D-3. Filterra® by Contech

Design Objective

Filterra is an engineered biofiltration device with components that make it similar to bioretention in pollutant removal and application, but has been optimized for high volume/flow treatment in a compact size. Its small footprint allows Filterra to be used on highly developed sites such as commercial parking lots, residential streets, parking lots, and urban streetscapes. The Filterra also must be maintained properly to ensure proper functioning.

Important Links

SCM Credit Document, D.3. Credit for Filterra

Figure 1: Filterra Offline Configuration

Figure 2: Filterra Internal Bypass Configuration

Figure 3: Filterra Peak Diversion

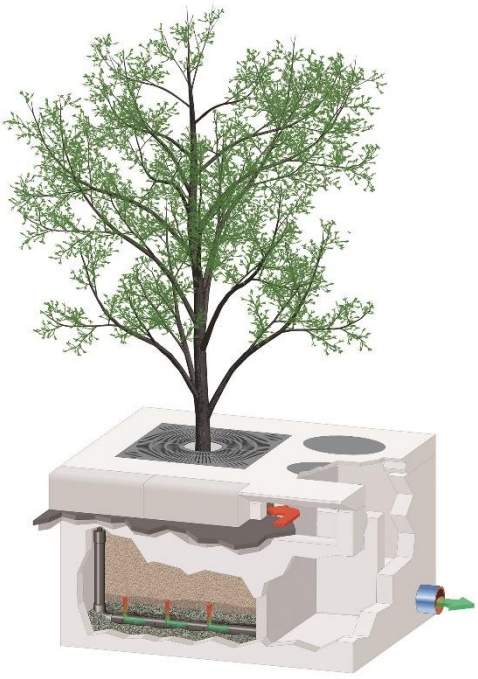

Figure 4: Filterra Bioscape Vault

Figure 5: Filterra Bioscape

Guidance on the MDC

MDC 1. SIZING.
The sizing for the Filterra system shall be based on providing treatment of the design water quality volume in North Carolina (1.0" or 1.5" rainfall depending on project location).

The Filterra system's engineered high flow media flows at a rate of 140"/hr. This flow rate allows the water quality volume to be processed at a rate greater than conventional SCMs such as sand filters, wet ponds, or traditional bioretention systems, reducing the size of the footprint that is needed. In 2008, Withers & Ravenel (based in North Carolina) performed an analysis to compare flow volumes through the Filterra system with flow volumes through conventional practices for both annual and water quality design storm runoff volumes. Withers & Ravenel used the results from this analysis to develop sizing charts for Filterra to determine the minimum Filterra media surface area was being provided to ensure the volume treated during the water quality design storm was comparable to that in conventional systems. Refer to Withers & Ravenel (2008) for more information.

Table 1 identifies the approximate maximum impervious drainage area for each Filterra unit based on this analysis. For simplicity in design as well as ensuring adequate media surface area is provided for maintenance longevity, Contech Engineered Solutions recommends a single sizing chart for North Carolina based on the results of the analysis from the coastal counties (targeting the 1.5" water quality volume). This exceeds the minimum requirements for the non-coastal counties and provides a minimum media surface area adequate for system longevity based on long-term in-field Filterra performance studies in the Mid-Atlantic area.

This approach is scalable based on the ratio of Filterra media to drainage area (FSA/DA). The results of the analysis performed by Withers & Ravenel yields a FSA/DA of 0.39%. For

drainage areas that are larger, or not fully impervious, Contech Engineered Solutions can prepare a custom sizing on a project specific basis to provide the most economical system design.

