Northwestern Pennsylvania Homeowner's Guide to Stormwater Management

Northwestern Pennsylvania Homeowner's Guide to Stormwater Management

This guide is intended to help property owners living in Northwestern Pennsylvania evaluate current runoff pathways and identify practices to better manage stormwater runoff on their properties. This guide includes several practices to choose from that are fairly simple to plan and construct.

This guide was funded by the Pennsylvania Department of Environmental Protection Growing Greener Grant Program administered by the Northwest Commission. The guide was produced by the Center for Watershed Protection for the Erie County Department of Planning and Community Development.

For more information, please contact:

Michael Guelcher

Erie County Department of Planning and Community Development

mguelcher@eriecountypa.gov

814-451-7335

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION

Growing Greener

Center for Watershed Protection

This guide was adapted in part from the Southwestern Pennsylvania's Homeowner's Guide to Stormwater produced by Penn's Corner Conservancy and Charitable Trust, Inc. and partners, as well as The Homeowner's Guide to Stormwater produced by the Little Conestoga Partnership and its funder the National Fish and Wildlife Foundation.

Section 1: What is Stormwater Runoff and Why is it a Concern?

Stormwater runoff is precipitation (rain or snowmelt) that flows over the land surface. It is created when precipitation falls on roads, driveways, parking lots, rooftops and other paved surfaces that do not allow water to soak into the ground. Rain that becomes runoff carries soil, pollutants, and other materials from the land swiftly into storm drains or streams that ultimately flow to Lake Erie or the Ohio River. Where rain falls on paved surfaces, a much greater amount of runoff is generated compared to runoff from the same storm falling over a forested area, where most of the water is absorbed by trees or soaks into the soil.

The Negative Impacts of Stormwater Runoff

Poorly managed stormwater runoff can cause many problems. These include:

- **Flooding:** When rain falls on hard surfaces, such as rooftops, parking lots, and roads, large volumes of stormwater runoff are created and quickly reach streams, causing them to rise and flood. As more hard surfaces are added to an area, the frequency and severity of flooding increases, threatening infrastructure, property, and people.
- **Pollution:** Stormwater runoff also picks up and carries with it many different pollutants that are found on paved surfaces such as sediment, nutrients, bacteria, oil and grease, trash, pesticides and metals. These pollutants come from a variety of sources, including pet waste, lawn fertilization, and illegal dumping and spills, and flow untreated into local streams, polluting our waters.

- **Erosion:** The unnaturally high volume and speed of stormwater runoff can cause severe stream bank erosion when it enters the stream channel. Ongoing bank erosion can eat away at streamside property and infrastructure, and damages natural habitat for fish and other aquatic life. This erosion is another source of sediment pollution in streams.
- **Threats to Human Health:** Polluted runoff is the leading known cause of high bacteria levels triggering beach closings, swimming advisories, and bans or restrictions on shellfish harvesting. Stormwater runoff can also carry toxic pollutants and viruses. Excessive stormwater runoff can overwhelm sewage treatment plants in combined sewer areas, causing discharges of these pollutants directly into waterways. These pollutants can contaminate drinking water supplies and hamper recreational opportunities, as well as harm fish and other aquatic life.

Regulations Created to Address the Negative Impacts of Stormwater Runoff

To combat ineffective stormwater management, especially after Hurricane Agnes, PA Act 167 was put into effect on October 4, 1978. Act 167 was created specifically to address “inadequate management of accelerated runoff of storm water resulting from development throughout a watershed.” The Act requires that counties must create and submit a detailed stormwater plan to the Pennsylvania Department of Environmental Protection that discusses how runoff will be addressed. This process requires that ordinances and regulations are created, and that they must be adopted by all municipalities within the county.

Homeowner Stormwater Management Requirements in Erie County

For all additions of new impervious area within Erie County, the following requirements contained in the Regulated Activities Table below apply. For details regarding the Small Project Stormwater Management (SWM) Application, Volume Control, and Peak Rate Control, please see the local municipal Stormwater Management Ordinance.

Amount of New Impervious Area (Square Feet or SF)	Stormwater Management Application Requirements
0 SF ≤ new impervious area < 1000 SF	Required: Exempt from additional requirements
1000 SF ≤ new impervious area < 2500 SF	Required: Documentation of Impervious Area[2]
2500 SF ≤ new impervious area < 5000 SF	Required: Volume Control (Section 304) and Small Project SWM Application (See Appendix F)
5000 SF ≤ new impervious area	Required: Peak Rate Control (Section 305), Volume Control (Section 304), and Stormwater Management Site Plan

[1] The municipality can require the applicant to provide supplemental and additional information beyond the Small Project SWM Application if there is a threat to property, health or safety

[2](Optional) The Small Project SWM Application allows documentation of new impervious surface, credits through disconnection of imperious surface and tree planning, and sizing Volume Control BMP's that may be required.

