FUSCOE ENGINEERING

WATER QUALITY MANAGEMENT PLAN (WQMP)

COSTCO TUSTIN

June 12, 2019

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COSTCO TUSTIN

GAS STATION & PARKING

TUSTIN, California

PREPARED FOR
COSTCO WHOLESALE
999 Lake Drive
Issaquah, WA 98027
425.463.2000

FUSCOE ENGINEERING, INC.
16795 Von Karman, Suite 100
Irvine, California 92606
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PROJECT MANAGER
Mark Nero, PE

DATE PREPARED: June 12, 2019

PROJECT NUMBER: 0756.059.02

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FINAL
WATER QUALITY MANAGEMENT PLAN (WQMP)

COSTCO TUSTIN GAS STATION & PARKING

2655 El Camino Real, Tustin, County of Orange

G-2019-00003
TRACT 14610
APN: 500-185-04 & 500-185-05

Prepared for:

COSTCO WHOLESALE
999 Lake Drive
Issaquah, WA 98027
425.463.2000

Prepared by:

FUSCOE ENGINEERING, INC.
16795 Von Karman, Suite 100
Irvine, CA 92618
949.474.1960
Mark Nero, PE

Date Prepared: May 02, 2019
Date Revised: June 12, 2019

PROJECT OWNER'S CERTIFICATION			
Permit/Application No.:	Pending	**Grading Permit No.:**	G-2019-00003
Tract/Parcel Map and Lot(s)No.:	Tract 14610	**Building Permit No.:**	Pending
Address of Project Site and APN:	2655 El Camino Real, Tustin, CA 92782 APN: 500-185-04 & 500-185-05		

This Water Quality Management Plan (WQMP) has been prepared for COSTCO WHOLESALE by FUSCOE ENGINEERING, INC. The WQMP is intended to comply with the requirements of the County of Orange 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 , including the ongoing operation and maintenance of all best management practices (BMPs), 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 Santa Ana Region. 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:			
Name:	Diana Salazar		
Title:	Director of Real Estate Development		
Company:	Costco Wholesale		
Address:	9 Corporate Park Suite 230, Irvine, CA 92606		
Email:	dsalazar@costco.com		
Telephone #:	714.978.5026		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature:	Diana Salazar	**Date:**	06-20-2019

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EDUCATIONAL MATERIALS (INCLUDED IN APPENDIX C)

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SECTION I DISCRETIONARY PERMITS AND WATER QUALITY CONDITIONS

PROJECT INFORMATION			
Permit/Application No.:	Pending	**Grading or Building Permit No.:**	G-2019-00003
Address of Project Site (or Tract Map and Lot Number if no address) and APN:	2655 El Camino Real, Tustin, CA 92782 APN: 500-185-04 & 500-185-05		
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Discretionary Permit(s):	N/A		
Water Quality Conditions of Approval or Issuance applied to this project: **(Please list verbatim.)**	See Appendix E for Conditions of Approval.		
CONCEPTUAL WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	Yes, a Preliminary Water Quality Management Plan was submitted and reviewed by the City of Tustin.		
WATERSHED-BASED PLAN CONDITIONS			
Applicable conditions from watershed - based plans including WIHMPs and TMDLs:	No approved WIHMP. The project is within the Newport Bay Watershed which has the following TMDLs: • Sediment • Nutrients • Pesticides • Fecal Coliform		

SECTION II PROJECT DESCRIPTION

II.1 PROJECT DESCRIPTION

The proposed Costco Tustin Gas Station & Parking project site encompasses approximately 2.38 acres in the City of Tustin. The project site is bounded by Bryan Ave to the northeast, Myford Road to the southeast, and El Camino Real to the southwest. A Vicinity Map is included in Section VI.

Under existing conditions, the project site is a parking lot serving the Costco Warehouse and Goodyear Tire Center. Adjacent land uses include residential homes to the northeast and northwest along with commercial land use to the southwest and southeast.

The table below summarizes the proposed project.

DESCRIPTION OF PROPOSED PROJECT	
Development Category (Model WQMP, Table 7.11-2; or 7.11-3):	8. All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discussed in Section 7.II-2.0 only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development. 9. Retail Gasoline Outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more, or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. *For the proposed Costco Tustin project, less than 50% of the total site will be subject to redevelopment and therefore, the numeric sizing criteria apply only to the redevelopment and not the entire property. However, the limit of work does take run-on from the existing Costco site. For the purpose of consistency, this report will refer to the drainage management area acreage (6.63 acres).*
Project Area (ft^2):	Total Costco Site: 521,413 ft^2 (11.97 acres) Drainage Management Area (DMA): 288,803 ft^2 (6.63 acres) Limit of Work: 103,791 ft^2 (2.38 acres)
# of Dwelling Units:	N/A
SIC Code:	5311 - Department Stores, 5541 - Gas Station

DESCRIPTION OF PROPOSED PROJECT				
Narrative Project Description:	The project proposes a new fueling facility consisting of four gasoline refueling islands each with four pumps, three 40,000 gallon-underground storage tanks (UTS), a fuel additive UST, a controller enclosure, and a canopy structure. An adjacent retail shop will be demolished and converted to additional parking for the existing Costco warehouse. A total of 2.38 acres of the total 11.97 acre property will be disturbed as part of this project (approximately 20% of the total property).			
Project Area:	**Pervious Area**	**Pervious Area Percentage**	**Impervious Area**	**Impervious Area Percentage**
Pre-Project Conditions:	0.24 ac	10%	2.14 ac	90%
Post-Project Conditions:	0.12 ac	5%	2.26 ac	95%
Drainage Patterns/ Connections:	Under existing conditions, runoff generally flows southwest exiting the site onto El Camino Real and entering the El Modena Channel. From there runoff flows downstream to join Peters Canyon Channel, Newport Bay and eventually out into the Pacific Ocean. Under proposed conditions, low flow runoff will be directed via a storm drain system to one of three modular wetland systems (MWS) for water quality treatment. High flows will bypass the biotreatment and exit the site. Drainage Management Area (DMA) A1 generally flows southwest to two inlets. The gas station runoff is diverted via ribbon gutter to an inlet and then to an oil water separator for treatment. The roof runoff from the gas station and area to the north flows into another inlet with lows flows treated by MWS #1. Treated flows and high flows reconvene in an 18" storm drain system that leads to a larger 36" storm drain system that exits the site onto El Camino Real and eventually leads to the El Modena Channel. DMA A2 runoff flows south and captures low flow runoff in a curb opening which is treated by MWS #2. High and low flows exit the site in a 36" storm drain system and immediately enter the El Modena Channel. DMA B runoff will flow south into MWS #3 via curb opening. Flows will then travel through a 12" storm drain connecting to an 18" storm drain and connect to existing city infrastructure. Flows cross El Camino Real through the 36" city storm drain system, eventually making its way to the El Modena Channel. From the El Modena Channel runoff flows downstream to join Peters Canyon Channel, Newport Bay and eventually exits into the Pacific Ocean.			
PROJECT FEATURES				
Building Summary:	No buildings are proposed for the project site. Additional parking will be constructed to serve the existing warehouse building as well as a gas station.			

DESCRIPTION OF PROPOSED PROJECT	
Landscaped Areas:	Landscaping will be provided throughout the parking lot and gas station in planter islands and tree boxes.
Parking Facilities:	With the removal of parking for the construction of the gas station, additional parking will be provided southwest of the existing warehouse building. The project site is proposing to have a new total of 607 parking stalls with 13 being ADA approved for the total 11.97 acre site.
Other Project Features:	The existing Costco warehouse includes food prep areas, loading docks, and maintenance bays. The proposed project will add a fueling station and additional parking. The site will not have any outdoor storage areas, vehicle/community car wash racks, or vehicle/equipment wash areas.
Outdoor Activities:	Outdoor activities are anticipated with passive uses in the common landscaped areas amongst the parking lot. All vehicular parking will be located in the adjacent lots from the warehouse. No outdoor storage of materials is anticipated.
Materials Stored:	Materials anticipated to be stored on-site include those associated with a commercial parking lot and gas station (i.e. spill kits, storage, etc.). No outdoor storage of materials is anticipated (materials will be stored indoors).
Wastes Generated:	The project is not anticipated to generate any wastes other than landscape clippings, typical trash, debris and refuse from customers. All wastes shall be collected and properly disposed of.

II.2 POTENTIAL STORM WATER POLLUTANTS

The table below, derived from Table 2 of the Countywide Model WQMP Technical Guidance Document (December 2013), summarizes the categories of land use or project features of concern and the general pollutant categories associated with them.

ANTICIPATED & POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE								
Priority Project Categories and/or Project Features	**General Pollutant Categories**							
	Suspended Solid/ Sediments	**Nutrients**	**Heavy Metals**	**Pathogens (Bacteria/ Virus)**	**Pesticides**	**Oil & Grease**	**Toxic Organic Compounds**	**Trash & Debris**
Detached Residential Development	E	E	N	E	E	E	N	E
Attached Residential Development	E	E	N	E	E	E[(2)]	N	E
Commercial/Industrial Development	E[(1)]	E[(1)]	E[(5)]	E[(3)]	E[(1)]	E	E	E
Automotive Repair Shops	N	N	E	N	N	E	E	E

ANTICIPATED & POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE								
Priority Project Categories and/or Project Features	General Pollutant Categories							
	Suspended Solid/ Sediments	Nutrients	Heavy Metals	Pathogens (Bacteria/ Virus)	Pesticides	Oil & Grease	Toxic Organic Compounds	Trash & Debris
Restaurants	E(1)(2)	E(1)	E(2)	E	E(1)	E	N	E
Hillside Development >5,000 ft²	E	E	N	E	E	E	N	E
Parking Lots	E	E(1)	E	E(4)	E(1)	E	E	E
Streets, Highways, & Freeways	E	E(1)	E	E(4)	E(1)	E	E	E
Retail Gasoline Outlets	N	N	E	N	N	E	E	E

Notes:
E = expected to be of concern N = not expected to be of concern
(1) Expected pollutant if landscaping exists on-site, otherwise not expected.
(2) Expected pollutant if the project includes uncovered parking areas, otherwise not expected.
(3) Expected pollutant if land use involves food or animal waste products, otherwise not expected.
(4) Bacterial indicators are routinely detected in pavement runoff.
(5) Expected if outdoor storage or metal roofs, otherwise not expected.
Source: County of Orange. (2013, December 20). Technical Guidance Document for the Preparation of Conceptual/ Preliminary and/or Project Water Quality Management Plans (WQMPs). Table 2.1.

Priority Project Categories and/or Features: Parking lot, Retail Gasoline Outlet

POLLUTANTS OF CONCERN		
Pollutant	E = Expected to be of concern N =Not Expected to be of concern	Additional Information and Comments
Suspended Solid/ Sediment	E	303(d) listed impairments, TMDL in effect (see table in Section III.3 for TMDL details)
Nutrients	E	303(d) listed impairments, TMDL in effect (see table in Section III.3 for TMDL details)
Heavy Metals	E	303(d) listed impairments, TMDL in effect (see table in Section III.3 for TMDL details)
Pathogens (Bacteria/Virus)	E	303(d) listed impairments, TMDL in effect (see table in Section III.3 for TMDL details)
Pesticides	E	303(d) listed impairments, TMDL in effect (see table in Section III.3 for TMDL details)
Oil & Grease	E	

POLLUTANTS OF CONCERN		
Pollutant	**E = Expected to be of concern N =Not Expected to be of concern**	**Additional Information and Comments**
Toxic Organic Compounds	E	303(d) listed impairments, TMDL in effect (see table in Section III.3 for TMDL details)
Trash & Debris	E	

II.3 HYDROLOGIC CONDITIONS OF CONCERN

The purpose of this section is to identify any hydrologic conditions of concern (HCOC) with respect to downstream flooding, erosion potential of natural channels downstream, impacts of increased flows on natural habitat, etc. As specified in Section 2.3.3 of the 2011 Model WQMP, projects must identify and mitigate any HCOCs. A HCOC is a combination of upland hydrologic conditions and stream biological and physical conditions that presents a condition of concern for physical and/or biological degradation of streams.

In the North Orange County permit area, HCOCs are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts and either of the following conditions exists:

- Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent

or

- Time of concentration (Tc) of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent.

If these conditions do not exist or streams are not potentially susceptible to hydromodification impacts, an HCOC does not exist and hydromodification does not need to be considered further. In the North Orange County permit area, downstream channels are considered not susceptible to hydromodification, and therefore do not have the potential for a HCOC, if all downstream conveyance channels that will receive runoff from the project are engineered, hardened, and regularly maintained to ensure design flow capacity, and no sensitive habitat areas will be affected.

Is the proposed project potentially susceptible to hydromodification impacts?

☒ **Yes** ☐ **No (show map)**

2-YEAR, 24-HOUR STORM SUMMARY- Basin A				
Condition	**Acreage**	**Tc**	**Peak Runoff**	**Volume**
Pre-development	6.11	6.4 min	10.7 cfs	0.104 ac-ft
Proposed	6.0	7 min	10.0 cfs	0.106 ac-ft
Difference	**-0.11**	**+0.6**	**-0.7**	**+0.002**
% Change		**+9.4%**	**-6.5%**	**+1.9**

2-YEAR, 24-HOUR STORM SUMMARY – Basin B				
Condition	**Acreage**	**Tc**	**Peak Runoff**	**Volume**
Pre-development	0.63	6.2 min	1.1 cfs	0.104 ac-ft
Proposed	0.63	6.2 min	1.1 cfs	0.106 ac-ft
Difference	**0**	**0**	**0**	**+0.002**
% Change		**0**	**0**	**+1.9**

As a result of the site development, peak runoff will decrease for the 2-year events. The post condition runoff volume will increase to 0.106 ac-ft which is less than 105% of the predeveloped runoff volumes. Tc's have slightly increased as a result of on-site routing from the proposed storm drain facilities toward the proposed drainage discharge location in the south and southwest corners of the site. Furthermore, the TGD recognizes that increases in Tc are acceptable, as a longer Tc is generally associated with natural conditions and nearly universally results in lower concerns for hydromodification impacts (TGD, Section 2.2.3.1, footnote 4). The decreased runoff and increased time of concentration helps ensure runoff will not affect downstream channels. An HCOC, therefore, does not exist and hydromodification does not need to be considered further.

The 2-year peak flow and small unit hydrograph calculations (i.e. 2-year volumes) for existing and proposed conditions are provided in Appendix G.

II.4 POST DEVELOPMENT DRAINAGE CHARACTERISTICS

Under proposed conditions, low flow runoff will be directed via a storm drain system to one of three modular wetland systems for water quality treatment. High flows will bypass the biotreatment and exit the site. DMA A1 generally flows southwest to two inlets. The gas station runoff is diverted via ribbon gutter to an inlet and then to an oil water separator for treatment. The roof runoff from the gas station and area to the north flows into another inlet with lows flows treat by MWS #1. Treated flows and high flows reconvene in an 18" storm drain system that leads to a larger 36" storm drain system that exits the site onto El Camino Real and eventually leads to the El Modena Channel.

DMA A2 runoff flows south and captures low flow runoff in a curb opening which is treated by MWS #2. High and low flows exit the site in a 36" storm drain system and immediately enter the El Modena Channel. DMA B runoff will flow south into MWS #3 via curb opening. Flows will then travel through a 12" storm drain connecting to an 18" storm drain and exit onto El Camino Real through a 36" storm drain system, eventually making its way to the El Modena Channel. From the El Modena Channel runoff flows downstream to join Peters Canyon Channel, Newport Bay and eventually exits into the Pacific Ocean.

II.5 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Public Streets:	City of Tustin
Private Streets:	Costco Wholesale
Landscaped Areas:	Costco Wholesale
Open Space:	Costco Wholesale
Easements:	City of Tustin
Parks:	N/A
Buildings:	Costco Wholesale
Structural BMPs:	Costco Wholesale

The Owner, Costco Wholesale shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Section V of this report.

SECTION III SITE DESCRIPTION

III.1 PHYSICAL SETTING

Planning Area/ Community Name:	Costco Tustin Gas Station & Parking
Address:	2655 El Camino Real, Tustin, CA 92782
Project Area Description:	The project site is located at the Tustin Marketplace and bounded by Bryan Ave to the northeast, Myford Road to the southeast, and El Camino Real to the southwest.
Land Use:	Planned Community Commercial/Business
Zoning:	PC Commercial
Acreage:	6.63 acres (Drainage Management Area) 2.38 acres (Limit of Work)
Predominant Soil Type:	Type C
Impervious Conditions:	Existing Impervious: 90% (10% Pervious) Proposed Impervious: 95% (5% Pervious)

III.2 SITE CHARACTERISTICS

Precipitation Zone:	0.75
Topography:	The project site is relatively flat and generally drains towards an existing low point at the southwest edge of the property.
Existing Drainage Patterns/ Connections:	Under existing conditions, runoff generally flows southwest exiting the site onto El Camino Real and entering the El Modena Channel. From there runoff flows downstream to join Peters Canyon Channel, Newport Bay and eventually out into the Pacific Ocean.

Proposed Drainage Patterns/ Connections:	Under proposed conditions, low flow runoff will be directed via a storm drain system to one of three modular wetland systems for water quality treatment. High flows will bypass the biotreatment and exit the site. DMA A1 generally flows southwest to two inlets. The gas station runoff is diverted via ribbon gutter to an inlet and then to an oil water separator for treatment. The roof runoff from the gas station and area to the north flows into another inlet with lows flows treat by MWS #1. Treated flows and high flows reconvene in an 18" storm drain system that leads to a larger 36" storm drain system that exits the site onto El Camino Real and eventually leads to the El Modena Channel. DMA A2 runoff flows south and captures low flow runoff in a curb opening which is treated by MWS #2. High and low flows exit the site in a 36" storm drain system and immediately enter the El Modena Channel. DMA B runoff will flow south into MWS #3 via curb opening. Flows will then travel through a 12" storm drain connecting to an 18" storm drain and exit onto El Camino Real through a 36" storm drain system, eventually making its way to the El Modena Channel. From the El Modena Channel runoff flows downstream to join Peters Canyon Channel, Newport Bay and eventually exits into the Pacific Ocean.
Soil Type, Geology, and Infiltration Properties:	A geotechnical study was performed by Kleinfelder in November of 2018. Soils within the vicinity of the project site generally consist of artificial fill materials and native alluvium. Artificial fill materials were found approximately 7-9.5 feet below ground surface (bgs) and consisted of medium stiff to stiff clays with varying amounts of sand and clayey sands. The alluvium layer consisted of fine-grained medium stiff to very stiff clays with varying amounts of sand content and isolated thin layers of medium dense to dense sands, silty sands, and clayey sands with varying amounts of gravel.
Hydrogeologic (Groundwater) Conditions:	The project site is located in an area with shallow groundwater levels, approximately between 10-20 feet below bgs as illustrated in the TGD Figure XVI-2e (see Appendix A). During the geotechnical study, Boring B-3 encountered groundwater at approximately 29 feet bgs, however, historical high groundwater levels in the area have been mapped at a depth approximately 20 feet below grade.
Geotechnical Conditions (relevant to infiltration):	According to Figure XVI-2a of the OC TGD, the project site has predominately Type C soils. Based on visual soil classification and laboratory testing of the soil samples collected during the prior field exploration, the onsite soils in the fill and alluvial soils consist primarily of fine-grained clays with varying amounts of sand and medium dense to dense clayey sands. Given the low infiltration capacity of the on-site soils, the Geotech recommends alternatives to infiltration Best Management Practices (BMPs), such as biofiltration systems. See Appendix F for more details.

Off-Site Drainage:	The project site does take off-site storm water flows from the existing Costco site. The limit of work (2.38 acres) runoff co-mingles with the existing site creating a drainage management area of 6.63 acres. This drainage management area will be used for sizing BMPs for water quality treatment.
Utility and Infrastructure Information:	Dry and wet utilities will be incorporated into the proposed project and will tie into existing facilities associated with the existing development.

III.3 WATERSHED DESCRIPTION

Receiving Waters:	Peters Canyon Channel, San Diego Creek Reach 1, Upper Newport Bay, Lower Newport Bay
303(d) Listed Impairments:	Peters Canyon Channel: DDT, Indicator Bacteria, Toxaphene, pH San Diego Creek Reach 1: Fecal Coliform, Nutrients, Pesticides, Sedimentation/Siltation, Selenium, Toxaphene Upper Newport Bay: Chlordane, Copper, DDT, Indicator, Bacteria, Metals, Nutrients, PCBs, Pesticides, Sediment Toxicity, Sedimentation/ Siltation Lower Newport Bay: Chlordane, Copper, DDT, Indicator Bacteria, Nutrients, PCBs, Pesticides, Sediment Toxicity
Applicable TMDLs:	San Diego Creek Reach 1: Metals, Nutrients, Pesticides, Siltation Upper Newport Bay: Metals, Nutrients, Pathogens, Pesticides, Siltation Lower Newport Bay: Metals, Nutrients, Pathogens, Pesticides, Siltation
Pollutants of Concern for the Project:	Per Section II.2: • Suspended Solid/ Sediment • Nutrients • Heavy Metals • Pathogens (Bacteria/Virus) • Pesticides • Oil & Grease • Toxic Organic Compounds • Trash & Debris
Hydrologic Conditions of Concern (HCOCs):	The project site is located in an area identified as "potential areas of erosion, habitat, & physical structure susceptibility and therefore is susceptible to hydromodification. Refer to Section II.3 for further information.
Environmentally Sensitive and Special Biological Significant Areas:	The project site is not located near an Environmentally Sensitive Area (ESA) according to the OC DAMP. There are no Areas of Special Biological Significance (ASBS) within the project site.

SECTION IV BEST MANAGEMENT PRACTICES (BMPs)

IV.1 PROJECT PERFORMANCE CRITERIA

Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?

☐ Yes ☒ No

PROJECT PERFORMANCE CRITERIA	
Hydromodification Control Performance Criteria: (Model WQMP Section 7.II-2.4.2.2)	If a hydrologic condition of concern (HCOC) exists, priority projects shall implement onsite or regional hydromodification controls such that: ▪ Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and ▪ Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent. Where the Project WQMP documents that excess runoff volume from the two-year runoff event cannot feasibly be retained and where in-stream controls cannot be used to otherwise mitigate HCOCs, the project shall implement on-site or regional hydromodification controls to: ▪ Retain the excess volume from the two-year runoff event to the MEP, and ▪ Implement on-site or regional hydromodification controls such that the post-development runoff two-year peak flow rate is no greater than 110 percent of the predevelopment runoff two-year peak flow rate.
LID Performance Criteria: (Model WQMP Section 7.II-2.4.3)	Infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume). LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) storm water runoff up to 80 percent average annual capture efficiency.
Treatment Control BMP Performance Criteria: (Model WQMP Section 7.II-3.2.2)	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate.

PROJECT PERFORMANCE CRITERIA	
LID Design Storm Capture Volume:	DCV = C × d × A × 43560 sf/ac × 1/12 in/ft Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 × imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 95 d = 0.75 inches A = 6.63 acres (tributary area) *DCV* = *(0.75 x 0.95 +0.15) x* 0.75 *inches x* 6.63 *ac x 43560 sf/ac x 1/12 in/ft* = 15,577 cu-ft *Refer to Section IV.2.2 for specific Drainage Manage Area (DMA) breakdown and Appendix A for detailed calculations (Worksheet B).*

IV.2 SITE DESIGN AND DRAINAGE PLAN

The following section describes the site design BMPs used in this project and the methods used to incorporate them. Careful consideration of site design is a critical first step in storm water pollution prevention from new developments and redevelopments.

IV.2.1 Site Design BMPs

Minimize Impervious Area

Impervious surfaces have been minimized by incorporating landscaped areas throughout the parking lot.

Maximize Natural Infiltration Capacity

Infiltration is not recommended for the project site due to poor infiltrating soils and proximity to groundwater. Refer to Section IV.3.2 for details.

Preserve Existing Drainage Patterns and Time of Concentration

Runoff from the site will continue to flow similar to existing conditions. Low-flows and first-flush runoff will drain to modular wetland systems for water quality treatment via biotreatment.

Gas Service Island Runoff

Runoff from the pump service islands are directed via ribbon gutter and enter a catch basin at the south edge of the gas station. Flows then pass through an oil water separator (OWS) system for treatment before joining the existing storm drain system and exiting the site. See the WQMP exhibit in Section 6 for location of OWS and OWS details.

Disconnect Impervious Areas

Landscaping will be provided throughout parking lot. Low flows and first flush runoff will drain to modular wetland systems for water quality treatment via biotreatment. Refer to Section IV.3.4 for further details.

Protect Existing Vegetation and Sensitive Areas, and Revegetate Disturbed Areas

There are no existing vegetated or sensitive areas to preserve on the project site. All disturbed areas will either be paved or landscaped.

Xeriscape Landscaping

Xeriscape landscaping is not proposed for the project. However, native and/or tolerant landscaping will be incorporated into the site design consistent with City guidelines.

The IDIV.2.2 Drainage Management Areas

In accordance with the MS4 permit and the 2011 Model WQMP, the project site has been divided into Drainage Management Areas (DMAs) to be utilized for defining drainage areas and sizing LID and other treatment control BMPs. DMAs have been delineated based on the proposed site grading patterns, drainage patterns, storm drain and catch basin locations. DMAs provided on WQMP exhibit in Section VI.

The design capture volumes (DCV) and treatment flow rates (Q_{Design}) for each DMA are summarized in the table below. These have been derived utilizing the "Simple Method" in accordance with the TGD Section III.1.1. Actual BMP sizing requirements, including 80 percent capture design volumes, flow rates, depths, and other design details for the specific BMPs proposed are provided in Section IV.3.4 below. Locations of DMAs and associated LID and treatment BMPs are identified on the exhibits in Section VI. Additional calculations and TGD Worksheets are provided in Appendix A.

DRAINAGE MANAGEMENT AREAS (DMAs)							
DMA/ Drainage Area ID[1]	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth[2] (in)	Estimated Tc (min)	Rainfall Intensity[3] (in/hr)	Simple Method DCV[4] (ft^3)	Q_{Design} [5] (cfs)
DMA A1	2.64	96	0.75	5	0.26	6,253	0.597
DMA A2	3.37	98	0.75	5	0.26	8,120	0.775
DMA B	0.63	84	0.75	5	0.26	1,338	0.128

TOTAL	6.63	95	0.75	5	0.26	15,577	1.488

Notes:
1. Refer to exhibits in Section VI for locations of each DMA.
2. Per Figure XVI-1 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
3. Per Figure III.4 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
4. Per Section III.1.1 of the Technical Guidance Document.
5. Per Section III.3.3 and Worksheet D of the Technical Guidance Document.

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

Low Impact Development (LID) BMPs are required in addition to site design measures and source controls to reduce pollutants in storm water discharges. LID BMPs are engineered facilities that are designed to retain or biotreat runoff on the project site. The 4th Term MS4 Storm Water Permit (Order R8-2009-0030) requires the evaluation and use of LID features using the following hierarchy of treatment: infiltration, evapotranspiration, harvest/reuse, and biotreatment. The following sections summarize the LID BMPs proposed for the project in accordance with the permit hierarchy and performance criteria outlined in Section IV.1.

IV.3.1 Hydrologic Source Controls (HSCs)

Hydrologic source controls (HSCs) can be considered to be a hybrid between site design practices and LID BMPs. HSCs are distinguished from site design BMPs in that they do not reduce the tributary area or reduce the imperviousness of a drainage area; rather they reduce the runoff volume that would result from a drainage area with a given imperviousness compared to what would result if HSCs were not used.

HYDROLOGIC SOURCE CONTROLS		
ID	**Name**	**Included?**
HSC-1	Localized on-lot infiltration	☐
HSC-2	Impervious area dispersion (e.g. roof top disconnection)	☐
HSC-3	Street trees (canopy interception)	☐
HSC-4	Residential rain barrels (not actively managed)	☐
HSC-5	Green roofs/Brown roofs	☐
HSC-6	Blue roofs	☐
HSC-7	Impervious area reduction (e.g. permeable pavers, site design)	☐

HSCs were not incorporated into the project's design at this stage in the project's development. Please refer to Section IV.3.4 for information on biotreatment BMPs.

IV.3.2 Infiltration BMPs

Infiltration BMPs are LID BMPs that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. Examples of infiltration BMPs include infiltration trenches, bioretention without underdrains, drywells, permeable pavement, and underground infiltration galleries.

INFILTRATION		
ID	**Name**	**Included?**
INF-3 INF-4	Bioretention Without Underdrains	☐
	Rain Gardens	☐
	Porous Landscaping	☐
	Infiltration Planters	☐
	Retention Swales	☐
INF-2	Infiltration Trenches	☐
INF-1	Infiltration Basins	☐
INF-5	Drywells	☐
INF-7	Subsurface Infiltration Galleries	☐
--	French Drains	☐
INF-6	Permeable Asphalt	☐
	Permeable Concrete	☐
	Permeable Concrete Pavers	☐
	Other:	☐

No infiltration BMPs are proposed within the redevelopment project. As discussed in Section III.2, the project site has poor infiltrating soils and shallow groundwater. The Geotech states, "Based on visual soil classification and laboratory testing of the soil samples collected during the prior field exploration, the onsite soils in the fill and alluvial soils consist primarily of fine-grained clays with varying amounts of sand and medium dense to dense clayey sands. Given the low infiltration capacity of the on-site soils, the Geotech recommends alternatives to infiltration Best Management Practices (BMPs), such as biofiltration systems." Therefore, direct or concentrated infiltration of runoff is not considered feasible for the project. Biotreatment will be used for water quality treatment (See Section IV.3.4). See also Appendices A and F for further details.

IV.3.3 Evapotranspiration & Rainwater Harvesting BMPs

Evapotranspiration (ET) BMPs are a class of retention BMPs that discharges stored volume predominately to ET, though some infiltration may occur. ET includes both evaporation and transpiration, and ET BMPs may incorporate one or more of these processes. BMPs must be designed to achieve the maximum feasible ET, where required to demonstrate that the maximum amount of water has been retained on-site. Since ET is not the sole process in these BMPs, specific design and sizing criteria have not been developed for ET-based BMPs.

EVAPOTRANSPIRATION		
ID	**Name**	**Included?**
--	HSCs, *see Section IV.3.1*	☐
--	Surface-based infiltration BMPs	☐
--	Biotreatment BMPs, see *Section VI.3.4*	☒
	Other:	☐

Biotreatment BMPs are proposed which utilize evapotranspiration as physical process for runoff volume reduction. Bioretention BMPs are described further in Section IV.3.4.

Harvest and use (aka. Rainwater Harvesting) BMPs are LID BMPs that capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. Harvest and use BMPs include both above-ground and below-ground cisterns. Examples of uses for harvested water include irrigation, toilet and urinal flushing, vehicle washing, evaporative cooling, industrial processes and other non-potable uses.

HARVEST & REUSE / RAINWATER HARVESTING		
ID	**Name**	**Included?**
HU-1	Above-ground cisterns and basins	☐
HU-2	Underground detention	☐
--	Other:	☐

In order to quantify harvested water demand for the common areas of the project, the Modified Estimated Applied Water Use (EAWU) method was used, consistent with Appendix X of the Model WQMP's Technical Guidance Document (TGD), dated December 20, 2013.

The Modified EAWU method is modified from the OC Irrigation Code (County Ordinance No. 09-010) to account for the wet season demand and storm events (assuming that no irrigation would be applied for approximately 30% of the days in the wet season).

The equation used to calculate the Modified EAWU is:

$$Modified\ EAWU = \frac{(ETo\text{wet} \times K\text{L} \times LA \times 0.015)}{IE}$$

Where:

$Modified\ EAWU$ = estimated daily average water use during wet season
ETo_{wet} = average reference ET from November through April (inches per month) per Table X.2 of the TGD
K_L = landscape coefficient (Table X.4 of the TGD)
LA = landscape area irrigated with harvested water (square feet)
IE = irrigation efficiency (assumed at 90%)

Note: In the equation, the coefficient (0.015) accounts for unit conversions and shut down of irrigation during and for three days following a significant precipitation event.

For a system to be considered "feasible", the system must be designed with a storage volume equal to the DCV from the tributary area and achieve more than 40% capture. The system must also be able to drawdown in 30 days to meet the 40% capture value. In addition, Table X.6 of the Technical Guidance Document sets forth the demand thresholds for minimum partial capture.

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE

Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

The following table summarizes the estimated applied water use for the common area landscaping of the project.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING									
Landscape Type	Total Area (ac)	% Impervious	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{Wet} [1] (in/mo)	K_L [2]	Modified EAWU (gpd)	Modified EAWU per impervious acre (gpd/ac)	Minimum Capture Threshold [3] (gpd/ac)
Blended Use	6.63	95	6.30	0.33	3	0.7	397.1	63.05	610
Design Capture Volume (gal)				116,518	Drawdown (days)				293.4

Notes:

1 Per Table X.2 for Santa Ana Region (similar climate type), Model WQMP Technical Guidance Document, dated December 20, 2013.
2 Per Table X.4 of the Model WQMP Technical Guidance Document, dated December 20, 2013.
3 Per Table X.6 of Model WQMP Technical Guidance Document, dated December 20, 2013.

As shown above, the project site does not have sufficient water demand during the wet season to support harvest and reuse. The project does not meet the minimum capture threshold of 610 gallons per day/acre with its Modified EAWU or estimated daily average water usage during the wet season. Therefore, the DCV will not be fully utilized and emptied for the next storm event. Drawdown of the DCV is anticipated to take approximately 293 days by the landscape's water demand usage, which is greater than the maximum drawdown time of 30 days

IV.3.4 Biotreatment BMPs

Biotreatment BMPs are a broad class of LID BMPs that reduce storm water volume to the maximum extent practicable, treat storm water using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (though biologically-active media), vegetative filtration (straining, sedimentation, interception, and stabilization of particles resulting from shallow flow through vegetation), general sorption processes (i.e., absorption, adsorption, ion-exchange, precipitation, surface complexation), biologically-mediated transformations, and other processes to address both suspended and dissolved constituents. Examples of biotreatment BMPs include bioretention with underdrains, vegetated swales, constructed wetlands, and proprietary biotreatment systems.

BIOTREATMENT		
ID	Name	Included?
BIO-1	Bioretention with underdrains	☐
	Storm Water planter boxes with underdrains	☐
	Rain gardens with underdrains	☐
BIO-5	Constructed wetlands	☐
BIO-2	Vegetated swales	☐

BIOTREATMENT		
ID	**Name**	**Included?**
BIO-3	Vegetated filter strips	☐
BIO-7	Proprietary vegetated biotreatment systems	☒
BIO-4	Wet extended detention basin	☐
BIO-6	Dry extended detention basins	☐
--	Other:	☐

Since infiltration of runoff for the project site is not considered feasible (see Sections III.2, IV.3.2 and Appendix F for details), and there is insufficient demand for harvest and reuse BMPs, biotreatment BMPs will be utilized for treatment of runoff from the project site.

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit (fitted with a connector pipe screen) collects treated flows and discharges back into the storm drain system and detention system. Modular Wetlands are certified by the State Water Board as a Full Trash Capture device in compliance with the CA State Trash Provisions. Additional details for the Modular Wetland units are included in Section VI of this WQMP.

As detailed in the table below, three modular wetland systems will be used to treat the water quality volume on the project site. The catch basin leading to MWS #1 will utilize a Bio Clean D-Vert structure to direct low flows to the MWS unit and high flows out to an existing storm drain infrastructure that exits the project site on El Camino Real. See WQMP exhibit for location of D-Vert. See Appendix A for detailed calculations and Section VI for BMP details.

BIOTREATMENT BMP SIZING							
DMA/ Drainage Area ID[1]	**BMP**	**Tributary Drainage Area (ac)**	**% Imp.**	**Q_{Design} [2] (cfs)**	**MWS Flow Capacity (cfs)**	**MWS Model Size**	**Sufficient?**
DMA A1	MWS #1	2.64	96	0.597	0.597	MWS L-8-20	Yes
DMA A2	MWS #2	3.37	98	0.775	0.775	MWS L-8-24 (High Capacity)	Yes

BIOTREATMENT BMP SIZING							
DMA/ Drainage Area ID[1]	BMP	Tributary Drainage Area (ac)	% Imp.	Q_{Design} [2] (cfs)	MWS Flow Capacity (cfs)	MWS Model Size	Sufficient?
DMA B	MWS #3	0.63	84	0.128	0.135	MWS L-4-13	Yes

Notes:
6. Refer to exhibits in Section VI for locations of each DMA.
7. Per Section Worksheet D of the Technical Guidance Document.

IV.3.5 Hydromodification Control BMPs

Not applicable. Refer to Section II.3 for further information.

IV.3.6 Regional/Sub-Regional LID BMPs

Not applicable. LID BMPs (biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs.

TREATMENT CONTROL BMPs		
ID	Name	Included?
TRT-1	Sand Filters	☐
TRT-2	Cartridge Media Filter	☐
PRE-1	Hydrodynamic Separation Device	☐
PRE-2	Catch Basin Insert	☐
	Other:	☐

Not applicable. LID BMPs (biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.3.8 Non-Structural Source Control BMPs

The table below indicates all BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
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)	☒	☐	
N6	Local Water Quality Permit Compliance	☐	☒	The City of Tustin does not issue water quality permits.
N7	Spill Contingency Plan	☒	☐	
N8	Underground Storage Tank Compliance	☒	☐	
N9	Hazardous Materials Disclosure Compliance	☒	☐	
N10	Uniform Fire Code Implementation	☒	☐	
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	☒	☐	

N1, Education for Property Owners, Tenants and Occupants

Educational materials will be provided to tenants or employees, including brochures and restrictions to reduce pollutants from reaching the storm drain system. Examples include tips for where to recycle oil, landscaping tips, sewer spills, and proper household hazardous waste disposal. Tenants will be provided with these materials by the property management prior to occupancy, and periodically thereafter. Refer to Section VII for a list of materials available and attached to this WQMP. Additional materials are available through the County of Orange Stormwater Program website

(http://ocwatersheds.com/PublicEd/) and the California Stormwater Quality Association's (CASQA) BMP Handbooks (https://www.casqa.org/resources/bmp-handbooks).

N2, Activity Restrictions

The Owner shall develop ongoing activity restrictions that include those that have the potential to create adverse impacts on water quality. Activities include, but are not limited to: handling and disposal of contaminants, fertilizer and pesticide application restrictions, litter control and pick-up, and vehicle or equipment repair and maintenance in non-designated areas, as well as any other activities that may potentially contribute to water pollution.

N3, Common Area Landscape Management

Management programs will be designed and implemented by the Owner to maintain all the common areas within the project site. These programs will cover how to reduce the potential pollutant sources of fertilizer and pesticide uses, utilization of water-efficient landscaping practices and proper disposal of landscape wastes by the owner/developer and/or contractors.

N4, BMP Maintenance

The Owner will be responsible for the implementation and maintenance of each applicable non-structural BMP, as well as scheduling inspections and maintenance of all applicable structural BMP facilities through its staff, landscape contractor, and/or any other necessary maintenance contractors. Details on BMP maintenance are provided in Section V of this WQMP, and the O&M Plan is included in Appendix D.

N5, Title 22 CCR Compliance (How development will comply)

Where applicable, the proposed project shall comply with Title 22 of the California Code of Regulations and relevant sections of the California Health and Safety Code regarding hazardous waste management, which will be enforced by County Environmental Health on behalf of the State. Compliance shall be maintained on an ongoing basis.

N7, Spill Contingency Plan

Any facilities that store liquid materials or wastes shall maintain procedures for spill response and cleanup activities. Emergency spill kits shall be kept on-site at all times. Spill kits shall include, at a minimum, dry adsorbent material such as kitty litter, mats or pillows, containment booms, wipes, goggles, gloves and disposal bags. Minor spills shall be cleaned up immediately using dry methods, consistent with measures identified in the fact sheets attached to this WQMP. Activities will be coordinated between the respective departments and the Police and Fire departments in the event of a spill. Procedures shall be maintained on an ongoing basis.

N8, Underground Storage Tank Compliance

All underground storage tanks shall meet applicable Federal, State, County, and local regulations. The system components are "product tight", which means that liquid should not get in or out. The fill sumps are equipped with water shrouds to seal between the sump and spill buckets. The spill buckets are equipped with tight seal fill and vapor adaptors & caps (EVR). The turbine sumps are also equipped with product tight covers. The dispensers are the only component that may encounter water

intrusion, but the containment sump will catch 100% of that water. The fuel piping inside of the dispensers are completely tight throughout.

N9, Hazardous Materials Disclosure Compliance

Any storage or utilization of hazardous wastes, where applicable, shall comply with the County of Orange Fire Authority hazardous material disclosure requirements. Compliance shall be maintained on an ongoing basis.

N10, Uniform Fire Code Implementation

The Owner shall ensure all structures comply with Article 80 of the Uniform Fire Code, City of Tustin Municipal Code, County of Orange Fire Authority, and Orange City Fire Department. Compliance shall be maintained on an ongoing basis.

N11, Common Area Litter Control

The Owner will be responsible for performing trash pickup and sweeping of littered common areas on a weekly basis or whenever necessary. Responsibilities will also include noting improper disposal materials by the public and reporting such violations for investigation.

N12, Employee Training

All employees of the Owner and any contractors will require training to ensure that employees are aware of maintenance activities that may result in pollutants reaching the storm drain. Training will include, but not be limited to, spill cleanup procedures, proper waste disposal, housekeeping practices, etc.

N14, Common Area Catch Basin Inspection

All on-site catch basin inlets and drainage facilities shall be inspected and maintained by the Owner at least once a year, prior to the rainy season, no later than October 1st of each year.

N15, Street Sweeping Private Streets and Parking Lots

The Owner shall be responsible for sweeping all on-site drive aisles and parking lots within the project on a quarterly basis.

