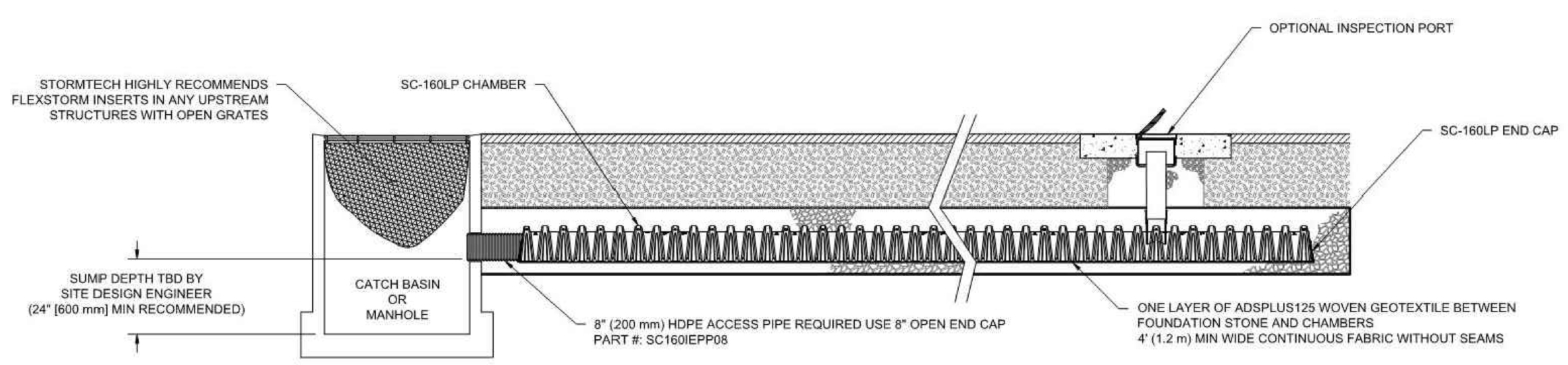
FORSTER SAN JUAN CAPISTRANO, CA | DATE: | DRAWN: TH | PROJECT #: | CHECKED: N/A

REV | DRW | CHK | DESCRIPTION

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

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

SHEET 3 OF 6



SC-160LP 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.

FORSTER SAN JUAN CAPISTRANO, CA | DATE: | DRAWN: TH | PROJECT #: | CHECKED: N/A

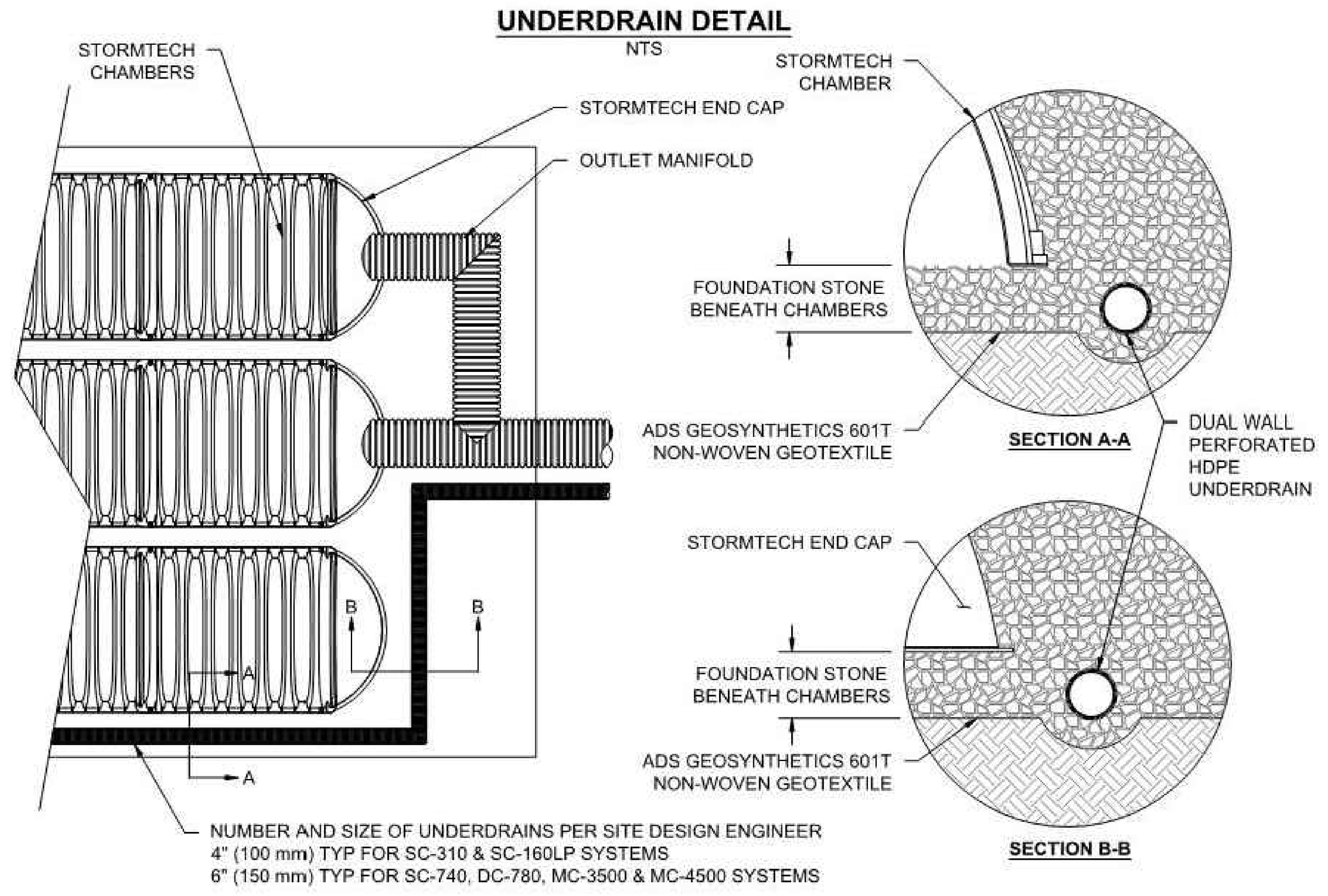
REV | DRW | CHK | DESCRIPTION

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

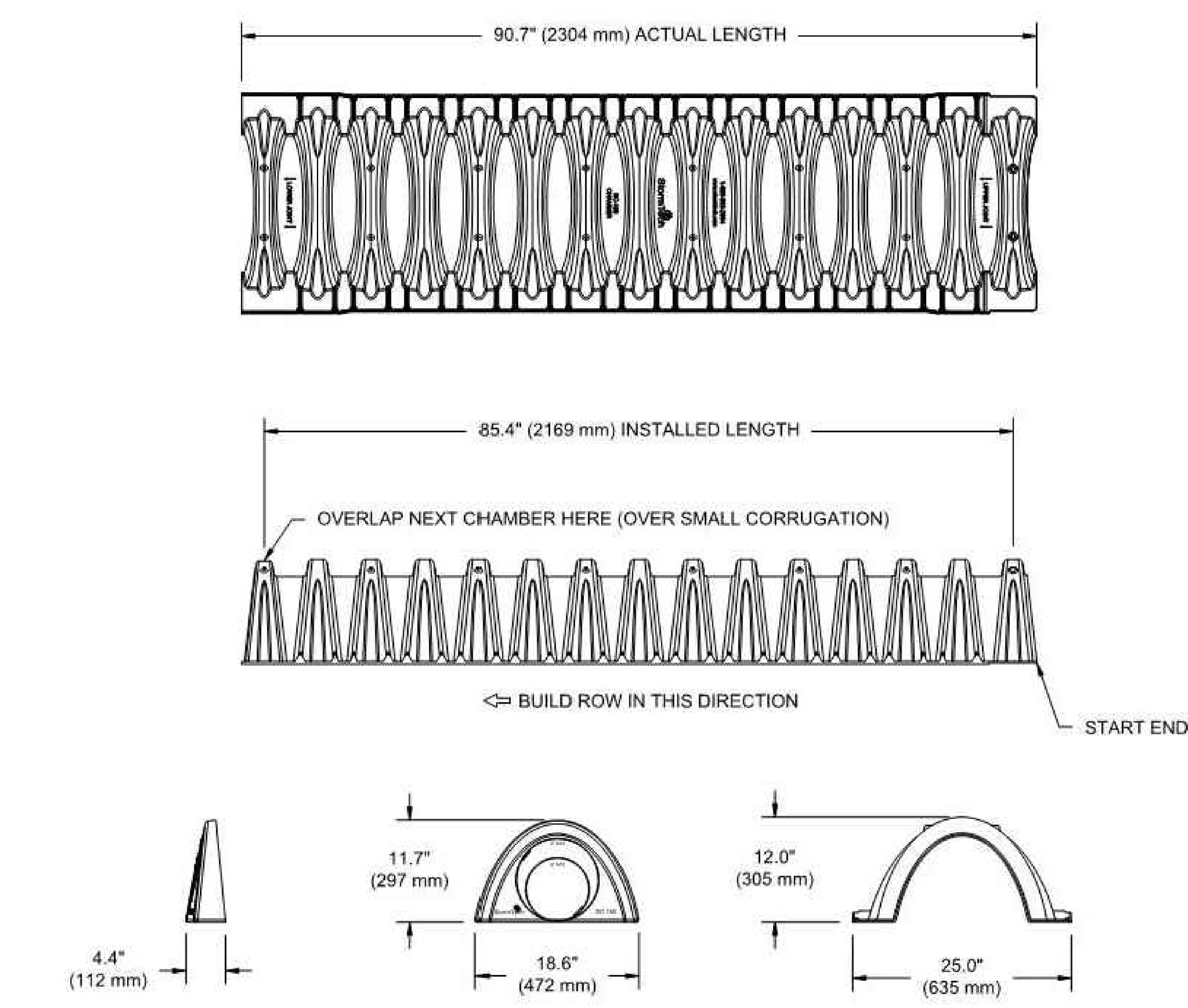
ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

SHEET 4 OF 6

UNDERDRAIN DETAIL
NTS



SC-160LP TECHNICAL SPECIFICATION
NTS

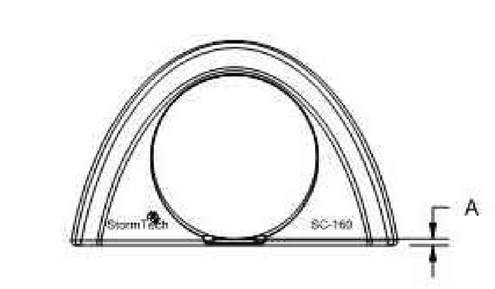


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	25.0" X 12.0" X 85.4"	(635 mm X 305 mm X 2169 mm)
CHAMBER STORAGE	6.85 CUBIC FEET	(0.19 m³)
MINIMUM INSTALLED STORAGE*	16.0 CUBIC FEET	(0.45 m³)
WEIGHT	24.0 lbs.	(10.9 kg)

*ASSUMES 6" (152 mm) ABOVE, 6" (152 mm) BELOW, AND STONE BETWEEN CHAMBERS WITH 40% STONE POROSITY.

PART #	STUB	A
SC160EPP	6" (150 mm)	0.66" (16 mm)
	8" (200 mm)	0.80" (20 mm)
SC160EPP08	8" (200 mm)	0.96" (24 mm)



ALL STUBS ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

NOTE: ALL DIMENSIONS ARE NOMINAL

FORSTER SAN JUAN CAPISTRANO, CA | DATE: | DRAWN: TH | PROJECT #: | CHECKED: N/A

REV | DRW | CHK | DESCRIPTION

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

SHEET 5 OF 6

REVISION RECORD

#	DATE	DESCRIPTION

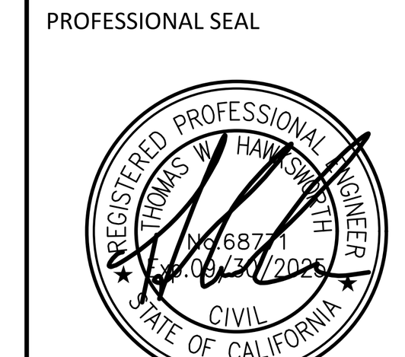
FORSTER MIXED USE

FORSTER STREET
SAN JUAN CAPISTRANO, CA

10070 W. FAIRVIEW DR
STE 102-187
BOISE, ID 83713
(208) 918-0028
thomas@c3civileng.com
www.c3civileng.com

C3 CIVIL ENGINEERING

PROFESSIONAL SEAL



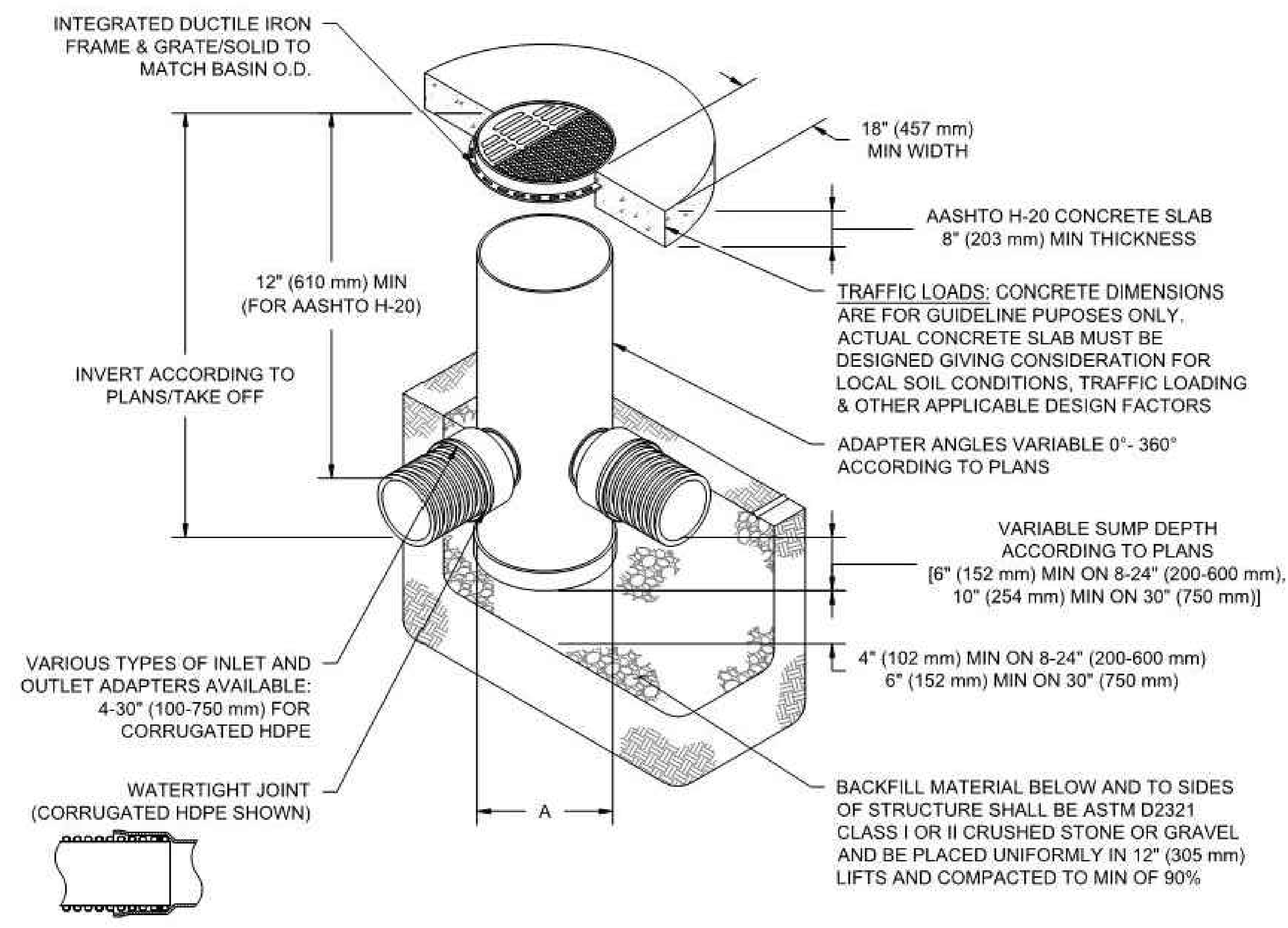
DATE: 12/11/2023
C3 JOB NO: 22-011
DRAWN BY: TH
CHECKED BY: TH

SHEET TITLE

DETAIL SHEET 2

SHEET NUMBER

NYLOPLAST DRAIN BASIN
NTS



INTEGRATED DUCTILE IRON FRAME & GRATE/SOLID TO MATCH BASIN O.D.
18" (457 mm) MIN WIDTH
AASHTO H-20 CONCRETE SLAB 8" (203 mm) MIN THICKNESS
12" (610 mm) MIN (FOR AASHTO H-20)
INVERT ACCORDING TO PLANS/TAKE OFF
TRAFFIC LOADS: CONCRETE DIMENSIONS ARE FOR GUIDELINE PUPOSES ONLY. ACTUAL CONCRETE SLAB MUST BE DESIGNED GIVING CONSIDERATION FOR LOCAL SOIL CONDITIONS, TRAFFIC LOADING & OTHER APPLICABLE DESIGN FACTORS
ADAPTER ANGLES VARIABLE 0°- 360° ACCORDING TO PLANS
VARIABLE SUMP DEPTH ACCORDING TO PLANS [6" (152 mm) MIN ON 8-24" (200-600 mm), 10" (254 mm) MIN ON 30" (750 mm)]
4" (102 mm) MIN ON 8-24" (200-600 mm) 6" (152 mm) MIN ON 30" (750 mm)
VARIOUS TYPES OF INLET AND OUTLET ADAPTERS AVAILABLE: 4-30" (100-750 mm) FOR CORRUGATED HDPE
WATERTIGHT JOINT (CORRUGATED HDPE SHOWN)
A
BACKFILL MATERIAL BELOW AND TO SIDES OF STRUCTURE SHALL BE ASTM D2321 CLASS I OR II CRUSHED STONE OR GRAVEL AND BE PLACED UNIFORMLY IN 12" (305 mm) LIFTS AND COMPACTED TO MIN OF 90%

NOTES
1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

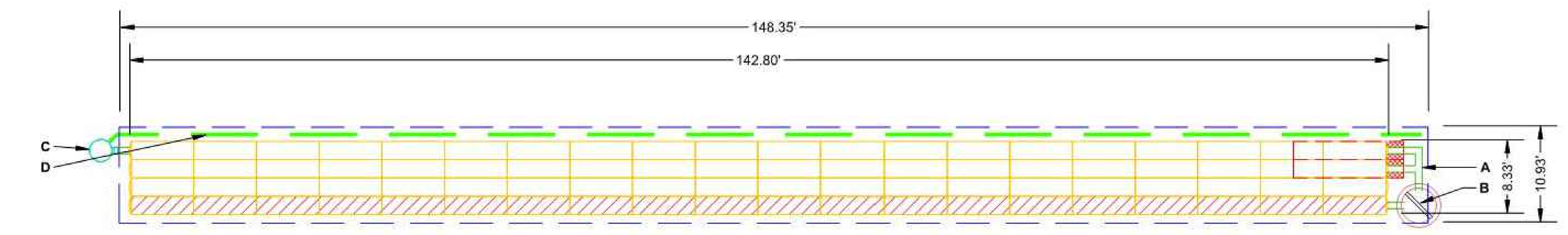
A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

FORSTER
SAN JUAN CAPISTRANO, CA
DATE: | DRAWN: TH
PROJECT #: | CHECKED: N/A
REV | DRW | CHK | DESCRIPTION
Nyloplast®
770-932-2443 | WWW.NYLOPLAST-US.COM
ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473
SHEET 6 OF 6

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
80	STORMTECH SC-160LP CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	108.50
8	STORMTECH SC-160LP END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	100.17
6	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	99.67
6	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	99.67
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	99.67
1627	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	99.00
		TOP OF SC-160LP CHAMBER:	98.50
		8" ISOLATOR ROW PLUS INVERT:	97.58
		8" BOTTOM CONNECTION INVERT:	97.58
1622	SYSTEM AREA (SF)	8" x 8" BOTTOM MANIFOLD INVERT:	97.56
318.6	SYSTEM PERIMETER (ft)	BOTTOM OF SC-160LP CHAMBER:	97.50
		UNDERDRAIN INVERT:	97.00
		BOTTOM OF STONE:	97.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
MANIFOLD	A	8" x 8" BOTTOM MANIFOLD, MOLDED FITTINGS	0.66"	
CONCRETE STRUCTURE W/WEIR	B	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		1.5 CFS IN
NYLOPLAST (OUTLET)	C	30" DIAMETER (DESIGN BY ENGINEER)		0.7 CFS OUT
UNDERDRAIN	D	4" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS (SEE DETAIL)
PLACE MINIMUM 12.50' OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS
BED LIMITS

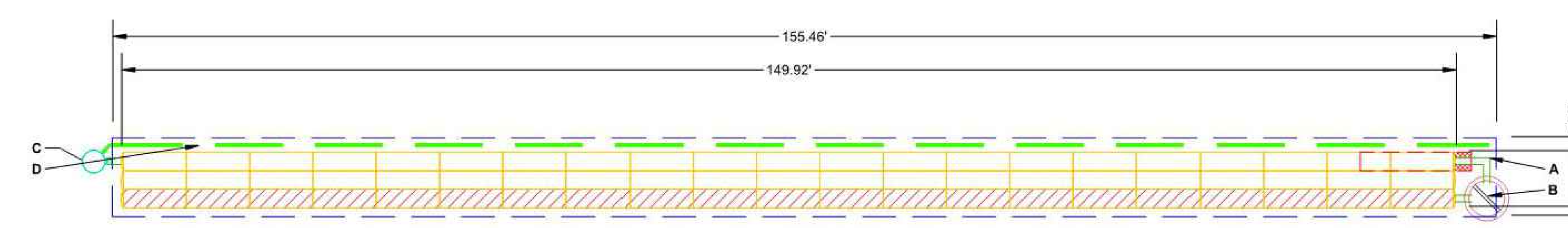
NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- 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.

FORSTER
SAN JUAN CAPISTRANO, CA
DATE: | DRAWN: TH
PROJECT #: | CHECKED: N/A
REV | DRW | CHK | DESCRIPTION
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473
0 15' 30'
SHEET 2 OF 6

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
63	STORMTECH SC-160LP CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	108.50
6	STORMTECH SC-160LP END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	100.17
6	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	99.67
6	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	99.67
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	99.67
1360	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	99.00
		TOP OF SC-160LP CHAMBER:	98.50
		8" ISOLATOR ROW PLUS INVERT:	97.58
		8" BOTTOM CONNECTION INVERT:	97.58
1376	SYSTEM AREA (SF)	8" x 8" BOTTOM MANIFOLD INVERT:	97.56
328.6	SYSTEM PERIMETER (ft)	BOTTOM OF SC-160LP CHAMBER:	97.50
		UNDERDRAIN INVERT:	97.00
		BOTTOM OF STONE:	97.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
MANIFOLD	A	8" x 8" BOTTOM MANIFOLD, MOLDED FITTINGS	0.66"	
CONCRETE STRUCTURE W/WEIR	B	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		0.7 CFS IN
NYLOPLAST (OUTLET)	C	30" DIAMETER (DESIGN BY ENGINEER)		0.7 CFS OUT
UNDERDRAIN	D	4" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS (SEE DETAIL)
PLACE MINIMUM 12.50' OF ADSPLUS125 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.
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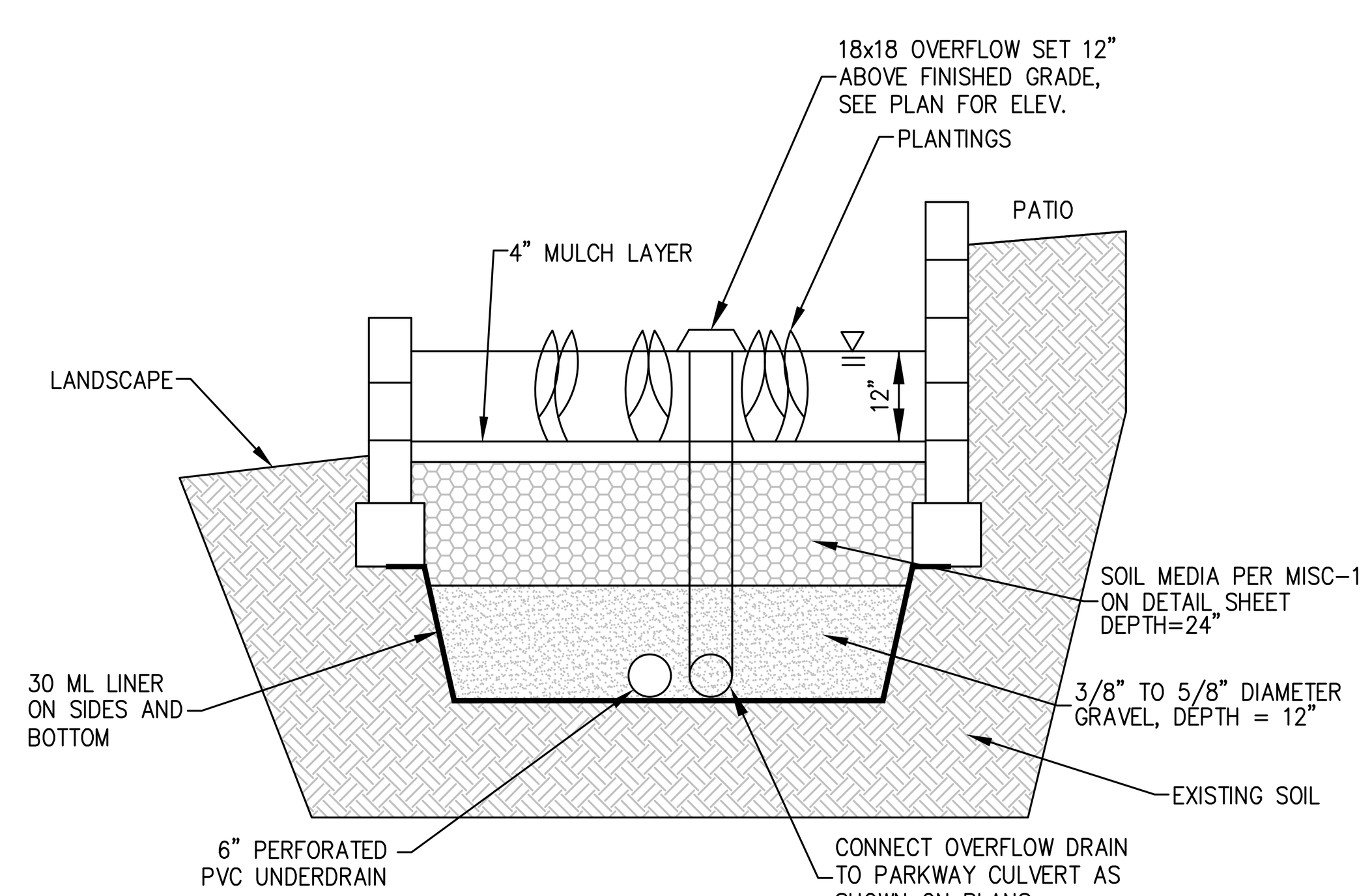
FORSTER DET A
SAN JUAN CAPISTRANO, CA
DATE: | DRAWN: TH
PROJECT #: | CHECKED: N/A
REV | DRW | CHK | DESCRIPTION
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473
0 15' 30'
SHEET 2 OF 6



18x18 OVERFLOW SET 12" ABOVE FINISHED GRADE, SEE PLAN FOR ELEV.
PLANTINGS
4" MULCH LAYER
PATIO
LANDSCAPE
12"
SOIL MEDIA PER MISC-1 ON DETAIL SHEET DEPTH=24"
30 ML LINER ON SIDES AND BOTTOM
3/8" TO 5/8" DIAMETER GRAVEL, DEPTH = 12"
EXISTING SOIL
6" PERFORATED PVC UNDERDRAIN
CONNECT OVERFLOW DRAIN TO PARKWAY CULVERT AS SHOWN ON PLANS.

BIO-RETENTION W/ UNDERDRAIN PLANTER
N.T.S.

