

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

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

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

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☐ L. Fuel Dispensing Areas	☐ Fueling areas ⁶ shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☐ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area ¹ .] The canopy [or cover] shall not drain onto the fueling area.		☐ The property owner shall dry sweep the fueling area routinely. ☐ See the Fact Sheet SD-30, "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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

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☐ M. Loading Docks	☐ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ☐ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ☐ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☐ Move loaded and unloaded items indoors as soon as possible. ☐ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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☐ M. Fire Sprinkler Test Water		☐ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☐ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
☐ O. Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☐ Rooftop equipment ☐ Drainage sumps ☐ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☐ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☐ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. Include controls for other sources as specified by local reviewer.	

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☒ P. Plazas, sidewalks, and parking lots.			☒ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.	

Appendix 9: O&M

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

Will be Available with the
Final WQMP

Appendix 10: Educational Materials

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

CATCH BASIN MARKER - DETAIL SHEET -

The City requires that catch basins be marked "No Dumping, Drains to Lake" using the **das Manufacturing Incorporated**, 3" x 5 1/4" Duracast style storm drain marker. Storm drain markers are required at all storm drain inlets/catch basins within the boundary of a development project.

Item No.	Description
NDL 3" x 5 1/4" Rectangle Storm Drain Marker	Blue/White/Green, "No Dumping, Drains to Lake" Duracast Style
AG	Adhesive Guide – imprinted on back of marker
RS-222-5	5 oz. Adhesive Squeeze Tube
RS-222-11	11 oz. Adhesive Cartridge for std. caulk gun

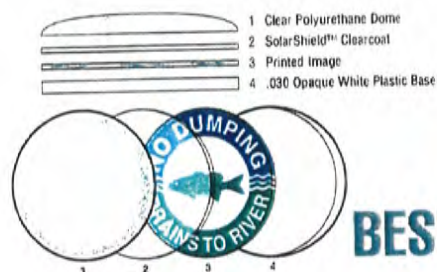
Ordering information: das Manufacturing Incorporated, 3610 Cinnamon Trace Dr., Valrico, FL 33596 / Ph 800-549-6024 / www.dasmanufacturing.com.

NDL



3" X 5 1/4" Rectangle

"Duracast" Style Example



D Duracast™ Style Markers *Abrasion & UV Resistant*

This marker has a polyurethane "dome" applied to the face of the marker. It is optically clear, self-healing, non-yellowing, and U.V. resistant. It provides protection against mechanical and chemical abrasion.

AG Back Printing

The adhesive guide insures proper adhesive application on the marker



das Curb Marker Adhesive #RS-222-5 / #RS-222-11

It is a single part adhesive which requires no mixing or special surface preparation. It provides a permanent bond to concrete, asphalt, metal or just about any flat vertical or horizontal non-soil surface.

Recommended application temperature range is 40–90 F. It will skin over in an hour, be firm within two (2) hrs and achieve a full cure within 18 hours.

Available in either a 5 oz. re-sealable squeeze tube or an 11 oz. cartridge for use with any caulk gun.

Placement

The marker should be placed in clear sight on the top of the inlet facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map. Refer to CASQA BMP SD-13 at <http://www.cabmphandbooks.com/Documents/Development/SD-13.pdf>



Storm Drain Signage SD-13 / January 2003 California Stormwater BMP Handbook
www.cabmphandbooks.com

Stormwater Pollution - Threatening Local Waterways

When you think of water pollution, you might think of foaming industrial outfalls or smelly sewage plants . . . but did you ever consider that YOU might be contributing to the water pollution problem?

Even after industry and sewage plants became regulated, it is still apparent that there are other sources of pollution entering our local waterways. In fact, monitoring programs found that runoff from urban and rural areas causes as much as 60-70% of our water pollution problem.

Many residents are unaware of the problem of stormwater pollution (polluted runoff), and the threat it poses to local waterways. Unfortunately, many people don't realize that storm drains connect to local waterways, so whatever ends up in the storm drains flows directly - without treatment - to our rivers, lakes and streams.

Another misconception is that stormwater pollution happens only when it rains. Actually, throughout the dry part of the year, pollutants such as motor oil, antifreeze, trash and grease accumulate on streets and parking lots. When rain finally does fall, the rain water carries these pollutants into the storm drain. Also, throughout the year, runoff water from lawns and landscaped areas can carry pesticides and fertilizers into the storm drains. Even activities such as washing our cars can result in detergents and dirt making their way into the storm drain.



Since pollution prevention is much easier and less costly than cleaning up after-the-fact, we must all work together to help keep our precious waterways clean.

Here's how YOU can help:

- Don't overdose our environment with pesticides and fertilizers. They contain products which promote algae growth in local waterways. Abundant algae growth suffocates aquatic life. Try non-toxic alternatives for pest control.
- Keep yard and grass clippings out of the storm drains. When these materials reach local waterways, they cloud the water and block sunlight that is essential to aquatic life.
- Pick-up animal waste, seal it in a bag and dispose of it in a trash can. Animal waste contains harmful bacteria and organisms that can spread diseases if allowed to reach the storm drain system.
- Never pour anything into the gutter or down a storm drain.
- Wash cars on a grassy area. Do not allow dirty, soapy water to flow into the street gutter or storm drains.

Here's how WE can help YOU:

The StormWater/CleanWater Protection Program provides a number of FREE pollution prevention materials for residents, schools and club organizations. Call **1-800-506-2555** to order any of the materials or services listed below:

- Less toxic alternatives for the home and garden
- Storm drain pollution prevention materials for children
- Classroom presentations
- Guest speakers for rotary/civic/group functions
- Watershed Maps (illustrating local rivers, lakes and streams)

For information or questions, call your stormwater coordinator at 413-3115.
Sponsored by the City of Moreno Valley and the StormWater/CleanWater Protection Program.



**Storm Water
Clean Water**
PROTECTION PROGRAM

Home Gardening – Made Easy and Pesticide Free



Do you love a beautiful flower garden and a bountiful vegetable patch, but don't like the idea of using pesticides and chemicals to keep pesty bugs away?

Come to a **FREE GARDEN WORKSHOP** to learn how to deter pests out of the garden without the use of pesticides.

At the workshop you will learn how specific plants help to repel pests and how other plants help attract beneficial insects like ladybugs and lacewings.

Call **1-800-506-2555** for information about a **FREE GARDEN WORKSHOP** near you.

Are these familiar garage and household items?

Do you know how to properly dispose of unwanted quantities?

While products such as household cleaners, bleach, oven cleaners, paints, solvents, motor oil and antifreeze serve useful purposes, you must remember to handle them as household hazardous waste (HHW) when you throw away unwanted quantities.

Help keep our environment clean! Recycle unwanted HHW items. There will be an **HHW Collection Event on June 19, 20 and 21** at the Moreno Valley City Corporate Yard located at 15670 Perris Blvd.

You may bring up to five gallons of hazardous liquid waste or a total of 50 pounds maximum per car/per trip (enforced by CHP). Multiple trips are allowed. Containers should be marked and secured to prevent leaks. Containers holding gasoline will not be returned. The collection event will be closed if rained out or excessive winds. Call 358-5256 for more information.

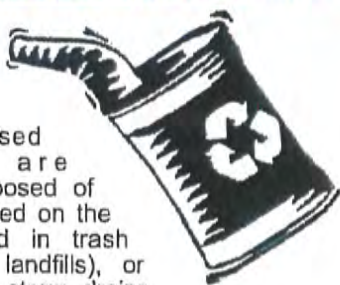
Tips to help protect our environment:

- Never pour any HHW into the gutter or down a storm drain.
- Never pour HHW on the ground as this may percolate to groundwater – an important drinking water resource.
- Never throw HHW in the trash as this may injure sanitation workers and contaminate landfills and the surrounding area.



Do-It-Yourselfers...Remember to Do It Safe and Right

In the United States alone, an estimated 200 million gallons of used motor oil are improperly disposed of by being dumped on the ground, tossed in trash (ending-up in landfills), or poured down storm drains. The good news is it's never been more convenient to recycle used motor oil and oil filters.



Recycle used motor oil by bringing it to a local store in your neighborhood.

Firestone Store - 24673 Alessandro Blvd. - (909) 242-6631
Kragen Auto Parts - 24021 Alessandro Blvd., #C - (909) 242-0641
Kragen Auto Parts - 12240 Perris Blvd. - (909) 247-5509
Auto Zone - 24570 Alessandro Blvd. - (909) 242-8439
Auto Zone - 12601 Perris Blvd. - (909) 242-4353
Auto Zone - 23031 Sunnymead Blvd. - (909) 924-5460
Pep Boys - 23470 Sunnymead Blvd. - (909) 247-4564
Grease Monkey - 23165 Hemlock - (909) 247-1873
Scher Tire - 23135 Hemlock - (909) 924-9797
Ramona Auto Services, Inc. - 12275 Heacock - (909) 243-6424

For additional recycling locations call 1-800-CLEANUP.

Landscape Design & Water Quality

Create a landscape design that reduces pesticide and fertilizer runoff and conserves water. Good plant choices, proper site preparation, installation of "smart" irrigation equipment, and use of porous materials for walkways and other unplanted areas are key elements in an environmentally friendly landscape.

Install porous surfaces in unplanted areas.

- ◆ Use flagstone, interlocking pavers, or pervious concrete on walkways and patios instead of impermeable surfaces such as concrete and asphalt.
- ◆ Interlocking pavers for driveways or an interceptor drain at the bottom of the driveway collect runoff and divert water into your landscape.
- ◆ Consider gravel, organic mulches or other materials that allow water to soak into the ground in unplanted areas.
- ◆ Avoid using concrete, asphalt, compacted bare soil, or other impervious surfaces wherever possible.

Improve water absorption.

- ◆ Add organic matter, such as compost, and aerate regularly to reduce compaction.
- ◆ Use perforated drainage lines to allow water to filter into surrounding soils.
- ◆ Install gravel sumps or other percolation areas to keep water from collecting in unwanted areas.

Choose plants that conserve water, buffer runoff, and resist pest problems.

- ◆ Plant water-efficient plants, including many native species, to reduce irrigation. Some natives require little to no fertilizer or pest management.
- ◆ Use turfgrasses and pest-resistant plants best adapted to the local climate.
- ◆ Install dense plantings with fibrous root systems along landscape edges to reduce runoff and soil erosion.



Create landscape features to collect runoff water.

- ◆ Incorporate long, shallow grassy depressions, known as swales, to hold large amounts of runoff from driveways, streets, or parking lots.
- ◆ Create low-lying areas in the garden to provide temporary storage for heavy runoff and allow sediment, water, and garden chemicals to soak into the ground. Establish plant species that can survive both wet and dryer conditions.
- ◆ Include trees to intercept rainfall.
- ◆ Use rain barrels to collect and store runoff from rooftops for irrigating plants.
- ◆ Add terrace walls or other features.

Install and properly operate irrigation systems and equipment.

- ◆ Check your irrigation system and if necessary, make adjustments; replace old and mismatched sprinklers with low-flow rotor heads.
- ◆ Consider the addition of a "smart" irrigation controller. These are designed to reduce excess irrigation by replacing only the amount of water lost through plant use and evaporation.
- ◆ Install drip systems or soaker hoses for trees, shrubs, and some ground covers.



Minimize the use of pesticides that pollute our waterways. Use nonchemical alternatives or less toxic pesticide products whenever possible. Read product labels carefully and follow instructions on proper use, storage, and disposal.

For more information about managing pests, contact your **University of California Cooperative Extension** office listed under the county government pages of your phone book or the UC IPM Web site at www.ipm.ucdavis.edu.



University of California
Cooperative Extension

What you use in your landscape affects our rivers and oceans!

Text developed through a grant from CA SWRCB and the CALFED Bay-Delta Program.

3.1 INFILTRATION BASIN

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evapotranspiration (when vegetated), Evaporation, and Sedimentation
Maximum Treatment Area	50 acres
Other Names	Bioinfiltration Basin

Description

An Infiltration Basin is a flat earthen basin designed to capture the design capture volume, V_{BMP} . The stormwater infiltrates through the bottom of the basin into the underlying soil over a 72 hour drawdown period. Flows exceeding V_{BMP} must discharge to a downstream conveyance system. Trash and sediment accumulate within the forebay as stormwater passes into the basin. Infiltration basins are highly effective in removing all targeted pollutants from stormwater runoff.



Figure 1 – Infiltration Basin

See Appendix A, and Appendix C, Section 1 of *Basin Guidelines*, for additional requirements.

Siting Considerations

The use of infiltration basins may be restricted by concerns over ground water contamination, soil permeability, and clogging at the site. See the applicable WQMP for any specific feasibility considerations for using infiltration BMPs. Where this BMP is being used, the soil beneath the basin must be thoroughly evaluated in a geotechnical report since the underlying soils are critical to the basin's long term performance. To protect the basin from erosion, the sides and bottom of the basin must be vegetated, preferably with native or low water use plant species.

In addition, these basins may not be appropriate for the following site conditions:

- Industrial sites or locations where spills of toxic materials may occur
- Sites with very low soil infiltration rates
- Sites with high groundwater tables or excessively high soil infiltration rates, where pollutants can affect ground water quality
- Sites with unstabilized soil or construction activity upstream
- On steeply sloping terrain
- Infiltration basins located in a fill condition should refer to Appendix A of this Handbook for details on special requirements/restrictions

INFILTRATION BASIN BMP FACT SHEET

Setbacks

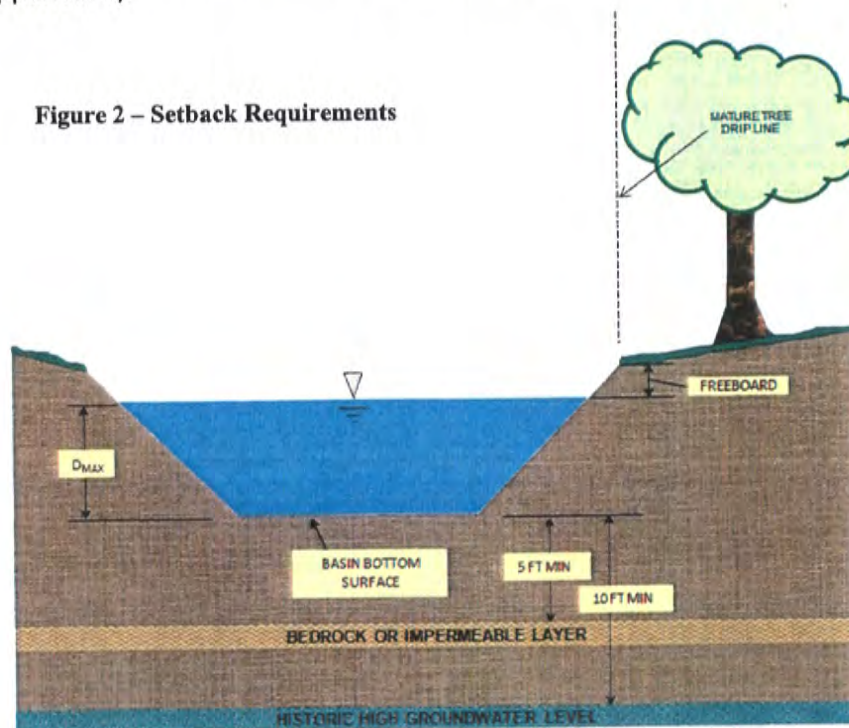
Always consult your geotechnical engineer for site specific recommendations regarding setbacks for infiltration trenches. Recommended setbacks are needed to protect buildings, existing trees, walls, onsite or nearby wells, streams, and tanks. Setbacks should be considered early in the design process since they can affect where infiltration facilities may be placed and how deep they are allowed to be. For instance, depth setbacks can dictate fairly shallow facilities that will have a larger footprint and, in some cases, may make an infiltration basin infeasible. In that instance, another BMP must be selected.

Infiltration basins typically must be set back:

- 10 feet from the historic high groundwater (measured vertically from the bottom of the basin, as shown in Figure 2)
- 5 feet from bedrock or impermeable surface layer (measured vertically from the bottom of the basin, as shown in Figure 2)
- From all existing mature tree drip lines as indicated in Figure 2 (to protect their root structure)
- 100 feet horizontally from wells, tanks or springs

Setbacks to walls and foundations must be included as part of the Geotechnical Report. All other setbacks shall be in accordance with applicable standards of the District's *Basin Guidelines* (Appendix C).

Figure 2 – Setback Requirements



INFILTRATION BASIN BMP FACT SHEET

Forebay

A concrete forebay shall be provided to reduce sediment clogging and to reduce erosion. The forebay shall have a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall / berm. Full height notch-type weir(s), offset from the line of flow from the basin inlet to prevent short circuiting, shall be used to outlet the forebay. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

Overflow

Flows exceeding V_{BMP} must discharge to an acceptable downstream conveyance system. Where an adequate outlet is present, an overflow structure may be used. Where an embankment is present, an emergency spillway may be used instead. Overflows must be placed just above the design water surface for V_{BMP} and be near the outlet of the system. The overflow structure shall be similar to the District's Standard Drawing CB 110. Additional details may be found in the District's *Basin Guidelines* (Appendix C).

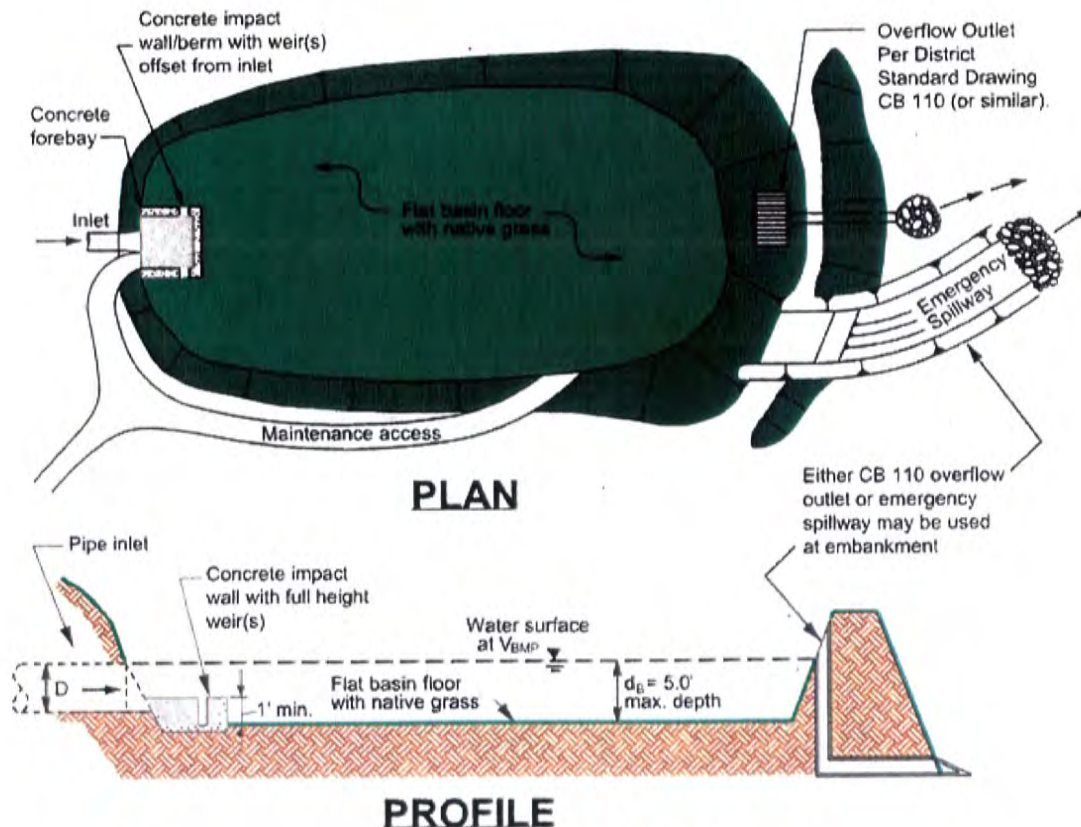


Figure 3 – Infiltration Basin

INFILTRATION BASIN BMP FACT SHEET

Landscaping Requirements

Basin vegetation provides erosion protection, improves sediment removal and assists in allowing infiltration to occur. The basin surface and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with County of Riverside Ordinance 859 and the District's *Basin Guidelines* (Appendix C), or other guidelines issued by the Engineering Authority.

Maintenance

Normal maintenance of an infiltration basin includes the maintenance of landscaping, debris and trash removal from the surface of the basin, and tending to problems associated with standing water (vectors, odors, etc.). Significant ponding, especially more than 72 hours after an event, may indicate that the basin surface is no longer providing sufficient infiltration and requires aeration. See the District's *Basin Guidelines* (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.).

Table 1 - Inspection and Maintenance

Schedule	Inspection and Maintenance Activity
Ongoing including just before annual storm seasons and following rainfall events.	- Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strenuously avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used, - Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. - Fertilizers should not be applied within 15 days before, after, or during the rain season. - Remove debris and litter from the entire basin to minimize clogging and improve aesthetics. - Check for obvious problems and repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. There should be no long-term ponding water. - Check for erosion and sediment laden areas in the basin. Repair as needed. Clean forebay if needed. - Revegetate side slopes where needed.
Annually. If possible, schedule these inspections within 72 hours after a significant rainfall.	- Inspection of hydraulic and structural facilities. Examine the inlet for blockage, the embankment and spillway integrity, as well as damage to any structural element. - Check for erosion, slumping and overgrowth. Repair as needed. - Check basin depth for sediment build up and reduced total capacity. Scrape bottom as needed and remove sediment. Restore to original cross-section and infiltration rate. Replant basin vegetation. - Verify the basin bottom is allowing acceptable infiltration. Use a disc or other method to aerate basin bottom only if there is actual significant loss of infiltrative capacity, rather than on a routine basis¹. - No water should be present 72 hours after an event. No long term standing water should be present at all. No algae formation should be visible. Correct problem as needed.
1. CA Stormwater BMP Handbook for New Development and Significant Redevelopment	

INFILTRATION BASIN BMP FACT SHEET

Table 2 - Design and Sizing Criteria for Infiltration Basins

Design Parameter	Infiltration Basin
Design Volume	V_{BMP}
Forebay Volume	0.5% V_{BMP}
Drawdown time (maximum)	72 hours
Maximum tributary area	50 acres ²
Minimum infiltration rate	Must be sufficient to drain the basin within the required Drawdown time over the life of the BMP. The WQMP may include specific requirements for minimum tested infiltration rates.
Maximum Depth	5 feet
Spillway erosion control	Energy dissipators to reduce velocities ¹
Basin Slope	0%
Freeboard (minimum)	1 foot ¹
Historic High Groundwater Setback (max)	10 feet
Bedrock/impermeable layer setback (max)	5 feet
Tree setbacks	Mature tree drip line must not overhang the basin
Set back from wells, tanks or springs	100 feet
Set back from foundations	As recommended in Geotechnical Report
1. Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures	
2. CA Stormwater BMP Handbook for New Development and Significant Redevelopment	

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the District's Basin Guidelines (Appendix C). In addition, information herein may be superseded by other guidelines issued by the co-permittee.

INFILTRATION BASIN SIZING PROCEDURE

1. Find the Design Volume, V_{BMP} .
 - a) Enter the Tributary Area, A_T .
 - b) Enter the Design Volume, V_{BMP} , determined from Section 2.1 of this Handbook.
2. Determine the Maximum Depth.
 - a) Enter the infiltration rate. The infiltration rate shall be established as described in Appendix A: "Infiltration Testing".
 - b) Enter the design Factor of Safety from Table 1 in Appendix A: "Infiltration Testing".
 - c) The spreadsheet will determine D_1 , the maximum allowable depth of the basin based on the infiltration rate along with the maximum drawdown time (72 hours) and the Factor of Safety.

$$D_1 = [(t) \times (I)] / 12s$$

Where I = site infiltration rate (in/hr)
 s = safety factor
 t = drawdown time (maximum 72 hours)

INFILTRATION BASIN BMP FACT SHEET

d)

Infiltration Basin - Design Procedure (Rev. 03-2012)		BMP ID	Legend:	Required Entries Calculated Cells
Company Name: _____		Date: _____		
Designed by: _____		County/City Case No.: _____		
Design Volume				
a) Tributary area (BMP subarea)		$A_T =$ _____ acres		
b) Enter V_{BMP} determined from Section 2.1 of this Handbook		$V_{BMP} =$ _____ ft^3		
Maximum Depth				
a) Infiltration rate		$I =$ _____ in/hr		
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)		$FS =$ _____		
c) Calculate D_1		$D_1 = \frac{I \text{ (in/hr)} \times 72 \text{ hrs}}{12 \text{ (in/ft)} \times FS}$		
d) Enter the depth of freeboard (at least 1 ft)		_____ ft		
e) Enter depth to historic high ground water (measured from top of basin)		_____ ft		
f) Enter depth to top of bedrock or impermeable layer (measured from top of basin)		_____ ft		
g) D_2 is the smaller of:				
Depth to groundwater - (10 ft + freeboard) and		$D_2 =$ _____ ft		
Depth to impermeable layer - (5 ft + freeboard)				
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet		$D_{MAX} =$ _____ ft		
Basin Geometry				
a) Basin side slopes (no steeper than 4:1)		$z =$ _____ :1		
b) Proposed basin depth (excluding freeboard)		$d_B =$ _____ ft		
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)		$A_S =$ _____ ft^2		
d) Proposed Design Surface Area		$A_D =$ _____ ft^2		
Forebay				
a) Forebay volume (minimum 0.5% V_{BMP})		Volume = _____ ft^3		
b) Forebay depth (height of berm/splashwall. 1 foot min.)		Depth = _____ ft		
c) Forebay surface area (minimum)		Area = _____ ft^2		
d) Full height notch-type weir		Width (W) = _____ in		
Notes: _____				

3.6 Extended Detention Basin

Type of BMP	LID - Biotreatment
Treatment Mechanisms	Sedimentation, Infiltration, Biofiltration, Evapotranspiration, and Evaporation
Minimum Tributary Drainage Area	5 acres
Other Names	Enhanced Water Quality Basin

Overview

The Extended Detention Basin (EDB) is designed to detain the design volume of stormwater, V_{BMP} , and maximize opportunities for volume losses through infiltration, evaporation, evapotranspiration and surface wetting. Additional pollutant removal is provided through sedimentation, in which pollutants can attach to sediment accumulated in the basin through the process of settling. Stormwater enters the EDB through a *forebay* where any trash, debris, and sediment accumulate for easy removal. Flows from the forebay enter the basin which is vegetated with native grasses that enhance infiltration and evapotranspiration, and which is interspersed with gravel-filled trenches that help further enhance infiltration. Water that does not get infiltrated or evapotranspired is conveyed to the *bottom stage* of the basin. At the bottom stage of the basin, low or incidental dry weather flows will be treated through a sand filter and collected in a subdrain structure. Any additional flows will be detained in the basin for an extended period by incorporating an outlet structure that is more restrictive than a traditional detention basin outlet. The restrictive outlet structure extends the drawdown time of the basin which further allows particles and associated pollutants to settle out before exiting the basin, while maximizing opportunities for additional incidental volume losses.