N16, Retail Gasoline Outlets

The Owner shall maintain clean fuel-dispensing areas, inspect for leaks, remove trash/debris, cleaning up spills, etc. Appropriately design fueling areas to minimize storm water exposure (see N8). Minimize pooling of water by elevating fueling area and draining to an oil/water separator. Utilization of fueling safeguards (see N8). The store manager shall ensure adequately stocked spill kits are kept on-site in the fueling area (see BMP N7). Underground storage tanks fit with spill containment and overflow prevention systems that meet regulations of Section 2635(b) of Title 23 of the Code of California Regulations (see BMP N8). Canopy over fuel pumps to eliminate direct precipitation and grade breaks to reduce runoff and run on. Posted notice to remind patrons not to top off fuel tanks to reduce spills. The gasoline station will have an oil/water separator to capture pollutants prior to discharging downstream.

IV.3.9 Structural Source Control BMPs

The table below indicates all BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S1 SD-13	Provide storm drain system stenciling and signage	☒	☐	
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor storage proposed.
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	No outdoor trash enclosures proposed.
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	No slopes on project site.
S6 SD-31	Properly Design: Dock areas	☐	☒	No loading docks proposed.
S7 SD-31	Properly Design: Maintenance bays	☐	☒	No maintenance bays proposed.
S8 SD-33	Properly Design: Vehicle wash areas	☐	☒	No wash racks proposed.
S9 SD-36	Properly Design: Outdoor processing areas	☐	☒	No outdoor storage proposed.
S10	Properly Design: Equipment wash areas	☐	☒	No washing proposed.
S11 SD-30	Properly Design: Fueling areas	☒	☐	
S12 SD-10	Properly Design: Hillside landscaping	☐	☒	No hillsides on project site.
S13	Properly Design: Wash water control for food preparation areas	☐	☒	No food prep proposed.
S14	Properly Design: Community car wash racks	☐	☒	No car wash racks proposed.

S1/SD-13, Provide storm drain system stenciling and signage

The phrase "NO DUMPING! DRAINS TO OCEAN", or an equally effective phrase approved by the City, will be stenciled on all major storm drain inlets within the project site to alert the public to the destination of pollutants discharged into storm water. Stencils shall be in place prior to release of certificate of occupancy. Stencils shall be inspected for legibility on an annual basis and re-stenciled as necessary.

S4/SD-12, Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

The Owner will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. The Owner will be responsible for implementing all efficient irrigation systems for common area landscaping including, but not limited to, provisions for water sensors and programmable irrigation cycles. This includes smart timers, rain sensors, and moisture shut-off valves. The irrigation systems shall be in conformance with water efficiency guidelines. Systems shall be tested twice per year, and water used during testing/flushing shall not be discharged to the storm drain system.

S11/SD-30, Properly Design: Fueling areas

The fuel dispensing area shall be paved with concrete. An overhanging roof structure shall be provided to cover the fuel dispensing area. Additionally, the cover must not drain into the fuel dispensing area and an appropriate slope will be utilized to prevent ponding. The fuel dispensing area will be separated from the rest of the site by a grade break around the perimeter that prevents run-on or runoff into the areas. A 520 gallon oil/water separator will be located in the fueling area. Additional spill kits will be kept on-site at the fueling station. Additional maintenance of the area will include frequent collection of trash & debris in the area, placement and maintenance of a proper number of covered trash receptacles, and routine sweeping of the area. See also BMP N16 above for further details on fueling area.

IV.4 ALTERNATIVE COMPLIANCE PLAN

IV.4.1 Water Quality Credits

Local jurisdictions may develop a water quality credit program that applies to certain types of development projects after they first evaluate the feasibility of meeting LID requirements on-site. If it is not feasible to meet the requirements for on-site LID, project proponents for specific project types can apply credits that would reduce project obligations for selecting and sizing other treatment BMPs or participating in other alternative programs.

WATER QUALITY CREDITS	
Credit	**Applicable?**
Redevelopment projects that reduce the overall impervious footprint of the project site.	☐

WATER QUALITY CREDITS	
Credit	**Applicable?**
Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface water quality if not redeveloped.	☐
Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance)	☐
Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).	☐
Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned	☐
Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).	☐
Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.	☐
Developments in a city center area.	☐
Developments in historic districts or historic preservation areas.	☐
Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.	☐
In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.	☐

Not applicable. Water quality credits will not be applied for the project. LID BMPs will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.4.2 Alternative Compliance Plan Information

Not applicable. LID BMPs (biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

SECTION V INSPECTION/MAINTENANCE RESPONSIBILITY FOR BMPs

It has been determined that Costco Wholesale shall assume all BMP inspection and maintenance responsibilities for the Costco Tustin Gas Station & Parking project.

Contact Name:	Diana Salazar
Title:	Director of Real Estate Development
Company:	Costco Wholesale
Address:	9 Corporate Park Suite 230, Irvine, CA 92606
Phone:	714.978.5026
Email:	dsalazar@costco.com

Should the maintenance responsibility be transferred at any time during the operational life of Costco Tustin Gas Station & Parking, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the City of Tustin at the time responsibility of the property subject to this WQMP is transferred. The transfer of responsibility shall be incorporated into this WQMP as an amendment.

The Owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification, survey, or other equally effective measure. The certification shall verify that, at a minimum, the inspection and maintenance of all structural BMPs including inspection and performance of any required maintenance in the late summer / early fall, prior to the start of the rainy season. A form that may be used to record implementation, maintenance, and inspection of BMPs is included in Appendix D.

The City of Tustin may conduct verifications to assure that implementation and appropriate maintenance of structural and non-structural BMPs prescribed within this WQMP is taking place at the project site. The Owner shall retain operations, inspections and maintenance records of these BMPs and they will be made available to the City or County upon request. All records must be maintained for at least five (5) years after the recorded inspection date for the lifetime of the project.

Long-term funding for BMP maintenance will be provided by Costco Wholesale.

The Operations and Maintenance (O&M) Plan can be found in Appendix D.

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
BIOTREATMENT BMPs				
	Modular Wetland Systems	The system shall be maintained per manufacturer's specifications. The system shall be inspected at a minimum of once every six months, prior to the start of the rainy season (October 1) each year, and after major storm events. Typical maintenance includes removing trash & debris from the catch basin screening filter (by hand), removal of sediment and solids in the settlement chamber (vacuum truck), replacement of the filter cartridge, and replacement of the drain down filter (if equipped). In addition, plants within the wetland chamber will require trimming as needed in conjunction with routine landscape maintenance activities. No fertilizer shall be used in this chamber. Wetland chamber should be inspected during rain events to verify flow through the system. If little to no flow is observed from the lower valve or orifice plate, the wetland media may require replacement. If prior treatment stages are properly maintained, the life of the wetland media can be up to 20 years.	2x per year	Owner
NON-STRUCTURAL SOURCE CONTROL BMPs				
N1	Education for Property Owners, Tenants and Occupants	Educational materials will be provided to tenants or employees annually. Materials to be distributed are found in Appendix C of this WQMP. Tenants will be provided these materials by the Property Management prior to occupancy and annually thereafter.	Upon first occupancy, Annually thereafter	Owner

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N2	Activity Restrictions	The Owner will prescribe activity restrictions to protect surface water quality, through lease terms or other equally effective measure, for the property. Restrictions include, but are not limited to, prohibiting vehicle maintenance, vehicle washing, and washing of impervious areas.	Ongoing	Owner
N3	Common Area Landscape Management	Maintenance shall be consistent with City requirements. Fertilizer and/or pesticide usage shall be consistent with City Guidelines for Use of Fertilizers (LIP Exhibit A-5.1V) as well as local requirements. Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis to prevent exposure of erodible surfaces. Trimmings, clippings, and other landscape wastes shall be properly disposed of in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and storm drain inlets.	Monthly	Owner
N4	BMP Maintenance	Maintenance of structural BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be kept by the Owner and shall be available for review upon request.	Ongoing	Owner
N5	Title 22 CCR Compliance (How development will comply)	The project site shall comply with Title 22 of the California Code of Regulations and relevant sections of the California Health and Safety Code regarding hazardous waste management, which will be enforced by OCHCA on behalf of the State.	Annually	Owner

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N6	Local Industrial Permit Compliance	Not Applicable		
N7	Spill Contingency Plan	Spill contingency measures shall be implemented on an ongoing basis by the Store Manager. Inspect/verify contingency plan and associated documentation is being followed on an annual basis. Verify spill kits are adequately stocked and placed at key locations in the food preparation area, fueling area, and maintenance area. Cleanup activities will be coordinated between the respective departments and the Police and Fire departments in the event of a spill.	Ongoing	Owner
N8	Underground Storage Tank Compliance	The Owner shall verify compliance with associated State and Health Care Agency regulations on an annual basis.	Annually	Owner
N9	Hazardous Materials Disclosure Compliance	The Owner shall verify compliance with hazardous materials disclosure requirements in accordance with associated fire, Health Care, and other appropriate agencies on an annual basis.	Annually	Owner
N10	Uniform Fire Code Implementation	The Owner shall verify compliance with Article 80 of the Uniform Fire Code enforced by fire protection agency on an annual basis.	Annually	Owner
N11	Common Area Litter Control	Litter patrol, violations investigations, reporting and other litter control activities shall be performed on a weekly basis and in conjunction with routine maintenance activities.	Weekly	Owner

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	**Inspection/Maintenance Activities**	**Minimum Frequency**	**Responsible Party**
N12	Employee Training	Educate all new employees/ managers on storm water pollution prevention, particularly good housekeeping practices, prior to the start of the rainy season (October 1). Refresher courses shall be conducted at a minimum annually, and more frequently if necessary.	Annually	Owner
N13	Housekeeping of Loading Docks	Not Applicable		
N14	Common Area Catch Basin Inspection	Catch basin inlets and other drainage facilities shall be inspected after each storm event and once per year. Inlets and other facilities shall be cleaned prior to the rainy season, by October 1 each year.	Annually	Owner
N15	Street Sweeping Private Streets and Parking Lots	Private streets, drive aisles & any exposed parking areas must be swept at least weekly, including prior to the start of the rainy season (October 1).	Weekly	Owner
N16	Retail Gasoline Outlets	Check for external corrosion, structural failure, and spills frequently. Inspect and clean storm drain inlet and catch basins within the facility boundary after each storm event and before October 1 each year in accordance with BMP N14. Maintain trash receptacles in accordance with BMP N11. Maintain spill kits in accordance with BMP N7. Maintenance of oil/water separator includes quarterly inspection, cleaning and removal of collected oil & grease via vacuum truck and proper disposal or recycling/ rendering of waste off-site. Replace any filters annually as needed.	Annually	Owner
STRUCTURAL SOURCE CONTROL BMPs				

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	**Inspection/Maintenance Activities**	**Minimum Frequency**	**Responsible Party**
S1 SD-13	Provide storm drain system stenciling and signage	Storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1 each year. Those determined to be illegible will be re-stenciled as soon as possible.	Annually	Owner
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	Not Applicable		
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	Not Applicable		
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Inspect, test and adjust irrigation system to eliminate overspray to hardscape areas, ensure timing and cycle lengths are correct.	Weekly Visual inspection testing 2x per year	Owner
S5	Protect slopes and channels and provide energy dissipation	Not Applicable		
S6 SD-31	Properly Design: Dock areas	Not Applicable		
S7 SD-31	Properly Design: Maintenance bays	Not Applicable		
S8 SD-33	Properly Design: Vehicle wash areas	Not Applicable		
S9 SD-36	Properly Design: Outdoor processing areas	Not Applicable		
S10	Properly Design: Equipment wash areas	Not Applicable		

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	**Inspection/Maintenance Activities**	**Minimum Frequency**	**Responsible Party**
S11 SD-30	Properly Design: Fueling areas	Check for external corrosion, structural failure, and spills frequently. Inspect and clean storm drain inlet and catch basins within the facility boundary after each storm event and before October 1 each year in accordance with BMP N14. Maintain trash receptacles in accordance with BMP N11. Maintain spill kits in accordance with BMP N7. Maintenance of oil/water separator and Safe Drain inserts includes quarterly inspection, cleaning and removal of collected oil & grease via vacuum truck and proper disposal or recycling/ rendering of waste off-site. Replace any filters annually as needed.	Annually	Owner
S12 SD-10	Properly Design: Hillside landscaping	Not Applicable		
S13	Properly Design: Wash water control for food preparation areas	Not Applicable		
S14	Properly Design: Community car wash racks	Not Applicable		

Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets.

SECTION VI SITE PLAN AND DRAINAGE PLAN

The exhibits provided in this section are to illustrate the post construction BMPs prescribed within this WQMP. Drainage flow information of the proposed project, such as general surface flow lines, concrete or other surface drainage conveyances, and storm drain facilities are also depicted. All structural source control and treatment control BMPs are shown as well.

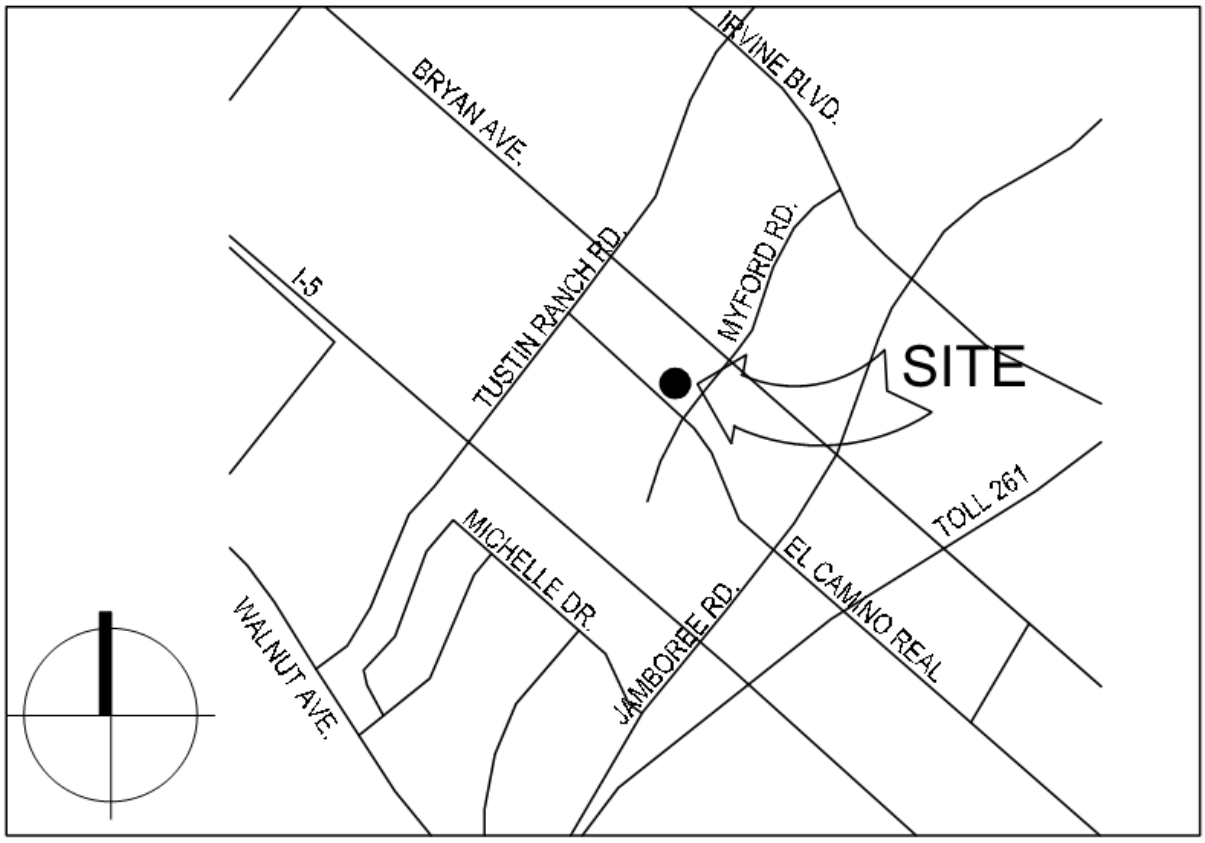
EXHIBITS

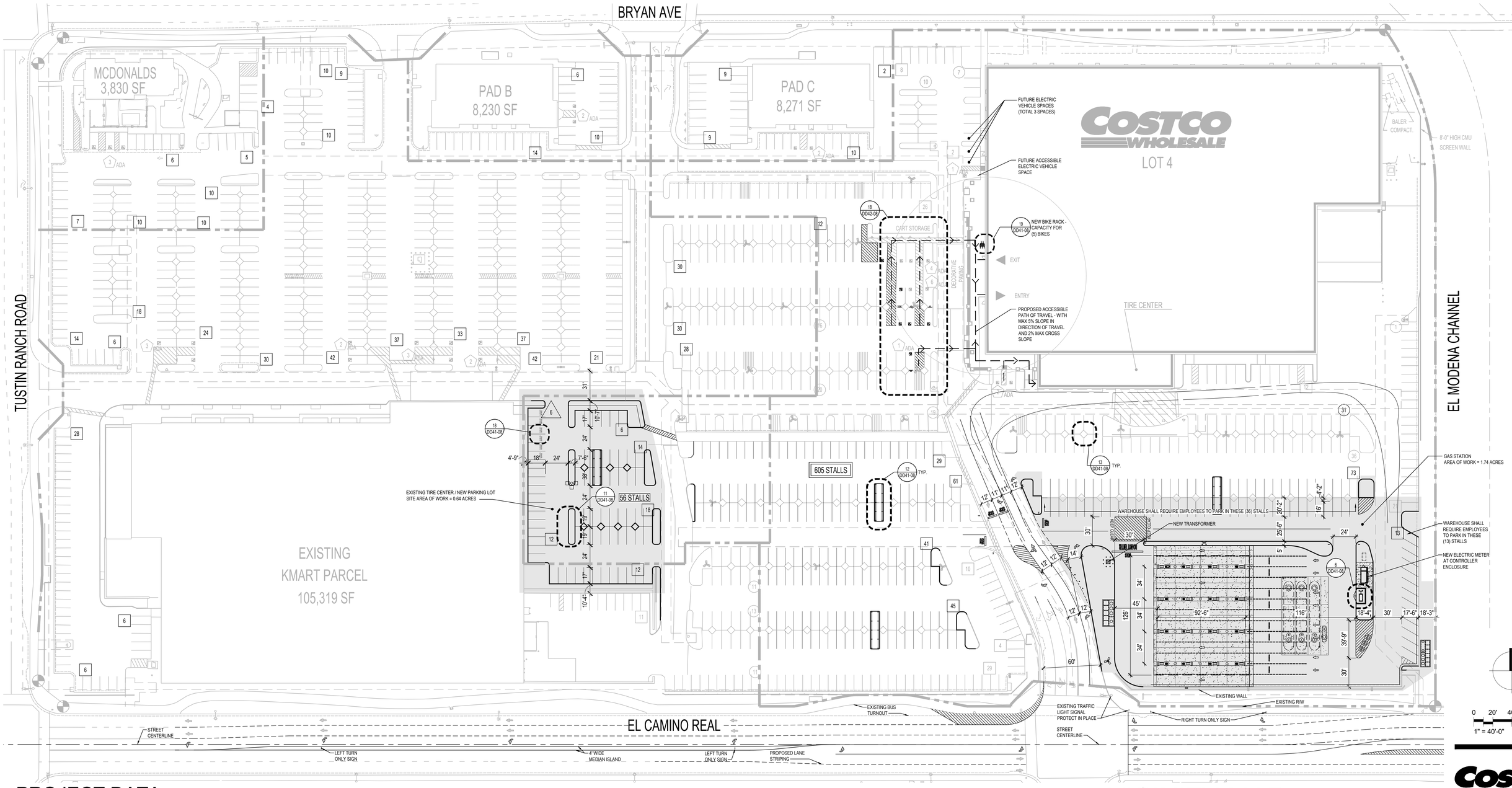
- Vicinity Map
- Site Plan
- WQMP Exhibit
- Modular Wetland System Details
- Oil Water Separator Detail
- D-VERT DVT10-8 Detail

BMP DETAILS & FACT SHEETS

- Excerpt from Certified Full Capture System from Bio Clean to the State Water Board
- BIO-7 Proprietary Biotreatment BMP Fact Sheet

VICINITY MAP





PROJECT DATA

CLIENT:	COSTCO WHOLESALE 999 LAKE DRIVE ISSAQUAH, WA 98027
PROJECT ADDRESS:	2655 EL CAMINO REAL TUSTIN, CA 92782
EXISTING SITE AREA:	10.96 ACRES (477,588 S.F.)
GOOD YEAR SITE AREA:	1.00 ACRES (43,949 S.F.)
SITE AREA OF WORK	2.38 ACRES (103,791 S.F.)
BOUNDARIES INFORMATION:	THIS PLAN HAS BEEN PREPARED BY USING MULVANNY ARCHITECTS SITE PLAN DATED 9/97.
ZONING:	PC COMMERCIAL - E. TUSTIN OVERLAY

EXISTING BUILDING DATA:	
EXISTING BUILDING AREA	115,724 S.F.
EXISTING TIRE CENTER	5,196 S.F.
EXISTING TOTAL BUILDING	120,920 S.F.
GOODYEAR TIRE CENTER - DEMO	9,136 S.F.

PROPOSED GAS:	
PROPOSED GAS CANOPY	12,684 S.F.
PROPOSED CONTROLLER ENCLOSURE	121 S.F.

EXISTING COSTCO PARKING:	
# 9' WIDE STALLS	116 STALLS
# 10' WIDE STALLS	494 STALLS
#ADA HANDICAP STALLS	13 STALLS
TOTAL PARKING	623 STALLS
NO. OF STALLS PER 100 S.F. OF BUILDING AREA:	5.15 STALLS
PROPOSED COSTCO PARKING:	
# 9' WIDE STALLS	439 STALLS
# 9' WIDE LOW EMISSION/ VAN POOL/ ELECTRICAL VEHICLE PARKING	6 STALLS
# 10' WIDE STALLS	134 STALLS
#ADA HANDICAP STALLS	14 STALLS
TOTAL PARKING	593 STALLS
REQ'D PARKING PER CITY: 4.5/1000	544 STALLS
REQ'D PARKING PER CC&R'S:	605 STALLS

TOTAL ADDITIONAL PARKING SPACES RELATED TO 2016 CALIFORNIA GREEN BUILDING CODE:	56 STALLS
REQ'D SHORT TERM BICYCLE PARKING (5%):	3 BIKES
PROVIDED:	5 BIKES
REQ'D CLEAN AIR VEHICLE PARKING:	6 STALLS
PROVIDED:	6 STALLS
REQ'D FUTURE ELECTRIC VEHICLE CHARGING STATIONS:	4 STALLS
PROVIDED:	4 STALLS

SHOPPING CENTER PARKING DATA	
EXISTING KMART	
PARKING REQUIRED BY CITY	
105,319 S.F. X 4.5/1000:	474 STALLS
105,319 S.F. X 5.0/1000 PER CC&R'S:	527 STALLS
PARKING PROVIDED:	529 STALLS
EXISTING MCDONALDS	
PARKING REQUIRED BY CITY	
8,230 S.F. X 4.5/1000:	18 STALLS
PARKING PROVIDED:	55 STALLS

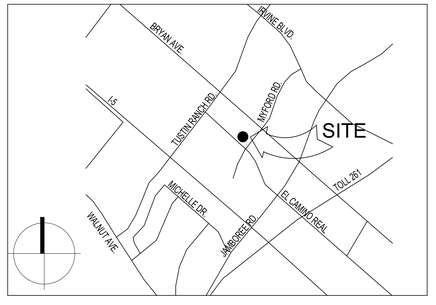
PAD B	
PARKING REQUIRED BY CITY	
8,230 S.F. X 4.5/1000:	37 STALLS
PARKING PROVIDED:	32 STALLS
PAD C	
PARKING REQUIRED BY CITY	
8,271 S.F. X 4.5/1000:	37 STALLS
PARKING PROVIDED:	32 STALLS
TOTAL PARKING REQ'D BY CITY:	619 STALLS
TOTAL PARKING REQ'D PER CC&R'S:	646 STALLS
TOTAL PROVIDED:	649 STALLS

LEGEND:

INDICATES SITE AREA OF WORK
TOTAL AREA = 2.38 ACRES

NOTE:
ALL PARKING FOR CENTER IS RECIPROCAL ACCESS PER AGREEMENT

VICINITY MAP



NOTES:
EXISTING CONDITIONS TO BE FIELD VERIFIED.

COSTCO WHOLESALE

TUSTIN, CALIFORNIA

SITE PLAN

SEPTEMBER 30, 2019

COSTCO WHOLESALE
TUSTIN, CA
#122

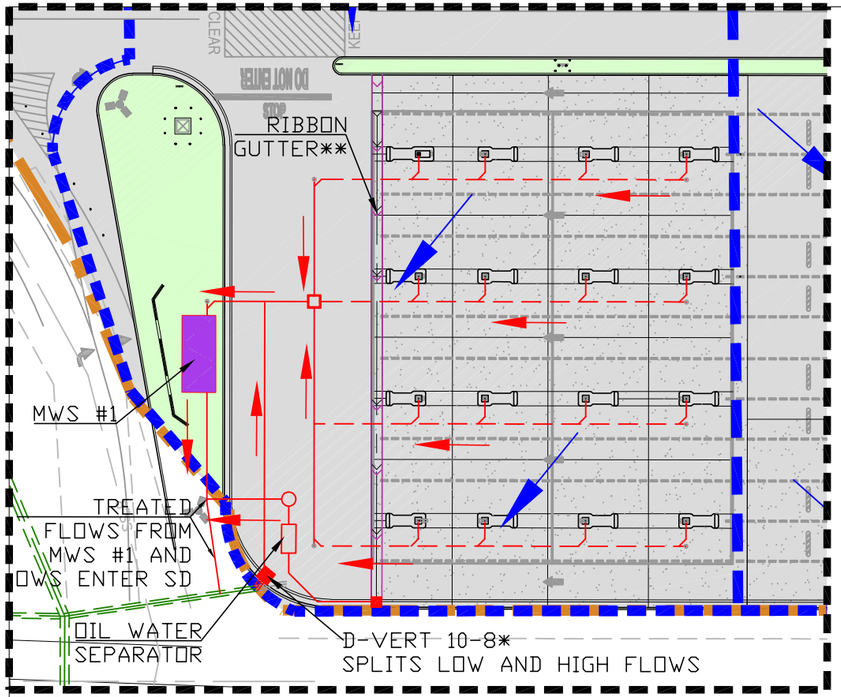
2655 EL CAMINO REAL
TUSTIN, CA 92782

1101 Second Ave, Ste 100
Seattle, WA 98101
206 962 6500
MG2.com

94-1380-23
SEPTEMBER 30, 2019

PROPOSED
SITE PLAN

DD11-08



ENLARGED SECTION

LEGEND

- PROPERTY LINE
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- PROPOSED RIBBON GUTTER**
- LIMIT OF WORK
- BMP DRAINAGE MANAGEMENT AREA BOUNDARY
- PROPOSED COMMON AREA LANDSCAPING
- STREET SWEEPING PRIVATE STREETS & PARKING LOTS
- CATCH BASIN STENCILING & MAINTENANCE
- MODULAR WETLAND SYSTEM
- DIRECTION OF PIPED FLOW
- DIRECTION OF SURFACE FLOW
- C-2 0.66AC — DRAINAGE MANAGEMENT AREA AND ACREAGE

NOTES:

*D-VERT 10-8 LOCATED INSIDE THE CATCH BASIN DIRECTS LOW FLOWS TO MWS #1 AND HIGH FLOWS OUT TO EL CAMINO REAL.

**RIBBON GUTTER INTERCEPTS ISLAND STATION DRAINAGE AND DIRECTS FLOWS TO AN OIL WATER SEPARATOR.

MODULAR WETLAND SYSTEM DESIGN SUMMARY

DMA	DRAINAGE AREA	IMP	Q DESIGN	SIZE / MODEL	COMBINED TREATMENT CAPACITY
A1	2.64 AC	96%	0.597 CFS	MWS-L-8-20-9-6.5-V-HC	0.597 CFS
A2	3.37 AC	98%	0.775 CFS	MWS-L-8-24-6-0-V-HC	0.775 CFS
B	0.63 AC	84%	0.128 CFS	MWS-L-4-13-4-0-C	0.135 CFS

100' 0' 50' 100'

SCALE: 1" = 100'

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

N

Scale: 1" = 100'

Exhibit Date: 06/12/2019

WATER QUALITY MANAGEMENT PLAN
COSTCO TUSTIN
GAS STATION & PARKING
TUSTIN, CA

F:\PROJECTS\756\059_SUPPORT FILES\REPORTS\WQMP\SECTION 6 GRAPHICS\756-59XH_COSTCOTUSTINWQMP_2019-06-11.DWG (10-03-19 3:46:40PM) Plotted by: Sarah Johnson

SPECIAL CONSTRUCTION PROCEDURES

ALL EXCAVATIONS, SUCH AS FOR REMOVAL OF THE EXISTING OIL WATER SEPARATOR AND NEW UNDERGROUND UTILITIES WHICH EXTEND MORE THAN 3 FEET BELOW THE FINISHED GRADES OR PAVEMENT SURFACE WILL REQUIRE SPECIAL BACKFILL PROCEDURES. THESE PROCEDURES ARE AS FOLLOWS:

THE PROJECT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE PLANS, SPECIFICATIONS, ENVIRONMENTAL REPORTS AND THE REQUIREMENTS OF THE AGENCY HAVING JURISDICTION, WHICHEVER IS THE MOST STRINGENT.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING A QUALITY CONTROL PROGRAM TO ENSURE THE PROPER EXECUTION OF THE WORK IN ACCORDANCE WITH ALL THE PROJECT REQUIREMENTS. AGENTS OF THE OWNER SHALL CONDUCT VARIOUS OBSERVATIONS AND TESTING AS NECESSARY FOR QUALITY ASSURANCE.

THE DTSC SHALL BE PROVIDED WITH A MINIMUM OF 48 HOURS NOTICE BEFORE THE START OF WORK TO ALLOW DTSC THE OPPORTUNITY TO OBSERVE THE INSTALLATION OF THE EZ WRAP AND CONSTRUCTION OF THE UNDERGROUND UTILITIES.

AT A MINIMUM, THE PIPE BEDDING, HAUNCHES, INITIAL BACKFILL AND FINAL BACKFILL FOR ALL UNDERGROUND UTILITIES, TO A MINIMUM OF ONE (1) FOOT ABOVE THE PIPE OR TO THE HISTORIC HIGH GROUNDWATER ELEVATION (3 FEET BELOW PAVEMENT SURFACE), WHICHEVER IS HIGHER, SHALL CONSIST OF A SAND-CEMENT SLURRY. A MINIMUM OF ONE (1) SACK SAND CEMENT SLURRY IS REQUIRED FOR BACKFILL OF DOMESTIC AND RECLAIMED WATER LINES INSTALLED BELOW THE HIGH GROUNDWATER ELEVATION. A MINIMUM TWO (2) SACK SAND CEMENT SLURRY SHALL BE USED FOR SEWER AND STORM WATER UNDERGROUND UTILITIES. THE TWO (2) SACK SAND-CEMENT SLURRY SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 220 POUNDS PER SQUARE INCH IN 48 HOURS. THE MINIMUM ONE (1) SACK SAND CEMENT SLURRY SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 80 PSI AT 48 HOURS. BACKFILL OVER THE SAND CEMENT SLURRY SHALL CONSIST OF IMPORTED OR ONSITE NATIVE SOILS TESTED AND APPROVED BY THE GEOTECHNICAL ENGINEER. THE SAND CEMENT SLURRY SHALL BE SAMPLED AND TESTED TO DETERMINE COMPRESSIVE STRENGTH IN ACCORDANCE WITH ASTM STANDARDS A MINIMUM OF ONCE PER DAY OR ONCE EVERY 100 CUBIC YARDS OF PLACEMENT, OR AT ANY CHANGE OF SUPPLIERS, WHICHEVER IS MORE STRINGENT. A MINIMUM OF FIVE SAMPLES SHALL BE PREPARED AND TESTED FOR EACH SAMPLING EVENT FOR COMPRESSIVE STRENGTH DETERMINATION. TWO SAMPLES SHALL BE TESTED AT 48 HOURS AND TWO SAMPLES SHALL BE TESTED AT 7 DAYS FOR COMPRESSIVE STRENGTH, AND ONE SAMPLE SHALL BE RETAINED FOR FURTHER TESTING. ALL SLURRY SHALL BE PLACED WITH INTERNAL VIBRATION WITHOUT DAMAGING THE PIPE, GASKETS, FITTING, ETC. THE BACKFILL AROUND SUBSURFACE STRUCTURES SUCH AS THE OIL-WATER SEPARATOR, MANHOLES, VAULTS, ETC. SHALL CONSIST OF A SAND CEMENT SLURRY AS DESCRIBED ABOVE FOR THE PIPE BACKFILL.

PROPER HANDLING OF POTENTIAL CONTAMINATED SOIL AND OTHER MATERIALS SHALL BE CONDUCTED DURING THE REMOVAL OF THE EXISTING OIL/WATER SEPARATOR AND ASSOCIATED COMPONENTS. THE REMOVED OIL/WATER SEPARATOR AND ASSOCIATED COMPONENTS SHALL BE PLACED ON A LINED/CONTAINMENT LAYER, ALL IMPACTED SOIL AND LINING MATERIALS SHALL BE REMOVED AND PROPERLY DISPOSED OF, FOLLOWED BY DECONTAMINATION OF THE OIL/WATER SEPARATOR PRIOR TO RE-LOCATION.

THE OIL/WATER SEPARATOR AND ASSOCIATED COMPONENTS SHALL BE COMPLETELY ENVELOPED BY STOPAQ PRODUCTS EZ WRAP. THE STOPAQ PRODUCTS EZ WRAP SEAM TAPE AND EZ PASTE PRODUCTS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS. THIS PRODUCT GENERALLY CONSISTS OF A MULTI-LAYERED WRAP/LINER THAT IS ADHERED TO THE UNDERGROUND UTILITY WITH PASTE. THE SPACE BETWEEN THE EXCAVATION SIDEWALLS AND THE WALLS OF THE OIL/WATER SEPARATOR SHALL BE BACKFILLED WITH A MINIMUM 2-SACK SAND-CEMENT SLURRY. THE INSTALLATION SHALL BE CONDUCTED SUCH THAT ALL JOINTS ARE SEALED TO PREVENT CONTAMINATED GROUNDWATER AND/OR SOIL FROM COMING INTO CONTACT WITH THE GASKETS USED ON THE SEPARATOR.

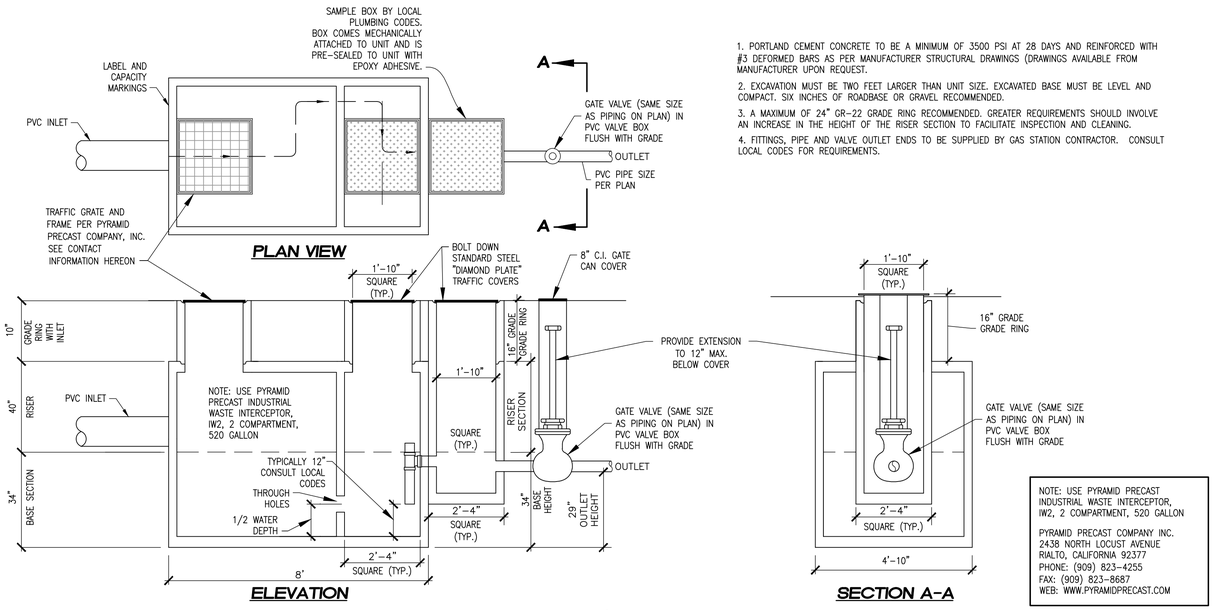
THE CONTRACTOR SHALL VERIFY THAT THE PROPOSED JOINT SEAL AND PASTE ARE COMPATIBLE WITH THE PIPE AND GASKET SYSTEMS USED ON THE PROJECT.

THE CONTRACTOR SHALL OBTAIN TRAINING AND CERTIFICATIONS FROM THE PRODUCT MANUFACTURER FOR ALL EMPLOYEES THAT WILL INSTALL THE PRODUCT. FURTHER, THE CONTRACTOR SHALL ARRANGE FOR THE PRODUCT MANUFACTURER TO CONDUCT PERIODIC SITE VISITS TO ENSURE THAT THE PRODUCTS ARE INSTALLED IN ACCORDANCE WITH THEIR REQUIREMENTS AND GUIDELINES. THE MANUFACTURERS REPRESENTATIVE (MR. EDWIN WELLES, PRESIDENT, STOPAQ AMCORR, INC.) CAN BE REACHED AT 877-586-3710 FOR ANY QUESTIONS RELATED TO THE INSTALLATION REQUIREMENTS FOR THE STOPAQ PRODUCTS.

THE PRODUCT MANUFACTURER SHALL INSPECT THE INSTALLATION OF THE EZ WRAP AND PROVIDE A LETTER STATING THAT, BASED ON THEIR OBSERVATIONS, THAT THE SYSTEM WAS INSTALLED IN ACCORDANCE WITH THEIR INSTALLATION REQUIREMENTS.

THE INSTALLATION OF THE EZ WRAP AND THE PLACEMENT OF THE SLURRY BACKFILL SHALL BE OBSERVED BY AN AGENT OF THE OWNER. A FINAL INSPECTION REPORT SHALL BE PROVIDED TO THE DTSC AND THE CITY OF TUSTIN AT THE COMPLETION OF THE PROJECT DOCUMENTING THAT THE INSTALLATION OF THE SPECIAL CONSTRUCTION REQUIREMENTS (I.E., EZ WRAP, THE UTILITY INSTALLATION, SLURRY BACKFILL, ETC.) HAS BEEN CONDUCTED IN ACCORDANCE WITH THE PROJECT REQUIREMENTS.

THE CONTRACTOR SHALL ADHERE TO THE SPECIAL CONSTRUCTION REQUIREMENTS FOR THE INSTALLATION OF THE UNDERGROUND STORAGE TANK DESCRIBED IN THE DECEMBER 13, 2013 LETTER PREPARED BY MOORE TWINING ASSOCIATES, INC., TITLED: "DETAILS FOR HDPE LINER INSTALLATION OF EXCAVATIONS FOR UNDERGROUND STORAGE TANK AND ASSOCIATED PIPING FOR PRODUCT LINES, VENT LINES AND ELECTRICAL LINES", THE MANUFACTURER'S INSTALLATION REQUIREMENTS, AND THE REQUIREMENTS OF THE PROJECT PLANS, WHICHEVER IS THE MOST STRINGENT.



1. PORTLAND CEMENT CONCRETE TO BE A MINIMUM OF 3500 PSI AT 28 DAYS AND REINFORCED WITH #3 DEFORMED BARS AS PER MANUFACTURER STRUCTURAL DRAWINGS (DRAWINGS AVAILABLE FROM MANUFACTURER UPON REQUEST.
2. EXCAVATION MUST BE TWO FEET LARGER THAN UNIT SIZE. EXCAVATED BASE MUST BE LEVEL AND COMPACT. SIX INCHES OF ROADBASE OR GRAVEL RECOMMENDED.
3. A MAXIMUM OF 24" GR-22 GRADE RING RECOMMENDED. GREATER REQUIREMENTS SHOULD INVOLVE AN INCREASE IN THE HEIGHT OF THE RISER SECTION TO FACILITATE INSPECTION AND CLEANING.
4. FITTINGS, PIPE AND VALVE OUTLET ENDS TO BE SUPPLIED BY GAS STATION CONTRACTOR. CONSULT LOCAL CODES FOR REQUIREMENTS.

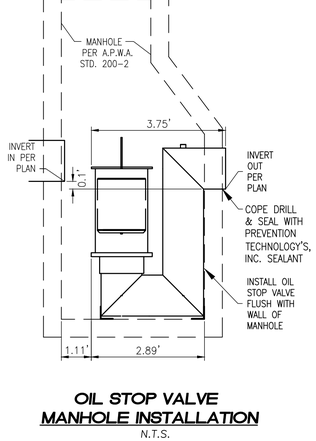
NOTE: USE PYRAMID PRECAST INDUSTRIAL WASTE INTERCEPTOR, IW2, 2 COMPARTMENT, 520 GALLON

PYRAMID PRECAST COMPANY INC.
2438 NORTH LOCUST AVENUE
RIALTO, CALIFORNIA 92377
PHONE: (909) 823-4255
FAX: (909) 823-8687
WEB: WWW.PYRAMIDPRECAST.COM

TWO STAGE OIL/ WATER SEPARATOR

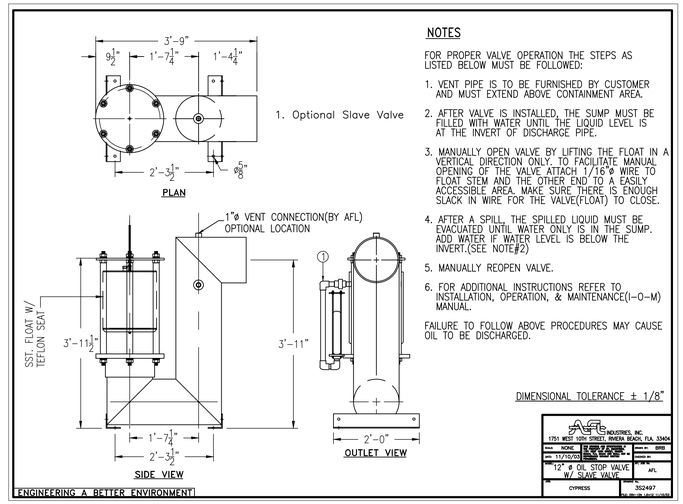
A

N.T.S.



