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# **RECYCLED PLASTIC (95%+) DRY FILTER BOX DROP-IN SPECIFICATION**

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*June 2020*

The following specification is a sample guideline to be customized by the engineer as needed for preparing a site-specific specification. This information is provided for reference purposes only and is not intended as a warranty or guarantee.

## **DROP-IN SPECIFICATION**

### **RECYCLED PLASTIC (95%+) DRY FILTER BOX FOR SURFACE BMPS**

#### **1. AUTHORIZED PRODUCTS**

- 1.1. The recycled plastic dry filter box shall be a Rain Guardian Bunker Pretreatment Chamber (U.S. Patent Nos. 8,501,016 and 8,858,804).

#### **2. AUTHORIZED SUPPLIERS**

- 2.1. Connecticut, Delaware, Florida, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, West Virginia, Vermont, Virginia

- 2.1.1. ACF Environmental  
2831 Cardwell Road  
Richmond, VA 23234  
(800) 448-3636  
acfenvironmental.com

- 2.2. Arkansas, Colorado, Illinois, Iowa, Kansas, Missouri, Nebraska, Oklahoma

- 2.2.1. ASP Enterprises/Quick Supply Co./Bowman Construction Supply, Inc.  
10990 Cassens Industrial Court  
Fenton, MO 63026  
(800) 869-9600  
aspent.com

- 2.3. Louisiana and Texas

- 2.3.1. Construction EcoServices  
1930 Aldine Western Road  
Houston, TX 77038  
(832) 456-1000  
constructionecoservices.com

- 2.4. Indiana and Michigan

- 2.4.1. Interface h2o, LLC  
10694 Chicago Drive  
Zeeland, MI 46494  
(616) 836-3535  
interfaceh2o.com

- 2.5. Tennessee

- 2.5.1. Jen-Hill Construction Materials  
145 Old Shackle Island Road  
Hendersonville, TN 37075  
(615) 824-1200  
jenhill.com

- 2.6. Arizona, California, Nevada, New Mexico, Oregon, Washington

- Porous Technologies, LLC  
163 Thadeus Street  
South Portland, ME 04106  
(909) 654-0869  
stormcrete.com

## 2.7. Kentucky and Ohio

2.7.1. Site Supply, Inc.  
713 Stimmel Road  
Columbus, OH 43223  
(800) 465-0900  
sitefabric.com

## 2.8. All other states

2.8.1. Anoka Conservation District  
1318 McKay Dr. NE, Suite 300  
Ham Lake, MN 55304  
(763) 434-2030 ext. 15  
AnokaSWCD.org | RainGuardian.biz

## 3. AUTHORIZED MANUFACTURERS

3.1. Anoka Conservation District  
1318 McKay Dr. NE, Suite 300  
Ham Lake, MN 55304  
(763) 434-2030  
AnokaSWCD.org | RainGuardian.biz

## 4. INTRODUCTION

### 4.1. Scope

4.1.1. This specification details requirements for proper design, installation, and maintenance of a recycled plastic dry filter box for surface stormwater best management practices (BMP).

### 4.2. Product Summary

- 4.2.1. A recycled plastic dry filter box is a pretreatment structure installed at grade with a curb-cut or curb inlet opening that allows water to enter a high performance modular biofiltration system, bioretention, rain garden, bioswale, or similar stormwater BMP.
- 4.2.2. The box provides a stable inlet, reduces runoff velocities, and captures gross pollutants; therefore, simplifying the recurring sediment removal and surface erosion common with turf, rip rap, or smooth concrete inlet aprons.
- 4.2.3. Capturing sediment within the box helps extend the life of a downstream primary treatment BMP by reducing the sediment load and internal scour/erosion.
- 4.2.4. Recycled plastic dry filter boxes can be installed on both new and existing projects where there are concerns about inlet stability and/or maintenance issues.

## 5. SPECIFICATIONS

5.1. Functional components of the recycled plastic dry filter box must include the components listed below and meet the standards in Table 1.

### 5.1.1. Top grate

5.1.1.1. Top grate mechanically separates larger debris pieces (e.g. leaf litter and garbage) from stormwater runoff, thereby increasing storage

space for sediment and finer debris within the unit. In addition, the top grate of the box must minimally support pedestrian foot traffic loads due to frequent positioning in the road right-of-way.

5.1.2. Impermeable side walls

5.1.2.1. Impermeable side walls which, when connected to a water permeable filter sidewall, create a debris and sediment trap. Chamber therefore allows heavier solids to settle and collect in an easy to clean location. The side walls also contain flow, thereby preventing inlet erosion.

5.1.3. Water permeable filter sidewall

5.1.3.1. The water permeable filter sidewall is independently connected to the impermeable side walls. The permeable filter allows for the box to dry out between runoff events, easing maintenance by preventing the need to remove sediment/debris in a slurry state. It also prevents anoxic conditions and habitat for mosquito reproduction.

5.1.4. Impermeable debris walls

5.1.4.1. Impermeable debris walls capture floatables when BMP is filled to capacity (e.g. leaf litter and seeds) and prevent transfer of floatables between the inlet and BMP.

