

T.M.D.L. DEVELOPMENT: CHEAP, FAST, ACCURATE (PICK TWO)

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Abstract. Nationally, regionally and specifically in the State of Georgia, legal requirements are mandating Total Maximum Daily Loads (TMDLs) be developed at an accelerated time scale for impaired waters. In Georgia, 571 impaired waters are listed on the 1998 Georgia 303(d) list (per Section 303(d) under the U.S. Clean Water Act). The total number of pollutants of concern in these waters is approximately 685. Therefore up to 685 TMDLs may be required for these waters and other impaired waters, identified in the future, for each of the pollutants of concern, in the next 6 to 7 years.

Developing a TMDL for a water body usually involves developing a mathematical water quality model of the water body to determine the "total maximum daily load" of pollutants from all sources (both point and nonpoint sources) that may be discharged into the waters while still maintaining the water quality standards. The available models range from the fairly simple hand-equation models to the highly complex, data-intensive and time-consuming state-of-the-art computer models. The choice of model and TMDL development method within this range determines whether the analysis is "fast, cheap, or accurate".

To meet this accelerated timeline, TMDL development will have to be fast paced and, with limited resources, it will also need to be cheap. Some of the waterbodies that are impaired are environmentally sensitive and may demand a more accurate projection of the pollutant loads necessary to protect the resource; or, if the prospective pollution reduction is very expensive, an accurate loading projection is needed to justify the expenditure.

Since TMDL development can be either "fast, cheap or accurate" (any two, but not all three), a practical method is needed to select the best approach. To accomplish this task, a common sense TMDL development approach is being developed. Georgia EPD and EPA Region 4, with the contract help of Tetra Tech, Inc. in Fairfax, Virginia, are in the process of producing a *TMDL Technical Procedures Manual: A Technical Roadmap for TMDL Development*.

T.M.D.L. TECHNICAL PROCEDURES MANUAL

The TMDL Technical Procedures Manual approach consist of six major components: 1) Definition of water quality target, standard or criteria; 2) Data collection and analysis; 3) Model selection & model calibration; 4) Definition of the waterbodies critical conditions; 5) Predictive modeling and 6) TMDL development and allocation of loads. Each of these components is important factor and must be covered in the technical portion of the TMDL development process.

Categorizing the TMDL Development Problem by: Waterbody Type, Impairment Response and Pollutant Type

To start the development process the TMDL development situation must first be categorized by waterbody type, impairment response and pollutant type.

Water Body Type. The waterbody types to be considered are: 1) Rivers and Streams which are relatively fast flowing with shorter resident times, with transport processes usually dominating the system, and which demonstrate immediate responses to pollutant loading. 2) Lakes and Reservoirs which are slow moving waters with long retention times and with deposition and accumulation processes and recycling processes. The responses may be both acute and delayed responses. 3) Estuaries that are similar to reservoirs, but have flow reversal, tidal influences and salinity.

Impairment Responses. The waterbody impairment responses or the condition of the waterbody that results in the impairment of water quality may be categorized as: 1) steady state (low stream flow); 2) cumulative response (lake) and 3) episodic response (wet weather). The steady state critical condition can be represented by constant pollutant discharge rate (design wastewater flow) and usually occurs at low stream flows. The cumulative impairment condition results under specific climatic conditions and may results from long-term loading

accumulation. The resultant problem may not have an immediate response and a fraction of loading inflows may accumulate in the system and become a source under certain conditions. The episodic condition impairment occurrence varies rapidly with time and may follow a random process. The cause may be accidental release, spills and bypasses that are wet-weather and rainstorm dependent. Nonpoint sources and wet weather point sources may be major contributors.

The complexity of analysis or the selection of the water quality model must consider the technical level detail needed, the resources available and the data available and required for adequate model calibration. The modeling analysis can range from simple to complex.

Simple, Moderate or Complex TMDL Analysis

A Level 1 analysis or desktop analysis uses a simple modeling approach to handle less complex problems. Existing readily available data and literature model reaction rates are used in the desktop model. This type of analysis is fast and cheap and best used for a screening analysis and for a priority setting tool.

The Level 2 or mid-range complexity analysis is used when the situation demands a more complex model to define pollutant impairment relationship. The environmental resource demands additional consideration and/or the pollution reduction cost demands additional consideration. Usually requires additional data collection or detailed analysis of existing data.

The Level 3 or detailed, process-based analysis is used to define complex waterbody relationships that have significant resource considerations and significant pollution reduction cost. This type of analysis requires a complex dynamic modeling approach and a large amount of data collection specifically to address or to define the problem.

T.M.D.L. CATEGORIES

The overall problem assessment can be divided into six TMDL categories. Category 1 is steady state analysis of rivers. Spreadsheet or mass balance calculations or simple to complex stream models can address the response. The pollutant source is a constant discharge flow and the background pollutant loading is derived from monitored background condition.

Category 2: cumulative build up in rivers. The response can be modeled by mass balance or cause and effect relationships and by steady state or dynamic stream models. The pollutant loading can be characterized using monitored background condition, a sediment budget, or wet weather area loading models.

Category 3: episodic pollutant impacts on rivers. The response can be modeled by mixing zone analysis or dynamic river models. The pollutant loading can be simulated by monitored wet weather conditions, sediment budgets, or wet weather loading models.

Category 4: a steady state cumulative impact in lakes and reservoirs. The response can be modeled by statistical analyses (Vollenweider), simple or by dynamic reservoir models. The pollutant loading can be determined by monitored wet weather conditions, sediment budgets, or wet weather loading models.

Category 5: episodic loads to lakes, reservoirs or estuaries. The response is modeled by mass balance or spreadsheet analyses, mixing zone model or dynamic lake or estuary models. The pollutant loading is characterized by monitored wet weather conditions, sediment budget, or wet weather loading models.

Category 6 is steady state cumulative loads to the estuaries where the responses can be modeled by statistical analyses, mixing zone analyses or dynamic models. The pollutant loading is characterized by monitored wet weather conditions, sediment budget, or wet weather loading models.

T.M.D.L. EXAMPLES

In 1998, EPA Region 4 completed 100 fecal coliform TMDLs in Georgia, as part of the TMDL lawsuit commitments. Since these TMDLs had to be completed in a short timeframe and with limited resources, the Level 1 (cheap and fast) Category 2 (mass balance and simple loading model) approach was used. The waterbodies selected were those in rural areas and where the land uses, hopefully, had not changed over the last few years. The model used was the EPA BASIN's NPSM (nonpoint source model). A percent reduction in the agriculture and urban fecal loading was calculated that would allow the Georgia instream fecal coliform water quality standard to be maintained. These reductions were based on existing data available through national databases and landuse data (1976) available through the BASINs interface. 43 of the 100 waterbodies were predominately agriculture based

sources of fecal coliform loading. The Georgia office of the Natural Resources Conservation Service and Georgia Environmental Protection Division are updating these TMDLs with better and more detailed pollutant source data and loadings. These TMDLs will then be revised with the updated data and information.

Other TMDL activities are occurring in the Savannah Harbor area and in Lake Weiss/Coosa River. Savannah is a Level 3 Category 6 TMDL, a complex dynamic estuary model including both point and nonpoint sources analyzing the BOD and nutrient loading impacts, along with proposed deepening impacts on the harbor dissolved oxygen regime. Lake Weiss is Level 2 Category 4 nutrient loading impacting algal components and dissolved oxygen in the lake.