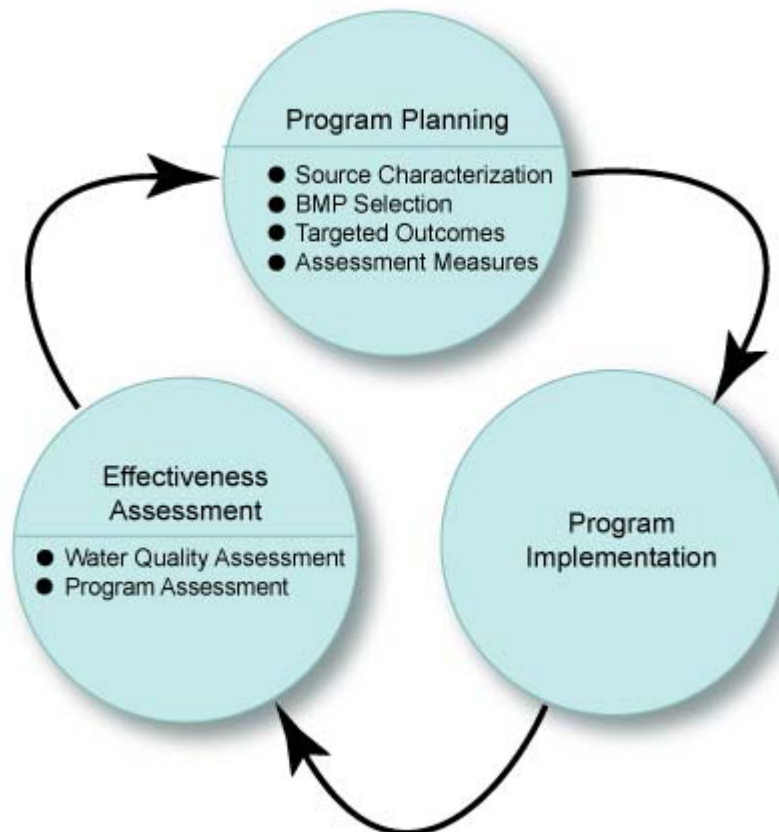


# SECTION 9 - EVALUATION METHODS FOR MEASURING SUCCESS

## INTRODUCTION

Watershed planning is meant to be an iterative process that will be continually revised and updated. This Watershed Management Plan (WMP) is a living document and is meant to be used, revised as new information becomes available, and altered to fit the changing needs of the watershed. This section establishes an overall program framework which emphasizes the importance of an on-going iterative process that consists of three elements: Program Planning, Program Implementation, and Effectiveness Assessment. The relationship between the three elements is presented in Figure 9-1. Portions of this chapter are based on “A Framework for Assessing the Effectiveness of Jurisdictional Urban Runoff Management Programs” developed by the San Diego Municipal Storm Water Co-Permittees (October 16, 2003).

Figure 9-1 Program Elements



## **PERMIT REQUIREMENTS**

Watershed management is intended to be a tool in a comprehensive and systematic approach to balancing land uses and human activities to meet mutually agreed upon social, economic, and environmental goals and objectives in a drainage basin. As required by the NPDES Wastewater Discharge General Permit, the WMP must include the following, all of which are intended to be done in the context of significant public participation:

1. Assess the nature and status of the watershed ecosystem. (Section 3)
2. Define long-term goals and short-term objectives for the system. (Section 6)
3. Determine actions needed to achieve long-term goals and short-term objectives. (Section 8)
4. Assess both benefits and costs of each action. (Section 8 and 9)
5. Implement desired actions by a specified schedule and permittee commitments.
6. Evaluate the effects of the implemented actions and progress toward goals and objectives.
7. Re-evaluate goals and objectives as part of an interactive process (MDEQ, 1997).

Development of this document has included Steps 1, 2 and 3 above, and some elements of Step 4. As communities and agencies review this document, and opportunities arise, site or program-specific information will be generated to develop greater detail regarding the costs and benefits of each action. The implemented actions presented in Section 8 will be assessed for cost-benefit and effectiveness based on volunteer watershed monitoring as presented in this section. Based on the results of the assessment, planned actions will be revised.

Communities must develop funding mechanisms to implement the WMP. Arrangements will be made to provide start-up funding for implementing recommendations. Development of proposals should involve the creation of detailed information regarding what BMPs are to be implemented, the locations of these BMPs, anticipated costs, and information regarding who will be responsible for implementation.

