EPA United States Environmental Protection Agency

Total Maximum Daily Loads

TMDLs at Work in Michigan

Getting the Sediment Out of Carrier Creek to Improve Habitat and Restore Aquatic Life

A history of changing landscapes in the Grand River watershed, first to support agricultural activity and then urban land uses, created a series of local water quality problems due to sediment from stormwater runoff and eroding streambanks. Excessive sediment eventually took a toll on Carrier Creek, a tributary to the Grand River in Eaton County, Michigan. Data collected by the Michigan Department of Environmental Quality (MDEQ), the Eaton County Drain Commissioner, and other key partners demonstrated that Carrier Creek did not have the habitat necessary to sustain healthy fish and macroinvertebrate communities and, therefore, was not supporting its aquatic life designated use.

Starting in 2000, local stakeholders worked together to implement nonpoint source best management practices (BMPs) using Clean Michigan Initiative grant funding from MDEQ. The TMDL for biota in Carrier Creek, completed in 2002, provided a framework for understanding the problems and making the connection between the sources, water quality standards, and implementation activities. Implementation activities, such as stream channel restoration and wetland creation, have reduced stream bank erosion, improved aquatic habitat, and improved the health of aquatic communities at some monitoring locations in Carrier Creek. Continued monitoring efforts will help stakeholders identify progress toward achieving the numeric biota and habitat endpoints to support the aquatic life designated use.

TMDL at a Glance

Carrier Creek TMDL
(approved July 2002)

www.deq.state.mi.us/documents/deq-swq-gleas-tmdlcarrier.pdf

- **Factors causing impairment**
  Aquatic life use impaired by habitat loss due to excessive sediment and changes in natural hydrology
- **Sources contributing to impairment**
  Soil erosion and stream bank erosion due to construction activities, road projects, drainage projects and urban runoff
- **Restoration options**
  Stream channel restoration and stabilization, stormwater management and retention projects, improve in-stream habitat, wetland construction, detention basin construction and re-vegetation
- **Stakeholder involvement**
  Eaton County Drain Commissioner, Friends of Carrier Creek, City of Lansing, Delta Charter Township, Michigan Department of Transportation, Trout Unlimited, and local consultants
- **Status of waterbody**
  All phases of restoration project completed as of fall 2008. Some trends in monitoring data indicating improvement in fish taxa and habitat conditions.
- **Benefits to stakeholders**
  Water quality improvements, added recreational and aesthetic value, healthier aquatic communities, reduced flooding, funding opportunities, effective partnerships

How are TMDLs at work in the Carrier Creek watershed?

The sediment TMDL to address aquatic life impairments in Carrier Creek provided a vehicle to compile the existing data and information about trends in the health of Carrier Creek's aquatic life, particularly the macroinvertebrate community, and provide the framework necessary to support implementation efforts. Stakeholders recognized that implementation activities to restore Carrier Creek could start before the completion of the TMDL, based on existing information on the factors causing impairment and the likely sources. Through the TMDL analysis, MDEQ provided stakeholders with documented numeric targets for restoring biological communities and habitat conditions related to changes in sediment load. The TMDL report supported the approach of implementing best management practices that will reduce sediment with the goal of improving biological integrity. In addition, the TMDL emphasized the need for reassessments of the biological communities of Carrier Creek to determine progress toward supporting the aquatic life designated use.

Who were the participating stakeholders and key partners?

MDEQ was responsible for the development of the Carrier Creek sediment TMDL for biota. Stakeholders participated after the TMDL was approved and included residents and officials from Eaton County, the city of Lansing, Delta Charter Township, and members of the Friends of Carrier Creek. State partners, in addition to MDEQ, included the Michigan Department of Transportation (MDOT). The U.S. Environmental Protection Agency (EPA) is a key federal partner involved

What is a total maximum daily load (TMDL)?

It is a study or analysis that calculates the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The TMDL establishes a pollutant budget and then allocates portions of the overall budget to the pollutant's sources. For more information on TMDLs, visit EPA's website at ***www.epa.gov/owow/tmdl***.

in both reviewing and approving the sediment TMDL for Carrier Creek and providing funding to support implementation.

How did stakeholders participate in the TMDL process?

