

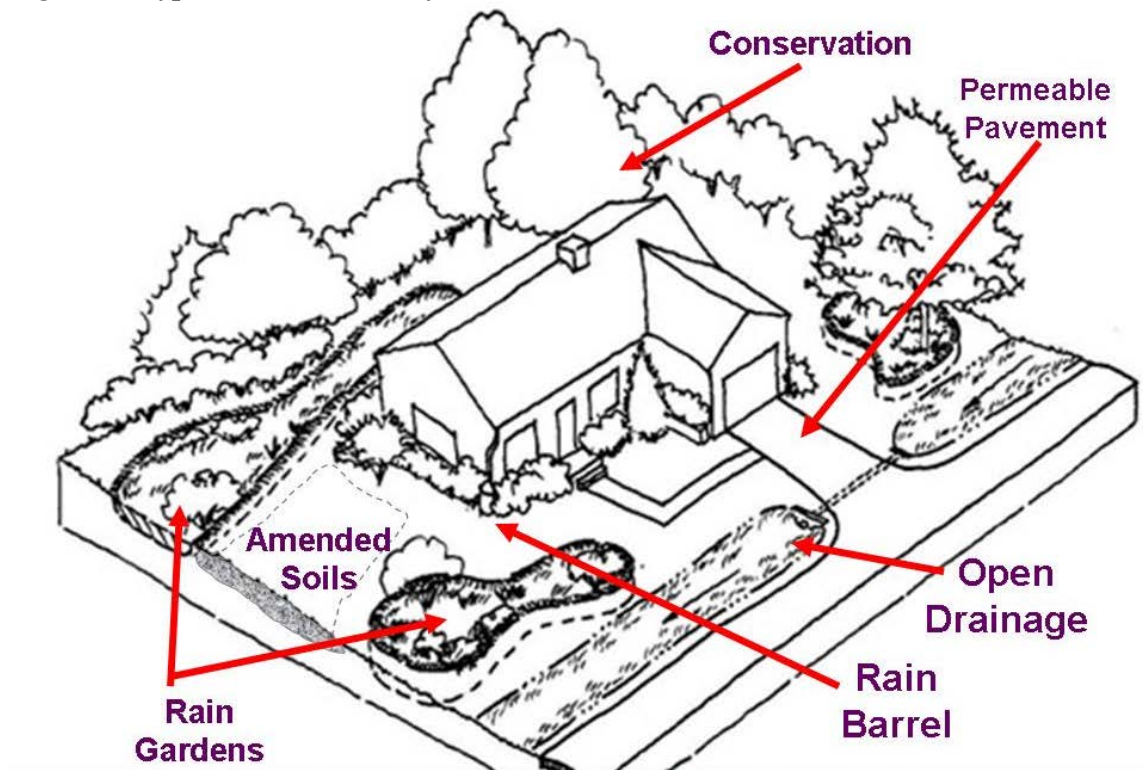
# **Stormwater Management Guide For Single Family Homes**

These practices are necessary to satisfy the water quantity and water quality criteria of the Virginia Stormwater Management Program (VSMP) Construction General Permit (9VAC25-880). These practices maintain dispersed flows and prevent environmental damage due to erosion and increased runoff from development. These practices may be used for in-lieu-of agreements or residential site plan submissions.

*The practices listed here are not comprehensive, and alternative practices may be appropriate for the site. Consult the Virginia Stormwater BMP Clearinghouse or the County for additional design options.*

<http://vwrrc.vt.edu/swc/StandardsSpecs.html>

**Figure 1: Typical House Lot Layout**



**House lot practices:**

- ❖ 1.1 Rooftop Disconnection
- ❖ 1.2 Mulched Landscape Beds
- ❖ 1.3 Rainwater Harvesting System
- ❖ 1.4 Rain Garden
- ❖ 1.5 Dry Well
- ❖ 1.6 Infiltration Trench
- ❖ 1.7 Grass Channel
- ❖ 1.8 Sheet Flow to Conservation Area

