JAMES V. FITZGERALD
AREA OF SPECIAL BIOLOGICAL SIGNIFICANCE
POLLUTION REDUCTION PROGRAM

BMP OPERATION & MAINTENANCE PLAN

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1 INTRODUCTION

As part of the James V. Fitzgerald ASBS Pollution Reduction Program (Project), the County of San Mateo (County) installed storm drain Best Management Practices (BMPs) throughout the James V. Fitzgerald Area of Special Biological Significance (ASBS) watershed. This involved retrofitting roadside drainages, shoulder areas, and existing catch basins with a variety of BMPs designed to help remove pollutants from runoff prior to discharging to the Fitzgerald ASBS. The BMPs included 16 vegetated swales, 2 bioretention systems, and 3 structural filtration devices (see Appendix A).

The purpose of this Operation and Maintenance Plan (O&M Plan) is to document minimum requirements and standards for inspection and maintenance of BMPs that were installed as part of the Project. The Project was funded in part by a Proposition 84 grant from the State Water Resources Control Board (State Board). The State Board Grant Agreement requires that the Grantee (County) maintain and operate the facility and structures constructed or improved as part of the Project throughout the life of the Project, consistent with the purposes for which this Grant was made. The Grantee assumes all operations and maintenance costs of the facilities and structures. Per the Grant Agreement, the useful life of any constructed portions of the Project begins upon completion of construction and continues until fifty (50) years thereafter for pipelines and structures and twenty (20) years for all else.

Adequate inspection and maintenance of BMPs are required in order to maintain function as originally designed. This O&M Plan serves as documentation and the rationale for operation and maintenance activities, including inspection of BMPs and maintenance to ensure continued BMP function and effectiveness. This document was modeled after O&M templates and checklists that were developed by the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) and EOA, Inc. to assist San Mateo County municipalities with operation and maintenance of various BMPs, stormwater treatment controls, and trash full-capture devices. The SMCWPPP materials were revised to reflect the specific conditions related to the BMPs implemented as part of the Project.

A successful O&M program begins with maintaining an inventory of each installed BMP. The inventory should, at a minimum, include the type of BMP, device manufacturer/type and

specifications, if applicable, installation date, and location. Basic BMP design parameters are also helpful for inspections and for determining if cleaning or maintenance is required. The BMP inventory for the ASBS Project is included below in Section 2.

A successful O&M program requires conducting routine inspections and maintenance to ensure that BMPs are functioning as designed. Staff responsibility for inspection and maintenance should be well defined, and staff should be appropriately trained. Documentation of the inspections and maintenance activities is necessary to demonstrate that the O&M program is active and effective, and also provides support for any needed program revisions.

2 BMP INVENTORY

2.1 BMP Locations

Seacliff Court

The Seacliff Court site is located west of Highway 1 in Montara. A 15-inch diameter corrugated metal pipe (CMP) delivers stormwater down the coastal bluff to the ASBS. The pipe receives stormwater runoff from approximately 200 linear feet of roadway and the neighboring residential properties. Runoff is routed to the inlet via an asphalt concrete (AC) valley gutter. The total drainage area is less than one acre. Runoff typically occurs only during storm events due to the relatively small drainage area. The State Board (State Board) ID for this discharge location is FIT002.

Two BMPs were installed at this site. In March 2012, a Bio Clean Media Flume Filter was installed at the inlet of the CMP located at the end of the County-maintained roadway. Prior to installation, a concrete apron and headwall were installed at the CMP inlet to allow for installation of the flume filter box. Details of the flume filter box are provided in Section 2.2 and in Appendix B.

Throughout the 2012 and 2013 rainy seasons, the flume filter box system required frequent maintenance due to the accumulation of sediment and debris. The sediment accumulation resulted from high velocity stormwater runoff eroding an unimproved drainage that ran along the edge of the pavement on the north side of the roadway, as well as transporting gravel from a

driveway at the top of the street.

In November 2014, a vegetated swale (approximately 120 feet long) was installed along the north side of the roadway to improve stormwater filtration, reduce the runoff velocity, and prevent further erosion along the roadway shoulder. Two small rock weirs were installed to further reduce the runoff velocity and capture sediment. The swale does not have an underdrain system. *Native Mow Free* sod and biofiltration soil (biosoil) were installed for surface and subsurface filtration. Details of the sod are provided in Section 2.2 and in Appendix C. A variety of native plants were also planted throughout the swale. Disturbed areas along the upper slope were seeded with native grass species.

Figure 1. Seacliff Court flume filter box.

Figure 2. Seacliff Court vegetated swale.

7th Street

The 7th Street site is located west of Highway 1 in Montara. An existing 15-inch diameter CMP is located at the end of 7th Street and delivers stormwater down the coastal bluff to the ASBS. The pipe receives stormwater runoff from 7th Street, a section of Highway 1, and County-maintained roadways and properties (primarily residential) east of Highway 1. Runoff is routed to the inlet via two ditches that parallel 7th Street. The northern drainage receives runoff from 7th Street west of Highway 1, residential properties along the north side of 7th Street, and a portion of Highway 1. The drainage area for the northern drainage is less than one acre. The southern drainage receives runoff from residential properties along the south side of 7th Street, a portion of Highway 1, and portions of East Street, Farallone Avenue, Main Street along 7th Street, and small a portion of 6th and 8th Street on the east side of Highway 1. The total drainage area is approximately 13 acres. Runoff in both drainages typically occurs only during storm events. The southern drainage ditch carries the majority of runoff. The State Board ID for this discharge location is FIT003.

In November 2011, a vegetated swale (approximately 85 feet long) was installed along the north

side of the roadway. Two small rock weirs were installed to reduce the runoff velocity and drop out sediment. The swale does not have an under drain system. *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration. In November 2014, the swale was regraded to improve flow and filtration function, and the native grass sod was replaced.

In July 2014, a vegetated swale (approximately 100 feet long) was installed along the south side of the roadway. Because of the larger drainage area and high runoff velocities through this area, a more complex vegetated swale system was constructed. Turf reinforcement mat (detailed in Section 2.2 and Appendix D) was installed beneath the plant and soil layers to provide a stronger anchoring matrix capable of withstanding high sheer stress and flow velocity. Rock transition areas were created at the inflow and outflow of the swale to dissipate energy and drop out sediment. Two rock weirs were also installed to reduce the runoff velocity through the system. The swale does not have an underdrain system. Native *Biofiltration Sod* and biosoil were installed for surface and subsurface filtration. A variety of native plants, including wetland species, were planted throughout the swale. Disturbed areas along the upper slope were seeded with native grass species.

Figure 3. 7th Street vegetated swale along north side of roadway.

Figure 4. 7th Street swale along south side of roadway.

Farallone Avenue @ 3rd Street

The Farallone Avenue at 3rd Street site is located in Montara east of Highway 1 along the east side of Farallone Avenue from 3rd Street to 2nd Street. The roadside drainage ditch drains to an unnamed tributary to Kanoff Creek. Both the unnamed tributary to Kanoff Creek and the drainage ditch along the eastern side of Farallone Avenue appear to be spring-fed. The existing roadway and drainage ditch are steep along this portion of Farallone Avenue. Over a linear distance of approximately 600 feet, there is roughly a 10% drop in the slope. During storm events, velocities within the drainage ditch are high with a considerable amount of erosion potential. The drainage area for the entire Farallone Avenue drainage, including the Project site (along the eastern side of Farallone Avenue) and the ditch along the western side of Farallone Avenue, is approximately 10 acres. This drainage does not flow directly to a County-maintained ASBS discharge.

In late October and early November 2014, a vegetated swale (approximately 215 feet long) was installed along the east side of the roadway. Because of the larger drainage area, steep slope,

and high runoff velocities through this area, a more complex vegetated swale system was constructed. Turf reinforcement mat (detailed in Section 2.2 and Appendix D) was installed beneath the plant and soil layers to provide a stronger anchoring matrix capable of withstanding high sheer stress and flow velocity. Rock transition areas were created at the inflow and outflow to dissipate energy and drop out sediment. Multiple rock weirs were also installed to reduce the runoff velocity through the system and capture sediment. The swale does not have an underdrain system. Native *Biofiltration Sod* and biosoil were installed for surface and subsurface filtration. A variety of native plants, including wetland species, were planted throughout the swale. Disturbed areas along the roadway shoulder and upper banks were seeded with native grass species.

The existing roadside ditch and improved vegetated swale system are considered sensitive habitat. Federally threatened California red-legged frogs (*Rana aurora draytonii*) have been observed within the drainage system. Any maintenance work in this area should be conducted in accordance with regulatory requirements and appropriate avoidance and minimization measures.

Figure 5. Farallone Avenue @ 3rd Street vegetated swale.

Farallone Avenue @4th Street

The Farallone Avenue at 4th Street site is located in Montara east of Highway 1 along the east side of Farallone Avenue from 4th Street to 3rd Street. As described above, the steep roadside drainage ditch along Farallone Avenue spring-fed and drains to an unnamed tributary to Kanoff Creek. This drainage does not flow directly to County-maintained ASBS discharge.

In October and early November 2014, a vegetated swale (approximately 130 feet long) was installed along the east side of the roadway. Because of the larger drainage area, steep slope, and high runoff velocities through this area, a more complex vegetated swale system was constructed. Turf reinforcement mat (detailed in Section 1.1.2 and Appendix D) was installed beneath the plant and soil layers to provide a stronger anchoring matrix capable of withstanding high sheer stress and flow velocity. Rock transition areas were created at the inflows and outflows (including driveway culverts) to dissipate energy and drop out sediment. Multiple rock weirs were also installed to reduce the runoff velocity through the system and capture sediment. *Native Biofiltration* sod and biosoil were installed for surface and subsurface filtration. The swale does not have an underdrain system. A variety of native plants, including wetland species, were planted throughout the swale. Disturbed areas along the roadway shoulder and upper banks were seeded with native grass species.

As described above, California red-legged frogs have been observed within the drainage system and maintenance work in this area should be conducted in accordance with regulatory requirements and appropriate avoidance and minimization measures.

Figure 6. Farallone Avenue @ 4th Street vegetated swale.

4th Street

The 4th Street site is located east of Highway 1 at the intersection with Farallone Avenue in Montara. Stormwater flows in a shallow unimproved drainage swale along the edge of pavement and neighboring lawn into a drop inlet located within the roadside ditch that parallels the north side of Farallone Avenue. The drainage area is approximately 0.5 acres. Runoff typically occurs only during storm events. This drainage does not flow directly to a County-maintained ASBS discharge.

In November 2014, a vegetated swale (approximately 105 feet long) was installed along the north side of the roadway beginning at the driveway at 301 4th Street and extending to the existing drop inlet along Farallone Avenue to improve stormwater filtration and increase capacity. The swale does not have an underdrain system. *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration.

Figure 7. 4th Street vegetated swale.

Main Street

The Main Street site is located east of Highway 1 between 8th Street and 9th Street in Montara. The drainage area is approximately 10 acres. Flow typically occurs only during storm events. This drainage does not flow directly to a County-maintained ASBS discharge.

In October 2013, a vegetated swale (approximately 80 feet long) was installed along the east side of the roadway beginning at the driveway at 1541 Main Street and extending to the AC swale across 9th Street to improve stormwater filtration and increase capacity. The swale does not have an underdrain system. *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration. Disturbed areas along the roadway shoulder and upper slope were seeded with native grass species.

During the first two rainy seasons (2013/2014 and 2014/2015) excessive sedimentation took place within the swale. Sediment sources were likely the result of gopher activity in the immediate area and sediment delivery from the upper portions of the drainage area caused by large storm events in December 2014. Following the heavy sedimentation and maintenance to remove the accumulated sediment, the sod was very sparse and patchy. The site was planted

with native *Juncus* spp. in March 2015. It is anticipated that the *Juncus* spp. will be less susceptible to damage if heavy sedimentation continues in the future.

Figure 8. Main Street vegetated swale.

11th Street

The 11th Street site is located west of Highway 1 in Montara. A 12-inch diameter CMP is located at the end of 11th Street and delivers stormwater down the coastal bluff to the ASBS. The discharge receives stormwater runoff from approximately 200 linear feet of roadway and the neighboring residential properties. Runoff is routed to the inlet via drainage (comprised of gravel, dirt, and mulch) along the roadway edge of pavement. The CMP is located just north of the fence line. The total drainage area is less than one acre. Runoff typically occurs only during storm events due to the relatively small drainage area. The State Board ID for this discharge location is FIT006.

In November 2014, a vegetated swale (approximately 50 feet long) was installed along the edge of the pavement at the end of 11th Street. The swale extends from the driveway at 130 11th Street and midway along the fence line bordering 179 11th Street towards the pipe outfall beyond the fence. The swale does not have an underdrain system. *Native Mow Free* sod and

biosoil were installed for surface and subsurface filtration.

Figure 9. 11th Street vegetated swale.

14th Street North

The 14th Street site is located at the end of 14th Street in Montara west of Highway 1. An existing 12-inch diameter CMP is located on the north side of the roadway and delivers stormwater down the coastal bluff to the ASBS. Runoff is routed to the inlet via the ditch that parallels the north side of 14th Street. The pipe receives stormwater runoff from 14th Street and a portion of Highway 1. Runoff typically occurs only during storm events. The State Board ID for this discharge location is FIT008.

In November 2014, a vegetated swale (approximately 115 feet long) was installed along the north side of the roadway. A rock transition area was created at the culvert outlet at the start of the swale system to dissipate energy and drop out sediment. The swale does not have an underdrain system. *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration. A variety of native plants were planted throughout the swale. Disturbed areas along the roadway upper slope were seeded with native grass species.

Figure 10. 14th Street north vegetated swale

14th Street South

The 14th Street site is located at the end of 14th Street in Montara west of Highway 1. An existing 15-inch high-density polyethylene pipe is located on the south side of the roadway and delivers stormwater down the coastal bluff to the ASBS. Runoff is routed to the inlet via the ditch that parallels the south side of 14th Street. The pipe receives stormwater runoff from 14th Street and a portion of Highway 1. Runoff typically occurs only during storm events. The State Board ID for this discharge location is FIT009.

In March 2012, a Bio Clean Media Flume Filter was installed at the inlet of the discharge pipe located at the end of the County-maintained roadway. Prior to installation, a concrete apron and headwall were installed at the pipe inlet to allow for installation of the flume filter box. Details of the flume filter box are provided in Section 2.2 and in Appendix B.

Figure 11. 14th Street south flume filter box.

Juliana Avenue

The Juliana Avenue site is located west of Highway 1 between Vallemar Street and Wienke Way in Moss Beach. The drainage receives runoff from the upper portion of Juliana Avenue and sections of Vallemar Street and Highway 1 via a roadside drainage leading to a small vegetated gully, which discharges directly to the ASBS. The drainage also receives runoff from the lower half of Juliana, runoff from the neighboring houses, and runoff from a short section of Wienke Way via roadside drainage leading to an existing 12-inch diameter CMP that drains to the same vegetated gully. The drainage area is approximately 2.5 acres. The State Board ID for this discharge location is FIT015.

In December 2011, a vegetated swale (approximately 200 feet long) was installed along the north side of the roadway (upper Juliana). An underdrain system comprised of biosoil, a 4" perforated drain pipe, permeable gravel, and 140N filter fabric was installed in the lower portion of the swale. Multiple rock grade check weirs were installed along the length of the swale to reduce the runoff velocity through the system. Concrete pavers were installed in the areas between the weirs to provide added stability while also allowing for infiltration. The entire swale was seeded

with native grass species. Additionally, native species were planted within the spaces between the pavers and along the side slopes of the swale. The pavers did not perform as well as anticipated in terms of allowing for adequate vegetation growth and sediment capture. In December 2013, the pavers were removed and replaced with Native Mow Free sod.

From October through December 2013, a vegetated swale (approximately 50 feet long) was installed at the end of Juliana Avenue near the intersection with Wienke Way from the existing side walk to the CMP (lower Juliana). *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration. The swale does not have an underdrain system. The sod did not survive through the 2014 summer due to severe drought conditions and was replaced in March 2015.

Figure 12. Juliana Avenue vegetated swale.

Figure 13. Juliana Avenue vegetated swale.

Wienke Way

The Wienke Way site is located west of Highway 1 in Moss Beach. The roadside drainage parallels the eastern side of Wienke Way and receives runoff from a large portion of Moss Beach, including runoff from Highway 1. At the end of the roadside drainage, runoff flows into an underground storm drain. An existing 24-inch diameter storm drain continues down Wienke Way approximately 200 feet, through a drainage easement located near 255 Wienke Way and into a 30-inch diameter pipe that discharges directly to the ASBS. The drainage area is approximately 30 acres. Significant flow typically occurs only during storm events. However, a trickle of water often continues into the dry season and is likely the result of local springs. The County ID for this drainage location is FITNEW1.

From October through December 2013, a vegetated swale (approximately 100 feet long) was installed from the driveway culvert at 178 Wienke Way to the driveway culvert at 198 Wienke Way. An underdrain system comprised of biosoil, a 4-inch perforated drain pipe, permeable gravel, and a water barrier to prevent lateral migration were installed in the lower portion of the

swale. Native *Biofiltration Sod* and biosoil were installed for surface and subsurface filtration. Additionally, a variety of native plants, primarily wetland species, were planted throughout the swale.

Figure 14. Wienke Way vegetated swale.

Carlos Street

The project site is located immediately east of Highway 1 along the eastern side of Carlos Street in Moss Beach. The project site extends from Etheldore Street south to California Avenue. Stormwater in this area drains via the roadway curb and gutter to two existing catch basins, one at the corner of Carlos Street and Etheldore Street and one at the corner of Carlos Street and California Avenue. Drainage from the California Avenue catch basin is piped to the upstream end of a roadside ditch (within the CalTrans right-of-way) that parallels Highway 1. Drainage from the Etheldore Street catch basin is piped to the downstream end of the CalTrans ditch. Flow from the CalTrans ditch is then piped beneath Highway 1 to the ditch and storm drain system that runs along Wienke Way on the west side of Highway 1. The Wienke Way drainage discharges, via a storm drain pipe, directly to the ASBS (FITNEW1).

Between September and November 2014, a bioretention system was constructed immediately

adjacent to the existing sidewalk along the east side of Carlos Street. The bioretention swales were constructed in two segments (approximately 270 linear feet total). The northern segment is six feet wide (including the side slopes) with 3:1 side slopes and extends from Etheldore Street to the Post Office driveway. The southern segment is two to three feet wide with vertical side slopes and extends from 2355 Carlos Street to California Avenue. The total impervious drainage area for the LID system is approximately 36,500 square feet.

Prior to completion of design plans, a detailed geotechnical study was conducted. Infiltration testing determined that the average infiltration rate of the soils was in the range of 0.0147 to 0.0412 inches per hour. These findings confirmed general soil information from the Natural Resources Conservation Service's Web Soil Survey, which identified the existing soils as within the hydrologic soil group (HSG) D, which is classified as having very slow infiltration rates when thoroughly wet. Based on the low infiltration rates and the geotechnical study recommendations, the bioretention systems were constructed with an underdrain system comprised of a 4-inch perforated PVC drain pipe situated near the top of a 12-inch layer of permeable gravel. The underdrain system drains to the north and ties into the existing manhole at the intersection of Carlos Street and Etheldore Street. Multiple cleanouts were installed along the length of the bioretention system. Cut-off walls extending 30 inches below grade were constructed to protect the existing pavement and sidewalks that surround the bioretention areas and direct water downward to the under drain pipe.

The bioretention swales are flow-through systems designed to infiltrate only low flows or "first flush" rain events. For larger rain events with rainfall depths greater than the ponding depth, flow exits the bioretention systems into the constructed gutters and enters into the existing catch basins.

The planting scheme for the bioretention swales incorporated locally sourced native plants. A 12- to 18-inch layer of imported biosoil was used to promote filtration. Design details for the bioretention system are provided in Section 2.2 and in Appendix E.

Figure 15. Northern segment of Carlos Street bioretention system.

Figure 16. Southern segment of Carlos Street bioretention system.

Beach Street

The Beach Street site is located at the end of Beach Street near the Fitzgerald Marine Reserve in Moss Beach. Runoff from Beach Street flows along both sides of the roadway and merges at the end of the street where it outfalls to a 15-inch diameter plastic pipe. The pipe delivers storm runoff down the coastal bluff to the ASBS and Fitzgerald Marine Reserve. Runoff typically occurs only during storm events. The drainage area is less than 0.5 acres. The State Board ID for this discharge location is FIT024.

In November 2014, two vegetated swales (approximately 70 linear feet total) were installed along the north side of the roadway. The swales do not have an underdrain system. *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration.

Figure 17. Beach Street vegetated swales.

Fitzgerald Marine Reserve Parking Lot

The Fitzgerald Marine Reserve Parking Lot is located in Moss Beach at the intersection of North Lake Street and Nevada Avenue. In October and November, 2014 the existing parking lot was retrofitted to incorporate stormwater treatment. A 12-inch trench drain was installed along the southern end of the parking lot to collect and route stormwater runoff to a new 400 square foot

bioretention area. The drainage area for the bioretention system is 9,376 square feet. The bioretention area consists of an 18-inch layer of biosoil and an underdrain system consisting of a 6-inch diameter perforated PVC pipe, cleanout, and 12-inch layer of permeable gravel wrapped in140N filter fabric. The planting scheme for the bioretention swales incorporated locally sourced native plants. The underdrain connects to a 12-inch diameter storm drain pipe which outfalls to the existing drainage ditch at the corner of North Lake Street and Nevada Avenue which leads to San Vicente Creek (FIT025). Details for the bioretention system are provided in Section 2.2 and in Appendix F.

Figure 18. Fitzgerald Marine Reserve Parking Lot bioretention system.

North Lake Street

The North Lake Street site is located in Moss Beach west of Highway 1 along the south side of the roadway near the intersection with Virginia Avenue. The existing catch basin was retrofitted with a storwater filtration device. The catch basin captures runoff from a portion of Vermont Street and North Lake Street and outfalls to San Vicente Creek (FIT025), which drains to the ASBS. The catch basin receives stormwater runoff from approximately 700 linear feet of roadway and the neighboring residential properties. The total drainage area is approximately 1.4

acres. Runoff typically only occurs during storm events.

In January 2013, a Contech Stormwater Management StormFilter catch basin device was installed. The retrofit involved removing the existing catch basin and installing a prefabricated steel catch basin 4-cartridge 18-inchStormFilter system with Zeolite-Perlite-Granular Activated Carbon (ZPG) filtration media. Design details for the bioretention system are provided in Section 2.2 and in Appendix G.

Figure 19. North Lake Street StormFilter system.

Cypress Avenue

The Cypress Avenue site is located in Moss Beach west of Highway 1 near the intersection with Beach Way. Roadside drainage flows from the east and west along the southern side of Cypress Avenue to a catch basin located near the intersection with Beach Way. A culvert exits the catch basin to the north and runs beneath Cypress Avenue to a junction box. A second culvert exits the junction box to the west and discharges directly to the ASBS (FIT027). The drainage receives runoff from portions of Cypress Avenue, Alton Avenue, Beach Way, and the neighboring residential properties. The drainage area is approximately three acres. Runoff typically only occurs during storm events.

In December 2011, a vegetated swale (approximately 100 feet long) was installed within the northern roadside drainage. An underdrain system comprised of biosoil, a 4-inch perforated drain pipe, permeable gravel, and 140N filter fabric was installed in the lower portion of the swale. Concrete pavers were installed to provide added stability while also allowing for infiltration. The entire swale was seeded with native grass species. Additionally, native species were planted within the spaces between the pavers and along the side slopes of the swale. The pavers did not perform as well as anticipated in terms of allowing for adequate vegetated growth and sediment capture. In November 2014, the pavers were removed and replaced with *Native Mow Free* sod. A variety of native plants were also planted throughout the swale. w

In November 2014, a short vegetated swale (approximately 40 linear feet total) was installed within the southern drainage from the corner of Beach Way to the existing catch basin. The swale does not have an underdrain system. Native *Biofiltration Sod* and biosoil were installed for surface and subsurface filtration.

Figure 20. Cypress Avenue vegetated swale (east segment).

Figure 21. Cypress Avenue vegetated swale (west segment).

Ocean Boulevard

The Ocean Boulevard site is located in Moss Beach west of Highway 1 at the southern end of Ocean Boulevard near the intersection with Bernal Avenue. Roadside drainage at this sites flows to an AC-lined ditch at the end of Ocean Boulevard. The AC-lined ditch extends approximately 50 feet to an existing 15-inch CMP that delivers stormwater down the coastal bluff to the ASBS. The site receives runoff from portions of Ocean Boulevard, Bernal Avenue, and the neighboring residential properties. The drainage area is approximately five acres. Runoff typically occurs only during storm events. The State Board ID for this discharge location is FIT029.

In 2011, the existing drainage over the gravel and dirt roadway shoulder was converted into a vegetated swale (approximately 170 linear feet). *Native Mow Free* sod and biosoil were installed for surface and subsurface filtration. The swale does not have an underdrain system. Following installation in 2011, the swale was damaged due to parking and heavy foot traffic. In November 2014, the swale was regraded to improve flow and filtration function, and native grass sod was replaced. Parking barriers were installed to prevent future damage due to parking and foot

traffic.

A variety of native plants were also planted throughout the swale and upslope area.

Figure 22. Ocean Boulevard vegetated swale.

Figure 23. Ocean Boulevard vegetated swale.