OIL STOP VALVE MANHOLE INSTALLATION

N.T.S.



OIL STOP VALVE AND MANHOLE INSTALLATION

B

N.T.S.

SPECIAL CONSTRUCTION PROCEDURES

NOTES:

THE INSTALLATION OF THE OIL/WATER SEPARATOR AND THE OIL STOP VALVE & MANHOLE, WILL REQUIRE THAT THE EXTERIOR OF ALL STRUCTURES BE CLEANED AND WRAPPED WITH EZ-WRAP PER THE "SPECIAL CONSTRUCTION PROCEDURES" ABOVE. SPECIAL PROCEDURES WILL BE REQUIRED TO PREVENT SPILLS, HANDLING, AND DISPOSAL OF CONTAMINATED WASTES GENERATED BY THE CLEANING OF THESE STRUCTURES. ALL UTILITY(IES) & VAULT(S) TRENCHING & BACKFILL SHALL BE IN ACCORDANCE WITH "SPECIAL CONSTRUCTION PROCEDURES" ABOVE.

LINER SYSTEMS FOR THE STRUCTURES, NEW TANKS, AND UTILITIES SHALL BE CONSISTENT WITH THE REQUREMENTS OF THESE PLANS, THE AGENCY HAVING JURISDICTION, APPLICABLE ENVIRONMENTAL REPORTS, MANUFACTURER'S INSTALLATION REQUIREMENTS AND PER ORIGINAL LINER SYSTEM PLANS AND DETAILS BY GEO-KINETICS, INC. AS APPLICABLE, WHICHEVER IS THE MOST STRINGENT.

PREPARED BY:
FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com
REGISTERED PROFESSIONAL ENGINEER MARK A. NERO NO. 80066 EXP. 09/30/20 CIVIL STATE OF CALIFORNIA
05/07/2019
MARK NERO RCE NO.80066 EXP. 09/30/20

COSTCO GAS STATION PRECISE GRADING PLAN

STORM DRAIN DETAILS

TRACT NO.: TRACT NO. 14610
STREET ADDRESS: 2655.5 EL CAMINO REAL
CITY I.D. NO.:
CITY PERMIT NO.: G2019-XXX

SHEET 10 OF 15

1ST SUBMITTAL | 05/07/2019 | COSTCO GAS STATION PRECISE GRADING PLAN

SITE SPECIFIC DATA			
PROJECT NUMBER		8180	
PROJECT NAME		COSTCO FUELING STATION	
PROJECT LOCATION		TUSTIN, CA	
STRUCTURE ID		----	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	

TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	----	N/A	N/A
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	87.78	PVC	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	91.78	91.78	91.78
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY. NOT FOR CONSTRUCTION.			

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. 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 GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON–SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
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.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING MODULAR WETLANDS FOR ACTIVATION OF UNIT. MANUFACTURES WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A MODULAR WETLANDS REPRESENTATIVE.

GENERAL NOTES

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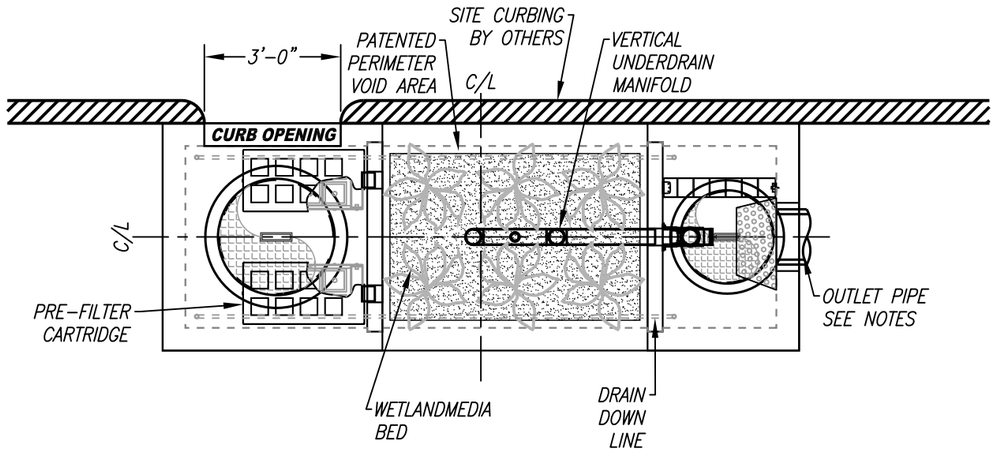
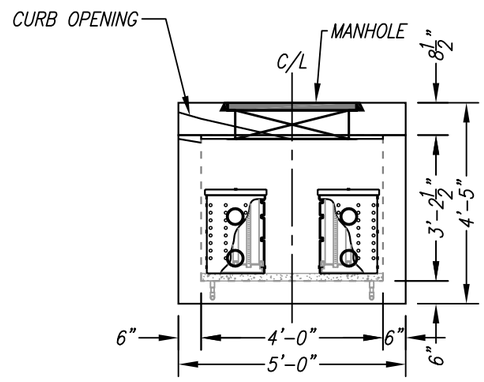
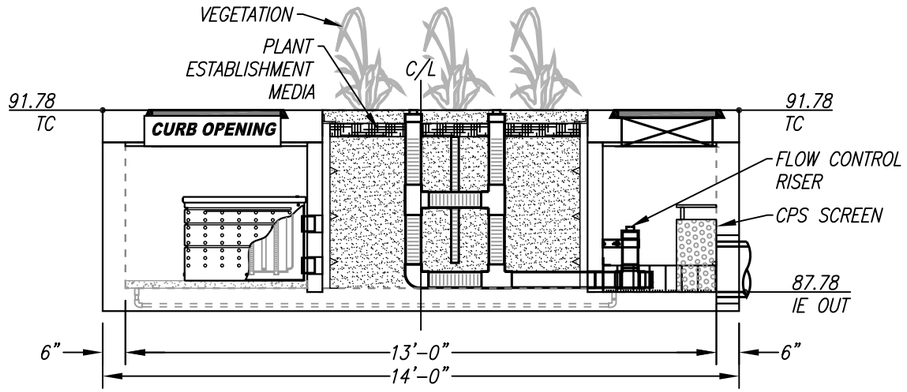
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



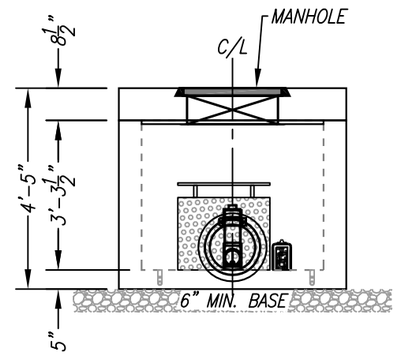
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.135
OPERATING HEAD (FT)	3.2
PRETREATMENT LOADING RATE (GPM/SF)	1.2
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-4-13-4'-0"-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

3/22/19TOLEE

SITE SPECIFIC DATA			
PROJECT NUMBER		8180	
PROJECT NAME		COSTCO FUELING STATION	
PROJECT LOCATION		TUSTIN, CA	
STRUCTURE ID		----	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
----		0.597	
TREATMENT HGL AVAILABLE (FT)			3.5
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			7.9
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	83.43	PVC	12"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	79.93	PVC	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	89.55	89.55	89.55
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	ø30"	N/A	ø30"
WETLANDMEDIA VOLUME (CY)			25.51
ORIFICE SIZE (DIA. INCHES)			2.45
NOTES: PRELIMINARY. NOT FOR CONSTRUCTION.			

INSTALLATION NOTES

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4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
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GENERAL NOTES

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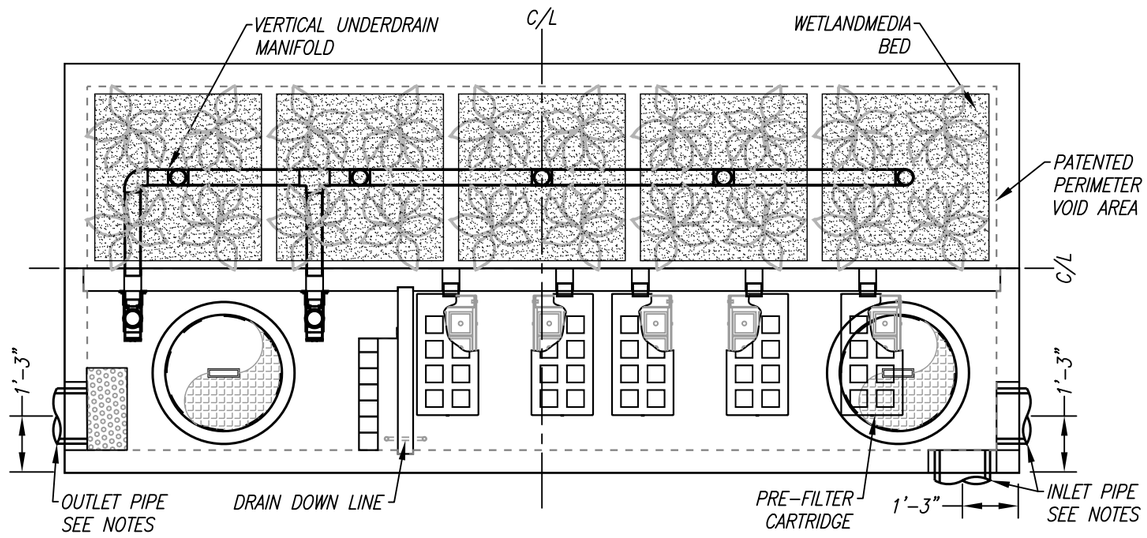
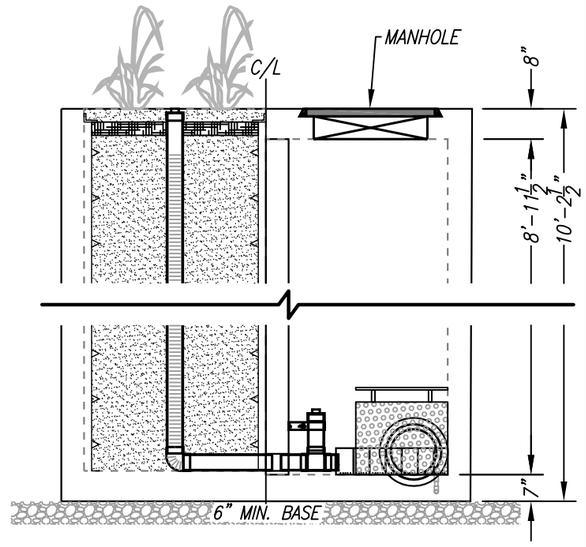
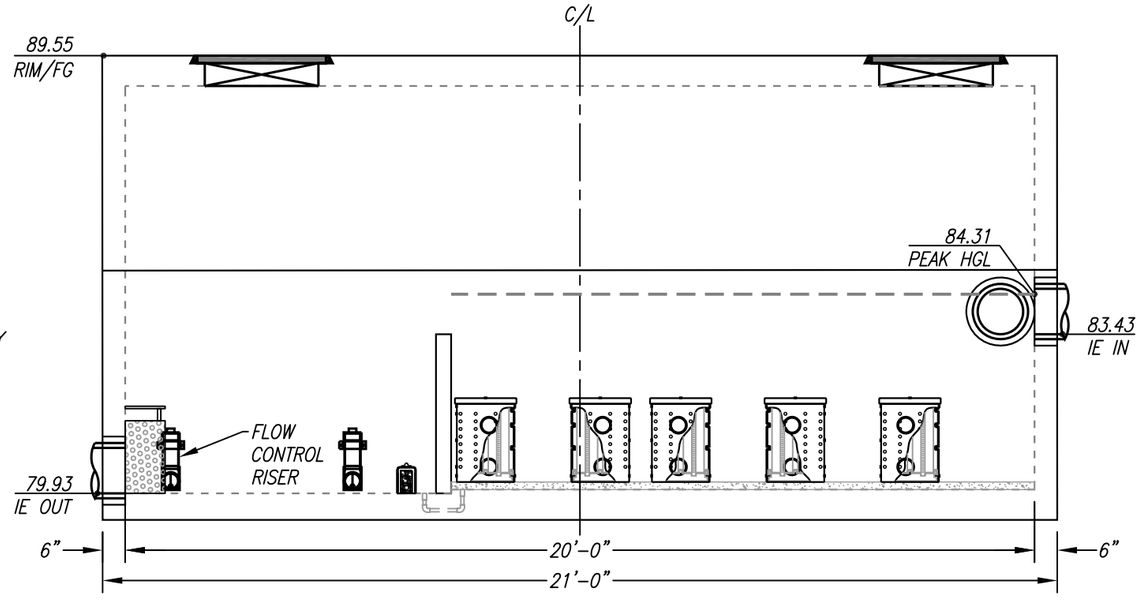


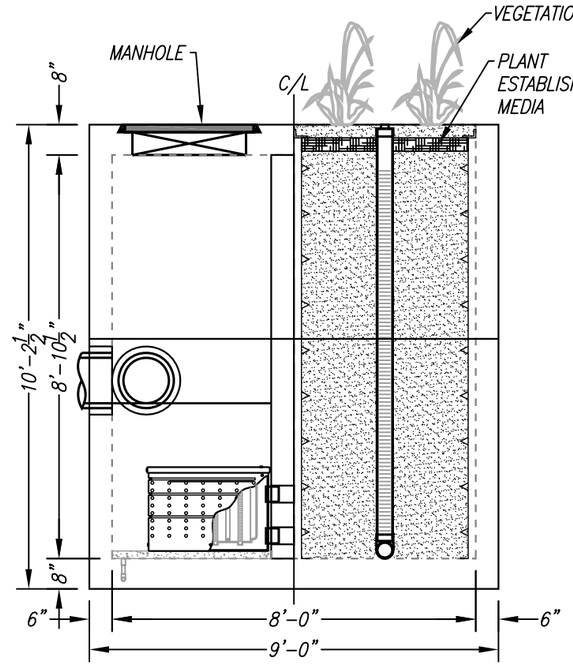
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INTERNAL BYPASS DISCLOSURE:

THE DESIGN AND CAPACITY OF THE PEAK CONVEYANCE METHOD TO BE REVIEWED AND APPROVED BY THE ENGINEER OF RECORD. HGL(S) AT PEAK FLOW SHALL BE ASSESSED TO ENSURE NO UPSTREAM FLOODING. PEAK HGL AND BYPASS CAPACITY SHOWN ON DRAWING ARE USED FOR GUIDANCE ONLY.

TREATMENT FLOW (CFS)	0.597
OPERATING HEAD (FT)	3.5
PRETREATMENT LOADING RATE (GPM/SF)	2.1
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-20-9'-6.5"-V-HC
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

3/22/19TOLEE

SITE SPECIFIC DATA			
PROJECT NUMBER		8180	
PROJECT NAME		COSTCO FUELING STATION	
PROJECT LOCATION		TUSTIN, CA	
STRUCTURE ID		----	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
----		0.775	
TREATMENT HGL AVAILABLE (FT)			3.8
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			10.1
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	85.72	PVC	12"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	81.92	PVC	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	88.0	88.0	88.0
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	3 EA ø30"	N/A	2 EA ø24"
WETLANDMEDIA VOLUME (CY)			19.30
ORIFICE SIZE (DIA. INCHES)			2.73

NOTES: PRELIMINARY. NOT FOR CONSTRUCTION.

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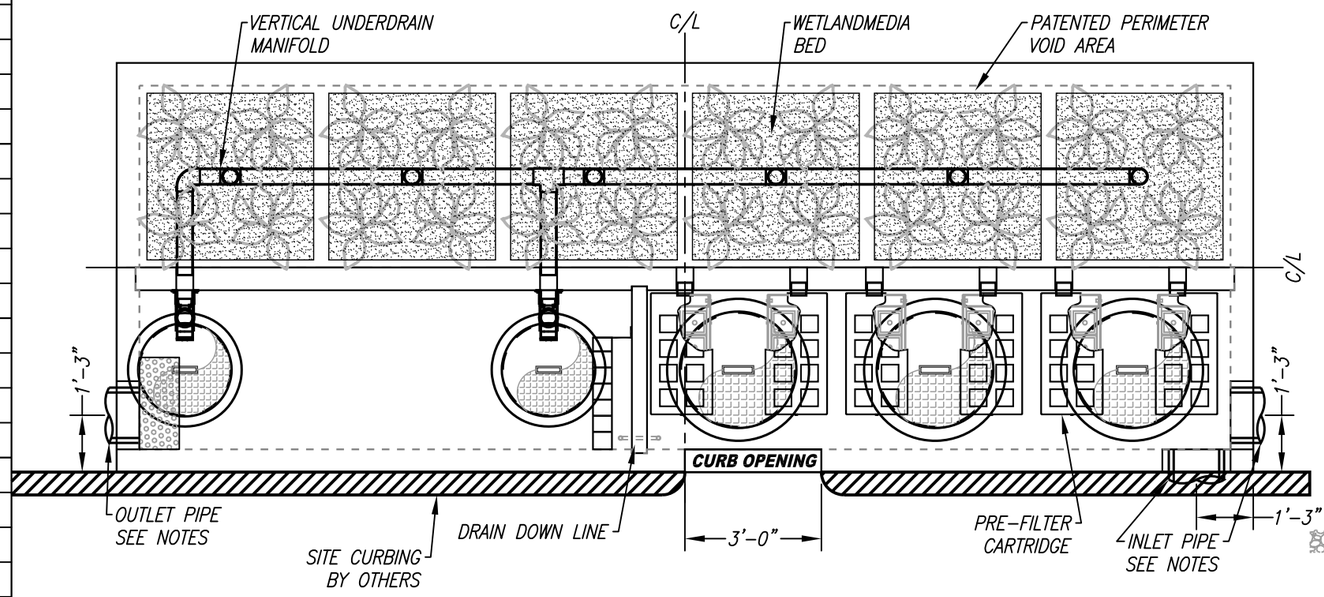
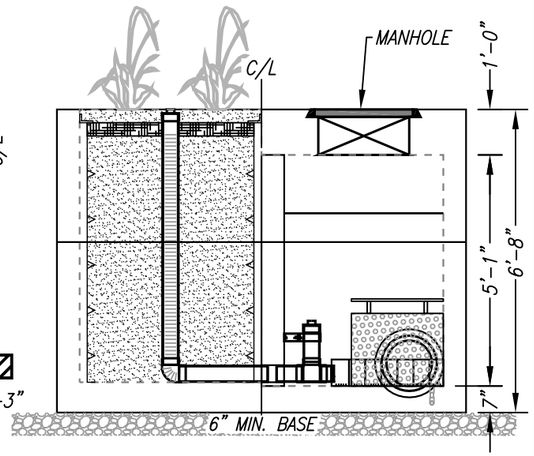
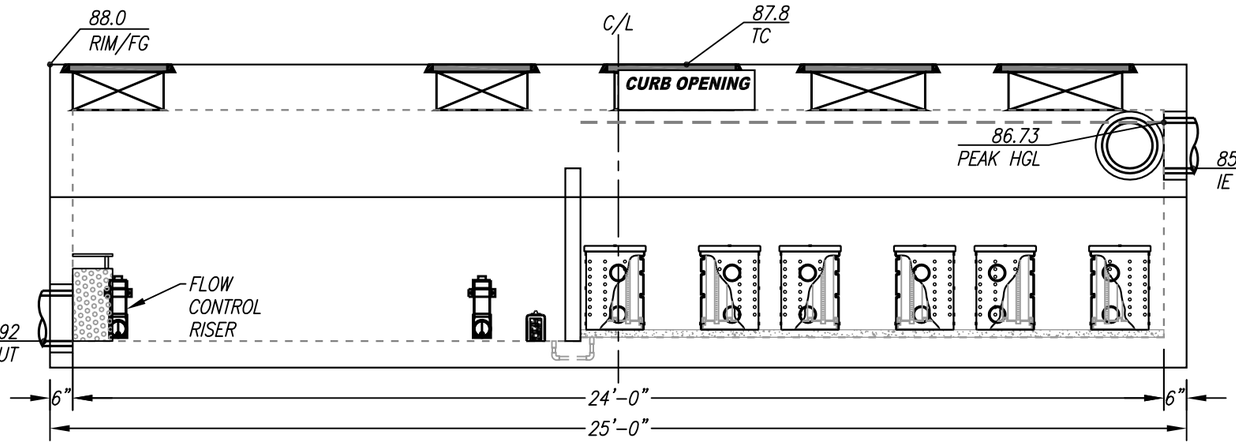


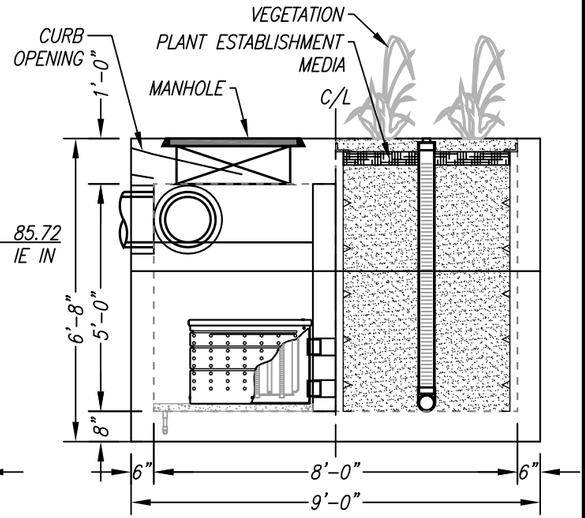
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INTERNAL BYPASS DISCLOSURE:

THE DESIGN AND CAPACITY OF THE PEAK CONVEYANCE METHOD TO BE REVIEWED AND APPROVED BY THE ENGINEER OF RECORD. HGL(S) AT PEAK FLOW SHALL BE ASSESSED TO ENSURE NO UPSTREAM FLOODING. PEAK HGL AND BYPASS CAPACITY SHOWN ON DRAWING ARE USED FOR GUIDANCE ONLY.

TREATMENT FLOW (CFS)	0.775
OPERATING HEAD (FT)	3.8
PRETREATMENT LOADING RATE (GPM/SF)	2.3
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-24-6'-0"-V-HC
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

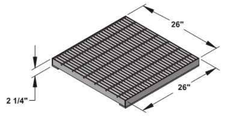
3/22/19TOLEE

2424 CAST IRON GRATE

PARKWAY 112 lbs.

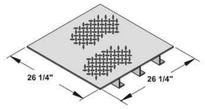
2424 STEEL GRATES

PARKWAY 48 lbs.
TRAFFIC 103 lbs.

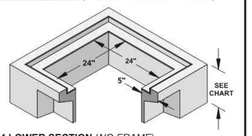


2424 STEEL COVER

PARKWAY 81 lbs.
TRAFFIC 114 lbs.

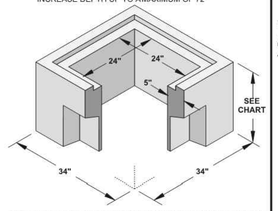


2424 TOP SECTION (*WITH GALVANIZED FRAME*)

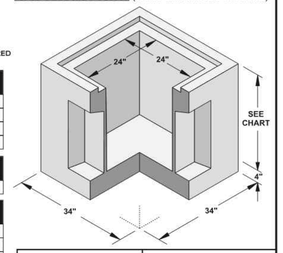


2424 LOWER SECTION (*NO FRAME*)

NOTE: USE 12", 18", 24" LOWERS TO INCREASE DEPTH UP TO AMAXIMUM OF 72"



2424 BOTTOM SECTION (*WITH OR WITHOUT FRAME*)



NOTES:

1. GRATES AND COVERS AVAILABLE PAINTED BLACK OR GALVANIZED
2. "ADA" GRATES AVAILABLE IN PARKWAY & TRAFFIC
3. "HEEL PROOF" GRATES AVAILABLE IN PARKWAY ONLY
4. A TOP SECTION WITH FRAME MUST BE USED IF BOLT DOWN REQUIRED

TOP SECTION	HT.	LBS	KNOCK-OUTS
2424 T6	6"	270	NONE
2424 T12	12"	495	(4) 6" x 11"
2424 T18	18"	745	(4) 9" x 12"
2424 T24	24"	870	(4) 14" x 14"

EXTENSION SECTION	HT.	LBS	KNOCK-OUTS
2424 E6	6"	270	NONE

LOWER SECTION	HT.	LBS	KNOCK-OUTS
2424 L12	12"	495	(4) 6" x 11"
2424 L18	18"	745	(4) 9" x 12"
2424 L24	24"	870	(4) 14" x 14"

BOTTOM SECTION	HT.	LBS	KNOCK-OUTS
2424 B30	30"	1595	(4) 18" x 18"
2424 B36	36"	1905	(4) 18" x 18"

24" x 24" CATCH BASIN

ORIG. DWG. DATE	REV. DWG. DATE
11-23-99	02-28-00

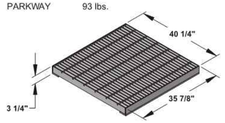
BROOKS PRODUCTS

2424 CB

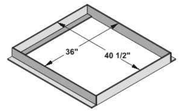
7-04

3636 STEEL GRATES - 1 Pc.

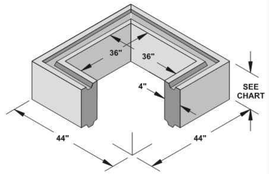
PARKWAY 93 lbs.



3636 FRAME ONLY

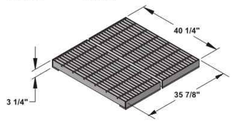


3636 EXTENSION (*NO FRAME*)



3636 STEEL GRATES - 2 Pc.

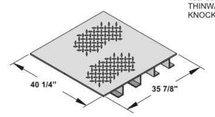
TRAFFIC 341 lbs.



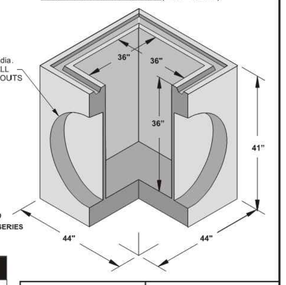
3636 BOTTOM SECTION (*NO FRAME*)

3636 STEEL COVER - 1 Pc.

PARKWAY 152 lbs.
TRAFFIC 190 lbs.



4ea. 30" dia. THINWALL KNOCK-OUTS



NOTES:

1. GRATES AND COVERS AVAILABLE PAINTED BLACK OR GALVANIZED
2. "ADA" OR "HEEL-PROOF" GRATES ARE NOT AVAILABLE FOR THIS SERIES
3. BOLT DOWN GRATES AND COVERS ARE AVAILABLE

EXTENSION SECTION	HT.	LBS	KNOCK-OUTS
3636 E6	6"	525	NONE
3636 E12	12"	1050	NONE

BOTTOM SECTION	HT.	LBS	KNOCK-OUTS
3636 B36	36"	2,230	(4) 30" DIA.

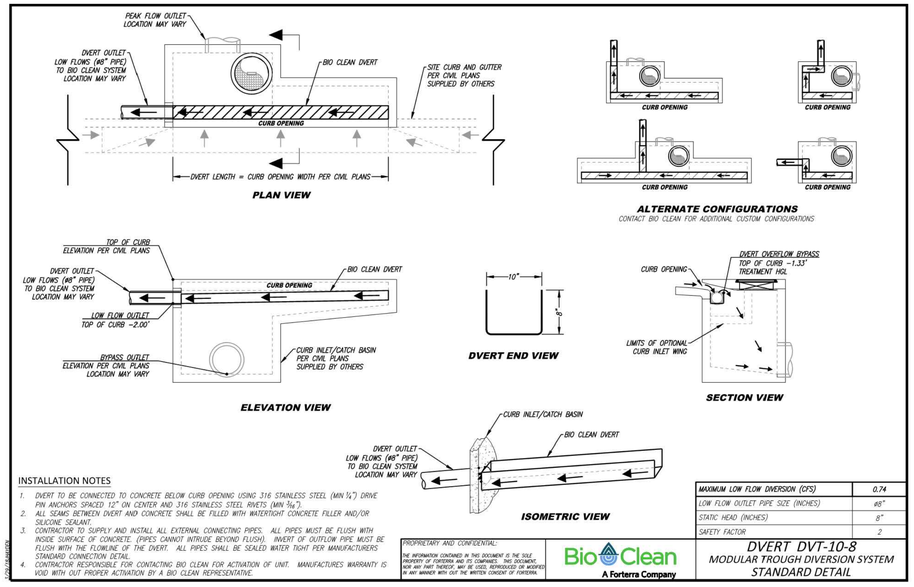
36" x 36" CATCH BASIN

ORIG. DWG. DATE	REV. DWG. DATE
11-23-99	02-18-00

BROOKS PRODUCTS

3636 CB

7-05



INSTALLATION NOTES

1. DVERT TO BE CONNECTED TO CONCRETE BELOW CURB OPENING USING 316 STAINLESS STEEL (MIN ¼") DRIVE PIN ANCHORS SPACED 12" ON CENTER AND 316 STAINLESS STEEL RIVETS (MIN 5/16").
2. ALL SEAMS BETWEEN DVERT AND CONCRETE SHALL BE FILLED WITH WATERTIGHT CONCRETE FILLER AND/OR SILICONE SEALANT.
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH THE FLOWLINE OF THE DVERT. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURES WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

MAXIMUM LOW FLOW DIVERSION (CFS)	0.74
LOW FLOW OUTLET PIPE SIZE (INCHES)	#8"
STATIC HEAD (INCHES)	8"
SAFETY FACTOR	2

Bio Clean — A Forterra Company

DVERT DVT-10-8
MODULAR TROUGH DIVERSION SYSTEM
STANDARD DETAIL

PREPARED BY:

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

REGISTERED PROFESSIONAL ENGINEER — MARK K. NERO — NO. 80066 — EXP. 09/30/20 — CIVIL — STATE OF CALIFORNIA

05/07/2019

MARK NERO RCE NO.80066 EXP. 09/30/20

COSTCO GAS STATION PRECISE GRADING PLAN

STORM DRAIN DETAILS

TRACT NO.: TRACT NO. 14610
STREET ADDRESS: 2655.5 EL CAMINO REAL
CITY I.D. NO.:
CITY PERMIT NO.: G2019-XXX

SHEET 11 OF 15

1ST SUBMITTAL
05/07/2019
COSTCO GAS STATION
PRECISE GRADING PLAN

F:\PROJECTS\756\059\PLANS\GRADING\PGP\GAS STATION\756-059GS11DT.DWG (05-06-19 3:25:21 PM) Plotted by: Debbie Bade

3.0 PHYSICAL DESCRIPTION

3.A. Description on how the Device works to trap all particles that are 5 mm or greater in size and how it is sized for varying flow volumes;

The Modular Wetlands® is a multi-stage, storm water treatment system that incorporates screening, sedimentation, filtration, adsorption, and biological remediation for removal of trash, floating and neutrally buoyant debris, suspended sediments, nutrients, heavy metals, and hydrocarbons from the storm water. The Device consists of a settling chamber, a cartridge-based media pre-filter, a wetland filtration chamber and an outlet chamber all housed in a precast concrete vault. The Modular Wetlands® is available in several configurations including configurations that allow for grated inlet flow, curb inlet flow, pipe or roof drain flow, and online or offline flow. All design flows must pass through a pre-filter which contains a series of screens that decrease in size to an

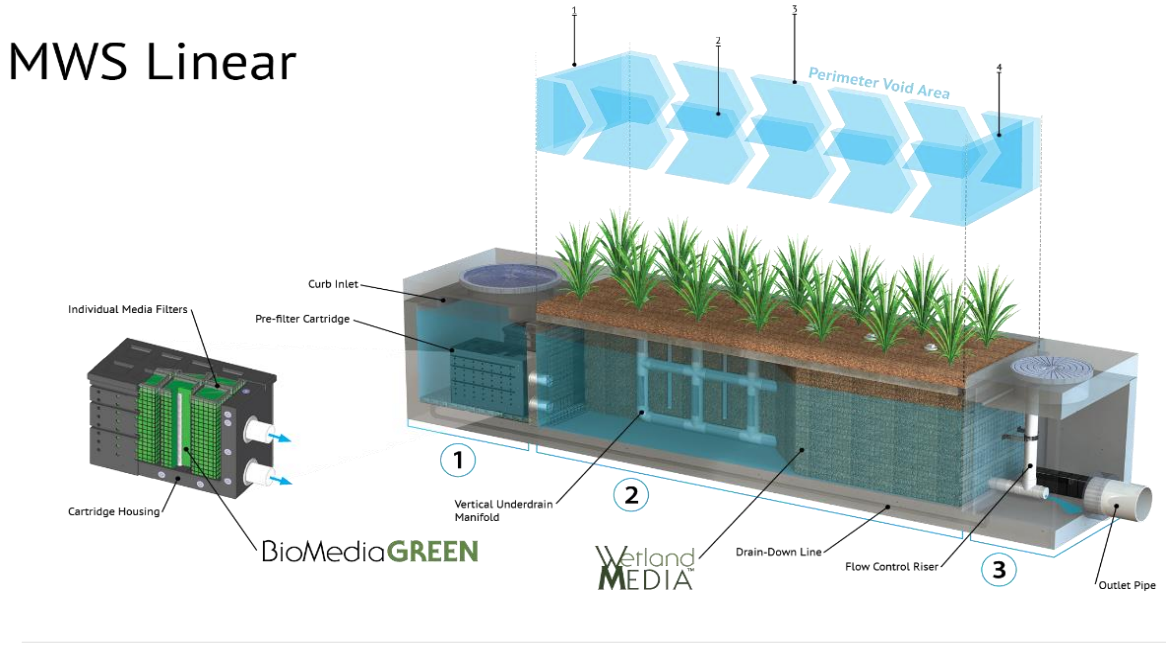


Figure 1 - Modular Wetlands® System Operational Diagram

aperture not greater than 3.175mm ensuring capture of all particles 5mm in size or larger. Captured trash and debris is stored in the pretreatment chamber which is hydraulically isolated from the outlet of the Device by screens.

Figure 1 illustrates the operation of the Modular Wetlands® system under normal flow conditions. Storm water flows must pass through a series of three treatment chambers prior to exiting the Device. Each of the three chambers provides a critical function to the multi-stage process for treating the storm water.

The treatment process begins when water enters the pre-treatment chamber of the Modular Wetlands® system. Water enters the Device either through a grated inlet, a curb inlet or through piped flows or a combination of the three depending on the designed configuration. Before the water may exit to the second treatment chamber, it must first pass through the pre-filter, which is comprised of a series of screens and granular media. See Figure 2. The pre-filter assembly has a main housing made from High Density Polyethylene. The housing is perforated and slotted and acts as a screen to block large material from entering the pre-filter. The openings in the housing

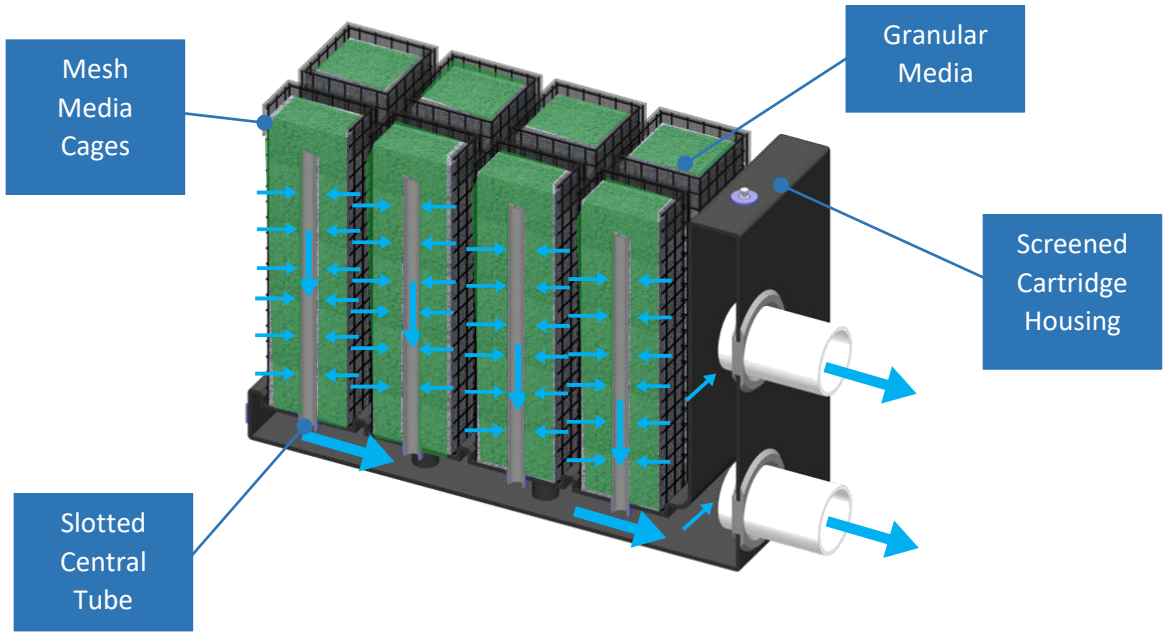


Figure 2 - Section View of the Modular Wetlands® Pre-Filter Assembly

are not larger than 0.75in diameter. The storm water progresses through the pre-filter and encounters the second screen. This screen is made from a vinyl coated wire mesh with openings not greater than 0.5in square. The mesh cage serves to hold the granular media and serves to block a slightly smaller trash and debris particle than the first screen. The media is additionally contained within a polyester bag. The bag also serves to contain the granular media but also functions as a screen to block additional trash and debris. The openings in the knitted polyester bag do not exceed 10mm in any given direction. The storm water next encounters the media. Since the media is in a granular form, it also serves to screen particles from the storm water. After treatment by the media, the water is collected in each cartridge by a central tube. The tube is made from a slotted PVC pipe and the slots have openings not greater than 3.175mm. All the tubes connect to a lower channel at the bottom of the pre-filter assembly and water is collected in this location prior to exiting the pre-treatment chamber. All flows must pass through the media and screens prior to

exiting the pre-treatment chamber thus ensuring all particles 5mm or greater in size are captured for all flows less than the maximum design flow.

The storm water exits the pre-filter chamber via a 4-inch diameter PVC pipe. One or more pre-filter assemblies may be utilized and each will convey water to the biofiltration chamber via these 4-inch diameter pipes. The biofiltration chamber consists of a proprietary wetland media, growing media, and plantings. The chamber provides an advanced level of treatment for the storm water that includes processes such as filtration, adsorption, absorption, denitrification, and

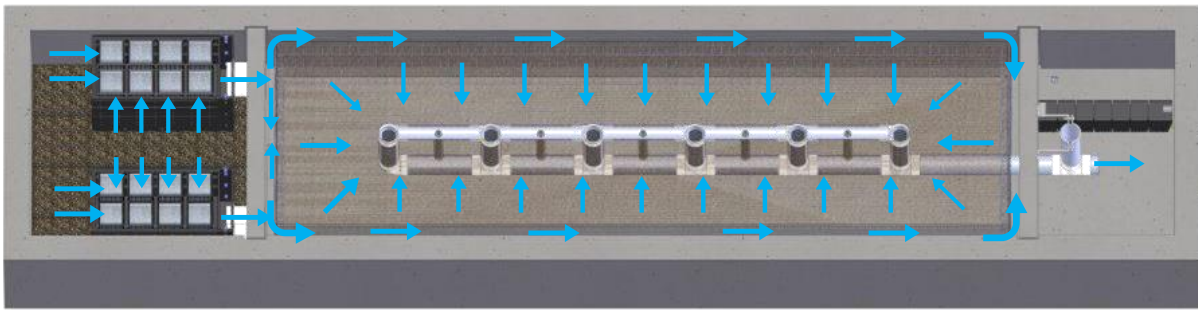


Figure 3 - Top Down Section View of the Modular Wetlands® system Illustrating Water Flows Through the Chambers

bioaccumulation. Once water enters the chamber it is routed to the perimeter of the chamber through a system of vertically arranged drain panels. This ensures even dispersal around the perimeter of the media bed. Water enters the media bed horizontally ensuring a large surface contact area, which minimizes blockage of the media. Water must pass through a minimum 20-inch thick depth of media prior to entering an assembly of perforated collection pipes at the center of the chamber. In addition, the media is contained within a polyester netting material with openings no larger than 5.0 mm in size. All water must pass through the netting and the media. There is no flow path that does not pass through the netting or media ensuring all water that enters the biofiltration chamber is screened and filtered.

The final chamber of the Modular Wetlands® system is the discharge chamber and as the name suggests this chamber regulates the discharge of water from the Device. An orifice plate or valve in this chamber is factory set to regulate the water discharge from the Device. Although this chamber provides no direct treatment, it does determine the amount of water that can be processed through the Modular Wetlands® system. The orifice plate and/or valve are set so that the design Maximum Treatment Flow Rate is not exceeded for the Device.

