TOTAL MAXIMUM DAILY LOAD (TMDL) DEVELOPMENT

For *Cadmium*

in

Purvis Creek near Brunswick, Georgia

(HUC 03070203)

EPA United States Environmental Protection Agency

Region 4 serving the southeast

Summary Page

Purvis Creek has been placed on the State of Georgia 303(d) list due to detection of cadmium in the water column at a concentration greater than the State of Georgia water quality chronic standard protective of aquatic life (GAEPD, 2000). As prescribed under the Clean Water Act, a Total Maximum Daily Load (TMDL) has been developed for this listed reach and is summarized below. The TMDL establishes the total mass of cadmium that can be discharged to the system under a prescribed set of critical conditions, and the waterbody meet its designated uses. The TMDL for cadmium for the listed segment was scheduled for development in 2000 as required by Consent Decree in the Georgia TMDL Lawsuit.

The total maximum daily load for cadmium to Purvis Creek is 55 grams per day to protect aquatic life with regard to chronic toxicity. No point source dischargers exist in Purvis Creek, and no point sources with cadmium effluent limits are discharging into the Turtle River system. The wasteload and load allocation cumulatively for this system should not exceed 55 grams per day dissolved cadmium. The Georgia Environmental Protection Division is encouraged to perform additional monitoring for total and/or dissolved cadmium in the water column in Purvis Creek under varying hydraulic conditions to determine if, in fact, the waterbody is attaining the chronic and acute standards for cadmium concentrations protective of aquatic life. Additional modeling may be necessary to determine the total maximum daily load protective of the acute standard if evidence suggests this standard is not being attained.

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Beverly H. Banister, Director Date

Water Management Division

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Executive Summary

The State of Georgia's 2000 303(d) list identified the coastal estuarine waters of Purvis Creek near Brunswick, Georgia as not supporting its designated use as a fishing water due to the detection of cadmium in the water column and concentrations exceeding the aquatic life water quality criterion in Georgia's Rules and Regulations.

This TMDL is being developed pursuant to the 2000 Georgia 303(d) list and the Consent Decree in the Georgia TMDL lawsuit that requires TMDLs to be developed for all waters on the current 303(d) list according to certain conditions prescribed in the Consent Decree.

The Brunswick River modeling grid was used to simulate the total maximum daily cadmium load that will allow for maintenance of the chronic aquatic life water quality standard for dissolved cadmium.

The total maximum daily load for Purvis Creek as determined by the modeling exercise is 55 grams per day. No point source dischargers exist in Purvis Creek, and no point sources with cadmium effluent limits are discharging into the Turtle River system. The wasteload and load allocation cumulatively for this system should not exceed 55 grams per day dissolved cadmium. The margin of safety for this system is incorporated implicitly using conservative model assumptions to develop allocations. The low slack period of the neap cycle represents a hydraulically critical scenario in Purvis Creek that maximizes hydraulic retention in the Purvis Creek tidal estuary and minimizes available dilution from ocean water. Without a better understanding of the source or sources of cadmium to Purvis Creek, hydraulic limitation represents the most conservative modeling assumption. In addition, this TMDL will conservatively assume that the State's measurement for “total” cadmium (13 ug/l) exceeds the State's chronic standard for “dissolved” cadmium (9.2 ug/l) and that the waterbody is impaired.

Introduction

The Environmental Protection Division of the Georgia Department of Natural Resources (Georgia EPD) assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into three categories; supporting, partially supporting, or not supporting their designated uses depending on water quality assessment results. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* every two years.

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. These water bodies are considered to be water quality limited and can not meet their designated use standards. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) established for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality based controls to be developed to reduce pollution and restore and maintain water quality. The TMDL establishes the allowable loadings to the water body, thereby providing the basis for addressing the water quality impairment.

Problem Definition

On its 2000 §303(d) list, the State of Georgia has identified Purvis Creek (Figure 1) as not supporting its designated use as a "fishing" water because of the detection of cadmium concentrations exceeding the chronic aquatic life water quality criteria standard in Georgia's Rules and Regulations. Purvis Creek is a saltwater tidal waterbody near the City of Brunswick in Glynn County, Georgia. The LCP Superfund site is located in the Purvis Creek watershed and this site maintained an industrial discharge (NPDES GA0003247) to Purvis Creek until 1994. Superfund's ecological assessment study did not detect cadmium in any sediment samples in Purvis Creek (EPA, 1997).