Table 1. Filterra Sizing based on Withers & Ravenel (2008) and NC Stormwater Rules

Filterra Model	Media Area at 140"/hr (sf)	Recommended Impervious Drainage Area (ac)	Outlet Pipe Size
4x4	16	0.06	4" PVC
4x6 / 6x4	24	0.14	4" PVC
4x8 / 8x4	32	0.19	4" PVC
6x6	36	0.21	4" PVC
6x8 / 8x6 / 4x12 / 12x4	48	0.28	4" PVC
6x10 / 10x6	60	0.35	6" PVC
6x12 / 12x6	72	0.42	6" PVC
7x13 / 13x7	91	0.54	6" PVC
Other / Custom Sizes / Filterra Bioscape	TBD	Media Area ÷ 0.39%	TBD

1. Contact Contech for information on other available configurations.
2. A standard PVC coupling is cast into the wall to connect to discharge piping.
3. Dimensions shown are internal.

MDC 2. PONDING DEPTH FOR DESIGN.
The ponding depth for the design water quality volume shall be 9 inches above the media layer for standard designs.

Custom designs in coordination with Contech Engineered Solutions may vary.

MDC 3. UNDERDRAIN. For Filterra units up to 48 square feet in media surface area, a 4" underdrain will be utilized. For larger surface areas (up to maximum standard sizes) a 6" underdrain will be utilized.

The underdrain system is connected on outside of modular container by means of a PVC coupler.

MDC 4. MEDIA DEPTH.
Standard Filterra Media depth shall be 21". Shallower depths may be allowed under special circumstances.

Media shall be provided by Contech Engineered Solutions and is delivered sealed within the modular container until activation.

MDC 5. MULCH DEPTH.
Filterra's mulch depth shall be three inches.

Mulch shall be initially provided by Contech Engineered Solutions and subsequently removed and re-installed by certified maintenance providers as trained by Contech Engineered Solutions and outlined in the Contech Engineered Solutions Operations and Maintenance Instructions.

MDC 6. PLANTING.
Planting shall be provided by Contech Engineered Solutions.

First year maintenance to ensure health of planting also to be provided by Contech Engineered Solutions. Planting to be selected by Purchaser from approved list provided by Contech Engineered Solutions. Purchaser must gain any required approval by owner, engineer of record and regulatory entity for viability on a project by project basis. Plant lists are available for multiple different Filterra configurations. Refer to Table 2 below for recommended native plant species.

MDC 7. DESIGN CONFIGURATIONS.
Filterra is available in multiple configurations to meet site needs.

The following list contains some common configurations, but is not all-inclusive:

a. Filterra Offline
b. Filterra Internal Bypass – Curb
c. Filterra Peak Diversion
d. Filterra Bioscape Vault
e. Filterra Bioscape

Contact Contech Engineered Solutions for more information on Filterra configuration design.

MDC 8. BYPASS CONFIGURATIONS.
Filterra systems must be designed in an offline configuration, or must contain internal bypass mechanisms provided by Contech Engineered Solutions.

MDC 9. ACTIVATION.
Activation of a Filterra will be provided by Contech Engineered Solutions when project is prepared for Activation.

Refer to the Activation Checklist (Table 3) for further information.

MDC 10. MAINTENANCE.
Refer to Contech Engineered Solutions Operations and Maintenance Manual (Link: Filterra Operation and Maintenance).