The overall TMDL process includes the following elements: Clean Water Act (CWA) section 303(d) listing decisions, TMDL development, and TMDL implementation. Each element of the TMDL process provided stakeholders with an opportunity to express concerns and share information about the water quality problems in the Carrier Creek with MDEQ and other key partners. A description of each element of the TMDL process is provided below.

Section 303(d) listing decisions

If a waterbody does not meet water quality standards (i.e., numeric or narrative criteria) for one or more pollutants, it goes on a state's 303(d) list. Impaired waterbodies on this list require a TMDL for each pollutant contributing to the impairment. Stakeholders have the opportunity to provide input during the 303(d) listing process. MDEQ placed Carrier Creek on Michigan's 303(d) list in 1996.

TMDL development

In 2002, MDEQ began developing a TMDL for sediment to address the aquatic life designated use impairment in Carrier Creek. The ultimate goal of restoring the condition of the biological communities and in-stream habitat in Carrier Creek is linked to reducing the amount of sediment entering Carrier Creek from the identified sources. The TMDL identifies two numeric end targets for determining attainment of water quality standards. The first numeric end target is a minimum score of –4 for macroinvertebrate community health determined through a biological assessment using Michigan's *Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers* (Procedure 51). The second numeric target is a score of 30 for in-stream habitat conditions focused on three sediment-related habitat metrics found in Michigan's Procedure 51.

Through the TMDL development process, MDEQ determined that no continuous permitted point sources discharge to Carrier Creek and that nonpoint sources are responsible for the sediment load. Specific nonpoint sources contributing excessive sediment to Carrier Creek include soil erosion resulting from changes to the natural shape of Carrier Creek (e.g., from winding to straight or channelized) to accommodate agricultural uses and construction projects. In addition, changes in the amount of impervious surfaces within the communities surrounding Carrier Creek have led to increases in urban runoff, which affects both the quality and the quantity of storm water conveyed by Carrier Creek. Figure 1 illustrates the appearance of Carrier Creek due to erosion and straightening that affect instream habitat.

Because the focus of the TMDL is to improve in-stream habitat and the health of biological communities, as quantified through Procedure 51 biological assessments, the

Note erosion of historic dredge spoils and poor instream habitat

Note shallow, linear stream channel and lack of instream habitat features

Figure 1. Pre-BMP Pictures of Carrier Creek.

Stakeholders Say...

"The Carrier Creek project successfully balanced the needs of so many competing interests. It protected the health of the Grand River, provided drainage for industrial, commercial, and residential development, and preserved the aesthetics of Carrier Creek. Ultimately, the project saved and greatly improved the water quality of the creek and improved the health of the wildlife. It will meet the needs of local communities in the long-term—for the next 75 years, not just the next 10 years."

—Lyle Frost, President
Friends of Carrier Creek

TMDL is not based on a specific mass load expressed as a weight or a volume. Instead, the TMDL focuses on reductions in sediment through the implementation of BMPs that will result in an acceptable macroinvertebrate community.

MDEQ made the draft TMDL available for public review and comment. Despite the availability of the draft, MDEQ did not receive any public comments.

TMDL implementation

Under the Reasonable Assurances section of the TMDL report, MDEQ acknowledged that stakeholders initiated implementation activities. Stakeholders developed a watershed management plan that identified the causes of the impairment and provided recommendations for BMPs with the goals of (1) minimizing and controlling sediment loads and (2) re-establishing the link between Carrier Creek's floodplain and adjacent wetlands. Under the umbrella of the Carrier Creek Storm Water Management and Restoration Project, a team of stakeholders worked to secure federal CWA section 319 nonpoint source grant funds and state section 319 matching funds through the Clean Michigan Initiative. The project team is led by the Eaton County Drain Commission with participation from the city of Lansing, Delta Charter Township, Friends of Carrier Creek, MDOT, MDEQ, and U.S. EPA Funds obtained for implementation projects included the following:

- A federal CWA section 319 nonpoint source grant of $19,890 and local matching funds of $75,900 to create an education and public information program.
- Three Clean Michigan Initiative Nonpoint Source Control grants totaling $1,232,637, with local matching funds totaling $4,227,751 to implement multiple BMPs in Carrier Creek.

