Preliminary Water Quality Management Plan (P-WQMP)

Project Name:

Barranca Channel Multi-Use Trail

CIP #371302

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WATER QUALITY MANAGEMENT PLAN

It is unlawful to make any changes or alterations on these plans without written permission from the City of Irvine Builsing & Safety Division. The stamping of this plan and specifications **SHALL NOT** be held to permit or bw an approval of the violation of any provisions of any City Ordinance or State Law as may be found during field inspections.

Approved By:

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BUILDING & SAFETY DIVISION

May 1, 2024

REGISTERED PROFESSIONAL ENGINEER
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No. C65388
CIVIL
STATE OF CALIFORNIA

Water Quality Management Plan (WQMP)
CIP #371302

This Water Quality Management Plan (WQMP) has been prepared for City of Irvine by BKF Engineers. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

This project is a street, road, highway or freeway of 5,000 square feet or more of paved surface or an above ground linear lined drainage project. Above ground linear lined drainage projects typically consist of lined vertical or trapezoidal channels. These projects may result in the creation of more than 10,000 square feet of impervious surface and have BMP implementation constraints similar to streets, roads, highways and freeways and must implement similar practices.

City of Irvine is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

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Filterra Internal Bypass Curb (FTIBC) Configuration Detail

Filterra ® – Vault Configuration Bioretention System Standard Specification

Filterra Bioretention Systems Installation Manual

Filterra Bioretention Systems Vault Owner's Manual

Attachment D. Supporting Documents

City of Irvine – Planning Areas, Land Use, & Zoning Exhibits

NRCS Web Soil Survey

IBC Trail Feasibility Study & Implementation Plan (2021) – Segment 6 Excerpts

IBC Multi-Use Trail Along Barranca Channel Concept Plans

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Section I Discretionary Permit(s) & Water Quality Conditions

Provide discretionary permit and water quality information. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available from the Orange County Stormwater Program (ocwatersheds.com).*

Project Infomation	
CIP / Project No.	CIP #371302
Additional Information/ Comments:	Irvine Business Complex (IBC) multi-use paved trail along Barranca Channel between Barranca Parkway and Jamboree Road
Water Quality Conditions	
Water Quality Conditions (list verbatim)	N/A
Watershed-Based Plan Conditions	
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	There are no WIHMPs approved for this watershed based on OC Watersheds. According to the 2018 303(d) list, the impaired water bodies that are downstream of the Project include: San Diego Creek Reach 1 – Benthic Community Effects, Dichlorodiphenyltrichloroethane (DDT), Indicator Bacteria, Nutrients, Sedimentation/Siltation, Selenium, Toxaphene, Malathion, and Toxicity Upper Newport Bay – Chlordane, Copper, Dichlorodiphenyltrichloroethane (DDT), Indicator Bacteria, Malathion, Nutrients, Polychlorinated Biphenyls (PCBs), Sedimentation/Siltation, and Toxicity Lower Newport Bay – Chlordane, Copper, Dichlorodiphenyltrichloroethane (DDT), Indicator Bacteria, Nutrients, Polychlorinated Biphenyls (PCBs), and Toxicity

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Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the TGD for information that must be included in the project description.*

Description of Proposed Project				
Development Category (Verbatim from WQMP):	Streets, roads, highways, and freeways. This category includes any paved surface that is 5,000 square feet or greater used for the transportation of automobiles, trucks, motorcycles, and other vehicles. (See discussion under **Section 7.II-1.5** relative to public projects).			
Project Area (ft^2): 101,786	SIC Code: N/A			
Narrative Project Description:	The Project is a 1.3-mile IBC multi-use paved trail along Barranca Channel between Barranca Parkway (between Von Karman Ave. and Millikan Ave.) and Jamboree Road (between Main St. and Kelvin Ave.). The trail will be 16.5-feet wide and includes safety fencing and lighting, 2 at grade street crossings (Alton Parkway and McGaw Avenue), at grade railway crossing, and connection with Kelvin Bridge overcrossing. The trail will provide transit for bicycle, pedestrian, and non-motorized users. This trail will also be used as maintenance vehicles access for Orange County Flood Control District. The Project is a "Green Streets Project".			
Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	2.03 ac	86.8%	0.31 ac	13.2%

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Post-Project Conditions	0.00 ac	0.0%	2.34 ac	100.0%
Drainage Patterns/Connections	Flows sheet flow along the paved trail, discharging into the Barranca Channel. The pre-project drainage patterns match post-project condition.			

II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the TGD for guidance.*

Pollutants of Concern

Pollutant	Circle One: E=Expected to be of concern	N=Not Expected to be of concern	Additional Information and Comments
Suspended Solids / Sediment	(E)	N	Potential sources: non-vegetated areas.
Nutrients	E	(N)	The post-project activities likely to occur within the proposed project are not predicted to be a source of nutrients.
Heavy Metals	E	(N)	The post-project activities likely to occur within the proposed project are not predicted to be a source of heavy metals.
Pathogens (Bacteria/Viruses)	(E)	N	Potential sources: animal fecal waste.
Pesticides	E	(N)	The post-project activities likely to occur within the proposed project are not predicted to be a source of pesticides.
Oil and Grease	E	(N)	The post-project activities likely to occur within the proposed project are not predicted to be a source of oil and grease.
Toxic Organic Compounds	E	(N)	The post-project activities likely to occur within the proposed project are not predicted to be a source of toxic organic compounds.

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Trash and Debris	E	N	The post-project likely to occur within the proposed project are not predicted to be a source of trash and debris.

- **Suspended Solids / Sediment:** consist of soils or other surficial materials that are eroded and then transported or deposited by wind, water, or gravity. Excessive sedimentation can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth. Sediments in runoff also transport other pollutants that adhere to them, including trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and phosphorus. The largest source of suspended solids / sediment is typically erosion from disturbed soils.
- **Nutrients:** includes the macro-nutrients nitrogen and phosphorus. They commonly exist in the form of mineral salts dissolved or suspended in water and as particulate organic matter transported by storm water. Excessive discharge of nutrients to water bodies and streams can cause eutrophication, including excessive aquatic algae and plant growth, loss of dissolved oxygen, release of toxins in sediment, and significant swings in hydrogen ion concentration (pH). Primary sources of nutrients in urban runoff are fertilizers, trash and debris, and eroded soils. Urban areas with improperly managed landscapes can be substantial sources.
- **Metals:** includes certain metals that can be toxic to aquatic life if concentrations become high enough to stress natural processes. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and are also raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. Copper and zinc are typically associated with building materials, including galvanized metal and ornamental copper, and automotive products, including tires and brake pads. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns regarding the potential for release of metals to the environment have already led to restricted metal usage in certain applications, for example lead additives in gasoline. The primary source of metals in urban storm water is typically commercially available metal products and automobiles.
- **Microbial Pathogens (Bacteria and Viruses):** include bacteria and viruses, which are ubiquitous microorganisms that thrive under a range of environmental conditions. Water containing excessive pathogenic bacteria and viruses can create a harmful environment for humans and aquatic life. The source of pathogenic bacteria and viruses is typically the transport of animal or human fecal wastes from the watershed, but pathogenic organisms do occur in the natural environment.
- **Oil and Grease:** are characterized as high-molecular weight organic compounds. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality. Introduction of these pollutants to water bodies may occur due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.

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- **Toxic Organic Compounds:** include organic compounds (pesticides, solvents, hydrocarbons) which at toxic concentrations constitute a hazard to humans and aquatic organisms. Storm water coming into contact with organic compounds can transport excessive levels organics to receiving waters. Dirt, grease, and grime retained in cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life. Sources of organic compounds include landscape maintenance areas, vehicle maintenance areas, waste handling areas, and potentially most other urban areas.
- **Trash and Debris:** includes trash, such as paper, plastic, and various waste materials, that can typically be found throughout the urban landscape, and debris which includes waste products of natural origin which are not naturally discharged to water bodies such as landscaping waste, woody debris, etc. The presence of trash and debris may have a significant impact on the recreational value of a water body and upon the health of aquatic habitat.

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II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are determined to be potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the TGD.*

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the TGD.*

According to "Section 2.2.3.1 Determining HCOCs in North Orange County" of the 2013 North OC TGD, Hydrologic Conditions of Concern (HCOCs) 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-year, 24-hour storm exceeds the pre-development runoff volume for the 2-year, 24-hour storm by more than 5 percent

OR

- Time of concentration of post-development runoff for the 2-year, 24-hour storm event exceeds the time of concentration of the pre-development condition for the 2-year, 24-hour storm event by more than 5 percent

Figure XIV.3 of the 2013 North OC TGD, entitled "Susceptibility Analysis Newport Bay-Newport Coastal Streams", identifies the susceptibility to hydromodification for reaches downstream of the Project. The Project discharges to San Diego Creek Reach 1, which includes a non-engineered, earthen (unstable) segment that is susceptible to hydromodification.

HCOCs exist for the Project, however, they are not considered. The Project is a proposed multi-use paved trail with limited right-of-way. Based on the Project, the Green Street Standards are applied and hydromodification is not considered.

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II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the TGD.*

The 16.5-feet wide trail slopes at 2% towards the Barranca Channel. Flows will overland across the path and down the channel side slopes into Barranca Channel, which successively discharges to San Diego Creek Reach 1 and Newport Bay.

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Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the TGD.*

Planning Area / Community Name	PA36 Irvine Business Complex (IBC) (see **Attachment D**)
Location/Address	1.3-mile trail along Barranca Channel between Barranca Parkway and Jamboree Road (see **Figure 1**)
	City of Irvine, Orange County, California
Land Use	"Urban & Industrial" per City of Irvine General Plan (see **Attachment D**)
Zoning	"IBC Multi-Use" and "IBC Residential" per City of Irvine Zoning Map (see **Attachment D**)
Acreage	2.34 acres
Predominant Soil Type	Based on the NRCS Web Soil Survey, the Project is composed of Hydrologic Soil Group C, see **Attachment D**. Figure XVI-2a of the 2013 North OC TGD, entitled "NRCS Hydrologic Soil Groups", shows the Project being in an area classified as Hydrologic Soil Groups C and D.

III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. Refer to Section 2.7.1 in the TGD.

Ownership of Land Adjacent to Right of Ways	The Barranca Channel and maintenance road where the Project is located is owned and operated by the Orange County Flood Control District (OCFCD) and Orange County Public Works Department (OCPW).
Topography/Longitudinal Slope	The Project site is relatively flat. The proposed trail has a longitudinal slope of less than 0.1% along the 1.3-mile length.
Grade differential between road surface and storm drain system.	N/A

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Soil Type, Geology, and Infiltration Properties	Preliminary geotechnical report is pending and currently not available. The soil is Hydrologic Soil Group C based on NRCS Web Soil Survey, consisting of Chino silty clay loam, Chino silty clay loam, and Omni clay.

Site Characteristics (continued)	
Hydrogeologic (Groundwater) Conditions	Figure XVI-2e of the 2013 North OC TGD, entitled "North Orange County Mapped Shallow Groundwater", shows the groundwater is less than or equal to 5 feet below existing ground.
Geotechnical Conditions (relevant to infiltration)	The Project site includes shallow ground water and Hydrologic Soil Group C. The Project is also situated in the "Approximate Selenium Contamination Area" based on Figure XVI-2f of the 2013 North OC TGD, entitled "North Orange County Groundwater Protection Areas". Infiltration is not feasible for the site.
Maintenance Access Considerations	There is an existing maintenance road along Barranca Channel.
Utility and Infrastructure Information	Project site runoff discharges into Barranca Channel, which is an OCFCD reinforced trapezoidal channel (16-ft base width, 12-ft height, 1.5:1 side slopes).

III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the TGD.*

Receiving Waters	The Project is within the San Diego Creek Watershed and the receiving waters include: San Diego Creek Reach 1, Upper Newport Bay and Lower Newport Bay.
303(d) Listed Impairments	According to the 2018 303(d) list, the impaired water bodies that are downstream of the Project include: • San Diego Creek Reach 1 – Benthic Community Effects, Dichlorodiphenyltrichloroethane (DDT), Indicator Bacteria, Nutrients, Sedimentation/Siltation, Selenium, Toxaphene, Malathion, and Toxicity • Upper Newport Bay – Chlordane, Copper, Dichlorodiphenyltrichloroethane (DDT), Indicator Bacteria,

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	Malathion, Nutrients, Polychlorinated Biphenyls (PCBs), Sedimentation/Siltation, and Toxicity • Lower Newport Bay – Chlordane, Copper, Dichlorodiphenyltrichloroethane (DDT), Indicator Bacteria, Nutrients, Polychlorinated Biphenyls (PCBs), and Toxicity
Applicable TMDLs	TMDLs: • San Diego Creek Reach 1 – DDT, Nutrients, Sedimentation/Siltation, Toxaphene • Upper Newport Bay – Chlordane, DDT, Indicator Bacteria, Nutrients, PCBs, Sedimentation/Siltation • Lower Newport Bay – Chlordane, DDT, Indicator Bacteria, Nutrients, PCBs
Pollutants of Concern for the Project	• Suspended Solids / Sediment • Pathogens (Bacteria/Viruses)
Environmentally Sensitive and Special Biological Significant Areas	The project does not reside within 200 feet of an adjacent Environmentally Sensitive Area (ESA). Also, Special Biologically Significant Areas do not exist within the City of Irvine.

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Section IV Best Management Practices (BMPs)

IV.1 Project Performance Criteria

The Project will incorporate United States Environmental Protection Agency (USEPA) guidance, "Managing Wet Weather with Green Infrastructure: Green Streets" as described in the **Model WQMP Appendix B,** in a manner consistent with the maximum extent practicable (MEP) standard. This approach includes:

- Selecting LID BMPs that integrate with both the opportunities and constraints of the project site and to attempt to address pollutants of concern and HCOCs,
- Developing innovative stormwater management configurations integrating "green" with "grey" infrastructure,
- Sizing BMPs opportunistically to provide stormwater pollution reduction to the MEP, accounting for the many competing considerations in right of ways.

Describe project performance criteria. This includes:

- If applicable, determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP*
- The standard LID hierarchy described in Section 7.II-2.4.3 of the Model WQMP is not applicable to this project and is replaced by considering all feasible LID approaches listed in the Green Streets manual.
- Calculate the target LID design storm capture volume for the project. The target is that Priority Projects infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume) *to Section 7.II-2.4.3 of the Model WQMP*

Project Performance Criteria (continued)	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	The Project will incorporate USEPA guidance, "Managing Wet Weather with Green Infrastructure: Green Streets" in a manner consistent with the Maximum Extent Practicable (MEP) standard. Following the North OC Model WQMP, assessment of potential impacts is based on: • Increases in runoff volume • Decreases in infiltration • Changes in time of concentration • Potential for increases in post-development downstream erosion

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	• Potential for adverse downstream impacts on physical structure, aquatic, and riparian habitat A project does not have an HCOC if either of the following conditions is met: • The volumes and time of concentration of stormwater runoff for the post-development condition do not significantly exceed those of the pre-development condition for a two-year frequency storm event (a difference of five percent or less is considered insignificant). • The site infiltrates at least the runoff from a two-year storm event. The Project follows the Green Street Standards and hydromodification is not considered.
Calculate target LID design storm capture volume for Project (Section 7.II-2.4.3 from MWQMP).	Design Capture Volume (DCV): DCV = C × d × A × 43560 ft2/ac × 1/12 in/ft C = Runoff Coefficient = (0.75 × impervious + 0.15) d = storm depth (inches) A = tributary area (acres) Design Flowrate (Q): Q = C× i × A C = Runoff Coefficient = (0.75 × impervious + 0.15) i = rainfall intensity (inches/hour) A = tributary area (acres)

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A summary of DCV and Q calculations for the five DMAs along Alton Parkway are tabulated below. See Section IV.2 of this P-WQMP.

DMA ID	Area (ac)	Imp %	C	DCV	Q
DMA 1	0.65	100%	0.90	1,595	0.15
DMA 2	0.57	100%	0.90	1,393	0.13
DMA 3	0.65	100%	0.90	1,594	0.15
DMA 4	0.24	100%	0.90	579	0.06
DMA 5	0.32	100%	0.90	772	0.07
∑	2.43	----	----	5,933	0.56

Calculations are included in **Attachment B**.

IV.2 Site Design & Drainage Plan

Describe site design and drainage plan including

- A narrative of site design practices utilized or rationale for not using practices.
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP.
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP plot plan.
- A listing of GIS coordinates for LID BMPs (unless not required by local jurisdiction).

Refer to Section 2.4.2 in the TGD.

Site Design

The 1.3-mile IBC multi-use paved trail is along Barranca Channel between Barranca Parkway and Jamboree Road. The trail proposes 2.34 acres of impervious area which will require treatment. Due to the limited right-of-way, to offset the impervious increase from the proposed trail, five flow-based BMPs will be constructed along Alton Parkway between Von Karman Avenue and Millikan Avenue to treat runoff from the existing roadway for a total impervious area of 2.43 acres.

DMAs

The five DMAs situated along Alton Parkway include the roadway and are 100% impervious. These DMAs each surface drain via gutter flow to their respective LID BMPs, refer to **Figure 3**.

BMPs

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The proposed LID BMPs will be Contech Filterra Internal Bypass Curb (FTIBC) configurations. Filterra units provide high flow treatment with a small footprint.

Stormwater runoff enters the Filterra bioretention system through a curb-inlet opening or pipe and flows through a specially designed filter media mixture contained in a landscaped concrete container. The filter media captures and immobilizes pollutants; those pollutants are then decomposed, volatilized and incorporated into the biomass of the Filterra system's micro/macro fauna and flora. Stormwater runoff flows through the media and into an underdrain system at the bottom of the container, where the treated water is discharged.

A summary of the five LID BMPs treating runoff for the Project is tabulated below. BMP locations shown on **Figure 3**.

BMP ID	BMP Type / Model	Description
BMP 1	Filterra 12x6 (FTIBC1206)	Treats 0.65-acres of roadway runoff from DMA 1
BMP 2	Filterra 12x6 (FTIBC1206)	Treats 0.57-acres of roadway runoff from DMA 2
BMP 3	Filterra 12x6 (FTIBC1206)	Treats 0.65-acres of roadway runoff from DMA 3
BMP 4	Filterra 6x6 (FTIBC0606)	Treats 0.24-acres of roadway runoff from DMA 4
BMP 5	Filterra 6x6 (FTIBC0606)	Treats 0.32-acres of roadway runoff from DMA 5

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IV.3 LID BMP Selection & Project Conformance Analysis

IV.3.1 Green Street / Linear Project BMPs

The following is a list of potential BMPs that may be applicable. Check the BMPs included. *Refer to 2.7.2 in the TGD.*

Name	Included?
Street trees (canopy interception)	☐
Stormwater Curb Extensions / Stormwater Planters	☐
Bioretention Areas	☐
Permeable Pavement	☐
Permeable Friction Course Overlays	☐
Vegetated Swales (compost amended were possible)	☐
Filter strips (amended road shoulder)	☐
Proprietary Biotreatment	☒
Infiltration Trench	☐
Cartridge Media Filters	☐
WSDOT Media Filter Drains	☐
Other:	☐
Other:	☐
Other:	☐

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Describe how the selected BMPs conform to the North Orange County Permit requirement to implement Green Streets in a manner consistent with the MEP standard. Show calculations below to demonstrate how much of the LID Design Capture Volume can be met with the selected BMPs. Where the BMPs cannot be designed to capture the entire DCV, provide a narrative explanation(s) of constraining factors that prevented full capture from being achieved.

The proposed multi-use paved trail is constrained with limited right-of-way, which prevents the construction of trees, bioretention areas, vegetated swales, filter strips, and infiltration trenches. Therefore, Filterra bioretention systems will treat runoff from existing impervious areas constructed along Alton Parkway between Von Karman Avenue and Millikan Avenue. These Filterra systems are flow-based, treating the Design Flowrate (Q).

The impervious area of the existing roadway treated by Filterra systems will exceed the Project's total proposed impervious area of the multi-use trail.

For each DMA, the impervious area is equated to a minimum required area of Filterra media based on the following:

Min. Req. Area of Filterra Media = WQ Design Flowrate (Q) / Filterra Biofiltration Media Flowrate

WQ Design Flowrate (Q) = C× i × A (See Section IV.1 of this P-WQMP.)

Filterra Biofiltration Media Flowrate = 100 in/hr = 0.0023148 ft/s

DMA 1: Min. Req. Area of Filterra Media = 0.15 cfs / 0.0023148 ft/s = 65 sq ft

- ✓ Use Filterra 12x6 (FTIBC1206), Media Area = 72 sq ft > 65 sq ft

DMA 2: Min. Req. Area of Filterra Media = 0.13 cfs / 0.0023148 ft/s = 56 sq ft

- ✓ Use Filterra 12x6 (FTIBC1206), Media Area = 72 sq ft > 56 sq ft

DMA 3: Min. Req. Area of Filterra Media = 0.15 cfs / 0.0023148 ft/s = 65 sq ft

- ✓ Use Filterra 12x6 (FTIBC1206), Media Area = 72 sq ft > 65 sq ft

DMA 4: Min. Req. Area of Filterra Media = 0.06 cfs / 0.0023148 ft/s = 26 sq ft

- ✓ Use Filterra 6x6 (FTIBC0606), Media Area = 36 sq ft > 26 sq ft

DMA 5: Min. Req. Area of Filterra Media = 0.07 cfs / 0.0023148 ft/s = 30 sq ft

- ✓ Use Filterra 6x6 (FTIBC0606), Media Area = 36 sq ft > 30 sq ft

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IV.3.2 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 TGD*. Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval.

Hydromodification Control BMPs	
BMP Name	**BMP Description**
N/A	N/A

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IV.3.3 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

Non-Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Right-of-Way Landscape Management	☐	☒	No landscape.
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste activities.
N6	Local Industrial Permit Compliance	☐	☒	No fuel dispensing / industrial waste areas.
N7	Spill Contingency Plan	☐	☒	No hazardous waste activities.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous waste activities.
N10	Uniform Fire Code Implementation	☐	☒	Not applicable for Project activities.
N11	Right-of-Way Litter Control	☐	☒	No significant litter sources.
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks.
N14	Right-of-Way Catch Basin Inspection	☒	☐	(For Alton Parkway)
N15	Street Sweeping	☒	☐	(For Alton Parkway)
N16	Retail Gasoline Outlets	☐	☐	No gasoline outlets.

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N1 Education for Property Owners, Tenants and Occupants

Practical and informational materials will be provided to the City/County employees and contractors that operate within Barranca Channel. These materials provided by the City will cover general good housekeeping practices to promote protection of stormwater quality.

N2 Activity Restrictions

Activities must be compliant with the water quality ordinance set forth by the County.

- The following activities are not permitted within Barranca Channel: No washing down paved trail surfaces where non-stormwater will discharge to the Channel.
- The following activities are not permitted along Alton Parkway: No dumping of waste materials into Filterra units.

N4 BMP Maintenance

The Project's WQMP will identify responsibility for implementation of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities.

N12 Employee Training

Education program applicable to future employees of the City/County. All employees will be trained and taught proper management techniques. Brochures and education materials provided to employees on an annual basis.

N14 (SC-74) Right-of-Way Catch Basin Inspection

City of Irvine to have all storm drain facilities (along Alton Parkway, location of proposed Filterra systems) inspected, cleaned, and maintained annually and after rain events. Cleaning should occur in the later summer/early fall prior to the start of the rainy season. Records should be kept to document annual maintenance.

N15 (SC-70) Street Sweeping

City of Irvine performs street sweeping on a weekly basis.

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BUILDING & SAFETY DIVISION

IV.3.4 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor storage.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	No trash/waste storage.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☐	☒	No landscape, no irrigation.
S5	Protect slopes and channels and provide energy dissipation	☒	☐	
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	Not applicable for Project.
S6	Dock areas	☐	☒	No dock areas.
S7	Maintenance bays	☐	☒	No maintenance bays.
S8	Vehicle wash areas	☐	☒	No vehicle wash areas.
S9	Outdoor processing areas	☐	☒	No outdoor processing areas.
S10	Equipment wash areas	☐	☒	No equipment wash areas.
S11	Fueling areas	☐	☒	No fueling areas.
S12	Hillside landscaping	☐	☒	No hillside landscaping.
S13	Wash water control for food preparation areas	☐	☒	No food preparation.
S14	Community car wash racks	☐	☒	No car wash racks.

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S1 (SD-13) Provide Storm Drain System Stenciling and Signage

Storm drain stenciling and signage to be installed at proposed Filterra units along Alton Parkway between Von Karman Avenue and Millikan Avenue.

Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain catch basins will include highly visible source control messages/graphics which includes prohibitive language (such as: NO DUMPING - DRAINS TO OCEAN) and/or graphical icons to prevent illegal dumping. Maintain legibility of stencils, and preform re-stenciling as necessary.

S5 Protect Slopes and Channels and Provide Energy Dissipation

The Project's proposed multi-use trail drains offsite to existing Barranca Channel. This existing Channel is lined and the potential to increase erosion is minimal.

Projects will protect slopes and channels as described in Section 3.4 of the North Orange County Technical Guidance Document.

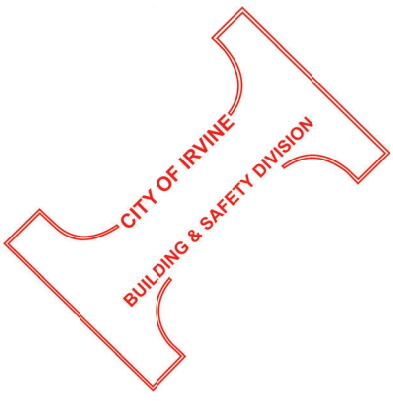
Project plans should include site design BMPs to decrease erosion potential of slopes and/or channels. The following design principles should be considered and implemented where determined applicable by the Permittee:

1. Convey runoff safely from the tops of slopes.
2. Avoid disturbing steep or unstable slopes.
3. Avoid disturbing natural channels.
4. Vegetate slopes with native or drought tolerant vegetation.
5. Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems, unless infiltration would cause geotechnical hazards.
6. Other design principles which are comparable and equally effective.

These practices should be implemented, as feasible, consistent with local codes and ordinances. Projects involving an alteration to bed, bank, or channel of a Water of the U.S. may require approval of regulatory agencies with jurisdiction over water bodies, (e.g., the U.S. Army Corps of Engineers, the Regional Boards and the California Department of Fish and Wildlife).