Note that all Regulated Activities must comply with the State Water Quality Requirements.

For further information regarding stormwater management requirements near you please contact:

Michael Guelcher

Erie County Department of Planning and Community Development

mguelcher@eriecountypa.gov

814-451-7335

Section 2: Evaluating Stormwater Runoff on Your Property

It is important to fully assess the opportunities and challenges on your property when selecting the most appropriate stormwater management practices. Some practices may not be feasible, and others may not be practical. Some may even be potentially dangerous or otherwise problematic. Following these steps will help eliminate some guesswork, ensure functional and effective practices are selected, and provide the greatest chance of long-term success. This is intended to be a quick reference tool.

Step 1 – Create an Existing Condition or Base Map

Start with an aerial photo from an online mapping tool like Google Maps, or perhaps a plat if one is available. The figure on Page 7 shows the site constraints that may affect the choice of practice and location. First, map the following on your plat or aerial photo:

- Outline property boundaries
- Highlight the impervious surfaces such as roofs, decks, sheds, pools, driveways, and sidewalks
- Mark locations of trees and landscaped areas
- Measure and calculate the areas of impervious surfaces for use in calculating size of practices

Step 2 – Map Flow Paths

Mark on the map the flow paths of runoff around the site. It is often easier to intercept water where it naturally flows, rather than divert it elsewhere.

Step 3 – Map Utilities and Easements

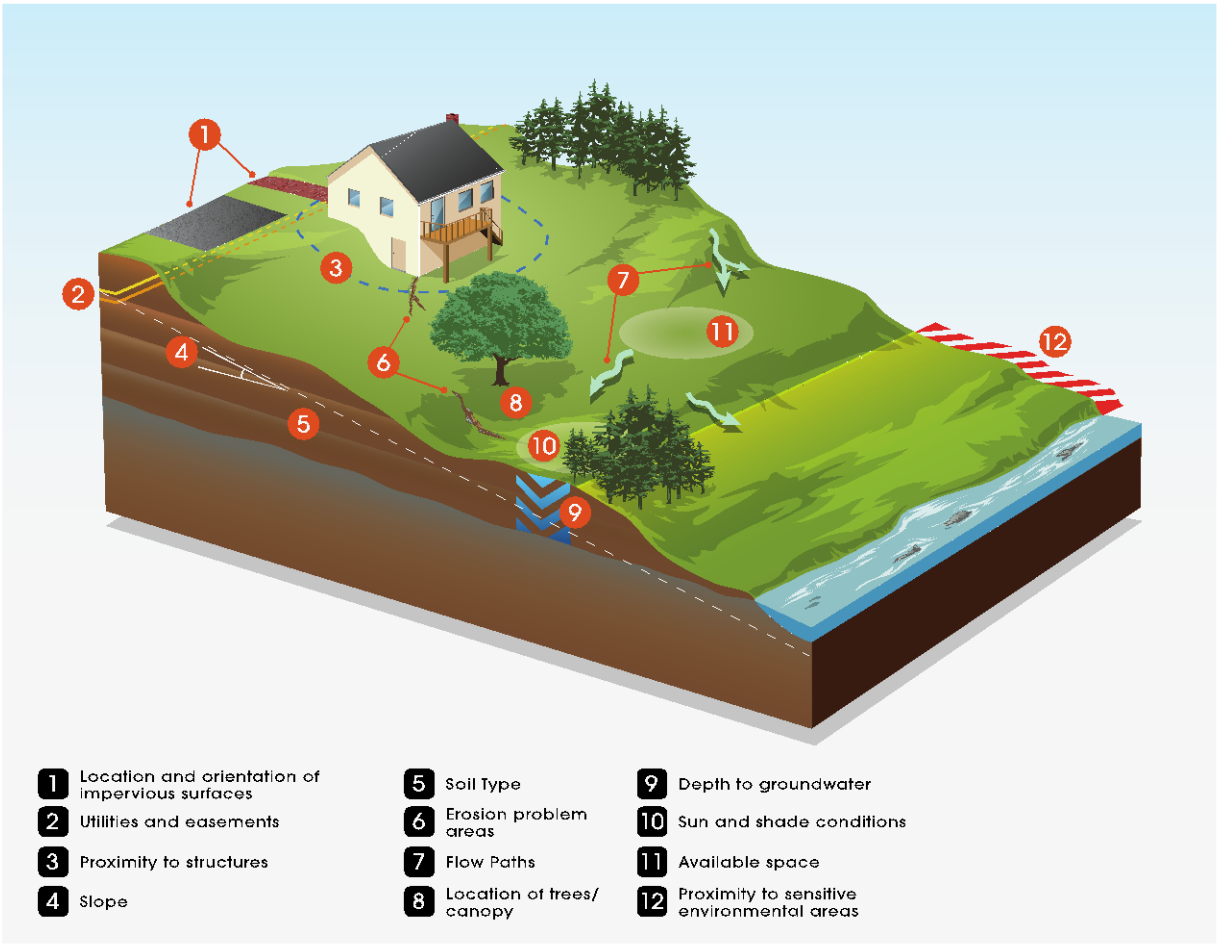
Resources such as Pennsylvania One Call may help identify the location of underground utilities such as electric, gas, sewer, water, cable and telecommunications lines, which must be avoided when digging. Always call Pennsylvania One Call (dial 811 or 1-800-242-1776) before digging!

