



July 2024

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), METALS, PHOSPHORUS & OIL TREATMENT

For

CONTECH Engineered Solutions Filterra®

Ecology's Decision:

Based on the Contech Engineered Solution's (Contech) submissions for the Filterra® system, Ecology hereby issues the following use level designation:

1. A General Use Level Designation for Basic, Metals, Phosphorus, and Oil Treatment for the Filterra system constructed with a minimum media thickness of 21 inches (1.75 feet), at the following water quality design hydraulic loading rates:

Treatment	Infiltration Rate (in/hr) for use in Sizing
Basic	324
Phosphorus	324
Oils	50
Metals	324

2. The Filterra is not appropriate for oil spill-control purposes.
3. Ecology approves Filterra systems for treatment at the hydraulic loading rates listed above, and sized based on the water quality design flow rate for an off-line system. Calculate the water quality design flow rates using the following procedures:
 - Western Washington: for treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model and as described in section III-2.6 of the 2024 Stormwater Management Manual for Western Washington (SWMMWW)
 - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 6.5.1 of the 2024 Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
 - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
4. This General Use Level Designation has no expiration date, but Ecology may revoke or amend the designation, and is subject to the conditions specified below.

Ecology's Conditions of Use:

Filtterra systems shall comply with these conditions shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the Filtterra systems in accordance with applicable Contech Filtterra manuals and this Ecology Decision.
2. The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in this Ecology Decision, Item 3, above) and the Infiltration Rate from the table above (use the lowest applicable Infiltration Rate depending on the level of treatment required). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the Infiltration Rate (converted to ft/sec) to obtain required surface area (sq-ft) of the Filtterra unit.
3. Each site plan must undergo Contech Filtterra review before Ecology can approve the unit for site installation. This will ensure that design parameters including site grading and slope are appropriate for use of a Filtterra unit.
4. Filtterra media shall conform to the specifications submitted to and approved by Ecology and shall be sourced from Contech with no substitutions.
5. Contech tested the Filtterra with and without plants. The GULD applies to the Filtterra whether plants are included in the final product or not.
6. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured treatment device.
 - Contech designs Filtterra systems for a target maintenance interval of 6 months in the Pacific Northwest. Maintenance includes removing and replacing the mulch layer above the media along with accumulated sediment, trash, and captured organic materials therein, evaluating plant health, and pruning the plant if deemed necessary.
 - Owners/operators must inspect the Filtterra system for a minimum of twelve months from the start of post-construction operation to determine site-specific inspection/maintenance schedules and requirements. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to the SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.
7. Conduct maintenance following manufacturer's guidelines. Follow maintenance procedures given in the most recent version of the Filtterra Operation and Maintenance Manual.
8. Filtterra systems come in standard sizes.
9. Install the Filtterra in such a manner that flows exceeding the maximum operating rate are conveyed around the mulch and media and will not resuspend captured sediment.

10. Discharges from the Filterra units shall not cause or contribute to water quality standards violations in receiving waters.

Approved Alternate Configurations

Filterra Internal Bypass - Pipe (FTIB-P)

1. The Filterra® Internal Bypass – Pipe allows for piped-in flow from area drains, grated inlets, trench drains, and/or roof drains. Design capture flows and peak flows enter the structure through an internal slotted pipe. Filterra® inverted the slotted pipe to allow design flows to drop through to a series of splash plates that then disperse the design flows over the top surface of the Filterra® planter area. Higher flows continue to bypass the slotted pipe and convey out the structure.
2. To select a FTIB-P unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filterra Internal Bypass – Curb (FTIB-C)