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Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

BMP Inspection/Maintenance

BMP	Reponsible Department / Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N1 Education for Property Owners, Tenants and Occupants	City of Irvine	Provide practical and informational materials to owners.	Annually
N2 Activity Restrictions	City of Irvine	Enforce compliance with County water quality ordinance – no washing paved trail and no waste dumping to Filterra units	Annually / Ongoing
N4 BMP Maintenance	City of Irvine	Maintain facility (Filterra) operation efficiency through trash/debris removal and vegetation upkeep	Semi-Annually
N12 Employee Training	City of Irvine	Offer educational and training resources to employees.	Annually
N14 Right-of-Way Catch Basin Inspection	City of Irvine	Inspect inlet facilities (Filterra) for structural integrity and clean/sweep area before wet season.	Annually and After Major Storms

CITY OF IRVINE
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N15 Street Sweeping	City of Irvine	Conduct mechanical sweeping schedule to remove trash/debris. Avoid wet weather sweeping if feasible.	Monthly
S1 Provide Storm Drain System Stenciling and Signage	City of Irvine	Inspect stencilling and signage to ensure message is visible and not damaged. Re-stencil as necessary.	Annually
S5 Protect Slopes and Channels and Provide Energy Dissipation	City of Irvine	Confirm paved path is not likely to increase channel side slope erosion.	Annually / Ongoing
Filterra Bioretention System	City of Irvine	Inspect and clean filtration system. Remove trash/debris and replace mulch before wet season. Verify infiltration rate of biofiltration media and amend/replace soil media as necessary.	Semi-Annually and After Major Storms

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Section VI Site Plan & Drainage Plan

VI.1 Site Plan & Drainage Plane

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Drainage connections
- BMP details

The following figures and documents are included:

- Refer to **Figure 1** for Project Vicinity Map
- Refer to **Figure 2** for Project Site Map
- Refer to **Figure 3** for Project BMP Facilities Map
- Refer to **Attachment C** for details of Filterra systems
- Refer to **Attachment D** for Project IBC Multi-Use Trail Concept Plans

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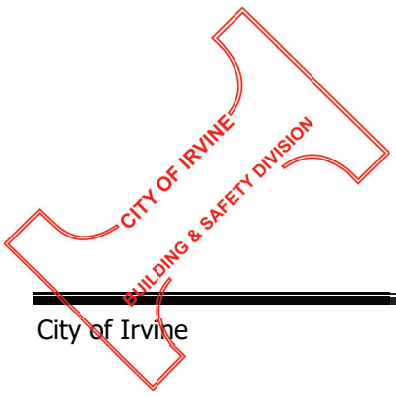
Section VII Educational Materials

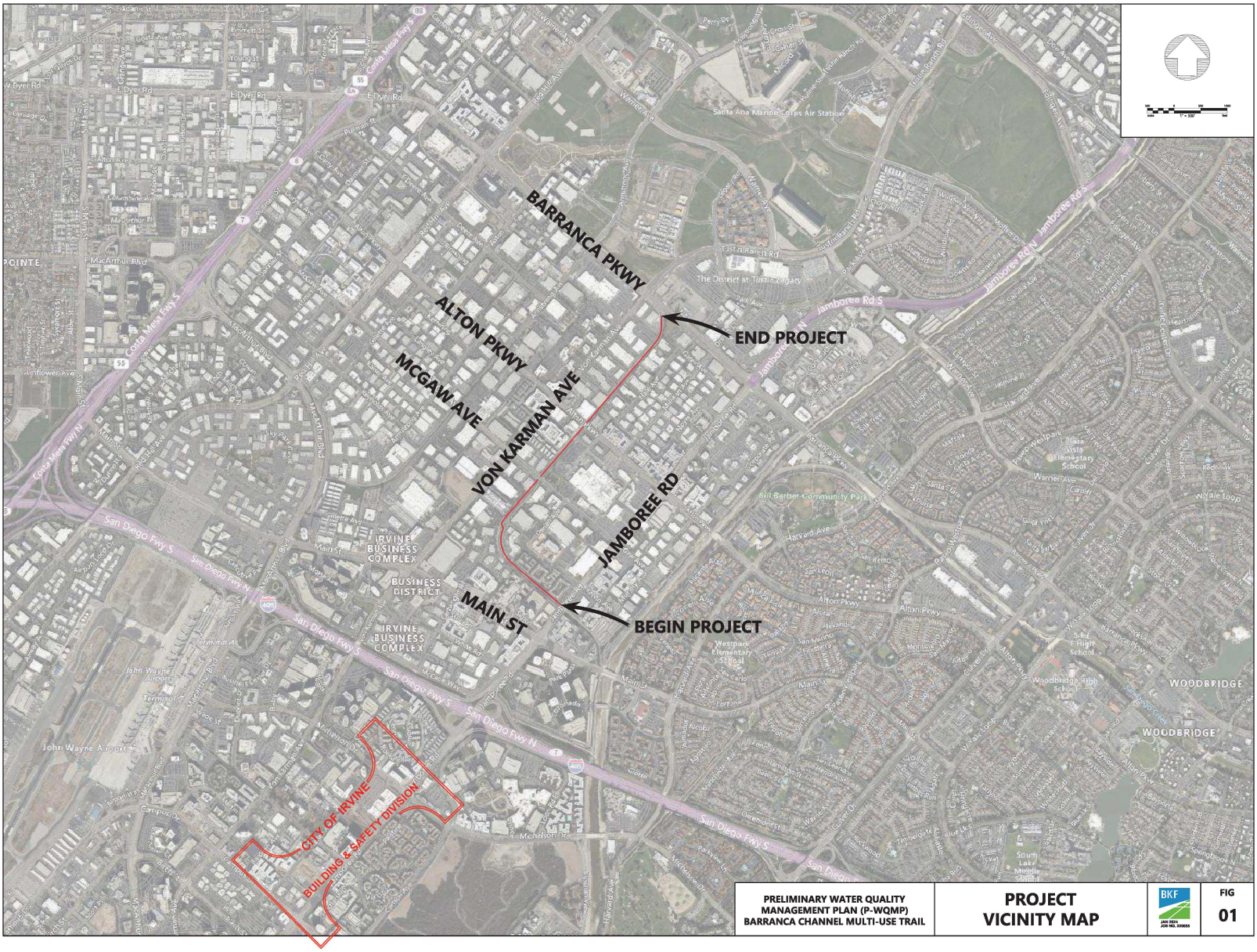
Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☐
Household Tips	☐	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐	CASQA SC-70 – Road and Street Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	CASQA SC-74 – Drainage System Maintenance	☒
Recycle at Your Local Used Oil Collection Center (South County)	☐	CASQA SD-13 – Storm Drain Signage	☒
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☐		☐
Sewer Spill	☐		☐
Tips for the Home Improvement Projects	☐		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☐		☐
Tips for Pet Care	☐		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☐		☐

Refer to **Attachment A** for educational materials.

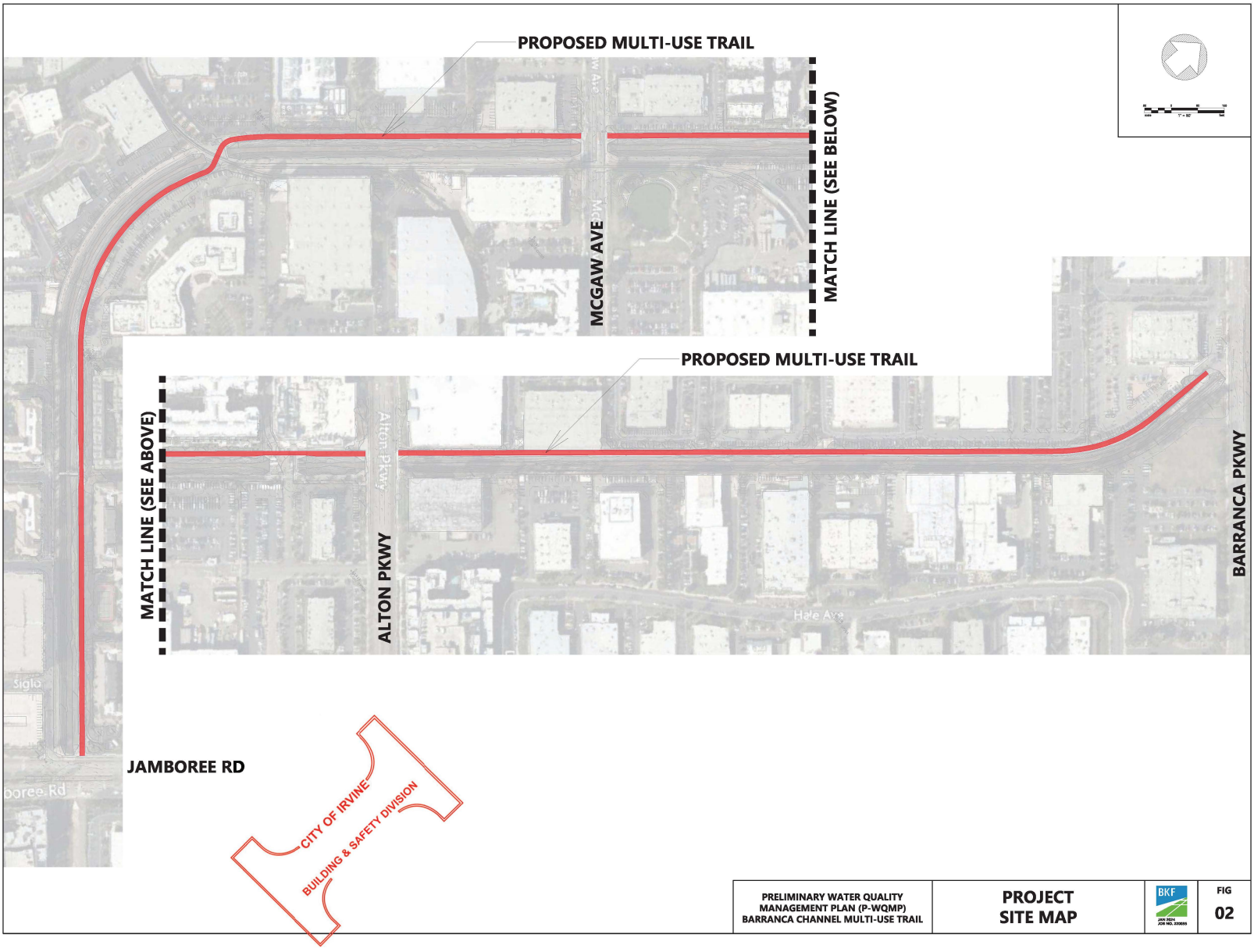
CITY OF IRVINE
BUILDING & SAFETY DIVISION

Figures

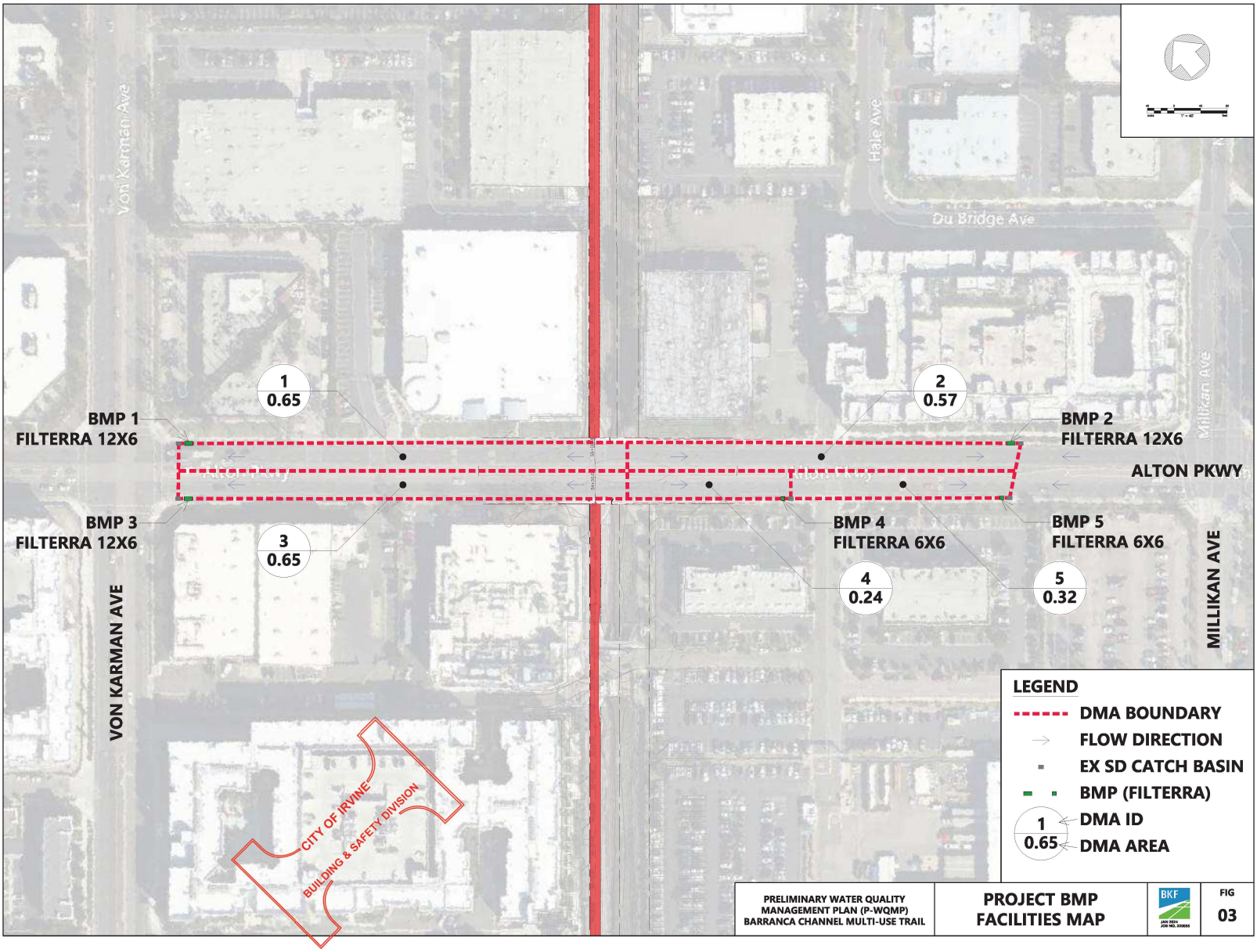




PRELIMINARY WATER QUALITY MANAGEMENT PLAN (P-WQMP) BARRANCA CHANNEL MULTI-USE TRAIL	PROJECT VICINITY MAP	BKF JAN 2024 JOB NO. 220085	FIG 01



PRELIMINARY WATER QUALITY MANAGEMENT PLAN (P-WQMP) BARRANCA CHANNEL MULTI-USE TRAIL	PROJECT SITE MAP	BKF JAN 2024 JOB NO. 330695	FIG 02



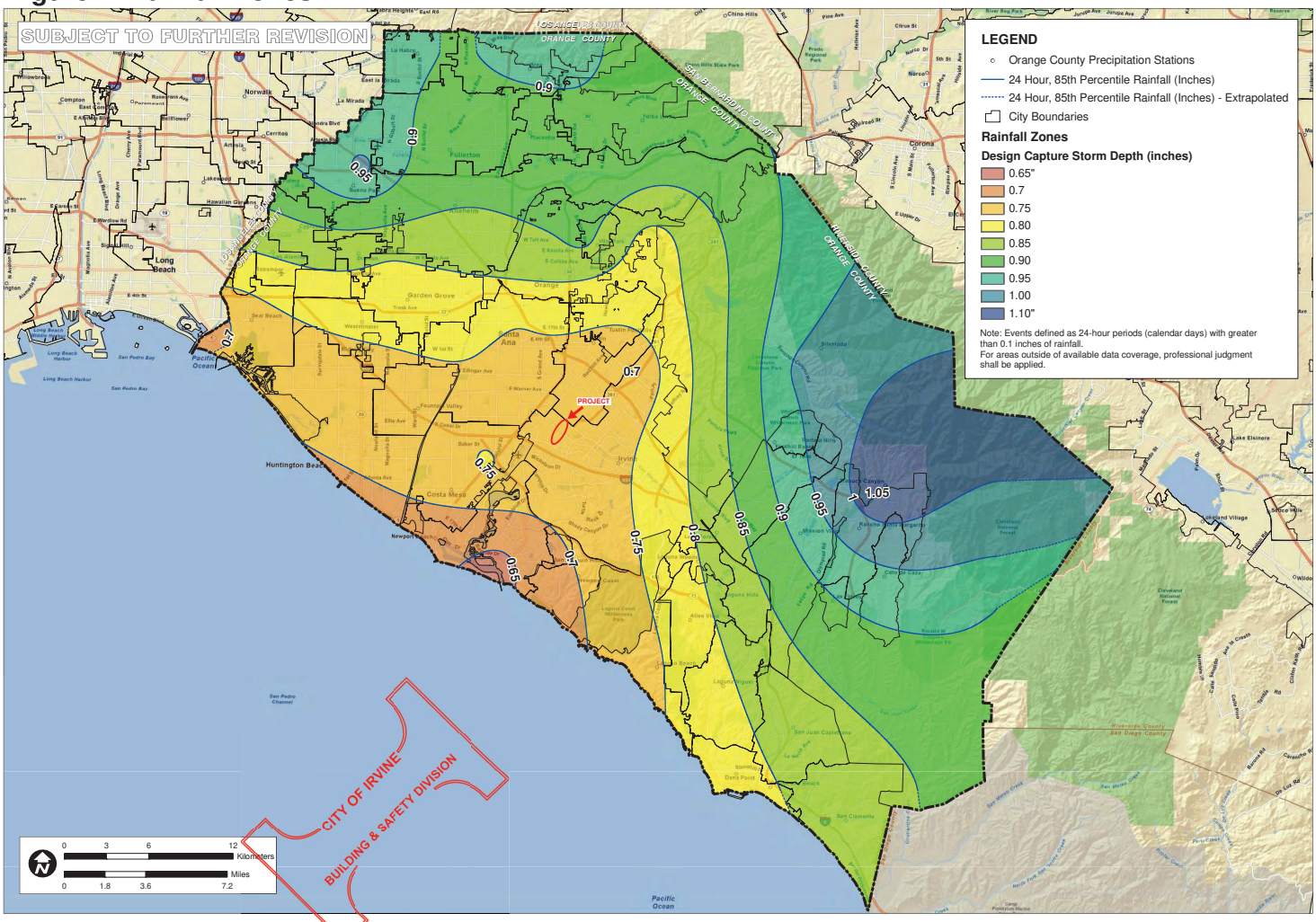
PRELIMINARY WATER QUALITY MANAGEMENT PLAN (P-WQMP)
BARRANCA CHANNEL MULTI-USE TRAIL

