

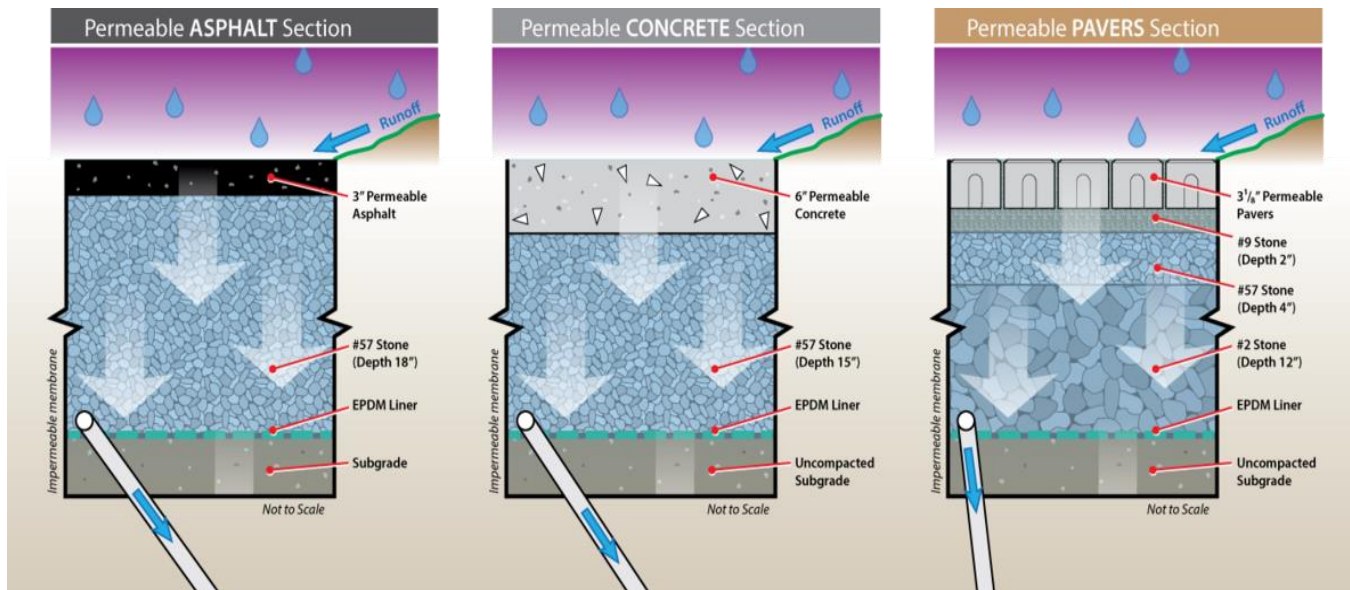
September Sustainability Lesson: Permeable Pavement

Learn what permeable pavement is and why it is beneficial.

Permeable pavement is a form of pedestrian or vehicle pathway that allows stormwater to infiltrate through or go around the material, thus absorbing into the soil underneath. The benefits to permeable pavement include a reduction in flooding during storms - keeping roadways, homes, and businesses safer and stronger long-term. It also helps to clean stormwater runoff by allowing the water to be absorbed into the ground while filtering out pollutants rather than flowing into and directly polluting rivers and streams. There are many materials that can be used when installing permeable surfaces. You can have permeable pavers, permeable concrete, permeable asphalt, or permeable rubber.



Options for permeable surfaces. [Source.](#)



Cross-sections of permeable surfaces. [Source.](#)

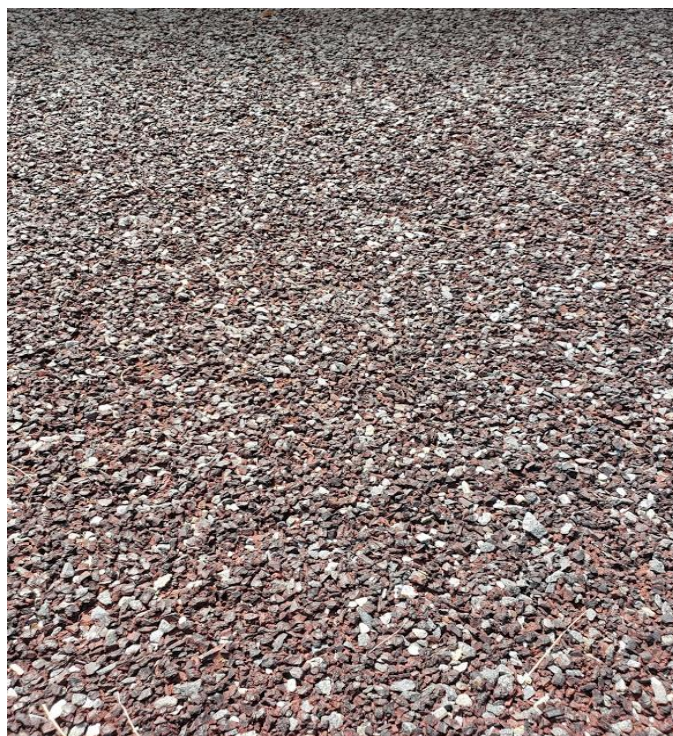
Permeable asphalt and concrete are similar in how they are installed. They are both mixed, poured, molded, and compacted. Each of these surfaces has spaces in between the mixture (even after compaction) so that rain water and runoff can filter through the pavement and recharge the groundwater, rather than flowing directly into our storm drains that pour into streams and rivers polluting the aquatic ecosystems.