Table 1- BMP Locations and Details

Site	Location Description	BMP Type(s)	Installation Date	Filter Media	Subdrain
Seacliff Court	At end of roadway	Bio Clean Media Flume Filter	Mar 2012	BioMediaGREEN booms	No
	Along northern side of roadway	Vegetated swale with weirs	Nov 2014	*Native Mow Free* sod, native plants, and biosoil	No
7th Street	West of Highway 1 along northern side of roadway	Vegetated swale with weirs	Nov 2011, Nov 2014	*Native Mow Free* sod and biosoil	No
	West of Highway 1 along southern side of roadway	Vegetated swale with TRM and weirs	July 2014	Native *Biofiltration Sod*, native plants, and biosoil	No
Farallone Avenue at 3rd Street	Along eastern side of roadway	Vegetated swale with weirs	Oct/Nov 2014	Native *Biofiltration Sod* and biosoil	No
Farallone Avenue at 4th Street	Along eastern side of roadway	Vegetated swales with weirs	Oct/Nov 2014	Native *Biofiltration Sod* and biosoil	No
4th Street	At corner of Farallone Avenue along the northern side of roadway	Vegetated swale	Nov 2014	*Native Mow Free* sod and biosoil	No
Main Street	Between 8th and 9th Street along the eastern side of the roadway	Vegetated swale	Oct 2013	*Native Mow Free* sod, native plants, and biosoil	No
11th Street	West Highway 1 at end of roadway	Vegetated swale	Nov 2014	*Native Mow Free* sod and biosoil	No
14th Street North	West of Highway 1 along north side of roadway	Vegetated swale	Nov 2014	*Native Mow Free* sod, native plants, and biosoil	No
14th Street South	West of Highway 1 near the end of south side of roadway	Bio Clean Media Flume Filter	Mar 2012	BioMediaGREEN booms	No

Juliana Avenue	Northern side of roadway between Vallemar Street and Wienke Way	Vegetated swale with weirs	Dec 2011	*Native Mow Free* sod, native plants, biosoil, and drain rock	Yes
	End of Juliana Avenue near the intersection with Wienke Way	Vegetated swale	Oct thr. Dec 2013	*Native Mow Free* sod and biosoil	No
Wienke Way	Northeastern side of roadway	Vegetated swale	Oct thr. Dec 2013	Native *Biofiltration Sod*, biosoil, and drain rock in lower half	Yes (lower half)
Carlos Street	East side of roadway between Etheldore Street and California Avenue	Two biofiltration areas	Sep thr. Nov 2014	Native plants, biofiltration soil, drain rock	Yes
Beach Street	Along northern and southern sides of roadway to the end of Beach Street	Two vegetated swales	Nov 2014	*Native Mow Free* sod and biosoil	No
Fitzgerald Marine Reserve Parking Lot	Southeast corner of parking lot	Parking lot trench drain and biofiltration area	Oct/Nov 2014	Native plants, biosoil, drain rock	Yes
North Lake Street	South side of roadway near intersection with Virginia Avenue	Contech StormFilter Catch Basin System	Jan 2013	Four ZPG StormFilter cartridges	No
Cypress Avenue	Southeastern side of roadway near intersection with Beach Way	Vegetated swale	Dec 2011	*Native Mow Free* sod, native plants, biosoil, and drain rock	Yes
	Southwestern side of roadway at intersection with Beach Way	Vegetated swale	Nov 2014	Native *Biofiltration Sod* and biosoil	No
Ocean Boulevard	Western side of roadway at the end of Ocean Boulevard	Vegetated swale	Nov 2011, Nov 2014	*Native Mow Free* sod, native plants, and biosoil	No

2.2 BMP Information and Device Specifications

Flume Filter

Bio Clean Media Flume Filters were installed at two locations, Seacliff Court and 14th Street South, in Montara. The concrete aprons were constructed by the Road Maintenance Division concrete crew in November 2011. The flume filters were installed in March 2012. Details of the 24-inch media type flume filters are provided in Appendix B. The treatment flow rate is 0.52 cubic feet per second. The units are equipped with overflow plates on each side of the filter box. Filtration media is stored inside of the unit and placed via the access door located on the top of the unit. Filter media consists of three 3-inch diameter BioMediaGREEN booms. The product MSDS is included in Appendix B.

StormFilter

A Contech StormFilter stormwater treatment system was installed at the North Lake Street site in Moss Beach in January 2013. The system consists of a steel catch basin with four 18-inch StormFilter cartridges with Zeolite-Perlite-Granular Activated Carbon (ZPG) media. System details are provided in Appendix G.

Vegetated Swales

Vegetated swales were installed at 16 sites throughout Montara and Moss Beach. Design varies depending on site characteristics i.e., slope, length, typical velocities, and available right-of-way. Design components included native grass sod, native plants, under drains, weirs, and turf reinforcement mats. The design components are discussed in more detail below.

Native Grass Sod

California native grass sod was installed within all of the vegetated swales. The sod was supplied by the Delta Bluegrass Company, Stockton, CA. One of two blends of sod, *Native Mow Free* or *Biofiltration Sod*, was selected based on the typical duration of swale inundation. Specification sheets are provided in Appendix C.

Sod was selected for the vegetated swales due to its filtration potential, low maintenance and water needs, and ability to provide quick coverage in order to help prevent the vegetated swales

from being overrun non-native species. For many of the swales, native plantings were dispersed throughout the sod installation area. In the long-term this provided a variety of species of varying size, durability, and water requirements. In areas with more perennial water, like Farallone Avenue and Wienke Way, the primary reason for sod installation was for initial coverage and erosion prevention, until the wetland indicator species that are more tolerant of frequent inundation, such as *Juncus* and *Carex species*, could become well established.

Native Plants

A list of native plants installed at the BMP locations is provided in Table 2. Useful websites for plant photos and additional information include:

- http://plants.montara.com/
- http://calphotos.berkeley.edu/
- http://www.calflora.org/species/index.html
- http://plants.usda.gov/java/
- http://ucjeps.berkeley.edu/interchange/

Table 2- Plant Species Installed in ASBS Vegetated Swales

Common Name	***Scientific Name***	**Wetland Status***
Red fescue	*Festuca rubra*	FAC
Purple needlegrass	*Nassella pulchra*	-
Meadow barley	*Hordeum brachyantherum*	FACW
Creeping wild rye	*Elymus triticoides= Leymus triticoides*	FAC
California brome	*Bromus carinatus*	-
Blue wildrye	*Elymus glaucus*	FACU
Gumplant	*Grindelia stricta*	FACW
Seapink	*Armeria maritima*	FACU
Pacific aster	*Symphyotrichum chilense = Aster chilensis*	FAC
Common yarrow	*Achillea millefolium*	FACU
Mugwort	*Artemisia douglasiana*	FACW
Coyote brush	*Baccharis pilularis*	-
Thimbleberry	*Rubus parvifloris*	FAC

California coffeeberry	*Rhamnus californica*	-
Red elderberry	*Sambucus racemosa*	FACU
Western sword fern	*Polystichum munitum*	FACU
Harford's sedge	*Carex harfordii*	OBL
Field sedge	*Carex praegracilis*	FACW
Beach strawberry	*Fragaria chiloensis*	FACU
Douglas iris	*Iris douglasiana*	-
Baltic rush	*Juncus balticus*	FACW
Soft or bog rush	*Juncus effuses*	FACW
Spreading rush	*Juncus patens*	FACW
Notes: OBL – Obligative Wetland – Almost always is a hydrophyte, rarely in uplands FACW – Facultative Wetland – Usually is a hydrophyte but occasionally found in uplands FAC – Facultative – Commonly occurs as either a hydrophyte or non-hydrophyte FACU – Facultative Upland – Occasionally is a hydrophyte but usually occurs in uplands *Wetland status based on NRCS, 2012.		

Underdrains

Underdrain systems were installed at the following sites: Juliana Avenue (upper swale), Wienke Way, and Cypress Way (eastern swale).

The vegetated swale systems installed by Go Native generally consisted of a 4-inch diameter perforated PVC pipe, embedded in a layer of 1.5-inch diameter drain rock wrapped in 140N filter fabric. The depth of the drain rock layer varied by site depending on the existing grade and outfall invert. For the Juliana Avenue and Cypress Way sites, the underdrain systems were installed in the lower third of the swale. The Cypress Way underdrain outfalls to the existing catch basin. The Juliana Avenue swale outfalls within the rock transition area leading to the gully below. For the Wienke Way site, the underdrain system was installed in the lower half of the swale and includes two parallel drain pipes. The pipe outlet was encased in a concrete endwall.

Weirs

Small rock weirs were installed (placed by hand) at the Seacliff Court and 7th Street (north) sites to reduce the runoff velocity and help capture sediment. A more extensive series of rock weirs were installed at the Farallone Avenue, Juliana Avenue, and 7th Street (south) sites, which experience

higher stormwater velocities due to larger drainage areas and slope. Rock transition areas were created at the inflow and outflow structures to dissipate energy and drop out sediment. Evenly spaced rock weirs were installed to reduce the runoff velocity through the system.

Turf Reinforcement Mat

Pyramat high performance turf reinforcement mats (TRM) were installed at the Farallone Avenue and 7th Street (south) sites. Product details and specifications are included in Appendix D. TRM was installed according to the guidelines included in Appendix D.

Bioretention Areas

Bioretention areas are landscaped, unlined channels that function as soil and plant-based filtration devices. These devices remove pollutants through retention and infiltration through the soil and underlying rock layer, and uptake through vegetation. Bioretention areas consist of the following layers, starting from the top: a surface ponding area, specialized or select plant species, a layer of mulch or rock, an engineered soil mix, and an underlying permeable drain rock layer with an underdrain that connects to the municipal storm drain system. Bioretention areas can receive both sheet flow from paved surfaces and concentrated flows from drainage facilities; where concentrated flows enter a bioretention area, energy dissipation devices such as rock should be placed to reduce the velocity of the runoff and prevent erosion. Two bioretention facilities were installed as part of this Project: the Fitzgerald Marine Reserve Parking and the Green Street Improvement Project at Carlos Street. Based on infiltration testing of existing soils, underdrain systems were recommended for both facilities. The design details are included in Appendices E and F.

3 PERSONNEL QUALIFICATIONS AND RESPONSIBILITY

3.1 O&M Responsibility

An important element of a successful O&M program is designation of staff responsible for each O&M program component. The County of San Mateo has designated the following staff positions to be responsible for the following O&M components:

Inspections

- DPW Facilities – *Road Maintenance District Supervisor* or *Resource Conservation Specialist*
- Parks Facilities – *District Park Ranger*

Maintenance

- DPW Facilities – *Road Maintenance Crew* or Contractor
- Parks Facilities – *District Park personnel*

Data Management & Program Documentation

- DPW Data - *Road Maintenance District Supervisor* or *Resource Conservation Specialist*
- Parks Data – *District Park Ranger* or *Parks Planner*

3.2 Qualifications and Staff Training

In order for O&M to be successful, staff must be appropriately trained. As part of the County Municipal Regional NPDES Permit stormwater compliance and inspection program, County staff routinely attend training related to LID and inspection. Inspection and maintenance staff should review all relevant background information prior to conducting O&M activities including, but not limited to, product information, specification sheets, design plans, and this document. Inspection staff should also have knowledge of native plants and LID principles.

In addition to training staff on proper inspection and maintenance procedures to maintain an effective O&M program, staff should also be trained on safety procedures to carry out the inspection and maintenance procedures at the BMP locations. The County offers a variety of safety training courses and materials and ensures that all staff are trained in safety procedures prior to performing any task relating to the inspection, cleaning, solids drying and disposal process.

At a minimum, the inspection and maintenance staff should be trained in the following areas:

- Proper operation of all equipment used during the inspection and maintenance process;
- Safety measures relating to the use of traffic control operations (flagging, signage, etc), devices (e.g., cones, barricades, signage, etc.), and highly visible safety apparel.

Guidance provided in the Manual on Uniform Traffic Control Devices dated December 2009 is the standard; and

- Material safety and proper disposal

Maintenance of all ASBS BMPs should be performed in accordance with the procedures described in this document and the relevant manufacturer specification and recommendations. All maintenance shall be performed in accordance with the County of San Mateo Watershed Protection Program Maintenance Standards (2004) and all other environmental regulations.

Useful resources related to BMPs and LID are provided below.

- SMCWPPP green streets and parking lots including design guidebook: http://www.flowstobay.org/greenstreets
- C.3 Stormwater Technical Guidance document which includes definitions and a chapter on operation and maintenance: http://www.flowstobay.org/sites/default/files/SMCWPPP%20C.3%20Technical%20Guidance%20Handbook_Oct_2014.pdf#overlay-context=newdevelopment
- Other related SMCWPPP New Development resources: http://www.flowstobay.org/newdevelopment
- CASQA BMP Handbook and LID Portal (contact SMCWPPP program manager for password): https://www.casqa.org/
- CalTrans LID resources: http://www.dot.ca.gov/hq/LandArch/ec/lid/index.htm
- EPA Low Impact Development resources: http://water.epa.gov/polwaste/green/index.cfm
- James V. Fitzgerald ASBS Pollution Reduction Program website: http://smchealth.org/asbs
- Bay-Friendly Landscaping & Gardening Coalition Bay Friendly Qualified Professionals training for staff involved in routine maintenance: http://www.bayfriendlycoalition.org/Landscapeprofessional.shtml

4 INSPECTIONS AND MAINTENANCE PROCEDURES

The principal maintenance objective for the BMPs is to maintain pollutant removal efficiency, as designed, by providing routine system inspection and maintenance. Inspection and maintenance frequency of BMPs varies based on BMP-type and site characteristics. Recommendations for inspection and maintenance by BMP-type are provided below. Inspection and Maintenance Checklists and CASQA BMP fact sheets for the various BMP types are included in Appendices H and I.

4.1 Flume Filter

The maintenance frequency for the Bio Clean Media Flume Filter devices varies depending on site characteristics and the magnitude and frequency of storm events during the rainy season. Routine visual inspections are recommended prior to the start of the rainy season and at the end of the rainy season. Periodic inspections are also recommended following significant storm events (i.e., rainfall totals greater than 0.5 inches). During inspections, the access hatch on the top of the unit should be opened to allow for visual inspection of the BioMediaGreen booms. The BioMediaGreen booms should be inspected for discoloration, odor, sedimentation, and clogging, and replaced on an as-needed basis. Replacement filters can be ordered through the Department of Public Works BMP supplier. Accumulated sediment and debris in front of the grate and overflow plates shall be removed at the time of maintenance. Based on maintenance experience throughout the first four years of operation, filters should be replaced approximately three to four times per year. General information on drain inserts is included in CASQA BMP fact sheet in Appendix H.

4.2 StormFilter

The StormFilter unit should be fully inspected once per year at the end of the rainy season/start of the dry season to determine if full service maintenance is needed (i.e., sediment removal and cartridge replacement). During this inspection, the grate should be removed to allow thorough inspection of the unit including sediment and static water depths, removal of cartridge cover and inspection of media, and observations of scum line and hydrocarbon accumulation. If maintenance is warranted, full service maintenance should be scheduled prior to the start of the

rainy season. Full service maintenance should include vacuuming of sediment and trash, power washing of internal components, and replacement of filter cartridges. Periodic visual inspections throughout the rainy season are also recommended to ensure there are no blockages or significant accumulations of sediment, leaf litter, or debris. Contech maintenance recommendations are included in Appendix G. Inspection and maintenance during the first two years of operation was conducted by Pacific Stormwater BMP Solutions. Example inspection and maintenance reports are included in Appendix G.

4.3 Vegetated Swales

The maintenance frequency for the vegetated swales varies depending on site characteristics and the magnitude and frequency of storm events during the rainy season. Routine visual inspections are recommended prior to the start of the rainy season and at the end of the rainy season. Periodic inspections are also recommended following significant storm events, i.e., rainfall totals greater than 0.5 inches. Maintenance should be conducted on an as-needed basis. Primary maintenance needs include watering, weeding, trash removal, sediment removal, and plant upkeep. An Inspection and Maintenance Checklist is included in Appendix I and shall be used to conduct routine and periodic inspections, and identify needed maintenance. The CASQA BMP fact sheet for vegetated swales is included in Appendix H and contains additional information on maintenance activities. Additional maintenance information is summarized below.

Temporary or supplemental watering during the establishment period is required to ensure a strong root system. Supplemental watering may also be required during longer drought periods. Wind can further increase the rate of evaporation of moisture from the sod. When supplemental watering is necessary, early morning hours are ideal to reduce water loss due to evaporation.

Swale grasses were intended to be low maintenance, therefore mowing is optional. If mowing is desired, a string trimmer or weed eater is recommended to cut the grass to the preferred height. Never remove more than 1/3 of the leaf blade with any single mow cycle. A dormant golden color is expected during the summer months; however the base should remain green.

Sod and plants may need to be replaced if subjected to damage from vehicles or intense foot traffic or severe condition such as prolonged drought or high flows. Sod installation

recommendations are included in Appendix C. Sod is perishable and should be installed immediately upon delivery. The day of installation, enough water should be applied to penetrate the sod and two inches of native soil. The roots are short so the sod cannot withstand large amounts of water at a single time. Root establishment will usually begin within seven to fourteen days depending on the time of year your sod is installed.

Fertilizer was not used during installation for the ASBS grant. During installation as part of the ASBS grant, biosoil (typically 6-inch depth) was added beneath the sod to promote subsurface filtration. Biosoil may need to be supplemented. The biosoil that was used during the installation was comprised of 95.6% sand and 4.4% clay. The soil specifications recommended by BASMAA for biotreatment and biofiltration purposes and included in the Municipal Regional Permit for sites designed to meet requirement in Provision C.3 are available at: http://www.flowstobay.org/newdevelopment. These specifications should also be used a guideline. For sites with observed gopher activity, wire mesh may be installed prior to sod installation to deter future gopher activity.

4.4 Bioretention Areas

The maintenance frequency for the two biorention systems (Carlos Street and Fitzgerald Marine Reserve Parking Lot) will vary depending on the site characteristics and the magnitude and frequency of storm events during the rainy season. Routine visual inspections are recommended prior to the start of the rainy season and at the end of the rainy season. Periodic inspections are also recommended following significant storm events, i.e., rainfall totals greater than 0.5 inches. Maintenance should be conducted on an as-needed basis. Primary maintenance needs include watering, weeding, trash removal, sediment removal, flushing of the under drain system, mulch replacement, and plant upkeep. An Inspection and Maintenance Checklist is included in Appendix I and shall be used to conduct routine and periodic inspections, and identify needed maintenance. The CASQA BMP fact sheet for bioretention areas is included in Appendix H and contains additional information on maintenance activities.

If additional plants are needed to maintain coverage, locally sourced native plants should be used. Temporary or supplemental watering during the establishment period is required to ensure a strong root system. Supplemental watering may also be required during longer drought periods.

When supplemental watering is necessary, early morning hours are ideal to reduce water loss due to evaporation.

4.5 O&M Documentation and Tracking

Documentation of the inspections and maintenance activities is necessary to demonstrate that the O&M program is active and effective, and to provide support for any needed program revisions. County staff shall maintain adequate records for maintenance activities and inspections. Field inspection forms (Appendix I) or equivalent inspection notes shall be completed for all routine inspections. Electronic copies of the inspection reports shall be kept on file for a minimum of 5 years. Inspection reports and maintenance records shall be reviewed regularly to determine future maintenance needs.

4.6 Pest Control

The use of pesticides at the BMP sites is prohibited.

With the exception of sites with perennial flow (Farallone Avenue and Wienke Way) and the North Lake Street StormFilter system, standing water shall not remain in the treatment measures for more than five days in order to prevent mosquito generation. Should any mosquito issues arise, contact the San Mateo County Mosquito Abatement District (SMCMAD), as needed for assistance. Mosquito larvicides shall be applied only when absolutely necessary, as indicated by the SMCMAD, and then only by a licensed professional or contractor. Contact information for SMCMAD is provided below.

San Mateo County Mosquito Abatement District

1351 Rollins Road
Burlingame, CA 94010
PH:(650) 344-8592 FAX: (650) 344-3843
Email: info@smcmad.org

4.6.1 Material Disposal

Handling and disposal of materials shall be in conducted in accordance with regulatory protocols. This includes sediment and filter media. Filter media used in stormwater treatment systems are designed to absorb petroleum hydrocarbons present in stormwater runoff. As a result, filter media may be considered a Class II hazardous waste (when removed for disposal) and require proper disposal in accordance with California EPA and RCRA regulations. The responsible party (hazardous waste generator) is required to assign all applicable California and EPA waste codes and place hazardous filter media within a Department of Transportation-approved shipping container for transport to a Class II landfill.

Solids removed will be managed and disposed in accordance with best management practices and all applicable regulations. Common practice is to dispose solids in the same manner as sediments collected from street sweeping operations, storm drain cleanouts, and deep sump manhole cleanouts unless they are contaminated with hazardous materials or hazardous waste.

5 REFERENCES

Aquatic and Wetland Company (AWC). 2012. Wetland Identification and Permitting: A Guidance Manual. July, 2012. http://www.aquaticandwetland.com/Permit.pdf.

Bossard, C.C., J.M. Randall, and M.C. Hoshovsky (eds.). 2000. Invasive Plants of California's Wildlands: *Cortaderia jubata*. Berkeley, California. University of California Press.

California Invasive Plant Council (Cal-IPC). 2006. Cal-IPC Inventory Plant Profiles: *Cortaderia jubata*. May, 2012. http://www.cal-ipc.org/ip/management/plant_profiles.

Cardno ENTRIX. 2011. Wetland Delineation Report for the Pescadero Landfill Closure and Transfer Station Adjacent Site. December 24, 2011.

Carter, V. 1997. Technical aspects of wetlands: Wetland hydrology, water quality, and associated functions. United States Geological Survey Water Supply Paper 2425. http://water.usgs.gov/nwsum/WSP2425/hydrology.html.

County of San Mateo Department of Public Works (SMCDPW). 2012. The Pescadero Landfill Closure Project Phase 2, Habitat Mitigation and Monitoring Plan. August, 2012.

County of San Mateo Planning and Building Division (SMCPBD). 1998. Local Coastal Program Policies, 1998 update. http://www.co.sanmateo.ca.us/vgn/images/portal/cit_609/10073428lcp_1098.pdf

Environmental Protection Agency (EPA). 2001. Functions and values of wetlands. United States EPA Office of Water. http://www.epa.gov/owow/wetlands/pdf/fun_val.pdf.

County of San Mateo Department of Public Works (County). 2012. Pescadero Landfill Closure Project Phase 2 Biological Impact Form. May, 2012.

Natural Resource Conservation Service (NRCS). 2012. Wetland Indicator Status, 2012 National Wetland Plant List. http://plants.usda.gov/wetland.html.

6 APPENDICES

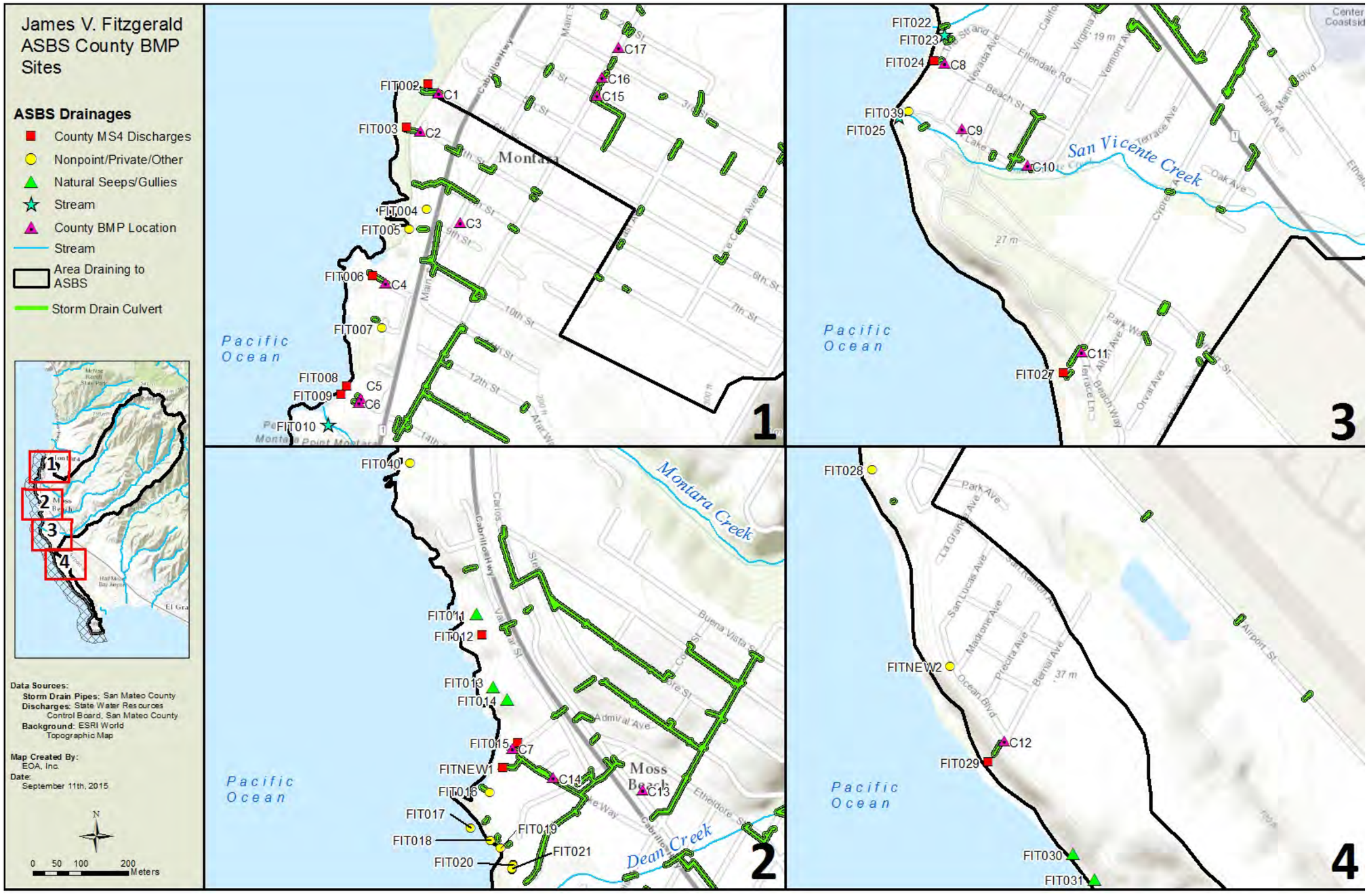
APPENDIX A:

BMP Site List and Map

Fitzgerald Pollution Reduction Program Pilot and Phase 2 BMPs Installed by the County

Site ID	ASBS ID	Site Name	Approx. Drainage Area	Pilot BMP	Pilot Comments	Proposed Phase 2 BMP
C1	FIT002	Seacliff Ct.	<1 ac	Flume filter storm drain insert	Frequent maintenance due to roadside ditch erosion	120-ft grassy swale with grade checks
C2	FIT003	7th St.	12.8 ac	Grassy swale	Only north drainage treated	Replace vegetation at Phase I BMP; construct 100-ft vegetated swale in south drainage; drainage controls
C3	N/A	Main St.	10 ac	--	--	100-ft grassy swale
C4	FIT006	11th St.	<1 ac	--	--	50-ft grassy swale; drainage controls
C5	FIT008	14th St. N	--	--	--	115-ft grassy swale
C6	FIT009	14th St. S	--	Flume filter storm drain insert	Frequent maintenance due to clogging	--
C7	FIT015	Juliana Avenue	2.5 ac	Vegetated swale	Lower drainage not captured and treated	50-ft grassy swale in secondary ditch to treat lower drainage area
C8	FIT024	Beach St.	<0.5 ac	--	--	70-ft grassy swale
C9	FIT025	FMR Parking Lot	--	--	--	Trench drain and bioretention basin
C10	Near FIT025	North Lake St. (San Vicente Creek)	1.4 ac	Catch basin vault with StormFilter cartridges	--	--
C11	FIT027	Cypress & Beach Way	0.5 ac	Vegetated swale	Lower drainage area not captured and treated	40-ft grassy swale to treat lower drainage area
C12	FIT029	Ocean Blvd & Bernal Ave	5 ac	Grassy swale	Swale damaged by parking & foot traffic	Replace & regrade grassy swale with 100-ft & 70-ft vegetated swales; add signage & fencing to prevent future trampling
C13	FITNEW1	Carlos St. (in Wienke Way watershed)	0.6 ac	--	--	2 bioretention facilities
C14	FITNEW1	Wienke Way	30 ac	--	--	100-ft vegetated swale
C15	Kanoff Creek	4th St. (Kanoff Creek)	0.5 ac	--	--	105-ft grassy swale
C16	Kanoff Creek	Farallone @ 4th St.	10 ac	--	--	130-ft vegetated swale
C17	Kanoff Creek	Farallone @ 3rd St.		--	--	215-ft vegetated swale

Notes: ac = acre, ft = feet



Phase 2 County BMP Locations, Fitzgerald Pollution Reduction Program.

