CUYAHOGA RIVER
REMEDIAL ACTION PLAN
RAP
THIS GUIDE IS PART OF A SERIES THAT COMPRISE A LOCAL WATERSHED STEWARDSHIP HANDBOOK.

UNDERSTANDING TMDL OR "TOTAL MAXIMUM DAILY LOAD"

Our waterways have improved, but now the focus for more cleanup is switching to overland runoff and requirements for action by local communities.

Water pollution makes rivers, streams and lakes unsafe or undesirable for drinking, fishing, swimming and other activities. Rising public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972, which by 1977 became commonly known as the Clean Water Act. The Act established the basic structure for integrated measures to restore and protect the Nation's waters.

TMDL is part of the Clean Water Act

Healthy streams are the goal of TMDL.

One of the most important programs developed by the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES) permit program that primarily regulates point sources that discharge wastewater and pollutants. Point sources are from pipes or other definable, and therefore controllable, specific locations that discharge their waste into waters of the United States.

Great progress towards cleanup of the nation's waterways was achieved through the NPDES permit process. However the process has not been completely effective in achieving clean water goals of restoring and maintaining the chemical, physical and biological integrity of the nation's waters.

Some water pollution simply does not come from a definable point. The writers of the Clean Water Act recognized this and added specific provisions in the law that requires that if point discharge controls are not successful, state pollution control agencies (in Ohio, the Ohio EPA) should undertake an analysis of the sources of pollution and develop a daily pollution "budget" through which a stream should be able to absorb and still achieve water quality standards.

This "budget" is referred to as a **Total Maximum Daily Load** or **TMDL** for short. TMDL has also become the name of the process that is used for establishing the daily limits on pollutants.

Increases in paved urban areas adds runoff and washes pollutants into our streams.

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As point sources of pollution have been reduced, the impact from non-point sources is becoming increasingly important. Non-point sources, those that come from surface runoff, are far more difficult to control because there is no one specific activity that can be changed that will have a specific effect. As storm water flows over land, especially in urbanizing areas, the water flushes any manner of pollution and washes it into the streams. The cumulative effect of the continual flushing action will impair the watercourse.

Methods to reduce overland sources of water pollution require broad-based changes in individual knowledge and behavior and direct involvement by local governments.

The process for identifying priorities for local action requires an understanding of the specific types and sources of pollution that are affecting a water body. TMDL is a way to help define the types of issues and remedial actions that when addressed at the local and individual level, over time, will have a significant cumulative effect on improving a water body.

TMDL is based on a stream's natural ability to absorb pollutants

As part of their natural function, streams can and do absorb and break down a wide range of contaminants every day. The TMDL limits are based on the biological, physical and chemical capacity of a water body to perform this function.

The ability of a stream to assimilate pollutants depends on a wide variety of parameters or factors, such as:

- Volume of water in the stream channel
- Temperature of the water
- Amount of turbulence or churning which happens to the water
- Depth of the water in the stream channel, nature of the stream's bottom
- Amount of direct sunlight reaching the water surface
- Amount of time it takes for water to travel a specific distance
- Background, natural biological conditions in the water

These factors establish a stream's ability to absorb pollution. As pollutants increase, a complex series of inter-related processes occur which will eventually severely restrict or even stop a stream from being able to assimilate additional pollutants.

Computer models help define limits and provide "what if" analysis

Pollutant assimilation capacity varies by a variety of natural factors.

As a result of much technical research and study, the absorption process and capacity of a water body can be described by a series of mathematical equations. These equations have been subsequently developed into a variety of computer models, and these models are used in the TMDL process to help establish what the daily pollution budget of a stream may be. These computer models and water chemistry standards are important aids to help plan and manage pollutants in a watershed. The models also allow people to try different "what if" scenarios without risking experimentation on the river. The fish and other aquatic communities ultimately define the daily pollution limits.

The process includes fish and water quality samples.

The process includes determining which stream segments are not attaining the goals of the Clean Water Act and then determining the causes of the problems and the subsequent sources of the pollution. Necessary data is gathered regarding the hydrologic and chemical/physical parameters for the specific stream to be studied. Fish tissue and sediment chemistry, when available, are also studied. The results from the samples are used to identify the types and magnitude of pollutants that are affecting the water body.

"Impairments, Sources, Causes" Let's review important TMDL terminology

The effects that the pollutants may have on the potential use of the water body are cataloged and referred to as **Impairments**.