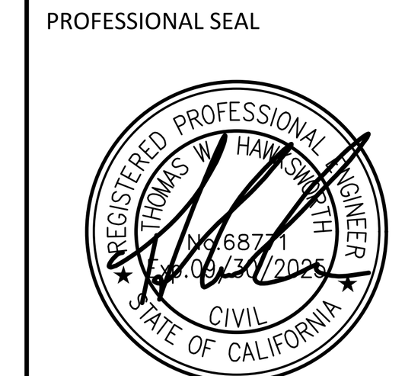
REVISION RECORD

#	DATE	DESCRIPTION

FORSTER MIXED USE
FORSTER STREET
SAN JUAN CAPISTRANO, CA

C3 CIVIL ENGINEERING
10070 W. FAIRVIEW DR
STE 102-1187
BOISE, ID 83713
(208) 918-0928
thomas@c3civileng.com
www.c3civileng.com

PROFESSIONAL SEAL



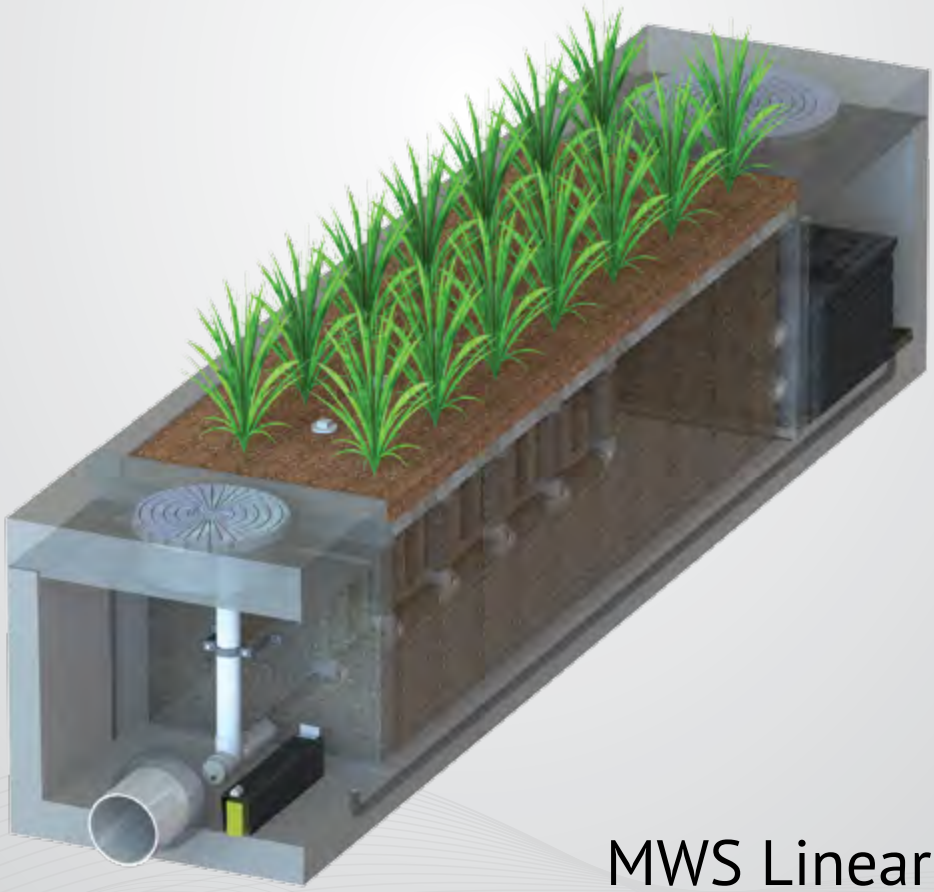
DATE: 12/11/2023
C3 JOB NO: 22-011
DRAWN BY: TH
CHECKED BY: TH

SHEET TITLE
DETAIL SHEET 3

SHEET NUMBER

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS Linear

Contents

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 water ways in urban areas.

MWS Linear

The Modular Wetland System 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 pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

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 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 are available on our website: www.ModularWetlands.com/Applications

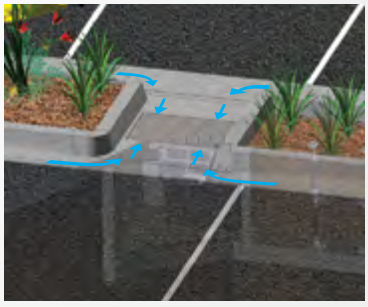
- Agriculture
- Reuse
- Low Impact Development
- Waste Water

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 stormdrain design.

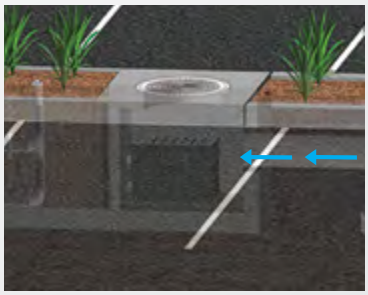
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways 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 pre-treatment chamber. It has the added benefit of allowing for 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 pre-treatment 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 roof top 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.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and 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.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

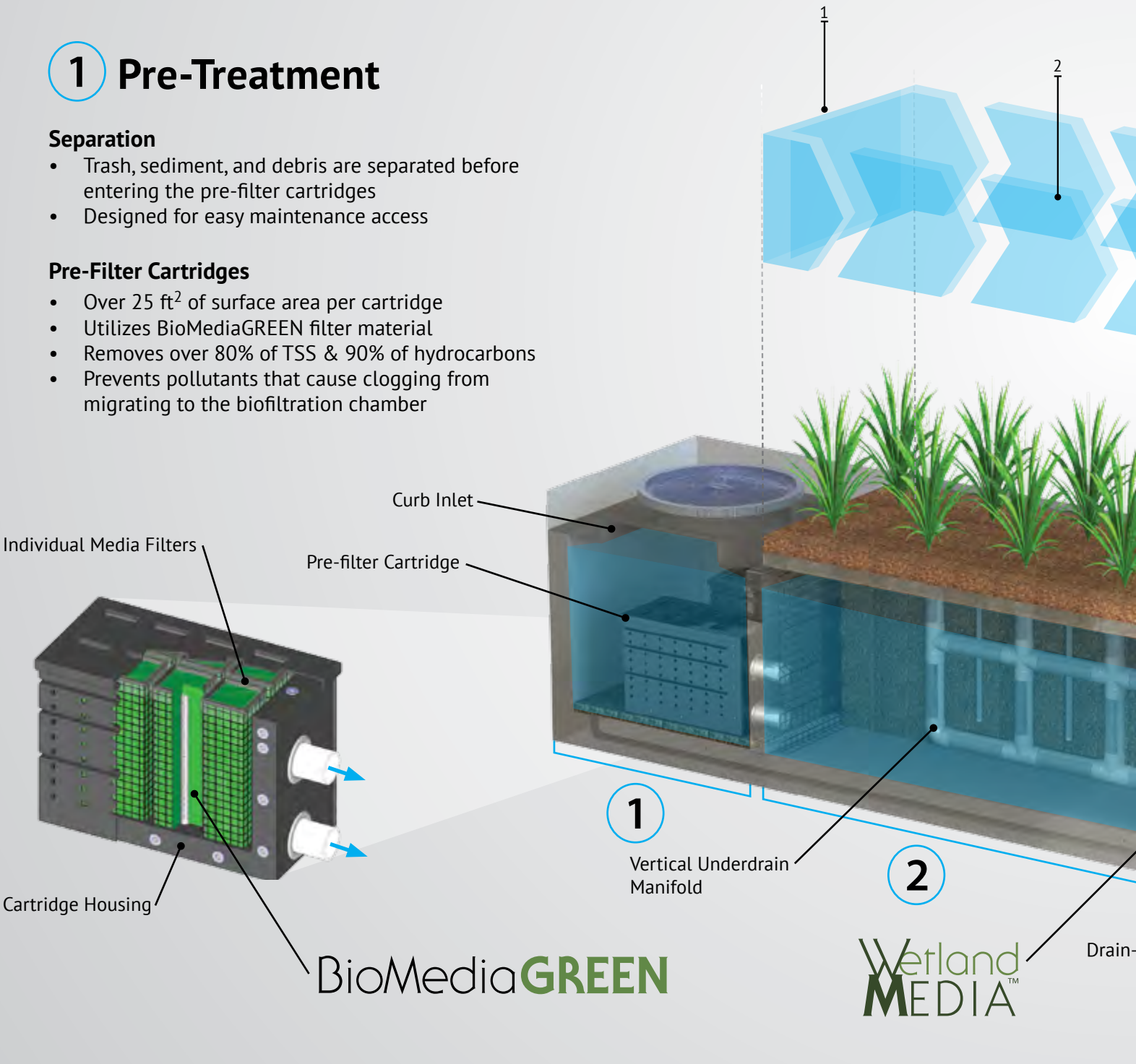
1 Pre-Treatment

Separation

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

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



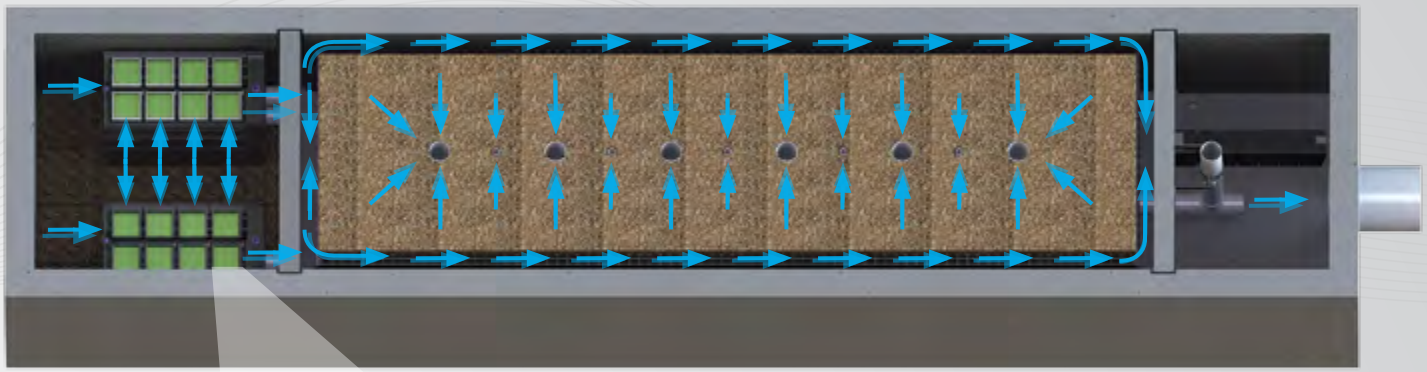


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

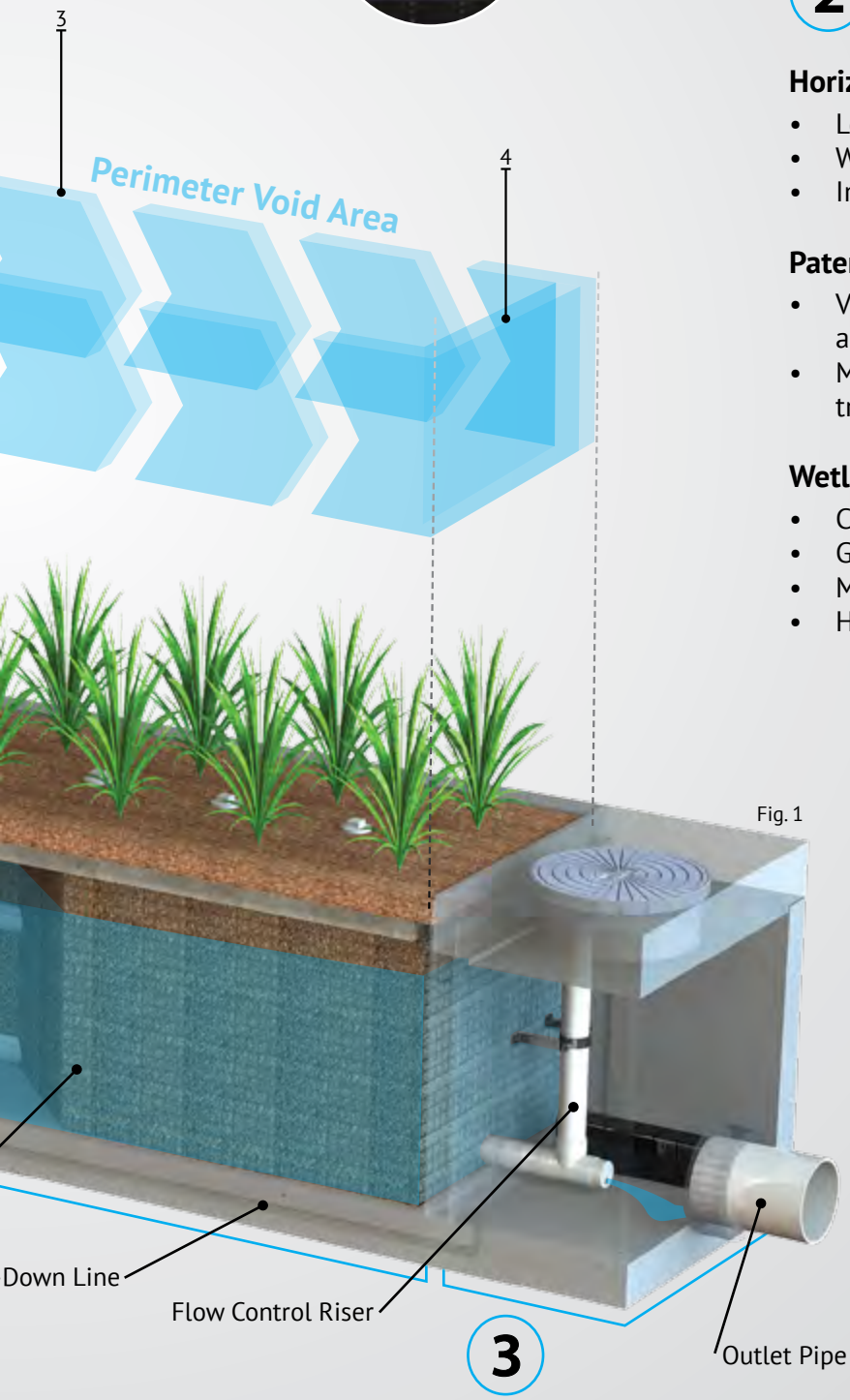


Fig. 1

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 light weight

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

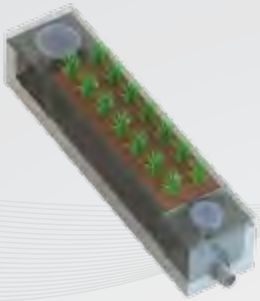
Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment 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 pre-treatment 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 bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment 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 pre-treatment chamber directly to the discharge chamber.

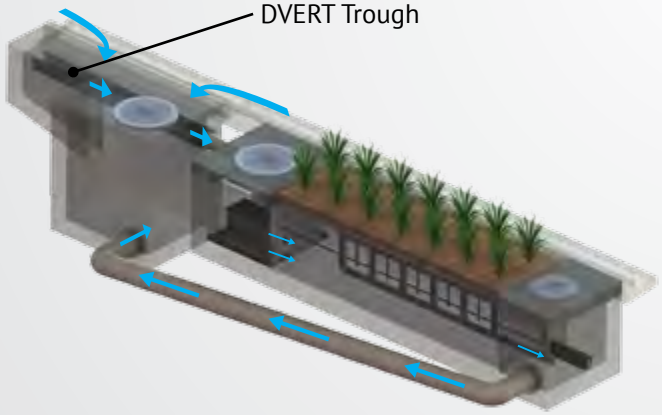
External Diversion Weir Structure

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 allows the MWS Linear to be installed anywhere space is available.

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 it's advanced pre-treatment 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 natures ability to process, transform, and remove even the most harmful pollutants.

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 DOE 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.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

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) Technical Criteria.

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 for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

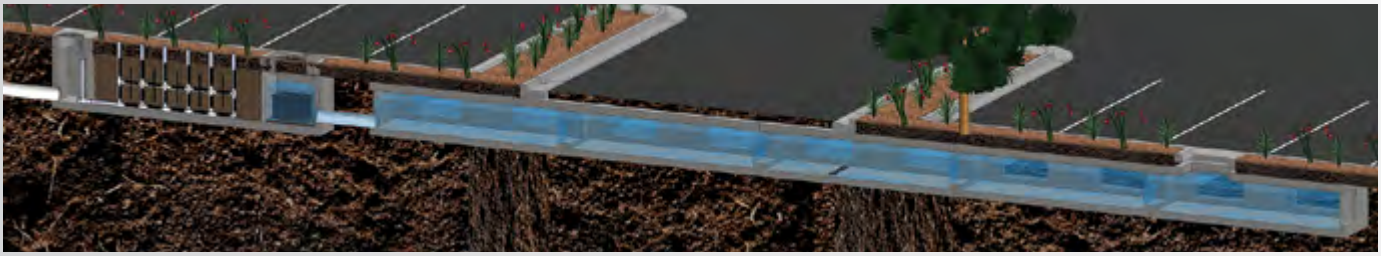
The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line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

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

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



Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
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-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

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 pre-cast 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 pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment 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.

Plant Selection

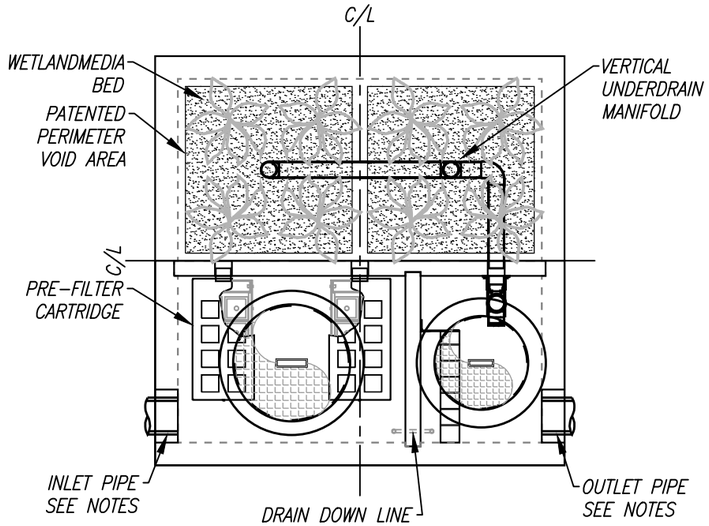
Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: 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 selecting the list relative to your project location's hardy zone.

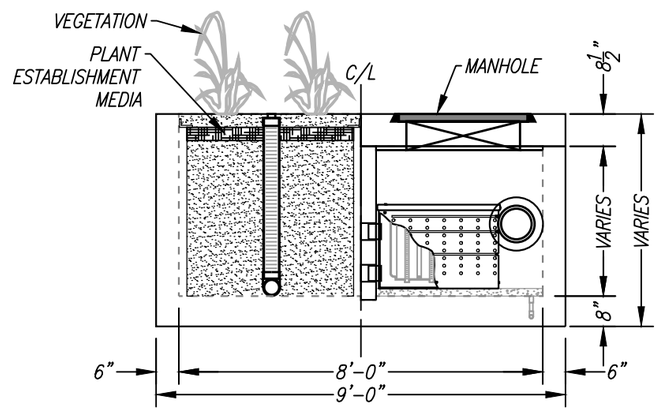
Please visit www.ModularWetlands.com/Plants for more information and various plant lists.

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.231	
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			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



LEFT END VIEW

INSTALLATION NOTES

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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 TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
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5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
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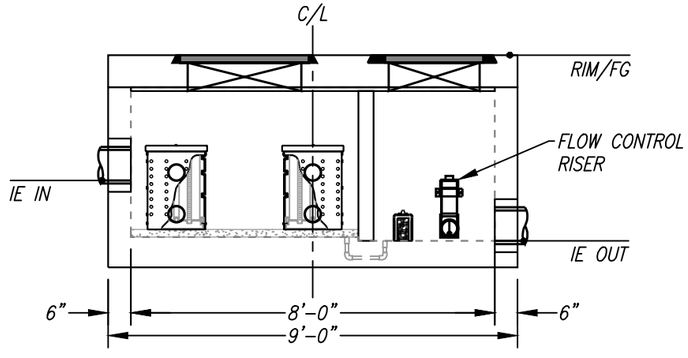
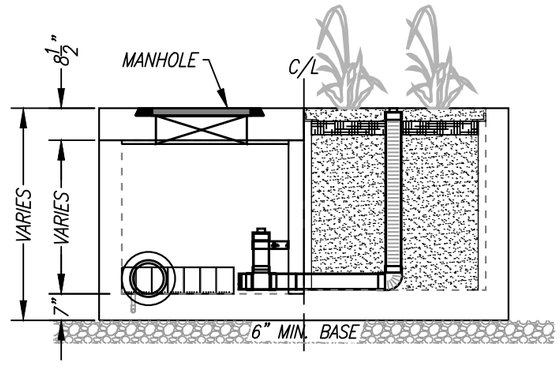


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.231
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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

5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.346	
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			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLANTER	ø24"
NOTES:			

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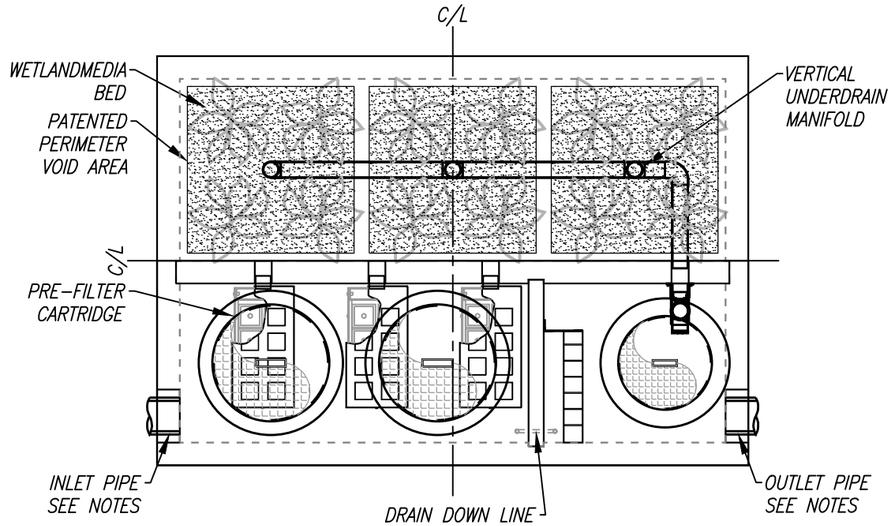
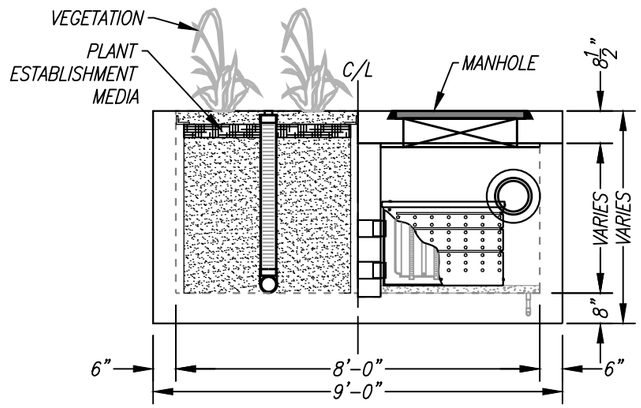


PLAN VIEW



LEFT END VIEW

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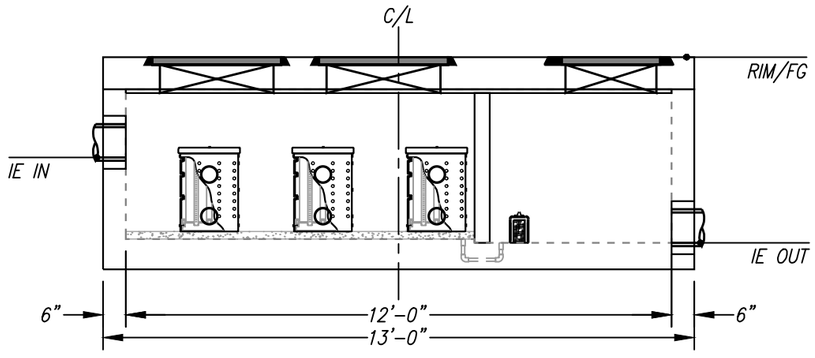
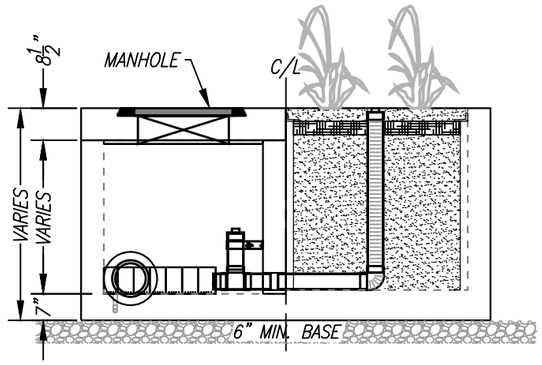


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5/23/19 10:LEF

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

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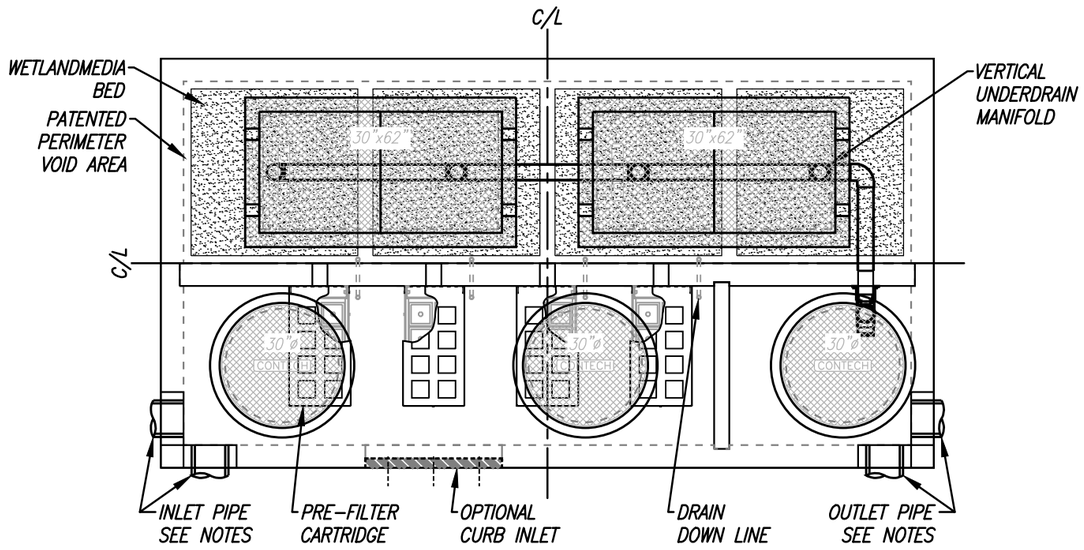
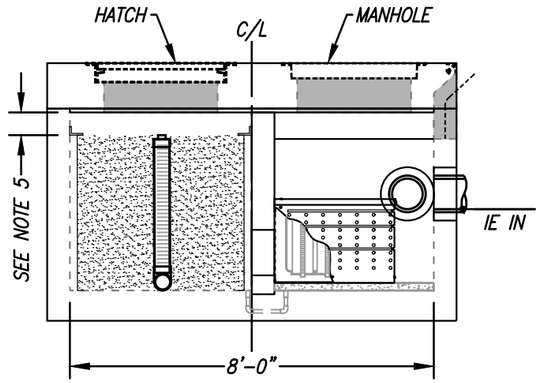
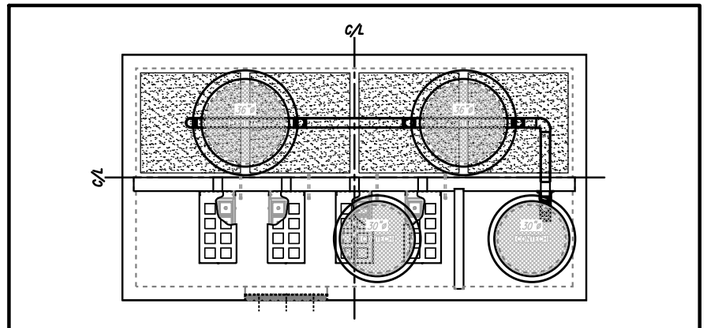


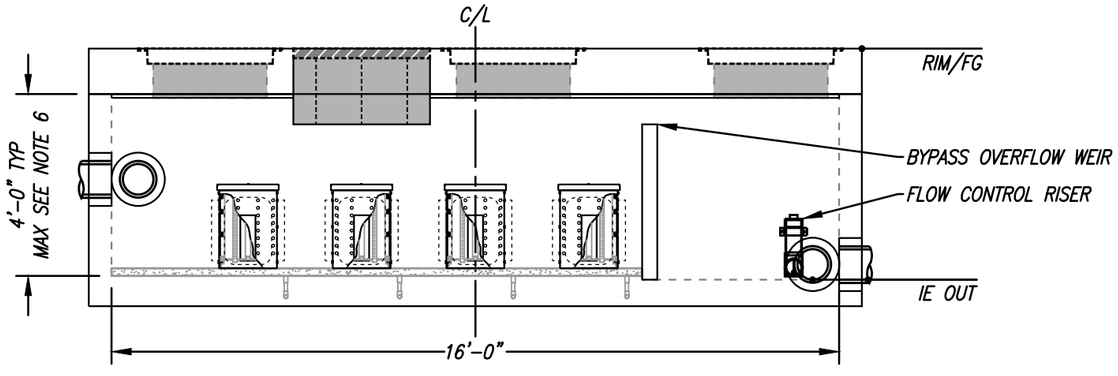
PLAN VIEW



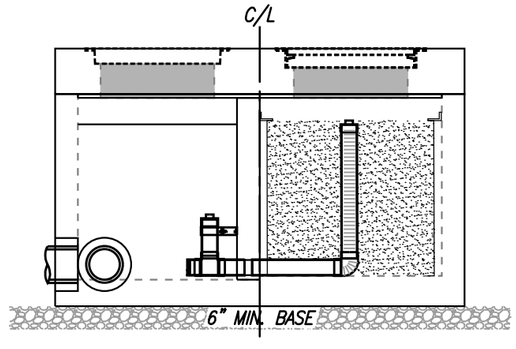
LEFT END VIEW



ALTERNATE DEEP ORIENTATION



ELEVATION VIEW



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4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. ALTERNATE DEEP FRAME & COVER ORIENTATION USED WHEN CEILING TO MEDIA DISTANCE IS 2.5' OR GREATER.
6. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

MWS-L-8-16-V-UG
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

WASHINGTON STATE DEPARTMENT OF ECOLOGY

July 2017

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, AND PHOSPHORUS TREATMENT

For the

MWS-Linear Modular Wetland

Ecology's Decision:

Based on Modular Wetland Systems, Inc. application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Basic treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

2. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Phosphorus treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

3. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Enhanced treatment

    - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

4. Ecology approves the MWS - Linear Modular Wetland Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:

    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
    - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
    - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

5. These use level designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use:

Applicants shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the MWS – Linear Modular Wetland Stormwater Treatment System units, in accordance with Modular Wetland Systems, Inc. applicable manuals and documents and the Ecology Decision.
2. Each site plan must undergo Modular Wetland Systems, Inc. review and approval before site installation. This ensures that site grading and slope are appropriate for use of a MWS – Linear Modular Wetland Stormwater Treatment System unit.
3. MWS – Linear Modular Wetland Stormwater Treatment System media shall conform to the specifications submitted to, and approved by, Ecology.
4. The applicant tested the MWS – Linear Modular Wetland Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to MWS – Linear Modular Wetland Stormwater Treatment Systems whether plants are included in the final product or not.
5. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

    - Typically, Modular Wetland Systems, Inc. designs MWS - Linear Modular Wetland systems for a target prefilter media life of 6 to 12 months.
    - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
    - Owners/operators must inspect MWS - Linear Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific

maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
    - Standing water remains in the vault between rain events, or
    - Bypass occurs during storms smaller than the design storm.
    - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
    - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6. Discharges from the MWS - Linear Modular Wetland Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant:	Modular Wetland Systems, Inc.
Applicant's Address:	*PO. Box 869* *Oceanside, CA 92054*

Application Documents:

- *Original Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011
- *Quality Assurance Project Plan*: Modular Wetland system – Linear Treatment System performance Monitoring Project, draft, January 2011.
- *Revised Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011
- *Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014*
- *Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014.*

Applicant's Use Level Request:

General use level designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The MWS – Linear Modular wetland is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 50-percent of Total Phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 30-percent of dissolved Copper from stormwater with influent concentrations between 0.005 and 0.020 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 60-percent of dissolved Zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/l.