APPENDIX B:

Flume Filter Details

TREATMENT FOR SURFACE FLOWS

Media Flume Filter

PROVEN STORMWATER TREATMENT TECHNOLOGY

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Overview

The Bio Clean Media Flume Filter is a stormwater pollution control device designed to capture high levels of trash, organics and hydrocarbons. Available with various sorbtive media, these filters provide full coverage and easily fits in any drainage flume, channel or culvert.

Its horizontal flow design allows it to treat sheet flows and other surface flows with no vertical drop from entry to discharge. A perfect solution for flat projects.

The Media Flume Filter is designed specifically for removing hydrocarbons and other contaminants from sheet flows. It contains a series of media booms that absorb oils & grease, and other various contaminants from the passing runoff. The booms are easily replaced through a top hatch.

Available in various sizes and custom made to fit any size or shape flume, channel or culvert. All components are extremely durable and backed by a 5 year warranty.

Advantages

- Easy Maintenance
- Quick Installation
- 5 Year Warranty
- Customized Configurations and Sizes

Performance

- 83% Removal of Oils & Grease
- 87% Removal of Total Petroleum Hydrocarbons (TPH) (Tested with BioSorb Hydrocarbon Absorbent)

Available with Other Media (perlite, activated charcoal, alumina) for Removal of Various Pollutants

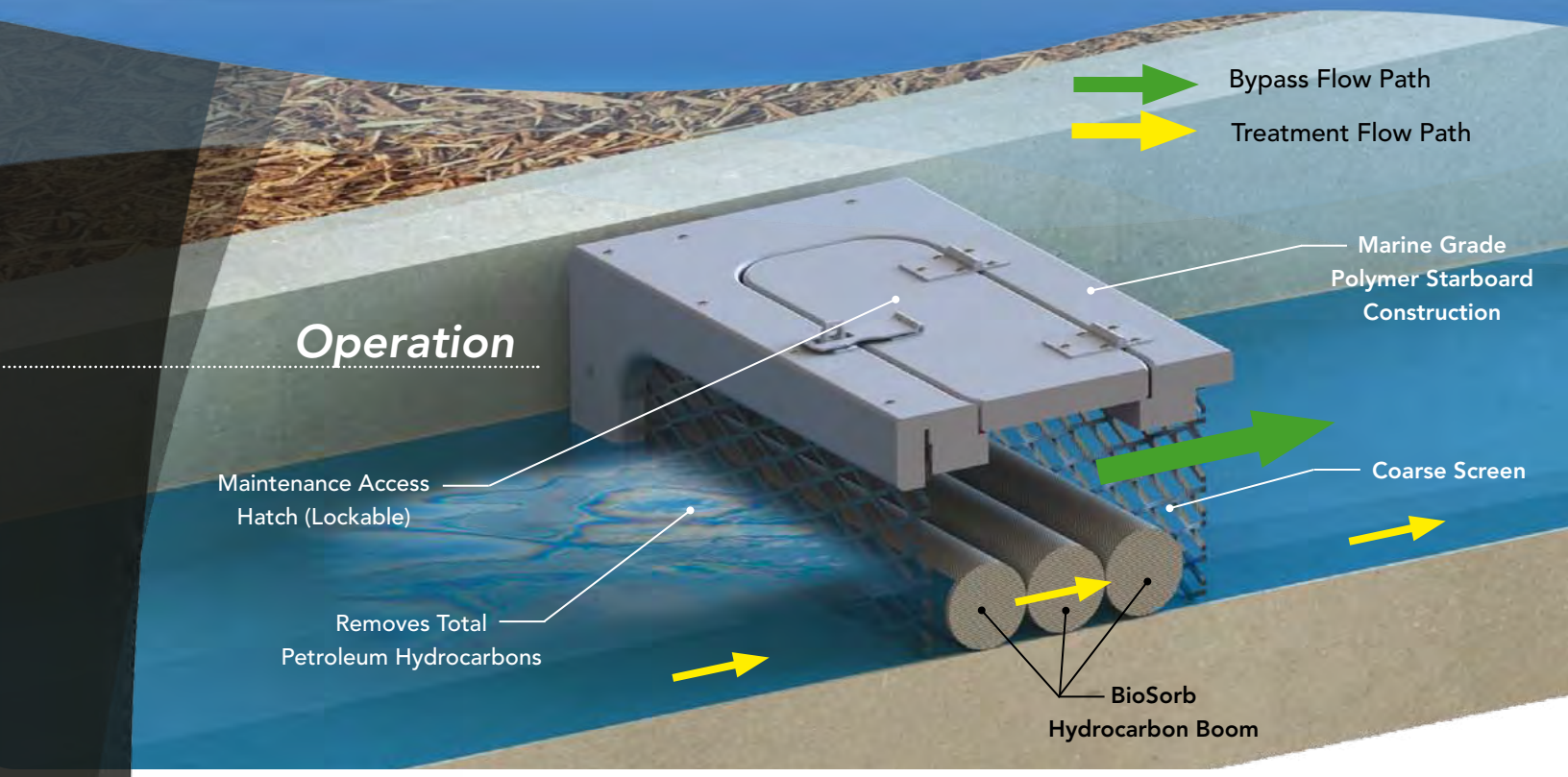
Specifications

Model #	Filter Width (inches)	Treatment Flow Rate (CFS)
BC-MFF-12	12	0.26
BC-MFF-18	18	0.39
BC-MFF-24	24	0.52
BC-MFF-36	36	0.78
BC-MFF-48	48	1.04
BC-MFF-60	60	1.3

Media Flume Filter

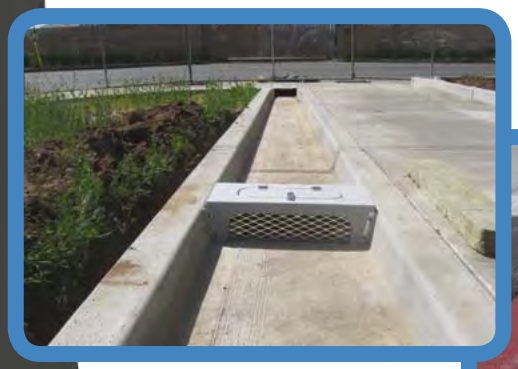
PROVEN STORMWATER TREATMENT TECHNOLOGY

Operation



Application

- Concrete Flumes
- Culverts
- Sidewalk Under Drains



Adaptable to Rectangular or Curved Bottom Drainage Channels

Access Hatch for Easy Media Replacement

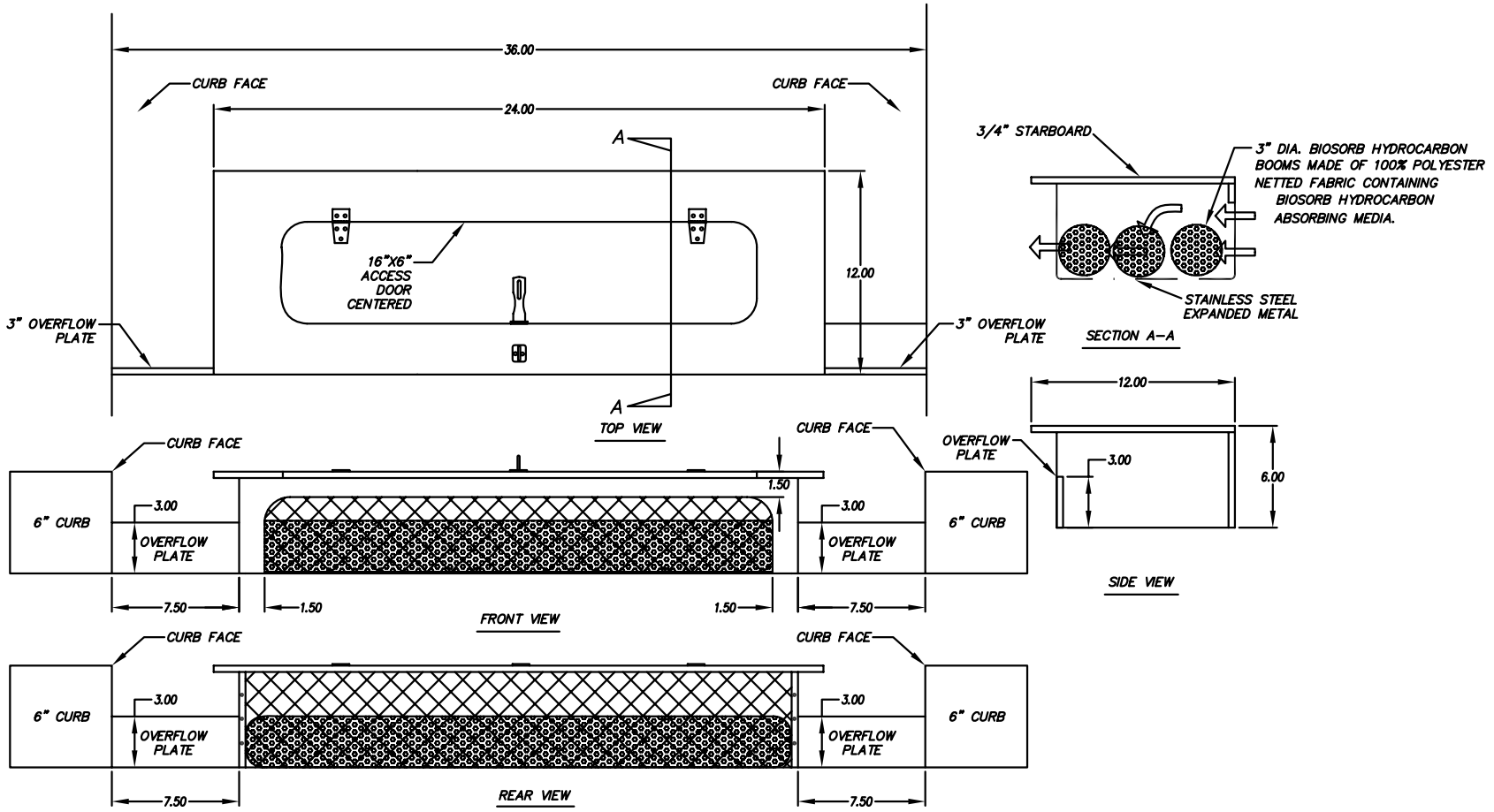
Installation & Maintenance

See our website for installation & maintenance manuals at www.BioCleanEnvironmental.com

2972 San Luis Rey Rd
Oceanside, CA 92058
p 760.433.7640 f 760.433.3176
www.BioCleanEnvironmental.com

BIO CLEAN

BIO CLEAN FLUME FILTER – 24 INCH – MEDIA TYPE



TREATMENT FLOW RATE = .52 CFS

TREATMENT FLOW RATE = .26 CFS PER LINEAR FOOT FLOW RATE ASSUMES 50% BLOCKAGE

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

P 760–433–7640 F 760–433–3176

EMAIL: info@biocleanenvironmental.net

\\Windows-svr\BioClean Files\MARKETING\PUBLISHING\GRAPHIC ART\Logo Art\BioCleanLogo.EPS.jpg

MODIFIED BY SAN MATEO COUNTY DPW OCT 2011

SIZE	FSCM NO.	DWG NO. BIO CLEAN FLUME FILTER 24" – MEDIA TYPE	REV
SCALE N.T.S.		SHEET 1 OF 3	

Material Safety Data Sheet

Company: Modular Wetland System, Inc.
Trade Name: BioMediaGREEN
Product Name: BioMediaGREEN Stormwater Filter Blocks
Revised On: 24-08-07
Replaces Issue: 8-11-99

1. Identification:

1.1 Product

Stormwater filtration media blocks

1.2 Company Address

Modular Wetland Systems, Inc
PO Box 869
Oceanside, CA 92058

1.3 If further information is required, please call or fax Modular Wetlands
Tel: 760-433-7640 Fax: 760-433-3176

2. Information on Ingredients:

Inert vitreous silicate mineral fibers bonded with a thermosetting phenolic resin which has been urea extended.

Table 1	CAS-No.	Contents	Exposure Limits
Synthetic vitreous (silicate) fibers	287922-11-6	95-100%	5 mg/m3 TWA respirable fraction (OSHA) 15 mg/m3 TWA total dust (OSHA) 1 fiber/cc TWA (ACGIH)

3. Hazardous Identification:

3.1 Mineral Fibers

The mineral fibers may cause transient mechanical irritation to skin.
High dust levels may irritate the throat and eyes.

4. First Aid Measures:

4.1 Skin

If irritation occurs, do not rub or scratch. Wash off under running water prior to washing with mild soap and water.

4.2 Eyes

If irritation occurs, do not rub the eyes. Flush eyes with water and consult a physician if irritation persists.

5. Fire Fighting Measures:

The products are non-combustible and do not pose a fire hazard. However packaging material may burn.

5.1 Suitable Extinguishing Media

Water, foam, carbon dioxide or dry powder.

5.2 Extinguishing media which must not be used for safety reasons.

None.

5.3 Combustion Products

Carbon dioxide, carbon monoxide and trace gasses.

5.4 Special protective equipment for fire-fighters.

Observe normal fire fighting procedure

6. Accidental release measures:

No special measures required.

7. Handling and storage:

7.1 Handling

- Use sharp tools when cutting
- If using mechanical cutting equipment, a dust extractor should be used
- Open boxes of blocks in a ventilated area
- When filling containers or mixers with other products misting and dust extraction are recommended
- To reduce dust wet floor before sweeping up
- Place off cuts and any unused filter blocks in bags

7.2 Storage.

– Store material to protect against adverse weather conditions including precipitation.

8. Exposure controls/personal protection:

Local regulations may apply.

8.1 Respiratory protection

If dust levels exceed applicable exposure limits, wear a NIOSH certified dust respirator. Use disposable face masks complying with NIOSH standards.

8.2 Hand Protection

Wear suitable gloves.

8.3 Eye protection

With heavy dust development, wear safety goggles.

8.4 Skin Protection

Wear loose fitting work clothes to prevent irritation. Skin irritation cannot occur if there is no contact with the skin. After work rinse hands and unprotected skin with cold water and then wash with soap and warm water. If working in a very dusty environment it is advisable to shower and change clothes.

9. Physical and chemical properties

9.1	Appearance:	Solid, Grey-green
9.1.1	Odor:	n.a.
9.1.2	pH (at 1000g/H2O, 25°C)	7-8 (DIN 54275)
9.1.3	Boiling point:	n.a.
9.1.4	Melting point:	above 1000°C
9.1.5	Flash point:	n.a.
9.1.6	Flammability:	n.a.
9.1.7	Autoflammability:	Non-flammable DIN 4102
9.1.8	Explosive properties:	n.a.
9.1.9	Explosive properties:	n.a.
9.1.10	Oxidizing properties:	n.a.
9.1.11	Vapor pressure:	n.a.
9.1.12	Fiber density:	approx. 2.6 g/cm3
9.1.13	Solubility:	n.a.
9.1.14	Partition coefficient:	n.a.
9.1.15	Other data:	n.a.

10. Stability and reactivity:

10.1 Stability	Stable
10.2 Reactivity	Not reactive
10.3 Thermal decomposition products	Not applicable

11. Toxicological information:

11.1 Coarse fibers

Coarse fibers can cause itching of the skin, foreign body reaction in the upper respiratory system (mucous membranes), and in the eyes. The itching and possible inflammation are a mechanical reaction to the coarse fibers (of more than about 5 :m in diameter) and are not damaging in the way chemical irritants may be. They generally abate within a short time after the end of exposure. When products are handled continually, the skin itching generally diminishes.

11.2 Respirable fibers

Animal studies

If long fibers are very durable and present in high concentrations they may lead to disease. Short-term inhalation studies of rats exposed to high levels of these fibers have shown that the long fibers disappear quickly from the lungs (are biodegradable).

The fibers have been tested in a long term chronic inhalation study with no evidence of significant fibrosis or any excess of lung tumors.

Experiences in humans (Epidemiological Studies)

Large morbidity and mortality studies of both European and North American fiber manufacturing workers have been conducted with the traditional fibers.

The studies have found no significant evidence of non-malignant lung disease (e.g. fibrosis). The studies provide no evidence of increased risks of lung cancer or of mesothelioma (cancer of the lining of the bodycavities).

The new fibers (high-alumica low-silica) are much more biosoluble and will disappear more rapid from the lungs than the traditional types.

12. Ecological Information:

Stable product with no known adverse environmental effects.

13. Disposal Consideration:

The product can typically be disposed of in an ordinary landfill (local regulations may apply). If you are unsure of the regulations, contact your local Public Health Department or the local office of the Environmental Protection Agency (EPA).

14. Transport information:

15. Regulatory information:

15.1 U.S. Regulations

The International Agency on Cancer (IARC) evaluated that there is inadequate evidence in experimental animals for the carcinogenicity of the new type of biosoluble fiber (high-alumicalow-silica (HT) fiber) IARC made. No overall evaluation of the newly developed biosoluble fiber-types.

The following information on carcinogen classification is applicable to the traditional stone wool fibers:

IARC: *Group 3 – is not classifiable as to its carcinogenity to humans.*
NTP: *Not listed*
ACGIH: *A3 Animal Carcinogen*

15.2 Europe – European Community (EC) Classification

The product contains Mineral Fibers [Man-made vitreous (silicate) fibers] that are exonerated from classification as a carcinogen according to Note Q in EU Commission Directive 97/69/EC (adapting Council Directive 67/548 /EEC to include the classification and labeling of synthetic vitreous fibers).

- Classification: Irritant
- Risk phrase: Irritating to skin.
- Safety phrase: Wear suitable protective clothing and gloves.

APPENDIX C:

Native Grass Sod Details

Producers and Installers of Premium Peat Grown Sod
Grown on Biodegradable Netting

Native Mow Free™

A low maintenance compliment to natural landscapes. This versatile grass can be maintained as a turf lawn or left unmowed.

- Western Mokelumne fescue- Festuca occidentalis
- Idaho fescue- Festuca idahoensis
- Molate fescue- Festuca rubra

- Contains two native fine fescues and one highly naturalized variety.
- Excellent shade and cold tolerance.
- Deep green glossy leaves.
- Slow growing, narrow leafed grass with blades that are very lax and flexuous.
- Provides soil stabilization for sloped areas.

D E L T A B L U E G R A S S C O M P A N Y

P.O. Box 307 Stockton, California 95201 (800) 637-8873 or (209) 469-7979

Producers and Installers of Premium Peat Grown Sod
Grown on Biodegradable Netting

Biofiltration Sod ™

Revolutionizing the development of native grasses on roadsides, bio-swales and other environmental mitigation areas.

- Purple needlegrass - Nassella pulchra *(California's State Grass)*
- Molate fescue - Festuca rubra
- California barley – Hordeum californicum
- Meadow barley – Hordeum brachyantherum brachyantherum

- A combination of coarse and fine bladed grasses that create an excellent weed barrier
- Withstands extreme heat in full sun conditions
- Adapts to most soil types
- Reduces soil erosion
- Will recharge and purify ground water

DELTA BLUEGRASS COMPANY

P.O. Box 307 Stockton, California 95201 (800) 637-8873 or (209) 469-7979

CALIFORNIA NATIVE SOD
COMPARE VARIOUS BLENDS

Maintained & Irrigated Applications						
Product Name	**Leaf Texture**	**Soil Type**	**Water Use**	**Shade Tolerance**	**Wear Tolerance**	**Mowing Height**
Native Bentgrass™	Medium	All	Low	Partial	High	2"-4"
Native Mow Free™	Fine	All	Low	Partial	Medium	4"-6"
Delta Grassland Mix™	Fine	All	Low	Partial	Medium-low	4"-6"
Biofiltration Sod™	Medium - Fine	All	Low	Prefers Full Sun	Low	4"-6"
Delta Native Heartland Sod™	Medium - Fine	All	Low	Partial	Low	4"-6"
Native Preservation Mix™	Fine	All	Low	Partial	Medium	4"-6"

**Ratings based on current and on-going studies. Management and cultural practices have not been completely developed within the native grass community. Delta Bluegrass Company has an extensive Research and Development Program which will continue to provide valuable data.*

Non-Maintained & Non- Irrigated Applications						
Product Name	**Leaf Texture**	**Soil Type**	**Water Use**	**Shade Tolerance**	**Wear Tolerance**	**Mature Plant Height**
Native Bentgrass™	Medium	All	During Establishment	Partial	High	12"-18"
Native Mow Free™	Fine	All	During Establishment	Partial	Medium	18"-24"
Delta Grassland Mix™	Fine	All	During Establishment	Partial	Medium-low	18"-24"
Biofiltration Sod™	Medium - Fine	All	During Establishment	Prefers Full Sun	Low	18"-31"
Delta Native Heartland Sod™	Medium - Fine	All	During Establishment	Partial	Low	18"-31"
Native Preservation Mix™	Fine	All	During Establishment	Partial	Medium	18"-24"

Native Preservation™ – Streetscape – Redding, CA

NON-MOWED NON-IRRIGATED AREAS

Native grasses control soil erosion, reduce dust, control ground temperatures, reduce noise and recharge ground water. Properly maintained sod is one of the most cost effective and environmentally beneficial products in urban development.

Bio-Swales / Retention Basins / Riparian Restoration

Best described by Ed Zuckerman, President and CEO of Delta Bluegrass Company,

"You need to put on a new pair of glasses when you look at California Native Sod. This is not the traditional lawn of our childhood. We are entering a new era where the complex beauty of native grasses needs to be appreciated"

In non-irrigated applications most native sod blends will establish and actively grow during the wet season. The specially selected combination of native grasses found in our sod will go dormant during the summer becoming golden summer fields and then green up in the fall to become beautiful cool season meadows. Temporary or supplemental irrigation is required during the establishment period.

STEPS FOR ESTABLISHMENT IN NON-MOWED / NON-IRRIGATED AREAS

- **SOIL PREPARATION**: Rototill the soil and add necessary amendments. Till into soil to a minimum depth of 4 to 6 inches or deeper. This will allow air and water to penetrate the root zone.

- **GRADING AND ROLLING:** Clear the sod surface of all debris, including dirt clods, rocks and root segments. Rake and level the area, making sure that the soil is about 1" below the level of sidewalks, patios and hard surfaces

- **FERTILIZING AND APPLICATION OF SOD:** Before laying sod, apply Delta Bluegrass Company's Bolero™ Sod & Seed Starter Fertilizer at a rate of 6 pounds per 1,000 square feet. This gives the new grass food to nourish it in the first few weeks of establishment. Sod can now be laid directly on the fertilized ground. Start from the back of your property line to the front along the longest straight line boundary. Work away from the line so you are not stepping on the fresh sod. Stagger sod slabs to offset seams. Make sure each piece of sod has good contact with the soil, because air pockets prevent proper rooting. If laying sod on a steep slope, use wooden pegs or sod staples to temporarily keep the sod in place. Be sure to roll sod horizontally to prevent ruts created by water rolling down the slope or slight incline of your surface.

- **TEMPORARY IRRIGATION:** The sod must develop an adequate root system and store enough carbohydrate reserves to enter dormancy and survive the dry summer months. Temporary or supplemental irrigation during the establishment period is required to ensure a strong root system. Allow natural rainfall to supply necessary moisture and cool winter conditions to sustain green sod.

- **MOWING:** In non-maintained areas, mowing is optional. Most often, areas will be trimmed only one or two times per year. This is usually in the mid and late spring to remove the florets or seed heads. A string trimmer or weed eater is the most commonly use landscape tool used to cut the grass to the preferred height. **NEVER** remove more than 1/3 of the leaf blade with any single mow cycle.

- **FERTILIZATION:** Native sod requires far less fertilizer than conventional turf. Fertilize two to three times per year in the appropriate season for the type of sod used. Generally, the first application is in early spring, February or early March. In cool coastal and mountain areas, a late spring application can be made with the last rainfall. This will help the plant to store up necessary nutrients before entering summer dormancy. After the first rainfall arrives and temperatures drop, apply Bolero™ Lawn Food fertilizer and allow rain to water fertilizer into grass. This will help promote to green up the grass and bring it out of summer dormancy.

Native Biofiltration™ - Cosumnes Elementery School – Sloughouse, CA

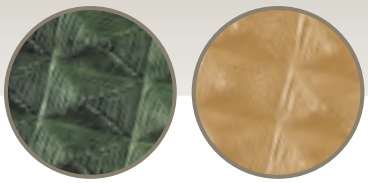
Installed in August of 2010, temporary irrigation was used during the establishment period and then removed. The area remained green throughout the cool season and here in late July 2011 it has become a dormant golden summer meadow.

DELTA BLUEGRASS COMPANY
P.O. Box 307 • Stockton, California 95201 • (800) 637-8873 • (209) 469-7979

APPENDIX D:

Turf Reinforcement Mat Details & Installation Guidelines

PYRAMAT® HIGH PERFORMANCE TURF REINFORCEMENT MATS



Pyramat® High Performance Turf Reinforcement Mats (HPTRMs) feature our patented woven technology composed of a unique, three-dimensional matrix of polypropylene yarns. These yarns are designed in a uniform, dimensionally stable and homogenous configuration of pyramid-like structures, and they feature our patented X3® fiber technology specially created to lock soil in place. HPTRMs exhibit extremely high tensile strength as well as superior interlock and reinforcement capacity with both soil and root systems. They stand up to the toughest erosion applications where high loading and/or high survivability conditions are required, including maintenance access, steep slopes, arid and semi-arid environments, pipe inlets and outlets, structural backfills, utility cuts, potential traffic areas, abrasion, high-flow channels and/or areas where greater factors of safety are desired. Pyramat's superior characteristics provide a longer design life than our first and second generation standard TRMs, and meet the definition of HPTRM as defined by the U.S. EPA Storm Water Fact Sheet, "Turf Reinforcement Mats" (EPA 832-F-99-002) and FHWA FP-03 Specifications Section 713.8.

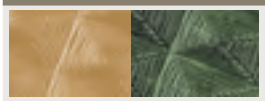
FEATURES & BENEFITS

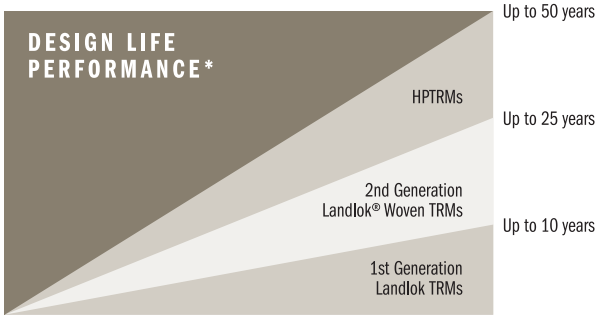
- A unique, patented matrix of pyramids formed with X3 fibers that gridlocks soil in place under unvegetated, partially vegetated and high-flow conditions
- Ideal for extended ultraviolet (UV) exposure, utility cuts, maintenance equipment traffic, pipe inlets and outlets and other high loadings
- X3 cross-sectional area for additional tensile strength, flexibility and seedling emergence
- Holds seed and soil in place on channels and slopes while vegetation grows
- Provides permanent reinforcement to enhance vegetation's natural ability to filter soil particles and prevent soil loss during storm events
- Promotes infiltration which leads to groundwater recharge
- Vegetation solution providing more pleasing aesthetics than conventional methods (i.e. rock riprap and concrete paving)
- Greater flexibility to maintain intimate contact with subgrade, resulting in rapid seedling emergence and minimal soil loss
- Can be used in arid and semi-arid environments
- Completely interconnected yarns that provide superior UV resistance throughout the HPTRM
- Meets requirement of 5 mm^2 or less mesh size to prevent wildlife entanglement in any sensitive habitats
- Superior product testing, performance and design life

Outperforms and is more cost-effective than conventional erosion control methods, including:

- Large rock riprap
- Grouted riprap
- Gabions
- Concrete paving
- Hard roadside shoulders
- Articulated concrete blocks
- Fabric formed revetments

PYRAMAT® HPTRMs PRODUCT FAMILY TABLE

PRODUCT		FUNCTIONAL LONGEVITY	COLOR	FIBER TYPE	# OF NETS	FP-03, SECTION 713 COMPLIANCE
	PYRAMAT®	PERMANENT	TAN OR GREEN	POLYPROPYLENE X3® FIBER TECHNOLOGY	0 (WOVEN)	EXCEEDS TYPE 5C



*Design life performance may vary depending upon field conditions and applications.