EXTENDED DETENTION BASIN BMP FACT SHEET

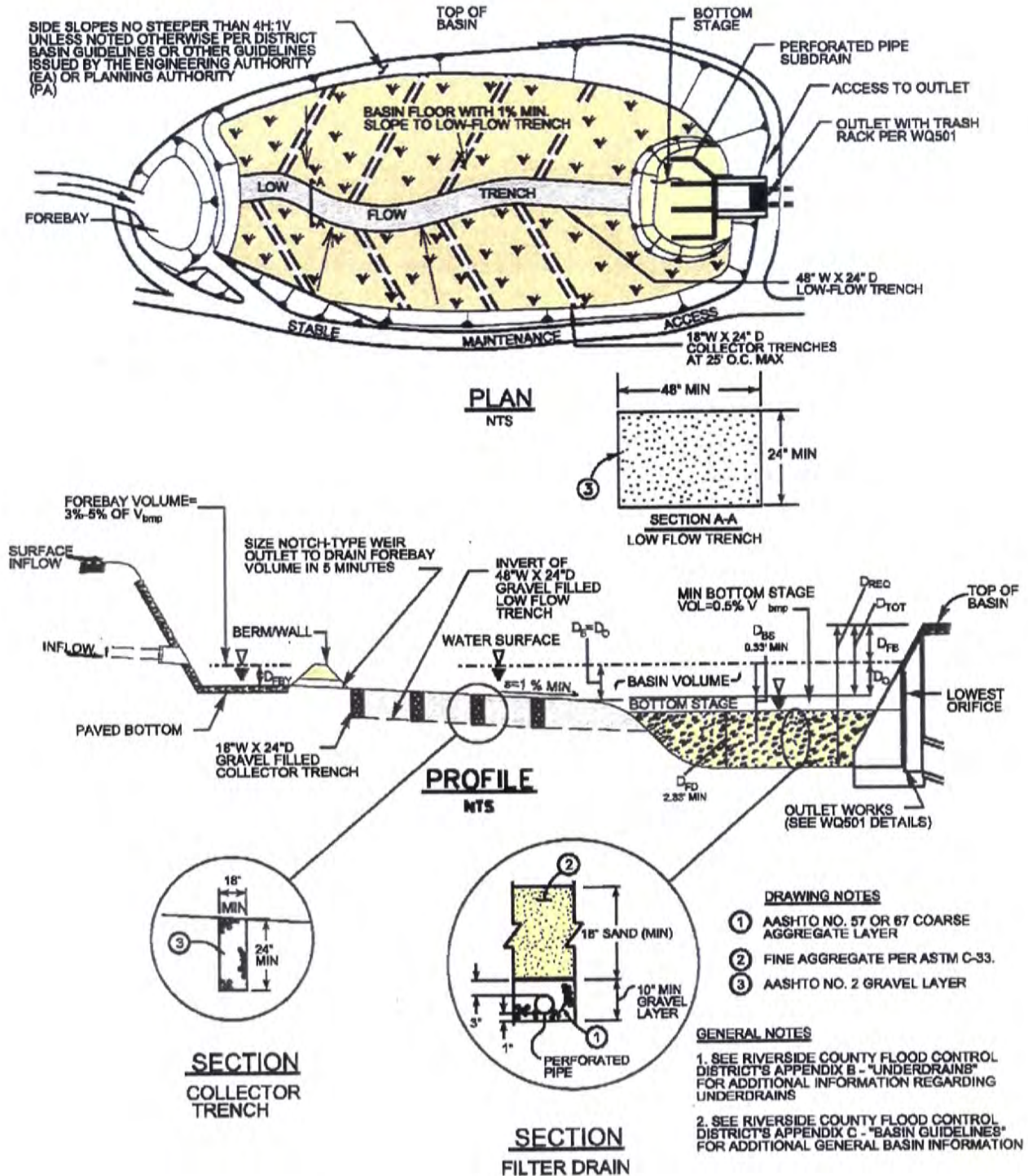


Figure 1 – Extended Detention Basin

EXTENDED DETENTION BASIN BMP FACT SHEET

Siting Considerations

Soils: EDBs can be used with almost all soils and geology. However, pollutant removal effectiveness is greatly improved when the underlying soil permits at least some infiltration.

Tributary Area: EDBs should only be used where the tributary drainage area is at least 5 acres, since meeting the draw-down requirements (discussed below) for smaller areas would result in very small outlet orifice diameters which would be prone to clogging.

Proximity to Receiving Waters: All site runoff must be treated to the MEP with appropriate BMPs *before* being discharged into Receiving Waters; as such the EDB cannot be constructed in-line within Receiving Waters.

Setbacks: Due to the infiltration characteristics incorporated into the EDB design, the lowest pervious point (beneath the filter drain) of the extended detention facility should be a minimum of 10' above the seasonal high groundwater table. All other setbacks shall be in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA).

Basin Guidelines: See Section 1 of the "Basin Guidelines" (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.) that may be required by the Engineering Authority (EA).

Landscaping Requirements

Basin vegetation provides erosion protection, enhances evapotranspiration and infiltration, and improves pollutant removal. The upper stage basin surface, berms and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through the use of pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the EA.

EXTENDED DETENTION BASIN BMP FACT SHEET

Maintenance Guidelines

Schedule	Inspection and Maintenance Activity
During every scheduled maintenance check (per below), and as needed at other times	- Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strongly avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used: - Care should be taken to avoid contact with the low-flow or other trenches, and the media filter in the bottom stage. - Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. - Fertilizers should not be applied within 15 days before, after, or during the rainy season. - No ponded water should be present for more than 72 hours to avoid nuisance or vector problems. No algae formation should be visible. Correct problems as needed.
Annually. If possible, schedule these inspections before the beginning of the rain season to allow for any repairs to occur before rains occur.	- Remove debris and litter from the entire basin - Inspect hydraulic and structural facilities. Examine the outlet for clogging, the embankment and spillway integrity, as well as damage to any structural element. - Check for erosion, slumping and overgrowth. Repair as needed. - Inspect sand media at the filter drain to verify it is allowing acceptable infiltration. Scarify top 3 inches by raking the filter drain's sand surface annually. - Check the media filter underdrains (via the cleanout) for damage or clogging. Repair as needed. - Remove accumulated sediment and debris from the forebay, and ensure that the notch weir is clear and will allow proper drainage. - Check gravel filled low flow and collector trenches for sediment buildup and repair as needed.
Every 5 years or sooner (depending on whether observed drain times to empty the basin are less than 72 hours).	Remove the top 3 inches of sand from the filter drain and backfill with 3 inches of new sand to return the sand layer to its original depth. When scarification or removal of the top 3 inches of sand is no longer effective, remove and replace sand filter layer.
Whenever substantial sediment accumulation has occurred.	Remove accumulated sediment from the bottom of the basin. Removal should extend to original basin depth.

EXTENDED DETENTION BASIN BMP FACT SHEET

Design Summary

Design Parameter	Extended Detention Basin
Drawdown time (total)	72 hours ^{2,3}
Minimum drawdown time for 50% V_{BMP}	24 hours ²
Minimum tributary area	5 acres ²
Outlet erosion control	Energy dissipaters to reduce velocities ¹
Forebay volume	3 to 5 % of V_{BMP} ³
Basin Invert Longitudinal Slope (min.)	1%
Basin Invert Transverse (cross) Slope (min)	1%
Low-flow trench width (min.)	48 inches
Low-flow trench depth (min.)	24 inches
Slope of low-flow trench along bottom excavated Surface (max.)	1%
Slope of gravel collector trenches along bottom excavated surface (max.)	1 %
Length to width ratio (min.)	1.5:1
Basin depth (min.)	1 foot ³
Bottom stage volume	0.5 % of V_{BMP} ³
Bottom stage depth (min)	0.33 feet ³
Filter drain depth (min)	2.33 feet ³
1. Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures 2. CA Stormwater BMP Handbook for New Development and Significant Redevelopment 3. Denver, Colorado's UDFCD Drainage Criteria Manual, Volume 3	

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the "Basin Guidelines" (Appendix C). In addition, information herein may be superseded by other guidelines issued by the Engineering Authority.

Design Procedure

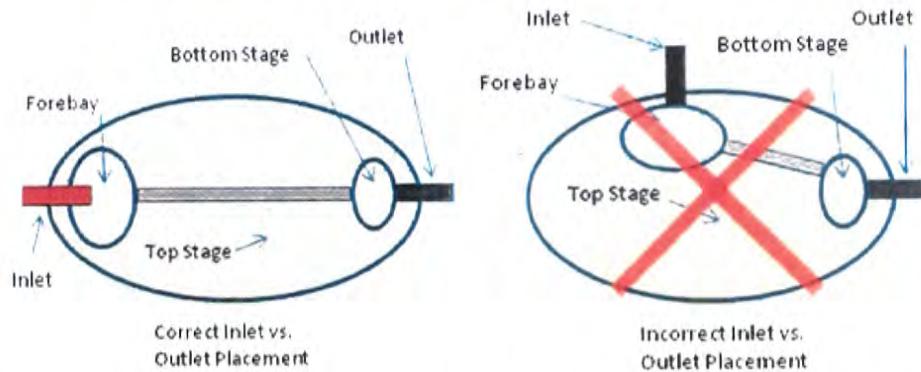
These steps correspond to and provide a description of the information required in the EDB Design Worksheet.

1. Find the Design Volume, V_{BMP} .
 - a) Enter the tributary area, A_T to the BMP. The minimum tributary area is 5 acres.
 - b) Enter the Design Volume, V_{BMP} , determined from Section 2.1 of this Handbook.

EXTENDED DETENTION BASIN BMP FACT SHEET

2. Basin Footprint

- a) Enter the length and width of the EDB. The length shall be measured between the inlet to the basin and the outlet structure; and the width shall be measured at the widest point of the basin invert. The length to width ratio should be 1.5:1 or longer to prevent short-circuiting and increase the overall effectiveness of the BMP.



- b) Enter the internal basin side slopes. See the "Basin Guidelines" (Appendix C) for side slope requirements. If variable internal side-slopes are used, enter the steepest slope that will be used.
- c) Using Figure 1 as a guide, enter the proposed basin depth, D_B , and the freeboard depth, D_{FB} . Based on the information provided, the spreadsheet will calculate the minimum total depth required, D_{REQ} , for this BMP. D_{REQ} is the depth from the bottom of the underdrain layer in the bottom stage (see step 5c), to the top of the freeboard. This calculated minimum required depth can be used to determine if enough elevation difference is available within the design topography to allow for use of this BMP.
- d) Additionally, the basin depth D_B is equal to D_O , which is the depth from the design pond water surface elevation to the lowest orifice in the outlet structure. D_O is confirmed by the spreadsheet and is used in the Basin Outlet Design described in step 6 below. It should be noted that this lowest orifice is a critical elevation in the design of this BMP. The Volume of the Basin V_{Basin} described in step 3d) is the volume of water above this lowest orifice. This lowest-orifice also represents the dry weather ponded water surface discussed in step 5c below. Below this elevation there must be a minimum of a 4-inch drop down to the surface of the Sand Filter in the bottom stage.

EXTENDED DETENTION BASIN BMP FACT SHEET

3. Basin Design

- a) The Total Basin Depth, D_{TOT} , is calculated automatically, and is the sum of the basin depth D_B plus the freeboard depth D_{FB} .
- b) Enter the longitudinal slope of the basin invert. This slope must be at least 1% and is measured along the low flow trench between the forebay and the bottom stage. Note that the surface of the sand layer in the bottom stage must be level (see Figure 1).
- c) Enter the transverse slope of the basin invert. This transverse (cross sectional) slope must be at least 1% sloped toward the low flow trench.
- d) Enter the Volume of the Basin, V_{Basin} . This volume must be the actual volume of water held within the basin as substantiated by modeling or appropriate volumetric calculations, and must be equal to or greater than V_{BMP} . This volume must be held above the lowest orifice in the Basin Outlet Design described in step 6 below.

4. Forebay Design

All flows must enter the basin through the forebay. The forebay provides a location for the settlement and collection of larger particles, and any other trash or debris. A relatively smooth and level concrete bottom surface should be provided to facilitate mechanical removal of any accumulated sediment, trash and debris.



Figure 2: Forebay filled with storm water

- a) Enter the Forebay Volume V_{FB} . This volume must be from 3 to 5 percent of V_{BMP} .
- b) A rock or concrete berm must be constructed to detain water before it drains into the basin. The top of the berm shall be set no higher than the invert of the inlet conveyance. Enter the Forebay Depth, D_{FBY} .
- c) The spreadsheet will calculate the minimum surface area of the forebay, A_{FB} , based on the provided Forebay Volume and Depth. Ensure that the plans provide for a forebay area at least this large.
- d) Although the forebay will be well submerged in the design event, a full height rectangular notch-type weir shall be constructed through the berm to prevent permanent ponding in the forebay, and allow water to slowly and fully drain to the main body of the basin. This notch should be offset from the inflow streamline to prevent low-flows from short circuiting. Enter the width, W , of this rectangular notch weir. The width shall not be less than 1.5 inches to prevent clogging. Additionally,

EXTENDED DETENTION BASIN BMP FACT SHEET

immediately outside the notch construct a minimum 1-foot by 1-foot gravel pad to prevent vegetative growth within the basin invert from blocking the notch.

5. Dry Weather and Low-Flow Management

The basin shall have both a low-flow gravel trench and a network of gravel collector trenches across the invert of the basin, as well as a bottom stage sand filter to treat low flows and dry weather flows (see Figure 1).

- a) Low Flow Trench: The low-flow gravel trench conveys flow from the forebay to the bottom stage, while allowing for maximum incidental infiltration and volume loss. The trench shall be a minimum of 48 inches wide by 24 inches deep. This trench shall be unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished surface of the basin invert, and shall not use underdrains. The bottom excavated surface of the low-flow trench shall be 1 percent or flatter to promote infiltration.



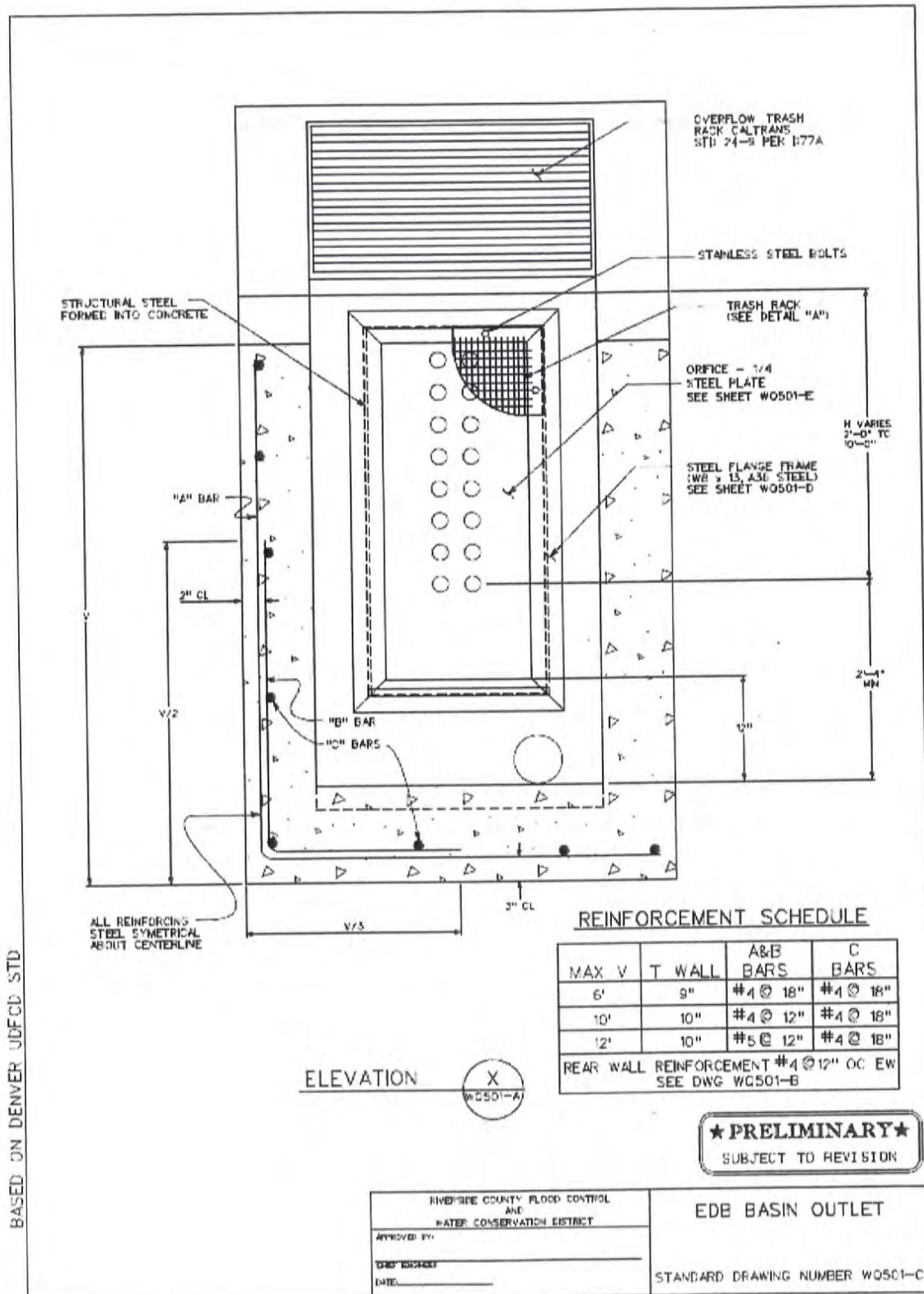
Figure 3: Gravel filled low-flow trench

- b) Collector Trenches: Gravel collector trenches beneath the top stage shall be arranged as illustrated in Figure 1 of Appendix C with minimal slope (1% maximum) along their bottom excavated surface to promote infiltration, and must extend from the low-flow trench to the toe of the basin side slopes. They shall be a minimum of 18-inches wide by 24-inches deep, unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished basin invert surface. The gravel collector trenches shall not use underdrains and shall be constructed with a maximum spacing of 25 feet, center to center. See Figure 1 of Appendix C.
- c) Bottom Stage: A depressed sand filter drain area, referred to as the bottom stage, must be constructed adjacent to the outlet structure to treat any dry weather flows. To ensure that dry weather flows are treated through the sand filter and not discharged through the orifice plate, the top surface of the sand filter must be depressed at least 4 inches below the lowest orifice in the outlet structure. This depressed area will create a micro pool of water that is then filtered down through the sand filter and out through underdrains. Based on the minimum dimensions described below, the minimum depth of excavation below the lowest orifice in the outlet structure is 2.33 feet.
- Enter the Depth of the bottom stage, D_{BS} . As mentioned above, this depth must be at least 4 inches, and extend down below the lowest orifice in the outlet structure.
 - Enter the area of the bottom stage, A_{BS} .

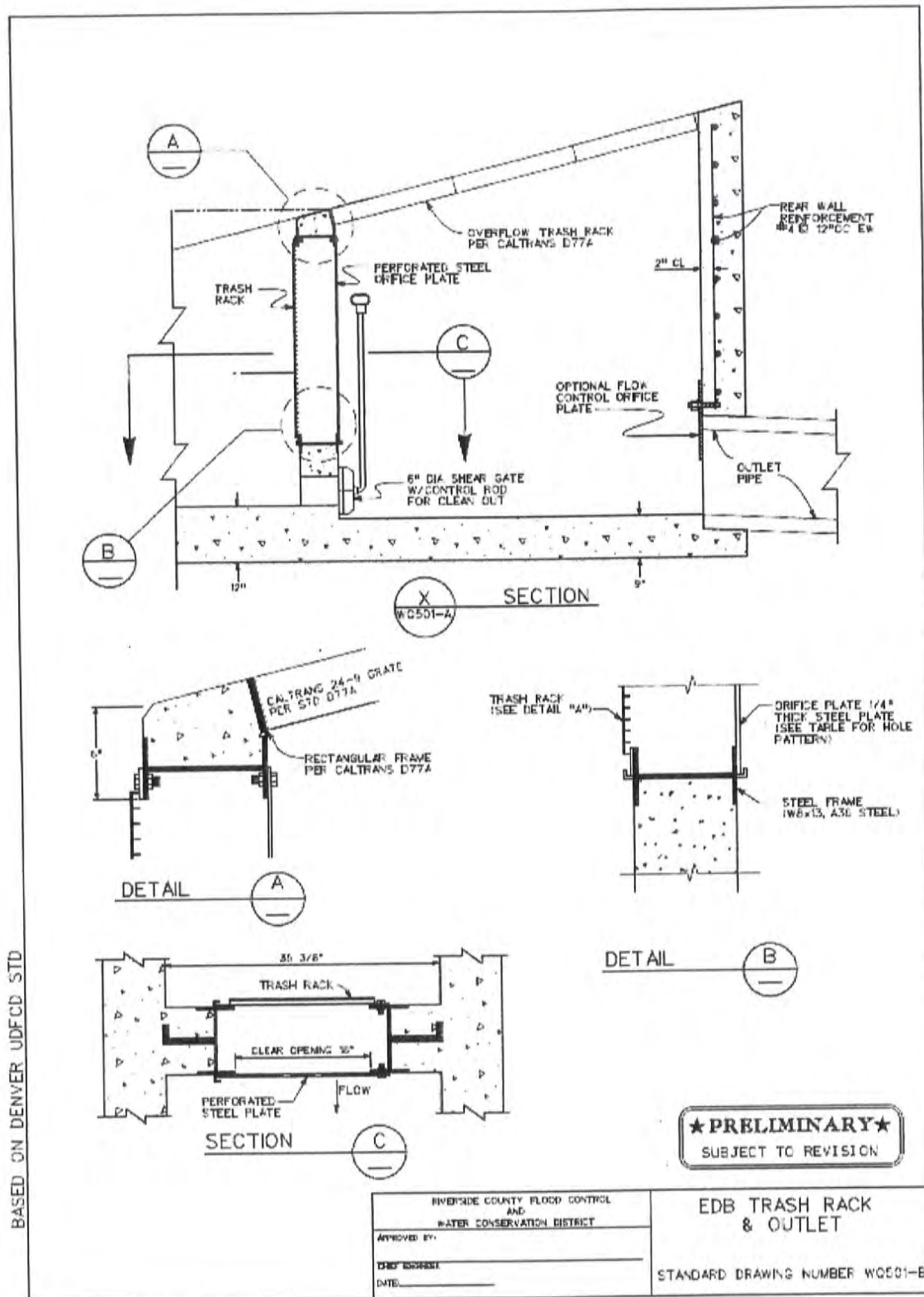
EXTENDED DETENTION BASIN BMP FACT SHEET

- iii. Based on the D_{BS} and A_{BS} entered, the spreadsheet will calculate V_{BS} . This volume is the volume of ponded water that will be held below the lowest orifice in the outlet structure, and above the surface of the sand filter. This volume must be at least 0.5% of V_{BMP} .
- iv. Enter the thickness of the ASTM C-33 sand layer that will be provided, D_s . A minimum thickness of 18 inches is required.
- v. Below the sand layer, a minimum 10-inch thick layer of gravel shall be installed with underdrains to drain the water that has been treated through the sand filter. The underdrains shall connect into the outlet structure. See Appendix B for standard underdrain construction. Enter the diameter of the underdrain pipe (minimum 6" dia.), and the spacing of the underdrains. The maximum spacing of the underdrains is 20 feet on center, however where the area of the bottom stage is particularly small (less than 500 square feet), the underdrain pipes shall be placed at no more than a 10-foot separation on center.