Under Public Act 342, Genesee County established a Storm Water Management System. Those Communities in Genesee County that signed a contract with the Genesee County Drain Commissioner's Office were:

Township of Argentine	<b>Township of Thetford</b>
Township of Atlas	<b>Charter Township of Vienna</b>
<b>Charter Township of Clayton</b>	City of Burton
Township of Davison	<b>City of Clio</b>
Charter Township of Fenton	City of Davison
<b>Charter Township of Flint</b>	City of Fenton
<b>Charter Township of Flushing</b>	<b>City of Flushing</b>
Township of Forest	City of Grand Blanc
Township of Gaines	City of Linden
<b>Charter Township of Genesee</b>	<b>City of Montrose</b>
Charter Township of Grand Blanc	<b>City of Mt. Morris</b>
<b>Charter Township of Montrose</b>	<b>City of Swartz Creek</b>
<b>Charter Township of Mt. Morris</b>	Village of Gaines
Charter Township of Mundy	Village of Goodrich
Township of Richfield	Village of Otisville

As part of the PA 342 contract these communities and Genesee County have pledged contribute monetarily to fund the various aspects of the Watershed Plans from fiscal year 2004 through 2008. A new contract will be negotiated upon the completion of this cycle.

The annual budget not to exceed \$500,000.00 has been set countywide. Currently the budget is set with the Public Education Program budgeted up to \$80,000/year, the Monitoring and Mapping program budgeted up to \$40,000/year and IDEP program and other minor expenses is allocated the remainder of the annual budget. The budget is broken up among the following responsibilities:

- (a) the Public Education Program Subcommittee, with responsibility for public education and participation; For those Services relating to Implementation Activities for which the Public Education Program Subcommittee is responsible, the Local Share thereof shall be allocated to each Municipality on the basis of a fraction, the numerator of which is the population for such Municipality at the beginning of such Fiscal Year and the denominator of which is the population for all Municipalities at the beginning of such Fiscal Year
- (b) the Monitoring and Mapping Subcommittee, with responsibility for the illicit discharge program, which will identify and map all municipal discharges to open waters; and for those Services relating to Implementation Activities for which the Monitoring and Mapping Subcommittee is responsible, the Local Share thereof shall be allocated to each Municipality on the basis of a fraction, the numerator of which is the weighted sum (determined as hereinafter provided) of the developed parcels in such Municipality at the beginning of such Fiscal Year and the denominator of which is the weighted sum of the developed parcels in all Municipalities at the beginning of such Fiscal Year. For purposes of this subsection (b), the weighted sum of developed parcels in each Municipality shall be determined by assigning one (1) unit for each developed residential parcel and four (4) units for each developed commercial

and industrial parcel and then adding the total number of assigned units for all developed parcels in such Municipality.

- (c) the New Construction Standards Subcommittee, with responsibility for construction standards, redevelopment standards, oversight of all watersheds and the preparation of the pollution prevention program known as the Storm Water Pollution Prevention Initiative; and for those Services relating to Implementation Activities for which the New Construction Standards Subcommittee is responsible, the Local Share thereof shall be allocated as follows: The Local Share of the cost of such Services that consist of administrative costs relating to the establishment of the five planning areas for the System (Cass River, Lower Flint, Lower Flint, Upper Flint and Shiawassee, hereinafter individually referred to as a "Planning Area" and collectively as the "Planning Areas") and the development of the standardized templates for the Planning Areas shall be allocated equally among the Planning Areas, and within each Planning Area shall be allocated to each Municipality therein on the basis of the equivalent acreage in each Municipality, using the same methodology for calculating equivalent acreage that the County Drain Commissioner would use for purposes of establishing drain assessments for benefiting parcels in a drainage district under Chapter 7 of the Drain Code (hereinafter referred to as the "Equivalent Acreage Methodology"). The Local Share of the cost of all other Services for which the New Construction Standards Subcommittee is responsible shall be allocated to the specific Planning Area to which such Services relate and within such Planning Area shall be allocated to each Municipality therein on the basis of the Equivalent Acreage Methodology.

Within the Lower Flint River Watershed, This is the only watershed planning going on.

### **PROGRAM PLANNING**

The program planning phase requires a significant amount of public participation as public input is sought to characterize the watershed and develop and prioritize goals and objectives for the watershed. This phase can be broken down into the four steps shown below:



While the elements of program planning interact in a cyclical manner, developing goals and objectives typically initiates the cycle. However, program planning also occurs following the effectiveness assessment phase if changes to the WMP are necessary.

#### ***Goal and Objective Development (Section 6)***

Goal and Objective development was completed as part of this WMP and was accomplished through activities outlined in the Public Participation Plan (PPP). Discussions at watershed committee meetings and stakeholder workshops helped to prioritize long-term watershed goals that would impact water quality within the watershed. It was important to involve the public as much as possible in the development process to gain support for implementation.