CONTECH ENGINEERED SOLUTIONS

Filterra Vault with Tree Grate Plant List - Mid-Atlantic Region

filterra

Table 2 - Allowable Native Plant List

Common Name[1,2,8]	Latin Name	Plant Type	Sun	Hardiness Range	Mature Height[5]	Mature Spread[5]	Sizing[7]	Availability[9]	Nativity
Beautyberry	*Callicarpa Americana*	Deciduous	Partial Shade to Full Sun	7A - 10B	4' - 8'	6' - 7'	L	MA, NW, SE, SC, NoCA, SoCA	SE-US, S-US
Blueberry, Highbush	*Vaccinium corymbosum*	Deciduous	Partial Shade to Full Sun	3B - 8A	6' - 12'	8' - 10'	L	MA, NE, E-Can	E-US, E-Can
Buttonbush	*Cephalanthus occidentalis*	Deciduous	Partial Shade to Full Sun	4A – 10A	4' – 6'	6' – 10'	L	MA, NE, NW, SE, SC	E-US
Cherry, Purpleleaf Sand	*Prunus x cistena*	Deciduous	Full Sun	5B – 8A	6' – 8'	6' – 10'	L	GL, MA, NW, SE, SC	Asia
Chokeberry, Black	*Aronia melanocarpa*	Deciduous	Full Shade to Full Sun	3B – 8B	3' – 6'	4' – 6'	M	GI, MA, NE, NW, SE, NoCA, SoCA, E-Can	E-Can, E-US
Chokeberry, Red	*Aronia arbutifolia*	Deciduous	Partial Shade to Full Sun	4B – 9A	6' – 10'	4' – 6'	M	GL, MA, NE, NW, SE, NoCA, SoCA	E-US
Chokecherry, Common	*Prunus virginiana*	Deciduous	Full Shade to Full Sun	2 - 7	15' – 25'	10' – 15'	Tree	GL, MA, E-Can	N-US, Can
Crabapple, American	*Malus coronaria*	Deciduous	Full Sun	3B - 8A	15' - 25'	10' - 25'	Tree	GL, MA, NE, NW, SE, NoCA, SoCA	Midwest-US
Crabapple, Sargent	*Malus sargentii*	Deciduous	Full Sun	4A – 8A	6' – 8'	10' – 12'	XL	GL, MA, NW, SE	Asia
Crape Myrtle	*Lagerstoemia indica*	Deciduous	Full Sun	7A - 9A	15' - 25'	15' - 25'	Tree	MA, SE, NoCA, SoCA	Asia
Dogwood, Chinese	*Cornus kousa*	Deciduous	Partial Shade to Full Sun	4B - 8A	15' - 25'	20' - 30'	Tree	GL, MA, NE, NW, SE	Asia
Dogwood, Cornelian Cherry	*Cornus mas*	Deciduous	Partial Shade to Full Sun	4B - 8A	15' - 20'	15' - 20'	Tree	GL, MA, NE, NW, SE	Europe
Dogwood, Flowering	*Cornus florida*	Deciduous	Partial Shade to Full Sun	5A – 8B	15' - 20'	15' - 20'	Tree	GL, MA, NW	E-US
Dogwood, Graystem	*Cornus racemosa*	Deciduous	Partial Shade to Full Sun	4 - 8	10' – 15'	10' – 15'	XL	GL, GP, MA, SE, E-Can	E-Can, NE-US, Midwest-US
Dogwood, Silky	*Cornus amomum*	Deciduous	Full Shade to Full Sun	4B – 8A	8' – 10'	8' – 15'	L	GL, MA, NW, SE	E-US, E-Can
Elderberry, American	*Sambucus canadensis*	Deciduous	Partial Shade to Full Sun	4A – 9B	10' – 15'	6' – 10'	L	GL, GP, MA, NW, SC, SE, NoCA, SoCA	E-US
Franklin Tree	*Franklinia alatamaha*	Deciduous	Partial Shade to Full Sun	5A - 8A	15' - 25'	10' - 15'	Tree	GL, MA, NE, NW, SC, SE	US-GA
Fringe Tree, Chinese	*Chionanthus retusus*	Deciduous	Full Shade to Full Sun	5B - 9A	15' - 25'	10' - 15'	Tree	GL, MA, NW, NE, SC, SE, NoCA, SoCA	Asia
Fringe Tree, White	*Chionanthus virginicus*	Deciduous	Full Shade to Full Sun	4A - 9A	12' - 20'	10' - 15'	Tree	GL, MA, NE, NW, SC, SE	E-US
Holly, Possum Haw	*Ilex decidua*	Deciduous	Full Shade to Full Sun	5A – 9A	15' – 20'	15' – 25'	Tree	GL, MA, SC, SE	SE-US
Holly, Winterberry	*Ilex verticillata*	Deciduous	Partial Shade to Full Sun	3B – 9A	6' – 10'	8' – 15'	L	GL, MA, NW, SC, SE, NoCA, SoCA, E-Can	E-US, E-Can
Hydrangea, Wild	*Hydrangea arborescens*	Deciduous	Partial Shade to Full Sun	4A – 9A	3' – 5'	3' – 6'	M	GL, MA, NW, SC, SE	E-US
Lilac, Dwarf	*Syringa meyeri*	Deciduous	Full Sun	3B – 8A	5' – 8'	8' – 10'	L	GL, MA, NE, NW, SC, SE, NoCA, SoCA	Asia
Lilac, Japanese Tree	*Syringa reticulata*	Deciduous	Full Sun	3A - 7A	15' - 25'	10' - 15'	XL	GL, MA, NE, NW, SC, SE	Asia
Maackia, Amur	*Maackia amurensis*	Deciduous	Full sun	4A - 7A	15' - 25'	15' - 25'	Tree	GL, MA, NE, NW, SE, SC	Asia