Ecology Recommendations:

- Modular Wetland Systems, Inc. has shown Ecology, through laboratory and field-testing, that the MWS - Linear Modular Wetland Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Total phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The MWS-Linear Modular wetland has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Modular Wetland Systems, Inc. should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Modular Wetland Systems, Inc. should use these data to establish required maintenance cycles.
2. Modular Wetland Systems, Inc. should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Modular Wetland Systems, Inc. will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at http://www.modularwetlands.com/

Contact Information:

Applicant: Zach Kent
BioClean A Forterra Company.
398 Vi9a El Centro
Oceanside, CA 92058
zach.kent@forterrabp.com

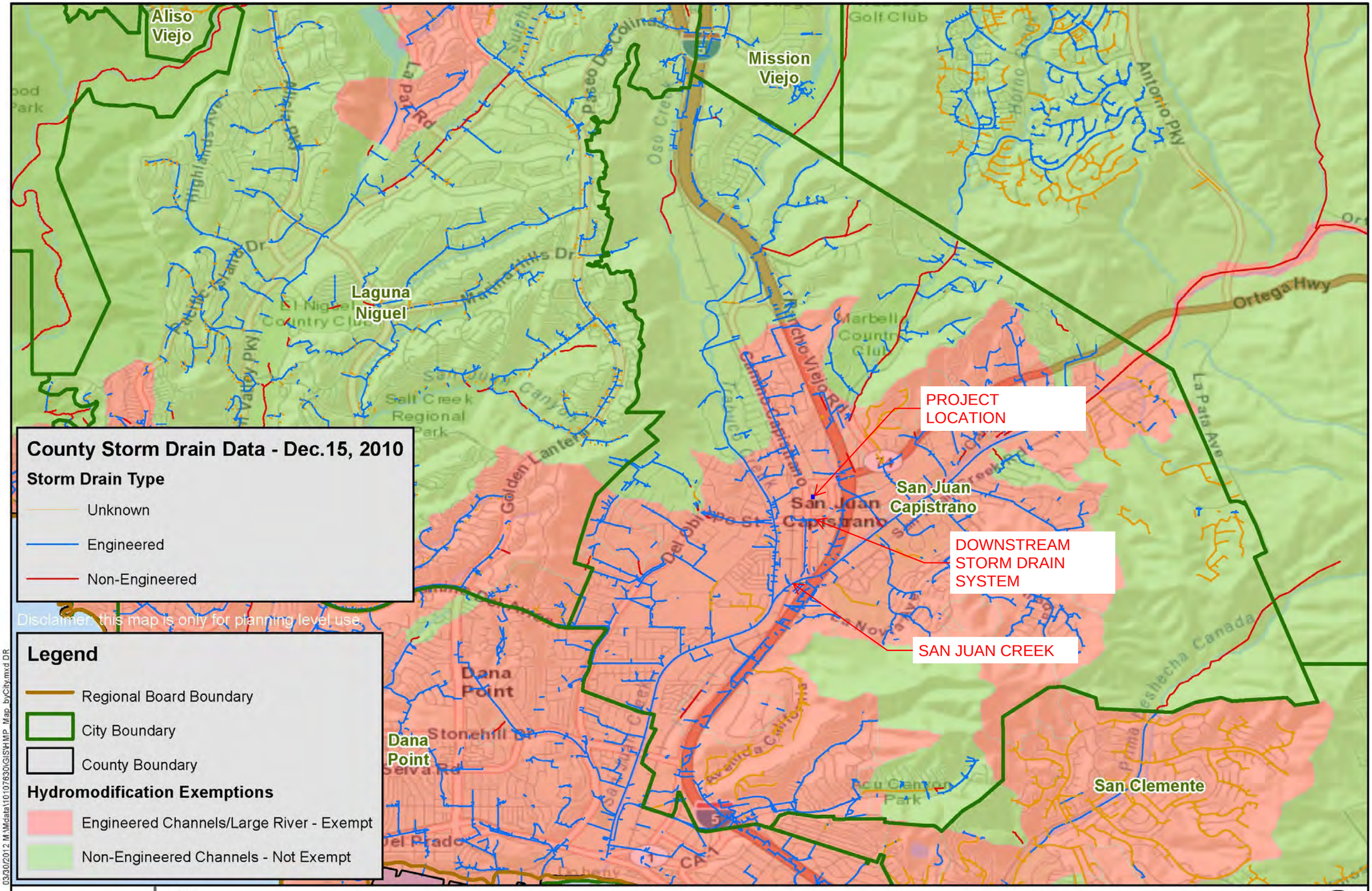
Applicant website: http://www.modularwetlands.com/

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Revision History

Date	**Revision**
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS-Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)



South Orange County Engineered Channel Exemption Areas

San Juan Capistrano Exemption Map

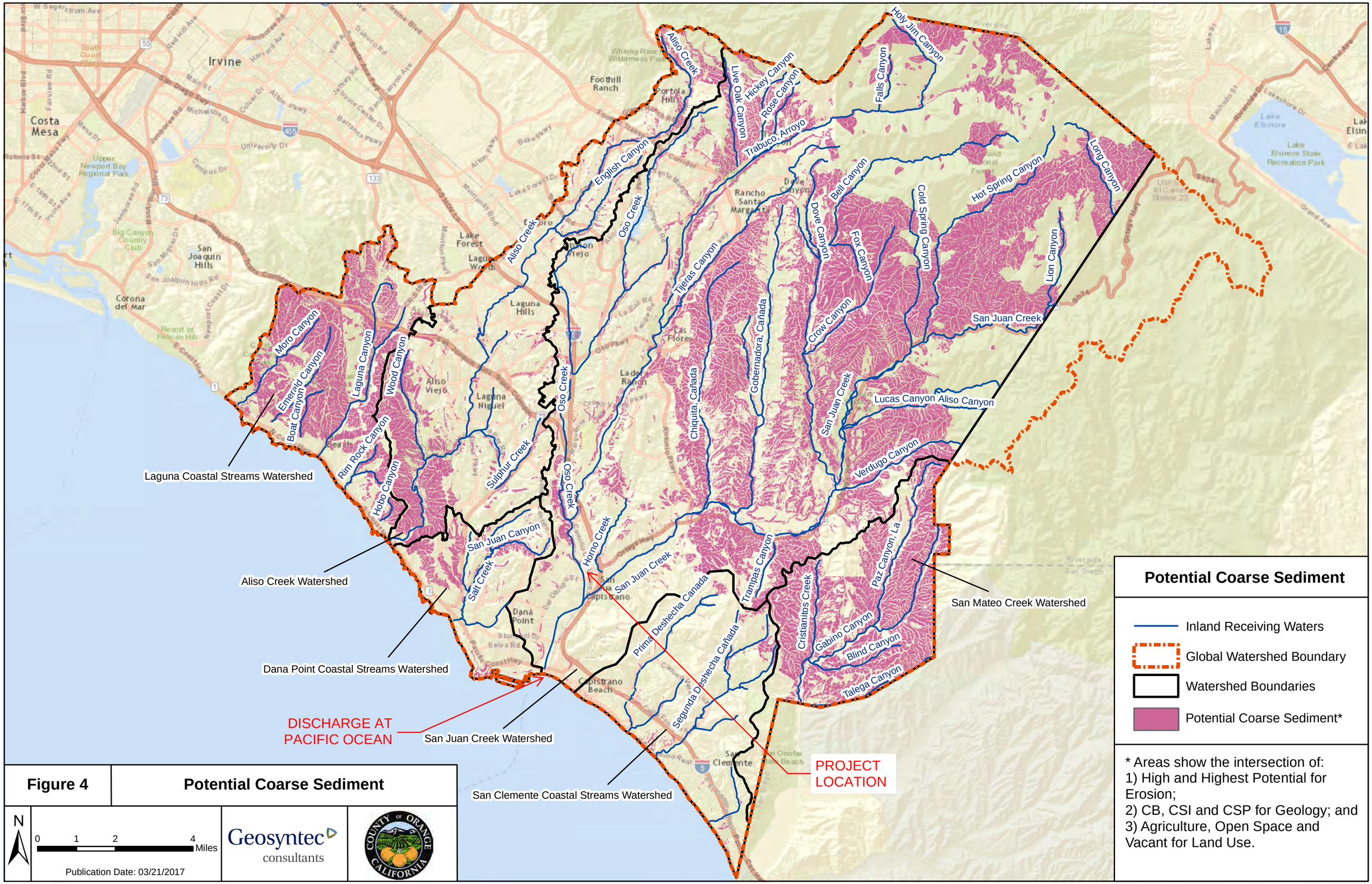
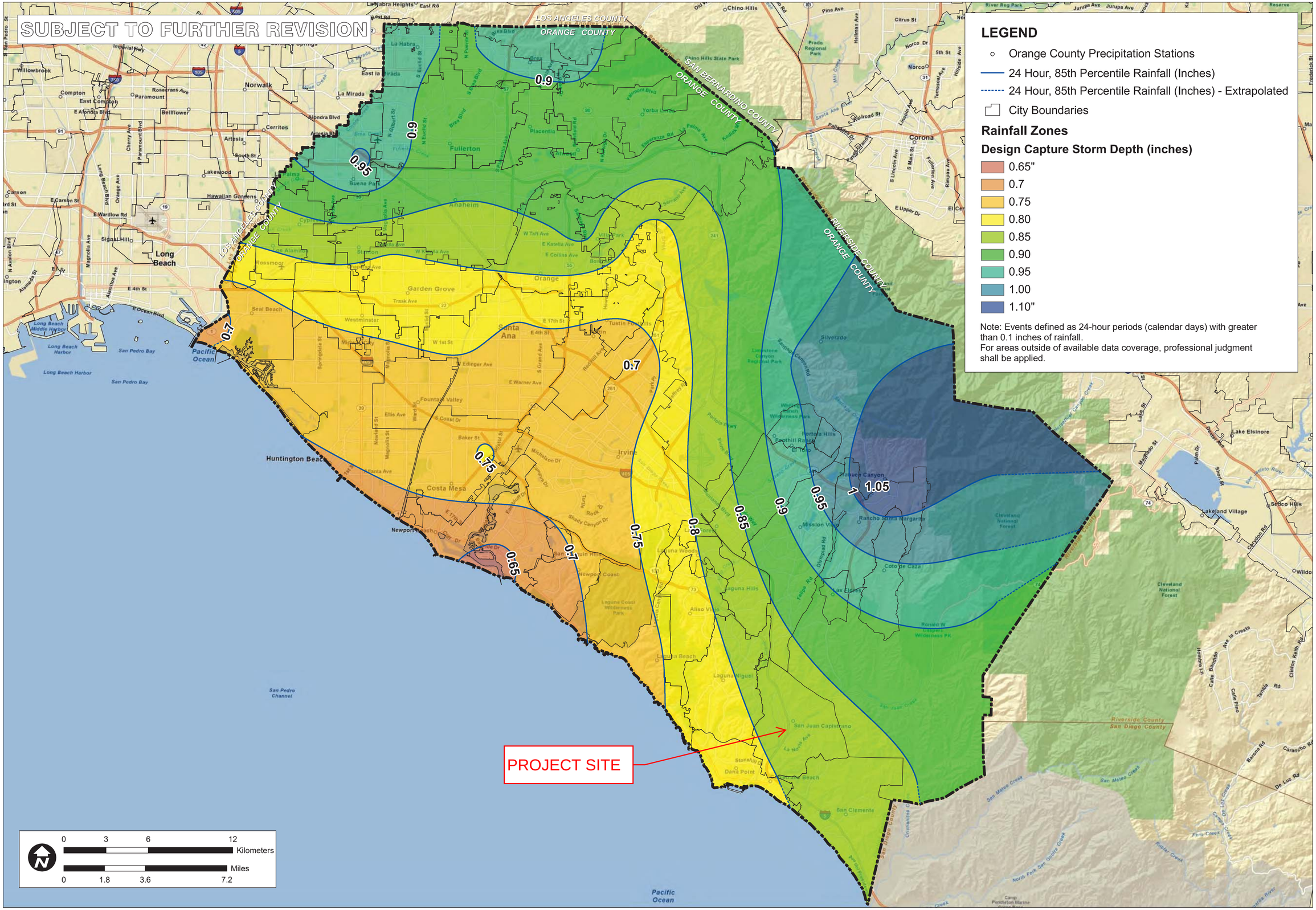


Figure 4 | **Potential Coarse Sediment**

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

SUBJECT TO FURTHER REVISION



LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

Rainfall Zones

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

0 3 6 12 Kilometers

0 1.8 3.6 7.2 Miles

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO., CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE XVI-1

Attachment D: Calculations

DMA A

Worksheet 7: Biofiltration Routing Method for Sizing Bioretention BMPs with Underdrains

Part 1: Calculate Design Storm Volume				
1	Enter design capture storm depth, *d* (inches)	d=	0.85	inches
2a	Enter the combined effect of provided HSCs, d_{HSC} (inches) (based on Worksheet 4)	d_{HSC}=	0	inches
2b	Calculate the remainder of the design capture storm depth, $d_{remainder}$ = d - d_{HSC}	$d_{remainder}$=	0.85	inches
3a	Enter DMA area tributary to BMP(s), *A* (acres) excluding any self-retaining areas	A=	0.197	acres
3b	Enter DMA Imperviousness, imp (unitless) after removal of self-retaining areas	imp=	0.75	
3c	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.71	
3d	Calculate runoff volume, *DCV = (C x $d_{remainder}$ x A x 43560 x (1/12)) (See Section E.2.2)*	DCV=	434	cu-ft
Part 2: Select Initial BMP Effective Footprint Area (can be iterative)				
4a	Calculate minimum area required for BMP to avoid premature clogging from Section E.4.1 (as percent of impervious tributary area)	$\%A_{min,clog}$=	5	%
4b	Calculate minimum area required for BMP to meet volume reduction requirements (Partial Infiltration category only) using Section E.4.2.	$\%A_{min,vol}$=	N/A	%
4c	Effective footprint of BMP as percent of tributary impervious area, must be equal to or greater than both $\%A_{min,clos}$ and $\%A_{min,vol}$ (as applicable)	$\%A_{BMP\_EFF}$	5	%
4d	Effective footprint of BMP ($\%A_{BMP\_EFF}$ * A * imp)	A_{BMP_EFF}	322	sq-ft
Part 3: Calculate Retention Volume in BMP				
5a	Determine gravel layer depth (18 inches or an alternative depth that will infiltrate within 48 hours)	D_{gravel}	12	inches
5b	Calculate effective retention storage depth of gravel layer D_{eff_gravel} = 0.4 porosity * D_{gravel} (Partial Infiltration Category only)	$D_{eff,gravel}$	4.8	inches
6	Calculate volume retained in gravel layer (Partial Infiltration Category only) Vgravel = $D_{eff,gravel}$ * A_{BMP_EFF} * (1 ft/12 inches)	V_{gravel_retain}	129	cu-ft
7a	Media depth D_{media} (24 inches typical) See BMP fact sheet (Appendix G)	D_{media}	24	inches
8b	Calculate volume retained in soil media layer, V_{media} =0.1*D_{media}*A_{BMP_EFF} * (1 ft/12 inches)	V_{media_retain}	64	cu-ft
Part 4: Calculate Required and Provided Biofiltered Volume				
9	Calculate the remaining DCV by subtracting the retained volume in the gravel layer and media layer from the initial design volume, DCV_{remain}= DCV-V_{gravel_retain}-V_{media_retain}	DCV_{remain}	241	cu-ft

Table E-4 (Rooftops and paths - None)

10	Calculate the required volume to be biofiltered by multiplying the remaining DCV by 1.5, V_{treat_req} = 1.5 * DCV_{remain}	V_{treat_req}	361	cu-ft
11a	Surface storage ponding depth (6-12 inches typical) See BMP fact sheet (Appendix G)	$D_{ponding}$	12	inches
11b	Calculate effective depth of the biofiltration storage above the underdrain, $D_{biofilter\_effective}$ = $D_{ponding}$ + 0.2 * D_{media}	$D_{biofilter\_effective}$	16.8	in
12a	Routing period (5 hours is default, proponent must justify any other value), T_{rout}	T_{rout}	5	hours
12b	Media infiltration rate (2.5 inches/hour default, proponent must justify any other value)	K_{media}	2.5	in/hr
12c	Calculate biofiltered volume, $V_{treated}$ = ($D_{biofilter\_effective}$ + K_{media}* T_{rout}) * A_{BMP_EFF} * (1 ft/12 in)	$V_{treated}$	786	cu-ft
13	Verify that $V_{treated}$ > V_{treat_req}. If it is not, must revise profile or footprint while conforming to criteria			

V_{treat} is greated than V_{trear_req} => BMP size in plans of 415sf is ok.

Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

Part 1: Determine the design storm intensity of the compact biofiltration BMP				
1	Enter the time of concentration, T_c (min) (See E.2.3**)** (account for upstream detention by increasing Tc to a maximum 60 minutes per Section E.3.5.2 if detention is provided)	T_c=	5	min
2	Using Figure E-7 or the figure included in the worksheet, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter capture efficiency corresponding to upstream HSCs and/or upstream BMPs, Y_2. Attach associated calculations.	Y_2 =	0	%
4	Using Figure E-7, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
5	Determine the design intensity that must be provided by BMP to achieve 80 percent capture, $I_{design}= I_1-I_2$	$I_{design\_80\%}$ =	0.26	in/hr
Part 2: Calculate the design flowrate of the compact biofiltration BMP (Section E.2.6)				
6a	Enter DMA area tributary to BMP (s), *A* (acres)	A=	1.400	acres
6b	Enter DMA Imperviousness, imp (unitless)	imp=	0.84	
6c	Calculate runoff coefficient, *c= (0.75 x imp) + 0.15*	c=	0.78	
6d	Calculate flowrate to achieve 80 percent capture, $Q_{80\%}$= *(c x* I_{design} *x A)*	$Q_{80\%}$=	0.28	cfs
7	Calculate design flowrate, $Q_{design}= Q_{80\%}$ *x 150%*	Q_{design}=	0.42	cfs
Part 3: Demonstrate that Supplemental Retention BMPs Conform to Volume Reduction Targets (Only DMAs Categorized as "Biotreatment with Partial Infiltration")				
8	Describe system, including features to maximize volume reduction (if applicable): N/A			
9	Summarize calculations to demonstrate that volume reduction targets are met, where feasible and applicable. N/A			

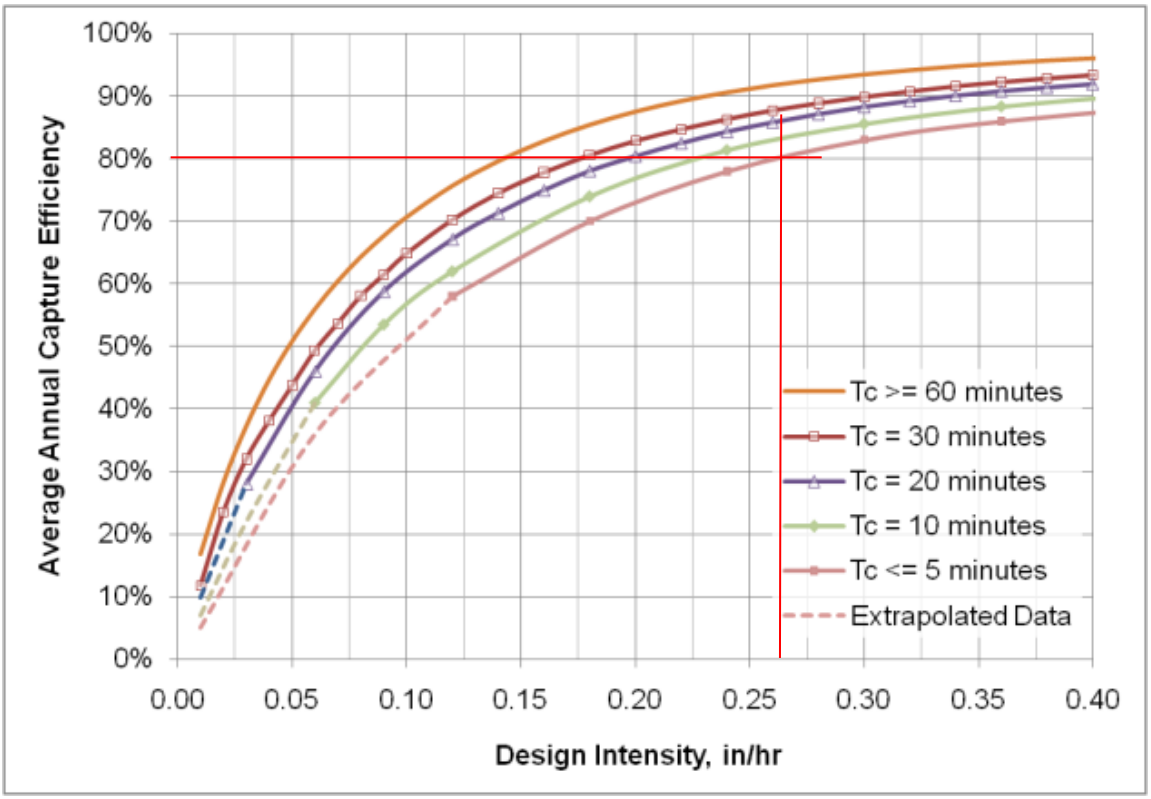
Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

Supporting Calculations

Provide time of concentration assumptions:

The Orange County Hydrology Manual was used to determine the T_c for this drainage area using software called HydroCAD. See Drainage Study for more details.

Graphical Operations



Provide supporting graphical operations in figure above.

Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

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2	Using Figure E-7 or the figure included in the worksheet, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter capture efficiency corresponding to upstream HSCs and/or upstream BMPs, Y_2. Attach associated calculations.	Y_2 =	0	%
4	Using Figure E-7, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
5	Determine the design intensity that must be provided by BMP to achieve 80 percent capture, $I_{design}= I_1-I_2$	$I_{design\_80\%}$ =	0.26	in/hr
Part 2: Calculate the design flowrate of the compact biofiltration BMP (Section E.2.6)				
6a	Enter DMA area tributary to BMP (s), *A* (acres)	A=	0.862	acres
6b	Enter DMA Imperviousness, imp (unitless)	imp=	0.85	
6c	Calculate runoff coefficient, *c= (0.75 x imp) + 0.15*	c=	0.79	
6d	Calculate flowrate to achieve 80 percent capture, $Q_{80\%}$= *(c x* I_{design} *x A)*	$Q_{80\%}$=	0.18	cfs
7	Calculate design flowrate, $Q_{design}= Q_{80\%}$ *x 150%*	Q_{design}=	0.27	cfs
Part 3: Demonstrate that Supplemental Retention BMPs Conform to Volume Reduction Targets (Only DMAs Categorized as "Biotreatment with Partial Infiltration")				
8	Describe system, including features to maximize volume reduction (if applicable): N/A			
9	Summarize calculations to demonstrate that volume reduction targets are met, where feasible and applicable. N/A			

Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

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The Orange County Hydrology Manual was used to determine the T_c for this drainage area using software called HydroCAD. See Drainage Study for more details.

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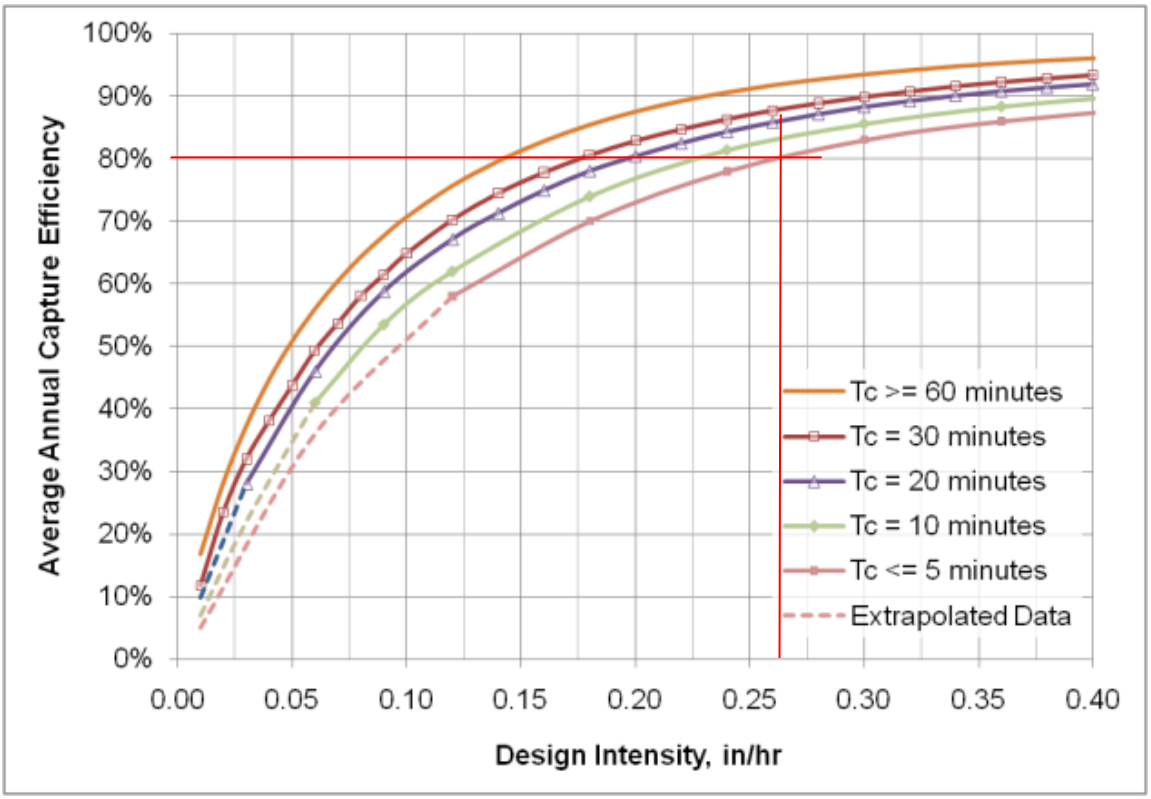

Provide supporting graphical operations in figure above.

Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

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1	Enter the time of concentration, T_c (min) (See E.2.3**)** (account for upstream detention by increasing Tc to a maximum 60 minutes per Section E.3.5.2 if detention is provided)	T_c=	5	min
2	Using Figure E-7 or the figure included in the worksheet, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter capture efficiency corresponding to upstream HSCs and/or upstream BMPs, Y_2. Attach associated calculations.	Y_2 =	0	%
4	Using Figure E-7, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
5	Determine the design intensity that must be provided by BMP to achieve 80 percent capture, $I_{design}= I_1-I_2$	$I_{design\_80\%}$ =	0.26	in/hr
Part 2: Calculate the design flowrate of the compact biofiltration BMP (Section E.2.6)				
6a	Enter DMA area tributary to BMP (s), *A* (acres)	A=	0.581	acres
6b	Enter DMA Imperviousness, imp (unitless)	imp=	0.75	
6c	Calculate runoff coefficient, *c= (0.75 x imp) + 0.15*	c=	0.71	
6d	Calculate flowrate to achieve 80 percent capture, $Q_{80\%}$= *(c x* I_{design} *x A)*	$Q_{80\%}$=	0.11	cfs
7	Calculate design flowrate, $Q_{design}= Q_{80\%}$ *x 150%*	Q_{design}=	0.16	cfs
Part 3: Demonstrate that Supplemental Retention BMPs Conform to Volume Reduction Targets (Only DMAs Categorized as "Biotreatment with Partial Infiltration")				
8	Describe system, including features to maximize volume reduction (if applicable): N/A			
9	Summarize calculations to demonstrate that volume reduction targets are met, where feasible and applicable. N/A			

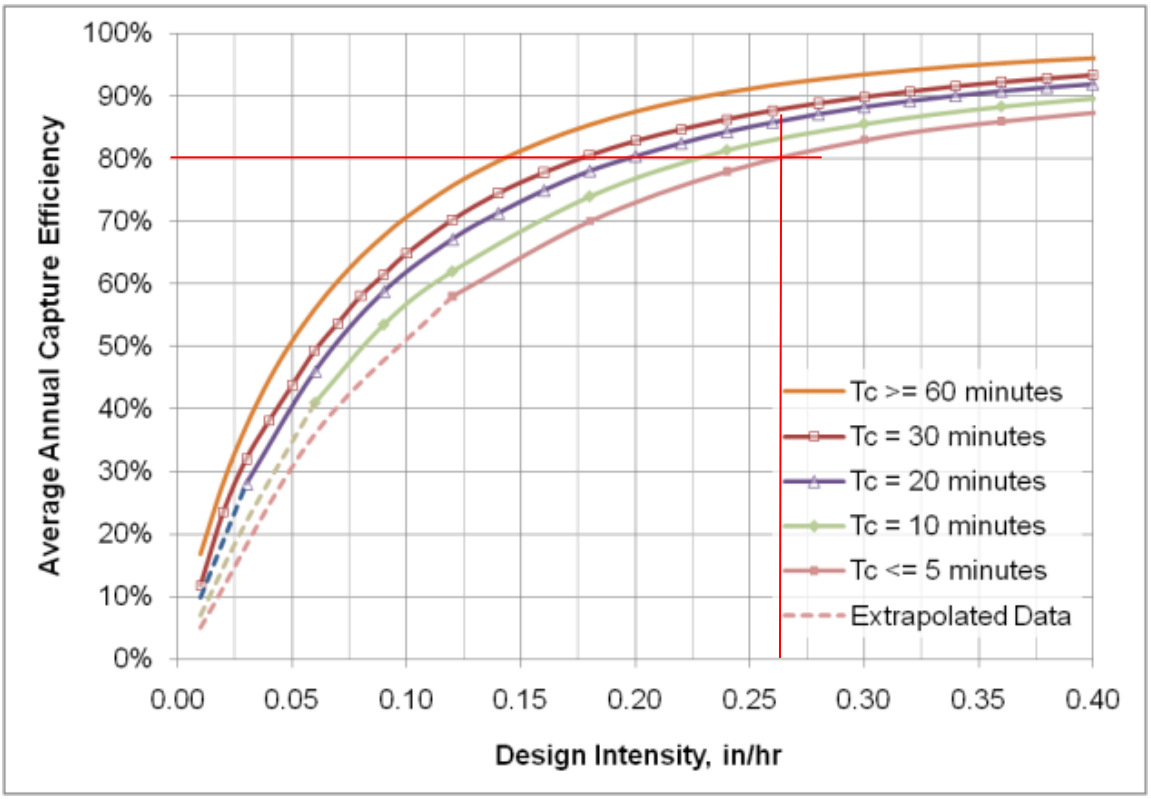
Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

Supporting Calculations

Provide time of concentration assumptions:

The Orange County Hydrology Manual was used to determine the T_c for this drainage area using software called HydroCAD. See Drainage Study for more details.

Graphical Operations



Provide supporting graphical operations in figure above.

Attachment E: Geotechnical Report

GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM
engineering group, inc.

GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED APARTMENT AND RETAIL DEVELOPMENT
31872, 31878, 31882 CAMINO CAPISTRANO
SAN JUAN CAPISTRANO, CALIFORNIA

SALEM PROJECT NO. 3-220-0514
JULY 28, 2020

PREPARED FOR:

MS. TINA PRATER
FRONTIER REAL ESTATE INVESTMENTS
610 NEWPORT CENTER DRIVE, SUITE 1520
NEWPORT BEACH, CA 92660

PREPARED BY:

SALEM ENGINEERING GROUP, INC.
8711 MONROE COURT, SUITE A
RANCHO CUCAMONGA, CA 91730
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8711 Monroe Court, Suite A
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Fax (909) 980-6435

July 28, 2020 Project No. 3-220-0514

Ms. Tina Prater
Frontier Real Estate Investments
610 Newport Center Drive, Suite 1520
Newport Beach, CA 92660

SUBJECT: GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED APARTMENT AND RETAIL DEVELOPMENT
31872, 31878, 31882 CAMINO CAPISTRANO
SAN JUAN CAPISTRANO, CALIFORNIA

Dear Ms. Prater:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Geotechnical Engineering Investigation report for the Proposed Apartment and Retail Development to be located at the subject site.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Clarence Jiang, GE
Senior Geotechnical Engineer
RGE 2477

R. Sammy Salem, MS, PE, GE
Principal Engineer
RCE 52762 / RGE 2549

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8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
Phone (909) 980-6455
Fax (909) 980-6435

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED APARTMENT AND RETAIL DEVELOPMENT
31872, 31878, 31882 CAMINO CAPISTRANO
SAN JUAN CAPISTRANO, CALIFORNIA

1. PURPOSE AND SCOPE

This report presents the results of our Geotechnical Engineering Investigation for the Proposed Apartment and Retail Development to be located in the City of San Juan Capistrano, California (see Figure 1, Vicinity Map).

The purpose of our geotechnical engineering investigation was to observe and sample the subsurface conditions encountered at the site, and provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed. The scope of our services for the investigation does not include a slope stability evaluation of the site.

The scope of this investigation included a field exploration, percolation testing, laboratory testing, engineering analysis and the preparation of this report. Our field exploration was performed on July 9, 2020 and included the drilling of nine (9) small-diameter soil borings to a maximum depth of 36½ feet at the site. Additionally, two (2) percolation tests were performed at a depth of approximately 5½ and 10 feet below the existing grade for the determination of the percolation rates. The locations of the soil borings and percolation tests are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation, exploratory boring logs are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties for engineering analyses. Appendix B presents the laboratory test results in tabular and graphic format. The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report. Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

2. PROJECT DESCRIPTION

Based on the information provided to us, we understand that the proposed development of the site will include construction of three 3-story, 96-unit apartment buildings with garage and 2 retail buildings with associated parking and landscaping on a 3.16-acre land. Maximum wall load is expected to be on the order of 5 kips per linear foot. Maximum column load is expected to be on the order of 200 kips. Floor slab soil bearing pressure is expected to be on the order of 150 psf. On-site parking and landscaping are planned to be associated with the development.

A grading plan was not available at the time of preparation of this report. As the site was recently graded with up to 20 feet of fill, we anticipate that cuts and fills during the earthwork will be moderate and limited to providing level building pads and positive site drainage. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified. The site configuration and locations of proposed improvements are shown on the Site Plan, Figure 2.

3. SITE LOCATION AND DESCRIPTION

The subject site is irregular in shape and encompasses approximately 3.16 acres. The site is located at the southeast corner of Camino Capistrano and Forster Street in the City of San Juan Capistrano, California (see Vicinity Plan, Figure 1).

The site was previously occupied by 3 commercial buildings with parking and landscaping. The upper structures of the former buildings have been demolished. Most of the concrete slabs, footings, pavements and all hardscapes have remained on-site. Weeds have been growing within the site. Miscellaneous debris was also present around the site. An abandoned water fountain is located in the northwestern-most portion of the site. Modular “Mobile Mini” units are located in the northeastern-most portion of the site.

The southern and southeastern portions of the site are graded lower than the rest of the site, and are connected to the upper portions of the site by stairs, retaining walls, slopes and driveways. The elevations of the site range from 100 feet in the southeast portion of the site to 115 feet in the northwest portion of the site based on Google Earth imagery.

4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-1 through B-9) were drilled on July 9, 2020 in the area shown on the Site Plan, Figure 2. The test borings were advanced with 6-inch diameter solid flight augers rotated by a truck-mounted CME 55 drill rig. The test borings were extended to a maximum depth of 36½ feet below existing grade. Drilling was limited due to auger refusal on dense/hard soil.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer and stratification lines were approximated on the basis of observations made at the time of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2487).

A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A." The logs of the test borings are presented in Appendix "A." The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The location of the test borings were determined by measuring from features shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted. Soil samples were obtained from the test borings at the depths shown on the logs of borings. The MCS samples were recovered and capped at both ends to preserve the samples at their natural

moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content. The borings were backfilled with soil cuttings after completion of the drilling.

5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, density, shear strength, consolidation potential, expansion index, plasticity index, maximum density and optimum moisture determination, and gradation of the materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and the results of laboratory test are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

6. GEOLOGIC SETTING

The site is located within the Peninsular Ranges Geomorphic Province along the coastal strip of southern Orange County. The site is in the San Joaquin Hills which are comprised primarily of fine-grained sedimentary rocks of the Capistrano Formation and Monterey Formation and coarse grained rocks of the San Onofre Breccia and Topanga Formation. The site is located near the confluence of the Trabuco Creek and San Juan Creek. The earth materials onsite are comprised primarily of artificial fill and Quaternary age alluvium deposits. The alluvium deposits from the Trabuco Creek and San Juan Creek extend to a depth of up to 200 feet in the site vicinity. Deposits encountered on the subject site during exploratory drilling are discussed in detail in this report.

7. GEOLOGIC HAZARDS

7.1 Faulting and Seismicity

Based on the proximity of several dominant active faults and seismogenic structures, as well as the historic seismic record, the area of the subject site is considered subject to relatively high seismicity. The seismic hazard most likely to impact the site is ground-shaking due to a large earthquake on one of the major active regional faults. Moderate to large earthquakes have affected the area of the subject site within historic time.

There are no known active fault traces in the project vicinity. The project area is not within an Alquist-Priolo Earthquake Fault (Special Studies) Zone and will not require a special site investigation by an Engineering Geologist. Soils on site are classified as Site Class D in accordance with Chapter 16 of the California Building Code. The proposed structures are determined to be in Seismic Design Category D.

To determine the distance of known active faults within 100 miles of the site, we used the United States Geological Survey (USGS) web-based application *2008 National Seismic Hazard Maps - Fault Parameters*. Site latitude is 33.4997° North; site longitude is 117.6614° West. The ten closest active faults are summarized below in Table 7.1.

TABLE 7.1
REGIONAL FAULT SUMMARY

Fault Name	Distance to Site (miles)	Maximum Earthquake Magnitude, M_w
Newport Inglewood Connected alt 1	5.6	7.5
San Joaquin Hills	6.8	7.1
Newport-Inglewood, alt 1	17.6	7.2
Elsinore; T+J+CM	19.5	7.6
Elsinore; W+GI+T+J+CM	20.2	7.9
Palos Verdes Connected	20.6	7.7
Coronado Bank	21.2	7.4
Chino, alt 2	23.0	6.8
Elsinore; W	23.1	7.0
Chino, alt 1	24.6	6.7

The faults tabulated above and numerous other faults in the region are sources of potential ground motion. However, earthquakes that might occur on other faults throughout California are also potential generators of significant ground motion and could subject the site to intense ground shaking.

7.2 Surface Fault Rupture

The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards. No active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low.

7.3 Ground Shaking

Seismic coefficients and spectral response acceleration values were developed based on the 2019 California Building Code (CBC). The CBC methodology for determining design ground motion values is based on the Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, which incorporate both probabilistic and deterministic seismic ground motion.

Based on the 2019 CBC, a Site Class D represents the on-site soil conditions with standard penetration resistance, N-values, averaging greater than 15 blow per foot but less than 50 blows per foot in the upper 100 feet below site grade. A table providing the recommended design acceleration parameters for the project site, based on a Site Class D designation, is included in Section 9.2.1 of this report. Based on the Office of Statewide Health Planning and Development (OHSPD) Seismic Design Maps, the estimated design peak ground acceleration adjusted for site class effects (PGA_M) was determined to be 0.554g (based on both probabilistic and deterministic seismic ground motion).

7.4 Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile. However,

liquefaction has occurred in soils other than clean sand. Groundwater was encountered at a depth of approximately 29 feet below ground surface during this investigation. Based on the State of California Hazard Zone Report 049, Dana Point Quadrangle, Plate 1.2, the historically highest groundwater is at a depth of approximately 5 feet below ground surface. The soils encountered within the depth of 50 feet on the project site consisted predominately of loose to very dense clayey sand with various amounts of gravel, clayey gravel with sand, and silty gravel with sand; and firm to hard sandy clay, clay with sand, clayey silt with sand, and silt with sand. Low to very low cohesion strength is associated with the sandy soil. A seismic hazard, which could cause damage to the proposed development during seismic shaking, is the post-liquefaction settlement of the liquefied sands. Based on the State of California, Seismic Hazard Zone Map, Dana Point Quadrangle, dated December 21, 2001, the site is located within the potential liquefaction zone.

The potential for soil liquefaction during a seismic event was calculated using LiqIT computer program (version 4.7.5) developed by GeoLogismiki of Greece. For the analysis, a maximum earthquake magnitude of 7.5 M_W, a peak horizontal ground surface acceleration of 0.55g (with a probability of exceedance in 50 years), and a groundwater depth of 5 feet were considered appropriate for the liquefaction analysis. The liquefaction analysis indicated that the site soils had a low potential for liquefaction under seismic conditions. The total liquefaction-induced settlement was calculated to be 1¼ inches. The liquefaction-induced differential settlement of the site is expected to be on the order of 0.63 inches over 40 feet. The liquefaction analyses are included in Appendix A.

7.5 Lateral Spreading

Lateral spreading is a phenomenon in which soils move laterally during seismic shaking and is often associated with liquefaction. The amount of movement depends on the soil strength, duration and intensity of seismic shaking, topography, and free face geometry. Due to the relatively flat site topography, we judge the likelihood of lateral spreading to be low.

7.6 Landslides

There are no known landslides at the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a hazard to this project.

7.7 Tsunamis and Seiches

The site is not located within a coastal area. Therefore, tsunamis (seismic sea waves) are not considered a significant hazard at the site. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.

8. SOIL AND GROUNDWATER CONDITIONS

8.1 Subsurface Conditions

The subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the soils within the depth of exploration consisted of up to 4 feet of fill soils underlain by alluvium consisting of loose to very dense clayey sand with various amounts of gravel, and silty gravel with sand;

and firm to hard sandy clay, clay with sand, clayey silt with sand, and silt with sand. The fill soils consisted of medium dense to very dense clayey sand with various amounts of gravel, silty gravel with sand; and firm to very stiff sandy clay and clay with sand.

Deeper fill may be present on site between our test boring locations. Verification of the extent of fill should be determined during site grading. Any undocumented/uncertified or uncompacted fill encountered during grading should be removed and replaced with engineered fill. Field and laboratory tests suggest that the deeper native material are moderately strong and slightly compressible. These soils extended to the termination depth of our borings.

The soils were classified in the field during the drilling and sampling operations. The stratification lines were approximated by the field engineer on the basis of observations made at the time of drilling. The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted.

The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The locations of the test borings were determined by measuring from feature shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

8.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free groundwater was encountered at depths of approximately 29 feet below existing grade during this investigation. Based on the State of California Hazard Zone Report 049, Dana Point Quadrangle, Plate 1.2, the historically highest groundwater is at a depth of approximately 5 feet below ground surface.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

8.3 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water.

A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride.

The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be 253 mg/kg. ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 8.3 below.

TABLE 8.3
WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS

Water Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Minimum Concrete Compressive Strength	Cementations Materials Type
0.0253	Not Applicable	S0	N/A	2,500 psi	No Restriction

The water-soluble chloride concentration detected in saturation extract from the soil samples was 20 mg/kg. This level of chloride concentration is considered to be mildly corrosive. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed.

8.4 Percolation Testing

Three percolation tests (P-1 and P-2) were performed at the assumed infiltration system areas, and were conducted in accordance with the guidelines established by the County of Orange. Results of the falling head tests are presented in the attachments to this report. The approximate locations of the percolation tests are shown on the attached Site Plan, Figure 2. Two boreholes were advanced to the depths shown on the percolation test worksheets. The holes were pre-saturated before percolation testing commenced. Percolation rates were measured by filling the test holes with clean water and measuring the water drops at a certain time interval. The percolation/infiltration rate data are presented in tabular format in Appendix A. The difference in the percolation rates are reflected by the varied type of soil materials at the bottom of the test hole. The test results are as follows:

PERCOLATION TEST RESULTS

Test No.	Depth (feet)	Measured Percolation Rate (min/inch)	Tested Infiltration Rate* (inch/hour)	Soil Type**
P-1	10	250.0	**0.01**	Sandy CLAY (CL)
P-2	5.5	27.8	**0.27**	Clayey SAND (SC)

*** Tested infiltration Rate = (ΔH 60 r) / (Δt(r + 2H_{avg}))**
**** At bottom of drilled holes**

The soil infiltration or percolation rates are based on tests conducted with clear water. The infiltration/percolation rates may vary with time as a result of soil clogging from water impurities. The infiltration/percolation rates will deteriorate over time due to the soil conditions and an appropriate factor of safety (FS) should be applied to the tested infiltration rate for the final design infiltration rate. The FS should be determined by the civil engineer based on Worksheet H of the County of Orange Technical Guidance Documents (TGD).

The soils may also become less permeable to impermeable if the soil is compacted. Thus, periodic maintenance consisting of clearing the bottom of the drainage system of clogged soils should be expected. The infiltration/percolation rate may become slower if the surrounding soil is wet or saturated due to prolonged rainfalls. Additional percolation tests should be conducted at bottom of the drainage system during construction to verify the infiltration/percolation rate. Groundwater, if closer to the bottom of the drainage system, will also reduce the infiltration/percolation rate.

The scope of our services did not include a groundwater study and was limited to the performance of percolation testing and soil profile description, and the submitted data only. Our services did not include those associated with septic system design. Neither did services include an Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring logs regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices. The work conducted through the course of this investigation, including the preparation of this report, has been performed in accordance with the generally accepted standards of geotechnical engineering practice, which existed in the geographic area at the time the report was written. No other warranty, express or implied, is made. Please be advised that when performing percolation testing services in relatively small diameter borings, that the testing may not fully model the actual full scale long term performance of a given site. This is particularly true where percolation test data is to be used in the design of large infiltration system such as may be proposed for the site. The measured percolation rate includes dispersion of the water at the sidewalls of the boring as well as into the underlying soils. Subsurface conditions, including percolation rates, can change over time as fine-grained soils migrate. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction of improvements at the site as planned, provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing program, and our understanding of the proposed development at this time.

9.1.2 The primary geotechnical constraints identified in our investigation is the presence of fill material, potentially collapsible soil, and potentially expansive material at the site. Recommendations to mitigate the effects of these soils are provided in this report.

9.1.3 Up to 4 feet of fill/potential fill soils were encountered in our test borings. Deeper fill may be present on site between our test boring locations. Undocumented/uncertified fill materials are

not suitable to support any future structures and should be excavated and recompacted in accordance with section 9.5 of this report. The extent and consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify the fill condition.

9.1.4 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is suspected that possible demolition activities of the existing structures may disturb the upper soils. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.

9.1.5 Some of the upper soils within the project site are identified primarily as clayey sand and sandy clay. The clayey soils exhibit a slightly moderate swell potential and are subject to volumetric changes if moisture contents vary. The clayey soil, in its present condition, possess hazards to construction in terms of possible post-construction movement of the foundations and floor systems if no mitigation measures are employed. The estimated swell pressures of the clayey material may cause movement affecting slabs and brittle exterior finishes. Accordingly, measures are considered necessary to reduce anticipated soil movement.

9.1.6 To minimize the potential soil movement due to expansive soil conditions, it is recommended that the upper 18 inches of soil beneath the required granular aggregate subbase within slab on grade and exterior flatwork areas be removed and replaced with Non-Expansive Engineered Fill meeting the requirements of section 9.4. Other than complete soil replacement, mitigation measures will not eliminate post-construction soil movement, but will reduce the soil movement. Success of the mitigation measures will depend on the thoroughness of the contractor and developer in dealing with the soil conditions. In any event, the developer should be aware that some soil movement is to be expected.

9.1.7 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed buildings may be supported using conventional shallow foundations provided that the recommendations presented herein are incorporated in the design and construction of the project.

9.1.8 SALEM shall review the project grading and foundation plans prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required. If SALEM is not provided plans and specifications for review, we cannot assume any responsibility for the future performance of the project.

9.1.9 SALEM shall be present at the site during site demolition and preparation to observe site clearing/demolition, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

9.1.10 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe

foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

9.2 Seismic Design Criteria

9.2.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2019 CBC, our recommended parameters are shown below. These parameters are based on Probabilistic Ground Motion of 2% Probability of Exceedance in 50 years. The Site Class was determined based on the results of our field exploration.

TABLE 9.2.1
SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value	ASCE 7-16 or 2019 CBC Reference
Site Coordinates (Datum = NAD 83)		33.4997 Lat -117.6614 Lon	
Site Class	--	D	ASCE 7 Table 20.3-1
Soil Profile Name	--	Stiff Soil	ASCE 7 Table 20.3-1
Risk Category	--	II	Table 1604.5
Site Coefficient for PGA	F_{PGA}	1.1	ASCE 7 Table 11.8-1
Peak Ground Acceleration (adjusted for Site Class effects)	PGA_M	0.554g	ASCE 7 Equation 11.8-1
Seismic Design Category	SDC	D	Table 1613.2.5
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_S	1.175 g	Figure 1613.2.1(1-8)
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.422 g	Figure 1613.2.1(1-8)
Site Class Modified Site Coefficient	F_a	1.03	Table 1613.2.3(1)
Site Class Modified Site Coefficient	F_v	*1.878	Table 1613.2.3(2)
MCE Spectral Response Acceleration (Short period - 0.2 sec) $S_{MS} = F_a S_S$	S_{MS}	1.21 g	Equation 16-36
MCE Spectral Response Acceleration (1.0 sec. period) $S_{M1} = F_v S_1$	S_{M1}	*0.793 g	Equation 16-37
Design Spectral Response Acceleration $S_{DS}=⅔S_{MS}$ (short period - 0.2 sec)	S_{DS}	0.807 g	Equation 16-38
Design Spectral Response Acceleration $S_{D1}=⅔S_{M1}$ (1.0 sec. period)	S_{D1}	*0.528 g	Equation 16-39
Short Term Transition Period (S_{D1}/S_{DS}), Seconds	T_S	0.655	ASCE 7-16, Section 11.4.6
Long Period Transition Period (seconds)	T_L	8	ASCE 7-16, Figure 22-14

*** Determined per ASCE Table 11.4-2 for use in calculating T_S only.**

9.2.2 A Site Specific Ground Motion Analysis was not included in the scope of this investigation. Per ASCE 11.4.8, structures on Site Class D with S_1 greater than or equal to 0.2 may require Site Specific Ground Motion Analysis. However, a site specific motion analysis may not be required based on Exceptions listed in ASCE 11.4.8. The Structural Engineer should verify whether Exception No. 2 of ASCE 7-16, Section 11.4.8 is valid for the site. In the event that a site specific ground motion analysis is required, SALEM should be contacted for these services.

9.2.3 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.3 Soil and Excavation Characteristics

9.3.1 Based on the soil conditions encountered in our soil borings, the onsite soils can be excavated with moderate to laborious effort using conventional heavy-duty or special excavation and earthmoving equipment.

9.3.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

9.3.3 The near surface soils identified as part of our investigation are, generally, moist to very moist due to the absorption characteristics of the soil. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

9.4 Materials for Fill

9.4.1 Excavated soils generated from cut operations at the site are suitable for use as general Engineered Fill in structural areas, provided they do not contain deleterious matter, organic material, or rock material larger than 3 inches in maximum dimension.

9.4.2 The upper soils are predominately silty gravel, clayey gravel, clayey sand, and sandy clay. The clayey soils are expected to have a moderate expansion potential. It is recommended the upper 18 inches of soil within building pad and exterior flatwork areas be replaced with Non-Expansive Fill ($EI \leq 20$). The replacement soils should extend 5 feet beyond the perimeter of the building.

9.4.3 The soils with an EI greater than 20 and less than 50 ($20 < EI \leq 70$) may be placed below a depth of 18 inches within building pad and exterior flatwork areas or in the parking and non-structural areas.

9.4.4 Import soil shall be well-graded, slightly cohesive silty fine sand or sandy silt, with relatively impervious characteristics when compacted. A clean sand or very sandy soil is not acceptable

for this purpose. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.4.4.

TABLE 9.4.4
IMPORT FILL REQUIREMENTS

Minimum Percent Passing No. 200 Sieve	15
Maximum Percent Passing No. 200 Sieve	50
Minimum Percent Passing No. 4 Sieve	70
Maximum Particle Size	3"
Maximum Plasticity Index	12
Maximum CBC Expansion Index	20

9.4.5 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.

9.4.6 Environmental characteristics and corrosion potential of import soil materials should also be considered.

9.4.7 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

9.5 Grading

9.5.1 A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

9.5.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

9.5.3 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), any existing uncertified fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report.

9.5.4 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 2 to 4 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of

grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. In addition, existing concrete and asphalt materials shall be removed from areas of proposed improvements and stockpiled separately from excavated soil material. The stripped vegetation, asphalt and concrete materials will not be suitable for use as Engineered Fill or within 5 feet of building pads or within pavement areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.5.5 Any undocumented and uncertified fill materials encountered during grading should be removed and replaced with engineered fill. The actual depth of the overexcavation and recompaction should be determined by our field representative during construction.

9.5.6 Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of building, including footings and non-cantilevered overhangs carrying structural loads.

9.5.7 It is recommended overexcavation and recompaction within the proposed building areas be performed to a minimum depth of **three (3) feet** below existing grade or **two (2) feet** below proposed footing bottom, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings.

9.5.8 To minimize the potential soil movement, it is recommended that the upper 18 inches of soil beneath the required granular aggregate subbase within slab on grade and exterior flatwork areas be removed and replaced with Non-Expansive Engineered Fill meeting the requirements of section 9.4.

9.5.9 Within pavement areas, overexcavation and recompaction should be performed to a minimum depth of 12 inches below existing grade or proposed grade, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 2 feet beyond the pavement edges.

9.5.10 Prior to placement of fill soils, the upper 10 to 12 inches of native subgrade soils should be scarified, moisture-conditioned to no less than the optimum moisture content and recompacted to a minimum of 90% (95% for granular non-expansive soils) of the maximum dry density based on ASTM D1557 Test Method.

9.5.11 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in thin lifts to allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

9.5.12 Engineered Fill soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 90% (95% for granular non-expansive soils) relative compaction.

9.5.13 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

9.5.14 Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base.