The Clean Water Act provides that a list of the "impaired" stream segments be prepared and that the lists include:

Causes of Impairments are the pollutants that actually damage the bio-chemical processes that affect aquatic life. For example, the toxic effects of heavy metals, the siltation (dirt in the stream) resulting from eroded topsoil, or the change in pH of the water that results from mine acid.

Source of Impairment is the origin of the pollutant. For example, an industry may discharge a heavy metal, a farm may erode topsoil, or a coal mine may be a source of acid water leaching into a stream.

Water quality professionals commonly refer to this list of the impaired stream segments as the "**303(d) list**", from Section 303(d) of the Clean Water Act. This list identifies the streams subject to the TMDL process. The 303(d) list is a way to calibrate sources and effects of pollution, allow for the states to prioritize impaired waters to better focus their resources, and to assist in making the information about impaired waters more readily available to the other agencies and interested citizens.

Based on the known levels of pollution and on the assimilation characteristics of the water body, computer models are applied to calculate pollutant load budgets for the stream.

The most common pollutants in the Lower Cuyahoga Watershed

There are many different kinds of pollutants that can be studied and modeled in a TMDL process. In the Lower Cuyahoga, the most widespread pollutants that need specific attention are:

Pathogens, such as bacteria from storm drains, discharge from failing septic systems and other sources of human and animal waste. Overflows during storms of untreated sewage from Combined Sewer Overflows (frequently referred to as CSOs) are a major source. Pathogens impose a risk of disease and infection to people if they come into contact with the polluted water. This obviously restricts the use of a stream for recreational purposes.

Storm discharge outfall.

Remedial Actions for Pathogens

Local education of septic system owners on proper operation and maintenance, educational programs and activities focused on the role of storm drains in a watershed and supportive measures to complement the plans to reconstruct sewer systems to eliminate CSOs.

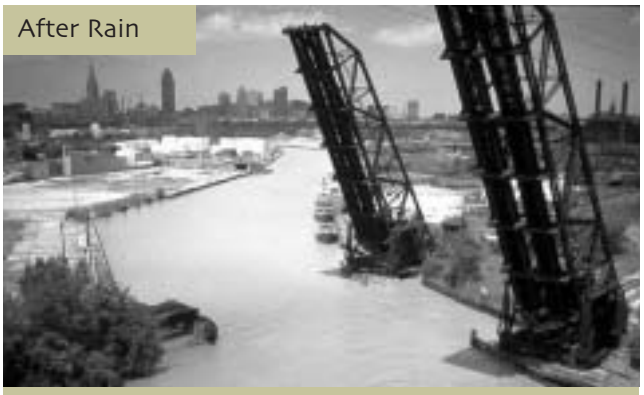
Nutrients, such as lawn fertilizer, animal waste, sewage treatment plant discharges and failing septic systems. Nutrients in the water function as excess fertilizer, causing algae and bacteria to grow at accelerated rates. Oxygen in the water is a critically important component for sustaining aquatic species. As algae grow and die, they consume dissolved oxygen. As oxygen is depleted, other species that are very important to the healthy functioning of a water body are suffocated. Nutrients can also overwhelm and disrupt the natural processes in a stream that absorbs pollutants. Nutrients are a common source of pollution to streams in urbanizing areas.

The water surface covered with algae bloom from failing septic systems.

Remedial Actions for Nutrients

Educational programs regarding fertilizer application, animal waste management and septic system improvements can help reduce nutrient impairments. Some communities may need to develop programs to provide cost-sharing or low interest loans for homeowners to alleviate failing septic systems. Understanding the magnitude of the impact from nutrients is a crucial step in the TMDL process for identifying remedial actions.

Sediment, from erosion as a result of undermanaged land disturbance activity. As areas urbanize, development activities can cause the removal of large amounts of vegetative cover and leave underlying soils exposed, often for long periods of time. Exposed, bare land is very susceptible to erosion.



Sediment from erosion affects the entire watershed.

When soil is washed off a site, it scours the landscape and stream banks causing further erosion. Eventually it will settle in the stream and dramatically alter the nature of the stream bottom.

The micro-biotic environment that exists in a stream bottom is one of the most important places that biochemical pollution assimilation processes occur. Covering the bottom of a stream with silt and mud greatly reduces its natural processes and alters fish and aquatic insect communities. Sediment can also smother bottom dwelling organisms, which are an important source of food for fish and other organisms.

As areas are urbanized, the amount of land surface that is covered with impervious surfaces increases. This increases the amount of storm water that flows off an area, rather than soaks in. The physical energy in the increased storm water flow will erode and alter the shape of the stream bank and channel, also causing sedimentation downstream.

