

# Nonmechanical Device for Stormwater Flow Control

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### Environmental Problem

To satisfy water quality criteria or total maximum daily load (TMDL) allocations, regulated sources of wet weather pollution (stormwater, combined sewer overflows (CSOs), and sanitary sewer overflows) require cost-effective flow control and treatment technologies. Flow controls maximize wet weather flows that can be treated without inhibiting drainage system hydraulics or blocking the flow path. Conventional flow control includes fixed weirs or more expensive mechanical devices that can inhibit the drainage system hydraulics or create higher capital and maintenance costs. Conventional approaches, in which devices are placed in the flow path, risk upstream flooding or less than optimal wet weather treatment.

### SBIR Technology Solution

With support from EPA's Small Business Innovation Research (SBIR) Program, WWETCO, LLC has developed a nonmechanical, passive-flow control device that will maximize flow attenuation and diversion of wet weather volumes to treatment. The WWETCO flow control can be installed at a cost comparable to the most inexpensive fixed weir controls. The device is simple, compact, and able to handle high velocities carrying trash and abrasive materials with virtually no maintenance. It is not affected by corrosive environments. The passive flow

control device consists of a flexible bladder that opens at the bottom in a structure containing a static fluid that seals the bladder against a conduit that transports dry and/or wet weather flow. The technology can be used in a stream or water conveyance channel, piping network, storage basin or structure, and as a part of a treatment system. The WWETCO flow technology can be incorporated into the outlet of stormwater ponds to carry a fixed water level during dry weather or to completely drain yet maximize their effectiveness for each runoff event.

The flow control device uses differential hydraulic pressure across the membrane to passively maintain an upstream water level during changing flow conditions. The flexible membrane takes on a shape to create the head loss required to maintain the upstream water level and pass the excess flow to the downstream level. The design allows the passage of aquatic biology or other base flows during dry weather. During runoff conditions after the upstream storage has been fully utilized, the flexible membrane lifts upward as needed to pass any excess volume or debris. Because the bladder opens from the bottom of the conduit, it is non-clogging and provides full-bore peak flow. The technology can be designed to seal the conduit completely or partially, allowing passage for dry weather flow such as sewage in a combined sewer inline storage application or stream/groundwater base flows. The WWETCO flow control provides diversion to treatment, bypass around treatment, and/or attenuated base flow through the flow control. It optimizes the use of all available upstream storage before bypassing any excess flow volumes not treated or stored. It also has the ability to bypass peak flow with no system capacity loss, eliminating any risk of upstream flooding.

The WWETCO flow control does not require additional head or a vertical drop in the drainage system to operate. It creates a differential head in the drainage flow path between the maximum upstream water level (set by the static level in the structure) and the downstream attenuated flow depth. Flow and treatment controls, therefore, can be placed at any location in the collection network or drainage system where there is existing infrastructure, available land/waterway for storage, or where residual pollutant removals are advantageous.

### Commercialization Information

Commercial applications include the optimization of various flow controls, such as diversion, storage, migratory tolerant stream attenuation, inline storage, flow to treatment, creating head for treatment, pond/stream level management, irrigation, fish ladders, or other situations requiring the maintenance of an upstream level. The preliminary commercialization plan was developed from Phase I research



WWETCO Compressed Media Filter and Flow Controls with ultraviolet disinfection for Weracoba Creek stormwater treatment in Columbus, Georgia



results and combined with local, state, and federal agency surveys of wet weather control needs. The Phase II commercialization plan defined full-scale hydraulic and operation performance, fabrication and production, specific marketing strategies, information dissemination, teaming arrangements, and funding. Primary focus markets include the development community and municipal governments that are under regulatory requirements with an estimated average value of \$40 million per year for the next 30 years (dependent upon geographic location, state and federal regulatory activity, and new development).

The flow control technology was tested in a project that demonstrated an innovative retrofit of an existing stormwater pond serving a 300-acre commercial impervious area in the Roaring Branch watershed, a tributary to the Middle Chattahoochee River in Columbus and Muscogee County, Georgia, and in a demonstration of disinfection and stormwater pollutant load reduction facility in Weracoba Creek Watershed in Columbus, Georgia. Additionally, the City of Columbus implemented a stormwater treatment system to control flow and filter the runoff from its 7-acre vehicle maintenance facility. The WWETCO flow control device was installed to provide passive wet weather treatment. The first two projects above were tested under EPA grant Quality Assurance Project Plan (QAPP) protocols, with results showing that macro-invertebrate species increased 100-fold and 60-fold, respectively, downstream of these facilities. This improved water quality raised the impaired stream segments from a Class C to a Class A rating.

## Company History

WWETCO specializes in the monitoring, measurement, evaluation, control, and treatment of wet-weather-related pollution. The managing principals of this environmental products and services firm have an average of 33 years of engineering experience, including planning, design, construction management,

manufacturing, operations, and performance testing. Since 1996, WWETCO has provided watershed measurements and wet weather control technology demonstrations for solutions to combined sewer overflows (CSOs), stormwater, tertiary filtration, nutrient control, optimization of biological treatment, lagoon controls and filtration and industrial pollution issues.

## SBIR Impact

- Cost-effective flow control and treatment technologies are required for wet weather pollution, and conventional approaches are inadequate.
- WWETCO has developed a non-mechanical, passive-flow control device that can be installed at costs comparable to the most inexpensive fixed weir controls, and requires virtually no maintenance.
- The device operates on a flow control-created hydraulic gradient that allows placement of flow and treatment controls at any location along the collection network or drainage system where residual pollutant removals are advantageous.
- WWETCO's flow control device provides passive wet weather treatment for the City of Columbus, Georgia's stormwater treatment system.