Step 4 – Map Problem Locations and Areas of Interest

Erosion, poor grass cover, invasive plants, steep slopes, rocky areas, areas planned for some future use, and environmentally sensitive areas such as stream buffers and forest conservation areas are all considerations relating to location and feasibility of stormwater management practices. Soils also play a big role in determining which practices are feasible.

Step 5 – Create Proposed Conditions Map

Mark the locations available for projects. The available space may partially determine which practices are feasible; undersized practices may not withstand storms or provide any benefit, and oversized practices may not get enough water to sustain the plants that are part of the practice. Use the local municipal regulations to determine the ideal size of the practices being considered.



Section 3: Creating an Effective Stormwater Plan for Your Property

Tools for the Job - Stormwater Management Practices

There are several different tools available to effectively treat stormwater management from your property. Each practice has sizing and siting constraints. The table below shows which practices are ✓ and are not ✗ appropriate for specific locations. It also lists special needs for certain practices to work on those locations. Four of the most common and easier to install stormwater management practices are introduced below:

Location	Rain Gardens	Infiltration Trenches and Dry Wells	Permeable Hardscapes	Vegetated Channels	Notes
Next to building	✓ 2,3	✗	✗	✓ 2,3	1. Refer to chapter for guidelines, section "Location and Feasibility". 2. Stormwater planters or ultra-urban bioretention are also options. 3. Direct overflow at least 5 ft. from foundation. 4. Locate underground tanks at least 10 ft. from foundation.
Next to drinking water well	✗	✗	✗	✗	1. Direct overflow at least 25 ft. from well.
Next to septic drain field	✗	✗	✗	✗	1. Do not site directly on drain field due to potential compression.
Under tree canopy	✗	✗	✗	✗	1. Plant selections should match sunlight conditions.
Sandy soils	✓	✓	✓	✓	

Location	Rain Gardens	Infiltration Trenches and Dry Wells	Permeable Hardscapes	Vegetated Channels	Notes
Clay soils	✓ 1	✗	✓ 1	✓ 1	1. Soil amendment or localized replacement may be necessary. See Soil Assessment for more detail.
Top of slope	✗ 1	✗ 1	✓ 2	✓ 3	1. Locate where they can accept more runoff. 2. Permeable Hardscapes can be at the bottom of a slope, but care should be taken in sizing to not overload the practice. 3. Vegetated channels should only be used for slopes between 1% and 6%.
Bottom of slope	✓	✓	✓ 1	✓ 1	1. It is important not to send too much water to these practices.
Near/over utility lines	✗ 2	✗ 2	✗ 2	✗ 2	1. Allowable proximity to utility lines should be confirmed by utility company or municipal government. 2. Under certain special circumstances, it may be possible to locate these over underground utilities, with careful coordination with the utility companies. 3. Underground tanks have the same considerations as below-ground practices. (See note 2)

Rain Gardens

What is it?

Rain Gardens are shallow landscaped depressions that receive stormwater runoff from surrounding areas, and hold and naturally treat that runoff. They are very similar to Conservation Landscapes, except that they are lower than the surrounding ground – therefore they collect and treat more runoff. The plants used in Rain Gardens need to be able to tolerate occasional inundation as well as dry conditions between rain storms.