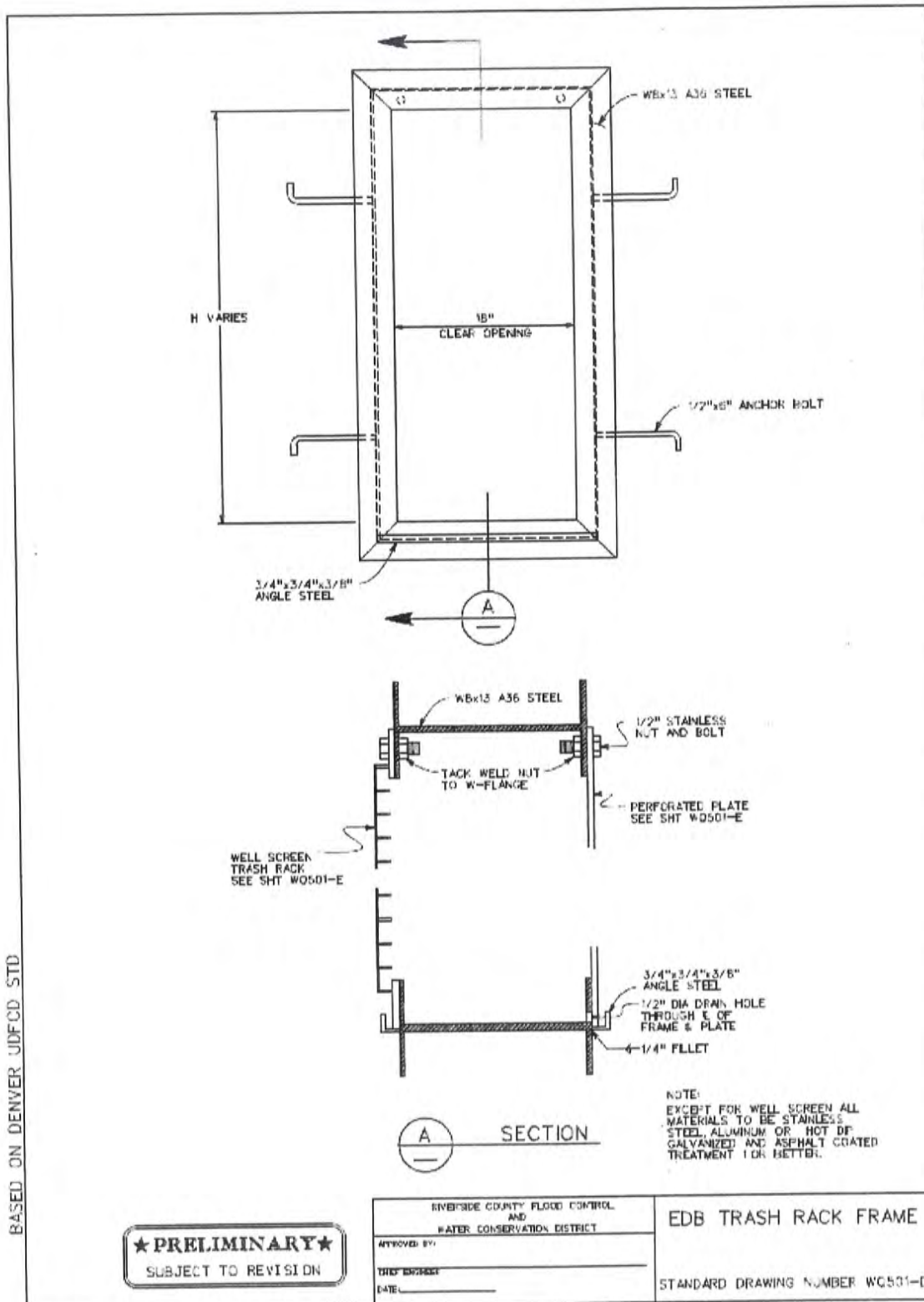
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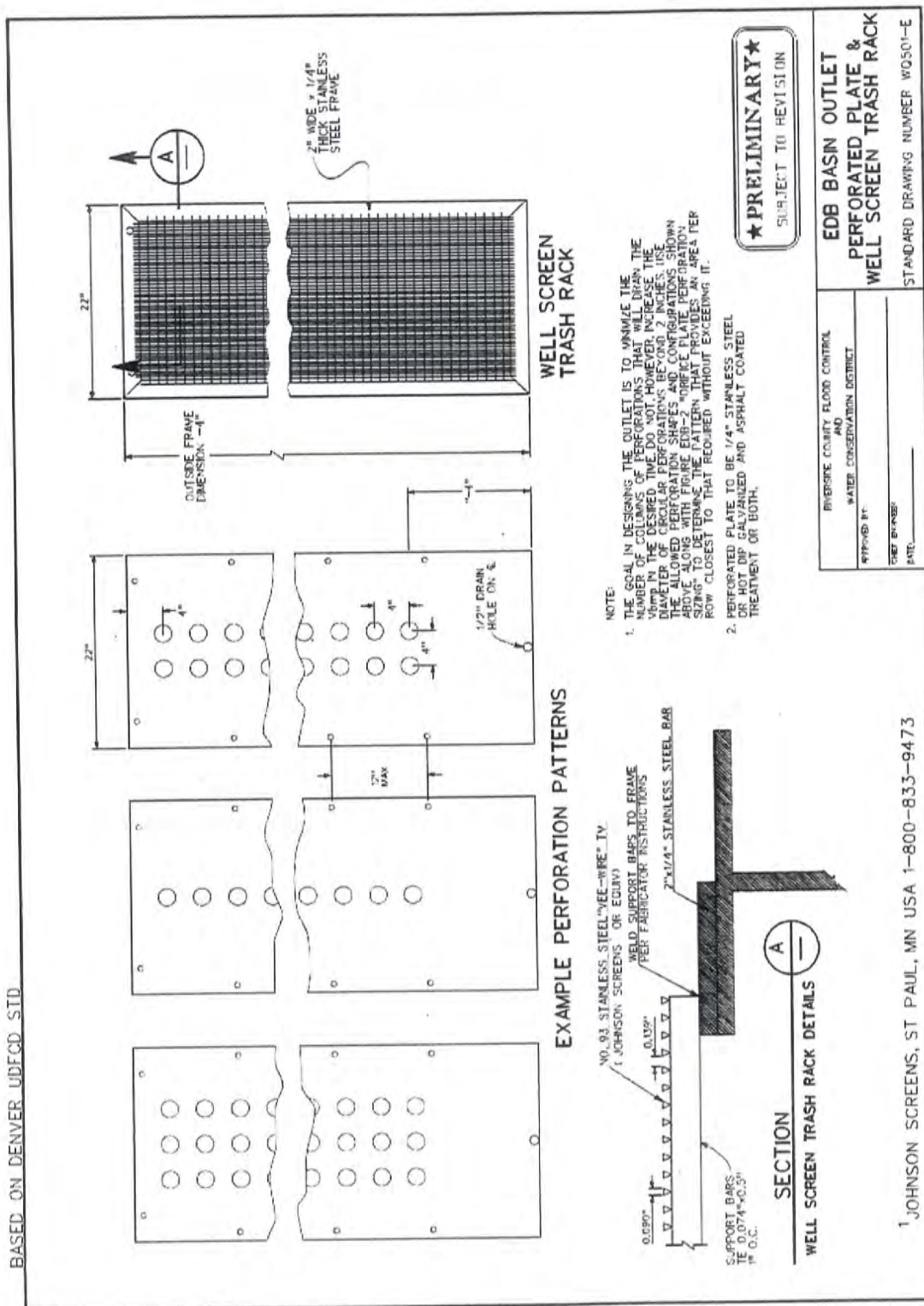
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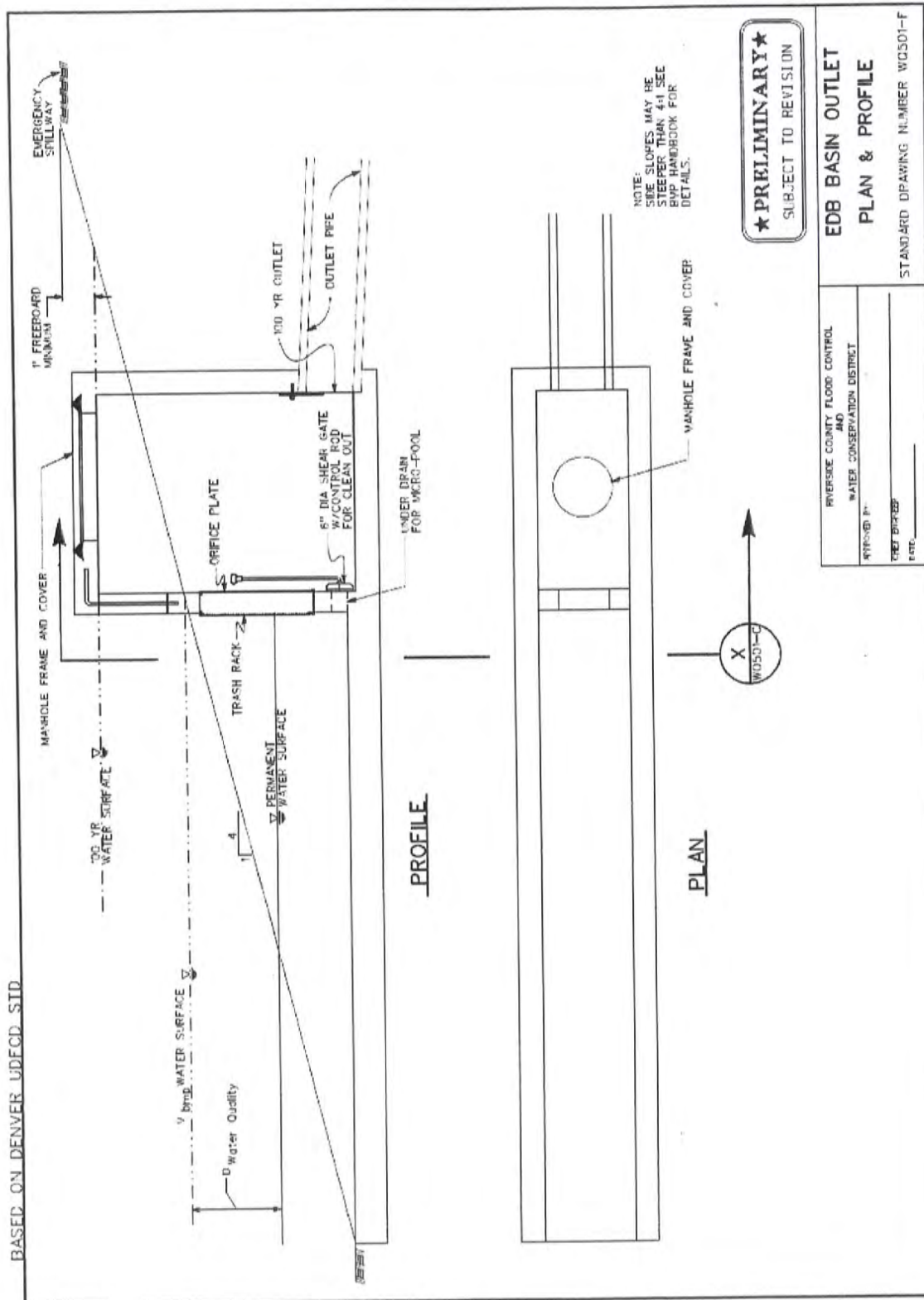
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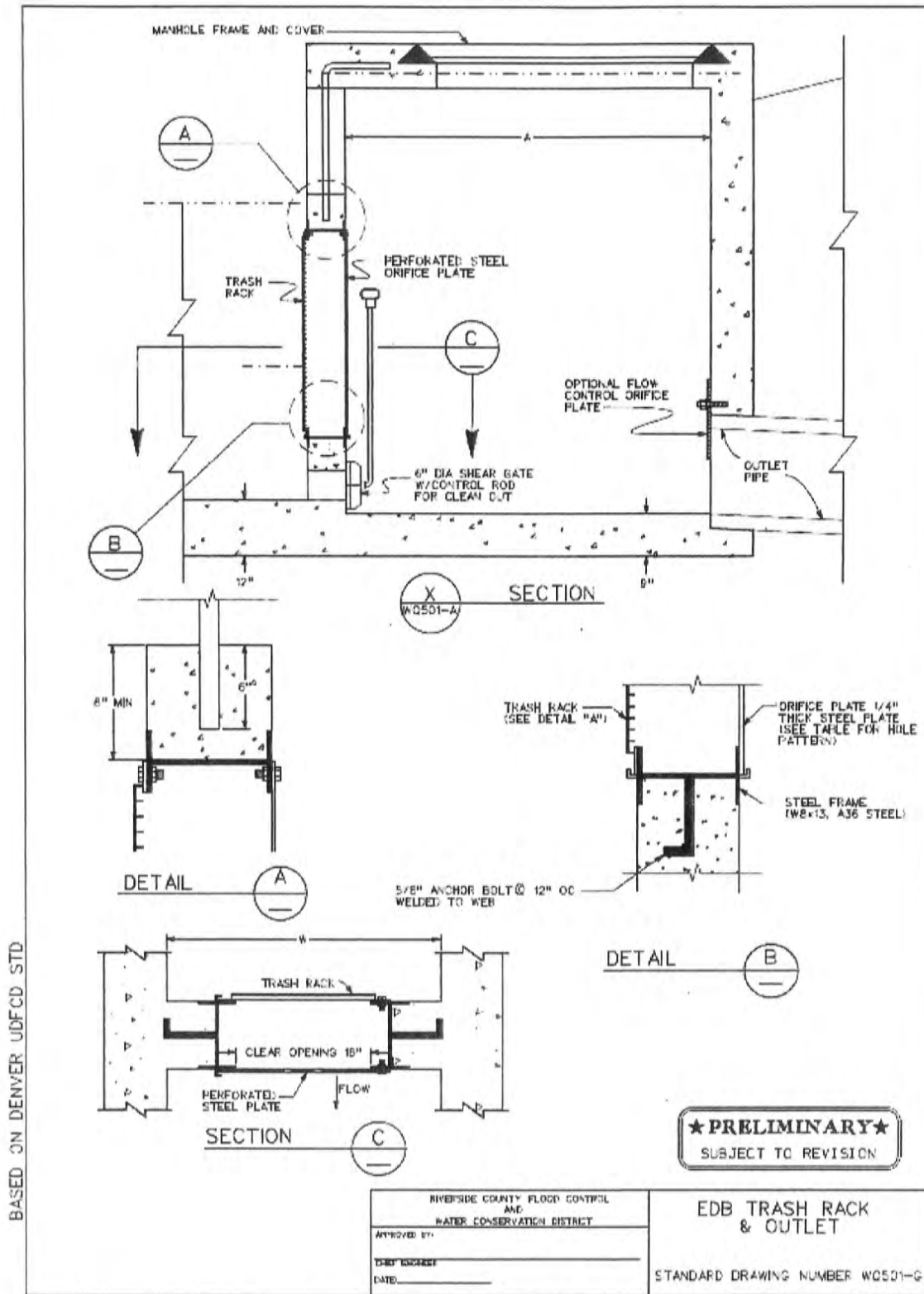
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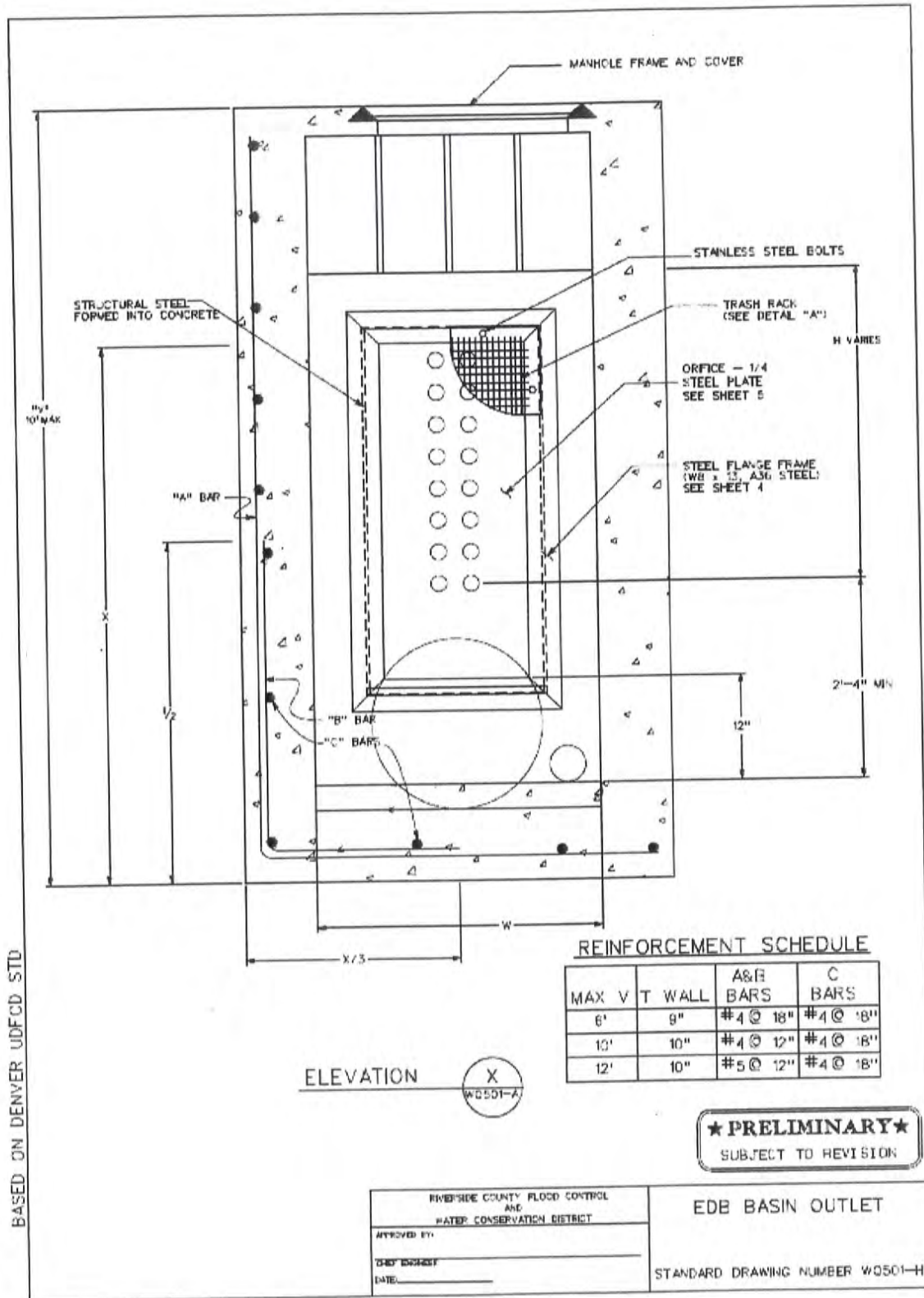
EXTENDED DETENTION BASIN BMP FACT SHEET



EXTENDED DETENTION BASIN BMP FACT SHEET



EXTENDED DETENTION BASIN BMP FACT SHEET



Extended Detention Basin Design Procedure		BMP Subarea No.	Legend:	Required Entries
				Calculated Cells

Company Name: _____ Date: _____
Designed by: _____ County/City Case No.: _____

Design Volume

Tributary Area (BMP Subarea) $A_T =$ _____ acres
Enter V_{BMP} , determined from Section 2.1 of this Handbook $V_{BMP} =$ _____ ft^3

Basin Footprint

Overall Geometry

Length at Basin Bottom Surface Length = _____ ft

Width at Basin Bottom Surface Width = _____ ft

Meets 1.5 : 1 requirement? ☒ Yes

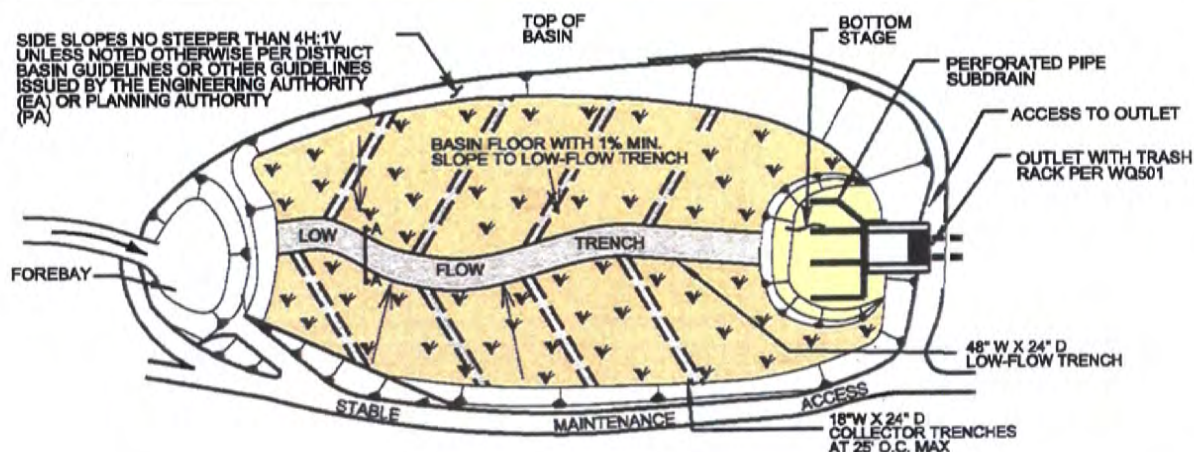
Side Slopes per "Basin Guidelines", Sect. 1.2 $z =$ _____ :1

Proposed Basin Depth (with no freeboard) $D_B =$ _____ ft

Depth of freeboard (if used) $D_{FB} =$ _____ ft

Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage ($D_{BS}=0.33'$) and minimum filter depth ($D_{FD}=2.33'$)) $D_{REQ} =$ _____ ft

Depth from design water surface elevation to lowest orifice $D_O =$ _____ ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)

$D_{TOT} =$ ft

Basin Invert Longitudinal Slope

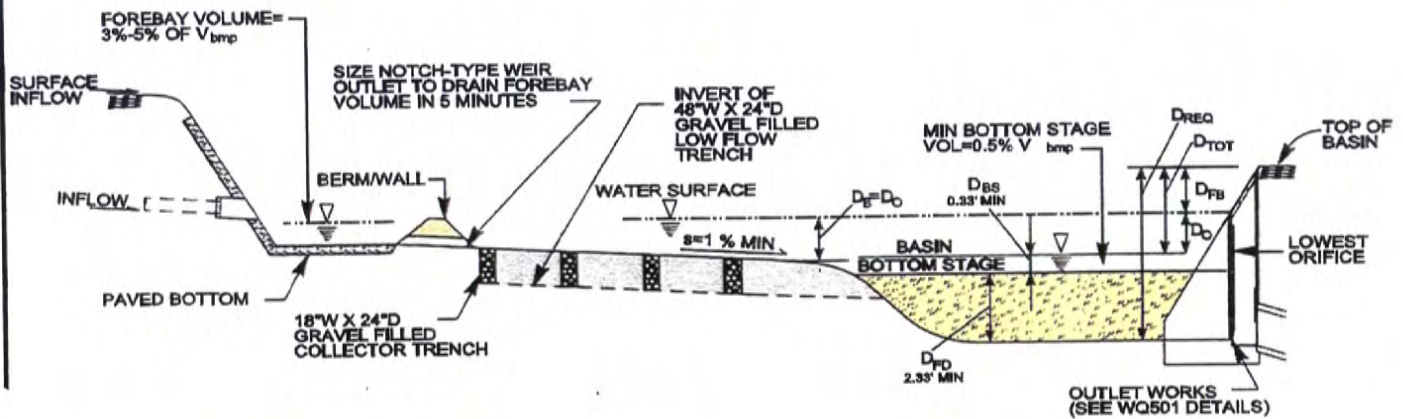
Slope = %

Basin Invert Transverse Slope (1% min)

Slope = %

Basin Volume

$V_{Basin} =$ ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})

$V_{FB} =$ ft^3

Forebay Depth (height of berm)

$D_{FBY} =$ ft

Minimum Forebay Surface Area

$A_{FB} =$ ft^2

Rectangular weir (notch)

$W =$ in

Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled)

Width (48 inches minimum)

Trench Invert Longitudinal Slope

Depth = inches

Width = inches

Slope = %

Collector Trenches (see graphic below)

Depth (24 inches minimum)

Width (18 inches minimum)

Trench Invert Longitudinal Slope

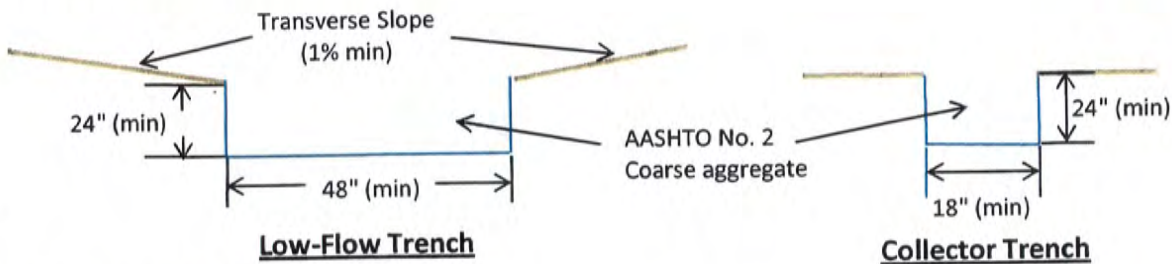
Spacing (25 feet on center maximum)

Depth = inches

Width = inches

Slope = %

S = feet



Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding)

Surface Area of Bottom Stage

Dry Weather Poned Volume (above sand layer)

Is V_{BS} no less than 0.5% V_{BMP} ? Enter Depth and Surface Area

Depth of ASTM-C33 sand (18 inch minimum)

