Reduction of Excessive Use of Water in Buildings: Use of Permeable Concrete to Create a Permeable Pavement System for Water Harvesting

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Ingles II – 2021.

New Methods for Water Harvesting

6 CLEAN WATER AND SANITATION

-Separation of non-drinking and drinking water

-Second water provision of non-drinking water

-Stormwater as the building´s non-drinking water resource

Permeable concrete

Permeable Pavement Systems

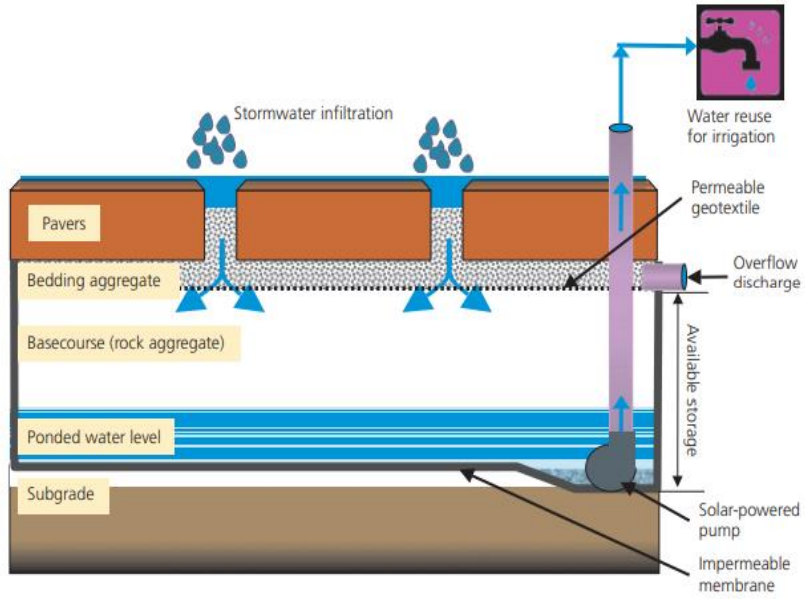


Figure 1. Permeable pavement system with water reuse capability (adapted from Myers *et al.* (2009a))

Map of the Presentation

PARTS OF THE SYSTEMS AND ITS OPERATION

- Permeable Pavement made of Permeable Concrete
- Basecourse Aggregate
- Impermeable Membrane
- Subgrade
- Water Pipeline