Do:

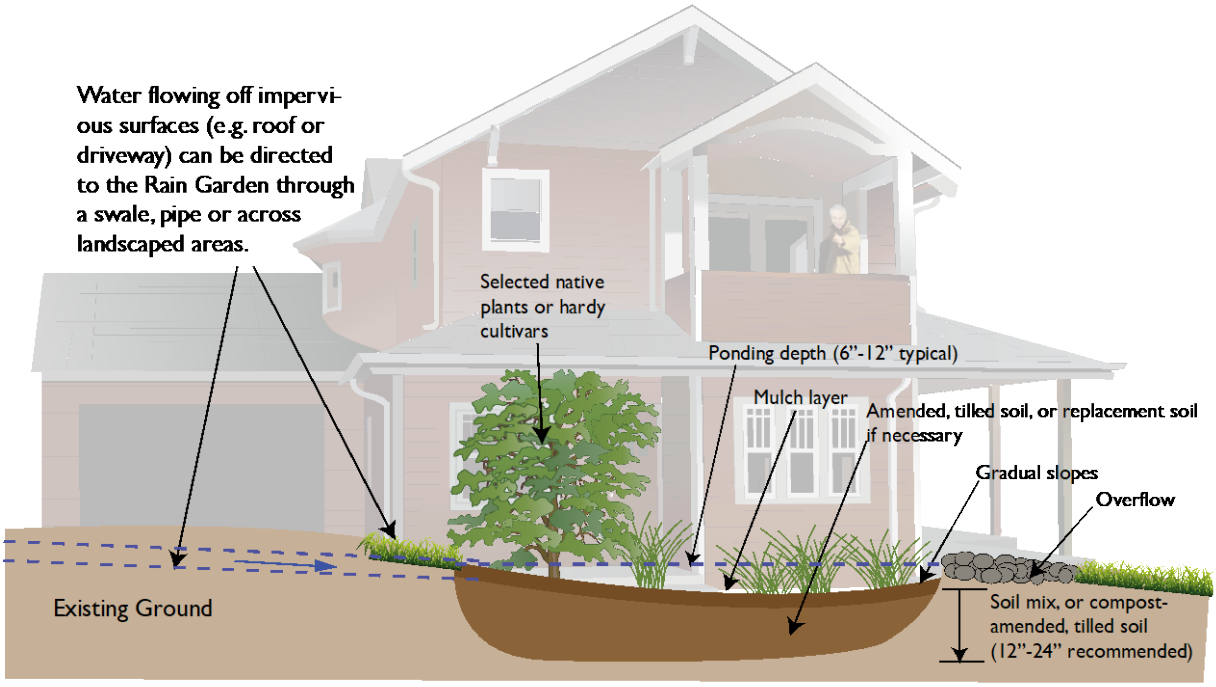
- Conduct a full site assessment to choose best spot for Rain Garden
- Place Rain Garden in a low spot and direct runoff to Rain Garden
- Consider "treatment train" options, such as catching roof runoff in Rain Barrels and draining those into the Rain Garden
- Call Pennsylvania One Call before digging
- Use appropriate soil mix, depending on existing soil characteristics
- Water plants during the first growing season, especially during dry conditions
- Inspect finished Rain Garden after several storms

Don't:

- Place Rain Garden in a soggy area (poorly drained soil) that already stays wet for many days after rain
- Place Rain Garden within 10 feet of building foundation
- Place Rain Garden under tree canopy, above utilities or septic fields, or next to wells
- Compact the soil under the Rain Garden during excavation

A homeowner with experience in landscaping can undertake a simple Rain Garden project. Consult a landscape contractor or design profession for moderate to complex projects, or when the project requirements are uncertain.

Overview



Where NOT to Locate a Rain Garden

1. Within 10 feet of a building foundation
2. Over Utilities
3. Near the edge of steep slopes or bluffs
4. Near an existing or reserve septic drainfield or tank
5. In low spots that do not drain well
6. Within 2 feet of high ground water level
7. Under a tree, or in other areas that would require disturbing healthy native vegetation
8. Where there is high groundwater during the winter
9. Near Wells- Stay back 50 feet from confined wells, or 100 feet from unconfined wells

