Honey Creek
Watershed Action Plan

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Honey Creek Watershed Action Plan Endorsement

The Sandusky River Watershed Coalition would like to recognize the involvement and support of the numerous organizations and individuals who have taken part in the development of this community-based watershed action plan.

We, the undersigned, support and agree to pursue implementation of this Watershed Action Plan and agree to seek the necessary resources to improve the over all water quality in the Honey Creek and Sandusky River Watersheds.

Crawford Co. Commissioners	Crawford Co. Engineer	Crawford Co. Farm Bureau
Crawford Co. Farm Service Agency	Crawford Co Health Dept.	Crawford Co. Natural Resources Conserv. Service
Crawford Co. OSU Extension	Crawford Co. Regional Planning Comm.	Crawford Co. Soil & Water Cons. Dist.
Huron Co. Commissioners	Huron Co. Engineer	Huron Co. Farm Bureau
Huron Co. Farm Service Agency	Huron Co Health Dept.	Huron Co. Natural Resources Conserv. Service
Huron Co. OSU Extension	Huron Co. Regional Planning Comm.	Huron Co. Soil & Water Cons. Dist.

Seneca Co. Commissioners	Seneca Co. Engineer	Seneca Co. Farm Bureau
Seneca Co. Farm Service Agency	Seneca Co Health Dept.	Seneca Co. Natural Resources Conserv. Service
Seneca Co. OSU Extension	Seneca Co. Regional Planning Comm.	Seneca Co. Soil & Water Cons. Dist.
Wyandot Co. Commissioners	Wyandot Co. Engineer	Wyandot Co. Farm Bureau
Wyandot Co. Farm Service Agency	Wyandot Co Health Dept.	Wyandot Co. Natural Resources Conserv. Service
Wyandot Co. OSU Extension	Wyandot Co. Regional Planning Comm.	Wyandot Co. Soil & Water Cons. Dist.
Ohio Department of Natural Resources	Ohio Environmental Protection Agency	Sandusky River Watershed Coalition
Heidelberg College Water Quality Laboratory		

Preface

The development of the Honey Creek Watershed Action Plan began in January 2004 with funding from the Lake Erie Protection Fund. The National Center for Water Quality Research (NCWQR), whom received the funding, began the effort with a series of public meetings in Attica. The input from these meetings along with TMDL data, NCWQR data, and the guidance of the Steering Committee and other watershed partners helped provide a framework for the development of the watershed plan.

The plan was initially released for public comment in March 2005, after a lengthy writing period. The plan was then submitted to Ohio Department of Natural Resources and Ohio Environmental Protection Agency for review and endorsement. On June 2, 2005, a letter was received from the State of Ohio providing feedback on the plan and requesting revisions prior to endorsement.

Over the next 7 months the Coalition worked to address the comments provided by state reviewers. On February 6, 2006, the Steering Committee of the Coalition approved the release of the revised plan to a short public comment period. Upon completion of that period, February 24, 2006, the plan was again submitted to the State of Ohio for review and endorsement.

During the period between the initial submission and the second submission of the plan, the Coalition and its partners began work on implementation projects within the watershed. These projects, including ongoing programs, new initiatives, and applications still awaiting a decision, are outlined below:

Lead Organization	Start Date	Project Description
Northern Ohio Educational Computer Association	Winter 2006	Water quality monitoring and teleconference project with watershed high school students.
Sandusky River Watershed Coalition	Fall 2005	Agricultural Environmental Self-Assessment Workshops.
Sandusky River Watershed Coalition	Fall 2004	Home Sewage Treatment System Replacement Program
Seneca Soil and Water Conservation District	Spring 2005	Sediment Reduction in the Honey Creek Watershed through Agricultural BMP's
Seneca Soil and Water Conservation District	Spring 2006	Nitrate Reduction in the Honey Creek Watershed. Project would target the water supply for the Village of Attica.
National Center for Water Quality Research, Heidelberg College	Sandusky River Watershed Symposium, June 27-28, 2006	A two day symposium is planned to cover recent nonpoint impact assessments, controls and research needs.

The Coalition and its partners will continue to implement projects as the planning process moves toward an endorsed plan. Meanwhile, the Coalition has also begun planning efforts in the Sandusky River-Tiffin and Broken Sword Creek watersheds. Initial submission of these plans for endorsement is expected in the Summer of 2006.

Chris Riddle, Coordinator, Sandusky River Watershed Coalition

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BMP	Best Management Practice
CMZ	Corridor Management Zone
CNPCP	Coastal Nonpoint Pollution Control Program
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act
EMZ	Emergency Management Zone
EWH	Exceptional Warmwater Habitat
FSA	Farm Service Agency
GIS	Geographic Information System
HSG	Hydrological Soil Group
HUC	Hydrological Unit Code
IBI	Index of Biological Integrity
ICI	Invertebrate Community Index
LaMP	Lakewide Management Plan
LEQI	Lake Erie Quality Index
LRW	Limited Resource Water
MIwb	Modified Index of Well Being
MWH	Modified Warmwater Habitat
NASS	National Agricultural Statistics Service
NPS	Nonpoint Source
NOAA	National Oceanic and Atmospheric Administration
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PDWS	Public Drinking Water Supply
QHEI	Qualitative Habitat Evaluation Index
RIMP	Resource Inventory and Management Plan (Sandusky Watershed)
RM	River Mile
SDWA	Safe Drinking Water Act
SRW	Sandusky River Watershed
SWAP	Source Water Assessment Program
SWPP	Source Water Protection Plan
TMDL	Total Maximum Daily Load
TSD	Technical Support Document (from OEPA to support TMDL studies)
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAP	Watershed Action Plan
WQL	Water Quality Laboratory
WRP	Wetlands Reserve Program
WWH	Warmwater Habitat

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Partial funding for development of this Honey Creek Watershed Action Plan was provided by a Lake Erie Protection Fund Small Grant Award – SG 230-04 to the Heidelberg College Water Quality Laboratory, Dr. Timothy T. Loftus, Project Director and Dr. David B. Baker, Project Associate. Additional funding was provided by the Water Quality Laboratory. We are grateful for the contributions generously provided by Mr. Christopher Riddle, Sandusky River Watershed Coalition, Watershed Coordinator, and Mr. John Crumrine, USDA NRCS District Conservationist for Seneca County (retired). Mr. Jack Kramer, Heidelberg College WQL, assisted with preparation of maps. Additionally, we wish to acknowledge the support of the Seneca County and Crawford County Soil and Water Conservation Districts. We also thank the Coalition's Steering Committee for having confidence in us to lead this effort. Finally, this WAP would not be possible without the input and support of numerous residents, farmers, and other stakeholders engaged in the stewardship of Honey Creek's natural resources.

Honey Creek
Watershed Action Plan

Executive Summary

Watershed action plans guide land-use and other implementation strategies that are designed to produce water quality improvements in accord with a water quality goal common throughout Ohio: a statewide average watershed assessment score of 80 by the year 2010. The Sandusky River Watershed Coalition has prepared the Honey Creek Watershed Action Plan (WAP) to mitigate identified causes and sources of water quality impairment through voluntary adoption and implementation of best management practices (BMPs).

The Clean Water Act and US Environmental Protection Agency regulations for protecting public health require that a Total Maximum Daily Load (TMDL) be developed for any waters found to be impaired for their designated use(s). Such waters are placed on the Section 303(d) list of impaired waterbodies in the US. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. In essence, a TMDL offers a quantitative approach for developing a restoration strategy for watersheds that fail to meet full attainment of biological and chemical water quality standards (WQS). The goal of a TMDL, therefore, is full attainment of WQS and ultimately, removal of waterbodies from the Section 303(d) list.

The Honey Creek WAP is based on the findings and recommendations of the "Total Maximum Daily Loads for the Upper Sandusky River Watershed" report that was developed by the Ohio Environmental Protection Agency, Division of Surface Water and released in "Final Report" form on August 10, 2004. This TMDL Report addresses the results from a detailed assessment conducted by Ohio EPA in 2001 of chemical, physical, and biological conditions in order to determine if streams and rivers in the Upper Sandusky study area were attaining their designated uses. Results of the 2001 field study are reported in the "Biological and Water Quality Study of the Sandusky River and Selected Tributaries" published in 2003.

The first three chapters of the Honey Creek WAP provide introductory and background information on a variety of fundamental concepts. Chapter 1 introduces several aspects that concern "watershed management". Chapter 2 discusses federal, state, and regional policies that serve as a context for the multiple water resource issues that are relevant to the citizenry of Honey Creek and for highlighting the importance of implementing watershed management. Chapter 3 offers an inventory of physical and social resources found throughout Honey Creek.

Chapters 4 and 5 bring focus to several important water resource concepts including "Designated Uses" and "Use Attainment". Designated uses that are relevant to Honey Creek include Aquatic Life Support, Public Drinking Water Supply, and Primary Contact Recreation. Parts of the Honey Creek Watershed are in full aquatic life support use attainment. Other parts of the watershed are either in partial or non-attainment. Thus, the overall watershed assessment score based upon the aquatic life support designated use is 64 out of 100. As a result, the Honey Creek Watershed is deemed impaired for the aquatic life support use designation.

The method that Ohio EPA will use to evaluate attainment of recreation uses is currently under development. Available data, however, show that Honey Creek is presently not considered impaired for recreational use. Ohio EPA is also developing an assessment methodology for the public drinking water supply use designation. This methodology will eventually be relevant as the surface water of Honey Creek feeds two public water supplies lying within the watershed, Attica and New Washington, and also contributes to the source water of two city supplies located downstream of Honey Creek's confluence with the Sandusky River: Tiffin and Fremont.

Causes of water quality impairment, identified by the Ohio EPA and addressed in Chapter 5, include:

1. habitat and flow alteration
2. sedimentation
3. phosphorus
4. organic enrichment and low dissolved oxygen
5. ammonia
6. nitrate
7. pathogens
8. contaminated sediment
9. sport fish consumption advisories

The Honey Creek WAP offers a strategy for meeting TMDLs developed for phosphorus reductions, aquatic life habitat improvements, and sedimentation reduction. Chapter 5, "Plan for watershed restoration activities," frames the implementation strategy around two problems:

Problem 1. High rates of sediment and nutrient export that impact downstream receiving waters including Sandusky Bay and Lake Erie.

Problem 2. Impaired biological communities within the streams of the Honey Creek Watershed.

Problem 1. High rates of sediment and nutrient export: Goals and Strategies.

Relative to Problem 1, the Upper Sandusky TMDL set the following goals for phosphorus export reductions:

1. point sources – 65% reduction (986 kg/yr or 2,174 lbs/yr reduction)
2. nonpoint sources – 25% reduction (14326 kg/yr or 31,589 lbs/yr reduction)
3. nonpoint source with margin of safety – 29% reduction (16,717 kg/yr or 36,326 lbs/yr)

Strategies for reducing phosphorus will also address the need for reducing erosion and sediment export from the watershed. These strategies for reducing phosphorus and sediment export are achievable through adoption and implementation of Best Management Practices (BMPs) listed below. Estimates of phosphorus reductions are based on a variety of sources such as the Lake Erie Phosphorus Reduction Program, the

Lake Erie Conservation Reserve Enhancement Program (CREP), and best professional judgment. BMPs that address nonpoint source pollution are categorized as cropland or streamside and include:

CROPLAND BMPs -

1. residue management
2. cover and green manure crops
3. field border establishment
4. conservation crop rotation
5. nutrient management
6. waste (manure) management
7. water and sediment control basins

STREAMSIDE BMPs -

1. increase establishment of filter strips
2. increase establishment of riparian forest buffers
3. wetland restoration
4. restrict livestock access to streams

Opportunities for targeting within the nonpoint source phosphorus reduction portion of the WAP are limited because the bulk of the reduction needed to meet the total phosphorus load reduction TMDL will come from increasing the application of conservation tillage from a current level of 55% to 80% use of conservation tillage on cropland. Since a preponderance of the soils in the watershed are categorized in hydrologic soil groups C and D (both of these soil groups have slow infiltration rates and are subject to surface runoff), it follows that most of the cropland contributes to surface runoff with attendant sediment and phosphorus pollution. A limited amount of targeting is possible based on local knowledge of "problem fields". Farmers indicated at public meetings, however, that they were already addressing such fields because it was in their best interest to do so. Lastly, point source phosphorus pollution controls will focus on the three wastewater treatment plants within the watershed.

Problem 2. Impaired biological communities within the streams of the Honey Creek Watershed: Goals and Strategies

Goals for addressing Problem 2 center on addressing elevated phosphorus concentrations, degraded aquatic habitat conditions, and altered stream flow regimes. The Coalition supports efforts to improve the watershed score to at least 80 out of 100 by 2010 **(Priority 1)**. The Coalition also supports the longer term goal of having all streams meet their aquatic life support use designation **(Priority 2)**.

Priority 1. The first priority is to bring all stations with drainage areas greater than 50 mi^2 into full compliance with aquatic life standards for their aquatic life use designations. Currently, three stations in this size range fail to meet the WWH criteria. These are stations 4, 5 and 6 along the main stem of Honey Creek. When these stations are brought into full compliance, the watershed score for Honey Creek will increase to 86.3 and thus meet the 2010 OEPA target of 80.

Specific strategies for meeting Priority 1 goals include:

CROPLAND BMPs
1. As listed above, but targeted to the cropland areas north of the Priority 1 stream reaches that drain areas of terminal moraines located along the northern boundary of the watershed. This should improve sediment scores in the affected stream reaches.

STREAMSIDE BMPs
1. As listed above, but targeted to the Priority 1 stream reaches that drain areas of terminal moraines located along the northern boundary of the watershed.

INSTREAM BMPs
1. reconnecting streams with floodplains
2. selective logjam removal
3. natural channel design (demonstration project)

OTHER MEASURES
1. controlled drainage (demonstration project)

POINT SOURCE CONTROLS
1. as listed above

Priority 2. The second and longer-term priority will be to bring all headwater streams within the watershed into compliance with their designated uses. At present, 9 of 13 stream segments with drainage areas less that 20 mi^2 (headwater streams) fail to meet designated uses.

Specific strategies for meeting Priority 2 goals include:

CROPLAND BMPs
1. as listed above, but targeted in headwater stream areas throughout the watershed

STREAMSIDE BMPs
1. as listed above, but targeted to headwater streams throughout the watershed

INSTREAM BMPs
1. as listed above
2. two-stage ditch construction where feasible (demonstration project)
3. maintenance of naturally occurring two-stage ditches as opposed to traditional ditch maintenance

The Honey Creek WAP introduces Problem 3: Elevated nitrate and herbicide concentrations in public water supplies. OEPA is currently developing an assessment method for Public Drinking Water Supply (PDWS) beneficial use attainment. Until this methodology is finalized, Honey Creek Watershed's PDWS use attainment cannot be assessed nor can strategies be devised. The WAP provides some background on this topic as a proactive measure of

information delivery, anticipating that these public drinking water supply issues will emerge in the near future.

Successful implementation of the Honey Creek WAP will require above all else, willing landowners. Furthermore, an additional staff person will be required for outreach and educational efforts directed towards the agricultural community and in support of Coalition efforts to implement the WAP and achieve water quality goals.

The Honey Creek WAP closes with Chapter six, Monitoring and Evaluation, and recommends evaluation activities to include:

1. Chemical Water Quality Monitoring
2. Biological Water Quality Monitoring
3. Tracking BMP adoption and implementation

CHAPTER 1
INTRODUCTION

The Honey Creek Watershed

Honey Creek, a major tributary of the Sandusky River, drains 179.8 square miles of land area in North Central Ohio. This land area represents the Honey Creek Watershed. The location of the Honey Creek Watershed within the Sandusky River Basin and Ohio is shown in Map 1. Map 1 also shows Honey Creek and its tributaries; federal, state, county, township and village roads; and the major villages. A detailed inventory of the Honey Creek Watershed is presented in Chapter 3.

What is a watershed?

A watershed is most often topographically defined and includes an area of land that contributes surface runoff to a single and common point along a river; often its mouth. The outlet for a watershed can be another river, lake, wetland, or the ocean. Watersheds are variable in size and can range from a small area within one's back yard to that of the Mississippi-Atchafalaya River Basin, the largest river basin in North America, draining an area of 3.2 million square kilometers, or about 41% of the lower 48 United States. Thus, watersheds at the smallest scale are typically nested hierarchically within larger watersheds.

The Honey Creek Watershed map (Map 1) illustrates this concept for Honey Creek as it is shown nested within the larger Sandusky Basin. The Sandusky Basin lies within the still larger Lake Erie basin incorporating parts of five states and the Canadian Province of Ontario. Honey Creek can also be subdivided into smaller subwatersheds. Map 1 illustrates this later concept by differentiating between the six Hydrologic Unit Code – 14 (HUC – 14) subwatersheds that collectively comprise the Honey Creek Watershed. The Honey Creek Watershed is an eleven digit Hydrological Unit. Its eleven digit code is Hydrological Unit Code (HUC) 04100011-080. The additional 3 units that denote the 14-digit watersheds are shown in the legend of Map 1 and in subsequent data tables.

What is watershed management?

Watershed management is an adaptive process of collaborative decision-making that is typically driven from either the bottom up, by local concern for the sustainable use of a highly valued natural resource, and/or from the top down, by federal and state laws that are designed to safeguard a resource. Watershed management can be comprehensive in scope, but at a minimum seeks to maintain or restore the chemical, biological, and physical integrity of water resources while safeguarding the economic good of the local communities involved. This socio-political process is concerned with matters of water quality and water quantity and the impact of both on public health and well being.

The watershed provides a planner with a convenient unit of study, an appropriate physical context for implementing land use planning and ecosystem management, and is necessary for understanding the relationships between natural and manmade phenomena

and water quality. The watershed as a planning and management unit is also beneficial to promoting inter-agency coordination and data availability. The watershed can serve to focus alignment of policies and strategies for surface and groundwater resources management. The alignment of state water resource programs by watershed and need for both intra- and interagency cooperation, have been identified as an issue of strategic importance. Thus, achieving environmental objectives regarding Ohio's surface and groundwater requires addressing the strategic need for watershed management.

What is a watershed action plan?

A watershed action plan (WAP) provides for an accounting of natural resource management objectives, including problems and concerns, and activities that watershed residents will pursue to address their objectives. A WAP is the product of a dynamic process of engagement by the watershed citizenry and other interested parties and serves as a guide for the local implementation of conservation efforts (i.e. watershed management). Figure 1.1 illustrates "Implementing the Watershed Approach" as adopted by the Ohio Environmental Protection Agency (OEPA, 1997).

Purpose of the Honey Creek Watershed Action Plan

The general purpose behind development and implementation of a WAP is to achieve environmental objectives, including public health, regarding Ohio's surface and ground water resources. Watershed action plans guide implementation strategies that are designed to produce water quality improvements in accord with the common water quality goal: a statewide average watershed assessment score of 80 by the year 2010. Since each watershed is unique, a WAP that is specific to an individual watershed is necessary for achieving local goals and objectives. Local participation and approval are also necessary in order to fully account for the local nature of issues and for both the planning process and resulting WAP to possess legitimacy among the watershed residents.

The Honey Creek WAP is based on the findings and recommendations of the "Total Maximum Daily Loads for the Upper Sandusky River Watershed" report that was developed by the Ohio EPA, Division of Surface Water, and released in "Final Report" form on August 10, 2004 (OEPA, 2004b). This TMDL report addresses the results from a detailed field assessment conducted by the Ohio EPA in 2001 of chemical, physical, and biological conditions in order to determine if streams and rivers in the Upper Sandusky study area were attaining their designated uses. Results of the 2001 field study are reported in the "Biological and Water Quality Study of the Sandusky River and Selected Tributaries" published in 2003 (OEPA. 2003).

Results from an earlier draft version of the TMDL were shared with the residents of Honey Creek at two public meetings held in February and March of 2004 (see Appendix). Concepts, findings, and preliminary recommendations, were also discussed at length over a series of monthly meetings conducted by the Sandusky River Watershed Coalition Steering Committee. This material was also the subject of other meetings conducted by the Coalition's Agriculture subcommittee and Stream Flow and Habitat subcommittee. Thus, ample time was spent engaging the public and other interested

parties on the substance and meaning of the TMDL. The Honey Creek WAP, therefore, reflects public input as well as what the local community deems to be an acceptable response including locally appropriate measures to address causes and sources of water quality impairments within the watershed.

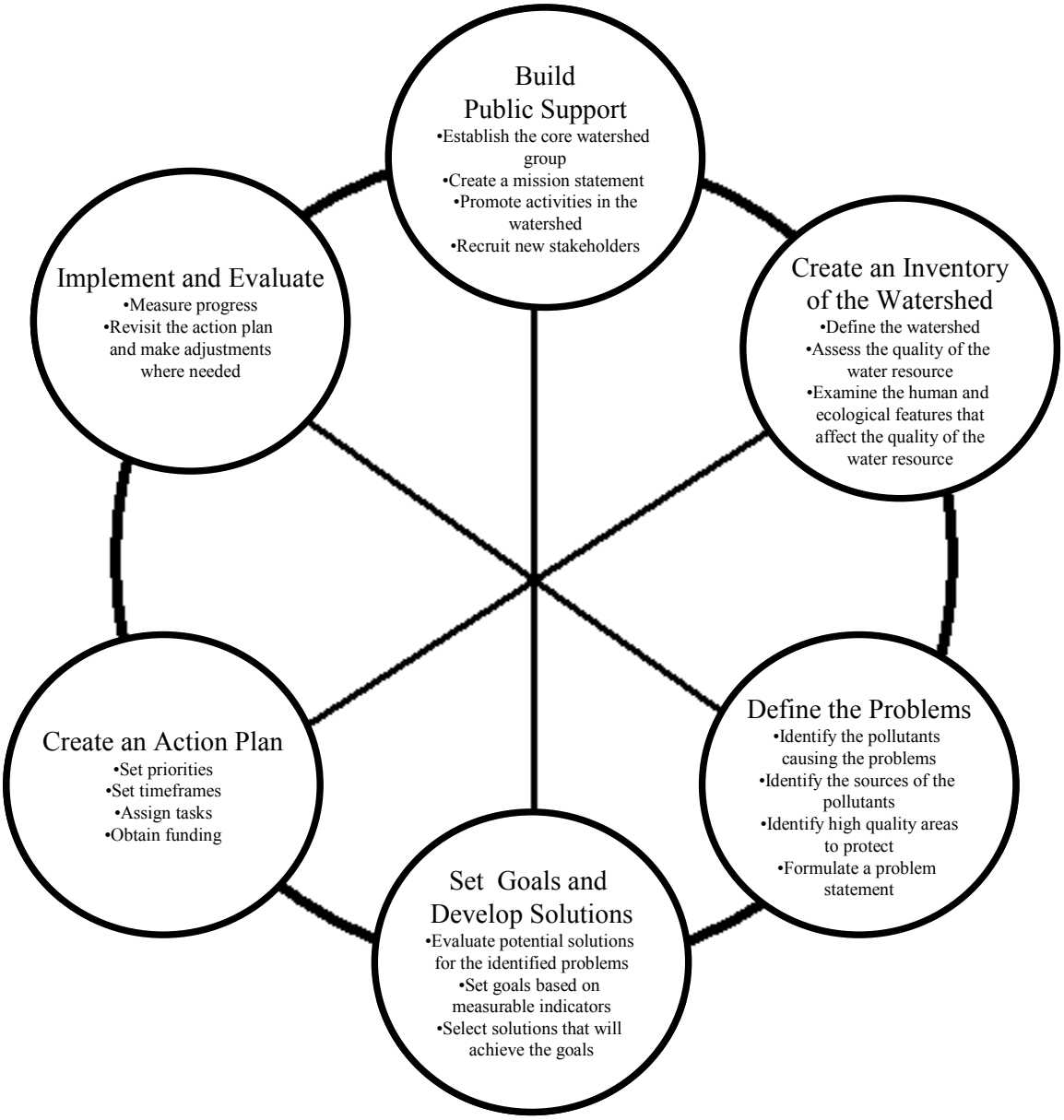

Figure 1.1 Implementing the Watershed Approach (OEPA, 1997)

Honey Creek Watershed Partners

At the outset of the Honey Creek Watershed planning process, the Sandusky River Watershed Coalition made a special request to forty-nine local agencies and organizations. Each entity received a letter and brochure requesting their support for the imminent development of a watershed action plan. The letters were followed up with phone calls in an attempt to reach each potential partner and allow for the opportunity to answer questions and consider comments. Of the organizations that rendered a decision on participation, two declined to participate in the process.

The following organizations have agreed to take part in the process as valuable local resources of information and experience. The Honey Creek Watershed Planning Partners are: Clinton Township Trustees (Sen. Co.), Crawford Co. Park District, Crawford Co. Commissioners, Crawford Co. Engineer, Crawford Co. Farm Bureau, Crawford Co. Health Department, Crawford Co. Soil & Water Conservation District, Mayor of New Washington, OSU Extension (Crawford and Wyandot Counties), Pheasants Forever, Seneca Co. Park District, Seneca Co. General Health District, Seneca Co. Soil & Water Conservation District, Upper Sandusky Chamber of Commerce, Wyandot Co Commissioners, Wyandot Co. Health Department, and Wyandot Co. Soil & Water Conservation District. The invitation for partnership remains open to those who have not yet formally agreed to support the planning process.

Regulated entities within the watershed, municipal wastewater treatment plants and public water suppliers, have been invited to participate in the watershed action planning process. The villages of New Washington and Attica have also produced source water assessment plans. These two public water suppliers and others attended a meeting in 2004, hosted by the Coalition and Ohio EPA, and were encouraged to develop source water protection plans with the potential for funding support from Section 319 grant money. To date, none of the public water suppliers have taken the initiative to develop a source water protection plan. Such plans may still be developed some day as either a component of the Honey Creek WAP or a complementary stand-alone document. In either event, the Coalition will continue to communicate with these regulated entities to take advantage of any opportunities for collaboration and strengthening partnerships.

Sandusky River Watershed Coalition

The Sandusky River Watershed Coalition, referred to hereafter as the Coalition, is a community-based organization that strives to promote local involvement in resource stewardship and development of watershed action plans as guidance for such stewardship. Founded in 1997, the Coalition is a venue through which a large number of local organizations, government agencies, and private citizens can coordinate activities and share information. A full time watershed coordinator was hired in 2001 to facilitate achievement of Coalition objectives. This staff was one of the first year recipients of the Ohio Department of Natural Resources' Watershed Coordinator Grants. Continued

support for the watershed coordinator's position depends on the ability of the Coalition to secure additional funding.

The Coalition is organized around a membership that includes both individuals and organizations. Membership dues are paid each year through either a cash donation or a time commitment. A complete list of members can be found in Table 1.1 or on the Coalition's website, www.sanduskyriver.org . From the membership, representatives are elected to two-year terms on a steering committee. The steering committee includes representatives from select counties within the watershed as well as at-large members. In addition, six subcommittees exist within the Coalition. These working groups each elect a chair every two years as well. The chair serves on the steering committee. Ex-officio members of the steering committee consist of government personnel who are not in a position to cast a vote and others who are included as seen fit by the steering committee. Monthly public meetings are held by the steering committee to guide Coalition activities. The Coalition is governed by a set of by-laws that are also available for review on the web at http://www.sanduskyriver.org/watershed/index.php?page=Committees/Steering+Committee/ . Scroll down to the bottom of this webpage and click on **By-Laws.doc**.

Table 1.1 Steering Committee of the Sandusky River Watershed Coalition

Seat	Election Year	Most Recent or Current Representative*
Crawford County	Odd Years	Don Fox, Bucyrus WTP
Erie County	Odd Years	Seat Vacant
Hardin/Marion County	Even Years	Seat Vacant
Sandusky County	Even Years	Joe Perry, Sandusky Co. SWCD
Seneca County	Even Years	James Bailey, Seneca Co. resident
Wyandot County	Odd Years	David Wolfe, Wyandot Dolomite
At-Large #1	Even Years	Jeff Hohman, Wyandot Co. SWCD
At-Large #2	Even Years	Jim Inglis, Pheasants Forever
At-Large #3	Odd Years	Dave Baker, Heidelberg College WQL
At-Large #4	Odd Years	John Crumrine, Seneca Co resident
Agriculture Committee	Odd Years	Tia Rice, Seneca Co. SWCD
Education Committee	Odd Years	Chris Monsour, Tiffin City Schools
Development Committee	Even Years	Bob Vargo, ODNR DNAP
Stream Flow & Habitat Committee	Even Years	Tim Loftus, Heidelberg College WQL
Wastewater Committee	Even Years	Kate Hanko, Crawford Co Health Dept.
Water Supply Committee	Odd Years	Stu Smith, Ground Water Science
Ex-officio	None specified	Multiple individuals

*Provided as general information on the diversity of the steering committee.