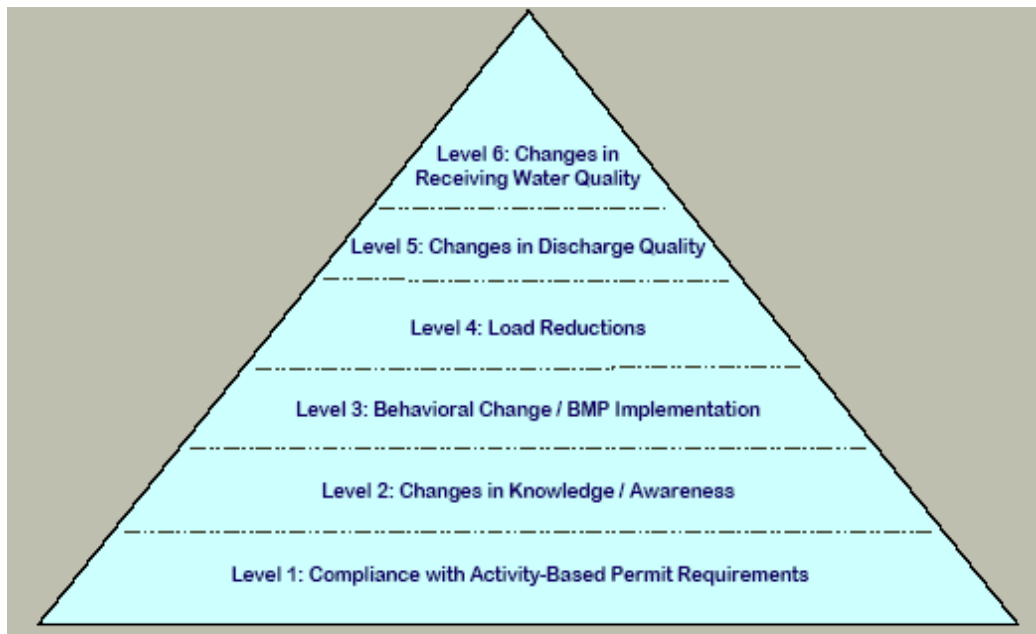
### **Action Development (Section 8)**

To implement the goals and objectives, specific actions were developed for each objective. Action development was completed as part of this WMP. The actions were assigned a schedule, responsible party, cost, and measure of success. The measure of success establishes a way to assess the completion or progress of an action. More details concerning measuring the effectiveness of actions are included later in this section.

### **Measures of Success**

Measures of success are essential to assessing the effectiveness of the overall program. Identification of quantifiable measures provides measurability and accountability within the program. To help organize successes and provide a relationship between success types, six success levels are established as shown in Figure 9-2.

Figure 9-2 Success Levels



Level One: Compliance with Activity-Based Permit Requirements- Activities conducted under this level include those that are described or required in the permit. These activities are expected to be beneficial to water quality because they are part of a successful watershed management plan. The watershed will be addressing these permit requirements including specific requirements of the Storm Water Pollution Prevention Initiative (SWPPI).

Level Two: Changes in Knowledge/Awareness- Changes in knowledge and awareness are targeted through the PPP and Public Education Plan (PEP), such as conducting stakeholder workshops and public briefings. Currently surveys are being used to receive a baseline for public knowledge that can be compared to future surveys.

Level Three: Behavioral Change/BMP Implementation- The desired success of Level Three is behavioral change due to an increase in knowledge. This may be documented through the use of a survey or tracking the number of BMPs installed or retrofitted.

Level Four: Load Reductions- BMPs are used to reduce the amount of pollutants entering local water bodies from storm water runoff. Load reductions may be calculated based on information provided once a BMP is installed. Load reductions may also be estimated for illicit discharges that are removed.

Level Five: Changes in Discharge Quality- Changes in the water quality of storm water discharge show the direct environmental benefit gained by the installation of BMPs and pollution prevention practices. The watershed will be working on this task through their Illicit Discharge Elimination Program (IDEP), which seeks to correct illicit discharges that are discovered through outfall screening and investigation. Should a sample show poor water quality, further sampling and testing will take place to pinpoint the source and work to remove it.

Level Six: Changes in Receiving Water Quality- The ultimate goal of Phase II NPDES Storm Water Legislation is to show improvement in water quality of receiving water bodies. Monitoring will be conducted on a periodic basis to show change in water quality and environmental benefit.

### **Assessment**

Assessment is the process of evaluating the attainment of the measures of success. Measures of success fall within two categories, direct and indirect. Indirect measures deal with degrees of activity or program implementation, while direct measures focus on characterizing water quality and quantifying pollutant loads. Measures of Success Levels One through Three are primarily indirect measures while Levels Four through Six are direct measures.

### **PROGRAM IMPLEMENTATION**

Program implementation is the second phase of the cycle and consists of applying the WMP which was developed or updated during the program planning phase.

Lessons learned and comments on the WMP are compiled during the implementation phase and are subsequently addressed in the effectiveness assessment phase to consider the suggested changes and comments.

### **EFFECTIVENESS ASSESSMENT**

The effectiveness assessment phase consists of a water quality assessment, a program assessment, and an integrated assessment. The integrated assessment facilitates examining the causal relationships between program implementation and changes in water quality.