9.5.15 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

9.5.16 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier months of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties. Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

9.5.17 Wet soils may become non conducive to site grading as the upper soils yield under the weight of the construction equipment. Therefore, mitigation measures should be performed for stabilization.

Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of slurry, crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation.

To expedite the stabilizing process, slurry or crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose. If the use of slurry, crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 6 to 24 inches of 2-sack slurry or ¾-inch to 1-inch crushed rocks. The thickness of the slurry or rock layer depends on the severity of the soil instability. The recommended 6 to 24 inches of crushed rock material will provide a stable platform.

It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. A layer of geofabric is recommended to be placed on top of the compacted crushed rock to minimize migration of soil particles into the voids of the crushed rock, resulting in soil movement. Although it is not required, the use of geogrid (e.g. Tensar TX7) below the slurry or crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization. Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

9.6 Shallow Foundations

9.6.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings and isolated pad footings bearing in properly compacted Engineered Fill.

9.6.2 The bearing wall footings considered for the structure should be continuous with a minimum width of 15 inches and extend to a minimum depth of 18 inches below the lowest adjacent grade. Isolated column footings should have a minimum width of 24 inches and extend a minimum depth of 18 inches below the lowest adjacent grade.

9.6.3 The bottom of footing excavations should be maintained free of loose and disturbed soil. Footing concrete should be placed into a neat excavation.

9.6.4 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

Loading Condition	Allowable Bearing
Dead Load Only	2,000 psf
Dead-Plus-Live Load	2,500 psf
Total Load, Including Wind or Seismic Loads	3,325 psf

9.6.5 For design purposes, total settlement due to static and seismic loading on the order of 1½ inches may be assumed for shallow footings. Differential settlement due to static and seismic loading, along a 40-foot exterior wall footing or between adjoining column footings, should be 1 inch, producing an angular distortion of 0.002. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. The footing excavations should not be allowed to dry out any time prior to pouring concrete.

9.6.6 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.32 acting between the base of foundations and the supporting subgrade.

9.6.7 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. An increase of one-third is permitted when using the alternate load combination that includes wind or earthquake loads.

9.6.8 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.

9.6.9 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing

rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

9.7 Concrete Slabs-on-Grade

9.7.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by six (6) inches of compacted clean granular aggregate subbase material compacted to at least 95% relative compaction.

9.7.2 Granular aggregate subbase material shall conform to ASTM D-2940, Latest Edition (Table 1, bases) with at least 95 percent passing a 1½-inch sieve and not more than 8% passing a No. 200 sieve or its approved equivalent to prevent capillary moisture rise.

9.7.3 We recommend reinforcing slabs, at a minimum, with No. 4 reinforcing bars placed 18 inches on center, each way.

9.7.4 Slabs subject to structural loading may be designed utilizing a modulus of subgrade reaction K of 120 pounds per square inch per inch. The K value was approximated based on inter-relationship of soil classification and bearing values (Portland Cement Association, Rocky Mountain Northwest).

9.7.5 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.

9.7.6 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement. The exterior floors should be poured separately in order to act independently of the walls and foundation system.

9.7.7 It is recommended that the utility trenches within the structure be compacted, as specified in our report, to minimize the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the structures is recommended.

9.7.8 Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To minimize moisture vapor intrusion, it is recommended that a vapor retarder be installed in accordance with manufacturer's recommendations and/or ASTM guidelines, whichever is more stringent. In addition, ventilation of the structure is recommended to reduce the accumulation of interior moisture.

9.7.9 In areas where it is desired to reduce floor dampness where moisture-sensitive coverings are anticipated, construction should have a suitable waterproof vapor retarder (a minimum of 15 mils

thick polyethylene vapor retarder sheeting, Raven Industries "VaporBlock 15, Stego Industries 15 mil "StegoWrap" or W.R. Meadows Sealtight 15 mil "Perminator") incorporated into the floor slab design. The water vapor retarder should be decay resistant material complying with ASTM E96 not exceeding 0.04 perms, ASTM E154 and ASTM E1745 Class A. The vapor barrier should be placed between the concrete slab and the compacted granular aggregate subbase material. The water vapor retarder (vapor barrier) should be installed in accordance with ASTM Specification E 1643-94.

9.7.10 The concrete maybe placed directly on vapor retarder. The vapor retarder should be inspected prior to concrete placement. Cut or punctured retarder should be repaired using vapor retarder material lapped 6 inches beyond damaged areas and taped.

9.7.11 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

9.7.12 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

9.8 Lateral Earth Pressures and Frictional Resistance

9.8.1 Active, at-rest and passive unit lateral earth pressures against footings and walls are summarized in the table below:

Lateral Pressure Conditions	Equivalent Fluid Pressure, pcf
Active Pressure, Drained	45
At-Rest Pressure, Drained	65
Passive Pressure	300
Related Parameters	
Allowable Coefficient of Friction	0.32
In-Place Soil Density (lbs/ft^3)	120

9.8.2 Active pressure applies to walls, which are free to rotate. At-rest pressure applies to walls, which are restrained against rotation. The preceding lateral earth pressures assume sufficient drainage behind retaining walls to prevent the build-up of hydrostatic pressure.

9.8.3 The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

9.8.4 The foregoing values of lateral earth pressures represent allowable soil values and a safety factor consistent with the design conditions should be included in their usage.

9.8.5 For stability against lateral sliding, which is resisted solely by the passive pressure, we recommend a minimum safety factor of 1.5.

9.8.6 For stability against lateral sliding, which is resisted by the combined passive and frictional resistance, a minimum safety factor of 2.0 is recommended.

9.8.7 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.1.

9.8.8 For dynamic seismic lateral loading the following equation shall be used:

Dynamic Seismic Lateral Loading Equation
Dynamic Seismic Lateral Load = $\frac{3}{8}\gamma K_h H^2$
Where: γ = In-Place Soil Density
K_h = Horizontal Acceleration = $\frac{2}{3}PGA_M$
H = Wall Height

9.9 Retaining Walls

9.9.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The gravel should conform to Class II permeable materials graded in accordance with the current CalTrans Standard Specifications.

9.9.2 Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

9.9.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The top of the perforated pipe should be placed at or below the bottom of the adjacent floor slab or pavements. The pipe should be placed in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Slots should be no wider than 1/8-inch in diameter, while perforations should be no more than ¼-inch in diameter.

9.9.4 If retaining walls are less than 5 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 2-inch minimum diameter

holes (concrete walls) or unmortared head joints (masonry walls) and placed no higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

9.9.5 During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

9.10 Temporary Excavations

9.10.1 We anticipate that the majority of the sandy site soils will be classified as Cal-OSHA “Type C” soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved “competent person” onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

9.10.2 It is the contractor’s responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

9.10.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

9.10.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in the following table:

RECOMMENDED EXCAVATION SLOPES

Depth of Excavation (ft)	Slope (Horizontal : Vertical)
0-5	1:1
5-10	2:1

9.10.5 If, due to space limitation, excavations near property lines or existing structures are performed in a vertical position, slot cuts, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.

9.10.6 Braced shorings should be designed for a maximum pressure distribution of 30H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.

9.10.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM Engineering Group, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

9.11 Underground Utilities

9.11.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 90% (95% for granular non-expansive soils) relative compaction at slightly above the optimum moisture content.

9.11.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 6 to 12 inches above the crown of the pipe. Pipe bedding and backfill material should conform to the requirements of the governing utility agency.

9.11.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the buildings or structures to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.

9.11.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

9.12 Surface Drainage

9.12.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

9.12.2 The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 5 percent for a minimum distance of 10 feet.

9.12.3 Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building and drainage gradients maintained to carry all surface water to collection facilities and off site. These grades should be maintained for the life of the project. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed.

9.12.4 Roof drains should be installed with appropriate downspout extensions out-falling on splash blocks so as to direct water a minimum of 5 feet away from the structures or be connected to the storm drain system for the development.

9.13 Pavement Design

9.13.1 Based on site soil conditions, an R-value of 15 was used for the preliminary flexible asphaltic concrete pavement design. The R-value may be verified during grading of the pavement areas.

9.13.2 The pavement design recommendations provided herein are based on the State of California Department of Transportation (CALTRANS) design manual. The following table shows the recommended pavement sections for various traffic indices.

TABLE 9.13.2
ASPHALT CONCRETE PAVEMENT

Traffic Index	Asphaltic Concrete	Clean Aggregate Base*	Compacted Subgrade**
5.0 (Vehicle Parking and Drive Areas)	4.0"	5.5"	12.0"
6.0 (Heavy Truck Areas)	4.0"	9.5"	12.0"

95% compaction based on ASTM D1557 Test Method
****90% (95% for granular non-expansive soils) compaction based on ASTM D1557 Test Method***

9.13.3 The following recommendations are for light-duty and heavy-duty Portland Cement Concrete pavement sections.

TABLE 9.13.3
PORTLAND CEMENT CONCRETE PAVEMENT

Traffic Index	Portland Cement Concrete*	Clean Aggregate Base**	Compacted Subgrade***
5.0 (Light Duty)	5.0"	6.0"	12.0"
6.0 (Heavy Duty)	6.0"	8.0"	12.0"

*** Minimum Compressive Strength of 4,000 psi, No. 4 bars at 15 inches o.c. each way***
****95% compaction based on ASTM D1557 Test Method***
*****90% (95% for granular non-expansive soils) compaction based on ASTM D1557 Test Method***

10. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

10.1 Plan and Specification Review

10.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

10.2 Construction Observation and Testing Services

10.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

10.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

10.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

11. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur between boring locations. The nature and extent of such variations may not become evident until construction is initiated.

If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase. Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during

construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants.

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil. The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping.

The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Jared Christiansen, EIT
Geotechnical Staff Engineer

Clarence Jiang, GE
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Principal Engineer
RCE 52762 / RGE 2549

Source Image: https://ngmdb.usgs.gov/topoview

VICINITY MAP

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Apartment and Retail Development
31872, 31878, 31882 Camino Capistrano
San Juan Capistrano, California

SCALE:	DATE:
NOT TO SCALE	07/2020
DRAWN BY:	APPROVED BY:
KV	CJ
PROJECT NO.	FIGURE NO.
3-220-0514	1

SALEM engineering group, inc.

SITE PLAN

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Apartment and Retail Development
31872, 31878, 31882 Camino Capistrano
San Juan Capistrano, California

SCALE: NOT TO SCALE	DATE: 07/2020
DRAWN BY: KV	APPROVED BY: CJ
PROJECT NO. 3-220-0514	FIGURE NO. 2

LEGEND:

B-1 Soil Boring Locations

P-1 Percolation Locations

All Locations Approximate

SALEM engineering group, inc.

APPENDIX

A

APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation (drilling) was conducted on July 9, 2020 and included a site visit, subsurface exploration, soil sampling. Percolation testing was performed on July 10, 2020. The locations of the exploratory borings and percolating tests are shown on the Site Plan, Figure 2. Boring logs for our exploration are presented in figures following the text in this appendix. Borings were located in the field using existing reference points. Therefore, actual boring locations may deviate slightly.

In general, our borings were performed using a truck-mounted CME 55 drill rig equipped with 6-inch diameter solid flight augers. Sampling in the borings was accomplished using a hydraulic 140-pound hammer with a 30-inch drop. Samples were obtained with a 3-inch outside-diameter (OD), split spoon (California Modified) sampler, and a 2-inch OD, Standard Penetration Test (SPT) sampler. The number of blows required to drive the sampler the last 12 inches (or fraction thereof) of the 18-inch sampling interval were recorded on the boring logs. The blow counts shown on the boring logs should not be interpreted as standard SPT "N" values; corrections have not been applied. Upon completion, borings were backfilled with drill cuttings.

Subsurface conditions encountered in the exploratory borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

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Test Boring: B-1 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

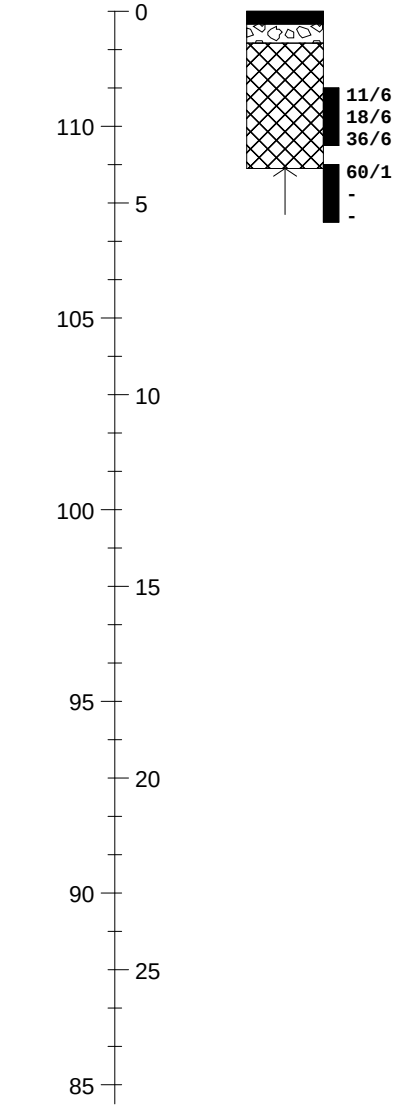
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 113'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		AC	Asphalt Concrete = 4 in.				
		AB	Aggregate Base = 6 in.				
	11/6 18/6 36/6	GM	FILL Silty GRAVEL with Sand Dense; moist; brown; fine to coarse gravel; fine to medium grain sand; trace clay. Very dense at 4'.	54	6.4	111.2	
	60/1 - -			60/1"	3.8	-	
			Auger refusal at 4 feet due to excessive gravel.				

Notes:

Figure Number A-1

Test Boring: B-2 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

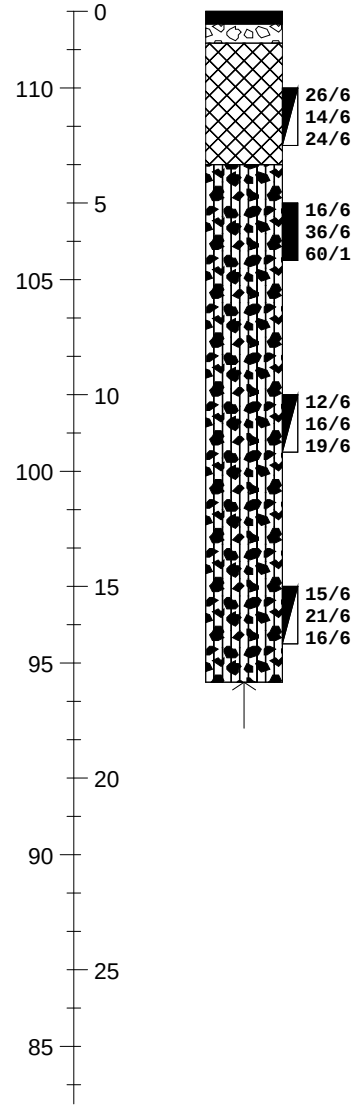
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 112'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		AC	Asphalt Concrete = 4 in.				
		AB	Aggregate Base = 6 in.				
		SC	FILL Clayey SAND Dense; moist; brown; fine to	38	9.5	-	
		GM	medium grain sand; with fine gravel.	96/7"	9.6	95.2	Partially disturbed sample.
			Silty GRAVEL with Sand Very dense; moist; brown; fine to coarse gravel; medium to coarse grain sand.				
			Grades as above; dense.	35	8.1	-	
			Grades as above.	37	10.1	-	
			Auger refusal at 17.5 feet BSG.				

Notes:

Figure Number A-2

SALEM engineering group, inc.

Test Boring: B-3 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

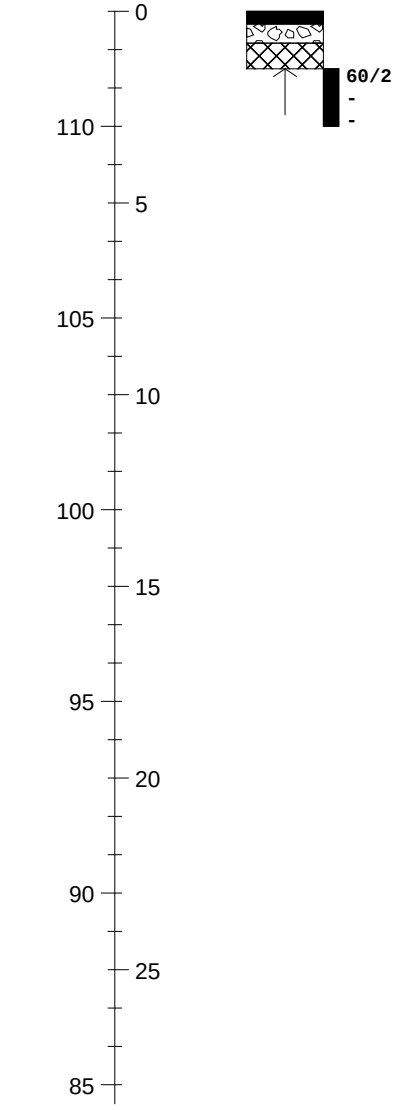
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 113'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		AC	Asphalt Concrete = 4 in.				
		AB	Aggregate Base = 6 in.				
	60/2 - -	GM	FILL Silty GRAVEL with Sand Very dense; moist; brown; fine to coarse gravel; fine to coarse grain sand.	60/2"	-	-	No recovery.
			Auger refusal at 1.5 feet BSG.				

Notes:

Figure Number A-3

SALEM engineering group, inc.

Test Boring: B-4 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

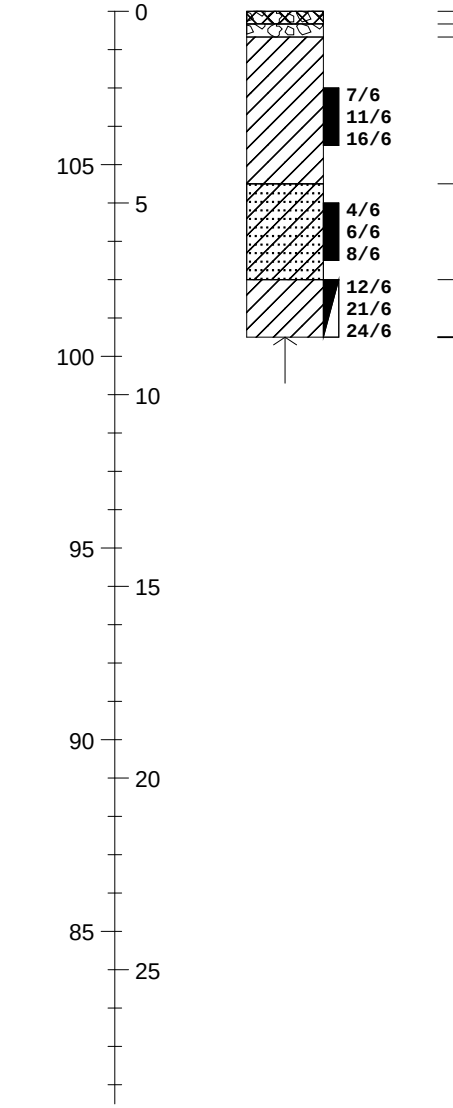
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 109'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		PCC	portland Cement Concrete = 4 in.				
		AB	Aggregate Base = 4 in.				
	7/6 11/6 16/6	CL	POTENTIAL FILL Sandy CLAY Very stiff; moist; dark brown; fine grain sand; with gravel.	27	9.8	110.8	
	4/6 6/6 8/6	SC	Clayey SAND Loose; moist; dark brown; fine to medium grain sand.	14	8.8	104.3	
	12/6 21/6 24/6	CL	Sandy CLAY Hard; moist; dark brown; fine grain sand; with gravel and cobbles. Auger refusal at 8.5 feet BSG.	45	20.7	-	

Notes:

Figure Number A-4

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Test Boring: B-5 **Page** 1 **Of:** 2

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

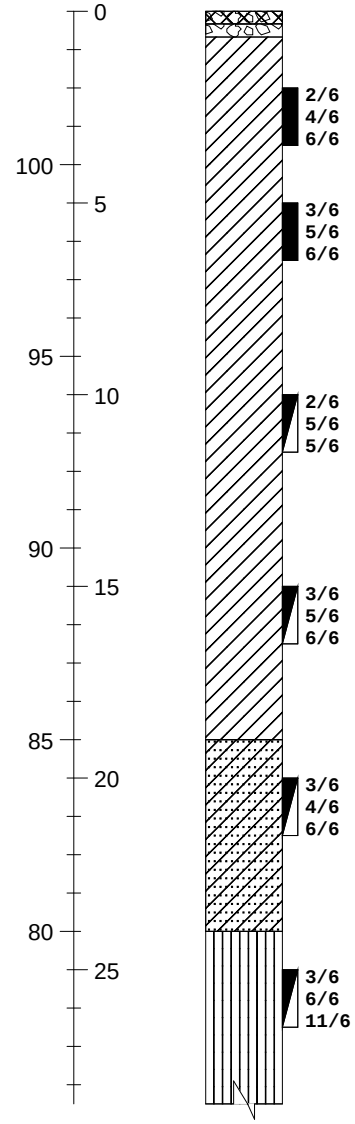
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 104'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** 29'

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** 29'



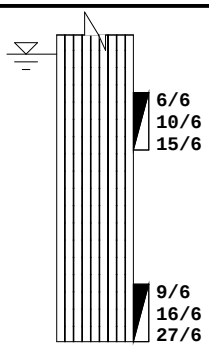
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		PCC	portland Cement Concrete = 4 in.				
		AB	Aggregate Base = 4 in.				
		CL	CLAY with Sand Firm; moist; dark brown; fine grain sand.	10	23.1	99.5	LL=36 PI=17
			Grades as above; stiff.	11	24.8	98.3	
			Grades as above.	10	23.1	-	
			Grades as above; with gravel.	11	17.8	-	
		SC	Clayey SAND Loose; very moist; brown; fine to medium grain sand; trace gravel.	10	13.8	-	
		ML	Clayey SILT with Sand Very stiff; wet; dark gray; fine grain sand.	17	36.6	-	

Notes:

Figure Number A-5

SALEM engineering group, inc.

Project Number: 3-220-0514
Date: 07/09/2020
Test Boring: B-5

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
75 / 30		ML	SILT with Sand Very stiff; saturated; dark gray; fine grain sand.	25	29.9	-	
70 / 35			Grades as above; hard.	43	27.1	-	
65 / 40			End of boring at 36.5 feet BSG.				
60 / 45							
55 / 50							
50 / 55							
45 / 60							

Notes:

Figure Number A-5

SALEM
engineering group, inc.

Test Boring: B-6 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

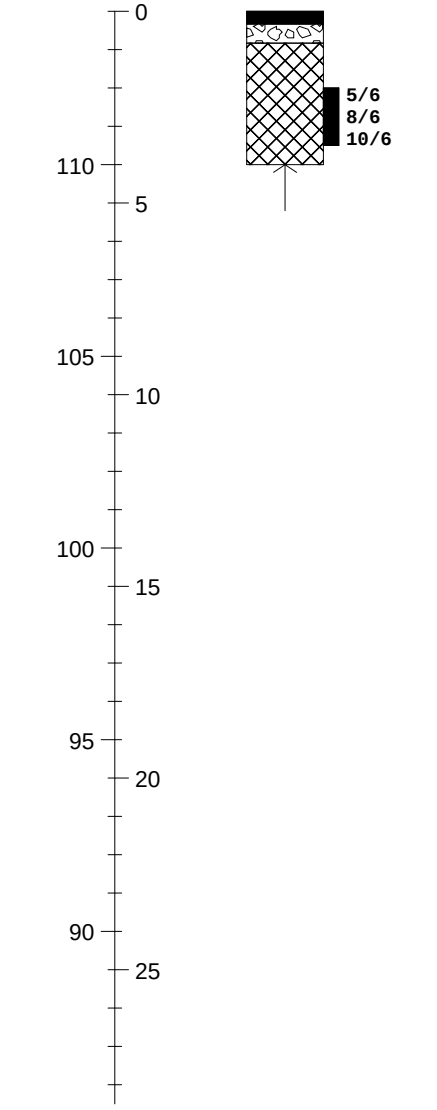
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 114'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		AC	Asphalt Concrete = 4 in.				
		AB	Aggregate Base = 6 in.				
	5/6 8/6 10/6	SC	FILL Gravelly Clayey SAND Medium dense; moist; brown; fine to coarse grain sand; fine to coarse gravel.	18	9.0	-	Disturbed sample.
			Auger refusal at 4 feet.				

Notes:

Figure Number A-6

SALEM engineering group, inc.

Test Boring: B-7 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

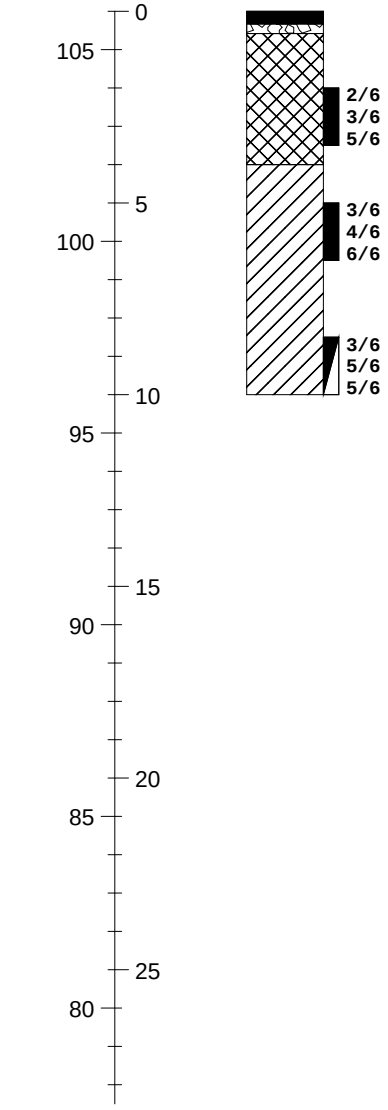
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 106'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
	AC	Asphalt Concrete = 4 in.				
	AB	Aggregete Base = 3 in.				
	CL	FILL Sandy CLAY Firm; moist; dark brown; fine to medium grain sand; with fine gravel.	8	21.7	94.4	
	CL	Sandy CLAY Firm; moist; brown; fine grain sand.	10	20.2	100.7	
		Grades as above; stiff.	10	22.0	-	
		End of boring at 10 feet BSG.				

Notes:

Figure Number A-7

SALEM
engineering group, inc.

Test Boring: B-8 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

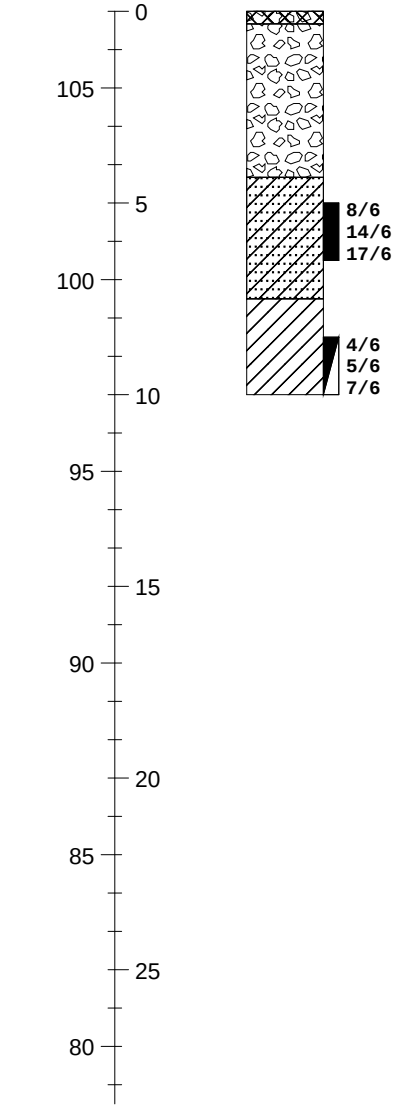
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 107'

Auger Type: 6 in Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		PCC	portland Cement Concrete = 4 in.				
		AB	Aggregate Base = 48 in.				
	8/6 14/6 17/6	SC	Clayey SAND Medium dense; moist; brown; fine grain sand; with gravel.	31	9.7	99.3	
	4/6 5/6 7/6	CL	Sandy CLAY Stiff; moist; dark gray; fine grain sand.	12	24.2	-	
			End of boring at 10 feet BSG.				

