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**CONNECTING LOW IMPACT SUSTAINABLE STORMWATER TECHNOLOGIES TO IMPROVE WATER  
QUALITY AND GROUNDWATER RESOURCES**

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**ABSTRACT:** During the past decades there has been an increasing trend in the United States and other countries to manage stormwater more effectively, more naturally, through basin wide management programs as well as implementing “low impact” stormwater management systems to not only reduce flooding but to also improve the *water quality* of storm flows. Many large systems recently adopted still rely on detention and infiltration to reduce the volume of runoff that is generated from impervious surface areas. In urbanizing environments many governments are implementing structural and non-structural Best Management Practices (“BMP”) to achieve these goals particularly under MS-4 programs. Very recently there have been projects that integrate innovative sustainable stormwater management BMPs, including large underground stormwater storage systems. Fountainhead Engineering Ltd (FHE) has used Rain Gardens as a situational alternative along with pervious pavements to detain and infiltrate storm flows replacing or reducing traditional detention and retention pond capacity. At the local level FHE has examined innovative approaches using a patented concrete stormwater block with a unique “built in” stormwater reservoir feature. The USEPA identifies concrete (grid) pavements consisting of concrete blocks with regularly inter-dispersed void areas to be a BMP.

This innovative stormwater system meets the ASTM D6684-04 standard and is a structural BMP for stormwater infiltration and has been made using recycled materials. The use of this patented permeable articulating concrete block/mat (P-ACB/M) provides local underground reservoir storage (with infiltration) for new developments and can be used to retrofit existing parking lots and paved surfaces. This “created” or built in aboveground storage capacity infiltrates to an underground stormwater unit filled with stone or recycled concrete. It is a very new and dynamic approach maximizing the use of recycled materials and can be manufactured using 100% recycled, carbon neutral lightweight aggregate (LWA) that generates LEED credits while reducing the weight of the block by up to 10%. Use of this system can significantly alter a local storm hydrograph minimizing the impacts of stormwater runoff locally and regionally by reducing or diverting a portion of these flows, improve water quality, and recharge local groundwater resources.

This new low impact stormwater approach can replace traditional impervious asphalt and concrete pavement that generate runoff. This new and patented approach with “built in” storage capacity into the blocks is referred to as “arch storage”. The block – installed “at grade” would replace the impervious concrete or asphalt areas that generate substantial runoff with an easy to install system that reduces runoff while providing significant stormwater storage capacity (typically a 1”- 3” rainfall event). The 43 pound stormwater block with this built in arch storage capacity are assembled into standard 8’ x 18’ articulated concrete mats (cabled together) typically weighing 6,300 pounds. In addition to the arch storage feature the mats are constructed to allow for significant stormwater infiltration vertically into a below ground storage reservoir engineered to local specifications or design storms. This allows for more natural vertical infiltration, recharging local groundwater and reducing first flush pollutants. The “PaveDrain™” mats install easily using standard construction equipment and can be pre-assembled in a variety of sizes customized for specific applications and this hardscape reduces runoff, recharges the groundwater more naturally and improves water quality. The PaveDrain units can also be manufactured on standard block machines around the country allowing for local and regional deployment of this unique new technology. Communities and businesses can use this system and reduce stormwater infrastructure requirements (and costs) while improving water quality for nearly the same cost of traditional paving. However, PaveDrain™ systems with built in storage capacity using recycled materials when teamed with other Low Impact Development or LEED approaches such as Rain Gardens may provide benefits to developers or sponsors of new projects and assists regulators by providing more effective on site and regional stormwater management improving water quality while also using a “green” alternative.

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