Impacted stream with silt build-up.

Remedial Action for sediments-

Identifying sources of the sediment through the TMDL process can help direct improved local efforts at administering effective erosion and sedimentation control programs. Reduction in sediments may be achieved by installing proper erosion and sediment controls on construction sites; maintaining these controls for the duration of construction activity; and reviewing the administration of the erosion and sediment control ordinances to ensure they are aggressively enforced.

Petrochemicals, Hydrocarbons (such as oil, grease, tar, etc.) from parking lots and roadways. As areas urbanize, more streets and parking lots are built and more oil, tar and other petroleum-based products drip and ooze onto the surfaces. Storm water flushes these into the waterway where they disrupt normal biological activity. The TMDL process can assess the extent of impact that these are having on a waterway.

Oil runoff into the stream.

Remedial Actions for Petrochemicals-

Better local design standards for parking lots and driveways can lead to lower impacts in the surrounding streams. Modifying existing parking lots and roadways to direct storm water through natural filters is another method that can be used to limit organic compounds in the waterways. Implementing storm drain stenciling projects and collection of oil products are great ways to keep petrochemicals from entering streams.

Proper disposal of Petrochemicals.

Organic enrichment, from untreated or poorly treated wastewater. Combined Sewer Overflows (CSOs) and home and commercial septic systems are a major source of this pollutant. Organic enrichment can also occur from other sources such as compost leachate and poor yard waste management.

Remedial Action for organic enrichment-

Improved yard waste pickup and street sweeping programs are important. Local educational programs for septic system owners on maintenance and operation; supporting and encouraging measures to reconstruct sewer systems to eliminate CSOs and local educational programs on fertilizer, yard and animal waste management.

Organic debris.

Overlap in the various remedial measures indicates how interconnected the sources are to causing problems in the streams. Many of the corrective meas-ures listed may eliminate multiple pollutants, and can have a broad-based benefit to the watershed. All of these measures involve action by local communities.

Improving a stream's ability to produce more dissolved oxygen can help too

The quantity of dissolved oxygen in the water body is a leading factor in providing a high quality aquatic environment. Many of the processes that assimilate pollution also use up dissolved oxygen and thereby reduce available oxygen for species living in the stream. It is not surprising that many of the hydrologic factors that give a stream its ability to absorb pollution affect the level of dissolved oxygen.

Stream bank restoration.

Improvements in the physical structure of a stream can increase the assimilative capacity of a stream and may allow for an increased load of pollutants without adverse effects. Communities in each tributary watershed through cooperative watershed planning may be able to identify several potential physical remediation or protection projects that will enhance their local tributary.

Riparian Buffers can have major impact on protecting a stream.

In order for streams to function effectively they need to be protected. Adopting local measures to

Extreme encroachment.

protect the stream bank and buffer area from encroachment and damage are extremely important measures. Steep slope protection, vegetative cover preservation and erosion management are all local measures that will keep a stream flowing free and allow it to help clean up our waters.

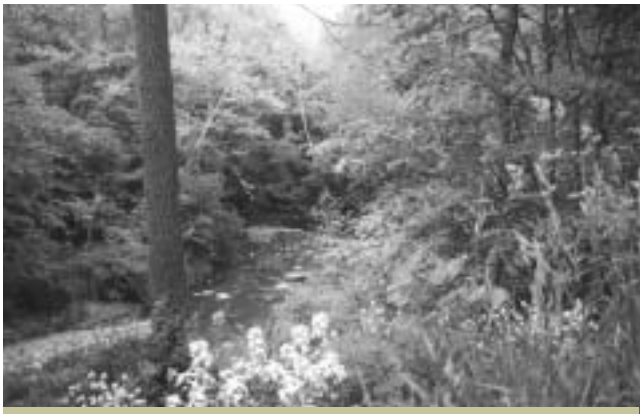
TMDL sets a budget and guidance for prioritizing local action

The TMDL modeling process is intended to establish budgets for each set of pollutants. The budget is allocated to known, permitted, point discharge sources, to non-point sources, to a margin of safety and to the stream's natural background. The point discharge sources budget is directly incorporated into the NPDES permits. The margin of safety is included to account for any unknowns and uncertainty in the modeling process regarding water quality and pollution budgets. The non-point sources and natural background may be grouped together in the budget allocation.

Once set, the budget for various pollutant loadings will direct localities as they develop and adopt local measures to support the attainment of the TMDL limits.

Because non-point source pollution comes from overland flow and is subject to the effects of widespread human activity, the methods and techniques to reduce or mitigate the effects also require widespread local and individual involvement and action.