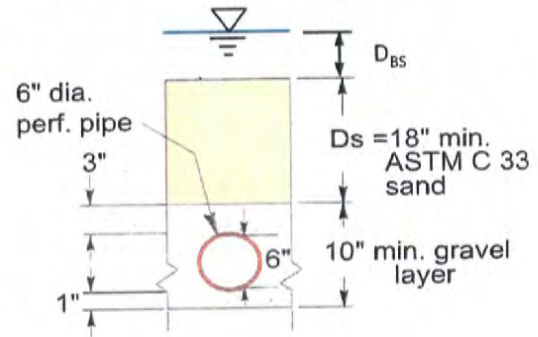
D_s = inches

Diameter of Subdrains

ϕ = in

Subdrain Spacing

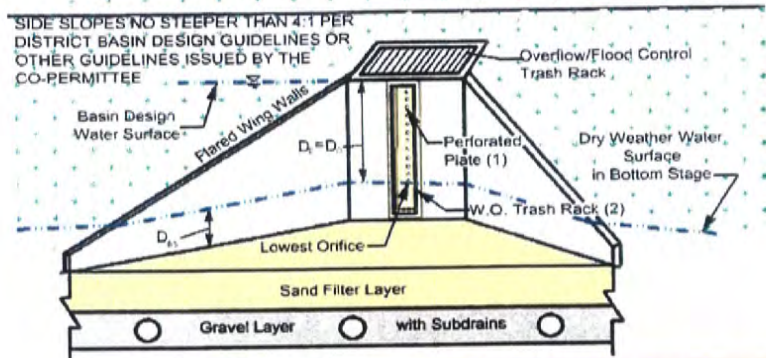
s = ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



All values on this worksheet must be filled out to use this calculator

Flow Rate, Q (cfs)

$$Q = CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C =

Orifice Area (ft²)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = inches

n = per row

N = rows

A_{eff} = 0.000 ft² per row

or

A_{eff} = 0.000 in² per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = Error * hrs

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin (within 72 hours):

Time (100 %) = Error * hrs

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33			
0.67			
1.00			
1.33			
1.67			
2.00			
2.33			
2.67			
3.00			
3.33			
3.67			
4.00			
4.33			
4.67			
5.00			
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
Σ =			0.00

Notes:



Bioretention Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y ☐ N ☐

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** = recommended frequency*

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Treatment Area				
Treatment area free of debris?	A / M / S			
Inlets and Outlets unobstructed?	A / M / S			
Is there standing water longer than 24 hours after a storm event?	A / M / S			
Evidence of erosion?	A / M / S			
Vegetation				
Surrounding area fully stabilized? (no evidence of material eroding into Bioretention area)	A / M / S			
Grass height not more than 6 inches?	A / M / S			
Plant height not less than design water depth?	A / M / S			
Plant composition according to approved plan?	A / M / S			
Vegetation overgrown?	A / M / S			
Other				
Hazards				
Have there been complaints from residents?	A / M / S			
Public hazards noted?	A / M / S			

Inspector Comments: _____

Overall Condition of Facility:

☐: Acceptable

☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____



Proprietary BMP Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y ☐ N ☐

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** = recommended frequency*

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Debris Removal				
Adjacent area free of debris?	A / M / S			
Inlets and Outlets free of debris?	A / M / S			
Facility (internally) free of debris?	A / M / S			
Vegetation				
Surrounding area fully stabilized? (no evidence of material eroding into sand filter)	A / M / S			
Grass mowed?	A / M / S			
Water Retention (where required)				
Water holding chambers at normal pool?	A / M / S			
Evidence of erosion?	A / M / S			
Sediment Deposition				
Filtration chamber free of sediments?	A / M / S			
Sedimentation chamber not more than 50% full?	A / M / S			
Structural Components				
Any evidence of structural deterioration?	A / M / S			
Grates in good condition?	A / M / S			
Spalling or cracking of structural parts?	A / M / S			
Outlet/Overflow Spillway	A / M / S			
Other				
Noticeable odors?	A / M / S			
Any evidence of filter(s) clogging?	A / M / S			
Evidence of flow bypassing facility?	A / M / S			

Inspector Comments: _____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____



Detention Basin Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y ☐ N ☐

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** = recommended frequency.*

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Embankment and Emergency Spillway				
Vegetation healthy?	A / M / S			
Erosion on embankment?	A / M / S			
Animal burrows in embankment?	A / M / S			
Cracking, sliding, bulging of dam?	A / M / S			
Drains blocked or not functioning?	A / M / S			
Leaks or seeps on embankment?	A / M / S			
Emergency spillway obstructed?	A / M / S			
Slope protection failure functional?	A / M / S			
Erosion in/around emergency spillway?	A / M / S			
Other (describe)	A / M / S			
Riser and Principal Spillway				
Low-flow orifice functional?	A / M / S			
Trash rack (Debris removal needed? Corrosion noted?)	A / M / S			
Sediment buildup in riser?	A / M / S			
Concrete/masonry condition (Cracks or displacement? Spalling?)	A / M / S			
Metal pipe in good condition?	A / M / S			
Control valve operation?	A / M / S			
Pond drain valve operation?	A / M / S			
Outfall channels function, not eroding?	A / M / S			
Other (describe)	A / M / S			
Sediment Forebays				
Sedimentation description				
Sediment cleanout needed (over 50% full)?	A / M / S			

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Permanent Pool Areas (if applicable)				
Undesirable vegetation growth?	A / M / S			
Visible pollution?	A / M / S			
Shoreline erosion?	A / M / S			
Erosion at outfalls into pond?	A / M / S			
Headwalls and endwalls in good condition?	A / M / S			
Encroachment into pond or easement area by other activities?	A / M / S			
Evidence of sediment accumulation?	A / M / S			
Dry Pond Areas (if applicable)				
Vegetation adequate?	A / M / S			
Undesirable vegetation or woody plant growth?	A / M / S			
Excessive sedimentation?	A / M / S			
Hazards				
Have there been complaints from residents?	A / M / S			
Public hazards noted?	A / M / S			

Inspector Comments: _____

Overall Condition of Facility: ☐ Acceptable ☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____



Permeable Pavement Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y ☐ N ☐

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** recommended frequency*

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Pavement Area				
Pavement area free of debris?	A / M / S			
Inlets and Outlets unobstructed?	A / M / S			
Is any water standing after a storm event?	A / M / S			
Any evidence of clogged pores that require vacuum-sweeping?	A / M / S			
Access to pervious pavement (egress and ingress routes) safe and efficient?	A / M / S			
Vegetation				
Adjacent area fully stabilized (no evidence of eroding material into or from pervious pavement area)?	A / M / S			
Any noticeable irrigation needs?	A / M / S			
Fallen leaves/plant debris collecting in paving area?	A / M / S			
Grass height over 4 inches?	A / M / S			
Vegetation health affected by oil/grease from vehicles?	A / M / S			
Other	A / M / S			
Hazards				
Obstructions or debris affecting overflows/emergency spillway?	A / M / S			
Load-bearing capability of pavement intact?	A / M / S			

Inspector Comments: _____

Overall Condition of Facility:

☐: Acceptable

☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Stormwater Pollution - Threatening Local Waterways

When you think of water pollution, you might think of foaming industrial outfalls or smelly sewage plants . . . but did you ever consider that YOU might be contributing to the water pollution problem?

Even after industry and sewage plants became regulated, it is still apparent that there are other sources of pollution entering our local waterways. In fact, monitoring programs found that runoff from urban and rural areas causes as much as 60-70% of our water pollution problem.

Many residents are unaware of the problem of stormwater pollution (polluted runoff), and the threat it poses to local waterways. Unfortunately, many people don't realize that storm drains connect to local waterways, so whatever ends up in the storm drains flows directly - without treatment - to our rivers, lakes and streams.

Another misconception is that stormwater pollution happens only when it rains. Actually, throughout the dry part of the year, pollutants such as motor oil, antifreeze, trash and grease accumulate on streets and parking lots. When rain finally does fall, the rain water carries these pollutants into the storm drain. Also, throughout the year, runoff water from lawns and landscaped areas can carry pesticides and fertilizers into the storm drains. Even activities such as washing our cars can result in detergents and dirt making their way into the storm drain.



Since pollution prevention is much easier and less costly than cleaning up after-the-fact, we must all work together to help keep our precious waterways clean.

Here's how YOU can help:

- Don't overdose our environment with pesticides and fertilizers. They contain products which promote algae growth in local waterways. Abundant algae growth suffocates aquatic life. Try non-toxic alternatives for pest control.
- Keep yard and grass clippings out of the storm drains. When these materials reach local waterways, they cloud the water and block sunlight that is essential to aquatic life.
- Pick-up animal waste, seal it in a bag and dispose of it in a trash can. Animal waste contains harmful bacteria and organisms that can spread diseases if allowed to reach the storm drain system.
- Never pour anything into the gutter or down a storm drain.
- Wash cars on a grassy area. Do not allow dirty, soapy water to flow into the street gutter or storm drains.

Here's how WE can help YOU:

The StormWater/CleanWater Protection Program provides a number of FREE pollution prevention materials for residents, schools and club organizations. Call **1-800-506-2555** to order any of the materials or services listed below:

- Less toxic alternatives for the home and garden
- Storm drain pollution prevention materials for children
- Classroom presentations
- Guest speakers for rotary/civic/group functions
- Watershed Maps (illustrating local rivers, lakes and streams)



Home Gardening – Made Easy and Pesticide Free



Do you love a beautiful flower garden and a bountiful vegetable patch, but don't like the idea of using pesticides and chemicals to keep pesty bugs away?

Come to a **FREE GARDEN WORKSHOP** to learn how to deter pests out of the garden without the use of pesticides.

At the workshop you will learn how specific plants help to repel pests and how other plants help attract beneficial insects like ladybugs and lacewings.

Call **1-800-506-2555** for information about a **FREE GARDEN WORKSHOP** near you.

Are these familiar garage and household items?

Do you know how to properly dispose of unwanted quantities?

While products such as household cleaners, bleach, oven cleaners, paints, solvents, motor oil and antifreeze serve useful purposes, you must remember to handle them as household hazardous waste (HHW) when you throw away unwanted quantities.

Help keep our environment clean! Recycle unwanted HHW items. There will be an **HHW Collection Event on June 19, 20 and 21** at the Moreno Valley City Corporate Yard located at 15670 Perris Blvd.

You may bring up to five gallons of hazardous liquid waste or a total of 50 pounds maximum per car/per trip (enforced by CHP). Multiple trips are allowed. Containers should be marked and secured to prevent leaks. Containers holding gasoline will not be returned. The collection event will be closed if rained out or excessive winds. Call 358-5256 for more information.

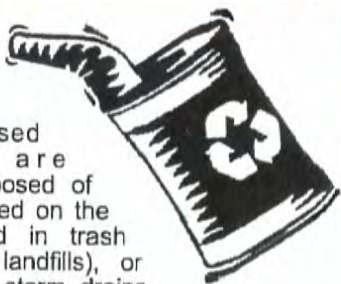
Tips to help protect our environment:

- Never pour any HHW into the gutter or down a storm drain.
- Never pour HHW on the ground as this may percolate to groundwater – an important drinking water resource.
- Never throw HHW in the trash as this may injure sanitation workers and contaminate landfills and the surrounding area.



Do-It-Yourselfers...Remember to Do It Safe and Right

In the United States alone, an estimated 200 million gallons of used motor oil are improperly disposed of by being dumped on the ground, tossed in trash (ending-up in landfills), or poured down storm drains. The good news is it's never been more convenient to recycle used motor oil and oil filters.



Recycle used motor oil by bringing it to a local store in your neighborhood.

Firestone Store - 24673 Alessandro Blvd. - (909) 242-6631
Kragen Auto Parts - 24021 Alessandro Blvd., #C - (909) 242-0641
Kragen Auto Parts - 12240 Perris Blvd. - (909) 247-5509
Auto Zone - 24570 Alessandro Blvd. - (909) 242-8439
Auto Zone - 12601 Perris Blvd. - (909) 242-4353
Auto Zone - 23031 Sunnymead Blvd. - (909) 924-5460
Pep Boys - 23470 Sunnymead Blvd. - (909) 247-4564
Grease Monkey - 23165 Hemlock - (909) 247-1873
Scher Tire - 23135 Hemlock - (909) 924-9797
Ramona Auto Services, Inc. - 12275 Heacock - (909) 243-6424

For additional recycling locations call 1-800-CLEANUP.

Landscape Design & Water Quality

Create a landscape design that reduces pesticide and fertilizer runoff and conserves water. Good plant choices, proper site preparation, installation of “smart” irrigation equipment, and use of porous materials for walkways and other unplanted areas are key elements in an environmentally friendly landscape.

Install porous surfaces in unplanted areas.

- ◆ Use flagstone, interlocking pavers, or pervious concrete on walkways and patios instead of impermeable surfaces such as concrete and asphalt.
- ◆ Interlocking pavers for driveways or an interceptor drain at the bottom of the driveway collect runoff and divert water into your landscape.
- ◆ Consider gravel, organic mulches or other materials that allow water to soak into the ground in unplanted areas.
- ◆ Avoid using concrete, asphalt, compacted bare soil, or other impervious surfaces wherever possible.

Improve water absorption.

- ◆ Add organic matter, such as compost, and aerate regularly to reduce compaction.
- ◆ Use perforated drainage lines to allow water to filter into surrounding soils.
- ◆ Install gravel sumps or other percolation areas to keep water from collecting in unwanted areas.

Choose plants that conserve water, buffer runoff, and resist pest problems.

- ◆ Plant water-efficient plants, including many native species, to reduce irrigation. Some natives require little to no fertilizer or pest management.
- ◆ Use turfgrasses and pest-resistant plants best adapted to the local climate.
- ◆ Install dense plantings with fibrous root systems along landscape edges to reduce runoff and soil erosion.



Create landscape features to collect runoff water.

- ◆ Incorporate long, shallow grassy depressions, known as swales, to hold large amounts of runoff from driveways, streets, or parking lots.
- ◆ Create low-lying areas in the garden to provide temporary storage for heavy runoff and allow sediment, water, and garden chemicals to soak into the ground. Establish plant species that can survive both wet and dryer conditions.
- ◆ Include trees to intercept rainfall.
- ◆ Use rain barrels to collect and store runoff from rooftops for irrigating plants.
- ◆ Add terrace walls or other features.

Install and properly operate irrigation systems and equipment.

- ◆ Check your irrigation system and if necessary, make adjustments; replace old and mismatched sprinklers with low-flow rotor heads.
- ◆ Consider the addition of a “smart” irrigation controller. These are designed to reduce excess irrigation by replacing only the amount of water lost through plant use and evaporation.
- ◆ Install drip systems or soaker hoses for trees, shrubs, and some ground covers.



Minimize the use of pesticides that pollute our waterways. Use nonchemical alternatives or less toxic pesticide products whenever possible. Read product labels carefully and follow instructions on proper use, storage, and disposal.

For more information about managing pests, contact your **University of California Cooperative Extension office** listed under the county government pages of your phone book or the UC IPM Web site at www.ipm.ucdavis.edu.



University of California
Cooperative Extension

What you use in your landscape affects our rivers and oceans!

Text developed through a grant from CA SWRCB and the CALFED Bay-Delta Program.



WESTERN ZONE

Engineering Design Assistance Kit (DAKit) v08 - WZ



filterterra®

Bioretention Systems

A Growing Idea in Stormwater Filtration

(866) 349-3458

(866) 349-3458

(804) 798-8400

design@filterterra.com

www.filterterra.com

Engineering

Sales

Fax

E-mail

Web

Filterterra® Stormwater Bioretention Filtration System

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Introduction and Scope of this Document

At federal, state and local levels, stormwater management is increasingly important. Americast’s Filterra® units can help developers comply with NPDES legislation by removing pollutants, using a small efficient natural system that is both cost-effective and reliable.

This document is compiled to assist engineers in the proper design for the best results where Filterra® is used for stormwater quality management. We want your project to be successful and it is important to this success that you follow guidelines contained herein. Please review the essential reading section (p. 6).

It is essential to:

- Adhere to the Design Guidelines, p.7
- Size the Filterra® unit correctly, using the regional Sizing Table, p.11
- Add Flowline detail (p.24), Gutter detail (p.25) and Plan Notes (p.26, 27) to your plans
- Complete the Project Information Form (p.9) & submit with plans to Americast for review before permitting. THIS REVIEW IS MANDATORY for warranty to apply and helps ensure that each Filterra® system operates efficiently to maximize performance and minimize maintenance.

Other documents available on request include:

Technical Whitepaper	Scientific paper more fully explaining processes occurring within the system
Filterra Product Performance Data Summary	Data sheet providing the latest facts available
Third Party Data	Data presented by independent parties
Letters of BMP Approval by various Agencies	Copies of official approvals where available
Installation, Operation & Maintenance Manual	Owner’s manual presenting technical and operational details.

Table of Contents

Introduction and Scope of this Document.....	3
A. Essential Reading - Filterra® Overview	
Filterra® Overview.....	6
Design Guidelines for using Filterra®	7
Items Considered in Filterra® Plan Reviews.....	8
Filterra® Project Information Form - IMPORTANT	9
Filterra® Project Process Flowchart.....	10
<i>Table 1: Filterra Quick Sizing Table.....</i>	<i>11</i>
<i>Guideline GU1-A: Filterra Grading & Gutter Flow.....</i>	<i>12</i>
<i>Guideline GU2: Filterra Avoid Head-On Gutter Flow.....</i>	<i>13</i>
<i>Guideline GU3: Filterra Parking Lot Corners.....</i>	<i>14</i>
B. Filterra® Plans, Placement & Grading	
<i>Scenario PLF1: Typical Filterra® Parking Lot Applications.....</i>	<i>16</i>
<i>Scenario PLG2: Filterra® Parking Lot Island Applications.....</i>	<i>17</i>
<i>Scenario PLG3: Filterra® Parking Lot Corner Applications.....</i>	<i>18</i>
<i>Drawing FTHYD-1: Typical Filterra® Hydromodification Configuration.....</i>	<i>19</i>
<i>Drawing FTSWL-1: Typical Filterra® Swale Configuration.....</i>	<i>20</i>
<i>Drawing FTSC-4: Typical Filterra® Sidewalk Configuration.....</i>	<i>21</i>
<i>Drawing FTRDF-1: Filterra® Roof Drain Flume Application.....</i>	<i>22</i>
C. Standard Filterra® Detail Drawings & Filterra Plan Notes	
<i>Drawing FLP-2: Filterra® Typical Flowline Relationship.....</i>	<i>24</i>
<i>Drawing CGT-5: Filterra® Throat Opening & Gutter or Flume Detail.....</i>	<i>25</i>
Filterra® Standard Plan Notes.....	26
<i>Drawing FTNL-4: Precast Filterra® Unit Narrow Length Configuration.....</i>	<i>28</i>
<i>Drawing FTST-2: Precast Filterra® Unit Standard Configuration.....</i>	<i>29</i>
<i>Drawing FTNW-4: Precast Filterra® Unit Narrow Width Configuration.....</i>	<i>30</i>
<i>Drawing FTIRR-3: Filterra® Irrigation Planning Layout.....</i>	<i>31</i>
D. Filterra® Technical Section	
Americast Filterra® Product Weights and Lifting Details.....	33
<i>Drawing FTOPC-3: Filterra® Precast Box Wall at Outfall Pipe Connection.....</i>	<i>34</i>
Filterra® Piping Technical Details.....	35
<i>Drawing DPI: Filterra® Precast Box Wall at Outfall Pipe Connection.....</i>	<i>35</i>
<i>Table 3: Filterra® Flow Rates & Pipe Details.....</i>	<i>35</i>
Filterra® Options: Recessed Tops.....	36
Filterra® Options: Ornamental Grates.....	37
Common Filterra® Placements.....	38
Filterra® Plant Selection.....	39
Filterra® Schematic.....	40

Section A

Essential Reading - Filterra Overview

Important!

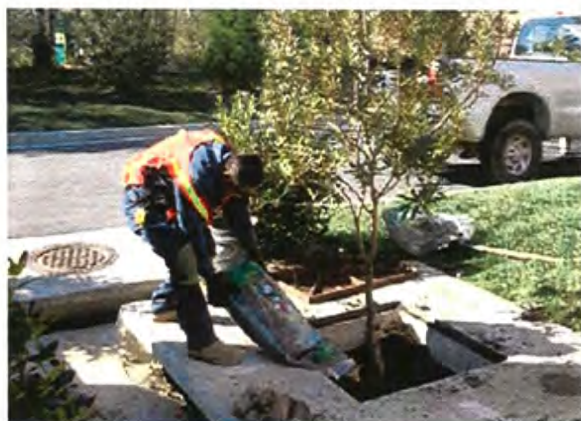
Please remember to complete and send the Project Information Form (p.9) to Filterra® with plans for evaluation. This review is mandatory as proper placement ensures optimum performance and validates the product warranty.

Toll Free: (866) 349-3458
Fax: (804) 798-8400
design@filterra.com

www.filterra.com

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

Filterra® is well-suited for the ultra-urban environment with high removal efficiencies for many pollutants such as petroleum, heavy metals, phosphorus, nitrogen, TSS and bacteria. 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. It takes up little space (often 0.2% Filter Surface Area/Drainage Area) and may be used on highly developed sites such as landscaped areas, green space, parking lots and streetscapes. Filterra® is exceedingly adaptable and is the urban solution for Low Impact Development.

Stormwater 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. Higher flows bypass the Filterra® via a downstream inlet structure, curb cut or other appropriate relief.

Expected Average Pollutant Removal Rates (Ranges Varying with Particle Size, Pollutant Loading and Site Conditions)

TSS Removal	85%
Phosphorous Removal	60% - 70%
Nitrogen Removal	43%
Heavy Metal Removal	33% - 82%
Predicted Oil & Grease	> 85%

Design Guidelines for Using Filterra®

1. Do not place in a sump condition. The Filterra® cannot be used as a stand alone inlet – it will need effective bypass during higher intensity rainfall events.

Plans MUST show Filterra® Top Curb (TC) and Flow Line (FL) spot elevations and also bypass TC (where applicable) and bypass FL spot elevations.

The Filterra® TC and FL elevations MUST be higher than the bypass TC and FL elevations for effective bypass. Use Drawing FLP-2 (p.24) as a detail on the project plans.

2. For proper trash collection ensure a minimum 4" and maximum 6" Filterra® throat opening depth and use Drawing CGT-5 (p.25) as a detail on the project plans.
3. Do not direct surface flow to the Filterra® in a "head-on" configuration. Refer to Guidelines GU1-A (p.12) and GU2 (p.13) for grading design that encourages flow to enter a Filterra® in a cross linear flow – left-to-right or right to-left in the gutter in front of the throat, as per a wet curb which prevents system damage. During extreme storm events the excess flow should continue past the Filterra® to a bypass inlet or other means of relief. Guideline GU3, Parking Lot Corners, shows common situations (p.14).
4. To calculate which size Filterra® is required, use Table 1, Filterra® Quick Sizing Table, appropriate to the project's geographical region and target treatment regime (p.11). The entire contributing drainage area to the Filterra® should be considered and the minimum allowable C factors noted. The maximum contributing drainage area will vary with site conditions. For further information relating to sizing, please contact Filterra.
5. To ensure correct installation, include the Standard Filterra® Plan Notes (p.26-27) on your Filterra® detail project sheet, as well as detailed drawings FLP-2 and CGT-5 (p.24,25).
6. Positive drainage of each Filterra® unit's effluent treatment pipe is required to prevent free standing water from accumulating in the system or underdrain. This could occur due to tidal influences or improper connection of Filterra's effluent pipe to a bypass structure or other outfall.
7. **Send plans and the completed Filterra® Project Information Form** (p.9) to Americast for Filterra® placement review. Plan sheets should include grading, drainage areas, stormwater schedules or profiles, landscape sheets and Filterra® detail sheets. **THIS REVIEW IS MANDATORY** for warranty to apply and helps ensure that each Filterra® system operates efficiently to maximize performance and minimize maintenance. Our staff also looks for value engineering opportunities.

Methods of sending information for review:

E-mail: design@filterra.com
AutoCAD or PDF files
Fax: (804) 798-8400
FTP Site: contact Filterra® for details

Mail or other:
Filterra Review
849 E. Stanley Blvd. #131
Livermore, CA 94550

Items Considered in Americast's Filterra® Plan Reviews

Following is a summary list of the items Americast considers during plan review. Plan sheets should include grading, drainage areas, stormwater schedules or profiles, landscape sheets and Filterra® details.

Notes

- Filterra® Structure Label or Identification Number
- Planned Filterra® Box Size
- Filterra® Contributing Drainage Area (not the bypass inlet Drainage Area)
- The C Factor for each individual Filterra® drainage area

Checks

- The planned Filterra® box size meets project's regional sizing specification
- Spot elevations (Top Curb & Flow Line) for Filterra® and bypass (TC & FL)
- The Filterra® spot elevations (TC & FL) are higher than bypass spot elevations
- The grading design encourages cross linear flow and not head-on flow
- Filterra® invert elevations are shown (3.5' below TC)
- Filterra® effluent treatment pipe invert elevations are higher than bypass structure or other out fall invert elevations
- The Filterra® outlet drain pipe is sized correctly
- The outlet drain pipe exits perpendicular to the Filterra® wall
- For any conflicting structures such as storm drain pipes below Filterra®
- For most efficient placement of Filterra® units
- Plans include Filterra® details listed below:

FLP-2: Filterra® Typical Flow Line and Outlet Pipe Relationship

CGT-5: Filterra® Throat Opening and Gutter or Flume Detail

Filterra® Standard Plan Notes (2 pages)

Complete & send to Americast by email, fax or mail.