PROJECT BMP FACILITIES MAP

BKF

FIG 03

Figure 4. Rainfall Zones



RAINFALL ZONES

ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT

ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/27/10
JOB NO.	8558-E

PACE Advanced Water Engineering

FIGURE XVI-1

P:\8500\8558-E-GIS\Mxd's\Re port\huffman\fig xvi-1 rain fall zones_20100215.mxd

Figure 5. NRCS Soil Groups

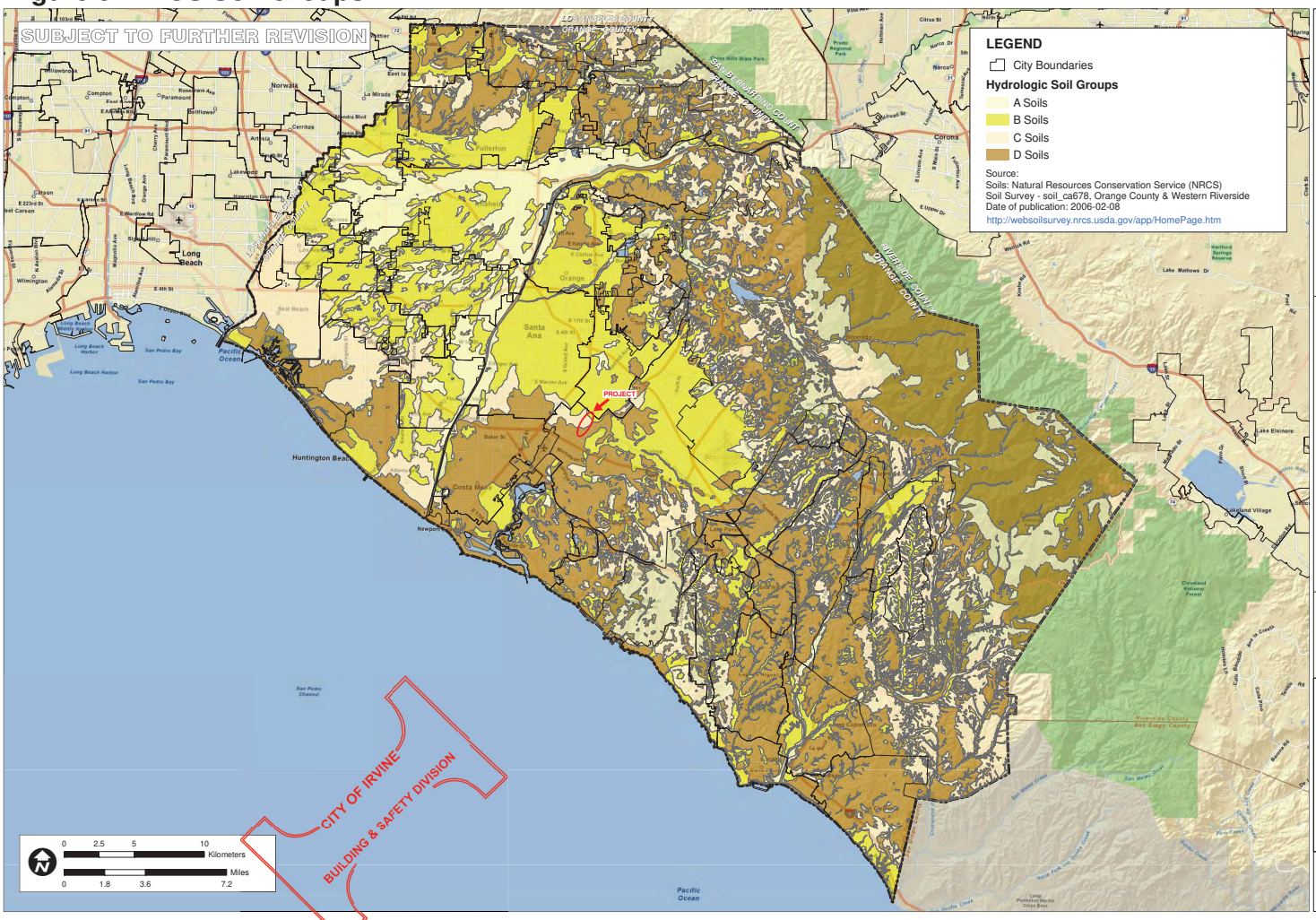


Figure 6. NRCS Type D

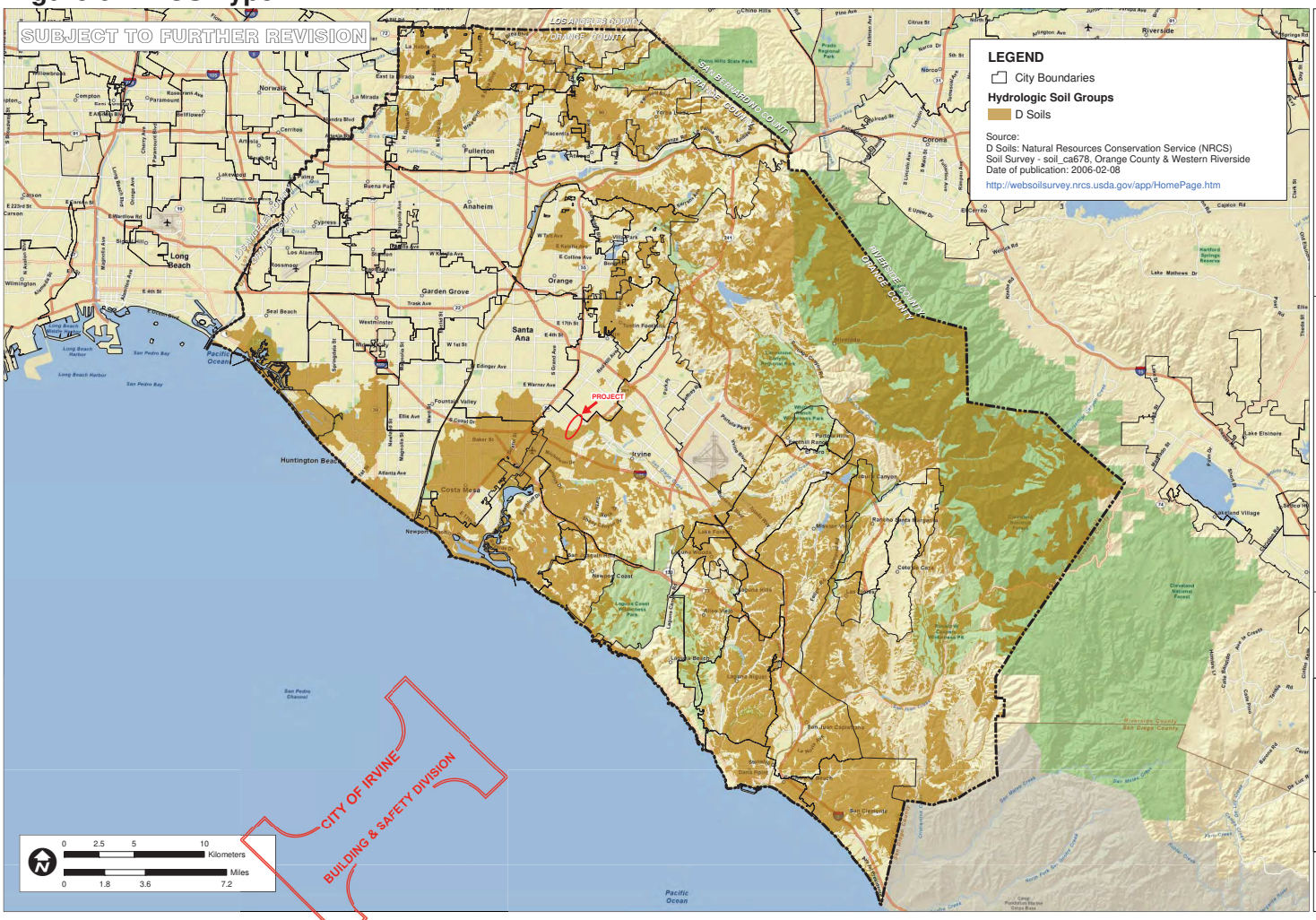


Figure 7. Geology Survey Potential Landslide

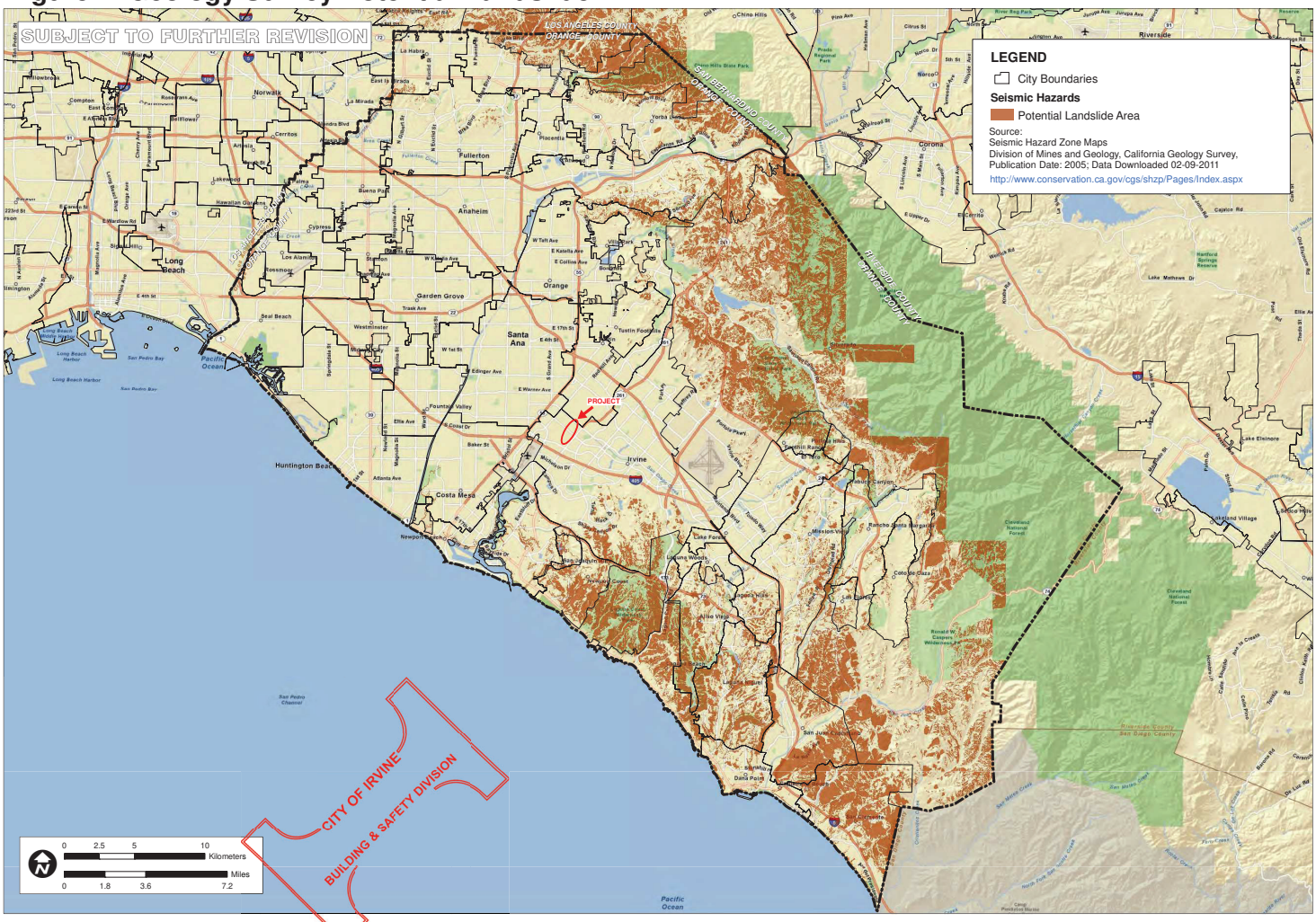


Figure 8. North OC First Groundwater

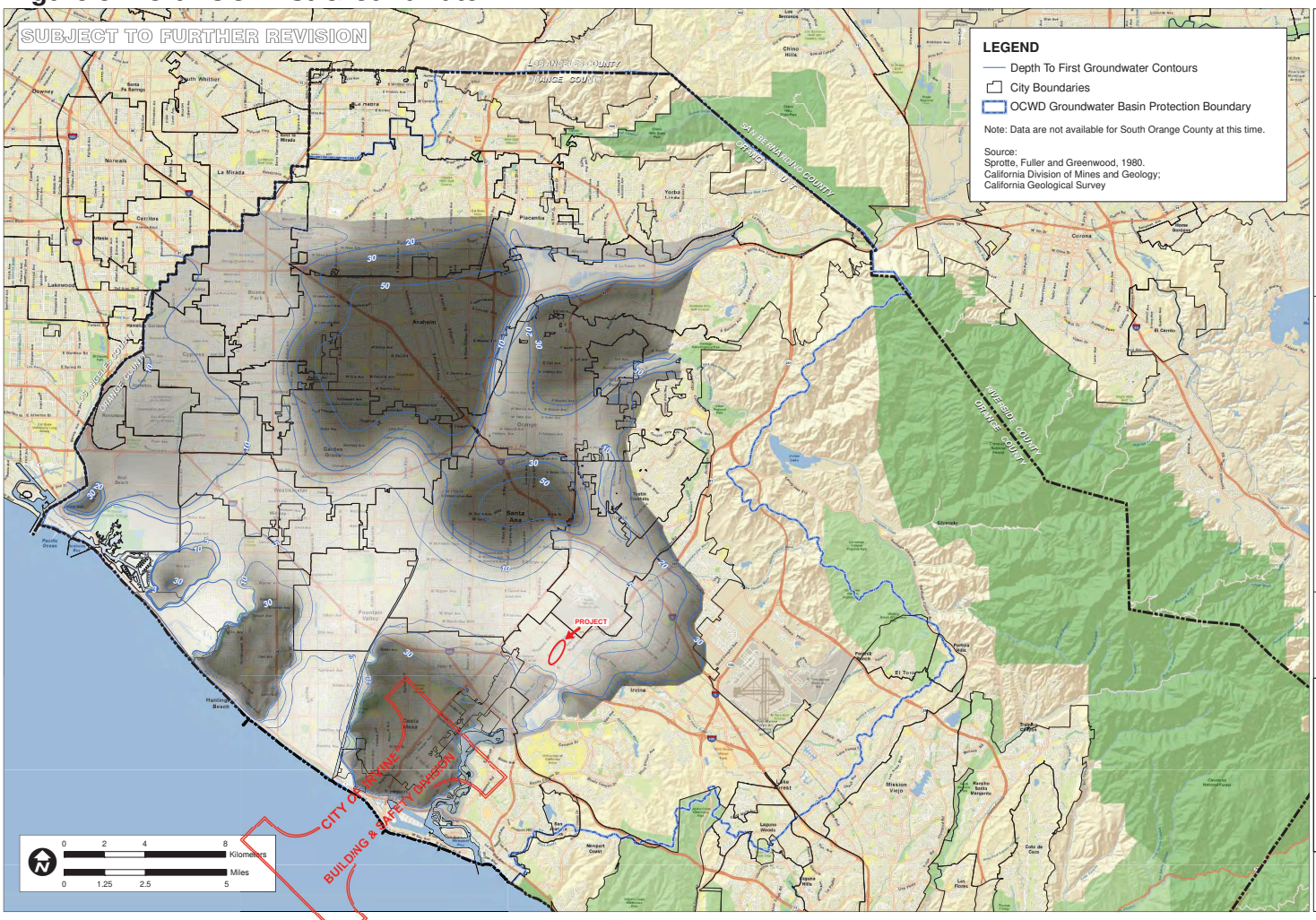


Figure 9. North OC Shallow Groundwater

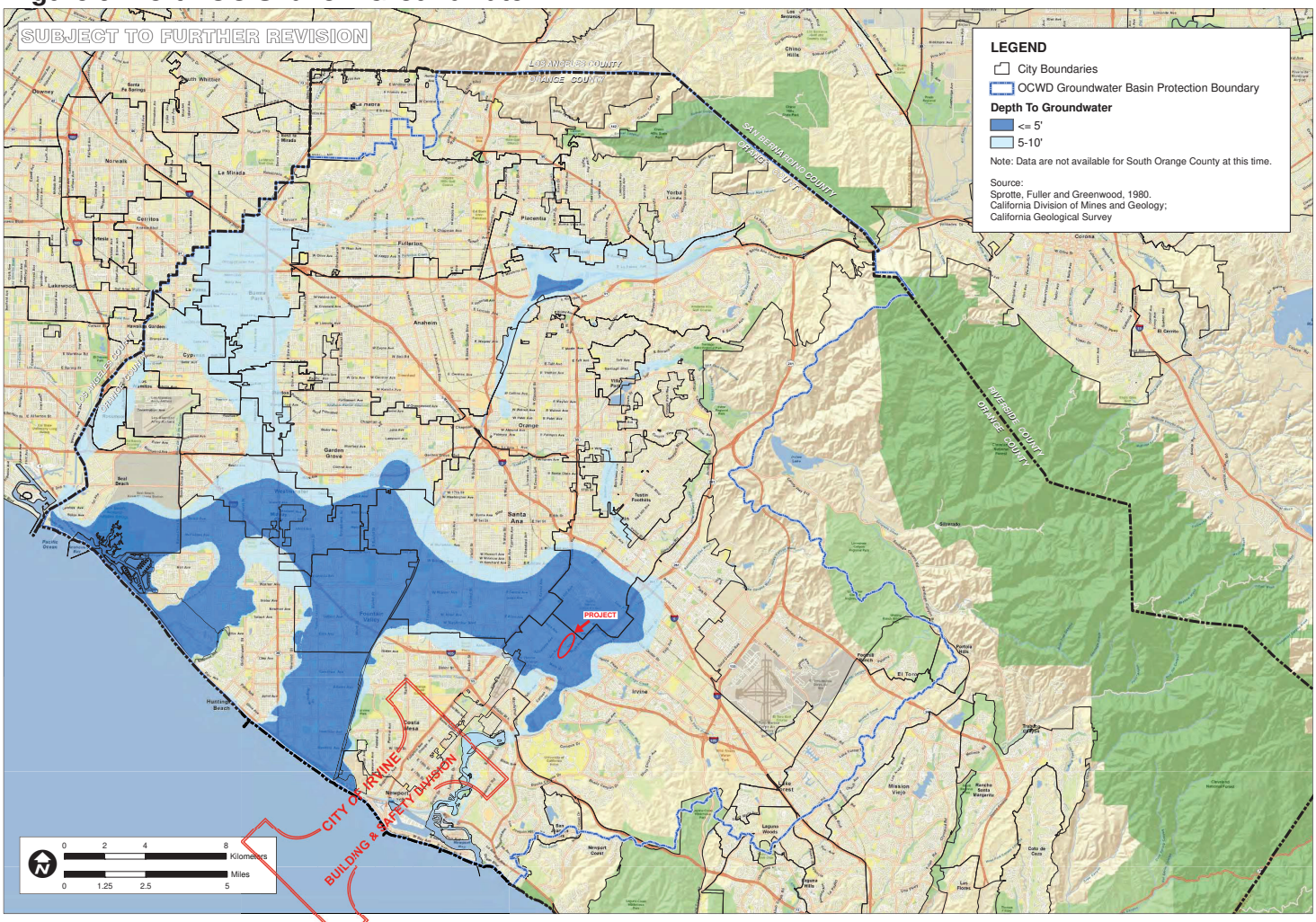
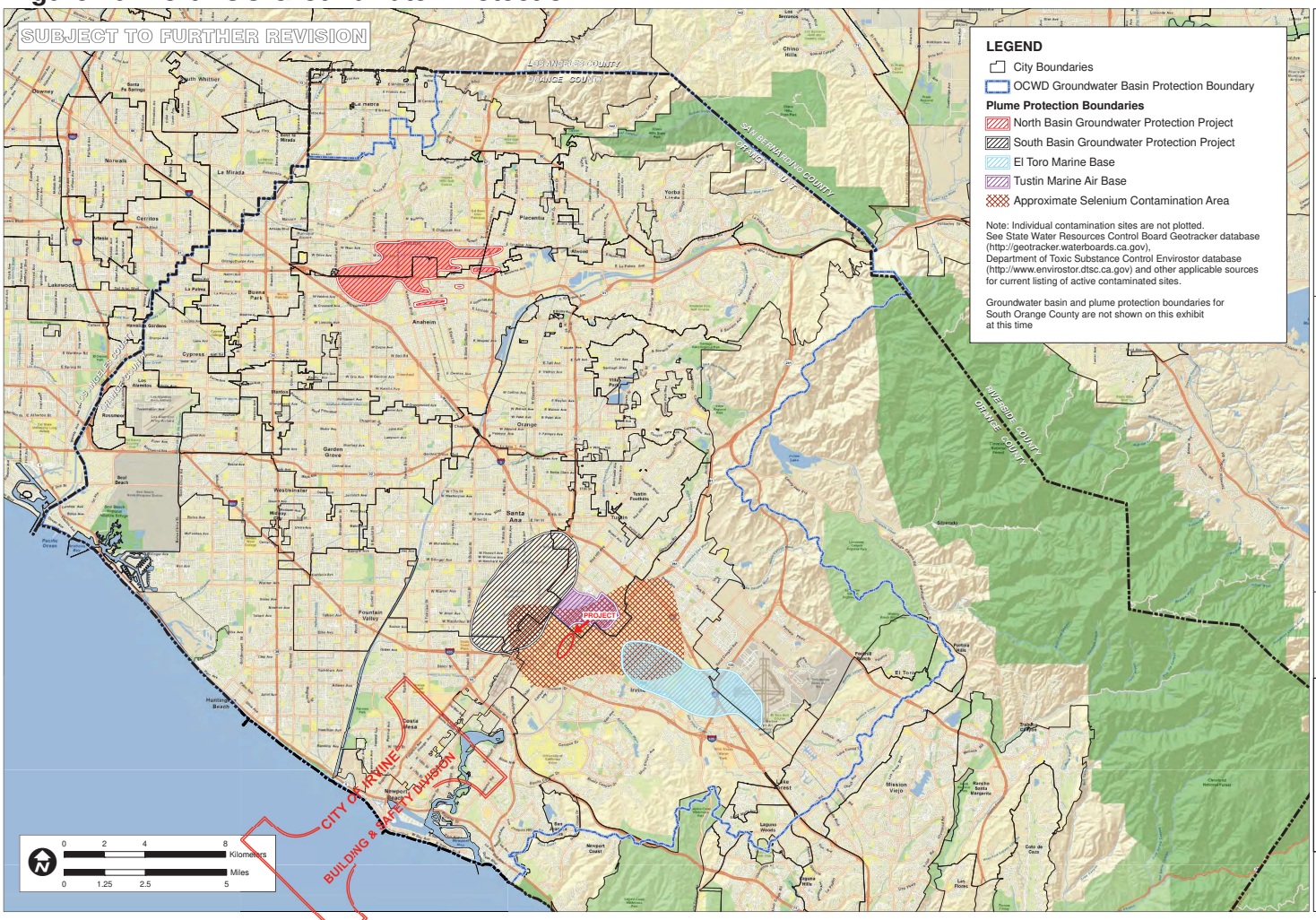


Figure 10. North OC Groundwater Protection



NORTH ORANGE COUNTY GROUNDWATER PROTECTION AREAS

ORANGE COUNTY INFILTRATION STUDY

ORANGE CO. CA

PACE Advanced Water Engineering

FIGURE XVI-2f

Figure 11. Infiltration Analysis

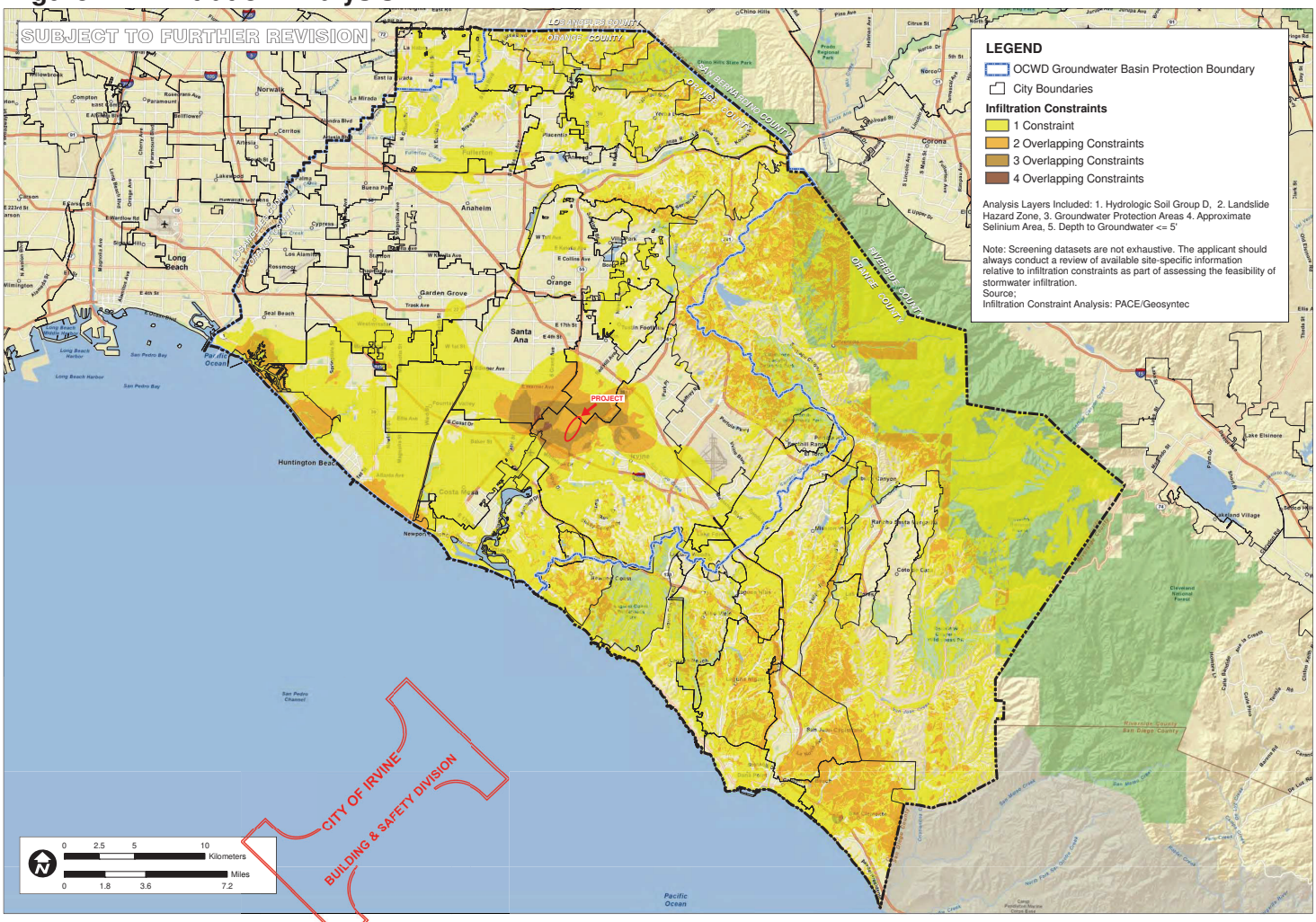
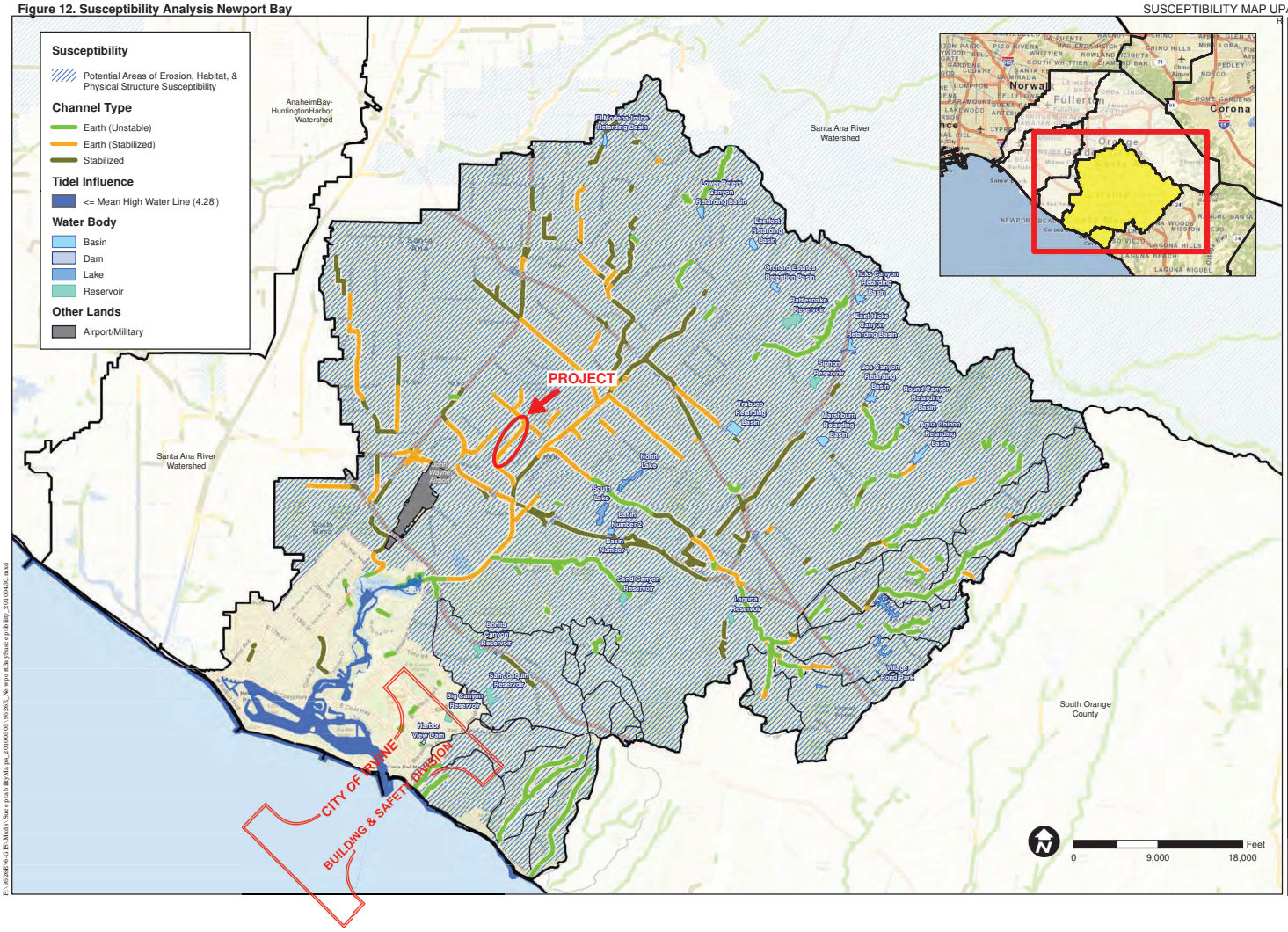


Figure 12. Susceptibility Analysis Newport Bay

SUSCEPTIBILITY MAP UPATE (FEB 2013)



SUSCEPTIBILITY ANALYS
NEWPORT BAY-
NEWPORT COASTAL STREAMS

ORANGE COUNTY
WATERSHED
MASTER PLANNING

ORANGE CO. CA

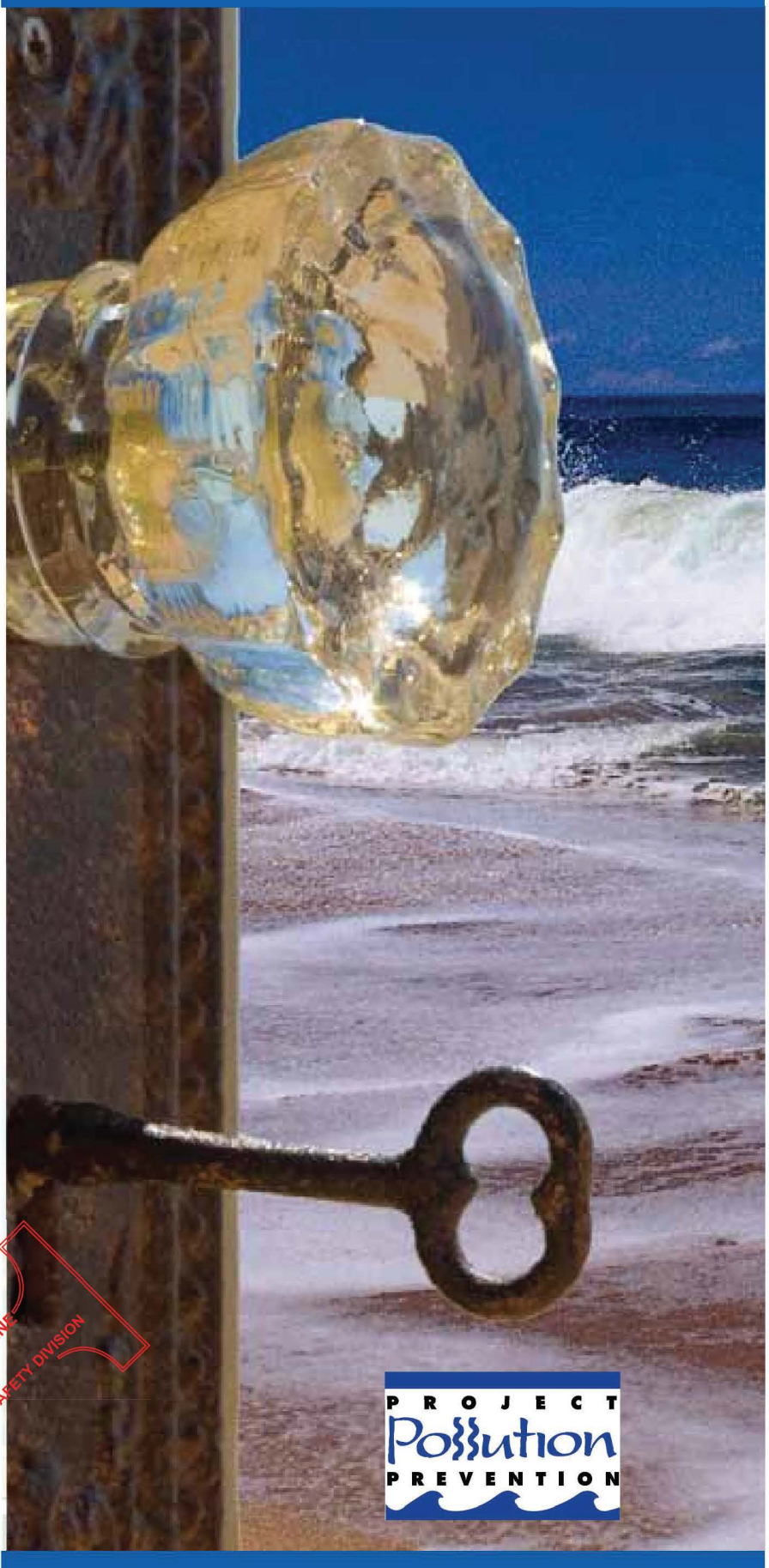
PACE
Advanced Water Engineering

FIGURE 4

Attachment A. Educational Materials

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The Ocean Begins at Your Front Door



CITY OF IRVINE
BUILDING & SAFETY DIVISION

PROJECT
Pollution
PREVENTION

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

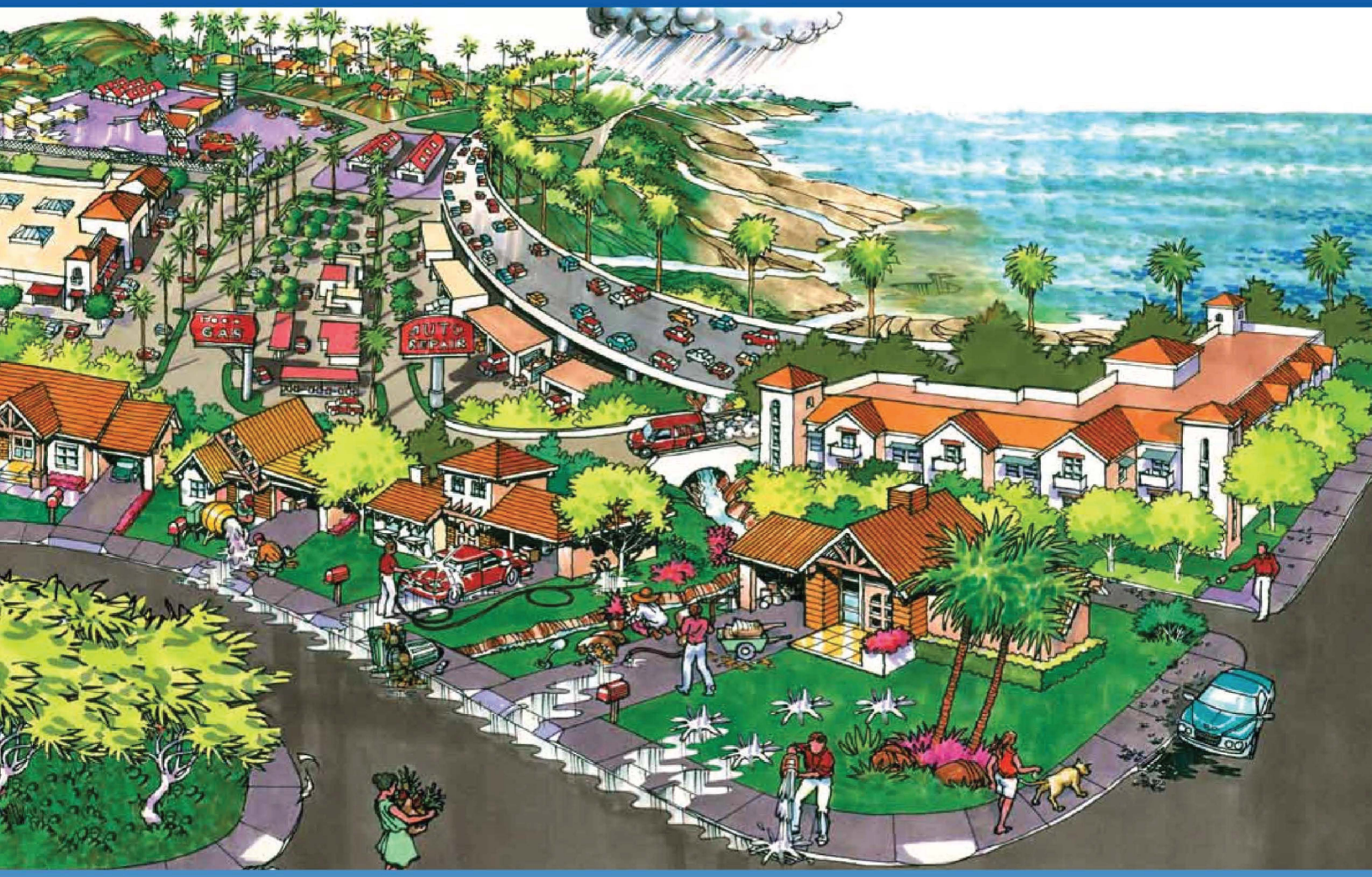
Automobile

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

CITY OF IRVINE

BUILDING & SAFETY DIVISION

The Ocean Begins at Your Front Door



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

CITY OF IRVINE

BUILDING & SAFETY DIVISION

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.



CITY OF IRVINE

BUILDING & SAFETY DIVISION

For More Information

Orange County Stormwater Program

California Environmental Protection Agency
www.calepa.ca.gov

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

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

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

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

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

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

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

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

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

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

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

CITY OF IRVINE
BUILDING & SAFETY DIVISION

Printed on Recycled Paper

Road and Street Maintenance SC-70



Objectives

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

Targeted Constituents

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

Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

Approach

Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

Suggested Protocols

Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.

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- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Street Repair and Maintenance

Pavement marking

- Schedule pavement marking activities for dry weather.

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- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

Concrete installation and repair

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

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Patching, resurfacing, and surface sealing

- Schedule patching, resurfacing and surface sealing for dry weather.
- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.
- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.
- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.
- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.
- Use only as much water as necessary for dust control, to avoid runoff.
- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Equipment cleaning maintenance and storage

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.
- Perform major equipment repairs at the corporation yard, when practical.
- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.
- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

Bridge and Structure Maintenance

Paint and Paint Removal

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Do not transfer or load paint near storm drain inlets or watercourses.

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- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.
- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.
- Capture all clean-up water, and dispose of properly.
- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

Graffiti Removal

- Schedule graffiti removal activities for dry weather.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.
- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.
- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Repair Work

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.
- Thoroughly clean up the job site when the repair work is completed.
- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.

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- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

Unpaved Roads and Trails

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

Non-Stormwater Discharges

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

Training

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

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Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

Requirements

Costs

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between $60,000 and $120,000. Newer technologies might have prices approaching $180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
  - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
  - Traffic control officers may be required to enforce parking restrictions.
  - Skillful design of cleaning routes is required for program to be productive.
  - Arrangements must be made for disposal of collected wastes.

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- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

Maintenance

- Not applicable

Supplemental Information

Further Detail of the BMP

Street sweeping

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

Mechanical Broom Sweepers - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

Vacuum Sweepers - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

Street Flushers - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

Cross-Media Transfer of Pollutants

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM10). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

Bridges

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.

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- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.
- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.
- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

De-icing

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.
- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.
- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

References and Resources

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

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Drainage System Maintenance SC-74



Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

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

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

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(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - 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
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

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- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup 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.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

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- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to

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cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

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Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

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When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 1999. Stormwater O&M Fact Sheet Catch Basin Cleaning. EPA 832-F-99-011. Office of Water, Washington, D.C. September.