**Instructions:**

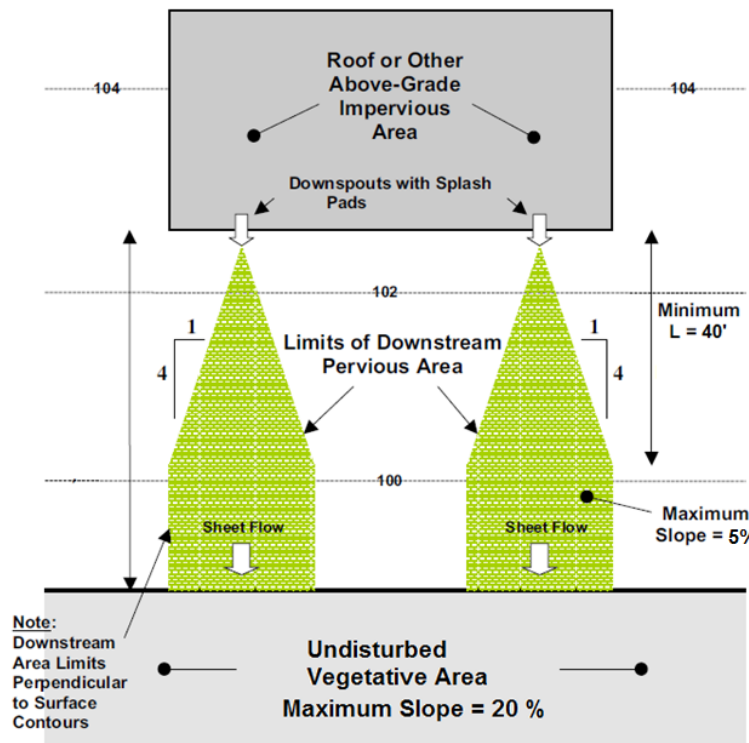
Choose one or more BMP to treat each square-foot of impervious surface associated with a single family home. Maintenance agreement is to be submitted for each permanent structure (e.g. 1.3, 1.4, 1.5, 1.6, and 1.7).

**Example:**

Typical 2,800 square foot home on a site with slopes from 2-10 percent; given the site constraints a combination of BMPs are used.

- |  |                       |
|--|-----------------------|
| • Simple Rooftop Disconnection (1.1)         | 1,000 sq. ft. of roof |
| • 5,000 sq. ft. of Mulched Landscaping (1.2) | 1,000 sq. ft. of roof |
| • 250 gallon Cistern (1.3)                   | 400 sq. ft. of roof   |
| • 28 sq. ft. Rain Garden (1.4)               | 200 sq. ft. roof      |
| • 10 sq. ft. Dry Well (1.5) 4 feet deep      | 200 sq. ft. roof      |

## 1.1 Rooftop Disconnection



**Description:** Rooftop disconnection (RD) is one of the simplest means of reducing stormwater from residential lots. RD takes roof runoff that has been collected in gutters and piped directly to storm drains and streams, and redirects it away from impervious surfaces to landscaped areas.

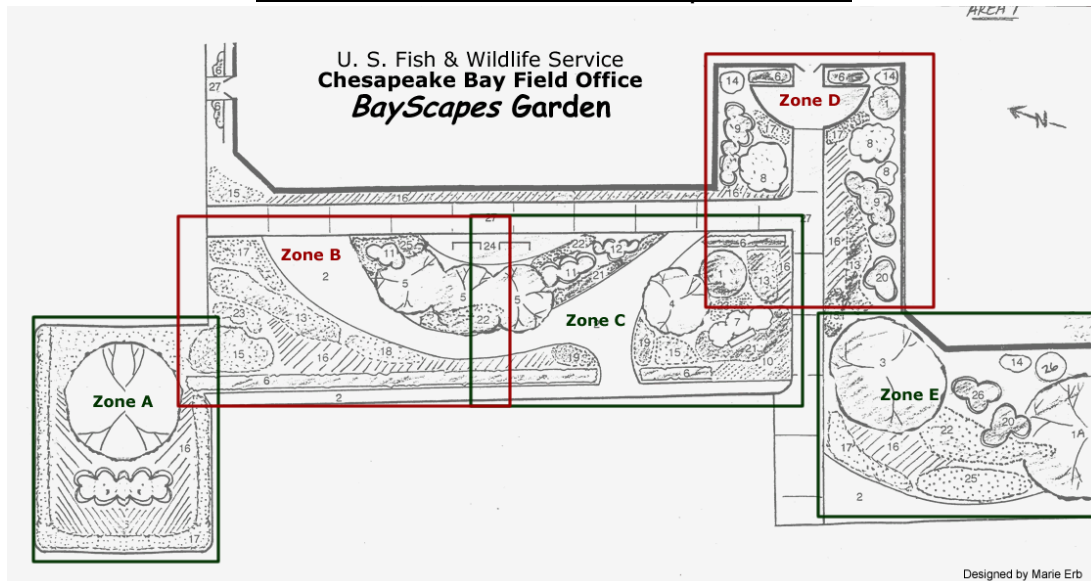
**Limitations:** Slope, Flow Length and the location of other structures.