PROPEX® | THE ADVANTAGE CREATORS.™
GEOSYNTHETICS

PYRAMAT® HIGH PERFORMANCE TURF REINFORCEMENT MATS

APPLICATION SUGGESTIONS FOR PYRAMAT® HPTRMs

	APPLICATION	FUNCTIONAL LONGEVITY	PRODUCT STYLE	INSTALLED COST[1]	ANCHOR SUGGESTIONS[2]
SLOPES	1H:1V OR STEEPER	PERMANENT	PYRAMAT®	$12.00 - 18.00/yd² $14.35 - 21.53/m²	2.5 ANCHORS/yd² 3 ANCHORS/m²
CHANNELS	SHEAR STRESS UP TO 15 lb/ft² (718 N/m²) VELOCITY UP TO 25 ft/sec (7.6 m/sec)				
BANKS	MODERATE WAVE ACTION = 1-2 ft (30 - 60 cm)				
CRITICAL STRUCTURES	PIPE INLETS & OUTLETS				

NOTES: 1. Installed cost estimates range from large to small projects according to material quantity. The estimates include material, seed, labor and equipment. Costs vary greatly in different regions of the country. 2. For anchor size and style, please see our HPTRM Installation Guidelines.

KEY PHYSICAL PROPERTIES OF PYRAMAT® HPTRMs

- Construction: Patented three-dimensional woven matrix makes it 10 times stronger than first generation TRMs, with performance unequaled in turf reinforcement.
- Tensile Strength: 4000 lb/ft (58.4 kN/m) tensile strength meets U.S. EPA definition of a High Performance Turf Reinforcement Mat.
- UV Resistance: Patented UV protection package provides superior resistance to the damaging effects of ultraviolet radiation.

SEVEN STEPS FOR SUCCESSFUL TRM SELECTIONS*

1. SELECT APPLICATIONS
2. DETERMINE FUNCTIONAL LONGEVITY
3. ANTICIPATE CLIMATE (ARID, SEMI-ARID, OR TEMPERATE)
4. UNDERSTAND TRADITIONAL SOLUTION
5. PREDICT NON-HYDRAULIC STRESSES (MAINTENANCE STRESSES)
6. KNOW VEGETATION TYPE
7. CALCULATE HYDRAULIC STRESSES

*See Propex Engineering Bulletins or EC-DESIGN® software for more information.

PYRAMAT® HPTRM PROPERTY TABLE[1] ENGLISH & METRIC VALUES

	PROPERTY	TEST METHOD	VALUE[2]	PYRAMAT®
PHYSICAL	MASS PER UNIT AREA	ASTM D-6566	MARV	13.5 oz/yd^2 455 g/m^2
	THICKNESS	ASTM D-6525	MARV	0.4 in 10.2 mm
	LIGHT PENETRATION	ASTM D-6567	TYPICAL	10%
	COLOR	VISUAL	–	GREEN, TAN
MECHANICAL	TENSILE STRENGTH	ASTM D-6818	MARV	4000 x 3000 lb/ft 58.4 x 43.8 kN/m
	TENSILE ELONGATION	ASTM D-6818	MaxARV	65%
	RESILIENCY	ASTM D-6524	MARV	80%
	FLEXIBILITY/STIFFNESS	ASTM D-6575	TYPICAL	0.534 in-lbs 615000 mg-cm
ENDURANCE	FUNCTIONAL LONGEVITY	OBSERVED	TYPICAL	PERMANENT
DURABILITY	UV RESISTANCE[4]	ASTM D-4355	MINIMUM	90% @ 6000 HOURS
PERFORMANCE	SEEDLING EMERGENCE[3]	ECTC DRAFT METHOD #4	TYPICAL	296%
PACKAGING	ROLL WIDTH	MEASURED	TYPICAL	8.5 ft 2.6 m
	ROLL LENGTH	MEASURED	TYPICAL	90 ft 27.4 m
	ROLL WEIGHT	CALCULATED	TYPICAL	76 lb 34 kg
	ROLL AREA	MEASURED	TYPICAL	85 yd^2 71 m^2

NOTES: 1. The listed property values are effective 06/2009 and are subject to change without notice. 2. MARV indicates Minimum Average Roll Value calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will exceed the reported value. Maximum Average Roll Values (MaxARV) is calculated as typical plus two standard deviations. 3. Calculated as percent increase in average plant biomass with tall fescue grass seed in sand 14 days after seeding versus a non-RECP protected control specimen. 4. All components must meet UV resistance values.

PYRAMAT® HPTRM PERFORMANCE VALUES ENGLISH & METRIC UNITS

MATERIAL	FUNCTIONAL LONGEVITY	SHORT-TERM MAXIMUM SHEAR STRESS AND VELOCITY						MANNING'S "n"		
		VEGETATED[5]		PARTIALLY[6]		UNVEGETATED[7]		0"-6"	6"-12"	12"-24"
PYRAMAT®	PERMANENT	15 lb/ft^2 718 N/m^2	25 ft/sec 7.6 m/sec	10 lb/ft^2 478 N/m^2	20 ft/sec 6.1 m/sec	6.0-8.0 lb/ft^2 285-383 N/m^2	15 ft/sec 4.6 m/sec	0.035	0.028	0.017

NOTES: 5. Maximum permissible shear stress has been obtained through fully vegetated (70% to 100% density) testing programs featuring specific soil types, vegetation classes, flow conditions and failure criteria. Achieved after 14 weeks of vegetative establishment versus the industry standard of two full growing seasons. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information. 6. Maximum permissible shear stress has been obtained through partially vegetated (30% to 70% density) testing programs featuring specific soil types, vegetation classes, flow conditions and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information. 7. Maximum permissible shear stress has been obtained through unvegetated (0% to 30% density) testing programs featuring specific soil types, vegetation classes, flow conditions and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.

For downloadable documents like construction specifications, installation guidelines, case studies and other technical information, please visit our web site at **geotextile.com**. These documents are available in easy-to-use Microsoft® Word format.

PROPEX® | THE ADVANTAGE CREATORS.™

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INSTALLATION GUIDELINES

FOR LANDLOK® TRMs AND PYRAMAT® HPTRMs

BEFORE YOU BEGIN

Thank you for purchasing high quality Landlok® Turf Reinforcement Mats (TRMs) and Pyramat® High Performance Turf Reinforcement Mats (HPTRMs) from Propex. We're committed to offering the best erosion control products in the industry.

It is important to follow these installation guidelines for a successful project. (Note: Construction shall be performed in accordance with the specific project bid documents, construction drawings, and specifications.) In addition, we suggest that a pre-installation meeting be held with the construction team and a representative from Propex. This meeting shall be scheduled by the contractor with at least two weeks notice. Also, Propex suggests that installation monitoring of our TRMs and HPTRMs be performed by a qualified independent third party.

SITE PREPARATION

- Grade and compact area of TRM/HPTRM installation as directed and approved by Engineer. Subgrade shall be uniform and smooth. Remove all rocks, clods, vegetation or other objects so the installed mat will have direct contact with soil surface.
- Prepare seedbed by loosening the top 2-3 in (50-75 mm) minimum of soil.
- Incorporate amendments such as lime and fertilizer and/or wet the soil, if needed.
- Do not mulch areas where mat is to be placed.

SEEDING

- Apply seed to soil surface before installing mat. Disturbed areas shall be reseeded.
- When soil filling, first install the mat, apply seed and then soil-fill per guidelines (see page 8).
- Consult project plans and/or specifications for seed types and application rates.

INSTALLATION GUIDELINES

FOR LANDLOK® TRMs AND PYRAMAT® HPTRMs

INSTALLATION ON STABLE SOIL SLOPES

- Excavate a 12 x 6 in (300 x 15 mm) minimum longitudinal anchor trench 2-3 ft (600-900 mm) over crest of slope (see Figure 2).
- Install top end of mat into trench and secure to bottom using suggested ground anchoring devices (see Tables 1 and 2 on page 7) spaced every 12 in (300 mm) minimum. Backfill and compact soil into trench (see Figure 2).
- Unroll mat down slope. Landlok® 1051 shall have the geotextile on bottom.
- Overlaps shall be 6 in (150 mm) minimum and anchored every 18 in (450 mm) minimum along the overlap. Secure using suggested ground anchoring devices shown in Table 1 for appropriate frequency and pattern. Overlaps are shingled away from prevailing winds (see Figure 1).
- Unroll mat in a manner to maintain direct contact with soil. Secure mat to ground surface using ground anchoring devices (see Table 1). Anchors shall be placed in accordance with the Anchor Pattern Guide on page 7.
- Excavate a 12 x 6 in (300 x 150 mm) key anchor trench at toe of slope (see Figure 3).
- Place bottom end of mat into key anchor trench at toe of slope and secure to bottom of trench using suggested ground anchoring devices (see Tables 1 and 2) spaced every 12 in (300 mm) minimum. Backfill and compact soil into trench (see Figure 3).
- If the potential for standing and/or flowing water exists at the toe of slope, the key anchor trench at the toe detail (see Figure 3) is not sufficient. Consult the project engineer for the appropriate detail.
- Irrigate as necessary to establish/maintain vegetation. Do not over-irrigate.

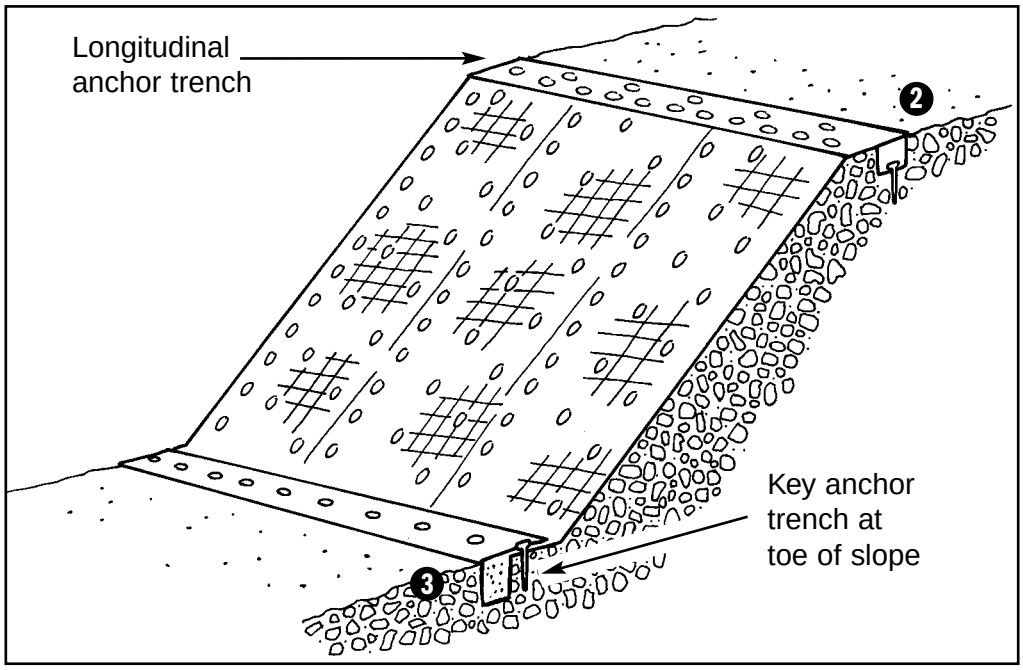


FIGURE 1

Installation of permanent turf reinforcement mat on slope

- Overlaps 6 in (150 mm) minimum
- Space anchors 18 in along overlaps down the slope
- Anchor pattern shall be in accordance with the "Anchor Pattern Guide" found on page 7

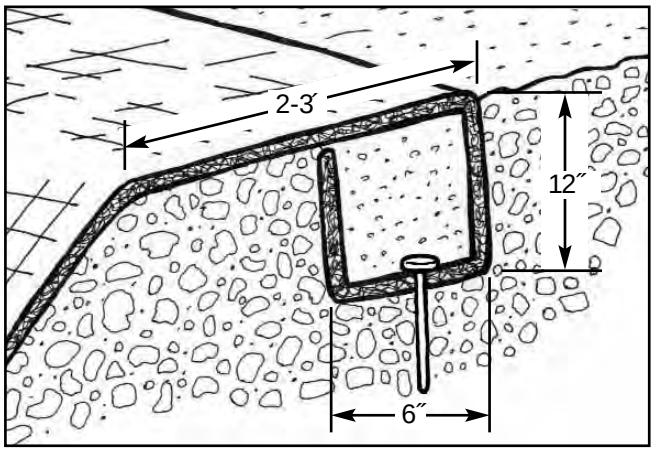


FIGURE 2

Longitudinal anchor trench at top of slope

- Space anchors 12 in (300 mm) along bottom of trench

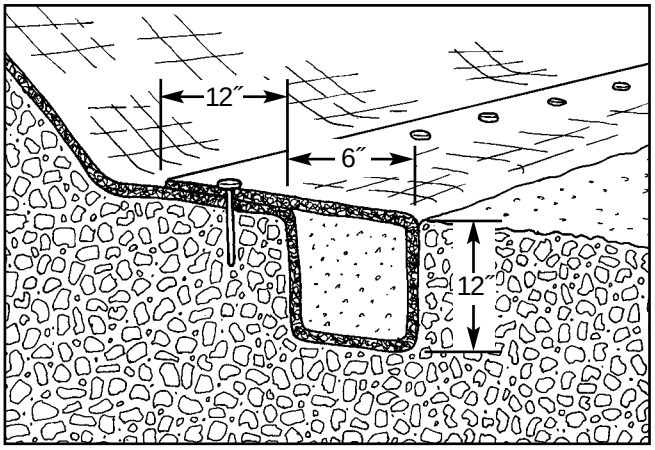


FIGURE 3

Key anchor trench at toe of slope

INSTALLATION IN STORM WATER CHANNELS

- Figure 4 shows general installation layout and details for TRMs and HPTRMs in storm water channels.
- Excavate an initial anchor trench 12 in (300 mm) minimum deep and 12 in (300 mm) minimum wide across the channel at downstream end of project (see Figure 5). Deeper initial anchor trench is needed in channels that have the potential for scour.
- Excavate longitudinal anchor trenches 12 in (300 mm) minimum deep and 6 in (150 mm) minimum wide along both sides of the installation to bury edges of mat (see Figure 6). The trench shall be located 2-3 ft (600-900 mm) over crest of slope.
- Place roll end into the initial anchor trench and secure with anchoring devices at 12 in (300 mm) minimum intervals (see Figure 5). Position adjacent rolls and secure in anchor trench in same manner. Backfill and compact soil into trench.
- Unroll mat in the upstream direction over the compacted trench.
- Continue installation as described above, overlapping adjacent rolls as follows:
  - Roll edge: 6 in (150 mm) minimum with upslope mat on top. Secure with one row of ground anchoring devices on 12 in (300 mm) minimum intervals (see Figure 7).
  - Roll end: 12 in (300 mm) minimum with upstream mat on top. Secure with two rows of ground anchoring devices staggered 12 in (300 mm) minimum apart on 12 in (300 mm) minimum intervals (see Figure 8).
- Fold and secure mat rolls snugly into intermittent check slots. Lay mat in the bottom and fold back against itself. Anchor through both layers of blanket or mat at 1 ft (300 mm) intervals then backfill and compact soil (Figure 9). Continue rolling upstream over the compacted slot to the next check slot or terminal anchor trench. Check slots are placed at 25 to 30 ft (7.6 to 9.1 m) intervals perpendicular to flow.

INSTALLATION GUIDELINES

FOR LANDLOK® TRMs AND PYRAMAT® HPTRMs

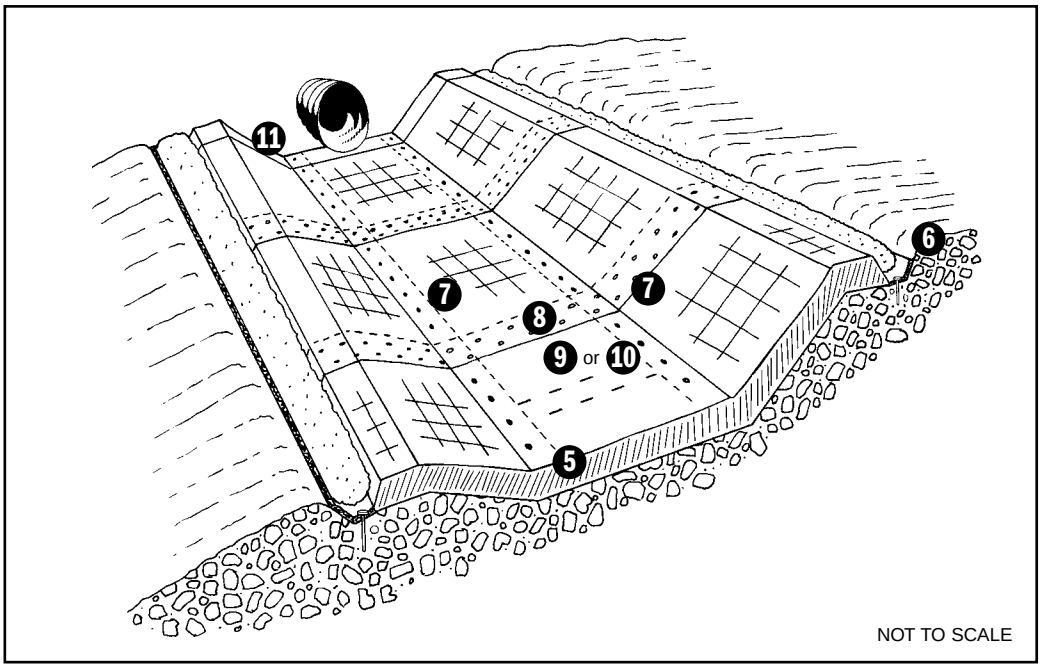


FIGURE 4 Installation of TRMs & HPTRMs in storm water channels

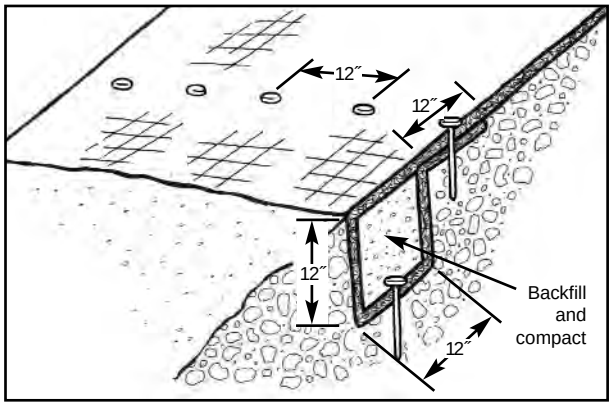


FIGURE 5 Initial anchor trench (downstream) detail

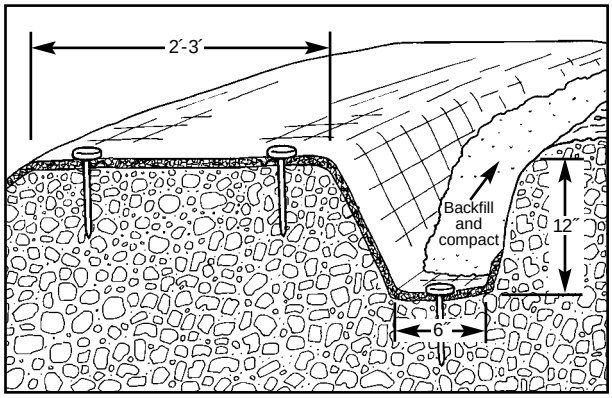


FIGURE 6 Longitudinal anchor trench detail (trapezoidal channel)

- An alternate method to the intermittent check slot is the simulated check slot. This method includes placing two staggered rows of anchors on 4 in (100 mm) centers at 30 ft (9.1 m) intervals (see Figure 10).
- Excavate terminal anchor trench 12 in wide x 12 in deep (300 x 300 mm) minimum across the channel at the upstream end of the project (see Figure 11). Deeper terminal anchor trench is needed in channels that have the potential for scour.
- Anchor, backfill and compact upstream end of mat in 12 x 12 in (300 x 300 mm) minimum terminal anchor trench (see Figure 11). Unroll mat in downstream direction over compacted trench with a minimum 2 ft (600 mm) lap. Secure with anchors in accordance with Figure 8.
- Secure mat using suggested ground anchoring devices (see Tables 1 and 2 on page 7) for appropriate frequency and pattern (see Anchor Pattern Guide on page 7).
- Seed and fill with soil for enhanced performance. See Soil Filling Section on page 8.
- When using Landlok® 1051, seed after installing mat and then fill with soil.
- Irrigate as necessary to establish/maintain vegetation. Do not over irrigate.

NOTE: If you encounter roll with factory overlap, install factory seam such that it shingles in the direction of the flow of water. Place anchoring devices in accordance with Figure 8 “Overlap at roll end” on page 5.

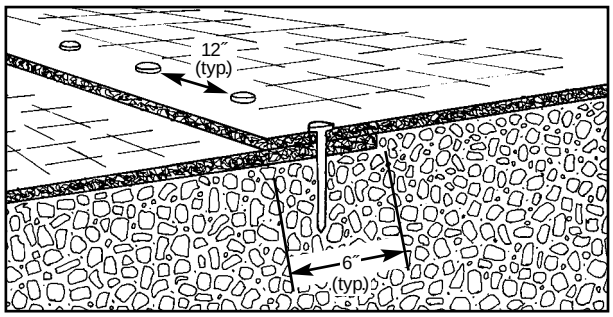


FIGURE 7 Overlap at roll edge

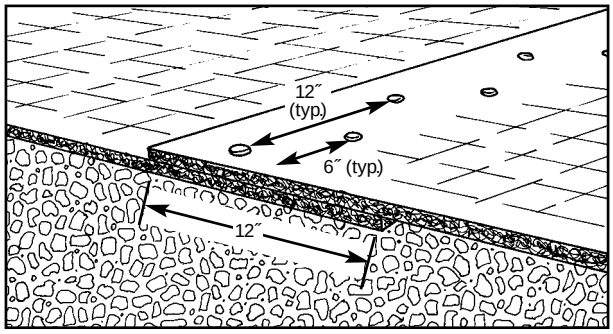


FIGURE 8 Overlap at roll end

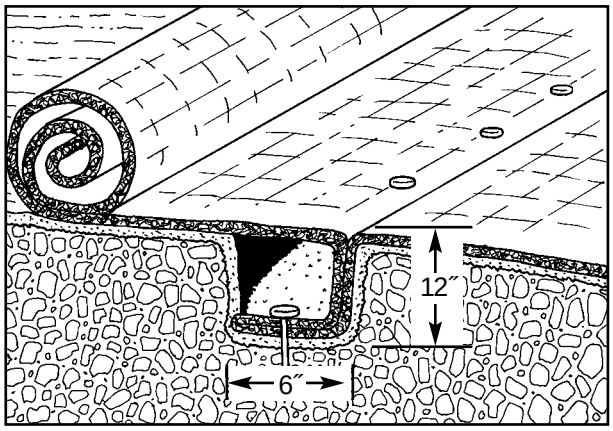


FIGURE 9 Intermittent check slot (channels)

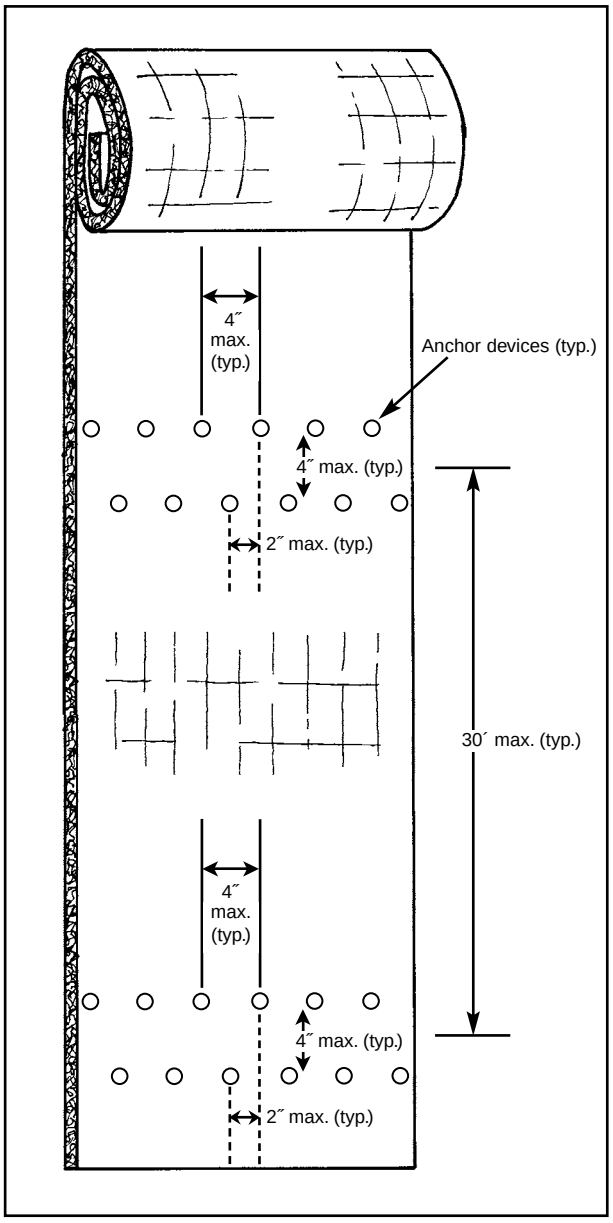


FIGURE 10 Simulated check slot

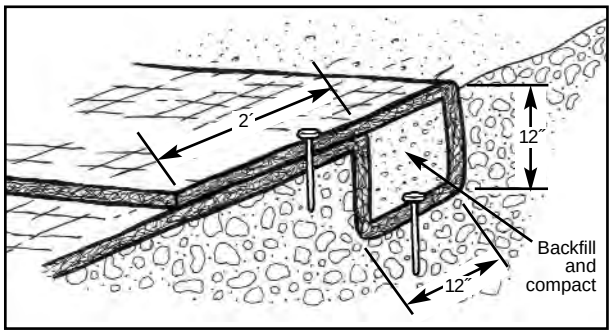


FIGURE 11 Terminal anchor trench (upstream) detail

INSTALLATION GUIDELINES

FOR LANDLOK® TRMs AND PYRAMAT® HPTRMs

SPECIAL TRANSITION GUIDELINES

- Rock Riprap
  - · Excavate an anchor trench 12 x 12 in (300 x 300 mm) minimum at the transition between the mat and the rock riprap.
  - · Place roll end into anchor trench and secure with suggested anchoring devices at 12 in (300 mm) minimum intervals. Position adjacent rolls and secure in anchor trench in same manner.
  - · Backfill the anchor trench with rock riprap.
  - · Place rock riprap as specified, extending approximately 3 ft (1 m) minimum beyond the anchor trench onto the mat.
- Concrete
  - · Alternative 1: Concrete Apron
    - Place ready mixed concrete directly onto a 3 ft (0.9 m) wide minimum strip of mat.
  - · Alternative 2: Concrete Backfill
    - Excavate an anchor trench 12 x 12 in (300 x 300 mm) minimum at the edge of the concrete structure.
    - Place roll end into anchor trench and secure with suggested anchoring devices at 12 in (300 mm) minimum intervals. Position adjacent rolls and secure in anchor trench in same manner.
    - Backfill trench with concrete slurry.
  - · Alternative 3: Bolt to Structure (HPTRMs Only)
    - Cast threaded dowel in fresh ready mix concrete or install expanding bolt into cured concrete. Then affix HPTRM with washer (minimum 2 in or 50 mm diameter) or batten strip and bolt.
- Pipe Inlets/Outlets (HPTRMs Only)
  - · Review the construction drawings and project specifications to evaluate the required area to be treated.
  - · Excavate an anchor trench 12 x 12 in (300 x 300 mm) minimum above the pipe to bury end of HPTRM roll. The trench shall be located a minimum 2-3 ft (600-900 mm) above the pipe inlet/outlet.
  - · Backfill and compact soil into trench.
  - · Cut HPTRM to meet project requirements, slope length and pipe diameter.
  - · Unroll HPTRM down the slope and secure around pipe circumference with ground anchoring devices spaced 6 in (150 mm) minimum. Also, the HPTRM can be secured around the pipe in a 12 x 12 in (300 x 300 mm) minimum trench filled with concrete slurry.