THE SYSTEM'S PERFORMANCE

- Water Catchment
- Water Demand in the Building
- Inspection and Maintenance

COMPARISON WITH OTHER SYSTEMS

Parts of the system and its operation

Permeable pavement of permeable concrete

Permeable pavement is a porous urban surface composed of →

- Open pore pavers
- Underlying stone reservoir

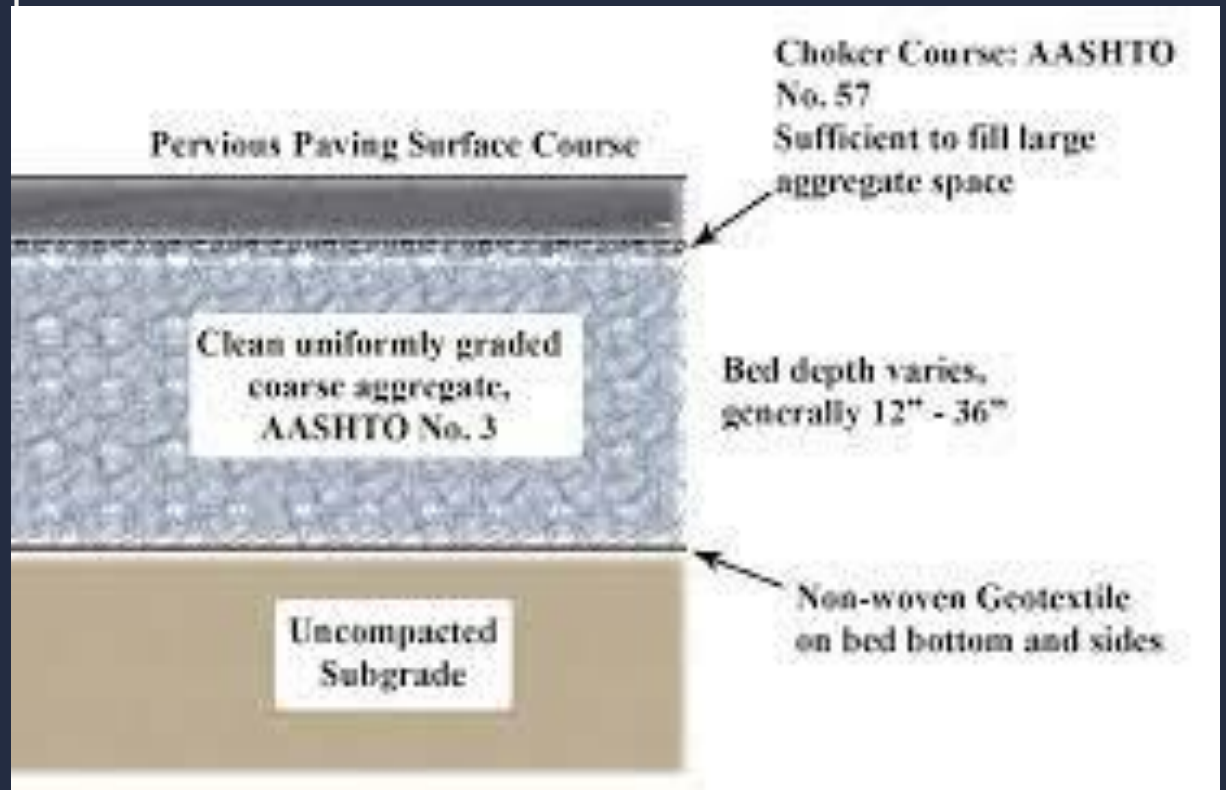
PC characteristics →

- This is a type of concrete with open network of pores to allow infiltration of storm water
- This concrete has a little or no amount of fine aggregate
- PC greatly withstands the damage caused by permanent use and weather action
- The PC can adopt the shape needed

Aggregate Basecourse

The aggreagate basecourse is in charge of →

- Complying with a structural and hydraulic function
- Transmitting the pavement's charges to the soil
- Storing the water in its matrix



Impermeable Membrane

The impermeable membrane is in charge of →

Generating the water reservoir with the aggregate basecourse

Avoiding rainwater infiltration into to the soil

Water pipeline

It takes water from the lower part of the basecourse and carries it to the water tap.

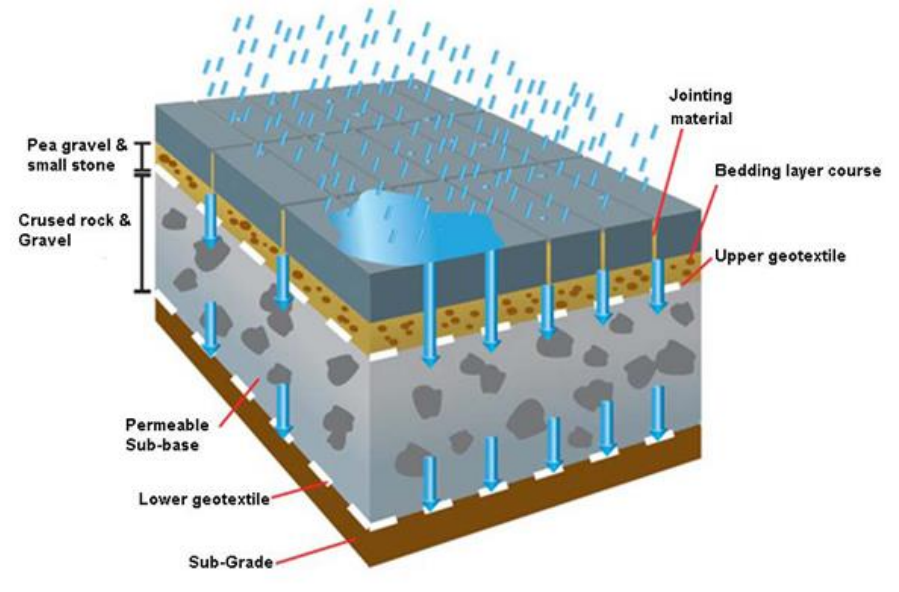
The System’s Performance

Water Catchment

The capacity of havested and stored will depend→

- Amount aggregate basecourse´s layers
- Infiltration of PPS
- Climatic factors
- Aggregate basecourse’s dimensions

For example, with a voids volume of 40% and a basecourse thickness of 40cm, the capacity will be of 160lt per m2. With this, in a house parking driveway of 25m2 the basecourse creates a tank of 4000lt.



