Total Maximum Daily Load (TMDL) Development

From Watershed Approach

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Overview

The development and approval of TMDLs for Puerto Rico impaired water bodies have been increasing in recent years. However, the need to develop of new TMDLs remains. The process of TMDL development is today well understood and many approaches are considered valid and proven to model pollution load/stream response relations.

Although several TMDLs has been approved by the USEPA for Puerto Rico and other areas in the United States, restoration of impaired water bodies is still pending or remains unreachable. This could be related to the feasibility, or unfeasibility, of approved TMDLs implementation plans.

Feasibility of a TMDL implementation plan is closely related to the load allocation analysis. Then, the allocation processes requires special attention and a carefully selected methodology to ensure a reasonable and attainable implementation plan.

TMDL Calculation

$$TMDL = \Sigma WLAi + \Sigma LAi + MOS$$

$\Sigma WLAi$: **Sum of waste load allocations (point sources)**

ΣLAi: **Sum of load allocations (nonpoint sources)**

MOS: **Margin of Safety**

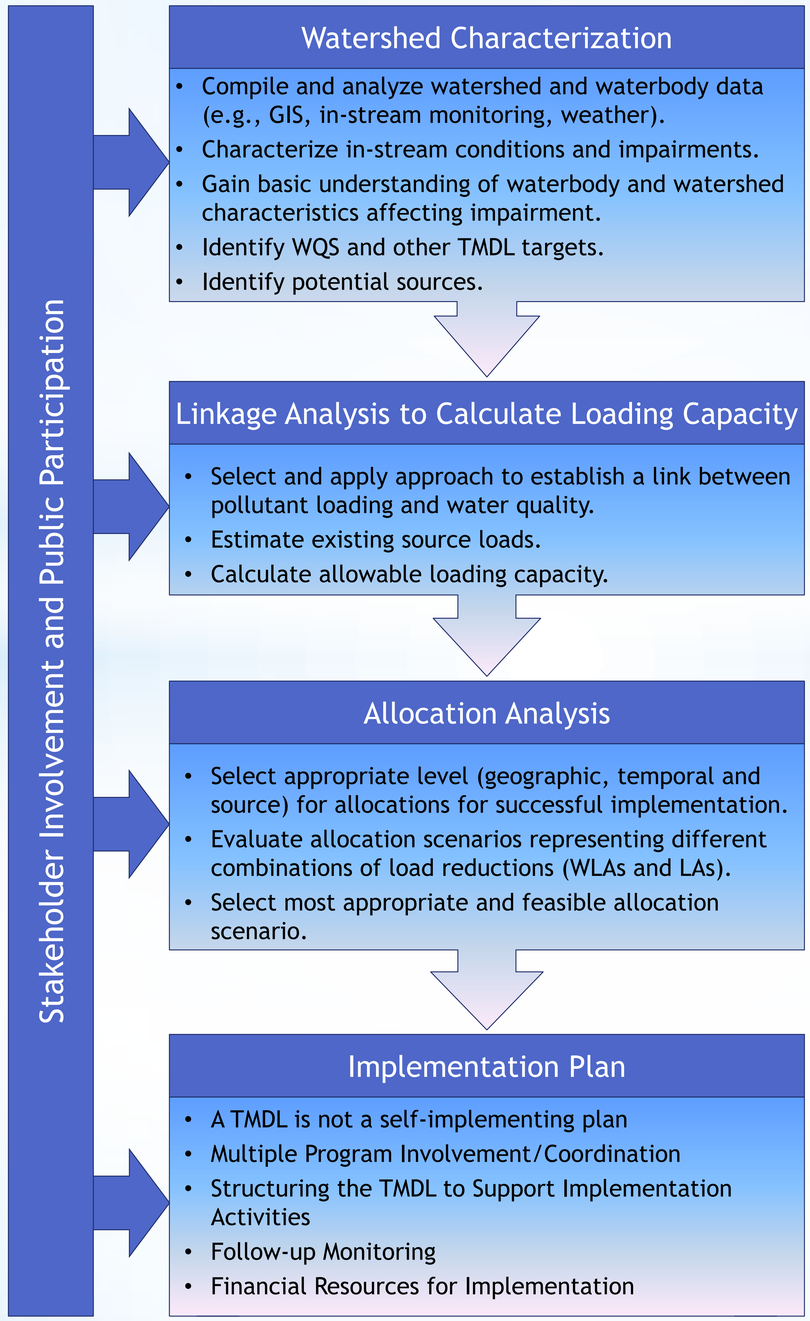
Completed for each waterbody/pollutant combination

Historical Background

The Clean Water Act (CWA) establishes the basis for surface water quality standards and regulates pollutants discharges into surface waters. The basis of the CWA were established in 1948 under the Federal Water Pollution Control Act, the first major U.S. law to address water pollution. In 1972, the Federal Water Pollution Control Amendments reorganized and expanded the Act. As amended, the law became commonly known as the CWA. Secs. 305(b) and 303(d) deal specifically with water quality assessment and TMDL development.

