Department of Environment + Natural Resources

12-10-13

Big question: Is gravel pervious?

The answer: It depends.

Three factors affect the perviousness of gravel:

1. **The type of gravel that is used**. Gravel that contains very few fine sediments and has uniform sizes of stone is the most pervious. Gravel that contains a large amount of fine sediment and includes a variety of stone sizes (which allows smaller stones to fill in the gaps between larger stones) is significantly less pervious.
2. **The soil that is under the gravel**. Soils with relatively large particle sizes (like sand) that are not compacted are the most pervious. Soils with relatively small particle sizes (like clay) that are heavily compacted are virtually impervious. In this setting, the purpose of gravel is to convey stormwater to the soil so that it can be infiltrated. If the soil cannot accept stormwater due to heavy compaction, then stormwater will initially soak into the gravel but will then run off around the edges of the gravel/soil interface. The result? Flows and pollutant loads that mimic those from a paved area.
3. **The management of the gravel**. Gravel that is subject to only infrequent (or no) vehicle loading and is protected from sediment loads is the most pervious. Gravel that is subject to frequent vehicle loadings and that receives sediment deposition from adjacent areas is significantly less pervious (sediment from adjacent areas can be deposited on gravel via stormwater flowing onto the gravel, wind deposition or vehicle tires). An important note: A gravel surface that is deep enough and with proper gravel sizing can provide enough structural support to protect the soils underneath from being compacted by vehicles.

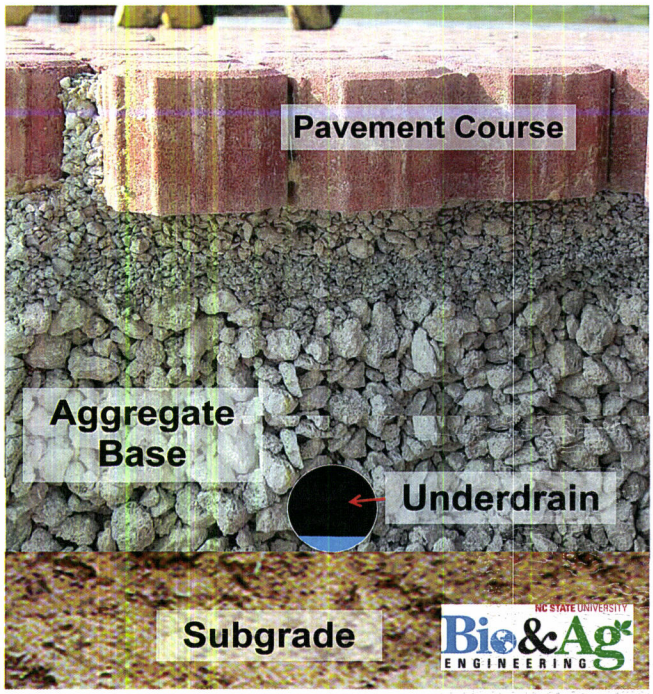
The state stormwater program has traditionally recognized that there are built-upon areas, areas not considered as built-upon and areas considered partially built-upon (which, until now, has been limited to permeable pavement designed in accordance with state standards). The wording in red shows an addition that could be made to recognize that some gravel behaves as a partially built-upon area.

Examples of Built-Upon Area	Examples of Areas NOT considered as Built-Upon	Examples of Partially Built-Upon Area
• Roofs • Impervious pavement • Gravel areas that are subject to frequent traffic or high sediment loads (and thus are unlikely to infiltrate water indefinitely)	• Slotted decks • Swimming pools • Gravel covered landscaped areas	• Permeable pavement designed, constructed and maintained per the BMP Manual • Gravel areas that are designed to maintain the infiltration rates of the gravel and the subsoil below and that are protected from sediment loads.

Permeable pavement designed for infiltration currently receives the following credits:

- For Hydrologic Soil Group A and B: 75% pervious and 25% BUA
- For Hydrologic Soil Group C and D: 50% pervious and 50% BUA

We suggest that permeable pavement be considered the "gold standard" of partially built-upon areas because it is designed, constructed and maintained specifically to infiltrate stormwater from the development site it serves. Soil beneath permeable pavement (the subgrade) is prepared to maximize its infiltration rates. Designs for permeable pavement are typically done by professional engineers and reviewed by local governments or the state. Before a permeable pavement system is approved, the owner must show provisions for ongoing maintenance. The pavement course (the pavers, or permeable asphalt/concrete) provides a surface to protect the underlying gravel from fines that can be swept when necessary.



Because gravel surfaces will likely not be held to the same standard as permeable pavement, we suggest that the credit they receive as a partially built-upon area be lower than that which is awarded to permeable pavement.

