Article 94

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Pollutant Removal Capability of a "Pocket" Wetland

Many stormwater engineers now employ small pocket ponds or wetlands to treat stormwater runoff generated by smaller development sites. The term "pocket" refers to a pond or wetland that has a such a small contributing drainage area that little or no baseflow is available to sustain water elevations during dry weather. Instead, water elevations are heavily influenced and, in some cases, maintained by a locally high water table. Until recently, very little was known about the pollutant removal performance of pocket wetlands or ponds. However, recent research and monitoring by Betty Rushton and Craig Dye in southern Florida has greatly increased our understanding of these systems. They recently completed a comprehensive analysis of a "pocket" wetland draining a six-acre office park near Tampa Bay, Florida. Their monitoring study examined storm dynamics and pollutant behavior at the facility over a two-year interval. In addition, they examined local groundwater interactions, accumulation of priority pollutants in pond sediments, and the pollutant chemistry of rainfall.

Constructed in 1986, the pond had a very small surface area (0.32 acres), was sized to provide a half-inch of runoff storage for water quality treatment, and had additional temporary detention of larger storms for peak-shaving purposes. Although the authors did not report the impervious cover for the site, they did compute a storm runoff coefficient of 0.32.

Runoff to the pond was conveyed by a 200 foot long grassed drainage channel, which may have provided partial pretreatment. The shallow pond (maximum depth of 18 inches) was sandwiched between two adjacent forested wetlands and had a flat bottom (see Figure 1). Pond water levels fluctuated during the year, drying out entirely during the dry season and then filling to the full 18 inch depth in the normally wetter "summer" season. Originally planted with arrowhead and pickerelweed, nearly 95% of the wetland surface area is now covered by cattail and algal mats.

For these reasons, the study pond can probably best be described as a pocket wetland, although it is technically considered a wet detention pond under Florida design guidelines. Hydrologic monitoring indicated that the pocket wetland had a mean residence time of 3.7 days on an annual basis, and a slightly shorter residence time (2.1 days) during the summer "rainy season." Physical monitoring indicated that the pocket wetland was strongly influenced by biological activity. For example, summer sampling showed a pronounced diurnal swing in dissolved oxygen in the pocket wetland, with complete nighttime anoxia followed by a partial daytime recovery to about four to five mg/l.

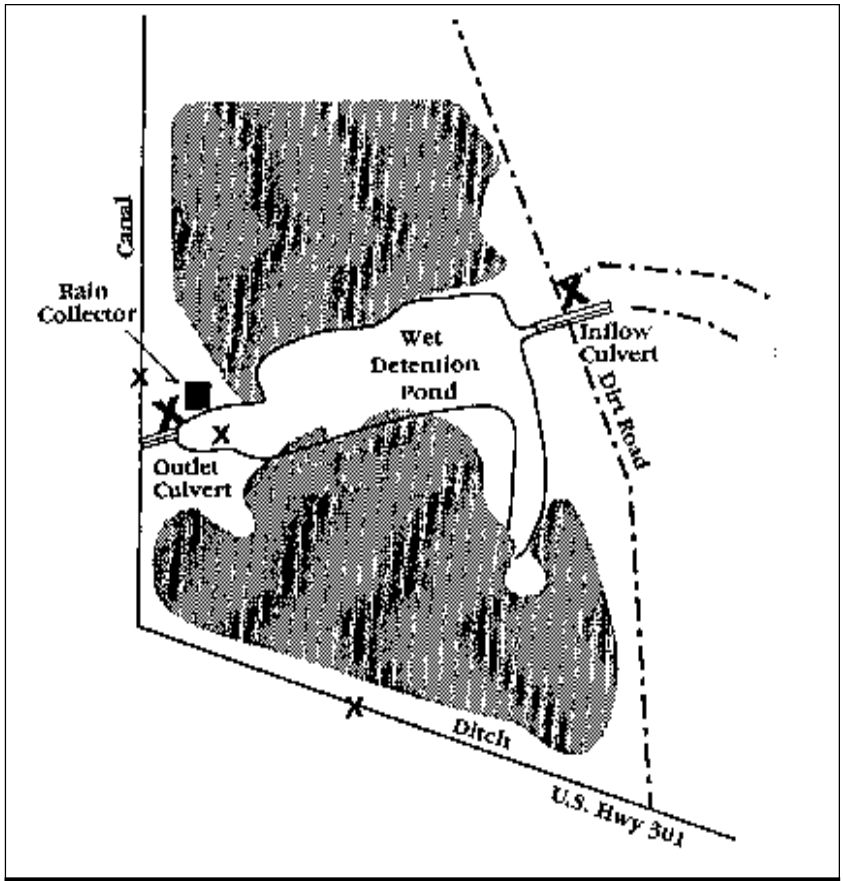

Figure 1: Plan View of the Pocket Wetland (Rushton and Dye, 1993)

Rushton and Dye collected flow-weighted composite samples from the inflow and outflow of the pocket wetland over 39 storm events over a three-year period. The computed removal efficiency of the pocket wetland is described in Table 1, and is expressed in terms of both concentration and mass load reduction. In general, the pocket wetland exhibited moderate to high capability to remove pollutants in stormwater runoff. Sediment, phosphorus and nitrate removal ranged from 50 to 70%. Removal of ammonia, organic nitrogen and zinc, however, was relatively modest, ranging from zero to 50%. This low removal may merely reflect the fact the incom-