In February 2000, the Coalition published the *Sandusky River Watershed Resource Inventory*. Following the completion of this document, the Coalition developed and published a management plan. The management plan was merged with the inventory to produce the *Sandusky River Watershed Resource Inventory and Management Plan,* or RIMP. The RIMP focused on the entire 1,884 square mile Sandusky watershed, including the Sandusky Bay basin, and was distributed in November, 2001 after a series of meetings were strategically held throughout the entire Sandusky Basin. During this time of outreach, a concerted effort was made to engage the diversity of interests and other stakeholders to participate in the planning process and ultimate stewardship of Sandusky Basin resources.

The eleven-chapter RIMP provides a considerable amount of information for a large-scale watershed, but lacks the detail necessary for implementing specific measures focused on subwatersheds. The RIMP was also produced prior to an important update, Appendix 8 Update, to state guidance for developing local WAPs. To enable development of WAPs on a more localized scale, the Coalition began the process of subwatershed planning in 2003, focusing first on the Honey Creek and Broken Sword watersheds. This process received initial funding through a Lake Erie Protection Fund grant awarded to the Heidelberg College Water Quality Laboratory in January, 2004. Funding requests for additional planning efforts have been directed to both private foundations as well as government agencies since the awarding of the initial planning grant. The completion of each new WAP is dependent on both local acceptance and state endorsement. Furthermore, continued support for the watershed coordinator's position depends on the ability of the Coalition and its partners to secure additional funding that aims to fulfill the Coalition's mission.

Mission Statement: We are a diverse group of individuals and organizations that provides leadership for the conservation and enhancement of the Sandusky River Watershed and its natural resources through community-based planning, education, and action.

CHAPTER 2
POLICY ENVIRONMENT

Two significant federal acts of legislation are at the heart of multi-institutional efforts to implement a watershed approach for protecting or improving our nation's waters:

1) the Federal Water Pollution Control Act Amendments of 1972 (aka, the Clean Water Act; Public Law 92-500), and
2) the Safe Drinking Water Act of 1974 (Public Law 93-523).

Additionally, a third piece of legislation is significant for Honey Creek, all other assessment units within the Sandusky Basin, and other watersheds that lie within a coastal zone: the Coastal Zone Management Act, signed into law in 1972. All three federal laws have been amended at least once since their enactment in the 1970's. In communion with federal law, several state laws and programs are also relevant to watershed planning and will be addressed below along with regional and local initiatives that have some bearing on land use activities within Honey Creek.

Clean Water Act (CWA)

Programs of importance that are products of the CWA include the Total Maximum Daily Load (TMDL) program, Section 319 nonpoint source management programs, and a permit system called the National Pollutant Discharge Elimination System (NPDES) that includes the Storm Water Program to name just a few that have relevance to Honey Creek.

The TMDL program, section 303(d) of the CWA, is a regulatory mechanism for reducing both nonpoint source and point source pollution in watersheds throughout the country. A TMDL is essentially a pollutant budget for restoring impaired water bodies (e.g. streams, lakes) in order that they may fully attain their designated use(s). Regulations that the US Environmental Protection Agency (USEPA) set forth in 1985 and amended in 1992 remain in effect for the TMDL program.

The State of Ohio, much like all other states, is compelled by law to assess the quality of state waters relative to their designated use(s), identify waters that are impaired for one or more of their designated uses, and develop a TMDL for remedial action where appropriate. The "Total Maximum Daily Loads for the Upper Sandusky River – Final Report" is a product of this program, has been developed by the Ohio Environmental Protection Agency (OEPA), and has relevance to residents of Honey Creek. The Honey Creek WAP presented here intends to incorporate that data and present a strategy for addressing identified impairments. Additional details of the TMDL for Honey Creek are presented below.

When the CWA was reauthorized by the Water Quality Act of 1987, new emphasis was placed on the importance of controlling nonpoint sources of pollution. Section 319 of the CWA compels states to identify waters that are threatened by nonpoint sources of pollution and develop programs to reduce and eliminate this type of "poison runoff". The State of Ohio is updating their nonpoint source pollution program as discussed below.

Section 319 also serves as a significant source of federal funding, channeled through the states, for programs (e.g. BMP adoptions) that are designed to reduce nonpoint source pollution. There is reason to believe that a state-endorsed WAP will be a requirement for eligibility to this source of funding support. Pollution reduction strategies outlined in Chapter 5 should be designed in such a way as to facilitate the application for and approval of future Section 319 grants.

The NPDES Storm Water Program has been implemented in two phases. Phase II, whose Final Rule was published in the Federal Register on 8 December 1999 (64 FR 68722), expands the Phase I program by extending pollution control expectations to smaller municipal separate storm sewer systems (MS4s) and operators of small (i.e. 1-5 acres) construction sites. Cities including Tiffin, Bucyrus, and Fremont, all within the Sandusky Basin, are potentially designated MS4s under Phase II. Their final status should be determined by OEPA in 2005.

Expectations for pollution control center on implementation of programs and practices to control polluted storm water runoff through the use of NPDES permits. The Phase II program approach attempts, among other matters, to facilitate and promote watershed planning and to implement the storm water program on a watershed basis (USEPA, 2000). Storm water management, therefore, will play an increasing important role in both the planning and implementation of watershed action plans that aim to remediate impaired waterbodies.

Safe Drinking Water Act (SDWA)

The SDWA created a federal program to monitor and improve the safety of the nation's drinking water supply. The SDWA authorizes the USEPA to set and implement drinking water standards to protect against both naturally occurring and man-made contaminants in public drinking water. The roots of Ohio's Source Water Protection Plan, a program to assist public water suppliers with protecting their sources of drinking water (streams and aquifers) from contamination, can be traced back to the SDWA.

Ohio's Source Water Protection Program addresses public water systems only and features two phases. The first phase is an assessment phase that involves delineating the area in need of protection, identifying the potential contaminant sources in that area, and determining the susceptibility of the source(s) of drinking water. The Ohio EPA reports that this phase was better than 99% complete for Ohio's community public water systems by January 2004. The second phase, just getting underway, involves developing and implementing a local drinking water source protection plan. This second phase is to be led by the public water system owner/operator with assistance from others including local watershed groups. It makes sense for these source water protection plans to be integrated into watershed action plans as both strive to protect the vital water resources necessary for human health, ecosystem health, and a healthy economy.

In the Honey Creek watershed, both the Village of Attica and the Village of New Washington draw on surface water as a raw source of drinking water. Water quality criteria established in Ohio Administrative Code for a public water supply apply within 500 yards of an intake. Both the Village of New Washington and Village of Attica have each completed a drinking water source assessment and are now encouraged to develop local protection plans. Coalition efforts at developing a Honey Creek WAP will be of

great benefit to protection of drinking water sources and will work with both villages as appropriate to protect this critical water resource.

Coastal Zone Management Act (CZMA)

The Coastal Zone Management Act of 1972 (Public Law 92-583) established a voluntary national program within the Department of Commerce to encourage coastal states, including Ohio, to both develop and implement coastal zone management plans. This policy represents a unique federal-state partnership and was devised for purposes of conserving the high-value coastal zone resources for present and future generations.

As part of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), Congress created a stand-alone provision to recognize the impacts of nonpoint source pollution on coastal water quality. Named after its placement within these amendments, Section 6217 requires that states and territories with approved coastal management programs develop a Coastal Nonpoint Pollution Control Program (CNPCP). The Ohio CNPCP is administered by the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation.

The CNPCP must be submitted to USEPA and the National Oceanic and Atmospheric Administration (NOAA) for approval and be implemented through changes to both the existing state coastal management program and the new nonpoint source management program that stems from Section 319 of the CWA. Within these state programs, management measures must be specified for restoring and protecting coastal waters from specific categories of nonpoint source pollution.

Management measures are defined in Section 6217 of the CZARA as "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives." Watershed action plans developed for the Ohio Lake Erie Basin, such as presented here for Honey Creek, must describe how the relevant management measures of the Ohio CNPCP will be implemented within the specific watershed if a watershed inventory or identified water quality impairments indicate applicability. Management measures must also be addressed in order for the State of Ohio to gain approval for its Coastal Nonpoint Source Pollution Control Program. Details regarding the relevant management measures are offered below in Chapter 5 – Implementation Plan for Improving Water Quality.

Ohio Nonpoint Source Management Plan

The State of Ohio is near completion of a new Nonpoint Source (NPS) Management Plan 2005 – 2010 for submission to the USEPA. The last comprehensive Ohio NPS Management Plan approved by the USEPA was produced in 1988 and guided by the CWA Amendments of 1987. Updates to this earlier plan were developed and appended in 1993 and 1998.

Over the course of the last several years, many new initiatives have come about to influence state NPS program direction. Thus, this new NPS Management Plan aims to

take these initiatives into consideration and serve as the most comprehensive and definitive expression of NPS management goals within the State of Ohio.

Implementation of watershed action plans will be a key ingredient of state NPS management and in that context should feature three core attributes. Watershed action plans must be science-based, community-led, and sustainable. As elements of the Ohio NPS Management Plan emerge in an approved form (2005), this Honey Creek WAP will describe the relevance of and relationship with state NPS management in greater detail where appropriate.

Lake Erie Protection & Restoration Plan

While neither a law nor regulatory mechanism, the Lake Erie Protection & Restoration Plan (Ohio Lake Erie Commission, 2004) is nonetheless the State of Ohio's blueprint for Lake Erie's future and guidance document for achieving the goals and objectives set forth in a companion piece, the Lake Erie Quality Index (LEQI) (http://www.epa.state.oh.us/oleo/reports/leqi/leqi2004/leqiz.htm). As noted above, Honey Creek is situated within the Lake Erie Watershed. Land use activities within Honey Creek, therefore, have a direct impact on Lake Erie.

Having released the Second Progress Report in September, 2004, the Lake Erie Protection & Restoration Plan proposes the implementation of 84 strategic actions for improving the environment, recreational opportunities, and economy of the Lake Erie Watershed. These strategies are grouped under ten areas that address water quality, pollution sources, habitat, biology, coastal recreation, boating, fishing, beaches, tourism, and shipping. While many of these areas are not directly relevant to life in the Honey Creek Watershed, some are. Several of the strategies having to do with water quality, pollution sources, habitat, and biology will have an impact on State views and expectations of land use activities within Honey Creek and the other subwatersheds of the Sandusky Basin.

For example, one of the strategies found under the Pollution Sources category states, "Increase from 52% to 80% the percentage of agricultural acreage in the Lake Erie Watershed under conservation tillage practices by 2010." This is one of four strategic actions that are designed to meet the strategic objective of reducing agricultural sediment loading from the Lake Erie Watershed by 67%. Thus, conservation tillage, establishing buffers along 80% of Lake Erie watershed ditches, streams, and tributaries, and other Protection and Restoration Plan actions will be achieved by local and related efforts that seek to reduce sediment and phosphorus loadings to Honey Creek.

Another strategic action of the Lake Erie Protection & Restoration Plan calls for reforesting riparian corridors and marginal agricultural acreage, floodplains, and wetlands using a variety of existing programs. This action is compatible with the need to reestablish and reconnect riparian corridors in Honey Creek. There are other examples where goals of the Honey Creek WAP and the Protection and Restoration Plan are complementary. Recommendations in this WAP that address the requirements of improving water quality in Honey Creek will, therefore, satisfy other State initiatives such as the Lake Erie Protection & Restoration Plan. To learn more about the Lake Erie Protection & Restoration Plan, please visit their website: http://www.epa.state.oh.us/oleo/reports/lepr/lepr2/secondreport.html.

Lake Erie Lakewide Management Plan (LaMP)

The Lake Erie Lakewide Management Plan (LaMP) provides a structure for the people of the United States and Canada to address environmental and natural resource concerns, coordinate research activities, pool resources, and make joint commitments to improving the environmental quality of our shared resource: Lake Erie (Lake Erie LaMP Work Group, 2004). An excerpt from this binational effort clarifies why the Lake Erie LaMP, updated yearly, is important to the residents of Honey Creek:

> The environmental integrity of Lake Erie is dependent not only on various characteristics and stressors within the lake itself, but also on actions implemented throughout the Lake Erie watershed and beyond. Urban sprawl, shoreline development, climate change, the introduction of exotic species, the exploitation and destruction of natural lands and resources, the dominant agricultural and industrial practices within the lake basin, and long-range transport of contaminants from outside the basin all impact the health of Lake Erie.

The Lake Erie LaMP identified land use practices as the dominant management category affecting the Lake Erie ecosystem. For agricultural land use, the Lake Erie LaMP calls for continuing reductions in the use of conventional tillage, agricultural chemicals and fertilizers. Specific watershed targets are to be established for securing, protecting, and restoring natural lands. Phosphorus exports from non-point sources, including agricultural land use, is to be very strongly reduced for purposes of favoring recovery and maintenance of healthy aquatic communities in the immediate receiving waters such as Sandusky Bay. Sewage treatment plants may be expected to improve upon their previously achieved phosphorus load reductions.

The Upper Sandusky TMDL calls for sewage or wastewater treatment plants in Attica, New Washington, and Bloomville to reduce phosphorus concentrations that are currently elevated and identified as one cause of aquatic life impairment within the Honey Creek subwatershed. Thus, pollutant reductions from both point and non-point sources will simultaneously achieve local and regional initiatives that are complementary to one and another.

To learn more about the Lake Erie LaMP, readers are encouraged to visit this website: http://www.epa.gov/glnpo/lakeerie/2004update/index.html.

Balanced Growth Task Force

The Balanced Growth Task Force of the Ohio Lake Erie Commission has produced a strategy to protect and restore Lake Erie and its watersheds for purposes of achieving long-term economic competitiveness, ecological health, and quality of life. The planning framework produced by the Task Force recommends a voluntary, incentive-based program for balanced growth in the Ohio Lake Erie basin. This framework reflects the

ten guiding principles that are outlined in the Lake Erie Protection and Restoration Plan discussed above.

Throughout the Balanced Growth planning framework, a watershed approach is promoted for planning and decision-making. Furthermore, this framework includes active roles for both local and state governments in supporting local watershed planning partnerships. The essence of the Balanced Growth framework is fully compatible with watershed action plans developed at the scale of Honey Creek. The Balanced Growth framework offers reason to believe that new incentives for implementing locally produced watershed action plans could be enjoyed by those groups with such plans.

This new strategy gives residents of the Honey Creek watershed more reason to "go with the flow" and produce a meaningful action plan that will lead to greater conservation and improved quality of life. To learn more about Balanced Growth in the Ohio Lake Erie Watershed, please visit the following website: http://www.epa.state.oh.us/oleo/bgi/BGIPF.pdf.

Seneca Regional Planning Commission

The Seneca Regional Planning Commission released the Seneca County Comprehensive Plan Update 2001 in November of that year, referred to hereafter as the Seneca Plan. The Seneca Plan offers a vision for land use that accommodates growth and development where adequate infrastructure currently exists and protects farmland on land parcels most remote from urbanized areas and related activities. Among the thirteen future land use categories offered by the Seneca Plan, a Critical Resource category, representing 6.1% of Seneca County (21,440 acres) may lend support for Honey Creek WAP implementation activities proposed below in Chapter 5.

The Critical Resource category of land use is defined as the 100-year floodplains throughout Seneca County. Additionally, this category includes 120-foot buffers along county streams. The Seneca Regional Planning Commission "strongly" discourages development within land areas identified as Critical Resource. While this is an important recommendation, much remains to be considered and implemented regarding current land use activities within these Critical Resource areas and the impact of land use on the ecological integrity of rivers and streams including water quality.

The Seneca Plan offers a wealth of data, maps, and information regarding Seneca County. The Seneca Plan is both comprehensive, in the sense that it encompasses the entire county, and general insofar as it lays out a vision for the location, extent, and types of future land use. Chapter 9 of the Seneca Plan, Strategic Implementation, recommends conservation of sensitive environmental or natural areas that should lend support to the Honey Creek WAP. In turn, the Honey Creek WAP will bring a much-needed focus to a plan for conservation that emphasizes water resources protection and remediation of water quality impairments. Proponents of both plans should be able to agree that restoring the ecological integrity of Honey Creek will also enhance public health along with the economic viability of the region.

Ohio Household Sewage Treatment Regulations

Household sewage treatment regulations are addressed in Ohio Revised Code Chapters 521, 3701, 3709, 3718, 6111, and 6112. Of particular significance is Substitute House Bill 231 (125th General Assembly) that charges the Public Health Council to adopt rules governing household sewage treatment systems and small flow on-site sewage treatment systems (not more than 1,000 gallons of sewage per day). Governor Taft signed this bill on February 1, 2005 and it became effective May 6, 2005. The Public Health Council must adopt rules to regulate sewage treatment systems not later than one year after the bill's effective date (Ohio Legislative Service Commission, 2004).

Substitute House Bill 231, supported in testimony by the Ohio Environmental Council, will address poorly installed or inadequately maintained household sewage treatment systems. The Bill's language calls for uniform standards applied across the state and gives county boards of health primary authority and resources to implement this upgraded code. Improved water quality in local streams and ditches and improved safety of public health should ultimately result from these new rules (Ohio Environmental Council, 2004).

CHAPTER 3
HONEY CREEK WATERSHED INVENTORY

When the Coalition prepared the "The Sandusky River Watershed: Resource Inventory & Management Plan" (RIMP) (Sandusky River Watershed Coalition, 2001), information on the individual HUC-11 watersheds was scattered throughout the text, with HUC-11GIS maps limited to an appendix. Several GIS maps for the Honey Creek Watershed are included under Tab 8 in the RIMP Appendix. This Chapter provides a more extensive inventory of resources within the Honey Creek Watershed.

Land Use

Land use in Honey Creek is illustrated in Map 2, 1994 Land Use/Land Cover. The land cover data in Map 2 are based on satellite imagery from the LANDSAT Thematic Mapper using coverage from September and October 1994. Table 3.1 summarizes land use for the six HUC-14 subwatersheds that comprise the Honey Creek Watershed. Honey Creek encompasses a total area of 179.7 square miles or approximately 115,000 acres. Like the Sandusky Basin itself, agriculture is the predominant land use (84.8%) for Honey Creek as a whole, with an emphasis on row-crop production of soybeans, corn, and wheat on artificially drained soils. Deciduous forest land accounts for 13.4% of the land use and land cover and is characterized by a highly fragmented pattern of relatively small woodlots that are generally isolated from one another within the agricultural matrix. Continuous woody vegetation is also present along the riparian corridors of the lower section of Honey Creek.

Watershed Hydrography

Stream Drainage Network. The stream drainage network is illustrated in Map 3. This map shows the stream order for Honey Creek and its tributaries. It is based on the Stream Reach 3 Files as provided by the OEPA and used in their Upper Sandusky TMDL study. In Map 3, the stream segments are color coded by stream order, using the Strahler-Horton stream order classification system (Strahler, 1952; Horton, 1945). In this system first order streams are those small streams with no tributaries. Where two first order tributaries join, a second order stream is formed. To form a third order stream, two second order tributaries must join and to form a fourth order tributary, two third order tributaries must join. Merging of a smaller or low order stream with a larger or high order stream does not change the stream order of the larger stream.

The stream order system provides a simple way to characterize the size and position of streams in a drainage network. In general, there are many more miles of low order streams than of high order streams in a drainage network. For Honey Creek, 64.1% of the 242.9 miles of streams are first order streams (Table 3.2). Honey Creek is unusual in that there are more miles of 4th order streams than 2nd and 3rd order streams (Table 3.2). This pattern is associated with the overall shape of the watershed in relation to watershed topography. It should be noted that the stream files, as digitized from USGS quarter

Table 3.1 Honey Creek land use by the HUC-14 subwatersheds.

The last six digits of fourteen-digit hydrologic unit code are shown.) **Honey Creek totals**

14 digit watershed Cover Type	Grid Code	080-010 Acres	080-020 Acres	080-030 Acres	080-040 Acres	080-050 Acres	080-060 Acres	Acres	Sq Mi
Urban	1	104	141	282	21	6	31	585	0.91
Agriculture	2	22,615	10,826	22,464	9,785	13,232	18,559	97,482	152.32
Shrub	3	13	11	54	19	43	99	241	0.38
Wooded	4	2,980	1,120	3,647	1,566	2,181	3,916	15,410	24.08
Water	5	7	6	7	2	31	9	62	0.10
Non forested wetlands	6	549	70	71	35	130	154	1,010	1.58
Barren	7	1	0	3	182	1	2	190	0.30
TOTAL (acres)		26,270	12,175	26,529	11,611	15,624	22,770	114,979	179.65
		Percent	Percent	Percent	Percent	Percent	Percent	Percent	
Urban	1	0.40	1.16	1.06	0.18	0.04	0.14	0.51	
Agriculture	2	86.09	88.92	84.68	84.28	84.69	81.51	84.78	
Shrub	3	0.05	0.09	0.20	0.17	0.28	0.44	0.21	
Wooded	4	11.35	9.20	13.75	13.49	13.96	17.20	13.40	
Water	5	0.03	0.05	0.03	0.01	0.20	0.04	0.05	
Non forested wetlands	6	2.09	0.58	0.27	0.30	0.84	0.68	0.88	
Barren	7	0.01	0.00	0.01	1.57	0.00	0.01	0.17	

Table 3.2 Stream lengths by stream order in the Honey Creek watershed.

Stream Order	Length (miles)	Percent of total miles
1	155.7	64.1
2	32.5	13.4
3	20.6	8.5
4	34.1	14.0
Total	242.9	100.

section maps, include more first order stream segments than does the Stream Reach 3 Files. These additional stream segments would increase the lengths of the lower order streams, but the main stem of Honey Creek remains a 4th order stream along 34.1 miles of its length.

Information for the major tributaries of Honey Creek is shown in Table 3.3. These data are taken for the ODNR's Gazetteer of Ohio Streams (ODNR, 1960). Similar data are provided for the other tributaries of the Sandusky River drainage network in Table 3.3 of the RIMP. The watersheds of the three largest tributaries to Honey Creek (Silver Creek, Aicholtz Ditch and Brokenknife Creek) are recognized as distinct HUC-14(digit) watersheds as indicated in Chapter 1. The main stem of Honey Creek is divided into the other three of six HUC-14 subwatersheds.

Table 3.3 Major tributaries of Honey Creek as reported in the 1960 Gazetteer of Ohio Streams (ODNR 1960).

Stream Name	Length (miles)	Elev. At Source (ft)	Elev. at mouth (ft)	Ave. Fall (ft/mi)	Flows into:	Drainage area (sq mi)
Honey Creek	39.3	1005	728	7.1	Sandusky River	176.7
Buckeye Creek	6.0	928	805	20.5	Honey Creek	9.17
Silver Creek	8.3	947	845	12.3	Honey Creek	24.07
Aicholtz Ditch	10.0	958	885	7.3	Honey Creek	19.58
Kagy Ditch	2.0	950	913	18.5	Aicholtz Ditch	1.10
Bollinger Ditch	2.8	962	928	12.1	Aicholtz Ditch	4.30
Hedden Ditch	2.7	9.61	897	23.7	Honey Creek	3.55
Hooper Ditch	2.5	950	914	14.4	Honey Creek	1.56
Schaaf Ditch	3.5	939	915	6.8	Honey Creek	4.03
Brokenknife Creek	5.0	952	917	7.0	Honey Creek	16.58

County Stream and Ditch Maintenance Programs: An important feature of the stream network within the Honey Creek Watershed is that many miles of streams are under county maintenance programs designed to ensure that these watercourses provide adequate outlets for tile drains and conveyance of flood waters that can often damage planted crops. In some cases, what are now streams did not exist as such prior to the onset of agricultural drainage programs. These ditches were specifically constructed to provide outlets for tile drainage and surface drainage of adjacent cropland. Maintenance can involve the chemical or physical control of brush and trees from banks, dipping out

of sediments that accumulate in the channel bottoms, and planting of grasses on ditch side slopes and as watercourse buffers. In other cases, natural streams have been straightened and "ditched" and are now under maintenance. In some areas levees or dikes are also used to separate the stream from its floodplain.

Within the Honey Creek Watershed, there are about 44.4 miles of streams that are under county maintenance programs, primarily first order streams. These represent about 18% of all stream miles in the watershed. The locations of these streams are shown in Map 4, County Maintained Ditches. For the county maintained ditches, watershed landowners are assessed fees to cover the costs of the maintenance programs (Chapters 6131 and 6137 of the Ohio Revised Code – "Ohio Drainage Laws')

In addition to those streams and ditches on county maintenance programs, local SWCD staff indicate that an equal number of miles of ditches and "ditched" streams have been constructed and maintained by individual land owners to better serve agricultural drainage functions. Neither of these types of systems is shown in Map 4.

Map 4 does show locations in the watershed where the natural development of "two stage" channels may be occurring. The map also shows locations where installation of two-stage ditches and/or extra wide ditches could be constructed in connection with ditch maintenance programs. These may have conveyance, maintenance and environmental benefits.

Riparian Land Use. The riparian land use alongside the stream channels in the Honey Creek Watershed is shown in Map 5. This map was constructed from the intersection of the stream reach file with the land use file. Approximately 28% of the banks are wooded, mostly along the mainstem of Honey Creek. Agricultural land use is adjacent to about 70% of the streams, and is especially prevalent in low order streams. It should be noted that grassed buffers along streams would be classified as agricultural land based on interpretations of satellite imagery. From the standpoint of stream habitat, wooded riparian corridors are preferred.

Streamflow Characteristics. The characteristics of streamflow within Honey Creek are documented at the U. S. Geological Survey Stream Gage (Number 0419700) at Melmore, Ohio (river mile 12.30). With a drainage area of 149 square miles, this gage provides information for the upper 84% of the watershed. This stream gage has operated continuously since 1976. Data summarizing the discharge characteristics of the station as of the 2003 water year are shown in Table 3.4.

The average annual runoff for Honey Creek is 11.68 inches. This is equivalent to a volume of water with an area the size of the entire watershed and a depth of 11.68 inches. This value is about average for subwatersheds in the Sandusky Basin (see RIMP, Table 3.4) and similar to those for surrounding watersheds. For example, the average annual runoff for Tymochtee Creek is 11.21 inches, for the Sandusky River at Fremont is 11.10 inches, and for the Huron River is 11.35 inches.

Seasonal Aspects of Discharge. The seasonal pattern of discharge for Honey Creek is shown in Figure 3.1, where average monthly discharges are plotted. February, March and April are the months with the highest average discharges while August, September and October have the lowest discharges. The pattern of variability in average monthly

Table 3.4 Summary statistics for USGS Stream Gage 0419700 (Honey Creek at Melmore, Ohio) for water years 1976-2003. (Water Resources Data, Ohio, Water Year 2003, Volume 2, available on the web at http://oh.water.usgs.gov/AR/ar.html.

Summary statistic	Value	Date
Annual mean discharge (average daily flow, cfs)	128	
Highest annual mean, cfs	189	1993
Lowest annual mean, cfs	48.1	1988
Highest daily mean, cfs	4000	Dec. 30, 1990
Lowest daily mean, cfs	0.07	Sep 28, 1988
Annual seven-day minimum, cfs	0.09	Sep 24, 1998
Maximum peak flow, cfs	4440	Jun 13, 1981
Maximum peak stage, feet	11.00	Jun 13, 1981
Instantaneous low flow, cfs	0.07	Sep 28, 1988
Annual runoff, cfs per square mile	0.86	
Annual runoff, inches	11.68	
10 percent of time flow exceeds, cfs	339	
50 percent of time flow exceeds, cfs	31	
90 percent of time flow exceeds, cfs	1.5	

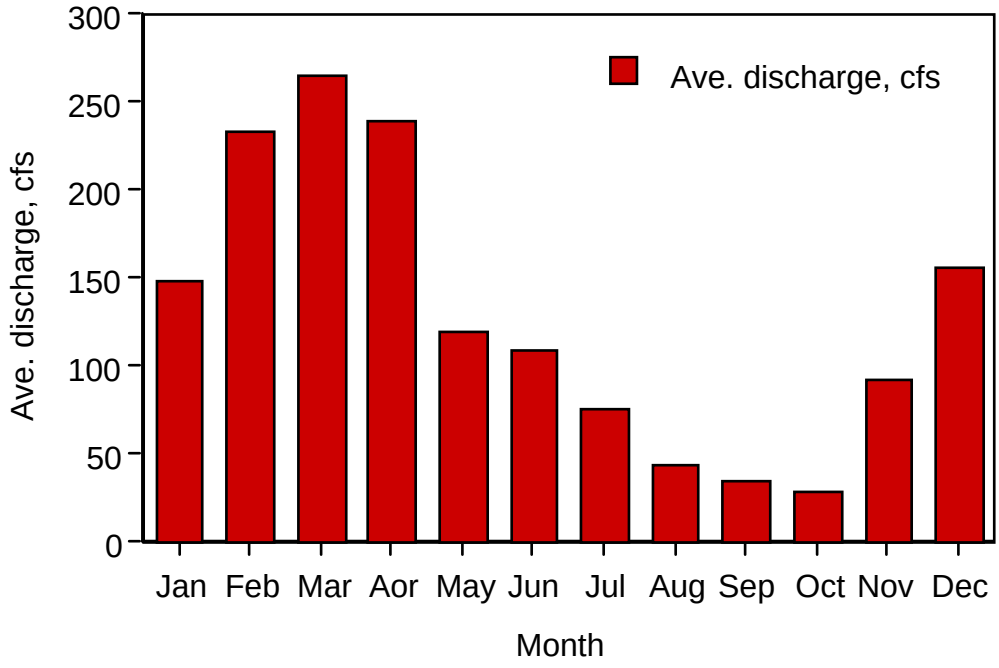

Figure 3.1 Average monthly discharge from Honey Creek at the Melmore gaging station for the 1976-2003 time period.

discharge differs from the pattern of annual monthly precipitation (Figure 3.2, RIMP). In the Sandusky Watershed, June, July and August are the months with highest precipitation while October, January and February are the months with the lowest precipitation.

