Protecting the Environment Through Stormwater Management

Presented by:

John E. Bensley, PE

BEALS+THOMAS

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Sources of Pollution in Stormwater Runoff

- Sediment
  - Sand from streets
  - Soils from construction sites
- Excess nutrients
  - Fertilizers
  - Decaying organic matter
- Bacteria and other pathogens
  - Pet, wildlife and human waste
- Debris
  - Litter
  - Automobile parts
- Household hazardous wastes
  - Insecticides and pesticides
  - Paint
  - Solvents
- Vehicles
  - Used motor oil and other toxic auto fluids
  - Copper and other heavy metal dust
- Industrial plants
  - Metal plating
  - Chemical manufacturing
- Salt storage
  - Road salting

www.nccwep.org

www.epa.gov and www.nccwep.org

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Enhancing Water Quality Runoff from Residential Properties

- Residential Rain Gardens
- Rain Barrels

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Bioretention Areas & Rain Gardens

Description: Bioretention is a technique that uses soils, plants, and microbes to treat stormwater before it is infiltrated and /or discharges. Bioretention cells (also called rain gardens in residential applications) are shallow depressions filled with sandy soil topped with a thick layer of mulch and planted with dense native vegetation.

Bioretention Areas & Rain Gardens

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There are two types of bioretention cells: those that are designed solely as an organic filter filtering bioretention areas and those configured to recharge groundwater in addition to acting as a filter exfiltrating bioretention areas. A filtering bioretention area includes an impermeable liner and underdrain that intercepts the runoff before it reaches the water table so that it may be conveyed to a discharge outlet, other best management practices, or the municipal storm drain system. An exfiltrating bioretention area has an underdrain that is designed to enhance exfiltration of runoff into the groundwater.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	An exfiltrating bioretention area provides groundwater recharge.
4 - TSS Removal	90% TSS removal credit with adequate pretreatment
5 - Higher Pollutant Loading	Can be used for certain land uses with higher potential pollutant loads if lined and sealed until adequate pretreatment is provided. Adequate pretreatment must include 44% TSS removal prior to infiltration. For land uses that have the potential to generate runoff with high concentrations of oil and grease such as high intensity use parking lots and gas stations, adequate pretreatment may also include an oil grit separator, sand filter or equivalent. In lieu of an oil grit separator or sand filter, a filtering bioretention area also may be used as a pretreatment device for infiltration practices exfiltrating runoff from land uses with a potential to generate runoff with high concentrations of oil and grease.
6 - Discharges near or to Critical Areas	Good option for discharges near cold-water fisheries. Should not be used near bathing beaches and shellfish growing areas.
7 - Redevelopment	Suitable with appropriate pretreatment

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	90% with vegetated filter strip or equivalent
• Total Nitrogen	30% to 50% if soil media at least 30 inches
• Total Phosphorus	30% to 90%
• Metals (copper, lead, zinc, cadmium)	40% to 90%
• Pathogens (coliform, e coli)	Insufficient data

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Residential Rain Gardens

- Rain gardens can be used for residential settings as well as commercial

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Rain Barrels

- Plastic or wood barrels that collect stormwater runoff from roofs via gutters or roofdrains.
- Rain barrels prevent stormwater from percolating through to the building foundation
- Water collected in rain barrels can be used for household chores such as washing cars, watering lawns, filling swimming pools, etc.
- The Town of Arlington offers a rain barrel discount purchase program through local vendors

Photo courtesy of
http://www.greatamericanrainbarrel.com/

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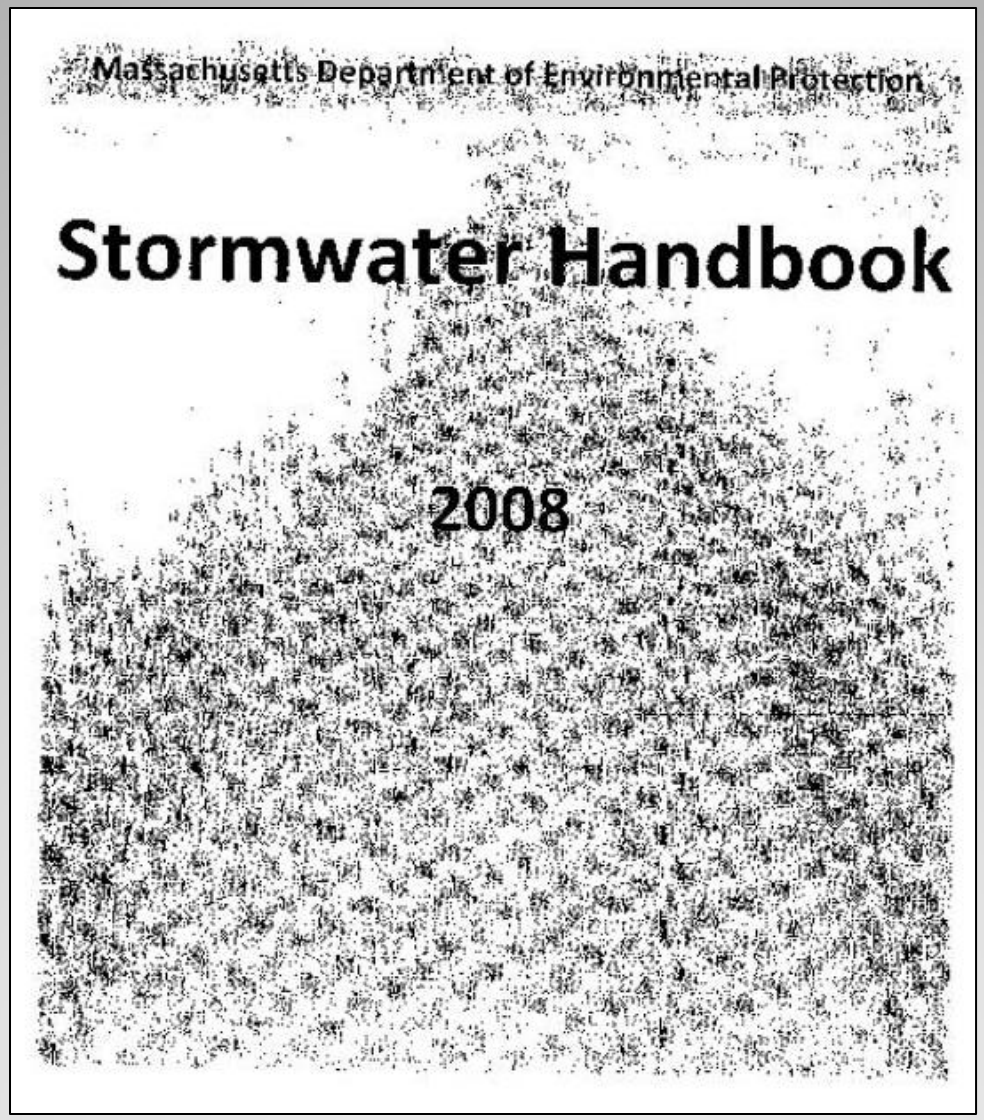