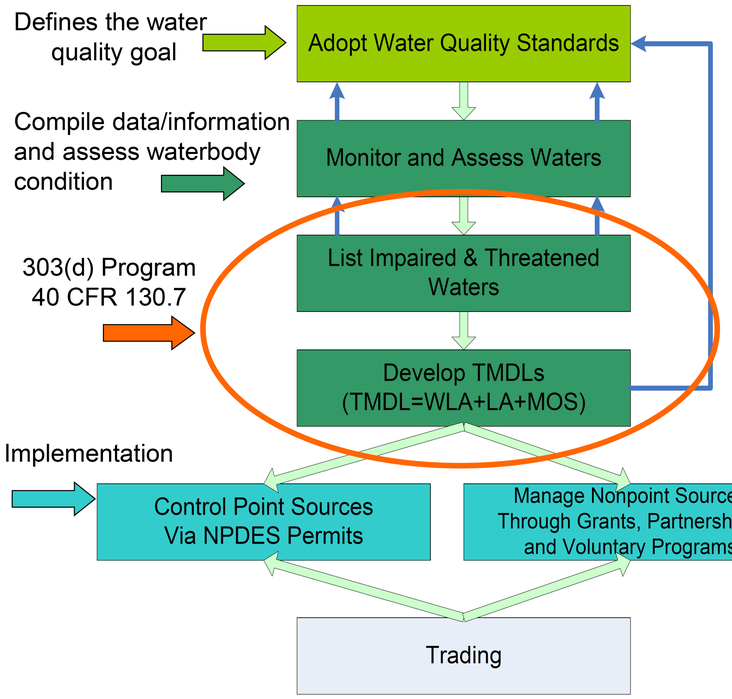
U.S. Environmental Protection Agency (USEPA). Laws & Regulations: History of the Clean Water Act Source: http://www2.epa.gov/laws-regulations/history-clean-water-act.

TMDL Development Methodology



U.S. Environmental Protection Agency (USEPA). 2008. *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. EPA 841-B-08-002. USEPA, Office of Water Non-point Source Control Branch, Washington, DC. P.38,81-91.

The CWA Approach



Conde R. (2008). Addressing 303(d) Listed Waters through Total Maximum Daily Loads (TMDLs). USEPA's Assessment and Watershed Protection Division, Watershed Branch, Washington D.C.

Socio-Technical System

Technological	Ethical Environment	Physical Surroundings	Stakeholders	Procedural	Laws, Statutes, Regulations	Data and Data Structure
Hardware: Monitoring Instruments and Equipment	Moral Constructs: Water Quality Vs Economic Equity	Watershed Approach: Extents to watershed limits.	Watershed Inhabitants Local Markets and Industry Communities	Biennial Reports 303(d), 305 (b)	CWA Sections 303(d), 305 (b)	Water Quality Monitoring: USGS & PREQB
Code: TMDL Expression; Documentation reports	Social Constructs: Stakeholders involvement	Watershed Scale: Size; Subdivisions; Level of Detail	Local Authorities Local Activists Groups ONGs	States identify Priorities	PREQB Water Quality Standards	Watershed Assessment: Land Use, Geography, Hydrography
Software: TMDL Mathematical Modeling and computer modeling	Rights: A Clean Environment	Subdivisions: Geographic limits; Political Limits; Land Uses	State Agencies: PRQEB	TMDL Development; Multidisciplinary Approach	EPA NPDES, MS4	Socio-Economic and Demographic Data
Tools: BMP Machinery and Technology	Duties: All pollutant sources shall reduce contributions		Federal Regulators: USEPA	Implementation Plan		

Overview

- **The development and approval of TMDLs for Puerto Rico impaired water bodies have been increasing in recent years. However, the need to develop of new TMDLs remains. The process of TMDL development is today well understood and many approaches are considered valid and proven to model pollution load/stream response relations.**
- **Although several TMDLs has been approved by the USEPA for Puerto Rico and other areas in the United States, restoration of impaired water bodies is still pending or remains unreachable. This could be related to the feasibility, or unfeasibility, of approved TMDLs implementation plans.**
- **Feasibility of a TMDL implementation plan is closely related to the load allocation analysis. Then, the allocation processes requires special attention and a carefully selected methodology to ensure a reasonable and attainable implementation plan.**

Background

- The Clean Water Act (CWA) Section 305 (b) requires that all States submit, every two years, a report of the overall water quality conditions and trends in each state to be submitted to the United States Environmental Protection Agency (USEPA). In addition, the CWA also requires from States a list of impaired waters.

