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## **Effectiveness of Vegetated Biostrips in the Treatment of Highway Storm Water Runoff**

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**Effectiveness of Vegetated Biostrips in the Treatment of Highway Storm Water Runoff**

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The California Department of Transportation has approved use of vegetative filter strips as a Best Management Practice (BMP) to improve water quality in storm water runoff. Vegetation is established adjacent to highways to accommodate functions including: erosion control, aesthetic, safety, environmental mitigation, conveyance of runoff and storm water treatment. As storm water travels through vegetation, pollutant removal is achieved through filtering, infiltration, adsorption and settling. The objective was to determine pollutant removal effectiveness of existing vegetative areas to develop minimum design requirements maximizing pollutant reduction. Design parameters include: flow velocity, residence time as a function of length and slope, infiltration, and vegetation density.

A 2-year statewide research study to assess effectiveness of existing vegetated areas was established. Eight areas were equipped with two to five 30-m collection systems and automated samplers designed to capture highway runoff, as it passed through various lengths of vegetated areas and at the edge of pavement (EOP). Test strip lengths between EOP and collection channels were 1.1 to 13.0 m. Slopes were 5 to 52 percent. Vegetation was unmodified, and included grasses, forbs, and legumes.

During 2001-2003; 15 to 20 storms were monitored at four Northern California sites. In Southern California at four sites, 5 to 15 storms were monitored, where dry weather caused the majority of runoff to infiltrate. Water quality event mean concentrations were measured at each location and included conventionals (e.g., total suspended solids, etc.), nutrients, and metals.

A literature review was conducted of biofilter strip designs and performance (not designed for water quality improvement). Findings:

- Total suspended solids (TSS) concentration reduction occurred on slopes 5 to 50 percent from an EOP concentration of 55 mg/L to an irreducible minimum concentration of 15 to 20 mg/L.
- A 60 percent reduction was achieved at one meter from EOP.

- Sites with slopes greater than 35 percent achieved a final concentration of 20 mg/L within 8 meters from EOP.
- Significant reductions in total and dissolved concentrations of copper, lead, and zinc were observed.
- No statistically significant reductions in nitrate, total Kjeldahl nitrogen, total phosphorus, and dissolved ortho-phosphate concentrations were observed.

The results indicate that substantial pollutant concentrations and load reduction occurs in vegetated areas adjacent to highways, even when areas were not originally designed for treatment. Thus, vegetated areas adjacent to highways (eliminating curb and gutter conveyance systems where possible) are a cost-effective, sustainable, storm water treatment system for highways.