



Permeable Hardscapes

Using Alternative Materials to Improve Sustainability

Are you concerned about water pollution in your community? Would you like to reduce flooding on your property but don't have room for a rain garden or a rain barrel? Is your driveway, walkway, or patio in need of repair or replacement? If you answered "yes" to any of these questions, permeable hardscapes might be a good solution. Permeable hardscapes help manage stormwater (surface water from heavy rains or snow) and are an alternative to hard surfaces.

Materials used as permeable hardscapes allow stormwater to seep into the ground (permeate) rather than pool in low spots or run off into storm

drains or local streams. Permeable hardscapes can be used for driveways, pathways, patios, and anywhere a hard surface is desired. Using permeable hardscapes can help reduce flooding, replenish valuable groundwater supplies, and lower the amount of pollution that goes into local rivers and streams.

How do Permeable Hardscapes Work?

Individual surfaces vary but all permeable hardscapes have a similar base structure with some differences (Figure 1). In general, a bed of gravel is installed underneath the hardscape surface to

provide storage (AAWSA, 2016); the spaces between the gravel hold the water and enable it to filter slowly into the soil (ICPI, 2016). Pervious concrete is usually placed directly on #57 stone, with no additional bridging layers (Schwartz, 2017). It is important to place permeable hardscapes in areas where the soil can absorb the water. If that is not possible, a pipe called an underdrain should be installed so the system can drain properly.

This Extension Brief is meant to provide the property owner with information about selecting permeable hardscapes. Installation should be performed by an experienced, certified contractor.

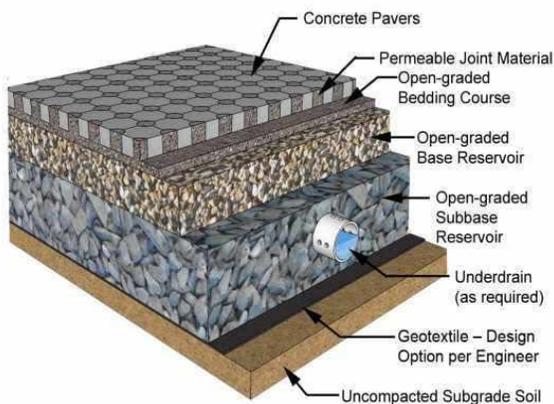


Figure 1: Cross section of typical permeable hardscape. Photo courtesy of Chesapeake Stormwater Network 2014.

Why Permeable Hardscapes?

Traditional hard surfaces (roads, walkways, patios) are impervious, meaning water cannot soak through the soil and be filtered. On these traditional surfaces, water will pond, flood, or flow into the nearest storm drain, carrying with it nutrients, chemicals, trash, debris, and heavy metals. Polluted water that enters the storm drain is carried directly to the nearest stream or river (Figure 2).

The greater the amount of impervious surface in a watershed, the more polluted water will be directly conveyed to local water bodies (Rasmussen et al.,

2012). This can cause problems like property loss (from erosion), fish deaths from algae-choked waters, and depleted drinking water supplies. These problems can significantly affect the community's ability to support water-based industries, tourism, recreation, and a high quality of life.

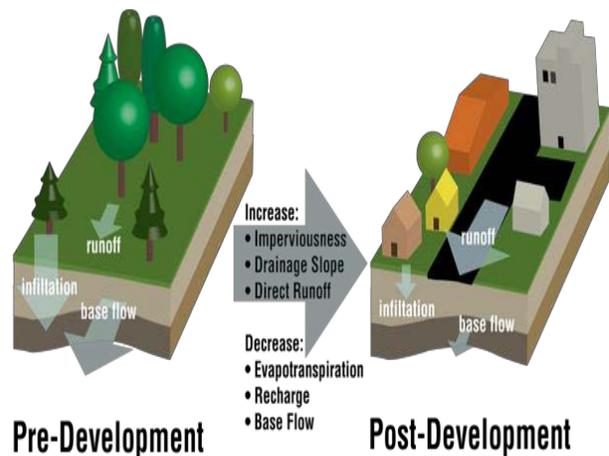


Figure 2: Movement of water and pollutants in pre-development and post-development states. Image by www.invisiblestructures.com.

Permeable hardscapes offer an attractive alternative to impervious surfaces. They can help reduce ponding and flooding, allow water to soak through and replenish drinking water supplies, and prevent pollution from reaching local streams and rivers. Research has shown that annual runoff volume from sites with permeable hardscapes was reduced by 60% when monitored over several years at several sites (Hunt & Szpir, 2006).

Examples of Permeable Hardscapes

There are three basic types of permeable hardscapes to choose from: porous asphalt (Figure 3), pervious concrete (Figure 4), and permeable interlocking concrete pavers (Figure 5) (Maryland Stormwater Design Manual, 2009).

Porous Asphalt

Porous asphalt is similar to the look of traditional asphalt but with a surface of interconnected spaces

to allow stormwater to seep through. It can be used in place of traditional asphalt, with some design modifications for residential streets or heavy truck traffic (NAPA 2008).



Figure 3: Porous Asphalt in Denton, MD. Photo by Eric Buehl.