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MassDEP Stormwater Management Standards

1. No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.
2. Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.
3. Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.
4. Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

    a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;

    b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

    c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

MassDEP Standards cont'd

5. For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

8. A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

10. All illicit discharges to the stormwater management system are prohibited.

Enhancing Water Quality Runoff from Commercial Properties

- Constructed Stormwater Wetlands
- Bioretention Areas
- Porous Pavement
- Green Roofs
- Subsurface Detention System
- Water Quality Inlets

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Constructed Stormwater Wetlands

Description: Constructed stormwater wetlands are stormwater wetland systems that maximize the removal of pollutants from stormwater runoff through wetland vegetation uptake, retention and settling.

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Ability to meet specific standards

Standard	Description
2 - Peak Flow	If properly designed, can provide peak flow attenuation.
3 - Recharge	Provides no groundwater recharge.
4 - TSS Removal	Provides 80% TSS removal when combined with sediment forebay for pretreatment
5 - Higher Pollutant Loading	May be used as treatment BMP provided basin bottom is lined and sealed
6 - Discharges near or to Critical Areas	Do not use near cold-water fisheries. Highly recommended for use near other critical areas.
7 - Redevelopment	Suitable if sufficient space is available.

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - 80% with pretreatment
- Total Nitrogen - 20% to 55%
- Total Phosphorus - 40% to 60%
- Metals (copper, lead, zinc, cadmium) - 20% to 85%
- Pathogens (coliform, e coli) - Up to 75%

Advantages/Benefits:

- Relatively low maintenance costs.
- High pollutant removal efficiencies for soluble pollutants and particulates.
- Removes nitrogen, phosphorus, oil and grease
- Enhances the aesthetics of a site and provides recreational benefits.
- Provides wildlife habitat.

Disadvantages/Limitations:

- Depending upon design, more land requirements than other BMPs.
- Until vegetation is well established, pollutant removal efficiencies may be lower than anticipated.
- Relatively high construction costs compared to other BMPs.
- May be difficult to maintain during extended dry periods
- Does not provide recharge
- Creates potential breeding habitat for mosquitoes
- May present a safety issue for nearby pedestrians
- Can serve as decoy wetlands, intercepting breeding amphibians moving toward vernal pools.

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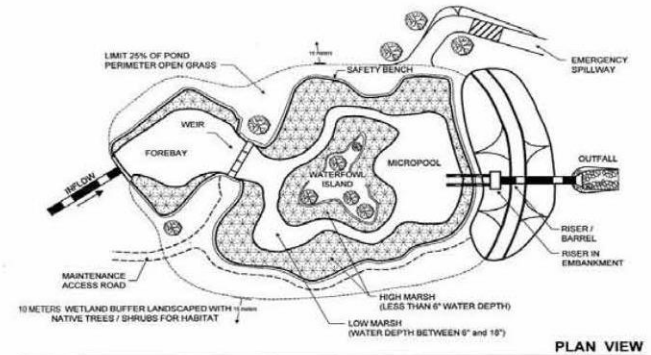

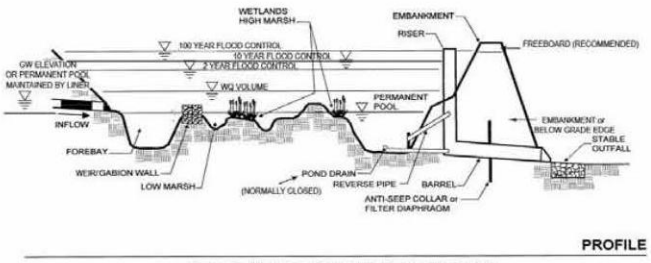

Example of Constructed Wetland: Shallow Marsh Type

adapted from Schueler 1992

Maintenance

Activity	Frequency
Inspect wetland during both the growing and non-growing seasons	Twice a year for the first three years of construction,
Clean out forebays	Once a year
Clean out sediment in basin/wetland systems	Once every 10 years

Special Features

There are five basic types of constructed stormwater wetlands: shallow marsh systems, basin/wetland systems, extended detention wetlands, pocket wetlands, and gravel wetlands.

Like other stormwater BMPs, constructed stormwater wetlands may not be located within natural wetland areas other than riverfront area, land subject to coastal storm flowage, isolated land subject to flooding or bordering land subject to flooding.

The Operation and Maintenance Plan for constructed stormwater wetlands must include measures for monitoring and preventing the spread of invasive species.

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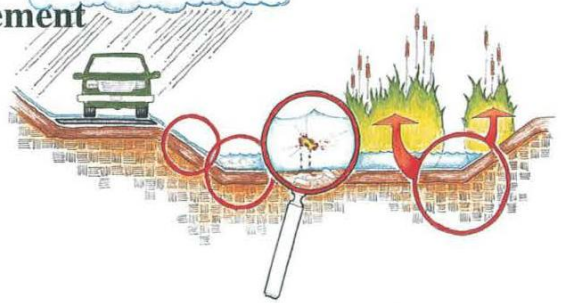
Constructed Wetlands for Stormwater Management



Water Quality Enhancement Mechanisms

Settling and Burial of Sediments	Pollutants, such as phosphorous and metals, bind to sediments in the water, which when slowed by vegetation settle to the bottom of the wetland and are buried within the soil.
Bacterial Decomposition	Vegetation, decaying plant matter and organic sediments come together within the wetland to create an environment in which microbes, whose activity promote the removal and transformation of nitrogen and various metals, can thrive.
Adsorption to Sediments, Vegetation and Detritus	Dissolved pollutants are removed from the water through adsorption, the attraction of ions or compounds to the surface of a solid, an activity promoted within wetlands by the high amount of organic matter and detritus (living and decaying plant matter). The higher the vegetative cover within the wetland, the higher the production of organic matter and the greater the adsorption process.
Uptake by Wetland Plants and Algae	Plants facilitate the removal of pollutants through their roots and the water column. Although storage of pollutants in wetland plants is seasonal and temporary, ending with their decomposition, trees and shrubs provide a long term solution, storing nutrients for their entire life cycle. In addition, those metals and nutrients absorbed through the growing season can also mitigate the adverse effects of excessive nutrients, which can be present on surface waters during the summer months causing algae blooms and reduced available oxygen. A healthy amount of algae serves to remove the soluble pollutants by converting these substances to biomass which, in turn, settles into the wetland sediments.