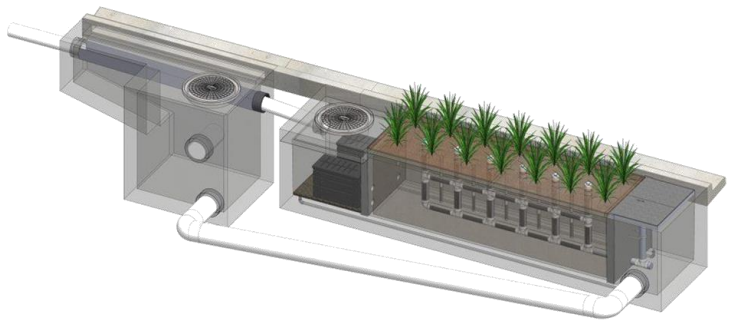


Figure 4 - DVert® Low Flow Diversion System

The Modular Wetlands system may be utilized as an online or offline system. Systems that are designed offline operation must ensure that the diversion mechanism utilized diverts all flows up to the flows generated by the Full Capture Design

Storm. Figure 4 is an illustration of BioClean's® DVert® low flow diversion system. This system routes flows for treatment to the Modular Wetlands® and all flows greater than those from the Design Storm are routed around the system via a bypass pipe. This ensures that large flows do not enter the Device thus eliminating resuspension of previously captured trash and debris from the

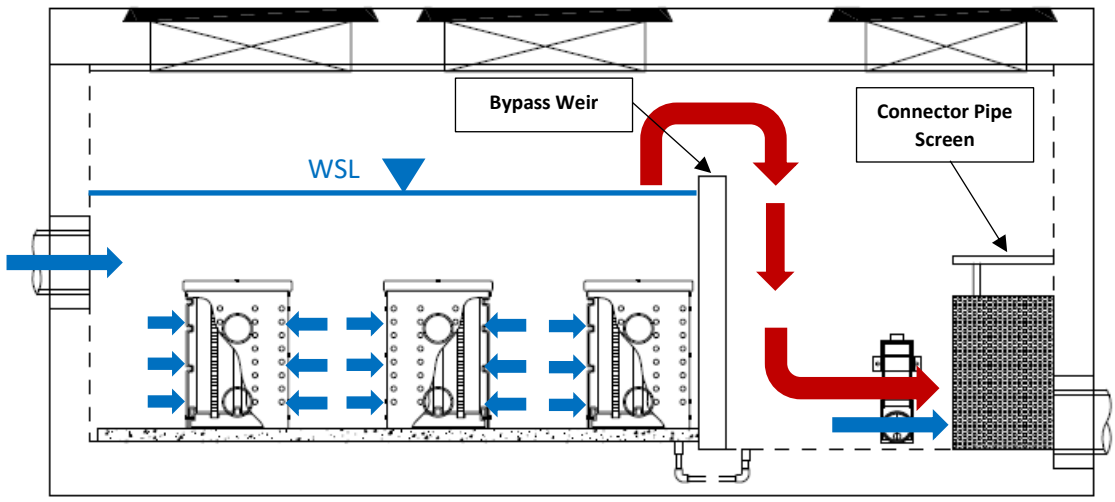


Figure 5 - Modular Wetlands® System in Bypass

pre-treatment chamber from these peak flows.

When utilized as an online Device, the Modular Wetland® System is designed to internally bypass. The design of the Device allows flow in excess of the maximum treatment flow rate to bypass the wetlands treatment chamber while still retaining the Full Capture properties of the Device. Figure 5 illustrates a typical Modular Wetland® System vault configured for internal bypass. Flow enters the vault on the left side of the vault as illustrated in the Figure with the large blue arrow. Stormwater may enter through one or multiple pipes, grate or curb inlets. Flows less than the maximum treatment flow rate for the Device are maintained at a level beneath the top of the bypass weir and all flows pass through the pre-treatment and wetlands treatment chambers. Flows in excess of the maximum treatment flow rate will cause the water level in the pre-treatment chambers to overtop the bypass weir. This flow path is illustrated in the Figure with the red arrows. These flows are not pre-treated and do not pass through the wetlands treatment area. To prevent the release of trash and to maintain Full Capture properties for the Device, the Modular Wetland® System configured for internal bypass is equipped with a Full Capture Certified Connector Pipe Screen (CPS). The Full Capture Certified CPS is installed at the outlet of the Device and all flows that enter the Device must pass through the CPS thus ensuring Full Capture of all Trash.

A video demonstrating the operation of the Modular Wetlands® can be found at the link below:

https://vimeo.com/211548965

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
Source: http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

☐ Consult proprietors for specific criteria concerning the design and performance.

☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.

☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

SECTION VII EDUCATIONAL MATERIALS

The educational materials included in this WQMP are provided to inform people involved in future uses, activities, or ownership of the site about the potential pitfalls associated with careless storm water management. "The Ocean Begins at Your Front Door" provides users with information about storm water that is/will be generated on site, what happens when water enters a storm drain, and its ultimate fate, discharging into the ocean. Also included are activities guidelines to educate anyone who is or will be associated with activities that have a potential to impact storm water runoff quality, and provide a menu of BMPs to effectively reduce the generation of storm water runoff pollutants from a variety of activities. The educational materials that may be used for the proposed project are included in Appendix C of this WQMP and are listed below.

EDUCATION MATERIALS			
Residential Materials (http://www.ocwatersheds.com)	**Check If Attached**	**Business Materials (http://www.ocwatersheds.com)**	**Check If Attached**
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	☐	**Other Materials (http://www.ocwatersheds.com) (https://www.casqa.org/resources/bmp-handbooks)**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐	DF-1 Drainage System Operation & Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	SC-11 Spill Prevention	☒
Recycle at Your Local Used Oil Collection Center (South County)	☐	SC-20 Fueling	☒
Tips for Maintaining Septic Tank Systems	☐	SC-Vehicle Washing	☐
Responsible Pest Control	☒	SD-10 Site Design & Landscape Planning	☐
Sewer Spill	☒	SD-11 Roof Runoff Controls	☒
Tips for the Home Improvement Projects	☐	SD-12 Efficient Irrigation	☒
Tips for Horse Care	☐	SD-13 Storm Drain Signage	☒
Tips for Landscaping and Gardening	☐	SD-31 Maintenance Bays & Docs	☐
Tips for Pet Care	☐	SD-32 Trash Storage Areas	☐
Tips for Pool Maintenance	☐		
Tips for Residential Pool, Landscape and Hardscape Drains	☐		
Tips for Projects Using Paint	☐		
Tips for Protecting Your Watershed	☒		
Other: Children's Brochure	☐		

APPENDICES

APPENDIX A

SUPPORTING CALCULATIONS

Worksheet B: Simple Design Capture Volume Sizing Method

Project: Costco Tustin Gas Station & Parking

Date: 02/07/2019

		DMA =	DMA A1	DMA A2	DMA B	
Step 1: Determine the design capture storm depth used for calculating volume						
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.75	0.75	0.75	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.75	0.75	0.75	inches
Step 2: Calculate the DCV						
1	Enter Project area tributary to BMP(s), *A* (acres)	A=	2.640	3.370	0.630	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	96.0%	98.0%	84.0%	%
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.870	0.885	0.780	
4	Calculate runoff volume, V_{design} = *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	6,253.0	8,119.7	1,337.8	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV						
Step 3a: Determine design infiltration rate						
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N/A	N/A	N/A	in/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N/A	N/A	N/A	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N/A	N/A	N/A	in/hr
Step 3b: Determine minimum BMP footprint						
4	Enter drawdown time, *T* (max 48 hours)	T=	*See Worksheet D*	*See Worksheet D*	*See Worksheet D*	hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=				feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=				sq-ft

Harvest & Reuse Irrigation Demand Calculations

11/29/2018

Storm Water Design Caputre Volume (SQDV)

Drainage Area / Land Use Type	Impervious Area (ac)	Irrigated Area (ac)	% impervious	Runoff Coefficient	Design Storm Depth (in)	Drainage Area (acres)	DCV (ft^3)	DCV (gal)
Total Site	6.30	0.33	95%	0.863	0.75	6.630	**15,577.3**	**116,518**
				0.150			**0.0**	**0**
				0.893			**0.0**	**0**
				0.885			**0.0**	**0**
				0.765			**0.0**	**0**
				0.893			**0.0**	**0**

	Eto
Irvine	3.00
Laguna Beach	2.75
Santa Ana	2.93

Modified

$$\text{EAWU} = \frac{\text{Eto} \times \text{KL} \times \text{LA} \times 0.015}{\text{IE}}$$

$$\text{EIATA} = \frac{\text{LA} \times \text{KL}}{\text{IE} \times \text{Tributary Imp. Area}}$$

Blend of High-Use and Low-Use Landscaping

Drainage Area / Land Use Type	Total Area (ac)	Total Area (sf)	% Impervious	Impervious (sf)	Pervious / LA (sf)	Eto	KL	Modified EAWU	EAWU/ Impervious Acre	Minimum EAWU/ Impervious Acre (Table X.6)	Feasible?	EIATA	Minimum EIATA (interpo-lated)	Drawdown (days)	Drawdown (hours)	% Capture (Fig. III.2)
Total Site	6.630	288,803	95%	274,363	14,440	3	0.55	397.10	63.05	610	No	0.03	0.00	293.4	7,042	>40
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE

Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

TABLE X.8: MINIMUM IRRIGATED AREA FOR POTENTIAL PARTIAL CAPTURE FEASIBILITY

General Landscape Type	Conservation Design: KL = 0.35			Active Turf Areas: KL = 0.7		
Closest ET Station	**Irvine**	**Santa Ana**	**Laguna**	**Irvine**	**Santa Ana**	**Laguna**
Design Capture Storm Depth, inches	**Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac**					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.9	0.41	0.42	0.45
0.80	0.88	0.9	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.1	1.12	1.2	0.55	0.56	0.6

Source: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs). March 22, 2011. Appendix X.

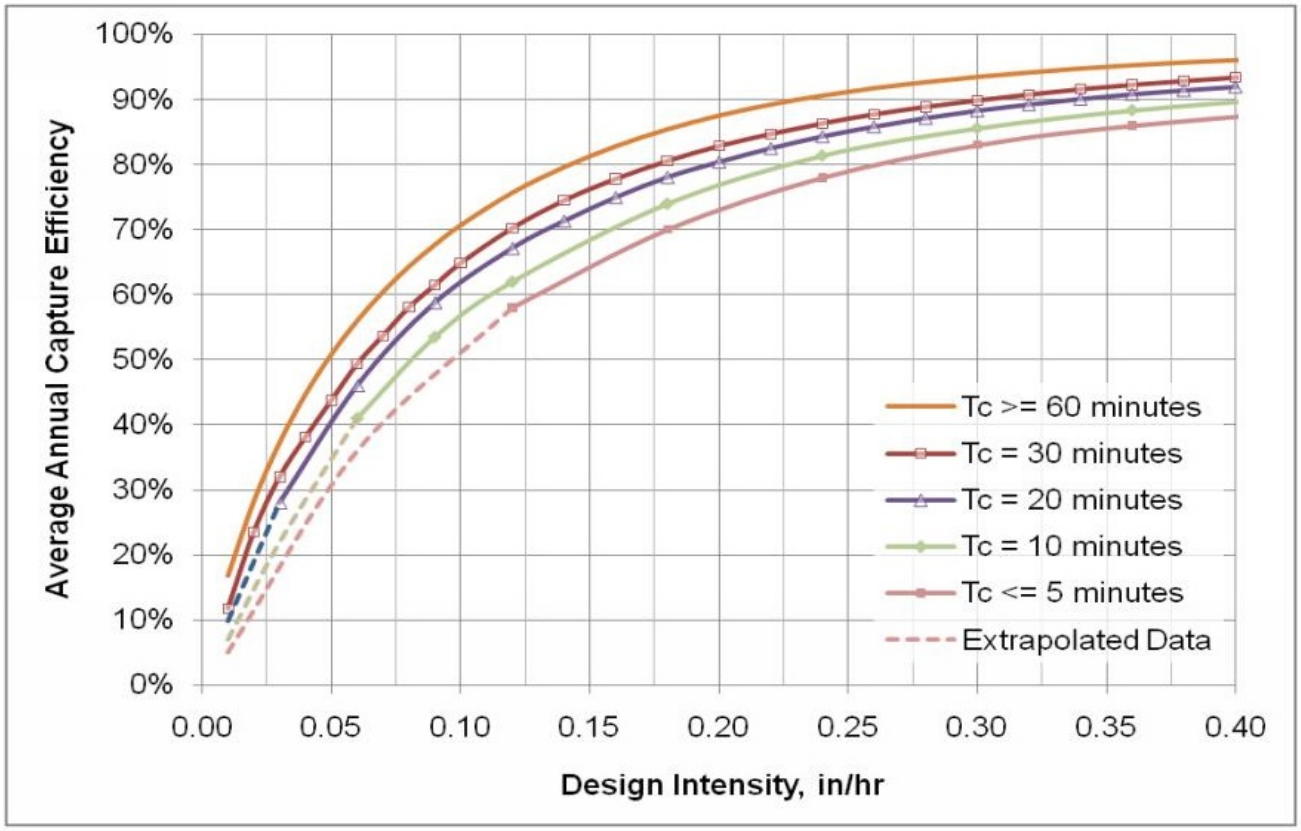
Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Project: Costco Tustin Gas Station & Parking

Date: 02/07/2019

			DMA A1	DMA A2	DMA B	
Step 1: Determine the design capture storm depth used for calculating volume						
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.0	5.0	5.0	min
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.260	0.260	0.260	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0%	0%	0%	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency (Y_2), I_2	I_2=	0	0	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	I_{design}=	0.260	0.260	0.260	in/hr
Step 2: Calculate the design flowrate						
1	Enter Project area tributary to BMP(s), A (acres)	A=	2.640	3.370	0.630	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	96.0%	98.0%	84.0%	%
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.870	0.885	0.780	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.597	0.775	0.128	cfs
Supporting Calculations						
Describe System:						
		Proprietary BioTreatment (BIO-7):				
		Unit Size / Model =	*L-8-20-9-6.5-V-HC*	*L-8-24-6-0-V-HC*	*L-4-13-4-0-C*	
		Unit Size / Model Treatment Capacity =	*0.597*	*0.775*	*0.135*	cfs
		Number of Units Needed =	*1*	*1*	*1*	
		Total Bio-treatment Provided =	*0.597*	*0.775*	*0.135*	cfs

Figure III.4. Capture Efficiency Nomograph for Off-line Flow-based Systems in Orange County



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.

Project Site

0.9
0.9
0.95
0.7
0.75
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1.05
1

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

TITLE: RAINFALL ZONES

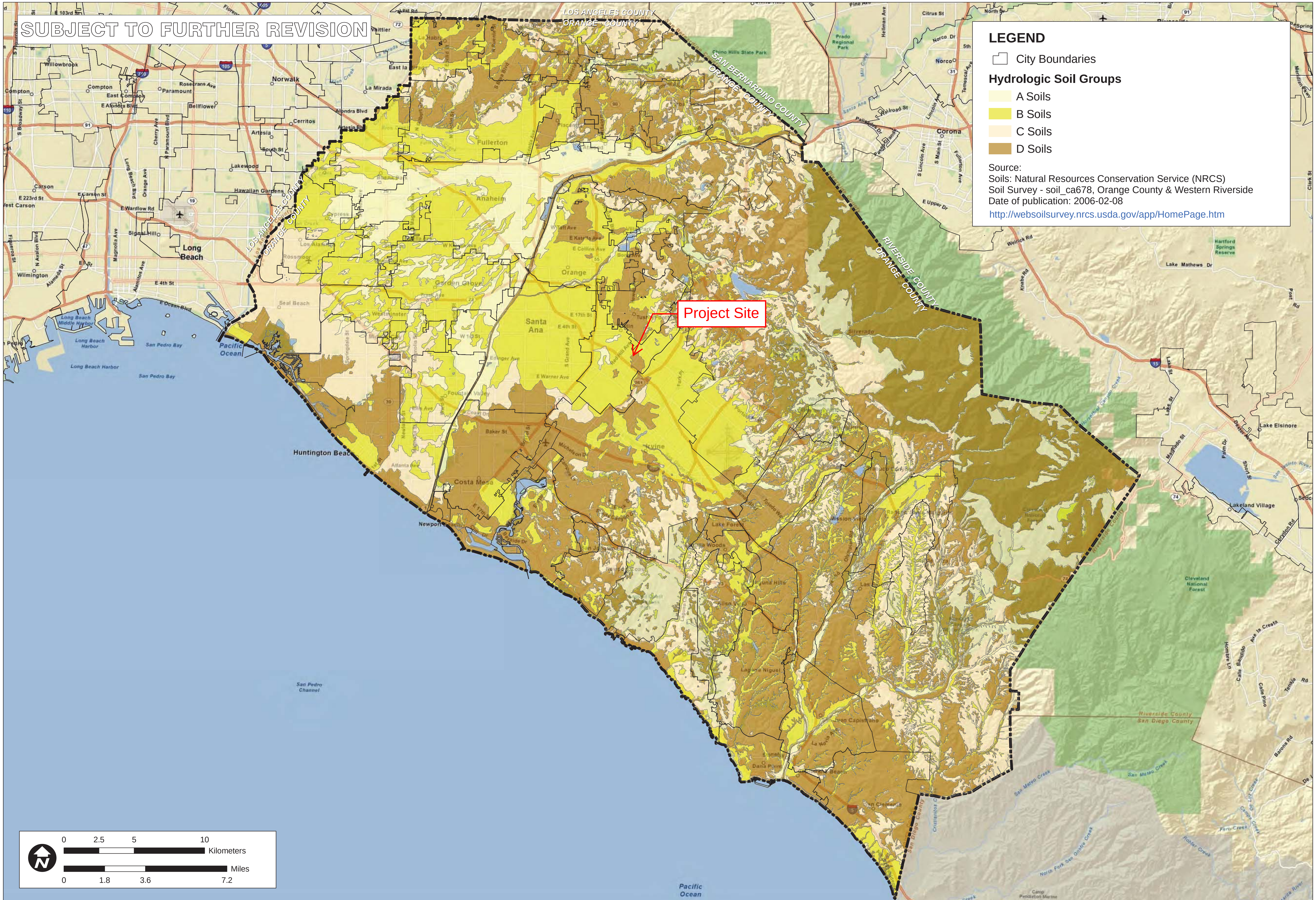
JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO., CA

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

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



TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE
XVI-2a

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd

SUBJECT TO FURTHER REVISION

LEGEND

- Depth To First Groundwater Contours
- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY

Project Site

0 2 4 8 Kilometers
0 1.25 2.5 5 Miles

TITLE
NORTH ORANGE COUNTY
MAPPED DEPTH TO FIRST
GROUNDWATER

JOB
ORANGE CO.
INFILTRATION STUDY
CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2d

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2d_DepthToGroundwaterOverview_20110215.mxd

SUSCEPTIBILITY MAP UPATE (FEB 2013)

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

Tidel Influence

- <= Mean High Water Line (4.28')

Water Body

- Basin
- Dam
- Lake
- Reservoir

Other Lands

- Airport/Military

AnaheimBay-HuntingtonHarbor Watershed

Santa Ana River Watershed

Santa Ana River Watershed

South Orange County

El Modena-Irvine Retarding Basin

Lower Peters Canyon Retarding Basin

Eastfoot Retarding Basin

Project Site

Orchard Estates Retention Basin

Hicks Canyon Retarding Basin

Rattlesnake Reservoir

East Hicks Canyon Retarding Basin

Siphon Reservoir

Bee Canyon Retarding Basin

Round Canyon Retarding Basin

Trabuco Retarding Basin

Marshburn Retarding Basin

Agua Chinon Retarding Basin

North Lake

South Lake

Basin Number 2

Basin Number 1

Sand Canyon Reservoir

Laguna Reservoir

Bonita Canyon Reservoir

San Joaquin Reservoir

Big Canyon Reservoir

Harbor View Dam

John Wayne Airport

Village Pond Park

Santa Ana

Costa Mesa

Newport Beach

Irvine

Orange

Norwalk

Fullerton

Corona

Laguna Hills

Laguna Beach

Laguna Niguel

Rancho Santa Margarita

Mission Viejo

Huntington Beach

Sunset Beach

Seal Beach

Los Alamitos

Rossmoor

Midway City

Foothill Ranch

Lake Forest

Aliso Viejo

Dana Point

San Clemente

Capistrano Beach

Ladera Ranch

Coto de Caza

Las Flores

Trabuco Canyon

Rancho Mission Viejo

Ortega Hwy

Pacific Coast Hwy

Newport Coast Dr

Jamboree Rd

Bake Pkwy

Irvine Blvd

Santiago Canyon Rd

Glenn Ranch Rd

Antonio Pkwy

Portola Pkwy

Alton Pkwy

Foothill Blvd

Ford Rd

Crown Valley Pkwy

Oso Pkwy

Aliso Creek Rd

Moulton Pkwy

Bolsa Chica Rd

Warner Ave

Edinger Ave

Talbert Ave

Slater Ave

Garfield Ave

Orangethorpe Ave

Lincoln Ave

Katella Ave

Chapman Ave

Santa Ana Blvd

Westminster Blvd

Beach Blvd

Brookhurst St

Euclid St

Harbor Blvd

Newport Blvd

Fairview Rd

Bristol St

Main St

Tustin Ranch Rd

Jeffrey Rd

Culver Dr

Sand Canyon Ave

Irvine Center Dr

Rancho Santa Margarita Blvd

Antonio Pkwy

Los Alisos Blvd

Marguerite Pkwy

Alicia Pkwy

Crown Valley Pkwy

Oso Pkwy

Aliso Creek Rd

Moulton Pkwy

Bolsa Chica Rd

Warner Ave

Edinger Ave

Talbert Ave

Slater Ave

Garfield Ave

Orangethorpe Ave

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Newport Blvd

Fairview Rd

Bristol St

Main St

Tustin Ranch Rd

Jeffrey Rd

Culver Dr

Sand Canyon Ave

Irvine Center Dr

Rancho Santa Margarita Blvd

Antonio Pkwy

Los Alisos Blvd

Marguerite Pkwy

Alicia Pkwy

0 9,000 18,000 Feet

P:\9526E\16-GIS\Mxds\SuceptabilityMaps_20100505\9526E_NewportBaySuscptibility_20100430.mxd

TITLE: SUSCEPTIBILITY ANALYIS NEWPORT BAY-NEWPORT COASTAL STREAMS

JOB: ORANGE COUNTY WATERSHED MASTER PLANNING ORANGE CO. CA

SCALE	1" = 12000'
DESIGNED	TH
DRAWNG	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE 4

Appendix B

Notice of Transfer of Responsibility

NOTICE OF TRANSFER OF RESPONSIBILITY

WATER QUALITY MANAGEMENT PLAN

Costco Tustin Gas Station & Parking
Tract No. 14610

Submission of this Notice Of Transfer of Responsibility constitutes notice to the City of Tustin that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

II. Information about Site Transferred

Name of Project (if applicable):	
Title of WQMP Applicable to site:	
Street Address of Site (if applicable):	
Planning Area (PA) and/ or Tract Number(s) for Site:	Lot Numbers (if Site is a portion of a tract):
Date WQMP Prepared (and revised if applicable):	

III. New Owner/ New Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner:	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any):

Lot/ Tract Numbers of Site Transferred to New Owner:
Remaining Lot/ Tract Numbers Subject to WQMP Still Held by Owner (if any):
Date of Ownership Transfer:

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of a project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by Previous Owner. Those portions retained by Previous Owner shall be labeled as "Previously Transferred".

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Order is now the Responsible Party of record for the WQMP for those portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the Previous Owner.

Printed Name of Previous Owner Representative:	Title:
Signature of Previous Owner Representative:	Date:

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Printed Name of New Owner Representative:	Title:
Signature:	Date:

APPENDIX C

EDUCATIONAL MATERIALS

The Ocean Begins at Your Front Door

Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.

Did You Know?

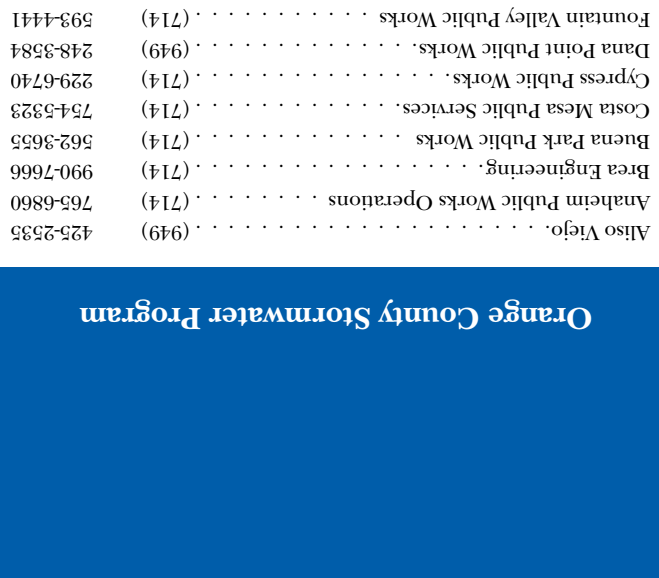
- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution 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?

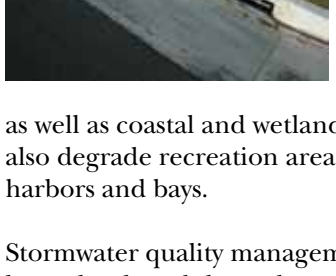
- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer 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.



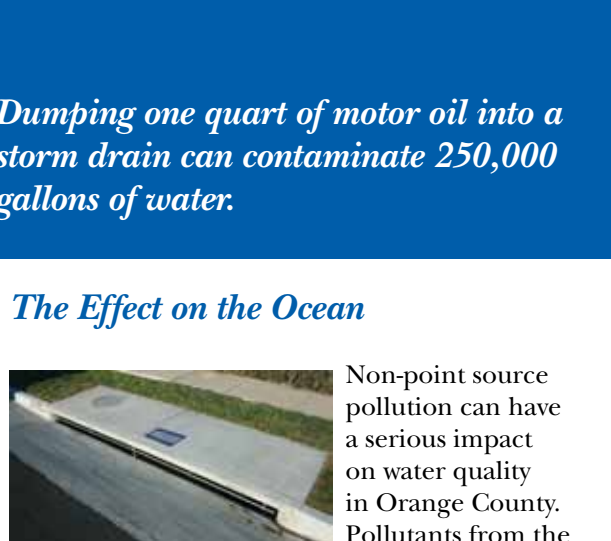
The Effect on the Ocean



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.



Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.

For More Information

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

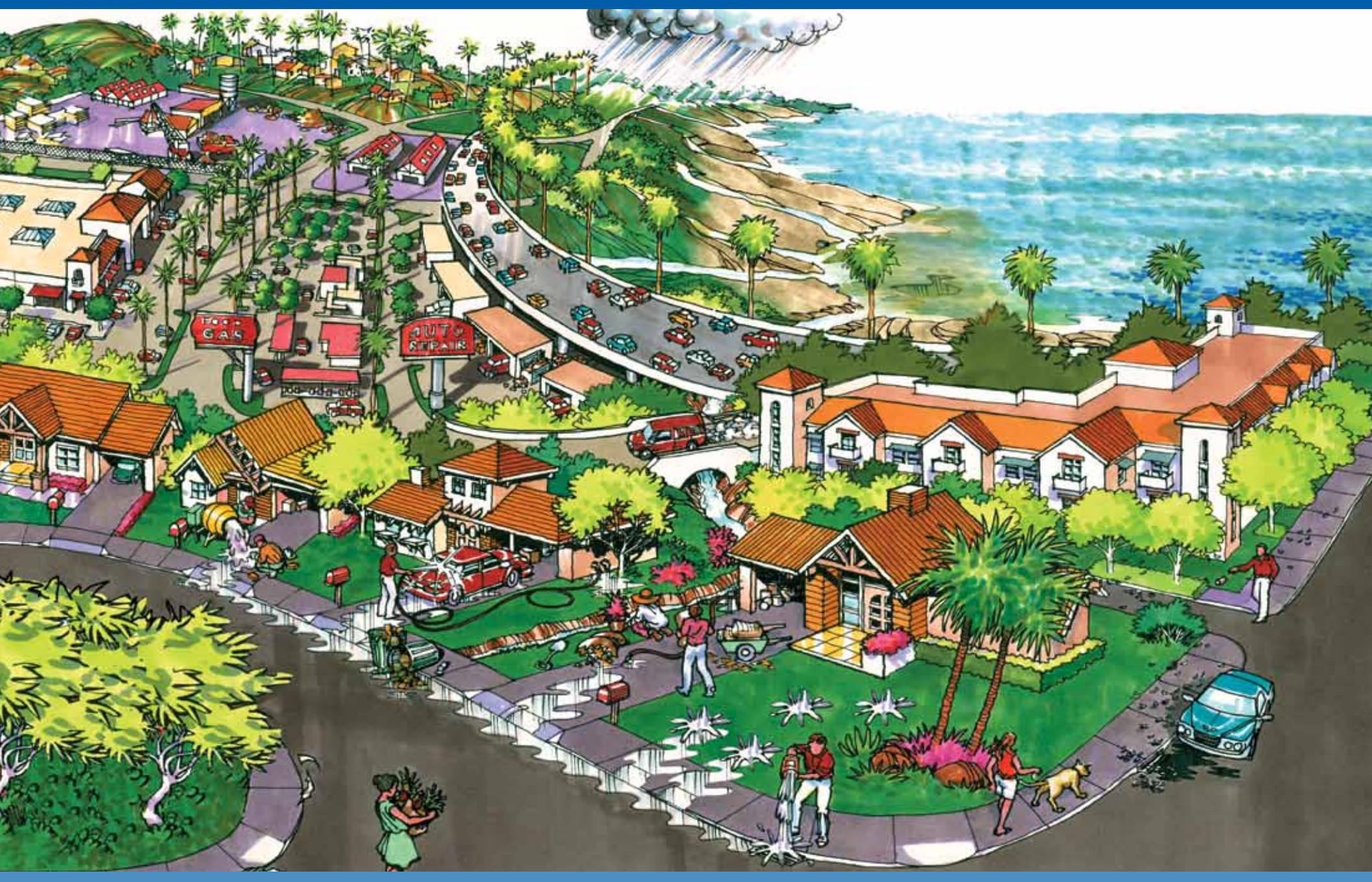
Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

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

Printed on Recycled Paper

Orange County Stormwater Program

The Ocean Begins at Your Front Door



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

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

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.

Funding for this brochure has been provided in full or in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Prop. 13).

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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

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

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

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board
Santa Ana Region (951) 782-4130
San Diego Region (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

DTP113 Rev 4/06
printed on recycled paper

Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities

Orange County Sanitation District

Health Care Agency
Environmental Health

PROJECT Pollution PREVENTION
www.ocwatersheds.com

This brochure was designed courtesy of the Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.

Overflowing cleanout pipe located on private property

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

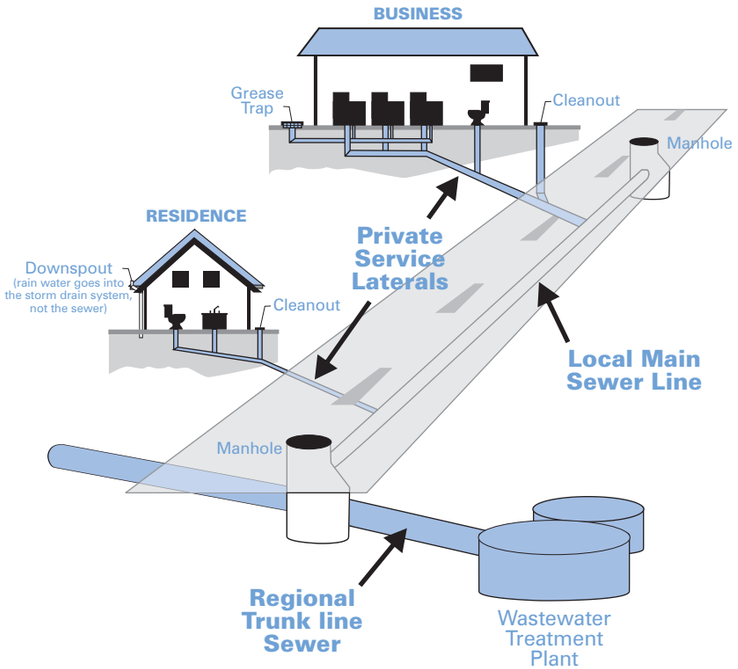
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.



How You Can Prevent Sewage Spills

1. **Never put grease down garbage disposals, drains or toilets.**
2. **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**
3. **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**

Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.

Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, if we are not careful, our daily activities can lead directly to water pollution problems. Water that drains through your watershed can pick up pollutants which are then transported to our waterways and beautiful ocean.

You can prevent water pollution by taking personal action and by working with members of your watershed community to prevent urban runoff from entering your waterway.

For more information, please call the **Orange County Stormwater Program** at **1.877.89.SPILL** 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**.

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help protect your watershed. 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 Protecting Your Watershed

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Protecting Your Watershed

My Watershed. Our Ocean.

Water + shed, *noun: A region of land within which water flows down into a specified water body, such as a river, lake, sea, or ocean; a drainage basin or catchment basin.*

Orange County is comprised of 11 major watersheds into which most of our water flows, connecting all of Orange County to the Pacific Ocean.

As water from rain (stormwater) or sprinklers and hoses (urban runoff) runs down your driveway and into your neighborhood streets, sidewalks and gutters, it flows into storm drains that lead to waterways within your watershed. The waterways from other cities merge as they make their way through our watersheds until all the runoff water in Orange County meets at the Pacific Ocean. The water that reaches our ocean is not pure. As it flows through the watershed, it picks up pollutants such as litter, cigarette butts, fertilizer, pesticides, pet waste, motor oil and lawn clippings. Unlike water that enters the sewer (from sinks and toilets), water that enters the storm drain is not treated before it flows, ultimately, to the ocean.

Water quality can be improved by "Adopting Your Watershed." Through this effort, we are challenging citizens and organizations to join the Orange County Stormwater Program and others who are working to protect and restore our creeks, rivers, bays and ocean.

There are many opportunities to get involved:

- Appreciate your watershed - explore the creeks, trails and ocean and make observations about its conditions. If you see anything abnormal (such as dead fish, oil spills, leaking barrels, and other pollution) contact the Orange County 24-hour water pollution problem reporting hotline at 1.877.89.SPILL to report the problem.
- Research your watershed. Learn about what watershed you live in by visiting www.ocwatersheds.com.
- Find a watershed organization in your community and volunteer to help. If there are no active groups, consider starting your own.
- Visit EPA's Adopt Your Watershed's Catalog of Watershed Groups at www.epa.gov/adopt to locate groups in your community.
- Organize or join in a creek, river, bay or ocean cleanup event such as Coastal & Inner Coastal Cleanup Day that takes place the 3rd Saturday of every September. For more information visit www.coast4u.org.

Follow these simple tips to protect the water quality of your watershed:

- **Sweep up debris and dispose of it in the trash. Do not hose down driveways or sidewalks into the street or gutter.**
- **Use dry cleanup methods such as cat litter to absorb spills and sweep up residue.**
- **Set your irrigation systems to reflect seasonal water needs or use weather-based controllers. Inspect for runoff regularly.**
- **Cover trashcans securely.**
- **Take hazardous waste to a household hazardous waste collection center. (For example, paint, batteries and petroleum products)**
- **Pick up after your pet.**
- **Follow application and disposal directions for pesticides and fertilizers.**
- **If you wash your car at home, wash it on your lawn or divert the runoff onto a landscaped area. Consider taking your car to a commercial car wash, where the water is reclaimed or recycled.**
- **Keep your car well maintained.**
- **Never pour oil or antifreeze in the street, gutter or storm drain.**

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

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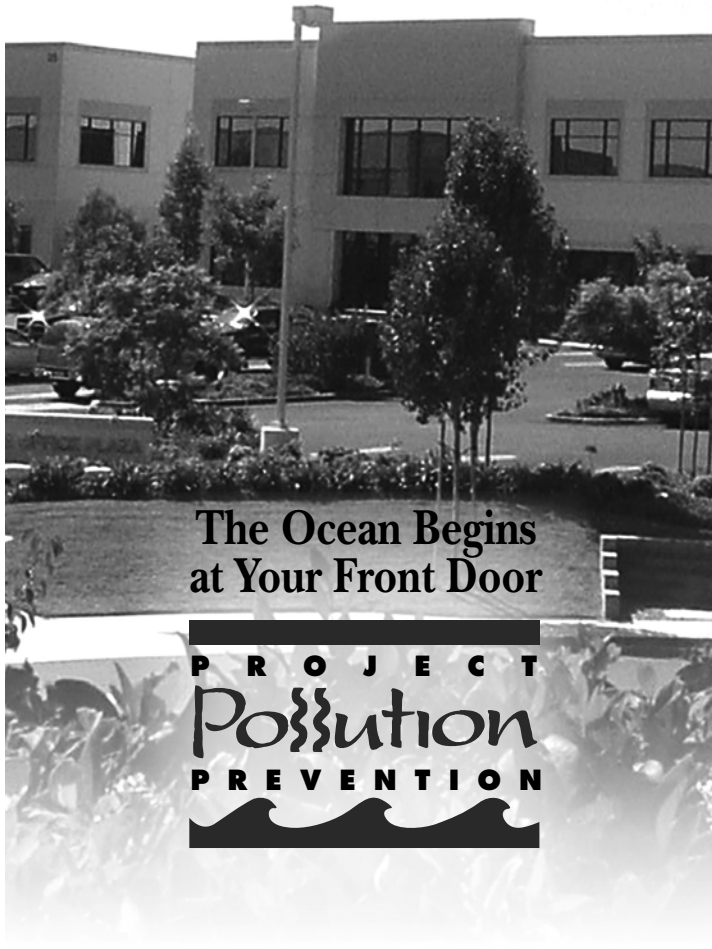
Help Prevent Ocean Pollution:

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

DF-1
DRAINAGE FACILITY OPERATION AND MAINTENANCE

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and storm water that may contain certain pollutants. Consequently these pollutants may accumulate in the system and must be removed periodically. In addition, the systems must also be maintained to function properly hydraulically to avoid flooding. Maintaining the system may involve the following activities:

1. Inspection and Cleaning of Stormwater Conveyance Structures
2. Controlling Illicit Connections and Discharges
3. Controlling Illegal Dumping

This list of Model Maintenance Procedures can be utilized as an inspection checklist to determine where better compliance with Designated Minimum Best Management Practices (notated with checkmarks and capital letters) is needed, and to recommend Additional Best Management Practices (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. BMPs applicable to certain constituents are notated as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
OtherToxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

Program/Facility Being Inspected: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

MAINTENANCE PROCEDURES:

1. Inspection and Cleaning of Drainage Facilities

Unsatisfactory	OK	General Guidelines
☐ _____	☐	T 1A. Annually inspect and clean drainage structures as needed.
☐ _____	☐	T 1B. Maintain appropriate records of cleaning and inspections.
☐ _____	☐	T 1C. Properly dispose of removed materials at a landfill or recycling facility.
☐ _____	☐	T 1D. Conduct intermittent supplemental visual inspections during the wet season to determine if there are problem inlets where sediment/trash or other pollutants accumulate, and provide for additional cleanouts as appropriate.
☐ _____	☐	T 1E. Prevent or clean up any discharges that may occur during the course of maintenance and cleaning procedures.
☐ _____	☐	T 1F. Verify that appropriate employees or subcontractors are trained in proper conductance of maintenance activities, including record keeping and disposal.
☐ _____	☐	T 1G. Annually inspect and clean v-ditches as needed, prior to the wet season. On shrub-covered slopes, vegetative debris may be placed on the downhill side of the ditch. Trash should be bagged and disposed at a landfill.

Unsatisfactory	OK
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

General Guidelines (cont.)

- 1a. Remove trash or debris as needed from open channels. It should be noted that major vegetative debris removal may require other regulatory permits prior to completing the work. (TRASH)
- 1b. Consider retrofitting energy dissipaters (e.g. riprap) below culvert outfalls to minimize potential for erosion. (SED)
- 1c. Repair any v-ditches that have cracked or displaced in a manner that accelerates erosion. (SED)
- 1d. If suspicious conditions appear to exist, test selected samples of the removed wastes for compliance with hazardous waste regulations prior to disposal. (TOX)
- 1e. Consider more frequent regular cleaning of selected drainage structures to help address ongoing specific impairments. (SED, BACT, NUT, TRASH)
- 1f. Consider structural retrofits to the MS4 to help address ongoing specific impairments (SED, BACT, NUT, TRASH, O&G)
- 1g. Consider cleaning out pipes at gradient breaks or other in-pipe debris accumulation points as identified/needed. (ANY, BACT, NUT, TRASH)

Storm Drain Flushing

- 1h. Flushing of storm drains or storm drain inlets should only be done when critically necessary and no other solution is practical. (SED, BACT, TRASH).
- 1i. If flushed, to the extent practical the material should be collected (vacuumed), treated with an appropriate filtering device to remove sand and debris and disposed of properly. (SED)

Waste Management

T 1H. Store wastes collected from cleaning activities of the drainage facilities in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- 1j. Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device to remove the sand and debris prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not permitted, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream. (SED, TRASH)
- 1k. Provide for laboratory analysis of at least one randomly collected sediment (less the debris) sample per year from the storm drain inlet leaning program to ensure that it does not meet the EPA criteria for hazardous waste. If the sample is determined to be hazardous, the sediment must be disposed of as hazardous waste and the source should be investigated. (TOX).

2. Controlling Illicit Connections and Discharges

Unsatisfactory	OK	General Guidelines
☐	☐	T 2A. Report prohibited discharges such as dumping, paint spills, abandoned oil containers, etc. observed during the course of normal daily activities so they can be investigated, contained, and cleaned up.
☐	☐	T 2B. Where field observations and/or monitoring data indicate significant problems, conduct field investigations to detect and eliminate existing illicit connections and improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)). (Refer to Appendices A-10 and A-11.)
☐	☐	T 2C. Report all observed illicit connections and discharges to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐	☐	T 2D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
		Storm Drain Stenciling ("No Dumping—Drains to Ocean")
☐	☐	T 2E. Implement and maintain a storm drain stenciling program.
☐	☐	• 2a. Consider adding the hotline number to the storm drain stencils (BACT, TOX, TRASH).