Figure 1 - Site Location Map

Target Identification

The water use classification for Purvis Creek is fishing. The fishing classification, as stated in Georgia's Rules and Regulations for Water Quality Control Chapter 391-3-6-.03(6)(c), is established to protect

the "[p]ropagation of Fish, Shellfish, Game and Other Aquatic Life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality." Chapter 391-3-6-.03(5)(e)(ii) of Georgia's Rules and Regulations establishes criteria for metals which applies to all waters in the State. The established chronic criterion and acute criterion for dissolved cadmium are as follows:

acute criterion for dissolved cadmium (saltwater) = 43 µg/l

chronic criterion for dissolved cadmium (saltwater) = 9.2 µg/l

The regulation cited above requires that instream concentrations of dissolved cadmium shall not exceed the acute criterion indicated above under 1Q10 or higher stream flow conditions and shall not exceed the chronic criterion indicated above under 7Q10 or higher stream flow conditions.

Hydraulically the Purvis Creek behaves as a tidal salt marsh. Water quality monitoring does not indicate that the acute standard has been violated, and so this TMDL will only target the chronic standard. This TMDL will use the chronic saltwater criterion for cadmium of 9.2 ug/l as the TMDL target.

Background

Available Monitoring Data

The State of Georgia monitored total cadmium in the water column in a tributary to Purvis Creek in 1991 on one occasion. This is the only measurement reported in the EPA STORET database for total cadmium or dissolved cadmium in the Purvis Creek tidal system.

August 21, 1991 Total Cadmium 13 ug/l

This value represents an exceedence of the chronic saltwater criterion for cadmium if total cadmium is assumed to be entirely dissolved for this measurement.

The LCP Superfund site exists in the Purvis Creek watershed. As part of the EPA Superfund ecological risk assessment, sediment samples were taken for cadmium in Purvis Creek in 1995. No cadmium was

detected in any of these samples (EPA, 1997).

Numeric Targets and Sources - Model Development

The calibrated version of the two-dimensional vertically integrated hydrodynamic model of Brunswick Harbor was utilized for the determination of the TMDL for a cadmium discharge within Purvis Creek. A full average neap-spring tide period (15 days) was considered together with a constant Turtle River flow of 9 m^3/s. A constant point source discharge at the indicated location at Purvis Creek (Figure 2) was assumed over the entire simulation period.

This concentration represents the chronic aquatic life target for dissolved cadmium in saltwater. The target concentration of 9.2 µg/L was reached in the mean field represented by the model grid cells in the targeted waterbody with a cadmium loading rate of 55 g/day.