Stream Flashiness. Flashiness is a measure of how quickly stream flows change during runoff events, relative to the total discharge of the stream. Flashy streams are those that, relative to other streams in their size range, have high peak flows during runoff events and low base flows. Staff of the WQL have developed a flashiness index and applied it to numerous Midwestern streams (Baker et al., 2004). Among streams of comparable size, the average flashiness index for Honey Creek is in the top portion of the upper middle quartile. Furthermore, the flashiness of Honey Creek has increased significantly during the period from 1976 through the present. High stream flashiness is typically detrimental to aquatic biota and the fact that flashiness is increasing in Honey Creek is a concern to the Coalition.

Other Stream and Floodplain Attributes. Currently, there is a paucity of data for several physical attributes of Honey Creek streams and floodplains. In time, as resources are organized around additional data collection and analysis efforts, this WAP will be updated to include information on the following attributes:

* Channel and floodplain condition, including miles of natural versus engineered/maintained channel, floodplain connectivity (longitudinal) and connectedness (lateral), streambank condition, extent and location of levees or other structures that isolate the river from its floodplain, riparian habitat, oxbow cutoffs
* extent and location of streams bordering conservation easements
* inventory of wetlands and opportunities (e.g. location, extent) for wetland restoration

Regarding the last item, the Coalition will ask Ohio EPA 401 Water Quality Certification Section for assistance on deploying the Ohio Rapid Assessment Method for wetlands.

Ecoregional Location

The Honey Creek Watershed is situated primarily within the Eastern Corn Belt Plains (Level III), Clayey, High Lime Till Plains (Level IV) Ecoregion of the conterminous United States. Streams of this ecoregion are typically low gradient. An area towards the mouth of Honey Creek in Seneca County lies within the Huron/Erie Lake Plains (Level III), Marblehead Drift/Limestone Plain (Level IV) Ecoregion. This latter ecoregion is characterized by areas of thin glacial drift and limestone-dolomite ridges and islands. Streams here typically flow over carbonate bedrock and are distinctly different from the streams found in the majority of Honey Creek and, indeed, throughout the Upper Sandusky Basin. The Ohio EPA uses water quality criteria for the Eastern Cornbelt Plains Ecoregion to evaluate biological conditions for the entire Honey Creek Watershed.

Soils

Soils in Honey Creek are derived from glacial drift of Wisconsin age. The great majority of the watershed features deep soils on till plains (e.g. Blount-Pandora association, Tiro-Pandora association). The main stem of Honey Creek flows through a combination of 1) deep soils on beach ridges, terraces, lake plains, outwash plains, and end moraines (e.g. Gallman-Digby-Haney association), and 2) deep soils on floodplains and terraces, and in upland depressions (e.g. Chagrin-Shoals-Ross association) (USDA, 1980).

Hydrological Soil Groups. Map 6: Hydrologic Soil Groups (HSGs), illustrates the pattern of HSGs throughout the Honey Creek Watershed. Table 3.5 indicates the percentages of the watershed area that fall within each hydrological group along with a numeric measure of transmission rates by grouping.

Hydrologic soil groups are useful for estimating surface runoff from precipitation. Soils that do not feature year-round vegetative protection (i.e. working agricultural fields) are assigned to one of four groups, A – D, that are grouped on the basis of their intake capacity of water when the soils are completely wet and continue to receive precipitation from long-duration storms.

USDA-NRCS engineers have classified soils by hydrologic grouping to indicate the minimum rate of infiltration obtained for bare soil (much like tilled cropland) after prolonged wetting by precipitation events. HSGs reflect variations in surface soil texture as well as the rate of which water moves in the soil profile (transmission rate). As such, HSGs are quite useful in helping estimate surface runoff amounts after storm events of varying frequency.

Group A soils feature high infiltration rates and have low ruoff potential, but none are found in the Honey Creek Watershed. Only 4.9% of the watershed soils are in Group B. These moderately well drained soils are located primarily on floodplains of the lower reaches of Honey Creek. 68.8% of the soils are in Group C, while another 1.4 % are in drainage class D. Both of these soil groups have slow infiltration rates and are subject to surface runoff.

Certain Group D soils in the watershed respond favorably to tile drainage. Thus 14.57% assume Group B characteristic with tile drainage (B/D) and another 2.78% assume Group C characteristics. Without tile drainage, fully 95% of the soils are in hydrologic soil Group C or D.

Identifying the location of soils that are most prone to surface runoff will assist with efforts to target adoption of BMPs as stakeholders move forward with implementing the Honey Creek WAP. While local knowledge will play a key role in efforts to target BMPs, spatial analysis of a combination of soil attributes (e.g. HSGs, slope lengths, drainage, and the soil's physical properties) and/or other physical features of the landscape can also be employed to inform these efforts. Additional funding will be required to support the expertise necessary for such analyses, which would employ the use of a Geographic Information System (GIS) and an appropriate model.

Table 3.5 Distribution of hydrologic soil groups in the Honey Creek Watershed.

Hydrological Soil Group	Transmission Rate	Acres	% of classified soils
A	>0.30 in/hr	0	0.0
B	0.15 to 0.30 in/hr	5,614	4.9
C	0.05 to 0.15 in/hr	79,182	68.8
D	0.00 to 0.05 in/hr	1,561	1.4
A/D		1,708	1.5
B/D		22,621	19.7
C/D		3,481	3.0
Not Classified		860	0.7
Total		105,072	100.0

Hydric Soils. Another soils-related map (Map 7,Hydric Soils) is presented to illustrate best potential sites for wetland or floodplain restoration. The definition of a hydric soil used by the USDA-NRCS and published in the Federal Register, July 13, 1994 is "… a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Thus, hydric soils are typically located along wide, flat drain ways or depressional areas of the landscape. In the Honey Creek Watershed, hydric soils represent 24,150 acres or approximately 21% of the watershed area.

Soils Slope Classes. As soil surveys are completed, the slopes associated with a given soil type are indicated by letters (A, B, C, D & F) attached to the soil symbol. For example, the Haney Soil, with the symbol Ha, occurs on A, B. and C slope classes and are mapped as HaA, HaB and HaC respectively. HaA has 0 – 2% slopes, HaB has 2 – 6% slopes, and HaC has 6 – 12% slopes. Soils with slope class D have 12 – 18% slopes while slope class F has 18 – 50% slopes. Where soil symbols do not have a slope class letter attached, the soils are either nearly level (0% slope) or fall into miscellaneous classes (USDA, 1980).

Map 8, Soil Slopes, shows the distribution of soil slopes within the Honey Creek Watershed. In Table 3.6, the percentage of various soil slope classes within the Honey Creek watershed is shown. About 63% of the soils have slopes between 0 and 2%, while 34% of the soils have slopes in the 2 – 6% range. Other slope classes are localized.

Table 3.6 Soil Slope Classes in the Honey Creek Watershed.

Soil Slope Class	Percent Slope	Acres	% of classified soils
None	0%	33,638	29.2%
A	0 – 2%	38,983	33.9%
B	2 – 6%	34,150	34.1%
C	6 – 12 %	2,535	2.2%
D	12 – 18%	235	0.2%
F	18 – 50%	364	0.3%
Total		115,026	100%

Geology

The position of the Sandusky Watershed and its subwatersheds relative to the Cincinnati Arch, bedrock formations and glacial features are shown in Chapter 2 of the SRW RIMP (Sandusky River Watershed Coalition, 2001). Honey Creek is situated within the glaciated part of Ohio and lies atop the Cincinnati Arch, a large geologic structure that stretches northward from northern Kentucky into west central Ohio. The most ancient part of the Cincinnati Arch, of Ordovician age, is exposed only in the southwestern part of the state. The eastern and southernmost reaches of Honey Creek flow through the Olentangy and Ohio Shales of more recent Devonian age. The central and northernmost portions of the watershed cut across the Columbus and Delaware limestone and shale bedrock from the same period. As Honey Creek flows towards its mouth with the Sandusky River, the underlying bedrock grades into the Monroe limestone (ODNR, 1992).

The topography of the Honey Creek watershed is shown in Map 9. Contour lines reflect ten-foot intervals. Honey Creek features 277 feet of relief. Highest elevations are in the extreme southeast corner of the watershed in Crawford County, southeast of Tiro. One would expect the highest elevation to be in the headwaters area furthest from the mouth of the stream/river main stem. Alternately, the lowest elevation is in the opposite part of the watershed and at the mouth of Honey Creek in Seneca County. The close contour intervals along the northern portion of the watershed, and again on the southern portion, show the location of terminal moraines.

The utility of this map of topography rests in part with the identification of steep terrain where stream power and erosion potential are greatest. It illustrates the location of both flood plains and steep banks alongside streams. This map also shows a close correspondence with Map 8 (Soil Slope Classes). Analysis with a GIS will reveal additional utility to inform the process of BMP targeting and implementation of the Honey Creek WAP.

Climate

Honey Creek, like most of Ohio, is situated in a humid continental climate zone that features cold winters and hot summers. Average low/high temperatures in Tiffin, Ohio during the years 1971-2000 ranged from 16.7 – 31.9 degrees Fahrenheit (F) in January and from 62.6 – 84.3 degrees F in July. The mean annual temperature during this period was 50 degrees F. Precipitation is near evenly distributed throughout the year. For the same period, the annual average at Tiffin was 37.08 inches (in); June was the wettest month (4.18 in) and February was the driest (2.00 in) (NOAA, 2002).

Political Geography and Demographics

A portion of Honey Creek is situated within each of the four counties listed below.

1. Seneca County (59%)
2. Crawford County (32%)
3. Huron County (9%)
4. Wyandot County (1%)

The Honey Creek Watershed is located within a predominantly rural landscape in northwest Ohio. The population in each of the counties except Huron has decreased since the year 2000. The vast majority of the population describes itself as white only (98.51%), with the second largest percentage falling in the "other" category, which includes individuals of multiple races (1.08%). Table 3.7 depicts the major political units within the watershed along with the planning commissions from which the population data were derived. Table 3.8 lists the populations within each of these locations that falls inside the watershed boundaries. Some units are not incorporated, but are areas of dense housing and are depicted on county maps, such as Melmore. These areas are of importance due to their impact on water quality and their potential for new infrastructure.

Table 3.8 shows an estimated total population for Honey Creek of 7898. Population statistics were drawn from the US Census Bureau for the year 2000. Watershed population within each watershed was estimated by multiplying the township's population by the approximate percentage of land area that lies within Honey Creek Watershed. This method of estimation is used because population data are not organized by watershed. Four townships included villages that were completely contained within the watershed boundaries. In these cases the area factor was applied only to the township population living outside of the village boundaries. Then the entire village population was added in to the estimated township population in the watershed to obtain the data reported in Table 3.8. The village populations are shown with their respective townships. The total village population represents 41% of the total watershed population.

Table 3.9 provides U.S. Census data from 1900-2000 for the four counties in which the watershed lies. The table also reports the 2003 populations based on the percentage change during the period April 2000-July 2003 reported by the U.S. Census Bureau. The population of the state of Ohio has risen 0.7% during the April 2000 – July 2003 time period, while the population of three of the four watershed counties decreased during this same time. The increase in Huron County occurred in developed areas outside of the watershed.

Table 3.7 Sample of political units and other entities within Honey Creek watershed.

County	Township	Locality	School District*	Other Planning Organizations
Seneca				Seneca Regional Planning Commission
	Hopewell		Hopewell-Loudon LSD	
	Seneca		Mohawk LSD	
	Clinton		Tiffin City LSD	
	Eden		Mohawk LSD	
		Melmore		
	Scipio		Seneca East LSD	
	Bloom		Seneca East LSD	
		Bloomville		
	Reed		Seneca East LSD	
	Venice		Seneca East LSD	
		Attica		
		Carrothers		
		Caroline		
		St. Stephens		
Huron				
	Richmond		Willard LSD	
Crawford				Crawford Regional Planning Commission
	Auburn		Buckeye Central LSD	
		Mechanicsburg		
		Tiro		
	Cranberry		Buckeye Central LSD	
		New Washington		
	Chatfield		Buckeye Central LSD	
	Lykens		Wynford LSD	
	Texas		Mohawk LSD	
	Vernon		Buckeye Central LSD	
Wyandot				Wyandot Regional Planning Commission
	Sycamore		Mohawk LSD	

Table 3.8 Honey Creek Watershed population by county, municipality, and township (estimated).

Crawford County	Population
Texas Twp.	41
Lykens Twp.	65
Chatfield Twp.	155
Cranberry Twp. *(including New Washington 987)*	1331
Auburn Twp. *(including Tiro 281)*	528
Sandusky Twp.	14
Vernon Twp.	25
Total (Crawford)	**2159**

Seneca County	Population
Bloom Twp. *(including Bloomville 1045)*	1847
Clinton Twp.	42
Eden Twp.	1333
Hopewell Twp.	29
Reed Twp.	95
Scipio Twp.	165
Seneca Twp.	16
Venice Twp *(including Attica 955)*	1688
Total (Seneca)	**5215**

Wyandot County	Population
Sycamore Twp.	80
Total (Wyandot)	**80**

Huron County	Population
Richmond Twp.	444
Total (Huron)	**444**

Estimated total population for Honey Creek Watershed	**7898**

Table 3.9 Population data for the watershed counties from 1900-2000.

County	1900	1910	1920	1930	1940	1950
Crawford	33,915	34,036	36,054	35,345	35,571	38,738
Huron	32,330	34,206	32,424	33,700	34,800	39,353
Seneca	41,163	42,421	43,176	47,941	48,499	52,978
Wyandot	21,125	20,760	19,481	19,036	19,218	19,785
	1960	**1970**	**1980**	**1990**	**2000**	**2003***
Crawford	46,775	50,364	50,075	47,870	46,966	46,074
Huron	47,326	49,587	54,608	56,240	59,487	60,260
Seneca	59,326	60,696	61,901	59,733	58,683	57,744
Wyandot	21,648	21,826	22,651	22,254	22,908	22,816

*2003 data based on US Census data for percentage of change in population from April 2000 – July 2003.

Agricultural Resources

Given that agricultural statistics data are not organized at the spatial scale of a watershed, the reader is referred to (1) USDA NASS 2002 Census of Agriculture County Profile, and (2) 2003 Ohio Dept. of Agriculture Annual Report and Statistics for such data for each of the four counties:

1. Seneca County -
   http://www.nass.usda.gov/census/census02/profiles/oh/cp39147.PDF
   http://www.nass.usda.gov/oh/profil03/seneca-shelby.pdf
2. Crawford County –
   http://www.nass.usda.gov/census/census02/profiles/oh/cp39033.PDF
   http://www.nass.usda.gov/oh/profil03/cosh-craw.pdf
3. Huron County –
   http://www.nass.usda.gov/census/census02/profiles/oh/cp39077.PDF
   http://www.nass.usda.gov/oh/profil03/holm-huron.pdf
4. Wyandot County –
   http://www.nass.usda.gov/census/census02/profiles/oh/cp39175.PDF
   http://www.nass.usda.gov/oh/profil03/wyandot.pdf

Row Crop Agriculture. From the above web sites summary data were obtained for each county and are reported in Table 3.10. From Table 3.10 and the above sources, the following can be extrapolated for the Honey Creek watershed:

1. soybeans is the dominant crop (acres harvested in 2003, cash receipts for 2002) followed closely by corn,
2. a plurality of farms are in the size class: 50-179 acres,
3. the majority of farms produced less than $50,000 in farm sales in 2002,
4. hogs and pigs generated the largest portion of cash receipts for 2002 for sales of livestock in all four counties except Huron,
5. the number of farms has declined between 1997 and 2002,
6. average farm size has increased between 1997 and 2002 for all four counties except Huron, and
7. government payments have increased between 1997 and 2002 as have the average per farm receiving payments.

Livestock. Livestock are an important component of agricultural operations. Livestock and associated manure, however, can be a major source of water quality problems. For example, liquid manure applications can enter tile drainage systems, delivering manure directly to streams. A fish kill was observed on Buckeye Creek on December 14, 2001. Manure applications were a suspected cause of the fish kill. Poor manure management, including inadequate manure storage facilities, can lead to excessive build-up of soil phosphorus levels, resulting in increased phosphorus loading to streams. In some cases, livestock have direct access to stream systems. Their presence in streams and on streambanks has a negative impact on water quality and aquatic resources.

Table 3.10 Land in farms and crop acreages for major counties in the Honey Creek Watershed.
*****

County/Feature	Crawford	Huron	Seneca	Wyandot	Total	% of total land area
Total area, acres	257,728	317,614	353,536	260,864	1,189,742	
Number of farms	690	865	1185	607	3,347	
Land in farms, acres	234,204	228,346	280,449	201,146	944,145	79.4
Soybean, acres	99,800	84,400	113,000	90,300	387,500	32.6
Corn, acres	74,000	56,800	79,400	55,800	266,000	22.4
Wheat, acres	27,000	26,100	42,100	31,700	126,900	10.7
Oats, acres	0	0	1,600	0	1,600	0.1
Hay, acres	5,600	7,400	5,900	3,600	22,500	1.9
CRP, acres**	3,071	1,088	8,015	6,434	18,608	1.6
Other farm, acres	24,733	52,558	30,434	13,312	121,037	10.2
Non-farmland, acres	23,524	89,268	73,087	59,718	245,597	20.6

*Data from 2002 Ohio Department of Agriculture Annual Report and Statistics.
**CRP (Conservation Reserve Program) acreage as of Sept. 2004, reported by USDA Farm Service Agency http://www.fsa.usda.gov/dafp/cepd/29th/Table1F.pdf

Table 3.11 provides an estimate of livestock numbers within the Honey Creek Watershed. This Table includes estimates based on extrapolation of county level data and estimates of the manure management specialist and other agricultural personnel who work in these counties. The estimates from the manure management specialist indicates that the Honey Creek Watershed contains more livestock than average for the counties that make up the watershed. This suggests that extrapolation from county-level livestock data to 11-digit watersheds, such as Honey Creek, may result in significant errors.

Conservation Practice Usage in Honey Creek: A Brief History. While open ditching and tiling of wet areas were practiced extensively within the watershed since 1875, the planning and application of modern conservation practices began in the early 1950's following the formation of Soil and Water Conservation Districts. With technical assistance from the UDSA-Soil Conservation Service, the Districts encouraged all farmers within the counties to prepare conservation plans that would halt soil erosion within a 5 to 10 year period. A key conservation practice in early plans included crop rotations that contained high residue producing crops such as corn, oats and wheat plus grass-legume hay and forage crops. Other practices planned and applied were grassed waterways for control of gully erosion, lime and fertility usage, winter cover crops and tile drainage. By default, small field sizes (8 to 10 acres), fencerows, numerous woodlots and the lack of large farm tillage tools also aided the effort to reduce erosion and related rapid runoff. Numerous small, but scattered, dairy, hog and sheep operations tended to minimize the impacts of manures on water quality.

Table 3.11 Estimate of livestock in Honey Creek Watershed.

Type	Number based on areal extrapolation of 2003 Ohio Agricultural Statistics for these counties	Number based on estimates of manure management specialist working in these counties*
Cattle and calves	3,744	1,170
Dairy cows	292	685
Swine	12,232	14,520
Sheep	840	1,340

* Conservative estimates excluding small operations

The implementation of these early conservation plans frequently led to the need for further open ditch drainage improvement, since adequate tile outlets were critical for optimal crop production and the effective maintenance of many of the conservation practices planned. This fact, along with newly written Ohio Drainage Law permitting the formation of county drainage maintenance programs after 1957, produced a 20 year period where both Districts and the Soil Conservation Service worked extensively to improve, stabilize and maintain open ditches. During this period, a watershed emphasis directed the planning and application of conservation measures. Practices were applied not only to halt erosion, but also to reduce the transport of sediment into newly constructed ditches. Grassed berms were encouraged along ditches and early attempts at conservation tillage were tried. The plow-plant system was one method; another tried was use of the "Miller Disc". Later a small number of farmers began no-tilling corn into grass-legume sods using high rate applications of atrazine to control vegetation. More pattern tile systems were also planned and installed. Field sizes and the size of farm tillage equipment increased. Livestock numbers began to decrease.

By the late 1970's, the focus of farm conservation planning shifted somewhat again. Now there was a greater emphasis on water quality. A key practice in these plans was conservation tillage and/or residue management. New herbicides and improved reduced tillage and no-tillage equipment enabled the growth and usage of these practices. A goal was to obtain 30 percent or more of previous crop residues on the soil surface AFTER planting.

One effort to encourage and at the same time monitor farmer adoption of conservation tillage practices was the 3 year Honey Creek Watershed Project begun in 1979. Funded by the U.S. Army Corps of Engineers as part of their Lake Erie Wastewater Management Study, the Project enabled Soil and Water Conservation Districts, supported by USDA-Soil Conservation Service, USDA-Agricultural Stabilization and Conservation Service and Ohio State University Extension, to hire staff and encourage the adoption of conservation tillage, especially no-till corn and soybeans. The success of this Project led to the Ohio EPA funded Accelerated Conservation Tillage

program (1982 to 1985) carried out not only in the Honey Creek watershed, but all of northwest Ohio. In the Honey Creek watershed, these combined efforts resulted in a rapid expansion of both no-till corn and soybean acres. By 1987, more than one quarter of the corn was no-tilled with no-till soybean acres close behind.

A rapid decline in no-till corn acres occurred following the drought of 1988. No-till corn roots could simply not develop in untilled, dry soil. For several years after 1988, many farmers reverted to conventional or reduced tillage methods. This loss in the no-till corn acres was offset, however, by rapid growth of no-till soybean acres after 1992, the year John Deere introduced its "750 No-till Drill". By the late 1990's, half of all soybeans within the watershed were planted using no-till. Also at this time, about 1,000 acres of cropland were enrolled in the Conservation Reserve Program. Most of these acres were planted to grass or grass/legume cover. Fencerows were now nearly gone and the size of farm equipment continued to grow. Remaining livestock operations were larger and more concentrated.

In the early to mid-1990's, Districts worked with farmers to find other methods of planting corn that would retain crop residues on the soil surface, yet ensure adequate corn yields. Zone tillage, strip tillage and use of the AerWay aerator prior to planting were tried. A program tailored locally to speed adoption of these "vertical" tillage options for corn along with practices like nutrient and pest management plus conservation buffers was the Honey Creek Environmental Quality Incentive Program or "EQIP" (1999 to 2001).

At about this same time, cooperating federal, state and local agencies initiated the Lake Erie Conservation Reserve Enhancement Program or "CREP". This program provides farmers with added monetary incentives to speed the adoption of conservation buffers, especially filter strips along streams and ditches. The goal here is to enhance water quality within the Lake Erie watershed by reducing sedimentation and nutrient runoff. Many stream or ditch side buffers have been installed within the Honey Creek watershed, but opportunities still remain to install more buffers.

Comprehensive Nutrient Management Planning is the most recent attempt to address water quality within the watershed. Several hog operations and a few dairy operation have recently developed these plans with assistance from the Districts and the Natural Resources Conservation Service. They are intended to enable livestock producers to meet current environmental guidelines or in some cases regulations by using methods that more effectively and efficiently manage both animal manures and commercial crop nutrients.

Cultural Resources

Cultural resources in the Honey Creek Watershed are mostly limited to outdoor recreation opportunities and are listed in Table 3.12. The Village of Attica is home to the Attica Fairgrounds, a reservoir, and an access point for Honey Creek. The Village of New Washington is home to two reservoirs, a library/museum, and a village park, which includes a pool and baseball fields. Each of the villages within the watershed has at least one school located within its limits.

The Seneca County Park District manages Forrest Nature Preserve and Garlo Heritage Nature Preserve. The Crawford County Park District does not own any property

Table 3.12 Cultural resources in the Honey Creek Watershed.

Entity	Location	County	Type	Contact
Forrest Nature Preserve	CR 6, E of SR 231	Seneca	Nature Preserve	www.senecacounty.com/parks/
Garlo Heritage Nature Preserve	CR 6 at SR 19	Seneca	Nature Preserve	www.senecacounty.com/parks/
Pheasant's Forever Property	TR 88	Seneca	Wildlife Habitat	
Silver Creek	TR 55 at SR 19	Seneca	Wildlife Area	www.dnr.state.oh.us
New Washington Reservoirs	CR 25 at SR 602	Crawford	Reservoir	
New Washington Library/Museum	SR 103	Crawford	Library	
New Washington Park/Pool/Ball Fields	Poplar/ Washington Streets	Crawford	Park	
Attica Fairgrounds	TR 12	Seneca	Fair-grounds	
Attica Reservoir	SR 4 S of town	Seneca	Reservoir	
Honey Creek Access	SR4 S of town	Seneca	River Access	
Mohawk Golf Club	St Rt 231, S of CR 16	Seneca	Golf Course	419-447-5876
Willard Marsh	Section Line Rd at Coder Rd	Huron	Wildlife Area	www.dnr.state.oh.us
Omar Chapel	408 SR 4	Seneca	Historic Site	www.historicdistricts.com

in the watershed, but is active within the county in efforts to protect riparian areas. The Seneca County Chapter of Pheasants Forever owns a 13-acre facility north of Bloomville that will be opening to the public in the near future. The Ohio Division of Wildlife owns both the Silver Creek Wildlife Area, which is adjacent to Garlo, as well as the Willard Marsh Wildlife Area, located in Huron County.

Mohawk Golf Club is the only golf course in the watershed. Omar Chapel, located in Attica, is the only building listed on the National Register of Historic Places. There are of course a variety of private and public access points to Honey Creek, which provides opportunities for fishing and canoeing, depending on the water level. The cities of Bucyrus, Tiffin, and Willard are the most convenient places for residents to find a variety of cultural resources otherwise unavailable within the watershed boundaries.

Biological Resources

The *Sandusky River Watershed Resource Inventory and Management Plan,* or RIMP, updated most recently in December, 2002, devotes an entire chapter to the biological resources of the Sandusky River Watershed. The RIMP features ten tables of lists of species found within this larger basin including threatened and endangered species at both state and national levels. Many of these species are very likely to be found within Honey Creek, but a biological inventory restricted to the Honey Creek Watershed has not been conducted to date. Thus, the reader is referred to the RIMP for a complete list of biological resources found in the Sandusky River Watershed.

The recovery of bald eagles in Ohio is particularly noteworthy. Eighty-eight nesting pairs of eagles were reported in 2003; up from four nesting pairs in 1979. Many eagle nests have been counted along the Sandusky River and have been identified within the Honey Creek watershed too. The increase in eagles over the past twenty-five years is indicative of progress made in pollution reduction, but there is still concern for elevated levels of contaminants such as DDT and PCBs in some eagles.

The bald eagle is one of three key indicator species used to assess the biological health of Lake Erie as documented in the State of the Lake Report, 2004: Lake Erie Quality Index (LEQI). For more information on the LEQI, including additional discussion of bald eagles, the reader is referred to the following website: http://www.epa.state.oh.us/oleo/reports/leqi/leqi2004/pdf/2004lakeeriequalityindex.pdf. Finally, the Ohio Environmental Protection Agency published the Biological and Water Quality Study of the Sandusky River and Selected Tributaries, 2001: Seneca, Wyandot, and Crawford Counties, Ohio in May, 2003. This report includes information specific to the Honey Creek Assessment Unit. Excerpts from this report are discussed below in Chapter 4.