GROUND ANCHORING DEVICES

- Ground anchoring devices are used to secure the mat to the soil using the suggested anchor device (see Tables 1 and 2 on page 7) at a minimum frequency and pattern shown on the Anchor Pattern Guide on page 7.
- U-shaped wire staples or metal geotextile pins can be used to anchor mat to the ground surface. Wire staples should be a minimum thickness of 8 gauge (4.3 mm). Metal pins should be at least 0.20 in (5 mm) diameter steel with a 1 $^{1}/_{2}$ in (38 mm) steel washer at the head of the pin. Wire staples and metal pins should be driven flush to the soil surface. All anchors should be between 6-24 in (150-600 mm) long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils. Heavier metal stakes may be required in rocky soils.

TABLE 1: SUGGESTED GROUND ANCHORING DEVICE SELECTION*

		DEGRADABLE STAKES	WIRE STAPLES	METAL PIN/WASHERS OR NAIL/WASHERS	PERCUSSION DRIVEN ANCHORS
PRODUCT	LANDLOK® ECBs	●	●		
	LANDLOK® TRMs		●	●	
	PYRAMAT®		●	●	●
APPLICATION	SLOPES	●	●	●	●
	BANKS			●	●
	CHANNELS		●	●	●

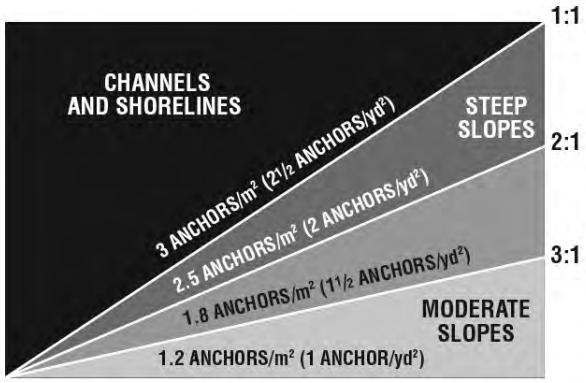
TABLE 2: SUGGESTED LENGTHS OF GROUND ANCHORING DEVICES*

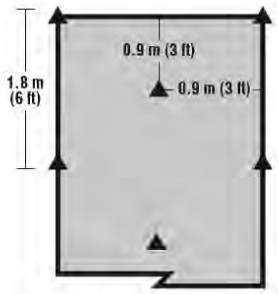
		6-INCH	12-INCH	18-INCH	24-INCH
SOIL TYPES	ROCKY	●			
	CLAYEY	●	●		
	SILTY		●	●	
	SANDY			●	●

*The performance of ground anchoring devices is highly dependent on numerous site/project specific variables. It is the sole responsibility of the project engineer and/or contractor to select the appropriate anchor type and length. Anchoring shall be selected to hold the mat in intimate contact with the soil subgrade and resist pullout in accordance with the project's design intent.

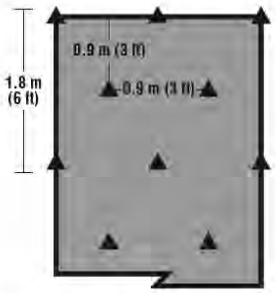
ANCHOR PATTERN GUIDE

- The shaded areas in the diagram provide anchor suggestions based on slope gradient and/or anticipated flow conditions. When the correct number of anchors has been determined, refer to the four illustrations below to establish anchor pattern. Increased anchoring may be required depending upon site conditions.

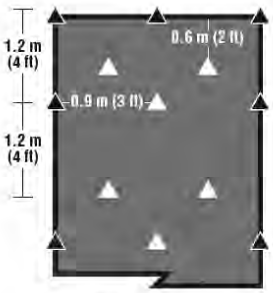




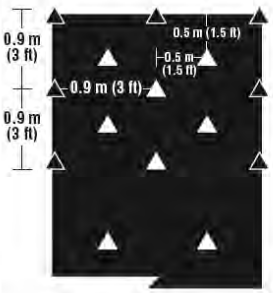
1.2 ANCHORS/m² (1 ANCHOR/yd²)



1.8 ANCHORS/m² (1½ ANCHORS/yd²)



2.5 ANCHORS/m² (2 ANCHORS/yd²)



3 ANCHORS/m² (2½ ANCHORS/yd²)

SOIL FILLING

- Soil filling is suggested for optimum performance.
- After seeding, spread and lightly rake ½ - ¾ in (12-19 mm) minimum of fine site soil or topsoil into the mat and completely fill the voids using backside of rake or other flat tool.
- If equipment must operate on the mat, make sure it is of the rubber-tired type. No tracked equipment or sharp turns are allowed on the mat.
- Avoid any traffic over the mat if loose or wet soil conditions exist.
- Smooth soil-fill in order to just expose the top netting of matrix. Do not place excessive soil above the mat.
- Broadcast additional seed and install a Landlok® ECB above the soil-filled mat (if desired).
- Hydraulically-applied mulch or seed may be used as an alternate to soil-fill on select applications. Consult manufacturer's technical representative for more information.
- Consult manufacturer's technical representative or local distributor for installation assistance, particularly if unique conditions apply (sandy soils and infertile environments).

MAINTENANCE

All slopes, channels, banks and other transition structures shall be maintained to assure the expected design life of the reinforced vegetated system. Here are a few tips that should prove helpful:

- Monitoring
  - · Should be conducted semi-annually and after major storm events. This should include: observing the condition of the vegetation; testing the irrigation system; checking condition of all permanent erosion control systems; observing sediment and debris deposits that need removal.
- Vegetation
  - · Repair and maintenance of various types of vegetation shall be consistent with their original design intent, including:
    - Grass/Turf Areas: applications shall be maintained for adequate cover and height.
    - Mowing: grasses shall be mowed according to normal maintenance schedules as determined by local jurisdictions or maintenance agreements; operations shall not start until vegetation achieves a minimum height of 6 in (150 mm); mower blades shall be greater than 6 in (150 mm) above the mat.
    - Unvegetated Areas: shall be re-seeded and soil-filled (if applicable).
- Sediment and Debris Deposits
  - · Accumulation of sediment and debris can reduce the hydraulic capacity of channels, clog inlet and outlet structures and can damage existing vegetation. Sediment and debris removal is a vital part of system maintenance.
    - Removal: shall be done carefully to avoid damage. When excavation is within 12 in (300 mm) minimum of matting, removal shall be done by hand or with a visual "spotter." If equipment must operate on the mat, make sure it is of the rubber-tired type. No tracked equipment or sharp turns are allowed on the mat.
      - · Alternatively, "stake chasers" or some other form of permanent visual markers can be utilized to provide a visual marker for maintenance activities.
- Damaged Sections
  - · Missing or damaged sections of the matting should be replaced per the installation guidelines.
    - Repairing Rips or Holes: these should be patched with identical matting material. First, carefully cut out the damaged section with a knife. Then replace and compact soil to the elevation of the surrounding subgrade and plant seed. Cut a piece of replacement material a minimum of 12 in (300 mm) larger than the rip or tear. Use ties to attach the replacement material to the existing material. At overlaps, the upstream and upslope material should be on top. Secure the replacement material with ground anchoring devices spaced every 6 in (150 mm) around the circumference of the repair and at the frequency and spacing shown in the Anchor Pattern Guide on page 7. Seed and soil fill replacement area.

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APPENDIX E:

Cross-Section Details for Green Street Improvement Project at Carlos St

NOTES:

1. OFFSET IS TO "C" LINE AND STATIONING REFERENCE SHOWN ON LAYOUT AND DETAILS.

PAVEMENT AND BIORETENTION SECTIONS

APPROVED:

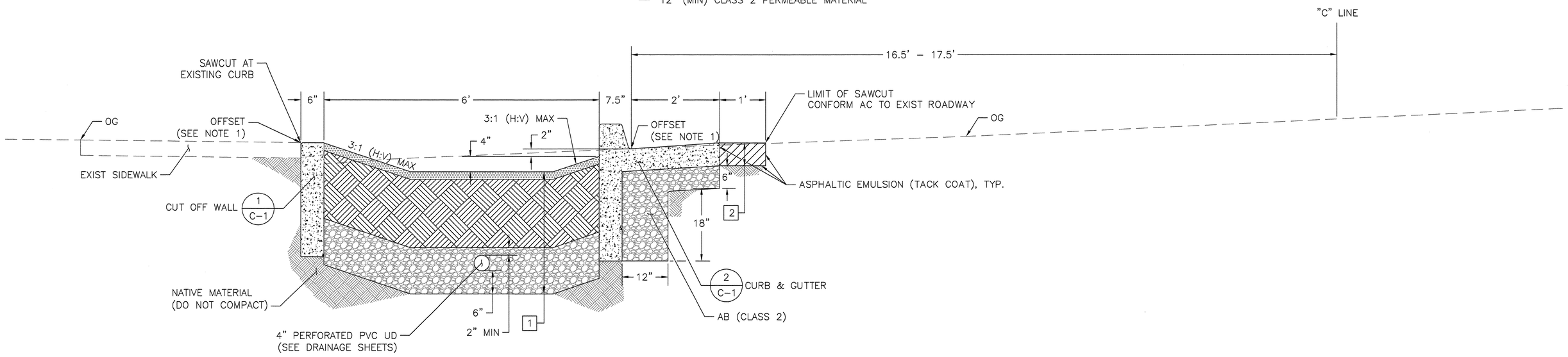
DATE: JUNE 13, 2014

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2015

REGISTERED PROFESSIONAL ENGINEER — JAMES C. PORTER — C 48056 — EXPIRES 12/31/15 — CIVIL — STATE OF CALIFORNIA

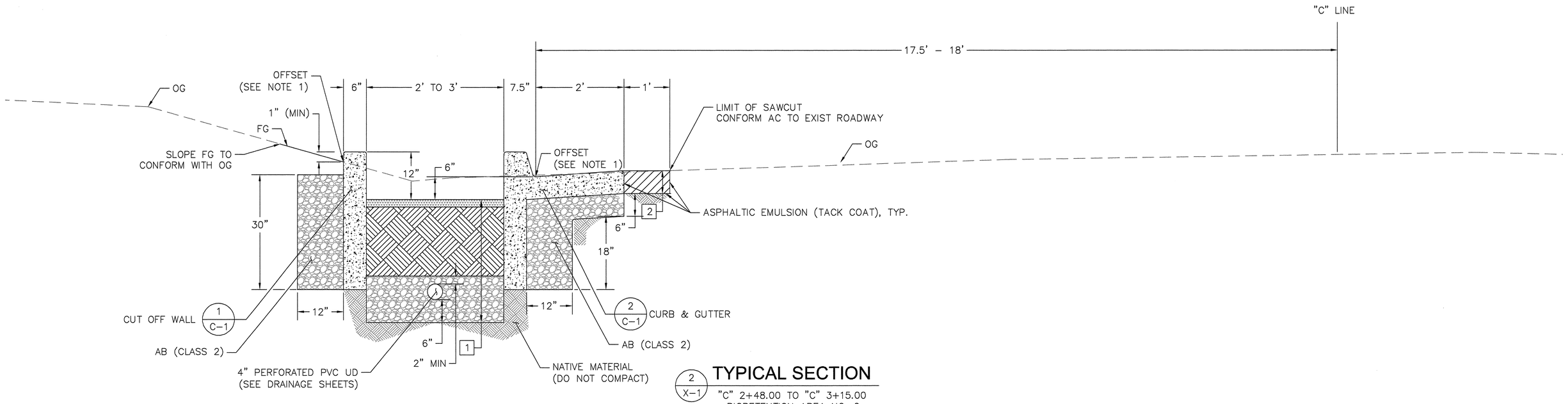
1 — 2" MULCH
18" BIORETENTION SOIL
12" (MIN) CLASS 2 PERMEABLE MATERIAL

2 — 6" DEEP AC (TYPE B)



1/X-1 TYPICAL SECTION

"C" 0+44.00 TO "C" 1+68.00
BIORETENTION AREA NO. 1
SCALE: 1" = 1'



2/X-1 TYPICAL SECTION

"C" 2+48.00 TO "C" 3+15.00
BIORETENTION AREA NO. 2
SCALE: 1" = 1'

WRECO

APPROVED DATE: 06-17-2014	REGISTERED PROFESSIONAL ENGINEER — ANALETTE A. OCHOA — No. 55279 — Exp. 12/31/14 — CIVIL — STATE OF CALIFORNIA
ANALETTE OCHOA, P.E	
WRECO	
R.C.E. # 55279 / EXPIRES 12-31-2014	DATE: 06-17-2014

COUNTY OF SAN MATEO PUBLIC WORKS

65%	04-18-2014	DESIGNED BY: AC	TYPICAL CROSS SECTIONS
95%	05-07-2014	CHECKED BY: AO	CARLOS STREET GREEN STREET
100%	06-11-2014	DRAWN BY: HY	
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS	555 COUNTY CENTER, 5th FLOOR
REVISION	DATE	SAN MATEO COUNTY	REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 06-17-2014
FILE NO.: 1/4924

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

X-1
SHEET 2 OF 18

FILENAME: G:\PROJECTS\2012\P1280 SAN MATEO CO ON-CALL FLOOD CONTROL\TO 08\DWG\TYPICAL CROSS SECTIONS.DWG (X-1)

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/15
CIVIL
STATE OF CALIFORNIA

APPROVED:

DATE: JUNE 13, 2014

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2015

NOTES:

1. OFFSET IS TO "C" LINE AND STATIONING REFERENCE SHOWN ON LAYOUT AND DETAILS.
2. FROM STA 3+45.50 TO STA 4+16.50 TRANSITION BIORETENTION SOIL DEPTH (A) AND TOP OF UNDERDRAIN PIPE CLEARANCE (B) LINEARLY, SEE TABLE.

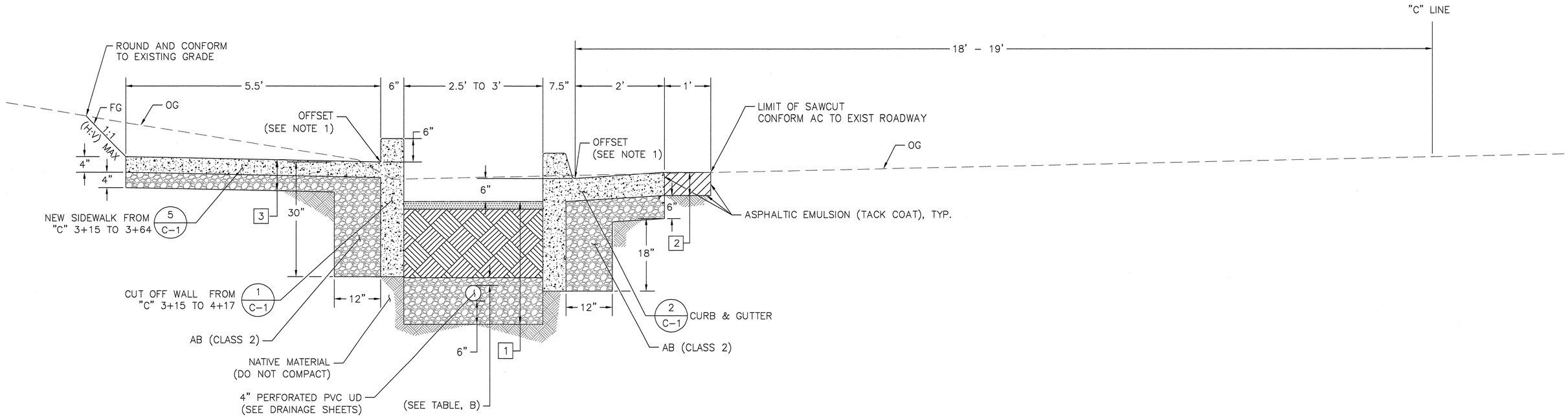
STATION	A	B (MIN)
3+15.00 TO 3+45.50	18"	2"
4+16.50 (SEE NOTE 2)	12"	0"

PAVEMENT AND BIORETENTION SECTIONS

1 — 2" MULCH
BIORETENTION SOIL (SEE TABLE, A)
12" (MIN) CLASS 2 PERMEABLE MATERIAL

2 — 6" DEEP AC (TYPE B)

3 — 4" CLASS 3 CONCRETE
4" AB (CLASS 2)



(1 / X-2) TYPICAL SECTION

"C" 3+15.00 TO "C" 4+16.50
BIORETENTION AREA NO. 2
SCALE: 1" = 1'

FILENAME: G:\PROJECTS\Y2012\P-1280 SAN MATEO CO ON-CALL FLOOD CONTROL\TO 08\DWG\[TYPICAL CROSS SECTIONS.DWG (X-2)]

WRECO

APPROVED DATE: 06-17-2014

Analette Ochoa

ANALETTE OCHOA, P.E
WRECO
R.C.E. # 55279 / EXPIRES 12-31-2014

REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

DATE: 06-17-2014

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE
65%	04-18-2014
95%	05-07-2014
100%	06-11-2014

DESIGNED BY: AC
CHECKED BY: AO
DRAWN BY: HY

TYPICAL CROSS SECTIONS
CARLOS STREET GREEN STREET

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
SAN MATEO COUNTY
555 COUNTY CENTER, 5th FLOOR
REDWOOD CITY, CALIFORNIA 94063

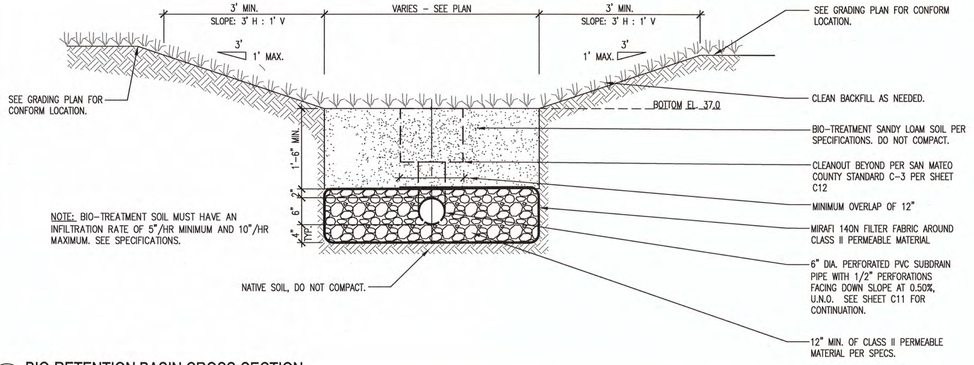
SCALE: AS SHOWN
DATE: 06-17-2014
FILE NO.: 1/4924

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3 4

X-2
SHEET 3 OF 18

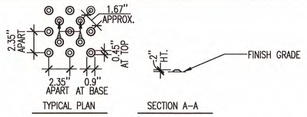
APPENDIX F:

Fitzgerald Marine Reserve Parking Lot Stormwater Treatment Details



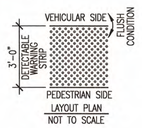
10 BIO-RETENTION BASIN CROSS-SECTION

SCALE: 3/4"=1'-0" (16) FILE NAME: NOTCH DRAWN BY: MASTER



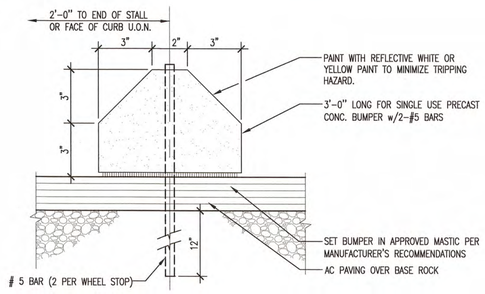
NOTES:

1. DRY-MOUNT PRE-FABRICATED DOME PANEL ON TOP OF ASPHALT PAVEMENT. INSTALL PER MANUFACTURER'S INSTRUCTIONS USING ADHESIVE PERIMETER SEALANT, AND FASTENS PROVIDED BY MANUFACTURER, ADA SOLUTIONS, INC. P.O. BOX 3, NORTH BILLERICA, MA (888) 501-9699 OR APPROVED EQUAL.
2. THE COLOR OF DETECTABLE WARNING (TRUNCATED DOMES) MUST BE YELLOW CONFORMING TO FEDERAL COLOR NO. 33538 OF STANDARD NO. 595B.



07 STAMPED TRUNCATED DOMES

SCALE: 1 1/2"=1'-0" (08) FILE NAME: MI-DOMES DRAWN BY: MASTER



04 WHEEL STOP

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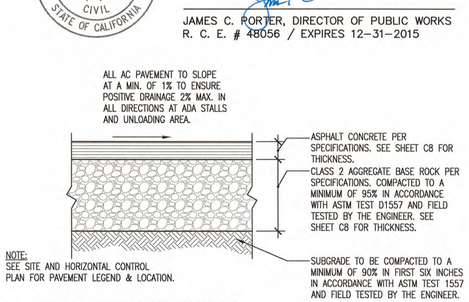


01 NEW AC PAVEMENT SECTION

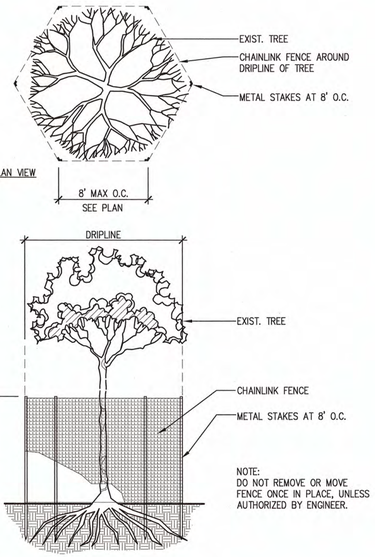
SCALE: N.T.S. (8) FILE NAME: ASHPAVE DRAWN BY: MASTER

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/15
CIVIL
STATE OF CALIFORNIA

APPROVED:

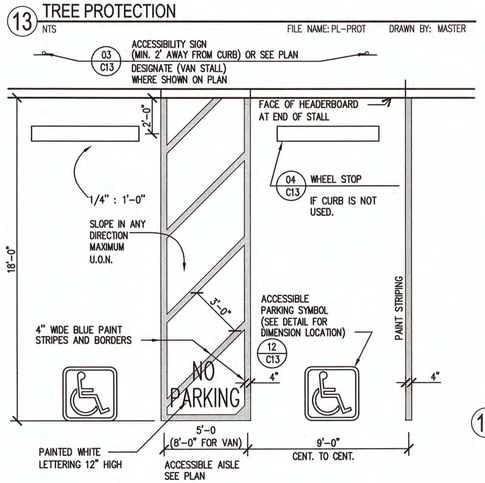
DATE: 9/19/14

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2015



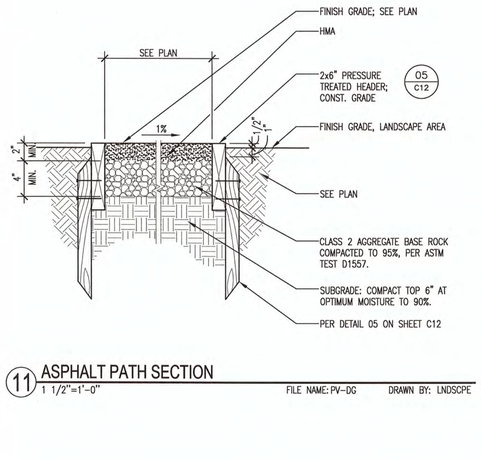
13 TREE PROTECTION

NTS FILE NAME: PL-PROT DRAWN BY: MASTER



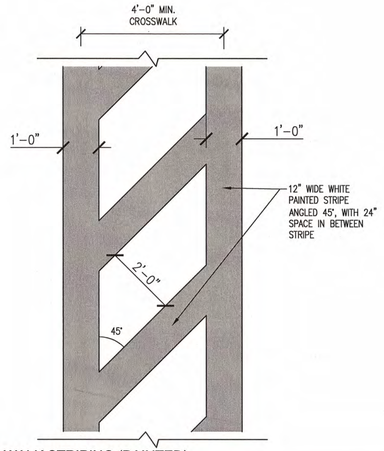
14 TYPICAL ACCESSIBLE PARKING STALL

SCALE: N.T.S. (48) FILE NAME: ACSTALL DRAWN BY: MASTER



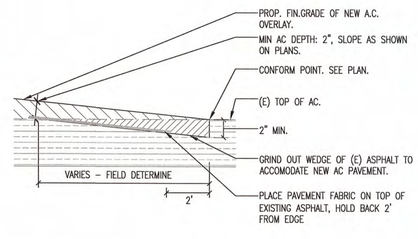
11 ASPHALT PATH SECTION

1 1/2"=1'-0" FILE NAME: PV-DG DRAWN BY: LNDSCPE



08 CROSS WALK STRIPING (PAINTED)

SCALE: 1/2" = 1'-0" (24) FILE NAME: X-WALK DRAWN BY: E.CHAN



05 WEDGE CUT AT CONFORM

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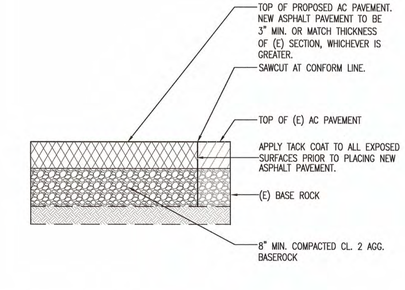