5.1.5. High volume overflow points

5.1.5.1. The recycled plastic dry filter box must provide for high volume overflow during large storm events such that water within the structure does not overtop the sidewalls, which would reduce the box's ability to retain floatables and maintain a stable inlet. The overflow points also ensure stormwater will not bypass the BMP until it reaches capacity.

5.1.6. Splash pad

5.1.6.1. The box should include a splash pad downstream of the principal (permeable filter wall) and emergency overflow (debris wall) points to reduce scouring below the box (i.e. within the aggregate base and BMP soil).

5.1.7. All components must be easy to clean without specialized equipment.

Table 1: Recycled plastic standards for the dry filter box. All materials will have UV additives to prevent deterioration of the plastic lumber from exposure to UV light and shall be resistant to termites, marine borers, salt spray, oil, and fungus.

| PROPERTY OF RECYCLED PLASTIC LUMBER  | METHOD AND/OR VALUE                  |
|--|--------------------------------------|
| Plastic lumber shall be manufactured with recycled HDPE, post-industrial and post-consumer | 95%+                                 |
| Flexural strength  | ASTM D6109, 1,350 PSI                |
| Flexural modulus secant @ 1% strain  | ASTM D6109, 79,000 PSI               |
| Compression strength (parallel to grain)   | ASTM D6108, 1,030 PSI                |
| Compression modulus (parallel to grain)  | ASTM D6108, 39,400 PSI               |
| Compression strength (perpendicular to grain)  | ASTM D6108, 390 PSI                  |
| Specific gravity   | ASTM D6111, 41.5 lbs/ft <sup>3</sup> |
| Flash point  | 644°F                                |

|  |                               |
|--|-------------------------------|
| Thermal expansion  | ASTM D6341, 0.000058 in/in/°F |
| Average screw pull out   | ASTM D6117, 511 lbs           |
| Average nail pull out  | ASTM D6117, 145 lbs           |
| Static coefficient of friction – dry plain surface               | ASTM C1028, 0.37              |
| Static coefficient of friction – wet plain surface               | ASTM C1028, 0.46              |
| Static coefficient of friction – dry wood grain embossed surface | ASTM C1028, 0.51              |
| Static coefficient of friction – wet wood grain embossed surface | ASTM C1028, 0.55              |
| Weight per foot of recycled plastic lumber                       | 1.5 lbs                       |
| Dry filter box total weight                                      | 54 lbs                        |
| Standard exterior dimensions of dry filter box                   | 51.25”L x 20”W x 16”H         |

## 6. DELIVERY, STORAGE, AND HANDLING

### 6.1. Delivery

6.1.1. Delivery of a recycled plastic dry filter box must be from an authorized supplier.

6.1.2. Reasonable accommodations should be made to protect all materials from damage during delivery. Shipments should be inspected upon arrival to insure no damage occurred during transportation. Any damage found after delivery will be the responsibility of the contractor.

### 6.2. Storage and Handling

6.2.1. Storage prior to installation should occur on smooth surfaces, free from dirt, mud, and debris. Boxes are designed to persist in all seasons so temperature and precipitation should not be a problem.

## 7. INSTALLATION

7.1. A recycled plastic dry filter box should rest on a level, solid base to prevent settling. A well-draining aggregate base material (minimum 6” thickness) should be compacted to 95% percent standard proctor. The aggregate base should have a surface area equal to or larger than the concrete pad on which the recycled plastic dry filter box will be secured.

7.2. The aggregate base location and distance behind the curb depends on site considerations but considerations should include bioretention basin side slopes and inlet slope to promote water flow into the unit.

7.3. The filter box must include a 4” concrete base to provide a firm foundation for the chamber structure and to supply a splash pad for water entering the unit.

7.4. Excavation at the unit installation location should ensure sufficient depth for the 6” aggregate base, recycled plastic dry filter box concrete base, and ponding depth of the bioretention practice. For example, if the ponding depth of the basin is designed to be 1’ and the recycled plastic dry filter box base is 4”, then soil should be excavated to 1’-10” (1’ ponding depth, 6” aggregate base, 4” filter box base).

7.5. Stormwater is most commonly directed into the box via a curb-cut or concrete inlet. Said inlet should be framed from the back of the curb to the unit inlet prior

to pouring. Top elevations of the framing should match the top of the curb on the street side and the top of the filter box on the bioretention side.

7.6. Side curbs of the poured inlet must have an insurmountable profile to prevent water flow from overtopping the downstream side of the inlet.

7.7. The slope of the inlet from the gutter to the filter box must be large enough to promote the inflow of water to the filter box.

## 8. OPERATION

8.1. Items below assume proper installation of the recycled plastic dry filter box based on design guidelines.

8.1.1. Stormwater entering the box via a curb-cut or concrete inlet must pass through the top metal grate. The grate provides for mechanical sorting of larger debris such as leaves and garbage.

8.1.2. Once in the box, the vertical, permeable filter wall allows for settling within the box and filtration of stormwater through the permeable filter screen.

Should the filter screen clog or the unit fill, maintenance will be required.