CHAPTER 4
WATER RESOURCE USE DESIGNATIONS IN THE HONEY CREEK WATERSHED

Introduction

To understand the general approaches to water resource protection used in Ohio and elsewhere, familiarity with the following set of terms and ideas is essential:

- **Use Designations**
- **Use Attainment/Use Impairment**
- **Water Quality Data (Chemical, Physical, Biological)**
- **Water Quality Standards/Criteria**
- **Causes and Sources of Impairments**
- **Remedial Measures/Watershed Action Plan**

Use designations identify the particular uses of water resources that the state deems worthy of protection. Ohio recognizes three such general areas of water use - aquatic life habitat, recreation, and water supply. Within each of these uses, subcategories exist that more specifically identify applicable uses for a particular stream segment or lake. For example, warmwater habitat is a particular aquatic life use designation applicable to most Ohio streams.

Use attainment indicates whether or not water quality (chemical, physical, or biological) is acceptable to support the designated uses. Stream segments or lakes can be in full, partial, or non-attainment of a particular use, such as warmwater habitat. Where the water quality of a stream segment fails to reach full attainment, that segment is said to have a use impairment. Thus a water quality problem, is referred to, in the terminology of the Ohio EPA, as a use impairment.

Water quality data are either quantitative or qualitative measurements of the chemical, physical or biological characteristics of a stream segment that are used to determine whether or not a particular use is impaired. One of the measurements to determine whether a stream segment meets the warmwater habitat use designation is a fish community index called the Index of Biological Integrity (IBI).

Water quality standards are particular values of water quality data used to determine whether or not a given use is impaired. The term "criteria" is often used interchangeably with water quality standard. The water quality standard for the IBI index for streams in this area having the warmwater use designation is 40 out of a maximum possible score of 60. To be in full attainment, the IBI index of such a stream must be 40 or higher.

Where stream segments are impaired relative to a particular use, i.e., applicable standards are not met, attempts are made to identify the particular causes and sources of impairment. For example, excessive nutrient concentrations derived from failed septic tanks may be a cause and source of impairment to the fish community, resulting in IBI values that fall below the standard.

Remedial measures are those actions which can address the causes and/or sources of impairment such that, when implemented, result in water quality improvements. A

watershed action plan **(WAP)** identifies the appropriate remedial measures for a watershed and sets forth a plan to achieve their implementation.

Use Designations in the Honey Creek Watershed

Use Designations in Ohio: An Overview. As noted above, Ohio recognizes three use designations for streams and rivers -- aquatic life habitat, water supply, and recreation. Each of the above three categories is subdivided into various levels of use, as shown in Sidebar 4.1 (Adapted from Sibebar 5.1 of the RIMP). The aquatic life use designations of exceptional warmwater habitat (EWH), warmwater habitat (WWH), modified warmwater habitat (MWH) and limited resource water (LRW) are particularly important, since OEPA relies heavily on the biological integrity of streams in their water resource assessments. These categories are described in more detail in Sidebar 4.2, which is reproduced from the OEPA Guide to Developing Local Watershed Action Plans in Ohio. Although designated uses of stream segments in the Upper Sandusky TMDL area, including Honey Creek, do not include segments designated as exceptional warmwater habitat, a description of that category is included since many segments of the Sandusky River mainstem do meet the standards for that category.

Ideally, the aquatic life use designations are based on field investigations by the OEPA that include determination of the Qualitative Habitat Evaluation Index (QHEI). For some stream segments, use designations were set in connection with published state water quality standards of 1978 and 1985 without the benefit of biological field investigations.

More background on use designations and their pre-TMDL status in the Sandusky Watershed are presented in Chapter 5 of the SRW RIMP.

Post-TMDL Use Designations in the Honey Creek Watershed. The 2001 Sandusky River TSD document provides a listing of current and proposed use designations of stream segments in the Upper Sandusky TMDL area (OEPA, 2003, Table 1C). The Honey Creek portion of that table is shown as Table 4.1. Based on the TMDL field studies, new recommendations of MWH were proposed for seven stream segments and LRW for one additional segment. The TMDL field studies confirmed the appropriateness of WWH designations for 6 sites. Designations of WWH for five stream segments are retained from published water quality standards, but those segments lack field verification. Those five tributaries form the balance of tributaries within the Honey Creek Watershed that were named in *the Gazetteer of Ohio Streams*, published of ODNR in 1960 (ODNR 1960). Apparently, the Gazetteer was the source of streams that received use designations in the state water quality standards of 1978 and 1985.

Many headwater streams in the Honey Creek Watershed are yet to be assigned use designations. Rather than assume that those undesignated streams are to be treated as WWH streams, the coalition views them simply as undesignated at this time. Many of these streams are under maintenance (Map 4) and thus would be classified as MWH. The topic of use designations for headwater streams is currently under investigation by the OEPA (http://www.epa.state.oh.us/dsw/wqs/headwaters/index.html). The Coalition chooses to await clarification of use designations for headwater streams before initiating specific programs for these streams. In any case, their use attainment status is unknown.

Sidebar 4.1 Designated Uses for Water Resources in Ohio

Aquatic Life Habitat Use Designations

In assessing the quality of Ohio's streams and rivers, the Ohio EPA relies heavily on whether or not a stream segment is achieving its aquatic life habitat use designation. The aquatic habitat use designations used by the Ohio EPA are:

- **Exceptional Warmwater Habitat (EWH)**
- **Warmwater Habitat (WWH)**
- **Modified Warmwater Habitat (MWH)**
- **Limited Resource Water (LRW)**
- **Seasonal Salmonid Habitats (SSH)**
- **Coldwater Habitat (CH)**

The vast majority of streams and rivers in Ohio are designated as Warmwater Habitat. Waters classified as Warmwater Habitat should be "capable of supporting and maintaining a balanced, integrated, adaptive community of aquatic organisms". This is the principal restoration target for water resources management in Ohio. Descriptions of the other aquatic life habitat use designations are available at the Ohio EPA web site (http://chagrin.epa.state.oh.us/watershed/aquatdef.htm).

Water Supply Use Designations

The Ohio EPA specifies the following three water supply use designations:

- **Public Water Supplies** - these are waters that with conventional treatment will be suitable for human intake and meet federal regulations for drinking water. Criteria associated with this use designation apply within 500 yards of surface water intakes for human consumption
- **Agricultural Supplies** - these waters are suitable for irrigation and livestock watering without treatment.
- **Industrial Supplies** - these waters are suitable for commercial and industrial uses with or without treatment.

Recreation Use Designations

In Ohio, Recreational Use Designations are in effect during the recreation season - May 1-October 15. There are three subdivisions of recreational use.

- **Bathing Waters** - these waters are suitable for swimming where a lifeguard and/or bathhouse facilities are present, and include any additional similar areas where the water quality is approved by the Director of the Ohio EPA.
- **Primary Contact Recreation** - these waters are suitable for full-body contact recreation such as swimming, canoeing and scuba diving with minimal threat to public health as a result of water quality.
- **Secondary Contact Recreation** - these waters are suitable for partial body contact recreation such as, but not limited to, wading, with minimal threat to public health as a result of water quality.

State Resource Waters Use Designation

State Resource Waters are water bodies that lie within park systems, wetlands, wildlife areas, wild, scenic and recreational rivers and publicly owned lakes and waters of exceptional recreational or ecological significance.

Sidebar 4.2. Aquatic Life Use Designations (applicable to the Upper Sandusky TMDL area)

Exceptional Warmwater Habitat (EWH) is the most biologically productive environment. These waters support unusual and exceptional assemblages of aquatic organisms, which are characterized by a high diversity of species, particularly those that are highly intolerant and/or rare, threatened, endangered or special status. This use represents a protection goal for water resource management efforts dealing with Ohio's best water resources. The standards for ammonia and dissolved oxygen are more stringent than in the other use designations.

Warmwater Habitat (WWH) defines the typical warmwater assemblage of aquatic organisms for Ohio's rivers and streams. It is the principal restoration target for the majority of water resource management efforts in Ohio. Criteria (standards) vary by ecoregion and site type.

Modified Warmwater Habitat (MWH) applies to stream with extensive and irretrievable physical habitatmodifications. The biological criteria for warmwater habitat are not attainable. The activities contributing to the modified warmwater habitat designation have been sanctioned and permitted by state or federal law.
the representative aquatic assemblages are generally composed of species that are tolerant to low dissolved oxygen, silt, nutrient enrichment and poor habitat quality. The ammonia and dissolved oxygen standards are less stringent than warmwater habitat. There are three subcategories:

- **Modified Warmwater Habitat - A** for those streams affected by acidic mine runoff;
- **Modified Warmwater Habitat - C** for those streams heavily channelized; and
- **Modified Warmwater Habitat - I** for those streams extensively impounded.

The biocriteria are set separately for each subcategory.

Limited Resource Water (LRW) applies to streams that have drainage areas of less than three square miles and either may lack water on a recurring annual basis, or have been irretrievable altered to the extent that noappreciable assemblage of aquatic life can be supported; no formal biological criteria are established for thisdesignation.

Map 10 shows the Aquatic Habitat use designations for the streams within the Honey Creek watershed, as described in Table 4.1. The map also shows the stream segments that do not have current use designations. Since use designation is a prerequisite to determination of use attainment, maps of use attainment can be no more detailed than those of use designation.

Table 4.1 also indicates that two sites are designated for public water supply. The site on Honey Creek at RM 28.35 serves as the intake for the Attica Water Treatment Plant. The site on Alum Ditch, a tributary to Brokenknife Creek, serves as the intake for the New Washington Water Treatment Plant and related pumped storage reservoirs. All stream segments are designated for use as both agricultural and industrial water supplies.

In addition, Table 4.1 indicates that all stream segments designated as either WWH or MWH for aquatic habitat are designated as sites for primary contact recreation (PCR). Only those sites designated as LRW for aquatic habitat are designated as secondary contact recreation (SCR).

Agricultural Drainage Uses. An essential reality of the stream networks of Honey Creek, and throughout the Sandusky Watershed, is that they not only serve as aquatic life habitat, but that they also serve as pathways of agricultural drainage that are essential to productive agriculture in the watershed. Many streams now referred to as headwater streams did not exist prior to agricultural drainage programs. Often ditches were dug to drain wetlands, and subsequently deepened and maintained to provide outlets for tile drainage. In other cases, streams that obviously existed prior to the onset of agricultural

Table 4.1 Waterbody Use Designations for the Honey Creek Watershed (Based on Table 1C of the 2001 Sandusky River TSD (OEPA, 2003)). See Sidebar 3.1 for abbreviations of use designations.

Water Body Segment	Use Designations												
		Aquatic Life Habitat						Water Supply			Recrea-tion		
	SRW	WWH	EWH	MWH	SSH	CWH	LRW	PWS	AWS	IWS	BW	PCR	SCR
Honey Creek at RM 28.35								o					
-RM 37.3 (Scott Rd) to RM 28.3 (SR4)				"+					**	**		**	
-RM 1.2 (CR 19) to RM 0.0				"+					**	**		**	
- all other segments		**							**	**		**	
Van Meter Creek				"+					**	**		**	
Buckeye Creek		**							**	**		**	
Silver Creek - headwaters to RM 8.7 (Brillhart Rd.)							"+		**	**			"+
- all other segments		**							**	**		**	
Slee Ditch (Silver Creek RM 0.72)		**							**	**		**	
Aicholtz Ditch - headwaters to RM 2.8 (CR 12)				"+					**	**		**	
-all other segments		**							**	**		**	
Kagy Ditch		*							*	*		*	
Bolinger Ditch		*							*	*		*	
Hedden Ditch		*							*	*		*	
Hooper Ditch		*							*	*		*	
Schaaf Ditch		*							*	*		*	
Brokenknife Creek - headwaters to RM 3.2 (Seneca Crawford County Line)				"+					**	**		**	
- all other segments		**							**	**		**	
Kibler Ditch (Brokenknife Cr. RM 5.27)							+		*	*			+
Alum Ditch (Brokenknife Cr. RM 5.50)								o					
Celery Creek (Honey Creek RM 32.84)				"+					**	**		**	
Tiro Creek (Honey Creek RM 41.3)				"+					**	**		**	

* Designations based on the 1978 and 1985 water quality standards.
\+ Designations based on pre-TMDL OEPA biological field assessments.
** Designations based on 1978 and 1985 standards for which results of a biological field assessment are now available (2001 TSD study).
"+ New recommendations based on the findings of this 2001 TSD study
o Designated uses based on results other than Ohio EPA biological data

drainage programs have been highly modified, either as part of drainage practices themselves, or as a consequence of agricultural land use in general. Because such modifications alter both the habitat and hydrology of the streams, they frequently result in altered channel forms and impaired biological communities.

A major concern of landowners in the watershed is that efforts to achieve designated aquatic life uses in the headwater streams that drain their cropland will interfere with the

drainage functions of those streams. The Coalition hopes that clarification of use designations for headwater streams in agricultural landscapes will emerge as part of OEPA's Headwater Initiative. While the MWH and LRW use designations do provide some relief to the concerns of farmers, aquatic communities may still not meet the les stringent criteria for these designations. Consequently, work is underway to develop a variety of BMPs that meet or reduce agricultural drainage needs while also improving the habitat and hydrology of headwater streams.

Leaving aside for the moment the issue of aquatic life use designation, it is instructive to acknowledge one basic ecological principle that applies to both man-altered and natural streams: water, nutrients, and energy are exported to downstream areas. Drainage ditches, therefore, whether modifications of natural streams or relatively new features of the landscape that have been created for purposes of conveyance, cannot be considered separate from the natural stream network. Such modifications of or additions to the natural stream network have a significant impact on water resources both locally and downstream (Karr and Dudley, 1981).

P**ollutant Export Issues:** Although there is no official use designation stating that watersheds should not export pollutants in quantities detrimental to downstream receiving waters, the necessity of reducing pollutant export from watersheds has long been recognized. Pollutant export from the Honey Creek Watershed has been monitored by the WQL since 1976 through detailed studies at the USGS Stream Gaging Station at Melmore. More than 14,000 water samples have been analyzed from that site for sediments and nutrients. The annual loads of suspended sediments and various nutrients exported from the watershed for each of the 10 years between 1994 and 2003 is shown in Table 4.2.

The data in Table 4.2 reflect the large annual variations in nutrient and sediment export as well as in stream discharge that are characteristic of streams in this region. Total annual discharge varied from 78 million cubic yards in 1999 and 2001 to 220 million cubic yards in 1997. Export of suspended solids varied even more, ranging from 2,645 short tons in 1999 to 48,047 short tons in 1997. Total phosphorus export ranges from 13 short tons in 1999 to 95 short tons in 1997. The highest exports of soluble reactive phosphorus and nitrate occurred in 2003. The annual variations in discharge and in nutrient and sediment export are primarily associated with variations in the frequency, magnitude and seasonal distribution of rainfall events which initiate runoff, erosion and tile flow leading to nutrient and sediment transport to and through Honey Creek and its tributaries.

The average annual discharge and export of nutrients and sediments at the WQL network of tributary monitoring stations is shown in Table 4.3. Note that the period of record does vary among several of the stations so that the average annual discharges do not represent comparable time periods for all of the streams. The data presented in Table 4.3 clearly indicate that export amounts tend to increase as watershed area increases. The Maumee River has the largest export of suspended solids, total phosphorus and nitrate, while the Scioto River has the largest export of soluble reactive phosphorus and the Cuyahoga has the largest export of chloride.

To directly compare runoff and nutrient and sediment export among watersheds of various sizes, unit area export rates are calculated. This calculation involves dividing the

Table 4.2 Annual discharge and export of suspended sediments (SS), total phosphorus (TP), Soluble Reactive Phosphorus (SRP), Nitrate plus nitrite nitrogen (nitrate-N) and chloride from the Honey Creek Watershed at the Melmore USGS stream gaging station as measured by the WQL. Units: discharge in million cubic yards, annual loads in short tons.

Water Year	Discharge	SS	TP	SRP	Nitrate-N	Chloride
1994	124	15,648	42	1.8	676	1,829
1995	135	17,632	46	3.7	767	2,347
1996	175	23,142	56	5.7	1,008	3,604
1997	220	48,047	95	9.6	1,006	3,769
1998	199	25,015	73	11.6	811	2,909
1999	78	2,645	13	3.1	366	1,984
2000	139	13,004	41	10.7	765	2,435
2001	78	3,593	15	5.5	404	2,380
2002	135	15,428	44	8.5	684	3,108
2003	150	12,673	42	13.6	1,077	3,174
Average	**143**	**17,683**	**47**	**7.4**	**756**	**2,754**

total export (annual or average annual) by the total watershed area, resulting in units of tons per square mile. Conversion factors are then used to produce more understandable units such as pounds per acre. Table 4.4 contains the average annual unit area export rates for the same rivers shown in Table 4.3. In the case of discharge, dividing the volume of discharge by the area gives units of length, which are then converted to inches.

Note that the unit area runoff in inches for Honey Creek is similar to that of other northwestern Ohio streams. Runoff does increase in the Eastern Ohio streams (Cuyahoga and Grand), due primarily to snow belt effects associated with Lake Erie. The Cuyahoga River has the highest unit area sediment export. The high rate for the Cuyahoga is likely due to naturally high erosion rates on the steep slopes and unstable stream banks of the Cuyahoga Valley. High bank erosion of previously filled flood plains and construction site erosion may also be playing a role in the high sediment export rate from the Cuyahoga watershed.

Unit area suspended sediment export from the Honey Creek Watershed is lower than average for the Sandusky River Watershed as a whole (371 lbs/acre versus 483 lbs/acre). However, the unit area export of total phosphorus, soluble reactive phosphorus and nitrate from Honey Creek (0.98, 0.15 and 15.9 lbs/acre, respectively) is similar to that of the Sandusky Watershed as a whole (1.00, 0.12 and 17.5 lbs/acre). The lowest export rates of nutrients come from the Grand River, which is a primarily forested watershed in eastern Ohio.

Table 4.3 Average annual discharge and sediment and nutrient loads for the indicated water years. Units: drainage area is square miles, discharge in million cubic yards, and sediment and nutrient loads in short tons.

River	Water Years	Drainage Area	Dis-charge	SS	TP	SRP	Nitrate	Chloride
Raisin	94-03	1,042	888	73,746	143	21.0	3,555	28,046
Maumee	94-03	6,330	6,290	879,506	1,972	336.4	34,261	153,398
Sandusky	94-03	1,253	1,229	193,524	400	49.3	7,026	29,589
Honey Cr	**94-03**	**149**	**143**	**17,683**	**47**	**7.4**	**756**	**2,754**
Rock Cr.	94-03	35	33	7,788	13	1.2	113	639
Vermilion	01-03	262	216	30,966	50	7.8	728	6,425
Cuyahoga	94-03	708	1,069	206,129	244	34.5	1,609	126,157
Grand	94-03	686	1,043	104,921	106	8.0	512	31,462
Muskingum	96-03	7,420	-	673,047	1,402	233.3	13,927	269,715
Scioto	97-03	3,854	4,242	406,795	1,157	420.0	15,735	153,965
Great Miami	97-03	2,685	3,316	314,086	1,045	418.1	12,953	127,312

.

The unit area export rates of total phosphorus from the agricultural watersheds of Northwestern Ohio are among the highest to be observed from Midwestern agricultural watersheds (Baker and Richards, 2002). These high rates of phosphorus export are related to the high clay content of area soils and the high average soil test values for phosphorus. Northwestern Ohio also has high nitrate export rates relative to other Midwestern agricultural areas. The high nitrate export rates in this area are associated with the extensive use of tile drainage in this region. Adoption of various agricultural BMPs in northwestern Ohio has reduced sediment and phosphorus export during the period from 1976 to 1995, but nitrate export has increased during this same time period. (Richards and Baker, 2002).

Table 4.4 Average annual unit area discharges and unit area loads for indicated water years for tributaries monitored by the WQL. (Unpublished data, WQL)

River	Year	Discharge, inches	SS, lbs/acre	TP, lbs/acre	SRP, lbs/acre	Nitrate, lbs/acre	Chloride, lbs/acre
Raisin	94-03	9.92	221	0.43	0.06	10.7	84
Maumee	94-03	11.56	435	0.98	0.17	16.9	76
Sandusky	94-03	11.40	483	1.00	0.12	17.5	74
Honey Cr.	**94-03**	**11.18**	**371**	**0.98**	**0.15**	**15.9**	**58**
Rock Cr.	94-03	11.23	717	1.21	0.11	10.4	59
Vermilion	01-03	9.58	370	0.60	0.09	8.7	77
Cuyahoga	94-03	17.56	911	1.08	0.15	7.1	557
Grand	94-03	17.67	478	0.49	0.04	2.3	143
Muskingum	96-03	-	284	0.59	0.10	5.9	114
Scioto	97-03	12.80	330	0.94	0.34	12.8	125
Great Miami	97-03	14.36	366	1.22	0.49	15.1	148

CHAPTER 5
USE ATTAINMENT FOR WATER RESOURCES IN THE HONEY CREEK WATERSHED

Use Attainment

This section is divided into sections describing the use attainment for each of the following three use designations assigned to segments of Honey Creek:

- Aquatic Life Use Attainment
- Recreation Use Attainment
- Public Water Supply Use Attainment

Aquatic Life Use Attainment

To understand the basis for biological use attainment analyses by the OEPA, additional background information is needed beyond the general concepts introduced earlier in this chapter. Much of the information presented below is taken from the OEPA Guide to Developing Local Watershed Action plans in Ohio (OEPA, 1997), the Sandusky River TSD (OEPA, 2003), the TMDL (OEPA, 2004b), and the RIMP (SRWC, 2001).

Biological Community Measurements: As part of the Upper Sandusky TMDL study, the Ohio EPA conducted detailed studies of the biological communities within the drainage network of the Honey Creek Watershed. The locations of the sampling stations are shown on Map 11 against the background of the use designation map for the watershed. The numbering of the stations is based on the watershed area upstream from the sampling site, with the largest area having the lowest number (1) and smallest area having the highest number (24).

The TMDL study plan called for fish studies at 24 stations, quantitative macroinvertebrate studies at 8 sites and qualitative macroinvertebrate studies at 16 sites. Fish collections were completed at 21 stations, quantitative macroinvertebrate studies at 5 sites and qualitative macroinvertebrate studies at 19 sites. The differences between the planned sampling and the completed sampling programs were attributed to low flow conditions at several of the sampling stations.

The OEPA utilizes standardized electrofishing techniques to study fish communities. These techniques are described in the OEPA User's Manual for Biological Field Assessment (OEPA, 1987). Quantitative macroinvertebrate studies involve the placement of artificial substrates in riffle environments of streams. Following a colonization period, the artificial substrates are collected and the macroinvertebrate communities evaluated relative to species composition and frequency. The qualitative macroinvertebrate studies involve the use of nets to collect representative species present in the stream. The macroinvertebrate methods are also described in the OEPA User's Manual for Biological Field Assessment (OEPA, 1987).

Biological Indices. The fish and macroinvertebrate data from the above studies are used to calculate the following three indices, as described in the OEPA Guide and presented below:

- **Index of Biological Integrity (IBI)** - The index of biological integrity is a measure of fish species diversity and species populations. The index is a number that reflects total native species composition, indicator species composition, pollutant intolerant and tolerant species composition, and fish condition. Combined, the higher the calculation, the healthier the aquatic ecosystem; conversely, the lower the index, the poorer the health of the aquatic ecosystem. The highest score is 60.
- **Modified Index of Well Being (MIwb)** - the modified index of well being factors out 13 pollutant tolerant species of fish and includes fish mass in the final analysis. Thus, if the IBI and the MIwb are examined together, an even clearer picture of the health of the biological community emerges. For example, if a high IBI is coupled with a low MIwb, it could tell us that while there is a variety of species and a good number of individuals of each species (high IBI) individual members of these species are smaller than what is expected. This might indicate that while fish are numerous, they are not maturing fully. In turn, this information could be useful in determining which pollution source is impacting the biological community. The highest value of the MIwb is 12. The MIwb is not applied to stream segments with drainage areas less than 20 square miles.
- **Invertebrate Community Index (ICI)** - the invertebrate community index is based on measurements of the macroinvertebrate communities living in a stream or river. It is particularly useful in evaluating stream health because: (1) there are a wide variety of macroinvertebrate taxa, which are known to be pollutant intolerant; and (2) there are a number of macroinvertebrate taxa, which are known to be pollutant tolerant. Like the IBI, the ICI scale is 0 - 60 with higher scores representing healthier macroinvertebrate communities and therefore more biologically diverse communities.

Biological Standards: In Ohio, numerical standards for the above indices have been incorporated into the state's pollution control laws. The minimum standards vary depending on the use designation and location (ecoregion) in the state. All of the watersheds within the Upper Sandusky TMDL study area are located in the Eastern Corn Belt Ecoregion (see Figure 2.3 in the OEPA Guide or Figure 5.2 in the RIMP). For streams in this ecoregion the standards for the three indices are shown in Figure 5.1 for each of the aquatic life use designations in the watershed. The standards are shown in tabular fashion in Table 5.1.

The figure illustrates how the standards become more stringent as the designation moves from lower to higher uses. The "bar" for acceptable quality is lifted as the use designation shifts from LRW to EWH for all three indices. As shown in Figure 5.1 and in Table 5.2, index values slightly below the standard are considered to be non-significant departures from the standard, and hence are deemed marginally acceptable. Where index values fall below those deemed marginally acceptable, stream segments are unacceptable relative to that index.

In Figure 5.1, each graph has a horizontal axis of drainage area at the sampling station. This is included on the graph because, as will be seen in subsequent sections of this chapter, index values tend to shift with drainage area, although biological standards are constant.

Reference Sites: The particular values of the standards shown above are based on biological measurements of reference streams in each ecoregion of the state. The reference stream segments are selected such that they have minimal pollutant impacts and optimal habitat characteristics for that ecoregion. The standards used for WWH general represent the 25th percentile of all of the index values for the reference sites. Thus, if the scores at all of the reference sites for a particular ecoregion were ranked from the highest to the lowest, the score 25% up from the lowest score is selected as the standard. Separate sets of reference sites are selected for MWH use designations. By using ecoregional reference sites, OEPA assures that local streams are evaluated relative to similar streams, in terms of soils, geology, and native vegetation. Two ecoregional WWH reference sites are located in the Upper Sandusky TMDL study area, as are five MWH reference sites.

Degrees of Use Attainment for Ohio Streams and Rivers: The OEPA has developed a standard set of terms to describe the degree to which biological use attainment is being met. These are as follows:

- **Fully Attaining** - All indices meet standards.
- **Fully Attaining but threatened** - All indices meet standards, but land use activities in the watershed pose an immediate threat to maintaining water quality at this level.
- **Partially Attaining** - One of two or two of three indices do not meet criteria and are not in the poor or very poor category.
- **Non-attaining -** None of the indices meet standards or one organism group indicates a severe toxic impact (poor or very poor category) even if the other organism groups indicate attainment.

Application of the above evaluations requires information on what index scores the OEPA views as poor or very poor. These, as well as other narrative criteria, are shown in Table 5.2..

Table 5.1 Water quality standards (biocriteria) for streams and rivers in the Eastern Corn Belt Plains ecoregion.