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United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm

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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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CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

Supplemental Information

Examples

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

Other Resources

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

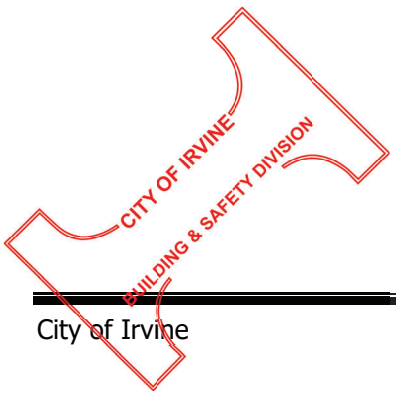
Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

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

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

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Attachment B. BMP Calculations



2013 North OC TGD
Appendix III.1. Hydrologic Methods for Design Capture Storm

Simple Method Runoff Coefficient for Volume-Based BMP Sizing
Design Capture Volume (DCV):

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
C = runoff coefficient = (0.75 × impervious + 0.15)
d = storm depth (inches) = 0.75 in, refer to
North OC TGD, Figure XVI-1 (attached herein)
A = tributary area (acres)

Simple Method Runoff Coefficient for Flow-Based BMP Sizing
Design Flowrate (Q):
Q = C × i × A
C = runoff coefficient = (0.75 × impervious + 0.15)
i = rainfall intensity (inches/hour) = 0.26 in/hr (T_c ≈ 5 minutes), refer to
North OC TGD, Appendix III, Capture Efficiency Figure (attached herein)
A = tributary area (acres)

DMA 1

A = 0.65 ac
Impervious = 100.0%

C = 0.75 x 100% + 0.15
C = 0.90

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
DCV = 0.90 x 0.75 x 0.65 x 43560 x 1/12
DCV = **1,595 cu ft**

Q = C × i × A
Q = 0.90 x 0.26 x 0.65
Q = **0.15 cfs**

For Filterra Bioretention System Sizing, manufacturer recommends between 100 in/hr and 175 in/hr
(100 in/hr is the biofiltration media flowrate, 175 in/hr is the maximum)
Use 100 in/hr,
100 in/hr x (1 ft/12 in) x (1 hr/3600 sec) = 0.0023148 ft/s

Min. Req. Area of Filterra Media = 0.15 / 0.0023148
65 sq ft

Refer to Filterra Configuration Detail for filter dimensions (See Attachment C)

→ **Use 6 x 12 Filterra Box**

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2013 North OC TGD
Appendix III.1. Hydrologic Methods for Design Capture Storm

Simple Method Runoff Coefficient for Volume-Based BMP Sizing
Design Capture Volume (DCV):

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
C = runoff coefficient = (0.75 × impervious + 0.15)
d = storm depth (inches) = 0.75 in, refer to
North OC TGD, Figure XVI-1 (attached herein)
A = tributary area (acres)

Simple Method Runoff Coefficient for Flow-Based BMP Sizing
Design Flowrate (Q):
Q = C × i × A
C = runoff coefficient = (0.75 × impervious + 0.15)
i = rainfall intensity (inches/hour) = 0.26 in/hr (T_c ≈ 5 minutes), refer to
North OC TGD, Appendix III, Capture Efficiency Figure (attached herein)
A = tributary area (acres)

DMA 2

A = 0.57 ac
Impervious = 100.0%

C = 0.75 x 100% + 0.15
C = 0.90

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
DCV = 0.90 x 0.75 x 0.57 x 43560 x 1/12
DCV = **1,393 cu ft**

Q = C × i × A
Q = 0.90 x 0.26 x 0.57
Q = **0.13 cfs**

For Filterra Bioretention System Sizing, manufacturer recommends between 100 in/hr and 175 in/hr
(100 in/hr is the biofiltration media flowrate, 175 in/hr is the maximum)
Use 100 in/hr,
100 in/hr x (1 ft/12 in) x (1 hr/3600 sec) = 0.0023148 ft/s

Min. Req. Area of Filterra Media = 0.13 / 0.0023148
56 sq ft

Refer to Filterra Configuration Detail for filter dimensions (See Attachment C)

→ **Use 6 x 12 Filterra Box**

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2013 North OC TGD
Appendix III.1. Hydrologic Methods for Design Capture Storm

Simple Method Runoff Coefficient for Volume-Based BMP Sizing
Design Capture Volume (DCV):

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
C = runoff coefficient = (0.75 × impervious + 0.15)
d = storm depth (inches) = 0.75 in, refer to
North OC TGD, Figure XVI-1 (attached herein)
A = tributary area (acres)

Simple Method Runoff Coefficient for Flow-Based BMP Sizing
Design Flowrate (Q):
Q = C × i × A
C = runoff coefficient = (0.75 × impervious + 0.15)
i = rainfall intensity (inches/hour) = 0.26 in/hr (T_c ≈ 5 minutes), refer to
North OC TGD, Appendix III, Capture Efficiency Figure (attached herein)
A = tributary area (acres)

DMA 3

A = 0.65 ac
Impervious = 100.0%

C = 0.75 x 100% + 0.15
C = 0.90

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
DCV = 0.90 x 0.75 x 0.65 x 43560 x 1/12
DCV = **1,594 cu ft**

Q = C × i × A
Q = 0.90 x 0.26 x 0.65
Q = **0.15 cfs**

For Filterra Bioretention System Sizing, manufacturer recommends between 100 in/hr and 175 in/hr
(100 in/hr is the biofiltration media flowrate, 175 in/hr is the maximum)
Use 100 in/hr,
100 in/hr x (1 ft/12 in) x (1 hr/3600 sec) = 0.0023148 ft/s

Min. Req. Area of Filterra Media = 0.15 / 0.0023148
65 sq ft

Refer to Filterra Configuration Detail for filter dimensions (See Attachment C)

→ **Use 6 x 12 Filterra Box**

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Appendix III.1. Hydrologic Methods for Design Capture Storm

Simple Method Runoff Coefficient for Volume-Based BMP Sizing
Design Capture Volume (DCV):

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
C = runoff coefficient = (0.75 × impervious + 0.15)
d = storm depth (inches) = 0.75 in, refer to
North OC TGD, Figure XVI-1 (attached herein)
A = tributary area (acres)

Simple Method Runoff Coefficient for Flow-Based BMP Sizing
Design Flowrate (Q):
Q = C × i × A
C = runoff coefficient = (0.75 × impervious + 0.15)
i = rainfall intensity (inches/hour) = 0.26 in/hr (T_c ≈ 5 minutes), refer to
North OC TGD, Appendix III, Capture Efficiency Figure (attached herein)
A = tributary area (acres)

DMA 4

A = 0.24 ac
Impervious = 100.0%

C = 0.75 x 100% + 0.15
C = 0.90

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
DCV = 0.90 x 0.75 x 0.24 x 43560 x 1/12
DCV = **579 cu ft**

Q = C × i × A
Q = 0.90 x 0.26 x 0.24
Q = **0.06 cfs**

For Filterra Bioretention System Sizing, manufacturer recommends between 100 in/hr and 175 in/hr
(100 in/hr is the biofiltration media flowrate, 175 in/hr is the maximum)
Use 100 in/hr,
100 in/hr x (1 ft/12 in) x (1 hr/3600 sec) = 0.0023148 ft/s

Min. Req. Area of Filterra Media = 0.06 / 0.0023148
26 sq ft

Refer to Filterra Configuration Detail for filter dimensions (See Attachment C)

→ **Use 6 x 6 Filterra Box**

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Appendix III.1. Hydrologic Methods for Design Capture Storm

Simple Method Runoff Coefficient for Volume-Based BMP Sizing
Design Capture Volume (DCV):

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
C = runoff coefficient = (0.75 × impervious + 0.15)
d = storm depth (inches) = 0.75 in, refer to
North OC TGD, Figure XVI-1 (attached herein)
A = tributary area (acres)

Simple Method Runoff Coefficient for Flow-Based BMP Sizing
Design Flowrate (Q):
Q = C × i × A
C = runoff coefficient = (0.75 × impervious + 0.15)
i = rainfall intensity (inches/hour) = 0.26 in/hr (T_c ≈ 5 minutes), refer to
North OC TGD, Appendix III, Capture Efficiency Figure (attached herein)
A = tributary area (acres)

DMA 5

A = 0.32 ac
Impervious = 100.0%

C = 0.75 x 100% + 0.15
C = 0.90

DCV = C × d × A × 43560 ft^2/ac × 1/12 in/ft
DCV = 0.90 x 0.75 x 0.32 x 43560 x 1/12
DCV = **772 cu ft**

Q = C × i × A
Q = 0.90 x 0.26 x 0.32
Q = **0.07 cfs**

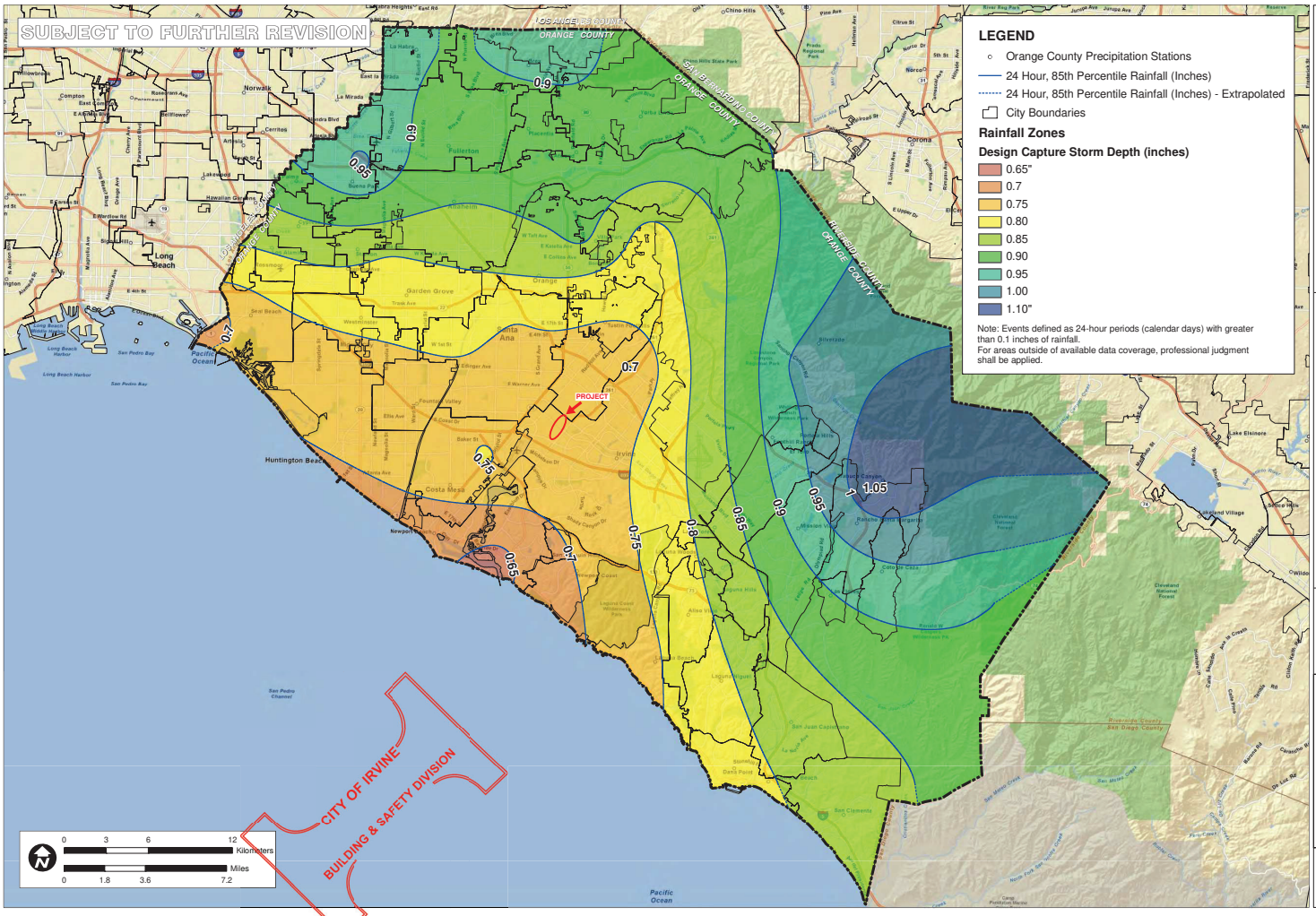
For Filterra Bioretention System Sizing, manufacturer recommends between 100 in/hr and 175 in/hr
(100 in/hr is the biofiltration media flowrate, 175 in/hr is the maximum)
Use 100 in/hr,
100 in/hr x (1 ft/12 in) x (1 hr/3600 sec) = 0.0023148 ft/s

Min. Req. Area of Filterra Media = 0.07 / 0.0023148
30 sq ft

Refer to Filterra Configuration Detail for filter dimensions (See Attachment C)

→ **Use 6 x 6 Filterra Box**

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RAINFALL ZONES

ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT

ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/27/10
JOB NO.	8558-E

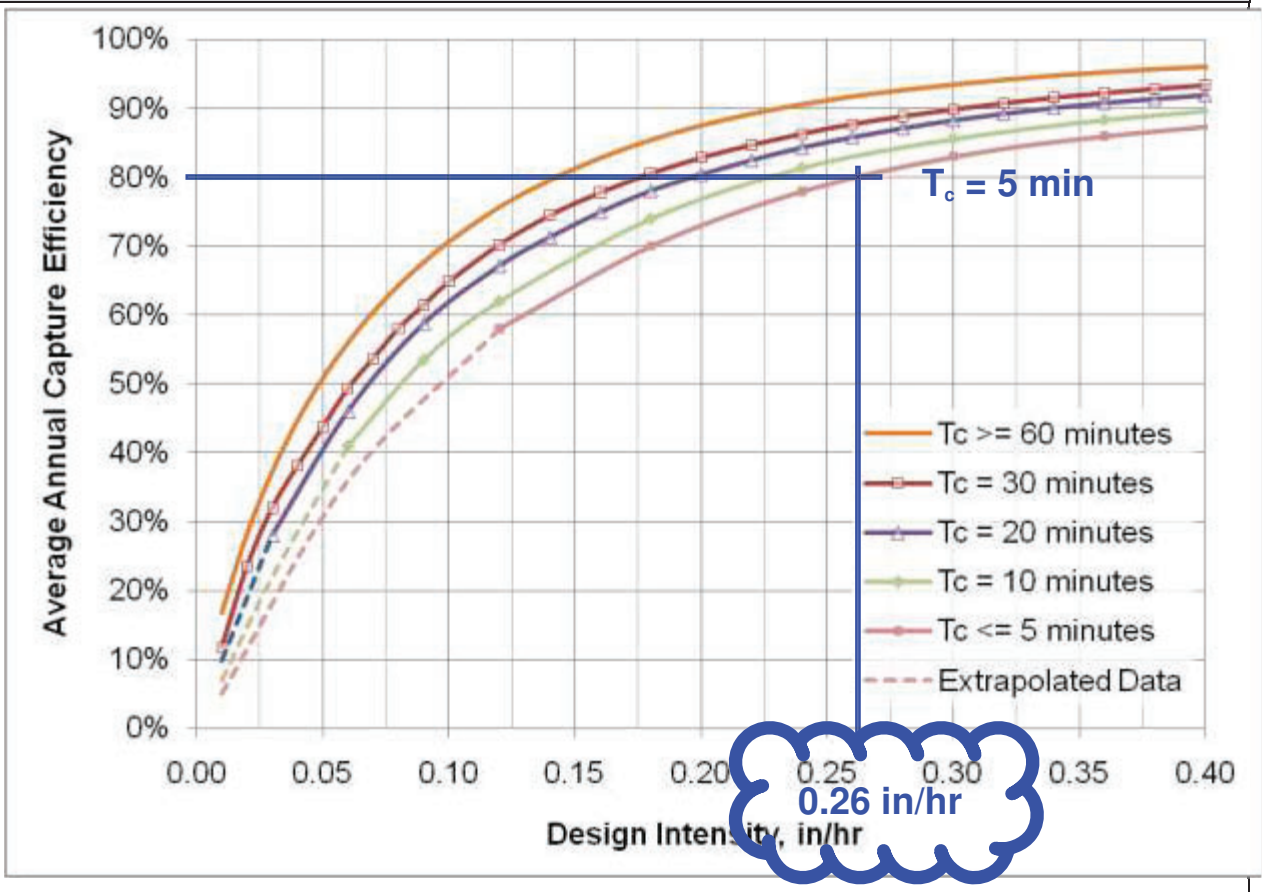
PACE Advanced Water Engineering

FIGURE XVI-1

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Worksheet D: Capture Efficiency Method for Flow-Based BMPs

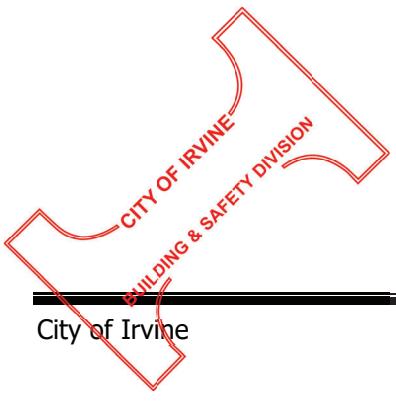
Graphical Operations

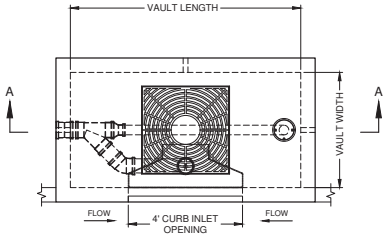


Provide supporting graphical operations. See Example III.7.

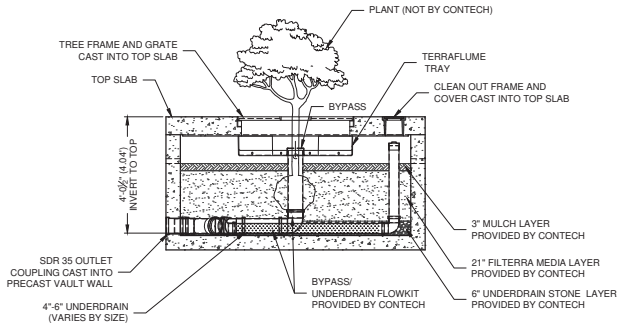
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Attachment C. Filterra Details

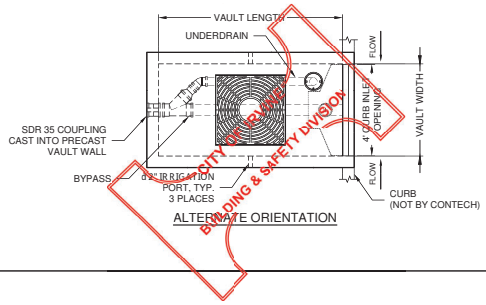




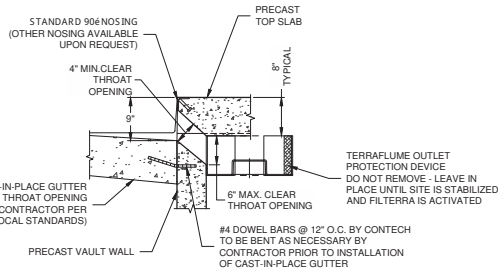
PLAN VIEW



SECTION A-A



ALTERNATE ORIENTATION



STANDARD CURB INLET WITH TERRAFLUME

NOT TO SCALE

FTIBC CONFIGURATION

VAULT SIZE (L x W)	MEDIA AREA (SF)	LONG SIDE INLET DESIG. / PART NO.	SHORT SIDE INLET DESIG. / PART NO.	AVAILABILITY	MAX. OUTLET/ BYPASS PIPE DIA.	MAX. BYPASS FLOW (CFS)	UNDER-DRAIN PIPE DIA. (PERF)	TREE GRATE QTY. & SIZE
4 x 4	16	FTIBC0404	FTIBC0404	ALL	6" SDR 35	1.42	4" SDR 35	(1) 3' x 3'
6 x 4	24	FTIBC0604	FTIBC0406	ALL	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
8 x 4	32	FTIBC0804	FTIBC0408	ALL (EXCEPT DE, MD, NJ, PA, VA, WV)	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
7.83 x 4.5	35	FTIBC078045	FTIBC045078	DE, MD, NJ, PA, VA, WV ONLY	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
6 x 6	36	FTIBC0606	FTIBC0606	ALL (EXCEPT CA, TX)	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
8 x 6	48	FTIBC0806	FTIBC0608	ALL	10" SDR 35	2.37	4" SDR 35	(1) 4' x 4'
10 x 6	60	FTIBC1006	FTIBC0610	ALL (EXCEPT CA, TX)	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
8 x 8	64	FTIBC0808	FTIBC0808	CA, TX ONLY	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
12 x 6	72	FTIBC1206	FTIBC0612	ALL (EXCEPT TX)	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'
10 x 8	80	FTIBC1008	FTIBC0810	CA, TX ONLY	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
13 x 7	91	FTIBC1307	FTIBC0713	ALL (EXCEPT CA, TX)	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'
12 x 8	96	FTIBC1208	FTIBC0812	CA,TX ONLY	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'
14 x 8	112	FTIBC1408	N/A	ALL	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING ON VAULT SIZE

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filterra

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

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9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

FILTERRA INTERNAL BYPASS CURB (FTIBC) CONFIGURATION DETAIL

I:\COMMON\CAD\TREATMENT\54 FILTERRA\40 STANDARD DRAWINGS\FTIBC - INTERNAL BYPASS CURB INLET\LAYOUT DETAILS\DWG\FTIBC - FILTERRA INTERNAL BYPASS CURB INLET CONFIG DTL.DWG 3/23/2023 3:32 PM

SECTION (_____)
Filterra®– Vault Configuration
Bioretention System Standard Specification

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the Filterra® Bioretention System by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the bioretention system, appurtenances and incidentals in accordance with the Drawings and as specified herein.

1.3 Bioretention system shall utilize the physical, chemical and biological mechanisms of an engineered biofiltration media, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system shall be a fully equipped, pre-constructed, drop-in-place unit designed for applications in the urban landscape to treat contaminated runoff from impervious surfaces.

1.4 Bioretention system shall be capable of stand-alone stormwater treatment.

1.5 Bioretention plants shall be incorporated into the system with plant material extending into the treatment zone of the engineered media at time of Activation.

1.6 The bioretention system shall be of a type that has been installed and in use for a minimum of five (5) consecutive years preceding the date of installation of the system. The Manufacturer shall have been, during the same consecutive five (5) year period, engaged in the engineering design and production of systems deployed for the treatment of stormwater runoff and which have a history of successful production, acceptable to the Engineer of Record and/or the approving Jurisdiction. The Manufacturer of the Filterra Bioretention System shall be, without exception:

Contech Engineered Solutions LLC
9100 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.7 Applicable provisions of any Division shall govern work in this section.

1.8 American Society for Testing and Materials (ASTM) Reference Specifications

1.8.1 ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

1.8.2 ASTM C858: Standard Specification of Underground Precast Concrete Utility Structures

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1.8.3 ASTM C990: Standard Specification for Joints for Precast Box Sections Using Preformed Flexible Joint Sealants

1.8.4 ASTM C109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

1.9 Manufacturer or authorized supplier to submit shop drawings for bioretention System with the vault, engineered biofiltration media and accessory equipment. Drawings shall include principal dimensions, engineered biofiltration media placement, location of piping and unit foundation.

1.9.1 Manufacturer or authorized supplier shall submit installation instructions to the contractor.

1.9.2 Manufacturer or authorized supplier shall submit Operations and Maintenance Manual to the contractor.

1.9.3 Before installation of the bioretention system, Contractor shall obtain the written approval of the Engineer of Record for the system drawings.

1.10 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Internal components including engineered biofiltration media, underdrain stone, PVC underdrain piping, and mulch must be included as part of the bioretention system and shall be provided by Contech Engineered Solutions LLC. Note that vegetation is an essential component of bioretention systems, and shall be provided at time of Activation by the contractor.

2.1.1 Engineered biofiltration media shall consist of both organic and inorganic components. Stormwater shall be directed to flow vertically through the media profile, saturating the full media profile without downstream flow control.

2.1.2 Underdrain stone shall be of size and shape to provide adequate bridging between the media and stone for the prevention of migration of fine particles. Underdrain stone must also be able to convey the design flow rate of the system without restriction and be approved for use in the Filterra Bioretention System by Contech Engineered Solutions LLC.

2.1.3 PVC Underdrain Piping shall be SDR35 with perforation pattern designed to

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convey system design flow rate without restriction.

2.1.4 Mulch shall be double shredded wood or bark mulch approved for use with the Filterra Bioretention System by Contech Engineered Solutions LLC.

2.2 Precast concrete vault shall be provided by Manufacturer or authorized supplier according to ASTM C857 and C858.

2.2.1 Vault joint sealant shall be Conseal CS-101 or approved equal. Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.

2.2.2 If interior concrete baffle walls are provided, baffle walls shall be cast-in or sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, SikaFlex 1a or equal. Contractor to provide sealant material and installation unless completed prior to shipment.

2.3 Tree grates and access covers shall be cast iron. Tree grate frames shall be galvanized steel.

2.4 Curb Nosing (where applicable) shall be galvanized steel and where specified shall be cast into a top slab designed to support a minimum of H5 loading at the curb.

2.5 All contractor-provided components shall meet the requirements of this section, the plans specifications and contract documents. In the case of conflict, the more stringent specification shall apply.

2.5.1 Crushed rock base material shall be six-inch minimum layer of ¾-inch minus rock. Compact undisturbed sub-grade materials to 95% of maximum density at +/-2% of optimum moisture content. Unsuitable material below sub-grade shall be replaced to engineer's approval.

2.5.2 Concrete shall have an unconfined compressive strength at 28 days of at least 3000 psi, with ¾-inch round rock, a 4-inch slump maximum, and shall be placed within 90 minutes of initial mixing.

2.5.3 Silicone Sealant shall be pure RTV silicone conforming to Federal Specification Number TT S001543A or TT S00230C or Engineer approved.

2.5.4 Grout shall be non-shrink grout meeting the requirements of Corps of Engineers CRD-C588. Specimens molded, cured and tested in accordance with ASTM C-109 shall have minimum compressive strength of 6,200 psi. Grout shall not exhibit visible bleeding.

2.5.5 Backfill material shall be ¾-inch minus crushed rock, or approved equal.

2.5.6 Vegetation shall comply with the type and size required by the approved drawings and shall be alive and free of obvious signs of disease. Vegetation shall be of species listed in approved Filterra Plant list or otherwise approved by Manufacturer. Vegetation shall be supplied by Contractor prior to Activation.

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3.0 PERFORMANCE

3.1 Treatment Capabilities shall be verified via third-party report following either TAPE or TARP protocols.

3.1.1 Engineered biofiltration media minimum treatment flow rate shall be 140"/hr. The system shall be designed to ensure that high flow events shall bypass the engineered biofiltration media preventing erosion and resuspension of pollutants.

3.1.2 The system shall remove a minimum of 85% Total Suspended Solids (TSS).

3.1.3 The system shall remove a minimum of 62% Total Phosphorus (TP).

3.1.4 The system shall remove a minimum of 34% Total Nitrogen (TN).

3.2 The system shall have General Use Level Designation from Washington Department of Ecology for Basic (TSS), Phosphorus, Enhanced (Metals), and Oil/Grease and have Certification by New Jersey Department of Environment.

3.3 Quality Assurance and Quality Control procedures shall be followed for all batches of engineered biofiltration media produced. Engineered biofiltration media shall be certified by the Manufacturer for performance and composition.

3.3.1 Media particle size distribution and composition shall be verified as per relevant ASTM Standards.

3.3.2 Media pollutant removal performance shall be verified as per relevant ASTM Standards as well as a minimum of one scientific method approved by the USEPA.

3.3.3 Media hydraulic performance shall be verified as per relevant ASTM Standards.

3.3.4 Media fertility shall be verified as per a minimum of one published scientific method.

3.4 The Manufacturer shall ensure through third party full scale field testing of installed units that the design flow rate of the system is not reduced over time. Studies shall be performed on a minimum of 10 systems of various ages, maintenance frequencies, and land uses. At least 80% of the tested systems shall have been installed 2.5 or more years. At least 50% of the systems shall have previous maintenance intervals greater than 2 times the manufacturer's recommendation.

4.0 EXECUTION

4.1 Set precast vault on crushed rock base material that has been placed in maximum 6-inch lifts, loose thickness, and compacted to at least 95-percent of the maximum dry density as determined by the standard Proctor compaction test, ASTM D698, at moisture content of +/- 2% of optimum water content.

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4.2 Inlet and outlet pipes shall be attached to provided couplers or grouted in and connected to precast concrete vault according to Engineer's requirements and specifications.

4.3 All throat and grate protection covers shall remain in place until the system is activated.

4.4 Contractor to cast-in-place throat inlet to convey stormwater into bioretention System according to Engineer's requirements and specifications.

4.5 Engineered biofiltration media shall be delivered installed in the vault, unless otherwise agreed upon with the Manufacturer. Contractor shall take appropriate action to protect the media from sediment and other debris during construction. The method ultimately selected shall be at Contractor's discretion and Contractor's risk.

4.5.1 If media is shipped separately from vault, Manufacturer or a Manufacturer's certified representative shall install media into the vault or be present to supervise installation in order to ensure proper installation.

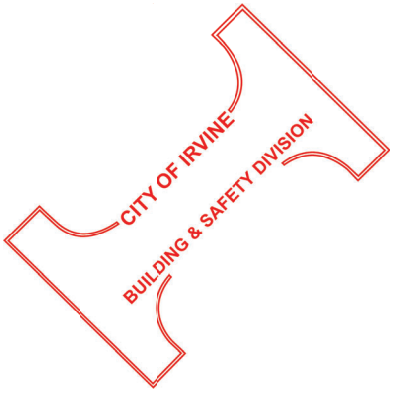
4.6 The bioretention system shall not be placed in operation (activated) until the project site is clean and stabilized (construction erosion control measures no longer required). The project site includes any surface that contributes storm drainage to the system. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of dirt and sediment. Activation shall be provided by Manufacturer or authorized supplier, and includes planting of the vegetation provided by the Contractor.

4.7 Each correctly installed system shall include a Final Inspection performed by Manufacturer or authorized supplier upon request between 6-12 months after Activation. The cost of this service shall be included in the price of the system and include the following.

4.7.1 System inspection to help owner establish proper routine maintenance intervals.

4.7.2 Routine maintenance: removal of foreign debris, silt, loose plant material and trash; mulch removal; engineered biofiltration media evaluation; plant health evaluation and pruning; replacement of mulch; disposal of all maintenance refuse items; and updating of maintenance records.

4.8 To ensure long term performance of the bioretention system, continuing annual maintenance programs should be performed or purchased by the owner per the latest Filterra Bioretention System Operation and Maintenance manual.











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filterra®
Bioretention Systems

INSTALLATION MANUAL

V02

Support: 800-338-1122 | Fax: 513-645-7993

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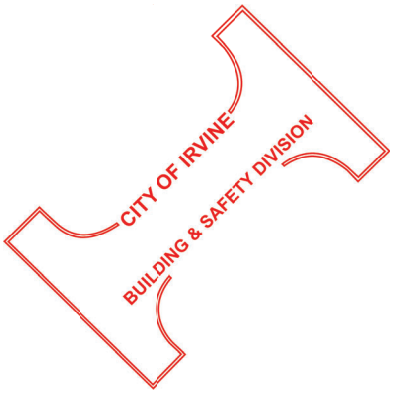
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FILTERRA® OVERVIEW

STORMWATER BIORETENTION FILTRATION SYSTEM



- Save valuable space with small footprint for urban sites.
- Improve BMP aesthetics with attractive trees or shrubs.
- Reduce lifetime cost with safer and less expensive maintenance.