3. Controlling Illegal Dumping

		Field Investigation
☐	☐	T 3A. Report prohibited discharges such as dumpings observed during the course of normal daily activities so they can be investigated, contained and cleaned up.
☐	☐	T 3B. Conduct field investigations to detect and eliminate improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)).
☐	☐	T 3C. Report all observed illegal dumping to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐	☐	T 3D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
☐	☐	T 3E. If perpetrator can be identified, take appropriate enforcement action.
☐	☐	• 3a. Consider posting "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs could also indicate fines and penalties for illegal dumping. (ANY)

Unsatisfactory	OK	Training/Education/Outreach
☐ _____	☐	T 3F. Verify that appropriate employees and subcontractors are trained to recognize and report illegal dumping.
☐ _____	☐	T 3G. Encourage public reporting of illegal dumping by advertising the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	• 3b. Take extra steps to educate the public in neighborhoods where illegal dumping has occurred to inform them why illegal dumping is a problem, and that illegal dumping carries a significant financial penalty. (ANY)

LIMITATIONS:

Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

Spill Prevention, Control & Cleanup SC-11

Photo Credit: Geoff Brosseau

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Targeted Constituents

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

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- If consistent illegal dumping is observed at the facility:
  - Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

- Routine maintenance:
  - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
  - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
  - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

  - Check tanks (and any containment sumps) daily 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.

- Label all containers 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).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. 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 the 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 of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, 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.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- 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).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- 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

Training

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- A Spill Prevention Control and Countermeasure Plan (SPCC) is required for facilities that are subject to the oil pollution regulations specified in Part 112 of Title 40 of the Code of Federal Regulations or if they have a storage capacity of 10,000 gallons or more of petroleum. (Health and Safety Code 6.67)
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off" of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

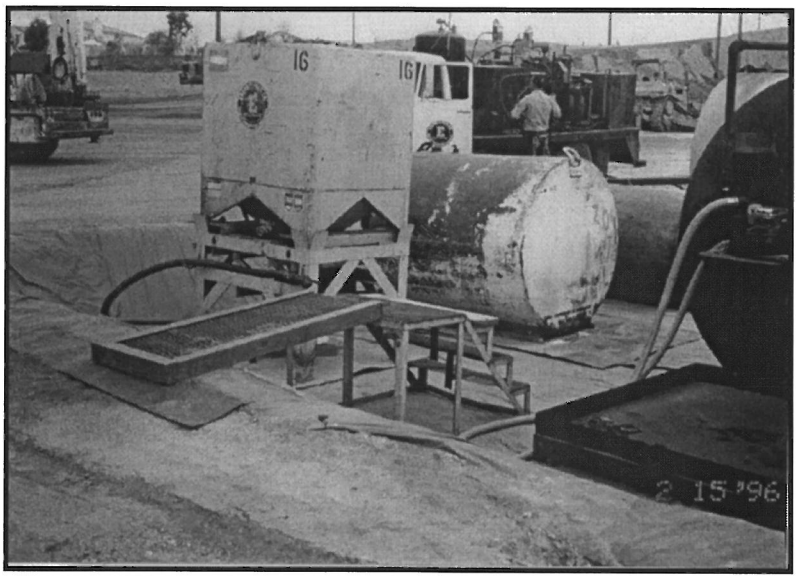
Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Vehicle & Equipment Fueling SC-20



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

Spills and leaks that occur during vehicle and equipment fueling can contribute hydrocarbons, oil and grease, as well as heavy metals to stormwater runoff. Implementing the following management practices can help prevent fuel spills and leaks.

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Educate employees about pollution prevention measures and goals.
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.

Suggested Protocols

General

- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.

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- Manage materials and waste to reduce adverse impacts on stormwater quality.
- Label drains within the facility boundary, by paint/stencil (or equivalent), to indicate whether they flow to an oil/water separator, directly to the sewer, or to a storm drain. Labels are not necessary for plumbing fixtures directly connected to the sanitary sewer.
- 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.
- Report leaking vehicles to fleet maintenance.
- Install inlet catch basin equipped with a small sedimentation basin or grit chamber to remove large particles from stormwater in highly impervious areas.
- Ensure the following safeguards are in place:
  - Overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
  - Protective guards around tanks and piping to prevent vehicle or forklift damage.
  - Clear tagging or labeling of all valves to reduce human error.

Fuel Dispensing Areas

- Maintain clean fuel-dispensing areas using dry cleanup methods such as sweeping for removal of litter and debris, or use of rags and absorbents for leaks and spills.
- If you periodically clean by washing, place a temporary plug in the downstream drain and pump out the accumulated water. Properly dispose the water. Note: permission from the local sewering agency must be obtained before discharging wash water to the sanitary sewer.
- Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
- Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- Design fueling area to prevent stormwater runoff and spills.
- Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area and use a perimeter drain or slope pavement inward with drainage to sump; pave area with concrete rather than asphalt.
- Where covering is not feasible and the fuel island is surrounded by pavement, apply a suitable sealant that protects the asphalt from spilled fuels.

- Install vapor recovery nozzles to help control drips as well as air pollution.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Cover storm drains in the vicinity during transfer.

Outdoor Waste Receptacle Area

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - Install a roof over the waste receptacle area.
  - Install a low containment berm around the waste receptacle area.
  - Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.

Air/Water Supply Area

- Minimize the possibility of stormwater pollution from air/water supply areas by doing at least one of the following:
  - Spot clean leaks and drips routinely to prevent runoff of spillage.
  - Grade and pave the air/water supply area to prevent run-on of stormwater.
  - Install a roof over the air/water supply area.
  - Install a low containment berm around the air/water supply area.

Inspection

- Aboveground Tank Leak and Spill Control:
  - Check 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 vice versa.
  - Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.

- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Periodically, integrity testing should be conducted by a qualified professional.

- Inspect and clean, if necessary, storm drain inlets and catch basins within the facility boundary before October 1 each year.

Training

- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Train employees on proper fueling and cleanup procedures.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Store portable absorbent booms (long flexible shafts or barriers made of absorbent material) in unbermed fueling areas.
- Report spills promptly.
- If a dead-end sump is not used to collect spills, install an oil/water separator.

Other Considerations

- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.

Requirements

Costs

- The retrofitting of existing fueling areas to minimize stormwater exposure or spill runoff can be expensive. Good design must occur during the initial installation.
- Extruded curb along the "upstream" side of the fueling area to prevent stormwater run-on is of modest cost.

Maintenance

- Clean oil/water separators at appropriate intervals.

- Keep ample supplies of spill cleanup materials on-site.
- Inspect fueling areas and storage tanks on a regular schedule.

Supplemental Information

Design Considerations

Designing New Installations

The elements listed below should be included in the design and construction of new or substantially remodeled facilities.

Fuel Dispensing Areas

- Fuel dispensing areas must be paved with Portland cement concrete (or, equivalent smooth impervious surface), with a 2 to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of stormwater to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the "fuel dispensing area" stated above.
- The fuel dispensing area must be covered, and the cover's minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area, as defined above. The cover must not drain onto the fuel dispensing area.
- If necessary, install and maintain an oil control device in the appropriate catch basin(s) to treat runoff from the fueling area.

Outdoor Waste Receptacle Area

- Grade and pave the outdoor waste receptacle area to prevent run-on of stormwater to the extent practicable.

Air/Water Supply Area

- Grade and pave the air/water supply area to prevent run-on of stormwater to the extent practicable.

Designated Fueling Area

- If your facility has large numbers of mobile equipment working throughout the site and you currently fuel them with a mobile fuel truck, consider establishing a designated fueling area. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain.

Examples

The Spill Prevention Control and Countermeasure (SPCC) Plan, which is required by law for some facilities, is an effective program to reduce the number of accidental spills and minimize contamination of stormwater runoff.

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program's elements, including specific BMP guidance and lists of equipment suppliers, are also applicable to industrial facilities.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Best Management Practice Guide for Retail Gasoline Outlets, California Stormwater Quality Task Force. 1997.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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

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

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

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

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

- Signage on top of curbs tends to weather and fade.

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

APPENDIX D

BMP MAINTENANCE SUPPLEMENT / O&M PLAN

OPERATIONS AND MAINTENANCE (O&M) PLAN

Water Quality Management Plan

For

Costco Tustin
Gas Station & Parking

Located at 2655 El Camino Real
in the
City of Tustin
County of Orange, California

March 13, 2019

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BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
NON-STRUCTURAL SOURCE CONTROL BMPs			
Yes	**N1. Education for Property Owners, Tenants and Occupants** Educational materials will be provided to tenants or employees, including brochures and restrictions to reduce pollutants from reaching the storm drain system. Examples include tips for recycling oil, landscaping tips, sewer spills, and proper household hazardous waste disposal. Tenants will be provided with these materials by the property management prior to occupancy, and periodically thereafter.	Educational materials will be provided to tenants annually. Materials to be distributed are found in Appendix C of this WQMP. Tenants will be provided these materials by the Property Management prior to occupancy and annually thereafter. Frequency: Upon first occupancy, Annually thereafter	Costco Wholesale
Yes	**N2. Activity Restrictions** The following activity restrictions for the protection of storm water quality: ▪ Vehicle, equipment, and/or mat washing outside is prohibited ▪ Application of fertilizers & pesticides shall be in conformance with City standards ▪ Any vehicle maintenance shall only be conducted indoors within the tire center.	The Owner will prescribe activity restrictions to protect surface water quality, through lease terms or other equally effective measure, for the property. Frequency: Ongoing	Costco Wholesale
Yes	**N3. Common Area Landscape Management** Costco Wholesale shall be responsible for ongoing maintenance and management of all landscaped areas on their property, consistent with OC DAMP Section 5.5, Management Guidelines for Use of Fertilizers as well as City	Maintenance shall be consistent with City requirements, plus fertilizer and/or pesticide usage shall be consistent with County guidelines for use of fertilizers and pesticides (OC DAMP Section 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting	Costco Wholesale

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
	standards. Program includes how to reduce the potential pollutant sources of fertilizer and pesticide uses, utilization of water-efficient landscaping practices, ongoing trimming and other landscape maintenance activities and proper disposal of landscape wastes by Costco Wholesale and/or contractors.	and replacement of mulch shall be performed as-needed. Trimmings, clippings, and other waste shall be properly disposed of off-site in accordance with local regulations. Temporary stockpiles during maintenance activities shall be placed away from water courses and storm drain inlets. See also BMP Fact Sheet IC7 in Appendix 4 of the Project WQMP. Frequency: Monthly	
Yes	N4. BMP Maintenance The Owner will be responsible for the implementation and maintenance of each applicable non-structural BMP, as well as scheduling inspections and maintenance of all applicable structural BMP facilities through its staff, landscape contractor, and/or any other necessary maintenance contractors.	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this O&M Plan. Records of inspections and BMP maintenance shall be maintained by the Owner and documented with the WQMP, and shall be available for review upon request. Frequency: Ongoing	Costco Wholesale
Yes	N5. Title 22 CCR Compliance (How development will comply) The project site shall comply with Title 22 of the California Code of Regulations and relevant sections of the California Health and Safety Code regarding hazardous waste management, which will be enforced by OCHCA on behalf of the State.	The Owner shall verify Title 22 California Code of Regulations compliance on an annual basis. Frequency: Annually	Costco Wholesale
No	N6. Local Industrial Permit Compliance	Not Applicable	

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
Yes	N7. Spill Contingency Plan Emergency spill kits containing dry-cleanup materials will be kept on-site at all times. Spill kits shall include, at a minimum, dry adsorbent material such as kitty litter, mats or pillows, containment booms, wipes, goggles, gloves and disposal bags. Minor spills shall be cleaned up immediately using dry methods, consistent with measures identified in Fact Sheet IC17 in Appendix 4 of the Project WQMP.	Spill contingency measures shall be implemented on an ongoing basis by the Store Manager. Inspect/verify contingency plan and associated documentation is being followed on an annual basis. Verify spill kits are adequately stocked and placed at key locations in the food preparation area, fueling area, and maintenance area. Cleanup activities will be coordinated between the respective departments and the Police and Fire departments in the event of a spill. Frequency: Ongoing	Costco Wholesale
Yes	N8. Underground Storage Tank Compliance All underground storage tanks, including fuel tanks and additive tank, shall meet applicable Federal, State, County, and local regulations. The system components are "product tight", which means that liquid should not get in or out. The fill sumps are equipped with water shrouds to seal between the sump and spill buckets. The spill buckets are equipped with tight seal fill and vapor adaptors & caps (EVR). The turbine sumps are also equipped with product tight covers. The dispensers are the only component that may encounter water intrusion, but the containment sump will catch 100% of that water. The fuel piping inside of the dispensers are completely tight throughout.	The Owner shall verify compliance with associated State and Health Care Agency regulations on an annual basis. Frequency: Annually	Costco Wholesale

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
Yes	N9. Hazardous Materials Disclosure Compliance The Owner will comply with the County of Orange Fire Authority hazardous material disclosure requirements where applicable. Costco Wholesale currently discloses any hazardous materials used or stored on-site to the OC Health Care Agency to aid in emergency preparation and response.	The Owner shall verify compliance with hazardous materials disclosure requirements in accordance with associated fire, Health Care, and other appropriate agencies on an annual basis. Frequency: Annually	Costco Wholesale
Yes	N10. Uniform Fire Code Implementation The Owner will ensure all structures comply with Article 80 of the Uniform Fire Code, City codes, County of Orange Fire Authority, and local standards.	The Owner shall verify compliance with Article 80 of the Uniform Fire Code enforced by fire protection agency on an annual basis. Frequency: Annually	Costco Wholesale
Yes	N11. Common Area Litter Control The Owner will be responsible for performing trash pick-up and sweeping of littered common areas on a weekly basis or whenever necessary, and proper disposal of waste collected. Responsibilities will also include investigating, noting and documenting improper disposal materials by the public.	Litter patrol, violations investigation, reporting and other litter control activities shall be performed in conjunction with maintenance activities. Litter collection and removal shall be performed on a weekly basis. Frequency: Weekly	Costco Wholesale

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
Yes	**N12. Employee Training** All employees of the Owner and any contractors of the City will require training to ensure that employees are aware of maintenance activities that may result in pollutants reaching the storm drain. Training will include, but not be limited to, spill cleanup procedures, proper waste disposal, housekeeping practices, etc.	The Owner shall educate all new employees/ managers on storm water pollution prevention, particularly good housekeeping practices, prior to the start of the rainy season (October 1). Refresher courses shall be conducted on an as needed basis. Materials that may be used are included in Appendix 3 of the Project WQMP. Frequency: Annually	Costco Wholesale
No	**N13. Housekeeping of Loading Docks**	Not Applicable	
Yes	**N14. Common Area Catch Basin Inspection** All on-site catch basin inlets, area drains, ribbon gutters, curb and gutters, swales and other drainage systems shall be inspected and cleaned out by the Owner at least once a year, prior to the rainy season in accordance with BMP Fact Sheet DF1 in Appendix 4 of the Project WQMP.	Catch basin inlets, area drains, swales, curb-and-gutter systems and other drainage systems shall be inspected after each storm event and, if necessary, cleaned prior to the storm season by October 1st each year. Frequency: Annually	Costco Wholesale
Yes	**N15. Street Sweeping Private Streets and Parking Lots** The Owner shall be responsible for the sweeping of all on-site drive aisles and parking areas weekly and upon request by the City.	Parking lots and drive aisles must be swept at least weekly, including prior to the start of the rainy season (October 1st), and upon request by the City. Frequency: Weekly	Costco Wholesale

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
Yes	N16. Retail Gasoline Outlets ▪ Maintaining clean fuel-dispensing areas, inspecting for leaks, removing trash/debris, cleaning up spills, etc. ▪ Appropriately designed fueling areas to minimize storm water exposure (see N8) ▪ Minimization of pooling of water by elevating fuel area and draining to oil/water separator to capture pollutants ▪ Utilization of fueling safeguards (see N8) ▪ The store manager shall ensure adequately stocked spill kits are kept on-site in the fueling area (see BMP N7) ▪ Underground storage tanks fit with spill containment and overflow prevention systems that meet regulations of Section 2635(b) of Title 23 of the Code of California Regulations (see BMP N8) ▪ Canopy over fuel pumps to eliminate direct precipitation and grade breaks to reduce runoff and runon ▪ Posted notice to remind patrons not to top off fuel tanks to reduce spills	Check for external corrosion, structural failure, and spills frequently. Inspect and clean storm drain inlet and catch basins within the facility boundary after each storm event and before October 1 each year in accordance with BMP N14. Maintain trash receptacles in accordance with BMP N11. Maintain spill kits in accordance with BMP N7. Maintenance of oil/water separator and Safe Drain inserts includes quarterly inspection, cleaning and removal of collected oil & grease via vacuum truck and proper disposal or recycling/ rendering of waste off-site. Replace any filters annually as needed. Frequency: Annually	Costco Wholesale
STRUCTURAL SOURCE CONTROL BMPs			

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
Yes	**S1. Provide storm drain system stenciling and signage** The phrase "NO DUMPING! DRAINS TO OCEAN" via City-approved curb markers will be stenciled on all catch basins within the project site to alert the public to the destination of pollutants discharged into storm water. Stencils shall be in place by completion of construction.	Storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1st each year. Those determined to be illegible will be re-stenciled as soon as possible. Frequency: Annually	Costco Wholesale
No	**S2. Design and construct outdoor material storage areas to reduce pollution introduction**	Not Applicable	
No	**S3. Design and construct trash and waste storage areas to reduce pollution introduction**	Not Applicable	
Yes	**S4. Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control** The Owner will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. The Owner will be responsible for implementing all efficient irrigation systems for common area landscaping including but not limited to provisions for water sensors and programmable irrigation cycles. The irrigation systems shall be in conformance with water use efficiency guidelines.	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, and day or nighttime temperatures based on system specifications and local climate patterns. Smartimer system shall be inspected and calibrated twice per year in accordance with manufacturer specifications to verify proper function. Frequency: Monthly	Costco Wholesale

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with BMP O&M Responsibility
No	S5. Protect slopes and channels and provide energy dissipation	Not Applicable	
No	S6. Dock areas	Not Applicable	
No	S7. Maintenance bays	Not Applicable	
No	S8. Vehicle wash areas	Not Applicable	
No	S9. Outdoor processing areas	Not Applicable	
No	S10. Equipment wash areas	Not Applicable	

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	**BMP Name and BMP Implementation, Maintenance and Inspection Procedures**	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with BMP O&M Responsibility**
Yes	**S11. Fueling areas** The fuel dispensing area shall be paved with concrete, with an overhanging roof structure to cover the fuel dispensing area. The cover must not drain into the fuel dispensing area and an appropriate slope will be utilized to prevent ponding. The fuel dispensing area will be separated from the rest of the site by a grade break around the perimeter that prevents runon or runoff into the areas. An 800 gallon oil/water separator (model no. 577-SA by Utility Vault Company) along with a 12" diameter Oil Stop Valve with Slave Valve (AFL Industries, Inc.) will be located in the fueling area to capture pollutants prior to discharging downstream. Additional spill kits will be kept on-site at the fueling station, and Safe Drain inserts will be placed in the storm drain inlets to capture any spills in the vicinity. Further maintenance of the area will include frequent collection of trash & debris on-site, placement and maintenance of covered trash receptacles, and routine sweeping of the area. See also BMP N17 above for further details on fueling area.	Check for external corrosion, structural failure, and spills frequently. Inspect and clean storm drain inlet and catch basins within the facility boundary after each storm event and before October 1 each year in accordance with BMP N14. Maintain trash receptacles in accordance with BMP N11. Maintain spill kits in accordance with BMP N7. Maintenance of oil/water separator and Safe Drain inserts includes quarterly inspection, cleaning and removal of collected oil & grease via vacuum truck and proper disposal or recycling/ rendering of waste off-site. Replace any filters annually as needed. Frequency: Annually	Costco Wholesale
No	**S12. Hillside landscaping**	Not Applicable	

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable ? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with BMP O&M Responsibility
No	S13. Wash water control for food preparation areas	Not Applicable	
No	S14. Community car wash racks	Not Applicable	

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX		
BMP Name and BMP Implementation, Maintenance and Inspection Procedures	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
TREATMENT CONTROL BMPs		
Biotreatment BMP # 1: Modular Wetland System	The Modular Wetland units shall be maintained in accordance with manufacturer's specifications. The system shall be inspected at a minimum of once every six months, prior to the start of the rainy season (October 1) each year, and after major storm events. Typical maintenance includes removing trash & debris from the catch basin screening filter (by hand), removal of sediment and solids in the settlement chamber (vacuum truck), replacement of the BioMediaGREEN™ filter cartridge, and replacement of the BioMediaGREEN™ drain down filter (if equipped). In addition, plants within the wetland chamber will require trimming as needed in conjunction with routine landscape maintenance activities. No fertilizer shall be used in this chamber. Wetland chamber should be inspected during rain events to verify flow through the system. If little to no flow is observed from the lower valve or orifice plate, the wetland media may require replacement. If prior treatment stages are properly maintained, the life of the wetland media can be up to 20 years. Frequency: 2x per year	Costco Wholesale

Required Permits

Permits are not required for the implementation, operation, and maintenance of the BMPs.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

Waste Management & Disposal

Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets.

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

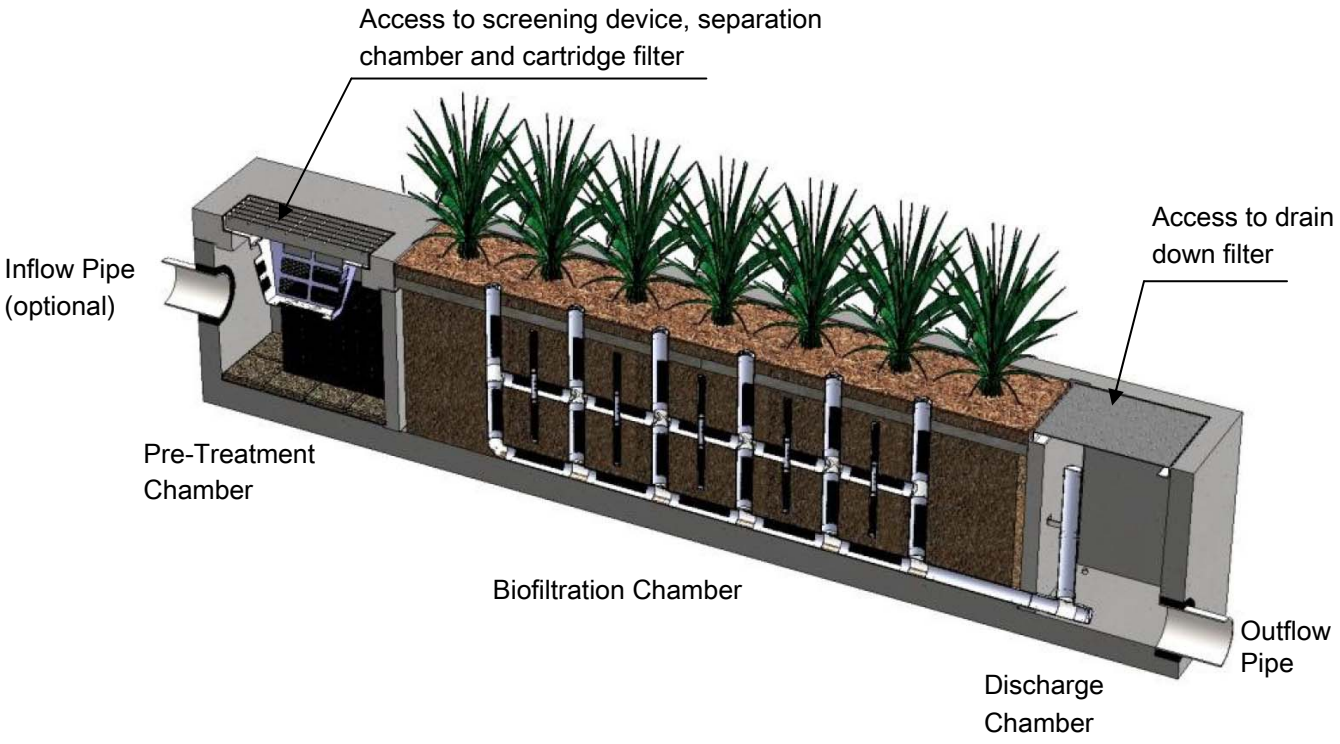
BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

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

Weather Condition _____ Additional Notes _____

Inspection Checklist

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

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

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

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

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

Weather Condition _____ Additional Notes _____

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

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

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

APPENDIX E

CONDITIONS OF APPROVAL

Conditions

1.	In accordance with City policies, the developer shall post security for the grading permit in an amount to be determined by the Building Official. The required amount must include items relating to hazardous conditions such as erosion and air/dust control, the cost of completing any Mechanically-Stabilized Earth (MSE) walls, provisions for landscaping as relating to slope stability, compliance with approved landscape plans, and contingency funds which must include an allowance for site maintenance.
2.	The developer shall submit a complete hydrology and hydraulic study (including off-site areas affecting the development), prepared by a California-registered professional civil engineer, consistent with the use of the criteria of the Orange County Hydrology Manual, to the City Building Official for review and approval. The study shall be consistent with the study submitted during the entitlement review process. The study report shall determine potential storm water runoff rates and peak flows for the City of Tustin and County of Orange design storms. Sufficient detail shall be provided to develop the existing conditions and proposed project conditions potential hydrograph and timing of peak flows. The study report shall demonstrate that the effect of storm water discharge to any City-, County-, or Other Agency-owned drainage or flood control facility as mitigated shall be designed and implemented to prevent post-construction storm flows from exceeding pre-construction volumes and rates.
3.	The developer shall submit storm drain plans, prepared by a California registered professional civil engineer, depicting proposed storm drain improvements for the project. All storm drain improvements shall comply with the City of Tustin Construction Standards for Private Streets, Storm Drain and On-Site Private Improvements Manual and the Orange County Local Drainage Manual.
4.	The developer shall submit precise grading plans, prepared by a California registered professional civil engineer, depicting proposed grading, erosion control and improvements for the project. All plans and design shall comply with the City of Tustin Grading Manual and requirements.
5.	Prior to approval of the final design plans and issuance of a grading permit, the developer shall conduct a site-specific geotechnical investigation for the entire site and prepare a report that fully assesses the geologic and soil conditions of the site. As part of the report preparation, soil sampling and any geotechnical testing will be completed at each location where structures are to be erected. The report shall provide grading and structural design recommendations for avoiding liquefaction, subsidence or collapse for each of the proposed structures. The recommendations shall be included in the plans submitted to the City.
6.	Prior to approval of the final design plans and issuance of a grading permit, the developer shall prepare, submit and obtain City approval of a Final Water Quality Management Plan (WQMP) specifically identifying the Best Management Practices (BMP's) that will be used on site to control predictable pollutant runoff. The plan shall identify the types of structural and non-structural measures to be used. The plan shall comply with the Orange County Drainage Area Management Plan (DAMP). The WQMP shall clearly show the locations of structural BMP's, and assignment of long term maintenance responsibilities (which shall also be included in the Maintenance Agreement).

APPENDIX F

GEOTECHNICAL REPORT

November 16, 2018
Kleinfelder Project No.: 20192059.001A

Costco Wholesale
9 Corporate Park, Suite 230
Irvine, California 92606

Attention: Ms. Diana P. Salazar
Director of Real Estate Development

Subject: Geotechnical Study
Proposed Fuel Facility
Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California
CW# 18-0212

Dear Ms. Salazar:

Kleinfelder is pleased to present this report summarizing our geotechnical study for the proposed fuel facility at Costco Wholesale Warehouse No. 122 located at 2655 El Camino Real in Tustin, California. The purpose of our geotechnical study was to evaluate subsurface soil and groundwater conditions at the project site to provide geotechnical recommendations for design and construction. The conclusions and recommendations presented in this report are subject to the limitations presented in Section 7.

We appreciate the opportunity to provide geotechnical engineering services to you on this project. If you have any questions regarding this report or if we can be of further service, please do not hesitate to contact Brian Crystal at (949) 727-4466, or Andy Franks, Kleinfelder's Client Account Manager for Costco, at (480) 650-4905.

Respectfully submitted,

KLEINFELDER

Daniel A. Castle, PE
Staff Engineer

Brian E. Crystal, PE, GE
Senior Project Manager

24411 Ridge Route Dr., Suite 225, Laguna Hills, CA 92653 p | 949.727.4466 f | 949.727.9242

GEOTECHNICAL STUDY
PROPOSED FUEL FACILITY
COSTCO WHOLESALE WAREHOUSE NO. 122
2655 EL CAMINO REAL
TUSTIN, CALIFORNIA
CW# 18-0212

KLF PROJECT NO. 20192059.001A

NOVEMBER 16, 2018

A Report Prepared for:

Costco Wholesale
9 Corporate Park, Suite 230
Irvine, California 92606

Geotechnical Study
Proposed Fuel Facility
Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California
CW# 18-0212

Prepared by:

Daniel A. Castle, PE
Staff Engineer

Reviewed by:

Brian E. Crystal, PE, GE
Senior Project Manager

KLEINFELDER
24411 Ridge Route Drive, Suite 225
Laguna Hills, California 92653
Phone: 949.727.4466
Fax: 949.727.9242

November 16, 2018
Kleinfelder Project No. 20192059.001A

Geotechnical Investigation Summary Checklist for Costco Wholesale Projects

General Information

Costco Real Estate Main Contact: Diana Salazar
Geotechnical Main Contact: Brian Crystal (949-585-3113)
Geotechnical Engineer of Record: Kleinfelder
Project Location: 2655 El Camino Real, Tustin, CA
CW#: 18-0212
Warehouse #: 122
Report Date: November 16, 2018
Consultant Project/Document Number: 20192059.001A/IRV18R86544
Addendums (List):

Report Purpose: ☐ Preliminary ☐ Draft ☒ Final ☐ Addendum/Revision

	Yes	No or NA	Describe/ Comments	Report Section
Pre-existing Conditions/Information				
Developer provided geotechnical report (describe):	☐	☒		1.2.1
Pre-existing development (describe)	☒	☐	Existing asphalt parking lot & retail development	2.1
Foundation type (describe):	☒	☐	Shallow & Deep	4.3
Performance Issues (describe):	☐	☒		
Environmental Issues (describe)	☐	☒		
Site Grading Records (stripping, compaction test results, field reports, etc.)	☐	☒		
Typical Building Structural Design Criteria				
Other (describe):	☐	☐	New fuel facility	1.1
Building size (describe):	☒	☐		1.1
Typical wall loading				
3 kips / foot* (Metal Buildings)	☐	☒		
4.5 kips / foot* (CMU or pre-cast)	☐	☒		
Typical column loading				
120 kips in non-snow regions	☐	☒		
150 kips in snow regions	☐	☒		
Typical canopy loading:	☐	☒	30 kips for fuel facility canopy	1.1
Typical floor slab loading				
500 pounds per square foot, (psf, total)	☐	☒		
250 psf (dead) at rack areas	☐	☒		
150 psf (dead) at non-rack areas	☐	☒		
350 psf (live)	☐	☒		
Paving Design (20-year life)				
Heavy Duty paving shall accommodate 30 trucks per day (Traffic Index of 7.0)	☒	☐		4.6.2
Light Duty paving shall accommodate 6,600 cars per day (Traffic Index of 5.0)	☒	☐		4.6.2

	Yes	No or NA	Describe/ Comments	Report Section
Performance Grade (PG) binder oil identified for local climate conditions	☒	☐	PG 64-10	4.6.3
Site Grading Conditions/Assumptions				
Deviations to Typical Criteria (list/describe):	☐	☒		
Design Finished Floor Elevation (FFE) (describe):	☐	☒		
Basis for FFE (assumed, per Civil) (describe):	☐	☒		
Effects of change to assumed FFE (describe):	☐	☒		
Maximum anticipated cuts (describe):	☐	☒		1.1
Maximum anticipated fills (describe):	☐	☒		
Cross sections prepared for sites that are not essentially flat	☐	☒		
Amount of import/export anticipated (describe):	☐	☒		
Frost Depth (describe):	☐	☒		
Retaining walls				
Number of walls (describe):	☐	☒		
Height/Length of walls (describe):	☐	☒		
Wall construction/type (describe):	☐	☒		
Cut/fill transition in pad (describe):	☐	☒		
Offsite Improvements (describe)	☐	☒		
Fieldwork/Results				
Costco Due Diligence Design Criteria				
Version (describe):	☒	☐	Version 2016, dated September 19, 2016	
Followed Criteria?	☒	☐		
Deviations to standard investigation (describe):	☐	☒		
Groundwater				
Depth (describe):	☒	☒	Approx. 29 feet below existing grade.	3.2
Perched	☐	☒		
Expected seasonal fluctuation (describe):	☒	☐		3.2
Piezometers installed?	☐	☒		
Unusual/Challenging Soils conditions encountered				
Moisture-sensitive soils	☒	☐		5.3
Undocumented fill	☐	☒		3.1.1
Unsuitable soils (require removal)	☐	☒		
Wet soils	☒	☐		5.3
Debris	☐	☒		

	Yes	No or NA	Describe/ Comments	Report Section
Bedrock/potential non-rippable conditions	☐	☒		
Refusal	☐	☒		
Collapsible soils	☐	☒		
Expansive soils	☐	☒	Low expansion potential in upper 5 feet	3.3.5
Compressible soils	☐	☒		
Liquefaction	☐	☒		
Sinkholes	☐	☒		
Other (describe):	☐	☒		
Potential Contamination Identified				
Soil	☐	☒		
Groundwater	☐	☒		
Restoration of Disturbed Areas				
Backfilled with soil	☒	☐		
Backfilled with grout	☒	☐		
Other (describe):	☐	☒		
Topsoil samples collected/analyzed	☐	☒		
Corrosivity testing performed/addressed	☒	☐	Corrosive to ferrous metals	4.7
Report				
Executive summary	☒	☐		E-1
Wet weather construction recommendations	☒	☐		5.2
Pad winterization/pad recommendations	☐	☒		
Frost protection recommendations	☐	☒		
Design Parameters				
Fill material parameters provided				
Structural fill (below foundations, slabs)	☒	☐		5.2.3
Site grading fill (below pavements, flatwork)	☒	☐		5.2.3
Select backfill (behind truck dock walls, foundations, grade beams, etc.)	☐	☒		
Trench backfill	☒	☐		5.2.6
Drainage fill	☐	☒		
Frost resistant fill	☐	☒		
Slab base aggregate	☐	☒		

	Yes	No or NA	Describe/ Comments	Report Section
Limits of debris/unsuitable removal provided	☐	☒		
Over-excavation/recompaction required	☐	☒		5.2.2
Depth (describe):	☐	☒		5.2.2
Extent (include cross-section diagram)	☐	☒		
Pad subgrade stabilization required (describe):	☐	☒	If needed	5.3
Surcharge	☐	☒		
Height (describe):	☐	☒		
Lateral extent (describe):	☐	☒		
Estimated duration (describe):	☐	☒		
Shallow Foundations	☒	☐		
psf allowable soil bearing pressure (describe):	☒	☐	3,000 psf	4.3.2
Deep Foundations	☐	☒		
Type (describe):	☒	☐	Drilled piles	4.4.3
Options and Value Engineering Matrix provided	☐	☒		
Floor Slabs				
Unreinforced (>2500 psf)	☐	☒		
Reinforced (describe why)	☐	☒		
Subgrade modulus (ksi/in) (describe):	☐	☒		
Base Material thickness (min 6") (describe):	☐	☒		
Seismic Conditions				
Governing Building Code (IBC, UBC, other)	☒	☐	2016 California Building Code	4.2
Geologic Hazard Identified	☐	☒		
Proximity to earthquake fault zone(s)	☐	☒		3.3
Proximity to seismic hazard zone(s)	☐	☒		3.3
Potential for liquefaction	☐	☒		3.3.4
Potential for lateral spreading	☐	☒		
Potential for seismic settlement	☒	☐	Anticipated to be less than ½ inch	3.3.4
Potential for slope stability/landslides	☐	☒		
Potential for groundshaking or geologic hazards	☒	☐	High	3.3
Retaining Walls	☐	☒		
Recommended Wall Types	☐	☒		

	Yes	No or NA	Describe/ Comments	Report Section
Recommend Kleinfelder Design	☐	☒		
Lateral earth pressure design values	☐	☒		
Active:	☐	☒		
At-rest:	☐	☒		
Passive:	☐	☒		
Seismic:	☐	☒		
Backfill material, placement requirements	☐	☒		
Drainage requirements and cross-section drawing	☐	☒		
Finger Drains	☒	☐		4.5
Required for frost	☐	☒		
Recommended for long term maintenance and constructability	☐	☒		
Pavement				
Pavement subgrade stabilization required (describe):	☐	☒	Proof-roll, scarify, and recompact	5.2.2
Costco asphalt mix design specified	☒	☐		4.6.3
Heavy and light duty pavement sections specified	☒	☐		4.6.2
Alternative pavement sections identified	☒	☐		4.6.4
Specification for offsite pavement sections included	☐	☒		
Data Gaps/Unknowns (describe):	☐	☒		

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EXECUTIVE SUMMARY

This report presents the results of our geotechnical study for the proposed new fuel facility at Costco Wholesale Warehouse No. 122 located at 2655 El Camino Real in Tustin, California. The site is currently part of Costco's parking lot. The purpose of our study is to evaluate subsurface soil and groundwater conditions at the project site to provide geotechnical recommendations for design and construction. Our geotechnical study was based on the Costco Wholesale Development Requirements (CWDRs), Version 2016, dated September 19, 2016.

The new fueling facility will consist of four gasoline refueling islands each with four pumps, three 40,000-gallon underground storage tanks (UST), a fuel additive UST, a controller enclosure, and a canopy structure. New asphalt concrete and Portland cement concrete pavements will be constructed as well. In addition, a retail building located immediately adjacent to an existing supermarket southwest of the warehouse will be demolished for additional surface parking. Grading plans were not available at this time; however, we anticipate the finished grades surrounding the new facility will generally match the existing grades with grade changes of a foot or less for positive drainage.

Subsurface conditions at the site were explored by drilling five borings. The borings were drilled to depths between approximately 3½ and 51½ feet below the existing ground surface (bgs). Soil materials encountered during the subsurface explorations consisted of fill overlying alluvium. As observed in our borings, the fill consists generally of medium stiff to stiff clays with varying amounts of sand content and clayey sands. The alluvium consists of fine-grained medium stiff to very stiff clays with varying amounts of sand content and isolated thin layers of medium dense to dense sands, silty sands, and clayey sands with gravel. The upper clayey fill is considered to have a low expansion potential based on laboratory testing. Groundwater was encountered in Boring B-3 at a depth of approximately 29 feet bgs.

Based on the results of our field exploration, laboratory testing, and geotechnical analyses, it is our professional opinion that the proposed project is geotechnically feasible, provided the recommendations presented in this geotechnical report are incorporated into the project design and construction. The following key items were developed from our study.

- The proposed fuel facility may be supported on a conventional shallow foundation system. As an alternative, the canopy may be supported on drilled piles.

- Based on our field exploration and understanding of the regional geology, we classify the site as Site Class D. Seismic design parameters are provided in Table 1 in Section 4.2.
- Spread footing foundations for the fuel facility canopy and kiosks will bear on the existing soil at the site. Following excavation to foundation subgrade elevation, exposed subgrade should be observed by a representative of Kleinfelder to evaluate the presence of satisfactory materials at design elevations. If unsatisfactory material, such as soft or disturbed soil, debris or otherwise unsuitable soil is present at the base of the footing excavation, it should be overexcavated and replaced with structural fill, structural concrete, or a 2-sack sand-cement slurry to the depth determined by the Kleinfelder representative.
- For new pavement areas for the new fuel facility, we recommend that the exposed subgrade be proof-rolled with heavy construction equipment (e.g. loader or smooth-drum roller) to disclose areas of soft and yielding material. Where soft and yielding material is observed, it should be overexcavated and replaced as structural fill. After proof-rolling and/or prior to placement of fill, the subgrade should be scarified to a depth of 6 to 8 inches, moisture conditioned, and compacted in accordance to the compaction criteria below. The proof-rolling should extend beyond the proposed improvements a horizontal distance of at least 2 feet, if practicable.
- For pavement areas for the new surface parking area, we recommend that the existing soils be overexcavated to a depth of at least 12 inches below existing grade or 12 inches below the finished subgrade elevation, whichever is deeper, after the area has been stripped of construction debris and soft earth materials. Prior to placing fill, the exposed subgrade be proof-rolled with heavy construction equipment (e.g. loader or smooth-drum roller) to disclose areas of soft and yielding material. Where soft and yielding material is observed, it should be overexcavated and replaced as structural fill. The overexcavated soil may be reused as structural fill.
- Due to poor draining subgrade conditions, we recommend drainage inlets and catch basins include pavement underdrains as shown in Detail 16_16 of the CWDRs.
- Due to the difficulty of compacting clays and the potential for expansion, we do not recommend compacting clayey soils to at least 95 percent. Clayey soils should be compacted to at least 92 percent of the soils maximum dry unit weight (ASTM D1557) at moisture contents of at least the optimum moisture content. Compacting the onsite clayey sands to at least 92 percent relative compaction will achieve the necessary strength assumed in our design recommendations. The moisture content of the fill should be maintained at 2 percent above optimum during compaction. If both criteria (minimum

compaction and moisture content) are not within the specified tolerances, the fill should not be accepted, and the contractor should rework the material until the fill is placed within the specified tolerances.

- Depending on time of year wet, unstable, or unsuitable soils may be encountered and may need to be removed. The contractor should be prepared to provide stabilization or other measures to stabilize wet soils as needed. Recommendations to stabilize wet or pumping subgrade are provided in Section 5.3.
- Based on our experience, it is common to encounter wet, unstable soils upon removal of site pavements or flatwork as a result of subsurface moisture becoming trapped beneath relatively impervious asphalt concrete or Portland cement concrete surfaces. The contractor should anticipate that pumping subgrade conditions may be encountered during site grading activities, and the subgrade may need to be stabilized. Recommendations to stabilize pumping subgrade are provided in Section 5.3.
- The minimum resistivity of the sample indicates that the soil may be highly corrosive to metals. The concentrations of soluble sulfates indicate that the subsurface soils represent a Class S0 exposure to sulfate attack on concrete in contact with the soil based on ACI 318-14 Table 19.3.1.1 (ACI, 2014). Therefore, in accordance with ACI Building Code 318-14, no special provisions for selection of cement type are required.
- Based on visual soil classification and laboratory testing of the soil samples collected during the prior field exploration, the onsite soils in the fill and alluvial soils consist primarily of fine-grained clays with varying amounts of sand and medium dense to dense clayey sands. Given the low infiltration capacity of the on-site soils, we recommend alternatives to infiltration Best Management Practices (BMPs), such as bio-filtration/bio-retention systems (bio-swales and planter boxes), be implemented at the project site.