1. The Filterra® Internal Bypass –Curb model (FTIB-C) incorporates a curb inlet, biofiltration treatment chamber, and internal high flow bypass in one single structure. Filterra® designed the FTIB-C model for use in a “Sag” or “Sump” condition and will accept flows from both directions along a gutter line. An internal flume tray weir component directs treatment flows entering the unit through the curb inlet to the biofiltration treatment chamber. Flows in excess of the water quality treatment flow rise above the flume tray weir and discharge through a standpipe orifice; providing bypass of untreated peak flows. Americast manufactures the FTIB-C model in a variety of sizes and configurations and you may use the unit on a continuous grade when a single structure providing both treatment and high flow bypass is preferred. The FTIB-C model can also incorporate a separate junction box chamber to allow larger diameter discharge pipe connections to the structure.
2. To select a FTIB-C unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filterra® Shallow

1. The Filterra Shallow provides additional flexibility for design engineers and designers in situations where various elevation constraints prevent application of a standard Filterra configuration. Engineers can design this system up to six inches shallower than any of the previous Filterra unit configurations noted above.
2. Ecology requires that the Filterra Shallow provide a media contact time equivalent to that of the standard unit. This means that with a smaller depth of media, the surface area must increase.
3. To select a Filterra Shallow System unit, the designer must first identify the size of the standard unit using the modeling guidance described above.

4. Once the size of the standard Filterra unit is established using the sizing technique described above, use information from the following table to select the appropriate size Filterra Shallow System unit.

Shallow Unit Basic, Metals, Phosphorus, and Oil Treatment Sizing

Standard Depth	Equivalent Shallow Depth
4x4	4x6 or 6x4
4x6 or 6x4	6x6
4x8 or 8x4	6x8 or 8x6
6x6	6x10 or 10x6
6x8 or 8x6	6x12 or 12x6
6x10 or 10x6	13x7

Notes:

1. Shallow Depth Boxes are less than the standard depth of 3.5 feet but no less than 3.0 feet deep (TC to INV).

Applicant: Contech Engineered Solutions, LLC.

Applicant's Address: 12901 SE 97th Ave, Suite 400
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Application Documents:

- State of Washington Department of Ecology Application for Conditional Use Designation, Americast (September 2006)
- Quality Assurance Project Plan Filterra® Bioretention Filtration System Performance Monitoring, Americast (April 2008)
- Quality Assurance Project Plan Addendum Filterra® Bioretention Filtration System Performance Monitoring, Americast (June 2008)
- Draft Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (August 2009)
- Final Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (December 2009)
- Technical Evaluation Report Appendices Filterra® Bioretention Filtration System Performance Monitoring, Americast, (August 2009)
- Memorandum to Department of Ecology Dated October 9, 2009 from Americast, Inc. and Herrera Environmental Consultants
- Quality Assurance Project Plan Filterra® Bioretention System Phosphorus treatment and Supplemental Basic and Enhanced Treatment Performance Monitoring, Americast (November 2011)
- Filterra® letter August 24, 2012 regarding sizing for the Filterra® Shallow System.
- University of Virginia Engineering Department Memo by Joanna Crowe Curran, Ph. D dated March 16, 2013 concerning capacity analysis of Filterra® internal weir inlet tray.
- Terraphase Engineering letter to Jodi Mills, P.E. dated April 2, 2013 regarding Terraflume Hydraulic Test, Filterra® Bioretention System and attachments.

- Technical Evaluation Report, Filterra® System Phosphorus Treatment and Supplemental Basic Treatment Performance Monitoring. March 27th, 2014.
- State of Washington Department of Ecology Application for Conditional Use Level Designation, Contech Engineered Solutions (May 2015)
- Quality Assurance Project Plan Filterra® Bioretention System, Contech Engineered Solutions (May 2015)
- Filterra Bioretention System Armco Avenue General Use Level Designation Technical Evaluation Report, Contech Engineered Solutions (August 2019)
- NJCAT Technology Verification, Filterra Bioretention System, Contech Engineered Solutions (October 2020)
- Basic Treatment PULD Application for Contech Enhanced Filtration System, Contech Engineered Solutions (November 2020)
- Contech Enhanced Filtration System, Application for Certification, Contech Engineered Solutions (November 2020)
- Quality Assurance Project Plan Contech Enhanced Filtration System (CEFS) Technology Performance Evaluation, Prepared by Contech Engineered Solutions (September 2021)
- Addendum to the Quality Assurance Project Plan – Contech Enhanced Filtration System, Prepared by Contech Engineered Solutions (August 2021)
- Contech Enhanced Filtration System Armco Avenue General Use Level Designation Technical Evaluation Report, Prepared by Contech Engineered Solutions (May 2024)