02 AC EDGE TREATMENT CONFORM

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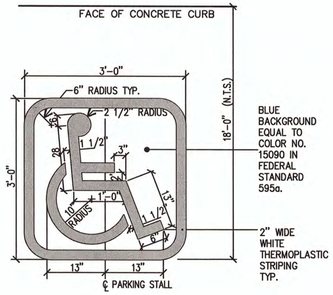

12 ACCESSIBLE PARKING SYMBOLS

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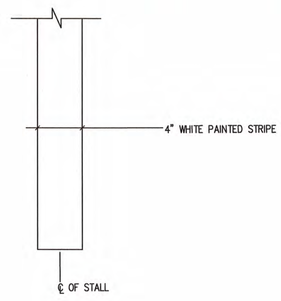
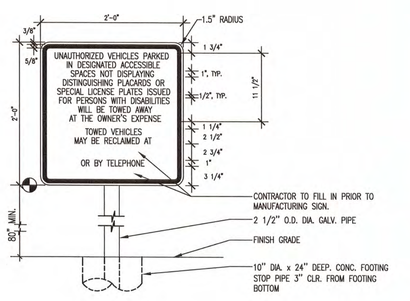


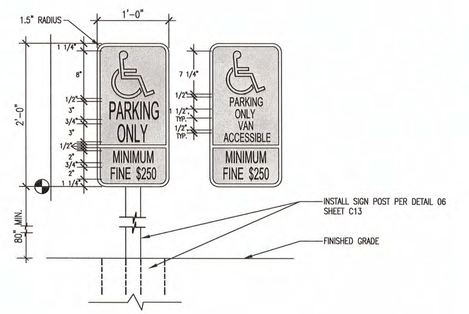
09 TYPICAL PARKING STALL STRIPING

SCALE: N.T.S.(1) FILE NAME: PARK-STL DRAWN BY: MASTER



06 ACCESSIBLE NOTICE SIGN AT ENTRANCE

SCALE: 1"=1'-0" (12) FILE NAME: ACCSIGN-2 DRAWN BY: MASTER



03 ACCESSIBLE PARKING SIGNS AT PARKING STALLS

SCALE: 1" = 1'-0" (12) FILE NAME: ACCSIGN DRAWN BY: MASTER

APPROVED DATE:	
DES ARCHITECTS + ENGINEERS	
CHRISTOPHER T. BOYLE	
R.C.E. # 40163 / EXPIRES 09-30-2016	

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER T. BOYLE
No. 40163
EXP. 9-30-16
CIVIL
STATE OF CALIFORNIA

COUNTY OF SAN MATEO PUBLIC WORKS

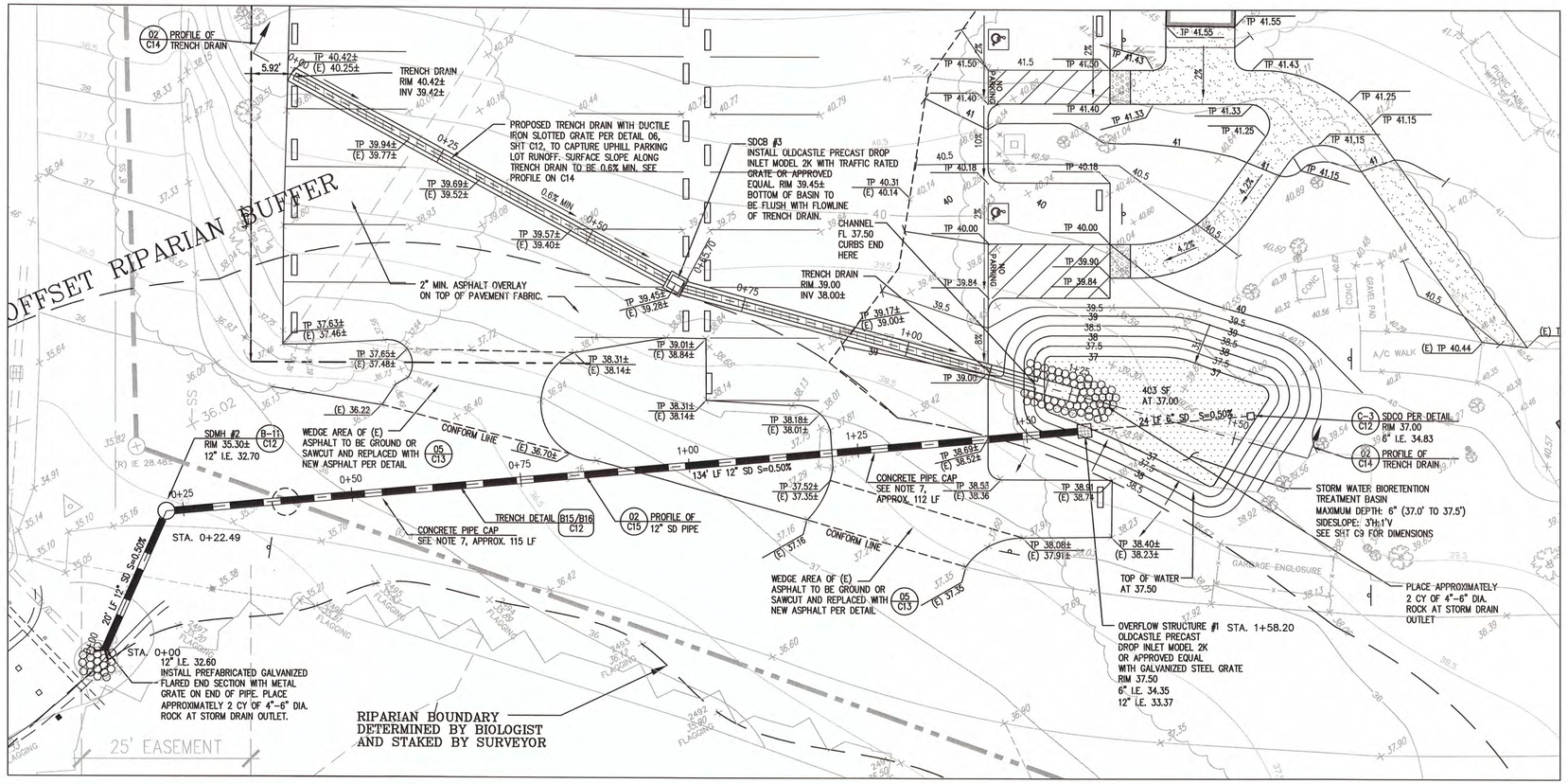
90% PACKAGE	07/03/2014	DESIGNED BY: EC	
100% PACKAGE	08/26/2014	CHECKED BY: CB	
		DRAWN BY: EC	
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY	555 COUNTY CENTER, 5TH FLOOR REDWOOD CITY, CALIFORNIA 94063
REVISION	DATE		

SITE DETAILS (SHEET 2 OF 2)

FITZGERALD MARINE RESERVE PARKING LOT UPGRADE

SCALE: AS SHOWN
DATE: 07/03/2014
FILE NO.:

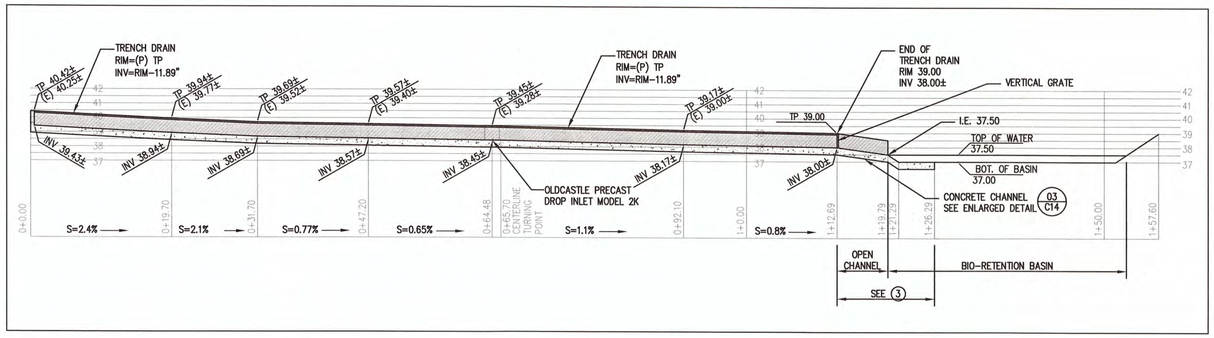
C13
SHEET 13 OF 17



1 TRENCH DRAIN AND 12" STORM DRAIN PIPE PLAN VIEW

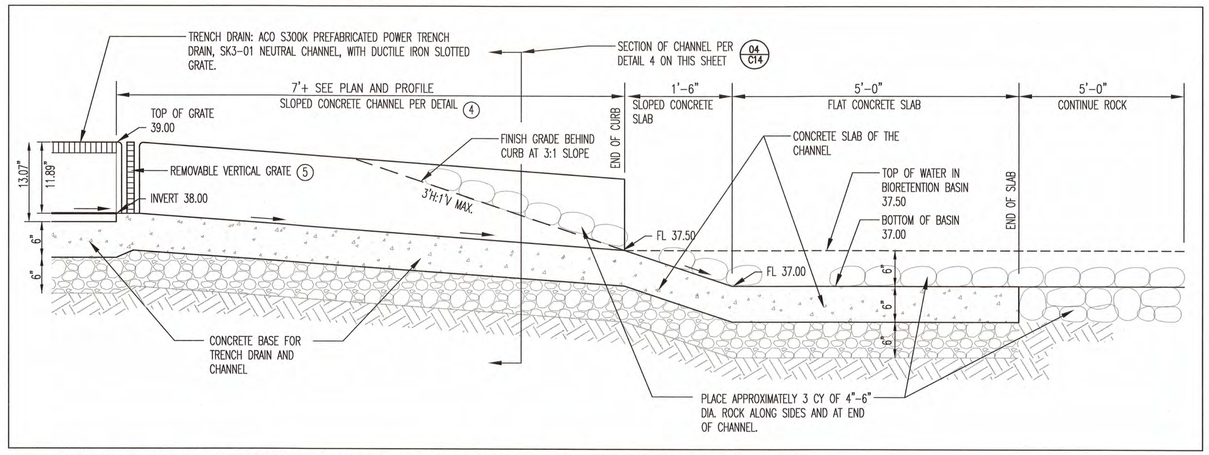
SEE C10 AND C12 FOR COMPLETE GRADING PLAN

SCALE : 1"=10'-0"



2 PROFILE OF TRENCH DRAIN

HORIZONTAL SCALE : 1"=10'-0"
VERTICAL SCALE : 1"=5'-0"



3 PROFILE OF CHANNEL FROM TRENCH DRAIN TO BIORETENTION AREA

SCALE : 1"=1'-0"

APPROVED DATE:	
DES ARCHITECTS + ENGINEERS	
CHRISTOPHER T. BOYLE	
R.C.E. # 40163 / EXPIRES 09-30-2016	

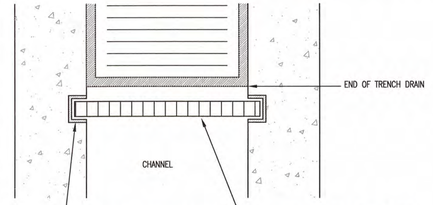
REGISTERED PROFESSIONAL ENGINEER CHRISTOPHER T. BOYLE No. 40163 EXP. 9-30-16 CIVIL STATE OF CALIFORNIA

APPROVED:

DATE: 9/19/14

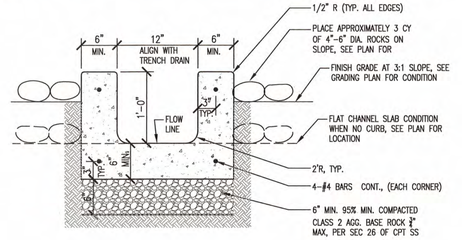
JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2015

REGISTERED PROFESSIONAL ENGINEER JAMES C. PORTER C 48056 EXPIRES 12/31/15 CIVIL STATE OF CALIFORNIA



5 REMOVABLE VERTICAL GRATE PLAN VIEW AND DETAIL

SCALE: NTS (12) FILE NAME: CHANNEL DRAWN BY: W.M.



- CONCRETE MATERIAL AND LABOR SHALL CONFORM TO ASTM C94 READY-MIXED CONCRETE, CONFORMING TO SECTIONS 73 AND 90 OF THE CALTRANS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS, CURRENT EDITION AND ADDENDUMS.
- COMPRESSIVE STRENGTH: 3,500 PSI
- MAXIMUM WATER-CEMENT RATIO: 0.50
- MAXIMUM CEMENT RATIO: 6 SACK
- FINISH: MEDIUM BROOM
- REQUIREMENT: MATERIAL AND LABOR PER SECTION 52 OF THE CDT STANDARD SPECIFICATIONS
- EXPANSION JOINTS FOR MANUFACTURER'S RECOMMENDATIONS. NO GREATER THAN 20 FEET. PLACE ½" DIAMETER X 18" LONG DOWELS AT EXPANSION JOINTS. PLACE ½" THICK EXPANSION JOINTS FULL WIDTH. ALIGN WITH TRENCH DRAIN UNIT JOINTS.

4 CONCRETE CHANNEL

SCALE: 1" = 1'-0" (12) FILE NAME: CHANNEL DRAWN BY: W.M.

COUNTY OF SAN MATEO PUBLIC WORKS

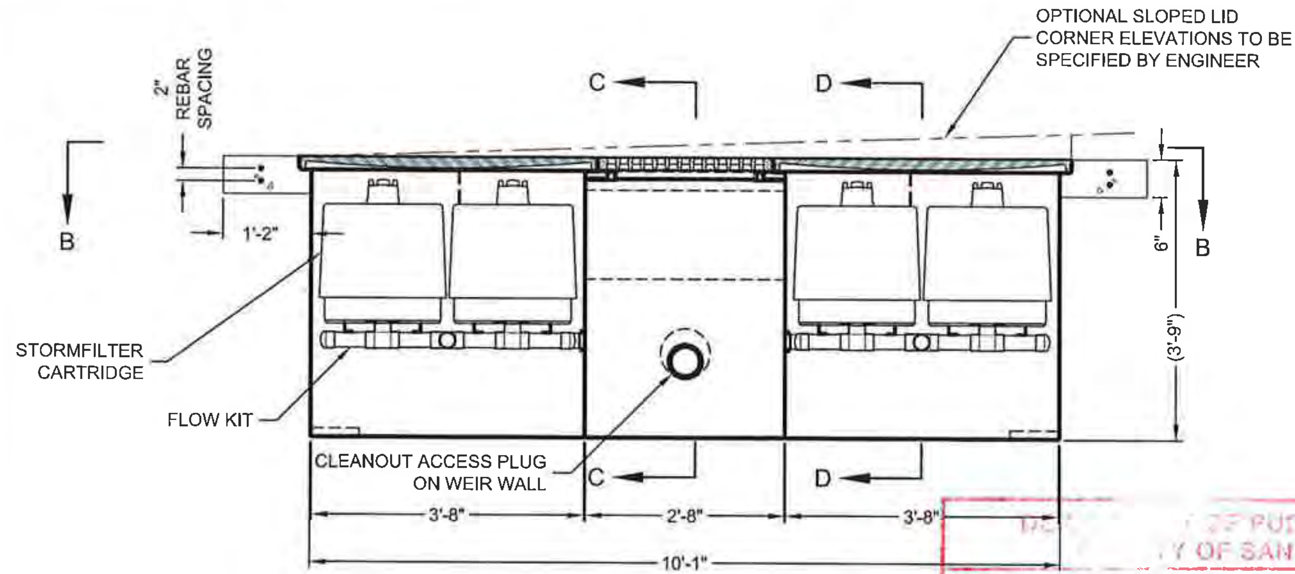
90% PACKAGE	07/03/2014	DESIGNED BY: WM	TRENCH DRAIN PLAN AND PROFILE
100% PACKAGE	08/26/2014	CHECKED BY: CB	FITZGERALD MARINE RESERVE PARKING LOT UPGRADE
		DRAWN BY: WM	JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS, SAN MATEO COUNTY
REVISION	DATE		555 COUNTY CENTER, 5TH FLOOR, REDWOOD CITY, CALIFORNIA 94063

SCALE: 1"=10'
DATE: 07/03/2014
FILE NO.:

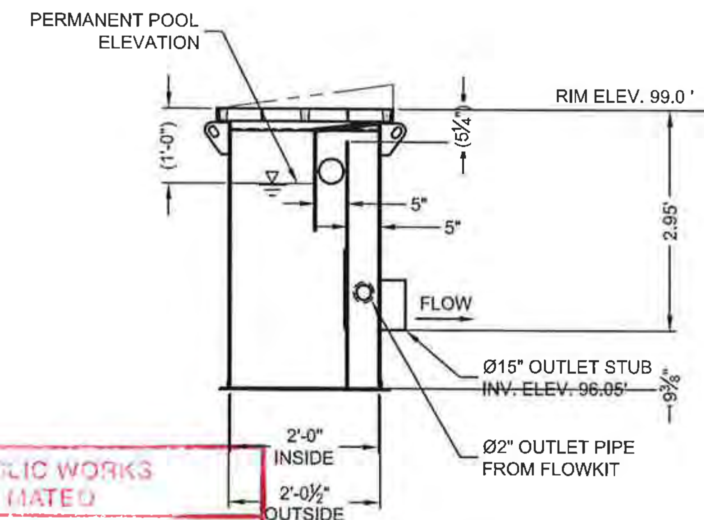
C14
SHEET 14 OF 17

APPENDIX G:

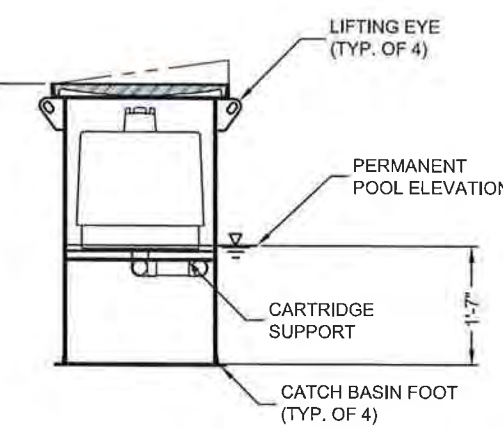
StormFilter Details



SECTION A-A
18" CARTRIDGES



SECTION C-C



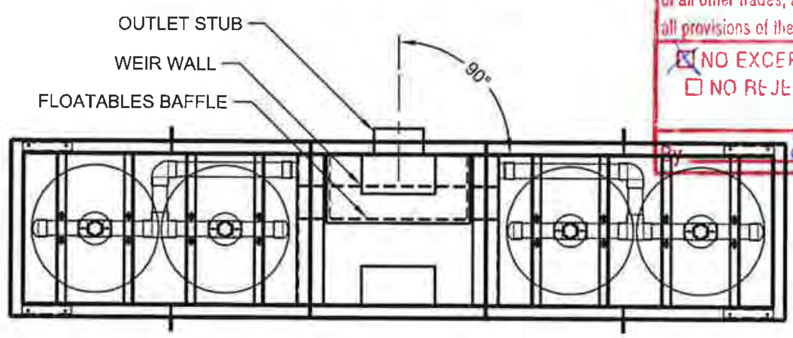
SECTION D-D

DEPARTMENT OF PUBLIC WORKS
COUNTY OF SAN MATEO

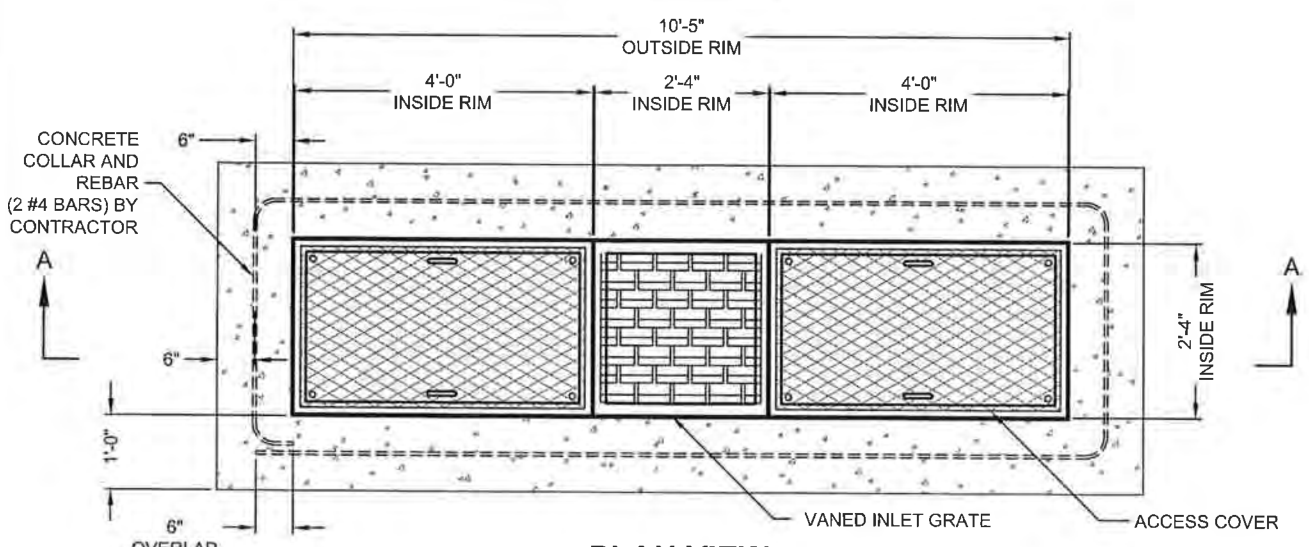
Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. The Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work. This review is subject to all provisions of the contract documents.

☒ NO EXCEPTION TAKEN ☐ MAKE CORRECTIONS NOTED
☐ NO REJECTED-RESUBMIT ☐ REVISE AND RESUBMIT
☐ SUBMIT SPECIFIED ITEM

By [signature] Date 10/22/12



SECTION B-B



PLAN VIEW

MATERIAL LIST- PROVIDED BY CONTECH

COUNT	DESCRIPTION	INSTALLED BY
4	18", 15 GPM, ZPG CARTRIDGE (BLK)	CONTECH
1	FLOW KIT	CONTECH
1	NON-POWDER COATED STEEL CATCH BASIN	CONTECH
1	28" x 28" VANED INLET COVER	
2	28" x 48" ACCESS COVER	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	NA CFS
PEAK FLOW RATE	NA CFS
RETURN PERIOD OF PEAK FLOW	NA YRS
FILTER MEDIA TYPE	ZPG

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **37 SECONDS**. SPECIFIC FLOW RATE SHALL BE 2 **GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM).**

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO HS20 LOAD RATING. FOR HS20 LOAD RATING ON STRUCTURE, CONCRETE COLLAR IS REQUIRED AND TO BE PROVIDED BY CONTRACTOR.

INSTALLATION NOTES

1. ANY SUB-BASE, AND/OR BACKFILL DEPTH ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE.
3. CONTRACTOR TO SET BOTTOM OF STRUCTURE AT LEVEL.
4. CATCHBASIN STORMFILTER EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER. MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
6. FOR H20 LOAD RATING, CONTRACTOR TO PROVIDE CONCRETE COLLAR AS SHOWN WITH QUANTITY (2) #4 REBAR.

STRUCTURE WEIGHT

APPROXIMATE HEAVIEST PICK = 2,910 LBS

CONTECH
CONTRACT
DRAWING

HILL

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Contech Engineered Solutions LLC ("Contech"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Contech. Failure to comply is done at the user's own risk and Contech expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY

4 CARTRIDGE STEEL CATCHBASIN
150412-01
SAN MATEO BMP PILOT
MOSS BEACH, CA
SITE DESIGNATION: NORTH LAKE

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-526-3999 513-645-7000 513-645-7993 FAX

The Stormwater Management StormFilter®

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,322,629; 5,624,576; 5,707,527; 5,985,157; 6,027,639; 6,649,048; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

DATE: 9/25/12	
DESIGNED:	DRAWN: N/A
CHECKED:	APPROVED:
PROJECT No.: 150412	SEQUENCE No.: 01
SHEET: 1 OF 1	

I:\MERLIN\PROJECT\ACTIVE\150400\150412\150412-1-STORMFILTER\DRAWINGS\CONTRACT\150412-01-SFCB4-CON-A.DWG 9/25/2012 11:24 AM

The Stormwater Management StormFilter® Specification

CatchBasin StormFilter™

March 2010

PART 1 GENERAL

1.1 Description

The Contractor shall furnish and install the Stormwater Management StormFilter® stormwater treatment system, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

StormFilter stormwater treatment system shall consist of an underground structure that houses passive siphon-actuated, radial-flow media-filled filter cartridges. The siphon actuated radial flow filter cartridges shall be rechargeable and shall incorporate a self actuated surface cleaning mechanism to increase the effective life of the filter media and to reduce the accumulation of material on the cartridge surface. Each radial flow filter cartridge shall operate at a predetermined flow rate through the use of an integrated flow control orifice located within each filter cartridge outlet manifold.

1.4. Manufacturer

The StormFilter stormwater treatment system shall be of a type that has been installed and in use successfully for a minimum of five (5) or more years. The StormFilter stormwater treatment system shall be supplied by CONTECH Construction Products Inc 11835 NE Glenn Widing Dr, Portland OR, 97220 (800 548-4667), without exception.

1.3 Related Sections

A. Section [ ]:

1.4 Submittals

A. CONTECH Construction Products Inc, or authorized supplier, to submit shop drawings for the StormFilter stormwater treatment system with structure, filters cartridges and accessory equipment. Drawings shall include principal dimensions, filter placement, location of piping and unit foundation.

B. CONTECH Construction Products Inc, or authorized supplier, shall submit an Operation and Maintenance Manual.

PART 2 PRODUCTS

2.1 Internal Components

Internal components shall consist of the following:

A. ABS manifold pipe shall meet ASTM specification F628. PVC manifold pipe shall meet ASTM specification D1785 and PVC fittings shall meet ASTM specification D2466.

B. Filter cartridge bottom pan, inner ring, and hood shall be constructed from linear low-density polyethylene (LLDPE) or ABS. Filter cartridge screen shall consist of 1” x ½”

welded wire fabric (16 gauge minimum) with a bonded PVC coating. Internal parts shall consist of ABS or PVC material. Siphon-priming float shall be constructed from high-density polyethylene (HDPE). All miscellaneous nuts, bolts, screws, and other fasteners shall be stainless steel or aluminum.

An orifice plate shall be supplied with each cartridge to restrict flow rate to a maximum of 22.5 gpm at system design head or as specified on drawings.

C. Filter Media: Filter media shall be provided by same manufacturer as Vertical Media Filtration System. Filter media shall consist of one or more of the following, as specified by the Engineer:

1. Perlite Media: Perlite media shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The perlite media shall have a bulk density ranging from 6.5 to 8.5 lb/ft^3 and particle sizes ranging from that passing through a 0.50 inch screen and retained on a U.S. Standard #8 sieve.