Address: 849 E.Stanley Blvd. # 131
Livermore, CA 94550

Toll Free: (866) 349-3458

Fax: (804) 798-8400
Email: design@filterra.com



filterra
Bioretention Systems

Project Information
Project Name/Number:
Regulatory Municipality and State (City, County, etc.):
Target Treatment Rate:

Engineering Contact Information
Engineering Firm:
Contact:
Email:

Current Date:
Phone:
Fax:

Filterra® Details (Email, mail or fax plans to Americast - Acceptable formats are AutoCAD or pdf)
Plans sheets should include (1) cover, (2) grading, (3) drainage areas, (4) stormwater schedules or profile, (5) landscaping & (6) Filterra® details.

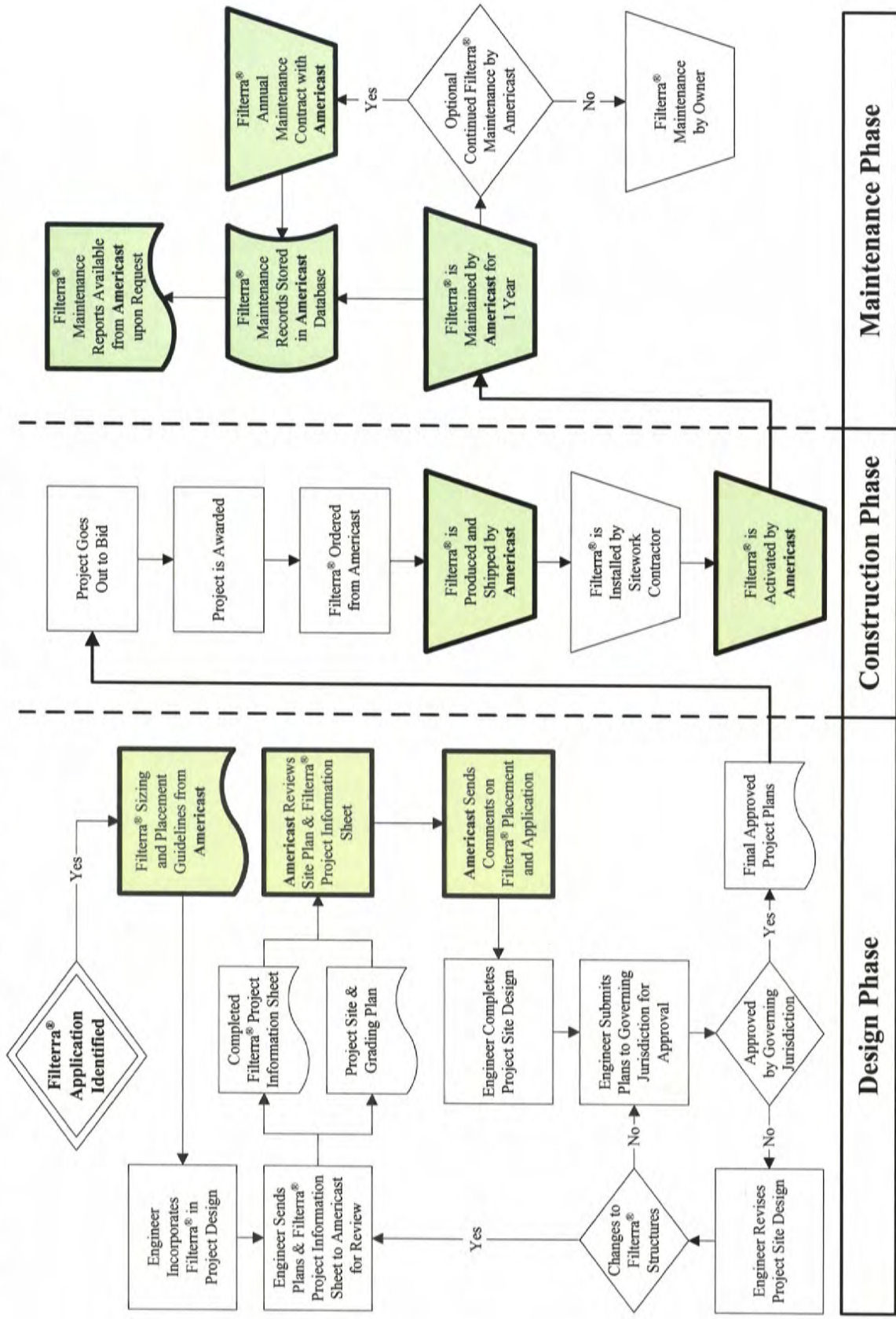
[illegible]

TC = Top Curb, FL = Flow Line

FLP Detail on plans (Y/N) ☐CGT Detail on plans (Y/N) ☐

FT Plan Notes shown (Y/N)

Filterra® Project Process Flowchart - Design to Maintenance



Bold items indicate services provided by Americast.

01/04/05



Table 1: Filterra® Quick Sizing Table
(Western Zone - 0.2 in/hr Uniform Intensity Approach)

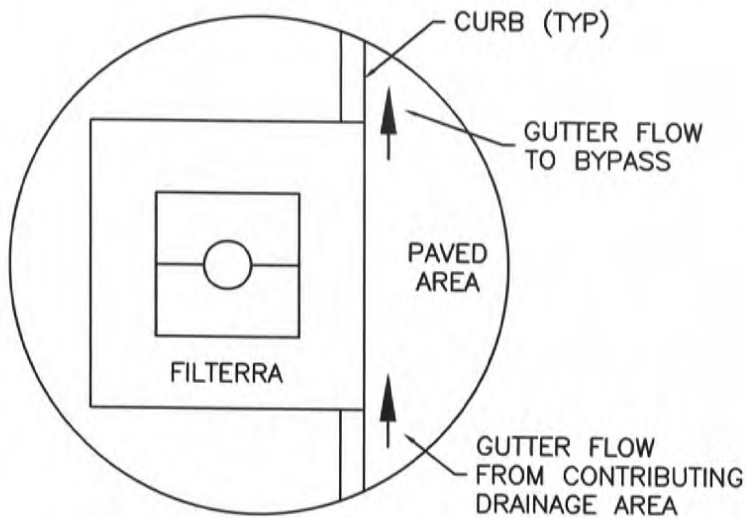
Available Filterra® Box Sizes (feet)	Recommended <u>Commercial</u> Contributing Drainage Area (acres) where C = 0.85	Outlet Pipe
4x4	up to 0.22	4" SDR-35 PVC
4x6.5 or 6.5x4	0.23 to 0.35	4" SDR-35 PVC
4x8 or 8x4	0.36 to 0.44	4" SDR-35 PVC
Standard 6x6	0.45 to 0.49	4" SDR-35 PVC
6x8 or 8x6	0.50 to 0.65	4" SDR-35 PVC
6x10 or 10x6	0.66 to 0.82	6" SDR-35 PVC
6x12 or 12x6	0.83 to 0.98	6" SDR-35 PVC

Available Filterra® Box Sizes (feet)	Recommended <u>Residential</u> Contributing Drainage Area (acres) where C = 0.50	Outlet Pipe
4x4	up to 0.37	4" SDR-35 PVC
4x6.5 or 6.5x4	0.38 to 0.60	4" SDR-35 PVC
4x8 or 8x4	0.61 to 0.74	4" SDR-35 PVC
Standard 6x6	0.75 to 0.83	4" SDR-35 PVC
6x8 or 8x6	0.84 to 1.11	4" SDR-35 PVC
6x10 or 10x6	1.12 to 1.39	6" SDR-35 PVC
6x12 or 12x6	1.40 to 1.67	6" SDR-35 PVC

Notes:

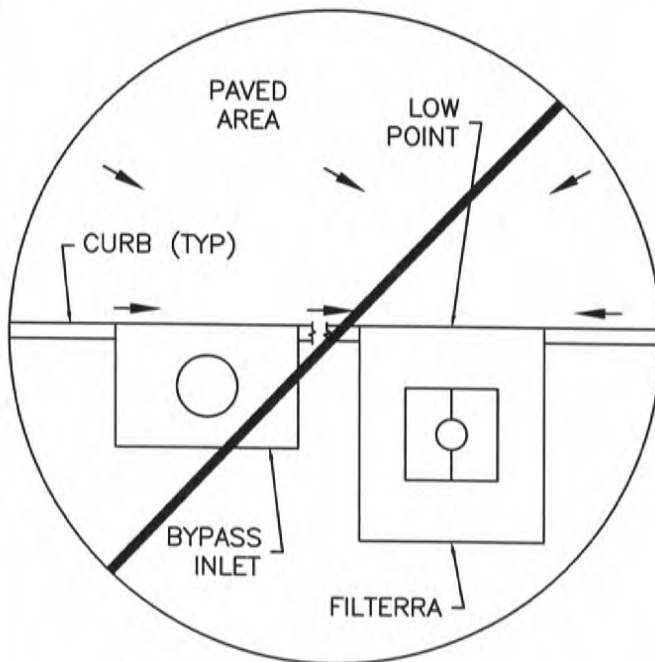
1. All boxes are a standard 3.5 feet depth (INV to TC)
2. A standard SDR-35 PVC pipe coupling is cast into the wall for easy connection to discharge drain
3. Dimensions shown are internal. Please add 1' to each external (using 6" walls)
4. In line with TR55 data, for Commercial Developments a minimum (runoff coefficient) C factor of 0.85 is recommended. For Residential Developments, use of C factors less than 0.5 require individual site review by Filterra.
5. Please ask for Sizing Tables for other target treatment goals, e.g. 0.3 in/hr
6. This sizing table is valid only for CA, NV, AZ, OR, ID, AK & HI

GRADING AND GUTTER FLOW

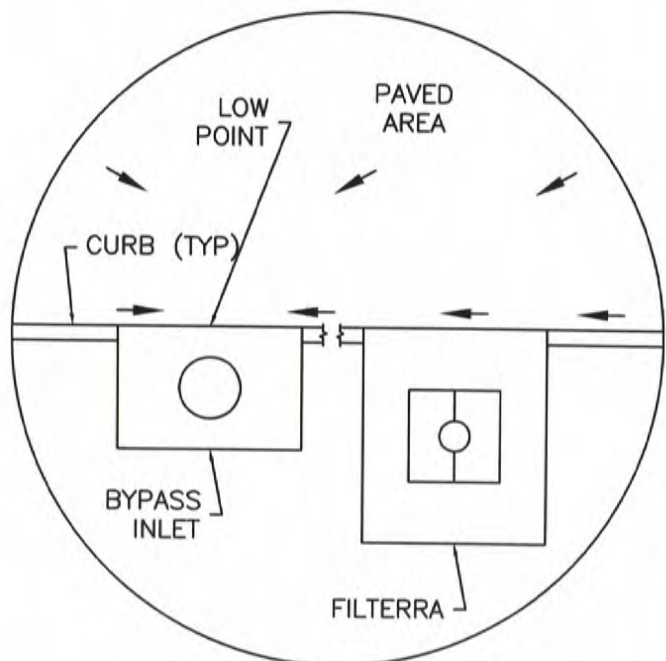


GUTTER FLOW

GRADING AND CURB AND GUTTER SHOULD BE SUCH THAT GUTTER FLOW APPROACHES THE FILTERRA FROM ONE SIDE OF THE THROAT AND FLOWS AWAY FROM THE FILTERRA ON THE OPPOSITE SIDE DURING EXTREME STORM EVENTS. DESIGN OR INSTALLATION SUCH THAT FLOW APPROACHES FROM BOTH SIDES WILL RESULT IN SITE MAINTENANCE ISSUES AND VOID MANUFACTURER'S MAINTENANCE PROGRAM AND WARRANTY.



INCORRECT



CORRECT

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DATE: 03-03-05

DWG: GU1-A

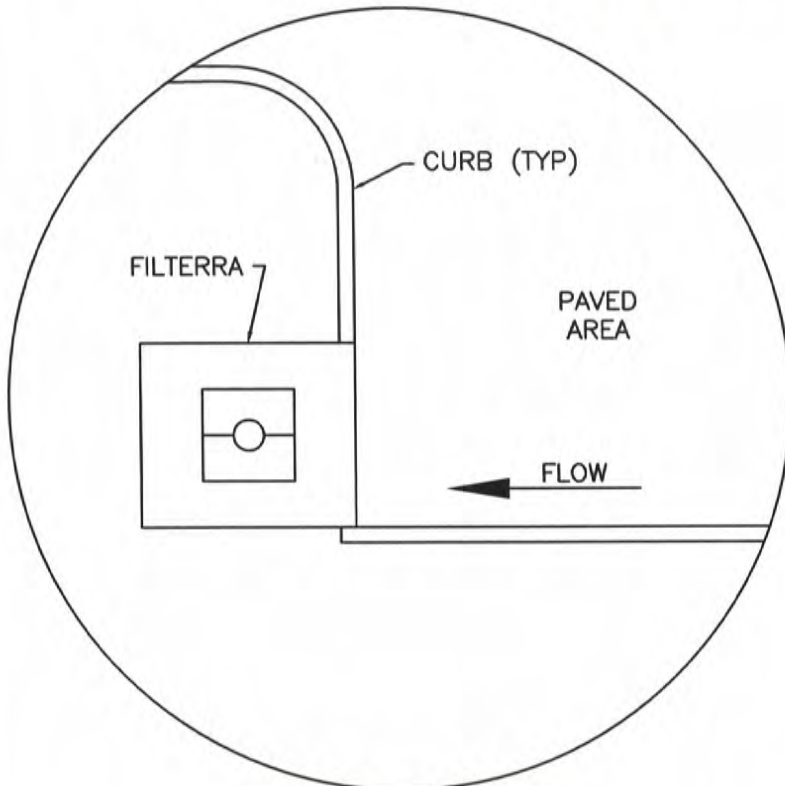
**FILTERRA® GUIDELINES
GRADING AND GUTTER FLOW**



filterra®

US PAT 6,277,274
AND 6,569,321

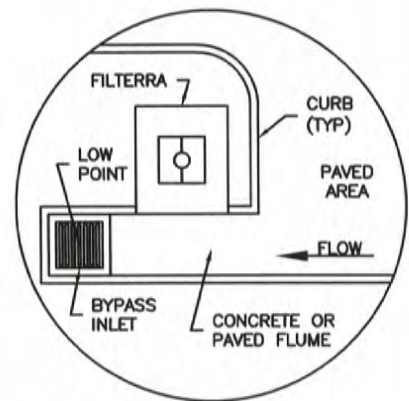
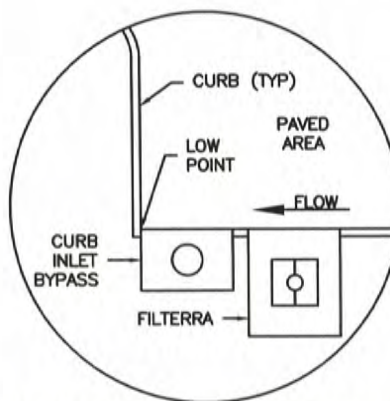
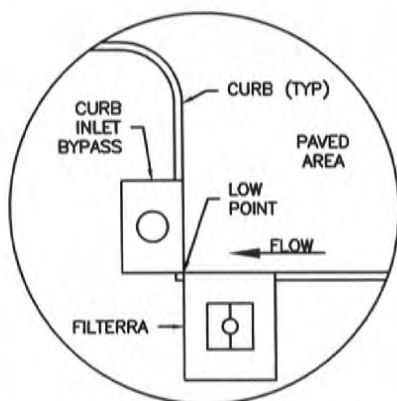
AVOID "HEAD-ON" GUTTER FLOW



PROBLEM

FLOW FROM THE ADJACENT GUTTER HITS THE FILTERRA "HEAD-ON". THIS CAN CAUSE SYSTEM DAMAGE (MEDIA EROSION OR SUSPENSION). REGARDLESS OF WHETHER BYPASS IS PROVIDED THIS IS A PROBLEM SCENARIO.

GUTTER FLOW SHOULD APPROACH THE FILTERRA PARALLEL TO THE THROAT SO THAT WATER FLOWS IN A LINEAR PATTERN IN FRONT OF THE THROAT. DURING EXTREME STORM EVENTS, EXCESS WATER SHOULD CONTINUE TO FLOW IN FRONT OF THE FILTERRA TO A BYPASS INLET OR OTHER RELIEF.



POSSIBLE SOLUTIONS

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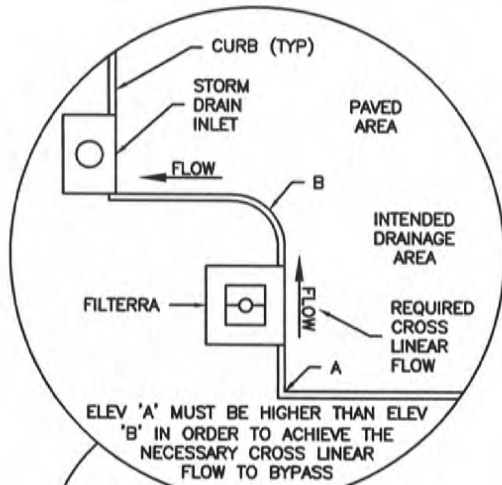
DWG: GU2

**FILTERRA® GUIDELINES
AVOID "HEAD-ON"
GUTTER FLOW**

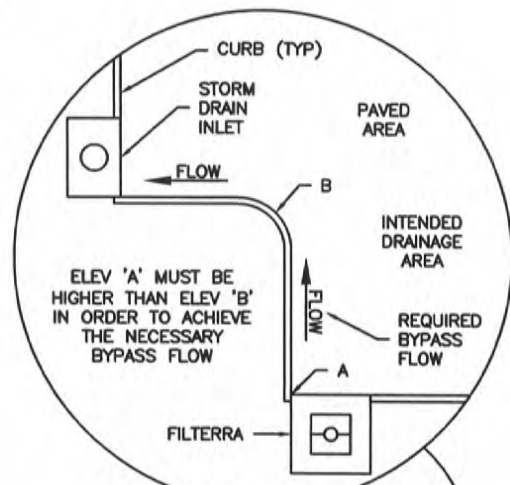


US PAT 6,277,274
AND 6,569,321

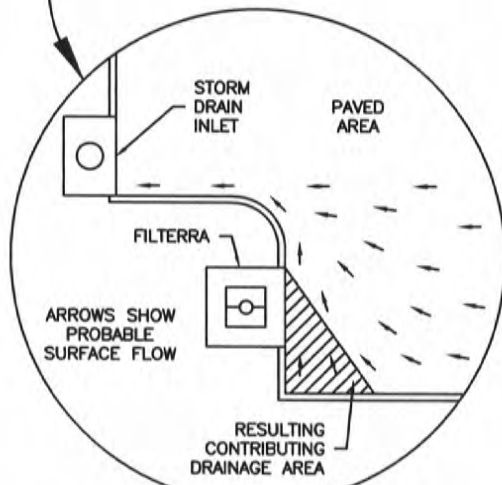
PARKING LOT CORNERS



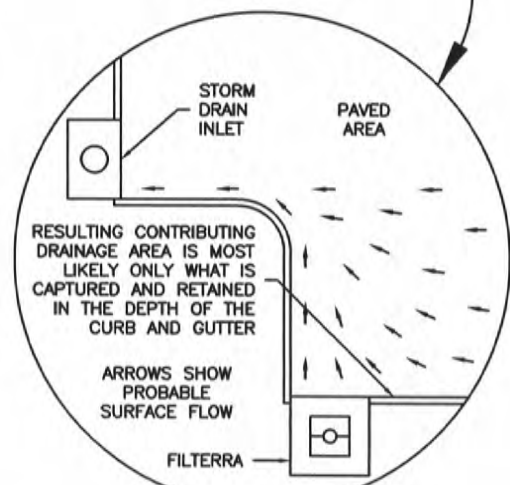
PLACEMENT



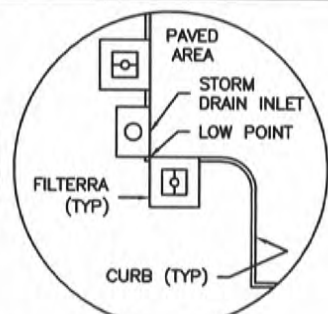
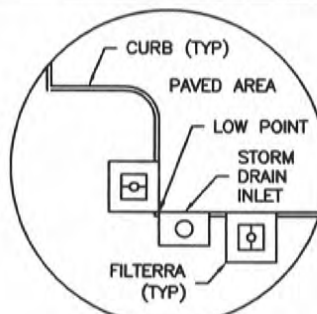
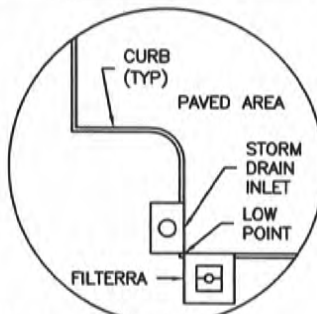
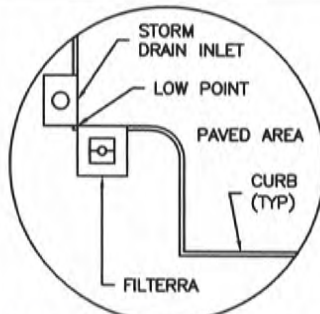
PLACEMENT



PROBLEM



PROBLEM



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POSSIBLE PLACEMENT SOLUTIONS



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DWG: GU3

**FILTERRA® GUIDELINES
PARKING LOT CORNERS**



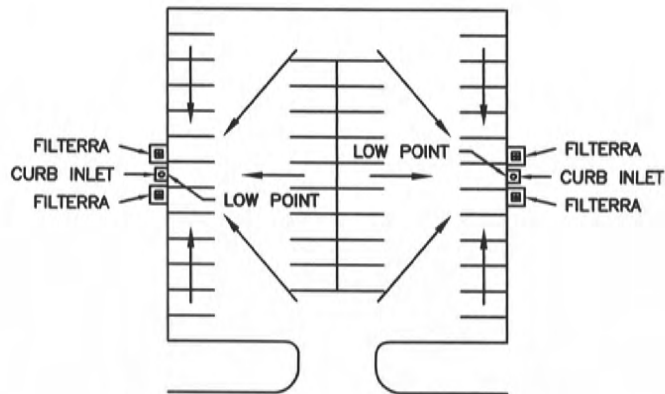
Section B

Filterra® Plans, Placement & Grading

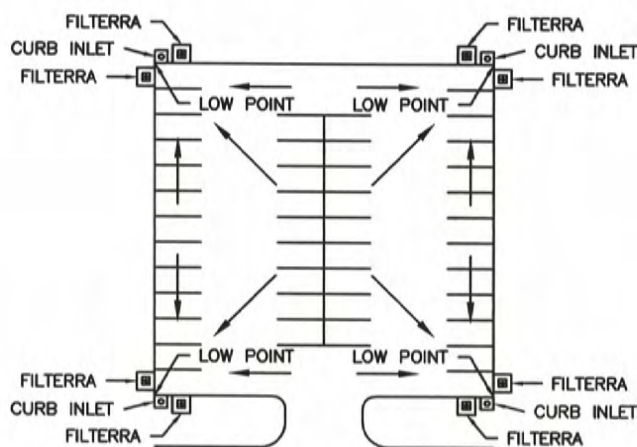
**Scenario Ideas to Ensure
Maximum Efficiency &
Minimum Space Used**

Toll Free: (866) 349-3458
Fax: (804) 798-8400
design@filterra.com

www.filterra.com

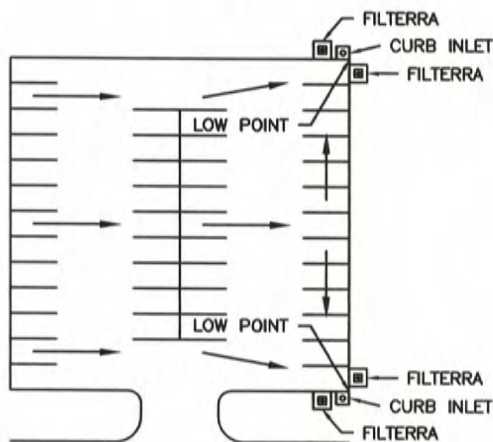


LOW POINTS AT 2 SIDES



LOW POINTS AT 4 CORNERS

ARROWS INDICATE
DIRECTION OF SURFACE
DRAINAGE FLOW



LOW POINTS AT 2 CORNERS

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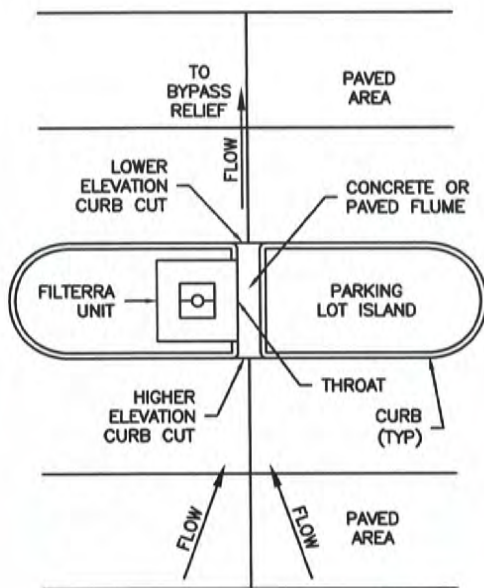
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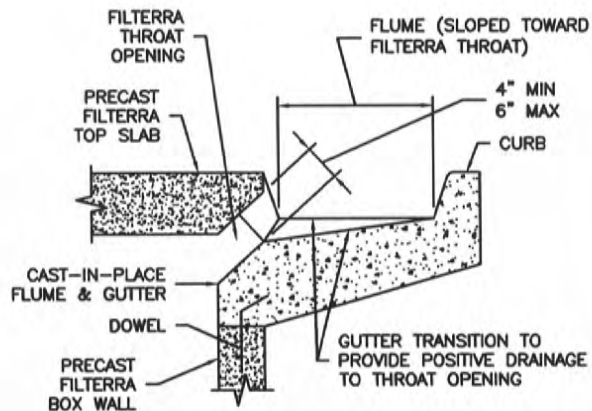
**FILTERRA® EXAMPLE SCENARIOS
TYPICAL PARKING
LOT APPLICATIONS**



