

Unified Sizing Criteria for Stormwater Design: Design Criteria to Encourage Low Impact Development in South Carolina

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ABSTRACT. As expanding land development, tightening federal stormwater regulations, and increasing numbers of impaired water bodies in South Carolina strain conventional civil design standards, it becomes increasingly important that future land developments be designed to protect and improve both water quantity and water quality in an economically viable manner. While many of the current land development and stormwater design regulations in our state include water quantity and water quality design criteria, the general lack of innovative water quality designs and better site planning practices warrants further evaluation. Many stormwater managers, consulting engineers, and developers like the idea of using Low Impact Development (LID) or Green Infrastructure (GI) design techniques; however, many mandated design standards can unintentionally discourage the use of LID and GI design due to the additional cost, long term maintenance, and complex engineering design.

The purpose of this presentation is to present a different approach to stormwater design methodology called the Unified Sizing Criteria (USC), which has been adopted in other states similar to South Carolina for well over a decade. In contrast with the pre-development vs. post-development peak runoff rate design criteria, the USC focuses on water quality protection, channel protection, overbank flood protection, and extreme flood protection within a framework of hydrology that emphasizes better site planning to produce more cost-effective site designs for a better long term stormwater management solution. Additionally, the USC provides a credit calculation system for the use of LID or GI design techniques, allowing the engineer to reduce the size of stormwater ponds and pipes (and their cost) in exchange for the implementation of these practices.

This presentation will explain the need for stormwater management based on impacts to stream flow, stream morphology, changes to aquatic habitat, and changes to water quality. After explaining the current South Carolina stormwater design regulations from the

Standards for Stormwater Management and Sediment Reduction Regulation 72-300 through 72-316, this presentation will provide contrasting details of the Unified Sizing Criteria design process. The presentation will discuss the following design criteria in detail:

Water Quality Volume

Since the vast majority of stormwater runoff volume comes from the small but frequent storm events, these events tend to have the largest impact on water quality in downstream water bodies. In order to effectively address downstream water quality without adding unnecessary construction or design costs, the USC requires extended detention or treatment of a calculated water quality volume for the 85th percentile storm event (approximately 1.2" of rainfall). The water quality volume is calculated based on the imperviousness and total area of a site. Once calculated, the water quality volume can be treated using various water quality Best Management Practices (BMP's).

Channel Protection Volume

Extensive studies have shown that the 1 to 2-year storm events move significantly more sediment downstream than other events in streams and drainage channels. Since this size event is typically below stream bankfull elevations, velocities and the associated amount of sediment transport are high. Larger storm events typically overtop stream banks to access the floodplain, thereby reducing water velocity. Urbanization and development can have significant effects on the peak runoff rates, runoff volumes, and time of concentrations that can increase sediment transport in these 1 to 2-year storm events. In order to effectively address the problem of sediment transport, the USC requires extended detention of the 1-year, 24 hour storm over a period of 24 hours to protect stream channels from erosive velocities.

Overbank Flood Protection

Overbank flooding is typically correlated with the 25-year storm event. To prevent flooding on downstream properties, the USC requires that post-

construction peak runoff rates be less than or equal to pre-development peak runoff rates for the 25-year, 24 hour storm event.

Extreme Flood Protection

Extreme flooding is typically correlated with the FEMA regulated 100-year, 24 hour storm event. The USC requires that the 100-year storm be properly managed through detention or floodplain management in similar fashion to FEMA regulations and typical County or City flood ordinances.

Stormwater Better Site Design

The Unified Sizing Criteria is designed to encourage and incentivize the use of better site design practices and techniques. Natural features and resources can be preserved by minimizing and avoiding impacts to riparian buffers, natural areas, floodplains, steep slopes, and highly erodible soils. Impervious cover can be reduced by reducing the size of driveways, building footprints, parking footprints, reduced building setbacks, and using fewer or alternative cul-de-sacs. Natural features can be used for stormwater management including: natural drainageways, vegetated swales, and drain runoff to pervious areas. If properly designed these design elements can reduce construction costs, increase property values, provide more open space for recreation, protect sensitive forests and habitats, and provide a naturally attractive landscape.

Site Design Stormwater Credits

In order to encourage the use of Stormwater Better Site Design, the USC provides a credit system for the use of certain site design practices. These credits can be used to meet or reduce the required water quality volume and to help or meet the larger storm design requirements by increasing times of concentrations and reducing imperviousness. The conservation of natural areas through deed restriction allows for a reduction in the total site area (used to calculate water quality volume) given that the natural area is a minimum of 10,000 square feet and is not disturbed during construction. In a similar fashion, stream buffers may be used to reduce the total site area, provided that they include a minimum undisturbed width of 50 feet in addition to other design parameters. Other better site design practices such as vegetated channels, overland flow filtration/infiltration zones, and environmentally sensitive large lot subdivisions also offer calculated credits that can be used to reduce construction costs and improve post-construction water quality and water quantity.

In conclusion, this presentation will explain the benefits that the Unified Sizing Criteria can bring to South

Carolina land development and stormwater regulations by controlling water quantity and quality at the source, utilizing simple and non-structural methods through a basic hydrologic framework, and providing cost-saving incentives for the use of Low Impact Development and Green Infrastructure design practices.

LITERATURE CITED

AMEC Earth and Environmental, Center for Watershed Protection, Debo and Associates, Jordan Jones and Goulding, Atlanta Regional Commission, 2001. Georgia Stormwater Management Manual. Volume 2 Technical Handbook.