#### ***Water Quality Assessment***

Water quality assessment is the analysis of water quality data to draw conclusions on the condition of or changes to the condition of receiving waters or discharges to those waters. The water quality assessment provides a way to assess the attainment of direct measures of success. Long-term assessment is also necessary to ensure that seasonal, annual, and other variables can be identified and are considered when interpreting the results.

Five watershed monitoring methods will be used throughout the watershed to help evaluate the effectiveness of WMP implementation. (Section 7) The five methods include the following:

- Benthic macroinvertebrate monitoring
- Frog and toad survey
- Stream crossing watershed survey and photographs
- Water quality monitoring
- Hot spot testing at hazardous sites

The different monitoring activities will be conducted in close proximity to one another in order to develop relationships between them and a holistic view of a particular area. For example, the photographic monitoring will be done at the macroinvertebrate sites along with the basic water quality monitoring. The road/stream crossing surveys will be done immediately upstream and downstream of the macroinvertebrate sites and will include photographic log files.

Volunteers from the general public will be trained to carry out the monitoring program. The benefits of using general volunteers to conduct monitoring include increasing public participation, increasing public education and decreasing the cost of the monitoring program. Including established volunteer programs in the monitoring effort may be beneficial. Established groups include the adopt-a-stream program, public school projects such as GREEN (Global Rivers Environmental Education Network), or other organized activities such as 4H clubs, scouting groups, and senior citizen groups.

#### *Benthic Macroinvertebrate Study*

The presence or absence of certain species of benthic macroinvertebrates is a good indicator of the health of a stream. A benthic macroinvertebrate is an organism having no backbone that dwells on the bottom of a water body. The presence of organisms tolerant to pollution and few or no organisms sensitive to pollution indicates pollution in the water.

The Flint River Watershed Coalition (FRWC) in partnership with the University of Michigan – Flint (UM-F) Center for Applied Environmental Research (CAER) has an existing benthic macroinvertebrate volunteer monitoring program in the Flint River Watershed. The watershed will seek to partner with the FRWC to enhance and expand the existing program. Helping to enhance the existing program may include activities such as advertising, soliciting volunteers, providing equipment, providing additional technical help, public education, analyzing the collected data, or publicizing the results.

#### *Basic Water Quality Monitoring*

Typical water quality monitoring parameters may include dissolved oxygen, ammonia, nitrate, pH, phosphate, and temperature. Volunteers will take grab samples at pre-determined locations and use simple test kits to conduct the analysis.

There is no existing water quality monitoring program.

#### *Frog and Toad Survey*

Like benthic macroinvertebrates, frogs and toads are sensitive to changes in water quality. The absence or decline of a frog and toad population indicates a loss of the

quality of their wetland habitat and ultimately their ecosystem. As a result of the concern for the rarity, decline, and population die-off of several species, the Michigan Department of Natural Resources (MDNR) developed the Michigan Frog and Toad Survey.

Genesee County has an existing frog and toad survey program which uses volunteers to monitor wetland sites three times annually during early spring, late spring, and summer. At each site, the volunteer listens for frog and toad breeding season calls and makes a simple estimate on the population size. Detailed information is given to the volunteer including how to establish a survey route and a tape or CD of frog and toad calls.

#### *Stream Crossing Watershed Survey with Photograph*

The stream crossing watershed survey is an approach used to collect information about the quality of a stream. A standard data collection form is used to ensure uniformity throughout the watersheds. The physical habitat of the site including water characteristics, stream characteristics, plant life, foam and trash presence, substrate type, stream morphology, land use, and corridor description are recorded. Also potential sources of pollution upstream and downstream of the site are identified if apparent.

There is no existing stream crossing watershed survey program.

#### *Hot Spot Water Quality Monitoring*

Much of the Flint River Watershed encompasses land which has a history of heavy industrialization. Many large companies settled in this area to begin mass production of cars, auto parts, trucks, metal manufacturing, and other industries. These types of activities have had a host of regulations to promote their cleanup since the promulgation of the Clean Water Act. Prior to this Act however, a number of pollutants were released without realizing their potential impacts on public health and safety and water quality in aquatic environments. In addition to historical pollution, various hot spots of pollution are believed to exist around the five major watersheds in Genesee County.

There is no existing hot spot water quality monitoring program.

#### **Program Assessment**

Program assessment involves reviewing the attainment of primarily the indirect measures of success. Measures of success will be reviewed for achievement and if the desired level of achievement is not attained, an investigation will be conducted to determine possible factors causing failure.

The PEP has developed and administered a phone survey to the public. Besides as a tool to direct the education committee, it can be used as a baseline assessment of where the public's knowledge is now. Future surveys can be used to measure change in knowledge and behavior. Other methods can provide measurable quantities like counting number of hits on the website or how many pounds of household hazardous waste have been dropped off.