8.1.3. As the box and BMP fill, the water level rises and the top debris walls of the box restrict floatable debris from entering or exiting the BMP.

8.1.4. Cold climate suitability

8.1.4.1. During winter, recycled plastic dry filter boxes will likely become buried in snow and ice which is no different from any other inlet type.

Runoff will likely continue to enter the box beneath the snow or when an open pathway is formed during snowmelt. When properly designed and installed, recycled plastic dry filter boxes will not shift or separate from the inlet as the ground freezes and thaws.

## 9. MAINTENANCE

9.1. Depending on the characteristics of the contributing watershed and seasonal variation, common maintenance needs include periodic removal of accumulated leaves (and other organic debris) and garbage from the top grate and sediment and fine debris from the recycled plastic dry filter box. Contributing watersheds with high sediment concentrations may require up to monthly or twice monthly visits to satisfy maintenance needs.

9.2. If sediment accumulates beyond an acceptable level in the system, it will be necessary to remove. This can be done by manual removal with a shovel or vacuum device. The filter screen can be cleaned manually through brushing or with pressurized water.

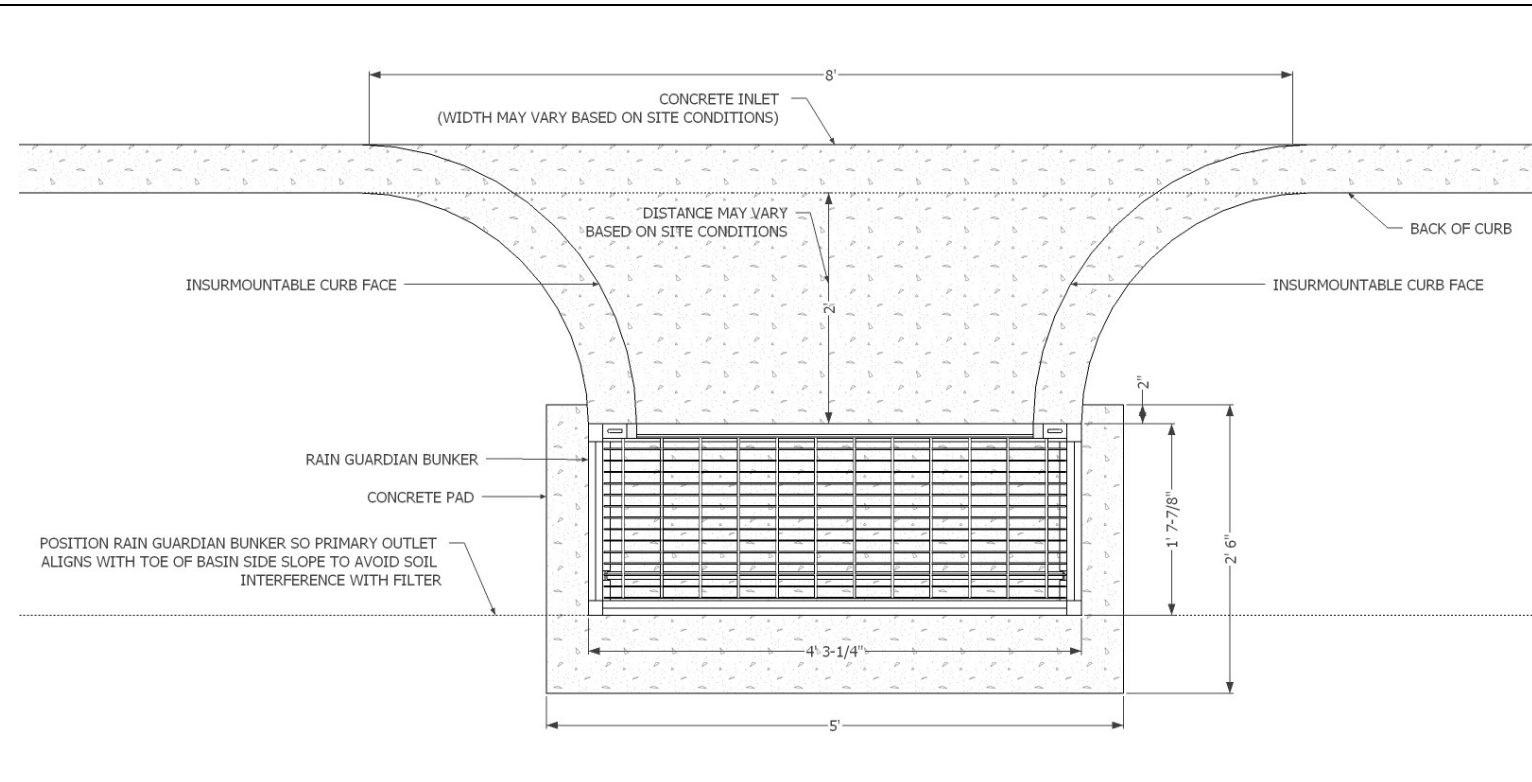
## 10. PAYMENT

10.1. Payment of recycled plastic dry filter boxes shall be based on a per unit price and may or may not include delivery of the box to the project site. The contractor is responsible for determining the style of box needed and total cost (including delivery fees, handling fees, and any associated taxes).