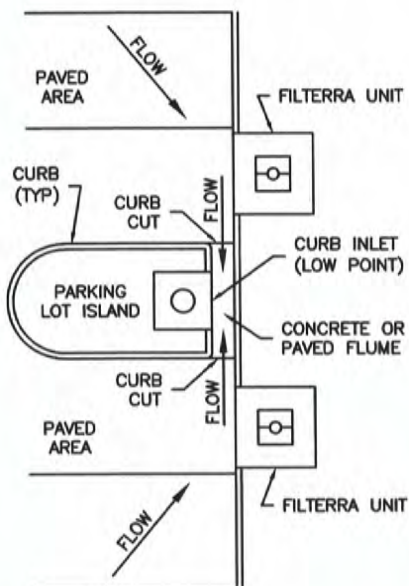
US PAT 6,277,274
AND 6,569,321



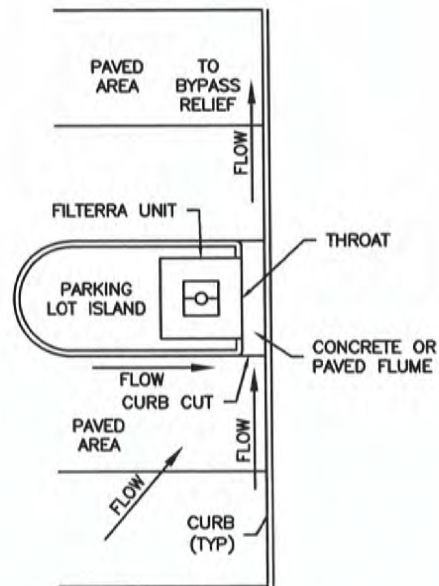
ON-GRADE ISLAND
IN OPEN PARKING LOT



SECTION VIEW OF FILTERRA
THROAT AND FLUME



LOW POINT ISLAND
AT SIDE OF PARKING LOT



ON-GRADE ISLAND
AT SIDE OF PARKING LOT

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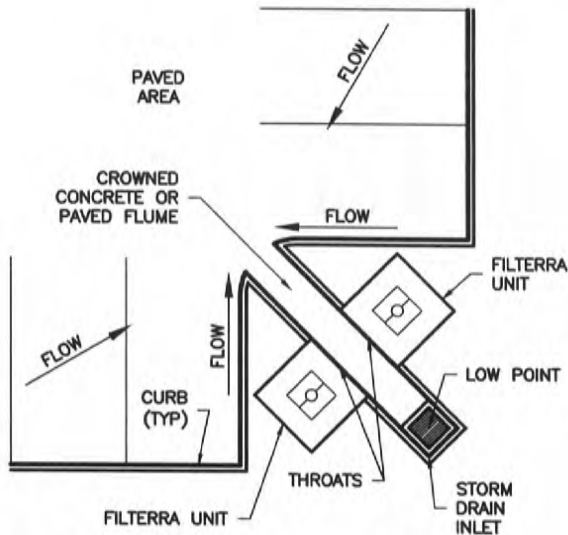
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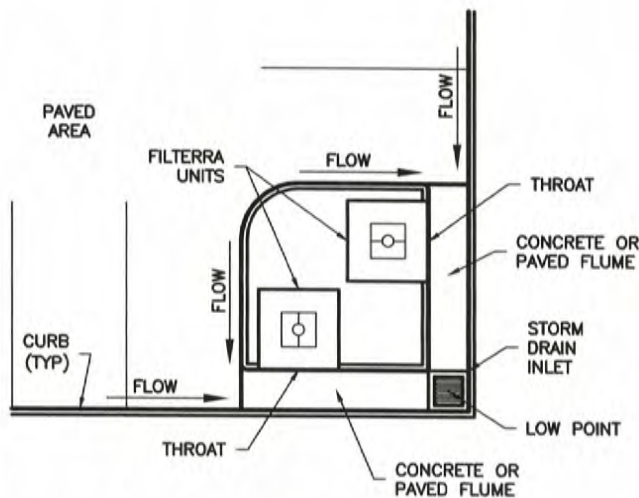
**FILTERRA® EXAMPLE SCENARIOS
PARKING LOT ISLAND
APPLICATIONS**



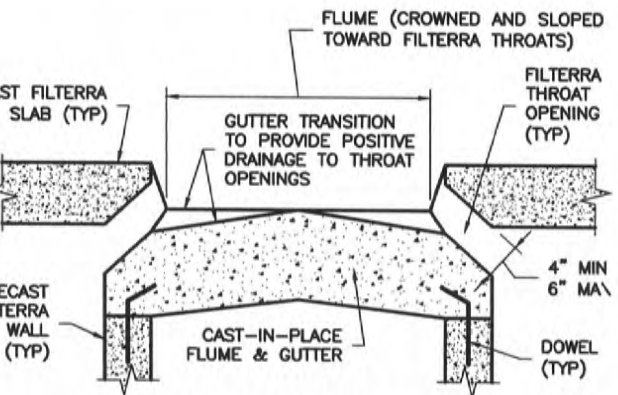
US PAT 6,277,274
AND 6,569,321



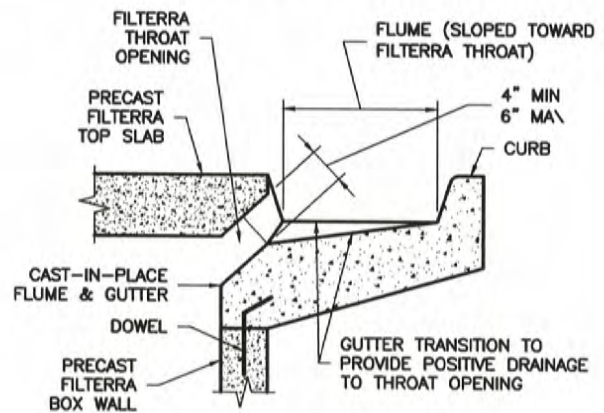
CROWNED FLUME CORNER



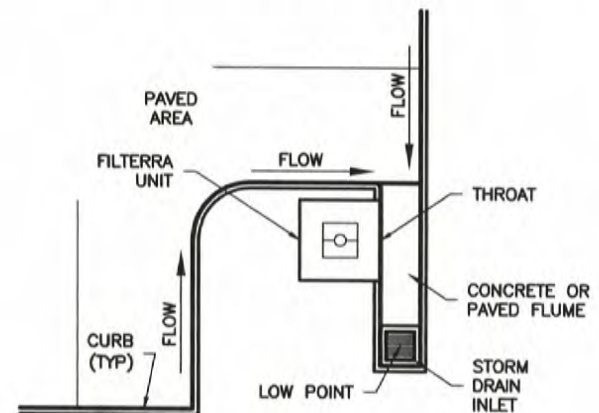
TWO FLUME CORNER



SECTION VIEW OF CROWNED FLUME



SECTION VIEW OF FILTERRA THROAT AND FLUME



ONE FLUME CORNER



DATE: 01-03-05

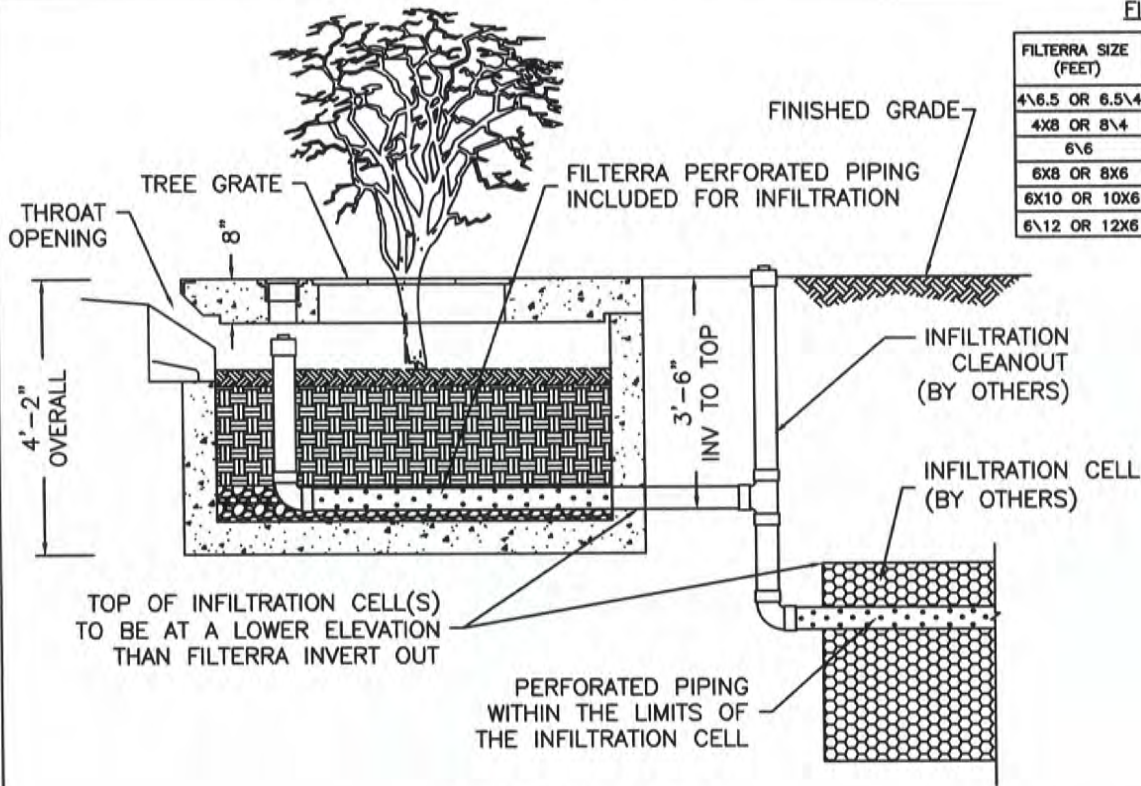
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**FILTERRA® EXAMPLE SCENARIOS
PARKING LOT CORNER
APPLICATIONS**

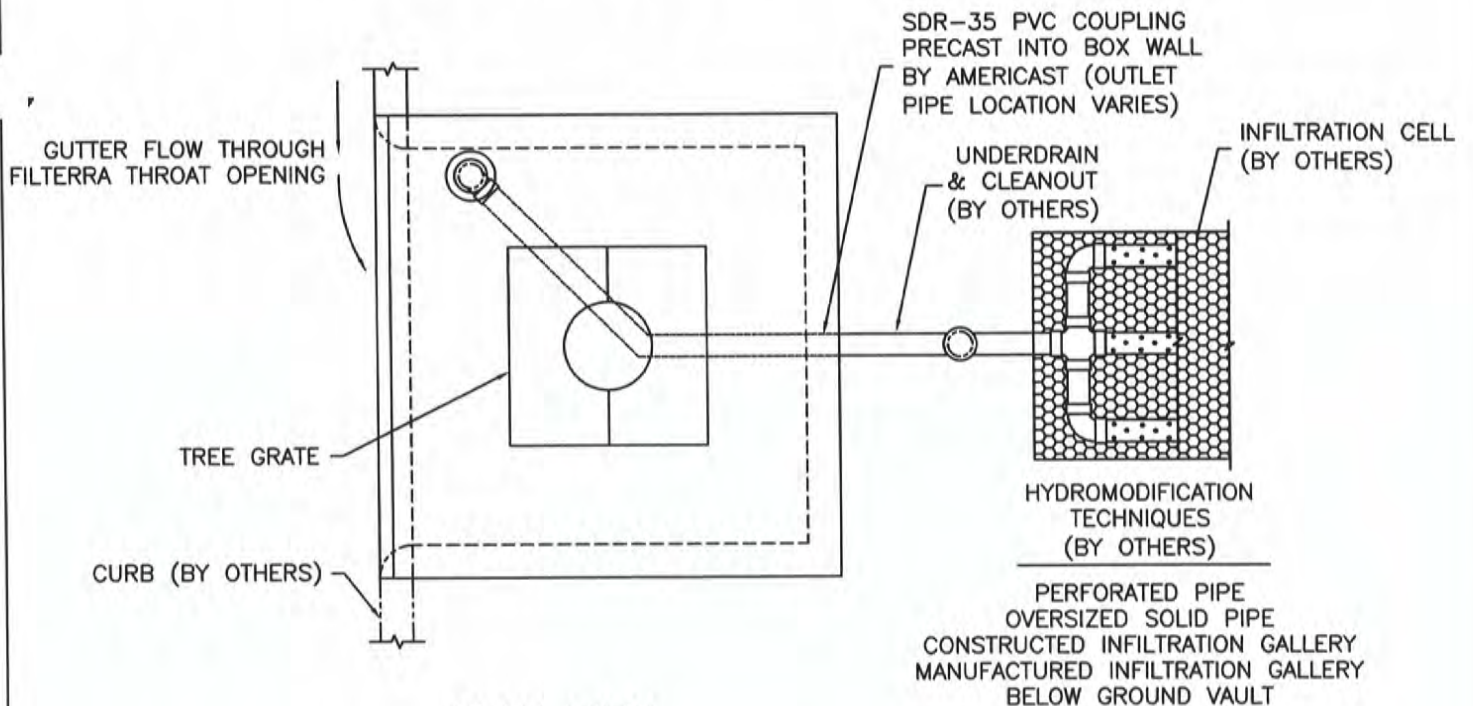


FILTERRA FLOW RATES

FILTERRA SIZE (FEET)	EXPECTED FLOW RATE (CFS)	CONNECTING DRAINAGE PIPE
4'x6.5 OR 6.5'x4	0.061	4" SDR-35 PVC
4'x8 OR 8'x4	0.075	4" SDR-35 PVC
6'x6	0.084	4" SDR-35 PVC
6'x8 OR 8'x6	0.112	4" SDR-35 PVC
6'x10 OR 10'x6	0.140	6" SDR-35 PVC
6'x12 OR 12'x6	0.168	6" SDR-35 PVC



SECTION VIEW



PLAN VIEW

INFILTRATION CELL BENEATH FILTERRA

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DRAWING AVAILABLE IN TIF FILE FORMAT.



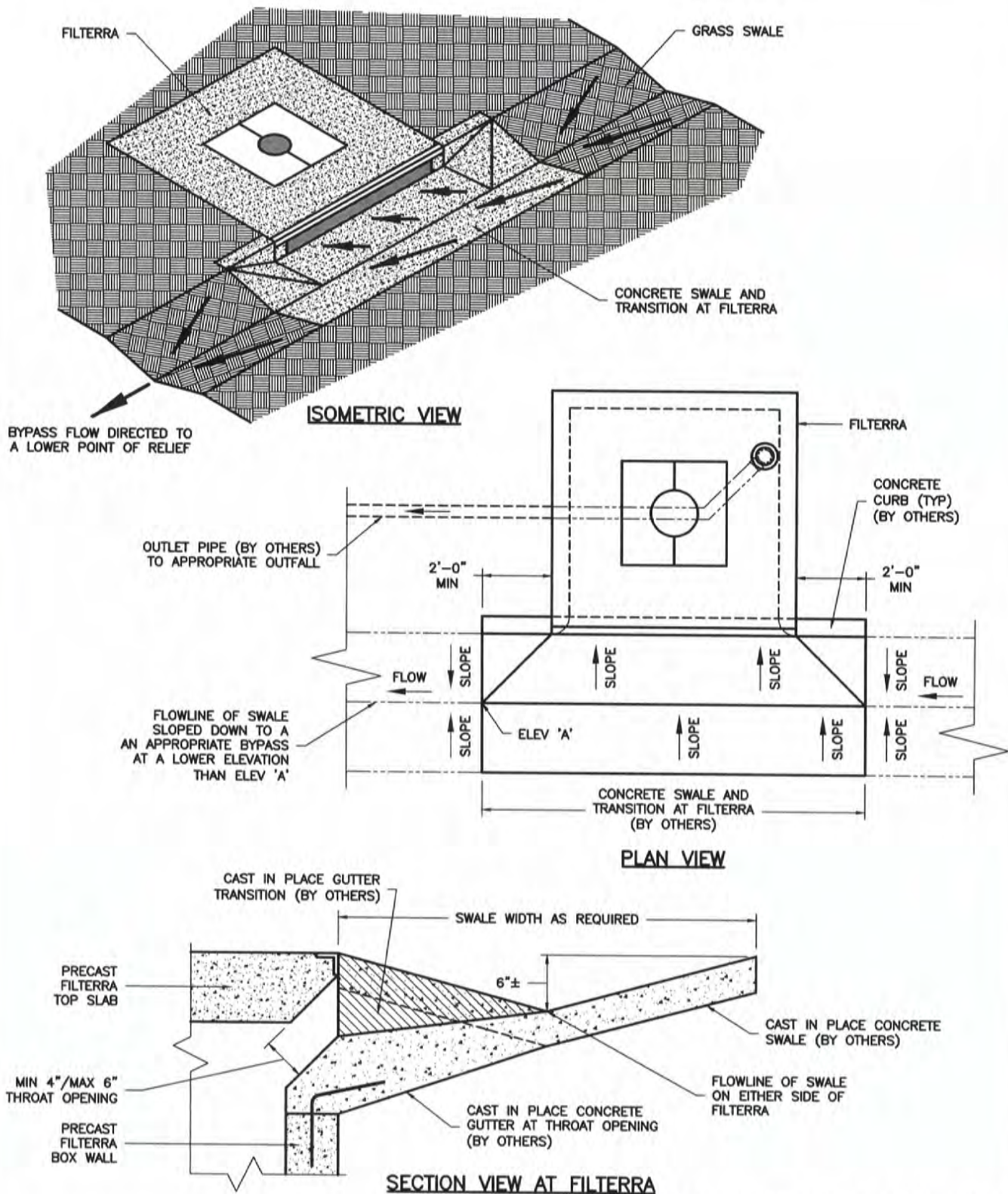
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DATE: 05-07-08

DWG: FTHYD-1

**TYPICAL
FILTERRA®
HYDROMODIFICATION
CONFIGURATION**





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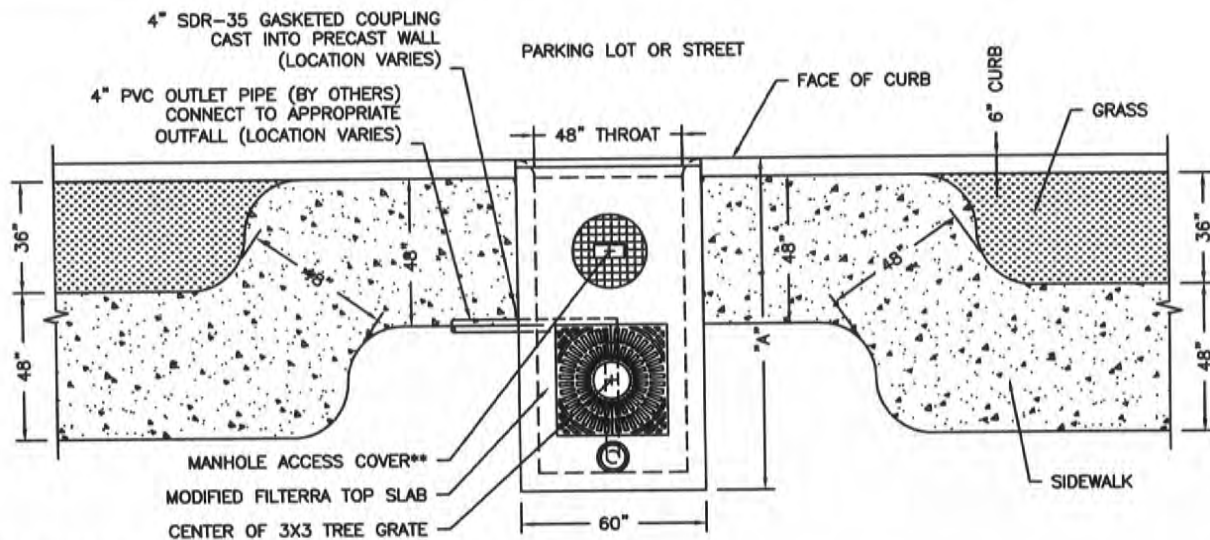
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DATE: 03-10-05

DWG: FTSWL-1

**PRECAST FILTERRA® UNIT
TYPICAL SWALE
CONFIGURATION**





BOX SIZE	DIM. "A"	TREE GRATE	MANHOLE
4x8	9'-0"	3'x3'	YES
6x8	9'-0"	4'x4'	YES
6x10	11'-0"	(1) 4'x4'	YES
6x12	13'-0"	(1) 4'x4'	YES

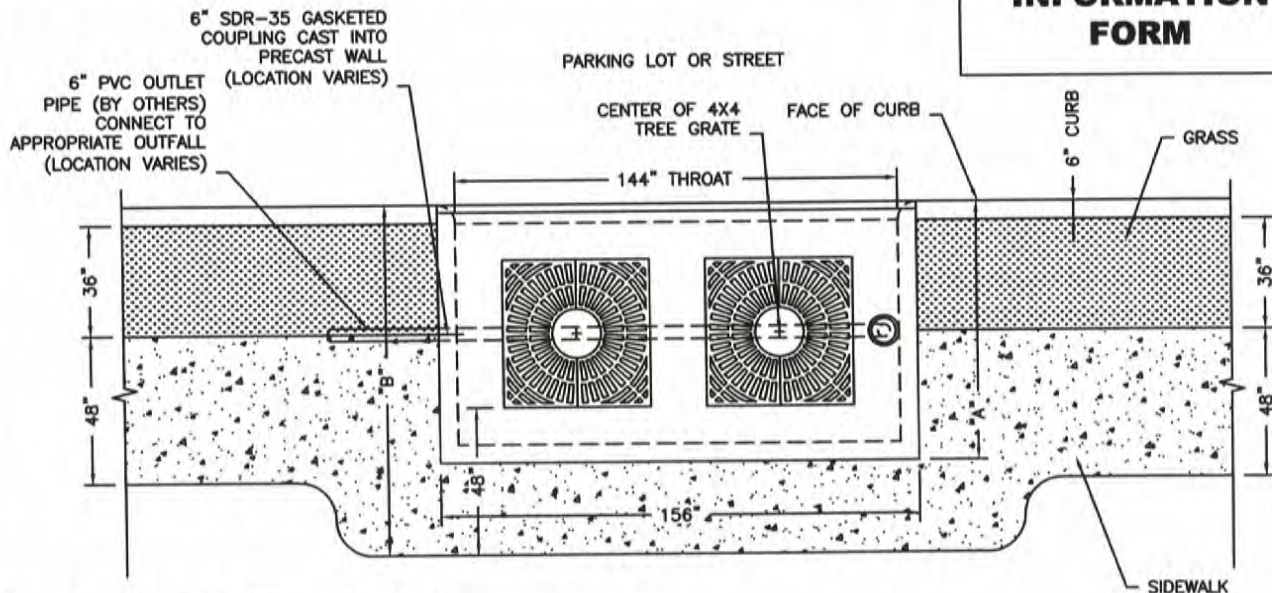
*3'x3' TREE GRATE IS OPTIONAL

**THE MANHOLE COVER IS REQUIRED ON SOME MODIFIED TOP SLABS FOR ACCESS DURING MAINTENANCE VISITS

MODIFIED NARROW LENGTH FILTERRA UNIT

ONLY FOR 4x8 (SHOWN)
6x8 AND 6x10 BOXES

**PLEASE NOTE
MODIFICATION
ON PROJECT
INFORMATION
FORM**



BOX SIZE	DIM. "A"	DIM. "B"	TREE GRATE
8x4	5'-0"	9'-0"	3'x3'
8x6	7'-0"	9'-0"	4'x4'
10x6	7'-0"	11'-0"	4'x4'
12x6	7'-0"	13'-0"	4'x4'

*3'x3' TREE GRATE IS OPTIONAL

STANDARD NARROW WIDTH FILTERRA UNIT

SUITABLE FOR ALL
STANDARD BOXES

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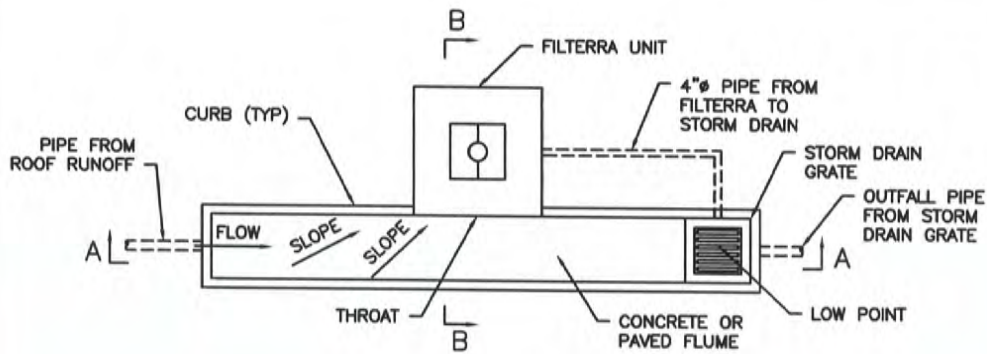
TOLL FREE (866) 349-3458

DATE: 03-17-09

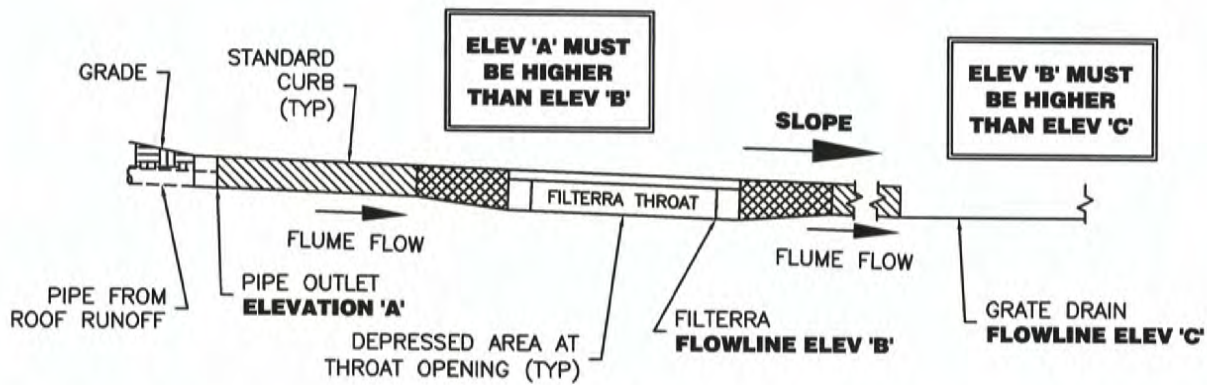
DWG: WZ FTSC-4

**TYPICAL FILTERRA®
SIDEWALK CONFIGURATIONS
WESTERN ZONE**

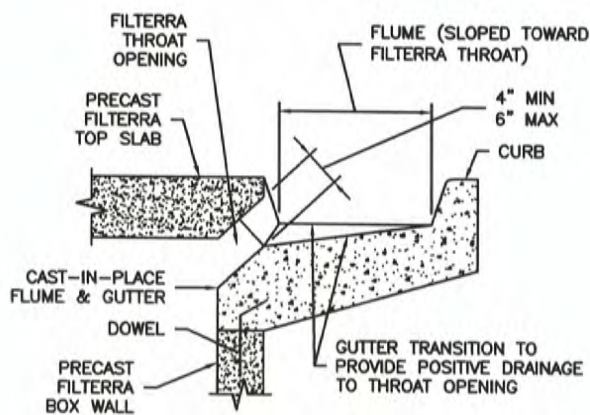




FLUME PLAN



FLUME CROSS SECTION A-A



FLUME SECTION B-B

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DWG: FTRDF-1

**FILTERRA® EXAMPLE SCENARIOS
ROOF DRAIN FLUME
APPLICATION**



US PAT 6,277,274
AND 6,569,321

Section C

Standard Filterra® Detail Drawings & Filterra® Plan Notes

For TIF versions of these detail drawings, please contact Americast.