Stormwater Facilities as Site Amenities

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Constructed Stormwater Wetlands

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Bioretention Areas

- Densely vegetated area with sandy soil and mulch
- Stormwater runoff percolates through mulch and soil which acts as a filter

Fay School Project by Beals and Thomas, Inc.
Southborough, MA

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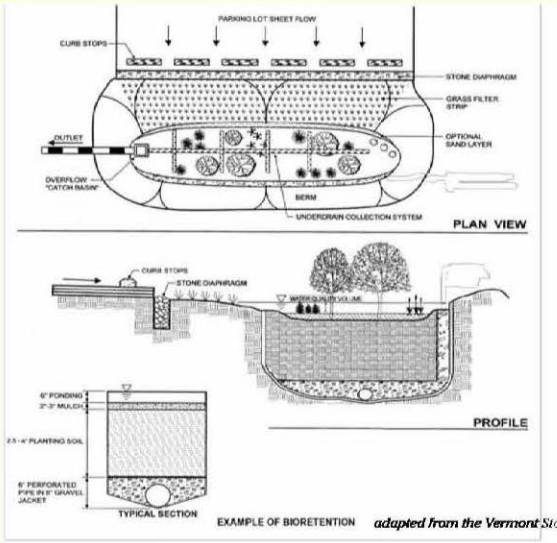

EXAMPLE OF BIORETENTION *adapted from the Vermont Stormwater Manual*

Special Features:

- Can be lined and sealed to prevent recharge where appropriate
- Adequate pretreatment is essential
- Not recommended in areas with steep slope
- Depth of soil media depends on type of vegetation that is proposed
- Soil media must be 30 inches deep to achieve removal of nitrogen

Advantages/Benefits:

- Can be designed to provide groundwater recharge and preserves the natural water balance of the site
- Can be designed to prevent recharge where appropriate
- Supplies shade, absorbs noise, and provides windbreaks
- Can remove other pollutants besides TSS including phosphorus, nitrogen and metals
- Can be used as a stormwater retrofit by modifying existing landscape or if a parking lot is being resurfaced
- Can be used on small lots with space constraints
- Small rain gardens are mosquito death traps
- Little or no hazard for amphibians or other small animals

Disadvantages/Limitations:

- Requires careful landscaping and maintenance
- Not suitable for large drainage areas

Maintenance

Activity	Frequency
Inspect and remove trash	Monthly
Mow	2 to 12 times per year
Mulch	Annually
Fertilize	Annually
Remove dead vegetation	Annually
Prune	Annually

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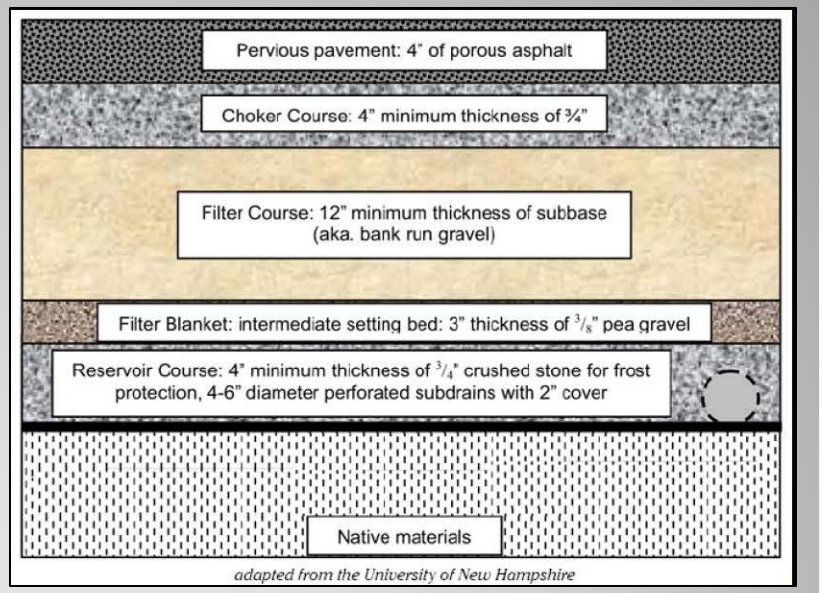
Porous Pavement

Porous Paver Parking Stalls



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← Porous Asphalt Parking Lot at UNH, with cross section

The use of porous materials (asphalt, concrete, pavers) for roadway and parking applications reduces impervious area and increases water quality treatment and recharge potential.

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Green Roofs

Land8.com

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Special Features

Runoff from a green roof, like the runoff from non-metal roofs, may be discharged to the ground via a dry well without further treatment.

Runoff from a green roof must be kept separate from the runoff from any land uses with higher potential pollutant loads.

Intensive green roofs that require nutrient-rich fertilizers must not be used where the runoff from such roofs may be discharged to nutrient impaired surface waters.

Green roofs are not appropriate in watersheds where recharge is a high priority.

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	No active removal of suspended solids
• Total phosphorus (TP)	Increases TP
• Total Nitrogen	No Removal to Increased TN
• Zinc	Not Reported
• Pathogens (coliform, e. coli)	Not Reported

Maintenance

Activity & Frequency
Green roofs require active maintenance, including irrigating, weeding, mulching, and pruning. For intensive green roofs, use fertilizers containing nitrogen, phosphorus, potassium and micronutrients to support the living plants. Regularly remove any woody plants that become established on the roof.