2. CSF Media: CSF media shall be made exclusively of composted fallen deciduous leaves. Filter media shall be granular. Media shall be dry at the time of installation. The CSF leaf media shall have a bulk density ranging from 40 to 50 lb/ft^3 and particle sizes ranging from that passing through a 0.50 inch screen to that retained on a U.S. Standard #8 sieve.

3. Metal Rx Media: Metal Rx media shall be made exclusively of composted fallen deciduous leaves. Filter media shall be granular. Media shall be dry at the time of installation. The Metal Rx media shall have a bulk density ranging from 40 to 50 lb/ft^3 and particle sizes ranging from that passing through a U.S. Standard #8 sieve to that retained on a U.S. Standard #14 sieve.

4. Zeolite Media: Zeolite media shall be made of naturally occurring clinoptilolite, which has a geological structure of potassium-calcium-sodium aluminosilicate. The zeolite media shall have a bulk density ranging from 44 to 48 lb/ft^3, particle sizes ranging from that passing through a U.S. Standard #4 sieve to that retained on a U.S. Standard #6 sieve, and a cation exchange capacity ranging from 1.0 to 2.2 meq/g.

5. Granular Activated Carbon: Granular activated carbon (GAC) shall be made of lignite coal that has been steam activated. The GAC media shall have a bulk density ranging from 28 to 31 lb/ft^3 and particle sizes ranging from that passing through a U.S. Standard #4 sieve to that retained on a U.S. Standard #8 sieve.

6. Zeolite-Perlite-Granular Activated Carbon (ZPG): ZPG is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% Perlite (see above) and a 1.3 ft^3 inner layer consisting of a mixture of 90% Zeolite (see above) and 10% Granular Activated Carbon (see above).

7. Zeolite-Perlite (Zeo/Perl): Zeo/Perl is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% Perlite (see above) and a 1.3 ft^3 inner layer consisting of 100% Zeolite.

8. CSF – Granular Activated Carbon (CSF/GAC): CSF/GAC is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% CSF media (see

above) and a 1.3 ft^3 inner layer consisting of 100% Granular Activated Carbon (see above).

9. Perlite – Metal Rx : Perlite/Metal Rx is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% Perlite (see above) and a 1.3 ft^3 inner layer consisting of 100% Metal Rx (see above).

10. PhosphoSorb: PhosphoSorb media shall be made from Perlite pellets with activated alumina bound to the surface. The PhosphoSorb media pellets shall be granular and have a bulk density from 18 to 25 lb/ft^3. The pellet size should range from that passing through a U.S. Standard ¼ inch sieve and retained on a #8 sieve.

2.2 STEEL CATCH BASIN COMPONENTS

A. Steel Catch Basin: Catch basin shall be all welded steel construction, fabricated from ASTM A36 ¼-inch steel and shall be designed to withstand AASHTO H-20 wheel loads.

B. Catch Basin Grate: Grating shall be ductile iron construction and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.

C. Catch Basin Solid Lid: Solid lid shall be gray cast iron, treated with non slip surfacing, and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.

2.3 CONTRACTOR-PROVIDED COMPONENTS

A. Concrete: Shall be 3000 psi, 28 day strength, ¾-inch round rock, 4-inch slump maximum, placed within 90 minutes of initial mixing, or as otherwise specified in the general technical specifications.

B. Rebar: Shall meet ASTM A-615M Grade 420 (60 ksi) or as otherwise specified in the general technical specifications.

C. Sub-Base: Shall be 6-inch minimum of ¾-inch minus rock or as otherwise specified in the general technical specifications.

D. Backfill: Shall be ¾-inch minus rock or as otherwise specified in the general technical specifications.

PART 3 EXECUTION

3.1 STEEL CATCH BASIN

A. Catch basin floor shall slope 1/4 inch maximum across the width and slope downstream 1 inch per 12 foot of length. Catch basin top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.

B. Contractor shall prevent sediment and debris from entering the filter unit during construction.

C. Contractor shall compact sub-base to 95% of maximum density or as otherwise specified by engineer. Unsuitable material below sub-grade shall be replaced as directed by engineer.

D. If necessary, the inlet chamber may be filled with clean water to assist in preventing flotation during construction until the structure is backfilled and the concrete collar is poured.

E. Contractor shall compact backfill to 95% of maximum density or as otherwise specified by engineer.

F. Catch basin outlet shall be connected to downstream (and upstream, if applicable) piping using a flexible-type coupling.

G. Concrete perimeter slab shall be constructed 1 foot wide and 6 inches thick. Slab shall include two #4 rebar hoops with minimum 6-inch overlap at closure. Allow 2-inch vertical spacing between hoops and minimum 2-inch clearance from concrete surfaces.

3.2 FILTER CARTRIDGE

Catch Basin StormFilter shall be provided complete with cartridge(s) and cartridge media installed.

3.3 CLEANUP

A. The project site shall be clean and free of dirt and debris before runoff is allowed to enter the filter. Site work shall be in a complete condition as approved by the engineer. The project site includes any surface that contributes storm drainage to the system.

B. The inlet/outlet chamber and filter chamber(s) shall be free of construction debris and sediment before the system is placed in operation.

C. Contractor shall remove the temporary filter fabric around the inlet grate to place the system in operation.

D. The 4-inch cleanout plug in the overflow weir wall shall remain in place for proper operation of the system.

3.4 Filter Cartridges

A. Filter cartridges shall be delivered with the CatchBasin. Contractor shall take appropriate action to protect the cartridges from sediment and other debris during construction. Methods for protecting the cartridges include but are not limited to:

1. Remove cartridges from the CatchBasin and store appropriately. Cartridges shall be reinstalled to operate according to 3.4 B (see below).

2. If vault is equipped with underdrain bypass piping, Contractor may leave cartridges in the vault and allow stormwater entering collection system to bypass filter bay through underdrain bypass piping.

3. Leave cartridges in the vault and plug inlet and outlet pipe to prevent stormwater from entering the vault.

The method ultimately selected shall be at Contractor's discretion and Contractor's risk.

B. Filter cartridges shall not be placed in operation until the vault is clean and the project site is clean and stabilized (construction erosion control measures no longer required). The project site includes any surface that contributes storm drainage to the StormFilter. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of dirt and sediments. Contact CONTECH Construction Products Inc to assist with system activation and/or inspect the system for proper installation once site is clean and stabilized.

PART 4 PERFORMANCE

4.1 Cartridge Operation

A. Each stormwater filtration system shall contain one or more siphon actuated media filter cartridges that maintain a uniform pressure profile across the face of the filter during operation. At the design flow rate the maximum filter hydraulic loading rate is not to exceed 2.1 gallons per minute per square foot of filter surface area. Stormwater shall enter the filter cartridges through sides and shall flow through the filter media radially from the outer perimeter to the inner cartridge lumen and shall have an average contact time no less than 38 seconds.

4.2 Documentation of Sediment Removal

A. The Filtration system should have the Washington GULD certification and approval from New Jersey DEP.

4.3 Cartridge Sediment Loading

A. Filter cartridges shall be of a design that has demonstrated a minimum sediment retention capacity of 22 pounds of silty loam per cartridge in laboratory tests without a reduction in hydraulic capacity. Laboratory data shall be corroborated with field observations showing similar longevity without impact to normal hydraulic performance of the stormwater filtration system. All laboratory and field tests submitted in support of this specification must have undergone peer review.

4.4 Overflow

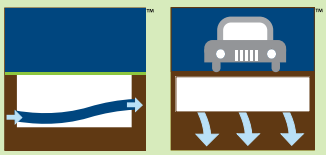
a. Each stormwater filtration system shall include an internal, offline overflow bypass. Water enters through the grate into the inlet bay that is separate from the cartridge bay and separate from the outlet bay. Low flows travel from the inlet bay, through a transfer opening and into the cartridge bay. High flows enter the outlet bay by topping the baffled weir separating the inlet and outlet bay. Flow rates beyond the design flow (overflow) will not enter the cartridge bay. Minimum of 0.5 cfs overflow capacity.

END OF SECTION




CONTECH®
ENGINEERED SOLUTIONS

The Stormwater Management Stormfilter®



Solutions Guide

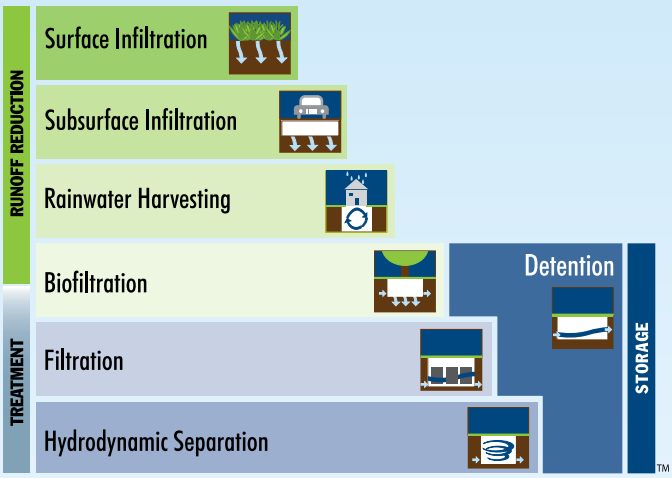
Scan Me!

URBANGREEN™

Stormwater Filtration

Selecting the right stormwater solution just got easier...

It's simple to choose the right low impact development (LID) solution to achieve your runoff reduction goals with the Contech UrbanGreen Staircase. First, select the runoff reduction practices that are most appropriate for your site, paying particular attention to pretreatment needs. If the entire design storm cannot be retained, select a treatment best management practice (BMP) for the balance. Finally, select a detention system to address any outstanding downstream erosion.



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Highly Effective Pollutant Removal

Stormwater quality standards are becoming increasingly complex, especially with the advent of total maximum daily load (TMDL) requirements. Meeting pollutant reduction goals typically requires a technology that is highly effective at removing solids and associated pollutants from stormwater. In some cases, the technology must also be capable of removing dissolved pollutants such as metals and phosphorus. Using a variety of media, filtration systems can meet that need.

For almost two decades the Stormwater Management StormFilter® has helped you meet the most stringent stormwater requirements. The system has been continually tested and refined to ensure maximum reliability and performance.

Learn more about filtration at www.ContechES.com/stormfilter

The Stormwater Management StormFilter helps you meet the most stringent stormwater requirements ❖❖❖

Choosing the Right System

The Fundamentals of Filtration

The performance and longevity of media filtration systems is governed by a number of variables that must be carefully considered when evaluating systems, including media type, media gradation, hydraulic loading rate. Understanding these variables requires careful testing and development of performance and longevity data to support proper filter design.

Media Surface Area

Filtration flow rates are typically expressed as a surface area specific operating rate such as gallons per minute per square foot (gpm/ft^2) of surface area. Lower specific operating rates translate to better performance and longer maintenance cycles. Specific operating rates higher than 2 gpm/ft^2 of media surface area negatively impact performance and longevity.

Surface vs. Radial Cartridge Filtration

When assessing filtration systems, it is important to consider whether filtration occurs primarily at the media surface or throughout a bed of media like in radial-cartridge filters. All else equal, radial-cartridge filters are longer lasting, since pollutants are captured and stored throughout the bed, as opposed to predominantly on the media surface. Radial cartridge filters capture more mass of pollutants per unit area of filter surface. Surface filters, such as membranes, are prone to rapid failure due to clogging, as pollutants occlude the media surface which requires frequent backwashing.

Media Hydraulic Conductivity and Flow Control

Filtration media is able to pass more flow per unit of media when it is new versus when it has been in operation for a while. With time, pollutants accumulate in the media bed and reduce its hydraulic capacity. It is critical that filtration devices are designed with excess hydraulic capacity to account for this loss. Also, finer media gradations remove finer particles, but have lower hydraulic capacity and occlude more rapidly. High performance and superior longevity can be achieved by controlling the flow through a more coarse media bed.

Performance: Laboratory Testing

Laboratory testing provides a means to generate hydraulic and basic performance data, but should be complimented with long-term field data. Laboratory performance trials should be executed with a fine sediment gradation such as Sil-Co-Sil 106 which has a median particle size of 22 microns. Testing with coarser gradations is not likely to be representative of field conditions.

Performance: Field Testing

Long-term field evaluations should be conducted on all filtration devices. Field studies should comply with the Technology Acceptance Reciprocity Partnership (TARP), Environmental Technology Verification (ETV) or the Technology Assessment Protocol – Ecology (TAPE) protocols. Testing should be overseen by a reputable third-party to be considered valid.

Longevity

It is essential that loading trials be conducted to evaluate the longevity of a media filter. These trials must be executed with "real" stormwater solids and not silica particles. Reliance on silica particles to assess longevity grossly overstates the loading capacity of the media and the results of such trials should not be relied on. Knowing how much mass a media filter can capture before failure allows it to be sized for a desired maintenance interval by estimating the pollutant load that will be delivered to the filter.

The Stormwater Management StormFilter®

A best management practice (BMP) designed to meet stringent regulatory requirements; the Stormwater Management StormFilter removes the most challenging target pollutants – including fine solids, soluble heavy metals, oil, and total nutrients – using a variety of media. For more than two decades, StormFilter has helped clients meet their regulatory needs and through product enhancements the design continues to be refined for ease of use.

Here's Why StormFilter is the Best Filter Available:

Superior Hydraulics

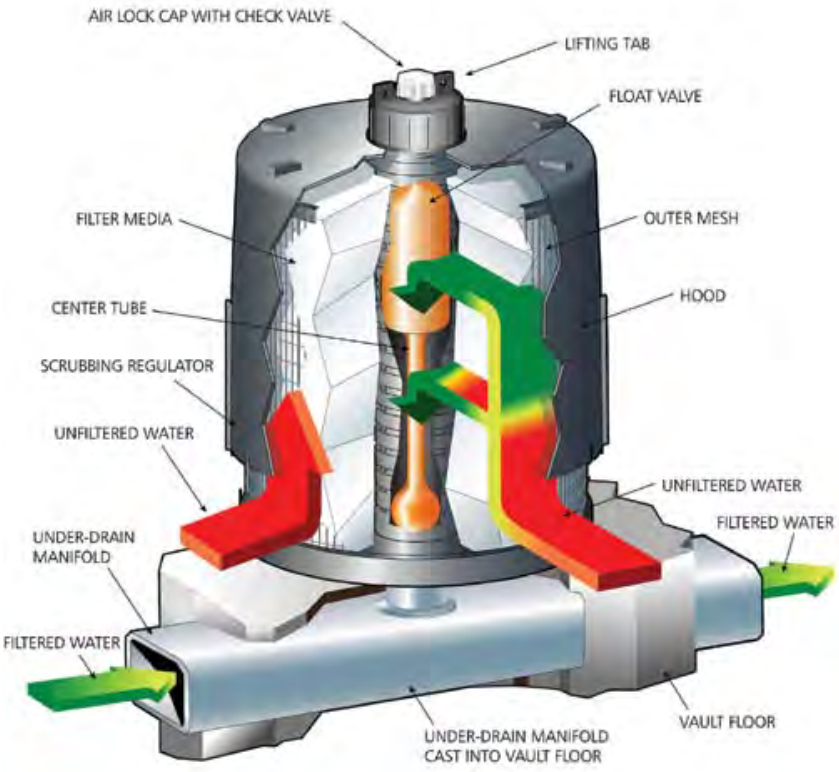
- External bypass – Protects treatment chamber from high flows and ensures captured pollutants are not lost during low frequency, high intensity storm events
- Multiple cartridge heights – Minimize head loss to fit within the hydraulic grade line and shrink system size, reducing install costs
- Over 30 StormFilter configurations in use across the country

Reliable Longevity

- One-of-a-kind self-cleaning hood – Prevents surface blinding, ensures use of all media, and prolongs cartridge life
- One to two-year maintenance cycles - Fewer maintenance events compared to similar products reduces costs over the lifetime of the system
- 15-years of maintenance experience – Predictable long-term performance comes standard

Proven Performance

- Only proven filter on the market - Performance verified by the WA Ecology and NJ DEP, and system approved for use with numerous local agencies
  - Qualifies for LEED® Sustainable Site Credit 6.2 – Stormwater Quality Control
- Achieve water quality goals with confidence – Easy approval speeds permitting
- 8th Generation Product – Design refined and perfected over two decades of research and experience
- Full-scale testing at more than 10 sites around the United States



Underground System Maximizes Land Use and Development Profitability

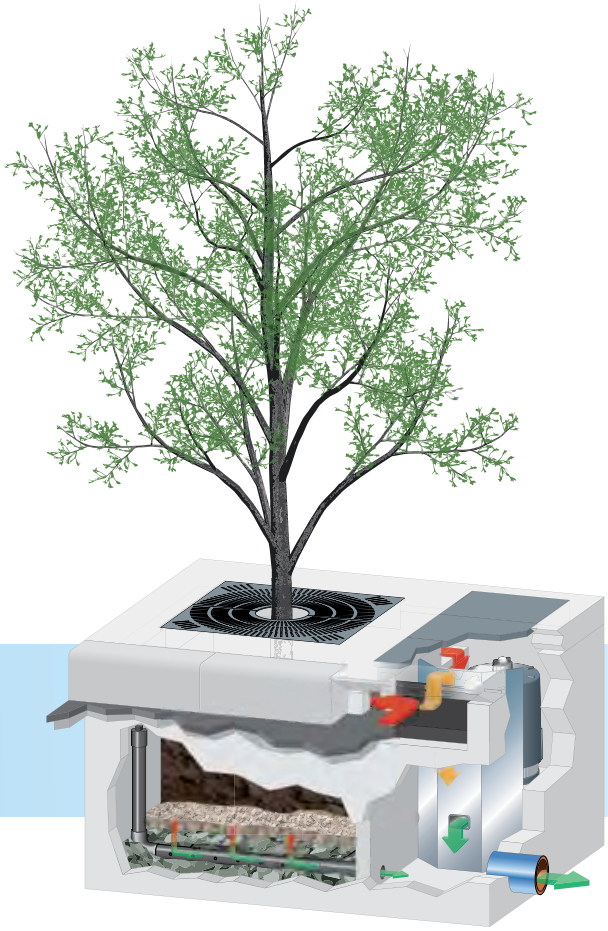
- Save land space, allow denser development and reduce sprawl
- Add parking, increase building size, develop outparcels by eliminating aboveground systems
- Compact design reduces construction and installation costs by limiting excavation

Patented Siphon-Actuated Filtration

During a storm, runoff passes through the filtration media and starts filling the cartridge center tube. Air below the hood is purged through a one-way check valve as the water rises. When water reaches the top of the float, buoyant forces pull the float free and allow filtered water to drain.

After the storm, the water level in the structure starts falling. A hanging water column remains under the cartridge hood until the water level reaches the scrubbing regulators at the bottom of the hood. Air then rushes through the regulators releasing water and creating air bubbles that agitate the surface of the filter media, causing accumulated sediment to drop to the vault floor. This patented surface-cleaning mechanism helps restore the filter's permeability between storm events.

See the StormFilter in action at www.ContechES.com/stormfilter



Self-cleaning hood prevents surface blinding, ensures use of all media, and prolongs cartridge life

❖❖❖

The StormFilter cartridges can also be utilized in our UrbanGreen BioFilter to expand the system's capacity and extend maintenance intervals. Find out more at www.ContechES.com/biofilter

Configurations and Applications

The StormFilter technology can be configured to meet your unique site requirements. Here are a few of the most common configurations, however many other configurations are available. Please contact your Contech Project Consultant to evaluate the best options for your site or find out more in the **StormFilter Configuration Guide available on www.ContechES.com/stormfilter.**

Upstream Treatment Configurations

The following suite of StormFilter configurations are easily incorporated on sites where LID site design is recommended. These low-cost, low-drop, point-of-entry systems also work well when you have a compact drainage area.

CatchBasin StormFilter

- Combines a catch basin, a high flow bypass device, and a StormFilter cartridge in one shallow structure
- Treats sheet flow
- Uses drop from the inlet grate to the conveyance pipe to drive the passive filtration cartridge
- No confined space required for maintenance

CatchBasin StormFilter

Curb Inlet

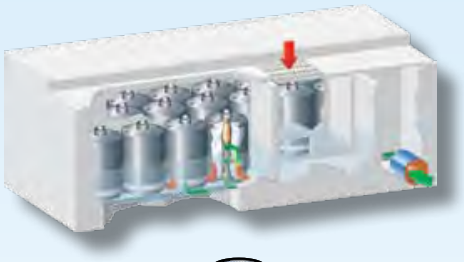
- Accommodates curb inlet openings from 3 to 10 feet long
- Uses drop from the curb inlet to the conveyance pipe to drive the passive filtration cartridges

Curb Inlet

Linear Grate

- Can be designed to meet volume based sizing requirements
- Can be installed in place of and similar to a typical catch basin
- No confined space entry required for maintenance
- Accommodates up to 29 StormFilter cartridges

Linear Grate

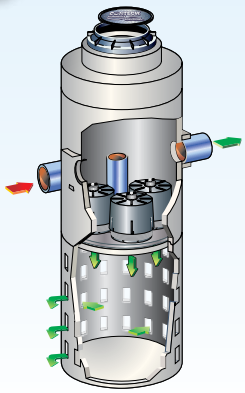


Infiltration/Retrofit Configuration

Infiltration

- Provides treatment and infiltration in one structure
- Available for new construction and retrofit applications
- Easy installation

Infiltration



Roof Runoff Treatment Configuration

DownSpout

- Easily integrated into existing gutter systems to treat pollution from rooftop runoff
- Fits most downspout configurations and sizes; single or dual-cartridge models available
- Treats up to 14,000 square feet of rooftop area per dual-cartridge system

DownSpout StormFilter

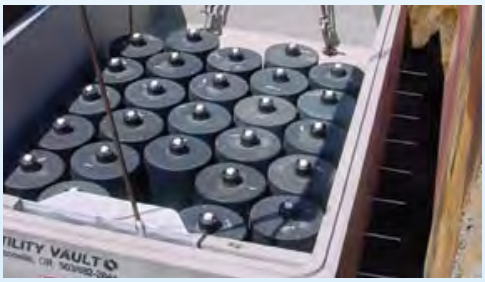
Downstream Treatment Configurations

Conventional stormwater treatment involves collecting, conveying and treating stormwater runoff with an end of pipe treatment system before discharging off-site. StormFilter configurations suitable for these applications are listed below and can be engineered to treat a wide range of flows.

Vault / Manhole

- Treats small to medium sized sites
- Simple installation - arrives on-site fully assembled
- May require off-line bypass structure

Vault



High Flow

- Treats flows from large sites
- Consists of large, precast components designed for easy assembly on-site
- Several configurations available, including: CON/SPAN®, Panel Vault, Box Culvert, or Cast-In-Place

High Flow

Volume

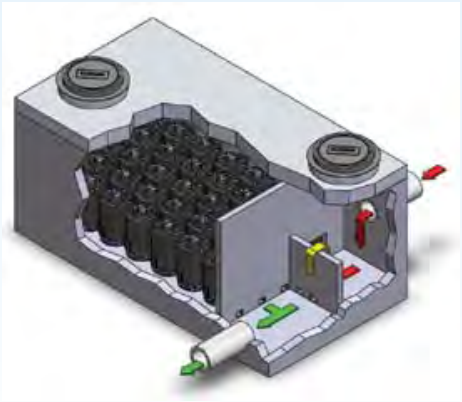
- Meets volume-based stormwater treatment regulations
- Captures and treats specific water quality volume (WQv)
- Provides treatment and controls the discharge rate
- Can be designed to capture all, or a portion, of the WQv

Manhole

Peak Diversion

- Provides off-line bypass and treatment in one structure
- Eliminates material and installation cost of additional structures to bypass peak flows
- Reduces the overall footprint of the treatment system, avoiding utility and right-of-way conflicts
- Internal weir allows high peak flows with low hydraulic head losses
- Accommodates large inlet and outlet pipes (up to 36") for high flow applications

Peak Diversion



Media Options

Our filtration products can be customized using different filter media to target site-specific pollutants. A combination of media is often recommended to maximize pollutant removal effectiveness.

PhosphoSorb™ is a lightweight media built from a Perlite-base that removes total phosphorus (TP) by adsorbing dissolved-P and filtering particulate-P simultaneously.

Perlite is naturally occurring puffed volcanic ash. Effective for removing TSS, oil and grease.

CSF® Leaf Media and MetalRx™ are created from deciduous leaves processed into granular, organic media. CSF is most effective for removing soluble metals, TSS, oil and grease, and buffering acid rain. MetalRx, a finer gradation, is used for higher levels of metal removal.

Zeolite is a naturally occurring mineral used to remove soluble metals, ammonium and some organics.

GAC (Granular Activated Carbon) has a micro-porous structure with an extensive surface area to provide high levels of adsorption. It is primarily used to remove oil and grease and organics such as PAHs and phthalates.

	PhosphoSorb	Perlite	CSF	MetalRx	Zeolite	GAC
Sediments	•	•	•			
Oil and Grease	•	•	•	•		
Soluble Metals	•		•	•	•	
Organics			•	•		•
Nutrients	•	•	•	•	•	
Total Phosphorus	•					

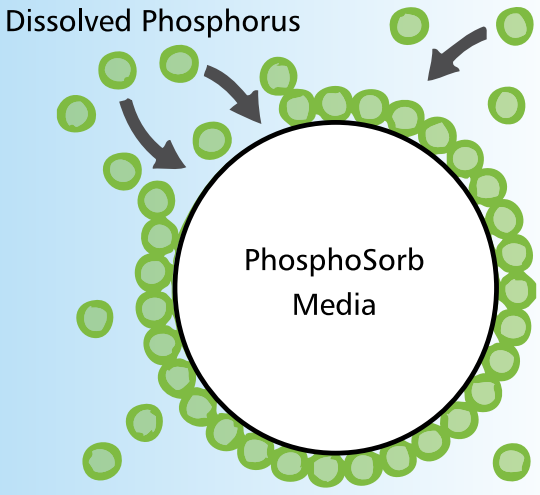
Note: Indicated media are most effective for associated pollutant type. Other media may treat pollutants, but to a lesser degree.

ZPG™ media, a proprietary blend of zeolite, perlite, and GAC, is also available and provides an alternative where leaf media cannot be used.

Focus on Phosphorous

Stormwater runoff with elevated phosphorus concentration can significantly impair water quality. More stringent stormwater regulations calling for higher levels of phosphorus removal are currently being implemented. To meet these requirements, more than just the physical separation of particulate P is needed. That's where the PhosphoSorb media can help.

A cost-effective, lightweight, adsorptive filtration media, PhosphoSorb offers the effective adsorption capacity of dissolved phosphorus and retention capacity of particulate phosphorus. Initial field results suggest removal of greater than 65% of the total phosphorus load can be expected when influent concentrations exceed 0.1 mg/l, and the media can remain in operation for more than 1 year without requiring maintenance due to media occlusion.