Recommended Maintenance for Rain Gardens

Maintenance Tasks	Frequency
• Water often during the first 2 months, and then as needed during first growing season (April-October), depending on rainfall • Expect up to 10% of the plant stock to fail in the first year, and plan accordingly for replacement plants	Upon establishment Small herbaceous plants will require more watering
• Check and repair eroded areas • Check inlets and overflow areas for debris or leaves that are blocking flow	After heavy rains in first 6 months Periodically in subsequent years
• Remove weeds by hand	Monthly for first growing season Every 3 months in subsequent years
• For meadow type Rain Gardens consisting of grasses, mow the Rain Garden in early spring • For other types of plantings, check for winter damage and add mulch to bare spots as desired (2–3 inches). Do not let mulch touch base of plants. • Cut back perennials and remove dead growth • High winter wildlife value perennials/grasses can be left until they start sprouting in the spring	February or March
• Add reinforcement planting to maintain the desired vegetation density • Prune trees and shrubs • Thin herbaceous plants as desired • Remove excess leaf matter after all leaves have fallen in the fall	Fall
• Remove invasive plants using recommended control methods • Remove any dead or diseased plants • Stabilize bare areas draining to the Rain Garden, especially if there is erosion • Remove trash	As needed
• Remove accumulated sediment at inflow points	Annually

Infiltration Trenches and Dry Wells

What is it?

Infiltration Trenches and Dry Wells are gravel-filled trenches and pits, respectively, that temporarily store stormwater runoff and allow it to seep into the ground. The primary functional structure of an Infiltration Practice is the below-ground gravel reservoir, as the water infiltrates into the soils through the base of the practice. The underlying soils must allow water to percolate through. Infiltration Trenches are typically open-topped, and Dry Wells are typically covered over with a layer of soil and planted with grass to blend in.

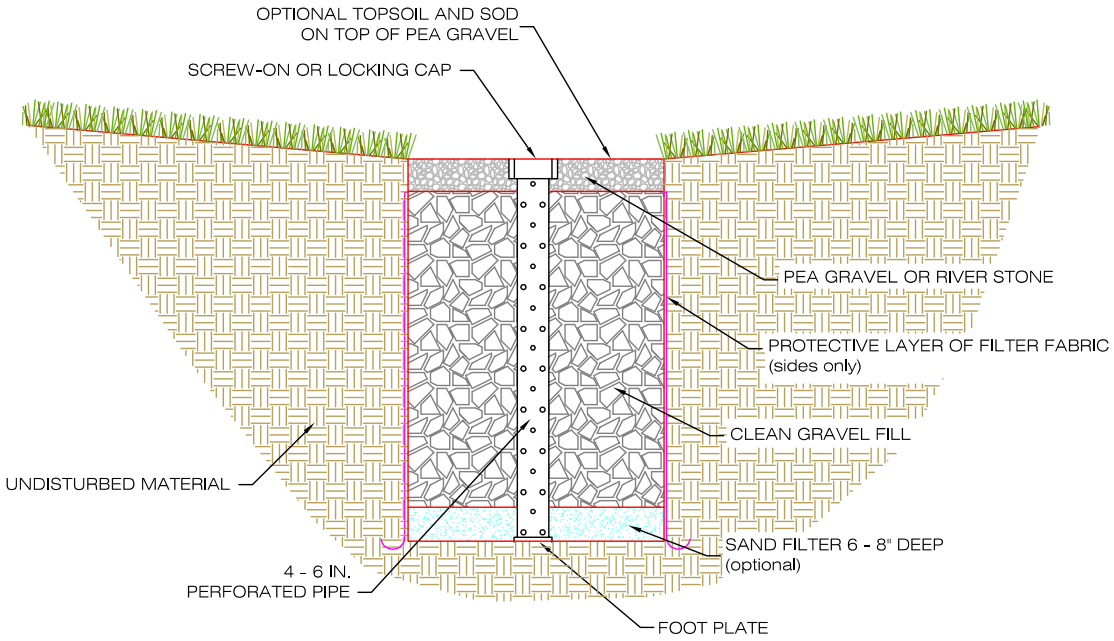
Do:

- Locate any utilities present when planning location of Dry Wells
- Plan for removal, disposal or use of excess soil
- Size the Infiltration Trench or Dry Well properly, and plan carefully for overflows
- Call Pennsylvania One Call to locate any utility lines before digging
- Scarify (roughen) the bottom of the trench or basin
- Place gravel in 4-12 inch layers

Don't:

- Install close to building foundation, especially if uphill from building
- Locate near water wells or septic fields
- Use filter fabric on the bottom of the excavation
- Compact the soils in the trench
- Rush if the excavation is near utilities – a little extra time could save a lot

Overview



Where NOT to Locate an Infiltration Practice

1. Within 10 feet of a building foundation
2. Over Utilities
3. Near the edge of steep slopes or bluffs
4. Near an existing or reserve septic drainfield or tank
5. In low spots that do not drain well
6. Within 2 feet of high ground water level
7. In areas that would require disturbing healthy native soils and vegetation like under existing tree canopy
8. Where there is high groundwater during the winter
9. Near Wells- Stay back 50 feet from confined wells, or 100 feet from unconfined wells