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**RAIN GUARDIAN™ BUNKER**  
**TYPICAL DETAILS**

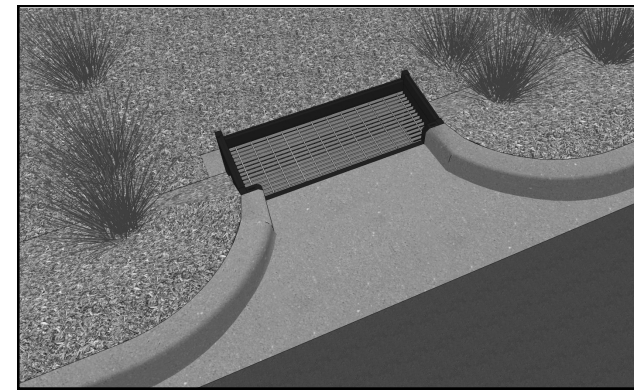
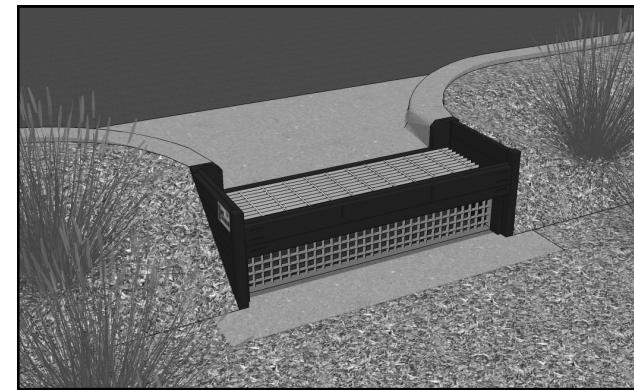
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**PLAN VIEW NOTES**

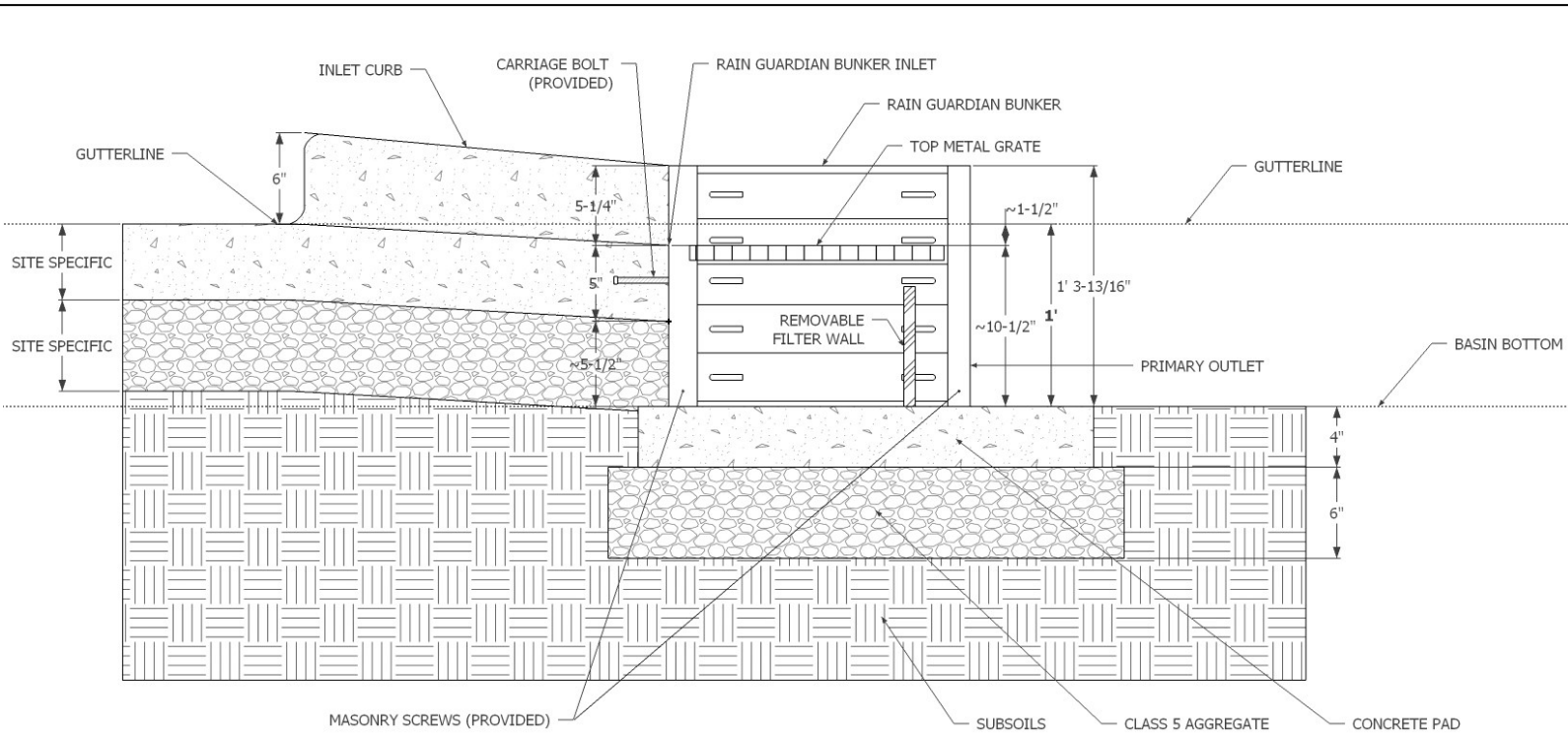
1. INLET WIDTH AND DISTANCE BETWEEN BACK OF CURB AND RAIN GUARDIAN BUNKER MAY VARY WITH SITE CONDITIONS. INSTALLATION FLUSH WITH THE BACK OF THE CURB CAN ALSO BE COMPLETED WITH THE RAIN GUARDIAN BUNKER.
2. CONCRETE PAD EXTENDS BEYOND THE FILTER WALL OF THE RAIN GUARDIAN BUNKER TO SERVE AS A SPLASH DISSIPATOR.