**Material Specifications:** BMP Clearinghouse #1; VESCH 3.18, 3.32, and 3.36

### Design Standard:

- Maximum roof area per downspout is 1,000 square feet
- Must discharge to a well-vegetated area that is at least 40 feet long with a slope less than 5 percent
- If flow length is less than 40 feet or slope is greater than 5 percent, an alternative practice is preferred (e.g. Rain Garden, Dry Well, etc.)
- Slopes less than 2 percent should be seeded and mulched in accordance with VESCH 3.32 and 3.30.
- Slopes greater than 2 percent shall be stabilized with temporary matting in accordance with VESCH 3.36.
- Install splash block or gravel apron at end of downspout to aid in dispersion. Extend the downspout at least 5 feet from building foundation if the grade is less than 1 percent.

## 1.2 Mulched Landscape Beds



**Description:** Use of native plants with a wood mulch groundcover that reduces the time and expense of mowing, watering, fertilizing, and treating lawn and garden areas. Landscape beds can address areas with existing problems such as erosion, poor soils, steep slopes and poor drainage.

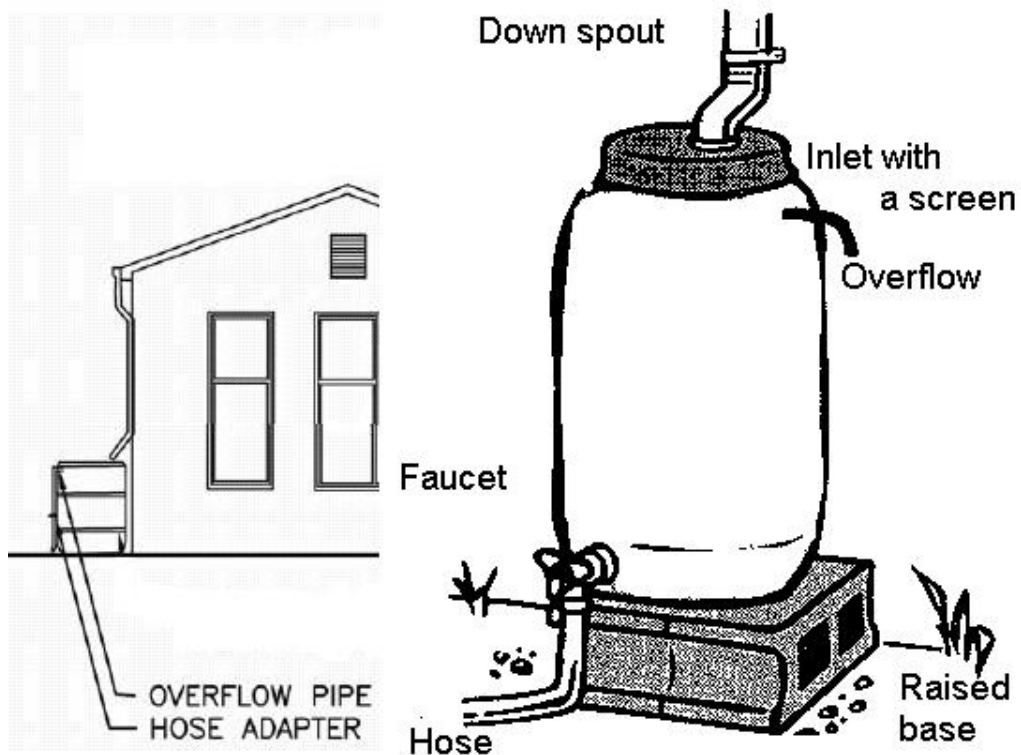
**Limitations:** Slope, foundation depth

**Material Specifications:** 4-inches Double Shredded Mulch; 3-year Weed Barrier; Plants: Plugs, Container, and/or Burlap stocks