Remove Pollutants and Comply with NPDES

The Filterra® Bioretention System is well-suited for the urban environment with high removal efficiencies for many pollutants such as petroleum, heavy metals, phosphorus, nitrogen, and TSS. Filterra is similar in concept to bioretention in its function and applications, with the major distinction that Filterra has been optimized for high volume/flow treatment and high pollutant removal. Filterra takes up little space (often 0.2% Filter Surface Area/Drainage Area) and may be used on highly developed sites such a landscaped areas, green spaces, parking lots and streetscapes; it is exceedingly adaptable and is the urban solution for Low Impact Development.

Stormwater runoff flows through a specially designed filter media mixture contained in a landscaped concrete container The filter media captures and immobilizes pollutants; those pollutants are then decomposed, volatilized and incorporated into the biomass of the filterra system's micro-macro fauna and flora. Once the stormwater runoff flows through the media it continues into an underdrain system at the bottom of the container, where the treated water is discharged. higher flows bypass the Filterra via a downstream inlet structure, curb cut or other appropriate relief.

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Section A

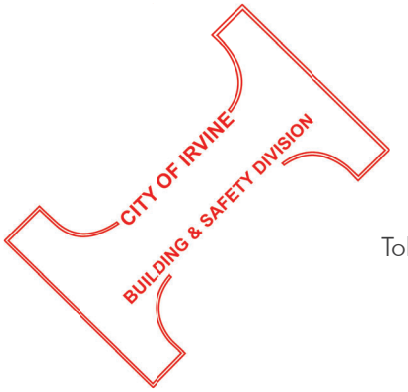
Installation

Installation Guidelines

Installations Procedure

Filterra Standard Offline Curb Inlet Detail

Filterra with Terraflume Curb Inlet Detail



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info@conteches.com

Installation Guidelines for Filterra®

Delivery & Unloading/Lifting

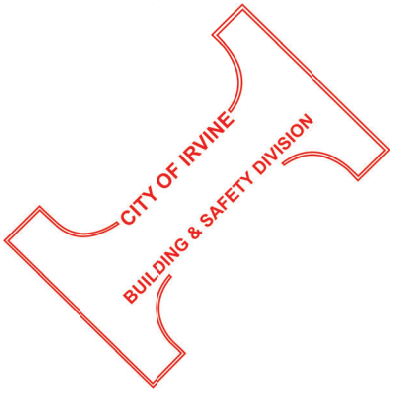
1. Contech shall deliver the Filterra units to the site in coordination with the Contractor.
2. The Contractor will require spreader bars and chains/cables/straps, as well as lifting hooks to safely and securely lift box sections and top slabs. In some cases, lifting hooks may be available for rental or purchase. Contact your Contech Project Coordinator for more information.
3. The unit and top must be lifted separately.

Inspection

1. Inspection of the Filterra unit and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any nonconformance to approved drawings or damage to ay part of the system shall be documented on the Filterra shipping ticket. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Filterra unit shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

1. The contractor is responsible for providing adequate and complete site/inlet protection when the Filterra unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).
2. The contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.
3. The Contractor or Owner is responsible for appropriately barricading the Filterra from traffic (in accordance with local codes).



Installation Guidelines for Filterra®

Installation

1. Installation Procedure for Sump Condition.

    a. Filterra Standard Offline System: The Standard Offline system cannot be used as a standalone inlet. It will need effective bypass during higher intensity rainfall events. To test a proposed location, imagine the Filterra throat is completely blocked (so it would act like a typical curb and gutter). If this results in any ponding or pooling drainage, the placement is inappropriate.

    b. Filterra Internal Bypass - Curb (FTIBC): FTIBC systems incorporating the Terraflume tray can be utilized as a stand-alone inlet and are typically installed in a sump condition.

2. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

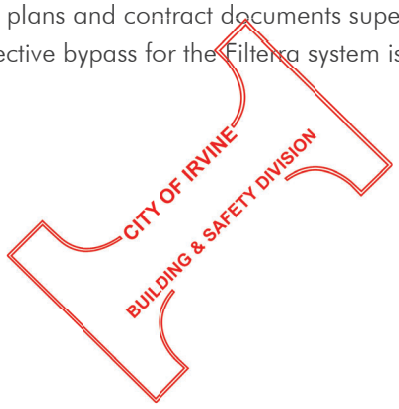
3. The unit shall be placed on the compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit is to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1% to 2% of the optimum moisture. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Contact Contech for guidance where slope exceeds 5%.

4. Once the unit is set, the internal wooden forms and protective silt fabric cover must be left intact. The top lid should be sealed onto the box before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on the top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation.

5. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct outlet will be marked on the Filterra box. Do NOT use plugged couplings marked "USE OTHER CONNECTION".

6. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6" lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Filterra unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.

7. It is the responsibility of the Contractor to provide curb and gutter and transition to the Filterra unit for proper stormwater flow into the system through the throat opening. A standard drawing of the throat and gutter detail is available on page 12. However, the plans and contract documents superseded all standard drawings. Flume variations are detailed in Section B of this manual. Effective bypass for the Filterra system is essential for correct operation (i.e. bypass to an overflow at lower elevation).



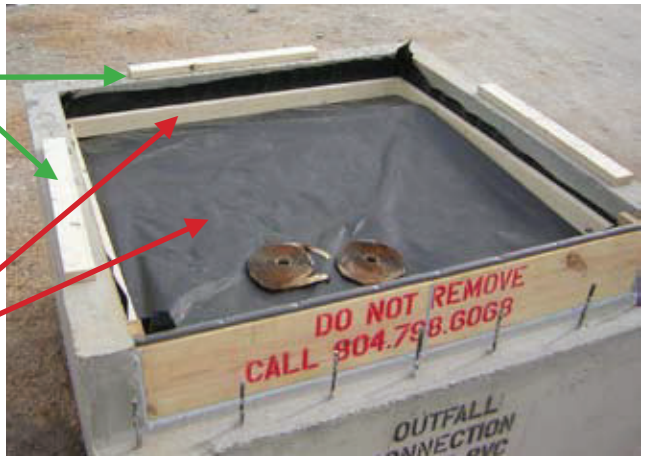
Installation Procedure

DO NOT remove protective boards or tree grates from the top slab.



Remove the shipping dunnage along the top of the box wall.

DO NOT remove wooden internal bracing or protective silt fabric.



DO NOT remove the protective throat board.

Curb and gutter details are provided on the protective throat board. On Filterra systems incorporating a Terraflume tray, the protective board is installed at the back of the Terraflume to allow runoff to bypass via the internal riser.



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The contractor MUST provide all rigging and lifting apparatus, such as cables, chains, straps, and hooks. In some cases, lifting hooks may be available for rental or purchase. Contact your Contech Project Coordinator for more information.



The unit and top slab MUST be lifted separately. At this time you can remove the boards between the box and top.

It is the contractor's responsibility to provide suitable lifting equipment to off load the Filterra unit. Filterra units are designed to be off loaded using the contractor's spreader bar.



1. Unload or Remove Top from Unit

Unload the top slab and set it on the ground.



2. Unload and Set Box

Unload the Filterra box and set into the pre-prepared hole with appropriate sub-grade.*

* Compacted sub-grade with a minimum of six inches of gravel bas which must match the final grade of curb line the area of the unit.



3. Apply Butyl Tape Seal

Apply butyl tape seal along the top of the box section. Butyl tape seal is provided with every unit.

Filterra installed protective throat board and installed silt fabric must be left in place to protect the unit from construction sediment.



4. Set Top on Box

Set the top slab on the box.



5. Connect Outfall Pipe

The correct outlet will be marked on the Filterra box.

DO NOT use plugged couplings marked "USE OTHER CONNECTION".



6. Install Curb and Gutter

It is the responsibility of the Contractor to provide curb and gutter and transition to the Filterra unit for proper flow into the system through a 4" - 6" throat opening. Details for the throat opening on the Filterra Standard Offline system as well as Filterra systems incorporating the Terraflume are included on pages 12 and 13.



7. Provide Inlet Protection

It is the responsibility of the Contractor to provide inlet protection/sediment control and cleaning around each Filterra unit.



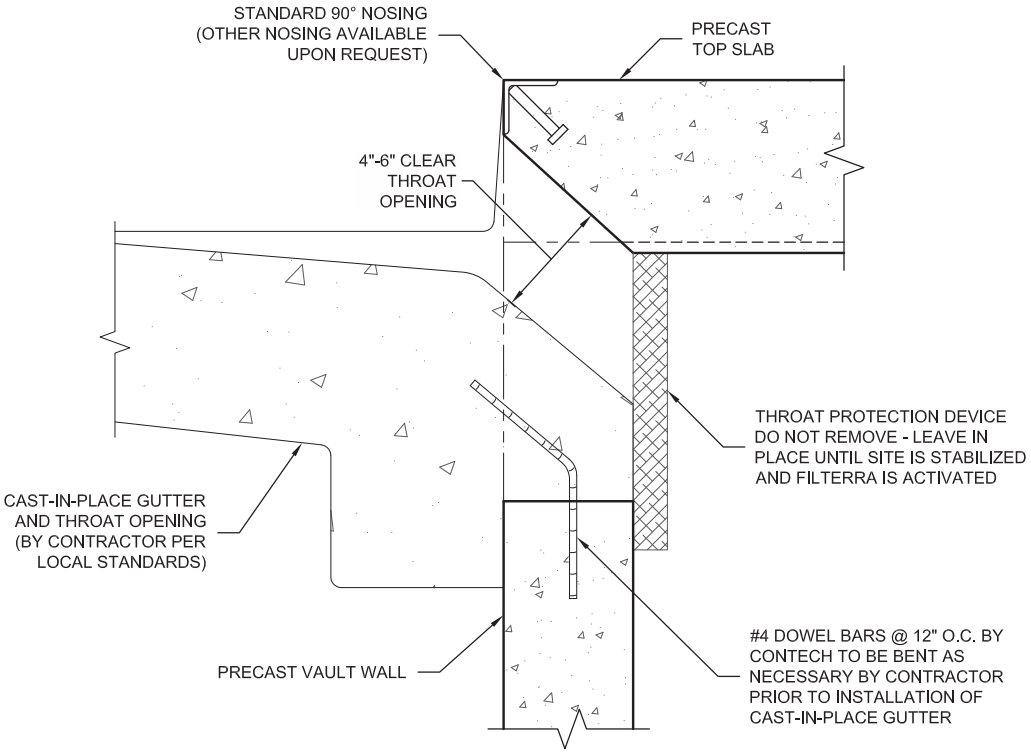
8. Activation

Activation is performed ONLY by Contech authorized personnel.

Activation can occur once the project site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed) and there is 4" - 6" throat opening.

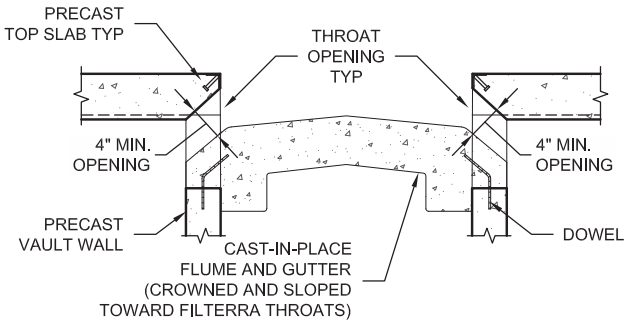
Call 800-338-1122 to schedule your activation.

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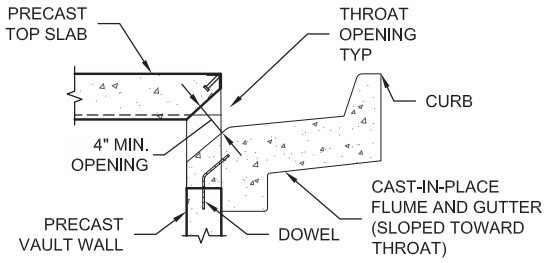


SECTION VIEW

STANDARD OFFLINE CURB INLET



CROWNED FLUME



REVERSE FLUME - SLOPED
TOWARDS FILTERRA THROAT

SECTION VIEWS OF TYPICAL FLUME APPLICATIONS

SEE ABOVE FOR DETAILS NOT SHOWN

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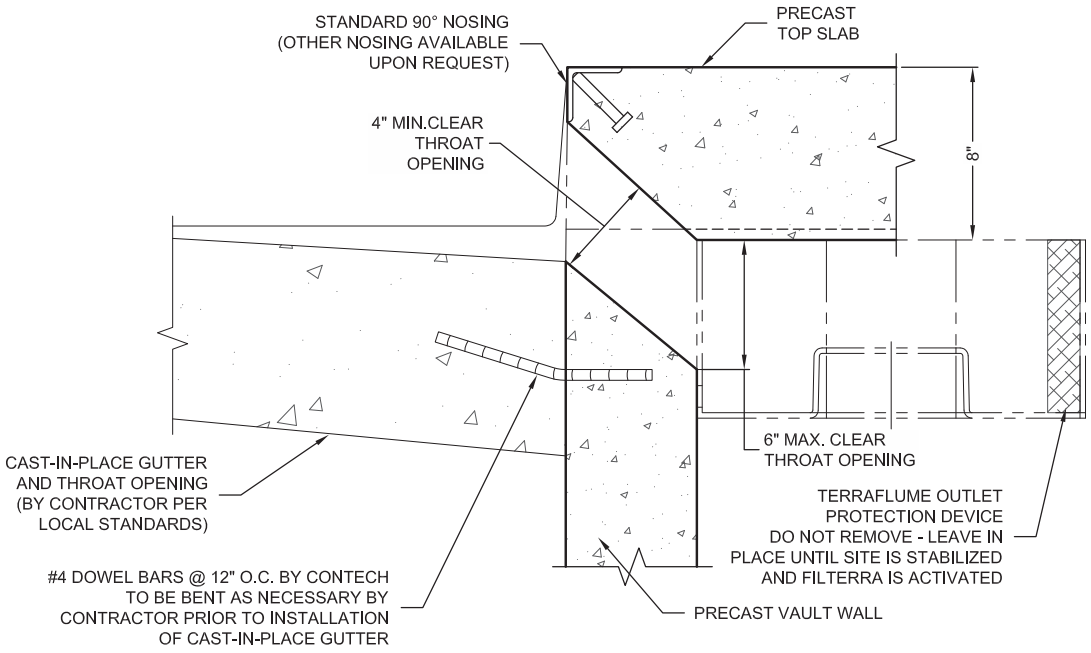
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FILTERRA STANDARD OFFLINE
CURB INLET DETAILS

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SECTION VIEW

STANDARD CURB INLET WITH TERRAFLUME

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FILTERRA WITH TERRAFLUME
CURB INLET DETAIL

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Section B

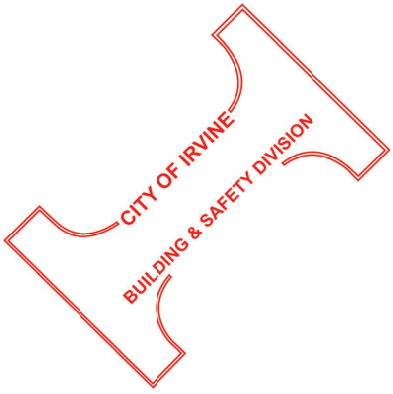
Curb and Gutter

Standard Curb and Gutter with Inlet Bypass

Curb Cut or Grate Inlet Bypass

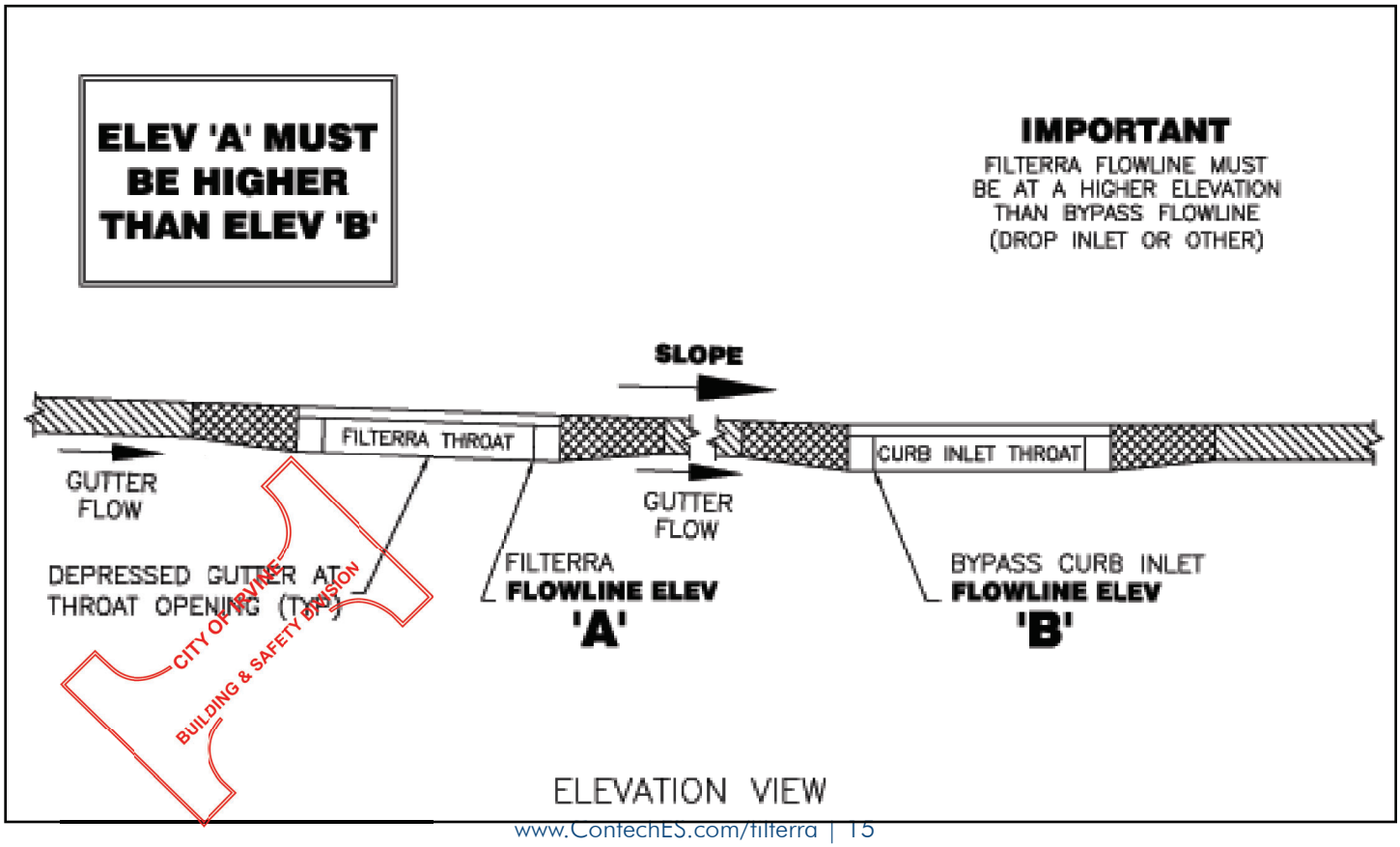
Single Sided Flume

Double Sided Flume

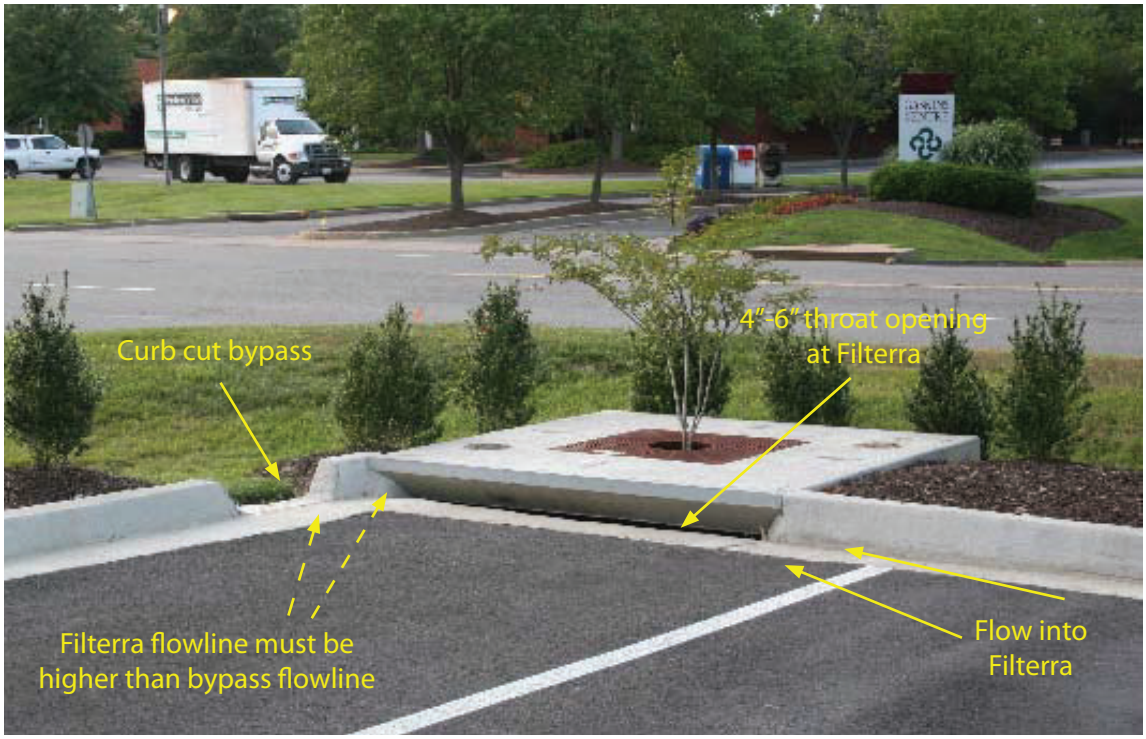


Standard Curb and Gutter with Inlet Bypass





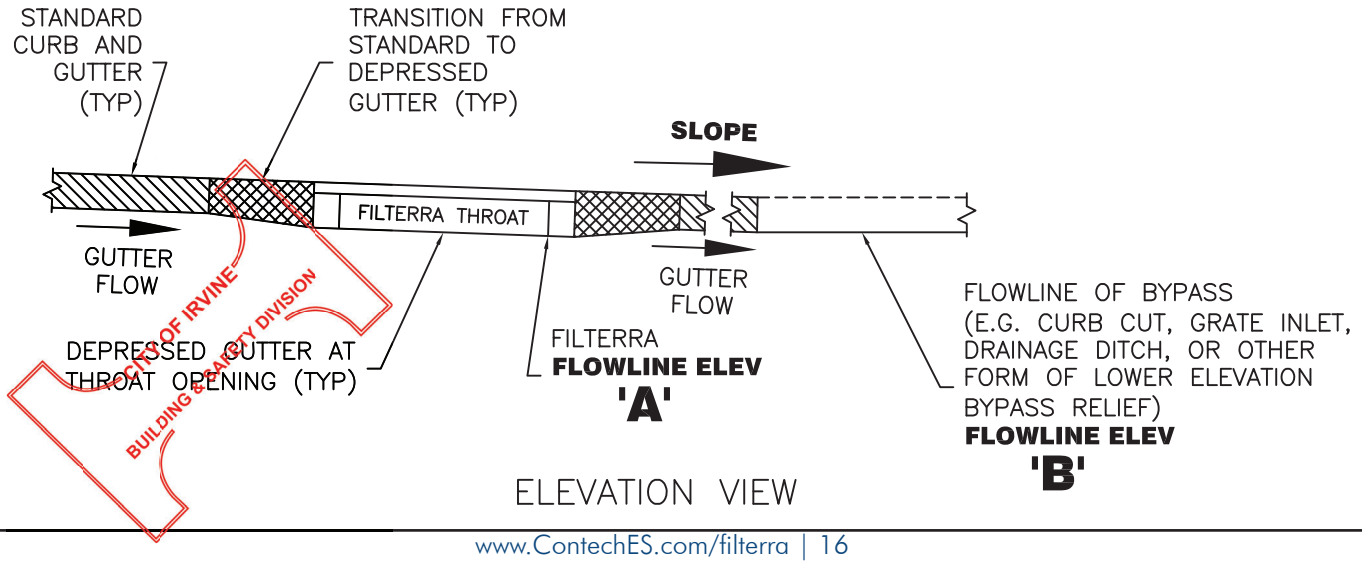
Curb Cut or Grate Inlet Bypass



ELEV 'A' MUST BE HIGHER THAN ELEV 'B'

IMPORTANT

FILTERRA FLOWLINE MUST BE AT A HIGHER ELEVATION THAN BYPASS FLOWLINE (DROP INLET OR OTHER)