Index - Site Type	LRW	MWH Channel modified	MWH impounded	WWH	EWH
IBI Headwater -Wading/Boat	18/18	24/24	-/30	40/42	50
MIwb Wading/Boat	4.0/4.0	6.2/5.8	-/6.6	8.3/8.5	9.4/9.6
ICI	8	22	-	36	46

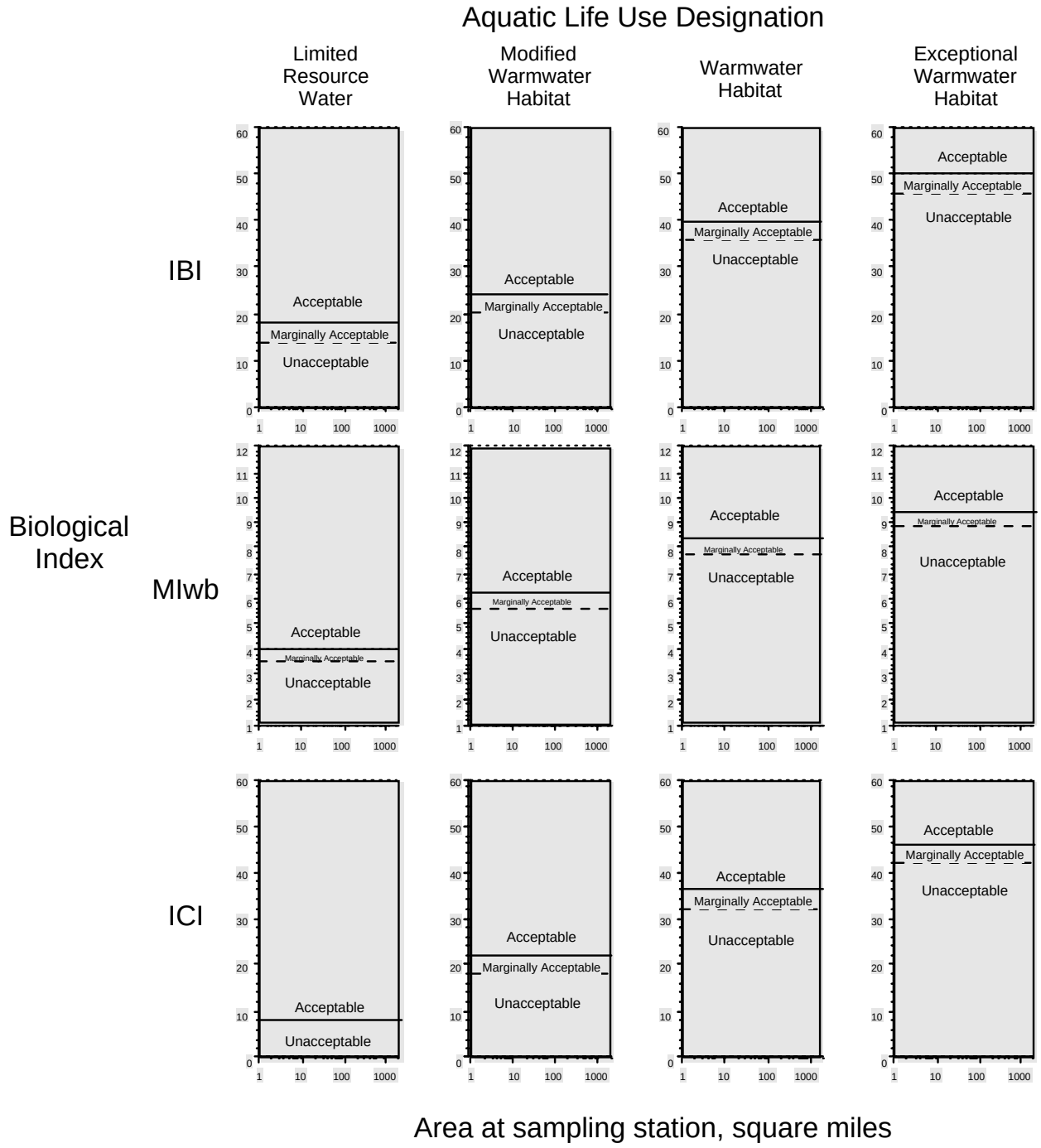

Figure 5.1 Relationship between use designations and aquatic life standards for three biological indices. Standards are for streams in the Eastern Cornbelt Ecoregion.

Table 5.2 Narrative evaluations for the three biological indices used in Ohio's biological assessments. The ranges for exceptional, very good, poor and very poor are applied statewide, regardless of ecoregion. The values for good, marginally good, and fair, as listed in the table, apply to streams in the Eastern Corn Belt Plains ecoregion.

IBI			MIwb		ICI	Narrative Evaluation
Headwater	Wading	Boat	Wading	Boat	All	
50-60	50-60	48-60	≥ 9.4	≥ 9.6	46-60	Exceptional
46-49	46-49	44-47	8.9-9.3	9.1-9.5	42-44	Very Good
40-45	40-45	42-43	8.3-8.8	8.5-9.0	36-40	Good
36-39	36-39	38-41	7.8-8.2	8.0-8.4	32-34	Marginally Good
28-35	28-35	26-37	5.9-7.7	6.4-7.9	14-30	Fair
18-27	18-27	16-25	4.5-5.8	5.0-6.3	2-12	Poor
12-17	12-17	12-15	0-4.4	0-4.9	<2	Very Poor

Results of Biological Studies in the Honey Creek Watershed

Biological Index Values and Attainment at Individual Sampling Stations. The results of the 2001 biological sampling program for stations in the Honey Creek Watershed are shown in Table 5.3 and Map 12. Table 5.3 combines information from the TSD, the TMDL study plan, and the draft TMDL. For each station the table includes information on the name of the stream, the sampling location, the river mile of the sampling location, the drainage area at the sampling location, the biological index scores, the QHEI (an index of habitat quality), the use designation at the sampling site, and the attainment status. The station numbers on Maps 11 and 12 correspond to the station numbers in Table 5.3. Thus, these station numbers provide the link between the locational data of the maps and the tabular date of Table 5.3.

Any index value that falls within the unacceptable range for that use designation is marked with an asterisk, while any value falling in the poor or very poor range is also underlined.

For the watershed as a whole, 50% (12) of the stations were in full attainment of the use designation, 21% (5) were in partial attainment, and 29% (7) were in non-attainment. Map 12 displays use attainment by the symbol color for each of the stations.

For the IBI fish index, 6 of 20 stations were in the unacceptable range; for the MIwb fish index, 3 of 8 stations were in the unacceptable range; for the quantitative ICI, 1 of 5 stations were in the unacceptable range; and for the qualitative ICI, 5 of 19 were in the poor or very poor range.

Indices in Relation to Watershed Area. Within the Upper Sandusky TMDL area, and most of Ohio, there is a distinct relationship between the size of the drainage area upstream from a sampling station and the values of its biological indices. These relationships within Honey Creek and the Upper Sandusky TMDL area are shown in Figure 5.2. In this case the drainage areas are broken down into four categories:

Table 5.3 Summary of biological studies completed in the Honey Creek Watershed during the 2001 Upper Sandusky TMDL studies.

Station #	Name of stream	Location of sampling site	River Mile	Area	IBI	MIwb	ICI	QHEI	Use Desig	Attainment
1	Honey Creek	C.R. 19	1.1	176	45	7.4	G	52.5	MWH	Full
2	Honey Creek	T.R. 58, Center Rd.	6.6	163	46	9.3	E	76.5	WWH	Full
3	Honey Creek	S.R. 67/S.R. 100	12.5	154	44	9.2	38	74.5	WWH	Full
4	Honey Creek	T.R. 58,Center Rd.	14.8	119	32*	7.6*	VG	62	WWH	Partial
5	Honey Creek	T.R. 173, Cemetery Rd.	18.05	113	32*	6.7*	42	58.5*	WWH	Partial
6	Honey Creek	T.R. 79, Slessman Rd.	25.03	89	32*	5.1*	30*	51*	WWH	**NON**
7	Honey Creek	T.R. 13, County Line Rd.	32.2	63	32	6.7	42	27*	MWH	Full
8	Honey Creek	TR 85, Bigham Rd.	34.1	28	28	7.3	32	32.5*	MWH	Full
9	Honey Creek	TR 67,Young Rd	38.4	16.3	32	NA	G	51*	WWH	Partial
10	Broken Knife Creek	TR 13, County Line Rd.	1	16.2	30*	NA	G	56.5*	WWH	Partial
11	Aicholz ditch	TR 77, Cooper Rd.	2.5	16.1	38_{ns}	NA	G	42.5*	WWH	Full
12	Silver Creek	SR 19, Bucyrus Clyde Rd.	4.1	16	26*	NA	MG	31.5*	WWH	**NON**
13	Honey Creek Trib. @ RM 32.84 (Celery Cr.)	TR 30 (ust. trib.), Section Line Rd.	2.2	10	X	NA	VP	-	MWH	(NON)
14	Silver Creek	CR58/14, Seneca/Crawford Line Rd.	7.7	9	36_{ns}	NA	MG	46.5*	WWH	Full
15	Honey Creek	TR 73, Waynesburg-Tiro Rd.	41.7	8.7	32*	NA	G	55.5*	WWH	Partial
16	Aicholz ditch	C.R. 23, Scipio Siding Rd	3.9	8.1	28	NA	P	28.5*	MWH	**NON**
17	Broken Knife Creek	TR 133, McCarthy Rd.	5.1	7.9	30	NA	G	25*	MWH	Full
18	Buckeye Creek	T.R. 17	0.8	7.2	46	NA	G	84	WWH	Full
19	Silver Creek	SR 4, Columbus-Sandusky Rd	10.6	4.5	X	NA	VP		LRW	(NON)
20	Buckeye Creek	TR 10/ 11, County Line Rd.	2.6	4.4	46	NA	MG	58*	WWH	Full
21	Honey Creek Trib @ RM 32.84 (Celery Cr.)	TR 14, Base Line Rd.	5.6	4.2	X	NA	p	-	MWH	(NON)
22	Van Meter Creek	TR 151, Infirmary Rd.	1.7	3.8	32	NA	G	47	MWH	Full
23	Silver Creek Trib @ RM 0.72 (Slee Ditch 05-213)	At mouth	0.1	3.3	44	NA	G	51.5*	WWH	Full
24	Honey Creek Trib @ RM 41.3 (Tiro Creek)	TR 190, Hammond Rd.	?.?		X		P		MWH	(NON)

headwater streams (< 20 square miles), wadeable streams (≥ 20 - <200 square miles), small rivers (≥ 200 - <500 square miles) and large rivers (≥500 square miles).

For the Upper Sandusky TMDL data set as a whole, there is a clear decrease in each index as the drainage area above sampling stations decreases (Figure 5.2). This is confirmed in Table 5.4, where the average index value is shown for each size range. It is noteworthy that, for the Sandusky River TMDL area, the average scores for the IBI and the ICI for the stations in the large river category meet the criteria for exceptional warmwater habitat (EWH) while the average scores for the headwater and wadeable streams fail to meet the criteria for warmwater habitat. These relationships will be reflected in the management strategies set forth to reach the attainment goals for the Honey Creek Watershed.

Attainment in Relation to Use Designation. In Table 5.5, the percentage of stations falling into the three attainment categories are shown in relation to use designation for the Honey Creek stations as well as for the Sandusky TMDL area as a whole. In the Honey Creek watershed, 14 stations were classified as WWH. Of these 50% were in full attainment, 36% were in partial attainment and 14% were in non-attainment. In the watershed, 9 stations were classified as MWH. Of these, 56% were in full attainment and 44% were in non-attainment. One Honey Creek station was designated as LRW and it was in non-attainment.

For the Upper Sandusky TMDL study area, 109 stations were classified as WWH. Of these, 33% were in full attainment, 25% in partial attainment and 42 % on non-attainment. For WWH stations, Honey Creek had a higher percentage of stations in full attainment than the Upper Sandusky TMDL study area as a whole. There were 32 stations classified as MWH in the Upper Sandusky TMDL area and the percentages in the various attainment categories were similar for both Honey Creek and the entire Upper Sandusky area. For both data sets, the percentage of stations in full attainment was higher for MWH stations than for WWW stations. It should also be noted that the percentage of the total stations that were designated as MWH was much higher in Honey Creek (37.5%) than for the Upper Sandusky TMDL area as a whole (21.7%).

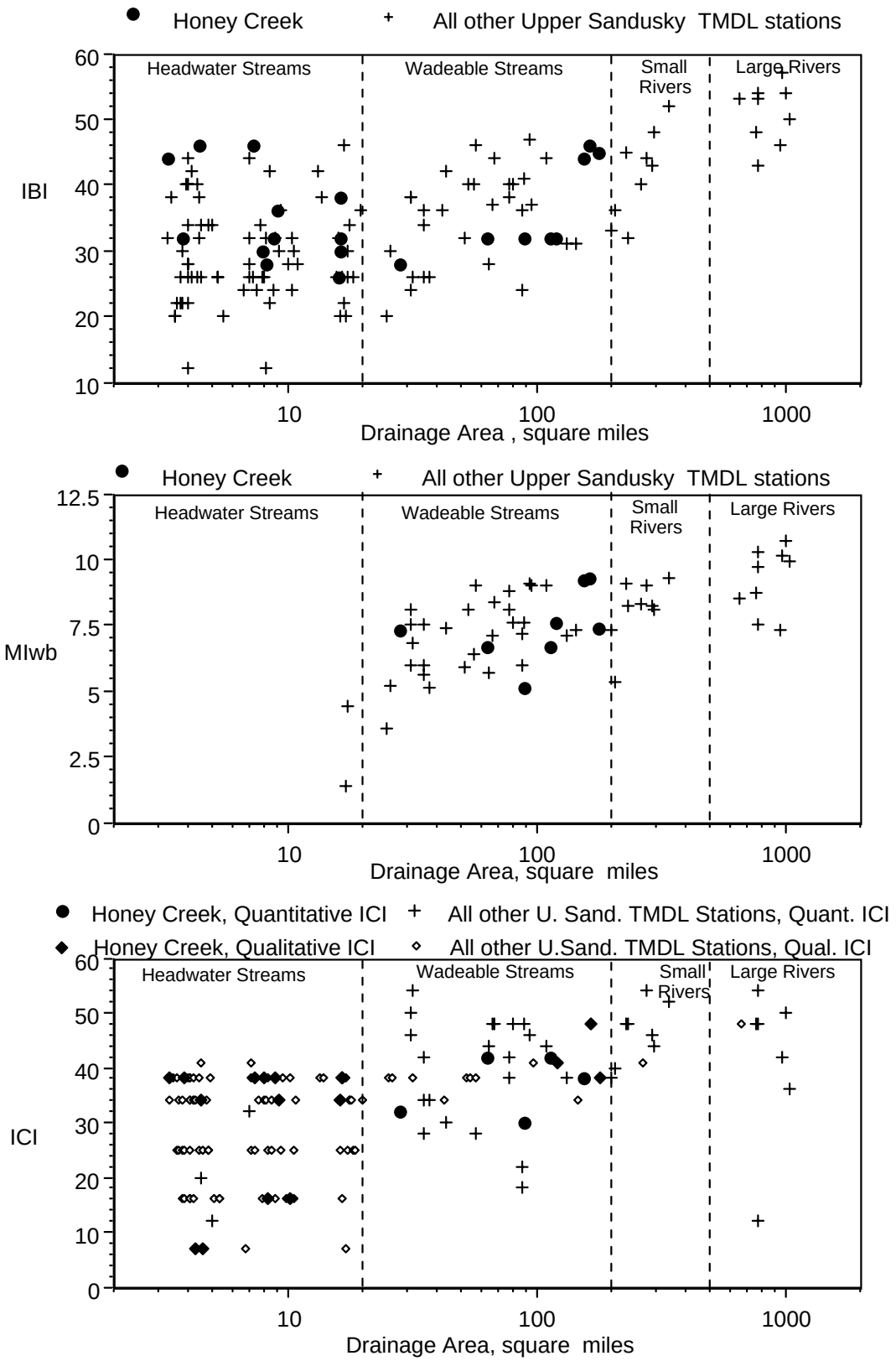

Figure 5.2 Relationships between index values and station drainage areas.

Table 5.4 Biological index values in relation to drainage area of sampling stations for the Upper Sandusky TMDL area and the Honey Creek Watershed.

Index/Station	Parameter	Headwater Streams	Wadeable Streams	Small Rivers	Large Rivers
		≤ 20 sq. mi.	≤ 200 - >20	≤ 500 - >200	> 500 sq. mi.
IBI, Sandusky	Mean Std. Deviat. n	30.3 ±7.52 82	35.3 ±7.00 39	42.5 ±6.41 8	50.9 ±4.48 9
IBI, Honey C.	Mean Std. Deviat. n	35.0 ±7.01 12	36.4 ±7.29 8	-	-
MIwb, Sand.	Mean Std. Deviat. n	-	7.18 ±1.34 38	8.19 ±1.26 8	9.19 ±1.24 9
MIwb, Honey	Mean Std. Deviat. n	-	7.41 ±1.37 8	-	-
ICI, Sandusky	Mean Std. Deviat. n	29.0 ±9.43 97	38.9 ±7.67 39	46.6 ±4.93 8	46.6 ±5.85 7
ICI, Honey C.	Mean Std. Deviat. n	29.3 ±12.1 16	38.9 ±5.79 8	-	-

Watershed Scores: In order to both evaluate and compare biological use attainment of streams the OEPA has developed a watershed scoring system. The calculation of the watershed score is illustrated in Table 5.6, using the Honey Creek watershed as an example. The monitoring stations within a watershed are divided into the four size ranges shown in column l. For the smallest three size ranges, the percentage of the stations in full attainment is calculated. In Table 5.6, the number of stations in each size range is shown in column 2 and, for the smallest three sizes, the percentage of the stations in full attainment is shown in column 3. For the largest size range (50-500), the station data, coupled with other information, are used to estimate attainment level on a stream segment basis. For this size range, the percentage of the stream miles in full attainment is then calculated and shown in column 4. The OEPA then uses weighting factors, as shown in column 5, to calculate a score for each size range by multiplying the weighting factor by the percent in full attainment. Those scores by size range are then added together to obtain a watershed score.

It should be noted that in the calculation of subwatershed scores, full attainment at a site with LWR (or MWH) designation has equal weight as full attainment at a site with WWW designation.

Table 5.5 Use attainment in relation to use designation for the Honey Creek Watershed and for the entire Upper Sandusky TMDL Area.

Honey Creek Use Attainment by Use Designation (Watershed Score = 57)				
Use Designation	**Full Attainment**	**Partial Attainment**	**Non attainment**	**Total #**
WWH	7 (50%)	5 (36%)	2 (14%)	14
MWH	5 (56%)	-	4 (44%)	9
LRW	-	-	1 (100%)	1
Total	12 (50%)	5 (21%)	7 (29%)	24
All Sandusky Subwatershed Sites (excludes Large Rivers) (Ave Watershed Score=44)				
Use Designation	**Full Attainment**	**Partial Attainment**	**Non attainment**	**Total #**
WWH	36 (33%)	27 (25%)	46 (42%)	109
MWH	17 (53%)	2 (6%)	13 (41%)	32
LRW	3 (50%)	-	3 (50%)	6
Total	56 (38%)	29 (20%)	62(42%)	147

In 2000, the average watershed score in Ohio was 47. The OEPA has set an average watershed score of 80 as the target for 2010 (OEPA, 2004c). The scores of the eight 11-digit subwatersheds of the Sandusky Watershed included in the TMDL study are shown in Table 4.11. None of the subwatersheds in the Upper Sandusky TMDL study area meet the OEPA target score of 80. The Honey Creek Watershed has the second highest watershed score (63.7) in the TMDL study area, exceeded only by the Broken Sword Watershed (71). These same two watersheds had the lowest percentage of stations designated as WWH (Table 5.7). Thus, their watershed scores are higher, at least in part, because they had lower standards to attain.

In Table 4.11, the average IBI scores are also shown for each 11-digit watershed in the Upper Sandusky TMDL area. While the watershed scores ranged from 71 to 13, the average IBI scores ranged from 36 to 29. The watershed with the highest watershed score (Broken Sword, 71) had the same average IBI score (32) as the watershed with the next to the lowest watershed score (Lower Tymochtee Creek, 27). The IBI has been used for this comparison because it the quantitative index most frequently available for stations in the Upper Sandusky TMDL area. It is evident that watershed scores are dependent on the use designations that have been assigned to individual stream reaches.

Watershed scores are also strongly impacted by the way sampling stations cluster within the size categories used to calculate the watershed score. In the case of Honey Creek (Table 4.10), only one of the 24 stations fell in the 20-50 square mile size category. That category is automatically assigned 25% of the total score. That single station, which was in full attainment of MWH use designation, contributed 25 points to the total watershed score for Honey Creek. In general, the 20 - 50 square mile size category is under-represented in the data sets, resulting in a small number of stations having a disproportionate impact on watershed scores. This problem was identified in the SRWC comments on the draft TMDL and acknowledged by OEPA in their responses. However, solutions have yet to be developed.

For the reasons mentioned above, the utility of watershed scores will be evaluated on a watershed by watershed basis in the preparation of watershed management plans by the SRWC.

Table 5.6 Calculation of watershed score for the Honey Creek Watershed.

1	2	3	4	5	6
Watershed size sq. miles	**Number of stations**	**Percent of stations in full attainment**	**Percent of river miles in full attainment**	**Weighting factor**	**Score per watershed size category**
<5	6	50%		0.125	6.3
5 - <20	10	40%		0.125	5.0
20 - <50	1	100%		0.25	25.0
50 - <500	7		54.8%	0.50	27.4
Total Score	24			1.00	63.7

Table 5.7 Ranked subwatershed scores for the Sandusky River Watershed.

Subwatershed	11 digit # 04100011-	Watershed Score	Percent WWH	Ave. IBI
Broken Sword Creek	030	71	43	32
Honey Creek	080	64	58	36
Sandusky River - Mexico	070	56	78	33
Sandusky River - Upper Sandusky	040	52	89	33
Sandusky River - Tiffin (Partial)	090	50	73	31
Sandusky River- Bucyrus	020	32	92	33
Lower Tymochtee Creek	060	27	93	32
Upper Tymochtee Creek	050	13	60	29
Average		**45.6**	**73.2%**	**32.4**

Attainment by 14-digit Watersheds. In Table 5.8, the results of the biological sampling program are arranged by the six 14-digit watersheds located in the Honey Creek Watershed. Even though the Upper Sandusky TMDL study has provided a greatly improved data set for evaluating biological use attainment at the 11-digit watershed level, the density of collection sites provides very limited data for evaluating water quality at the 14-digit watershed level. Care must be exercised in interpreting the data for the following reasons:

- Some of the subwatersheds have very limited sampling (2 of 6 14-digit watersheds in the Honey Creek Watershed contain only 2 sampling stations and a third contains only 3 stations.

Table 5.8 Biological study results by 14-digit watersheds within the Honey Creek Watershed.

Station #	Name of stream	Location of sampling site	River Mile	Area	IBI	MIwb	ICI	QHEI	Use Desig	Attainment
-010	**Honey Creek headwaters to above Broken Knife Creek**									
8	Honey Creek	TR 85, Bigham Rd.	34.1	28	28	7.3	32	32.5*	MWH	Full
9	Honey Creek	TR 67,Young Rd	38.4	16.3	32	NA	G	51*	WWH	Partial
13	Honey Creek Trib. @ RM 32.84 (Celery Cr.)	TR 30 (ust. trib.), Section Line Rd.	2.2	10	X	NA	VP	-	MWH	(NON)
15	Honey Creek	TR 73, Waynesburg-Tiro Rd.	41.7	8.7	32*	NA	G	55.5*	WWH	Partial
21	Honey Creek Trib @ RM 32.84 (Celery Cr.)	TR 14, Base Line Rd.	5.6	4.2	X	NA	p	-	MWH	(NON)
24	Honey Creek Trib @ RM 41.3 (Tiro Creek)	TR 190, Hammond Rd.	?.?		X		P		MWH	(NON)
-020	**Broken Knife Creek**									
10	Broken Knife Creek	TR 13, County Line Rd.	1	16.2	30*	NA	G	56.5*	WWH	Partial
17	Broken Knife Creek	TR 133, McCarthy Rd.	5.1	7.9	30	NA	G	25*	MWH	Full
-030	**Honey Creek below Broken Knife to above Silver Creek (except Aicholz Ditch)**									
5	Honey Creek	T.R. 173, Cemetery Rd.	18.05	113	32*	6.7*	42	58.5*	WWH	Partial
6	Honey Creek	T.R. 79, Slessman Rd.	25.03	89	32*	5.1*	30*	51*	WWH	**NON**
7	Honey Creek	T.R. 13, County Line Rd.	32.2	63	32	6.7	42	27*	MWH	Full
-040	**Aicholtz Ditch**									
11	Aicholz ditch	TR 77, Cooper Rd.	2.5	16.1	38_{ns}	NA	G	42.5*	WWH	Full
16	Aicholz ditch	C.R. 23, Scipio Siding Rd	3.9	8.1	28	NA	P	28.5*	MWH	**NON**
-050	**Silver Creek**									
12	Silver Creek	SR 19, Bucyrus Clyde Rd.	4.1	16	26*	NA	MG	31.5*	WWH	**NON**
14	Silver Creek	CR58/14, Seneca/Crawford Line Rd.	7.7	9	36_{ns}	NA	MG	46.5*	WWH	Full
19	Silver Creek	SR 4, Columbus-Sandusky Rd	10.6	4.5	X	NA	VP		LRW	(NON)
23	Silver Creek Trib @ RM 0.72 (Slee Ditch 05-213)	At mouth	0.1	3.3	44	NA	G	51.5*	WWH	Full
-060	**Honey Creek below Silver Creek to Sandusky River**									
1	Honey Creek	C.R. 19	1.1	176	45	7.4	G	52.5	MWH	Full
2	Honey Creek	T.R. 58, Center Rd.	6.6	163	46	9.3	E	76.5	WWH	Full
3	Honey Creek	S.R. 67/S.R. 100	12.5	154	44	9.2	38	74.5	WWH	Full

Station #	Name of stream	Location of sampling site	River Mile	Area	IBI	MIwb	ICI	QHEI	Use Desig	Attainment
4	Honey Creek	T.R. 58,Center Rd.	14.8	119	32*	7.6*	VG	62	WWH	Partial
18	Buckeye Creek	T.R. 17	0.8	7.2	46	NA	G	84	WWH	Full
20	Buckeye Creek	TR 10/ 11, County Line Rd.	2.6	4.4	46	NA	MG	58*	WWH	Full
22	Van Meter Creek	TR 151, Infirmary RD.	1.7	3.8	32	NA	G	47	MWH	Full

Key to Table 5.8	
Station #	refers to the sampling station numbers shown on the Use Attainment and Use Designation maps for the watershed. The numbers are assigned by decreasing watershed area.
Milepoint	distance, in miles,upstream from the mouth of each tributary or stream.
Area	drainage area (square miles) of watershed upstream from each sampling point.
Use designation : WWH - Warmwater Habitat; MWH - Modified Warmwater Habitat, LRW - Limited Resource Water	
IBI (Index of Biological Integrity) - a measure of the quality of the fish community.	
MIwb (Modified Index of Well Being) - another measure of the quality of the fish community.	
ICI (Invertebrate Community Index) - a measure of the quality of the community of aquatic insects, snails, and worms, etc. Quantitative form has scores from 1 to 60. Qualitative ICI uses the following abbreviations: e - excellent, VG - very good, G - good, MG - marginally good, F - fair, P - poor, and VP - very poor	
QHEI Qualitative Habitat Evaluation Index - An index that reflects the quality of the habitat at the sampling site. Ranges up to 100 for the best sites.	
Attainment	Reflects the degree to which the index scores (IBI, MIwb, ICI) meet the standards for the designated use at that station. Full - all three indices meet their standards, partial - one of two or two of three indices fail to meet their standards, Non - none of the indices meet their standards or one index is in the poor or very poor range.
*	indicates that that index value falls below the standard for that use designation
Ns	indicates that that index value is only marginally below its standard, and will be accepted as meeting the standard
( )	indicates that the attainment status is based on evaluation of a single biological group (index)
_ (underline)	indicates that that index value is significantly below its standard and is in the poor or very poor range.

- The distribution of drainage area sizes at sampling stations differs greatly among 14-digit watersheds. Thus 14-digit watersheds located along downstream reaches of major tributaries contain sites with much larger drainage areas. Because of the relationships between drainage areas and index scores, these downstream 14-digit watersheds tend to have greater degrees of attainment. For example, the -060 subwatershed (Honey Creek below Silver Creek to the Sandusky River) contains four sites with drainage areas over 100 square miles. For three of the 14-digit watersheds, sampling stations are limited to headwater sites (drainage areas less than 20 square miles).

Among the headwater stations in the Honey Creek Watershed two tributaries stand out as having IBI scores well within the WWW criteria. These include two stations (#18 & #20) along Buckeye Creek in the -060 14 digit watershed (Honey Creek below Silver Creek to Sandusky River) and Slee Ditch (#23) in the -050 14-digit watershed (Silver Creek). Two other headwaters stations have non-significant departures from WWW IBI criteria. These are stations #14 on Silver Creek and #11 on Aicholz Ditch.