Permeable pavers are the same pavers that you would use on any patio or walkway. What makes that pathway permeable is how those pavers are installed. The pavers are placed with gaps or openings between each one and those gaps are filled with sand or small pebbles. Underneath that is another 2 to 3 layers of rocks, gradually getting larger the further down. This allows excess amounts of water to flow in between the pavers and down through the multiple layers of rocks that will eventually absorb into the soil below.

The permeable pathway at Duke Farms is a combination of gravel (grey) and recycled bits of tire (red) and works just like the other options above. At Duke Farms you can find this permeable pathway in between the parking lot and the start of the trails, also known as the “pedestrian path”.



Permeable pedestrian path at Duke Farms.



Close up of the pedestrian path at Duke Farms.



Activity 1: DIY Permeable Pavement

In this activity you will create a small mold of permeable concrete to see how it works firsthand.

Materials:

- Plastic mold
- Rocks (all being a similar size)
- Cement powder
- Water
- Mixing bucket/tray
- Mixing utensil (trowel, paint mixer, etc.)
- Gloves
- Protective eyewear
- Protective face mask

Instructions:

Be sure to wear your safety gear, especially when working with the cement powder

1. You will need to start with 3-parts rock to 1-part cement powder. Combine the dry materials in your mixing bucket.
2. Add a little bit of water at a time. Mix well, being sure to scrape all surfaces of the bucket or tray before adding more water (if needed).
3. Fill your mold with the mixture and pack down with your mixing utensil or hands with gloves on.
4. Mixture *should* be dry in 24 hours but depending on the temperature and humidity it may take a little longer. Look at the mold from all angles to observe the color of the mixture and gently try to remove it from the mold to make sure it is set before committing to releasing the concrete.
5. Once it is removed from the mold pour a cup of water over the surface of the concrete and see what happens!

Note: Getting the water content is key for this mixture to work. You know the consistency is correct when you have fully mixed all the ingredients together well and you can form a ball with it mostly sticking together and does not fall apart. The mixture should also have a shiny look to it.

For the original video and for more detailed information on the process, check out this [video](#)!

More Eco-friendly Ideas

View *Permeable Pavers: Patios, Walkways, and Driveways Made of Porous Pavement* by Mother Earth News [here](#).

More examples of permeable pavement options at home:



Eco-friendly green driveways – A living permeable driveway, porous and alive – reduce storm drain run off with a rustic look. Photo source: Chic Ecologist



Photo source: Landscape network



Photo source: Belgard

Rutgers University New Jersey Agricultural Experimental Station

This RU article is a very detailed document for those who wish to learn more.

Green Infrastructure Practices: An Introduction to Permeable Pavement

An introduction to the article...

Permeable pavement is a stormwater drainage system that allows rainwater and runoff to move through the pavement's surface to a storage layer below, with the water eventually seeping into the underlying soil. Permeable pavement is beneficial to the environment because it can reduce stormwater volume, treat stormwater water quality, replenish the groundwater supply, and lower air temperatures on hot days

Access the complete article [here](#).

Activity 2: Real Life Applications

Observe the photos below and respond in the space provided with your suggestions to their problems. Then, brainstorm and design a space that utilizes green infrastructure.

1. These homeowners may need to modify their driveway. What recommendation would you have for them?



Photo source: The Hour

2. This driveway is slanted towards the center. How does this help with flooding? Explain the materials that are selected and why.



Photo source: DIY Chatroom

3. This homeowner is keeping the driveway gravel. The edged soil will be planted with grass. Is this a wise decision? Why or why not?



Photo source: Project Small House

Design, draw, and label a driveway or a walkway to a building that will limit large unwanted puddles and flooding. Include a list of materials that you would suggest using.

Materials list:

Design and draw:





Learning about the topic of permeable pavement aligns with the newly-adopted NJ Student Learning Standards. For more information about how you may use this lesson in your classrooms or for additional resources, contact Kate Reilly, Manager of Education, Duke Farms. kreilly@dukefarms.org

Adopted 2020 New Jersey Student Learning Standards (NJSLS)

Climate Change

New Jersey is the first state in the country to require climate change curriculum across all content areas and at a K-12 level. As stated by the NJDOE:

On June 3, 2020, the State Board of Education adopted the 2020 NJSLS in the following content areas:

- Career Readiness, Life Literacies, and Key Skills;
- Comprehensive Health and Physical Education;
- Computer Science & Design Thinking;
- Science;
- Social Studies;
- Visual and Performing Arts;
- and World Languages.

These standards truly represent a foundation from which districts will build coherent curriculum and instruction that prepares each New Jersey student with the knowledge and skills to succeed in our rapidly changing world. They will put New Jersey again at the forefront of national education by including the following:

- Climate Change across all content areas, leveraging the passion students have shown for this critical issue and providing them opportunities to develop a deep understanding of the science behind the changes and to explore the solutions our world desperately needs.