Assessing the attainment of the measures of success is a yearly task that will be reported in the annual progress reports. The annual progress report is required to cover decisions made, actions performed, and results for the IDEP, PEP, SWPPI, and any other storm water actions conducted during the previous permit year (The IDEP and PEP are separate documents containing additional actions and measures of success not

covered in this WMP.) The annual report must also cover updates of nested drainage system agreements and point source discharges to the storm water system.

***Integrated Assessment***

The integrated assessment incorporates the water quality assessment and program assessment and evaluates the entire watershed management plan as a whole. The integrated assessment identifies and addresses data gaps in the water quality monitoring program and finds causal relationships between actions taken through the WMP and changes in load reductions, discharge quality, and receiving water quality.

As a result of the integrated assessment, targeted updates and revisions will be made to the WMP for submittal to the MDEQ by the March 1, 2007 deadline indicated on the certificate of coverage.

**SUMMARY**

The framework presented here is not meant to be inclusive, but rather a guide illustrating the embodiment of the watershed management plan. The emphasis of the plan is to focus on high priority constituents, sources, benefits etc. rather than all potential problems. Attention is given to the importance of long-term assessments that boast strategy rather than ambition.



# SECTION 10 - STEPS FOR PLAN SUSTAINABILITY

Below are various ways that the implementation of the watershed plan can be sustained. More than one method is being used in the Lower Flint River Watershed.

## **OPTIONS FOR SUSTAINABILITY**

Analyzing methods for sustainability is a critical component of watershed management planning. Especially since this watershed management plan is being used for Phase II permit compliance. Sustainability means finding a way to keep going to implement the WMP once it is complete. It also means that the plan is being continuously updated and improved to meeting local needs.

### ***Watershed Councils- Michigan's Local River Management***

Watershed Councils can be formed through Michigan's Natural Resources and Environmental PA 451 of 1994, Part 311 Local River Management. Watershed groups such as the Clinton River Watershed Council and the Huron River Watershed Council were formed under this act. The Clinton River Watershed Council eventually reorganized to become a 501(c)3 nonprofit organization. This allowed the council to receive additional revenue from grants, businesses and individual membership contributions.

### ***Watershed Councils- Voluntary Partnerships***

Watershed groups can also be formed through other means such as a voluntary association of local governments organized to promote cooperative action on water management issues. Watershed groups such as the Partnership for the Saginaw Bay Watershed are formed in this manner.

A key component of sustainability is obtaining and keeping a wide variety of local support. This support and public involvement will keep momentum for implementing this watershed management plan. Local support will also help maintain funding through all available means and open doors for partnerships in areas where other groups have similar missions.

## **PHASE II LEGAL RELATIONSHIP**

Michigan has a number of different methods available for community groups to form into a legal entity. At least six approaches are available under Michigan statutes to lead and assign funding responsibilities for Phase II permitting. These options include the following:

- 1) Drain Code – Public Act 40 (1956)
- 2) Inter-Municipal Committee Act – Public Act 200 (1957)
- 3) Municipal Sewerage and Water Systems - Public Act 233 (1955)
- 4) County Public Improvement Act – Public Act 342 (1939)

- 5) County Department and Board of Public Works – Public Act 185 (1957)
- 6) Voluntary Cooperation

This section provides a brief summary of how each of these options can be used, and some limitations or considerations for using each option. Any of these options could be used independently or in combination to handle a specific project area.

A summary of the possible Phase II storm water permit leadership options is presented in Table 10-1 Summary of Phase II Storm Water Leadership Options. The title of each option is listed in this table along with the appropriate Michigan Public Act, a statement on how the approach works, limitations, and some areas where these approaches are either in use or are being considered for use.

**Table 10-1 Summary of Phase II Storm Water Leadership Options**

<b>Option</b>	<b>Title</b>	<b>Public Act</b>	<b>Approach</b>	<b>Limitations</b>
<b>1</b>	Drain Code	40 (1956)	<ul style="list-style-type: none"> <li>• Public Health Projects using Chapter 20</li> </ul>	Separate projects each drain requires petition/notice
<b>2</b>	Inter-Municipal Committee Act	200 (1957)	<ul style="list-style-type: none"> <li>• Resolutions to study issues or problems</li> </ul>	Studies only
<b>3</b>	Municipal Sewerage and Water Systems Act	233 (1955)	<ul style="list-style-type: none"> <li>• Incorporate an Authority</li> <li>• Sewage disposal system includes storm sewers</li> </ul>	Intended for water and wastewater services
<b>4</b>	County Public Improvement Act	342 (1939)	<ul style="list-style-type: none"> <li>• County Board resolution and/or contracts with any unit of government</li> <li>• Sewers include storm water</li> </ul>	Difficult to start storm water limited to
<b>5</b>	County Department and Board of Public Works	185 (1957)	<ul style="list-style-type: none"> <li>• County Board action and contract with local government units</li> <li>• Sewers include storm water</li> </ul>	Difficult to start if limited to storm water
<b>6</b>	Voluntary Cooperation or Agreements	None	<ul style="list-style-type: none"> <li>• Attitude of trust and agree to work together</li> </ul>	Requires trust and individual accountability