- A water body is considered impaired when chronic or recurring monitored violations of the applicable water quality standard has occurred. A single water body or segment may be impaired for a designated use (i.e. recreational, industrial use, potable water supply, irrigation, etc.) for more than one pollutant.

- The impaired water list is also known as “303 (d) list” because its requirement is based on the CWA Section 303 (d).

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Conceptual Example: Multiple Categories

Segment start

Segment end

DU 1	Use not supported	Category 5
DU 2	TMDL completed	Category 4a
DU 3	Insufficient information	Category 3

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Point Sources

Ditch/Conveyance

Concentrated Animal Feeding Operation (CAFO)

Note: EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h) and (i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

Pipe

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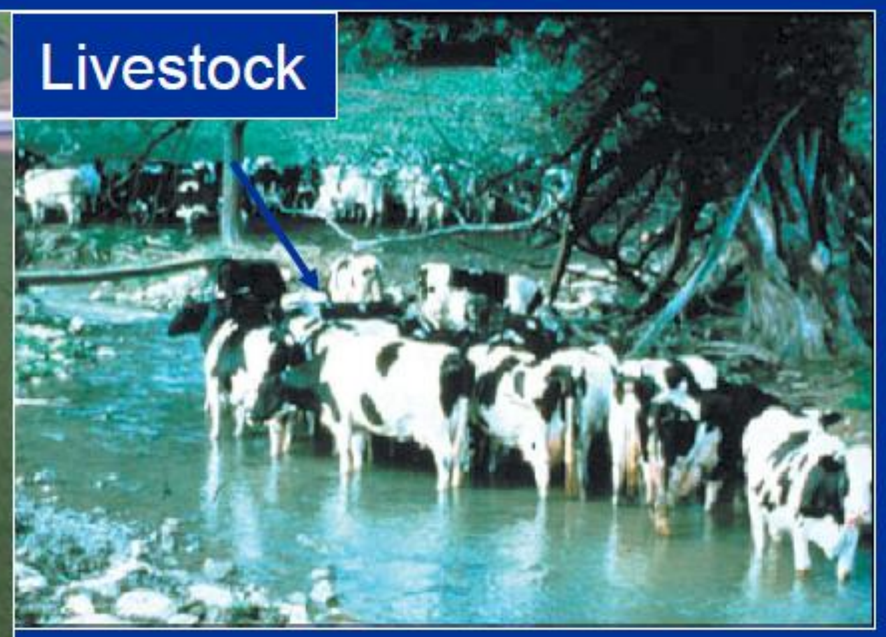
Nonpoint Sources



Nonpoint sources do not need NPDES permits.

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Watershed Characterization

- Compile and analyze watershed and waterbody data (e.g., GIS, in-stream monitoring, weather).
- Characterize in-stream conditions and impairments.
- Gain basic understanding of waterbody and watershed characteristics affecting impairment.
- Identify WQS and other TMDL targets.
- Identify potential sources.

Linkage Analysis to Calculate Loading Capacity

- Select and apply approach to establish a link between pollutant loading and water quality.
- Estimate existing source loads.
- Calculate allowable loading capacity.

Allocation Analysis

- Select appropriate level (geographic, temporal and source) for allocations for successful implementation.
- Evaluate allocation scenarios representing different combinations of load reductions (WLAs and LAs).
- Select most appropriate and feasible allocation scenario.