**INSTALLED VIEWS**



**INSTALLATION NOTES**

1. INSTALL THE CONCRETE PAD WITH A 1' 10" OFFSET FROM THE BACK OF THE CURB TO ACCOMMODATE THE CONCRETE INLET. THIS DISTANCE MAY VARY BASED ON SITE CONDITIONS, BUT CONSIDERATIONS SHOULD INCLUDE SLOPE OF THE INLET AND BASIN SIDE SLOPES ADJACENT TO THE RAIN GUARDIAN BUNKER. POSITION RAIN GUARDIAN BUNKER SO PRIMARY OUTLET ALIGNS WITH TOE OF BASIN SIDE SLOPE TO AVOID SOIL INTERFERENCE WITH REMOVABLE FILTER WALL. THE CONCRETE PAD SHOULD BE REINFORCED WITH REBAR.
2. EXCAVATE 1' 10" BELOW THE GUTTERLINE ELEVATION (I.E. THE BIORETENTION OVERFLOW ELEVATION) TO ACCOMMODATE THE 1' PONDING DEPTH, 6" CLASS 5 AGGREGATE, AND 4" CONCRETE PAD TO WHICH THE RAIN GUARDIAN BUNKER WILL BE SECURED. THEREFORE, THE TOP OF THE FINISHED CONCRETE PAD IS PRECISELY 1' BELOW THE GUTTERLINE ELEVATION. THE TOP OF THE RAIN GUARDIAN BUNKER METAL GRATE WILL BE 10-1/2" ABOVE THE TOP OF THE CONCRETE PAD AND 1-1/2" BELOW THE GUTTERLINE ELEVATION TO ACCOMMODATE A SLOPED INLET FROM THE GUTTER TO THE RAIN GUARDIAN BUNKER.
3. THE RAIN GUARDIAN BUNKER SHOULD BE POSITIONED 2" FROM THE EDGE OF THE CONCRETE PAD CLOSEST TO THE BACK OF THE CURB. THEREFORE, THE RAIN GUARDIAN BUNKER WILL BE 2" FROM THE BACK OF THE CURB.
4. USING THE PILOT HOLE IN EACH OF THE FOUR CORNER POSTS, PREDRILL 5/32" HOLES INTO THE CONCRETE PAD WITH A 4-1/2" MASONRY BIT AND HAMMER DRILL.
5. SECURE RAIN GUARDIAN BUNKER TO CONCRETE PAD WITH FOUR 3/16" X 2-3/4" MASONRY SCREWS (PROVIDED).
6. INSTALL FRAMING FOR INLET BETWEEN RAIN GUARDIAN BUNKER AND BACK OF CURB. TOP ELEVATIONS OF THE FRAMING SHOULD MATCH THE TOP OF THE CURB ON THE STREET SIDE AND THE TOP OF THE RAIN GUARDIAN BUNKER ON THE BIORETENTION SIDE.
7. WHEN POURING THE CONCRETE INLET, ENSURE THE CARRIAGE BOLTS ON THE RAIN GUARDIAN BUNKER ARE SURROUNDED BY AT LEAST 2" OF CONCRETE ON ALL SIDES.
8. SIDE CURBS OF THE POURED INLET MUST HAVE AN INSURMOUNTABLE PROFILE TO PREVENT WATER FLOW FROM OVERTOPPING THE DOWNSTREAM SIDE OF THE INLET.
9. WRAP CABLE THROUGH TOP METAL GRATE AND SECURE WITH PROVIDED CLAMP. ENSURE SUFFICIENT SLACK EXISTS IN CABLE TO ALLOW FOR GRATE REMOVAL AND PLACEMENT IN CONCRETE INLET DURING CLEANING. REMOVABLE FILTER WALL SHOULD BE INSTALLED WITH FILTER FABRIC FACING THE RAIN GUARDIAN BUNKER INLET.