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Case Study: Arlington 360 Project

- Arlington 360 site discharges stormwater runoff to Mill Brook
  - According to MassDEP, Mill Brook is impaired for e. coli

- Redevelopment of former 18± acre Symmes Hospital campus
- Existing hospital building and abandoned dormitory have been demolished and replaced with
  - Public park and other public open space areas
  - 70,000 sf Assisted Living Facility
  - 176 residential units

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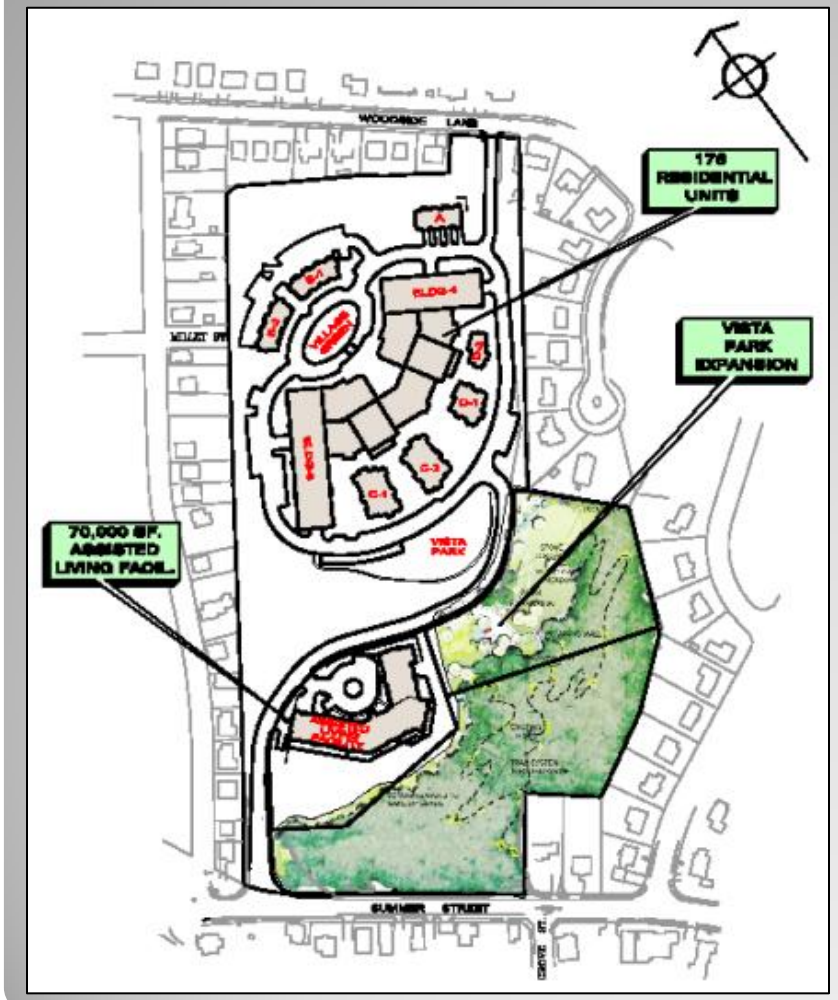
Arlington 360 Project



- Redevelopment utilized low impact development measures
  - Impervious area on site will not increase
  - Existing stormwater system will be upgraded to improve the quality of stormwater discharges and maintain the quantity and rate of runoff below pre-construction levels

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Arlington 360
Site Restrictions

- Shallow depth to bedrock
- Low permeability
  - Rock outcrop-Hollis soils topped with miscellaneous fill soils
- Steep grades
  - Hospital Road is at a 12% slope and many areas on site exceed this

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Arlington 360
Stormwater Management System

- Redevelopment project
- Existing system comprised of manholes, catchbasins and storm drains provides conveyance but no storage.
- Proposed system of manholes, catch basins and storm drains will be a significant upgrade
  - 2 subsurface detention systems
  - Water quality inlets
  - Deep sump hooded catchbasins
  - Good housekeeping practices
  - Construction period erosion controls

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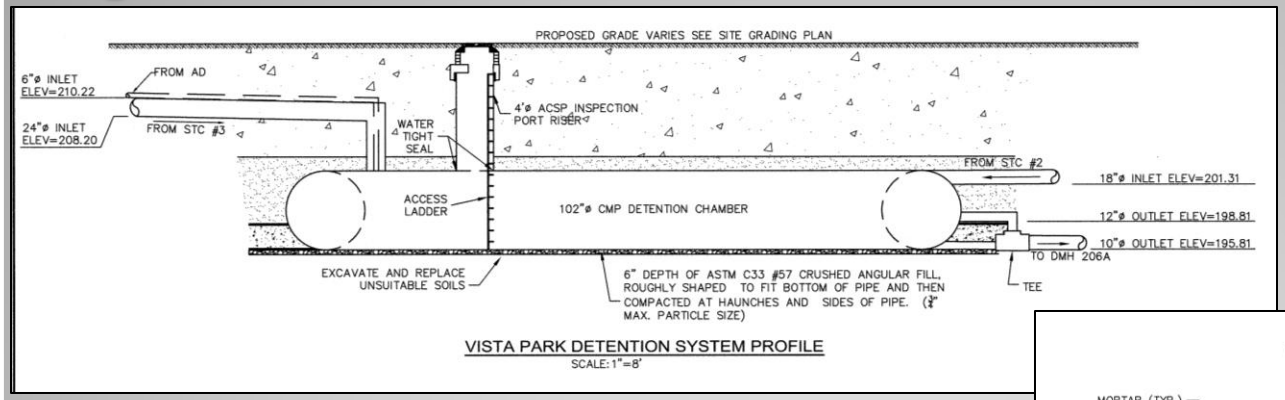
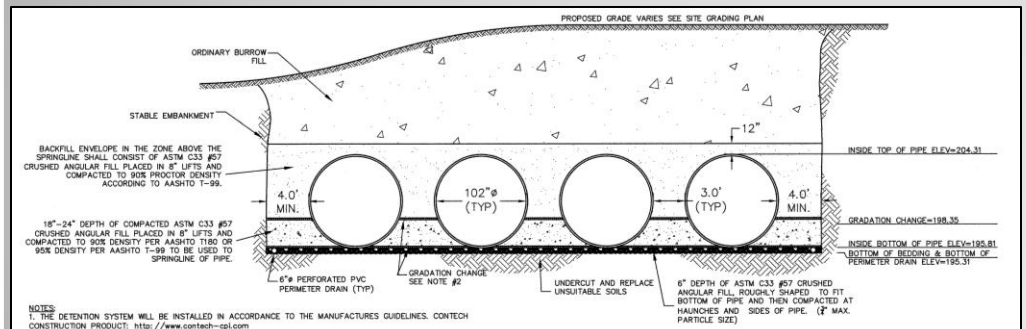
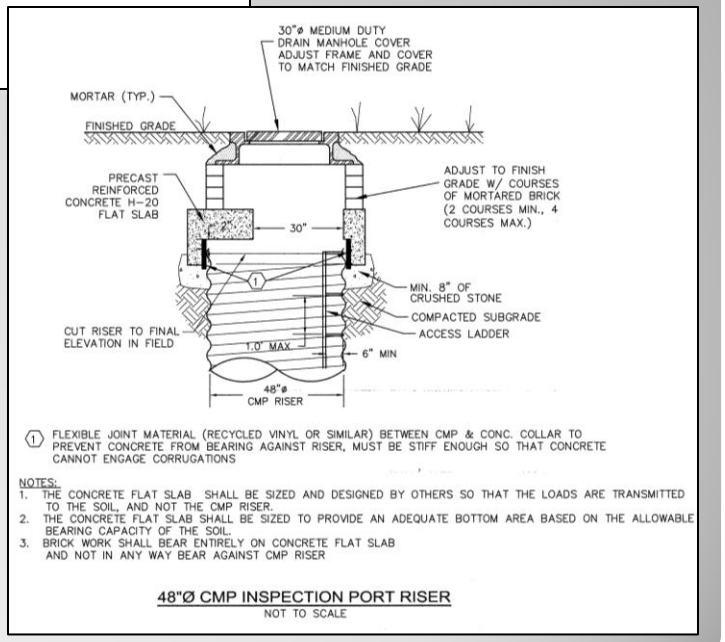
Vista Park Subsurface Detention System