Toll Free: (866) 349-3458

E-mail: design@filterra.com

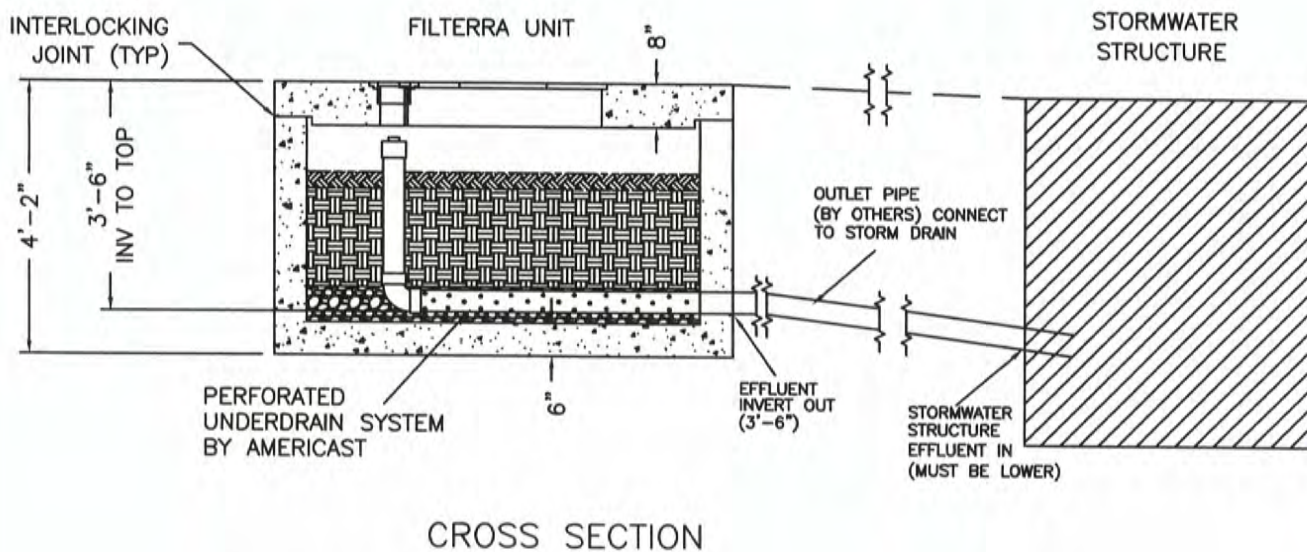
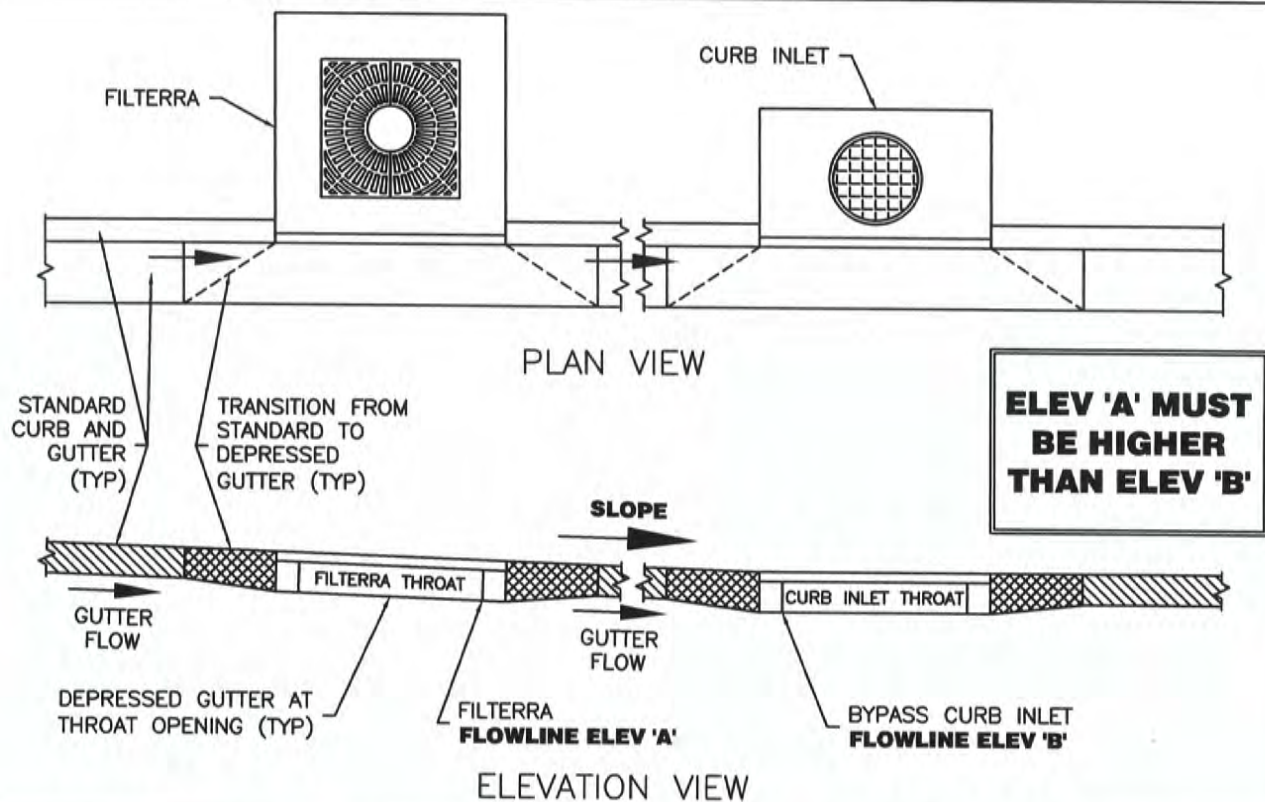
Reproduction of these detail drawings is permitted for use only in site plans or contract documents for eventual supply by Americast or its authorized dealer. Other uses are prohibited and may infringe copyright or patent protection laws.

Filterra and Americast reserve the right to alter specifications without notice. Please make certain the Filterra Project Information Form is completed to ensure the verification of the latest specifications for your project.

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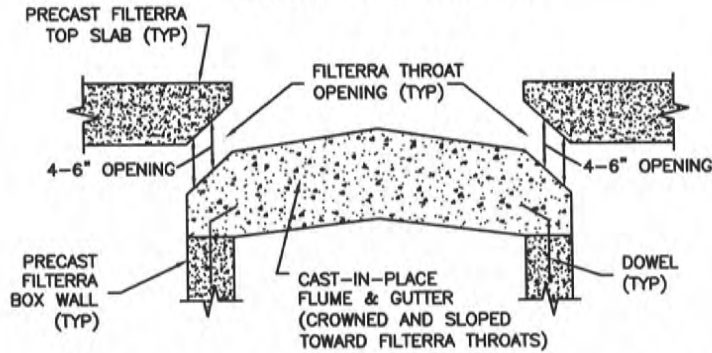
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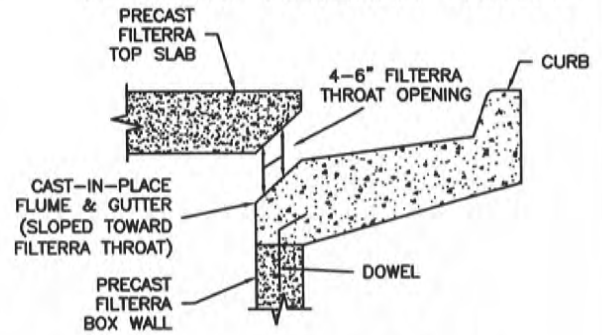
**FILTERRA® TYPICAL FLOWLINE
AND OULET PIPE RELATIONSHIP**



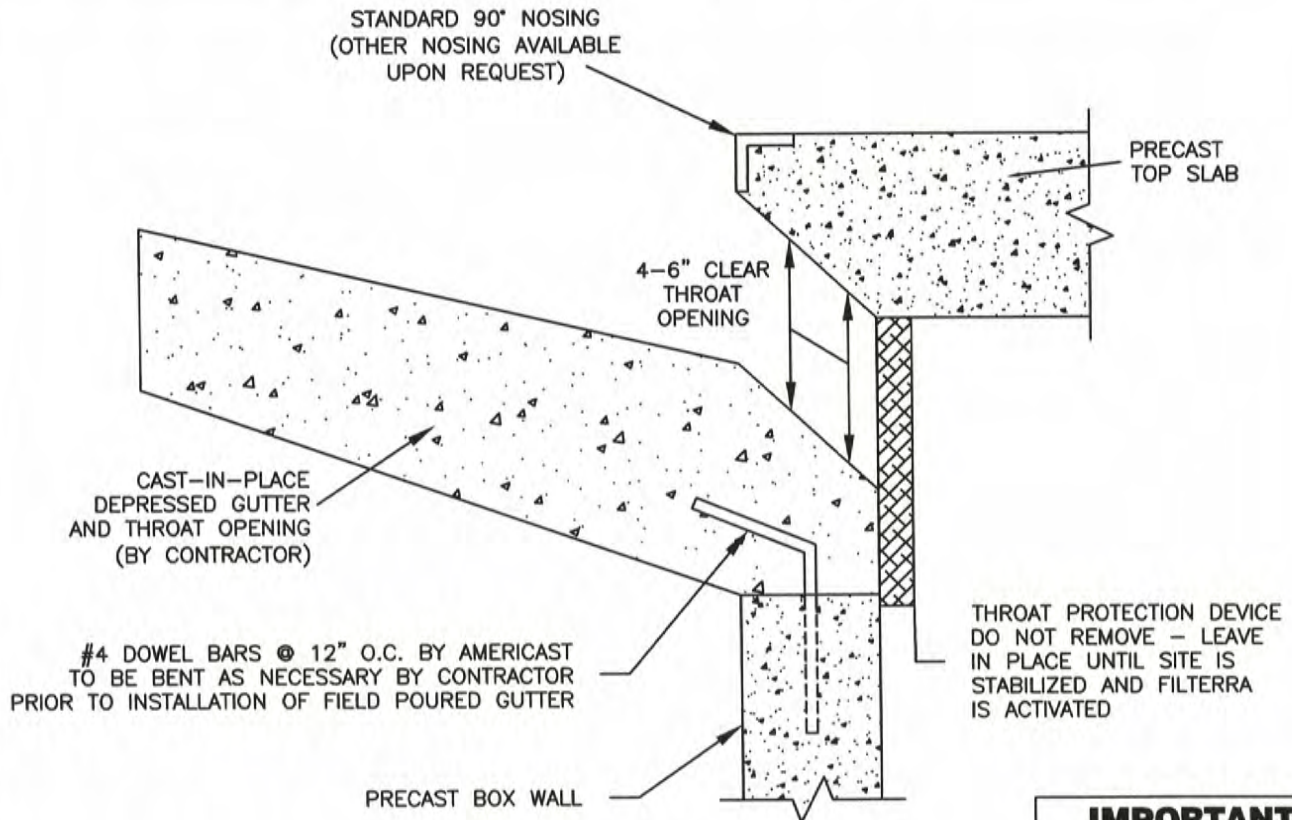
CROWNED FLUME



FLUME - SLOPED TOWARDS FILTERRA THROAT



SECTIONS VIEWS OF FILTERRA IN TYPICAL FLUME APPLICATIONS
SEE BELOW FOR DETAILS NOT SHOWN



SECTION VIEW STANDARD FILTERRA THROAT OPENING

IMPORTANT

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

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DRAWING AVAILABLE IN TIFF FILE FORMAT.



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DATE: 02-26-09

DWG: CGT-5

**FILTERRA® THROAT OPENING
AND GUTTER OR FLUME DETAIL**



Filterra® Standard Plan Notes

Construction & Installation

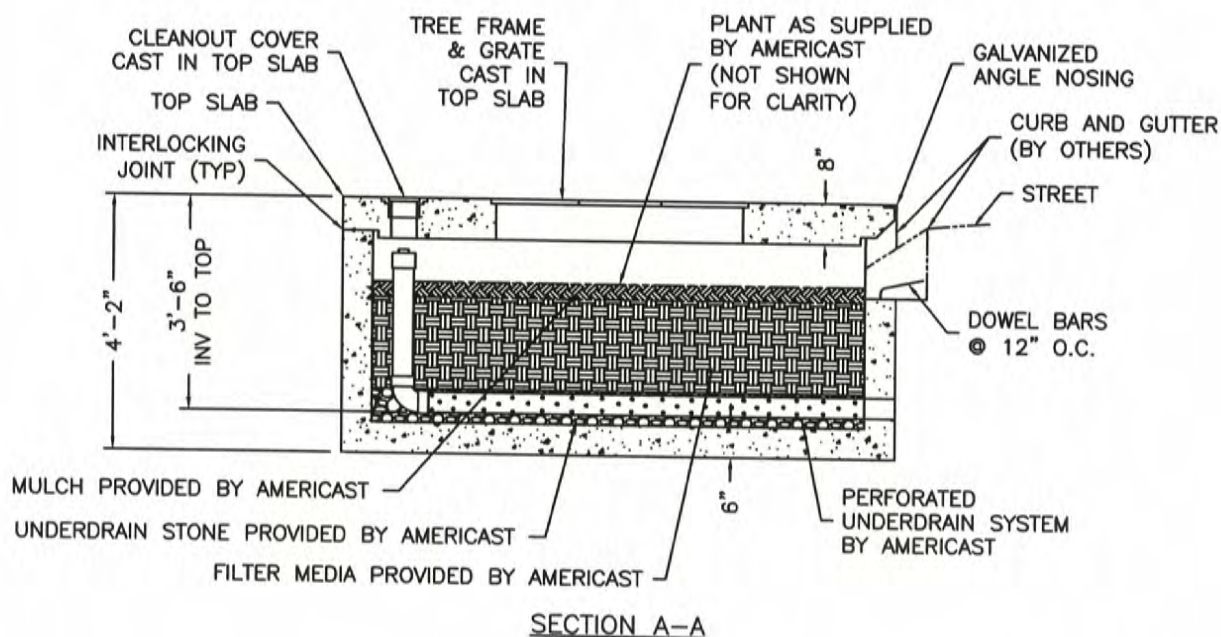
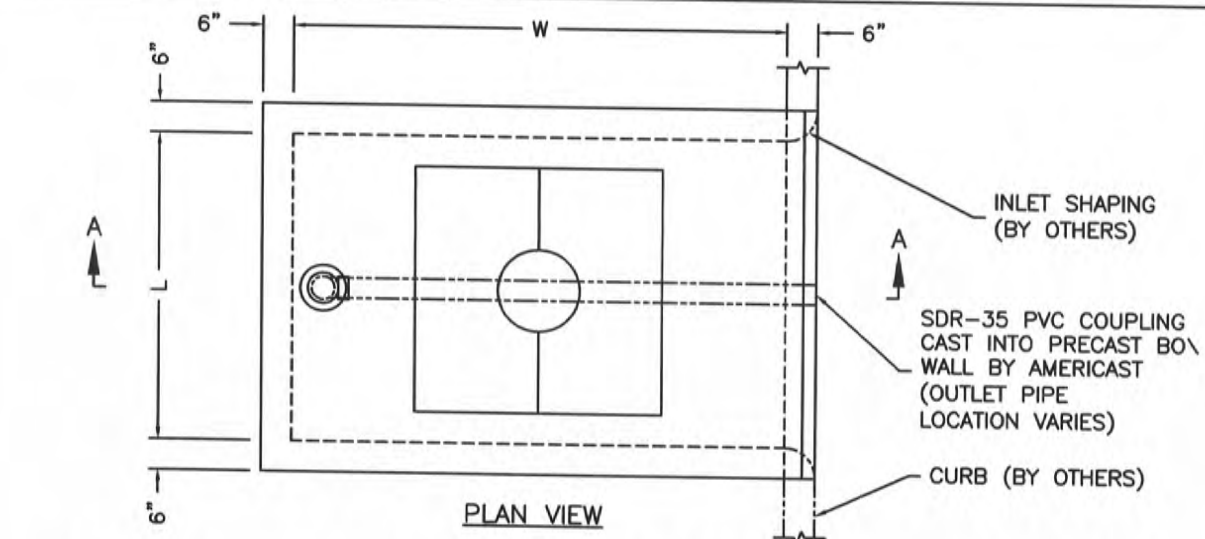
- A. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.
- B. If the Filterra® is stored before installation, the top slab must be placed on the box using the 2x4 wood provided, to prevent any contamination from the site. All internal fittings supplied (if any), must be left in place as per the delivery.
- C. The unit shall be placed on a 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- 2% of optimum moisture. Unsuitable material below sub-grade shall be replaced to the site engineer's approval.
- D. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations.
- E. Once the unit is set, the internal wooden forms and protective mesh cover must be left intact. Remove only the temporary wooden shipping blocks between the box and top slab. The top lid should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on top of the lid and boards sealed in the unit's throat must **NOT** be removed. The Supplier (Americast or its authorized dealer) will remove these sections at the time of activation. 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 Filterra® unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures", unless directed otherwise in contract documents.
- F. Curb and gutter construction (where present) shall ensure that the flow-line of the Filterra® units is at a greater elevation than the flow-line of the bypass structure or relief (drop inlet, curb cut or similar). Failure to comply with this guideline may cause failure and/or damage to the Filterra® environmental device.
- G. Each Filterra® unit must receive adequate irrigation to ensure survival of the living system during periods of drier weather. This may be achieved through a piped system, gutter flow or through the tree grate.

Activation

- A. Activation of the Filterra® unit is performed ONLY by the Supplier. Purchaser is responsible for Filterra® inlet protection and subsequent clean out cost. This process cannot commence until the project site is fully stabilized and cleaned (full landscaping, grass cover, final paving and street sweeping completed), negating the chance of construction materials contaminating the Filterra® system. Care shall be taken during construction not to damage the protective throat and top plates.
- B. Activation includes installation of plant(s) and mulch layers as necessary.

Included Maintenance

- A. Each correctly installed Filterra® unit is to be maintained by the Supplier, or a Supplier approved contractor for a minimum period of 1 year. The cost of this service is to be included in the price of each Filterra® unit. Extended maintenance contracts are available at extra cost upon request.
- B. Annual included maintenance consists of a maximum of (2) scheduled visits. The visits are scheduled seasonally; the spring visit aims to clean up after winter loads that may include salts and sands. The fall visit helps the system by removing excessive leaf litter.
- C. Each Included Maintenance visit consists of the following tasks.
 - 1. Filterra® unit inspection
 - 2. Foreign debris, silt, mulch & trash removal
 - 3. Filter media evaluation and recharge as necessary
 - 4. Plant health evaluation and pruning or replacement as necessary
 - 5. Replacement of mulch
 - 6. Disposal of all maintenance refuse items
 - 7. Maintenance records updated and stored (reports available upon request)
- D. The beginning and ending date of Supplier's obligation to maintain the installed system shall be determined by the Supplier at the time the system is activated. Owners must promptly notify the Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology.



DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
4 \ 6.5	4'-0"	6'-6"	(1) 3x3	4" SDR-35 PVC
4 x 8	4'-0"	8'-0"	(1) 3x3	4" SDR-35 PVC
6 x 8	6'-0"	8'-0"	(1) 4x4	4" SDR-35 PVC
6 x 10	6'-0"	10'-0"	(1) 4x4	6" SDR-35 PVC
6 x 12	6'-0"	12'-0"	(2) 4x4	6" SDR-35 PVC

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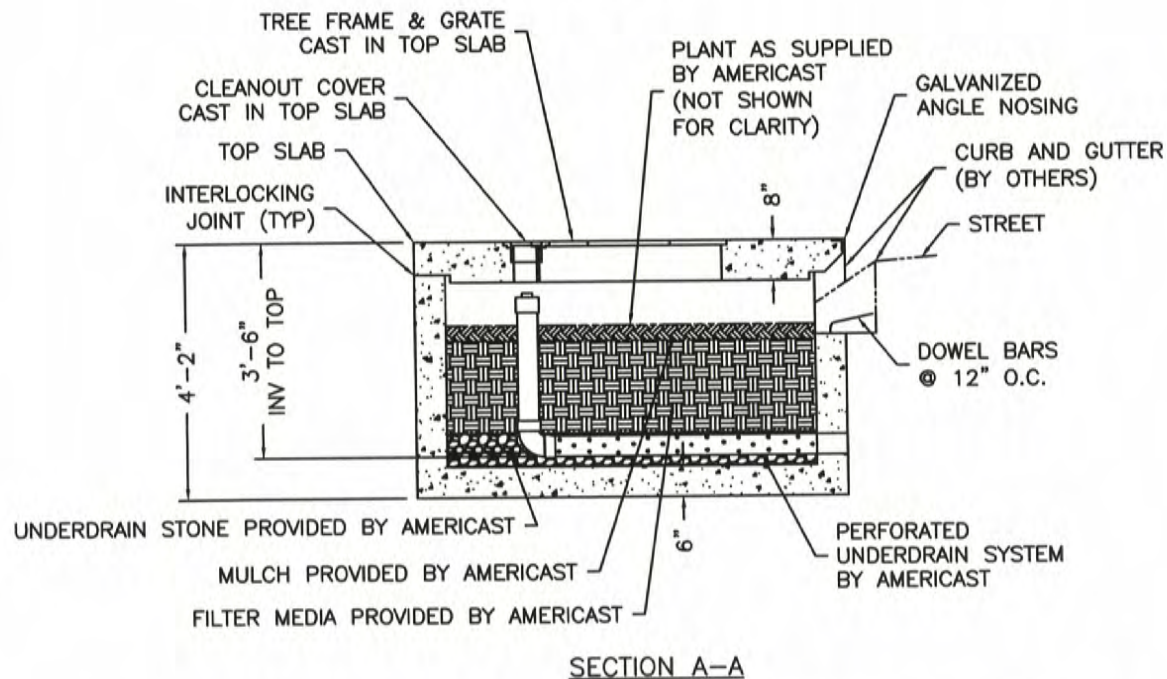
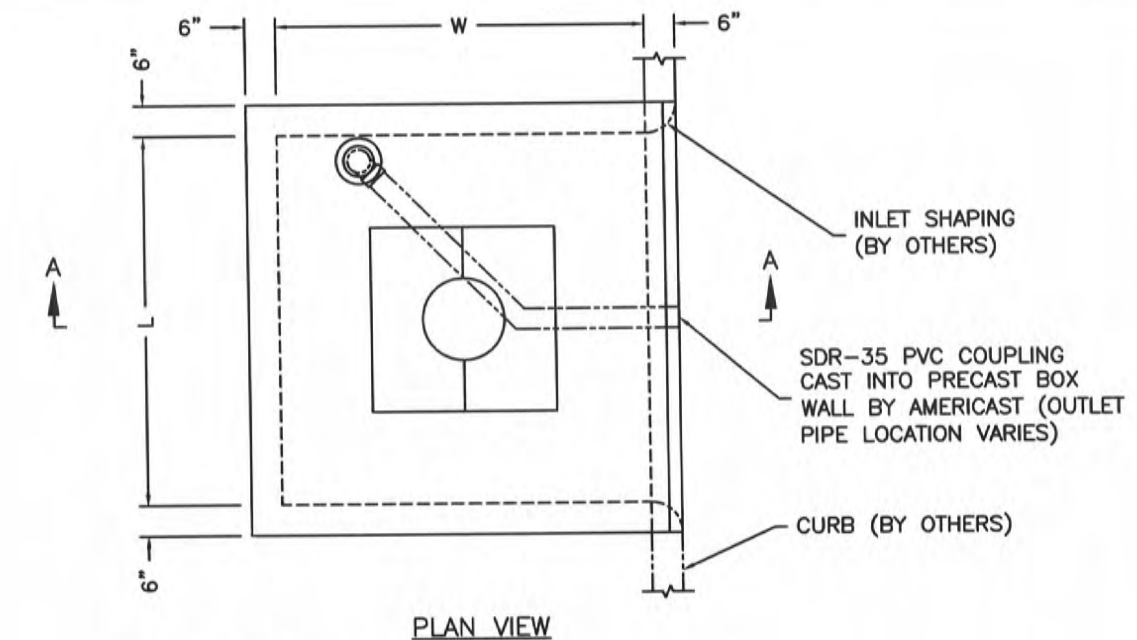
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DWG: WZ FTNL-4