### Design Standards:

- Minimum size shall be 5,000 square feet or 5 times the treated roof area, whichever is greater.
- Landscaping shall be contiguous wood mulch cover with a mixture of trees, shrubs and perennials.
- Shall be located in areas that were disturbed, have existing turf lawns or existing tilled garden areas. May be installed as a transitional area between managed lawn and undisturbed forest.
- All vegetation shall be native as defined by the Virginia Natural Heritage. [http://www.dcr.virginia.gov/natural\\_heritage/nativeplants.shtml](http://www.dcr.virginia.gov/natural_heritage/nativeplants.shtml)
- All vegetation should be planted in the appropriate season, and at the proper spacing and density to survive the first two growing seasons.
- Wood mulch and/or weed barrier shall be used until vegetation is fully established. Weed barrier or herbicides shall be used when planted on existing turf lawns.
- Shall not conflict with any applicable local, state or federal permits such as building, VDOT entrances, or zoning.

### 1.3 Rainwater Harvesting System



**Description:** Rainwater harvesting systems intercept, divert, store, and release rainfall for future use.

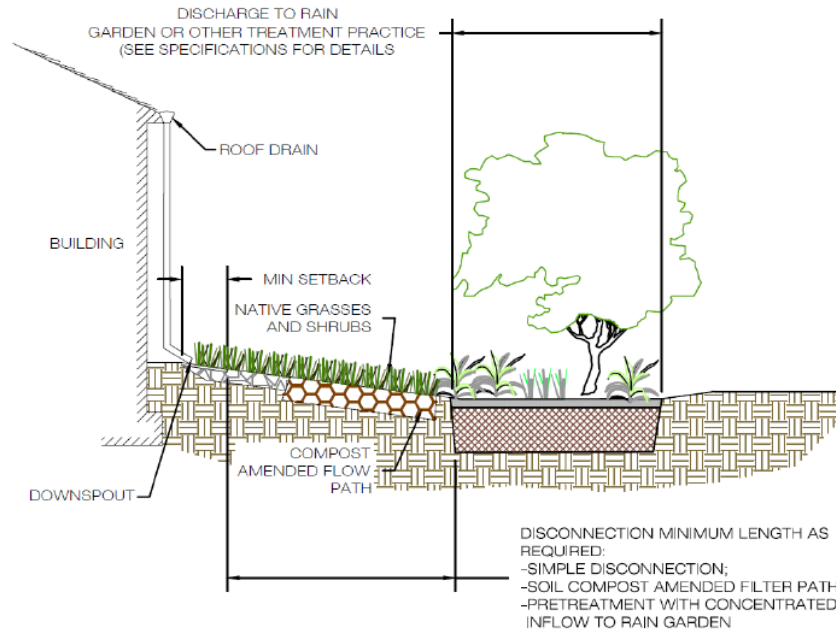
**Limitations:** Elevation and Storage capacity

**Material Specifications:** BMP Clearinghouse #5; Va. Rainwater Harvesting Manual

#### Design Standards:

- Minimum size shall be 250 gallons per 400 square feet of rooftop.
- Cisterns must be installed in accordance with manufacturer specifications.
- Above ground systems shall be elevated at least 2 feet for gravity flow.
- Provide a filter or diverter box on the downspout to aid in reducing debris within the cistern.
- Provide an adequate overflow. Ensure that the overflow will not scour the foundation of the structure or erode the adjacent yard. A splash block or routing the overflow hose into another practice can reduce the flow velocity.
- All applicable federal, state and local permits must be obtained prior to constructions. Local Building Officials and Health Department Officials should be consulted prior to installation of rainwater harvesting systems designed for indoor uses. The cistern shall be sized to meet at least the 5-day water demand.

## 1.4 Rain Garden



**Description:** The use of a graded or natural depression that can be improved with soil amendments and native plants.

**Limitations:** Slope, Water Table and Bedrock depth, and subsoil compaction. Distance to septic fields, wells and structures.