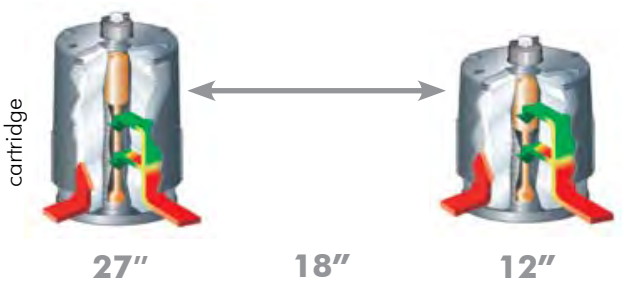


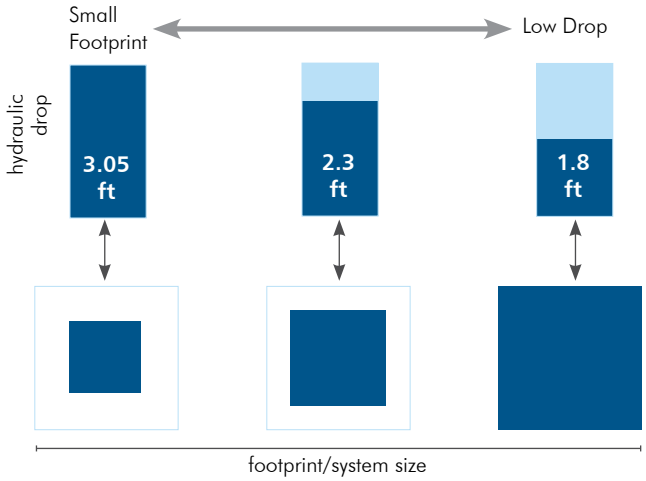
Cartridge Options

With multiple cartridge heights available, you have a choice when fitting a StormFilter system onto your site.

The 27" cartridge provides 50% more treatment per square foot of system than the 18" cartridge. So, you are meeting the same treatment standards with fewer cartridges, which means a smaller system.

If you are limited by hydraulic constraints, choose our low drop cartridge, which provide filtration treatment with only 1.8 feet of headloss.





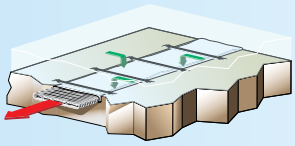
Cartridge Flow Rates

Cartridge Type	Hydraulic Drop	Treatment Capacity (gpm)	
		1 gpm/ft2	2 gpm/ft2
StormFilter 27"	3.05 feet	11.25	22.5
StormFilter 18"	2.3 feet.	7.5	15
StormFilter Low Drop	1.8 feet	5	10
MFS 22"	2.3 feet	9	18
MFS 12"	1.4 feet	5	10

Multiple cartridge heights are available to meet your hydraulics needs ❖❖❖

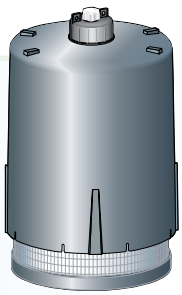
StormFilter Accessories

Drain-Down



- Provides complete dewatering of the StormFilter vault by gradually removing residual water in the sump after the storm event
- Aids in vector control by eliminating mosquito-breeding habitat
- Eliminates putrefaction and leaching of collected pollutants
- Lowers maintenance cost by reducing decanting and disposal volume

Sorbent Hood Cover



- Absorbs free surface oil and grease on contact
- Will not release captured oil, even when saturated
- Made from recycled synthetic fiber

Cartridge Lifting Hook

- Specially designed to help you easily lift cartridges during maintenance

Maintenance

Longevity is a function of applying existing filtration physics to the maximum extent possible in order to decrease maintenance frequency without sacrificing performance. Maintenance is an integral part of ensuring long term effectiveness of a filter system. The quality of treatment can only be guaranteed by a well maintained structure, whether it is proprietary or nonproprietary. The notion that some BMPs, including low impact development (LID) structures, have no maintenance cost burden is a misconception.

Longer Maintenance Intervals Reduce Life Cycle Costs

Maintenance intervals can be a large unseen cost for developers and owners. Including a maintenance interval in the product specification will ensure that no one is surprised with high long term costs.

The Stormwater Management StormFilter can be designed with up to a 2 year maintenance interval, proven by over a decade of installations, which can greatly reduce costs. Our filter cartridges are made with 60% of recyclable material.

Ease of Maintenance Matters

The StormFilter has been optimized over time to make maintenance easy. Cartridges feature a 1/4 turn connector, so they can be quickly removed and installed. A removable hood allows for effortless access to spent media, especially compared to sealed systems that require cutting the cartridge hood. Finally, all StormFilter structures can be accessed without restriction for inspection, media replacement, and washing of structure.

Experience Counts

Contech has over 120,000 StormFilter cartridges in use throughout the country. We have a plant dedicated to the production of filtration cartridges based in Portland, OR, that supports maintenance events with exchange of full cartridge and maintenance contracts. All cartridge components go through a QA/QC review at the refilling point to ensure that the correct media gradation is supplied and that it is packed properly which provides reliable operation and performance.

Not All Stormwater Filtration Systems are the Same

When you choose the Stormwater Management StormFilter, you are choosing the industry leading technology. Our experienced design engineers can help you design the system that will work for your site and your budget.

View a StormFilter maintenance event at www.contech-cpi.com/stormfilter

Maintenance Required If:

Greater than 4" of sediment is on the structure floor

Greater than ¼" of sediment is on the top of the cartridges

Great than 4" of standing water in vault for more than 24 hours after a storm

Annual StormFilter vault inspection is recommended and it doesn't require confined space entry ❖❖❖

Pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Spent filter media can be dumped directly onto the structure floor, so the emptied lightweight cartridges can be easily removed, thus eliminating the need for handling heavy units.

Easy to access treatment system can make a difference in maintenance expenses.

StormFilter structures can be accessed without confined space for inspection.

The quality of treatment can only be guaranteed by a well maintained structure

❖❖❖

Next Steps

Learn more

Read our white paper, *Evaluation of Stormwater Filtration Systems*, to learn more. You'll receive free PDH credits for completing a quick quiz.
Available at **www.ContechES.com/stormfilter**

Connect with us

We're always available to make your job easier. Search for your local rep a **www.ContechES.com.** While you're there, be sure to check out our upcoming seminar schedule or request an in-house technical presentation.

Start a Project

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CONTECH®
ENGINEERED SOLUTIONS

OPERATION AND MAINTENANCE

CatchBasin StormFilter™

Important: These guidelines should be used as a part of your site stormwater plan.

Overview

The CatchBasin StormFilter™ (CBSF) consists of a multi-chamber steel, concrete, or plastic catch basin unit that can contain up to four StormFilter cartridges. The steel CBSF is offered both as a standard and as a deep unit.

The CBSF is installed flush with the finished grade and is applicable for both constrained lot and retrofit applications. It can also be fitted with an inlet pipe for roof leaders or similar applications.

The CBSF unit treats peak water quality design flows up to 0.13 cfs, coupled with an internal weir overflow capacity of 1.0 cfs for the standard unit, and 1.8 cfs for the deep steel and concrete units. Plastic units have an internal weir overflow capacity of 0.5 cfs.

Design Operation

The CBSF is installed as the primary receiver of runoff, similar to a standard, grated catch basin. The steel and concrete CBSF units have an H-20 rated, traffic bearing lid that allows the filter to be installed in parking lots, and for all practical purposes, takes up no land area. Plastic units can be used in landscaped areas and for other non-traffic-bearing applications.

The CBSF consists of a sumped inlet chamber and a cartridge chamber(s). Runoff enters the sumped inlet chamber either by sheet flow from a paved surface or from an inlet pipe discharging directly to the unit vault. The inlet chamber is equipped with an internal baffle, which traps debris and floating oil and grease, and an overflow weir. While in the inlet chamber, heavier solids are allowed to settle into the deep sump, while lighter solids and soluble pollutants are directed under the baffle and into the cartridge chamber through a port between the baffle and the overflow weir.

Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in the cartridge's center tube from where it is directed by an under-drain manifold to the outlet pipe on the downstream side of the overflow weir and discharged.

When flows into the CBSF exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge bay, and discharges to the outlet pipe.

Applications

The CBSF is particularly useful where small flows are being treated or for sites that are flat and have little available hydraulic head to spare. The unit is ideal for applications in which standard catch basins are to be used. Both water quality and catchment issues can be resolved with the use of the CBSF.

Retro-Fit

The retrofit market has many possible applications for the CBSF. The CBSF can be installed by replacing an existing catch basin without having to "chase the grade," thus reducing the high cost of re piping the storm system.

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CatchBasin StormFilter™

Maintenance Guidelines

Maintenance procedures for typical catch basins can be applied to the CatchBasin StormFilter (CBSF). The filter cartridges contained in the CBSF are easily removed and replaced during maintenance activities according to the following guidelines.

1. Establish a safe working area as per typical catch basin service activity.
2. Remove steel grate and diamond plate cover (weight 100 lbs. each).
3. Turn cartridge(s) counter-clockwise to disconnect from pipe manifold.
4. Remove 4" center cap from cartridge and replace with lifting cap.
5. Remove cartridge(s) from catch basin by hand or with vactor truck boom.
6. Remove accumulated sediment via vactor truck (min. clearance 13" x 24").
7. Remove accumulated sediment from cartridge bay. (min. clearance 9.25" x 11").
8. Rinse interior of both bays and vactor remaining water and sediment.
9. Install fresh cartridge(s) threading clockwise to pipe manifold.
10. Replace cover and grate.
11. Return original cartridges to Contech for cleaning.

Media may be removed from the filter cartridges using the vactor truck before the cartridges are removed from the catch basin structure. Empty cartridges can be easily removed from the catch basin structure by hand. Empty cartridges should be reassembled and returned to Contech as appropriate.

Materials required include a lifting cap, vactor truck and fresh filter cartridges. Contact Contech for specifications and availability of the lifting cap. The vactor truck must be equipped with a hose capable of reaching areas of restricted clearance. the owner may refresh spent cartridges. Refreshed cartridges are also available from Contech on an exchange basis. Contact the maintenance department of Contech at 503-258-3157 for more information.

Maintenance is estimated at 26 minutes of site time. For units with more than one cartridge, add approximately 5 minutes for each additional cartridge. Add travel time as required.

Mosquito Abatement

In certain areas of the United States, mosquito abatement is desirable to reduce the incidence of vectors.

In BMPs with standing water, which could provide mosquito breeding habitat, certain abatement measures can be taken.

1. Periodic observation of the standing water to determine if the facility is harboring mosquito larvae.
2. Regular catch basin maintenance.
3. Use of larvicides containing Bacillus thuringiensis israelensis (BTI). BTI is a bacterium toxic to mosquito and black fly larvae.

In some cases, the presence of petroleum hydrocarbons may interrupt the mosquito growth cycle.

Using Larvicides in the CatchBasin StormFilter

Larvicides should be used according to manufacturer's recommendations.

Two widely available products are Mosquito Dunks and Summit B.t.i. Briquets. For more information, visit http://www.summitchemical.com/mos_ctrl/d efault.htm.

The larvicide must be in contact with the permanent pool. The larvicide should also be fastened to the CatchBasin StormFilter by string or wire to prevent displacement by high flows. A magnet can be used with a steel catch basin.

For more information on mosquito abatement in stormwater BMPs, refer to the following: http://www.ucmrp.ucdavis.edu/publications/managingmosquitoesstormwater8125.pdf

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StormFilter Maintenance Guidelines

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site, and may be required in the event of a chemical spill or due to excessive sediment loading.

Maintenance Procedures

Although there are other effective maintenance options, CONTECH recommends the following two step procedure:

1. Inspection: Determine the need for maintenance.

2. Maintenance: Cartridge replacement and sediment removal.

Inspection and Maintenance Activity Timing

At least one scheduled inspection activity should take place per year with maintenance following as warranted.

First, inspection should be done before the winter season. During which, the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, maintenance should be performed during periods of dry weather.

In addition, you should check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation. It may be necessary to adjust the inspection/maintenance activity schedule depending on the actual operating conditions encountered by the system.

Generally, inspection activities can be conducted at any time, and maintenance should occur when flows into the system are unlikely.

Maintenance Activity Frequency

Maintenance is performed on an as needed basis, based on inspection. Average maintenance lifecycle is 1-3 years. The primary factor controlling timing of maintenance of the StormFilter is sediment loading. Until appropriate timeline is determined, use the following:

Inspection:

One time per year

After major storms

Maintenance:

As needed

Per regulatory requirement

In the event of a chemical spill

Inspection Procedures

It is desirable to inspect during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and CONTECH immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. Use the following as a general guide. (Other factors, such as regulatory requirements, may need to be considered)

1. Sediment loading on the vault floor. If >4" of accumulated sediment, then go to maintenance.
2. Sediment loading on top of the cartridge. If >1/4" of accumulation, then go to maintenance.
3. Submerged cartridges. If >4" of static water in the cartridge bay for more that 24 hrs after end of rain event, then go to maintenance.
4. Plugged media. If pore space between media granules is absent, then go to maintenance.
5. Bypass condition. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), then go to maintenance.
6. Hazardous material release. If hazardous material release (automotive fluids or other) is reported, then go to maintenance.
7. Pronounced scum line. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, then go to maintenance.
8. Calendar Lifecycle. If system has not been maintained for 3 years, then go to maintenance.

Assumptions:

No rainfall for 24 hours or more.

No upstream detention (at least not draining into StormFilter).

Structure is online. Outlet pipe is clear of obstruction. Construction bypass is plugged.

Maintenance

Depending on the configuration of the particular system, workers will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flow is occurring.

Replacement cartridges can be delivered to the site or customers facility. Contact CONTECH for more information.

Warning: In the case of a spill, the worker should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and CONTECH immediately.

To conduct cartridge replacement and sediment removal:

1. If applicable, set up safety equipment to protect workers and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that workers enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Unscrew (counterclockwise rotations) each filter cartridge from the underdrain connector. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact CONTECH for suggested attachment devices.

Important: Cartridges containing leaf media (CSF) do not require unscrewing from their connectors. Do not damage the manifold connectors. They should remain installed in the manifold and can be capped during the maintenance activity to prevent sediments from entering the under drain manifold.

B. Remove the used cartridges (up to 250 lbs.) from the vault.

Important: Avoid damaging the cartridges during removal and installation.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps A through C until all cartridges have been removed.

Method 2:

A. Enter the vault using appropriate confined space protocols.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood screws (3) hood and float.

D. At location under structure access, tip the cartridge on its side.

Important: Note that cartridges containing media other than the leaf media require unscrewing from their threaded connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and capped if necessary.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through E until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. Use vacuum truck for highest effectiveness.
9. Once the sediments are removed, assess the condition of the vault and the connectors. The connectors are short sections of 2-inch schedule 40 PVC, or threaded schedule 80 PVC that should protrude about 1" above the floor of the vault. Lightly wash down the vault interior.
   a. Replace any damaged connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used empty cartridges to CONTECH.

Material Disposal

The accumulated sediment must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals. Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with applicable waste disposal regulations. Coordinate disposal of solids and liquids as part of your maintenance procedure. Contact the local public works department to inquire how they disposes of their street waste residuals.

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See the CONTECH standard quotation or acknowledgement for applicable warranties and other terms and conditions of sale.
The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; related foreign patents or other patents pending.

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Stormwater Inspection Report

North Lake Street

REPORT CONTENTS

This report contains information regarding the results off the BMP(s) inspection performed at North Lake Street site.
The following information is provided for each BMP:

Inspection Date
Inspector Information
Weather Conditions
BMP Location
BMP Designation, Type and Configuration
Sediment, Water, and Hydrocarbon Levels if present
BMP overall Condition
BMP Components Condition
Additional Comments and Observations
Inspection Photos
Any further recommended Action

INSPECTION SUMMARY

Based on the results of an inspection of BMP(s), the following action was completed:

☐ All inspected BMPs are operating within manufacturer's established specifications. Next inspection to take place prior to Winter 2014

☐ Repairs to one or more off the inspected BMPs is required.

☑ Full service maintenance of one or more of the inspected BMP(s) is being recommended. See report specifics for details.

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Stormwater Inspection Report

PROJECT INFORMATION

Name North Lake St **Project#**

Address 279 North Lake St, Moss Beach, Ca

INSPECTION DETAILS

Field Manager John Roope **System ID** .01

Date 2/22/2014 **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF **MEDIA TYPE** ZPG

CONFIGURATION Catch Basin **CARTRIDGE#** Three

SIZE 4 cartridge

Sediment Depth - Sump 8" **Pronounced Scum Line?** Yes

Sediment Depth - Cartridge Bay 7" **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 19"

Physical Condition of Unit: Unit appears to be in good working condition.

Field Managers Comments:

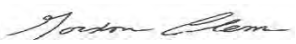
Inspection completed and system appears to be treating runoff as designed. ZPG media has impacted outside layer. Maintenance is being recommended due to the scum line 2" below the rim elevation of gutter pan.

Maintenance Required? Yes **Repairs Required?** No

MAINTENANCE AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem **Company:** Pacific Stormwater BMP Solutions

Signature:  **Date:** 2/22/14

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Inspection Report

INSPECTION PHOTOS

Site location

Unit location

Sediment on top

Sediment on top

Inlet Bay

8" Sediment

Scumline above top of filter cartridge

ZPG media

STORMWATER TREATMENT UNIT

MAINTENANCE COMPLIANCE 2014

North Lake St
279 North Lake St
Moss Beach, Ca.

Let it be known that on the 22nd of February 2014 the CONTECH stormwater management SFCB with Four ZPG cartidge filter system was inspected by a qualified professional at a frequency and in a manner consistent with the manufacturer's guidelines for general inspection and maintenance. All systems are operating as designed. Maintenance is being recommended at this time.

Therefore, based on these activities and by signed authorization below, this hereby certifies that the StormFilter Stormwater treatment systems at the above referenced location are currently performing as designed.

CERTIFICATE AUTHORIZATION

Gordon Clem
Maintenance Manager
Pacific Stormwater BMP Solutions
3/7/14

Pacific Stormwater BMP Solutions

Stormwater Compliance Report 2014

North Lake Street

prepared by:

Pacific Stormwater BMP Solutions,LLC
Phone 707.544.5012
www.pacstorm.com

REPORT CONTENTS

This report contains information regarding the results off the BMP(s) inspected at the referenced site.

The following information is provided for each BMP:

Maintenance Date

Maintenance Information
Weather Conditions
BMP Location
BMP Designation, Type and Configuration
Sediment, Water, and Hydrocarbon Levels
BMP Maintenance Condition
BMP Physical Condition
Additional Comments and Observations
Maintenance Photos (where applicable)
Recommended Action
Certificate of Compliance (if applicable)

MAINTENANCE SUMMARY

Based on the results of the inspection BMP(s), the following action is recommended:

☑ All Storm water treatment devices are operating within manufacturer's established specifications. Next inspection recommended: March 2015

☐ Repairs to one or more off the inspected BMPs was required. See report specifics for details.

☑ Routine maintenance of one or more of the inspected BMPs was completed. See report specifics for details.

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Stormwater Compliance Report

PROJECT INFORMATION

Name 279 North Lake Street
Address North Lake Street
Moss Beach, Ca

Project#

Maintenance Details Unit #1

Manager Gordon Clem
Date 5/20/2014

System ID
GPS Coordinates

Weather Dry

SYSTEM TYPE StormFilter SF
CONFIGURATION Catch Basin
SIZE 4 cartridge

MEDIA TYPE ZPG
CARTRIDGE# 4

Sediment Depth - Cartridge Bay 8"
Sediment Depth - Inlet bay 13"
Sediment Depth - Top of Cartridges .5"
Water Level 19"

Pronounced Scum Line? Yes
Excessive Hydrocarbons? Yes

Physical Condition of Units: Unit appears to be in good working condition.

Field Comments:
System in good working order. Full service maintenance was completed in accordance with manufacturers recommendations. All sediment was removed and Four cartridge filters were replaced with manufacturer supplied ZPG cartridge. System is ready for Winter 2014.

Maintenance completed? Yes
Repairs Required? No

MAINTENANCE AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem
Company: **Pacific Stormwater Solutions**, Inc.

Signature: Gordon Clem
Date: 5/20/14

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Compliance Report

Maintenance Photos

Site location

System prior to maintenance beginning

Spent filters removed
sediment removal

All sediment removed from inlet bay of Catch Basin

Clean catch basin with new filters added

STORMWATER TREATMENT UNIT MAINTENANCE REPORT 2014

North Lake Street

279 N Lake St
Moss Beach, Ca

Let it be known that on May 20th, 2014 a Four (4) filter Contech catchbasin storm water treatment system located at above referenced site was maintained by a qualified professional in a manner consistent with the manufacturer's guidelines for general maintenance. All sediment and spent filter cartridges were removed and replaced with OEM ZPG Filters.

Therefore, based on these activities and by signed authorization below, this hereby certifies that the StormFilter stormwater treatment systems at the above referenced location are currently performing as designed. Ready for Winter 2014

CERTIFICATE AUTHORIZATION

Gordon Clem
Maintenance Manager
Pacific Stormwater Solutions, LLC.
5/20/2014

APPENDIX H:

CASQA BMP Fact Sheets

Drain Inserts MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

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

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.
- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.

Vegetated Swale TC-30

Maintenance Concerns, Objectives, and Goals

- Channelization
- Vegetation/Landscape Maintenance
- Vector Control
- Aesthetics
- Hydraulic and Removal Efficacy

General Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for residential, industrial, and commercial areas with low flow and smaller populations.

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Inspection/Maintenance Considerations

It is important to consider that a thick vegetative cover is needed for vegetated swales to function properly. Usually, swales require little more than normal landscape maintenance activities such as irrigation and mowing to maintain pollutant removal efficiency. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g., debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained. The application of fertilizers and pesticides should be minimized.

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Inspection Activities	Suggested Frequency
■ Inspect after seeding and after first major storms for any damages.	Post construction
■ Inspect for signs of erosion, damage to vegetation, channelization of flow, debris and litter, and areas of sediment accumulation. Perform inspections at the beginning and end of the wet season. Additional inspections after periods of heavy runoff are desirable.	Semi-annual
■ Inspect level spreader for clogging, grass along side slopes for erosion and formation of rills or gullies, and sand/soil bed for erosion problems.	Annual
Maintenance Activities	**Suggested Frequency**
■ Mow grass to maintain a height of 3–4 inches, for safety, aesthetic, or other purposes. Litter should always be removed prior to mowing. Clippings should be composted. ■ Irrigate swale during dry season (April through October) or when necessary to maintain the vegetation. ■ Provide weed control, if necessary to control invasive species.	As needed (frequent, seasonally)
■ Remove litter, branches, rocks blockages, and other debris and dispose of properly. ■ Maintain inlet flow spreader (if applicable). ■ Repair any damaged areas within a channel identified during inspections. Erosion rills or gullies should be corrected as needed. Bare areas should be replanted as necessary.	Semi-annual
■ Declog the pea gravel diaphragm, if necessary. ■ Correct erosion problems in the sand/soil bed of dry swales. ■ Plant an alternative grass species if the original grass cover has not been successfully established. Reseed and apply mulch to damaged areas.	Annual (as needed)
■ Remove all accumulated sediment that may obstruct flow through the swale. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation, or once it has accumulated to 10% of the original design volume. Replace the grass areas damaged in the process. ■ Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.	As needed (infrequent)

Additional Information

Recent research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

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

Bioretention TC-32

Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

- ● Low
- ▲ Medium
- ■ High

Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

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Inspection Activities	Suggested Frequency
■ Inspect soil and repair eroded areas.	Monthly
■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.	Semi-annual inspection
■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket. ■ Check for debris and litter, and areas of sediment accumulation. ■ Inspect health of trees and shrubs.	
Maintenance Activities	**Suggested Frequency**
■ Water plants daily for 2 weeks.	At project completion
■ Remove litter and debris.	Monthly
■ Remove sediment. ■ Remulch void areas. ■ Treat diseased trees and shrubs. ■ Mow turf areas. ■ Repair erosion at inflow points. ■ Repair outflow structures. ■ Unclog underdrain. ■ Regulate soil pH regulation.	As needed
■ Remove and replace dead and diseased vegetation.	Semi-annual
■ Add mulch. ■ Replace tree stakes and wires.	Annual
■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.	Every 2-3 years, or as needed

Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

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

APPENDIX I:

Inspection and Maintenance Checklists

Vegetated Swales and Bioretention Areas
Inspection and Maintenance Checklist

Location: _____ Date of Inspection: _____ Inspector(s): _____

Type of Inspection: ˜ Pre-Wet Season ˜ End of Wet Season ˜ After heavy runoff ˜ Other:_____

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Potential Maintenance Activities and Results Expected When Maintenance Is Performed**
1. Standing Water (not applicable at Farallone Ave and Wienke Way sites)	When water stands in the vegetated swale or bioretention area between storms and does not drain within five days after rainfall.			There should be no areas of standing water once inflow has ceased. Any of the following may apply: sediment or trash blockages removed, improved grade, or flushed under drain.
2. Trash and Debris Accumulation	Trash and debris accumulated in the vegetated swale or bioretention area.			Trash and debris removed from area and disposed of properly.
3. Sediment Accumulation	Evidence of sedimentation greater than 2 inches and/or covering vegetation.			Sediment removed and disposed of properly. Ensure that existing design grade has not been modified.
4. Erosion	Channels or rills have formed around inlets, areas of bare soil, eroded or scoured swale bottom or side slopes, and/or other evidence of erosion.			No erosion or scouring. Determine cause of erosion and correct condition. For ruts or bare areas less than 12 inches wide, spot repair with appropriate material. For larger areas, regrade and revegetate.
5. Vegetation	Native vegetation is dead, diseased, or sparse. Area overrun with non-native species. Area overgrown and preventing adequate flow or filtration. Grasses excessively tall.			Determine why plant growth is poor and correct condition. Remove weedy and invasive species. Increase irrigation. Trim vegetation. Replant with plugs, sod, or seed to ensure that vegetation is healthy with adequate coverage.
6. Mulch/Gravel	Mulch or gravel is missing or patchy in appearance. Areas of bare earth are exposed, or mulch or gravel layer is less than 2 inches in depth.			All bare earth is covered, with the exception of area immediately surrounding plant base. Rake or replace mulch. Mulch or gravel is even in appearance, at a depth of approximately 2 inches.
7. Inlet/Outlet	Inlet/outlet area clogged with sediment or debris.			Clogging or blockage of inlet/outlet area removed so that water flows freely. Obstructions and sediment are disposed of properly.
8. Miscellaneous	Any condition not covered above that needs attention in order for the BMP to function as designed.			Meet the design specifications.

Non-Proprietary Media Filter
Inspection and Maintenance Checklist

Property Address: _____ Property Owner: _____

Treatment Measure No.: _____ Date of Inspection: _____ Type of Inspection: ˜ Monthly ˜ Pre-Wet Season
˜ After heavy runoff ˜ End of Wet Season

Inspector(s): _____ ˜ Other:_____

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Results Expected When Maintenance Is Performed**
1. Sediment, trash and debris accumulation	Sediment, trash and debris accumulated inside of the flume filter box or in front of screen or overflow plates. Filter does not drain as specified.			Sediment, trash and debris removed from inside of the flume filter box and in front of screen and overflow plates. Filter drains per design specifications.
2. Standing water	Non-proprietary media filter does not drain within five days after rainfall.			Clogs removed from flume filter box, screen, overflow plates. Filter drains per design specifications.
3. Mosquitoes	Evidence of mosquito larvae in non-proprietary media filter.			Clogs removed from sedimentation basin, riser pipe and filter bed. Filter drains per design specifications.
4. Miscellaneous	Any condition not covered above that needs attention in order for the non-proprietary media filter to function as designed.			Meet the design specifications.