VISTA PARK DETENTION SYSTEM PROFILE
SCALE: 1"=8'



VISTA PARK DETENTION SYSTEM CROSS SECTION
SCALE: 1"=8'



1 FLEXIBLE JOINT MATERIAL (RECYCLED VINYL OR SIMILAR) BETWEEN CMP & CONC. COLLAR TO PREVENT CONCRETE FROM BEARING AGAINST RISER, MUST BE STIFF ENOUGH SO THAT CONCRETE CANNOT ENGAGE CORRUGATIONS

NOTES:
1. THE CONCRETE FLAT SLAB SHALL BE SIZED AND DESIGNED BY OTHERS SO THAT THE LOADS ARE TRANSMITTED TO THE SOIL, AND NOT THE CMP RISER.
2. THE CONCRETE FLAT SLAB SHALL BE SIZED TO PROVIDE AN ADEQUATE BOTTOM AREA BASED ON THE ALLOWABLE BEARING CAPACITY OF THE SOIL.
3. BRICK WORK SHALL BEAR ENTIRELY ON CONCRETE FLAT SLAB AND NOT IN ANY WAY BEAR AGAINST CMP RISER

48"Ø CMP INSPECTION PORT RISER
NOT TO SCALE

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Vista Park Subsurface Detention System

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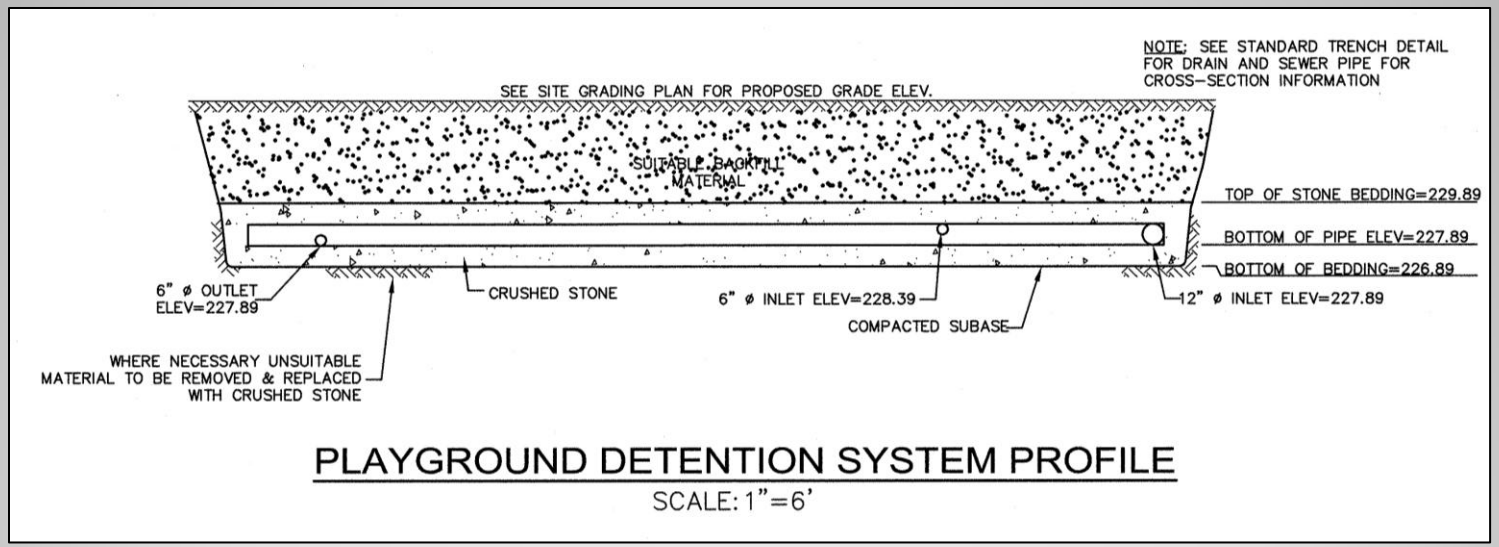
Playground Subsurface Detention System