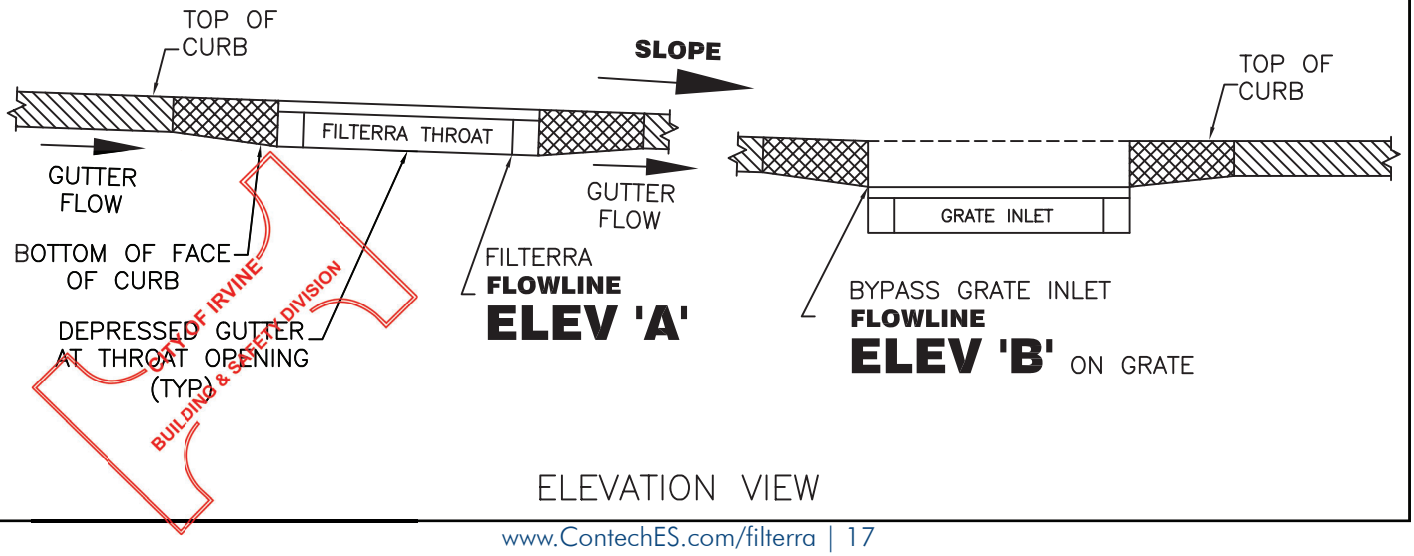
ELEVATION VIEW

Single Side Flume



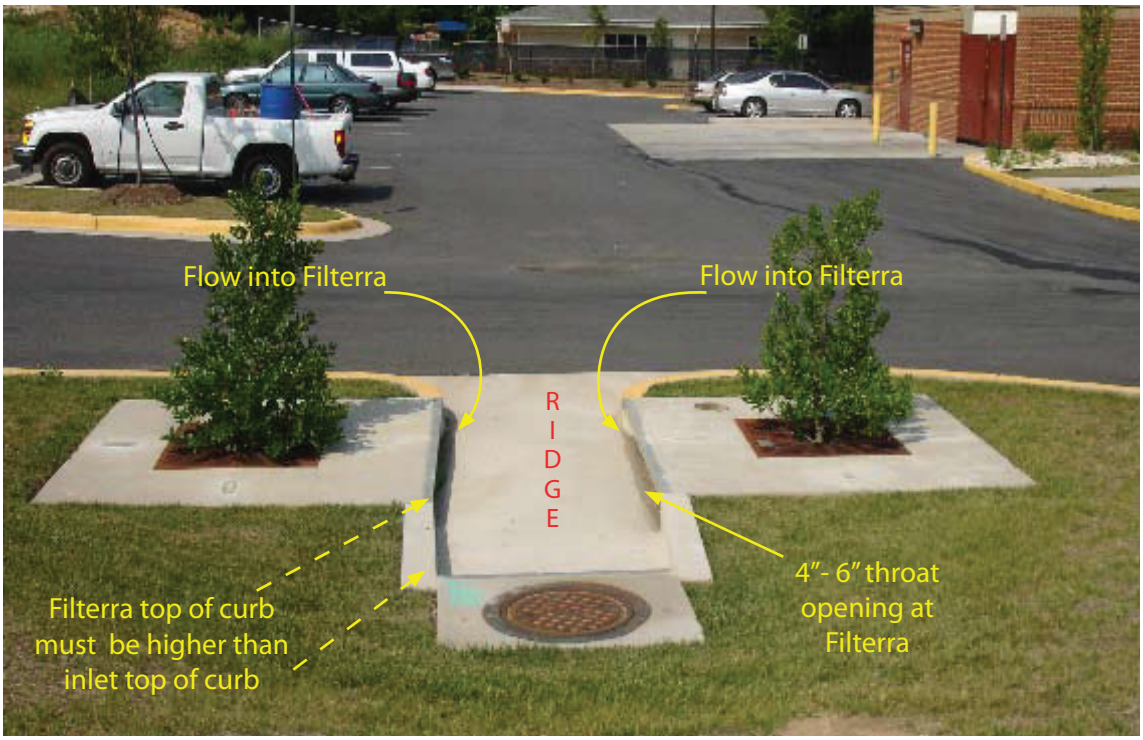
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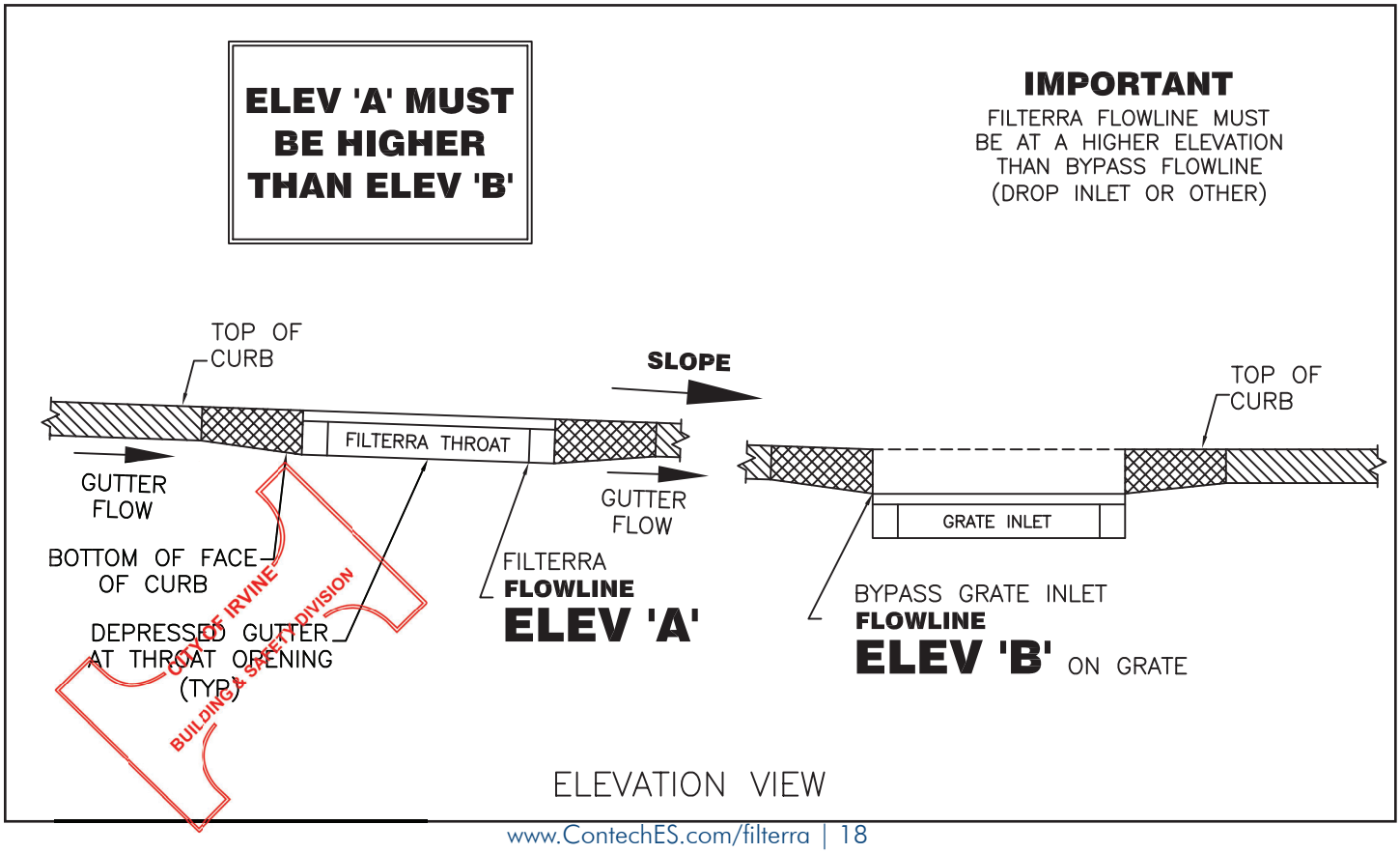
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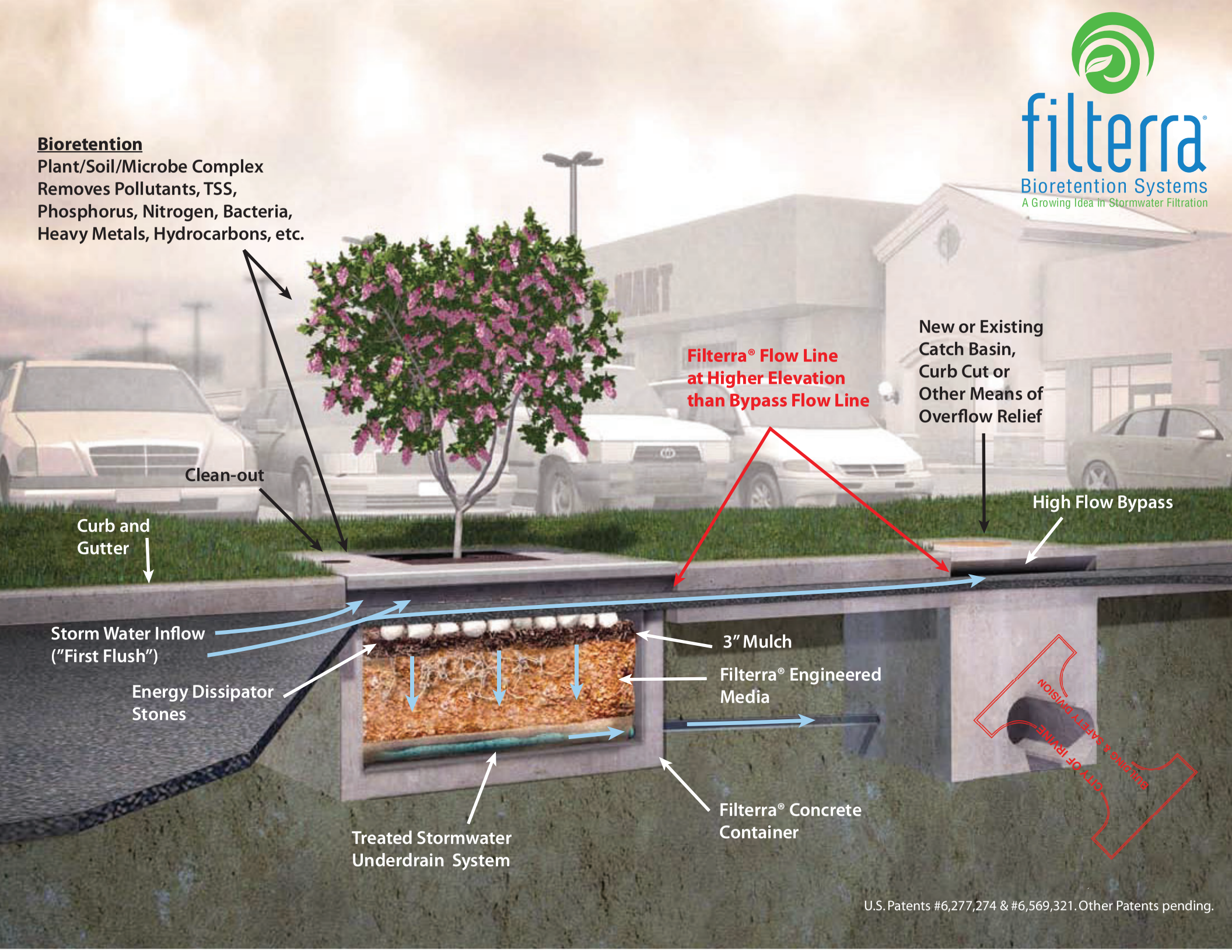


ELEVATION VIEW

Double Side Flume






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Bioretention Systems
A Growing Idea in Stormwater Filtration
Bioretention
Plant/Soil/Microbe Complex
Removes Pollutants, TSS,
Phosphorus, Nitrogen, Bacteria,
Heavy Metals, Hydrocarbons, etc.
Filterra® Flow Line
at Higher Elevation
than Bypass Flow Line
New or Existing
Catch Basin,
Curb Cut or
Other Means of
Overflow Relief
Clean-out
High Flow Bypass
Curb and
Gutter
Storm Water Inflow
("First Flush")
Energy Dissipator
Stones
3" Mulch
Filterra® Engineered
Media
Filterra® Concrete
Container
Treated Stormwater
Underdrain System
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U.S. Patents #6,277,274 & #6,569,321. Other Patents pending.

Filterra Vault Owner's Manual

(Precast Vault Configurations)

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Bioretention Systems

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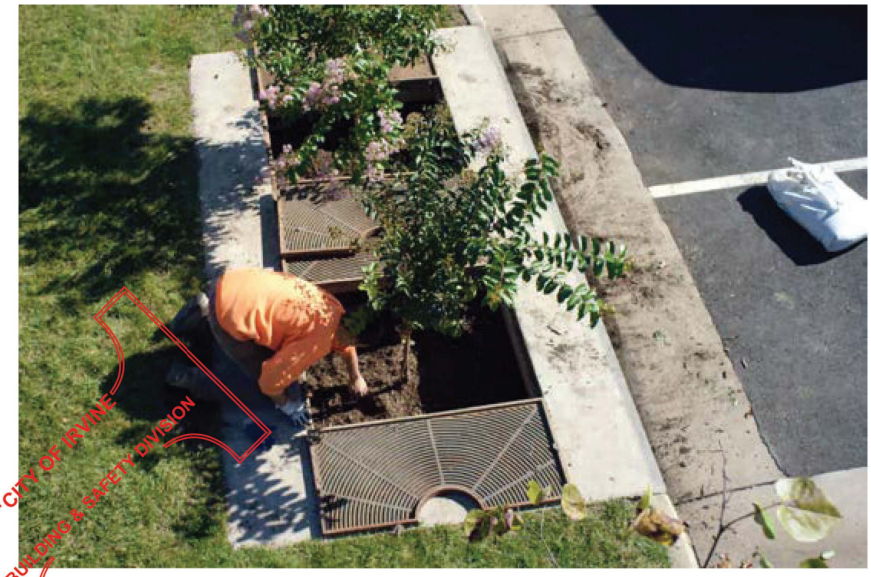
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This Owner's Manual applies to all precast Filterra Configurations, including Filterra Bioscape Vault and Filterra HC.







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filterra®
Bioretention Systems

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Introduction

Thank you for your purchase of the Filterra® Bioretention System. Filterra is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. The system's biota (vegetation and soil microorganisms) then further breakdown and absorb captured pollutants. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

The Filterra system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra system.

Included with your purchase is Activation of the Filterra system by the manufacturer as well as a 1-year warranty from delivery of the system and a final site assessment of unit condition (mulch replacement, debris removal, and pruning of vegetation) scheduled between 6 and 12 months after activation, upon request.

Design and Installation

Each project presents different scopes for the use of Filterra systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra box sizing (by rainfall region) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra units as shown in approved plans. A comprehensive installation manual is available at www.ContechES.com.

Activation Overview

Activation of the Filterra system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices.
- Planting of the system's vegetation (provided by the purchaser).
- Placement of pretreatment mulch layer using mulch acceptable for use in Filterra systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch acceptable for use in Filterra systems. More information is available in the Filterra Activation Package.



Minimum Requirements

The minimum requirements for Filterra Activation are as follows:

1. **The purchaser must have procured vegetation meeting the requirements outlined in the Filterra Activation Package.**

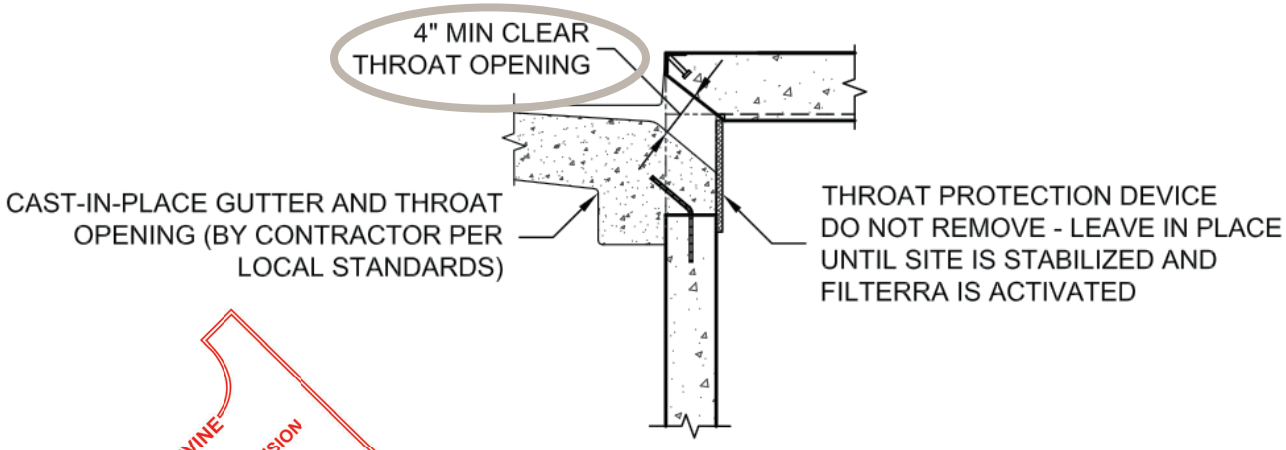
2. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.



3. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra system.



4. Filterra throat opening should be at least 4" in order to ensure adequate capacity for inflow and debris.



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The Filterra Activation Package is available on the Contech website (www.ContechES.com/filterra) and ensures that the proper conditions are met for Contech to perform the Activation service. Vegetation meeting Contech's requirements must be provided at time of Activation. If the site does not meet the conditions required for Activation, or acceptable vegetation is not provided by the purchaser at time of Activation, a charge of $1,500 will be invoiced to the purchaser.

Filterra Plant Selection Overview

A Plant List is available on the Contech website highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra system. Plants installed in the Filterra system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra system.

More information is available in the Filterra Activation Package.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra system's warranty and waive the manufacturer provided Activation and Final Site Assessment services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra system or runoff protection devices
- Removal of any Filterra system components
- Failure to prevent construction related runoff from entering the Filterra system
- Failure to properly store and protect any Filterra components (including media and underdrain stone) that may be shipped separately from the vault

Final Site Assessment

With proper routine maintenance, the biofiltration media within the Filterra system should last as long as traditional bioretention media. A final site assessment is included by the manufacturer, upon request, on all Filterra systems between 6 and 12 months after activation. This includes a final assessment of unit condition, debris removal, mulch replacement, and pruning of vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra systems also contain pretreatment or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the final site assessment, and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.



Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan of your Filterra media.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The unit will recycle and accumulate pollutants within the biomass, but is also subjected to other materials entering the inlet. This may include trash, silt and leaves etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra's flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

When to Maintain?

Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; in regions with less rainfall often only (1) one visit per annum is sufficient. Varying land uses can affect maintenance frequency. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the maintenance provider of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology.



Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not included as part of the final site assessment. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra (where the cleaned runoff drains to, such as drop inlet) and block off the throat of the Filterra. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

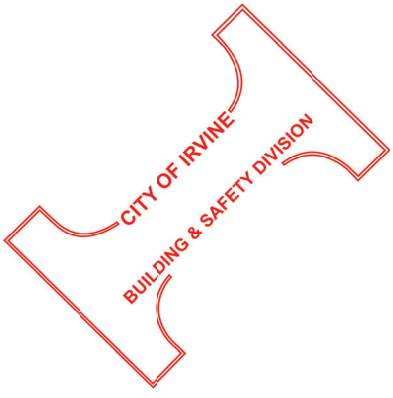
1. Inspection of Filterra and surrounding area
2. Removal of tree grate and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation and pruning or replacement as necessary
6. Clean area around Filterra
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs ea.). Most visits require minor trash removal and a full replacement of mulch. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media available from the Supplier.

Box Length	Box Width	Filter Surface Area (ft^2)	Volume at 3" (ft^3)	# of 2 ft^3 Mulch Bags
4	4	16	4	2
6	4	24	6	3
8	4	32	8	4
6	6	36	9	5
8	6	48	12	6
10	6	60	15	8
12	6	72	18	9
13	7	91	23	12

Other sizes not listed - 1 bag per 8 ft^2 of media.



Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.



1. Inspection of Filterra and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes | no
Damage to Box Structure	yes | no
Damage to Grate	yes | no
Is Bypass Clear	yes | no

If yes answered to any of these observations, record with close-up photograph (numbered).



2. Removal of tree grate and erosion control stones

- Remove cast iron grates for access into Filterra box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes | no
Cups/ Bags	yes | no
Leaves	yes | no
Buckets Removed	_____



- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	_____
Inches of Media Added	_____

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4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra inlet to allow for entry of trash during a storm event.
- Replace Filterra grates correctly using appropriate lifting or moving tools, taking care not to damage the plant.



5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

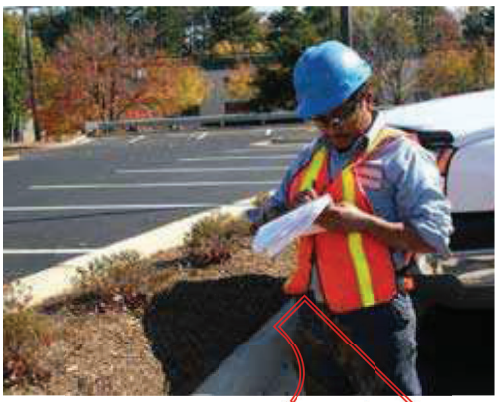
Record on Maintenance Report the following:

Height above Grate	_____ (ft)
Width at Widest Point	_____ (ft)
Health	healthy | unhealthy
Damage to Plant	yes | no
Plant Replaced	yes | no



6. Clean area around Filterra

- Clean area around unit and remove all refuse to be disposed of appropriately.



7. Complete paperwork

- Deliver Maintenance Report.
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

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Plant Care for Filterra® Systems

After Activation, the Contractor is responsible for proper care of the vegetation until the site is handed over to the Owner. After that, it is the Site Owner's responsibility to care for the vegetation. Contech recommends the following care for the plants:

1. To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
2. Plant staking may be required.
3. With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
4. Contech recommends irrigation of the Filterra® Vegetation. The following guidance will help to ensure the vegetation is properly irrigated.

Irrigation Recommendations:

- Each Filterra® system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the tree grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra® plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore if dry periods exceed 3 weeks, irrigation may be required.

*** Five gallons per square yard approximates 1 inch of water. Therefore for a 6' x 6 foot Filterra® approximately 20-60 gallons of applied water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five gallon bucket to estimate the applied water flow rate. Then calculate the time needed to irrigate the Filterra®, For example is the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6'x6' filter.*

Plant Replacement:

In some cases, plants will require replacement. Please follow the procedures below to ensure a properly functioning Filterra® system.

1. Remove the existing plant, and leave as much of the Filterra® media in place as possible.
2. Select a replacement per the Filterra® Activation Package.
3. Prior to removing the plant from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
4. Cut away any roots which are growing out of the container drain holes.
5. Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively, the pot can be cut away to minimize root ball disturbance.
6. Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
7. Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
8. All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
9. Reinstall or add mulch to a depth of 3" per Contech's mulch specifications for Filterra® systems.

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Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.
Maintenance is ideally to be performed twice annually.				

Filterra Inspection & Maintenance Log

Filterra System Size/Model:_____ **Location:** _____

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Grate	Vegetation Species	Issues with System	Comments
1/1/17	*5 – 5 gal Buckets*	*3″*	*Lowe's Premium Brown Mulch*	*4′*	*Galaxy Magnolia*	*- Standing water in downstream structure*	*- Removed blockage in downstream structure*

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Appendix 1 – Filterra® Vault Activation Package

FILTERRA® VAULT ACTIVATION PACKAGE

CONTECH® ENGINEERED SOLUTIONS

The Filterra system will be (or has been) delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra system.

Included with your purchase is Activation of the Filterra system by the manufacturer as well as a 1-year warranty from delivery of the system and a Final Site Assessment (assessment of unit condition, mulch replacement, debris removal, and pruning of vegetation) scheduled between 6 months and 1 year after Activation, upon request.

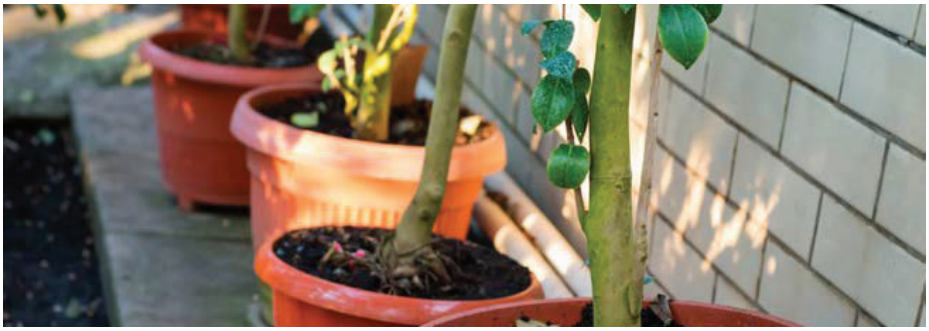
Activation of the Filterra system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices
- Planting of the system's vegetation (provided by the purchaser)
- Placement of pretreatment mulch layer using mulch acceptable for use in Filterra systems.

Activation MUST be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch acceptable for use in Filterra systems. The purchaser should request Activation from Contech after the site is stabilized, but prior to turning over the site to the owner. Please allow 1-2 weeks to schedule Activation.

The purchaser must ensure that the site is acceptable for Filterra Activation. A checklist (included as page 3 of this document must be completed and submitted to the Contech Activation Coordinator. The minimum 4 requirements for Filterra Activation are as follows:

1. The purchaser must have sourced vegetation meeting the requirements outlined in "Plant Selection for Filterra Systems" starting on page 4 of this document.



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** UNPREPARED SITE FEE NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized activations will void the system warranty and waive manufacturer supplied activation and final inspection.*

2. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.



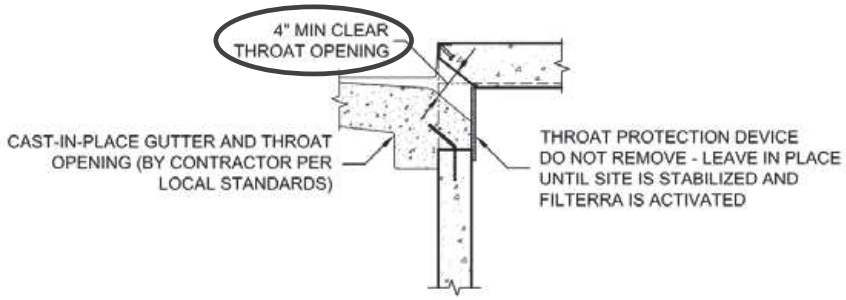


3. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra system.





4. Where curb inlets are included as part of the Filterra system, Filterra throat opening should be at least 4" clear in order to ensure adequate capacity for inflow and debris.



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Filterra® Vault Activation Checklist

Project Name:_____Company:_____

Site Contact Name: _____ Site Contact Phone/Email: _____

Site Owner/End User Name:_____Site Owner/End User Phone/Email: _____

Preferred Activation Date: _____(provide 2 weeks minimum from date this form is submitted)

Site Designation	Top Opening Type	Final Pavement Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height (where applicable)	Vegetation Sourced by Contractor
	☐ Tree Grate ☐ Full Grate (No tree opening) ☐ Bioscape Vault (Open Planter)	☐ Verified	☐ Verified	☐ Verified	☐ Verified	☐ Species on FT Plant List ☐ Container Grown (15 gal. max) ☐ 4' Tall Min. (Tree grate units only) ____ Qty provided
	☐ Tree Grate ☐ Full Grate (No tree opening) ☐ Bioscape Vault (Open Planter)	☐ Verified	☐ Verified	☐ Verified	☐ Verified	☐ Species on FT Plant List ☐ Container Grown (15 gal. max) ☐ 4' Tall Min. (Tree grate units only) ____ Qty provided
	☐ Tree Grate ☐ Full Grate (No tree opening) ☐ Bioscape Vault (Open Planter)	☐ Verified	☐ Verified	☐ Verified	☐ Verified	☐ Species on FT Plant List ☐ Container Grown (15 gal. max) ☐ 4' Tall Min. (Tree grate units only) ____ Qty provided
	☐ Tree Grate ☐ Full Grate (No tree opening) ☐ Bioscape Vault (Open Planter)	☐ Verified	☐ Verified	☐ Verified	☐ Verified	☐ Species on FT Plant List ☐ Container Grown (15 gal. max) ☐ 4' Tall Min. (Tree grate units only) ____ Qty provided

Attach additional sheets as necessary.

NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for activation AND/OR acceptable plants are not provided by the contractor. ONLY Contech authorized representatives can perform activation of Filterra systems; unauthorized activations will void the system warranty and waive manufacturer supplied activation and final inspection.

Signature _____ Date _____

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* *UNPREPARED SITE FEE NOTE: A charge of $1500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized activations will void the system warranty and waive manufacturer supplied activation and final inspection.*

Planting Selection for Filterra® Vault Systems



All Filterra systems require vegetation for proper long-term performance. As indicated in the Activation Package, the Contractor is responsible for sourcing the proper vegetation prior to Activation. Contech or a Contech representative will install the vegetation during the Activation process.

Contractors should identify the Top Opening style for each Filterra requiring Activation on the Activation Checklist. Contech offers three types, which are detailed on page 5 of this document:

- Vault with Tree Grate
- Vault with Full Grate
- Bioscape / Open Planter

Contractors must ensure the vegetation meets the following 4 requirements:

1. Select plant(s) as specified in the engineering plans and specifications AND that are listed on Contech's Configuration Specific Plant Lists**.
2. All plants MUST be container-grown in nursery containers no larger than 15 gallons. Crated and/or Ball/Burlap plants are NOT permitted.
3. For Vaults with Tree Grates, plant height must be 4' Minimum, from soil surface to top of plant.
4. Provide plant quantities per the following guidance:
   - Vault with Tree Grate – 1 per Tree Grate
   - Vault with Full Grate – 4-5 Small or Extra Small Grasses per Full Grate
   - Bioscape – Quantities should be selected based on plant palette options found starting on page 6 of this document.

If Contech or Contech's representative shows up for Activation and any of the 4 requirements above are not met, Activation cannot be performed and the Contractor will be billed a $1,500 Unprepared Site fee*.

Some additional vegetation recommendations for the best possible Activation and Installation are as follows:

- Select plant(s) with full root development but not to the point where root bound.
- For Filterra systems with a Tree Grate, select plants with taller trunks. Lower branches can be pruned away provided there are sufficient branches above the grate for tree or shrub development.
- For Filterra systems with a Tree Grate, plant(s) should have a single trunk at installation.
- Plant species shall not have a mature height greater than 30 feet.

** In some cases, Contech may consider alternate plant species as approved by the Product Manager. Please list the plant name in the space below and submit this sheet to your Contech Activation Coordinator. If the plant species is approved, either the Product Manager or the Activation Coordinator will sign the form and return to you for inclusion with your Activation Checklist.