**CROSS-SECTION VIEW NOTES**

1. THE TOP OF THE CLASS 5 BASE (COMPACTED TO 95% STANDARD PROCTOR) IS PRECISELY 1' 4" BELOW THE GUTTERLINE ELEVATION.
2. THE TOP OF THE CONCRETE PAD IS PRECISELY 1' BELOW THE GUTTERLINE.



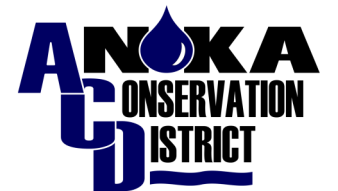
**PRETREATMENT FOR BIORETENTION**

Rain Gardens • Swales • Filtration Basins • Infiltration Basins

[www.RainGuardian.biz](http://www.RainGuardian.biz)

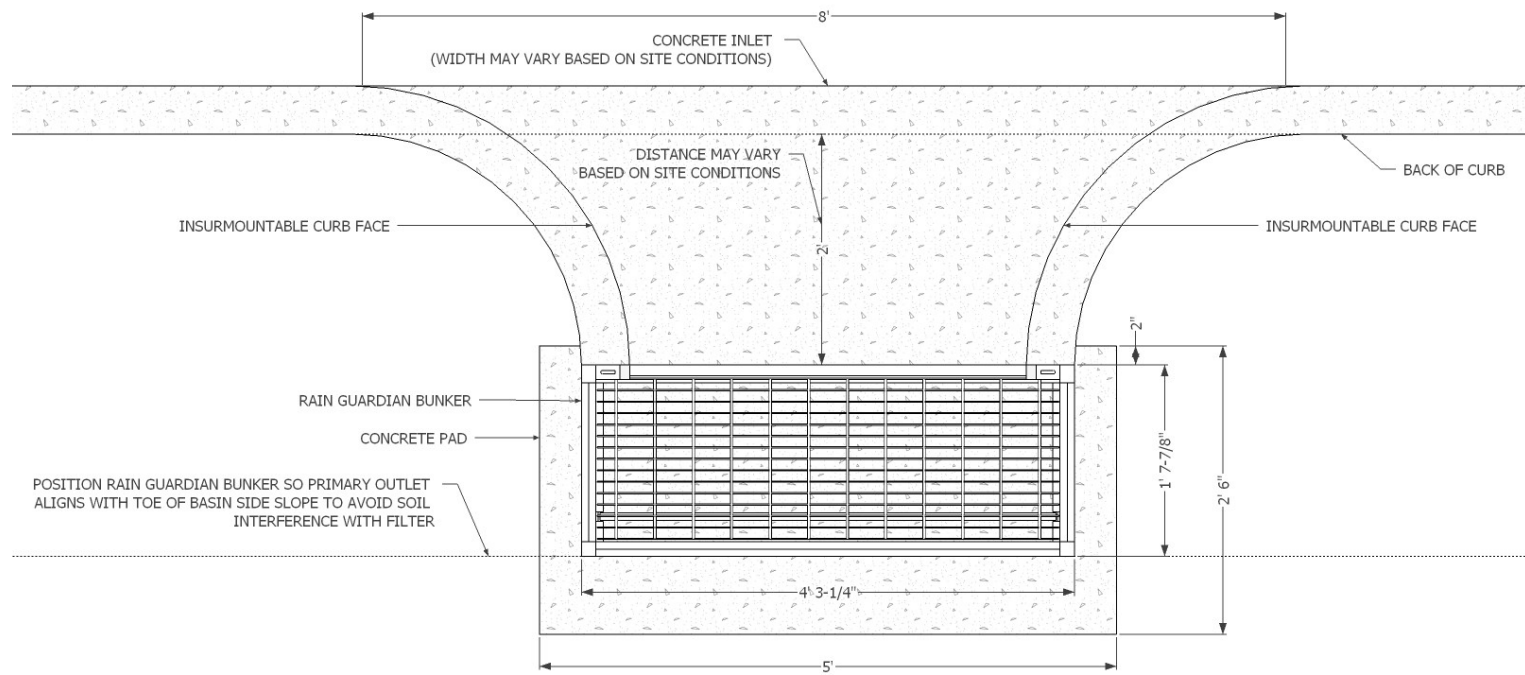
**RAIN GUARDIAN BUNKER  
PRETREATMENT CHAMBER  
BIORETENTION PONDING DEPTH: 1'  
TYPICAL DETAIL**

| REVISION HISTORY |     |           |             |
|------------------|-----|-----------|-------------|
| REV              | BY  | DATE      | DESCRIPTION |
| A                | MDH | 12/1/15   | BUNKER—1'   |
|                  |     |           |             |
|                  |     |           |             |
|                  |     |           |             |
|                  |     |           |             |
| SCALE            |     | VARIABLE  |             |
| U.S. PATENT      |     | 8,501,016 |             |



Anoka Conservation District  
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763-434-2030