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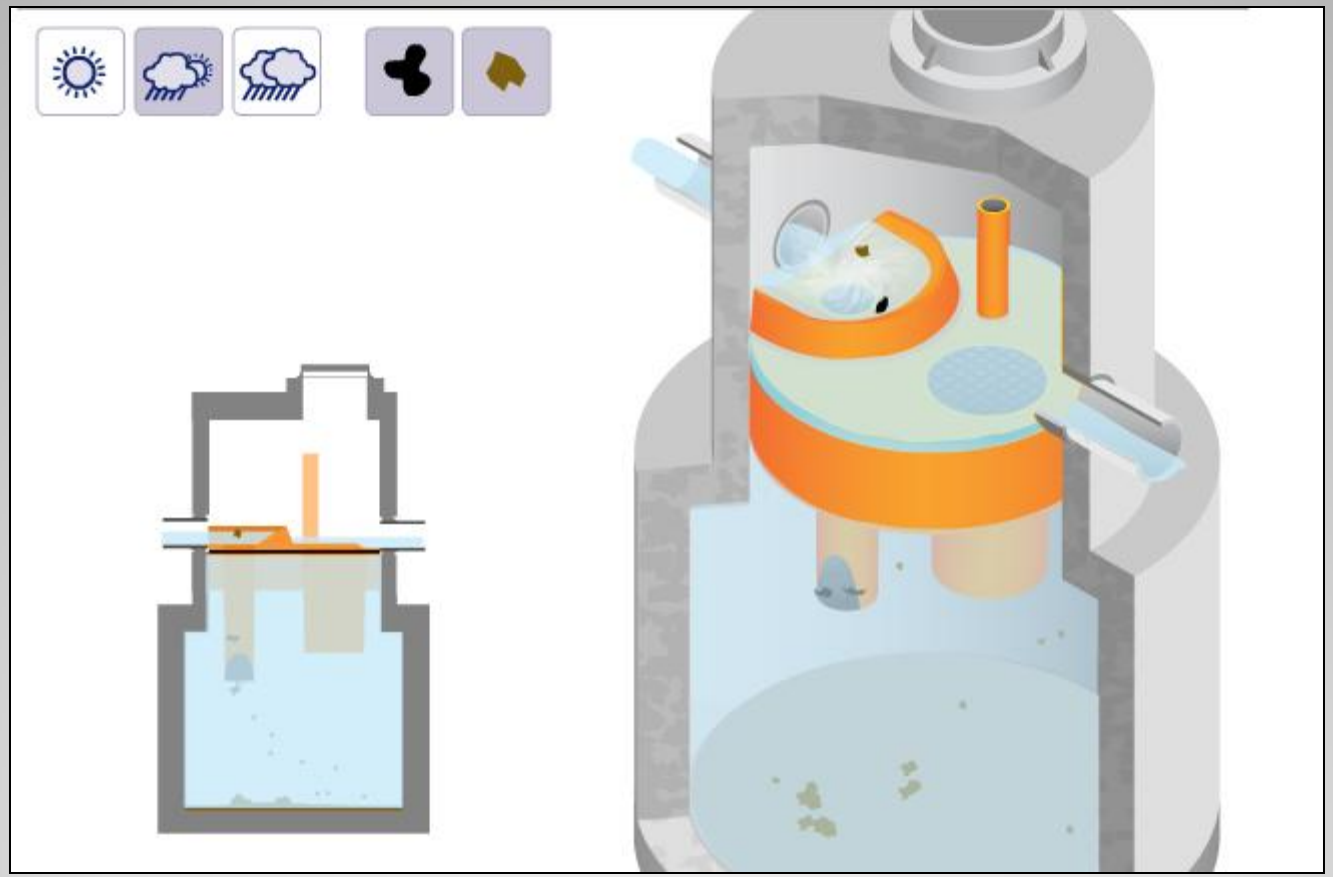
Stormceptor® Water Quality Inlets



www.stormceptor.com

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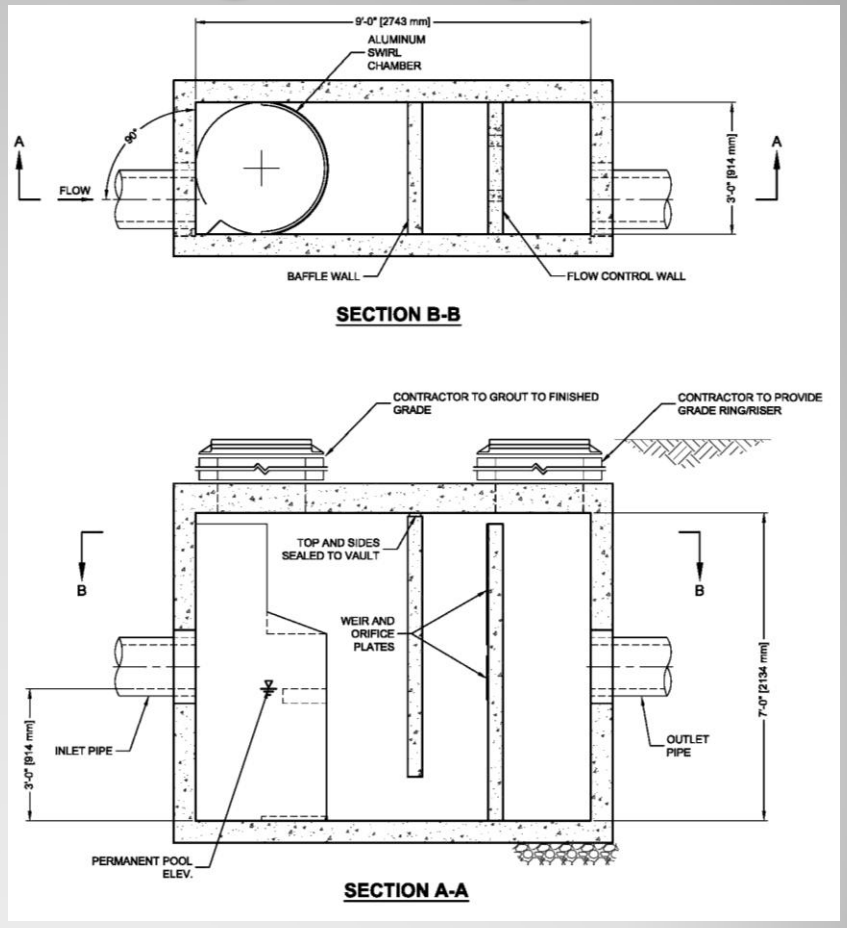
Vortechs® Water Quality Tank