Requested Plant Species: _____ Approved: _____

Date: _____

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** UNPREPARED SITE FEE NOTE: A charge of $1,500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the Contractor. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized activation will void the system warranty and waive manufacturer supplied activation and final inspection.*

Filterra® Top Opening Examples

Filterra® Vault with Tree Grate

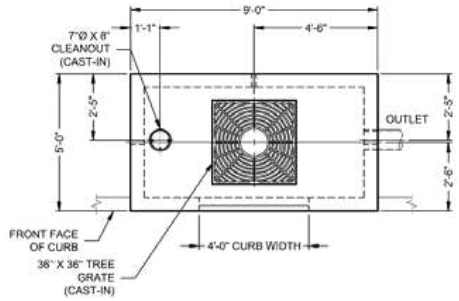


Figure 1a. Filterra with Tree Grate Drawing



Figure 1b. Filterra with Tree Grate Photo (not yet planted)

Filterra® Vault with Full Grate

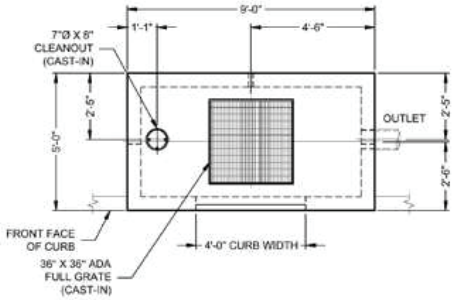


Figure 2a. Filterra with Full Grate Drawing



Figure 2b. Filterra with Full Grate Photo

Filterra® Bioscape Vault

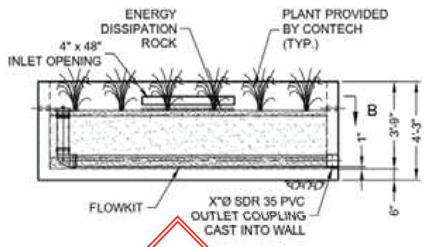


Figure 3a. Filterra Bioscape Vault Drawing



Figure 3b. Filterra Bioscape Vault Photo

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** UNPREPARED SITE FEE NOTE: A charge of $ 500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized activations will void the system warranty and waive manufacturer supplied activation and final inspection.*

Filterra® Bioscape Vault Plant Palettes

KEY: (refer to plant lists for species sizing)



A. EXTRA SMALL GRASS
- Up to 2' mature spread
- 1-2 gallon typical (1 gal. minimum)

B. SMALL GRASS/SHRUB
- 2'-4' mature spread
- 1-7 gallon typical

C. MEDIUM SHRUB
- 4'-6' mature spread
- 1-7 gallon typical

D. LARGE SHRUB OR EXTRA LARGE SHRUB OR TREE
- 6' mature spread and greater, 30' max. mature height
- Up to 15 gallon maximum

NOTE: *For larger vaults and in-ground Filterra Bioscape systems, palettes can be scaled (i.e. Qty 6 of the 22x8 Palette can be used for a 1056 sf Filterra Bioscape).*

MIX & MATCH SUBSTITUTION OPTIONS:

1 Large Shrub or Extra Large Shrub or Tree
- 2 Medium Shrubs
- 4 Small Grass/SHrubs
- 12 Extra Small Grasses

1 Medium Shrub
- 2 Small Grass/Shrubs
- 6 Extra Small Grasses

1 Small Grass/Shrub
- 3 Extra Small Grasses

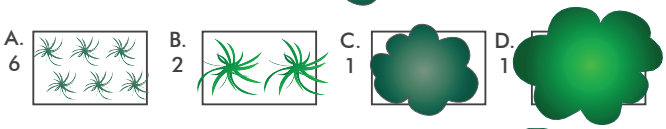
4x4 Media Bay



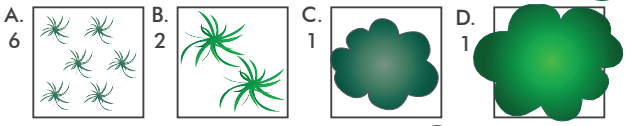
4x6/6x4 Media Bay



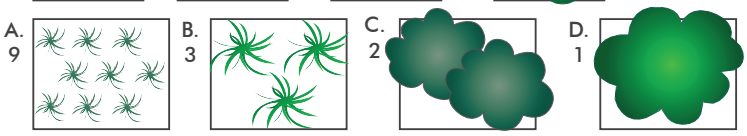
4x8/8x4 & 4.5x7.83/7.83x4.5 Media Bay



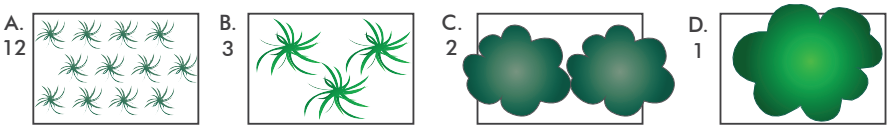
6x6 Media Bay



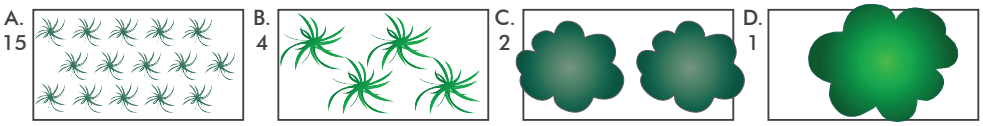
6x8/8x6 Media Bay



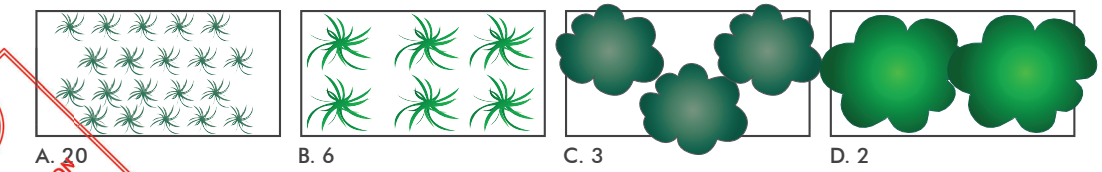
6x10/10x6 & 8x8 Media Bay



6x12/12x6 Media Bay



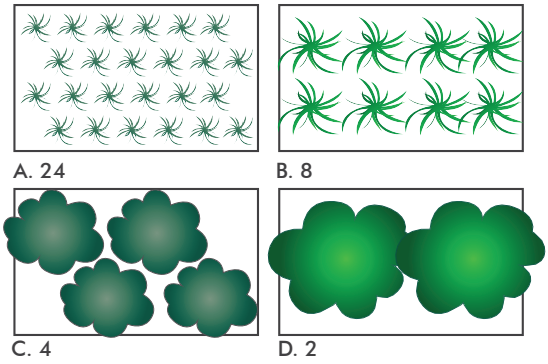
7x13/13x7/12x8 & 14x8 Media Bay



CITY OF IRVINE
BUILDING & SAFETY DIVISION

** UNPREPARED SITE FEE NOTE: A charge of $ 500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized activations will void the system warranty and waive manufacturer supplied activation and final inspection.*

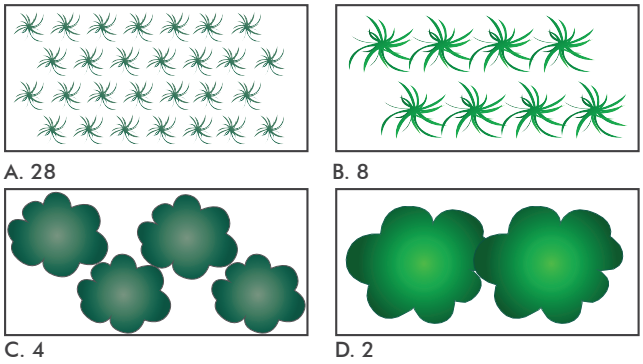
16x8 & 15x9 Media Bay



A. 24 B. 8

C. 4 D. 2

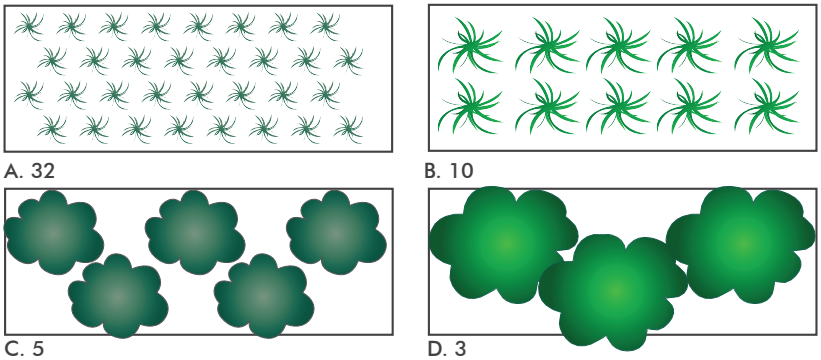
18x8 Media Bay



A. 28 B. 8

C. 4 D. 2

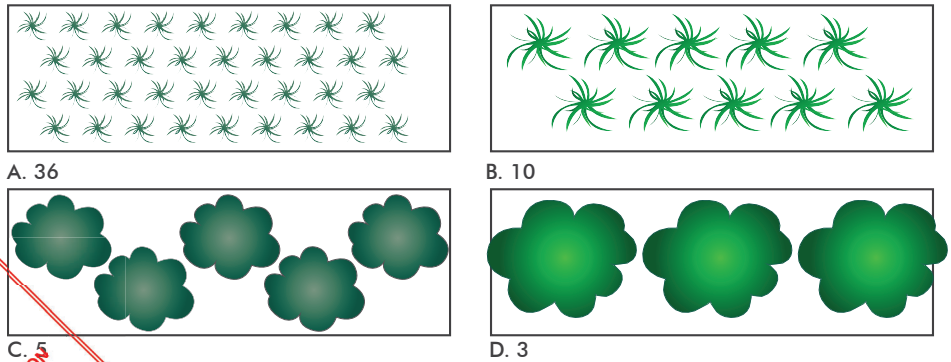
20x8 Media Bay



A. 32 B. 10

C. 5 D. 3

22x8 Media Bay



A. 36 B. 10

C. 5 D. 3

CITY OF IRVINE
BUILDING & SAFETY DIVISION

* *UNPREPARED SITE FEE NOTE: A charge of $1,500.00 will be invoiced for each activation visit requested by customer where Contech determines that the site does not meet the conditions required for Activation AND/OR acceptable plants are not provided by the contractor. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized activations will void the system warranty and waive manufacturer supplied activation and final inspection.*

Appendix 2 – Filterra® Tree Grate Opening Expansion Procedure

The standard grates used on all Filterra configurations that employ Tree Grates are fabricated with a 6″ opening that is designed with a breakaway section that can be removed, allowing the grate opening to be expanded to 12″ as the tree matures and the trunk widens.

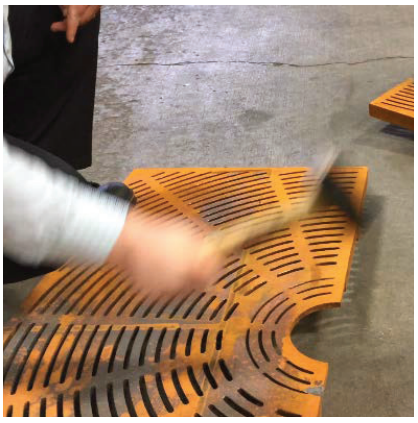
The following tools are required to expand the opening:

- Mini sledgehammer (3 lb. or greater)
- Safety Glasses / Goggles

The following guidelines should be followed to properly expand the tree opening from 6″ to 12″:



1. Remove the grate from the Filterra frame, place it flat on a hard surface, and support the grate by stepping on the edge or using other weighted items such as a few mulch bags if this is being done during a Filterra maintenance event. Put on safety glasses/goggles. Align the mini sledgehammer as shown in the figure to the left. The head of the sledgehammer should be aimed just inside the wide cast iron bar between the larger grate section and the breakaway section.

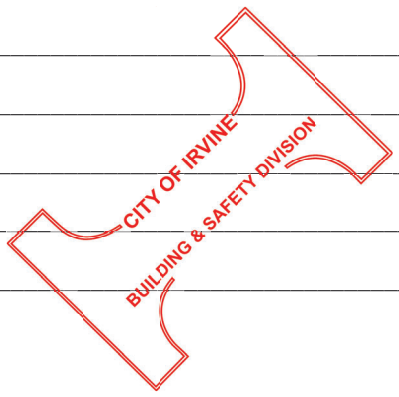


2. Repeatedly hit the grate at this spot with the mini sledgehammer.

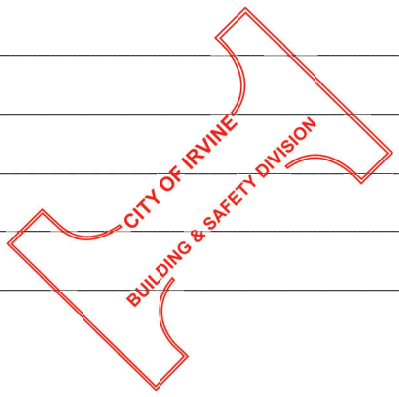


3. After several hits, the breakaway section should snap cleanly off of the larger grate section. Reinstall the grate into the Filterra grate frame. Recycle or dispose of the breakaway section per local guidelines.

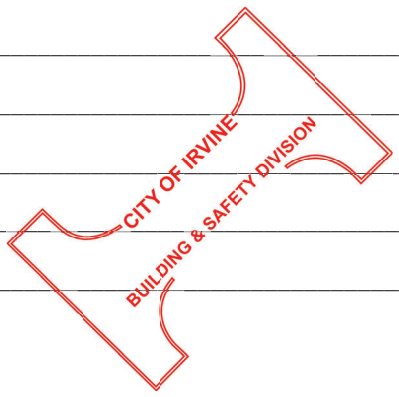
Notes



Notes



Notes



filterra®
Bioretention Systems

CONTECH®
ENGINEERED SOLUTIONS

9100 Centre Pointe Drive, Suite 400
West Chester, OH 45069
info@conteches.com | 800-338-1122
www.ContechES.com

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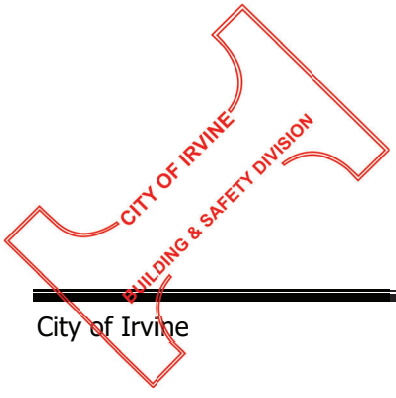
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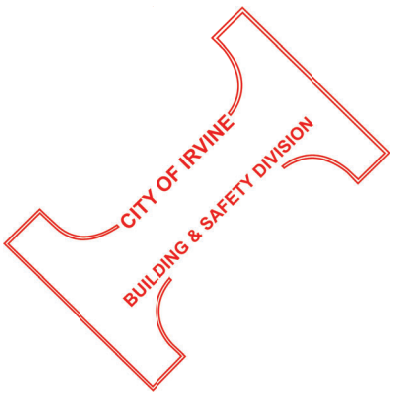
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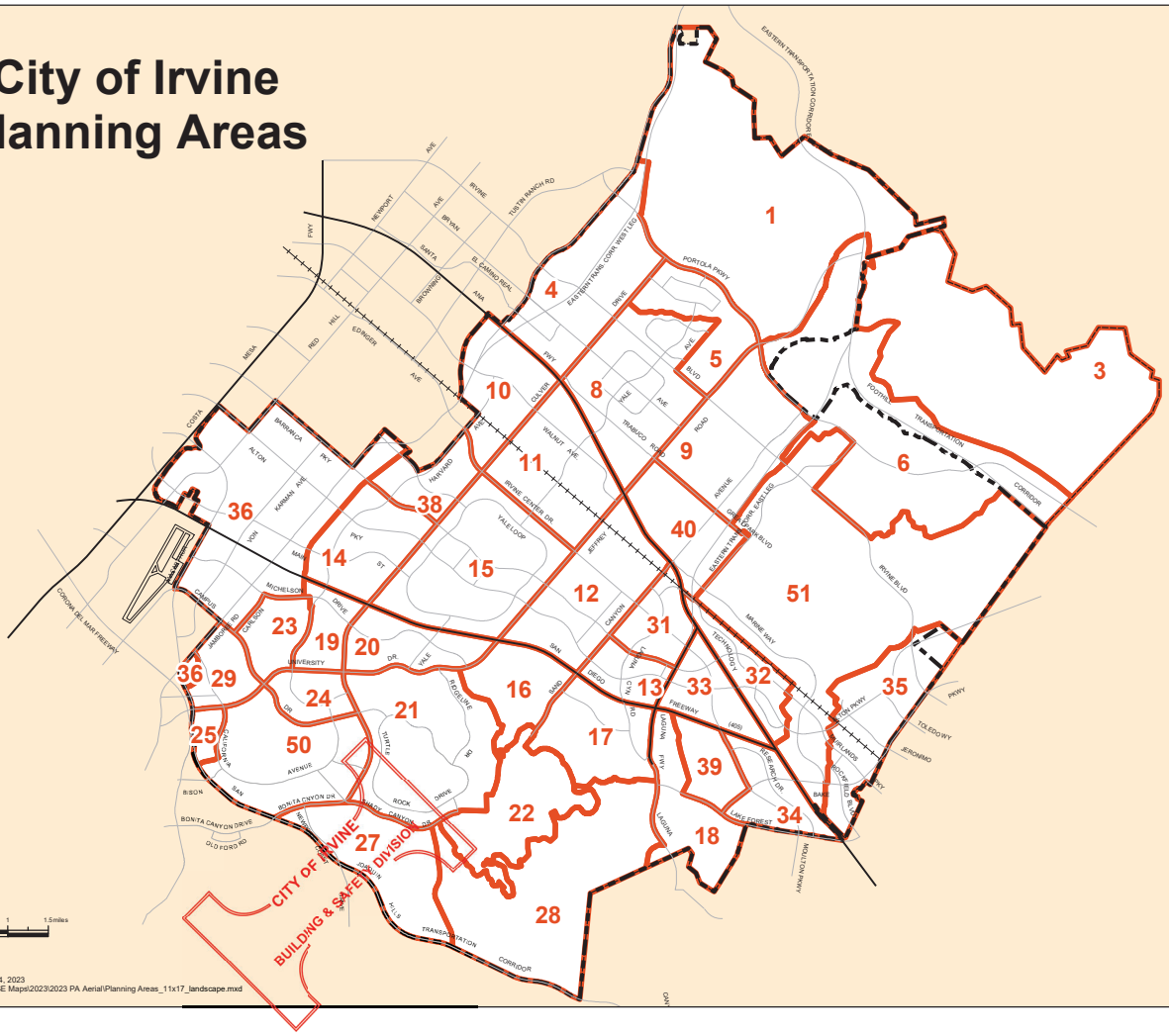
Attachment D. Supporting Documents



City of Irvine – Planning Areas, Land Use, & Zoning Exhibits



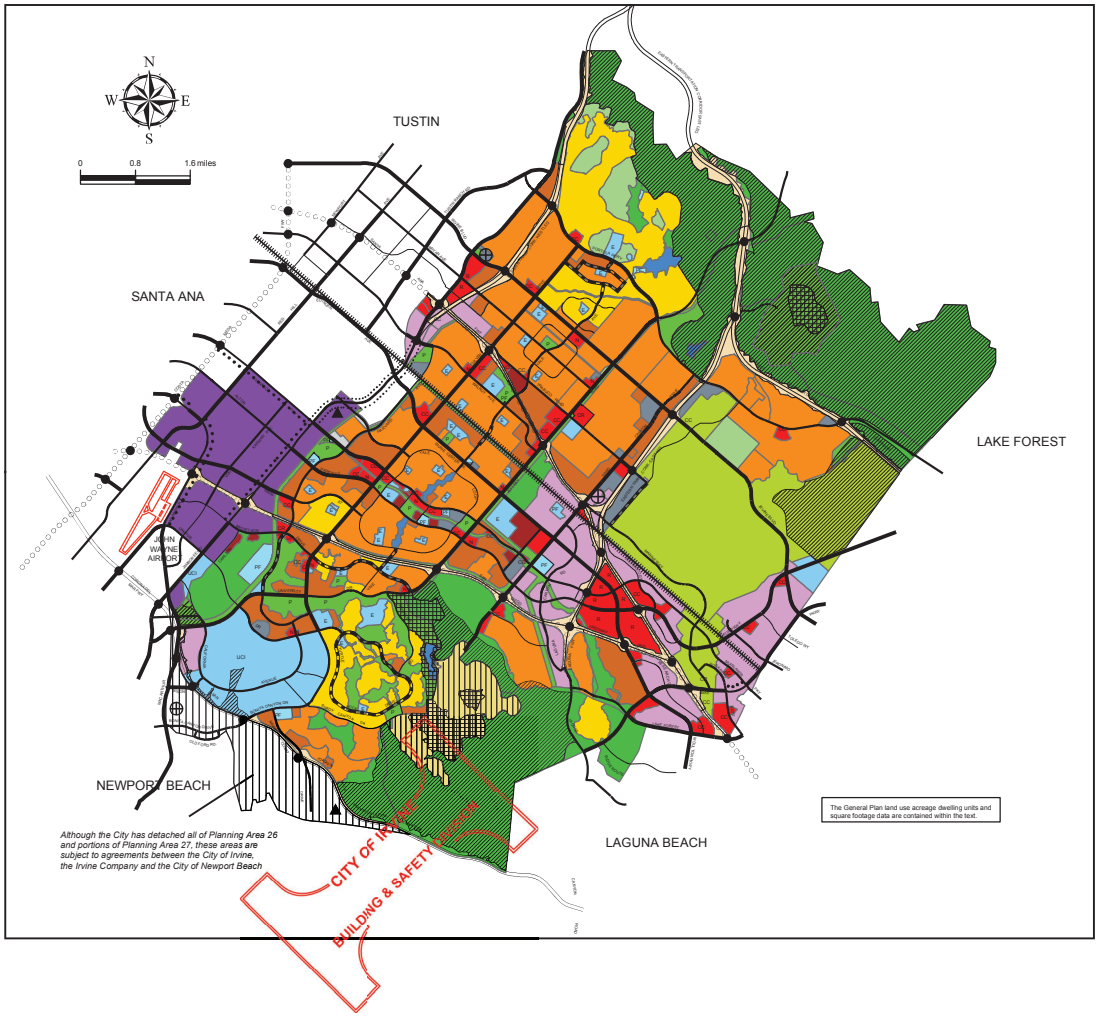
City of Irvine Planning Areas



PA1 Orchard Hills
PA3 Limestone Canyon - Open Space
PA4 Lower Peters Canyon
PA5 Northwood Point
PA6 Portola Springs
PA8 Northwood
PA9
PA9A Woodbury
PA9B & C2 Stonegate
PA9C1 Woodbury East
PA10 Walnut
PA11 El Camino Real
PA12 Oakcreek
PA13 Irvine Spectrum 4
PA14 Westpark
PA15 Woodbridge
PA16 Quail Hill - Open Space

PA17 Quail Hill
PA18
N: Laguna Altura
S: Hidden Canyon
PA19 Rancho San Joaquin
PA20 University Park
PA21 Turtle Rock
PA22 Shady Canyon
PA23 San Joaquin Marsh
PA24 University Town Center
PA25 University Research Center
PA27 Turtle Ridge
PA28 Bommer Canyon - Open Space
PA29 UCI - North Campus
PA31 Irvine Spectrum 6
PA32 Irvine Spectrum 3
PA33 Irvine Spectrum Center
PA34 Irvine Spectrum 5
PA35 Irvine Spectrum 2
PA36 Irvine Business Complex
PA38 Westpark II
PA39 Los Olivos
PA40 Cypress Village
PA50 University of California, Irvine
PA51 Great Park

Date: Tuesday, April 4, 2023
Path: A:\projects\BASE Maps\2023\2023 PA Aerial\Planning Areas_11x17_landscape.mxd



City of Irvine General Plan

Figure A-3

LAND USE

LEGEND

CONSERVATION OPEN SPACE
- Recreation
- Preservation
- Water Bodies
- Agriculture
- Golf Course Overlay
- Landfill Overlay
- NCCP Reserve
- NCCP Special Linkage

RESIDENTIAL
- Estate(4)
- Low Density(4)
- Medium Density(4)
- Medium High Density(4)
- High Density(4)

MILITARY(1)(2)(4)

MULTI USE(2)(4)

Orange County Great Park

COMMERCIAL
- N — Neighborhood Commercial(4)
- CC — Community Commercial(4)
- R — Regional Commercial(4)
- CR — Commercial Recreation(4)

BUSINESS/INDUSTRIAL
- Research and Industrial(4)
- Urban and Industrial(3)(4)

INSTITUTIONAL
- E — Educational Facilities(1)(2)(3)(4)
- PF — Public Facilities(4)

- Historic Resources
- Waste Facility
- Freeway / Interchange
- Transportation Corridor
- Expressway
- Major Highway 8-Lanes
- Major Highway 6-Lanes
- Primary Highway
- Secondary Highway
- Commuter
- Railroads

NOTES TO LAND USES

(1) Land Use authority and corresponding regulatory activities are the responsibilities of the government agencies which own this land.

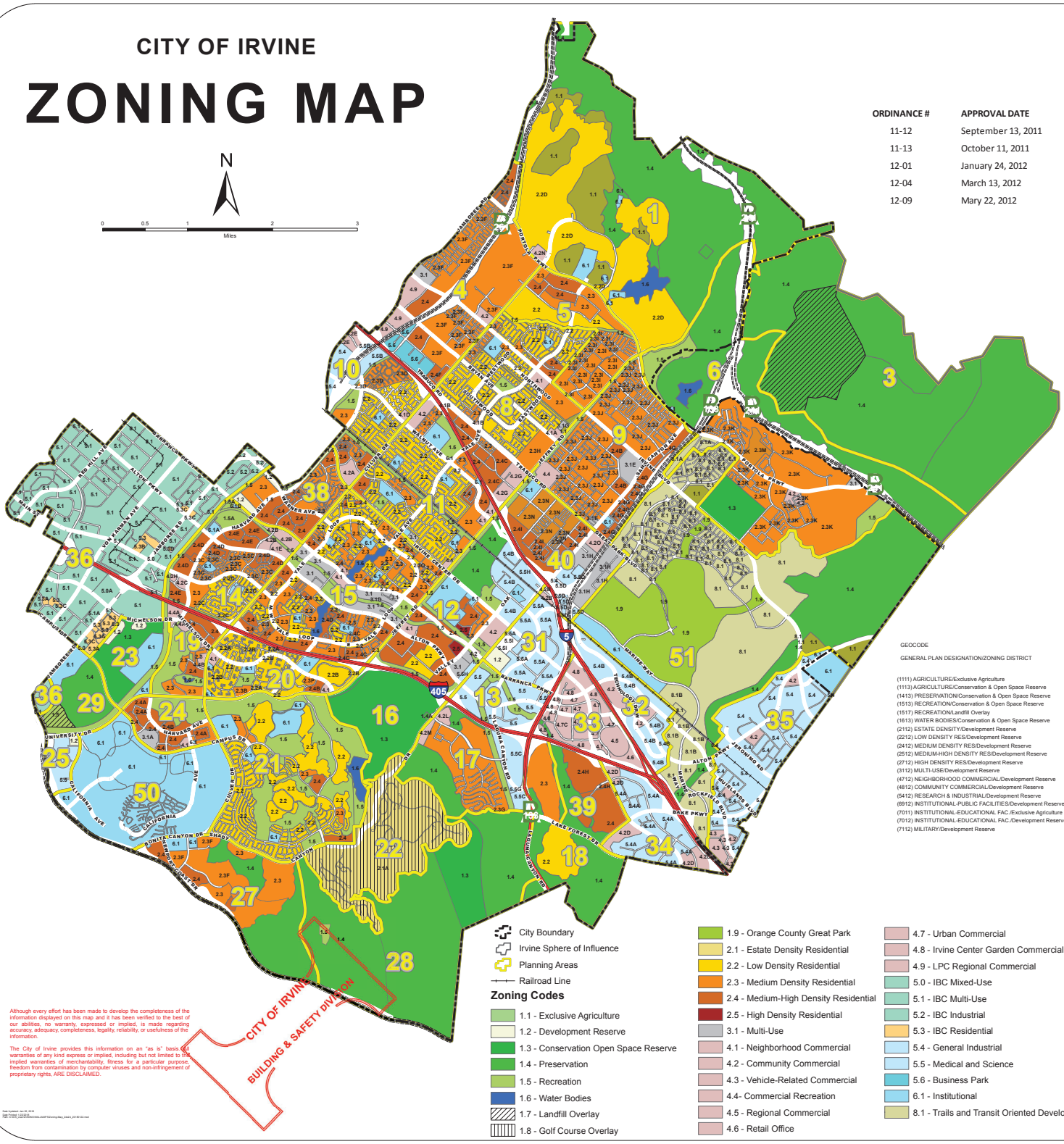
(2) These governmental agencies are subject to the General Plan requirements contained within the California Government Code sections 65401 and 65402.

(3) These Land Use categories also allow residential developments noted in the General Plan text.

(4) The Land Use Element Table A-1 establishes and regulates land use building intensity standards. Building intensity standards are allocated by Planning Area.

CITY OF IRVINE

ZONING MAP



ORDINANCE #	APPROVAL DATE
11-12	September 13, 2011
11-13	October 11, 2011
12-01	January 24, 2012
12-04	March 13, 2012
12-09	Mary 22, 2012

GEOCODE

GENERAL PLAN DESIGNATION/ZONING DISTRICT

(1111) AGRICULTURE/Exclusive Agriculture
(1113) AGRICULTURE/Conservation & Open Space Reserve
(1413) PRESERVATION/Conservation & Open Space Reserve
(1513) RECREATION/Conservation & Open Space Reserve
(1517) RECREATION/Landfill Overlay
(1613) WATER BODIES/Conservation & Open Space Reserve
(2112) ESTATE DENSITY/Development Reserve
(2212) LOW DENSITY RES/Development Reserve
(2412) MEDIUM DENSITY RES/Development Reserve
(2512) MEDIUM-HIGH DENSITY RES/Development Reserve
(2712) HIGH DENSITY RES/Development Reserve
(3112) MULTI-USE/Development Reserve
(4712) NEIGHBORHOOD COMMERCIAL/Development Reserve
(4812) COMMUNITY COMMERCIAL/Development Reserve
(5412) RESEARCH & INDUSTRIAL/Development Reserve
(6912) INSTITUTIONAL-PUBLIC FACILITIES/Development Reserve
(7011) INSTITUTIONAL-EDUCATIONAL FAC./Exclusive Agriculture
(7012) INSTITUTIONAL-EDUCATIONAL FAC./Development Reserve
(7112) MILITARY/Development Reserve

City Boundary
Irvine Sphere of Influence
Planning Areas
Railroad Line

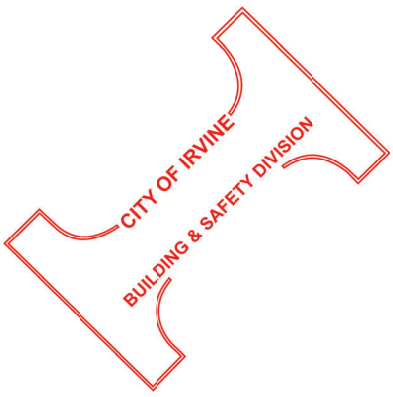
Zoning Codes

- 1.1 - Exclusive Agriculture
- 1.2 - Development Reserve
- 1.3 - Conservation Open Space Reserve
- 1.4 - Preservation
- 1.5 - Recreation
- 1.6 - Water Bodies
- 1.7 - Landfill Overlay
- 1.8 - Golf Course Overlay
- 1.9 - Orange County Great Park
- 2.1 - Estate Density Residential
- 2.2 - Low Density Residential
- 2.3 - Medium Density Residential
- 2.4 - Medium-High Density Residential
- 2.5 - High Density Residential
- 3.1 - Multi-Use
- 4.1 - Neighborhood Commercial
- 4.2 - Community Commercial
- 4.3 - Vehicle-Related Commercial
- 4.4- Commercial Recreation
- 4.5 - Regional Commercial
- 4.6 - Retail Office
- 4.7 - Urban Commercial
- 4.8 - Irvine Center Garden Commercial
- 4.9 - LPC Regional Commercial
- 5.0 - IBC Mixed-Use
- 5.1 - IBC Multi-Use
- 5.2 - IBC Industrial
- 5.3 - IBC Residential
- 5.4 - General Industrial
- 5.5 - Medical and Science
- 5.6 - Business Park
- 6.1 - Institutional
- 8.1 - Trails and Transit Oriented Development

Although every effort has been made to develop the completeness of the information displayed on this map and it has been verified to the best of our abilities, no warranty, expressed or implied, is made regarding accuracy, adequacy, completeness, legality, reliability, or usefulness of the information.