**Material Specifications:** BMP Clearinghouse #1, #4 and Appendix E

**Design Standards:**

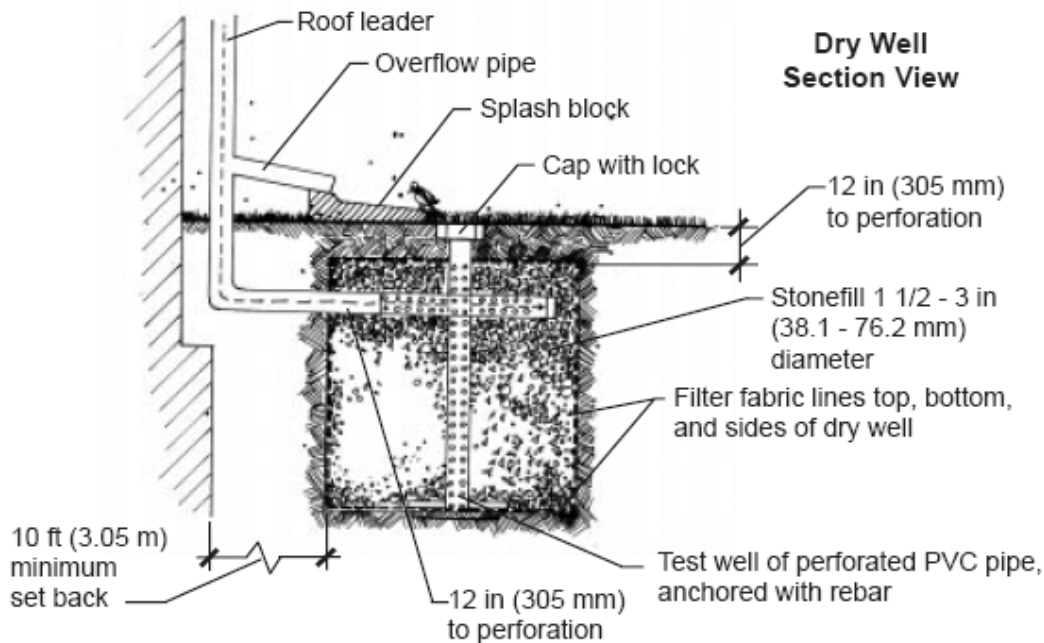
- Maximum roof area per downspout shall be 1,000 square feet
- Surface area of planting bed shall multiple the roof area by the soil factor below.

Soil Type	Average Ponding Depth		
	3-inch	6-inch	9-inch
A	0.20	0.10	0.07
B	0.23	0.12	0.08
C	0.28	0.14	0.09
D	0.30	0.15	0.10

- Slopes should be less than 7 percent. This practice shall have a 30-foot setback from the top of slopes steeper than 15 percent.
- Minimum setback from building foundation is 10 feet down gradient or 25 feet up gradient. Minimum setback from septic field and well is 50 feet.
- An earthen berm may be necessary to maintain a temporary ponding depth. The berm shall be 9-12 inches above the planting bed. The limits of the ponding area shall not encroach on foundations.
- Compaction shall be prevented within the ponding area.
- Scarify the planting bed and incorporate compost amendments into the native soil at a rate of 1 part compost to 2 parts soil.
- Weed barrier or herbicides shall be used when planted on existing turf lawns.



## 1.5 Dry Well



**Description:** An underground pit filled with open-graded gravel and wrapped with nonwoven geotextile fabric. The dry well accepts runoff from roof downspouts and other stormwater pipes.

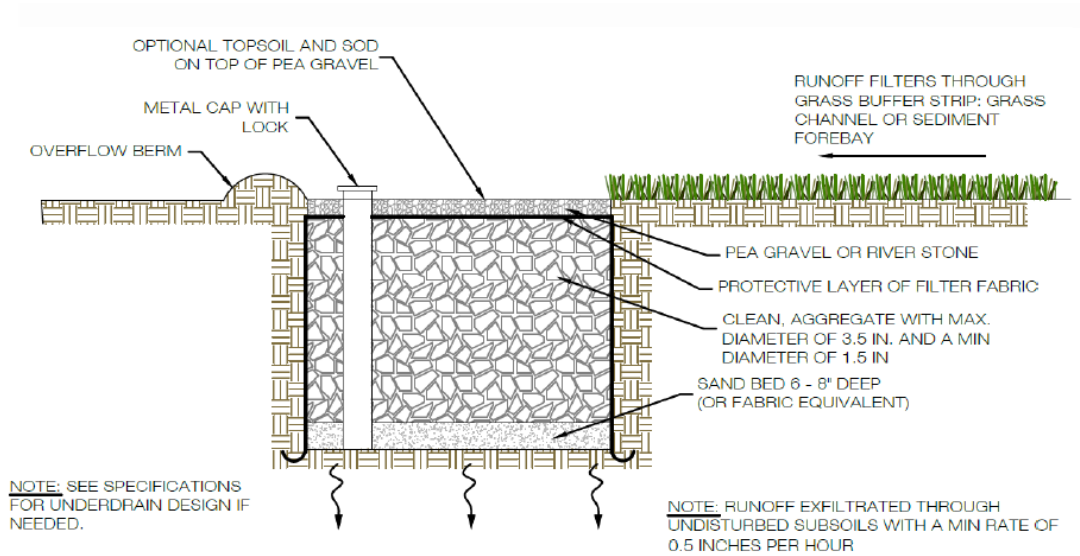
**Limitations:** Slope, Water Table and Bedrock depth, and subsoil compaction. Distance to septic fields, wells and structures.