Pervious Concrete

Pervious concrete is similar to the look of traditional concrete but with small spaces on the surface to allow stormwater to seep through. Can be used for sidewalks and driving surfaces; should limit heavy vehicle traffic.



Figure 4: Pervious Concrete in Ellicott City, MD. Photo by Krisztian Varsa.

Permeable Interlocking Concrete Pavers (PICP)

Concrete blocks or pavers with spaces in between that are filled with permeable material such as sand or gravel or turf (Hunt & Szpir, 2006). Commonly used in parking areas or light traffic driving surfaces (Maryland Stormwater Design Manual, 2009).

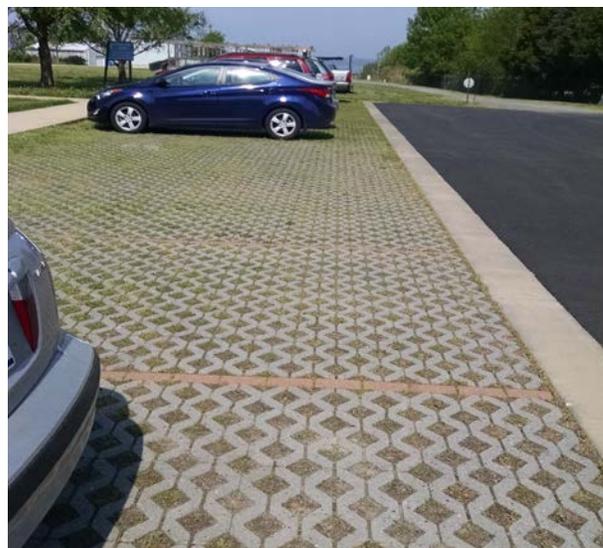


Figure 5: Interlocking Pavers in Oxford, MD. Photo by Eric Buehl.

Design and Location Considerations

Permeable hardscapes should be installed on flat or minimally sloped (less than 5%) areas (AAWSA, 2016). Steep slopes can cause ponding or saturation of the system (Maryland Stormwater Design Manual, 2009). When considering whether permeable hardscapes are right for you and your property, be sure to **avoid** the following (AAWSA, 2016):

- Nearby foundations. Permeable hardscapes should be located downhill from structures or far enough away to avoid flooding.
- Underground utilities. Call Miss Utility (1-800-257-7777) or visit [Miss Utility](#) online to ensure your safety.
- Poor drainage. It is good practice to check your [infiltration rate](#) before installation and select another site if drainage is less than 0.5 inches/hour.
- Nearby loose soil/mulch, tree canopy, or a high volume of water drainage. These can overwhelm and clog your permeable hardscape, particularly if they are located uphill from the site.

- High groundwater table. This could introduce pollutants directly to the groundwater instead of allowing them to be filtered by the soil.
- Nearby (less than 30 feet) wellhead or septic system.
- Locating in the [Critical Area](#). The Critical Area is the ribbon of land within 1000 feet of the tidal influence of the Bay (Maryland DNR, 2017).
- A drainage area that is more than two times the area of the hardscape.

Permeable hardscapes are designed to infiltrate a “normal” storm (1-3 inches over 24 hours); heavy rains may not be able to soak in fast enough and some water will end up sheet flowing off the hardscape. Design and installation should include a path for excess water (either a perforated underdrain or overflow) so erosion does not occur (AAWSA, 2016).

Durability and Maintenance

While costs vary and in some cases can be higher than traditional hard surfaces, permeable hardscapes can last as long or longer than traditional asphalt (20 – 25 years), have little/no freeze-thaw issues (and therefore are less susceptible to black ice and potholes), do not require resealing (ICPI, 2016), and can enhance the value of your property (Montgomery County, 2016). They do require a trained contractor to install and regular maintenance should be performed (see Tables 1 and 2).

Permeable Hardscape Maintenance: Do's	
Action	When
Inspect after big storms (more than 3 inches in 24 hours) to make sure rainwater is draining properly through the material.	After big storms and quarterly
Vacuum sweep as needed to remove clogs and washed out sediment.	After storms and quarterly
Notify contractors working on your property that permeable surfaces are nearby, to prevent damage. Consider posting a sign indicating the permeable surfaces.	As needed
For interlocking concrete pavers, replace/replenish the joint material after sweeping.	As needed
Remove leaves.	Fall
Remove snow with a rubber tipped shovel or plow or keep plow tip 1 inch above permeable surface.	Winter and as needed

Table 1: Modified from Montgomery County, 2016.

Permeable Hardscape Maintenance: Don'ts
Do not pile snow that contains sand or salt on your permeable hardscape.
Do not stockpile mulch, sand, salt, soil, or yard waste.
Do not replace vehicle fluids over permeable hardscapes.
Do not apply sealants over permeable hardscapes or repave the area with materials that do not allow water to pass through.
Do not let commercial trucks regularly drive on or turn around on permeable hardscapes.
Do not apply sand for winter snow removal on permeable hardscapes or adjacent areas, such as sidewalks, that may drain onto the hardscape.
Do not disturb soil uphill from permeable hardscapes without installing a silt fence first.

Table 2: Modified from Montgomery County, 2016.

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