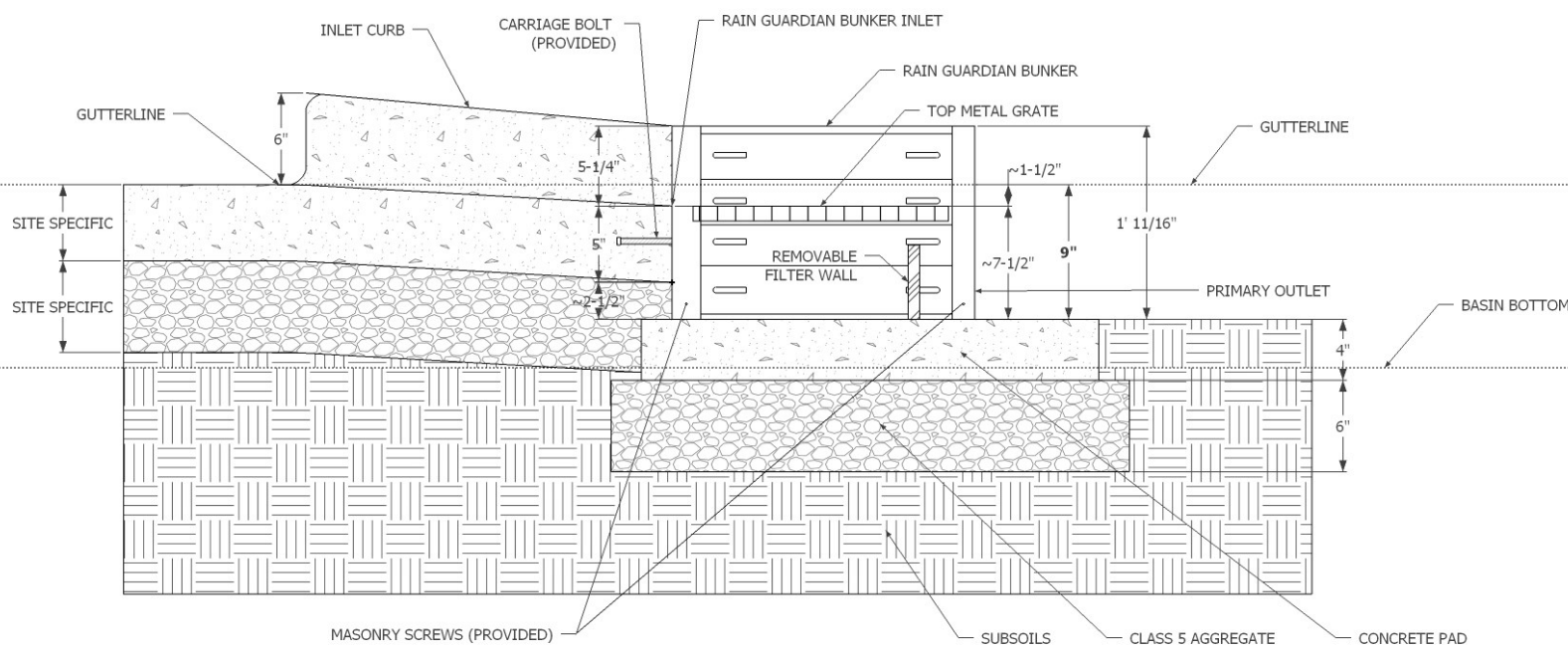
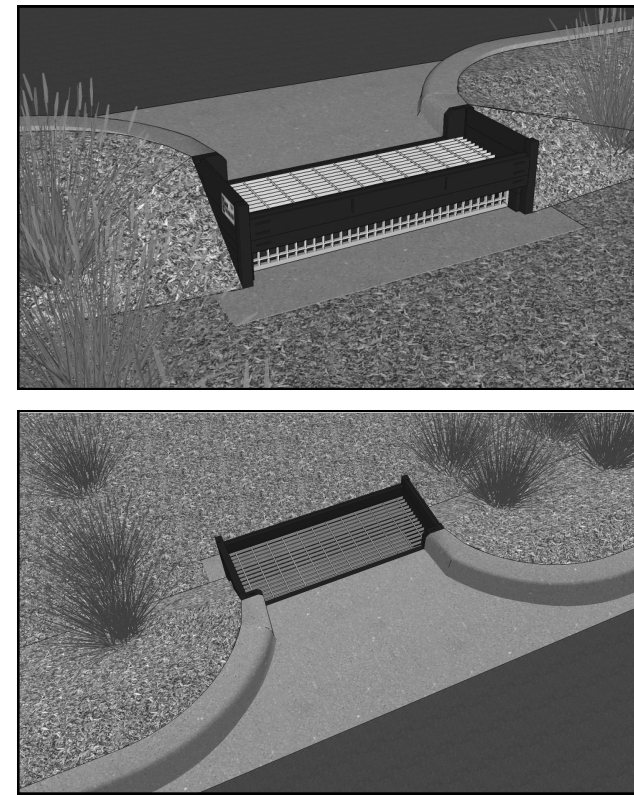




**PLAN VIEW NOTES**

1. INLET WIDTH AND DISTANCE BETWEEN BACK OF CURB AND RAIN GUARDIAN BUNKER MAY VARY WITH SITE CONDITIONS. INSTALLATION FLUSH WITH THE BACK OF THE CURB CAN ALSO BE COMPLETED WITH THE RAIN GUARDIAN BUNKER.
2. CONCRETE PAD EXTENDS BEYOND THE FILTER WALL OF THE RAIN GUARDIAN BUNKER TO SERVE AS A SPLASH DISSIPATOR.