The findings, conclusions, and recommendations presented in this executive summary should not be relied upon without consulting our geotechnical report for more detailed description of the geotechnical evaluation performed by Kleinfelder. The conclusions and recommendations presented in this report are subject to the limitations presented in Section 7.

1 INTRODUCTION

This report presents the results of our geotechnical study for the proposed fuel facility at Costco Wholesale Warehouse No. 122 located at 2655 El Camino Real in Tustin, California. The location of the project site is presented on Figure 1, Site Vicinity Map. The purpose of our study is to evaluate subsurface soil and groundwater conditions at the project site to provide geotechnical recommendations for design and construction. The scope of our services was presented in our proposal titled, "Proposal for Geotechnical Study, Proposed Fuel Facility, Costco Wholesale Warehouse No. 122, 2655 El Camino Real, Tustin, California 92782, CW# 18-0212," dated September 25, 2018.

Our report includes a description of the work performed, a discussion of the geotechnical conditions observed at the site, and recommendations developed from our engineering analyses of field and laboratory data. Our geotechnical study was based on the Costco Wholesale Development Requirements (CWDRs), Version 2016, dated September 19, 2016.

1.1 PROJECT DESCRIPTION

We understand Costco plans to construct a new fuel facility located to the south of the existing warehouse. The proposed fuel facility site is currently parking for the warehouse that is planned to be demolished to facilitate construction of the fuel facility. The new fueling facility will consist of four gasoline refueling islands each with four pumps, three 40,000-gallon underground storage tanks (USTs), a fuel additive UST, a controller enclosure, and a canopy structure. New asphalt concrete and Portland cement concrete pavements will be constructed as well. In addition, a retail building located immediately adjacent to the existing supermarket southwest of the warehouse will be demolished for additional surface parking.

Based on our experience with fuel facilities, the canopy for the service islands is typically founded on spread footings and the design is typically governed by overturning moments from wind and seismic loading. Typical column dead loads are anticipated to be approximately 4 kips and typical live loads are approximately 30 kips, which result in bearing pressures of less than 500 pounds per square (psf).

The tank excavation is anticipated to be approximately 16 feet deep. The tanks are planned to be placed on gravel bedding and anchored with "deadmen" anchors to resist potential buoyant forces. Grading plans were not provided; however, we anticipate the finished grades surrounding

the new facility will generally match the existing grades with maximum grade changes of two feet or less.

1.2 SCOPE OF SERVICES

The scope of our geotechnical study consisted of a literature review, subsurface explorations, geotechnical laboratory testing, engineering evaluation and analysis, and preparation of this report. Studies to assess environmental hazards that may affect the soil and groundwater at the site are addressed under separate cover. A description of our scope of services performed for the geotechnical portion of the project follows.

1.2.1 Task 1 – Background Data Review

We reviewed readily-available published and unpublished geologic literature in our files and the files of public agencies, including selected publications prepared by the California Geological Survey (formerly known as the California Division of Mines and Geology) and the U.S. Geological Survey (USGS). We also reviewed readily available seismic and faulting information, including data for designated earthquake fault zones as well as our in-house database of faulting in the general site vicinity.

1.2.2 Task 2 – Field Exploration

Subsurface conditions at the site were explored by drilling five borings to depths between approximately 3½ and 51½ feet below the existing ground surface (bgs). The borings were drilled using truck-mounted hollow-stem-auger drilling equipment. The approximate locations of the explorations are presented on Figure 2. Boring B-4 (a proposed 10-foot boring) was not drilled due to safety concerns from an impending thunderstorm during our fieldwork.

Prior to commencement of the fieldwork, various geophysical techniques were used at the exploration locations to identify potential conflicts with subsurface structures. Exploration locations were also cleared for buried utilities through Underground Service Alert (USA).

A Kleinfelder engineer supervised the field operations and logged the explorations. Selected bulk and drive samples were retrieved and transported to our laboratory for further evaluation. The number of blows necessary to drive a Standard Penetration Test (SPT) sampler or a California-type sampler was recorded. Appendix A presents a description of the field exploration program, exploration logs, and a legend of terms and symbols used on the logs. Soil descriptions used on the logs result from field observations and data, as well as from laboratory test data. Stratification

lines on the logs represent the approximate boundary between soil and/or rock types, and the actual transition may vary and can be gradual.

1.2.3 Task 3 – Laboratory Testing

Laboratory testing was performed on representative bulk and relatively undisturbed samples to assist in soil classification and development of engineering parameters for geotechnical design. Laboratory testing consisted of moisture content, dry unit weight, grain-size distribution, Atterberg limits, R-value, and preliminary corrosion potential tests (sulfate, pH, minimum resistivity, chloride content). Appendix B presents a summary of the testing performed.

1.2.4 Task 4 – Geotechnical Analyses

We analyzed field and laboratory data in conjunction with the assumed finished grades, facility layout, and assumed structural loads to provide geotechnical recommendations for the design and construction. We evaluated feasible foundation systems, including constructability and compatibility constraints, pavement support, and earthwork. Potential geologic hazards, including ground shaking, liquefaction potential, flood hazard, fault rupture hazard, and seismically-induced settlement were also evaluated. Seismic design parameters based on the 2016 California Building Code (CBC) are also presented.

1.2.5 Task 5 – Report Preparation

This report summarizes the work performed, data acquired, and our findings, conclusions, and geotechnical recommendations for the design and construction of the proposed addition. Our report includes the following items:

- Executive summary and geotechnical checklist per the CWDRs;
- Site Vicinity Map (Figure 1) and Exploration Location Map (Figure 2) showing the approximate exploration locations;
- Boring logs (Appendix A);
- Results of laboratory tests (Appendix B);
- Discussion of general site conditions;
- Discussion of general subsurface conditions as encountered in our field exploration, including the depth to groundwater;
- Discussion of geologic and seismic hazards;

- Recommendations for seismic design parameters in accordance with the 2016 CBC;
- Recommendations for site preparation, earthwork, temporary slope inclinations, fill placement, and compaction specifications;
- Recommendations for the excavation of subsurface soil deposits;
- Recommendations for the UST excavation side slopes, including temporary shoring recommendation;
- Recommendations for foundation design (shallow foundation and drilled pile), allowable bearing pressures, embedment depths, settlement estimates, and compatibility constraints under various loading conditions;
- Recommendations for flexible and rigid pavement structural sections for light- and heavy-duty pavement based on the traffic loading, as stated in the CWDRs;
- Preliminary evaluation of the corrosion potential of the on-site soils; and
- Recommendations for storm water management.

2 SITE CONDITIONS

2.1 SITE DESCRIPTION

The proposed fuel facility site is located southwest the existing Costco warehouse, as shown in Figure 2. The site is currently part of the existing parking lot. The area of the proposed fuel facility is bounded by the existing Costco warehouse parking lot to the northeast, El Modena Channel to the southeast, El Camino Real to the southwest, and an existing retail development to the northwest. The area of proposed parking lot expansion located southwest of the existing warehouse is currently occupied by an existing retail development.

2.2 SURFACE DRAINAGE CONDITIONS

Site drainage is currently by sheet flow over the developed lot into storm drains, or onto the adjacent bordering streets and into the local storm-drain system.

3 SUBSURFACE CONDITIONS

3.1 SUBSURFACE CONDITIONS

Subsurface conditions at the location of the proposed fuel facility consists of fill placed during previous grading at the site over alluvial material. A discussion of the subsurface materials encountered is presented in the following sections. Detailed descriptions of the deposits are provided in our boring logs presented in Appendix A.

3.1.1 Fill

Fill soils associated with previous site grading were encountered in our explorations during our field investigation. The fill consists generally of medium stiff to stiff clays with varying amounts of sand content and clayey sands. As observed in our borings, the fill depth encountered within our borings was approximately 7 to 9½ feet thick near the proposed fuel facility.

3.1.2 Alluvium

The fill is underlain by alluvial soils. The alluvium consists of fine-grained medium stiff to very stiff clays with varying amounts of sand content and isolated thin layers of medium dense to dense sands, silty sands, and clayey sands with varying amounts of gravel.

3.2 GROUNDWATER

During our subsurface exploration, groundwater was encountered within Boring B-3 at a depth approximately 29 feet bgs. Historic high groundwater levels in the area has been mapped at a depth approximately 20 feet below grade. Fluctuations of the groundwater level, localized zones of perched water, and increased soil moisture content should be anticipated during and following the rainy season.

3.3 ASSESSMENT OF POTENTIAL GEOLOGIC HAZARDS

3.3.1 Localized Faulting

The site is not located within or nearby a currently delineated State of California Alquist-Priolo Earthquake Fault Zone (CGS, 2018). Additionally, published regional geologic maps do not indicate faults within or nearby the site. Based on absence of known faults nearby the site, it is our opinion that the hazard with respects to fault rupture is low.

3.3.2 Flood Hazard

The Federal Emergency and Management Administration (FEMA) maintain a collection of Flood Insurance Rate Maps (FIRM), which cover the entire United States. These maps identify those areas which may be subjected to 100-year and 500-year cycle floods. Based on our review of the maps, the site is located within Zone X. Zone X is defined as an area of a 0.2 percent chance of flooding; an area of 1 percent annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 1 percent annual flood chance. The flood zone is based on our review of FEMA Map Number 06059C0281J (FEMA, 2009).

3.3.3 Landsliding

Landslides are ground failures (several tens to hundreds of feet deep) in which a (mass of earth material, including debris and often portions of bedrock) large section of a slope detaches and slides downhill. Landslides are not to be confused with minor surficial slope failures (slumps), which are usually limited to the topsoil zone and can occur on slopes composed of almost any geologic material. Landslides can cause damage to structures both above and below the slide mass. Structures above the slide area are typically damaged by undermining of foundations. Areas below a slide mass can be damaged by being overridden and crushed by the failed slope material.

Because the existing site consists of a relatively level pad with no significant nearby slopes, it is our opinion that the hazard with respects to landslides or other forms of natural slope instability is considered negligible.

3.3.4 Liquefaction and Seismic Settlement

The term liquefaction describes a phenomenon in which saturated, cohesionless soils temporarily lose shear strength (liquefy) due to increased pore water pressures induced by strong, cyclic ground motions during an earthquake. Structures founded on or above potentially liquefiable soils may experience bearing capacity failures due to the temporary loss of foundation support, vertical settlements (both total and differential), and/or undergo lateral spreading. The factors known to influence liquefaction potential include soil type, relative density, grain size, confining pressure, depth to groundwater, and the intensity and duration of the seismic ground shaking. Liquefaction is most prevalent in loose to medium dense, silty, sandy, and gravelly soils below the groundwater table.

Because of subsurface soils at the site are comprised of medium stiff to hard clays and sandy clays with medium plasticity, the potential for liquefaction is not considered a hazard at the site. Seismic settlement is anticipated to be less than ½ inch.

3.3.5 Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade.

The fill soils in the upper 5 feet generally consisted of sandy clay to lean clay with varying amounts of sand. Based on the expansion index lab testing performed, the sandy clay and lean clay fill is considered to have a low expansion potential. Our recommendations include mitigation measures for the relatively low expansive soils.

3.3.6 Subsidence

The site is not located in an area of known ground subsidence due to the withdrawal of subsurface fluids. Accordingly, the potential for subsidence occurring at the site due to the withdrawal of oil, gas, or water is considered low.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 GENERAL

Based on the results of our field exploration, laboratory testing and engineering analyses conducted during this study, it is our professional opinion that the proposed project is geotechnically feasible, provided the recommendations presented in this report are incorporated into the project design and construction.

- The proposed fuel facility may be supported on a conventional shallow foundation system. As an alternative, the canopy may be supported on drilled piles.
- Spread footing foundations for the fuel facility canopy may bear on the existing soil at the site. Following excavation to foundation subgrade elevation, exposed subgrade should be observed by a representative of Kleinfelder to evaluate the presence of satisfactory materials at design elevations. If unsatisfactory material, such as soft or disturbed soil, debris or otherwise unsuitable soil is present at the base of the footing excavation, it should be overexcavated and replaced with structural fill, structural concrete, or a 2-sack sand-cement slurry to the depth determined by the Kleinfelder representative.
- For new pavement areas for the new fuel facility, we recommend that the exposed subgrade be proof-rolled with heavy construction equipment (e.g. loader or smooth-drum roller) to disclose areas of soft and yielding material after the area has been stripped of soft earth materials and debris. Where soft or yielding material are observed, the material should be overexcavated and replaced with structural fill. The proof-rolling should extend beyond the proposed improvements a horizontal distance of at least 2 feet, if practicable.
- For pavement areas for the new surface parking area, we recommend that the existing soils be overexcavated to a depth of at least 12 inches below existing grade or 12 inches below the finished subgrade elevation, whichever is deeper, after the area has been stripped of construction debris and soft earth materials. Prior to placing fill, the exposed subgrade be proof-rolled with heavy construction equipment (e.g. loader or smooth-drum roller) to disclose areas of soft and yielding material. Where soft and yielding material is observed, it should be overexcavated and replaced as structural fill. The overexcavated soil may be reused as structural fill.
- Due to poor draining subgrade conditions, we recommend drainage inlets and catch basins include pavement underdrains as shown in Detail 16_16 of the CWDRs.

- In the area of the proposed fuel facility, it is common to encounter wet, unstable soils upon removal of site pavements or flatwork as a result of subsurface moisture becoming trapped beneath relatively impervious asphalt concrete or Portland cement concrete surfaces. The contractor should anticipate that pumping subgrade conditions may be encountered during site grading activities, and the subgrade may need to be stabilized. Recommendations to stabilize pumping subgrade are provided in Section 5.3.
- Due to compaction difficulties, we do not recommend compacting the onsite clayey soils to 95 percent of the maximum dry unit weight (ASTM D1557), as required in the CWDRs. Onsite clayey soils should be compacted to at least 92 percent of the soils maximum dry unit weight (ASTM D1557). Compacting the onsite soils to at least 92 percent relative compaction will achieve the necessary strength assumed in our design recommendations.
- The minimum resistivity of the sample indicates that the soil may be highly corrosive to metals. The concentrations of soluble sulfates indicate that the subsurface soils represent a Class S0 exposure to sulfate attack on concrete in contact with the soil based on ACI 318-14 Table 19.3.1.1 (ACI, 2014). Therefore, in accordance with ACI Building Code 318-14, no special provisions for selection of cement type are required.
- Based on visual soil classification and laboratory testing of the soil samples collected during the prior field exploration, the onsite soils in the fill and alluvial soils consist primarily of fine-grained clays with varying amounts of sand and medium dense to dense clayey sands. Given the low infiltration capacity of the on-site soils, we recommend alternatives to infiltration Best Management Practices (BMPs), such as bio-filtration/bio-retention systems (bio-swales and planter boxes), be implemented at the project site.

The following opinions, conclusions, and recommendations are based on the properties of the materials encountered in the borings, the results of the laboratory-testing program, and our engineering analyses performed. Our recommendations regarding the geotechnical aspects of the design and construction of the project are presented in the following sections.

4.2 SEISMIC DESIGN CONSIDERATIONS

4.2.1 2016 CBC Seismic Design Parameters

Based on information obtained from the investigation, published geologic literature and maps, and on our interpretation of the ASCE/SEI 7-10 criteria, it is our opinion that the project site may be classified as Site Class D, Stiff Soil, according to Section 1613.3.2 of 2016 CBC and Table 20.3-1 of ASCE/SEI 7-10 (2010). Approximate coordinates for the site are noted below.

- Latitude: 33.7277°N
- Longitude: 117.7963°W

The Risk-Targeted Maximum Considered Earthquake (MCE_R) mapped spectral accelerations for 0.2 seconds and 1 second periods (S_s and S_1) were estimated using Section 1613.3 of the 2016 CBC and the U.S. Geological Survey (USGS) web based application (available at http://geohazards.usgs.gov/designmaps/us/application.php). The mapped acceleration values and associated soil amplification factors (F_a and F_v) based on the 2016 CBC and corresponding site modified spectral accelerations (S_{MS} and S_{M1}) and design spectral accelerations (S_{DS} and S_{D1}) are presented in Table 1.

Table 1
2016 CBC Seismic Design Parameters

DESIGN PARAMETER	RECOMMENDED VALUE
Site Class	D
S_s (g)	1.493
S_1 (g)	0.549
F_a	1.0
F_v	1.5
S_{MS} (g)	1.493
S_{M1} (g)	0.824
S_{DS} (g)	0.995
S_{D1} (g)	0.549
PGA_M (g)	0.544

4.3 FOUNDATIONS

4.3.1 General

Based on the results of our field exploration, laboratory testing, and geotechnical analyses, the proposed fueling facility may be supported on a conventional shallow foundation system. As an alternative, the canopy may be supported on drilled piles. New light poles may also be supported on short drilled piles. Recommendations for the design and construction of spread footings and drilled piles are presented below.

4.3.2 Shallow Foundations

Allowable Soil Bearing Pressure

Spread footings founded on the alluvium soils may be designed for a net allowable soil bearing pressure of 3,000 psf for dead plus sustained live loads. Footings should be established at a depth of at least 24 inches below the lowest adjacent exterior grade, whichever is lower. A one-third increase in the above bearing pressures can be used for wind or seismic loads. The footing dimension and reinforcement should be designed by the structural engineer; however, continuous footings should have minimum widths of 18 inches.

Estimated Settlement

We understand that new spread footing foundations for the canopy will be embedded approximately 6 to 7 feet below the finished grade. We estimate total static settlement for foundations designed and constructed in accordance with the recommendations presented above to be approximately ½ inch. Differential static settlement between similarly loaded footings is estimated to be less than ½ inch over 50 feet.

Lateral Resistance

Lateral load resistance may be derived from passive resistance along the vertical sides of the footings, friction acting at the base of the footing, or a combination of the two. An allowable passive resistance of 250 psf per foot of depth may be used for design. Allowable passive resistance values should not exceed 2,500 psf. An allowable coefficient of friction value of 0.30 between the base of the footings and the engineered fill soils can be used for sliding resistance using the dead load forces. Friction and Friction and passive resistance may be combined without reduction. We recommend that the first foot of soil cover be neglected in the passive resistance calculations if the ground surface is not protected from erosion or disturbance by a slab, pavement or in a similar manner.

4.3.3 Drilled Pile Foundations

Axial Capacity

The compressive axial capacity of drilled piles may be estimated based on an average allowable skin friction capacity of 400 pounds per square foot. The upper one foot of the skin friction capacity should be ignored. The uplift capacity may be estimated as 70 percent of the allowable compressive

axial capacity. A one-third increase in the allowable capacities may be used for transient loading conditions such as wind or seismic loads.

Settlement

Static settlement of the proposed canopy supported on drilled piles, as recommended, is estimated to be less than ½ inch.

Lateral Resistance

The drilled pile foundations lateral resistance can be designed in general accordance with Section 1807.3 of the 2016 CBC. We recommend a lateral soil bearing pressure of 250 psf per foot of depth below grade in the upper 15 feet. The total lateral soil bearing pressure should not exceed 2,500 psf per pile. Since drilled piles will act as isolated pole foundations, the allowable lateral soil bearing pressure may be increased by a factor of 2 for short-term lateral loads provided the structure will not be adversely affected by ½ inch of lateral movement at the ground surface.

4.4 EXTERIOR FLATWORK

Prior to casting exterior flatwork, the subgrade soils should be scarified, moisture conditioned, and recompacted or overexcavated, as recommended in Section 5.2.2. Exterior concrete slabs for pedestrian traffic or landscape should be at least four inches thick. Weakened plane joints should be located at intervals of about 6 feet. Careful control of the water/cement ratio should be performed to avoid shrinkage cracking due to excess water or poor concrete finishing or curing. Unreinforced slabs should not be built in areas where further saturation may occur following construction.

4.5 SITE DRAINAGE

Foundation and slab performance depends greatly on proper irrigation and how well runoff water drains from the site. This drainage should be maintained both during construction and over the entire life of the project. The ground surface around structures should be graded such that water drains rapidly away from structures without ponding. The surface gradient needed to do this depends on the surface type and should follow CWDRs (Costco, 2016).

Due to poor draining subgrade conditions, we recommend drainage inlets and catch basins include pavement underdrains as shown in Detail 16_16 of the CWDRs.

We recommend that landscape planters either not be located adjacent to structures and pavement areas or be properly drained to area drains. Drought resistant plants and minimum watering are recommended for planters immediately adjacent to structures. No raised planters should be installed immediately adjacent to structures unless they are damp-proofed and have a drainpipe connected to an area drain outlet. Planters should be built such that water exiting from them will not seep into the foundation areas or beneath slabs and pavement. Otherwise, waterproofing the slab and walls should be considered. Roof water should be directed to fall on hardscape areas sloping to an area drain, or roof gutters and downspouts should be installed and routed to area drains. Roof downspouts and their associated drains should be isolated from other subdrain systems to avoid flooding. In any event, maintenance personnel should be instructed to limit irrigation to the minimum necessary to properly sustain landscaping plants. Should excessive irrigation, waterline breaks, or unusually high rainfall occur, saturated zones and "perched" groundwater may develop. Consequently, the site should be graded so that water drains away readily without saturating the foundation or landscaped areas. Potential sources of water such as water pipes, drains, and the like should be frequently examined for signs of leakage or damage. Any such leakage or damage should be promptly repaired. Wet utilities should also be designed to be watertight.

4.6 PAVEMENTS

The required pavement structural sections will depend on the expected wheel loads, volume of traffic, and subgrade soils. We have provided asphalt concrete pavement sections for traffic indices provided in the CWDRs (Costco, 2016). Positive drainage of the paved areas should be provided since moisture infiltration into the subgrade may decrease the life of pavements. Curbing located adjacent to paved areas should be founded in the subgrade, not the aggregate base, to provide a cutoff, which reduces water infiltration into the base course.

The following pavement sections provided above are based on the soil conditions encountered during our field investigation, our assumptions regarding final site grades, and limited laboratory testing.

4.6.1 Costco Design Parameters

We developed pavement design recommendations using traffic indices provided in the CWDRs (2016) based on the following assumptions:

- A 20-year pavement design life;

- Light-duty pavements subject to 6,600 passenger vehicle trips per year (Traffic Index of 5.0);
- Heavy-duty pavements subject to 30 tractor-trailer truck tips per day (Traffic Index of 7.0);
- For asphalt concrete pavements: an R-value of 10 based on laboratory testing and our local experience; and
- For Portland cement concrete (PCC) Pavements: a 28-day flexural strength (modulus of rupture determined by the third-point method) of at least 550 pounds per square inch (psi) (approximate compressive strength of 4,000 psi); a modulus of subgrade reaction (k value) of 75 pounds per cubic inch (pci); and interlock at the control joints.

4.6.2 Asphalt Concrete Pavement

We have developed new pavements sections using the Caltrans Highway Design Manual so that the new pavement sections are compatible with the existing pavement sections. Hot Mix Asphalt (HMA) should conform to requirements of the Costco Wholesale Specification Section 321216, Asphalt Paving. Table 2 presents recommended HMA pavement sections. Prior to placement of aggregate base, pavement subgrade should be prepared in accordance with Section 5.2.2.

Table 2
Asphalt Concrete Pavement Sections

TRAFFIC USE	TRAFFIC INDEX, TI	ASPHALT CONCRETE * (INCHES)	AGGREGATE BASE (INCHES)
Light-Duty Pavement	5.0	4.0	6.5
Heavy-Duty Pavement	7.0	6.5	10.5

* rounded to the nearest ½ inch.

4.6.3 Asphalt Performance Grade Binder

An asphalt performance grade (PG) binder of 64-10 should be used for the project. This recommendation was developed in accordance with Costco Wholesale Asphalt Paving Specification Section 321216. Air temperature data nearest the project site was used with the MERRA Climate Data option and the PG binder was selected using the FHWA program LTTPBind Online web-based tool based on the AASHTO M323-13 standard. The high-end and low-end temperature rating was selected to provide a reliability of at least 98 and 90 percent, respectively.

4.6.4 Portland Cement Concrete Pavement

We designed PCC pavement in accordance with the Portland Cement Association (PCA) Thickness Design for Concrete Pavements (PCA, 1984) using the design parameters stated above. For heavy-duty pavements, we recommend that PCC pavement should be comprised of 8.0 inches of PCC with 6 inches of aggregate base. Prior to placement of aggregate base, pavement subgrade should be prepared in accordance with Section 5.2.2.

4.6.5 Aggregate Base

Aggregate base materials should meet current Caltrans specifications for Class 2 aggregate base. Alternatively, the aggregate base course could meet the specifications for untreated base materials (crushed aggregate base or crushed miscellaneous base) as defined in Section 200-2 of the current edition of the Standard Specifications for Public Works Construction (Greenbook). Please note that Caltrans Class 2 aggregate base and crushed miscellaneous base (CMB) may utilize recycled materials. The use of recycled material requires Costco's approval.

4.7 SOIL CORROSION

The corrosion potential of the on-site materials to steel and buried concrete was preliminarily evaluated. Laboratory testing was performed on two representative soil samples to evaluate pH, minimum resistivity, chloride and soluble sulfate content. The test results are presented in Table 3.

Table 3
Corrosion Test Results

BORING	DEPTH (FT)	MINIMUM RESISTIVITY (OHM-CM)	PH	SOLUBLE SULFATE CONTENT (PPM)	SOLUBLE CHLORIDE CONTENT (PPM)
B-2	3	831	8.7	393	188
B-3	10	1,309	7.4	54	58

These tests are only an indicator of soil corrosivity for the samples tested. Other soils found on site may be more, less, or of a similar corrosive nature. Imported fill materials should be tested to confirm that their corrosion potential is not more severe than those noted.

Resistivity values less 1,000 ohm-cm are considered extremely corrosive to buried ferrous metals (NACE, 2006). The concentrations of soluble sulfates indicate that the subsurface soils represent

a Class S0 exposure to sulfate attack on concrete in contact with the soil based on ACI 318-14 Table 19.3.1.1 (ACI, 2014). Therefore, in accordance with ACI Building Code 318-14, no special provisions for selection of cement type are required.

Kleinfelder's scope of services does not include corrosion engineering and, therefore, a detailed analysis of the corrosion test results is not included. We understand gasoline station equipment is constructed of corrosion resistant synthetic materials. We recommend the gasoline station designer review these results and consult a corrosion expert for further evaluation, if necessary.

4.8 STORMWATER MANAGEMENT

We have evaluated the potential for storm water infiltration/percolation into the subgrade soils at the subject project site in accordance with to the Orange County Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans, dated December 20, 2013. Pursuant to the TGD, an infiltration evaluation is a two-step process. The first step is to characterize the site to assess whether infiltration is feasible. If infiltration is feasible, then infiltration testing is needed to provide a design infiltration rate (step two).

Based on visual soil classification and laboratory testing of the soil samples collected during the prior field exploration, the onsite soils in the fill and alluvial soils consist primarily of fine-grained clays with varying amounts of sand and medium dense to dense clayey sands. Given the low infiltration capacity of the on-site soils, we recommend alternatives to infiltration Best Management Practices (BMPs), such as bio-filtration/bio-retention systems (bio-swales and planter boxes), be implemented at the project site.

If bio-filtration/bio-retention systems are employed, we recommend that the BMPs be built such that water exiting from them will not seep into the foundation areas or beneath slabs and pavement. If planters are located within 10 feet of structures or foundations, or adjacent to slabs and pavements, then some means of diverting water away from the structures, foundation soils, or soils that support slabs and pavements would be required, such as lining the planters.

5 CONSTRUCTION RECOMMENDATIONS

5.1 GENERAL

The following recommendations should be used by the contractor for construction of the project.

5.2 EARTHWORK

5.2.1 General

Site preparation and earthwork operations should be performed in accordance with applicable codes, safety regulations and other local, state or federal specifications, and the recommendations included in this report. References to maximum dry unit weights are established in accordance with the latest version of ASTM Standard Test Method D1557 (modified Proctor). The earthwork operations should be observed and tested by a representative of Kleinfelder.

The moisture content of the fill is considered very important, and therefore, both relative compaction and moisture content should be used to evaluate compaction acceptance. If both criteria are not within the specified tolerances, the fill should not be accepted, and the contractor should rework the material until the fill is placed within the specified tolerances.

5.2.2 Site Preparation

Abandoned utilities, existing pavements, foundations, and other existing improvements within the proposed fuel facility areas should be removed and the excavation(s) backfilled with engineered fill. Debris produced by demolition operations, including wood, steel, piping, plastics, etc., should be separated and disposed of off-site. Existing utility pipelines or conduits that extend beyond the limits of the proposed construction and are to be abandoned in place, should be plugged with non-shrinking cement grout to prevent migration of soil and/or water. Demolition, disposal and grading operations should be observed and tested by a representative of Kleinfelder. Areas to receive fill should be stripped of all dry, loose or soft earth materials and unsuitable fill materials to the satisfaction of a representative of Kleinfelder.

- Pavement, Sidewalks and Other Flatwork Areas for the New Fuel Facility: After the area has been stripped of soft earth materials and debris, we recommend that the exposed subgrade be proof-rolled with heavy construction equipment (e.g. loader or smooth-drum roller) to disclose areas of soft and yielding material. Where soft and yielding material is

observed, it should be overexcavated and replaced as structural fill. After proof-rolling and/or prior to placement of fill, the subgrade should be scarified to a depth of 6 to 8 inches, moisture conditioned, and compacted in accordance to the compaction criteria below. The proof-rolling should extend beyond the proposed improvements a horizontal distance of at least 2 feet.

- Pavement, Sidewalks and Other Flatwork Areas for the New Surface Parking Area: We recommend that the existing soils be overexcavated to a depth of at least 12 inches below existing grade or 12 inches below the finished subgrade elevation, whichever is deeper, after the area has been stripped of construction debris and soft earth materials. Prior to placing fill, the exposed subgrade be proof-rolled with heavy construction equipment (e.g. loader or smooth-drum roller) to disclose areas of soft and yielding material. Where soft and yielding material is observed, it should be overexcavated and replaced as structural fill. The overexcavated soil may be reused as structural fill.

Based on past experience, it is common to encounter wet, unstable soils upon removal of site pavements or flatwork as a result of subsurface moisture becoming trapped beneath relatively impervious asphalt concrete or Portland cement concrete surfaces. Perched groundwater may also develop above clayey soils, saturating near-surface materials. The contractor should anticipate that pumping subgrade conditions may be encountered during site grading activities, and the subgrade may need to be stabilized. Recommendations to stabilize pumping subgrade are provided in Section 5.3.

5.2.3 Foundation Excavations

Spread Footings

Following excavation to the foundation subgrade elevations, the exposed subgrade should be observed by a representative of the geotechnical engineer to evaluate the presence of satisfactory materials at design elevations. If unsatisfactory material, such as soft or disturbed soil, debris or otherwise unsuitable soil is present at the base of footing excavations, then unsuitable materials should be overexcavated and replaced (e.g. with structural concrete, 2-sack sand-cement slurry, structural fill) to the depth and extent determined by the geotechnical engineer. As a minimum, the contractor should be prepared to scarify, moisture condition, and re-compact the upper 12 inches of footing subgrade.

Drilled Piles

The performance and capacities of piles can be influenced significantly by the selected construction methods and procedures used. Construction methods that create large zones of disturbance around the drilled shafts can lead to lower than expected skin friction due to excessive stress relief around the shaft length. Drilling of the pile shafts should be accomplished using conventional heavy-duty excavation equipment maintained in good condition.

While clayey soils are not prone to caving, isolated pockets of sandy soils may cave during drilling of the pile shafts and temporary steel casing may be needed to stabilize the sides of the pile shaft. Concrete should be placed immediately after drilling of the hole is complete. The concrete should be pumped to the bottom of the drilled shaft using a down-hole tremie. If steel casing is used, the casing should be removed as the concrete is placed but the bottom of the casing should be kept at least 5 feet below the top of the concrete.

5.2.3 Fill Material and Compaction Criteria

The on-site soils, minus any debris, organic matter, or other deleterious materials, may be used in the site fills. Rock or other soil fragments greater than 3 inches in size should not be used in the fills. The presence of oversized materials, such as cobbles and boulders, should be anticipated.

Due to compaction difficulties, we do not recommend compacting the onsite clayey soils to 95 percent of the maximum dry unit weight (ASTM D1557), as required in the CWDRs. Onsite clayey soils should be compacted to at least 92 percent of the soils maximum dry unit weight (ASTM D1557). Compacting the onsite soils to at least 92 percent relative compaction will achieve the necessary strength assumed in our design recommendations.

The moisture content of the fill should be maintained at 2 percent above optimum during compaction. If both criteria (minimum compaction and moisture content) are not within the specified tolerances, the fill should not be accepted, and the contractor should rework the material until the fill is placed within the specified tolerances.

Fill should be placed in loose horizontal lifts not more than 8 inches thick (loose measurement). The prepared subgrade in paved areas should be covered with aggregate base within 24 hours to reduce drying of the subgrade soil. Utility trench backfill should be mechanically compacted. Flooding should not be permitted.

Based on past experiences, it is common to encounter wet, unstable soils upon removal of site pavements or flatwork as a result of subsurface moisture becoming trapped beneath relatively impervious asphalt concrete or Portland cement surfaces. Processing may require ripping the material, disking to break up clumps, and blending to attain uniform moisture contents necessary for compaction. Compaction of mass graded areas should be accomplished with a sheep's foot type roller compactor to aid in moisture conditioning.

Import materials, if required, should have an expansion index of less than 20 with no more than 30 percent of the particles passing the No. 200 sieve and no particles greater than 3 inches in maximum dimension. The maximum expansion index for imported soils may be modified by the project geotechnical engineer depending on its proposed use. Imported fill should be documented to be free of hazardous materials, including petroleum or petroleum byproducts, chemicals and harmful minerals. Kleinfelder should evaluate the proposed imported materials prior to their transportation and use on site.

5.2.4 Excavation Characteristics

The existing fill and alluvium deposits consist of medium stiff to very stiff clays with varying amounts of sand. The excavations for the USTs and foundations should be excavatable with conventional heavy-duty construction equipment. However, caving of the sidewalls during excavation in the may occur depending on conditions at the time of excavation and should be anticipated by the contractor.

A representative of Kleinfelder should be present during excavation in this area to observe the soil conditions. If soft, loose, or deleterious materials are encountered in the base of the excavation then the materials should be removed and replaced as compacted fill or otherwise remediated to provide competent bearing material under site improvements.

5.2.5 Temporary Excavations

All excavations must comply with applicable local, state, and federal safety regulations, including OSHA requirements. The responsibility for excavation safety and stability of temporary construction slopes lies solely with the contractor. We are providing this information below solely as a service to our client. Under no circumstances should this information provided be interpreted to mean that Kleinfelder is assuming responsibility for final engineering of excavations or shoring, construction site safety, or the contractors' activities; such responsibility is not being implied and should not be inferred.

Minor sloughing and/or raveling of slopes should be anticipated as they dry out. Where space for sloped embankments is not available, shoring will be necessary. In addition, excavations within a 1:1 plane extending downward from a horizontal distance of 2 feet beyond the bottom outer edge of existing improvements should not be attempted without bracing and/or underpinning the footings, as discussed above. The geotechnical engineer or their field representative should observe the excavations so that modifications can be made to the excavations, as necessary, based on variations in the encountered soil conditions. All applicable excavation safety requirements and regulations, including OSHA requirements, should be met.

All trench excavations should be braced and shored in accordance with good construction practice and all applicable safety ordinances and codes. Stockpiled (excavated) materials should be placed no closer to the edge of an excavation than a distance equal to the depth of the excavation, but no closer than 4 feet.

5.2.6 Trench Backfill

Pipe zone backfill (i.e. material beneath and in the immediate vicinity of the pipe) should consist of imported soil less than ¾-inch in maximum dimension. Trench zone backfill (i.e., material placed between the pipe zone backfill and finished subgrade) may consist of onsite soil or imported fill that meets the requirements for engineered fill provided above.

If imported material is used for trench zone backfill, we recommend it consist of silty sand. In general, gravel and cobble should not be used for trench zone backfill due to the potential for soil migration into the relatively large void spaces present in this type of material and water seepage along trenches backfilled with coarse-grained sand and/or gravel.

Recommendations provided above for pipe zone backfill are minimum requirements only. More stringent material specifications may be required to fulfill local building requirements and/or bedding requirements for specific types of pipes. We recommend the project civil engineer develop these material specifications based on planned pipe types, bedding conditions, and other factors beyond the scope of this study.

Trench backfill should be placed and compacted in accordance with recommendations provided for engineered fill in Section 5.2.3. Mechanical compaction is recommended; ponding or jetting should be avoided, especially in areas supporting structural loads or beneath concrete slabs supported on grade, pavements, or other improvements.

5.3 UNSTABLE SUBGRADE CONDITIONS

It is common to encounter wet, unstable soils upon removal of site pavements or flatwork as a result of subsurface moisture becoming trapped beneath relatively impervious asphalt concrete or Portland cement concrete surfaces. Additionally, depending on time of year and weather conditions we anticipate that near surface soils may become saturated. Pumping subgrade conditions may be encountered during site grading activities, and the subgrade may need to be stabilized with geotextiles and crushed rock. Additionally, should grading be performed during or following periods of rainfall, the moisture content of the near-surface soils will also be significantly above the optimum moisture content. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include the following:

- Drying: Drying unstable subgrade involves disking or ripping wet subgrade to a depth of approximately 18 to 24 inches and allowing the exposed soil to dry. Multiple passes of the equipment (likely on a daily basis) will be needed because as the surface of the soil dries, a crust forms that reduces further evaporation. Frequent disking will help prevent the formation of a crust and will promote drying. This process could take several days to several weeks depending on the depth of ripping, the number of passes, and the weather.
- Removal and Replacement with Crushed Rock and Geotextile Fabric: Unstable subgrade could be over-excavated 12 to 24 inches below existing grade and replaced with ¾- or 1-inch crushed rock underlain by geotextile fabric. The geotextile fabric should consist of a woven geotextile, such as Mirafi 600X or equivalent. The final depth of removal will depend upon the conditions observed in the field once over-excavation begins. The geotextile fabric should be placed in accordance with the manufacturer's recommendations.
- Soil Treatment: Unstable subgrade could be stabilized by mixing the upper 12 to 18 inches of the subgrade with Portland cement, Class C flyash or lime. For estimating purposes, an application rate of 10 to 12 percent Class C flyash, 3 to 5 percent high calcium quick lime, or 4 to 5 percent Portland cement may be used. Final application rates should be determined in the field at the time of construction in consultation with the geotechnical engineer. Chemical treatment should be performed by a specialty contractor experienced in this work. Since soil treatment uses the on-site soil, the expense of importing material can be avoided.

5.4 TEMPORARY SHORING

5.4.1 General

Temporary shoring may be required in areas adjacent to existing structures or improvements where excavations cannot be adequately sloped. Temporary shoring may consist of a turn-key shoring system, soldier piles and lagging, or other system. Recommendations for design of temporary shoring are presented below.

The shoring design should be provided by a civil engineer registered in the State of California and experienced in the design and construction of shoring under similar conditions. Once the final excavation and shoring plans are complete, the plans and design should be reviewed by Kleinfelder for conformance with the design intent and geotechnical recommendations provided herein.

5.4.2 Lateral Pressures

For the design of cantilevered shoring, an equivalent fluid pressure of 35 pounds per cubic foot (pcf) may be used for level backfill. Where the surface of the retained earth slopes up away from the shoring, a greater pressure should be used. Design data can be developed for additional cases when the design conditions are established.

In addition to the recommended earth pressure, any surcharge (live, including traffic, or dead load) located within a 1:1 plane drawn upward from the base of the shored excavation should be added to the lateral earth pressures. The lateral contribution of a uniform surcharge load located immediately behind the wall may be calculated by multiplying the surcharge by 0.5 for the level backfill condition. Lateral load contributions of surcharges located at a distance behind the shored wall may be provided once the load configurations and layouts are known. As a minimum, a 2-foot equivalent soil surcharge (250 psf) is recommended to account for nominal construction loads. It should be noted that the above pressures do not include hydrostatic pressure and assume groundwater will not be encountered in the excavation, or dewatering will be used to lower the ground water table below the bottom of the excavation. Groundwater was encountered at approximately 29 feet below ground surface.

5.4.3 Design of Soldier Piles

All soldier piles should extend to a sufficient depth below the excavation bottom to provide the required lateral resistance. We recommend the required embedment depths be calculated based

on the principles of force and moment equilibrium. For this method, the allowable passive pressure against soldier piles that extend below the level of excavation may be assumed to be a uniform pressure of 3,000 psf. To account for arching, the passive resistance may be assumed to act over a width 2.0 times the width of the embedded portion of the pile, provided adjacent piles are spaced at least 2.5 pile diameters, center-to-center.

Drilling of the soldier pile shafts could be accomplished using heavy-duty drilling equipment. The on-site soils below the base of the excavation include isolated sandy layers, which may subject to caving. In addition, groundwater was encountered at a depth of approximately 29 feet bgs. Temporary steel casing may be required to stabilize the sides of the pile shaft. Concrete for piles should be placed immediately after the drilling of the hole is complete. The concrete should be pumped to the bottom of the drilled shaft using a tremie. Once concrete pumping is initiated, a minimum head of 5 feet of concrete above the bottom of the tremie should be established and maintained throughout the concrete placement to prevent contamination of the concrete by soil inclusions. If steel casing is used, the casing should be removed as the concrete is placed.

To develop full lateral resistance, provisions should be taken to assure firm contact between the soldier piles and undisturbed materials. The concrete placed in the soldier pile excavations may be a lean-mix concrete. However, the concrete used in that portion of the soldier pile that is below the planned excavated level should provide sufficient strength to adequately transfer the imposed loads to the surrounding materials.

5.4.4 Lagging

Continuous treated timber lagging should be used between the soldier piles. The lagging should be installed as the excavation proceeds. If treated timber is used, the lagging may remain in place after backfilling. The lagging should be designed for the recommended earth pressure but limited to a maximum value of 400 psf.

5.4.5 Deflection

Shoring adjacent to existing structures or improvements should be designed and constructed to reduce potential movement. The shoring system designer should evaluate potential deflections in their design.