Applicant’s Use Level Request:

General Level Use Designation as a Basic, Metals, Phosphorus, and Oil Treatment device in accordance with Ecology’s Stormwater Management Manual for Western Washington.

Applicant’s Performance Claims:

Based on field testing, the Filterra is able to meet TAPE performance goals for TSS, dissolved metals, and total phosphorus at an infiltration rate of 324 in/hr, and is able to meet TAPE performance goals for oil at an infiltration rate of 50 in/hr.

Ecology’s Recommendations:

Ecology finds that Contech has shown Ecology, through laboratory and field testing, that the Filterra is capable of attaining Ecology’s Basic, Metals, Phosphorus, and Oil treatment goals.

Findings of Fact:

Field Testing 2021-2023

1. Contech completed field testing of a 4 ft. x 3 ft. unvegetated Filterra unit (referred to as a Contech Enhanced Filtration System [CEFS] during testing) in Hillsboro, Oregon between June 2021 and April 2023. Throughout the monitoring period a total of 35 individual storm events were sampled.

2. The CEFS utilized the same media formulation and dimensional layout as a Filterra unit but did not include plants.
3. Contech evaluated the system for basic, metals, and phosphorus treatment against a hydraulic loading rate of 3.36 gpm/sf (324 in/hr).
4. Herrera Environmental Consultants conducted a third-party review of the data and TER to ensure the monitoring complied with the QAPP and met the requirements of the TAPE guidance document.
5. Particle size distribution analysis showed 39% of the influent particulate finer than 62.5 microns (μm) for the samples collected during the 35-event period. The similarity of influent and effluent PSD prompted a review of the influence of laboratory procedure on the results. Upon recommendation of Herrera Environmental Consultants, a secondary laboratory was consulted which provided TAPE PSD analysis on multiple previous TAPE testing campaigns, including the Ship Canal test site. Six supplemental events were sampled for PSD between 1/4/24 and 2/16/24. Results from the second laboratory showed 77% of influent particulate finer than 62.5 microns (μm).
6. Of the 35 sampled events, 21 met requirements for TSS analysis. Influent TSS concentrations ranged from 20 mg/L to 269 mg/L, with a mean concentration of 57 mg/L. For samples with an influent concentration between 20 and 100 mg/L ($n=17$) the upper 95 percent confidence limit of the mean TSS effluent concentration was 17.5 mg/L. For samples with an influent concentration greater than 100 mg/L ($n=4$) the lower 95 percent confidence limit of the mean TSS reduction was 83.5%. Influent concentrations greater than 200 mg/L (the upper end of the TAPE influent concentration range) were capped at 200 mg/L before calculating the pollutant removal efficiency.
7. Of the 35 sampled events, 27 met requirements for dissolved copper analysis. Influent dissolved copper concentrations ranged from 7.3 $\mu\text{g/L}$ to 46.0 $\mu\text{g/L}$, with a mean concentration of 18.1 $\mu\text{g/L}$. The lower 95 percent confidence limit of the mean dissolved copper reduction was 39.8%. Influent concentrations greater than 20 $\mu\text{g/L}$ (the upper end of the TAPE influent concentration range) were capped at 20 $\mu\text{g/L}$ before calculating the pollutant removal efficiency.
8. Of the 35 sampled events, 28 met requirements for dissolved zinc analysis. Influent dissolved zinc concentrations ranged from 33.9 $\mu\text{g/L}$ to 178.0 $\mu\text{g/L}$, with a mean concentration of 74.4 $\mu\text{g/L}$. The lower 95 percent confidence limit of the mean dissolved zinc reduction was 62.4%.
9. Of the 35 sampled events, 16 met requirements for the total phosphorus analysis. Influent total phosphorus concentrations ranged from 0.101 mg/L to 0.571 mg/L with a mean concentration of 0.298 mg/L. The lower 95 percent confidence limit of the mean total phosphorus reduction was 64.4%.
10. Maintenance was conducted 3 times during the 23-month study period with frequency ranging from every 4 to 9 months. Maintenance performed consisted of replacing the mulch layer.