Recreation Use Attainment

Recreation beneficial use designation. To meet the Clean Water Act's charge to establish swimmable/fishable waters requires that recreation be designated a beneficial use. Recreation use designations apply during the recreation season only, defined as the period from May 1 to October 15, and include three subcategories of use: bathing waters, primary contact, and secondary contact (see Sidebar 4.1). Almost all the Honey Creek watershed has been given the primary contact recreation (PCR) designation (OAC 3745-1-12). This designation refers to waters suitable for full-body recreation such as swimming or canoeing. The water generally has at least a 1 meter depth over an area of at lest 100 square feet to meet this designation. Secondary Contact Recreation (SCR) is the designation for waters that are too small and shallow to allow primary contact. Only 2 sites in the Honey Creek Watershed have the SCR designation: Kibler Ditch and the headwaters of Silver Creek.

Assessment method for recreation use attainment. Ohio EPA's newly developed method for assessing attainment of recreation uses is described in the Ohio 2004 Integrated Water Quality Monitoring and Assessment Report (OEPA, 2004a). Fecal coliform is used as an indicator organism for the presence of pathogens. The Water Quality Criterion (Table 7-13, OAC 3745-1-07) states that the geometric mean fecal coliform content, based on no less than five samples within a thirty-day period, shall not exceed 1000 CFU (colony forming units) per 100mL and fecal coliform content shall not exceed 2000 CFU per 100mL in more than 10% of the samples taken during any thirty-day period.

In the Ohio 2004 Integrated Report, the pool of raw data for fecal coliform was not large enough to allow direct comparison of the geometric mean to the water quality criterion. Therefore, waters were designated impaired when the 75th percentile exceeded 1000 or the 90th percentile exceeded 2000 CFU per 100 mL. A minimum of three

sampling locations and 15 measurements within a given assessment unit were required to assess attainment.

Fecal coliform data and the watershed's recreational use attainment. The 2001 TMDL study in the Honey Creek watershed reported a geometric mean of 506 CFU/100mL and a 90th percentile of 1859 CFU/100mL. The Ohio 2004 Integrated Report (Appendix D.2.) provides the following data: for pooled data taken from 21 ambient sites with 34 ambient sampling records, the geometric mean was 155 CFU/100mL, the 75th percentile was 635 CFU/100mL, and the 90th percentile was 1200 CFU/100mL. On the basis of these data the OEPA has determined that the Honey Creek watershed assessment unit is not impaired for the primary contact recreation use designation. (OEPA, 2004a). Data measured in the 2001 OEPA study is broken down by site in Table 5.9.

One site along Honey Creek was mentioned as a problem location in the 2001 Sandusky River TSD (OEPA, 2003). The Honey Creek Subdivision, near the confluence of Honey Creek with the Sandusky River, has 34 homes which were served by on-lot sewage treatment systems. A sample taken at this site (RM 1.1 on Honey Creek) had a fecal coliform count of greater than 10,000 CFU/100mL, and the report suggested that septic system overflows were connected to a storm sewer tile. The problem has been addressed by the installation of a package sewage treatment plant.

Table 5.9 Coliform bacterial counts as reported in the 2001 TMDL study.

Site (Each site had 5 sets of samples collected at 2-week intervals)	River Mile	Fecal Coliform (CFU/100 mL)	Applicable statewide water quality criteria (3745-1-07)
Honey Creek	41.66	2500	Recreation OMZM*
	32.23	1200	Recreation OMZA
	14.8	1200	Recreation OMZA
	1.1	>10000	Recreation OMZM
Buckeye Creek	0.73	1100	Recreation OMZA
Silver Creek	7.75	1800	Recreation OMZA
Aicholz Ditch	2.46	1900	Recreation OMZA
Brokenknife Creek	5.08	4000	Recreation OMZM
	3.19	1400	Recreation OMZA

*OMZM: Outside Mixing Zone Maximum, OMZA: Outside Mixing Zone Average

Potential causes and sources of impairment. Although the Honey Creek Watershed has not been designated as impaired for PCR use, impairments have been cited for the Upper Sandusky River Watershed. Since Honey Creek Watershed contains land uses similar to the rest of the Upper Sandusky River Watershed, the potential for future degradation of PCR use exists and should be guarded against. With this goal in mind, potential causes and sources of impairment are examined here.

The TMDL Report for the Upper Sandusky River, prepared by the OEPA Division of Surface Water, includes recreation in its assessment of beneficial uses. The report identifies pathogens as the primary cause of recreation use impairment. Sources include combined sewer overflows, agricultural sources (manure), and septic systems.

Bacteria and other pathogens are a human health issue for recreational use attainment, because people can be exposed to these organisms while wading, swimming, and fishing. Measurement of fecal coliform, a bacterium ubiquitous in fecal matter, serves as an indicator of the presence of fecal contamination from human and/or animal sources. Where such contamination exists, serious disease-causing organisms may be present. Diseases that can be caused by exposure to bacterial pathogens include diarrhea, urinary tract infections, typhoid fever, gastroenteritis, and dysentery. Viral pathogens include polio, hepatitis A, and encephalitis. Other water-borne pathogens that cause concern are cryptosporidium and giardia.

Municipal wastewater treatment facilities are required to disinfect the effluent they discharge into public water bodies during the recreation season (May 1-Oct. 15). However, combined sewer overflows can cause untreated sewage to bypass the treatment plant and enter into streams, bringing dangerous levels of pathogens with it. Combined sewer overflows may occur in sewer systems that carry both sanitary waste and stormwater. During a heavy rain, the sewage influent may be diverted directly to the stream to prevent flooding of the treatment system.

Another source of pathogens is livestock production. Manure can enter streams from pasture land, direct access of livestock to the stream, feedlot runoff, and manure disposal by land application. Artificial tile drainage systems can carry contaminants from liquid manure application.

Drainage from poorly designed or maintained septic systems can contribute pathogens to water resources. Cross connecting septic systems to storm sewers in housing developments and small towns can facilitate pollution of receiving streams. In some instances septic systems have been known to be connected to agricultural tile drainage systems.

In waterways where hydrological modification has isolated the channel from the landscape, sediments can become concentrated. Since pathogens can attach to suspended or bed load sediments, these pathogens may also become more concentrated.

Public Water Supply Use Attainment

Two communities have public water supplies that take water from the surface waters of the Honey Creek Watershed: Attica and New Washington. Attica pumps water from Honey Creek at RM 28.35 and stores it in an upground reservoir. New Washington takes water from Alum Ditch at RM 5.50 on Brokenknife Creek and also pumps it into an upground reservoir.

Water quality criteria for public water supplies. Waters located within five hundred yards of a drinking water intake are given the use designation of "public water supply" (OAC 3745-1-07). OEPA water quality criteria for the protection of human health fall under two sub-categories: drinking and non-drinking (OAC 3745-1-33). The "drinking"

human health criteria apply to all water bodies located within five hundred yards of drinking water intakes.

The Ohio Administrative Code document on water quality criteria for the Lake Erie drainage basin lists the "drinking" human health criteria (OAC-3745-1-33, Table 33-2). Chemicals listed include 16 organics (including several pesticides, industrial chemicals, and PCB), 3 metals (arsenic, iron, and mercury), dissolved solids, and inorganic ions cyanide, chloride, nitrate + nitrite, and sulfate.

The source waters near the intakes of these plants were not sampled in the 2001 Sandusky River TSD and the above mentioned human health criteria have not been assessed for these waters. However, a drinking water source assessment has been conducted for both water treatment facilities under the Source Water Assessment Program (SWAP) required by the Safe Drinking Water Act and the results are reported below (Drinking Water Source Assessment Reports).

Drinking Water Source Assessment for the Village of Attica. The Attica public water system serves 1,200 people and produces an average of 108,000 gallons per day. The Drinking Water Source Protection Area (approximately 74 square miles) includes the drainage area upstream of the plant intake and is subdivided into a Corridor Management Zone (CMZ) and Emergency Management Zone (EMZ). The CMZ extends from Honey Creek RM 28.35 to 10 miles upstream at RM 38.5 and includes the area 1000 feet to each side of the stream. It also includes any tributaries along this section of the mainstem with an expanse 500 feet wide on each side. The EMZ is a semicircle that extends 500 feet upstream and 100 feet downstream of the intake.

The land uses for the protection area are 68.7% row crops, 19.5% pasture/hay, 9.9% deciduous forest, and several other uses at less than 1%.

The assessment report gives compliance monitoring results for finished water. The system had no health-based or maximum contaminant level (MCL) violations. It should be noted that an OEPA Pesticide Special Study detected nitrate and several pesticides in the finished water, suggesting contamination from local land use activities (OEPA, 1999).

Biological and chemical monitoring of the streams within the protection area yielded several results that are relevant to source water quality. In a sample from Honey Creek at Bigham Road, atrazine and metalochlor were detected at 0.95µg/L and 0.28µg/L, respectively. These values are well below the health advisory levels for these compounds. Samples taken from Brokenknife Creek at RM 5.08 and RM 3.19 had elevated bacteria levels from an unknown source.

Potential contaminant sources include agricultural runoff, animal feedlots, pesticides and fertilizer storage areas, above ground oil tank storage, industrial storm water, feed lot runoff, gas line rupture, malfunctioning septic systems, and wastewater treatment plant discharges.

Among the protective strategies suggested in the Drinking Water Source Assessment report are controlling runoff from agricultural areas, establishing an emergency response plan for spills, improving home and commercial septic systems, and coordinating local emergency response agencies.

Drinking Water Source Assessment for the Village of New Washington. The New Washington public water system serves 1,000 people and produces an average of 93,800

gallons per day. In addition to surface water taken from Alum Ditch, a tributary of Broken Knife Creek, the system draws from four ground water wells.

The protection area has a CMZ that is 1000 feet wide on each side of Alum Creek. The EMZ is a semicircle that extends 500 feet upstream and 100 feet downstream of the intake.

Land use in the protection area includes 87.1% agriculture covering, 9.5% pasture/hay, 2.8% deciduous forest, and 0.6% open water.

Compliance monitoring (1991-2002) on finished drinking water indicates no health-based or MCL violations. An OEPA Pesticide Special Study (1995-1999) showed elevated levels of nitrate and several pesticides in the finished water attributed to agricultural land use activities.

Potential contaminant sources include agricultural runoff, failing home septic systems, and spills along transportation routes. Protective strategies recommended in the report include controlling runoff from agricultural areas, establishing an emergency response plan for spills, improving septic systems, and coordinating with local emergency response agencies.

Source Water Protection Plan (SWPP) for the public water supplies. A SWPP has not yet been developed for New Washington or Attica public water systems. Until such a plan is completed, the stream restoration and protection activities proposed in the Watershed Action Plan set forth in this document will serve to benefit the protection of these drinking water sources.

Benefits of Ohio's Source Water Assessment and Protection Program for the Honey Creek Watershed: Public water treatment systems have an excellent record of providing safe drinking water to Ohio. However, should treatment fail for any reason, public health can be put at risk. The experience of the City of Milwaukee in 1993 gives evidence of this risk. When the city's public water supply became contaminated with cryptosporidium from animal wastes, 69 people died and 4,400 were hospitalized among the 850,000 residents in this system. By protecting the source water used by a water treatment plant, we can lessen the risks associated with failures in the treatment systems.

Other concerns for safeguarding source waters include the toxic substances on the OEPA human health water quality criteria list mentioned above. Some toxic substances are not removed by standard water treatment processes or are not removed in a consistent manner. When a treatment plant employs activated charcoal to remove organics, for example, the efficiency of the charcoal bed can change with time. If the bed is not maintained properly, organics may pass through to the finished drinking water. Improving the quality of the source water lowers the risk to human health from ineffective or failed treatment processes. An added potential benefit of source water protection may be reduced treatment costs for the municipalities within the watershed.

Honey Creek Contribution to Source Water for Sandusky River Communities. Streams in the Honey Creek Watershed supply water not only to communities that lie within the watershed, but also to communities on the Sandusky River downstream from the mouth of Honey Creek, including Tiffin and Fremont. Water from the Honey Creek Watershed contributes to the source water for these public water supplies. Therefore,

their source water protection depends in part on water quality in Honey Creek Watershed. This issue is addressed in Chapter 6, Problem 3.

Ground Water

Throughout Ohio ground water is an important resource for both public and private drinking water supplies, irrigated agriculture and more. The Ohio EPA is the designated state ground water quality management agency for addressing and preventing ground water pollution and other water quality problems (OEPA, 2000). The Ohio DNR, Division of Water, conducts ground water mapping and research, develops water supply studies, ensures the safety of existing dams, regulates construction of new dams, dikes, and levees, provides technical assistance services, and much more.

The Ohio DNR, Division of Water, has produced county ground water resource maps for all Ohio counties. They are intended to aid in the development of reliable ground water supplies throughout the state. For example, ground water resource maps show the expected yield to a drilled well at any location within the county along with other types of data (ODNR, date unknown). Given that the Honey Creek Watershed is predominantly rural, there is a rather large reliance among watershed residents on ground water made available via private wells. Maps for the four counties with land area in Honey Creek can be accessed from the following website: http://www.dnr.state.oh.us/water/gwrmaps/

Ground water pollution potential maps have been developed by the Ohio DNR, Division of Water, for most counties in Ohio using the DRASTIC mapping system. The DRASTIC system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system for pollution potential. The DRASTIC index values vary from 23 to 230. The higher the DRASTIC index, the greater is the vulnerability to contamination (ODNR, date unknown).

Ground water pollution potential analysis in Seneca County resulted in a map that illustrates ten hydrogeologic settings with varying vulnerability to ground water contamination. The map for Seneca County illustrates ground water pollution indexes ranging from 98 to 217 (ODNR, 1994). A similar map for Crawford County illustrates areas with ground water pollution indexes ranging from 88 to 157 (ODNR, 2003). High vulnerability in portions of Seneca County reflects the presence of karst geology. Map 13 illustrates nitrate nitrogen concentrations found in private well samples tested by the Heidelberg College Water Quality Laboratory between the years 1986 and 1993.

The Sandusky River Watershed Coalition implemented an educational-outreach program in 2003 directed to local public water suppliers and landowners. Program topics included ground water pollution, high pollution potential in karst geology areas, and action plans for public water suppliers to implement.

Chapter 6
PLAN FOR WATERSHED RESTORATION ACTIVITIES

This Action Plan will address the following water resource related problems and needs in the Honey Creek Watershed:

1. **Problem 1 - High rates of sediment and nutrient export that impact downstream receiving waters, including Sandusky Bay and Lake Erie**
2. **Problem 2 - Impaired Biological Communities within the streams of the Honey Creek Watershed**
3. **Problem 3 - Elevated nitrate and herbicide concentrations in public water supplies.**
4. **Special Management Efforts: Household Sewage Treatment Systems**
5. **Special Management Efforts: Coastal Nonpoint Pollution Control Program**
6. **Educational Programs**
7. **Fund Raising Programs**

The chapter closes with discussion of the three following topics: 1) recommendations for addressing household sewage treatment systems, 2) Ohio's Coastal Nonpoint Pollution Control Program management measures, and 3) educational outreach and fundraising plans.

Agricultural Programs to Reduce Water Resource Impairments: An Overview

Agriculture dominates land use in the Honey Creek Watershed as noted in Table 3.1. Consequently, many, but not all, of the causes and sources of water quality problems are associated with agricultural land uses. Numerous discussions on agricultural pollution abatement issues have taken place within the Sandusky River Watershed Coalition and its committees, as well as between the Coalition's Steering Committee and various agricultural groups, including individual Soil and Water Conservation Districts and area agricultural service center staff. A listing of some of these meetings is shown in the Appendix. These meetings provided the Steering Committee with a good overview of the concerns and needs of Soil and Water Districts relative to future efforts for reducing water resources problems in the Sandusky Watershed.

The Coalition's Agricultural Subcommittee has also solicited input from the Crawford, Seneca, and Wyandot Soil and Water Districts regarding BMPs they considered appropriate for future grant applications. Their recommendations, as summarized by the Agricultural Subcommittee, are presented in Sidebar 6.1. Subsequently, WQL staff developed a set of "Guiding Principles for Watershed Action Plan Development Relative to Agricultural Nonpoint Pollution." These guiding principals attempt to summarize and integrate a variety of diverse messages coming from various Coalition constituencies. These guiding principles have been endorsed by the Coalition's Steering Committee and are shown in Sidebar 6.2.

Sidebar 6.1 Sandusky River Watershed Coalition
Agricultural Subcommittee
Recommendations for watershed BMPs, 12/18/04

(These recommendations are based on input from the Crawford, Seneca and Wyandot SWCDs)

1. Repair broken tile mains in connection with the development of water retention areas and/or controlled drainage. Broken tile mains are often sites of serious erosion and sediment delivery to streams.
2. Increase participation in filter strip programs by increased marketing of existing programs (CRP, CREP) and/or by increasing rental rate payments (from private sources) so that payments would exceed the value of the average crop on non flooding soils.
3. Use selective logjam removal to alleviate local flooding problems, focusing on large, complete blockage logjams. Allow smaller logjams to remain for stream habitat enhancement.
4. Use rotation incentive payments so that farmers can incorporate small grains, hay or cover crops into their rotations. Target to fields next to water courses; extend the rotation to at least three years; must be green (i.e. growing) during the winter. Cost share must cover seed costs, labor and chemical burn down in spring. Cover crops can be used in this category or as stand alone measures.
5. Innovative equipment - variable rate equipment, manure equipment, yield monitors, etc.. Aid to producers for conservation equipment purchase often opens doors for participation in additional conservation programs.

Some Specific BMPs to Promote

1. Filter strips, target all ditches
2. Tillage/planting equipment (non inversion
3. and no-till
4. Tile blow-out repairs
5. Manure storage
6. Manure spreading equipment
7. Composters
8. Nutrient and pest management
9. Cover crops
10. Waterways and structures
11. Repair old tile mains
12. Natural channel design (demo)
13. Incentive for continuous no-till (tier levels?)
14. Promote 3-4 year rotations (not just a corn/soybean rotation)
15. Reduce use of triazine products (Atrazine)
16. Carbon sequestration (This is an outcome of a BMP such as tree planting rather than a BMP in and of itself.)
17. Windbreaks
18. Reduce nitrate delivery via tile (What BMP will achieve this goal?)
19. Filter strip payments/incentives to tenants farmers
20. Buydowns - GPS, yield monitors, mapping systems, geo-referencing equipment
21. Record keeping software- GIS info software
22. Conservation tillage equipment for corn production
23. Log jam removal
24. Field buffers (around whole fields, not just next to streams)

In preparing this Watershed Action Plan, the WQL and Coalition organized two public meetings in the Honey Creek Watershed. In the first meeting the results of the TMDL study were presented, including the impairments observed in the Honey Creek Watershed, along with the causes and sources of those impairments, as interpreted by the OEPA. In the second meeting, watershed residents were asked to identify possible solutions (i.e. BMPs) that would address the problems. Their recommendations will be presented in following sections of this chapter, in relation to the problems they address. The materials provided by the WQL and Coalition Staff for these two meetings, along with attendance lists and meeting minutes, are included in the Appendix A.

Problem 1. High rates of sediment and nutrient export that impact downstream receiving waters including Sandusky Bay and Lake Erie.

Background. As shown in Table 4.4, the unit area export (lbs/acre/year) of sediment, phosphorus and nitrate from the Honey Creek Watershed is comparable to those of other northwestern Ohio watersheds. In general, the export rates for northwestern Ohio are high relative to other agricultural watersheds in Ohio and in the Midwest. These high export rates, especially for phosphorus and sediment, contribute to water quality problems in Sandusky Bay and Lake Erie. The high export rate of nitrates impacts drinking water supplies both within the watershed and at downstream locations such as Tiffin and Fremont, Ohio. Plans to reduce nitrate export will be addressed in relation to drinking water concerns and this section will focus on efforts to reduce phosphorus and sediment export.

Most of the sediment and nutrient export from Honey Creek occurs during storm runoff events. Since these events occupy a relatively short period of time, the elevated concentrations of nutrients and sediments during storm events are thought to have negligible direct effects on the aquatic life of area streams (Rankin et al, 1999). However, the suspended sediment transport during storms can indirectly affect aquatic life through contributing to embeddedness of bottom substrates in streams, as well as siltation in headwater streams and ditches.

About 80% of the total phosphorus export from the Honey Creek Watershed is in the form of particulate phosphorus that is attached to sediment particles, especially the clay-sized fractions. Consequently, much of the effort to reduce phosphorus export is associated with reducing erosion and sediment export from the watershed. Other control measures for phosphorus focus on reducing the phosphorus content of sediment through fertilizer and manure management programs.

Sources of Phosphorus within the Honey Creek Watershed: In the TMDL study, the Ohio EPA determined the sources of phosphorus within the Honey Creek Watershed that contribute to phosphorus export. Table 6.1 shows the results of their determination. Agriculture is the source of about 92.6% of the phosphorus exported from the watershed, with natural background sources responsible for 3.2%, point sources (Attica, New Washington, and Bloomville sewage treatment plants) responsible for 2.5%, and septic tanks responsible for 0.7%.

The sources of agricultural phosphorus within the watershed correspond primarily to those cropland areas where surface runoff water carries eroded sediments into the stream systems. Since about 95% of the soils in the Honey Creek watershed are in Hydrological Soil Groups C and D (Map 6 and Table 3.5), which have slow infiltration rates and high runoff potential, relatively large portions of the cropland are likely to contribute to phosphorus export from the watershed. Those areas having higher slopes and in close proximity to stream systems would likely be particularly important as sources of phosphorus. Both particulate and soluble phosphorus runoff is higher from cropland with high phosphorus soil test values than from areas with low phosphorus soil test values, especially where the high test values exceed those required for optimal crop production.

Table 6.1 Phosphorus sources in the Honey Creek Watershed (TMDL, Table 20)

Phosphorus Source	kg/yr	Percent
Point Sources	1,497	2.5
Combined sewer overflows	0	0.0
Unregulated nonpoint source (Agricultural runoff) (multi-year average)	54,559	92.6
Stormwater (urban runoff)	574	1.0
Home sewage treatment (septic) systems	398	0.7
Background/ground water	1,900	3.2
Air Deposition	14	0.0
Total	**58,942**	**100.0**

Goals for reductions in phosphorus export. The TMDL study calls for the following reductions in phosphorus loading:

- Point sources - 65% reduction (986 kg/yr or 2,174 lbs/yr reduction)
- Nonpoint sources - 25% reduction (14,326 kg/yr or 31,589 lbs/yr reduction)
- **NPS with margin of safety - 29% reduction (16, 717 kg/yr or 36,326 lbs/yr)**

Because of uncertainties in the relationships between loads and water quality, the TMDL procedures call for incorporation of a Margin of Safety into load reductions. For the Sandusky River, a margin of safety of 5% of the target load has been adopted in the TMDL. This has the effect of increasing the load reductions to be sure that water quality objectives are met. The TMDL does not set a time limit for attainment of this goal.

The TMDL also calls for load reductions of 65% from point sources. Since point sources comprise such a small proportion of the total phosphorus export from the watershed, these reductions will have minimal impact on reducing phosphorus export from the watershed. The point source phosphorus reductions are aimed at improving aquatic life within the streams by reducing phosphorus concentrations during low and medium flow periods.

Tools to Reduce Agricultural Phosphorus Export:

At the second public meeting in Honey Creek, area residents suggested the following measures as locally appropriate means to reduce phosphorus export from the watershed:

- No till
- Strip till
- Conservation tillage
- Buffer strips
- Phosphorus application
  - Soil testing
  - Grid sampling
- Rotations that include wheat, hay, and year-round cover
- Better manure practices
- Subsurface drainage
- Programs to increase BMP implementation
- Buffer strips around roadside culverts and catch basins
- Grassed waterways
- Cover crops
- Property line filter strips and field borders.
- Reconnect streams to floodplains.

The above measures are a subset of applicable measures described in the NRCS Field Office Technical Guide. State agencies are currently revising Ohio's Nonpoint Source Management Program. That document will also include listings of BMPs to address various water resource goals.

Management Plan for Load Reduction. *Narrative Plan*. Efforts to reduce phosphorus and sediment export from the Honey Creek Watershed will focus on two features of the landscape -- cropland areas and streamside areas. Programs focused on croplands will include efforts to reduce erosion and runoff through increased use of various conservation tillage procedures, including no-till, strip till, reduced till and other forms of vertical tillage ("AerWay systems"). These procedures reduce raindrop impact on bare soil, which initiates soil erosion. They also increase infiltration, thereby reducing sheet flow and rill erosion which transport eroded particles off the fields. Cropland programs will also include advancing fertilizer and manure management on croplands through soil testing and precision application. Grants will be sought to aid farmers in equipment purchases related to both tillage improvements and precision fertilizer (and pesticide) application. Other cropland programs will focus on increasing the use of winter cover crops and diversifying crop rotations to minimize the use of corn-soybean rotations and soybean-soybean-corn rotations. More varied cropping rotations, as recommended here, will reduce erosion and soil compaction problems.

Streamside BMPs will include establishment of buffer strips along headwater streams and establishment of woody riparian corridors along wadeable streams, and where possible, also along headwater streams. While it is preferable to provide details of a targeted approach to implementing streamside BMPs (i.e. provide specific locations and/or names of targeted streams), insufficient data will temporarily prevent us from doing so at this time. It is the intention of the Coalition to generate these data, conduct additional landscape-scale analyses, and adopt a targeted approach to include an outreach plan to landowners in support of this aspect of the Honey Creek WAP.

These buffers trap portions of the sediment and nutrients that otherwise would move from cropland to streams. In addition, buffers, where they replace cropland, can also reduce erosion at certain positions on the landscape with potentially high sediment

delivery to streams. Both of these effects reduce sediment and phosphorus loading to streams. Where runoff moves from fields to streams via grassed waterways or other concentrated flow pathways (gullies and tile main blow-outs), streamside buffers have minimal impact in reducing pollutant loading to streams. In these cases, consideration will be given to the establishment of wetland areas adjacent to streams where the output from grassed waterways and tile mains could undergo temporary storage, allowing sediment deposition and nutrient uptake and transformation.

Area soil conservation staff and farmers have suggested that establishment of buffers (grass or woody) at the margins of fields could also be effective in reducing erosion and in trapping sediment and pollutants. Such field borders could also concentrate farm implement traffic and thereby minimize compaction under the cropland.

An additional streamside BMP includes reconnecting the stream channel to the floodplain. This could occur in selected areas where previous channelization has occurred and/or levies have been constructed. Reconnecting streams and their floodplains would reduce sediment export through flood plain deposition, reduce peak discharges at downstream locations, and provide for nutrient uptake and transformations. In short, restoring full floodplain functions would yield important ecosystem services that would help to achieve the desired water quality improvements.

Targeting for load reductions will occur broadly throughout the Honey Creek Watershed. As noted earlier in Chapter 3, 94% of the soils in the watershed are in soil drainage classes C and D. As such they have slow infiltration rates and a high tendency for runoff. Although extensive use of tile drainage has improved the infiltration on about 15% of these soils, the soils nevertheless tend to seal at the soil surface during heavy rains, and consequently yield considerable surface runoff. The use of distributed parameter models to attempt to target specific fields for BMP application is beyond the scope of these studies. Instead we will rely of the local knowledge of SWCD and NRCS staff and of the farming community to prioritize practices to those areas having high erosion rates and high delivery of eroded materials to streams. The various maps in this document are expected to support this common sense targeting based on local expertise.

Although point sources are a minor contributor to phosphorus export from the watershed, reductions from these sources will be addressed in relation to their impacts on stream biota during low flow periods.

Management Plan for Load Reduction. *Tabular Summary.* To implement the plan described above, the specific task described in Table 6.2 will be undertaken.
We have estimated that upon implementation of the measures outlined in Table 6.2 annual phosphorus load reductions of 38,000 lbs will be achieved. The bases for these calculations are shown in Table 6.3.

Table 6.2. WAP implementation strategies for reducing phosphorus and sediment export from the Honey Creek Watershed. For spreadsheet calculations used to achieve phosphorus load reduction, see Table 6.3. The lead agency is listed *first*.