Table 2 (Cont.).

Common Name[1,2,8]	Latin Name	Plant Type	Sun	Hardiness Range	Mature Height[5]	Mature Spread[5]	Sizing[7]	Availability[9]	Nativity
Magnolia, Ann	*Magnolia x 'Ann'*	Deciduous	Partial Shade to Full Sun	3B – 7A	10' – 12'	10' – 12'	XL	GL, MA, NW, SC, SE	Asia
Magnolia, Galaxy	*Magnolia x 'Galaxy'*	Deciduous	Partial Shade to Full Sun	5A - 8B	15' - 20'	15' - 25'	Tree	GL, MA, NE, NW, SC, SE, NoCA, SoCA	Asia
Magnolia, Saucer	*Magnolia x soulangiana*	Deciduous	Partial Shade to Full Sun	5A - 9A	15' - 25'	15' - 25'	Tree	MA, NE, NW, SC, SE, NoCA, SoCA	Asia
Magnolia, Star	*Magnolia stellata*	Deciduous	Partial Shade to Full Sun	4A - 8B	10' - 20'	10' - 15'	XL	GL, MA, NE, NW, SC, SE	Asia
Ninebark, Common Eastern	*Physocarpus opulifolius*	Deciduous	Partial Shade to Full Sun	2A - 7A	6' - 10'	6' - 10'	L	MA, E-Can	E-US, Midwest-US, S-US, E-US, Midwest-US, S-US, E-NE-US, Maritimes-Can
Ninebark, 'Diabolo'	*Physocarpus opulifolius 'Diabolo'*	Deciduous	Full Sun	3A - 7A	6' - 8'	8' - 10'	L	MA, NW	
Northern Bayberry	*Myrica pensylvanica*	Deciduous	Partial Shade to Full Sun	3A – 7A	10' – 15'	6' – 10'	L	GL, MA, NE, SE, E-Can	NE-US,
Plum, Cherry	*Prunus cerasifera*	Deciduous	Full Sun	5B – 8A	15' – 25'	15' – 25'	Tree	GL, MA, SC, SE	Europe, Asia
Redbud, Eastern	*Cercis canadensis*	Deciduous	Partial Shade to Full Sun	4B - 9A	15' - 25'	15' - 25'	Tree	GL, GP, MA, NE, NW, SE, NoCA, SoCA	E-US, S-US, Mexico
Serviceberry	*Amelanchier x grandiflora*	Deciduous	Partial Shade to Full Sun	4A - 7A	15' - 25'	15' - 25'	Tree	GL, MA, NE, NW, SC, SE	Northern Hemisphere
Serviceberry 'Allegheny'	*Amelanchier laevis "Allegheny"*	Deciduous	Partial Shade to Full Sun	4A - 7A	15' - 25'	15' - 25'	Tree	GL, MA, E-Can	E-Can, E-US
Serviceberry 'Downy', 'Autumn Brilliance'	*Amelanchier arborea "Downy", "Autumn*	Deciduous	Partial Shade to Full Sun	4A - 7A	15' - 25'	15' - 25'	Tree	GL, NE, MA, E-Can	E-Can, E-US