5.4.6 Monitoring

Some deflection of the shored excavation should be anticipated during the planned excavation. We recommend the project civil engineer perform a survey of all existing utilities and structures adjacent to the shored excavation. The purpose of this survey would be to evaluate the ability of existing utility lines or improvements to withstand horizontal movements associated with a shored excavation and to establish the baseline condition in case of unfounded claims of damage. If existing improvements are not capable of withstanding anticipated lateral movements, alternative shoring systems may be required.

Horizontal and vertical movements of the shoring system should be monitored by a licensed surveyor. The construction monitoring and performance of the shoring system are ultimately the contractor's responsibility. However, at a minimum, we recommend that the top of shoring be surveyed prior to excavation and that the top and bottom of the soldier beams be surveyed on a weekly basis until the shoring is not needed. Surveying should consist of measuring movements in vertical and two perpendicular horizontal directions.

5.5 EXTERIOR FLATWORK

Prior to casting exterior flatwork, the subgrade soils should be moisture conditioned and recompacted or overexcavated, as recommended in Section 5.2.2. The moisture content of the subgrade soils should be maintained at the required level until placement of any flatwork or engineered fill. Careful control of the water/cement ratio should be performed to avoid shrinkage cracking due to excess water or poor concrete finishing or curing. Unreinforced slabs should not be built in areas where further saturation may occur following construction.

5.6 PAVEMENTS

5.6.1 HMA Design

Hot Mix Asphalt (HMA) should conform to requirements of the Costco Wholesale Specification Section 321216, Asphalt Paving. Costco design guidelines require that the HMA section be placed in at least two lifts. The HMA specification allows the use of ½- or ¾-inch Nominal Maximum Aggregate Size (NMAS) mixes for the base course and ⅜- or ½-inch NMAS mixes for surface course. Section 1.3.C of the HMA specification requires a minimum asphalt concrete lift thickness of no less than 2 times the Maximum Size of Aggregate (MSA) of the HMA mix or 1¾ inches, whichever is greater. However, minimum lift thicknesses of 1½ inches will be allowed for ⅜- or ½-inch NMAS mixes. Section 2.1.B.4 of the HMA specification states that the optimum asphalt lift

(or course) thickness shall be a minimum of 3 times the MSA of the HMA mix. However, lift thicknesses should not exceed 3 inches.

5.6.2 Construction Considerations

The pavement sections provided in Section 4.6 are contingent on the following recommendations being implemented during construction.

- Pavement subgrade should be prepared as recommended in Section 5.2.2.
- Subgrade soils should be in a stable, non-pumping condition at the time the aggregate base materials are placed and compacted.
- Aggregate base materials should be compacted to at least 95 percent relative compaction (ASTM D1557).
- Asphalt paving materials and placement methods should meet current Costco Wholesale Specifications Section 321216.
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become wet.

Note that pavement materials and construction must be completed in strict accordance with the Costco's specifications that contain very specific pavement material (asphalt, aggregate and concrete) criteria and construction practices to be used (compaction and material sampling). The general contractor and pavement construction subcontractor should be aware that asphalt and concrete mix designs must be submitted to the design architect and Kleinfelder at least 45 days prior to the scheduled production and laydown for review and approval.

6 ADDITIONAL SERVICES

6.1 PLANS AND SPECIFICATIONS REVIEW

We recommend that Kleinfelder perform a general review of the project plans and specifications before they are finalized to verify that our geotechnical recommendations have been properly interpreted and implemented during design. If we are not accorded the privilege of performing this review, we can assume no responsibility for misinterpretation of our recommendations.

6.2 CONSTRUCTION OBSERVATION AND TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Because geotechnical engineering is an inexact science due to the variability of natural processes, and because we sample only a limited portion of the soils affecting the performance of the proposed structure, unanticipated or changed conditions can be encountered during grading. Proper geotechnical observation and testing during construction are imperative to allow the geotechnical engineer the opportunity to verify assumptions made during the design process. Therefore, we recommend that Kleinfelder be retained during the construction of the proposed improvements to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study.

Our services are typically needed at the following stages of grading.

- After demolition;
- During grading;
- During the installation of temporary construction shoring;
- After the overexcavation, but prior to scarification;
- During utility trench backfill;
- During base placement and site paving; and
- After excavation for foundations.

7 LIMITATIONS

This geotechnical study has been prepared for the exclusive use of Costco Wholesale and their agents for specific application to the proposed fuel facility on-site relocation at Costco Wholesale Warehouse No. 122 located at 2655 El Camino Real in Tustin, California. The findings, conclusions and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made.

The scope of services was limited to a background data review and the field exploration described in Section 1.2. It should be recognized that definition and evaluation of subsurface conditions are difficult. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. The conclusions of this assessment are based on our field exploration and laboratory testing programs, and engineering analyses.

Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service, which provide information for their purposes at acceptable levels of risk. The client and key members of the design team should discuss the issues covered in this report with Kleinfelder, so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk and expectations for future performance and maintenance.

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil or groundwater conditions could vary between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, the client is responsible for ensuring that Kleinfelder is notified immediately so that we may reevaluate the recommendations of this report. If the scope of the proposed construction, including the estimated Traffic Index or locations of the improvements, changes from that described in this report, the conclusions and recommendations contained in this report are not considered valid until the changes are reviewed, and the conclusions of this report are modified or approved in writing, by Kleinfelder.

The scope of services for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

Kleinfelder cannot be responsible for interpretation by others of this report or the conditions encountered in the field. Kleinfelder must be retained so that all geotechnical aspects of construction will be monitored on a full-time basis by a representative from Kleinfelder, including site preparation, preparation of foundations, and placement of engineered fill and trench backfill. These services provide Kleinfelder the opportunity to observe the actual soil and groundwater conditions encountered during construction and to evaluate the applicability of the recommendations presented in this report to the site conditions. If Kleinfelder is not retained to provide these services, we will cease to be the engineer of record for this project and will assume no responsibility for any potential claim during or after construction on this project. If changed site conditions affect the recommendations presented herein, Kleinfelder must also be retained to perform a supplemental evaluation and to issue a revision to our original report.

This report, and any future addenda or reports regarding this site, may be made available to bidders to supply them with only the data contained in the report regarding subsurface conditions and laboratory test results at the point and time noted. Bidders may not rely on interpretations, opinion, recommendations, or conclusions contained in the report. Because of the limited nature of any subsurface study, the contractor may encounter conditions during construction which differ from those presented in this report. In such event, the contractor should promptly notify the owner so that Kleinfelder's geotechnical engineer can be contacted to confirm those conditions. We recommend the contractor describe the nature and extent of the differing conditions in writing and that the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during earthwork and foundation construction.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party, other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of this report and the nature of the new project, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party and the client agrees to defend, indemnify, and hold harmless Kleinfelder from any claims or liability associated with such unauthorized use or non-compliance.

8 REFERENCES

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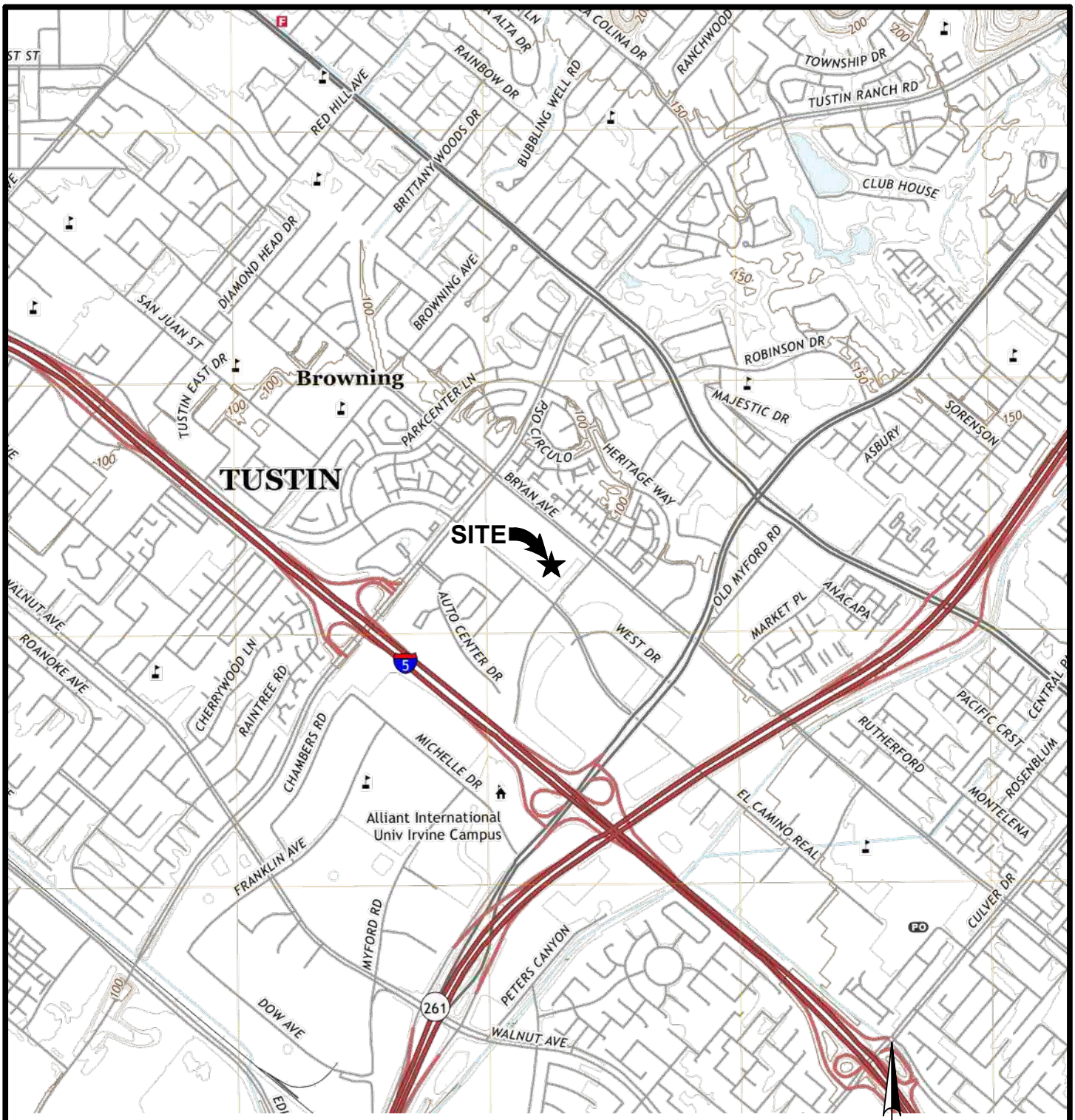
FIGURES



SOURCE: U.S.G.S. 7.5' topographic series, Tustin, California quadrangle dated 2018.

N

2,000 1,000 0 2,000

APPROXIMATE SCALE (feet)

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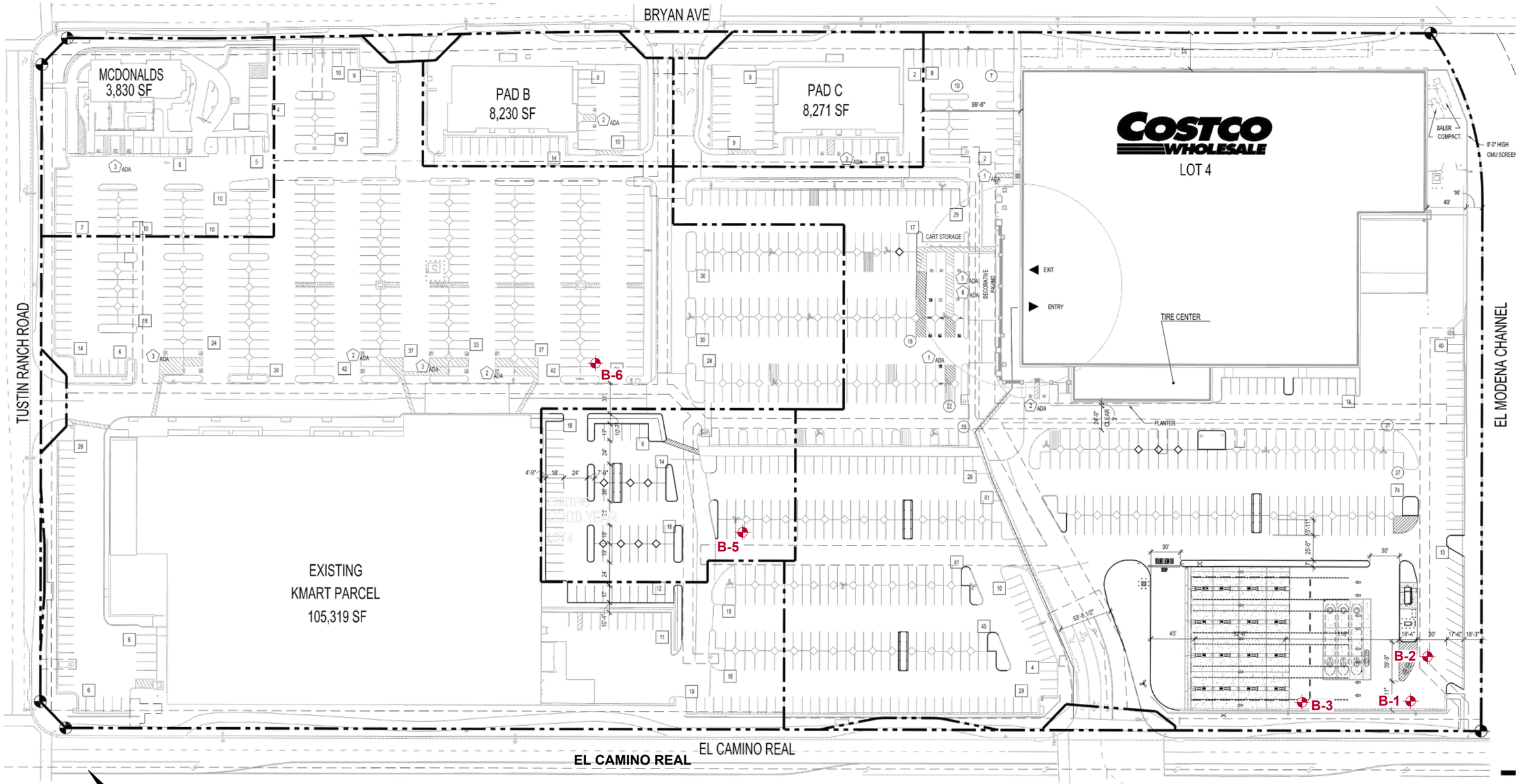
SITE VICINITY MAP

COSTCO WHOLESALE WAREHOUSE No. 122
2655 EL CAMINO REAL
TUSTIN, CALIFORNIA

FIGURE

1



REFERENCE: BASE MAP PROVIDED BY MG2, DATED 11/07/2018

100 50 0 100

APPROXIMATE SCALE (feet)

EXPLANATION

B-6 APPROXIMATE BORING LOCATION

NOTE: BORING B-4 WAS NOT DRILLED

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EXPLORATION LOCATION MAP

COSTCO WHOLESALE WAREHOUSE No. 122
2655 EL CAMINO REAL
TUSTIN, CALIFORNIA

FIGURE
2

APPENDIX A
FIELD EXPLORATIONS

APPENDIX A
FIELD EXPLORATION

GENERAL

Our field exploration program consisted of five borings. It should be noted that Boring B-4 (a proposed 10-foot boring) was not drilled due to safety concerns from an impending thunderstorm during our fieldwork. The borings were excavated on October 12, 2018. Prior to commencement of the fieldwork, various geophysical techniques were used at the boring locations to identify potential conflicts with subsurface structures. The boring locations were also cleared for buried utilities through Underground Service Alert (USA).

The explorations were located as close to the proposed fuel facility area as possible. The borings were drilled to depths between approximately 3½ and 51½ feet bgs. The borings were drilled by Calpac Drilling of San Diego, California with a (B-61) truck-mounted, hollow-stem-auger (HSA) drilling equipment. The approximate locations of the explorations are presented on Figure 2, Exploration Location Map.

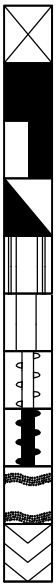
The logs for the borings are presented as Figure A-3 through A-8. An explanation to the log is presented as Figure A-1 and A-2. The Log of Boring describes the earth materials encountered, samples obtained and show field and laboratory tests performed. The log also shows the location, boring number, drilling date, and the name of the drilling subcontractor. The borings were logged by a Kleinfelder engineer using the Unified Soil Classification System. The boundaries between soil types shown on the log are approximate because the transition between different soil layers may be gradual. Bulk and drive samples of selected earth materials were obtained from the borings.

A California-type sampler was used to obtain drive samples of the soil encountered. This sampler consists of a 3-inch O.D., 2.4-inch I.D. split barrel shaft that is pushed or driven a total of 18 inches into the soil at the bottom of the boring. The soil was retained in six 1-inch brass rings for laboratory testing. An additional 2 inches of soil from each drive remained in the cutting shoe and was usually discarded after visually classifying the soil. The sampler was driven using a 140-pound hammer falling 30 inches. The total number of blows required to drive the sampler the final 12 inches is termed blow count and is recorded on the Log of Boring.

Samples were also obtained using a Standard Penetration Sampler (SPT). This sampler consists of a 2-inch O.D., 1⅜-inch I.D. split barrel shaft that is advanced into the soils at the bottom of the

drill hole a total of 18 inches. The sampler was driven using a 140-pound hammer falling 30 inches. The total number of hammer blows required to drive the sampler the final 12 inches is termed the blow count (N) and is recorded on the Log of Boring. The procedures we employed in the field are generally consistent with those described in ASTM Standard Test Method D1586.

SAMPLER AND DRILLING METHOD GRAPHICS



BULK / GRAB / BAG SAMPLE

MODIFIED CALIFORNIA SAMPLER
(2 or 2-1/2 in. (50.8 or 63.5 mm.) outer diameter)

CALIFORNIA SAMPLER
(3 in. (76.2 mm.) outer diameter)

STANDARD PENETRATION SPLIT SPOON SAMPLER
(2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

HQ CORE SAMPLE
(2.500 in. (63.5 mm.) core diameter)

SHELBY TUBE SAMPLER

HOLLOW STEM AUGER

SOLID STEM AUGER

WASH BORING

SONIC CONTINUOUS SAMPLER

GROUND WATER GRAPHICS

WATER LEVEL (level where first observed)

WATER LEVEL (level after exploration completion)

WATER LEVEL (additional levels after exploration)

OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS
WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3		**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3		**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3		**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3		**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES			**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
					GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3		**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3		**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3		**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3		**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES			**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
					SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
					SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit greater than 50)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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GRAPHICS KEY

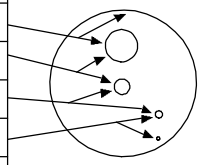
Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE

A-1

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

	AMOUNT	
Term of Use	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N_{60} (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

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SOIL DESCRIPTION KEY

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE

A-2

Date Begin - End:	10/12/2018	**Drilling Company:**	Cal Pac	**BORING LOG B-1**	
Logged By:	D. Castle	**Drill Crew:**	Keith/James		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Mobile B-61	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Sunny & Clear	**Auger Diameter:**	7.5 in. O.D.		

Latitude: 33.72708°
Longitude: -117.79631°
Approximate Ground Surface Elevation (ft.): 88.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		ASPHALT: 4.75-inches											Hand auger to 5 ft bgs.
		BASE COURSE: 7-inches					14.4						Expansion Index
85		**ARTIFICIAL FILL:** **Sandy Lean CLAY (CL)**: dark brown to dark reddish brown, dry to moist, little to some fine sand, concrete debris											
	5	stiff, rootlets present		BC=4 7 8 PP=4.5+	18"		14.6 14.7	105.7					
80		**ALLUVIUM:** **Lean CLAY with Sand (CL)**: fine-grained, brown and dark brown, dry to moist, medium stiff, few gypsum stringers		BC=4 6 7 PP=4.5+	18"		15.5	114.2					Pocket Vane Shear: (0.32)(2.5) = 0.80tsf Unconfined Compression
	10	**Clayey SAND (SC)**: fine to medium-grained, medium plasticity, brown to yellowish brown, dry to moist, medium dense		BC=9 16 17	18"		6.8	117.7					
75		light brown gray, medium dense to dense		BC=7 13 22	18"		4.7	108.9					
	15	**Lean CLAY (CL)**: yellowish brown, stiff, medium to coarse sand lense within sandy clay		BC=4 10 8	18"		10.6	110.6					
		medium plasticity, brown, moist, trace fine sand											
70		medium plasticity, brown to dark brown, moist, stiff, few fine sand		BC=5 8 13 PP=4.0	18"		22.5	104.1					
	20	medium stiff		BC=3 6 10	18"		20.9	104.8					Unconfined Compression
		trace fine sand											Drilling vibrations
65													
	25	brown to yellowish brown, trace mica, trace sand		BC=3 5 10 PP=4.25	18"		16.3						
60		The boring was terminated at approximately 26.5 ft. below ground surface. Backfilled with cuttings and patched with rapid setting concrete dyed black											
	30												
55													

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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BORING LOG B-1

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE
A-3

PAGE: 1 of 1

Date Begin - End:	10/12/2018	**Drilling Company:**	Cal Pac	**BORING LOG B-2**	
Logged By:	D. Castle	**Drill Crew:**	Keith/James		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Mobile B-61	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Sunny & Clear	**Auger Diameter:**	7.5 in. O.D.		

Latitude: 33.72715°
Longitude: -117.79612°
Approximate Ground Surface Elevation (ft.): 89.00
Surface Condition: Asphalt

Approx. Elevation (ft)	Depth (ft)	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		ASPHALT: 4.5-inches											Hand auger to 5 ft bgs.
		BASE COURSE: 8.5-inches											
		ARTIFICIAL FILL: **Lean CLAY (CL)**: medium plasticity, dark brown, moist, few fine to medium sand, few fine to coarse, subrounded to rounded gravel			6"		10.8						Corrosion
85	5	dark brown to black, stiff		BC=4 10 10	16"		14.8	106.2					
		light brownish gray, yellow splotches, pieces of concrete debris		BC=2 4 5	18"		15.9						
80	10	**ALLUVIUM:** **Lean CLAY with Sand (CL)**: medium plasticity, mottled light brownish grey and yellowish brown, moist, stiff		BC=6 4 9	15"		13.9	114.1					Unconfined Compression
		medium plasticity, moist, mottled light brownish gray and yellowish brown, caliche nodules and stringers present		BC=4 5 6	18"		11.8						
75	15	**Sandy Lean CLAY (CL)**: medium plasticity, olive yellow to yellowish brown, moist, stiff, some fine to medium sand		BC=5 10 10	18"		7.6	109.7					
		Clayey SAND (SC): fine-grained, medium plasticity, yellowish brown, moist, medium dense											
70	20	**Lean CLAY (CL)**: medium plasticity, brown, moist, stiff		BC=2 5 8	17"		19.3						
		yellowish brown, iron oxide staining, slightly micaceous		BC=4 7 12	14"		14.2	95.4					
65	25	**Lean CLAY with Sand (CL)**: yellowish brown, moist, stiff, manganese oxide staining, little fine to medium sand, slightly micaceous		BC=3 7 10	14"		15.8	109.1					
60	30												
55													

The boring was terminated at approximately 26.5 ft. below ground surface. Backfilled with cuttings and patched with rapid setting concrete dyed black

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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BORING LOG B-2

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE
A-4
PAGE: 1 of 1

Date Begin - End: 10/12/2018 **Drilling Company:** Cal Pac

BORING LOG B-3

Logged By: D. Castle **Drill Crew:** Keith/James

Hor.-Vert. Datum: Not Available **Drilling Equipment:** Mobile B-61 **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger

Weather: Sunny & Clear **Auger Diameter:** 7.5 in. O.D.

Latitude: 33.72728°
Longitude: -117.79659°
Approximate Ground Surface Elevation (ft.): 88.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ASPHALT: 4.5-inches											Hand auger to 5 ft bgs.
			BASE COURSE: 8.5-inches											
			ARTIFICIAL FILL:											
85			**Clayey SAND (SC)**: fine to medium-grained, low to medium plasticity, brown, dry to moist			6"		19.4						
			Sandy Lean CLAY (CL): medium plasticity, dark brown, dry to moist, little fine sand											
	5		**Lean CLAY (CL)**: medium plasticity, black, moist, medium stiff to stiff, iron oxide staining, 2-inch seem of medium sand, pieces of concrete debris		BC=2 3 5 PP=3.25	18"								
80			**Sandy Lean CLAY (CL)**: medium plasticity, mottled yellowish brown with olive brown, moist, stiff, fine to medium-grained sandconcrete debris		BC=3 5 5	18"		11.8			37			
			ALLUVIUM:											
	10		**Sandy Lean CLAY (CL)**: medium plasticity, mottled yellowish brown with olive brown, moist, stiff, fine to coarse-grained sand, caliche stringers, slightly micaceous		BC=4 5 7 PP=4.5+	18"								Corrosion
75			**Clayey SAND (SC)**: fine to coarse-grained, yellowish brown, moist, some medium plasticity clay fines		BC=4 3 4	18"								
	15		**Lean CLAY (CL)**: medium plasticity, dark brown, moist, medium stiff, few fine sand brown to dark brown, caliche stringers present		BC=3 6 8 PP=4	18"		18.0				44	11	
70			stiff, sand stringers present		BC=3 4 5	18"								
			Sandy CLAY (CL): medium plasticity, brown, moist, stiff, fine to medium sand, caliche stringers											
	20		**Lean CLAY (CL)**: low to medium plasticity, brown, moist, stiff, few fine to medium sand, gypsum stringers		BC=2 4 6 PP=3.5	18"		19.7						
65			medium to high plasticity, brown to yellowish brown, caliche stringers, charcoal fragment present											
	25				BC=3 4 5	18"						28	14	
60														
	30		wet, trace gravel		BC=5 11 10	18"		26.0						
			Poorly Graded SAND with Gravel (SP): medium to coarse-grained, dark brown, wet, medium dense, fine, sub-rounded gravel					10.1			6.0			
55														

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PROJECT NO.:	20192059
DRAWN BY:	JZ
CHECKED BY:	DC
DATE:	10/31/2018
REVISED:	-

BORING LOG B-3

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE
A-5

Date Begin - End: 10/12/2018 **Drilling Company:** Cal Pac

Logged By: D. Castle **Drill Crew:** Keith/James

Hor.-Vert. Datum: Not Available **Drilling Equipment:** Mobile B-61 **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger

Weather: Sunny & Clear **Auger Diameter:** 7.5 in. O.D.

BORING LOG B-3

FIELD EXPLORATION | LABORATORY RESULTS

Latitude: 33.72728°
Longitude: -117.79659°
Approximate Ground Surface Elevation (ft.): 88.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
50	0		fine-grained, dark brown **Silty SAND with Gravel (SM)**: medium to coarse-grained, wet, dense, fine to coarse, sub-rounded gravel, predominantely fine		BC=9 18 19	18"		24.6			13			
	5		**Lean CLAY (CL)**: medium plasticity, yellowish brown to brown with olive yellow mottles, wet, medium stiff											
40	10				BC=2 2 3	18"						48	21	
45	15													
45	15		yellowish brown, stiff		BC=2 4 6	18"								
40	20													
50	25		medium stiff		BC=2 3 3	18"								
35	30													
55	35													
30	40													
60	45													
25	50													
65	55													
20	60													

The boring was terminated at approximately 51.5 ft. below ground surface. Backfill with bentonite cement and patched with rapid setting concrete dyed black

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 29.5 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 29.5 ft. below ground surface at the end of drilling.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.:	20192059
DRAWN BY:	JZ
CHECKED BY:	DC
DATE:	10/31/2018
REVISED:	-

BORING LOG B-3

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE
A-6

Date Begin - End:	10/12/2018	**Drilling Company:**	Cal Pac	**BORING LOG B-5**
Logged By:	D. Castle	**Drill Crew:**	Keith/James	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger	
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger	
Weather:	Sunny & Clear	**Auger Diameter:**	7 in. O.D.	

FIELD EXPLORATION

Latitude: 33.72924°
Longitude: -117.79769°
Approximate Ground Surface Elevation (ft.): 94.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ASPHALT: 3-inches											
			BASE COURSE: 6-inches											
			ARTIFICIAL FILL: **Silty SAND (SM)**: fine to medium-grained, non-plastic, brown, dry					11.4						
			Lean CLAY with Sand (CL): brown, dry to moist, little fine to medium sand at 2.5-feet becomes dark brown											
90	5													
85	10													
80														

The boring was terminated at approximately 3.5 ft. below ground surface. Backfilled with cuttings and patched with rapid setting concrete dyed black

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.:	20192059
DRAWN BY:	JZ
CHECKED BY:	DC
DATE:	10/31/2018
REVISED:	-

BORING LOG B-5

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE
A-7

PAGE: 1 of 1

BORING LOG B-6

Date Begin - End:	10/12/2018	**Drilling Company:**	Cal Pac
Logged By:	D. Castle	**Drill Crew:**	Keith/James
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger
Weather:	Sunny & Clear	**Auger Diameter:**	7 in. O.D.

FIELD EXPLORATION

Latitude: 33.72864°
Longitude: -117.79767°
Approximate Ground Surface Elevation (ft.): 91.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ASPHALT: 3.5-inches											
			BASE COURSE: 7-inches											
90			**ARTIFICIAL FILL:** **Lean CLAY with Sand (CL)**: medium plasticity, dark brown, moist					17.9						R-Value
	5													
85														
	10													
80														

The boring was terminated at approximately 3.5 ft. below ground surface. Backfilled with cuttings and patched with rapid setting concrete dyed black

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.:	20192059
DRAWN BY:	JZ
CHECKED BY:	DC
DATE:	10/31/2018
REVISED:	-

BORING LOG B-6

Costco Wholesale Warehouse No. 122
2655 El Camino Real
Tustin, California 92782

FIGURE
A-8

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

GENERAL

Laboratory tests were performed on selected samples as an aid in classifying the soils and to evaluate physical properties of the soils that may affect foundation design and construction procedures. The tests were performed in general conformance with the current ASTM or California Department of Transportation (Caltrans) standards by AP Engineering and Testing Inc. of Pomona, California. A description of the laboratory-testing program is presented below.

MOISTURE AND UNIT WEIGHT

Moisture content and dry unit weight testing was performed on a selected sample recovered from our borings. Moisture contents were determined in general accordance with ASTM Test Method D2216; dry unit weight was calculated using the entire weight of the samples collected in general accordance with ASTM Test Method D7263. Results of the testing are presented on the boring logs in Appendix A and as an attachment in this appendix.

PERCENT PASSING NO. 200 SIEVE

Selected samples were subject to a wash through the No. 200 sieve to determine the fines content of the onsite soils and to aid in classification of the soils. The percent finer than the No. 200 sieve was performed in accordance with ASTM Standard Test Method D1140. The results of the tests are presented on the boring logs in Appendix A and as an attachment in this appendix.

ATTERBERG LIMITS

Atterberg limits testing was performed on a selected soil samples to assist in classification. Testing was performed in general accordance with ASTM D4318. Results are presented on the boring logs in Appendix A and as an attachment in this appendix.

UNCONFINED COMPRESSION TEST

Unconfined compression testing was performed on relatively undisturbed samples to estimate the shear strength of the fine-grained soils. Testing was performed in general accordance with ASTM D2166. Results of the testing are attached to this appendix.

EXPANSION INDEX

Expansion index testing was performed on the near surface soils to evaluate the swell potential of the soils during inundation (saturation). Testing was performed in general accordance with ASTM D4829. Results of the testing are attached to this appendix.

R-VALUE TESTS

One resistance value (R-value) test was performed on a bulk soil sample obtained within the proposed fuel facility area to evaluate pavement support characteristics of the near-surface onsite soils. R-value tests were performed in accordance with Caltrans Standard Test Method 301. Results of the testing are attached to this appendix.

SOIL CORROSIVITY TESTS

A series of chemical tests were performed on selected samples of the near-surface soils to estimate pH, resistivity and sulfate and chloride contents. The samples were tested for pH and minimum resistivity, soluble chlorides, and soluble sulfates, respectively. Test results may be used by a qualified corrosion engineer to evaluate the general corrosion potential with respect to construction materials. The results of the tests are presented in Table 3 of Section 4.7 of the report and attached to this appendix.

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MOISTURE AND DENSITY TEST RESULTS

Client: Kleinfelder
Project Name: Costco Tustin Ranch Gas OSR
Project No.: 20192059.001A

AP Lab No.: 18-1038
Date: 10/22/18

Boring No.	Sample No.	Sample Depth (ft.)	Moisture Content (%)	Dry Density (pcf)
B-1	1	1	14.4	NA
B-1	2	6	14.6	105.7
B-1	3	6.5	14.7	NA
B-1	4	8.5	15.5	114.2
B-1	5	11	6.8	117.7
B-1	6	13.5	4.7	108.9
B-1	7	16	10.6	110.6
B-1	8	18.5	22.5	104.1
B-1	9	21	20.9	104.8
B-1	10	25	16.3	NA
B-2	1	3	10.8	NA
B-2	2	6	14.8	106.2
B-2	3	7.5	15.9	NA
B-2	4	11	13.9	114.1
B-2	5	12.5	11.8	NA
B-2	6	16	7.6	109.7
B-2	7	17.5	19.3	NA
B-2	8	21	14.2	95.4
B-2	9	26	15.8	109.1
B-3	1	2	19.4	NA
B-3	3	7.5	11.8	NA
B-3	7	15	18.0	NA
B-3	10	20	19.7	NA
B-3	12	30	26.0	NA
B-3	13	30.75	10.1	NA
B-3	14	35	24.6	NA
B-5	1	1	11.4	NA
B-6	1	1	17.9	NA

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PERCENT PASSING NO. 200 SIEVE

ASTM D1140

Client: Kleinfelder
AP Lab No.: 18-1038
Project Name: Costco Tustin Ranch Gas OSR
Test Date: 10/24/18
Project Number: 20192059.001A

Boring No.	Sample No.	Depth (ft)	Percent Fines (%)
B-3	3	7.5	36.5
B-3	13	30.75	6.0
B-3	14	35	12.9

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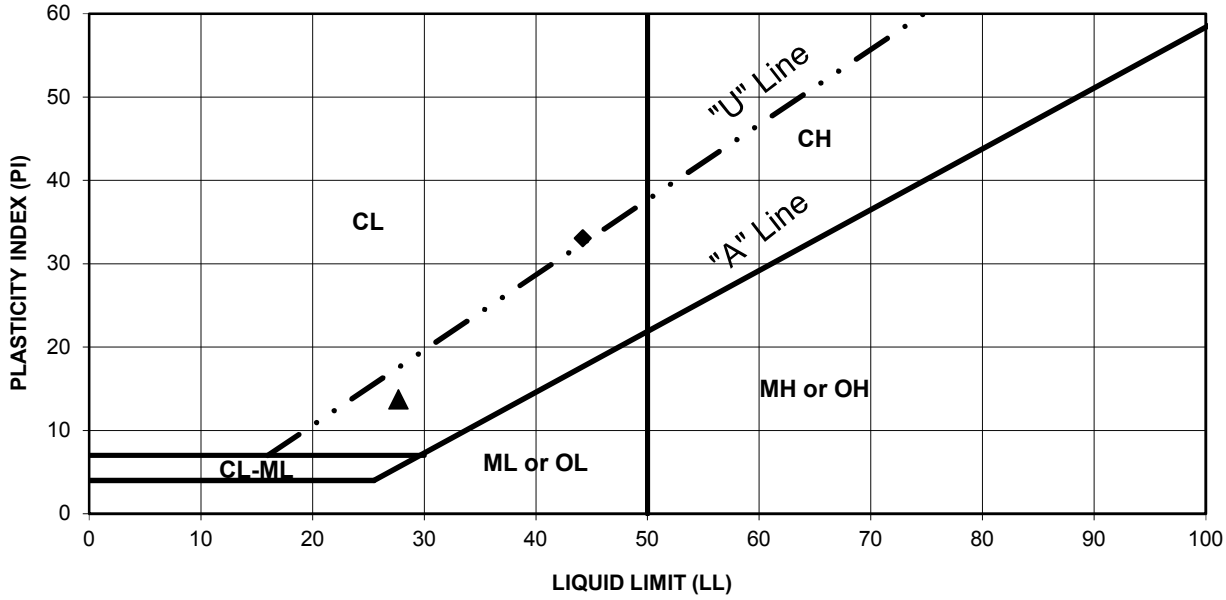
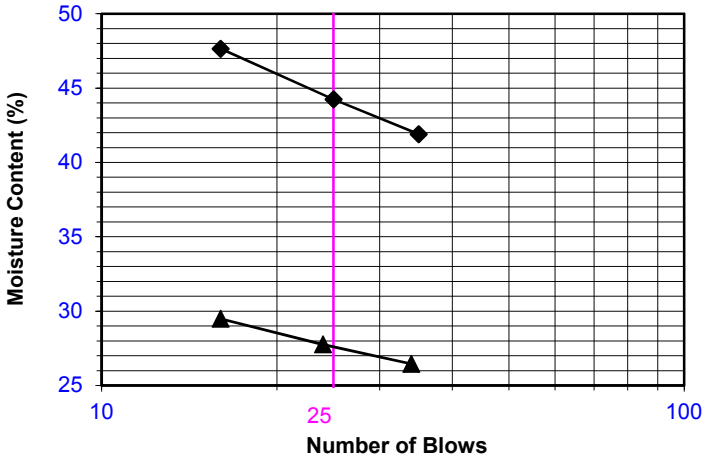
ATTERBERG LIMITS
ASTM D 4318

Project Name: Costco Tustin Ranch Gas OSR **Tested By:** DK Date: 10/28/18
Project No.: 20192059.001A **Checked By:** AP Date: 10/30/18



PROCEDURE USED

- ☐ Wet Preparation
- ☒ Dry Preparation
- ☒ Procedure A Multipoint Test
- ☐ Procedure B One-point Test



Symbol	Boring Number	Sample Number	Depth (feet)	LL	PL	PI	Plasticity Chart Symbol
♦	B-3	7	15	44	11	33	CL
▲	B-3	11	25	28	14	14	CL

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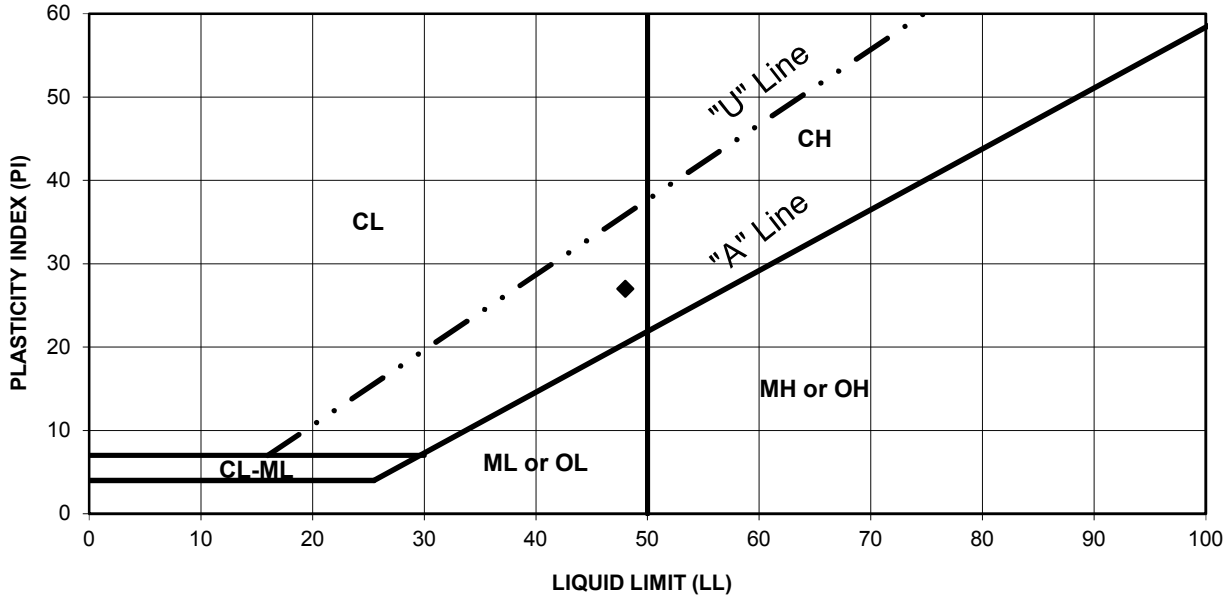
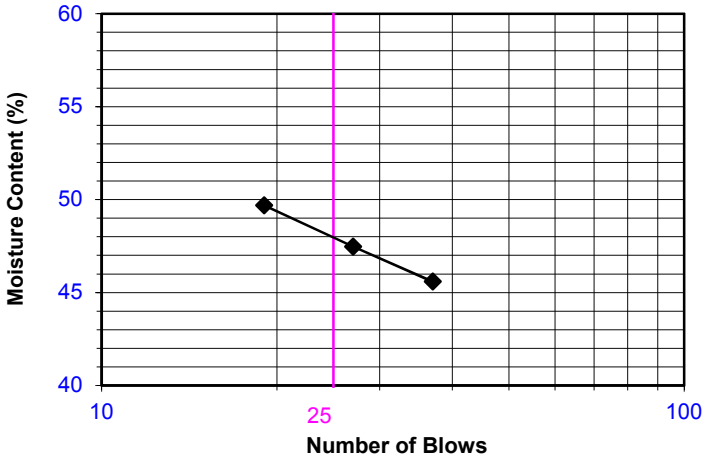
ATTERBERG LIMITS
ASTM D 4318

Project Name: Costco Tustin Ranch Gas OSR **Tested By:** DK Date: 10/28/18
Project No.: 20192059.001A **Checked By:** AP Date: 10/30/18



PROCEDURE USED

- ☐ Wet Preparation
- ☒ Dry Preparation
- ☒ Procedure A Multipoint Test
- ☐ Procedure B One-point Test