Recommended Maintenance for Infiltration Practices

Maintenance Tasks	Frequency
• Ensure the contributing drainage area is stabilized, and repair any areas that are eroding • Check downspouts and channels leading to the trenches, and remove any accumulated debris	Quarterly
• Check observation wells (if any) 3 days after a rain event with ½ inch of rainfall or greater. • Treat the practice for clogging if standing water is still present after 3 days • If no observation wells are included, but the practice is very shallow, observe ponding by removing some pea gravel at the surface of the trench	Twice/year
(Clogging troubleshooting) • If the Infiltration Trench starts to drain slowly, remove the top pea gravel or topsoil/turf layer. If filter fabric is present, this may be the source of the clogging. Remove this layer of filter fabric. Check to see if the trench will draw down and replace the overlying material with clean pea gravel or topsoil. • If a Dry Well does not drain properly, dig down to check inflow points for excessive leaves or debris.	Once/year or as needed
(Overhaul) • If the Infiltration Trench or Dry Well is clogged from the bottom, and water stands on the surface, then the practice will need to be reconstructed. If the issue is the underlying soils, the practice should be replaced with a Rain Garden or Conservation Landscape.	Once/year or as needed

Infiltration Practices should be designed and constructed by a contractor with experience and knowledge about this practice. The design and construction details provided in this chapter may allow homeowners to better understand the practice, but not to construct this practice without the help of an experienced contractor.

Permeable Hardscapes

What is it?

Permeable Hardscapes use alternatives to traditional paving materials that allow water to seep into the ground rather than become runoff. The surface materials used can be pavers that have spaces between them to allow water to flow through, or in some cases, porous concrete or asphalt. After infiltrating through the surface layer, rainfall seeps into a thick layer of gravel below. This gravel stores and then slowly routes the water into the ground or to a stable outfall. Permeable Hardscapes at the residential and small commercial or institutional scale are typically used for walkways, patios, or parking spots.

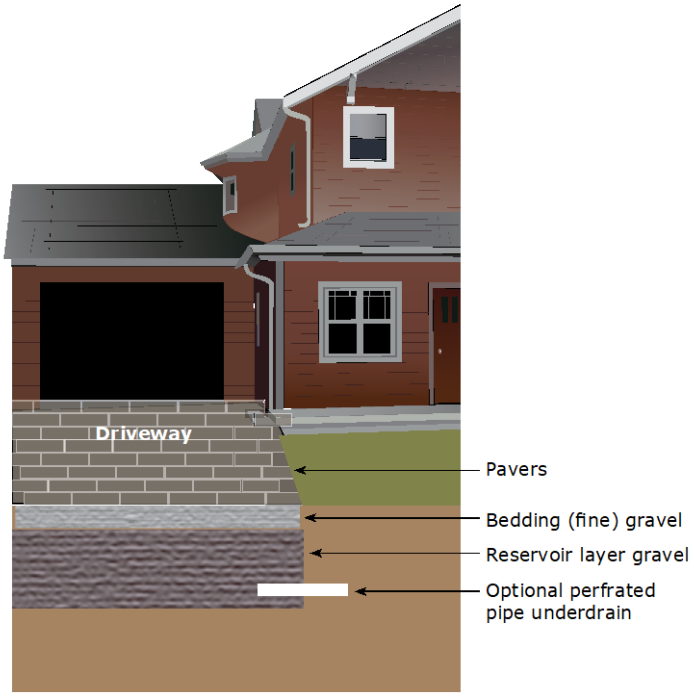
Do:

- Test soil to determine suitability for Permeable Hardscape (needs infiltration rate 1 inch/hour or more)
- Add underdrain if soils infiltrate slowly, or if the drainage area is large
- Add a grass filter strip or other pre-treatment of incoming water to minimize maintenance and chances of failure
- Rake, till, or otherwise scarify the bottom surface of the excavation to improve infiltration
- Check levels and elevations carefully and frequently during installation
- Make sure the edges around the installation are solid. If the surroundings slump or get washed away, so will the hardscape!