Smoketree	*Cotinus coggygria*	Deciduous	Full Sun	5A – 8A	10' – 15'	15' – 25'	Tree	GL, MA, NW, SE	Asia
Smoketree, American	*Cotinus obovatus*	Deciduous	Partial Shade to Full Sun	4B - 8A	20' - 25'	20' – 25'	Tree	GL, MA, NE, NW, SC, SE	SE-US
Sweet Pepperbush	*Clethra alnifolia*	Deciduous	Partial Shade to Full Sun	3 - 9	5' – 8'	4' – 6'	M	GL, MA, NW	E-US, E-Can
Sweetshrub	*Calycanthus floridus*	Deciduous	Full Shade to Full Sun	5B – 10A	6' – 10'	6' – 12'	L	GL, MA, NW, SC, SE, NoCA, SoCA	E-US
Sweetspire, Virginia	*Itea virginica*	Deciduous	Partial Shade to Full Sun	5A – 9A	4' – 6'	6' – 10'	L	GL, MA, NW, SC, SE	SE-US, S-US
Viburnum, American Cranberrybush	*Viburnum trilobum*	Deciduous	Partial Shade to Full Sun	2A - 7B	8' - 12'	8' - 15'	XL	MA, NE, SE, E-Can	NE-US, E-Can
Viburnum, Arrowwood	*Viburnum dentatum*	Deciduous	Full Shade to Full Sun	2B – 8B	5' – 15'	5' – 12'	L	GL, MA, NW, SC, SE, E-Can	E-US, S-US, E-Can
Viburnum, Blackhaw	*Viburnum prunifolium*	Deciduous	Full Shade to Full Sun	3B – 9A	12' – 15'	15' – 20'	Tree	GL, MA, NE, NW, SE	E-US
Viburnum, Nannyberry	*Viburnum lentago*	Deciduous	Full Shade to Full Sun	3A - 7A	15' – 25'	15' – 25'	Tree	GL, MA, SE, E-Can	NE-US, Midwest-US, E-Can
Witch Hazel, Common	*Hamamelis virginiana*	Deciduous	Full Shade to Full Sun	3B – 8B	15' – 25'	15' – 25'	Tree	GL, MA, SC, SE	E-US, E-Can
Anise	*Illicium parviflorum*	Evergreen	Full Shade to Full Sun	6A – 10A	15' – 20'	10' – 15'	XL	MA, SC, SE	US-FL
Camellia, Japanese	*Camellia japonica*	Evergreen	Partial Shade to Full Sun	7A - 9A	10' - 15'	6' - 10'	L	MA, NW, SC, SE, NoCA, SoCA	Asia
Haawa (Tree Form)	*Pittosporum confertiflorum*	Evergreen	Full Sun to Part Sun	Hawaii	6' - 30'	10'	XL	Oahu, Lanai, Maui, Hawaii	US-HI

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Table 2 (Cont.).