Some additional implementation issues associated with the gravel definition:

- **Undersized stormwater practices**. Assigning a high "perviousness" to gravel doesn't accurately account for the amount of stormwater and could lead to undersized stormwater practices that do not function correctly.
- **Redevelopment disincentives**. Currently our rules allow areas that are impervious to be redeveloped without stormwater controls as long as the built-upon area is not increased and equal or better stormwater control is in place. Before the new definition, a landowner wanting to develop a gravel parking lot would not be required to provide stormwater controls for the new development. However, if gravel is considered pervious, then someone developing a gravel lot would have to provide stormwater control for all the built-upon area added.
- **Questions with existing approved projects**. Existing approved projects that include gravel may want to add more built-upon area on their project site getting credit for the gravel that was previously counted as built-upon. This could lead to numerous existing stormwater practices receiving more stormwater than they were designed to handle.
- **Inconsistent local government programs**. Local governments may choose not to change their ordinance and continue to treat gravel as impervious, which could create inconsistencies across the state.

Division of Energy, Mineral, and Land Resources' Stormwater Program Implementation Concerns with Gravel Exclusion from Built Upon Area

- General - concern with the broad approach of the definition. It treats all gravel as pervious. Technical information shows that compacted gravel areas (parking, roads, etc.) are essentially impervious over time. Treating these as pervious can lead to designs that don't accurately account for the amount of stormwater that becomes runoff. This will lead to undersized BMPs that will not function correctly to treat stormwater properly and will impact water quality. This can also lead to flooding issues. Design professionals would be responsible for the designs to assure they were accurately handling the flow volumes and rates.

- Redevelopment - currently our rules allow areas that are impervious to be redeveloped without stormwater permitting as long as the built-upon area is not increased and equal or better stormwater control is in place. This would include a scenario like someone coming in with a gravel parking lot that they wanted to build on. This could be handled as redevelopment previously. With the new definition, gravel is pervious so the same scenario would be handled just like a project that was developing a natural area. They would have to provide stormwater control for all the built-upon area added.

- Existing permits - we are getting questions about existing permits that have gravel and whether they can now go in and add more built-upon area on their project site getting credit for the gravel that was previously counted as built-upon. This could lead to numerous existing systems now ending up with more stormwater than they were designed to handle. People are also questioning whether they need a permit modification to do this.

- Local government programs - where local governments implement the stormwater requirements through their own existing ordinances, we interpret the change to not apply to their programs. They do not have to change their ordinance and can continue to treat gravel as they have been.

Built Upon Area calculations with respect to new vs. existing impervious surfaces (redevelopment)

Under the state stormwater programs overseen by DEMLR (Coastal Counties, Phase 2, ORW, HWQ, Water Supply Watershed and the Universal Stormwater Management Program), the Division does not require the permittee to treat areas of a project that are already built-upon. Language in these rules generally refer to redevelopment in a very similar manner as "...activities that results in no net increase in built-upon area and that provides greater or equal stormwater control than the previous development..." A diagram is attached that has been used to explain this redevelopment credit in the Division's stormwater programs.

The redevelopment process has been implemented in a manner that provides flexibility to the permittee including allowing the built-upon area to be redistributed on the project site as long as the final conditions are similar in nature to the previous conditions. As an example, if the permittee removes existing built-upon areas and replaces them with new built-upon areas (even if they are in a different location), they would still be allowed to avoid providing stormwater treatment for an area equivalent to the existing built-upon area. In other words, if the built-upon area after development is less than or equal to the pre-development built-upon area, then no stormwater treatment is required. If the built-upon area after development exceeds the pre-development built-upon area, they only have to treat the difference in built-upon area has to be treated.

It should be noted that the language in the rules also mentions that the redevelopment needs to provide equal or better stormwater control that the previous development. This could be an issue if someone had existing development that sheet flowed through grassed areas and in the redevelopment they were piping all of the flow and sending it straight to surface waters. This is not considered to be equal or better than the existing condition and stormwater control is required in these cases. In addition, people also have to be aware that in their redevelopment designs, if the existing BUA drains through a stormwater control measure then they have to account for that flow in the measure to assure that the measure will function properly.

The Division has found that this portion of our rules has been simple to understand and implement. It seems fair to our permittees and helps to encourage reuse of existing properties, which is beneficial for the economy and the environment.

Modifications to the built-upon area definition associated with gravel could impact redevelopment implementation. In the past, gravel areas were treated as impervious and would be counted as existing built-upon area. A change that considers gravel as non built-upon area would mean that these areas, when redeveloped, would have to be considered new development and the stormwater flow treated.

Please note that there may be other program areas that have specific requirements designed to improve water quality in an impaired water area where existing development would be treated differently. Because these requirements are attempting to address areas with existing pollution problems, they may require that redevelopment attempt to address reductions in stormwater impacts.

Permeable Pavement