The initial phase of the implementation project began in 2001 and consisted of stream stabilization in an upstream reach by narrowing and deepening an over wide channel using a series of stone meander structures. In addition, the project team used numerous in-stream structures (e.g. crossvanes, j-hooks, and lunkers) to stabilize eroding banks and removed berms to provide greater access of stream flow to the floodplain. Figure 2 shows the improvements to Carrier Creek resulting from the restored stream meanders, and the use of crossvanes and j-hooks. The remaining work under Phase I involved the reconstruction of 1,200 feet of stream channel to stop massive erosion. Phase II involved the construction of a storm water wetland at the upstream end of the impaired reach to assist in flow mitigation and habitat restoration.

Community outreach was a key part of the overall restoration project and included grant funding for information and education from 2001–2003. To keep local stakeholders informed about restoration efforts, the project team maintained a website (www.carriercreek.com) that provided status updates and other project related information. To involve stakeholders, the project team held public meetings that not only provided project status updates, but also recruited volunteers. Other outreach included local high school class presentations and field trips for hands-on monitoring experience, educational brochures and newsletters, and cross-training for other county drain commissioners in the state of Michigan.

Restored stream meanders

Crossvane

J-Hook

Figure 2. Post-BMP Pictures of Carrier Creek.

Monitoring is an essential component of TMDL implementation because it provides the data and information necessary to gauge progress toward achieving the biota and habitat endpoints identified through the TMDL analysis. The TMDL states that MDEQ will conduct monitoring after implementing the applicable BMPs. Annual sampling will occur during the June to August timeframe at specified locations within Carrier Creek. Sampling for the macroinvertebrate community and habitat will follow the protocols set forth in Procedure 51. According to the TMDL, the sampling will continue at six specified sites until the target values are met for two consecutive years.

What is the current status of Carrier Creek as a result of the TMDL process?

Monitoring data collected in Carrier Creek before and after implementing the restoration project show a few signs of in-stream improvements. According to the U.S. Environmental Protection Agency's CWA section 319 Nonpoint Source Success Story for Carrier Creek, the number of fish taxa increased from 2000 (pre-restoration) to 2007 (post-restoration). Habitat assessment data from 2006 also show an improvement from the 2000 pre-restoration conditions at one monitoring site. The project team recently completed implementation of Phase II of the project; subsequent monitoring data from stations in Carrier Creek will indicate if the newly completed implementation activities produced additional progress toward TMDL target values.

How did local stakeholders benefit from the TMDL process?

The efforts implemented under the Carrier Creek Storm Water Management and Restoration Project has generated initial improvements in biota and habitat conditions. Once monitoring data show that biota and habitat meet the target values established through the TMDL, project partners will know that Carrier Creek can again support its aquatic life designated use. The project has generated interim benefits for stakeholders, including the following:

- **Improved hydrology and habitat**. The projects were effective in increasing channel stability, improving in-stream habitat, reconnecting the channel to its floodplain, and decreasing stream flashiness during periods of elevated storm runoff.
- **Increased awareness and involvement.** Restoration projects included the implementation of local educational programs to gain public support and voluntary assistance. The project team distributed brochures, fact sheets, and newsletters, conducted field trips for local high school students, and provided cross-training opportunities for other Michigan drain commissioners.
- **Continued monitoring.** The TMDL process has provided local stakeholders with the framework and rationale for continued monitoring in Carrier Creek to assess whether implementation projects are making progress toward achieving water quality standards.
- **Effective local partnerships.** Cooperative efforts among MDEQ, the Eaton County Drain Commissioner, Friends of Carrier Creek, and other local partners and volunteers were underway before the finalization of the Carrier Creek biota TMDL. However, these local partnerships will serve as the driving force to achieving the TMDL target values and attaining water quality standards in Carrier Creek.

EPA

December 2009 • EPA 841-F-09-002K

For more information on the Carrier Creek biota TMDL, contact Joe Rathbun, Michigan Department of Environmental Quality Water Bureau, rathbunj@michigan.gov, (517) 373-8868

For more information on the Michigan TMDL Program, visit
www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-12464--,00.html