Task Description/ Objectives	Resource Requirements: Who; How - Current Programs, New Programs	Time Frame	Performance Indicators
1. Cropland BMPs			
1.a. Residue Management – no till, strip till and mulch till on an additional 19,000 acres of cropland. (This would move residue management from about 55% of cropland to 80% of cropland.)	**Who:** *NRCS,* County SWCD, OSU-Ext **How / Current:** EQIP (low funding priority) **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at the rate of $15 / acre	1 January 2005 – 31 December 2010	Increase in residue management as reflected in annual tillage surveys within the watershed.
1.b. Cover and Green Manure Crops for an additional 10,000 acres of cropland throughout the watershed.	**Who:** *NRCS,* County SWCD, OSU-Ext **How / Current:** EQIP (low funding priority) **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at the rate of $15 / acre	1 January 2005 – 31 December 2010	Increase in cover crops as reflected in annual tillage surveys; track acres of subsidies for establishment of cover crops.
1.c. Field Border establishment protecting 8,000 acres of cropland	**Who:** *FSA,* NRCS, County SWCD, OSU-Ext **How / Current:** CRP **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund conservation easement at rate of $3,000 /acre	1 January 2005 – 31 December 2010	7.5 ac of field borders – average field size of 60 ac with a 50 ft wide border surrounding the field
1.d. Conservation Crop Rotation to include an additional 800 acres of wheat and 200 acres of hay	**Who:** *County SWCD*, NRCS, OSU-Ext **How / Current:** Communication effort to promote benefits of interseeding and double-cropping **How / New:** additional multi-county staff person to work with farmers and promote	1 January 2005 – 31 December 2010	Increase in wheat and hay acreage as documented in crop history reports

	benefits of BMP implementation in the context of the WAP, grant to fund at rate of $15 / acre		
1.e. Nutrient Management – new CCA plans on 15000 acres, new CNMP plans on 3000 acres	**Who:** *NRCS,* County SWCD, OSU-Ext **How / Current:** EQIP, communication effort to promote benefits of precision agriculture **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP	1 January 2005 – 31 December 2010	Track number of new CCA and CNMP plans developed.
1.f. Waste management, manure-target two dairy operations and eight hog operations	**Who:** *NRCS,* County SWCD, OSU-Ext **How / Current:** EQIP, communication effort by manure management specialist **How / New:** grant to fund at average rate of $20,000 / operation	1 January 2005 – 31 December 2010	Track number of new CNMP plans developed.
1. g. Water and Sediment Control Basin to collect runoff from 500 new acres	**Who:** *County SWCD*, NRCS, OSU-Ext **How / Current: ?** **How / New:** grant to fund at rate of $10,000	1 January 2005 – 31 December 2010	Target ten most severe cases of gulley erosion, possibly in conjunction with tile-main blowouts
Task Description/ Objectives	**Resource Requirements: Who; How - Current Programs, New Programs**	**Time Frame**	**Performance Indicators**
2. Streamside BMPs			
2.a. Filter Strip - Establish on an additional 20% of streams; emphasis on first and second order streams (49 miles)	**Who:** *FSA,* NRCS, County SWCD, OSU-Ext **How / Current:** CRP, Lake Erie CREP, conservation easements **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP	1 January 2005 – 31 December 2010	Miles and/or acres of buffer strips established as recorded in project records.

2.b. Riparian Forest Buffer - Contribute to 20% overall increase as listed above, but with emphasis on third and fourth order streams	**Who:** *FSA,* NRCS, County SWCD,OSU-Ext **How / Current:** CRP, Lake Erie CREP, WRP, Clean Ohio Fund, conservation easements **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP	1 January 2005 – 31 December 2010	Miles and/or acres of riparian forest buffers established as recorded in project records.
2.c. Wetland Development or Restoration on 500 new acres, to include reconnecting streams with floodplains	**Who:** *FSA,* NRCS, County SWCD, OSU-Ext **How / Current:** CRP, Lake Erie CREP, WRP, Clean Ohio Fund, conservation easements **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, Duck Unlimited program?	1 January 2005 – 31 December 2010	Acres of wetlands/active floodplain restored as recorded in NRCS/SWCD project records.
2.d. Livestock Restriction (access to streams) at 15 sites	**Who:** *NRCS*, County SWCD, OSU-Ext **How / Current:** EQIP, communication effort to promote rotational grazing **How / New:** additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at rate of $5,000 / site	1 January 2005 – 31 December 2010	Track 15 new exclusion/limited access grazing systems implemented
Task Description/ Objectives	**Resource Requirements: Who; How - Current Programs, New Programs**	**Time Frame**	**Performance Indicators**
3. Point Source Controls			
3.a. Reduce point source inputs (to stream) at three Waste Water Treatment Plants in the watershed.	**Who:** Ohio EPA **How / Current:** NPDES **How / New:** TMDL compliance?	1 January 2006 – 31 December 2007	Track NPDES permitting process.

Table 6.3 Phosphorus Reduction Calculations – Honey Creek Watershed

BMP	***Watershed Acres***	***% Cropland Acres***	***Cropland Acres***	***Opportunity % Increase***	***Opportunity Acres***	***P Reduction Factor (lbs/ac)***	***P Reduction (lbs)***
Residue management	115100	66	75966	25	18991.5	0.82	**15573.03**
		see Table 3.10		*assumes 55% of cropland receives this BMP now*			
	Avg SS Export per Yr (short tons)	***SS Reduction Goal from buffers (%)***	***SS Load Reduction per Year (short tons)***	***Ratio of SS to PP***	***PP Reduction (short tons)***		
filter strip / riparian forest buffer							
	17683	15.0	2652.45	465 to 1	5.7		**11408.39**
	see Table 4.2		*assumes 4.5 ton / ac SS load reduction*				
	New Acreage Goal	***1/10th Reduction SS Yield (short tons)***	***Convert SS to PP(divide by 465)***	***Convert to lbs. (X 2000)***			
cover and green manure crop							
	10000	1000	2.15	4301.08			**4301.08**
	translates into 13% of total cropland						
	Implementation Goal (acres)	***Expected Reduction in P (lbs/acre)***					
field borders	8000	0.4					**3200.00**
	translates into 989 ac of land placed in field borders or 1% of total cropland						

	Implementation Goal (acres)	***Expected Reduction in P (lbs)***					
conservation crop rotation							
wheat	800	912					
hay	200	258					**1170**
	Implementation Goal (acres)	***Unit Area Load – TP (lbs / acre)***	***Expected Reduction of P delivery (%)***	***P Reduction (lbs)***			
nutrient management							
CCA plan	15000	0.98	10	1470			
CNMP plan	3000	0.98	30	882			**2352**
	Implementation Goal (acres)	***% P reduction / acre***	***P Reduction (lbs)***				
water and sediment control basin							
	500	10	50				**50**
		assumes 1 ton sediment reduction / ac draining into new control basin					
	Implementation Goal (acres)	***% P reduction / acre***	***P Reduction (lbs)***				
wetland development or restoration							
	500	50	250				
		assumes 1 ton sediment reduction /ac draining to wetland			**Total P reduction (lbs)**		**38054.49**

Problem 2. Impaired Biological Communities within the streams of the Honey Creek Watershed

Background. The biological communities in the Honey Creek Watershed failed to meet standards for their designated uses at 12 out of 24 sites analyzed in the TMDL study (see Chapter 4). In most cases these failures were due to characteristics of the fish communities, rather than the invertebrate communities. Also smaller streams were more likely to be impaired than larger streams. The watershed score for the Honey Creek Watershed, as calculated by the OEPA, is 63.7 out of a possible score of 100 (see Chapter 4, Table 4.10).

Causes and Sources of Biological Impairments in the Honey Creek Watershed: The primary causes and sources of biological impairments in the Honey Creek Watershed are summarized in Table 6.4. Except for elevated phosphorus concentrations during low flow periods, which are primarily associated with point sources of phosphorus, most of the causes of biological impairments of streams are associated with agricultural land use.

Table 6.4 Summary of causes and sources of biological impairments in the Honey Creek Watershed.

	Causes of Biological Impairments	Sources of Impairments
1.	Elevated phosphorus concentrations during low flow periods. These conditions lead to excessive algal growth that causes large day-night fluctuations in oxygen concentrations.	Municipal sewage treatment plants, failed septic tanks, improper manure handling
2.	Poor stream habitat, as reflected by low scores for the Qualitative Habitat Evaluation Index (QHEI), The QHEI Index includes assessments of the following seven stream habitat parameters: • substrate quality • instream cover • channel morphology • riparian zone and bank erosion • pool quality • riffle quality • gradient	Sheet and gully erosion from croplands, stream-bank erosion, construction site erosion. Farm animal access to streams. Channelization for agricultural drainage. Log-jam removal for drainage enhancements. Separation of stream channels from flood plains. Natural limitations of streams associated with low stream gradients, available substrates, etc.
3.	Altered stream flow regimes - • lowered base flows • higher peak flows	Extensive use of tile drainage for cropland, soil compaction, wetland drainage, channelization, separation of stream channels from floodplains, increase in impervious areas associated with urbanization, dam construction.
4.	Excessive temperature fluctuations	Removal of woody riparian corridors, low base flow in streams. Widened stream channels.
5.	Organic loading resulting in low dissolved oxygen and siltation	Septic tanks, poor sewage treatment, livestock wastes, manure spills
6.	Accidental spills	Fertilizer and manure handling facilities, transportation accidents.

Elevated phosphorus concentrations - While there are no specific standards for phosphorus concentrations in streams, the OEPA has set phosphorus concentrations guidelines for streams of various sizes and use designations. These guidelines are shown in Table 6.5. The guidelines

suggest that higher phosphorus concentrations are expected and allowed in MWH than is WWH streams. The phosphorus data for the Sandusky TMDL do not meet those expectations. In fact the median phosphorus concentration for Sandusky MWH streams was 0.08 mg/liter for headwater streams and 0.06 for wadeable streams. Both median values met the targets for WWH streams and were actually lower than the corresponding medians for WWH streams (0.10 mg/L for headwater and 0.12 mg/L for wadeable). Because of generally low phosphorus concentrations in Sandusky MWH streams, we are comparing all concentrations to the WWH target values.

Table 6.5 Phosphorus concentration guidelines to support biological use attainment

Watershed Size	Statewide Criteria Total Phosphorus Conc. (mg/L)	
	WWH	MWH
Headwaters (H) - drainage area < 20 sq mi	0.08	0.34
Wadeable (W) - drainage area 20 - 200 sq mi	0.10	0.28
Small Rivers (SR) - Drainage area > 200 sq mi	0.17	0.25

In Table 6.6 the phosphorus concentrations observed in the Honey Creek Watershed as part of the TMDL study are shown in relation to the WWH use designation. The highest phosphorus concentrations were found at station #6 on Honey Creek, below the Attica Wastewater Treatment Plant (WWTR). All five samples exceeded the target value of 0.10 mg/L and the average concentration at that site was 0.27 mg/L or 2.7 fold greater than the target value. The elevated phosphorus concentrations from the Attica WWTP were also evident at two downstream stations along Honey Creek (stations #5 and #4). Although the effluent from the Bloomville WWTP enters Honey Creek upstream from station #5, discharges from that plant are limited to periods of high flow in the streams so that low flow phosphorus values should not be impacted. The effluent from the New Washington WWTP enters Broken Knife Creek just upstream from station 17. This effluent is the likely cause of the elevated phosphorus concentrations in Broken Knife Creek. Sources of elevated phosphorus in other tributaries to Honey Creek are unknown.

Aquatic Habitat conditions in the Honey Creek Watershed. The Ohio EPA uses the Qualitative Habitat Evaluation Index (QHEI) to assess habitat conditions in the streams where they conduct biological surveys. Procedures for determining the QHEI are described by E.T. Rankin (Rankin, 1989). The QHEI score is the sum of seven separate factors. These include the substrate conditions, the instream cover, the channel conditions, the riparian conditions, the pool development, the riffle development and the stream gradient. As part of the TMDL, the OEPA has set target values for the QHEI score and the substrate score for various use designations. These target values are shown in Table 6.7.

The QHEI score, as well as the scores of each of the seven factors contributing to the QHEI score are shown in Table 6.8 for those stations where QHEI determinations were completed in the TMDL study. This table also includes the biological index data for each station, a summary of the phosphorus concentration results, and summaries of additional comments included in the TMDL text regarding causes of impairments at specific stations. An asterisk is used to indicate those values that do not meet standards or target values for specific parameters. For components of the QHEI that have no target value, the maximum possible score is shown. If all factors had their maximum score the QHEI would total 100 at that station. The highest QHEI score observed

in the Honey Creek watershed was 84, a value that occurred at station #18 on Buckeye Creek. The detail provided in Table 6.8 supports targeting of specific measures related to individual habitat or chemical problems for individual stations.

Although siltation and embeddedness are included in the determination of the substrate scores, they are so important to stream biota that OEPA staff takes special note of these conditions in assessing causes of impairment. Such notes were listed for many of the stations in Honey Creek. Soft clay was noted at station #16. Muck bottoms were noted at stations #13, #21 and #24, all of which are located in areas having highly organic soils (See Map 7, the hydric soils map).

Altered Stream Flow Regimes. The clearing of forested lands for agricultural production greatly increases the peak discharges during runoff events. Subsequent installation of tile drainage, construction of ditches to receive the tile outlets, and channelization of natural streams further contribute to peak runoff events and, at the same time, diminish base flow in streams by lowering the water table and decreasing groundwater recharge. Consequently, the flow regimes that supported the presettlement aquatic fauna of the Honey Creek Watershed have been greatly altered. Higher peak flows and lower base flows increase the flashiness of streams. Measurements of stream flashiness at the Melmore gaging station confirm that, during the past 25 years, the flashiness of the Honey Creek has increased (Baker et al. 2004). One consequence of the increased flashiness is simply the absence of flowing water in streams where, given their drainage areas, continuous flows would be expected in this climate. At four stations (#13, #19, #21 and #24) flows were so low that fish collections could not be completed. At several of the stations, flows diminished during the study period such that the final chemical sampling could not be completed.

These altered flow regimes interact with other habitat factors, such as streambed substrate quality (i.e. siltation and embeddedness). Higher peak flows can accelerate bank erosion, which further contributes to siltation of streams. Channelization often separates stream channels from their floodplains as does construction of levies or berms, resulting in increased sediment delivery to downstream receiving waters.

Table 6.6. Total phosphorus concentrations at 18 Honey Creek watershed stations observed during the 2001 TMDL study.

Station #	Area mi2	Date	phosphorus (mg/L)	TP Standard (mg/L)	Station #	Area mi2	Date	phosphorus (mg/L)	TP Standard (mg/L)
1	176	61401	0.06	0.10	10	16.2	61401	0.06	0.08
Honey Creek	176	62801	0.06	0.10	Brokenknife Cr.	16.2	62801	0.05	0.08
C.R. 19	176	71201	0.07	0.10	Crawford/	16.2	71201	0.25	0.08
	176	72601	0.1	0.10	Seneca	16.2	72601	0.16	0.08
	176	80901	0.08	0.10	Line Rd.	16.2	80901	0.1	0.08
2	163	61401	0.07	0.10	11	16.1	61401	0.08	0.08
Honey Creek	163	62801	0.06	0.10	Aicholz Ditch	16.1	62801	0.1	0.08
T.R. 58	163	71201	0.06	0.10	T.R. 77	16.1	71201	0.29	0.08
	163	72601	0.07	0.10		16.1	72601	0.13	0.08
	163	80901	0.11	0.10		16.1	80901		0.08
3	154	61401	0.1	0.10	12	16	61401	0.11	0.08
Honey Creek	154	62801	0.11	0.10	Silver Creek	16	62801	0.12	0.08
S.R. 67/	154	71201	0.08	0.10	S.R. 19	16	71201	0.34	0.08
S.R 100	154	72601	0.07	0.10		16	72601	0.17	0.08
	154	80901	0.19	0.10		16	80901		
4	119	61401	0.09	0.10	13	10	61401	0.05	0.08
Honey Creek	119	62801	0.1	0.10	Honey Creek	10	62801	0.15	0.08
T.R. 58	119	71201	0.26	0.10	Trib.	10	71201	0.64	0.08
	119	72601	0.1	0.10	Celery Cr.	10	72601	0.2	0.08
	119	80901	0.13	0.10	Section Line Rd.	10	80901	0.17	0.08
5	113	61401	0.12	0.10	14	9	61401	0.08	0.08
Honey Creek	113	62801	0.09	0.10	Silver Creek	9	62801	0.07	0.08
T.R. 173	113	71201	0.27	0.10	Seneca/	9	71201	0.25	0.08
	113	72601	0.25	0.10	Crawford	9	72601	0.17	0.08
	113	80901	0.31	0.10	Line rd.	9	80901		
6	89	61401	0.18	0.10	15	8.7	61401	0.1	0.08
Honey Creek	89	62801	0.31	0.10	Honey Creek	8.7	62801	0.025	0.08
T.R. 79	89	71201	0.24	0.10	Waynesburg-	8.7	71201	0.14	0.08
	89	72601	0.27	0.10	Tiro Rd.	8.7	72601	0.09	0.08
	89	80901	0.33	0.10		8.7	80901	0.1	0.08
7	63	61401	0.07	0.10	16	8.1	61401	0.05	0.08
Honey Creek	63	62801	0.16	0.10	Aicholz Ditch	8.1	62801	0.09	0.08
T.R. 13	63	71201	0.27	0.10	C.R. 23	8.1	71201	0.31	0.08
	63	72601	0.14	0.10		8.1	72601	0.18	0.08
	63	80901	0.13	0.10		8.1	80901	0.21	0.08
8	28	61401	0.025	0.10	17	7.9	61401	0.07	0.08
Honey Creek	28	62801	0.025	0.10	Brokenknife C.	7.9	62801	0.19	0.08
Bigham Rd.	28	71201	0.14	0.10	McCarthy Rd.	7.9	71201	0.23	0.08
	28	72601	0.025	0.10		7.9	72601	0.17	0.08
	28	80901	0.025	0.10		7.9	80901	0.18	0.08
9	16.1	61401	0.11	0.08	18	7.2	61401	0.08	0.08
Honey Creek	16.1	62801	0.13	0.08	Buckeye Creek	7.2	62801	0.17	0.08
Young Rd.	16.1	71201	0.19	0.08	T.R. 17	7.2	71201	0.025	0.08
	16.1	72601	0.025	0.08		7.2	72601	0.13	0.08
	16.1	80901	0.07	0.08		7.2	80901	0.06	0.08

Underlined values exceed target (informal standard) for that size stream.

Table 6.7. Target values for QHEI scores and substrate subscores, by use designation, included in the TMDL study.

Aquatic Life Use Designation	QHEI Score	Substrate Score
WWH	60	12.5
MWH	45	10
LRW	30	8

Other Causes and Sources - Excessively high temperatures were observed at several locations in the Honey Creek watershed (See Table 8B in the TSD document). These high temperatures are often a consequence of a lack shade due to the absence of a woody riparian corridor and to the low base flows characteristic of many area streams. The high temperatures can contribute to low oxygen levels by decreasing the solubility of oxygen and by stimulating algal growths.

Organic loading is identified as a cause of impairment at several stations. The term organic loading should be limited to instances where organic carbon sources such as sewage, manure, and food processing wastes are directly entering streams. This organic loading can lead to low dissolved oxygen levels and to the formation of organic sludge deposits on the stream bottom.

Organic loading, as described above, should be distinguished from inorganic nutrient loading (e.g. phosphorus loading). Inorganic nutrient loading can lead to excessive algal growth in streams and lakes. The living algae produce oxygen during the day but consume oxygen at night. This leads to excessive diurnal (day-night) fluctuations of oxygen. When the algae dye, they contribute to the organic carbon load in the stream. However the cause of the algal problem (i.e. nutrients and sunlight) is sufficiently distinct from that of direct organic carbon loading that the two problems should be distinguished from one another. In the Sandusky TMDL report, sometimes the above distinction is not made.

Spills associated with transportation accidents and chemical and manure storage facilities have also been observed in the watershed. These spills often introduce toxic chemicals directly into streams, resulting in fish kills and impacting drinking water supplies. Most fish kills observed in the watershed are associated with agricultural activities.

Table 6.8. Summary of biological indices, use attainment, QHEI component scores and other possible causes of impairment at TMDL sampling stations in the Honey Creek Watershed

Station #	1	2	3	4	5	6	7	8	9	10	11	12
Stream Name	Honey Cr.	Honey Cr.	Honey Cr.	Honey Cr.	Honey Cr.	Honey Cr.	Honey Cr.	Honey Cr.	Honey Cr.	Broken Knife	Aicholtz Ditch	Silver Cr.
Use Desig	MWH	WWH	WWH	WWH	WWH	WWH	MWH	MWH	WWH	WWH	WWH	WWH
Milepoint	1.1	6.6	12.5	14.8	18.05	25.03	32.2	34.1	38.4	1	2.5	4.1
Area, mi^2	176	163	154	119	113	89	63	28	16.3	16.2	16.1	16
Use Attain	Full	Full	Full	Partial	Partial	Non	Full	Full	Partial	Partial	Full	Non
IBI	45	46	44	32*	32*	32*	32	28	32*	30*	38	26*
MIwb	7.4	9.3	9.2	7.6*	6.7*	5.1*	6.7	7.3	-	-	-	-
ICI	G	E	38	VG	42	30	42	32	G	G	G	MG
Point sources					Bloomville	Attica	New Wash					
Elevated Phos.	0/5>0.1	1/5>0.1	2/5>0.1	2/5>0.1	4/5>0.1	5/5>0.1	4/5>0.1	1/5>0.1	3/5>0.1	2/5>0.1	2/4>0.1	4/4>0.1
QHEI/target	52.5/45	76.5/60	74.5/60	62/60	58.5/60*	51/60*	27/45*	32.5/45*	51/60*	56.5/60*	42.5/60*	31.5/60*
Substrate/targ	11/10	19.0/12	18.5/12	15/12	17.5/12	5.5/12*	1.0/10*	8.0/10*	9.5/12*	11.0/12*	5.5/12*	5.0/12*
Cover/max	12/20	12/20	15/20	7.0/20	7.0/20	12/20	5.0/20	4.0/20	7.0/20	12/20	7.0/20	4.0/20
Channel/max	11.0/20	17.0/20	17.0/20	15/20	15/20	15/20	6.0/20	7.5/20	10/20	16/20	10.0/20	7.0/20
Riparian/max	6.5/10	8.5/10	6.5/10	8/10	3/10	8/10	3.0/10	2.0/10	6/10	4.5/10	8.0/10	7.5/10
Pool/max	8.0/12	6.0/12	6.0/12	4/12	4/12	6/12	8.0/12	5.0/12	9/12	6.0/12	2.0/12	2.0/12
Riffle/max	0.0/8	4.0/8	3.5/8	3/8	2/8	0.5/8	0.0/8	2.0/8.0	-0.5/8	1.0/8	0.0/8	0.0/8
Gradient/max	4/10	10/10	8/10	10/10	10/10	4/10	4/10	4/10	10/10	6/10	10/10	6/10
Siltation				Siltation*	Siltation	Siltation	Siltation	Siltation	Siltation			
Embedded.				Embed.*	Embed.	Embed.	Embed.	Embed.	Embed.	Embed	Embed.	
Hydro-modification								Channel-ized			Low flow	
Septic tanks												
Enrch-ment/DO											Yes	

* Values marked with an asterisk are below the standards or target values set for the aquatic life use designation at that site.

Table 6.8. Summary of biological indices, use attainment, QHEI component scores and other possible causes of impairment at TMDL sampling stations in the Honey Creek Watershed. (continued).

Station #	13	14	15	16	17	18	19	20	21	22	23	24
Stream Name	Celery Cr	Silver Cr.	Honey Cr	Aicholtz Ditch	Broken Knife Cr.	Buckeye Cr.	Silver Cr.	Buckeye Cr.	Celery Cr	Van Meter Cr.	Slee Ditch	Tiro Cr.
Use Desig	MWH	WWH	WWH	MWH	MWH	WWH	LWR	WWH	MWH	MWH	WWH	MWH
Milepoint	2.2	7.7	41.7	3.9	5.1	0.8	10.6	2.6	5.6	1.7	0.1	?
Area, mi2	10	9	8.7	8.1	7.9	7.2	4.5	4.4	4.2	3.8	3.3	?
Use Attain	Non	Full	Partial	Non	Full	Full	Non	Full	Non	Full	Full	Non
IBI	-	36	32*	28	30	46	-	46	-	32	44	-
MIwb	-	-	-	-	-	-	-	-	-	-	-	-
ICI	VP*	MG	G	P*	G	G	VP*	MG	P*	G	G	P*
Point sources					New Wash							
Elevated Phos.	(yes)	2/4>0.1	1/5>0.1	3/5>0.1	4/5>0.1	2/5>0.1	(yes)	-	4/5>0.1	-	-	(yes)
QHEI/tar		46.5/60*	55.5/60*	28.5/45*	25/45*	84/60	-	58/60*	-	47/45	51.5/60*	-
Substrate		5.5/12*	10/12*	5.0/10*	5.0/10*	17/12		15/12		15/10	14.5/12	
Cover		9.0/20	8.0/20	5/20	2.0/20	19.0/20		11.0/20		6.0/20	5.0/20	
Channel		14/20	14/20	7.5/20	5.5/20	17.0/20		12.0/20		7.0/20	11.0/20	
Riparian		6.5/10	8.5/10	6.0/10	2.0/10	6.0/10		3.0/10		3.0/10	8.0/10	
Pool		6.0/12	5.0/12	1.0/12	5.0/12	10.0/12		6.0/12		4.0/12	3.0/12	
Riffle		-0.5/8	0.0/8	0.0/8	-0.5/8	5.0/8		1.0/8		2.0/8	2.0/8	
Gradient		6/10	10/10	4/10	6/10	10/10		10/10		10/10	8/10	
Siltation	Muck		Siltation	Soft clay					Muck			Muck
Embedded.			Embed.									
Hydro-modifica.	Channeliz-ed					GW inputs	Intermit-tant flow				GW inputs	
Septic tanks					Possible							
Enrichment/ DO	yes			yes					yes			

* Values marked with an asterisk are below the standards or target values set for the use designation at that site.

Goals for Biological Communities in the Honey Creek Watershed: The following goals have been adopted by the Coalition for biological communities in the Honey Creek Watershed:

Priority 1. Improve the watershed score to at least 80 out of 100 by 2010
(This is consistent with Ohio EPA's goals for 2010 (OEPA, 2004)).

Priority 2. Long-term Goal - all streams should meet their aquatic life use designations
(This is consistent with the federal Clean Water Act and the TMDL program and would result in a watershed score of 100)

Restoration Strategies.
For Priority 1. The first priority is to bring all stations with drainage areas greater than 50 mi^2 into full compliance with aquatic life standards for their aquatic life use designations. Currently, three stations in this size range fail to meet the WWH criteria. These are stations 4, 5 and 6 along the main stem of Honey Creek. When these stations are brought into full compliance, the watershed score for Honey Creek will increase to 86.3 and thus meet the 2010 OEPA target of 80.
For Priority 2. The second and longer-term priority will be to bring all headwater streams within the watershed into compliance with their designated uses. At present, 9 of 13 stream segments with drainage areas less that 20 mi^2 (headwater streams) fail to meet designated uses.

Management Plan for Priority 1 Programs. *Narrative strategy***.** The programs to improve aquatic life within the mainstem of Honey Creek with drainage areas greater than 50 mi^2 will focus on both point sources and nonpoint sources. All three impaired WWH stations lie downstream from the entrance of effluents from the Attica WWTP. Elevated phosphorus concentrations in Honey Creek at these stations illustrate the impacts of this WWTP (Table 6.6). At Station #4, the QHEI score meets the WWH target, while at Station #5, the QHEI is just below the target value (Table 6.8). These observations suggest chemical rather than habitat limitations. The TMDL calls for a 63% reduction in phosphorus effluent from this plant. The Coalition will work with officials from Attica and the OEPA to improve treatment at the Attica WWTP.

Efforts to improve stream habitat will be especially important in the vicinity of stations #6. Here the QHEI score is 51 relative to the target of 60. However, the substrate score at this site is only 5.5 relative to the target of 12. Efforts to improve the substrate at this site will focus on reducing erosion and sediment transport from the croplands draining into tributaries entering the Honey Creek from the north. These tributaries drain the terminal moraine areas on the border between the Honey Creek and Rock Creek watersheds and, because of the higher field slopes and channel gradients, likely carry sediments having relative larger particle sizes into the mainstem of Honey Creek. These larger particles may contribute to the observed embeddedness of stream bottom substrates along this and downstream reaches of Honey Creek. The erosion control programs associated with the sediment and phosphorus load reduction efforts (see Table 6.2), including both the cropland and streamside BMPs, will be prioritized to this area because they will benefit both the load reduction efforts and the efforts to restore aquatic communities along the mainstem of the Honey Creek. Other efforts to improve aquatic habitat in the priority 1 area will include programs to establish woody riparian buffers where such buffers are lacking. Instream BMPs, such as selective logjam removal and stream bank protection measures, will be undertaken where appropriate.

The possibility of conducting a natural channel design demonstration project to improve stream habitat in the priority 1 area of Honey Creek area will be explored. A unique feature of such a project would be the large drainage area and consequently the large size of the stream, relative to many natural channel design projects in Ohio.

