



**NOTES:**

- FOR FULL BIORETENTION STORMWATER SYSTEM SPECIFICATIONS, PLEASE REFER TO THE UNH STORMWATER CENTER'S BIORETENTION SPECIFICATIONS PUBLICATION, DATED FEBRUARY 2017, FOUND AT: [https://www.unh.edu/unhsc/sites/default/files/media/unhsc\\_bsm\\_spec\\_2-28-17\\_0.pdf](https://www.unh.edu/unhsc/sites/default/files/media/unhsc_bsm_spec_2-28-17_0.pdf)
- SYSTEM FOOTPRINT NEED NOT BE RECTANGULAR. ANY SHAPE IS POSSIBLE. THESE DETAILS USE THE RECTANGULAR SHAPE AS AN EXAMPLE.
- THESE DETAILS ARE NOT TO SCALE; FOR DIMENSIONS AND SPECIFICATIONS, REFERENCE EACH LETTER TO THE TABLE OF METRICS.
- BIORETENTION SOIL MIX SHALL NOT BE PLACED UNTIL AFTER ENGINEERING APPROVAL AND INSPECTION OF SUBGRADE.
- BIORETENTION SYSTEM IS RECOMMENDED TO HAVE PRETREATMENT (FOREBAY, SWALE, OR OTHER APPROVED STRUCTURE). PRETREATMENT IS REQUIRED FOR PROJECTS REQUIRING ALTERATION OF TERRAIN (AOT) PERMITTING.
- PLANT THE SYSTEM AS SPECIFIED; AT A MINIMUM, SEED THE SYSTEM FLOOR AND SIDE SLOPES WITH RYE GRASS MIXTURE CONTAINING PERENNIAL AND WINTER RYES, AT A RATE SPECIFIED BY THE MANUFACTURER. STABILIZE THE SLOPES WITH STRAW TO A DEPTH OF 1".
- GENERAL CONSTRUCTION GUIDELINES:
  - VERIFY THAT NO FOREIGN OR DELETERIOUS MATERIAL OR LIQUID SUCH AS PAINT, PAINT WASHOUT, CONCRETE SLURRY, ASPHALT/CONCRETE LAYERS OR CHUNKS, CEMENT, PLASTER, OILS, GASOLINE, DIESEL FUEL, PAINT THINNER, TURPENTINE, TAR, ROOFING COMPOUND, SOLID WASTE, OR ACID HAS BEEN DEPOSITED IN PLANTING SOIL (BIORETENTION MEDIA OR LOAM ON SIDE SLOPES).
  - PROCEED WITH PLACEMENT OF ANY SUBSURFACE MATERIALS ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.
  - COMPACT EACH BLENDED LIFT OF BIORETENTION SOIL MEDIA TO 75% OF MAXIMUM STANDARD PROCTOR DENSITY ACCORDING TO ASTM D698.
  - GRADE SOIL MEDIA TO A SMOOTH, UNIFORM SURFACE PLANE WITH LOOSE, UNIFORMLY FINE TEXTURE. ROLL AND RAKE, REMOVE RIDGES, AND FILL DEPRESSIONS TO MEET FINISH GRADES.
  - LIGHTLY COMPACT FINISHED FLOOR ELEVATION AND FINISHED SLOPES USING THE BUCKET OF AN EXCAVATOR, NON-MOTORIZED ROLLER, HAND TAMP, OR OTHER MEANS, THEN ROUGHEN SURFACE WITH A RAKE TO LOOSEN SOILS BEFORE SEEDING.
  - DO NOT COMPACT THE SUBGRADE AT THE BOTTOM OF EXCAVATION UNLESS PERMEABILITY EXCEEDS  $1 \times 10^{-5} \text{ cm/s}$
- BIORETENTION SOIL MEDIA (BSM) MIXTURE SPECIFICATIONS:
  - STICKS AND ROOTS SHOULD BE MINIMIZED IN THE BSM MIXTURE, AND PREFERABLY LIMITED TO NOTHING LARGER THAN 4.76 mm (0.187 in).
  - DEBRIS AND OTHER FOREIGN MATERIALS SHOULD BE MINIMIZED.
  - ORGANIC MATTER SHOULD MAKE UP A MINIMUM OF 3% BY VOLUME AND A MAXIMUM 8% BY VOLUME OF THE BSM.
  - BSM MIXTURE SHOULD HAVE A SOIL REACTION pH OF 6 TO 7.
  - CATION EXCHANGE CAPACITY (CEC) OF BSM SHOULD BE A MINIMUM OF 10 meq PER 100 mL AT A pH OF 7.0.
- IF BSM IS PURCHASED FROM A MANUFACTURER, BSM MIXTURE SHALL NOT CONTAIN THE FOLLOWING:
  - UNACCEPTABLE MATERIALS: CONCRETE SLURRY, CONCRETE LAYERS OR CHUNKS,