Don't:

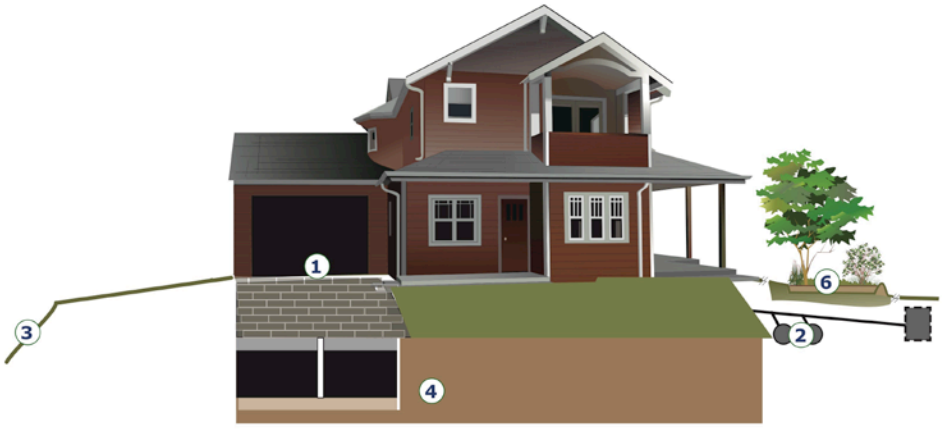
- Locate next to building foundation, water well, septic field
- Direct runoff toward a building foundation
- Send too much water to Permeable Hardscape, especially from *pervious* surfaces. Too much fine sediment = clogging
- Ignore manufacturer specifications and recommendations – each product may have different requirements
- Pressure-wash the spaces between pavers to clean sediment. Instead, use light vacuuming.

Overview



Existing soils that allow infiltration at 1 inch per hour minimum if soils do not have a lot of clay, preferably 2 inches per hour.

Where NOT to Locate a Permeable Hardscape



1. Close to building foundation 5 feet downhill, 25 feet uphill (for projects less than 1,000 square feet)*
2. Over utilities or septic systems
3. Near the edge of loose or steep slopes or bluffs
4. Over impermeable soils
5. Where a lot of water runs onto the Permeable Hardscape from upstream.
6. Under trees or over tree roots

*For projects closer than these setbacks, impermeable liners and/or custom drainage systems may be used, with experienced professional guidance and installation.

Recommended Maintenance for Permeable Hardscapes

Maintenance Tasks	Schedule
• Sweep the surface if sand or debris accumulates • Leaf blowers can also be used, but make sure debris is removed from the pavement surface • Agitate with a rough brush and vacuum the surface with a wet/dry vac if the joints fill with sand • Remove and replace clogged blocks in segmented pavers • Hire a vacuum sweeper to restore the surface for moderate or larger applications • Repair any structural damage to the paver surface (e.g., cracking, broken pavers, sinkholes)	As needed, particularly at change of seasons when leaves, winter sanding, and other debris may accumulate
• Repair and stabilize any areas that are eroding or washing dirt or debris onto the surface • Check downspouts and channels leading to the Permeable Hardscape and remove any accumulated debris	Quarterly, if other areas drain to the hardscape

Permeable Hardscapes should be designed and constructed by a contractor with experience and knowledge about this practice. The design and construction details provided in this chapter may allow homeowners to better understand the practice, but not to construct this practice without the help of an experienced contractor.

Vegetated Channels

What is it?

A vegetated channel, also called a vegetated swale or bioswale, is a wide and shallow stormwater channel used to convey and slow down stormwater runoff, filter pollutants, and in some cases infiltrate runoff into the subsurface. For infiltration of runoff, the underlying soils must allow water to percolate through. Vegetated channels should be used for longitudinal slopes of 1% to 6% with check dams potentially utilized for slopes on the higher end of the acceptable slope range. Check dams are obstructions often made of stone that slow down stormwater flows by creating small pools that temporarily store runoff.

Do:

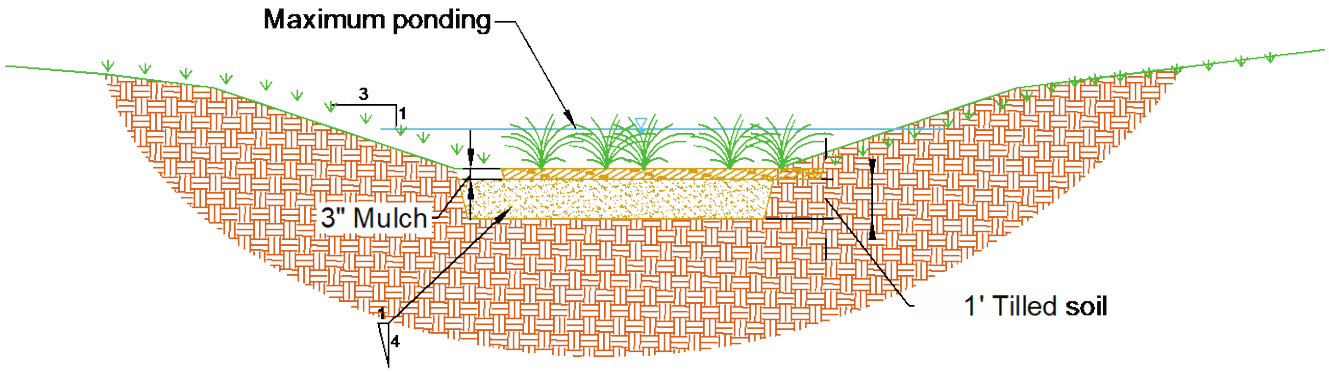
- Locate any utilities present when planning the location of Vegetated Channels
- Plan for the appropriate removal, disposal, or use of excess soil
- Size the Vegetated Channel properly, and carefully plan for overflows and where the runoff will ultimately be directed
- Use Pennsylvania One Call to locate any utility lines before digging
- Scarify (roughen) the soil at the bottom of the Vegetated Channel

