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FECAL COLIFORM TMDL DEVELOPMENT

Baldwin Creek WATERSHED,

Chattahoochee -RIVER BASIN

Introduction:

Levels of fecal coliform can be elevated in water bodies as the result of both point and nonpoint sources of pollution. Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for their water bodies that are not meeting designated uses under technology-based controls for pollution. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

General Steps to the Fecal Coliform TMDL Development

Step 1. Problem Definition

Objective: *Identify the background information and framework for a specific TMDL-listed water that will guide the TMDL development process.*

The impaired stream segment has a designated use classification of Fishing.

The data from the Georgia 305(b) report were used for determining the stream segment impairment and for listing the water on the Georgia 1996 303(d) list. The determination for impairment and inclusion on the Georgia 303(d) list, was that greater than 20% of the samples had a fecal coliform concentration greater than 400 cfu/100 ml, where a cfu is a coliform unit that can be measured as membrane filter or multiple tube methods. This screening determination may or may not indicate a water quality standard violation since the Georgia fecal coliform standard is based on a 30 day geometric mean.

Step 2. Target Identification

Objective: *Identify numeric or measurable parameter target values that can be used to evaluate the TMDL and restoration of water quality in the listed water body.*

The target levels are the fecal coliform levels established in Georgia's Water Quality Standards. Georgia State Water Quality Standards for Fecal Coliform are established in Georgia Rule and Regulations for Water Quality, November 1996. The criterion for fecal coliform bacteria from May through October is a 30 day geometric mean of 200 mpn/100 ml and from November through April a 30 day geometric mean of 1,000 mpn/100 ml with a maximum of 4,000 mpn/100 ml. Note mpn is defined as most probable number and is equivalent to cfu.

Step 3. Source Assessment

Objective: *Characterize type, magnitude, and location of sources of fecal coliform loading to the water body.*

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Potential Sources of Fecal Coliform:
Both point and nonpoint sources may contribute fecal coliform to a water body. Potential sources of fecal coliform are numerous, and often occur in combination. Poorly treated municipal sewage comprises a major source of fecal coliform. Urban storm water runoff and combined sewer overflows (CSOs) can be a source of fecal coliform. Rural storm water runoff can transport significant loads of fecal coliform from livestock pastures and animal feedlots. Wildlife can also contribute fecal coliform. Most sources of fecal coliform loads can be assigned to two broad classes: point source loads, and nonpoint source loads.

Point Source Loads: *Loads from Municipal and Industrial Water Pollution Control Plants*
The greatest potential source of human fecal coliform is raw sewage. Raw sewage typically has a total coliform count of 10^7 to 10^9 MPN/100 ml (Novotny et al., 1989), along with significant concentrations of fecal coliform bacteria, viruses, protozoans, and other parasites. Typical treatment in a municipal plant reduces the total coliform count in effluent by about 3 orders of magnitude, to the range of 10^4 to 10^6 MPN/100 ml. Georgia requires disinfection of the treated wastewater discharge which results in significantly reducing the fecal coliform levels and a regulatory NPDES permit limit of 200 colonies/100 ml.. Raw sewage, while usually not discharged intentionally, may reach water bodies through leaks in sanitary sewer systems and for a few communities in Georgia through combined sewer overflows (CSOs).

Nonpoint Sources Loads:
Nonpoint sources of fecal coliform are typically separated into urban and rural components. Runoff and load generation processes differ systematically between these environments. In urban or suburban settings with high amounts of paved impervious area, important sources of loading are surface storm flow, failing septic tanks, and leakage of sanitary sewer systems. In rural settings, impervious area is usually much lower, and sources of fecal coliform may include diffuse runoff of animal wastes associated with the erosion of sediments, runoff from concentrated animal operations, and failing septic tanks.

Most nonpoint loads result from storm water and rainfall washoff, and estimation of load requires both flow volume and pollutant concentration in runoff. Modeling techniques can provide good estimates of surface storm flow volume, in both urban and rural settings. Modeling is typically conducted for single targets such as fecal coliform. All loading data are complicated by a lack of data and high variability in available monitoring data.

Fecal coliform bacteria have been detected in storm runoff from urban areas at densities high enough to suggest a potential health risk. Fecal coliform concentrations in urban storm water may be higher than concentrations in treatment plant effluent. The origins of urban bacterial loads are diverse, and may include leakage from sanitary sewers, failing septic tanks and direct loading of human fecal matter, as well as bacteria derived from dog and cat feces (which generally contain few fecal coliform of concern to humans).

Buildup and washoff of pollutants on urban impervious surfaces may be simulated directly. This physically based approach is incorporated into many popular storm water models, such as the Storm Water Management Model (SWMM) and Hydrological Simulation Program-Fortran (HSPF). Buildup refers to all of the complex spectrum of dry-weather processes that deposit or remove pollutants between storms, including deposition, street cleaning, etc. These processes lead to an accumulation of material associated with solids which are then Washed off during storm events.

The rural nonpoint sources of fecal coliform of greatest concern are typically associated with animal operations, in which large quantities of fecal matter are generated. Fecal coliform from these areas may reach water bodies either through direct runoff, or following the spreading of waste on fields. Land application of municipal waste sludge may also be a significant source of fecal coliform load. Outside of these areas, a lower background loading rate can be expected, resulting from the net inputs of domestic and wild animals, and so on.