Option 4: County Public Improvement Act (PA 342, 1939)

A County Board of Commissioners can use this act to authorize and provide water, sewer, sewage disposal, and garbage collection and disposal services. As defined in the Act, sewers can include storm sewers to transport and collect storm water. The County Board resolution must designate the county agency to supervise, control, manage, and operate the improvements, and facilities and to provide services. The County agencies eligible for designation include the County Road Commission, the Drain Commissioner, or the Board of Public Works. Services of the County Agency can be provided by contract with any other unit of local government.

The County Agency designated by the County Board is responsible to establish just, equitable, and uniform rates, charges, or assessments to be paid for the services provided. Any contracting unit of government may use the following methods of raising funds to pay for services:

- 1) Annual property tax levy
- 2) Special assessments on property
- 3) Rates or charges to service users
- 4) Tax revenue from the state
- 5) Other funds, which may validly be used for the contracted purpose

This method is currently being used in Genesee County to prepare a watershed permit for the county, except for the City of Flint, which is covered by a Phase I permit.

**LOWER FLINT RIVER WATERSHED**

**However, this group is moving forward with implementation plans under Act 342 (Option #4). All the communities within the Lower Flint River Watershed have signed contracts with the Genesee County Drain Commissioner's Office. All the school districts within Genesee County also have signed contracts to be nested jurisdiction under their communities Certificate of Coverage.**



## SECTION 11 - REFERENCES

Bemish, K. "Development of management guidelines for new and existing septic systems in Washtenaw County, Michigan using a Geographic Information System." Diss. University of Michigan, Ann Arbor, Michigan. pp 14-19. 2001.

Brenner, A.T., Brush, L.A., Martin, J.S., Olsson, K.Y., Rentschler, P.E., and Wolf, J.K., 1999. The Huron River Watershed Council: grassroots organization for holistic watershed management. *Watershed Science Technology*, 39 (12), 331-337.

Brown, E., A. Peterson, R. Kline-Robach, K. Smith, and L. Wolfson. Developing a Watershed Management Plan for Water Quality: An Introductory Guide. February 2000.

Cave, K., T. Quarsebarth, and E. Harold. "Selection of storm water pollutant loading factors." Rouge River National Wet Weather Demonstration Project Technical Memorandum RPO-MOD-TM34.00. Detroit, Michigan. 1994.

Center for Watershed Protection. "On Watershed Education, Watershed Protection Techniques." Article 127. 3(3): 671-679.

Center for Watershed Protection. "Understanding Watershed Behavior, Watershed Protection Techniques." Article 126,3(3): 671-679.

Center of Watershed Protection. Rapid Watershed Planning Handbook - A Comprehensive Guide for Managing Urbanizing Watersheds. October 1998.

Comer, P.J., et al. Michigan's pre-settlement vegetation as interpreted for the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory. Lansing, Michigan. Digital Map. 1995.

Crowe, C. 1945. *The City of Flint grows up; the success of an American community*. Harper and Brothers Publishers, New York, New York.

Cwikiel, Wilfred. *Michigan Wetlands – Yours to Protect: A Citizen's Guide to Wetland Protection* (Third Edition) 2003. Tip of the Mitt Watershed Council, Petoskey, MI 49770.

Delhi Charter Township. "Delhi Charter Township Wellhead Protection Plan." June 1999.

Ellis, F. 1879. *History of Genesee County, Michigan, with illustrations and biographical sketches of its prominent men and pioneers*. Everts and Abbott Press, Philadelphia, Pennsylvania.

Goforth, Reuben R. "In Search of Native Clams in the Grand and St. Joseph Rivers." Excerpt from *State of the Great Lakes, Annual Report for 2000*. MDEQ. pp 21-27. March 2001.

Great Lakes Commission. "Assessment of the Lake Michigan Monitoring Inventory; A Report on the Lake Michigan Tributary Monitoring Project." August 2000.

Hartig, John H., Gail Krantzberg, Lisa Maynard, and Michael A. Zarull. Sediment Remediation Can Improve Great Lakes Water Quality. Water Environment Association. pp.12-13. October 1999.

HNTB Team. "Proposal for Regional Growth, Choices for the Future Action Plan." Tri-County Regional Planning Commission.

Huron Pines Resource Conservation and Development Area Council, Inc. Clean Water by Design, Great Lakes Better Backroads Guidebook. Grayling, Michigan. May 1998.