Symbol	Boring Number	Sample Number	Depth (feet)	LL	PL	PI	Plasticity Chart Symbol
♦	B-3	16	40	48	21	27	CL

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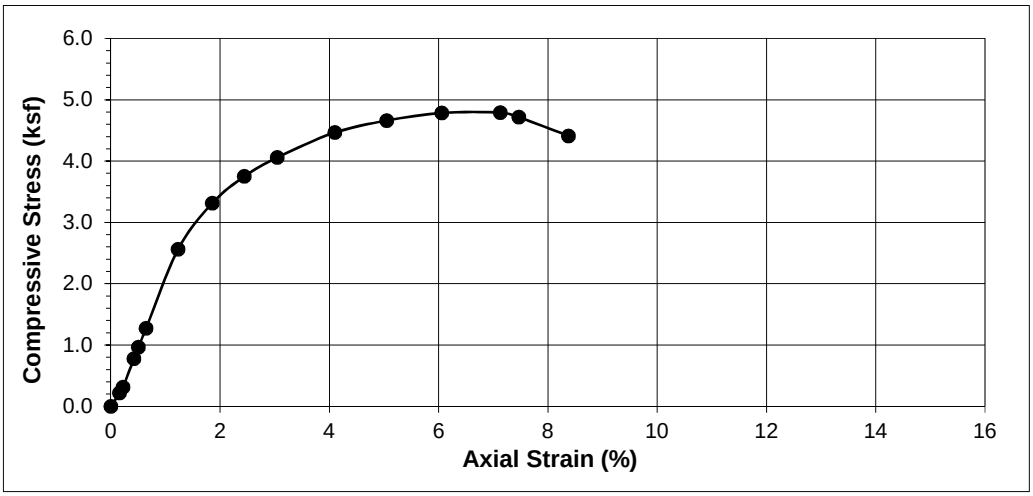
UNCONFINED COMPRESSION TEST RESULTS
ASTM D 2166

Project Name:	Costco Tustin Ranch Gas OSR	Sample Type:	Mod Cal
Project No.:	20192059.001A	Soil Description	Clay
Boring No.:	B-1	Dry Density (pcf):	104.2
Sample No.:	9	Moisture Content (%)	20.9
Depth (feet):	21	Test Date:	10/29/18
Sample Diameter (inch):	2.422	Wt. Wet Soil+Container(gms)	895.34
Sample Height (inch):	4.953	Wt. Dry Soil+Container(gms)	765.2
Sample Weight (gms):	754.73	Wt. Container (gms)	141.77



After Test

Load (lbs)	Deformation (inch)	Area (sq.in)	Compressive Stress (ksf)	Axial Strain (%)
0	0.000	4.61	0.00	0.00
7	0.008	4.61	0.22	0.16
10	0.011	4.62	0.31	0.22
25	0.021	4.63	0.78	0.42
31	0.025	4.63	0.96	0.50
41	0.032	4.64	1.27	0.65
83	0.061	4.66	2.56	1.23
108	0.092	4.69	3.31	1.86
123	0.121	4.72	3.75	2.44
134	0.151	4.75	4.06	3.05
149	0.203	4.80	4.47	4.10
157	0.250	4.85	4.66	5.05
163	0.300	4.90	4.79	6.06
165	0.353	4.96	4.79	7.13
163	0.370	4.98	4.71	7.47
154	0.415	5.03	4.41	8.38

Unconfined Compressive Strength (ksf) = **4.79**

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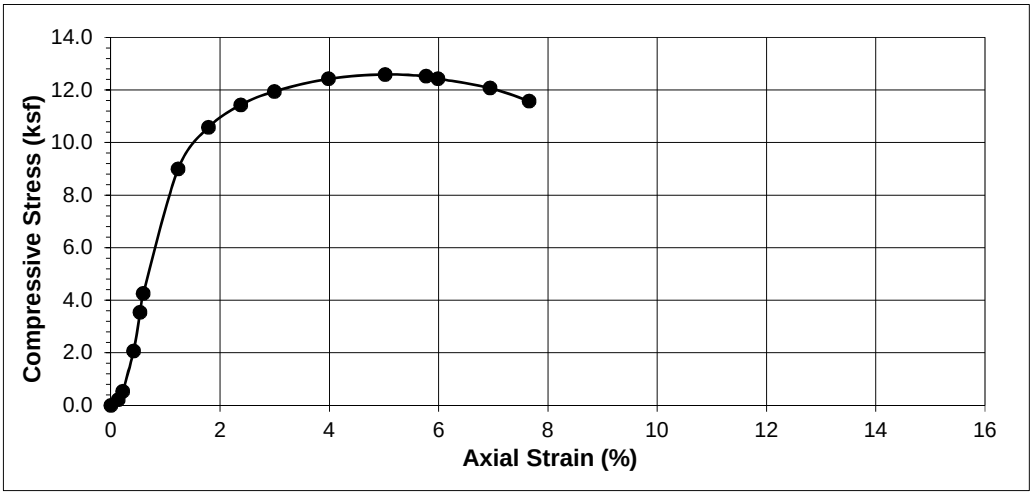
UNCONFINED COMPRESSION TEST RESULTS
ASTM D 2166

Project Name:	Costco Tustin Ranch Gas OSR	Sample Type:	Mod Cal
Project No.:	20192059.001A	Soil Description	Clay
Boring No.:	B-1	Dry Density (pcf):	114.4
Sample No.:	4	Moisture Content (%)	15.5
Depth (feet):	8.5	Test Date:	10/29/18

Sample Diameter (inch):	2.413	Wt. Wet Soil+Container(gms)	948.02
Sample Height (inch):	5.042	Wt. Dry Soil+Container(gms)	840.58
Sample Weight (gms):	800.02	Wt. Container (gms)	149.17



After Test

Load (lbs)	Deformation (inch)	Area (sq.in)	Compressive Stress (ksf)	Axial Strain (%)
0	0.000	4.57	0.00	0.00
7	0.007	4.58	0.22	0.14
17	0.011	4.58	0.53	0.22
66	0.021	4.59	2.07	0.42
113	0.027	4.60	3.54	0.54
136	0.030	4.60	4.26	0.60
289	0.062	4.63	8.99	1.23
342	0.090	4.66	10.58	1.79
372	0.120	4.68	11.44	2.38
391	0.151	4.71	11.94	2.99
411	0.201	4.76	12.43	3.99
421	0.253	4.81	12.59	5.02
422	0.291	4.85	12.52	5.77
420	0.302	4.86	12.43	5.99
412	0.350	4.91	12.07	6.94
398	0.386	4.95	11.57	7.66

Unconfined Compressive Strength (ksf) = **12.59**

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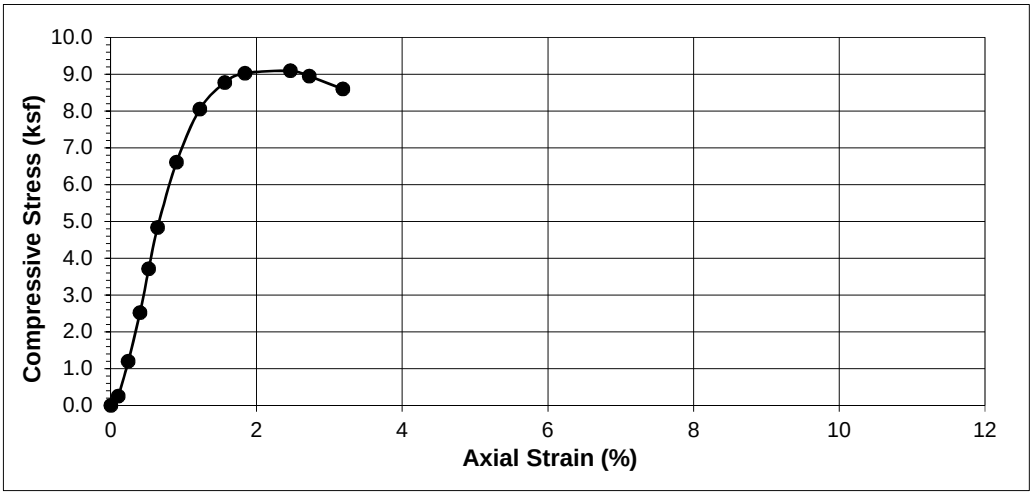
UNCONFINED COMPRESSION TEST RESULTS
ASTM D 2166

Project Name:	Costco Tustin Ranch Gas OSR	Sample Type:	Mod Cal
Project No.:	20192059.001A	Soil Description	Clay
Boring No.:	B-2	Dry Density (pcf):	114.6
Sample No.:	4	Moisture Content (%)	13.9
Depth (feet):	11	Test Date:	10/29/18

Sample Diameter (inch):	2.409	Wt. Wet Soil+Container(gms)	958.33
Sample Height (inch):	4.990	Wt. Dry Soil+Container(gms)	863.03
Sample Weight (gms):	779.80	Wt. Container (gms)	179.74



After Test

Load (lbs)	Deformation (inch)	Area (sq.in)	Compressive Stress (ksf)	Axial Strain (%)
0	0.000	4.56	0.00	0.00
8	0.005	4.56	0.25	0.10
38	0.012	4.57	1.20	0.24
80	0.020	4.58	2.52	0.40
118	0.026	4.58	3.71	0.52
154	0.032	4.59	4.83	0.64
211	0.045	4.60	6.61	0.90
258	0.061	4.61	8.05	1.22
282	0.078	4.63	8.77	1.56
291	0.092	4.64	9.02	1.84
295	0.123	4.67	9.09	2.46
291	0.136	4.69	8.94	2.73
281	0.159	4.71	8.59	3.19

Unconfined Compressive Strength (ksf) = **9.09**

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EXPANSION INDEX TEST RESULTS

ASTM D 4829

Client Name: Kleinfelder
Project Name: Costco Tustin Ranch Gas OSR
Project No.: 20192059.001A

AP Job No.: 18-1038
Date: 10/25/18

Boring No.	Sample No.	Depth (ft)	Soil Description	Molded Dry Density (pcf)	Molded Moisture Content (%)	Init. Degree Saturation (%)	Measured Expansion Index	Corrected Expansion Index
B-1	1	1	Sandy Clay	105.1	11.2	50.4	40	40

ASTM EXPANSION CLASSIFICATION

Expansion Index	Classification
0-20	V. Low
21-50	Low
51-90	Medium
91-130	High
>130	V. High

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R-VALUE TEST DATA

ASTM D2844

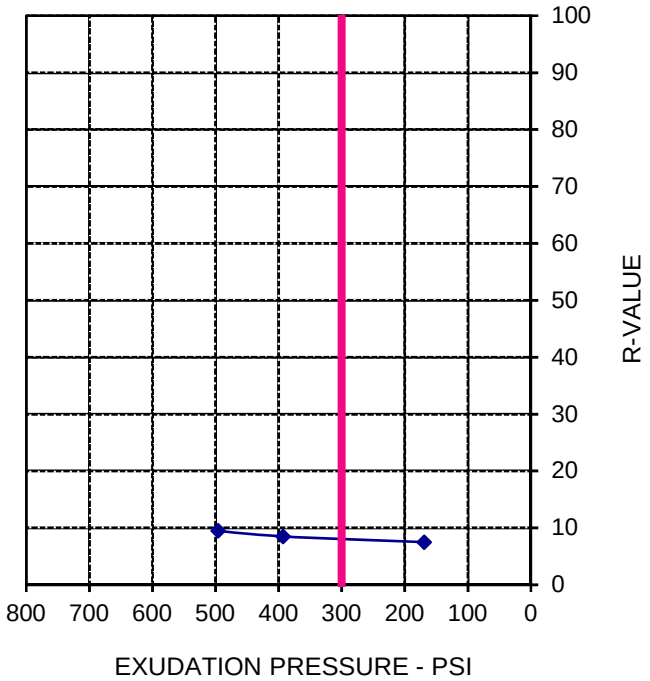
Project Name:	Costco Tustin Ranch Gas OSR	Tested By:	ST	Date:	10/19/18
Project Number:	20192059.001A	Computed By:	KM	Date:	10/23/18
Boring No.:	B-6	Checked By:	AP	Date:	10/30/18
Sample No.:	1	Depth (ft.):	1		
Location:	N/A				
Soil Description:	Lean Clay				

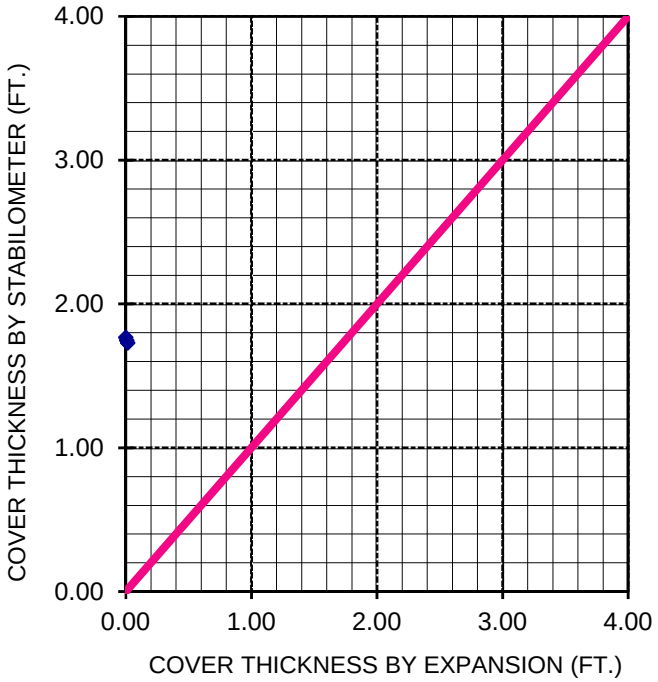
Mold Number	G	H	I	
Water Added, g	53	39	34	
Compact Moisture(%)	23.3	21.7	21.1	
Compaction Gage Pressure, psi	50	50	50	
Exudation Pressure, psi	169	393	496	
Sample Height, Inches	2.6	2.6	2.6	
Gross Weight Mold, g	2889	2907	2854	
Tare Weight Mold, g	1827	1836	1818	
Net Sample Weight, g	1062	1071	1035	
Expansion, inchesx10^{-4}	0	2	4	
Stability 2,000 (160 psi)	60/140	60/140	60/139	
Turns Displacement	4.52	4.02	3.88	
R-Value Uncorrected	7	8	9	
R-Value Corrected	8	9	10	
Dry Density, pcf	100.4	102.5	99.6	
Traffic Index	8.0	8.0	8.0	
G.E. by Stability	1.77	1.75	1.73	
G.E. by Expansion	0.00	0.01	0.01	

R-VALUE		
	By Exudation:	8
	By Expansion:	*N/A
	At Equilibrium: (by Exudation)	8

Remarks

Gf = 1.34, and 0.0 % Retained on the ¾"
*Not Applicable





AP Engineering and Testing, Inc.
DBE|MBE|SBE
2607 Pomona Boulevard | Pomona, CA 91768
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com

CORROSION TEST RESULTS

Client Name: Kleinfelder
Project Name: Costco Tustin Ranch Gas OSR
Project No.: 20192059.001A

AP Job No.: 18-1038
Date: 10/29/18

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B-2	1	3	CL	831	8.7	393	188
B-3	4	10	CL	1309	7.4	54	58

NOTES:
Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

APPENDIX G

2-YEAR HYDROLOGY CALCULATIONS

ORANGE COUNTY HYDROLOGY RUNOFF - RATIONAL METHOD
SITE RUNOFF

COSTCO Tustin Ranch

EXISTING **2 YEAR STORM EVENT**
BASIN A

Hyrdological Soil Type	F_p
A	0.40
B	0.30
C	0.25
D	0.20

Hyrdological Soil Type= D
F_p= 0.2

T_c = 6.4 min see nomograph

Example

2 YEAR STORM EVENT

F_p= 0.20 in\hr
a_i= 0.9
a_p= 0.1 = 1 - a_i
I= 1.96 in\hr
Area, A = 6.11 Ac
F_m= a_p x F_p eqn (C.7)
F_m= 0.02

Mean Precipitation Intensities (non-mountainous)

based on: $I_{Tc} = a \times T_c^b$

		a	b
I_2 =	1.96 in/hr	5.702	-0.574
I_5 =	2.77 in/hr	7.87	-0.562
I_{10} =	3.52 in/hr	10.209	-0.573
I_{25} =	4.19 in/hr	11.995	-0.566
I_{50} =	4.73 in/hr	13.521	-0.566
I_{100} =	5.37 in/hr	15.56	-0.573

PEAK FLOW SUMMARY

C=0.9(ai+(1-Fp)ap)/I eqn (D.3) Q = C x I x A eqn (D.1)

C_2=	0.891	Q_2=	**10.7** cfs
C_5=	0.894	Q_5=	**15.1** cfs
C_{10}=	0.895	Q_{10}=	**19.3** cfs
C_{25}=	0.896	Q_{25}=	**23.0** cfs
C_{50}=	0.896	Q_{50}=	**25.9** cfs
C_{100}=	0.897	Q_{100}=	**29.4** cfs

ORANGE COUNTY HYDROLOGY RUNOFF - RATIONAL METHOD
SITE RUNOFF

COSTCO Tustin Ranch EXISTING **2 YEAR STORM EVENT**
BASIN B

Hyrdological Soil Type	F_p
A	0.40
B	0.30
C	0.25
D	0.20

Hyrdological Soil Type= D
F_p= 0.2

T_c = 6.2 min see nomograph

Example

2 YEAR STORM EVENT

F_p= 0.20 in\hr
a_i= 0.9
a_p= 0.1 = 1 - a_i
I= 2.00 in\hr
Area, A = 0.63 Ac
F_m= a_p x F_p eqn (C.7)
F_m= 0.02

Mean Precipitation Intensities (non-mountainous)

based on: $I_{Tc} = a \times T_c^b$

			a	b
I_2 =	2.00	in/hr	5.702	-0.574
I_5 =	2.82	in/hr	7.87	-0.562
I_{10} =	3.59	in/hr	10.209	-0.573
I_{25} =	4.27	in/hr	11.995	-0.566
I_{50} =	4.81	in/hr	13.521	-0.566
I_{100} =	5.47	in/hr	15.56	-0.573

PEAK FLOW SUMMARY

C=0.9(ai+(1-Fp)ap)/I eqn (D.3) Q = C x I x A eqn (D.1)

C_2=	0.891	Q_2=	**1.1** cfs
C_5=	0.894	Q_5=	**1.6** cfs
C_{10}=	0.895	Q_{10}=	**2.0** cfs
C_{25}=	0.896	Q_{25}=	**2.4** cfs
C_{50}=	0.896	Q_{50}=	**2.7** cfs
C_{100}=	0.897	Q_{100}=	**3.1** cfs

ORANGE COUNTY HYDROLOGY RUNOFF - RATIONAL METHOD
SITE RUNOFF

COSTCO Tustin Ranch

PROPOSED **2 YEAR STORM EVENT**
BASIN A

Hyrdological Soil Type	F_p
A	0.40
B	0.30
C	0.25
D	0.20

Hyrdological Soil Type= D
F_p= 0.2

T_c = 7 min see nomograph

Example

2 YEAR STORM EVENT

F_p= 0.20 in\hr
a_i= 0.9
a_p= 0.1 = 1 - a_i
I= 1.87 in\hr
Area, A = 6.00 Ac
F_m= a_p x F_p eqn (C.7)
F_m= 0.02

Mean Precipitation Intensities (non-mountainous)

based on: $I_{Tc} = a \times T_c^b$

		a	b
I_2 =	1.87 in/hr	5.702	-0.574
I_5 =	2.64 in/hr	7.87	-0.562
I_{10} =	3.35 in/hr	10.209	-0.573
I_{25} =	3.99 in/hr	11.995	-0.566
I_{50} =	4.49 in/hr	13.521	-0.566
I_{100} =	5.10 in/hr	15.56	-0.573

PEAK FLOW SUMMARY

C=0.9(ai+(1-Fp)ap)/I eqn (D.3) Q = C x I x A eqn (D.1)

C_2=	0.890	Q_2=	**10.0** cfs
C_5=	0.893	Q_5=	**14.1** cfs
C_{10}=	0.895	Q_{10}=	**18.0** cfs
C_{25}=	0.895	Q_{25}=	**21.4** cfs
C_{50}=	0.896	Q_{50}=	**24.2** cfs
C_{100}=	0.896	Q_{100}=	**27.4** cfs

ORANGE COUNTY HYDROLOGY RUNOFF - RATIONAL METHOD
SITE RUNOFF
COSTCO Tustin Ranch

PRORATION OF TOTAL FLOWS FOR BASIN A SUBAREAS

PROPOSED

BASIN	AREA	%	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}
TOTAL	6.00		10.0	14.1	18.0	21.4	24.2	27.4
A1	2.63	44%	4.4	6.2	7.9	9.4	10.6	12.0
A2	3.37	56%	5.6	7.9	10.1	12.0	13.6	15.4
CHECK	6.00	100%	10.0	14.1	18.0	21.4	24.2	27.4

YEAR STORM EVENT

ORANGE COUNTY HYDROLOGY RUNOFF - RATIONAL METHOD
SITE RUNOFF

COSTCO Tustin Ranch — **PROPOSED 2 YEAR STORM EVENT**

BASIN B

Hyrdological Soil Type	F_p
A	0.40
B	0.30
C	0.25
D	0.20

Hyrdological Soil Type= D

F_p= 0.2

T_c = 6.2 min see nomograph

Example

2 YEAR STORM EVENT

F_p= 0.20 in\hr

a_i= 0.9

a_p= 0.1 = 1 - a_i

I= 2.00 in\hr

Area, A = 0.63 Ac

F_m= a_p x F_p eqn (C.7)

F_m= 0.02

Mean Precipitation Intensities (non-mountainous)

based on: $I_{Tc} = a \times T_c^b$

		a	b
I_2 =	2.00 in/hr	5.702	-0.574
I_5 =	2.82 in/hr	7.87	-0.562
I_{10} =	3.59 in/hr	10.209	-0.573
I_{25} =	4.27 in/hr	11.995	-0.566
I_{50} =	4.81 in/hr	13.521	-0.566
I_{100} =	5.47 in/hr	15.56	-0.573

PEAK FLOW SUMMARY

C=0.9(ai+(1-Fp)ap)/I eqn (D.3) Q = C x I x A eqn (D.1)

C_2=	0.891	Q_2=	**1.1** cfs
C_5=	0.894	Q_5=	**1.6** cfs
C_{10}=	0.895	Q_{10}=	**2.0** cfs
C_{25}=	0.896	Q_{25}=	**2.4** cfs
C_{50}=	0.896	Q_{50}=	**2.7** cfs
C_{100}=	0.897	Q_{100}=	**3.1** cfs

ORANGE COUNTY HYDROLOGY RUNOFF - RATIONAL METHOD
SIMPLIFIED HYDROGRAPHS
COSTCO Tustin Ranch **PROPOSED DETENTION**

2-YEAR EVENT

Weighted T_c

Existing

Basin	A	B	Total
T_c (min.)	6.4	6.2	
Area, A (Ac)	6.11	0.63	6.74
Flow, Q_2 (cfs)	10.69	1.12	11.82

Weighted $T_c = T_{c1}(A_1/A_T) + T_{c2}(A_2/A_T) + \ldots$
$=$ **6.4** minutes or 383 seconds

Proposed

Basin	A	B	Total
T_c (min.)	7	6.2	
Area, A (Ac)	6.00	0.63	6.63
Flow, Q_2 (cfs)	9.97	1.12	11.09

Weighted $T_c = T_{c1}(A_1/A_T) + T_{c2}(A_2/A_T) + \ldots$
$=$ **6.9** minutes or 415 seconds

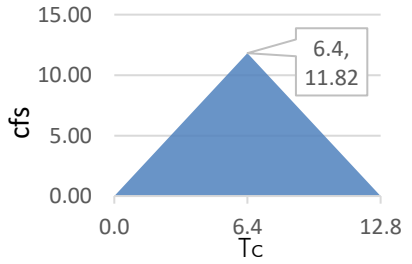
VOLUME

Existing

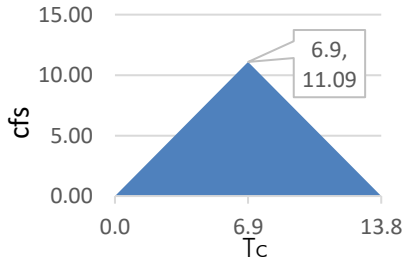
Volume, $V_E = (Q_2 \times 2 \times \text{Weighted } T_c)/2$ $=$ **4,530** ft^3

Proposed

Volume, $V_P = (Q_2 \times 2x \text{ Weighted } T_c)/2$ $=$ **4,610** ft^3



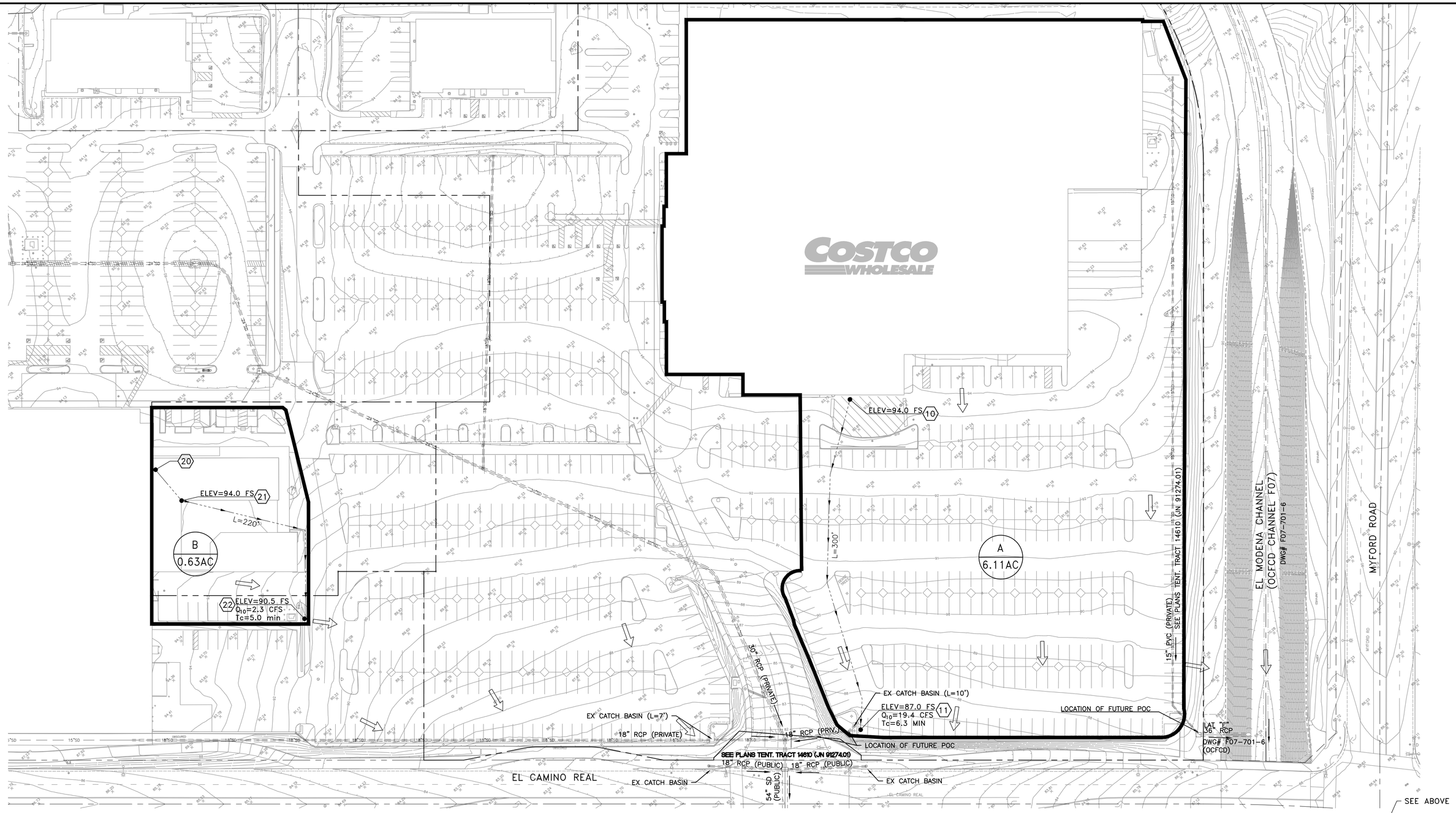
Existing Small Area Unit Hydrograph



Proposed Small Area Unit Hydrograph

DETENTION

Detention volume, $V_D = V_P - V_E$ $=$ 80 ft^3
use **80** ft^3



HYDROLOGIC CONDITIONS

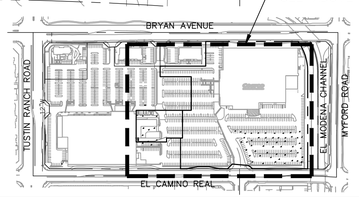
SOIL TYPE:	D
Ai:	0.9
Ap:	0.1
Fm:	0.02 IN/HR
TOTAL AREA:	6.7 AC

LEGEND:

- RIGHT-OF-WAY LINE
- CENTERLINE
- DMA BOUNDARY
- FLOW LINE
- STORM DRAIN LINE
- B/B2 / 11.3AC — BASIN/SUBAREA DESIGNATION / AREA (ACRES)
- 10 — HYDROLOGY NODE
- Q_{10} — CALCULATED RUNOFF (CFS) FOR 10 YEAR FREQUENCY
- FLOW DIRECTION

ABBREVIATIONS:

AC	ACRES
CFS	CUBIC FEET PER SECOND
ELEV	ELEVATION
FS	FINISH SURFACE
L	LENGTH
MIN	MINUTES
OCFCD	ORANGE COUNTY FLOOD CONTROL DISTRICT, FACILITY OWNER
PRIV	PRIVATE STORM FACILITIES, OWNED BY OWNERS ASSOCIATION
PUBLIC	PUBLIC STORM FACILITIES, OWNED BY THE CITY OF TUSTIN
T_c	TIME OF CONCENTRATION



40' 0' 20' 40'
SCALE: 1" = 40'

PREPARED BY:
FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

FINAL EXISTING HYDROLOGY MAP

COSTCO WHOLESALE #122
TUSTIN, CA

PREPARED ON: 11/28/2018

SHEET 1 OF 1

F:\PROJECTS\7565\059_SUPPORT FILES\REPORTS\HYDROLOGY\FINAL\X7565-059-HY-EXIST.DWG (04-30-19 3:45:41PM) Plotted by: Stuart Moore

COSTCO WHOLESALE

ELEV=94.3 FS 20

L=225'

B
0.63AC

21

PROP MWS-L-4-13

22 ELEV=90.5 FS
Q_{10}=2.0 CFS
Tc=6.2 min

10 ELEV=94.0 FS

12 ELEV=94.2 FS

A1
2.63AC

A
6.00AC

A2
3.37AC

L=350'

L=300'

PROP LANDSCAPE ISLAND W/ 6" CURB

PROP ATTENDANT OFFICE

PROP ROOF OF FUELING AREA

PROP UNDERGROUND FUEL TANKS

PROP RIBBON GUTTER

PROP OIL STOP VALVE

PROP SAND OIL INTERCEPTOR

PROP INLET

13 ELEV=88.3 FS
Q_{10}=10.0 CFS
Tc=7.1 MIN

PROP MWS-L-8-20

PROP MWS-L-8-24 WITH CURB INLET AND INTERNAL HIGH FLOW BYPASS

PROP 24" PIPE (PRIVATE)

15" PVC (PRIVATE)

CONNECT PROP 24" TO EX INLET (POC)

LAT 1 36" RCP
DWG# F07-701-6
(OCFCD)

EL MODENA CHANNEL
OCFCD CHANNEL F07 (PUBLIC)
DWG# F07-701-6

MYFORD ROAD

EXIST CURB & GUTTER

PROP CURB

30" RCP (PRIVATE)

PROP RETAINING WALL

PROP 12" PIPE (PRIVATE)

CONNECT PROP 12" TO EX 18"

PROP 36" CATCH BASIN INLET W/ DIVERT FOR LOWFLOW DIVERSION CONNECT TO EXIST PIPE (POC)

EX CATCH BASIN (L=7')

18" RCP (PRIVATE)

18" RCP (PRIVATE)

11 ELEV=89.3 FS
Q_{10}=8.0 CFS
Tc=6.8 MIN

POC FOR FLOWS FROM MWS

SEE PLANS TENT. TRACT 14610 (IN 912740)

EL CAMINO REAL

EX CATCH BASIN

18" RCP (PUBLIC)

54" SD (PUBLIC)

18" RCP (PUBLIC)

EX CATCH BASIN

LEGEND:

- RIGHT-OF-WAY LINE
- CENTERLINE
- DMA BOUNDARY
- FLOW LINE
- EXISTING STORM DRAIN
- 12"SD — PROPOSED STORM DRAIN
- PROPOSED MODULAR WETLANDS SYSTEM
- B/B2 / 11.3AC — BASIN/SUBAREA DESIGNATION; AREA (ACRES)
- 10 / Q_{10} — HYDROLOGY NODE; CALCULATED RUNOFF (CFS) FOR 10 YEAR FREQUENCY
- FLOW DIRECTION
- ROOF OVER GAS PUMPS

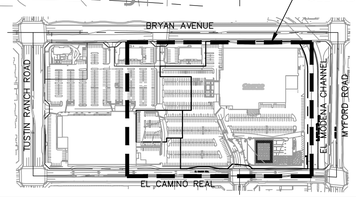
HYDROLOGIC CONDITIONS

SOIL TYPE:	D
Ai:	0.9
Ap:	0.1
Fm:	0.02 IN/HR
TOTAL AREA:	6.7 AC

ABBREVIATIONS:

AC	ACRES
CFS	CUBIC FEET PER SECOND
ELEV	ELEVATION
FS	FINISH SURFACE
L	LENGTH
MIN	MINUTES
OCFCD	ORANGE COUNTY FLOOD CONTROL DISTRICT, FACILITY OWNER
PRIV	PRIVATE STORM FACILITIES, OWNED BY OWNERS ASSOCIATION
PUBLIC	PUBLIC STORM FACILITIES, OWNED BY THE CITY OF TUSTIN
T_c	TIME OF CONCENTRATION

40' 0' 20' 40'
SCALE: 1" = 40'



PREPARED BY:
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16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

FINAL PROPOSED HYDROLOGY MAP

COSTCO WHOLESALE #122
TUSTIN, CA

PREPARED ON: 5/1/2019

SHEET 1 OF 1

F:\PROJECTS\V756\V069__SUPPORT FILES\REPORTS\HYDROLOGY\FINAL\APPENDICES\4-MAPS\V756-069-HY-PROP.DWG (05-02-19 3:22:22PM) Plotted by: Stuart Moore

Appendix H

City Covenant

[To Be Used for projects not involving land subdivisions]

RECORDING REQUESTED BY AND WHEN RECORDED MAIL TO:

Building Official
City of Tustin
300 Centennial Way
Tustin, CA 92780-3767

Space Above This Line For Recorder's Use Only

COVENANT AND AGREEMENT REGARDING O & M PLAN TO FUND AND MAINTAIN WATER QUALITY BMPS, CONSENT TO INSPECT, AND INDEMNIFICATION

This Agreement Regarding O&M Plan to Fund and Maintain Water Quality BMPs, Consent to Inspect, and Indemnification and Covenant Running With the Land ("Agreement") is made on this ___ day of _____, 20__, by and between The City of Tustin, a California municipal corporation ("Covenantee" or "City") and the undersigned property owner(s) ("Covenantor").

RECITALS

A. Covenantor is the owner of the following real property ("Property") [Provide Address, Legal Description and APN Number]):

B. The City is the owner of interests in that certain real property within the City of Tustin, County of Orange, State of California, containing storm drains, pipelines, and related appurtenances constituting the City's municipal separate storm sewer system (the City's "Storm Drain System").

C. Covenantor intends to develop, improve, and/or use the Property in such a way that approval of the City for such development, improvement, and/or use is required pursuant to the applicable laws.

D. As a condition for said approval by the City, City required Covenator, and Covenantor desires to, restrict the use of Property according to the conditions,

covenants, equitable servitudes, and restrictions contained herein for the express benefit of the City's Storm Drain System.

NOW, THEREFORE, incorporating the foregoing Recitals and in consideration thereof, in consideration of the covenants and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and expressly for the benefit of, and to bind, their successors in interest, the parties hereto agree as follows:

AGREEMENT

1. Operation and Maintenance ("O&M") Plan for Best Management Practices ("BMPs")

Covenantor, and each successive owner of an interest in all or any part of the Property ("Owner(s)") shall, throughout the period of their respective ownership, implement, and fund implementation of, the O&M Plan for the Property, which was approved by the City as part of the Water Quality Management Plan ("WQMP") required for development of the Property, and shall operate, inspect, maintain, repair, and replace the Best Management Practices ("BMPs") described in the O&M Plan for the Property, which includes:

a. Description of all post-construction BMPs (non-structural and structural),
b. Description of the Property owner's(s') responsibilities and required training of persons performing BMP implementation, operation, maintenance, and inspection,
c. Implementation frequency and operating schedule,
d. Inspection/maintenance frequency and schedule,
e. Specific BMP implementation, maintenance, and inspection activities,
f. Description of all permits required for the implementation, operation, and maintenance of BMPs,
g. Forms to be used in documenting implementation, operation, maintenance, and inspection of BMPs,
h. Recordkeeping requirements.

A copy of the approved O&M Plan is described in the current WQMP for the project, as it may be amended from time to time according to its terms, which is on file with the City of Tustin Community Development Department, and is incorporated herein by this reference.

2. Compliance with Tustin City Code and Consent to Inspect

Owners shall use and maintain the Property in full compliance with the provisions of the O&M Plan and the Tustin City Code section 4900 et seq., as it may be amended from time to time. Owners hereby consent to inspection of the Property by an inspector authorized by the City Manager, or his or her designee, for the purpose for verifying compliance with the provisions of this Agreement.

3. Indemnification

Owners agree to indemnify, defend, and hold harmless the City, its elected officers, employees, agents, and contractors from and against any and all liability, expense, including costs and legal fees, and claims of damage of any nature whatsoever including, but not limited to, death, bodily injury, personal injury, or property damage arising from or connected with the City inspection of the Property except where such liability, expense, or claim for damage results from the sole negligence or willful misconduct of the City its elected officers, employees, agents, or contractors.

4. Rights and Obligations Run With the Land

Unless terminated in accordance with Paragraph 5, below, or by law, the rights and obligations of the parties hereunder shall constitute covenants, benefits, burdens, conditions, equitable servitudes, and restrictions which run with the land in perpetuity and which shall be binding upon, and inure to the benefit of, each Owner during its respective period of ownership of all or any part of the Property. No Owner shall be bound by, or entitled to the benefit of, said rights and obligations, upon transfer by the Owner of its entire interest in the Property, in fee, to a successor in interest to the Property.

5. Termination of Agreement Upon Termination of WQMP

This Agreement and the conditions, covenants, equitable servitudes, and restrictions set forth herein shall terminate upon termination of the WQMP applicable to the Property in accordance with its terms. Upon termination of the WQMP applicable to the Property, the Owner may request that the City execute a recordable document approved by the City approving and acknowledging termination of this Agreement. A recorded document duly executed and acknowledged by the Director of Community Development of City, or his or her designee, approving termination of this Agreement shall be conclusive evidence of such termination.

7. Enforcement

The City may, but shall not be obligated to, enforce this Agreement by a proceeding at law or in equity against any person or persons violating or attempting to violate any condition, covenant, equitable servitude, or restriction provided for herein, either to restrain such violation or to recover damages.

8. Entire Agreement.

This Agreement constitutes the entire agreement and understanding between the parties with respect of the subject matter of this Agreement and supersedes all prior or contemporaneous agreements and understandings with respect to the subject matter hereof, whether oral or written.

9. Severability.

If any part of this Agreement is declared by a final decision of a court of competent jurisdiction to be invalid for any reason, such shall not affect the validity of the rest of the Agreement. The other parts of this Agreement shall remain in effect as if this Agreement had been executed without the invalid part. The parties declare that they intend and desire that the remaining parts of this Agreement continue to be effective without any part or parts that have been declared invalid.

10. Counterparts.

This Agreement may be executed in counterparts, each of which so executed shall, irrespective of the date of its execution and delivery, be deemed an original, and all such counterparts together shall constitute one and the same instrument.

11. Attorneys' Fees.

If any party files an action or brings any proceeding against the other arising from this Agreement, the prevailing party shall be entitled to recover as an element of its costs of suit, and not as damages, reasonable attorneys' fees and costs to be fixed by the court. A party not entitled to recover its costs shall not recover attorneys' fees. No sum for attorneys' fees shall be included in calculating the amount of a judgment for purposes of deciding whether a party is entitled to its costs or attorneys' fees.

12. Amendment.

No modification, amendment, addition to, or alteration of the terms of this Agreement whether written or verbal, shall be valid unless made in writing, formally approved and executed by the City and the current Owner(s) of the Property, and duly recorded.

13. Authority of Signatories to Agreement.

Each person executing this Agreement represents and warrants that he or she is duly authorized and has legal capacity to execute and deliver this Agreement on behalf of the parties for which execution is made. Each party represents and warrants to the other that the execution of this Agreement and the performance of such party's obligations hereunder have been duly authorized and that the agreement is a valid and legal agreement binding on such party and enforceable in accordance with its terms.

[*SIGNATURES ON FOLLOWING PAGE*]

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date set forth above.

"CITY" / "COVENANTEE"
CITY OF TUSTIN

_____
Dana L. Ogdon, AICP
Assistant Director of Community Development

ATTEST:

_____
Erica N. Yasuda, City Clerk

APPROVED AS TO FORM:

_____
David Kendig, City Attorney

"COVENANTOR"

DIANA GALAZAR-CHU -
_____
Name of Covenantor

_____
Signature

DIR. R.E. DEVELOPMENT
_____
Title

_____
Signature

_____
Title

[Signatures to be Notarized]

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of _____)

On _____ before me, _____
(insert name and title of the officer)

personally appeared _____,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature _____**(Seal)**