**Material Specifications:** BMP Clearinghouse #8; VESCH 3.28

### **Design Standards:**

- Maximum roof area treated shall be 2,500 square feet
- Dry Well should have a minimum width of 3 feet and a depth of 1 to 5 feet.
- $SA\% = 9.5 / (48 d)$ ; where SA% is the dry well surface area divided by roof area treated; and d is the depth.
- Maximum depth shall be 2 feet above bedrock and the water table
- Slopes should be less than 7 percent. This practice shall have a 30-foot setback from the top of slopes steeper than 15 percent.
- Minimum setback from building foundation is 10 feet down gradient or 25 feet up gradient. Minimum setback from septic field is 50 feet and well is 100 feet.
- Install an overflow mechanism for higher storm events.
- Screen the downspout inlets to reduce debris and mosquitoes.
- Sod covers the top of the gravel pit.

## 1.6 Infiltration Trench



**Description:** An excavated trench filled with layers of open-graded aggregate stone that provides temporary runoff storage and groundwater recharge.

**Limitations:** Slope, Water Table and Bedrock depth, and subsoil compaction. Distance to septic fields, wells and structures.

**Material Specifications:** BMP Clearinghouse #8, BMP Clearinghouse App. A, B, and C

**Design Standards:**

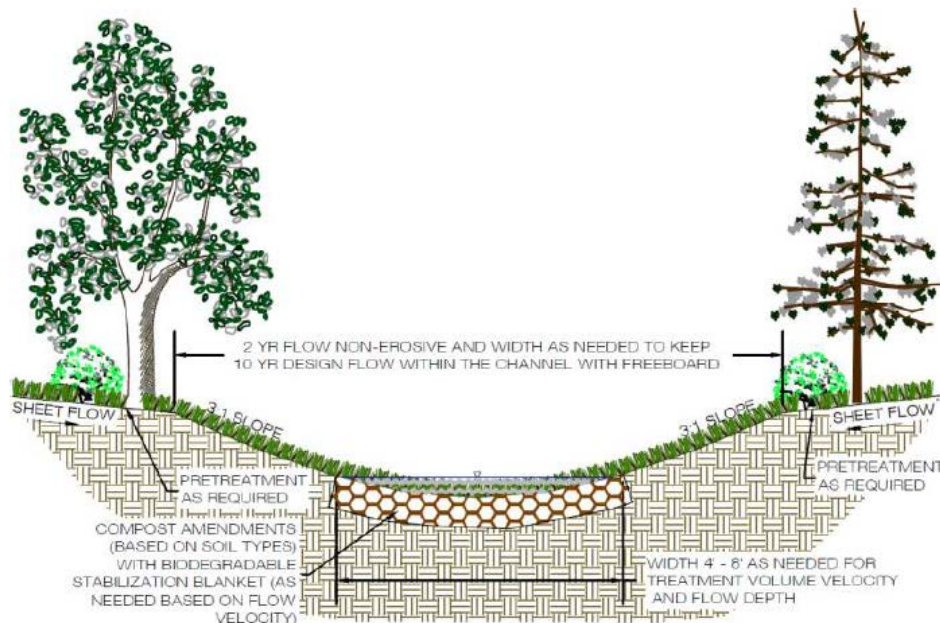
- Maximum contributing drainage area treated shall be 2 acres
- Trench should be a minimum of 3 feet wide and a depth of 1 to 3 feet.
- $SA\% = 10 R_v / (48 d)$ ; where SA% is the trench surface area divided by drainage area; d is the depth; and R<sub>v</sub> is a composite runoff factor.