Notes:

Figure Number A-8

Test Boring: B-9 **Page** 1 **Of:** 1

Project Number: 3-220-0514

Date: 07/09/2020

Client: Frontier Real Estate Investments

Project: Proposed Apartment and Retail Development

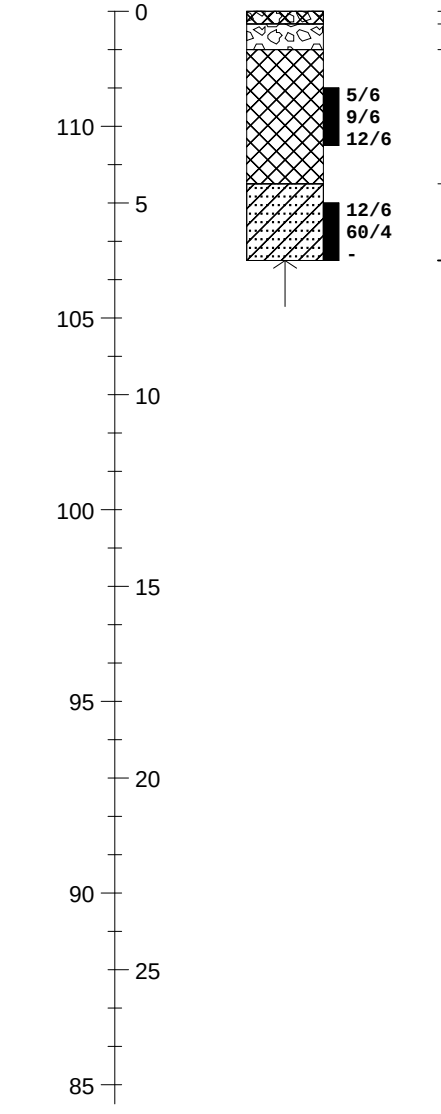
Location: 31872, 31878, 31882 Camino Capristrano, San Juan Capristrano, California

Drilled By: SALEM **Logged By:** EGR

Drill Type: CME 55 **Elevation:** 113'

Auger Type: 6 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		PCC	portland Cement Concrete = 4 in.				
		AB	Aggregate Base = 8 in.				
	5/6 9/6 12/6	CL	FILL CLAY with Sand Very stiff; moist; brown; fine grain sand.	21	17.8	113.1	LL=39 PI=24
	12/6 60/4 -	SC	Clayey SAND Very dense; moist; brown; fine grain sand; with gravel and cobbles.	60/4"	6.5	111.2	
			Auger refusal at 6.5 feet BSG.				

Notes:

Figure Number A-9

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Asphaltic Concrete
	Aggregate Base
	Fill
	Silty gravel
	Portland Cement Concrete
	Lean Clay
	Clayey sand
	Silt
Misc. Symbols	
	Drill rejection
	Boring continues
	Water table during drilling

Symbol	Description
Soil Samplers	
	California sampler
	Standard penetration test

Notes:

Granular Soils
Blows Per Foot (Uncorrected)

	MCS	SPT
Very loose	<5	<4
Loose	5-15	4-10
Medium dense	16-40	11-30
Dense	41-65	31-50
Very dense	>65	>50

Cohesive Soils
Blows Per Foot (Uncorrected)

	MCS	SPT
Very soft	<3	<2
Soft	3-5	2-4
Firm	6-10	5-8
Stiff	11-20	9-15
Very Stiff	21-40	16-30
Hard	>40	>30

MCS = Modified California Sampler
SPT = Standard Penetration Test Sampler

Percolation Test Worksheet

Project: **Proposed Apartment and Retail Development** **Job No.:** **3-220-0514**
31872, 31878, 31882 Camino Capistrol **Date Drilled:** **7/9/2020**
San Juan Capistrano, California **Soil Classification:** **Sandy CLAY (CL)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 120 in.

Test Hole No.: **P-1** **Presoaking Date:** **7/9/2020**
Tested by: **JC** **Test Date:** **7/10/2020**
Drilled Hole Depth: **10.0** ft.
Pipe Stick up: 2.0 ft.

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
11:55	12:25	12.0	Y	0:30	8.35	8.36	0.12	30	250.0	43.8	43.7	43.7	0.01
12:25	12:55	12.0	N	0:30	8.36	8.37	0.12	30	250.0	43.7	43.6	43.6	0.01
12:55	13:25	12.0	N	0:30	8.37	8.38	0.12	30	250.0	43.6	43.4	43.5	0.01
13:25	13:55	12.0	N	0:30	8.38	8.39	0.12	30	250.0	43.4	43.3	43.4	0.01
13:55	14:25	12.0	N	0:30	8.39	8.40	0.12	30	250.0	43.3	43.2	43.3	0.01
14:25	14:55	12.0	N	0:30	8.40	8.41	0.12	30	250.0	43.2	43.1	43.1	0.01
14:55	15:25	12.0	N	0:30	8.41	8.42	0.12	30	250.0	43.1	43.0	43.0	0.01
15:25	15:55	12.0	N	0:30	8.42	8.43	0.12	30	250.0	43.0	42.8	42.9	0.01
15:55	16:25	12.0	N	0:30	8.43	8.44	0.12	30	250.0	42.8	42.7	42.8	0.01
16:25	16:55	12.0	N	0:30	8.44	8.45	0.12	30	250.0	42.7	42.6	42.7	0.01
16:55	17:25	12.0	N	0:30	8.45	8.46	0.12	30	250.0	42.6	42.5	42.5	0.01
17:25	17:55	12.0	N	0:30	8.46	8.47	0.12	30	250.0	42.5	42.4	42.4	0.01
Recommended for Design:										**Infiltration Rate**			**0.01**

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Apartment and Retail Development** **Job No.:** **3-220-0514**
31872, 31878, 31882 Camino Capistrono **Date Drilled:** **7/9/2020**
San Juan Capistrano, California **Soil Classification:** **Clayey SAND (SC)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 66 in.

Test Hole No.: **P-2** **Presoaking Date:** **7/9/2020**
Tested by: **JC** **Test Date:** **7/10/2020**
Drilled Hole Depth: **5.5** ft.
Pipe Stick up: 2.0 ft.

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
11:50	12:20	7.5	Y	0:30	4.65	4.92	3.24	30	9.3	34.2	31.0	32.6	0.37
12:20	12:50	7.5	N	0:30	4.92	5.15	2.76	30	10.9	31.0	28.2	29.6	0.35
12:50	13:20	7.5	N	0:30	5.15	5.34	2.28	30	13.2	28.2	25.9	27.1	0.31
13:20	13:50	7.5	N	0:30	5.34	5.51	2.04	30	14.7	25.9	23.9	24.9	0.30
13:50	14:20	7.5	N	0:30	5.51	5.67	1.92	30	15.6	23.9	22.0	22.9	0.31
14:20	14:50	7.5	N	0:30	5.67	5.81	1.68	30	17.9	22.0	20.3	21.1	0.29
14:50	15:20	7.5	N	0:30	5.81	5.94	1.56	30	19.2	20.3	18.7	19.5	0.29
15:20	15:50	7.5	N	0:30	5.94	6.06	1.44	30	20.8	18.7	17.3	18.0	0.29
15:50	16:20	7.5	N	0:30	6.06	6.17	1.32	30	22.7	17.3	16.0	16.6	0.28
16:20	16:50	7.5	N	0:30	6.17	6.27	1.20	30	25.0	16.0	14.8	15.4	0.28
16:50	17:20	7.5	N	0:30	6.27	6.36	1.08	30	27.8	14.8	13.7	14.2	0.27
17:20	17:50	7.5	N	0:30	6.36	6.45	1.08	30	27.8	13.7	12.6	13.1	0.29
Recommended for Design:										**Infiltration Rate**			**0.27**

SALEM engineering group, inc.

Salem Engineering Group, Inc.
8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
(909) 980-6455

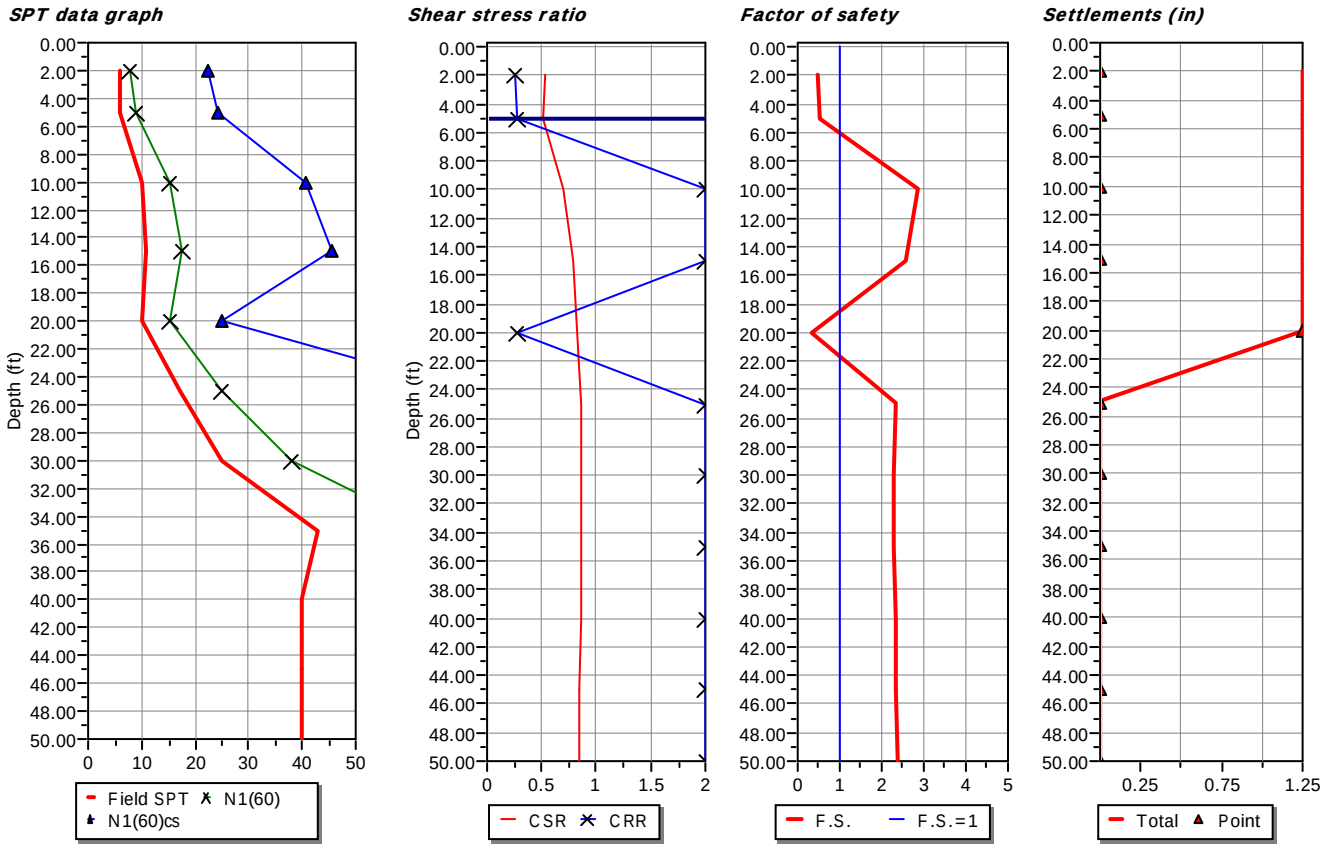
LIQUEFACTION ANALYSIS REPORT

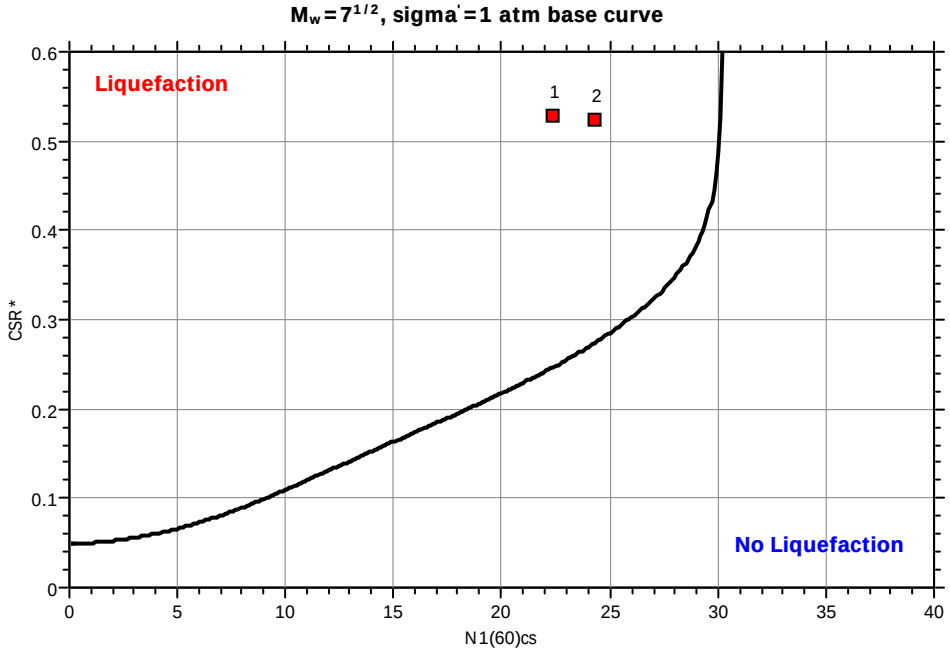
Project title : 3-220-0514

Project subtitle : San Juan Capistrano

Input parameters and analysis data

In-situ data type:	Standard Penetration Test	Depth to water table:	5.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	7.90
Analysis method:	NCEER 1998	Peak ground accelaration:	0.55 g
Fines correction method:	Robertson & Wride	User defined F.S.:	1.30





:: Field input data ::

Point ID	Depth (ft)	Field N_{SPT} (blows/feet)	Unit weight (pcf)	Fines content (%)
1	2.00	6.00	120.00	78.00
2	5.00	6.00	120.00	75.00
3	10.00	10.00	120.00	72.00
4	15.00	11.00	120.00	70.00
5	20.00	10.00	120.00	31.00
6	25.00	17.00	120.00	80.00
7	30.00	25.00	120.00	84.00
8	35.00	43.00	120.00	79.00
9	40.00	40.00	120.00	80.00
10	45.00	40.00	120.00	80.00
11	50.00	40.00	120.00	80.00

Depth : Depth from free surface, at which SPT was performed (ft)
Field SPT : SPT blows measured at field (blows/feet)
Unit weight : Bulk unit weight of soil at test depth (pcf)
Fines content : Percentage of fines in soil (%)

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR^*
1	2.00	0.12	0.00	0.12	1.00	0.36	0.88	0.41	1.00	0.41
2	5.00	0.30	0.00	0.30	0.99	0.35	0.88	0.40	1.00	0.40
3	10.00	0.60	0.16	0.44	0.98	0.47	0.88	0.54	1.00	0.54
4	15.00	0.90	0.31	0.59	0.97	0.53	0.88	0.60	1.00	0.60
5	20.00	1.20	0.47	0.73	0.95	0.56	0.88	0.64	1.00	0.64
6	25.00	1.50	0.62	0.88	0.94	0.58	0.88	0.66	1.00	0.66
7	30.00	1.80	0.78	1.02	0.93	0.59	0.88	0.67	1.00	0.67
8	35.00	2.10	0.94	1.16	0.89	0.57	0.88	0.66	0.98	0.67
9	40.00	2.40	1.09	1.31	0.85	0.56	0.88	0.64	0.96	0.67
10	45.00	2.70	1.25	1.45	0.81	0.54	0.88	0.61	0.94	0.66
11	50.00	3.00	1.41	1.60	0.77	0.52	0.88	0.59	0.92	0.64

Depth : Depth from free surface, at which SPT was performed (ft)
Sigma : Total overburden pressure at test point, during earthquake (tsf)
u : Water pressure at test point, during earthquake (tsf)
Sigma' : Effective overburden pressure, during earthquake (tsf)
r_d : Nonlinear shear mass factor
CSR : Cyclic Stress Ratio
MSF : Magnitude Scaling Factor
$CSR_{eq,M=7.5}$ CSR adjusted for M=7.5
K_{sigma} Effective overburden stress factor
CSR^* CSR fully adjusted

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ ::

Point ID	Field SPT	C_n	C_e	C_b	C_r	C_s	$N_{1(60)}$	DeltaN	$N_{1(60)cs}$	$CRR_{7.5}$
1	6.00	1.70	0.86	1.00	0.75	1.20	7.90	14.43	22.33	0.25
2	6.00	1.70	0.90	1.00	0.80	1.20	8.84	15.47	24.31	0.27
3	10.00	1.53	0.97	1.00	0.85	1.20	15.20	25.47	40.67	2.00
4	11.00	1.33	1.04	1.00	0.95	1.20	17.40	28.28	45.68	2.00
5	10.00	1.19	1.11	1.00	0.95	1.20	15.12	9.83	24.95	0.28
6	17.00	1.09	1.18	1.00	0.95	1.20	24.97	46.81	71.78	2.00
7	25.00	1.01	1.25	1.00	1.00	1.20	37.92	74.89	112.82	2.00
8	43.00	0.95	1.32	1.00	1.00	1.20	64.44	119.22	183.67	2.00
9	40.00	0.89	1.33	1.00	1.00	1.20	57.20	107.25	164.45	2.00
10	40.00	0.85	1.33	1.00	1.00	1.20	54.29	101.79	156.08	2.00
11	40.00	0.81	1.33	1.00	1.00	1.20	51.78	97.09	148.88	2.00

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ ::

Point ID	Field SPT	C_n	C_e	C_b	C_r	C_s	$N_{1(60)}$	DeltaN	$N_{1(60)cs}$	$CRR_{7.5}$

C_n : Overburden corretion factor
C_e : Energy correction factor
C_b : Borehole diameter correction factor
C_r : Rod length correction factor
C_s : Liner correction factor
$N_{1(60)}$: Corrected N_{SPT}
DeltaN : Addition to corrected N_{SPT} value due to the presence of fines
$N_{1(60)cs}$: Corected $N_{1(60)}$ value for fines
$CRR_{7.5)}$: Cyclic resistance ratio for M=7.5

:: Settlements calculation for saturated sands ::

Point ID	$N_{1(60)}$	N_1	FS_L	e_v (%)	Settle. (in)
1	22.33	18.61	0.47	2.30	0.00
2	24.31	20.25	0.52	2.13	0.00
3	40.67	33.89	2.85	0.00	0.00
4	45.68	38.07	2.55	0.00	0.00
5	24.95	20.79	0.34	2.08	1.25
6	71.78	59.82	2.33	0.00	0.00
7	112.82	94.01	2.29	0.00	0.00
8	183.67	153.05	2.29	0.00	0.00
9	164.45	137.04	2.31	0.00	0.00
10	156.08	130.07	2.34	0.00	0.00
11	148.88	124.06	2.40	0.00	0.00

Total settlement : 1.25

$N_{1,(60)}$: Stress normalized and corrected SPT blow count
N_1: Japanese equivalent corrected value
FS_L: Calculated factor of safety
e_v: Post-liquefaction volumentric strain (%)
Settle.: Calculated settlement (in)

:: Liquefaction potential according to Iwasaki ::

Point ID	F	w_z	I_L
1	0.53	9.70	3.16
2	0.48	9.24	4.04
3	0.00	8.48	0.00
4	0.00	7.71	0.00
5	0.66	6.95	6.97
6	0.00	6.19	0.00
7	0.00	5.43	0.00
8	0.00	4.67	0.00
9	0.00	3.90	0.00
10	0.00	3.14	0.00
11	0.00	2.38	0.00

Overall potential I_L : 14.17

I_L = 0.00 - No liquefaction
I_L between 0.00 and 5 - Liquefaction not probable
I_L between 5 and 15 - Liquefaction probable
I_L > 15 - Liquefaction certain

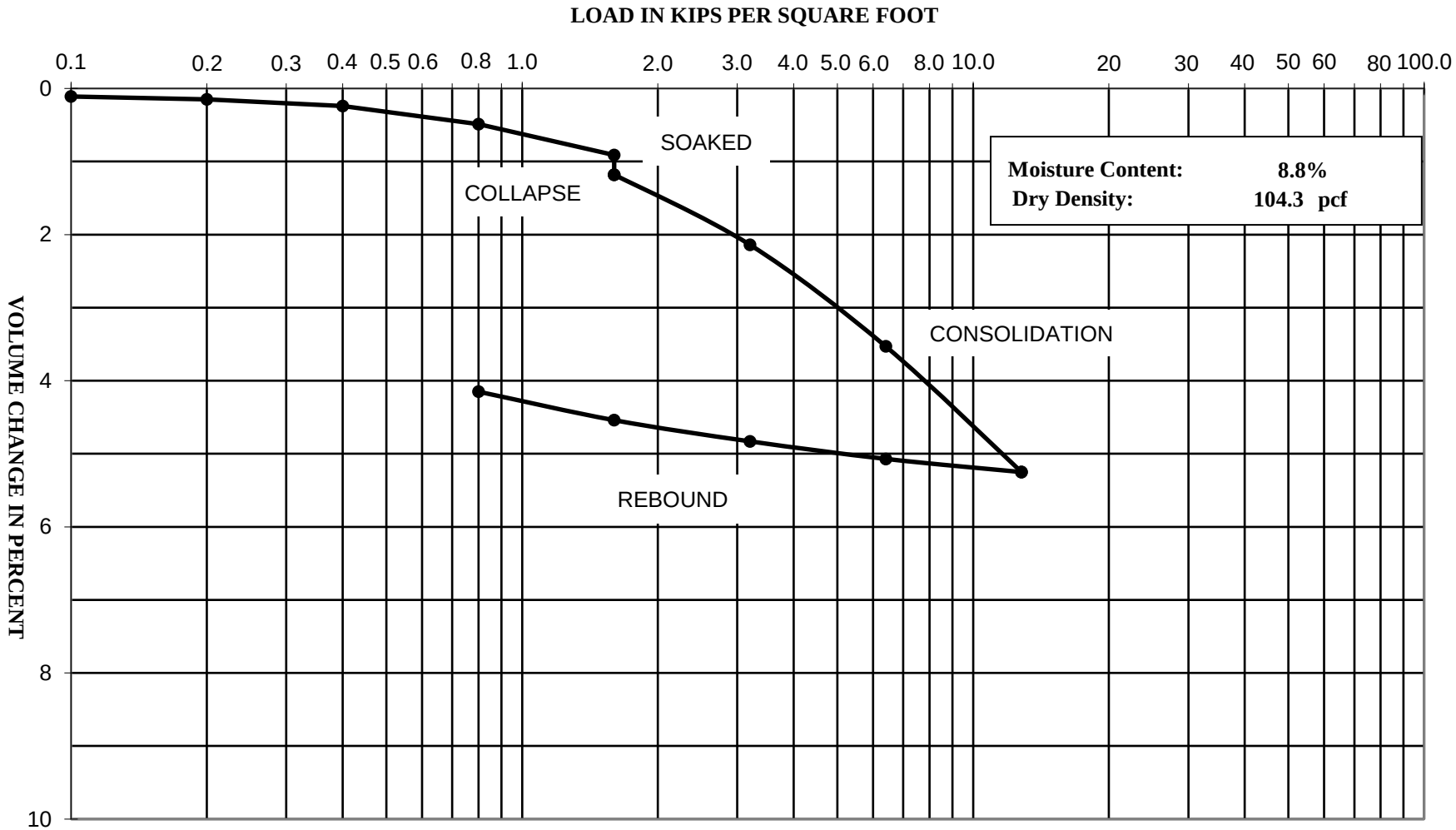
APPENDIX

B

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM), Caltrans, or other suggested procedures. Selected samples were tested for in-situ dry density and moisture content, corrosivity, consolidation, shear strength, expansion index, plasticity index, maximum density and optimum moisture content, and grain size distribution. The results of the laboratory tests are summarized in the following figures.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



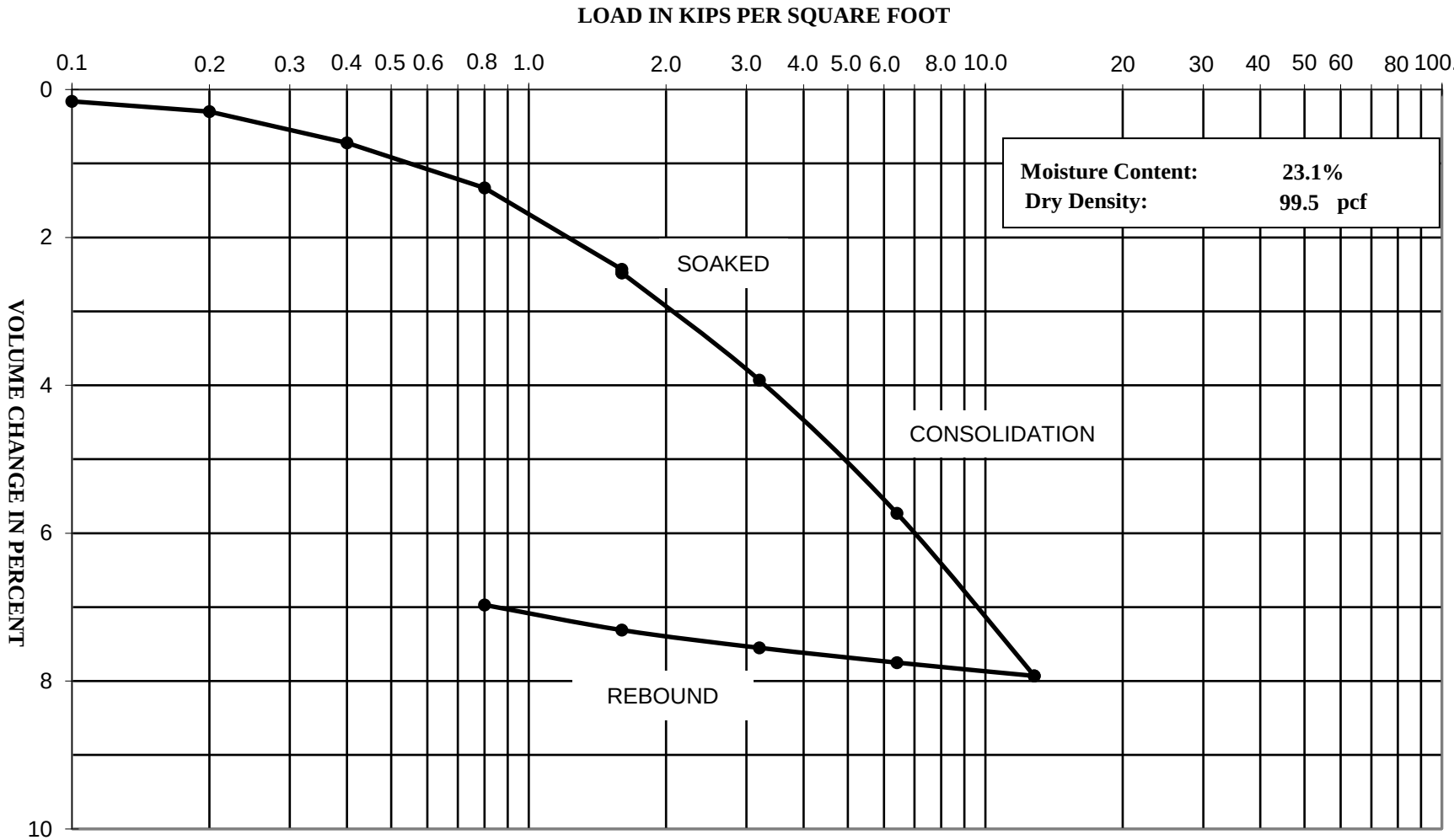
Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

Project Number: 3-220-0514

Boring: B-4 @ 5'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

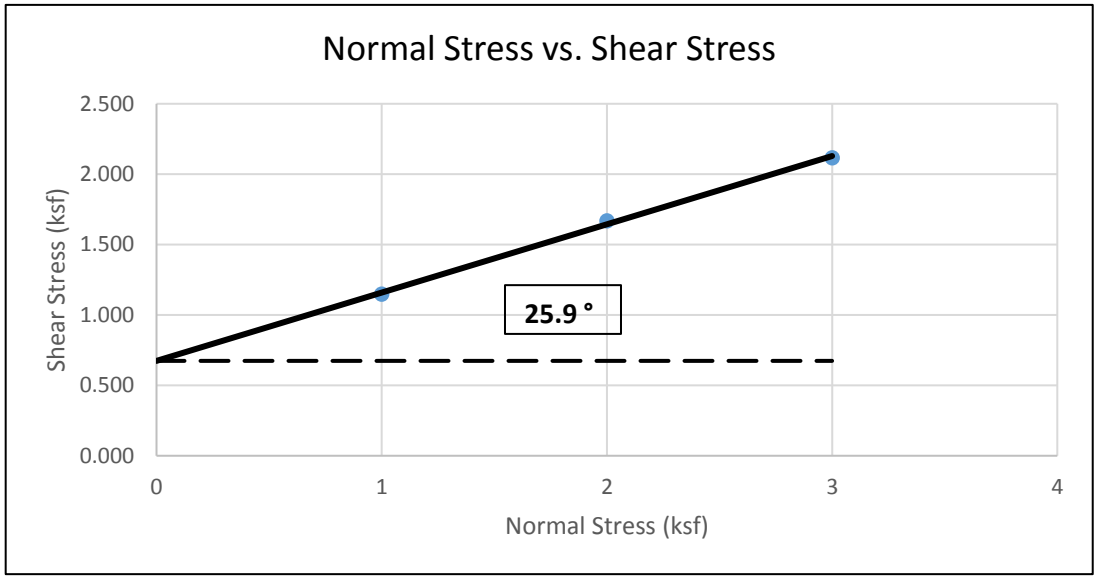
Project Number: 3-220-0514

Boring: B-5 @ 2'

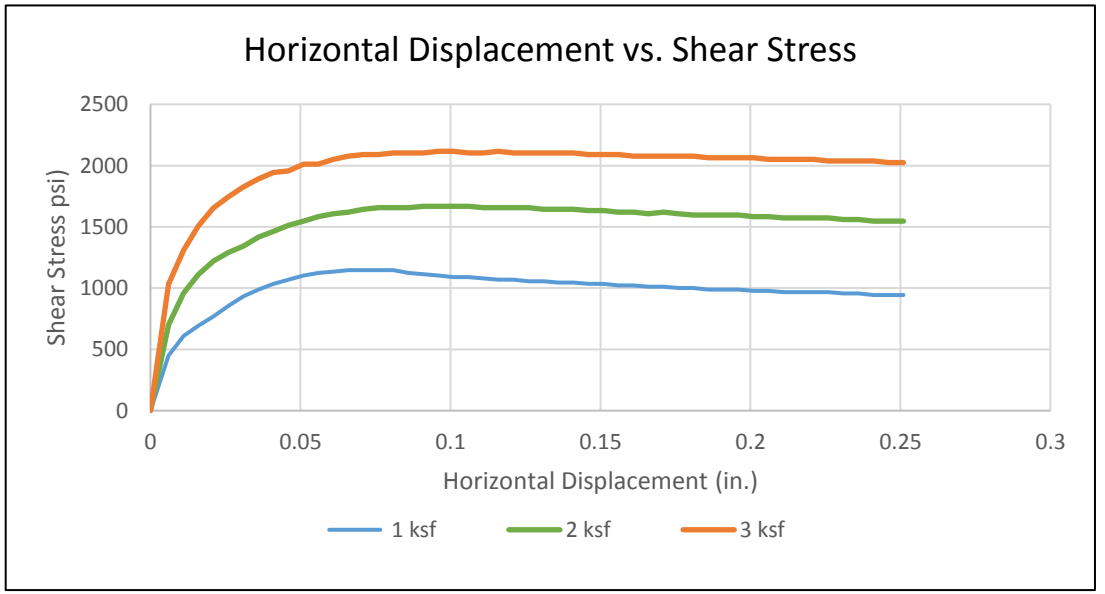
SALEM engineering group, inc.