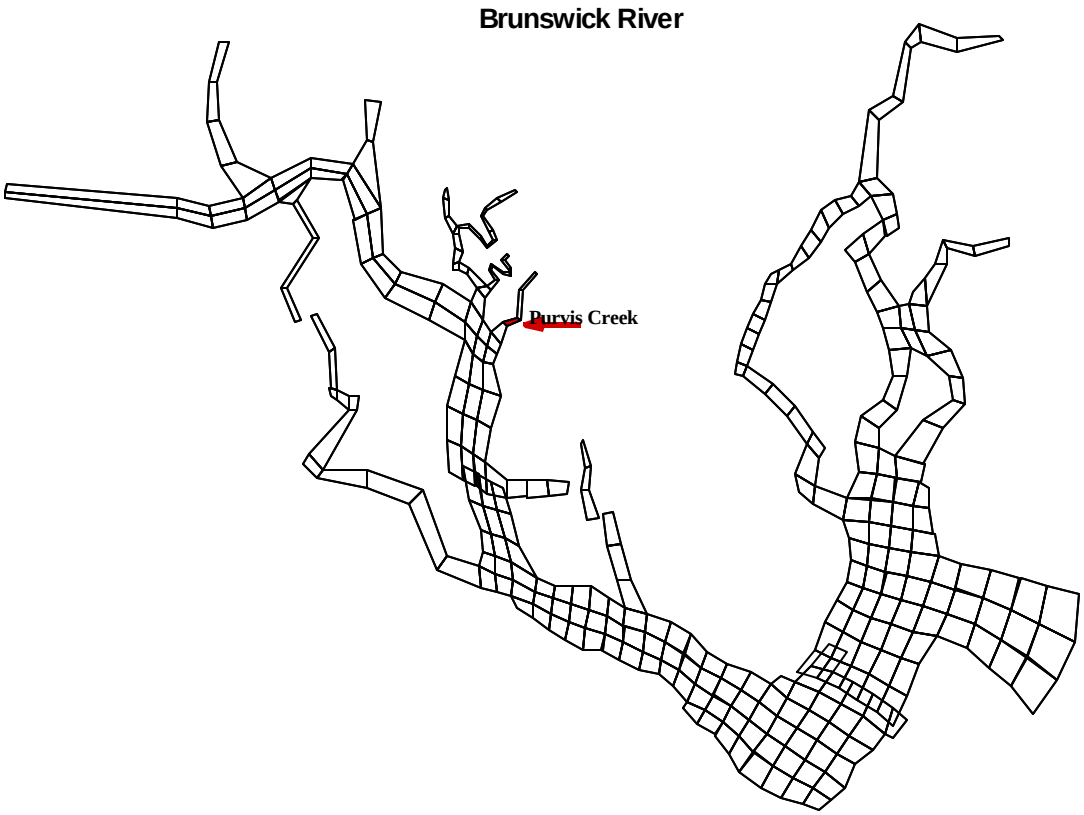

Figure 2 - Model grid (Entire Brunswick River System)

Total Maximum Daily Load (TMDL)

Critical Condition Determination

The lack of understanding regarding the source of the cadmium makes the determination of appropriate critical conditions difficult. Until there is a better understanding of the source of cadmium, it is assumed that critical conditions occur during low flows.

Seasonal Variation

Seasonal variation is not an applicable consideration to this TMDL due to the approach.

Margin of Safety

The margin of safety for this system is incorporated implicitly using conservative model assumptions to develop allocations. The low slack period of the neap cycle represents a hydraulically critical scenario in Purvis Creek which maximizes hydraulic retention in the Purvis Creek tidal estuary and minimizes available dilution from ocean water. Without a better understanding of the source or sources of cadmium to Purvis Creek, hydraulic limitation represents the most conservative modeling assumption. In addition, this TMDL will conservatively assume that the State's measurement for "total" cadmium (13 ug/l) exceeds the State's chronic standard for "dissolved" cadmium (9.2 ug/l) and that the waterbody is impaired.

TMDL Determination

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while achieving water quality standards. The components of the TMDL are the Wasteload Allocation (WLA) and the Load Allocation (LA) and taking into consideration a margin of safety (MOS) and seasonality. The WLA is the pollutant allocation to point sources while the LA is the pollutant allocation to natural background and nonpoint sources.

The total maximum daily load for Purvis Creek as determined by the modeling exercise is 55 grams per day. No point source dischargers exist in Purvis Creek, and no point sources with cadmium effluent limits are discharging into the Turtle River system. The wasteload and load allocation cumulatively for this system should not exceed 55 grams per day dissolved cadmium. Applying loading during the hydraulic limitation of the slack neap tide cycle implicitly incorporates the margin of safety.

Allocation of Responsibility and Recommendations

Cadmium is a naturally occurring trace metal which is expected to be detected at some background level in the environment, depending on the location. Cadmium is by nature a persistent compound which may cycle between environmental compartments. Cadmium is believed to have an atmospheric deposition component. It is very difficult to delineate anthropogenic from natural background atmospheric cadmium contributions. Metal smelting operations are considered to be a primary anthropogenic source of atmospheric cadmium

loading. This TMDL should be revisited to account for the reduced localized assimilative capacity of the Purvis Creek tributary due to the potential inclusion of atmospheric cadmium emissions in the water column cadmium budget should data become available to warrant revision.

In addition, naturally occurring background sources of cadmium in the water column are inherently accounted for in the load allocation budget. The wasteload allocation should not assume the entire cadmium loading budget without a detailed accounting of background and nonpoint source cadmium loading. This is not an issue currently because there are no permitted cadmium dischargers in Purvis Creek or its tidally connected waterbodies (Turtle River system).

The Georgia Environmental Protection Division is encouraged to perform additional monitoring for total and/or dissolved cadmium in the water column in Purvis Creek under varying hydraulic conditions to determine if, in fact, the waterbody is attaining the chronic and acute standards for cadmium concentrations protective of aquatic life. Additional modeling may be necessary to determine the total maximum daily load protective of the acute standard if evidence suggests this standard is not being attained.

References

EPA, 1997. *Final Report- Ecological Assessment: Ecological Risk Evaluation of the Salt Marsh and Adjacent Areas at the LCP Superfund Site, Brunswick, GA.* USEPA Region 4 Environmental Response Team Center, Office of Emergency and Remedial Response.

Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03, Water Use Classifications and Water Quality Standards.

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