**INSTALLED VIEWS**



**CROSS-SECTION VIEW NOTES**

1. THE TOP OF THE CLASS 5 BASE (COMPACTED TO 95% STANDARD PROCTOR) IS PRECISELY 1" BELOW THE GUTTERLINE ELEVATION.
2. THE TOP OF THE CONCRETE PAD IS PRECISELY 9" BELOW THE GUTTERLINE.

**INSTALLATION NOTES**

1. INSTALL THE CONCRETE PAD WITH A 1' 10" OFFSET FROM THE BACK OF THE CURB TO ACCOMMODATE THE CONCRETE INLET. THIS DISTANCE MAY VARY BASED ON SITE CONDITIONS, BUT CONSIDERATIONS SHOULD INCLUDE SLOPE OF THE INLET AND BASIN SIDE SLOPES ADJACENT TO THE RAIN GUARDIAN BUNKER. POSITION RAIN GUARDIAN BUNKER SO PRIMARY OUTLET ALIGNS WITH TOE OF BASIN SIDE SLOPE TO AVOID SOIL INTERFERENCE WITH REMOVABLE FILTER WALL. THE CONCRETE PAD SHOULD BE REINFORCED WITH REBAR.
2. EXCAVATE 1' 7" BELOW THE GUTTERLINE ELEVATION (I.E. THE BIORETENTION OVERFLOW ELEVATION) TO ACCOMMODATE THE 9" PONDING DEPTH, 6" CLASS 5 AGGREGATE, AND 4" CONCRETE PAD TO WHICH THE RAIN GUARDIAN BUNKER WILL BE SECURED. THEREFORE, THE TOP OF THE FINISHED CONCRETE PAD IS PRECISELY 9" BELOW THE GUTTERLINE ELEVATION. THE TOP OF THE RAIN GUARDIAN BUNKER METAL GRATE WILL BE 7-1/2" ABOVE THE TOP OF THE CONCRETE PAD AND 1-1/2" BELOW THE GUTTERLINE ELEVATION TO ACCOMMODATE A SLOPED INLET FROM THE GUTTER TO THE RAIN GUARDIAN BUNKER.
3. THE RAIN GUARDIAN BUNKER SHOULD BE POSITIONED 2" FROM THE EDGE OF THE CONCRETE PAD CLOSEST TO THE BACK OF THE CURB. THEREFORE, THE RAIN GUARDIAN BUNKER WILL BE 2' FROM THE BACK OF THE CURB.
4. USING THE PILOT HOLE IN EACH OF THE FOUR CORNER POSTS, PREDRILL 5/32" HOLES INTO THE CONCRETE PAD WITH A 4-1/2" MASONRY BIT AND HAMMER DRILL.
5. SECURE RAIN GUARDIAN BUNKER TO CONCRETE PAD WITH FOUR 3/16" X 2-3/4" MASONRY SCREWS (PROVIDED).
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7. WHEN POURING THE CONCRETE INLET, ENSURE THE CARRIAGE BOLTS ON THE RAIN GUARDIAN BUNKER ARE SURROUNDED BY AT LEAST 2" OF CONCRETE ON ALL SIDES.
8. SIDE CURBS OF THE POURED INLET MUST HAVE AN INSURMOUNTABLE PROFILE TO PREVENT WATER FLOW FROM OVERTOPPING THE DOWNSTREAM SIDE OF THE INLET.
9. WRAP CABLE THROUGH TOP METAL GRATE AND SECURE WITH PROVIDED CLAMP. ENSURE SUFFICIENT SLACK EXISTS IN CABLE TO ALLOW FOR GRATE REMOVAL AND PLACEMENT IN CONCRETE INLET DURING CLEANING. REMOVABLE FILTER WALL SHOULD BE INSTALLED WITH FILTER FABRIC FACING THE RAIN GUARDIAN BUNKER INLET.

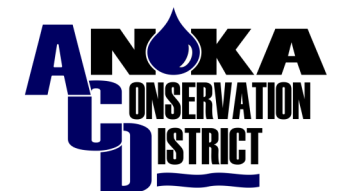
**NOTE: THE 9" RAIN GUARDIAN BUNKER IS A NON-STANDARD PRODUCT AND REQUIRES ADVANCED NOTICE WHEN ORDERING.**

# RAIN GUARDIAN BUNKER PRETREATMENT CHAMBER

## BIORETENTION PONDING DEPTH: 9"

## TYPICAL DETAIL

| REVISION HISTORY |     |           |             |
|------------------|-----|-----------|-------------|
| REV              | BY  | DATE      | DESCRIPTION |
| A                | MDH | 12/1/15   | BUNKER-9"   |
|                  |     |           |             |
|                  |     |           |             |
|                  |     |           |             |
| SCALE            |     | VARIABLE  |             |
| U.S. PATENT      |     | 8,501,016 |             |



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