R <sub>v</sub> Coefficients	A soils	B Soils	C Soils	D Soils
Forest/Meadow/Mulched Landscaping	0.02	0.03	0.04	0.05
Managed Turf Lawn	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

- Maximum depth shall be 2 feet above bedrock and the water table.
- Slopes should be less than 7 percent. This practice shall have a 30-foot setback from the top of slopes steeper than 15 percent.
- This is a linear practice installed along the perimeter of driveways or buildings and may be incorporated into a grass channel, see 1.7.
- Minimum setback from building foundation is 10 feet down gradient or 25 feet up gradient. Minimum setback from septic field is 50 feet and well is 100 feet.



## 1.7 Grass Channel



**Description:** Grass channels are wide, gently sloping, open channels with grass sides used as a stormwater conveyance system.

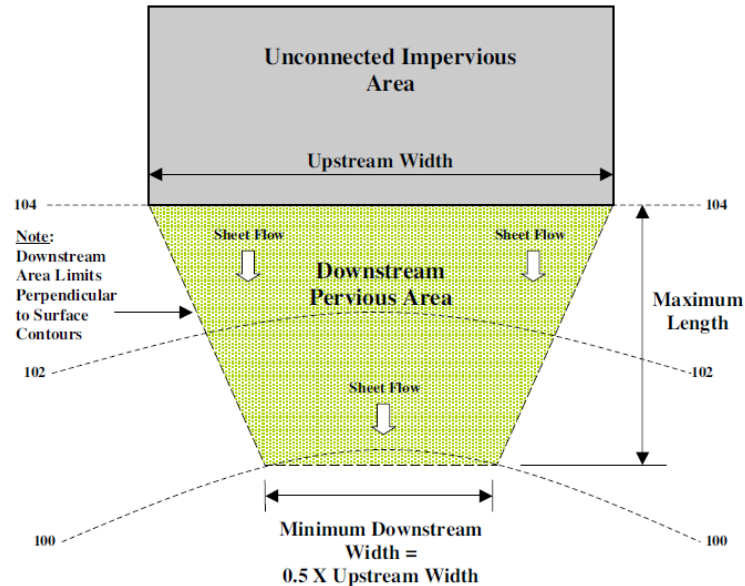
**Limitations:** Steep Slopes; Setbacks; Side Slopes

**Material Specifications:** BMP Clearinghouse #3; VESCH 3.17, 3.20, 3.32, and 3.36

**Design Standards:**

- Maximum contributing drainage area is 5 acres
- Bottom width of channel shall be at least 4 feet. Side slopes of channel shall be 3:1 or flatter
- Longitudinal Slopes of less than 2 percent. Slopes greater than 2 percent require permanent check dams. Slopes greater than 4 percent shall incorporate additional practices. Slopes greater than 10 percent are not suitable for this practice.
- Must discharge to a well-vegetated area that has a slope less than 15 percent. A gravel diaphragm, rip rap apron or engineered level spreader may be needed at the outlet.
- Slopes less than 2 percent should be seeded and mulched in accordance with VESCH 3.32 and 3.30. Slopes greater than 2 percent shall be stabilized with temporary matting in accordance with VESCH 3.36.
- The channel shall have the capacity to carrying the 10-year design storm. Requires a minimum of 6 inches of freeboard when the channel follows a roadway.
- The channel shall have a 2-year flow velocity that is non-erosive.

## 1.8 Sheet Flow to Conservation Area



**Note:** In determining maximum length and effective size of downstream impervious area, downstream area width cannot be less than one half of upstream width regardless of distance to downstream conveyance system.

**Description:** This practice incorporates a group of best management practices (BMPs) designed to preserve natural areas and disperse concentrated runoff to sheet flow.

**Limitations:** Steep Slope; Concentrated Flow

**Material Specifications:** BMP Clearinghouse #2; VESCH 3.18, and 3.38

**Design Standards:**

- Maximum impervious surface shall be 5,000 square feet or 20 percent impervious cover of contributing drainage area.
- Minimum size of receiving area shall be 10,000 square feet of contiguous undisturbed vegetation.
- Minimum length of receiving area shall be 35 feet for slopes less than 3 percent and 50 feet for slopes less than 6 percent.
- Longest flow length across impervious surface shall be 75 feet. Gravel diaphragms or permeable berms must be used if flow length is longer.
- Longest flow length across turf lawns shall be 150 feet.
- Concentrated flows shall use an engineered level spreader
- Disturbance of a stream buffer to achieve this design is not recommended.