- Removes fine sediment, oil, and debris
- Provides stable storage of captures pollutants



www.conteches.com

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Water Quality Tank

www.conteches.com

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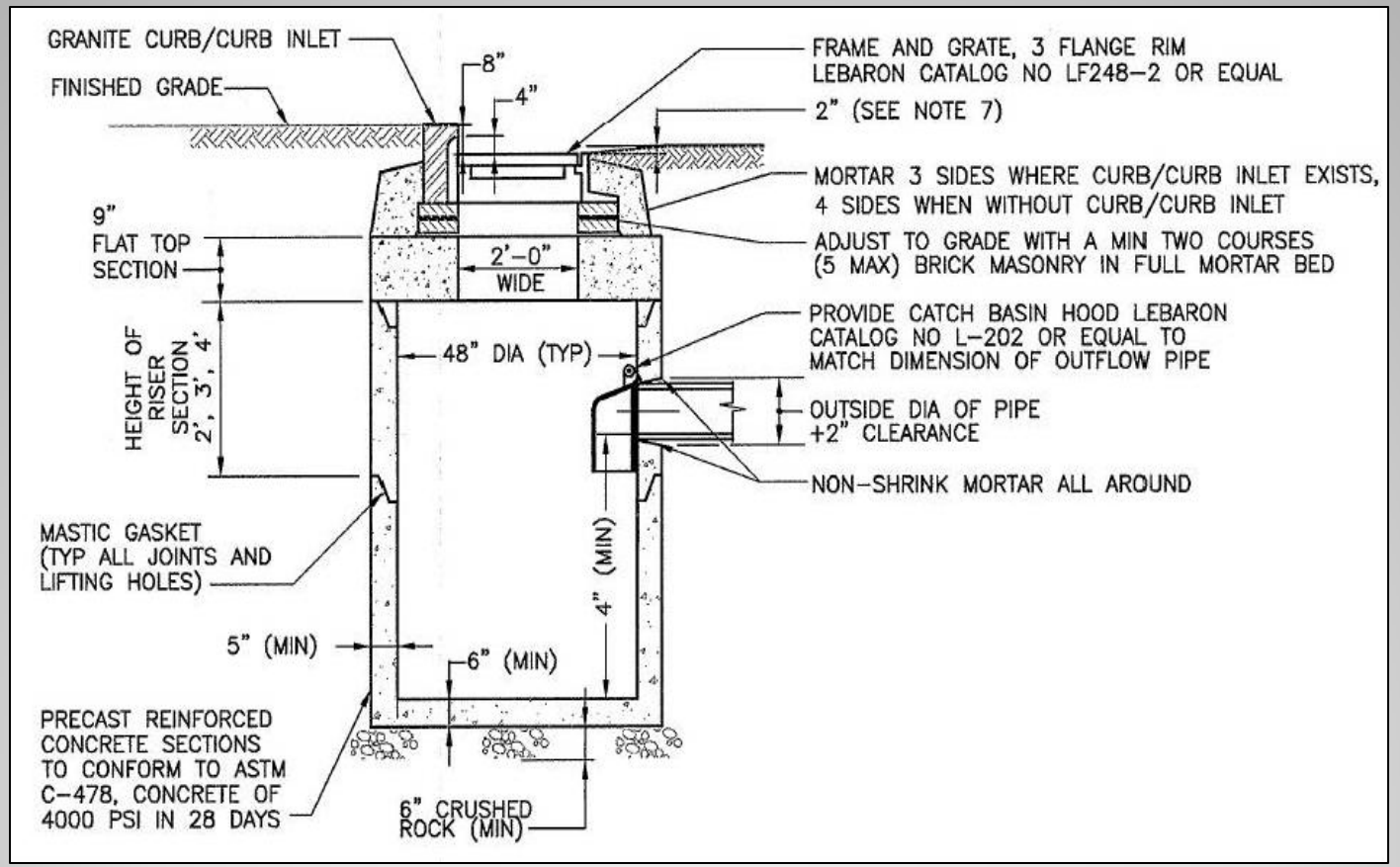
Deep Sump Hooded Catch Basin



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Good Housekeeping Practices

- Snow management and snow disposal
- Proper storage of deicing materials
- Site maintenance
  - Vegetation maintenance
  - Debris clearing
  - Storm drain stenciling
  - Septic system maintenance

Erosion and Sedimentation Control

- Silt Fence and Haybales or Straw Wattles During Construction
  - Haybales and straw wattles absorb water and filter sediment
  - Silt fencing restrains sediment
- Mulching
  - Stabilizes soils
  - Reduces the speed of stormwater runoff over an area
  - Holds seeds in place
- Erosion Control Matting
  - More stable than regular mulch
- Stone Retaining Walls
  - Retain earth behind aesthetic rock wall
- Permanent Seeding and Planting
  - Vegetation slows the speed of stormwater runoff

Erosion and Sedimentation Control at Work

www.hopnews.com

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Erosion and Sedimentation Control Failure

www.flintriverconservation.org

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Enhancing Stormwater Runoff Quality as an Individual

- Car Washing
  - Wash cars on grass instead of pavement. Grass will provide infiltration and retention, slowing the discharge of water to natural water bodies.
- Dog Walking
  - Pick up after your dog
  - Dispose of dog waste in toilet or trash
- Fertilizers
- Rain Barrels
- Roof downspouts discharged to lawn
- Pollution Prevention

Blake-manning.com

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Vegetated Filter Strips

Description: Vegetated filter strips, also known as filter strips, grass buffer strips and grass filters, are uniformly graded vegetated surfaces (i.e., grass or close-growing native vegetation) that receive runoff from adjacent impervious areas. Vegetated filter strips typically treat sheet flow or small concentrated flows that can be distributed along the width of the strip using a level spreader. Vegetated filter strips are designed to slow runoff velocities, trap sediment, and promote infiltration, thereby reducing runoff volumes.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides some peak flow attenuation but usually not enough to achieve compliance with Standard 2.
3 - Recharge	No recharge credit
4 - TSS Removal	If greater than or equal to 25' and less than 50' wide, 10% TSS removal. If greater than or equal to 50' wide, 45% TSS removal.
5 - Higher Pollutant Loading	May be used as part of a pretreatment train if lined
6 - Discharges near or to Critical Areas	May be used as part of a pretreatment train if lined. May be used near cold-water fisheries.
7 - Redevelopment	Suitable for pretreatment or as a stand-alone practice if sufficient land is available.

Advantages/Benefits:

- Reduces runoff volumes and peak flows.
- Slows runoff velocities and removes sediment.
- Low maintenance requirements.
- Serves as an effective pretreatment for bioretention cells.
- Can mimic natural hydrology.
- Small filter strips may be used in certain urban settings.
- Ideal for residential settings and to treat runoff from small parking lots and roads.
- Can be used as part of runoff conveyance system in combination with other BMPs.
- Little or no entrapment hazard for amphibians or other small creatures.