Field Testing 2015-2019

1. Contech completed field testing of a 4 ft. x 4 ft. Filterra unit at one site in Hillsboro, Oregon from September 2015 to July 2019. Throughout the monitoring period a total of 24 individual storm events were sampled, of which 23 qualified for TAPE sampling criteria.

2. Contech encountered several unanticipated events and challenges that prevented them from collecting continuous flow and rainfall data. An analysis of the flow data from the sampled events, including both the qualifying and non-qualifying events, demonstrated the system treated over 99% of the influent flows. Peak flows during these events ranged from 25% to 250% of the design flow rate of 29 gallons per minute.
3. Of the 23 TAPE qualified sample events, 13 met requirements for TSS analysis. Influent concentrations ranged from 20.8 mg/L to 83 mg/L, with a mean concentration of 46.3 mg/L. The UCL95 mean effluent concentration was 15.9 mg/L, meeting the 20 mg/L performance goal for Basic Treatment.
4. All 23 TAPE qualified sample events met requirements for dissolved zinc analysis. Influent concentrations range from 0.0384 mg/L to 0.2680 mg/L, with a mean concentration of 0.0807 mg/L. The LCL 95 mean percent removal was 62.9%, meeting the 60% performance goal for Metals Treatment.
5. Thirteen of the 23 TAPE qualified sample events met requirements for dissolved copper analysis. Influent concentrations ranged from 0.00543 mg/L to 0.01660 mg/L, with a mean concentration of 0.0103 mg/L. The LCL 95 mean percent removal was 41.2%, meeting the 30% performance goal for Metals Treatment.
6. Total zinc concentrations were analyzed for all 24 sample events. Influent EMCs for total zinc ranged from 0.048 mg/L to 5.290 mg/L with a median of 0.162 mg/L. Corresponding effluent EMCs for total zinc ranged from 0.015 mg/L to 0.067 mg/L with a median of 0.029 mg/L. Total event loadings for the study for total zinc were 316.85 g at the influent and 12.92 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 95.9%.
7. Total copper concentrations were analyzed for all 24 sample events. Influent EMCs for total copper ranged from 0.003 mg/L to 35.600 mg/L with a median value of 0.043 mg/L. Corresponding effluent EMCs for total copper ranged from 0.002 mg/L to 0.015 mg/L with a median of 0.004 mg/L. Total event loadings for total copper for the study were 1,810.06 g at the influent and 1.90 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 99.9%.

Field Testing 2013

1. Filterra completed field-testing of a 6.5 ft x 4 ft. unit at one site in Bellingham, Washington. Continuous flow and rainfall data collected from January 1, 2013 through July 23, 2013 indicated that 59 storm events occurred. Water quality data was obtained from 22 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. The system treated 98.9% of the total 8-month runoff volume during the testing period. Consequently, the system achieved the goal of treating 91% of the volume from the site. Stormwater runoff bypassed Filterra treatment during four of the 59 storm events.
3. Of the 22 sampled events, 18 qualified for TSS analysis (influent TSS concentrations ranged from 25 to 138 mg/L). The data were segregated into sample pairs with influent concentration greater than and less than 100 mg/L. The UCL95 mean effluent

concentration for the data with influent less than 100 mg/L was 5.2 mg/L, below the 20-mg/L threshold. Although the TAPE guidelines do not require an evaluation of TSS removal efficiency for influent concentrations below 100 mg/L, the mean TSS removal for these samples was 90.1%. Average removal of influent TSS concentrations greater than 100 mg/L (three events) was 85%. In addition, the system consistently exhibited TSS removal greater than 80% at flow rates equivalent to a 100 in/hr infiltration rate and was observed at 150 in/hr.