- CEMENT, PLASTER, BUILDING DEBRIS, ASPHALT, BRICKS, OILS, GASOLINE, DIESEL FUEL, PAINT THINNER, TURPENTINE, TAR, ROOFING COMPOUND, ACID, SOLID WASTE, OR OTHER EXTRANEUS MATERIALS THAT ARE HARMFUL TO PLANTS.
- UNUSABLE MATERIALS: STONES, ROOTS, PLANTS, SOD, CLAY LUMPS, OR POCKETS OF COARSE SAND THAT EXCEED A COMBINED MAXIMUM OF 5% BY DRY WEIGHT OF THE MANUFACTURED SOIL.
- LARGE MATERIALS: STONES, CLODS, ROOTS, CLAY LUMPS EXCEEDING 0.187 in (4.76 mm) IN ANY DIMENSION.
- ORGANIC SOIL AMENDMENTS:
  - NO COMPOST SHOULD BE USED IN THE PLANTING MIX (USED ON THE SIDE SLOPES AND SURROUNDING AREA) UNLESS SPECIFIED BY THE ENGINEER.
  - SPHAGNUM PEAT: PARTIALLY DECOMPOSED SPHAGNUM PEAT MOSS, FINELY DIVIDED OR OF GRANULAR TEXTURE WITH 100% PASSING THROUGH A 1/2-in (13 mm) SIEVE, WITH A pH OF 3.4 TO 4.8.
  - WOOD DERIVATIVES: SHREDDED WOOD, WOOD CHIPS, GROUND BARK, OR WOOD WASTE; OF UNIFORM TEXTURE AND FREE OF STONES, STICKS, SOIL, OR TOXIC MATERIAL.
- THE CRUSHED STONE LAYER SHOULD CONSIST OF AASHTO #5 STONE (3/4-in).
- THE VOLUME OF WATER CONTAINED ABOVE THE BSM ELEVATION AND BELOW THE HIGH FLOW SPILLWAY IS STATISTICALLY DESIGNED TO HOLD A SPECIFIC RUNOFF VOLUME.
- THE DESIGN VOLUME ABOVE THE BSM IS PREFERABLY THE WQV. THIS VOLUME MAY NOT BE ACHIEVABLE FOR RETROFIT INSTALLATIONS

BIORETENTION SYSTEM DESIGN METRICS				
ID	DESIGN PARAMETER	MIN	DESIGN	UNITS
A	SYSTEM FLOOR WIDTH			FT
B	SYSTEM FLOOR LENGTH			FT
C	BIORETENTION FOOTPRINT AREA			SF
D	WATER QUALITY VOLUME			CF
E	WQV AND RISER CAP ELEVATION			FT
F	SYSTEM FLOOR ELEVATION			FT
G	BOTTOM BSM ELEVATION			FT
H	BOTTOM STONE ELEVATION			FT
I	TOP STONE/OUTLET INVERT ELEVATION			FT
J	WQV PONDING DEPTH			IN
K	BSM MEDIA DEPTH	18		IN
Li	INLET END PEA GRAVEL DEPTH			IN
Lo	OUTLET END PEA GRAVEL DEPTH	3		IN
Mi	INLET END CRUSHED STONE DEPTH			IN
Mo	OUTLET END CRUSHED STONE DEPTH	14		IN
N	SUBDRAIN DEPTH ABOVE BOTTOM	4		IN
O	PERFORATED SUBDRAIN DIAMETER	6		IN