Don’t:

- Install close to building foundation, especially if uphill from building
- Locate near water wells or septic fields
- Use filter fabric on the bottom of the excavation
- Compact the soils at the bottom of the Vegetated Channel
- Rush if the excavation is near utilities – a little extra time could save a lot

Vegetated Channels should be designed and constructed by a contractor with experience and knowledge about this practice. The design and construction details provided in this chapter may allow homeowners to better understand the practice, but not to construct this practice without the help of an experienced contractor.

Overview



Where NOT to Locate a Vegetated Channel

1. Within 10 feet of a building foundation
2. Over Utilities
3. Near the edge of steep slopes or bluffs
4. Near an existing or reserve septic drainfield or tank
5. In low spots that do not drain well
6. Within 2 feet of high ground water level
7. Under a tree, or in other areas that would require disturbing healthy native vegetation
8. Where there is high groundwater during the winter
9. Near Wells- Stay back 50 feet from confined wells, or 100 feet from unconfined wells

Recommended Maintenance for Vegetated Channels

Maintenance Tasks	Schedule
• Inspect the Vegetated Channel and replace any dead or dying vegetation	As needed
• Water new vegetation often during the first two months, and then as needed during first growing season (April-October), depending on rainfall • Expect up to 10% of the plant stock to fail in the first year, and plan accordingly for replacement plants	Upon establishment Small herbaceous plants will require more watering
• Check and repair eroded areas • Check inflow and overflow areas for debris or leaves that are blocking flow	After heavy rains in first six months Periodically in subsequent years
• Remove weeds by hand	Monthly for first growing season Every three months in subsequent years
• For meadow type plantings consisting of grasses, mow the Vegetated Channel in early spring • For other types of plantings, check for winter damage and add mulch to bare spots as desired (2–3 inches). Do not let mulch touch base of plants. • Cut back perennials and remove dead growth • High winter wildlife value perennials/grasses can be left until they start sprouting in the spring	February or March
• Add reinforcement plantings to maintain the desired vegetation density • Prune trees and shrubs • Thin herbaceous plants as desired • Remove excess leaf matter after all leaves have fallen in the fall	Fall
• Remove invasive plants using recommended control methods • Remove any dead or diseased plants • Stabilize bare areas draining to the Vegetated Channel, especially if there is erosion • Remove trash	As needed
• Remove accumulated sediment at inflow points	Annually

Section 4: Resources

The following resources are available online to provide further detailed information regarding the design and implementation of stormwater management practices.

Rain Gardens

Rain Gardens in Connecticut: A Design Guide for Homeowners (UConn Cooperative Extension System) http://nemo.uconn.edu/publications/rain_garden_broch.pdf

Rain Gardens: A How-To Manual for Homeowners (University of Wisconsin Extension) https://dnr.wi.gov/topic/shorelandzoning/documents/rgmanual.pdf

Infiltration Trenches and Dry Wells

New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself Stormwater Solutions: Dripline Infiltration Trench, Driveway Infiltration Trench, and Dry Well (NH Dept. of Environmental Sciences)
https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf

Permeable Hardscapes

New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself Stormwater Solutions: Pervious Walkways & Patios (NH Dept. of Environmental Sciences)
https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf

Tools for Evaluating Stormwater Runoff

EPA's National Stormwater Calculator is a desktop application that estimates the annual amount and frequency of runoff from a specific site anywhere in the United States. https://swcweb.epa.gov/stormwatercalculator/

Various Stormwater Management Practices

The Pennsylvania Stormwater Best Management Practices Manual
http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=4673