The City of Irvine provides this information on an "as is" basis. All warranties of any kind express or implied, including but not limited to the implied warranties of merchantability, fitness for a particular purpose, freedom from contamination by computer viruses and non-infringement of proprietary rights, ARE DISCLAIMED.

NRCS Web Soil Survey



Soil Map—Orange County and Part of Riverside County, California
(trailwide)



CITY OF IRVINE
BUILDING & SAFETY DIVISION

Map Scale: 1:10,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 450 900 1800 2700

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 17, Aug 30, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 17, 2023—Feb 8, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

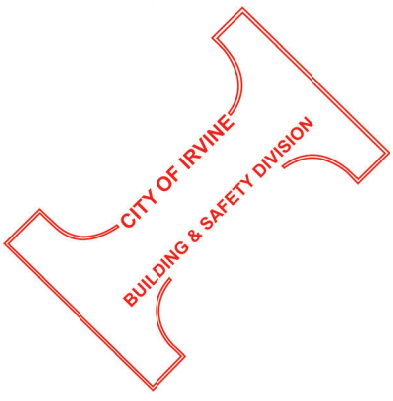
CITY OF IRVINE
BUILDING & SAFETY DIVISION

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
139	Chino silty clay loam (Soil Group C)	8.4	44.6%
140	Chino silty clay loam, drained (Soil Group C)	2.4	12.9%
184	Omni clay, drained (Soil Group C)	8.0	42.5%
Totals for Area of Interest		**18.9**	**100.0%**

CITY OF IRVINE
BUILDING & SAFETY DIVISION

IBC Trail Feasibility Study & Implementation Plan (2021) – Segment 6 Excerpts





Irvine Business Complex (IBC)

Trail Feasibility Study & Implementation Plan

FINAL JUNE 2021

CITY OF IRVINE
BUILDING & SAFETY DIVISION

Submitted to **City of Irvine**
By **IBI Group**
with **PlaceWorks** and **Zephyr UAS**

IBI GROUP

CITY OF IRVINE 1971

3.6. Segment 6: Barranca Channel

This segment extends south from Barranca Parkway between Von Karman Avenue and Millikan Avenue to the intersection of Main Street and the San Diego Creek. Segment 6 follows the Barranca Channel south where it crosses the east side of the "U" loop of Segment 2. Segment 7 and 8 spur off of the trail when the channel turns east toward the San Diego Creek near Main Street. This potential trail connects with Segment 4: San Diego Creek Creekwalk just north of Main Street. The alignment of Segment 6 is illustrated in Figure 3.11. Photographs of the segment are shown in Figure 3.12.

The segment is approximately 1.5 miles long. It generally has a minimum 20-foot wide, gravel paved access road on both banks of the channel, with the following exceptions:

- Between Barranca Parkway and Alton Parkway, the southeastern bank is narrow (approximately 6 feet wide) and consists of compacted soil without gravel paving.
- Between Jamboree Road and Main Street, the southwestern bank is narrow (approximately 4 feet to 6 feet wide) and consists of compacted soil without gravel paving.

The banks of the channel in this segment are generally unarmored, with riprap and/or concrete sections occurring both upstream and downstream of street crossings. The channel is generally fenced with chain-link along its length. The gravel road is well maintained, with little to no vegetation growing within the segment. Non-native vegetation adjacent to the east bank includes Eucalyptus (Eucalyptus sp.), Brisbane Box (Lophostemon sp.), Pine (Pinus sp.), and Mexican Fan Palm (Washingtonia sp.).

This segment is concurrent with Segment 2: 'U Loop' for approximately 450 yards, from Segment 2's terminus north of McGaw Avenue to the intersection of these two segments behind the business at 17462 Von Karman Avenue.

Segment 6 has a new bicycle-pedestrian bridge currently under construction called the Kelvin Bridge. The Kelvin Bridge crosses over the Barranca Channel and is located approximately 1,000 feet west of Jamboree Road. The Kelvin Bridge will provide a paved access and crossing for the neighborhoods located generally between Kelvin Avenue near the Kelvin Court Apartments, and Main Street.

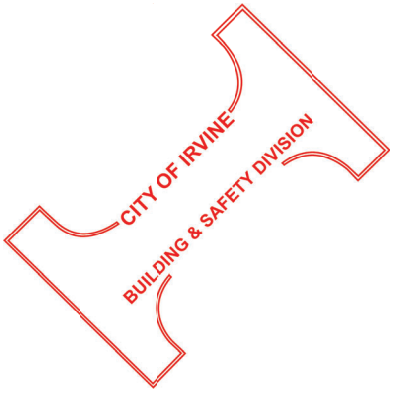
Access into the segment is possible from Alton Parkway, McGaw Avenue, Jamboree Road, and Main Street. Curves in the segment limit view sheds into the segment from Barranca Parkway and Main Street.

Land adjacent to this segment is dedicated to parking lots, access roads, and buildings. There is no evidence of existing private recreational uses along or adjacent to this segment. This segment is located adjacent to a combination of land uses, including residential, commercial, industrial, and some retail nearby.

The segment is owned by the OCFCD, who oversees the maintenance and operation of the flood control channel and utilizes the existing maintenance roadway for access. Right-of-way maps for this segment are provided in Appendix D.

This segment has street crossings at the following public roadways:

- Alton Parkway
- McGaw Avenue
- Jamboree Road



IBC Segment 6 Alignment

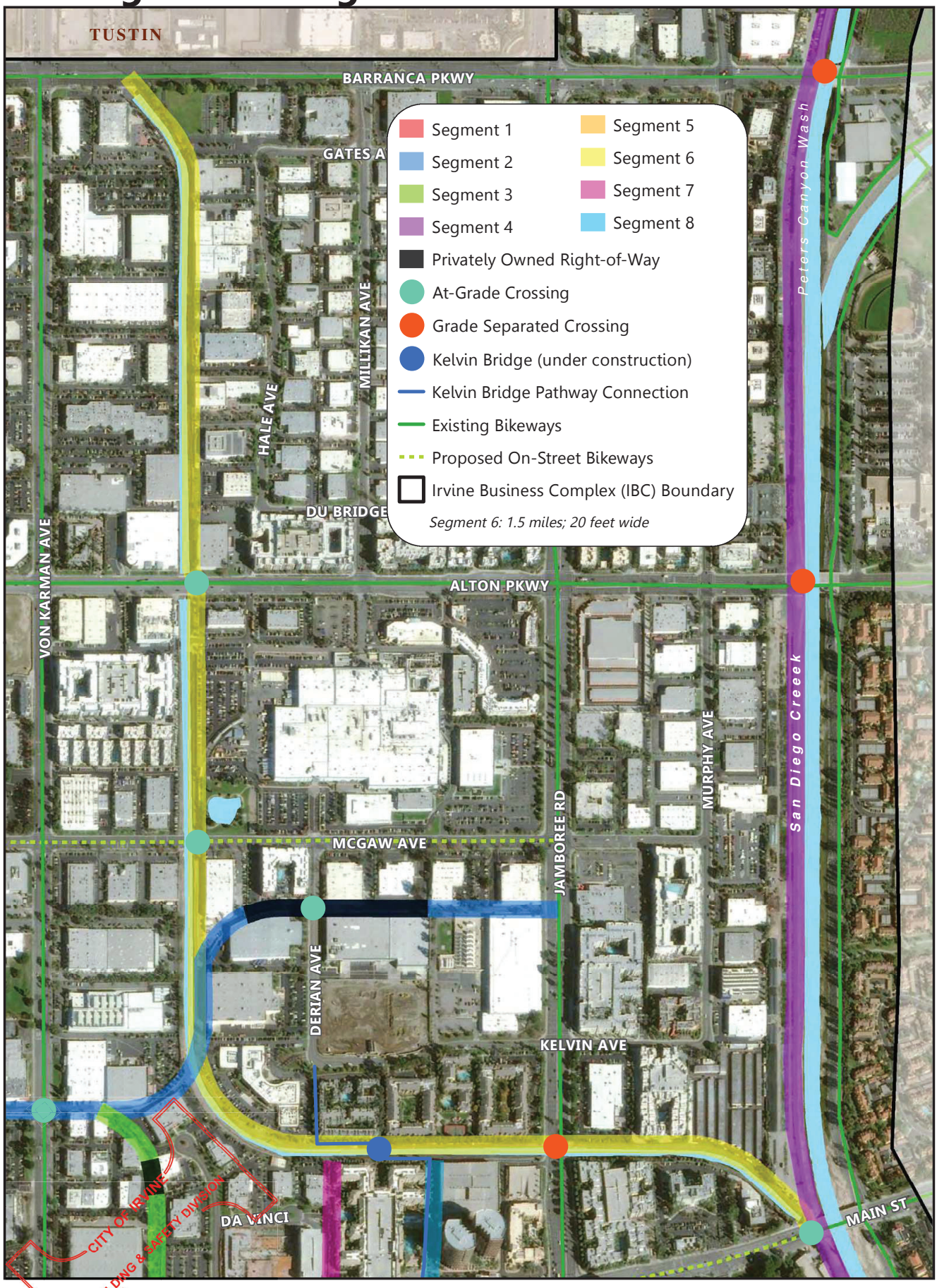


Figure 3.12: Segment 6 Photographs



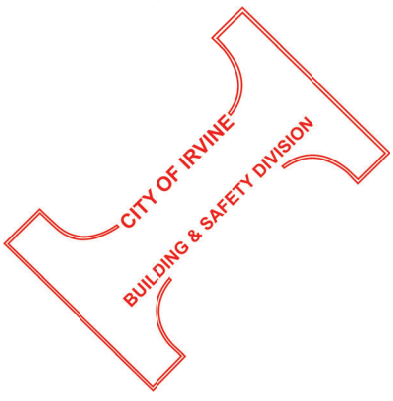
Segment 6 north of Da Vinci facing northwest



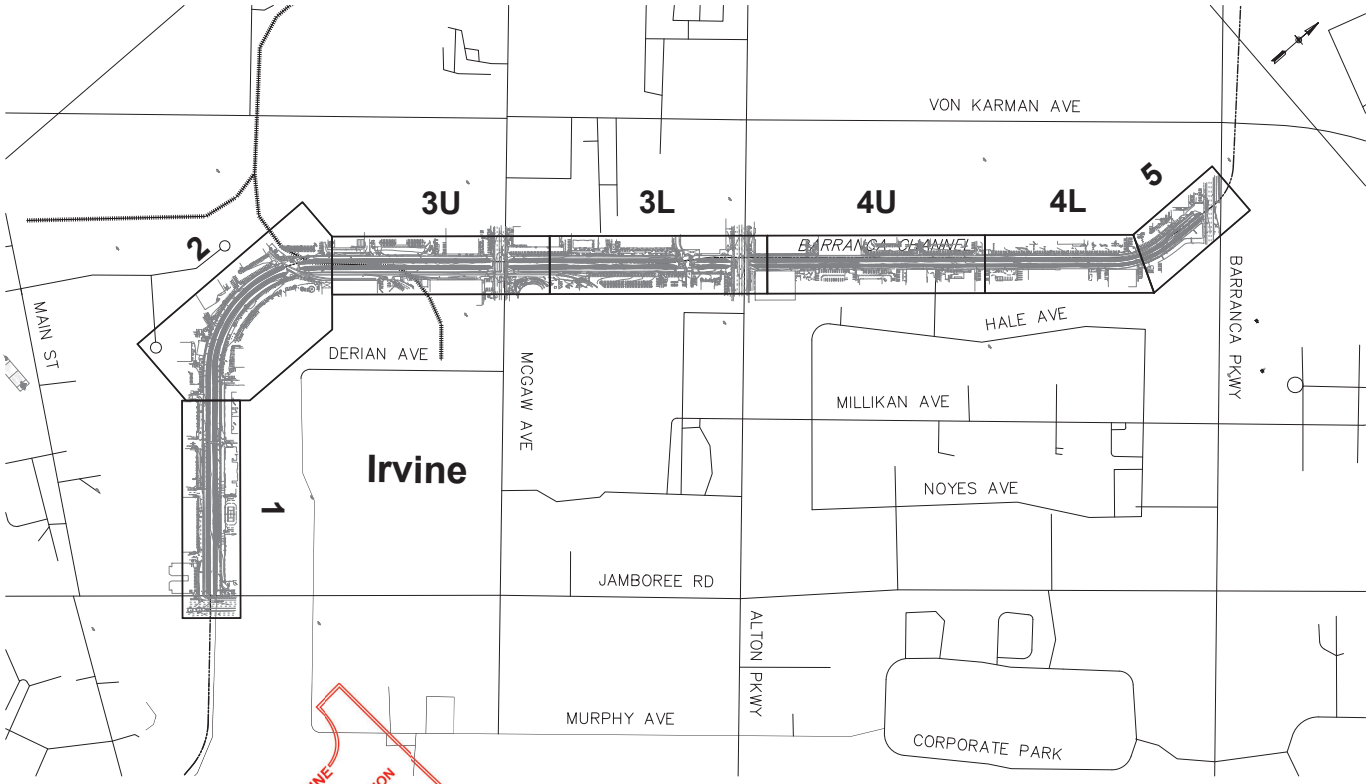
Segment 6 north of Cartwright Road at the Segment 2 intersection facing north

CITY OF IRVINE
BUILDING & SAFETY DIVISION

IBC Multi-Use Trail Along Barranca Channel
Concept Plans



NOT FOR CONSTRUCTION



CITY OF IRVINE
BUILDING & SAFETY DIVISION

DRAFT

NO.	DATE	REVISIONS	ENGR.	APPROV.	DATE
7					
6					
5					
4					
3					
2					
1	11/09/2022				

DRAWN BY: L. LA POINT DATE: 11/09/2022
DESIGNED BY: DATE
CHECKED BY: DATE

PLAN PREPARED BY: IBI

IBC MULTI-USE TRAIL
ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

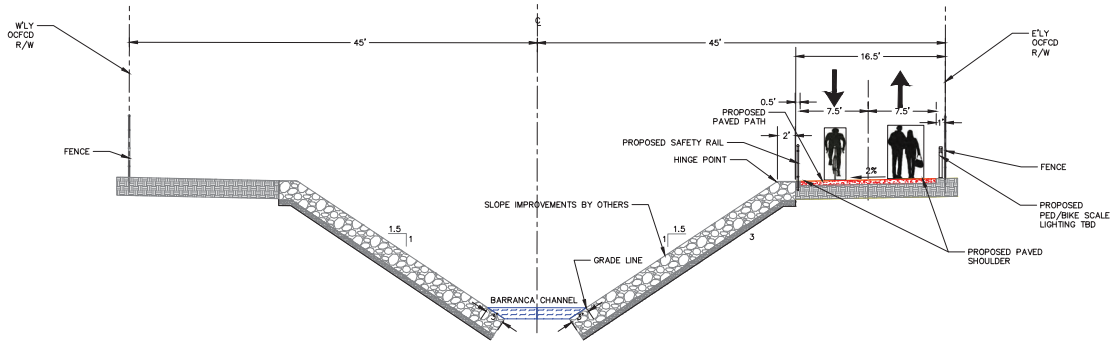
CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET KEYMAP OF 5

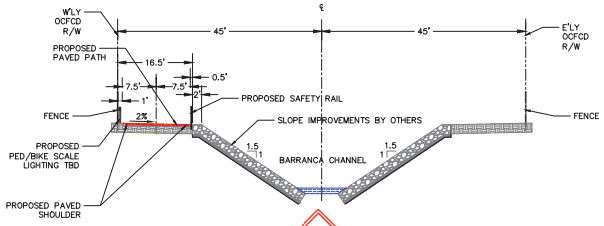
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SHEET REVISED: 10/21/22

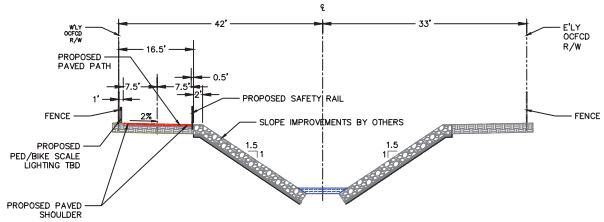
NOT FOR CONSTRUCTION



TYPICAL SECTION
JAMBOREE ROAD TO BNSF RAILROAD CROSSING



TYPICAL SECTION
BNSF RAILROAD CROSSING TO ALTON PARKWAY



TYPICAL SECTION
ALTON PARKWAY TO BARRANCA PARKWAY

CITY OF IRVINE
BUILDING & SAFETY DIVISION

DRAFT

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1	11/09/2022				

DRAWN BY: L. LA POINT — DATE: 11/09/2022
DESIGNED BY: — DATE
CHECKED BY: — DATE

PLAN PREPARED BY:
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IBC MULTI-USE TRAIL
ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

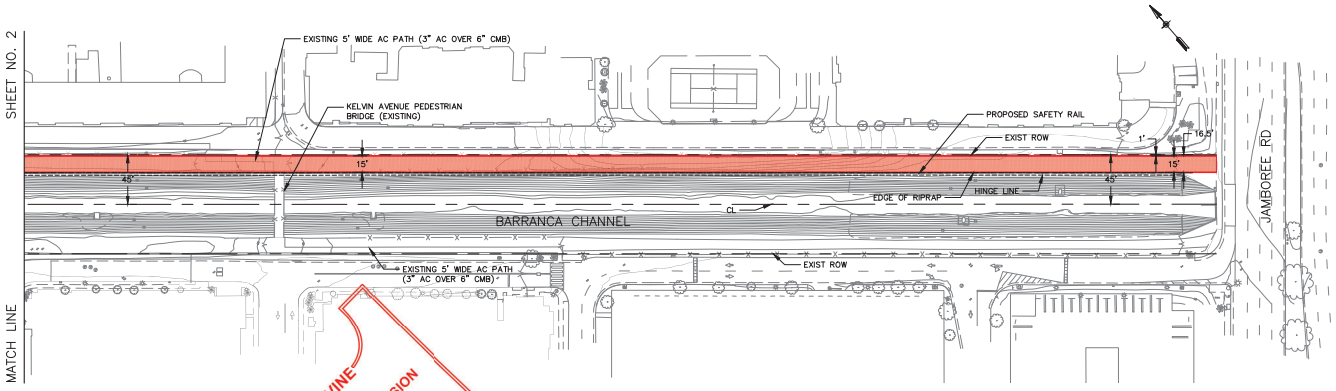
CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET TYP OF 5

VIEW = PATH =
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SHEET REVISED: 10/21/22

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LEGEND

- RIGHT OF WAY
- 15'-WIDE MULTI-USE PATH FOOTPRINT
- HINGE LINE
- PROPOSED SAFETY RAIL

CITY OF IRVINE
BUILDING & SAFETY DIVISION

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CHECKED BY: DATE

PLAN PREPARED BY: IBI

IBC MULTI-USE TRAIL
ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET 1 OF 5

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SHEET REVISED: 10/21/22

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LEGEND

- RIGHT OF WAY
- 15'-WIDE MULTI-USE PATH FOOTPRINT
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CITY OF IRVINE
BUILDING & SAFETY DIVISION

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ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

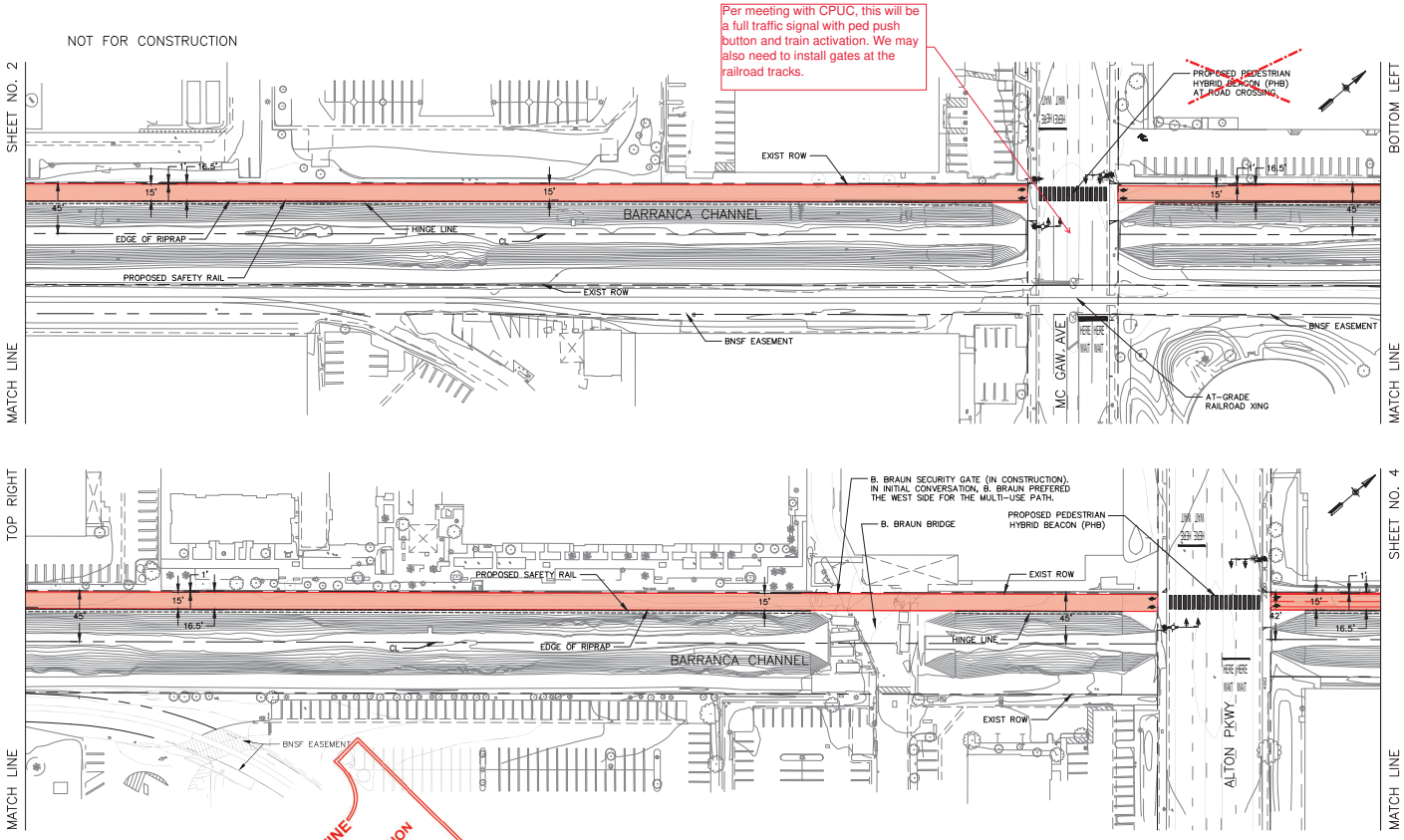
CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET 2 OF 5

VIEW = DWG = PATH =

SHEET REVISED: 10/21/22

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LEGEND

- RIGHT OF WAY
- 15'-WIDE MULTI-USE PATH FOOTPRINT
- HINGE LINE
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CITY OF IRVINE BUILDING & SAFETY DIVISION

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ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

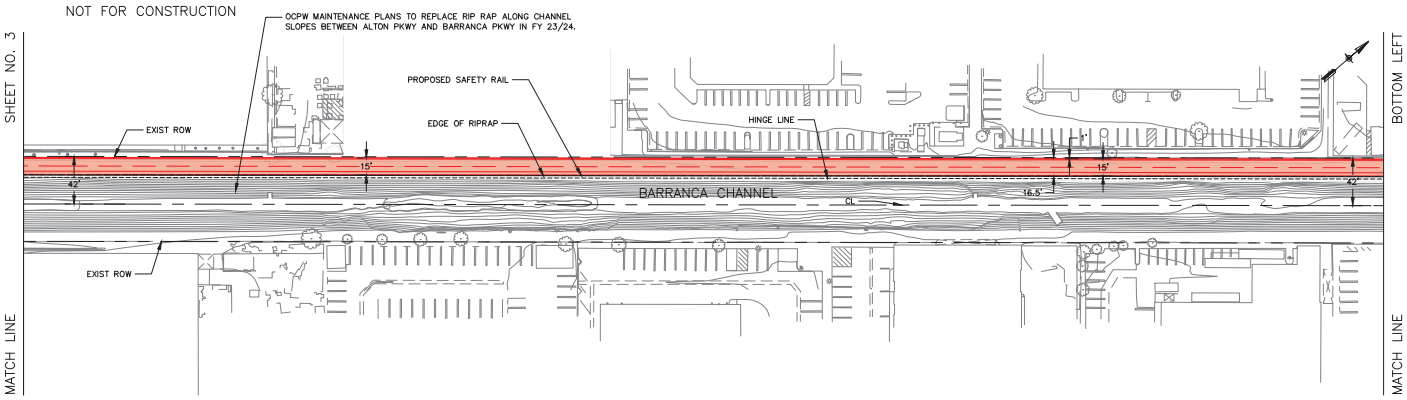
CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

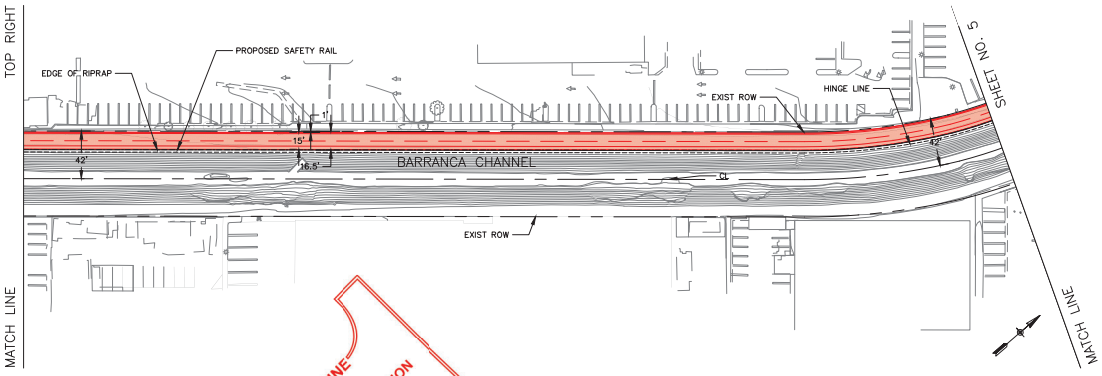
PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET 3 OF 5

VIEW = PATH = DWG =

SHEET REVISED: 10/21/22

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LEGEND

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- PROPOSED SAFETY RAIL

CITY OF IRVINE
BUILDING & SAFETY DIVISION

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ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

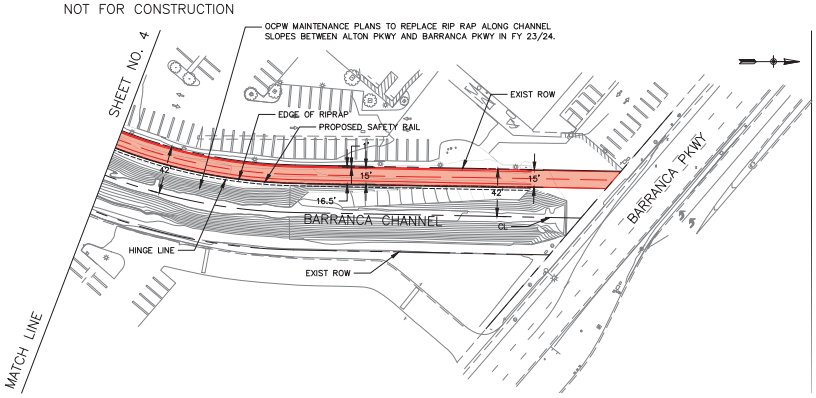
CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET 4 OF 5

VIEW = PATH =
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SHEET REVISED: 10/21/22

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LEGEND

- RIGHT OF WAY
- 15'-WIDE MULTI-USE PATH FOOTPRINT
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CITY OF IRVINE
BUILDING & SAFETY DIVISION

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IBC MULTI-USE TRAIL
ALONG BARRANCA CHANNEL
(BARRANCA PKWY TO JAMBOREE RD)

CITY OF IRVINE
PUBLIC WORKS DEPARTMENT

PLAN CHECK NO.
PERMIT NO.
PROJECT NO. 138014
SHEET 5 OF 5

VIEW = PATH =
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