**PRECAST FILTERRA® UNIT
NARROW LENGTH CONFIGURATION
WESTERN ZONE**





DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
4 x 4	4'-0"	4'-0"	(1) 3x3	4" SDR-35 PVC
6 x 6	6'-0"	6'-0"	(1) 3x3	4" SDR-35 PVC

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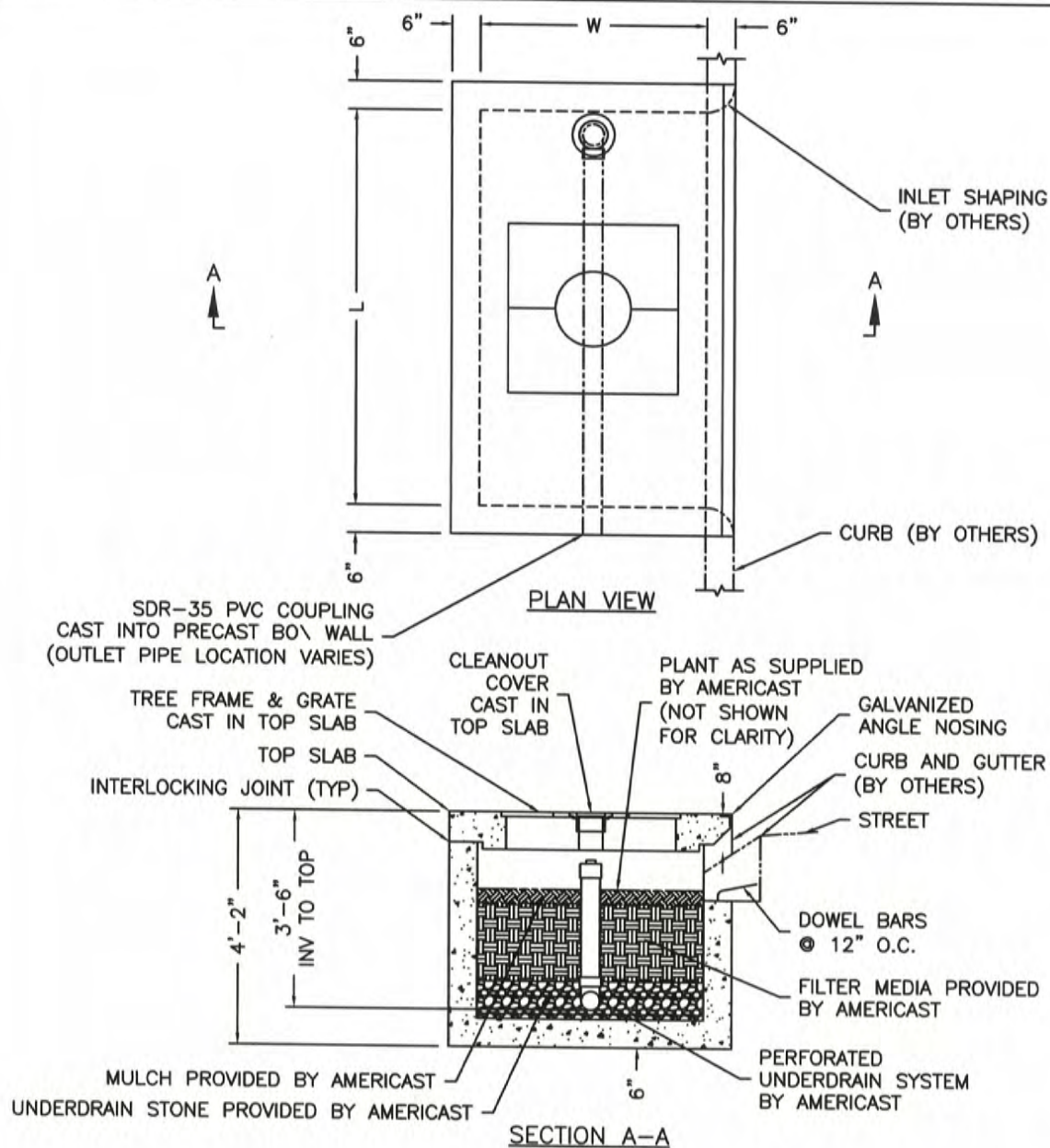
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DWG: WZ FTST-3

**PRECAST FILTERRA® UNIT
STANDARD CONFIGURATION
WESTERN ZONE**





DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
6.5 x 4	6'-6"	4'-0"	(1) 3x3	4" SDR-35 PVC
8 x 4	8'-0"	4'-0"	(1) 3x3	4" SDR-35 PVC
8 x 6	8'-0"	6'-0"	(1) 4x4	4" SDR-35 PVC
10 x 6	10'-0"	6'-0"	(1) 4x4	6" SDR-35 PVC
12 x 6	12'-0"	6'-0"	(2) 4x4	6" SDR-35 PVC

MODIFICATIONS OF DRAWINGS ARE ONLY PERMITTED BY WRITTEN AUTHORIZATION FROM FILTERRA

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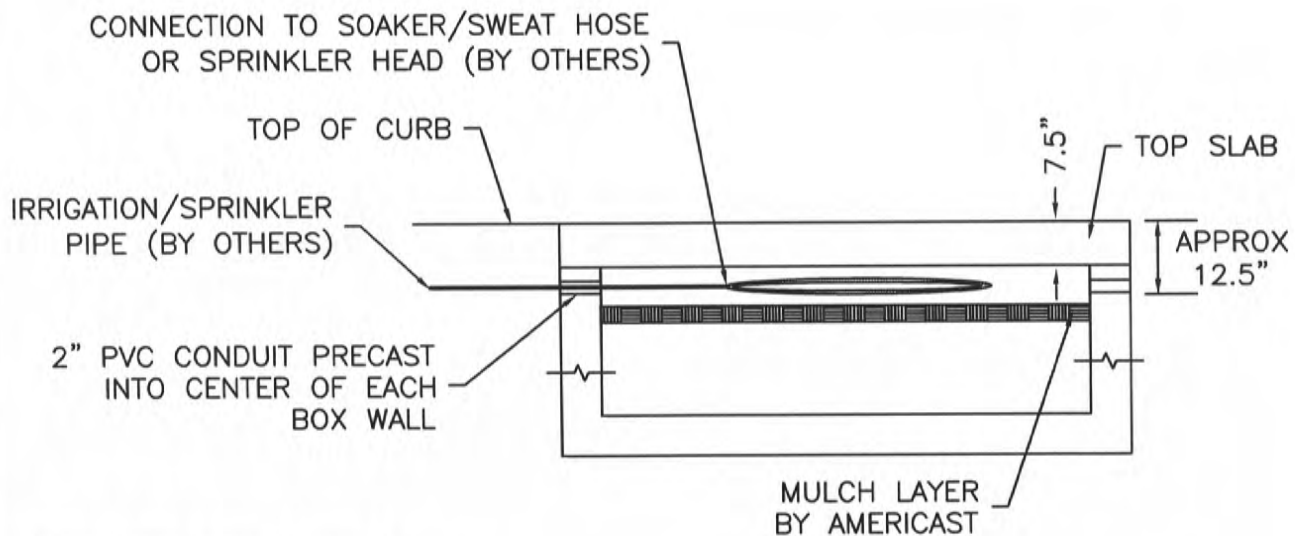


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DWG: WZ FTNW-4

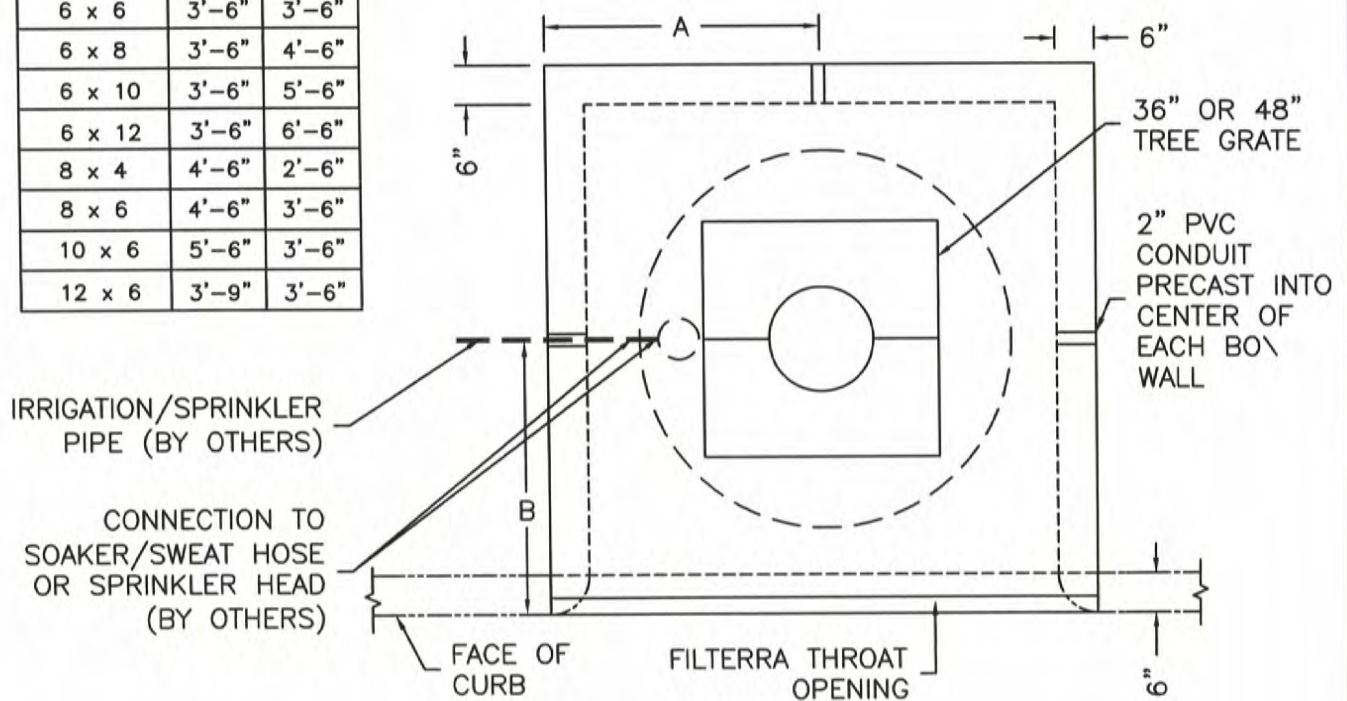
**PRECAST FILTERRA® UNIT
NARROW WIDTH CONFIGURATION
WESTERN ZONE**





ELEVATION VIEW

UNIT SIZE	A	B
4 \ 4	2'-6"	2'-6"
4 \ 6.5	2'-6"	3'-9"
4 x 8	2'-6"	4'-6"
6.5 x 4	3'-9"	2'-6"
6 x 6	3'-6"	3'-6"
6 x 8	3'-6"	4'-6"
6 x 10	3'-6"	5'-6"
6 x 12	3'-6"	6'-6"
8 x 4	4'-6"	2'-6"
8 x 6	4'-6"	3'-6"
10 x 6	5'-6"	3'-6"
12 x 6	3'-9"	3'-6"



PLAN VIEW

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**FILTERRA® IRRIGATION
PLANNING LAYOUT
WESTERN ZONE**



Section D

Filtterra[®] Technical Section

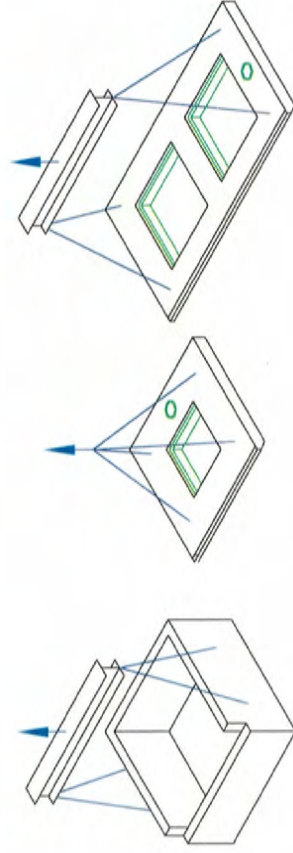
Toll Free: (866) 349-3458
Fax: (804) 798-8400
design@filtterra.com

www.filtterra.com

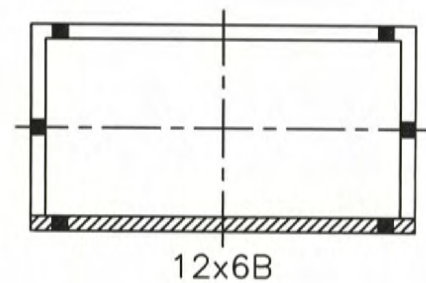
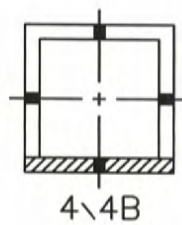
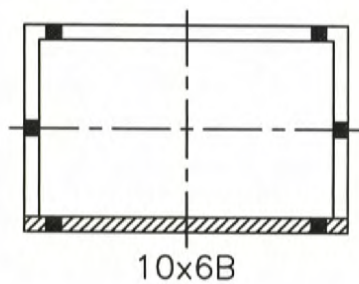
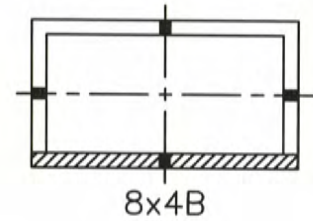
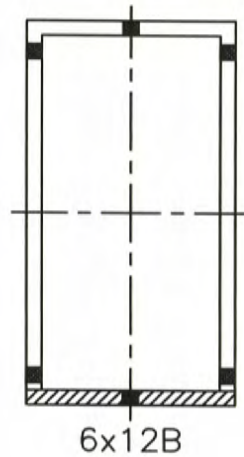
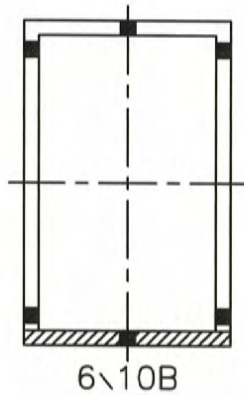
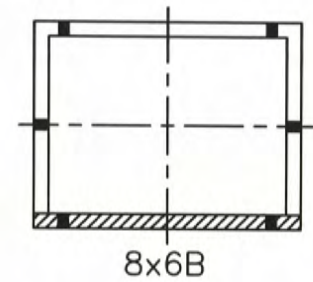
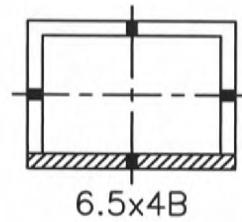
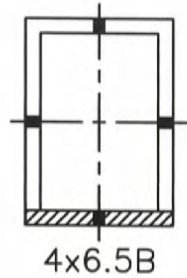
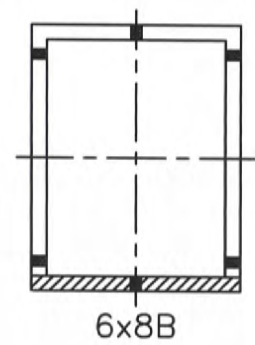
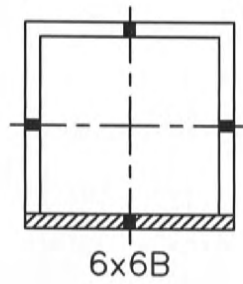
Americast Filterra Weights and Lifting Details

WESTERN ZONE

		Top Only		Box + Media		*Spreader Bar	
		Pounds	Tons	Pounds	Tons	Min	Max
4'-0" Throat	4x4	1,808	0.90	9,180	4.59	5.00 ft	7.50 ft
	4x6.5	3,071	1.54	13,464	6.73	5.00 ft	7.50 ft
	4x8	3,829	1.91	16,035	8.02	5.00 ft	7.50 ft
6'-0" Throat	6.5x4	2,833	1.42	13,270	6.64	5.50 ft	7.50 ft
	Std 6x6	4,221	2.11	17,051	8.53	7.00 ft	9.00 ft
	6x8	5,121	2.56	21,649	10.82	7.00 ft	9.00 ft
	6x10	6,545	3.27	26,248	13.12	7.00 ft	9.00 ft
	6x12	6,825	3.41	30,847	15.42	7.00 ft	9.00 ft
8'-0" Throat	8x4	3,787	1.89	15,725	7.86	5.50 ft	7.50 ft
	8x6	5,100	2.55	21,494	10.75	7.50 ft	9.50 ft
10'-0" Throat	10x6	6,503	3.25	25,938	12.97	7.50 ft	9.50 ft
12'-0" Throat	12x6	6,762	3.38	30,382	15.19	7.50 ft	9.50 ft



* A 7.50 ft spreader bar is suitable for all sizes shown.



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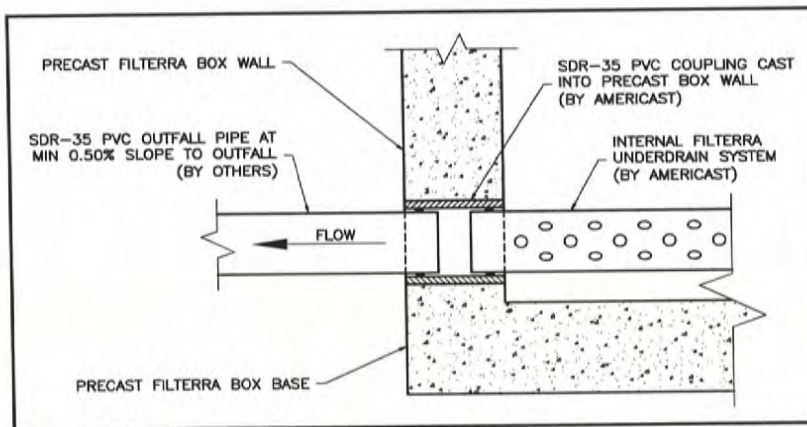
DWG: WZ FTOPC-3

**FILTERRA® PVC OUTLET
PIPE COUPLING LOCATIONS
WESTERN ZONE**



Filterra® Piping Technical Details

Filterra® is supplied with an internal underdrain system that exits a wall in a perpendicular direction. Most efficient drainage is accomplished when the drain exits on the lower side of the Filterra®, i.e. nearest the overflow bypass. This is more important when using the larger sized Filterras®.



*Drawing DP1:
Section View through Filterra
Precast Box Wall at Outfall Pipe
Connection*

All units are supplied with the drainage pipe coupling precast into the wall, at a depth of 3.50 feet (INV to TC). Drawing DP1 is a detail of the coupling. The coupling used is SDR-35 PVC.

Typically, a minimum slope of 0.50% is adequate to accommodate the flow of treated water from the Filterra®, but each site may present unique conditions based on routing of the outfall pipe (elbows). The pipe must not be a restricting point for the successful operation of Filterra®. All connecting pipes must accommodate freefall flow. Table 3 lists expected flow rates of the various size Filterra® units and these flow rates can be used to confirm or calculate the minimum outfall pipe slope.

Table 3: Filterra Flow Rates & Pipe Details

Filterra® Size (feet)	Expected Flow Rate (cubic feet/second)	Connecting Drainage Pipe
4x4	0.037	4" SDR-35 PVC
4x6.5 or 6.5x4	0.061	4" SDR-35 PVC
4x8 or 8x4	0.075	4" SDR-35 PVC
6x6	0.084	4" SDR-35 PVC
6x8 or 8x6	0.112	4" SDR-35 PVC
6x10 or 10x6	0.140	6" SDR-35 PVC
6x12 or 12x6	0.168	6" SDR-35 PVC

Filtterra® Modified Options: Recessed Tops



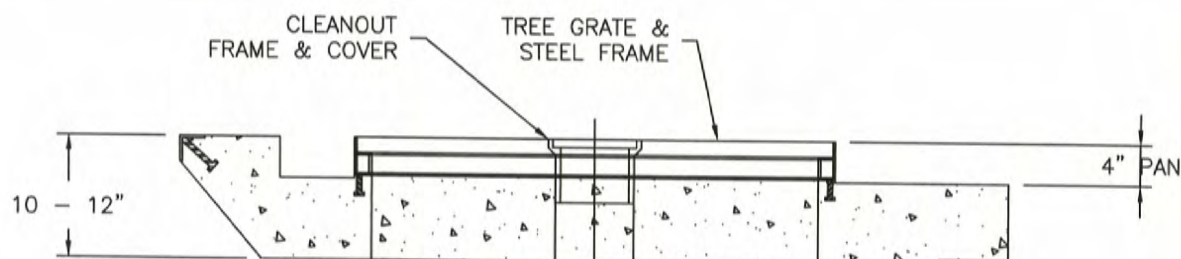
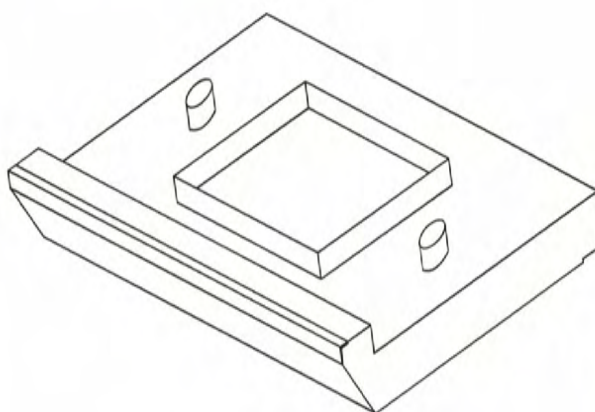
Filtterra® modified recessed tops allow a seamless integration using pavers, mulch or sod.

NOTE: Modified recessed tops increase the depth of the Filtterra® invert out.

Modified recessed top with mulch



Modified recessed top prior to shipping



Filterra® Modified Options: Ornamental Grates

Modified colored grates are plastic coated to reduce corrosion. All grates are available in 36" and 48". Some modified grates may not be ADA compliant. For additional options please call (866) 349-3458.



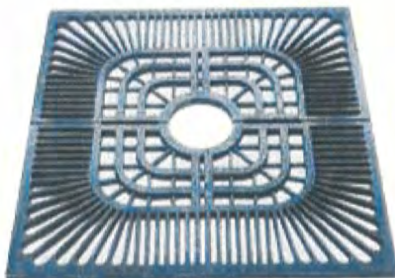
FT Radial

Color Choices: ■ Black ■ Green



FT New Orleans

Color Choices: ■ Black ■ Green



UA Standard Flat



UA Title-24



UA OT Title-24



UA Chinook

Common Filterra® Placements



Providing aesthetics and treatment in a residential area.



Typical Filterra placement at a fast food chain.



Even the largest Filterra unit blends in with landscaping.



Filterra used with a flumed bypass in a commercial parking lot.



Ideal for stormwater treatment where space is tight.



High flows bypass Filterra into a grass swale.

Filterra® Plant Selections

The Filterra® Stormwater Bioretention Filtration System harnesses the power of nature to capture, immobilize and cycle pollutants to treat stormwater runoff. Trees, grasses and shrubs do more than make it attractive; they also enhance pollutant removal.

Above ground, the system's shrubs, grasses or trees add beauty and value to the urban landscape. Underground, nature's complex physical, chemical and biological processes are hard at work removing a wide range of non-point source pollutants from treated stormwater. Pollutants are decomposed, volatilized and incorporated into the biomass of Filterra's micro/macro fauna and flora.

A wide range of plants are suitable for use in bioretention systems, and a list is available indicating those suitable for use with Filterra. The selection varies by location according to climate.

Additional photos are available at www.filterra.com. Some of the most popular selections to date are shown below:



Filterra® with Heavenly Bamboo



Filterra® with Foster Holly



Filterra® with Yedda Hawthorn



Filterra® with Crape Myrtle



filterra
Bioretention Systems
A Growing Idea in Stormwater Filtration

Bioretention

Plant/Soil/Microbe Complex
Removes Pollutants, TSS,
Phosphorus, Nitrogen, Bacteria,
Heavy Metals, Hydrocarbons, etc.

New or Existing
Catch Basin,
Curb Cut or
Other Means of
Overflow Relief

**Filterra® Flow Line
at Higher Elevation
than Bypass Flow Line**

High Flow Bypass

Clean-out

Curb and
Gutter

Storm Water Inflow
("First Flush")

Energy Dissipator
Stones

3" Mulch

Filterra® Engineered
Media

Filterra® Concrete
Container

Treated Stormwater
Underdrain System