Water demand in the building

The water demand per capita/day varies from 50lt to 209lt

Souza and Ghisi note:

When the catchment surface area is small (100 m2), the potential for potable water savings of most cities ranges from 10% to 40%. However, by increasing the catchment area to 400 m2, a higher potential for potable savings can be achieved, since a greater amount of rainwater can be collected. [5, 4.2]

[1, p.2.]

Table 1. The Contribution of PPS Reservoirs to UK Interior and Exterior Daily Water Use

Quantity	Standard practice house (212 L/person/day)	Best practice house (90 L/person/day)
Interior water use from PPS (Litres/person/day)	52	30
Water saved by PPS (%)	25	33
Exterior water use from PPS* (Litres/person/day)	90	90
Water saved by PPS (%)	100	100

*This value is based on 30 minutes of irrigation per day at a tap flow rate of 12 litres per minute

Inspection and Maintenance

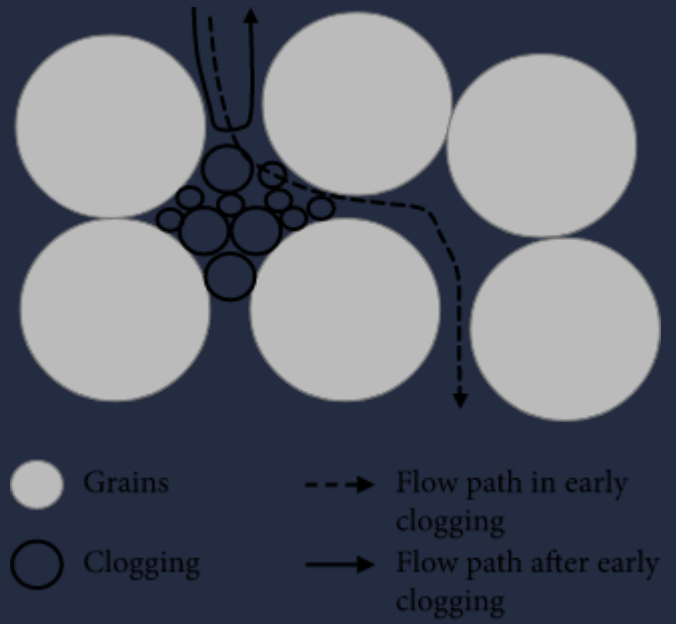
The **clogging** is the process by which the permeable pavement's voids are blocked because of water pollution.