Common Name [1,2,8]	Latin Name	Plant Type	Sun	Hardiness Range	Mature Height [5]	Mature Spread [5]	Sizing [7]	Availability [9]	Nativity
Hawaiian Holly (Shrub or Tree)	*Ilex anomala*	Evergreen	Full Sun to Part Sun	Hawaii	10' - 30'	40'	Tree	Kauai, Oahu, Molokai, Lanai, Maui, Hawaii	US-HI
Hawaiian Sumac (Tree Form)	*Rhus sandwicensis*	Evergreen	Full Sun to Part Sun	Hawaii	6' - 30'	10'	XL	Kauai, Oahu, Molokai, Maui, Hawaii	US-HI
Holly, Chinese	*Ilex cornuta*	Evergreen	Partial Shade to Full Sun	7A - 9A	15' - 25'	15' - 25'	Tree	MA, NE, NW, SE, NoCA, SoCA	Asia
Holly, Foster's	*Ilex x attenuata 'Fosteri'*	Evergreen	Partial Shade to Full Sun	6A - 9A	20' - 25'	6' - 10'	L	MA, NE, NW, SC, SE, NoCA, SoCA	SE-US
Holly, Nellie Stevens	*Ilex x*	Evergreen	Partial Shade to Full Sun	6A - 9A	15' - 25'	6' - 10'	L	MA, NE, NW, SC, SE, NoCA, SoCA	Europe/Asia-Developed
Holly, Skypencil	*Ilex crenata Steeds; Skypencil*	Evergreen	Partial Shade to Full Sun	6A – 9A	6' – 10'	6' – 10'	L	MA, NW, SC	Asia
Holly, Yaupon	*Ilex vomitoria*	Evergreen	Full Shade to Full Sun	7A - 10A	15' - 18'	10' - 15'	XL	MA, NW, SC, SE, NoCA, SoCA	SE-US
Koolau Range Cheesewood	*Pittosporum glabrum*	Evergreen	Full Sun to Part Sun	Hawaii	15' - 30'	10'	XL	Kauai, Oahu, Molokai, Lanai, Maui	US-HI
Magnolia, Sweetbay or Swamp	*Magnolia virginiana*	Evergreen	Full Shade to Full Sun	5A - 10A	12' - 20'	15' - 25'	Tree	MA, NE, NW, SE	SE-US
Mamane (Tree Form)	*Sophora chrysophylla*	Evergreen	Full Sun to Part Sun	Hawaii	6' - 30'	10' - 20'	XL	Kauai, Oahu, Molokai, Lanai, Maui, Hawaii	US-HI
Ohia Lehua (Tree Form)	*Metrosideros polymorpha*	Evergreen	Full Sun to Part Sun	Hawaii	6' - 30'	10' - 20'	XL	Kauai, Oahu, Molokai, Lanai, Maui, Hawaii	US-HI
Wax Myrtle, Southern	*Myrica cerifera*	Evergreen	Partial Shade to Full Sun	7B - 11	15' - 25'	15' - 25'	Tree	MA, SC, SE	SE-US

Notes:

1. The species listed are drought tolerant and have applicability to bioretention due to shallow root zones.
2. The species highlighted in green are typically more readily available in the noted regions as the listed species or another similar cultivar.
3. This list is subject to availability and Contech reserves the right to make appropriate substitutions when necessary.
4. For species not listed, please contact Contech for suitability.
5. Mature height and spread do not reflect plant size at planting / system activation. Contact Contech for information on available sizes at activation.
6. Contech promotes the use of non-invasive species in Filterra systems, and has made efforts to maintain a plant list free of invasives. However, always check with local sources, as some species listed (even natives) may be invasive in some regions and not others.
7. All Filterra vault systems incorporate a ponding depth ranging from 12"-36" between finished grade and media surface. For systems with more than 18" from finished grade to media (FTIBC, FTIBP, FTPD, etc), Contech recommends choosing a species with "Sizing" noted as "XL" or "Tree".
8. The species highlighted in orange are available for an additional charge of $250 per plant required.
9. Availability Key: GL=Great Lakes; GP=Great Plains; MA=Mid-Atlantic; NE=Northeast; NW=Northwest; SW=Southwest; SE=Southeast; SC=South Central; NoCA=Northern CA; SoCA=Southern CA; E-Can=Eastern Canada; W-Can=Western Canada

Table 3 – Activation Checklist

Filterra® Activation Checklist

CONTECH ENGINEERED SOLUTIONS

Project Name: ______________________ Company: ______________________

Site Contact Name: ______________________ Site Contact Phone/Email: ______________________

Site Owner/End User Name: ______________________ Site Owner/End User Phone/Email: ______________________

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

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

Attach additional sheets as necessary.

NOTE: A charge of $500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation and 1st Year Maintenance.

______________________ ______________________

Signature Date

References

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