4. Ten of the 22 sampled events qualified for TP analysis. Americast augmented the dataset using two sample pairs from previous monitoring at the site. Influent TP concentrations ranged from 0.11 to 0.52 mg/L. The mean TP removal for these twelve events was 72.6%. The LCL95 mean percent removal was 66.0, well above the TAPE requirement of 50%. Treatment above 50% was evident at 100 in/hr infiltration rate and as high as 150 in/hr. Consequently, the Filterra test system met the TAPE Phosphorus Treatment goal at 100 in/hr. Influent ortho-P concentrations ranged from 0.005 to 0.012 mg/L; effluent ortho-P concentrations ranged from 0.005 to 0.013 mg/L. The reporting limit/resolution for the ortho-P test method is 0.01 mg/L, therefore the influent and effluent ortho-P concentrations were both at and near non-detect concentrations.

Field Testing 2008-2009

1. Filterra completed field-testing at two sites at the Port of Tacoma. Continuous flow and rainfall data collected during the 2008-2009 monitoring period indicated that 89 storm events occurred. The monitoring obtained water quality data from 27 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. During the testing at the Port of Tacoma, 98.96 to 99.89% of the annual influent runoff volume passed through the POT1 and POT2 test systems respectively. Stormwater runoff bypassed the POT1 test system during nine storm events and bypassed the POT2 test system during one storm event. Bypass volumes ranged from 0.13% to 15.3% of the influent storm volume. Both test systems achieved the 91% water quality treatment-goal over the 1-year monitoring period.
3. Consultants observed infiltration rates as high as 133 in/hr during the various storms. Filterra did not provide any paired data that identified percent removal of TSS, metals, oil, or phosphorus at an instantaneous observed flow rate.
4. The maximum storm average hydraulic loading rate associated with water quality data is <40 in/hr, with the majority of flow rates < 25 in/hr. The average instantaneous hydraulic loading rate ranged from 8.6 to 53 in/hr.
5. The field data showed a removal rate greater than 80% for TSS with an influent concentration greater than 20 mg/L at an average instantaneous hydraulic loading rate up to 53 in/hr (average influent concentration of 28.8 mg/L, average effluent concentration of 4.3 mg/L).
6. The field data showed a removal rate generally greater than 54% for dissolved zinc at an average instantaneous hydraulic loading rate up to 60 in/hr and an average influent concentration of 0.266 mg/L (average effluent concentration of 0.115 mg/L).

7. The field data showed a removal rate generally greater than 40% for dissolved copper at an average instantaneous hydraulic loading rate up to 35 in/hr and an average influent concentration of 0.0070 mg/L (average effluent concentration of 0.0036 mg/L).
8. The field data showed an average removal rate of 93% for total petroleum hydrocarbon (TPH) at an average instantaneous hydraulic loading rate up to 53 in/hr and an average influent concentration of 52 mg/L (average effluent concentration of 2.3 mg/L). The data also shows achievement of less than 15 mg/L TPH for grab samples. Filterra provided limited visible sheen data due to access limitations at the outlet monitoring location.
9. The field data showed low percentage removals of total phosphorus at all storm flows at an average influent concentration of 0.189 mg/L (average effluent concentration of 0.171 mg/L). We may relate the relatively poor treatment performance of the Filterra system at this location to influent characteristics for total phosphorus that are unique to the Port of Tacoma site. It appears that the Filterra system will not meet the 50% removal performance goal when the majority of phosphorus in the runoff is expected to be in the dissolved form.