The TMDL report includes an inventory of potential and ongoing local and regional action measures that can help propel a stream toward recovery. This inventory of local measures helps make the TMDL report an important reference guide to assist watershed managers and local officials expand their knowledge of stream stewardship activities.



Intact buffers act as filters, they add shade and stabilize banks.

TMDL is an important tool in our restoration process

TMDL can be thought of as a tool to translate complex hydrologic, biologic and chemical science regarding water quality into opportunities for remedial action.

As federally mandated storm water management plans are developed, local officials will have a wide range of measures available that will need local support. Support of TMDL goals can help prioritize these measures.

Knowledge and understanding are keys to action. Understanding TMDL can help citizens and localities find new ways to work together to restore and preserve our waterways.

This **RAP Guide to TMDL** is part of a Handbook that the RAP is preparing to help local officials and interested citizens understand the importance of local involvement in order to achieve the restoration and preservation of the lower Cuyahoga River and its tributaries.

About the RAP

This RAP Guide to TMDL is part of a series of publications that the RAP is preparing and distributing to help local officials understand the importance of watershed stewardship and support the restoration and preservation of the Cuyahoga River and its tributaries.

The RAP was created in 1988 by Ohio EPA as a community based program aimed at restoring the Cuyahoga River. Our mission is to plan and promote the restoration of the environmental quality of the Cuyahoga River through the remediation of existing conditions and prevention of further pollution and other degradation. The RAP's 39 stakeholder partners include businesses, community groups, government agencies and citizens with an interest in the River.

The **RAP** offers:

- Organizational, Educational and Technical Services
- Planning and Support for Implementation of Stream Remediation and Renovation Projects
- Special Programs for Local Officials
- Tributary-based Maps and Watershed Information for Local Communities
- Support for local Public Outreach and Involvement Programs

The RAP is a proven resource for bringing together technical knowledge, stakeholders and local officials in a supportive setting to develop and implement effective solutions for renovating our local streams.

The Cuyahoga River Community Planning Organization receives financial support for the RAP from the Cleveland Foundation, The GAR Foundation, The George Gund Foundation, Ohio EPA, federal and state grants, corporate sponsorship, community participation, memberships and donations.

Our resources are focused on assisting citizens and localities to work together in addressing ways to restore and preserve our waterways.

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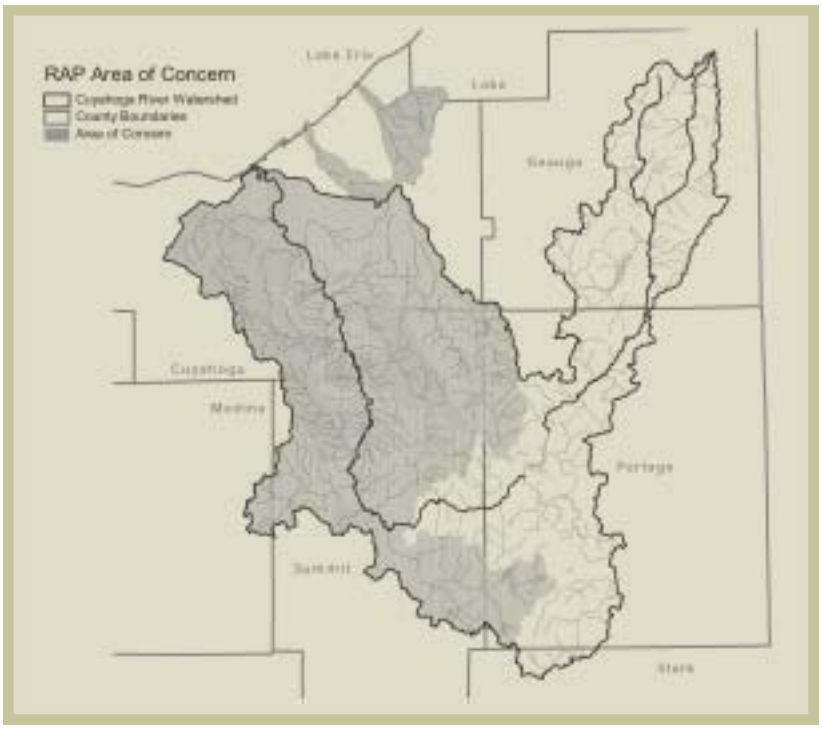

For more information about TMDL and other ways to support stream and watershed remediation in your community, call the Cuyahoga River Remedial Action Plan or RAP at (216) 241-2414 ext. 307

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