Disadvantages/Limitations:

- Variability in removal efficiencies, depending on design.
- Little or no treatment is provided if the filter strip is short-circuited by concentrated flows.
- Often a poor retrofit option due to large land requirements.
- Effective only on drainage areas with gentle slopes (less than 6 percent).
- Improper grading can greatly diminish pollutant removal.

Pollutant Removal Efficiencies

• TSS (if filter strip is 25 feet wide)	10% assumed (Regulatory)
• TSS (if filter strip is 50 feet wide)	45% assumed (Regulatory)
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data

Tree Box Filter

Description: The Tree Box Filter consists of an open bottom concrete barrel filled with a porous soil media, an underdrain in crushed gravel, and a tree. Stormwater is directed from surrounding impervious surfaces through the top of the soil media. Stormwater percolates through the media to the underlying ground. Treated stormwater beyond the design capacity is directed to the underdrain where it may be directed to a storm drain, other device, or surface water discharge.

Advantages/Benefits:

- May be used as a pretreatment device
- Provides decentralized stormwater treatment
- Ideal for redevelopment or in the ultra-urban setting

Disadvantages/Limitations:

- Treats small volumes

Special Features

Reduces volume and rate of runoff.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	No infiltration credit
4 - TSS Removal	Presumed to remove 80% TSS
5 - Higher Pollutant Loading	May be used as pretreatment device if lined
6 - Discharges to near or to Critical Areas	Not suitable for vernal pools or swimming areas. At other critical areas, may be used as a pretreatment device.
7 - Redevelopment	May be used for retrofit.

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS)- 80% presumed for regulatory purposes
- Total phosphorus (TP)- Not Reported
- Dissolved Inorganic Nitrogen- Not Reported
- Zinc- Not Reported
- Pathogens (coliform, e. coli)- Not Reported

Drainage Channels

Description: Drainage channels are traditional vegetated open channels that are designed to provide for non-erosive conveyance. They receive no infiltration or TSS removal credit (Standards 3 and 4).

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides negligible groundwater recharge.
4 - TSS Removal	0% TSS removal credit.
5 - Higher Pollutant Loading	Use as conveyance.
6 - Discharges near or to Critical Areas	May be used to achieve temperature reduction for runoff discharging to cold-water fisheries.
7 - Redevelopment	Limited applicability

Advantages/Benefits:

- Conveys stormwater
- Generally less expensive than curb and gutter systems.
- Accents natural landscape.
- Compatible with LID design practices
- Roadside channels reduce driving hazards by keeping stormwater flows away from street surfaces during storms

Disadvantages/Limitations:

- Higher degree of maintenance required than for curb and gutter systems.
- Roadside channels are subject to damage from off-street parking and snow removal.
- Provides limited pollutant removal compared to water quality swales
- May be impractical in areas with flat grades, steep topography or poorly drained soils
- Large area requirements for highly impervious sites.

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - 0%
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data

Dry Wells

Description: Dry wells are small excavated pits, backfilled with aggregate, and used to infiltrate uncontaminated runoff from non-metal roofs or metal roofs located outside the Zone II or Interim Wellhead Protection Area of a public water supply and outside an industrial site. Do not use dry wells to infiltrate any runoff that could be significantly contaminated with sediment and other pollutants. Never use dry wells to infiltrate runoff from land uses with higher potential pollutant loads, including parking lot runoff.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	Provides groundwater recharge.
4 - TSS Removal	80% TSS removal for runoff from non-metal roofs and runoff from metal roofs that are located outside the Zone II or Interim Wellhead Protection Area of a public water supply and outside an industrial site.
5 - Higher Pollutant Loading	May not be used for runoff from land uses with higher potential pollutant loads, May not be used for runoff from metal roofs located at industrial sites.
6 - Discharges near or to Critical Areas	Within a Zone II or IWPAmay be used only for runoff from nonmetal roofs. Outside a Zone II or Interim Wellhead Protection Area, may be used for both metal and nonmetal roofs provided the roof is not located on an industrial site.
7 - Redevelopment	For rooftop runoff from non-metal roofs and from metal roofs located outside a Zone II or IWPA and outside industrial sites.

Advantages/Benefits:

- Applicable for runoff from non-metal roofs and metal roofs located outside of the Zone IIs or IWPA of a public water supply, and outside industrial sites
- Can reduce the size and cost of downstream BMPs and/or storm drains
- Feasible for new development and retrofit areas
- Provides groundwater recharge

Disadvantages/Limitations:

- Clogging likely when used for runoff other than that from residential rooftops.
- May experience high failure rate due to clogging.
- Only applicable in small drainage areas of one acre or less
- When located near buildings, potential issues with water seeping into cellars or inducing cracking or heaving in slabs
- Overflow from roof leader must be directed away from sidewalks or driveways

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80%
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data

Leaching Catch Basins

Description: A leaching catch basin is pre-cast concrete barrel and riser with an open bottom that permits runoff to infiltrate into the ground. There are two configurations:

1. Stand-alone barrel/riser and
2. Barrel/riser combined with a deep sump catch basins that provides pretreatment.

80% TSS removal is awarded to the deep sump catch basin/leaching catch basin pretreatment combination provided the system is off-line.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	May provide some peak rate attenuation if sufficient number of leaching catch basins are provided to control 10-year storm
3 - Recharge	Provides groundwater recharge
4 - TSS Removal	80% TSS removal providing a deep sump catch basin is used for pretreatment and provided it is designed to be off-line
5 - Higher Pollutant Loading	May be used if 44% of TSS is removed with a pretreatment BMP prior to infiltration. For land uses that have the potential to generate runoff with high concentrations of oil and grease, an oil grit separator or equivalent may be required for pretreatment prior to discharge to the leaching catch basin. Infiltration must be done in compliance with 314 CMR 5.00.
6 - Discharges near or to Critical Areas	Not suitable except as terminal treatment for discharges to or near cold-water fisheries.
7 - Redevelopment	May be a good retrofit for sites with existing catch basins

Advantages/Benefits:

- Provide groundwater recharge.
- Remove coarse sediment

Disadvantages/Limitations:

- Need frequent maintenance. Can become a source of pollutants via resuspension if not properly maintained.
- Cannot effectively remove soluble pollutants or fine particles.
- Do not provide adequate treatment of runoff unless combined with deep sump catch basin
- Entrapment hazard for amphians and other small animals.

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80% if combined with deep sump catch basin and if designed to be off-line
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☐ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment

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