Ingham County Drain Commissioner. "Willow Creek: An Application of Soil Bioengineering." Ingham County Drain Commissioner, DEQ. December 18, 1996.

Jackson County. 2002. Jackson County Web Site, <http://www.co.jackson.mi.us/trailway.asp>.

Lower One Subwatershed Advisory Group (Canton Community, Plymouth Township, Salem Township, Superior Township, Van Buren Township, Ypsilanti Township, Washtenaw County, Wayne County). "Lower One Rouge River Subwatershed Management Plan." April 2001.

MDEQ. Clean Water Act Section 303(d) List. Michigan Submittal for Year 2000, SWQ-00-018. May 2000.

MDEQ. Office of the Great Lakes. State of the Great Lakes: 2000 Annual Report. March 2001.

MDEQ. "Michigan's Watershed-Based MS4 Voluntary General Permit Draft Guidance." September 1997.

MDEQ. Checklist for an Approved Watershed Management Plan. May 1999.

MDEQ, SWQD. Administrative Rules Part 4. Water Quality Standards of the 1994 PA 451 Part 31. April 2, 1999.

MDEQ, SWQD. Guidebook of Best Management Practices for Michigan Watersheds. October 1998.

Michigan Department of Environmental Quality. "Statewide Ground Water Database". Provided: November 2004.

Michigan Department of Environmental Quality. "Developing a Watershed Management Plan for Water Quality: An Introductory Guide." 2000.

Michigan Department of Environmental Quality – Michigan Water Use Reporting Program. "2002 Self-Supplied Industrial Facilities in Michigan".

Michigan Department of Environmental Quality – Michigan Water Use Reporting Program. “2002 Water Withdrawals for Community Public Water Supply Systems in Michigan”.

Michigan Department of Environmental Quality – Michigan Water Use Reporting Program. “2001 Estimated Water Withdrawals for Agricultural Irrigation in Michigan”.

Michigan Department of Environmental Quality – Water Division. “Water Quality and Pollution Control in Michigan: 2004 Sections 303(d) and 305(b) Integrated Report”. May 2004.

Michigan Department of Community Health. Michigan 2001 Fish Advisory. 2001.

Michigan Department of Management & Budget, Soil Erosion & Sedimentation Control Manual, 2002

Michigan Department of Natural Resources, Flint River Assessment, 2001

Michigan Economic Development Corporation.

Via: [travel.michigan.org/attachments/G13104/Metro\\_Beach09.jpg](http://travel.michigan.org/attachments/G13104/Metro_Beach09.jpg). Last accessed: January 13<sup>th</sup>, 2005.

Michigan Geographic Data Library Web Site, <http://www.michigan.gov/cgi/0,1607,7-158-12693---,00.html>

Michigan State Section American Water Resources Association, Defining Watershed Management in Michigan: Proceedings of the Second Annual Conference of the Michigan Section American Water Resources Association, pp. 45-49. *Edited by Ditschman, E.P.*, Ann Arbor, MI

Michigan Water Resources Commission. Water Resource Conditions and Uses. Lansing, Michigan. 1961.

Michigan State University Institute of Water Resources, MSU Extension, and MDEQ. Nonpoint Source Program, Developing a Watershed Management Plan for Water Quality: An Introductory Guide. February 2000.

Michigan State University Extension, Water Quality Area of Expertise. Protecting Inland Lakes, An Intensive Training Program for Lakeside Residents, Programmer’s Guide. 1999.

Mill Creek Subwatershed Stakeholder Advisory Group, Mill Creek Subwatershed Management Plan, September 2003

North Carolina State University. “Picture of boy drinking water” via <http://www2.ncsu.edu/ncsu/CIL/WRRI/annual/0203SDWA.html>. Last accessed: December 15<sup>th</sup>, 2004.

Richards, P.L. “Agricultural tile drainage in southeast Michigan: extent, impact, and simulation in hydrological models.” Unpublished manuscript. pp1-10. 1999.

Richards, P.L., and A. Brenner. "Potential Contributing Source Areas for Runoff in Glacial Landscapes: Delineation and Modeling with Implications for Urbanization." *Water Resource Research*. 2001.

River Network web site (<http://www.rivernetwork.org/> )

Simpson, Jonathan. Milwaukee Survey Used to Design Pollution Prevention Program, *Watershed Protection Techniques*. Article 138. 1(3): 133-134.

Soil Conservation Service. "Urban Hydrology for Small Watersheds." Technical Release No. 55, pp. 1-1 to 3-9. 1975.

Sorrell, R.C. Computing flood discharges for small ungaged watersheds. MDEQ, Land and Water Management Division. Lansing, Michigan. pp. 1-29. 2001.