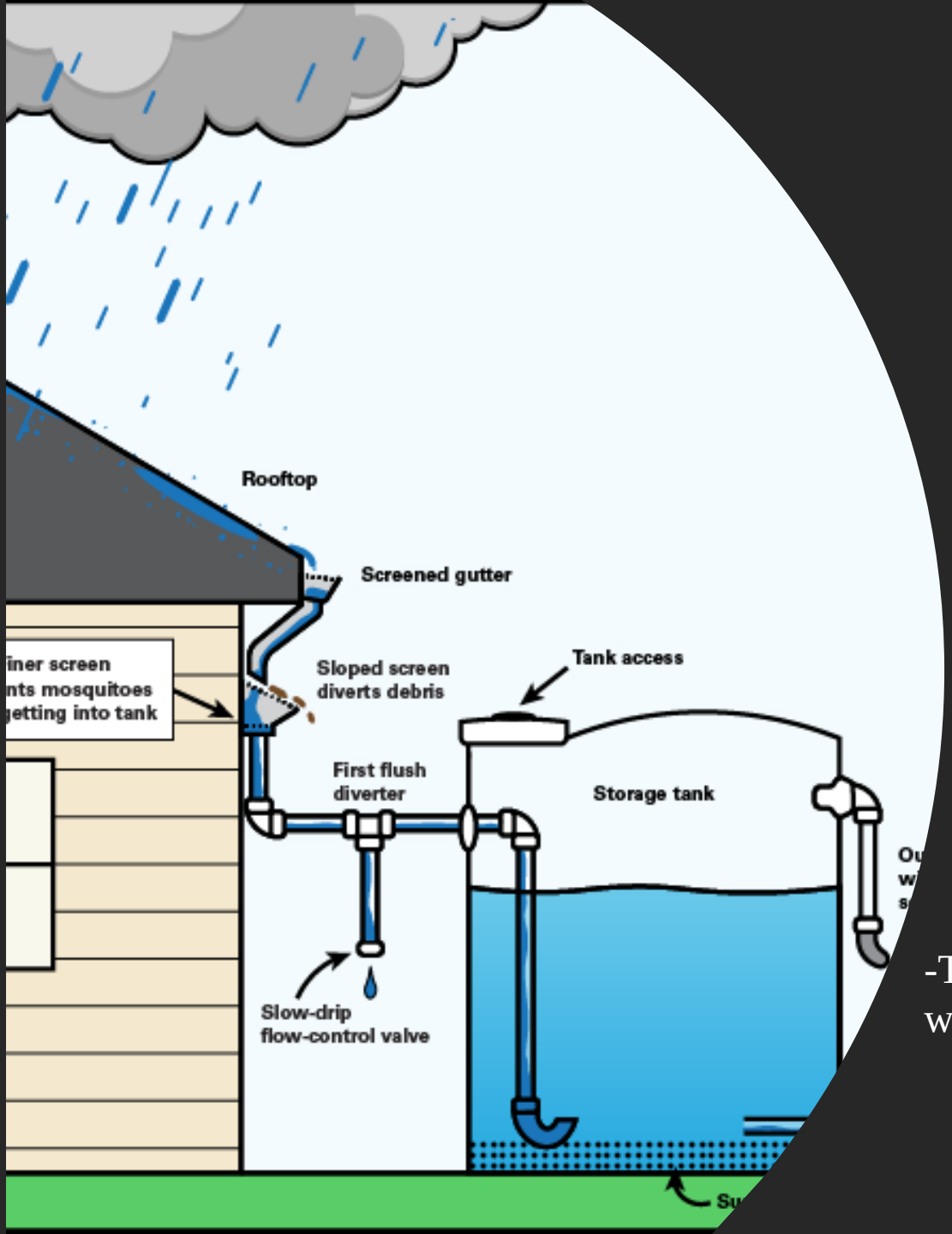
Clogging solutions→

Cleaning the upper surface

Going down the tortuosity

Keeping the pore structure uniform

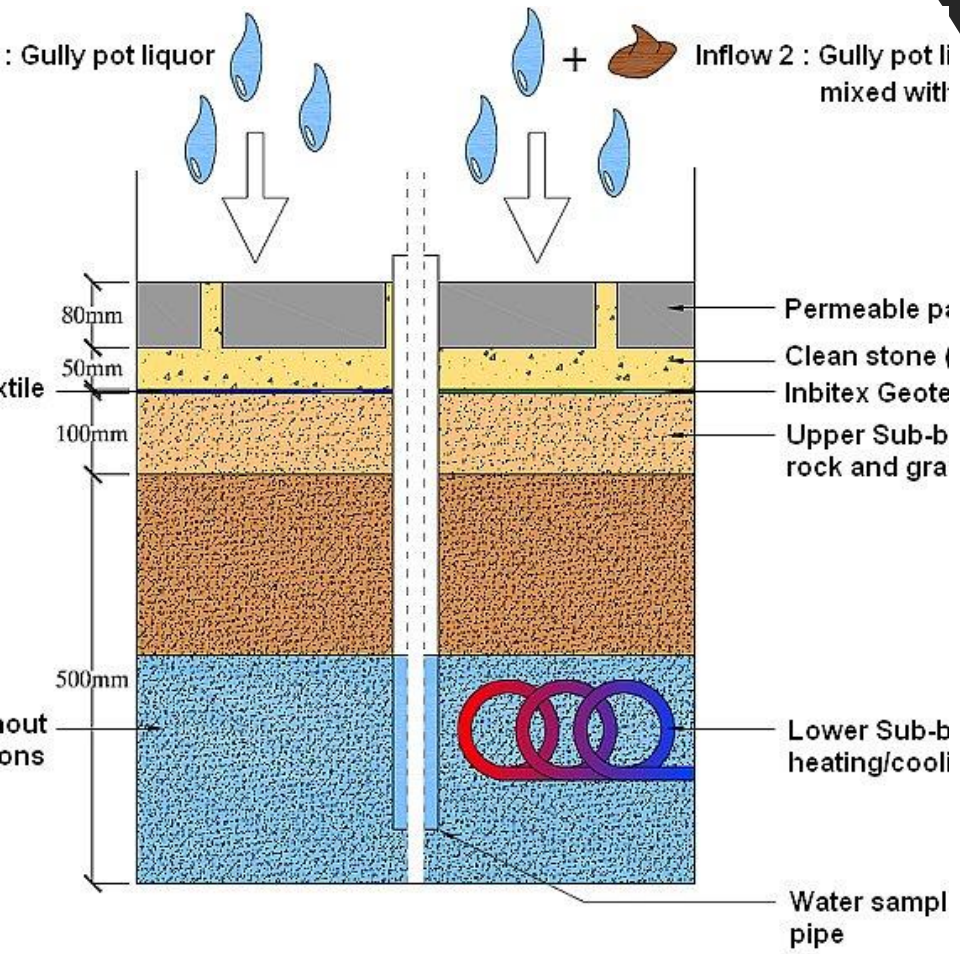




Comparison With Other Systems

-The PPS has the advantage of storing water without another reservoir than itself

-The PPS tank can be connected with other systems to harvest water or other water reservoirs

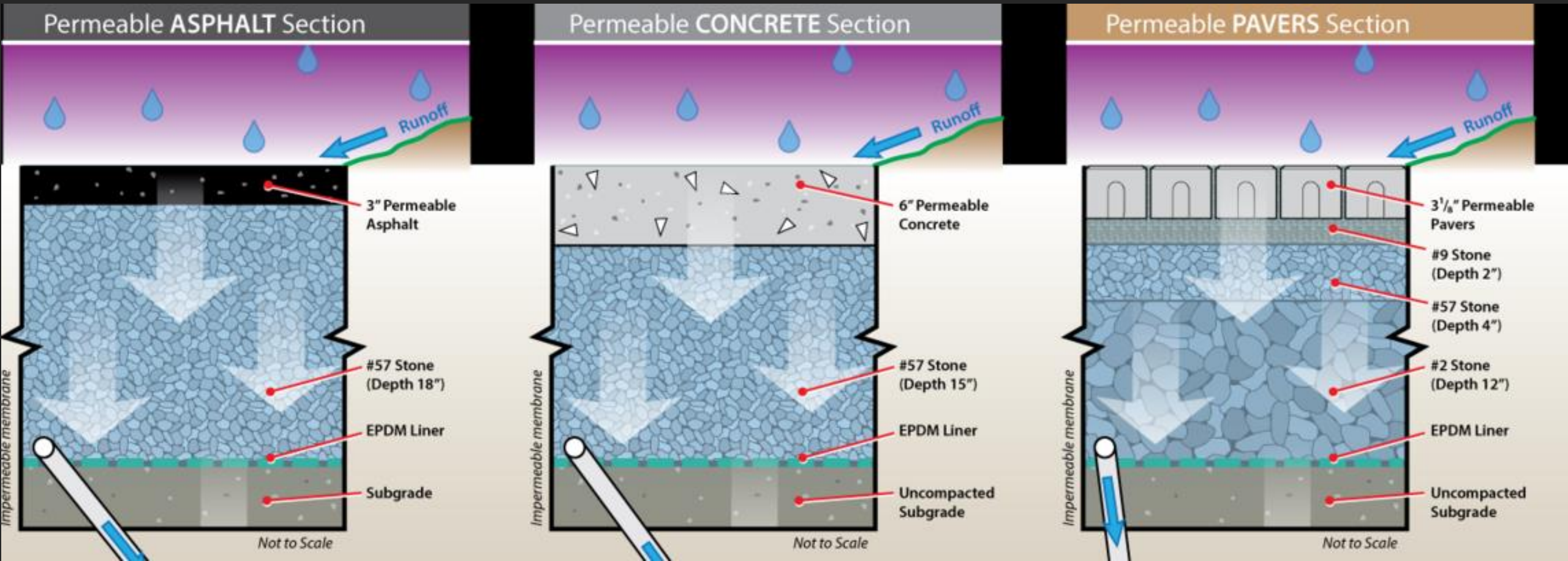


PPS can have other functions than just harvesting water

These can create systems for heating building

The PPS have a lot of combinations of their components

Different infiltration, water capacity and water quality types



In Conclusion:

-This paper has shown an option to create a PPS

-The PPS is an excellent option in areas with shortage of water

-This PPS uses accessible technology and does not need highly skilled workforce to be installed

-The PPS presented in this paper can be made in an actual context or inspire a new PPS

-The ideal combination of PPS's components will depend on both the area where the PPS will be working and the builders tastes and preferences.

References

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