Selecting the Appropriate Level

Screening Criterion 1:

Identify Opportunities based on Impairments and Related Issues

- Type/location/similarity of impairments
- Waterbody type
- Expected sources and pathways
- Priority waters
- Necessary level of detail or preferred approach, if known

Screening Criterion 2:

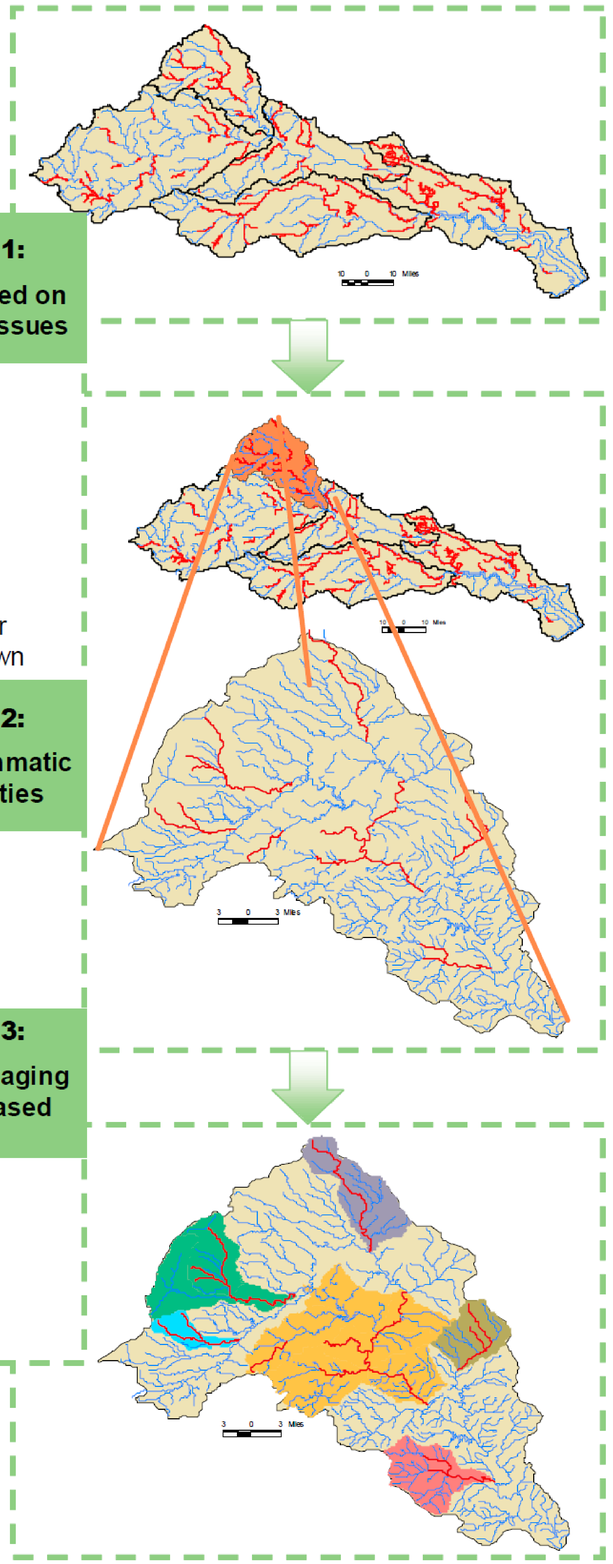
Account for Other Programmatic Commitments and Priorities

- Consent decrees
- Priority rankings
- Public concerns
- Available resources

Screening Criterion 3:

Identify Potential for Leveraging on Existing Watershed-based Programs or Efforts

- State planning boundaries
- USGS boundaries
- Watersheds from related programs (e.g., 319)
- Active stakeholder groups



Load Allocations Decisional Factors

Considerations to support the decision include:

- Scale or resolution of source allocations
- Equitability or feasibility of allocations
- Stakeholder priorities and implementation plans

Factors affecting allocation decisions:

- Location and relative magnitude of sources
- Pollutants of concern
- Feasibility of necessary load reductions
- Equitability among sources
- Ongoing or planning controls
- Stakeholder priorities

Issues that affect the allocation process include:

- Economics
- Political considerations
- Feasibility
- Equitability
- Types of sources and management options
- Public involvement
- Implementation
- Limits of technology
- Variability in loads, effectiveness of BMPs

Implementation Plan

- A TMDL is not a self-implementing plan
- Multiple Program Involvement/Coordination
- Structuring the TMDL to Support Implementation Activities
- Follow-up Monitoring
- Financial Resources for Implementation

Why Implementation Plans Fails

- Planning activities were conducted at too great scale
- The plan was a one-time study rather than a long-term management process
- Stakeholder involvement and local ownership were lacking
- The plan skirted land use/management issues in the watershed
- The document was too long or complex
- The recommendations were too general
- The plan failed to identify and address conflicts

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Are TMDLs an Appropriate Technology?

- Are Ecologically Sound
- Labor intensive
- Energy Efficient
- Conductive to Decentralization
- Compatible with laws of Ecology
- Make uses of modern kwnoledge
- Gentle in the use of Resources