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California Regional Water Quality Control Board, San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

Reference: **ORDER NO. R9-2013-0001/NPDES NO. CAS0109266**

Subject: Sustainable Structural Source Control Storm Water BMPs

Board Members:

Water is the most precious resource next to clean air that we have in southern California. Without a safe, reliable source clean water for drinking, cooking, bathing, and commercial uses (high-tech research and manufacturing), the habitability of our region is seriously degraded. As you prepare the referenced order, I urge you to strongly consider the implementation and use of sustainable, structural source control BMPs that will capture, treat, and infiltrate storm and landscape water in-place.

Sustainability is defined as practices that allow the present generation to meet our needs without compromising the ability of the succeeding generations to meet their needs. Founded on economic, environmental, and social principles, sustainability ties together low-cost infrastructure to solve environmental issues in everyone's best interest.

The paper "California's Water Energy Relationship" prepared by the California Energy Commission noted that 19% of the state's electrical usage plus huge quantities of natural gas and diesel fuel were used in development, transportation, and usage of California's water. Of this nearly one-fifth of an already constrained resource, 22% is used in moving water from northern to southern California (10,300 GWh or 4.1% of the total electrical usage). Four percent is used in wastewater processing. A first line of defense is needed to reduce the need for more imported water and reduce the amount of water being processed and decrease the demand on an already overstressed electrical system.

Until "toilet to tap" becomes socially accepted, systems that naturally capture, treat, and slowly release storm and landscape water into the shallow and deep aquifers and waterways are needed. Such low-impact development systems are more sustainable and less costly than large storm water treatment plants that ultimately discharge huge plumes of clean water into

the ocean. Examples of these LIDs are pervious concrete, permeable interlocking pavers, rain-gardens, storm detention basins, and porous asphalt.

Pervious concrete is in the simplest terms conventional concrete that is made without the inclusion of sand. It contains only cementitious material (portland cement and perhaps fly ash a recycled industrial by-product), water, and coarse aggregate. The concrete has a void content of 18% to 25% and is typically placed over a 6-inch to 10-inch recharge basin of 1-inch maximum size aggregate. Pervious concrete can be designed to accept the water from the parking lot, building roof, and hardscape so that even in the slowest draining soils, no water will leave the site.

Permeable interlocking pavers are small precast concrete blocks that portions of their corners removed. The ½-inch square opening at the intersection of four blocks is filled with small aggregate which allows water to infiltrate into a permeable base under the pavers. Their performance is very similar to pervious concrete.

The pre-infiltration storage capacity of one acre of PV/PIPs is approximately 9,600 cf or 2.7-in of storm water. The water that passes through PV/PIPs is cleaned by naturally occurring micro-organisms as it infiltrates the soil. Once in the soil, the water stays in a shallow aquifer where it available to surface vegetation or it eventually replenishes local waterways or it continues to deeper aquifers where it can be removed by pumping for domestic and commercial uses. Pervious concrete and permeable interlocking pavers will provide a 20 to 30-year service life with minimal maintenance. The uses of PC/PIPs are generally in parking lots, but they have also been used in sidewalks, nature trails, low-volume streets, and gutters. Caltrans has used pervious concrete in rest stop parking lots and on highway shoulders.

PC/PIPs used in parking lots free space for additional economic and recreational development. Development is constrained by the amount of parking that is available. When storm detention basins are used, valuable land is consumed in constructing an "attractive nuisance" that fills with trash during dry periods and breeds mosquitoes when wet. PV/PIPs are storm detention basins that have dual uses. An example of pervious concrete replacing a storm detention basin is Stratford Place, a 19 unit sub-division in Sultan, WA, where two detention basins were replaced with pervious concrete streets, sidewalks, and driveways allowing the developer to construct two additional homes with overall construction savings of $260,000. The completed site hydraulically mimicked the natural state. The Kaiser Hospital organization is now using pervious concrete for parking lots in its new projects.

PV/PIPs are energy efficient. Once constructed, the energy requirement is possibly an occasional sweeping to keep the surface voids open.

Rain gardens are attractive methods for capturing and treating storm water, but have a limited capacity compared to PV/PIPs. Detention basins can store large quantities of water, but are generally attractive nuisances. Porous asphalt pavement is similar to pervious concrete in that fine aggregate is removed to create the voided interstitial structure. The major drawback to PAP is that asphalt is a flexible material that is subject to weathering of the organic structural

material. In hot weather, the PAP can be shoved by traffic closing the surface voids. Ultraviolet radiation degrades the asphalt surface (oil). Typical asphalt pavement surfaces are rejuvenated by spraying with fresh oil or a slurry seal. Neither option is viable for PAP since the surface voids would be closed. Further, as the price of oil rises and refining techniques are improved, the amount of asphalt oil is reduced and its price is increasing compared to portland cement which has been relatively stable.

In closing, a sustainable first line of defense is needed to capture, treat, and infiltrate storm and landscape water back into our natural system. Wyatt Troxell, a former board member of the Inland Empire Utility Agency, commented after a pervious concrete presentation that "for every acre of ground that covered by streets or buildings, we must import an acre-foot of water forever." Capturing, treating, and re-using water is essential.

Respectfully,

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