Direct Shear Test (ASTM D3080)

Project Name:	Proposed Apartments & Retail Development - San Juan Capistrano, CA
Project Number:	3-220-0514
Client:	Frontier Real Estate Investments
Sample Location:	B-5 @ 5'
Sample Type:	Undisturbed Ring
Soil Classification:	CLAY with Sand (CL)
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	7/16/2020
Equipment Used:	Geomatic Direct Shear Machine



	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.003		
Peak Shear Stress (ksf)	1.147	1.668	2.117
Residual Shear Stress (ksf)	0.000	0.000	0.000



Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	23.8		
Final Moisture Content (%)	24.8	23.6	24.6
Dry Density (pcf)	97.8	100.2	98.2

Peak Shear Strength Values	
Slope	0.49
Friction Angle	25.9
Cohesion (psf)	674

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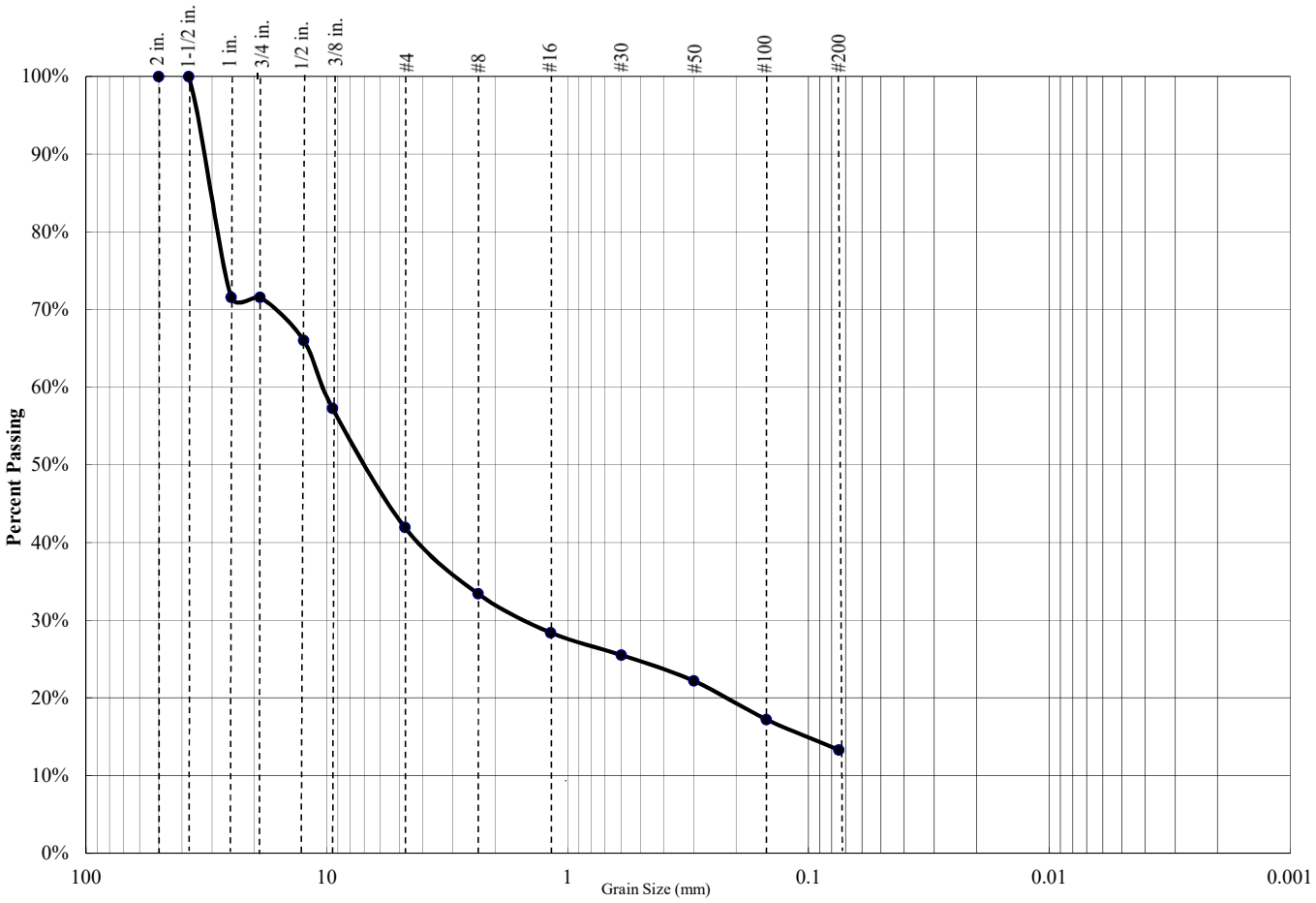
SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
58%	29%	13%

Sieve Size	Percent Passing
3/4 inch	71.6%
1/2 inch	66.0%
3/8 inch	57.3%
#4	42.0%
#8	33.4%
#16	28.4%
#30	25.5%
#50	22.2%
#100	17.2%
#200	13.3%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Silty GRAVEL with Sand (GM)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

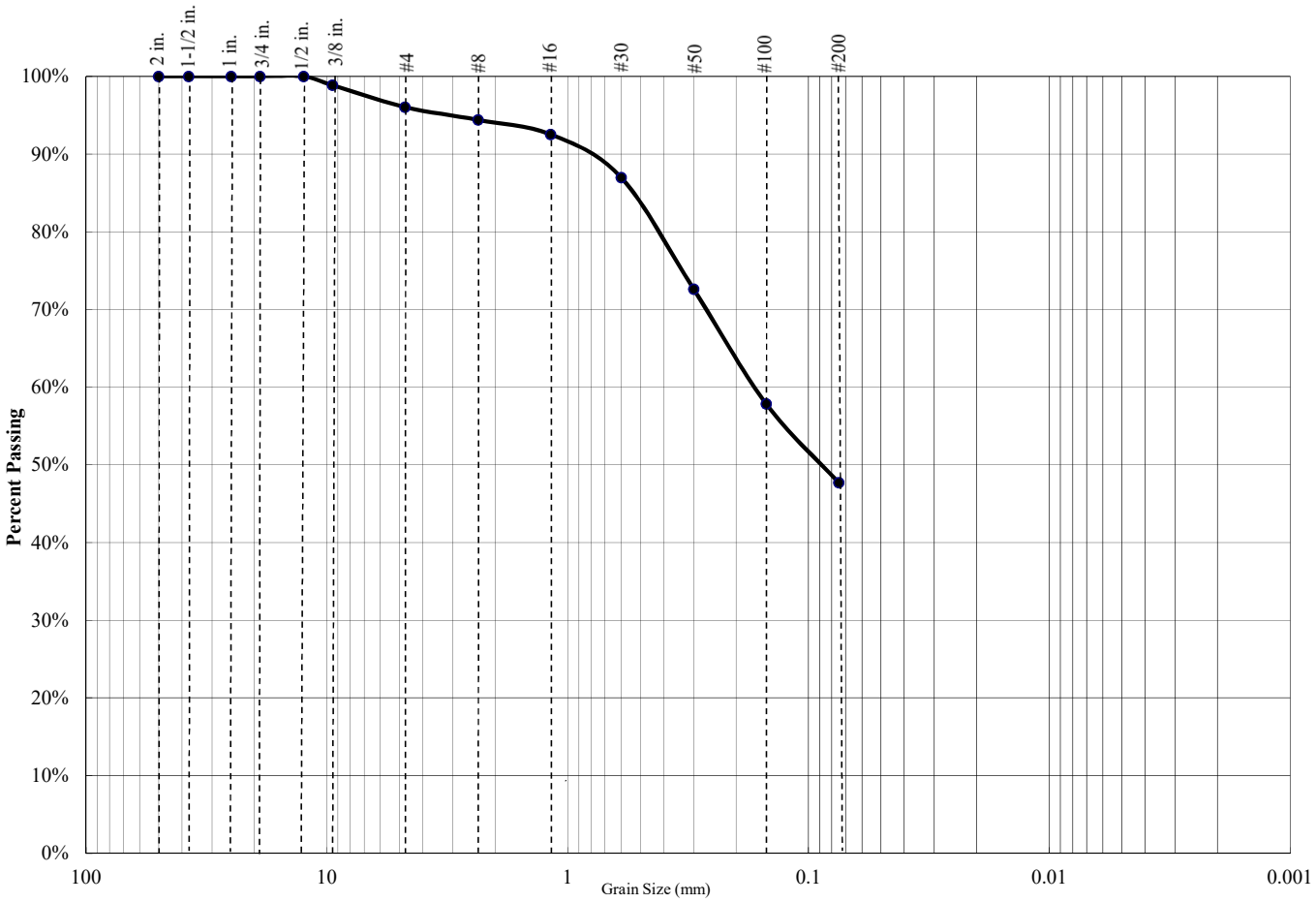
Project Number: 3-220-0514

Boring: B-2 @ 10'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
4%	48%	48%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	98.9%
#4	96.1%
#8	94.4%
#16	92.5%
#30	87.0%
#50	72.6%
#100	57.9%
#200	47.7%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Clayey SAND (SC)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

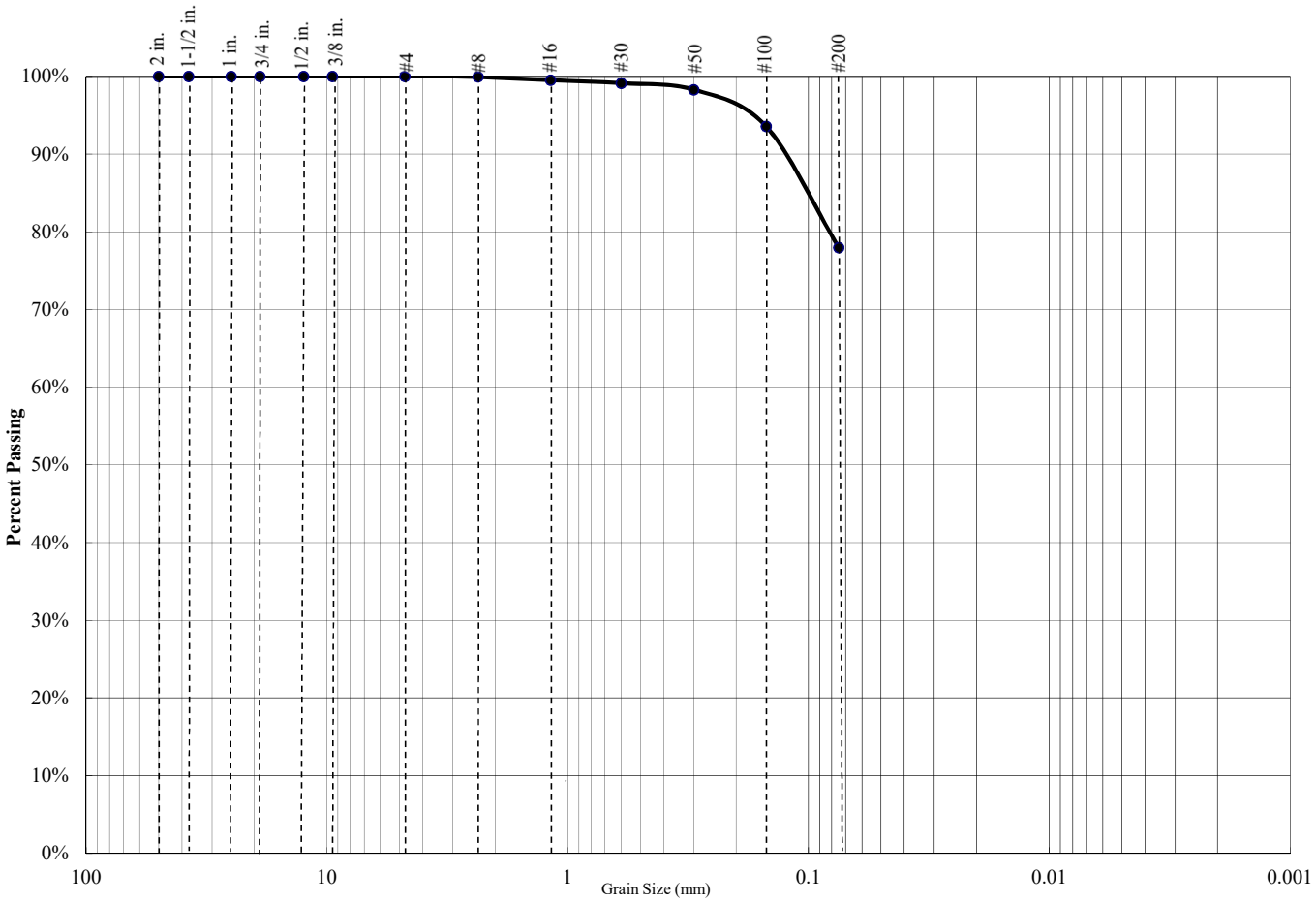
Project Number: 3-220-0514

Boring: B-4 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	22%	78%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	100.0%
#16	99.5%
#30	99.1%
#50	98.3%
#100	93.6%
#200	78.0%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
CLAY with Sand (CL)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

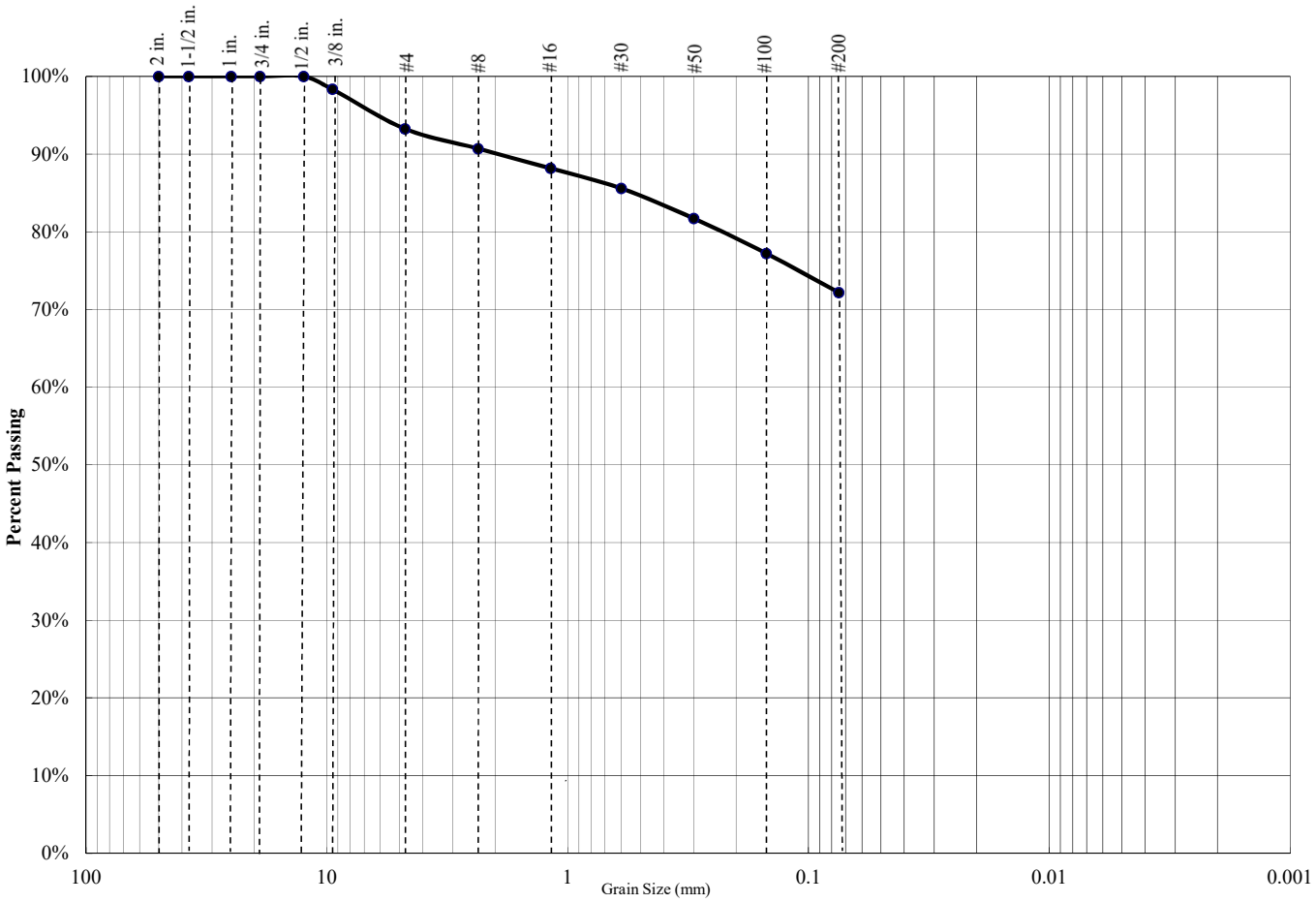
Project Number: 3-220-0514

Boring: B-5 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
7%	21%	72%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	98.3%
#4	93.3%
#8	90.7%
#16	88.2%
#30	85.6%
#50	81.7%
#100	77.2%
#200	72.2%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
CLAY with Sand (CL)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

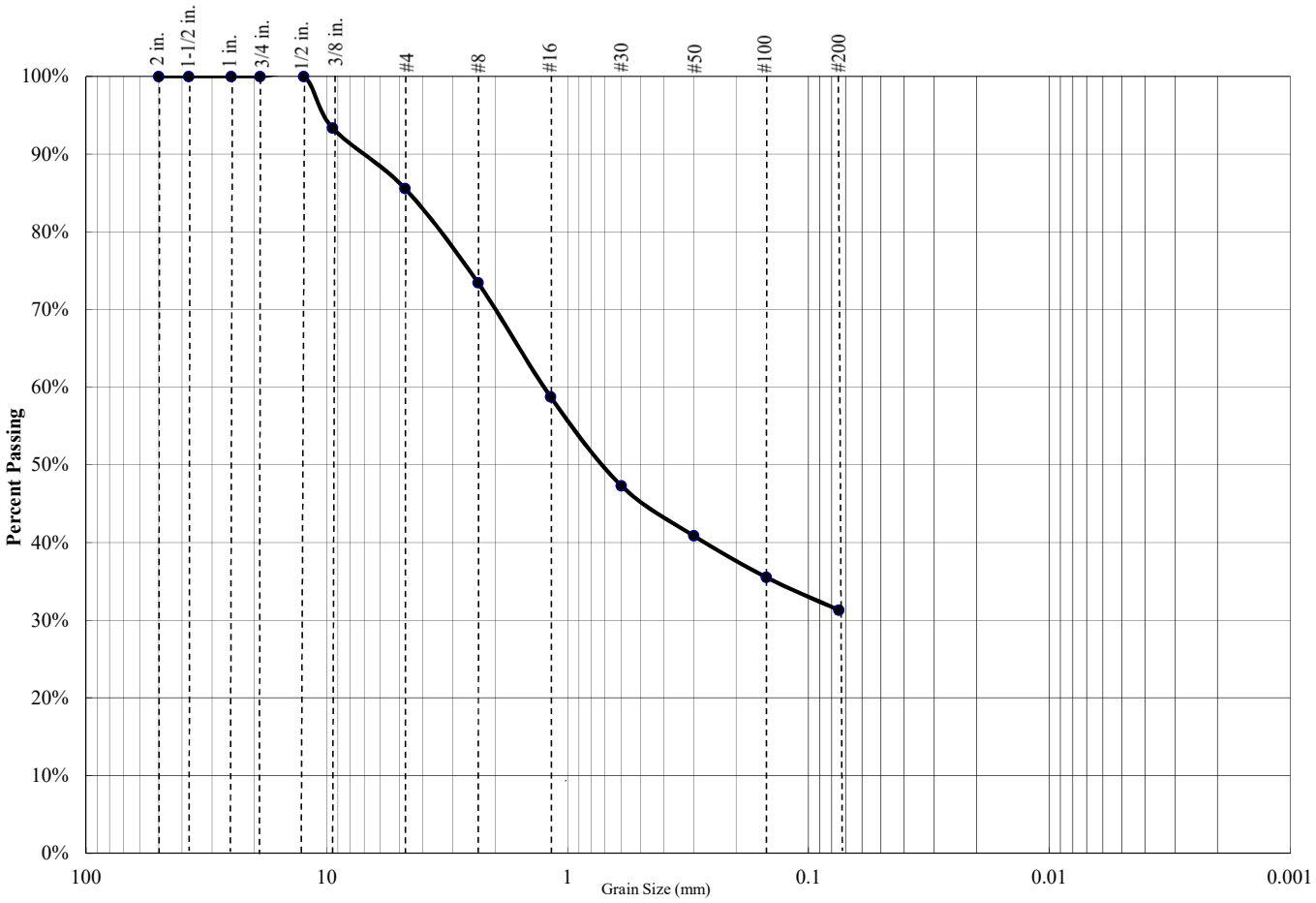
Project Number: 3-220-0514

Boring: B-5 @ 10'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
14%	55%	31%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	93.4%
#4	85.6%
#8	73.5%
#16	58.8%
#30	47.3%
#50	40.9%
#100	35.5%
#200	31.3%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Clayey SAND (SC)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

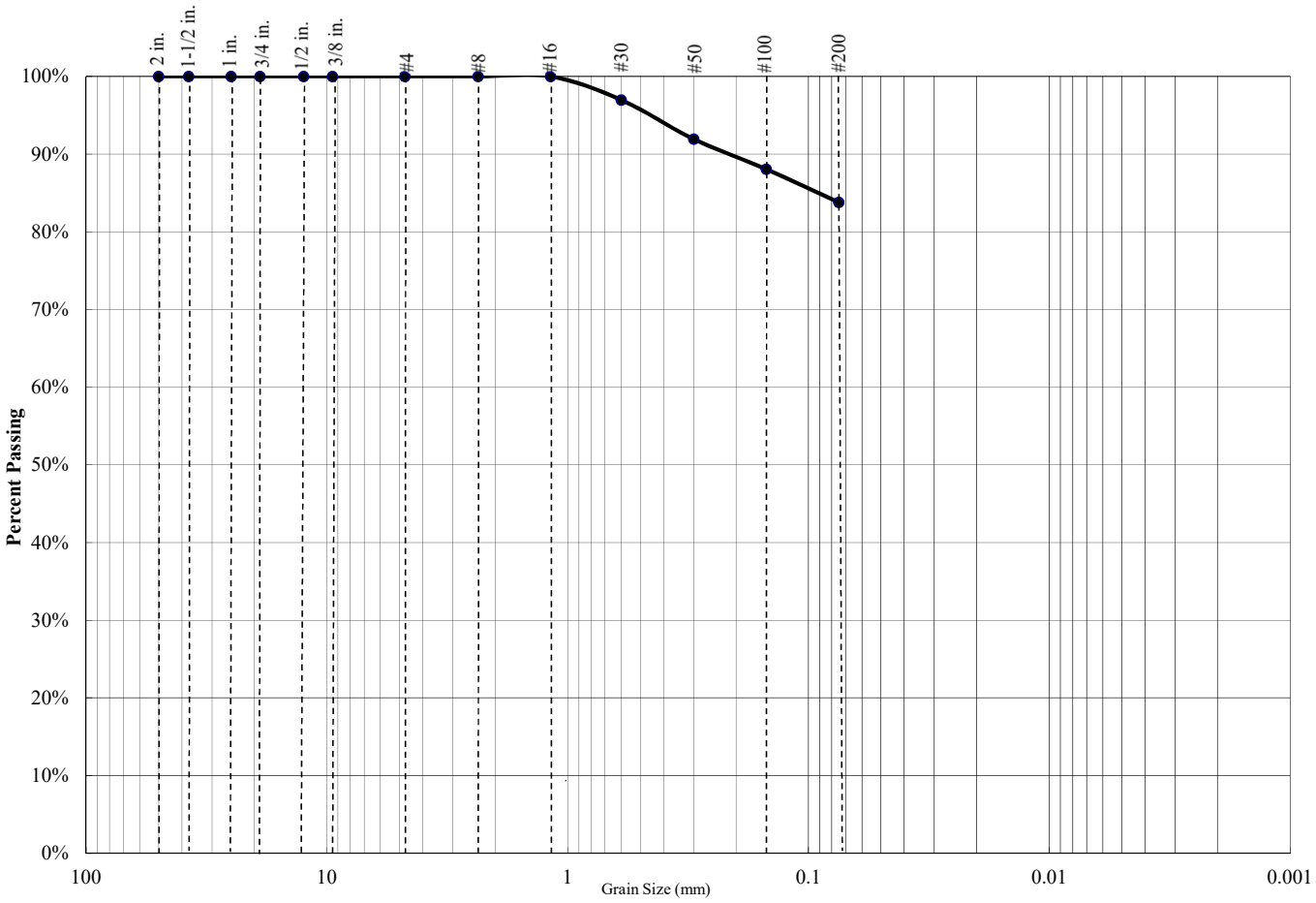
Project Number: 3-220-0514

Boring: B-5 @ 20'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	16%	84%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	100.0%
#16	100.0%
#30	97.0%
#50	91.9%
#100	88.1%
#200	83.8%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
SILT with Sand (ML)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