Laboratory Testing

1. Contech conducted testing of a 4 ft. x 4 ft. unit in July 2020 at Contech's laboratory in Ashland, Virginia. The unit included the Filterra® HC media blend without the use of any vegetation that is standard in Filterra installations.
 - The laboratory testing was performed in accordance with the New Jersey Department of Environmental Protection (NJDEP) Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device. Since Contech did the testing, A. Morton Thomas and Associates, inc. performed independent third-party observation.
 - The testing evaluated a full-scale 4 ft. x 4 ft. unit at a hydraulic loading rate of 3.12 gpm/sq. ft (300 in/hr). The test sediment used with compliant with the NJDEP particle size distribution requirements, with a d50 particle size of 69 µm.
 - Contech evaluated TSS removal efficiency over 15 events. The influent concentration ranged from 182 mg/L to 211 mg/L with a mean concentration of 200.7 mg/L and a mean removal efficiency of 86%.
 - Contech evaluated sediment mass loading capacity over an additional 21 events as a continuation of the removal efficiency testing. During the sediment mass loading capacity evaluation Contech increased the target influent concentration to 400 mg/L. The cumulative removal efficiency over the 36 events was 82% and the cumulative mass captured was 110 kg.
2. Filterra performed laboratory testing on a scaled down version of the Filterra unit. The lab data showed an average removal from 83-91% for TSS with influents ranging from 21 to 320 mg/L, 82-84% for total copper with influents ranging from 0.94 to 2.3 mg/L, and 50-61% for orthophosphate with influents ranging from 2.46 to 14.37 mg/L.
 - Filterra conducted permeability tests on the soil media.
 - Lab scale testing using Sil-Co-Sil 106 showed removals ranging from 70.1% to 95.5% with a median removal of 90.7%, for influent concentrations ranging from 8.3 to 260 mg/L. Filterra ran these laboratory tests at an infiltration rate of 50 in/hr.

- Supplemental lab testing conducted in September 2009 using Sil-Co-Sil 106 showed an average removal of 90.6%. These laboratory tests were run at infiltration rates ranging from 25 to 150 in/hr for influent concentrations ranging from 41.6 to 252.5 mg/L. Regression analysis results indicate that the Filterra system’s TSS removal performance is independent of influent concentration in the concentration range evaluated at hydraulic loading rates of up to 150 in/hr.

Other Filterra Related Issues to be Addressed by the Company:

1. Conduct hydraulic testing to obtain additional information about the maintenance longevity and requirements. Complete testing by May 30, 2027.

Technology Description: <https://www.conteches.com/stormwater-management/biofiltration-solutions/filterra/>

Contact Information:

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Date	Revision
December 2009	GULD for Basic, Enhanced, and Oil granted, CULD for Phosphorus
September 2011	Extended CULD for Phosphorus Treatment
September 2012	Revised design storm discussion, added Shallow System.
January 2013	Revised format to match Ecology standards, changed Filterra contact information
February 2013	Added FTIB-P system
March 2013	Added FTIB-C system
April 2013	Modified requirements for identifying appropriate size of unit
June 2013	Modified description of FTIB-C alternate configuration

March 2014	GULD awarded for Phosphorus Treatment. GULD updated for a higher flow-rate for Basic Treatment.
June 2014	Revised sizing calculation methods
March 2015	Revised Contact Information
June 2015	CULD for Basic and Enhanced at 100 in/hr infiltration rate
September 2019	GULD for Basic and Enhanced at 175 in/hr infiltration rate
February 2020	Revised sizing language to note sizing based on off-line calculations
June 2020	Added Phosphorus to Filterra Shallow sizing table
January 2024	Revised Dissolved Metals (Enhanced) to Metals
July 2024	GULD for Basic, Enhanced, and Phosphorus at 324 in/hr infiltration rate for vegetated and unvegetated Filterra systems. Updated Contech address