BIORETENTION SYSTEM DESIGN METRICS				
ID	DESIGN PARAMETER	MIN	DESIGN	UNITS
P	RISER PIPE DIAMETER	6		IN
Q	OUTLET PIPE DIAMETER	6		IN
R	INFLOW PIPE DIAMETER			IN
S	PERFORATED SUBDRAIN LENGTH			FT
T	OUTLET PIPE LENGTH			FT
U	INFLOW PIPE LENGTH			FT
V	SLOPE GRADE (RUN PER 1ft RISE)			FT
W	ROCK APRON WIDTH			FT
X	ROCK APRON LENGTH			FT
Y	RISER DOME GRATE DIAMETER			IN
Z	PVC LINER SLOPE			%
AA	OUTLET PIPE SLOPE			%
BB	CLEAN-OUT RISER DIAMETER			IN
CC	CLEAN-OUT RISER ELEVATION			FT
DD	PVC LINER GAP	0.1*B		FT
EE	OUTLET PIPE ORIFICE DIAMETER	1		IN

ACCEPTABLE PARTICLE SIZE DISTRIBUTION OF FINAL BIORETENTION SOIL MIX				
MEDIA TYPE	SIEVE #	SIZE (in)	SIZE (mm)	% PASSING
COARSE SAND	4	0.187	4.76	100
MEDIUM SAND	10	0.079	2.00	95
FINE SAND	40	0.017	0.42	40-15
SILTS	200	0.003	0.075	10-20
CLAYS	<200	PAN	PAN	0-5

BIORETENTION SOIL MEDIA COMPONENTS:\*

- AMOUNTS MIXED BY TOTAL VOLUME
- 60-85% - SAND (0.5 TO 2.0 mm) (SEE SPECS ABOVE)
- 15-25% - LOAM OR TOPSOIL
- 3-8% - ORGANIC MATTER
- 0-5% - WATER TREATMENT RESIDUALS OR IRON FILINGS\*\*

\*ALTERNATELY, USE MEDIA SPECIFIED IN THE ALTERATION OF TERRAIN RULES, Env-Wq 1508.07(k)

\*\*THIS IS AN AMENDMENT USED FOR ENHANCED PHOSPHORUS ADSORPTION

INTERNAL STORAGE RESERVOIR (ISR) NOTES:

- THE HYBRID BIORETENTION SYSTEM HARBORS AN ANAEROBIC INTERNAL STORAGE RESERVOIR FOR NITROGEN REMOVAL.
- THE ISR IS SEPARATED BY AN IMPERMEABLE PVC LINER BETWEEN THE PEA GRAVEL AND CRUSHED STONE LAYERS.
- THE PVC LINER SLOPES FROM THE OUTLET TOWARDS THE INLET TO MAXIMIZE STORAGE RETENTION AND PROVIDE EXTRA TREATMENT/FILTER TIME VIA PLUG FLOW THROUGH CRUSHED STONE.
- DESIGN GUIDELINES FOR THE SUBSURFACE GRAVEL WETLAND SPECIFICATIONS (UNHSC, 2016) IDENTIFIED THAT THE WATER VOLUME IN THE ISR BE AT LEAST 0.26\*WQV [WATER QUALITY VOLUME], OR 26% OF THE WQV.
- PVC LINER THICKNESS OF 40 TO 60 mil, PREFERABLY SEAMLESS. IF SEAMS ARE UNAVOIDABLE, THE SEAMS SHOULD BE SEALED.

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to UNHSC without delay. The Copyrights to all designs and drawings are the property of UNHSC. Reproduction or use for any purpose other than that authorized by UNHSC is forbidden.



University of New Hampshire  
35 Colovos Road  
Durham, NH 03824  
Phone (603) 862-2818  
Fax (603) 862-3957  
<http://www.unh.edu/unhsc>

02	10 Sept 2019	DES Revisions
01	12 Mar 2019	Initial design
No.	Date	Revision
Designed:	JCB	Checked:
		TPB/JJH
Approved:		TPB/JJH

GRAPHIC SCALE

N/A - DRAWING NOT TO SIZE

Original Drawing Size = 34 x 22 in.

Project: **STANDARD DETAIL BIORETENTION ISR**  
STORMWATER SYSTEM

Date: 21 FEB 2020  
Sheet No. 01 of 01