Southeastern Wisconsin Regional Planning Commission, Cost of Urban Nonpoint Source Water Pollution Control Measures, June 1991

Spitzley, Christine. "The Road Less Traveled: Understanding and Addressing Groundwater Risks, Wellhead Protection as a Risk Reduction Tool." Tri-County Regional Planning Commission. pp. 244-246. 1999.

State of Michigan. "Michigan Administrative Code." Part 4. Last Revised: April 2, 1999.

United States Department of Agriculture, Natural Resource Conservation Service of Michigan. Water Erosion Prediction and Control, Technical Guide. Lansing, Michigan. pp 1-13. 1995.

United States Department of Agriculture NRCS. Conservation practice standards field office technical guide, Section IV, Vol. I. Lansing, Michigan. 2001.

United States Department of Agriculture Soil Conservation Service, Soil Survey for Genesee County, Michigan, 1972

USDA Soil Conservation Service. Survey report for major and local drainage Portage River Michigan. 35 pp. 1958.

USDA NRCS. 2001. Michigan conservation practice standards field office guide, Section IV, Vol. I. Lansing, Michigan.

U.S. EPA web site ([www.epa.gov/owow/tmdl/intro.html](http://www.epa.gov/owow/tmdl/intro.html)).

USEPA web site (<http://it.tetrattech-ffx.com/stepl/>), 2004

USEPA web site (<http://www.epa.gov/superfund/sites/>), 2004

USGS web site (<http://mi.water.usgs.gov/stations.php>). 2004

Wiley, M.J., P.W. Seelbach, and S.P. Bowler. "Ecological Targets for Rehabilitation of the Rouge River." Final Report to the Rouge River Wet Weather Demonstration Project

Office. School of Natural Resources and Environment, University of Michigan. Ann Arbor, Michigan. 1998.

Wischmeier, W.H. and D.D. Smith. Predicting Rainfall-Erosion Losses from Cropland East of the Rocky Mountains. USDA Agriculture Handbook No. 282. 1965.

Wischmeier, W.H. and D.D. Smith. Predicting Rainfall-Erosion Losses – A Guide to Conservation Planning. USDA Agriculture Handbook No. 537. 1978

Yorn, M. Septic Tank Density and Groundwater Contamination, Ground Water 23. pp. 586-591. 1985.

Zorn, T.G., P.W. Seelbach, and M.J. Wiley. Patterns in the Distributions of Stream Fishes in Michigan's Lower Peninsula. Michigan Department of Natural Resources, Fisheries Research. Report No. 2035. Ann Arbor, Michigan. 1998.

Zorn, T.G., P.W. Seelbach, and M.J. Wiley. "Distributions of Stream Fishes and their Relationship to Stream Size and Hydrology in Michigan's Lower Peninsula." Transactions of the American Fisheries Society. 131:70-85. 2002.

USDA Soil Conservation Service. Survey report for major and local drainage Portage River Michigan. 35 pp. 1958.

USDA NRCS. 2001. Michigan conservation practice standards field office guide, Section IV, Vol. I. Lansing, Michigan.

DAS Manufacturing. "Curb marker graphic." via <http://www.dasmanufacturing.com/storm/>. Last accessed February 28, 2005

Hamilton, City of, Ontario, Canada. "Street sweeping photo." via <http://hamilton.ca/public-works/Fleet-And-Facilities/Fleet-Services/default.asp>. Last accessed May 23, 2005.

Ingham Conservation District (ICD). "Row boat photo." via <http://www.inghamconservation.com>. Last accessed February 28, 2005.

Kent State University (KSU). "River clean-up photo." via <http://www.kent.edu/images/river.jpg>. Last accessed May 23, 2005

Lansing Oar and Paddle Club (LOAPC). "Canoeing photo." via <http://www.loapc.com>. Last accessed February 28, 2005

Michigan Department of Environmental Quality Water Division. "Developing a Watershed Management Plan for Water Quality: An Introductory Guide." 2000.

Michigan Waterfowl. "Wetland habitat photo." via <http://www.michiganwaterfowl.com>. Last accessed February 28, 2005.

National Oceanic and Atmospheric Association (NOAA). "Site plan illustration" via <http://www.csc.noaa.gov/alternatives/conservestatic.html>. Last accessed May 24, 2005.

North Carolina State University (NCSU). "Picture of boy drinking water." via <http://www2.ncsu.edu/ncsu/CIL/WRRI/annual/0203SDWA.html>. Last accessed December 15, 2004.

State of Michigan. "Michigan Administrative Code." Part 4. Last Revised: April 2, 1999

United States Environmental Protection Agency (US-EPA). "Storm Water Phase II Final Rule Fact Sheet Series." Publication 833-F00-005. January 2000.

United States Environmental Protection Agency (US-EPA). "Smart growth definition." via [http://www.epa.gov/smartgrowth/about\\_sg.htm](http://www.epa.gov/smartgrowth/about_sg.htm). Last accessed May 25, 2005.