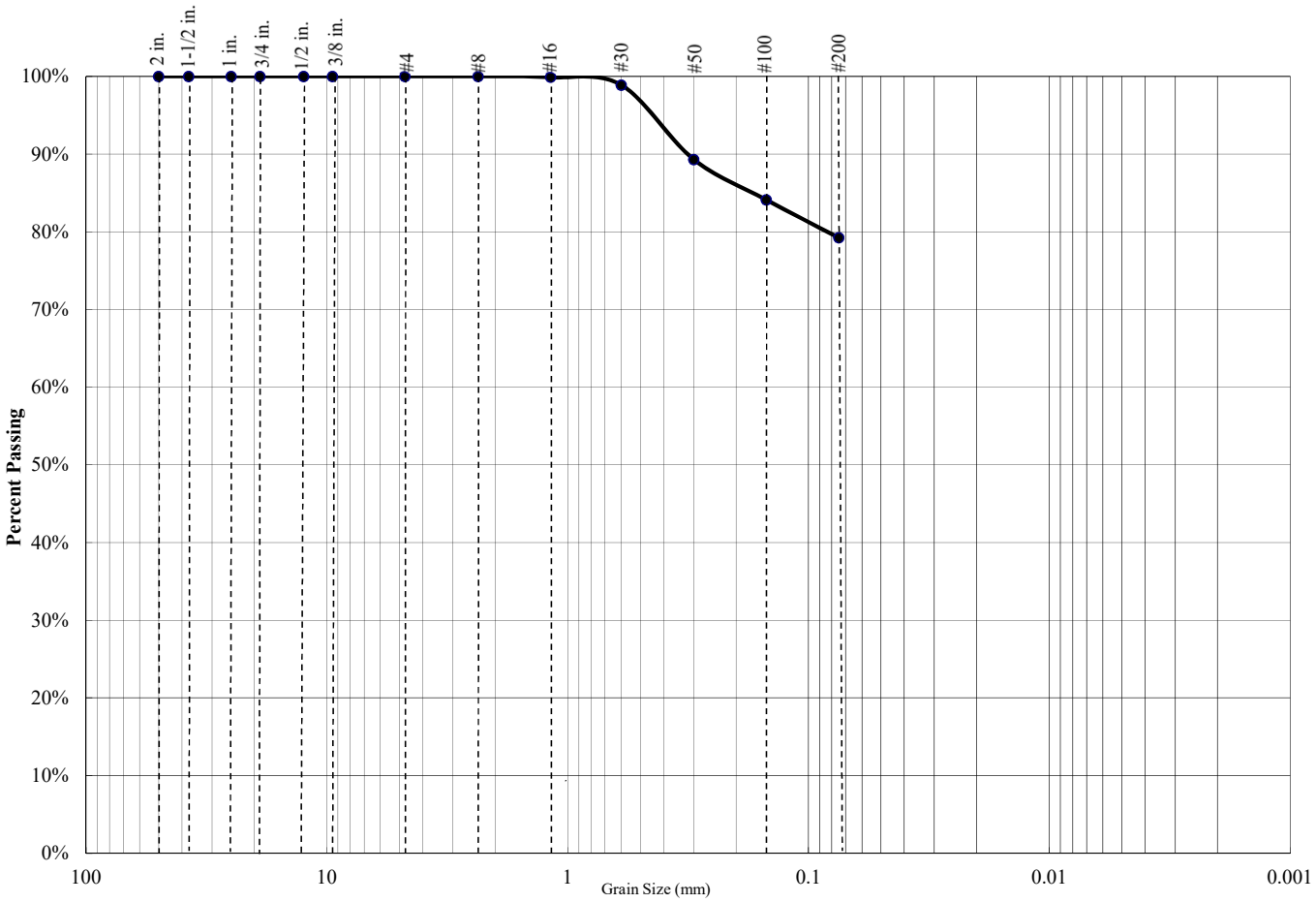
Project Number: 3-220-0514

Boring: B-5 @ 30'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	21%	79%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	100.0%
#16	99.9%
#30	98.9%
#50	89.3%
#100	84.1%
#200	79.2%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
SILT with Sand (ML)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

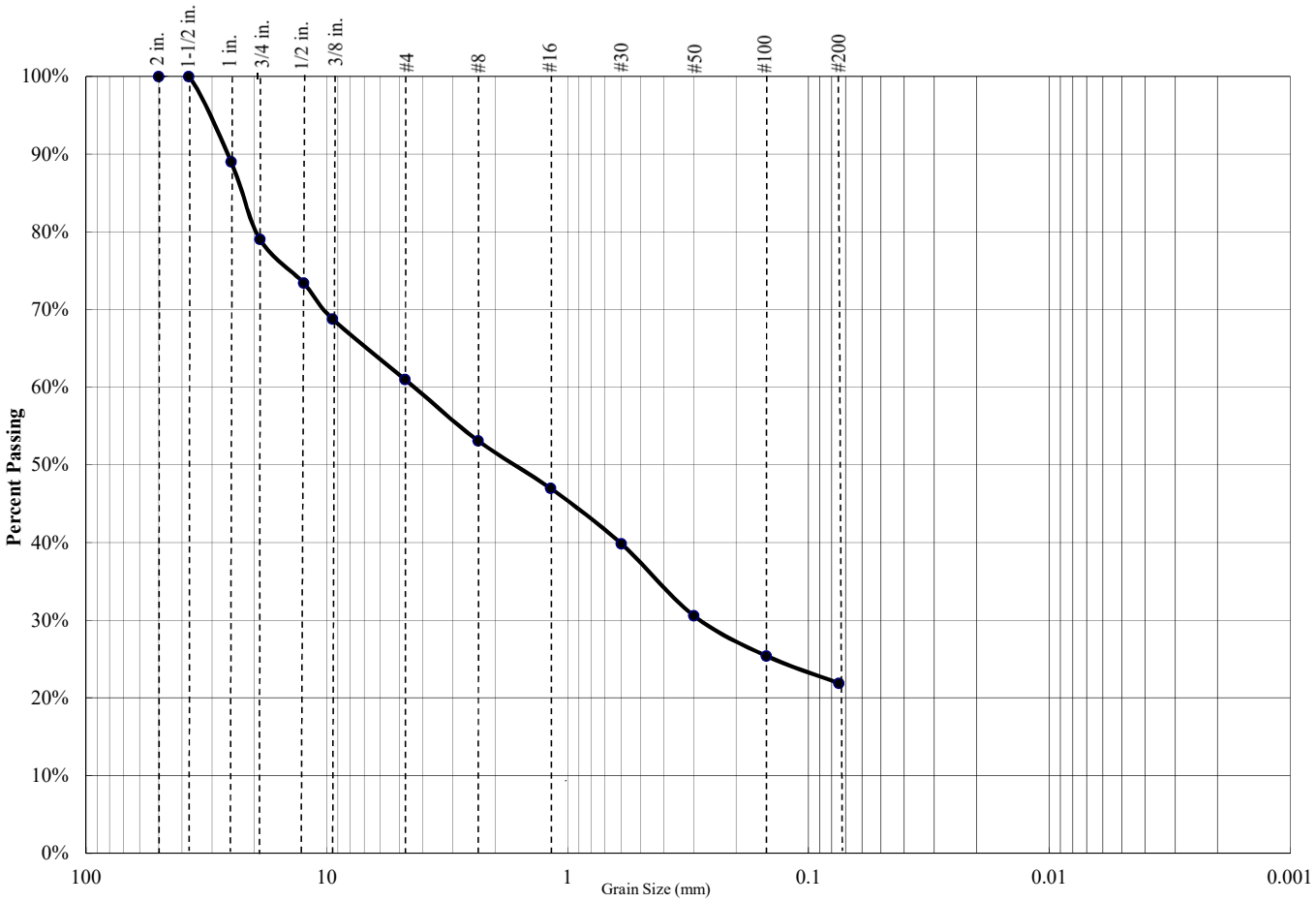
Project Number: 3-220-0514

Boring: B-5 @ 35'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
39%	39%	22%

Sieve Size	Percent Passing
3/4 inch	79.1%
1/2 inch	73.4%
3/8 inch	68.8%
#4	61.0%
#8	53.1%
#16	47.0%
#30	39.9%
#50	30.6%
#100	25.4%
#200	21.9%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Clayey SAND (SC)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

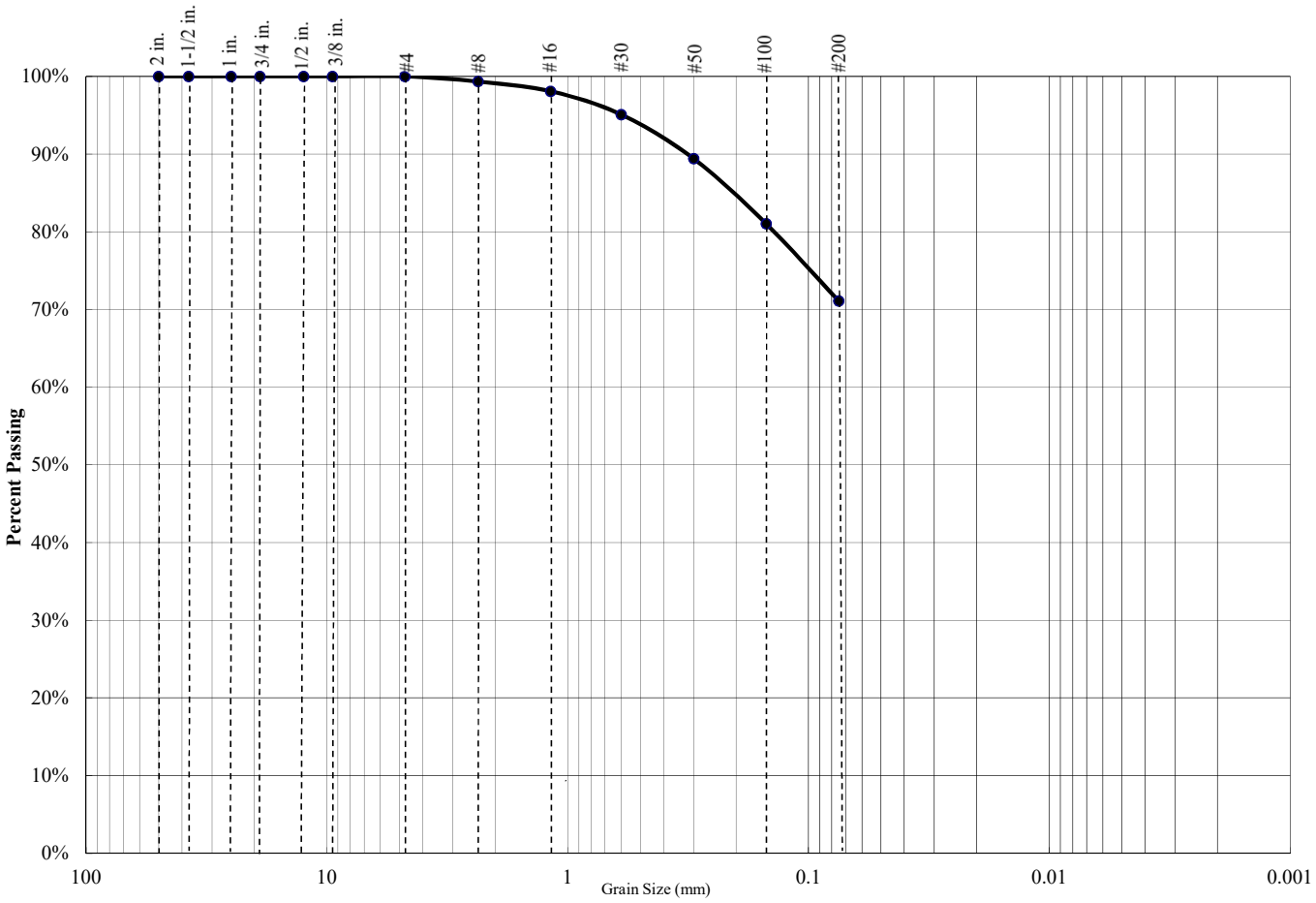
Project Number: 3-220-0514

Boring: B-6 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	29%	71%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.3%
#16	98.1%
#30	95.1%
#50	89.4%
#100	81.0%
#200	71.1%

Atterberg Limits		
PL=	LL=	PI=

Coefficients			
D_{85}=		D_{60}=	D_{50}=
D_{30}=		D_{15}=	D_{10}=
C_u=	N/A	C_c=	N/A

USCS CLASSIFICATION
CLAY with Sand (CL)

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA

Project Number: 3-220-0514

Boring: B-9 @ 2'

SALEM engineering group, inc.

EXPANSION INDEX TEST
ASTM D4829

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA
Project Number: 3-220-0514
Date Sampled: 7/9/2020 Date Tested: 7/13/2020
Sampled By: EGR Tested By: M. Noorzay
Sample Location: B-1 @ 1'-4'
Soil Description: Brown Silty GRAVEL (GM) with Sand and trace Clay

Trial #	1	2	3
Weight of Soil & Mold, g.	784.0		
Weight of Mold, g.	367.7		
Weight of Soil, g.	416.3		
Wet Density, pcf	125.6		
Weight of Moisture Sample (Wet), g.	800.0		
Weight of Moisture Sample (Dry), g.	735.3		
Moisture Content, %	8.8		
Dry Density, pcf	115.4		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	51.6		

Time	Inital	30 min	1 hr	6 hrs	12 hrs	24 hrs
Dial Reading	0	0.002	0.004	--	--	0.005

Expansion Index $_{measured}$ = 5
Expansion Index $_{50}$ = 5.7

Expansion Index = **6**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

SALEM engineering group, inc.

Atterberg Limits Determination

ASTM D4318

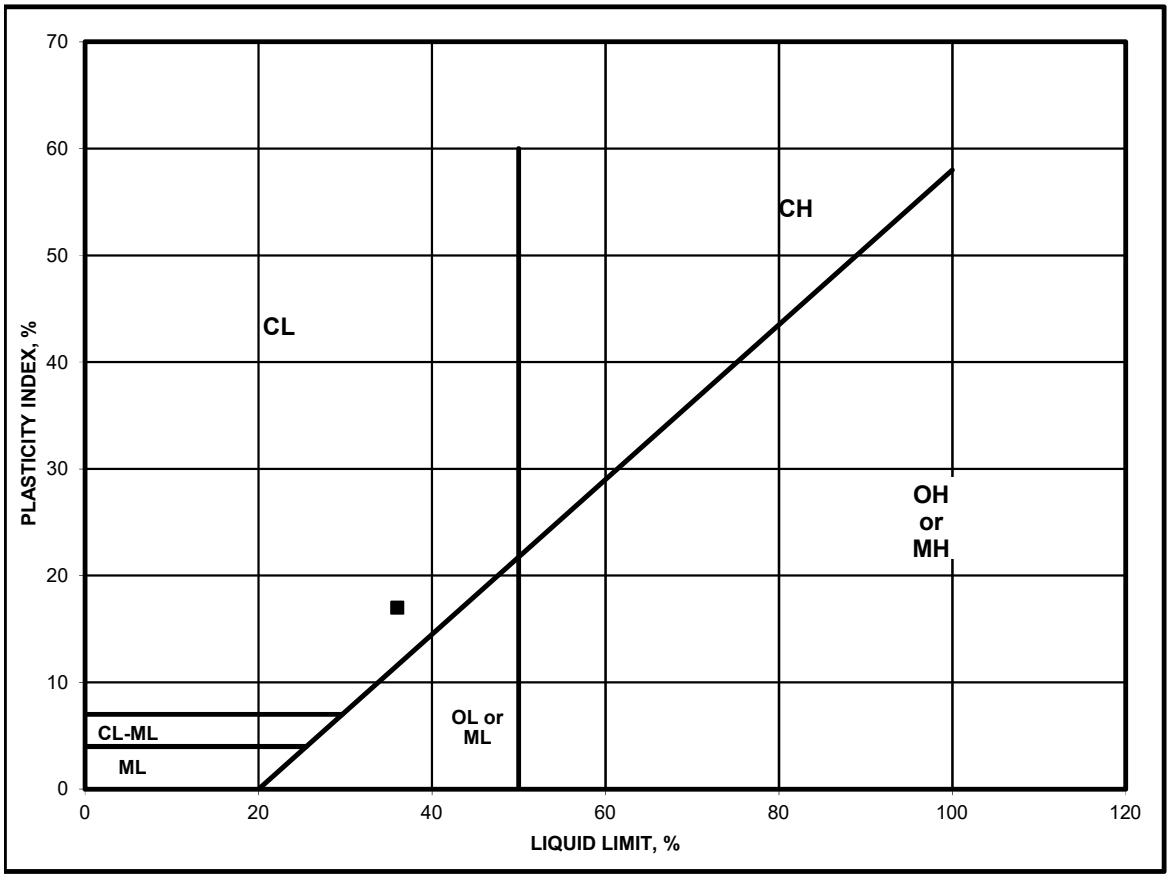
Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA
Project Number: 3-220-0514
Date Sampled: 7/9/2020 Date Tested: 7/17/2020
Sampled By: EGR Tested By: M. Noorzay
Sample Location: B-5 @ 2'

Run Number	Plastic Limit			Liquid Limit		
	1	2	3	1	2	3
Weight of Wet Soil & Tare	28.98	29.81	29.20	33.31	33.26	33.38
Weight of Dry Soil & Tare	27.63	28.38	27.87	30.18	29.91	29.92
Weight of Water	1.35	1.43	1.33	3.13	3.35	3.46
Weight of Tare	20.66	20.95	20.92	21.11	20.81	20.73
Weight of Dry Soil	6.97	7.43	6.95	9.07	9.10	9.19
Water Content	19.4	19.2	19.1	34.5	36.8	37.6
Number of Blows				32	21	20

Plastic Limit : 19 **Liquid Limit : 36**

Plasticity Index : 17

Unified Soil Classification : CL



SALEM engineering group, inc.

Atterberg Limits Determination

ASTM D4318

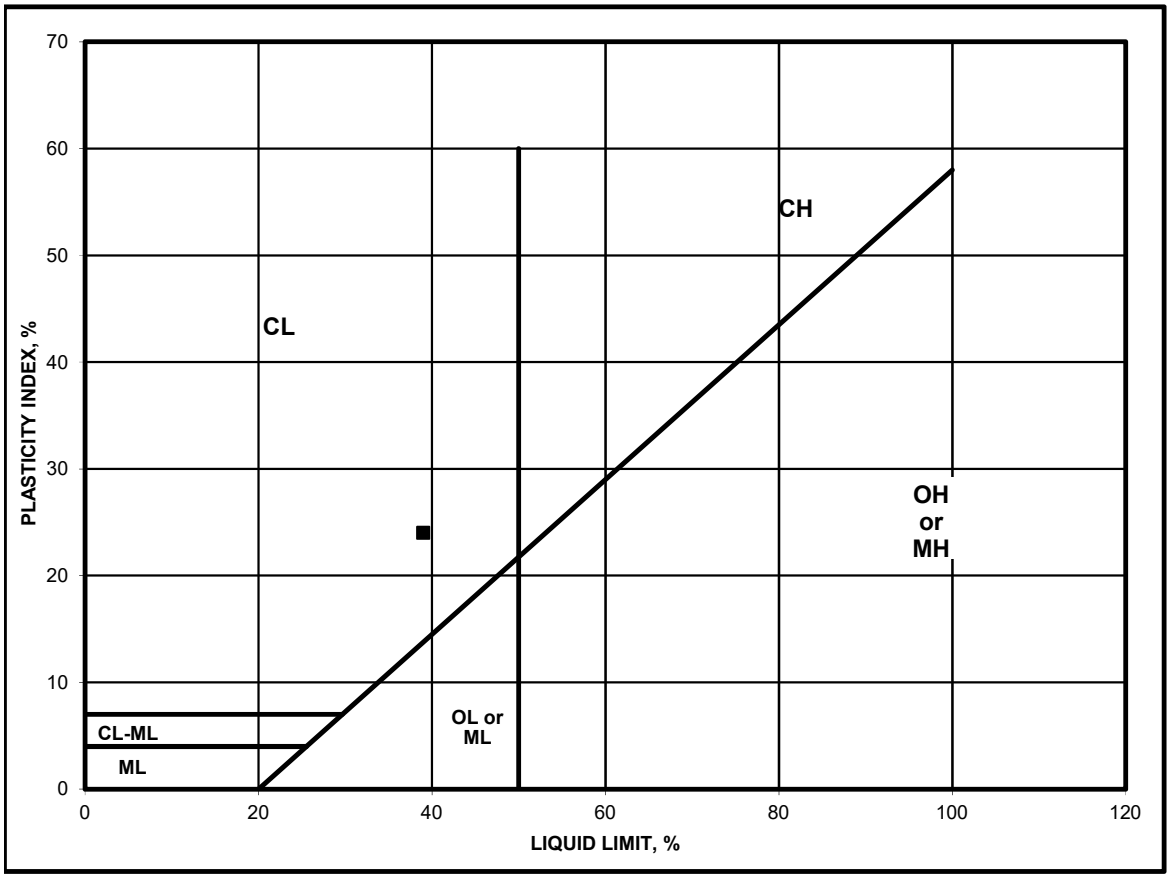
Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA
Project Number: 3-220-0514
Date Sampled: 7/9/2020 Date Tested: 7/17/2020
Sampled By: EGR Tested By: M. Noorzay
Sample Location: B-9 @ 2'

Run Number	Plastic Limit			Liquid Limit		
	1	2	3	1	2	3
Weight of Wet Soil & Tare	30.57	27.80	28.72	34.02	35.63	34.15
Weight of Dry Soil & Tare	29.29	26.86	27.68	30.57	31.56	30.17
Weight of Water	1.28	0.94	1.04	3.45	4.07	3.98
Weight of Tare	20.85	20.75	20.97	20.95	20.78	20.73
Weight of Dry Soil	8.44	6.11	6.71	9.62	10.78	9.44
Water Content	15.2	15.4	15.5	35.9	37.8	42.2
Number of Blows				34	30	18

Plastic Limit : 15 **Liquid Limit : 39**

Plasticity Index : 24

Unified Soil Classification : CL



SALEM engineering group, inc.

CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA
Project Number: 3-220-0514
Date Sampled: 7/9/2020 Date Tested: 7/13/2020
Sampled By: EGR Tested By: M. Noorzay
Soil Description: Brown Silty GRAVEL (GM) with Sand and trace Clay

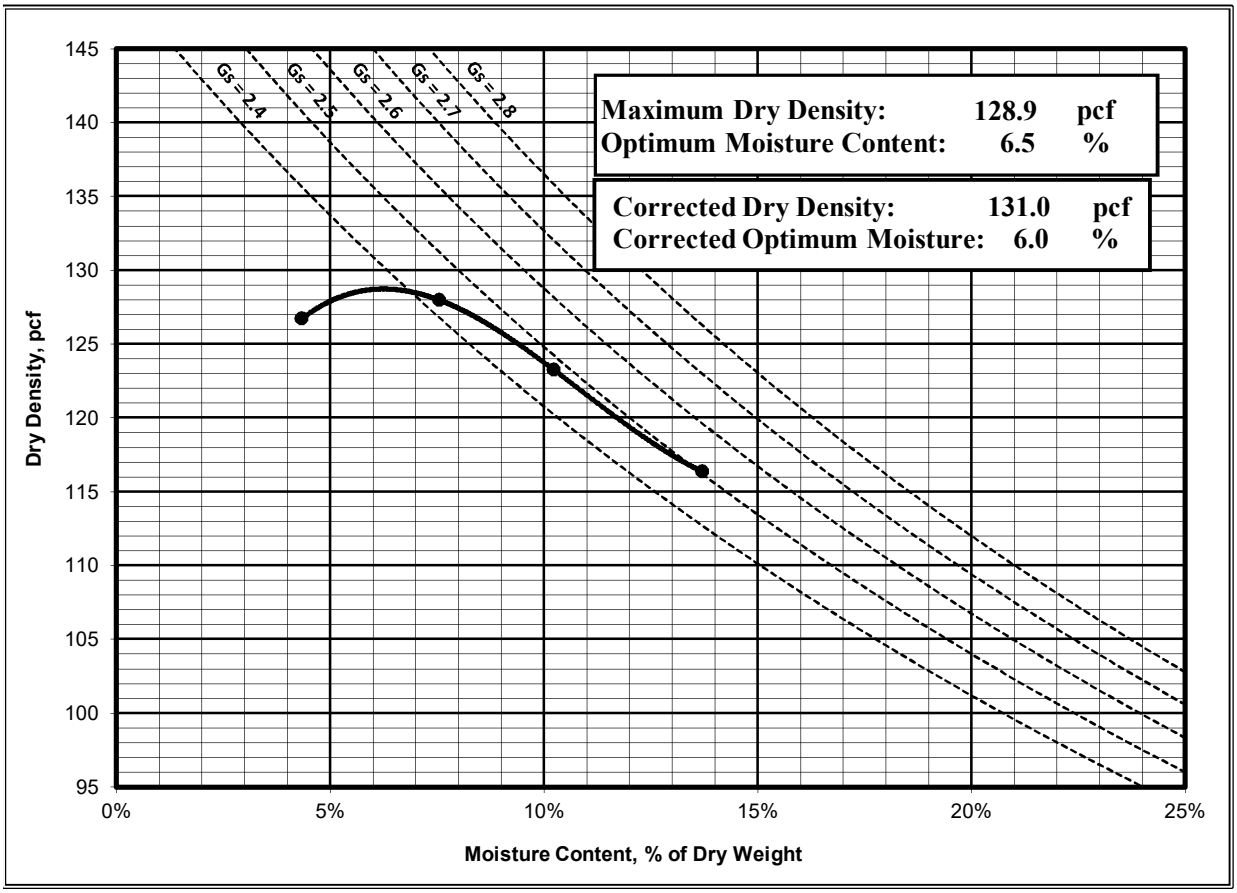
Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-1 @ 1'-4'	250 mg/kg	20 mg/kg	7.8
1b.	B-1 @ 1'-4'	250 mg/kg	20 mg/kg	7.8
1c.	B-1 @ 1'-4'	260 mg/kg	20 mg/kg	7.8
Average:		**253 mg/kg**	**20 mg/kg**	**7.8**

SALEM engineering group, inc.

Laboratory Compaction Curve
ASTM D1557

Project Name: Proposed Apartment and Retail Development - San Juan Capistrano, CA
Project Number: 3-220-0514
Date Sampled: 7/9/2020 Date Tested: 7/14/2020
Sampled By: EGR Tested By: M. Noorzay
Sample Location: B-1 @ 1'-4'
Soil Description: Brown Silty GRAVEL (GM) with Sand and trace Clay
Test Method: Method C

	1	2	3	4
Weight of Moist Specimen & Mold, (g)	7364.7	7548.7	7488.6	7367.2
Weight of Compaction Mold, (g)	2866.5	2866.5	2866.5	2866.5
Weight of Moist Specimen, (g)	4498.2	4682.2	4622.1	4500.7
Volume of Mold, (ft^3)	0.0750	0.0750	0.0750	0.0750
Wet Density, (pcf)	132.2	137.6	135.9	132.3
Weight of Wet (Moisture) Sample, (g)	500.0	500.0	500.0	500.0
Weight of Dry (Moisture) Sample, (g)	479.2	464.9	453.6	439.7
Moisture Content, (%)	4.3%	7.6%	10.2%	13.7%
Dry Density, (pcf)	126.7	128.0	123.3	116.3



SALEM engineering group, inc.

APPENDIX

C

APPENDIX C
GENERAL EARTHWORK AND PAVEMENT SPECIFICATIONS

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

1.0 SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including, but not limited to, the furnishing of all labor, tools and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans and disposal of excess materials.

2.0 PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of SALEM Engineering Group, Incorporated, hereinafter referred to as the Soils Engineer and/or Testing Agency. Attainment of design grades, when achieved, shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary adjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer, or project Architect. No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

3.0 TECHNICAL REQUIREMENTS: All compacted materials shall be densified to no less that 95 percent of relative compaction (90% for silty or clayey soil) based on ASTM D1557 Test Method (latest edition), UBC or CAL-216, or as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

4.0 SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the Geotechnical Engineering Report. The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

5.0 DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or wind-blown materials attributable to his work. Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.

6.0 CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter and all other matter determined by the Soils Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed improvement areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations is not permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

7.0 SUBGRADE PREPARATION: Surfaces to receive Engineered Fill and/or building or slab loads shall be prepared as outlined above, scarified to a minimum of 12 inches, moisture-conditioned as necessary, and recompacted to 95 percent relative compaction (90% for silty or clayey soil).

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 95 percent relative compaction (90% for silty or clayey soil). All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any fill material.

8.0 EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

9.0 FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence or approval of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills, provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

10.0 PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. Compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer. Both cut and fill shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

11.0 SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing, or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill

operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill is as specified.

12.0 DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed. The term “Standard Specifications”: hereinafter referred to, is the most recent edition of the Standard Specifications of the State of California, Department of Transportation. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as determined by ASTM D1557 Test Method (latest edition) or California Test Method 216 (CAL-216), as applicable.

13.0 PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 95 percent (90% for silty or clayey soil) based upon ASTM D1557. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

14.0 AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, ¾-inch or 1½-inches maximum size. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

15.0 AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II Subbase material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216, and it shall be spread and compacted in accordance with the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

16.0 ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10, unless otherwise stipulated or local conditions warrant more stringent grade. The mineral aggregate shall be Type A or B, ½ inch maximum size, medium grading, and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning, and mixing of the materials shall conform to Section 39. The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with a combination steel-wheel and pneumatic rollers, as described in the Standard Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.