Management Plan for Priority 1 Programs. *Tabular Summary.* To implement the plan described above, the specific tasks described in Table 6.9 will be undertaken.

Management Plan for Priority 2 Program: *Narrative Strategy***.** Efforts to restore the headwater streams in the Honey Creek Watershed will initially be linked to the cropland and streamside BMPs associated with the basin wide programs to reduce sediment and phosphorus loading to Lake Erie. By reducing sediment loading into streams, the substrate component of the QHEI should improve. Part of this improvement will derive from the tendency of streams to develop natural channels relative to the sediment loading and flow regime characteristics of the area. The reductions in delivery of eroded soils from cropland will lengthen the time between channel maintenance activities related to maintenance of tile outlets. Thus the streams will have more time develop "natural" channels, even where the channels are confined to drainage ditches and previously channelized natural streams.

BMPs aimed at restoring more natural flow regimes within stream systems of the Honey Creek will also contribute to restoration of headwater streams. By reducing peak flows, channel erosion will be reduced, while increasing base flows will improve substrate and riffle-pool conditions. The effectiveness of various BMPs in restoring flow regimes in tiled cropland remains to be seen and likely will be the subject of demonstration project proposals.

Instream BMPs within headwater streams will include selective logjam removal on an as-needed basis. Where channel maintenance activities are needed, demonstration projects of two-stage ditch installation or natural channel design features will be considered.

It should be noted that most of the headwater streams in the Honey Creek Watershed have not received specific use designations by the OEPA. The OEPA is undertaking a "Headwater Initiative" to better clarify management options for various types of headwater streams. Part of the Headwater Initiative is based on the concept that the headwater streams constitute significant limiting factors to use designation and use attainment for downstream, larger rivers. That condition does not seem to apply to the Sandusky River, and possibly other agricultural river systems in Ohio. In the case of the Sandusky River, the mainstem of the river, as well as the lower portions of its major tributaries generally meet WWH standards and even EWH standards, while headwater streams frequently fail to meet MWH and WWH standards. In the watershed scoring system used by the OEPA, headwater streams account for only 25% of the watershed score, even though they comprise about 85-90% of the stream miles.

Table 6.9. Specific WAP implementation strategies for meeting priority 1 goals.

Task Description/ Objectives	Resource Requirements: Who; How – Current Programs, New Programs	Time Frame	Performance Indicators
1. Cropland BMPs (see Table 6.2, Task 1.a. – d., 1.g). These efforts will be targeted to croplands to the north of the priority 1 stream reaches which drain areas of terminal moraines.	**(see Table 6.2, Task 1.a. – d., 1.g)**	1 January 2005 – 31 December 2008	Improved substrate scores in the Priority 1 stream reaches and performance indicators listed in Table 6.2
2. Streamside BMPs (see Table 6.2, Task 2.a. – d.), These efforts will be targeted to croplands to the north of the priority 1 stream reaches which drain areas of terminal moraines.	**(see Table 6.2, Task 2.a. – d.)**	1 January 2005 – 31 December 2008	Improved riparian scores at Priority 1 stream reaches and performance indicators listed in Table 6.2
3. Point source controls (see Table 6.2, Task 3.a.)	**(see Table 6.2, Task 3.a.)**	1 January 2005 – 31 December 2008	Reduced phosphorus concentrations at stations 4, 5 and 6.
4. In-stream BMPs			
4.a. Use selective log jam removal as part of a larger streamflow restoration project	**Who:** *willing landowners*, County SWCD, other Coalition partners **How / Current:** ? **How / New:** fiscal year '06 Section 319?	1 January 2005 – 31 December 2007	Incorporated into work plan of demonstration project proposal.

Task Description/ Objectives	Resource Requirements: Who; How – Current Programs, New Programs	Time Frame	Performance Indicators
4.b. Reconnect flood plains to streams.	**Who:** *willing landowners,* County SWCD, NRCS, OSU-Ext, land trust (e.g. Black Swamp Conservancy) **How / Current:** WRP, Clean Ohio Fund **How / New:** fiscal year '06 Section 319?	1 January 2005 – 31 December 2007	Incorporated into work plan of demonstration project proposal.
4.c. Natural channel design demonstration project in vicinity of Station # 6	**Who:** *willing landowners,* County SWCD, other Coalition partners **How / Current:** ? **How / New:** grant to fund demo. project	1 January 2005 – 31 December 2007	Incorporated into work plan of demonstration project proposal.
5. Other measures			
5.a. Controlled drainage demonstration project	**Who:** *willing landowners,* County SWCD, other Coalition partners **How / Current:** ? **How / New:** grant to fund demo. project	1 January 2005 – 31 December 2007	Incorporated into work plan of demonstration project proposal.

Management Plan for Priority 2 Program: *Tabular Summary.* The specific plans for meeting priority 2 goals are shown in Table 6.10. Successful implementation of the strategies presented here will require, above all else, willing landowners. As set forth in the strategy tables, an additional staff person will be required for outreach and educational efforts directed towards the agricultural community and in support of Coalition efforts to implement the WAP and achieve water quality goals.

Problem 3. Elevated nitrate and herbicide concentrations in public water supplies.

The surface water of Honey Creek feeds not only the two public water supplies lying within the watershed's boundaries, but also contributes to the source water of two city supplies located downstream of Honey Creek's mouth, those of Tiffin and Fremont. OEPA designed the state's water quality standards to protect aquatic life use with the belief that aquatic life use protection would also guarantee the safety of public water supply use. Several Ohio water bodies, however, have required the expense of non-conventional treatment, even though these bodies met existing water quality standards (OEPA, 2005). It would seem then that source waters need explicit assessment and protection under Section 305(b) of the Clean Water Act. The OEPA, therefore, is developing an assessment methodology expressly for the Public Drinking Water Supply (PDWS) beneficial use designation (OEPA, 2005). If a water body with a PDSW use designation fails this assessment, it will be identified as impaired and can be brought into the TMDL process to address the impairment.

OEPA's water quality goal for PDSW use is that the waters after conventional treatment will be suitable for human consumption and able to meet federal drinking water standards (OEPA, 2005). Conventional treatment includes conventional filtration and standard disinfection processes. Treatment that is beyond the conventional includes activated carbon, ion exchange, electrodialysis, ozonation, reverse osmosis, enhanced coagulation and membrane filtration. Activated carbon, for example, is used by several treatment plants in the Sandusky River Watershed for the purpose of removing pesticides and other organic chemicals. The burden associated with providing extra treatment, borne by those who depend on and purchase this drinking water, is a direct and quantifiable expense of nonpoint source pollution.

OEPA's water quality goal seeks to provide for safe water without the expense of additional treatment beyond conventional means and also provides for public safety in the event that the additional treatment lapses or fails. For that reason treated water compliance data, since they may reflect the result of additional treatment, are not sufficient for assessing compliance with this goal. Monitoring the source water near the intake is required to meet this goal. Should the source water be judged impaired, the upstream waters that feed the intake will need improvement.

Table 6.10. Specific WAP implementation strategies for meeting priority 2 goals.

Task Description/ Objectives	Resource Requirements: Who; How – Current Programs, New Programs	Time Frame	Performance Indicators
Cropland BMPs (see Table 6.2, Task 1.a. - d, 1.g.), targeting throughout the watershed	**(see Table 6.2, Task 1.a. - d, 1.g.)**	1 January 2005 – 31 December 2010	Improved substrate scores in the Priority 2 (headwater) stream reaches and performance indicators listed in Table 5.2
Streamside BMPs (see Table 6.2, Task 2.a. – d.), targeting throughout the watershed	**(see Table 6.2, Task 2.a. – d.)**	1 January 2005 – 31 December 2010	Improved QHEI scores in headwater streams and performance indicators listed in Table 5.2
In-stream BMPs (see Table 6.2, Task 4.a. – c.)	**(see Table 6.2, Task 4.a. – c.)**		
4.d. Two Stage Ditch Demonstration Project (as opportunity arises in connection with ditch maintenance/construction)	**Who:** *County SWCD*, County Ditch Maintenance, County Engineer, other Coalition partners **How / Current:** landowner contribution in lieu of traditional ditch maintenance assessment **How / New:** fiscal year ’06 Section 319?	1 January 2005 – 31 December 2010	Incorporated into work plan of demonstration project proposal.

OEPA proposes to assess active public drinking water intakes for the following water quality indicators: nitrate, pesticides, other chemicals with established primary SDWA MCLs, and *Cryptosporidium*. The Water Quality Laboratory conducts detailed monitoring of nitrates and pesticides commonly used in the watershed. The Safe Drinking Water Act sets the MCL for nitrates at 10 mg/L. The WQL monitoring program for Water Years 1990 through 1995 has produced nitrate data that exceed this MCL 6.7% of the time in Honey Creek and 5.6% of the time in the Sandusky River at Fremont. Trend analysis by the WQL indicates that nitrate levels, for the years 1994 through 2003, are rising in the Sandusky River.

WQL pesticide data for Honey Creek and the Sandusky River demonstrate that the annual time-weighted mean concentrations (TWMC) of five herbicides commonly used in the watershed fall below the MCLs for these compounds (Richards, 2001) Atrazine displays the highest TWMC values, approaching as high as 2/3 the MCL in some years. The time-weighted mean concentration reflects both the short-term rise in concentration during growing season runoff events and the long periods of very low concentrations in the off-season. Maximum concentrations during the growing season have often been many times the MCL. These maxima, however, are of very short duration, occurring only near the peak flow of a runoff event.

Until the OEPA completes their methodology development and assessment for Public Drinking Water Supply use attainment, it will not be possible to judge whether Honey Creek watershed is impaired for this use. After the methodology is published, PDWS use impairment will be addressed in an addendum to this document if found to be the case.

Household Sewage Treatment Systems

Household sewage treatment system (HSTS) plans have been developed and approved for each of the four counties in the Honey Creek Watershed. These plans describe the state of HSTS's and small flow on-site sewage treatment systems (< 1,000 gallons per day) in the county, target critical areas for HSTS repair, and outline a method for addressing failing systems. HSTS plans are available for review at each of the four county health departments. The Honey Creek WAP intends to work in tandem with these plans as an important component of improving water quality and public health within the watershed.

According to the Seneca County HSTS Plan, 7,900 homes in the county (~85%) are between 20-30 years old. The HSTS's for these homes are nearing the end of their useful life and will need to be replaced in the next 5-15 years. The Seneca County General Health District estimates that approximately ten percent of the systems in the county are currently failing (~920 systems). The county averages forty to fifty replacements each year.

The Crawford County General Health District estimates that ten to twenty percent of the county's HSTS's are currently failing. Crawford County cautions that this estimate may still be lower than the actual rate. The Crawford County General Health District also notes that poor sighting of homes and under-educated landowners (regarding HSTS's) coming from more urban settings are issues that need to be addressed within the county. The Crawford County General Health District attempts to educate new homeowners during site inspections when possible and conducts HSTS inspections prior to a property sale.

A chart of critical areas that have been identified for HSTS replacement is featured in Table 6.11. Additionally, the Seneca County General Health District has recorded elevated

bacteria counts within the Honey Creek Watershed at: Honey Creek main stem, Aicholz Ditch, and Brokenknife Creek. In the case of Brokenknife Creek, the elevated bacteria may be due to failing HSTS's in Crawford County.

Table 6.11. HSTS areas of concern within Honey Creek Watershed.

Area	County	Issue	Action Needed
Connely Rd @ St Rt 103	Crawford	High fecal counts in streams, 10 systems that could be failing.	Inspect and replace failing systems – area has been targeted through 2004 EPA S. 319 grant.
Tiro	Crawford	Small lots with old systems, replacements are not an option.	Sanitary sewers are needed, CCGHD recommends working with Great Lakes RCAP on this issue.
Honey Creek Subdivision	Seneca	Not all of lots near subdivision have been tied into the package plant.	Package plant needs upgraded to all ~30 homes to tie in.
Lake Mohawk	Seneca	Small lots and off-lot discharge systems create a potential for high bacteria levels. Lake Mohawk is a beach facility.	Package plant for the community needs to be considered.
Caroline	Seneca	Area of Concern	Due to lot sizes, density, and the age of homes, these unsewered areas are of special concern.
Carrothers	Seneca	Area of Concern	
Melmore	Seneca	Area of Concern	

Ohio's Coastal Nonpoint Pollution Control Program: Management Measures (Responses to Review of Draft Management Plan)

Introduction. Ohio's Coastal Zone Management Program requires that watershed action plans explicitly address specific management measures. We have done so in Table 6.12. Some of these management measures are addressed elsewhere in the Honey Creek Watershed Action Plan. For example the preceding section on Household Sewage Treatment Systems (Page 86) is also addressed under management measure 5.6.2 in Table 6.12. Additional comments on the various management measures of the Coastal Nonpoint Pollution Control Program are contained within Appendix 3 of this document.

Table 6.12 Ohio's Coastal Nonpoint Pollution Control Program: Management Measures

Management Measure	Agencies (Lead Agency listed first)	Strategy	Cost*	Timeline	Target Area	Guidance Document/BMP Manual
5.3.1 – New Development	Regional Planning Commissions (Seneca Co, Huron Co, Crawford Co, and Wyandot Co) in partnership with SRWC	Review planning document to determine coverage of CMM. Address any gaps with individual Regional Planning Commissions.	$3,000 for staff to review county plans (per commission). $5,000 for staff to research or develop new language to cover any omissions (per commission). $5,000 for staff to work with Commissions on changes to planning documents, and to request adoption of recommended changes (per commission). Total: $13,000 per county/commission within the Honey Creek Watershed.	2007-2010	Full Honey Creek watershed, focus on areas near mouth of watershed, near Tiffin, where develop is most likely to occur.	To be determined based on needs within a given community – will vary between rural and urban areas. Example: Seneca Regional Plan (and other similar plans currently adopted or in development by regional planning entities). Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.3.2 – Watershed Protection	SRWC	Development of watershed action plans at 11-digit HUC level. Watershed wide education and implementation program,	$40,000 for staff and related expenses per watershed plan. $10,000 per year for staff and $5,000 per year for other costs for watershed wide education and	2007-2015	Sandusky River Watershed (04100011)	Guide to developing watershed action plans in Ohio. Appendix 8 update. Honey Creek Watershed Action Plan – as model for future planning

		including watershed festival and Clean Sweep, river clean-up events. Implementation of water quality projects.	information program. Unknown total cost for implementation of water quality projects. $20,000 per year for staff to update plans as necessary. Total: $440,000 for remaining watershed plans, $15,000 per year for education, $20,000 per year for upkeep of all 14 plans in Sandusky River Basin.			documents. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.3.3 – Site Development	SRWC in partnership with Coastal Management staff, ODOT staff, and county engineers	Review County Engineer practices, educate engineers on use of ODOT manual, work with partners to establish strategy for adoption of manual.	$15,000 – for two conferences and a workshop for engineers. $3,000 – for education of County Engineers Association of Ohio through workshop with ODOT and ODNR participation. $30,000 – for staff time to work with partners on development of new policies. $8,000 – for staff time to work towards adoption of new policies. $3,000 – for public	2007-2010	Full Honey Creek watershed, focus on areas near mouth of watershed, near Tiffin, where develop is most likely to occur.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

			outreach regarding new standards and the impacts on water quality. Total: $59,000			
5.5.1 – Existing Development	Regional Planning Commissions (for each county) in partnership with SRWC	Review city/county planning documents to determine coverage of CMM. Address any gaps with individual Commissions. Incorporated areas without planning commissions (Bloomville, Attica, and New Washington will be asked to adopt same language as adopted by planning commissions).	To be completed with CMM 5.3.1, New Development no additional costs expected.	2007-2010	Full Honey Creek watershed, prioritized near population centers – Bloomville, New Washington, and Attica.	To be determined based on needs within a given community – will vary between rural and urban areas. Example: Seneca Regional Plan (and other similar plans currently adopted or in development by regional planning entities). Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.6.1 – New On-Site Disposal Systems	County health departments (Seneca, Crawford, Huron, and Wyandot) in partnership with	Review changes as mandated by new HSTS rules (expected May 2006). Determine shortcomings of	$2,000 – for staff to review new laws as they relate to CMM. $5,000 – for staff to work with ODNR and local health departments to develop	2007-2008	Full Honey Creek watershed, focus on rural areas, away from sewers,	To be determined based on new state regulations and necessary changes. HSTS plans for 4 counties in watershed will also be used.

	SRWC Each county will take lead in its own county, as the current status and the needs for changes to their codes will vary.	rules and language necessary to meet CMM. Implement changes to county HSTS plans to meet CMM.	language to address shortcomings of HSTS rules. $5,000 – for staff to work with partners to request adoption of new rules. (Also note cost for development of GIS layer for each county, as outlined in 5.6.2, Operating Onsite Systems) Total: $12,000		where low density makes new sewers unlikely. Additional targeting will be based on GIS maps when created.	Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.6.2 – Operating HSTS	County health (Seneca, Crawford, Wyandot, and Huron Counties) departments in partnership with SRWC.	Regular (every 5 years) inspection program for each home sewage treatment system in watershed by county health department or approved contractor.	$50 per home per year for implementation of project. $15,000 for staff time to work with HD's to draft language and request adoption by county health boards. $15,000 per county to develop GIS layer of septic systems. Upkeep of systems can be tracked using the GIS layer. Total: $30,000 to develop, $50 per home per year to maintain.	2007-2008	Full Honey Creek watershed, additional targeting will be possible with development of GIS layer for each county.	To be determined based on new state regulations and necessary changes. HSTS plans & HC WAP include strategies for implementation in targeted areas. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

5.8.1 – Planning, Siting, and Developing Local Roads and Highways	SRWC in partnership with Coastal Nonpoint Source Coordinator, ODOT Staff, and county engineers.	Develop a guidebook for distribution to county engineers to adopt which would satisfy the management measure.	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46,000	2007-2012	Full Honey Creek watershed, focus on areas near City of Tiffin, where develop density is most likely to increase.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.2 – Local Bridges	SRWC in partnership with Coastal NPS Coordinator, ODOT Staff, and county engineers.	Develop a guidebook for distribution to Lake Erie Watershed county engineers to adopt, which would satisfy the management measure.	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46,000	2007-2012	All locally controlled bridges.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.5 – Operation and Maintenance of Roads, Highways,	SRWC in partnership with Coastal NPS Coordinator, ODOT Staff, and county engineers.	Develop a guidebook for distribution to county engineers to adopt which would satisfy the	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook	2007-2012	Full Honey Creek watershed, focus on areas near City of	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying

and Bridges		management measure.	would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46.000		Tiffin, where develop density is most likely to increase.	Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.6 – Runoff Systems for Roads, Highways, and Bridges	SRWC in partnership with Coastal NPS Coordinator, ODOT Staff, and county engineers	Develop a guidebook for distribution to county engineers to adopt which would satisfy the management measure.	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46,000	2007-2012	Full Honey Creek watershed, focus on areas near City of Tiffin, where develop density is most likely to increase.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
7.4.1 – Operation and Maintenance Program for Existing Modified Channels – Surface Water	Ohio Department of Natural Resources, Division of Soil and Water Conservation is leading ORDAC. SRWC in partnership with state and local Soil and Water Conservation	Participate in Ohio Rural Drainage Advisory Committee. Complete an inventory of channel modification within the watershed. Create inventory of areas for	$5,000 – for staff participation in ORDAC $3,000 – for staff to complete inventory of channelization practices. $5,000 – for staff to work with agencies and landowners to determine potential demonstration sites.	2007-2010	Channelized stream sections – especially county maintained ditches.	To be developed through ORDAC. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

	Districts and county engineers (Crawford, Seneca, Sandusky, and Wyandot Counties) will provide input as applicable.	potential demonstration projects. Publicize demonstration projects as potential solutions for landowners.	$5,000 – for staff to promote demonstration projects as implemented Total: $18,000			
7.4.2 – Operation and Maintenance Program for Existing Modified Channels – Insteram and Riparian Habitat	Ohio Department of Natural Resources, Division of Soil and Water Conservation is leading ORDAC. SRWC in partnership with state and local Soil and Water Conservation Districts and county engineers (Crawford, Seneca, Sandusky, and Wyandot Counties) will provide input as applicable.	Participate in Ohio Rural Drainage Advisory Committee. Complete an inventory of channel modification within the watershed. Create inventory of areas for potential demonstration projects. Publicize demonstration projects as potential solutions for landowners.	$5,000 – for staff participation in ORDAC $3,000 – for staff to complete inventory of channelization practices. $5,000 – for staff to work with agencies and landowners to determine potential demonstration sites. $5,000 – for staff to promote demonstration projects as implemented Total: $18,000	2007-2010	Channelized stream sections – especially county maintained ditches.	To be developed through ORDAC. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
7.5.3 – Dams	SRWC in partnership with National Center	Develop sampling program for upstream and	$5,000 – for staff to develop monitoring program.	2007-2015	Mohawk Lake (and other dams	Guidance Specifying Management Measures for Sources

	for Water Quality Research	downstream of dam at Mohawk Lake. Secure funding for monitoring program to determine water quality impacts. Solutions will be based on particular problems as they arise.	$20,000 – annual cost for implementation of basic monitoring program. $5,000 – annual cost for staff to analyze and interpret data. Total: $30,000 for first year, $25,000 for each additional year.		as necessary).	of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
7.6.1 – Eroding Streambanks and Shorelines	SRWC in partnership with local SWCD's (Seneca, Crawford, Huron, and Wyandot Counties)	Develop an inventory of erosion areas where BMP's could be installed. Develop a list of acceptable local BMP's. Implement BMP's and provide public education opportunities where possible.	$10,000 –to work with SWCD and landowners to develop inventory. $3,000 – for staff to develop list of acceptable BMP's. $5,000 – for staff to implement public education campaign for implemented BMP demonstration sites. Total: $18,000	2007-2010	HC Watershed wide inventory, demonstrations will focus on areas with noted impacts.	ORDAC guidance as developed, and other relevant guidance as determined necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

*Costs include staff time and associated organizational costs, such as supplies, rent, etc for staff to complete these tasks. Costs do not include actual implementation/installation of any practices, except where explicitly stated. Costs for most practices cannot be estimated at this time, as they will be site and practice specific. Costs are based on 2006 estimates, and should be expected to increase each year.

Educational Outreach

The Education Standing Committee of the SRWC is active in pursuing funding to support K-12 related projects that will benefit the community as a whole and will help improve the understanding that students have of water quality issues. The Development Standing Committee of the SRWC has taken the lead on educating the adult public on watershed related issues. Recent projects include the printing of a recreational-resources map with funding from the Lake Erie Protection Fund, the development of a watershed video project concept in cooperation with WBGU-PBS, and an examination of signage needs for the Sandusky River. In addition, the SRWC has received a grant from the Ohio Environmental Education Fund to implement a farmer self evaluation developed by the Ohio Farm Bureau. This program has been targeted to the Honey Creek watershed for initial implementation. The SRWC has also cooperated in a successful grant program by area schools to incorporate water quality monitoring into their curriculum. This project includes Seneca East High School which is located in the Honey Creek Watershed.

The SRWC is also undergoing a strategic planning process at this time. The goal of the forthcoming strategic plan is to focus the SRWC's resources on the most appropriate activities in the coming years. Part of this activity will include the development of a method for producing more concise and effective implementation procedures. This includes assigning responsibility for tasks to specific organizations and individuals. Specific activities beyond the generalities contained in this plan should be the responsibility of the above-mentioned standing committees, as outlined during our strategic planning process. Table 6.13 features the core educational outreach activities.

Table 6.13. Core educational outreach activities of the SRWC.

Activity	Location	Schedule
Quarterly Membership Meetings	Rotates between counties.	Fourth Thursday of January, April, July, October.
Monthly Steering Committee Meetings	Seneca Co. Ag. Service Center	First Monday of each month.
Fair Booths	County Fairs	Summers
Riverfest	Lowe-Volk Park	Annually in late May
Subcommittee Meetings	Varies	At least quarterly.
Watershed Newsletter	Via Mail	Quarterly, 1 month before Membership Meetings.
Press Releases	All watershed outlets	As necessary, average 1 or more per month.
Website	www.sanduskyriver.org	N/A

Fundraising Plan

The SRWC is working to develop a Membership and Fundraising standing committee for purposes of sustaining the organization in general and watershed coordinator position in particular. For the interim, the Coordinator is responsible for Membership and Fundraising activities. An annual membership drive is held, and includes requests made to individuals, organizations, businesses, and governments. During its initial years, the SRWC averaged approximately $6,000 per year in donations. From November 2003-June 2005 the SRWC has raised approximately $18,000 in cash donations from the community. This is equal to 50% of our annual goal, and is an area in need of volunteer support. All other income for the Coalition will need to be raised through successful grant applications.

Activities that need to be completed in the Honey Creek Watershed will require funding through grant-proposal appeals to government programs, private foundations and other entities that support watershed planning initiatives. Seeking this funding will be a primary objective of the SRWC for the foreseeable future.

Chapter 7
Monitoring and Evaluation

Monitoring Summary

To evaluate progress in addressing the problems described in Chapter 5, chemical and biological monitoring will be required. The Water Quality Laboratory has been monitoring the water quality of Honey Creek since 1976 with the analysis of more than 14,000 samples. In the latest year (FY 2004), 576 samples were analyzed for nutrient and sediment, 178 samples for pesticides, and approximately 500 samples for metals. The samples are taken by automatic sampler at Melmore where State Route 100 crosses Honey Creek. A USGS gaging station at this same location produces a continuous record of discharge. Samples for nutrient and sediment analysis are taken daily during low flow and three times per day during runoff events. Samples for pesticide analysis follow a seasonal schedule. During the growing season samples are taken twice per week during low flow and three times per day during runoff events. For the rest of the year samples are taken every two weeks.

This monitoring program is essential to assessing achievement of the sediment and nutrient load reduction goals set forth in Problem 1 (Chapter 6). The program will also be relevant to the source water protection issues raised in Problem 3. Given that this water quality monitoring program is currently subsidized by the WQL, funding for continued monitoring will be sought through grant writing and proposals submitted to appropriate entities.

The OEPA last conducted a biological assessment in 2001. Since their goal is to repeat this assessment every 5-10 years, the Honey Creek Watershed could come up for assessment again as early as 2006. It is more likely, however, that the next assessment will be conducted some time between 2007 and 2010. Such assessments produce the biological indices that determine the watershed score. The priority 1 goal for Honey Creek biota (Chapter 6) is based on attaining a watershed score of 80(%) by 2010.

Achieving the goals set forth in this watershed action plan will depend on the implementation of the BMPs that comprise the specific strategies proposed here. Performance indicators set forth in the task tables of Chapter 5 form the basis for evaluating this implementation. The Watershed Coalition will devise specific plans to track these indicators.

Table 7.1. Evaluation of Honey Creek WAP implementation and efficacy.

Evaluation Activity	Who	How	Time Frame
Chemical Water Quality Monitoring	Heidelberg College WQL	Apply for funding; $35,000 / year	1 January 2005 – December 2010.
Biological Water Quality Monitoring	Ohio EPA, DSW	State funded 5-year Basin Approach	2007-2010
Track BMP Implementation	USDA NRCS, SWCDs, Coalition, others	Variety of existing and new techniques and reporting devices	1 January 2005 – 31 December 2010.

Plan Update/ Revision

Strategy to keep the plan in front of the general public and responsible officials. The goal of the Sandusky River Watershed Coalition is to create stronger interest and involvement of citizens in each of the subwatershed assessment units (e.g. Honey Creek) that comprise the larger Sandusky Basin. These groups will participate in and be largely responsible for keeping the watershed action plan active and current within the local community. Until such local groups or subchapters of the Coalition are established, the SRWC will be responsible for the visibility and promotion of the Honey Creek WAP. This will occur through several methods, as outlined in the following sections.

Distribution list for the plan. When the Honey Creek planning process got underway, a group of 60 local organizations were asked to take part as planning partners. These groups, even those who did not choose to actively participate in the planning, will receive an electronic copy of the Honey Creek WAP and will be directed to the SRWC website for further information. Many local groups will have the opportunity to formally endorse the WAP prior to state endorsement. The SRWC is committed to providing an opportunity for any group in the watershed to meet with SRWC staff and partners to discuss the WAP. These local organizations will also be advised that their participation on a local advisory board for the Honey Creek WAP will help assure rapid implementation of the plan. An ideal outcome of this process will have one representative from each of the HUC-11 subwatersheds participate on the SRWC Steering Committee as a voting member.

On-going information/education component. This will be the main responsibility of the local subwatershed group as listed under the first section (in addition to implementation activities as a part of the SRWC). Until this group is organized, the SRWC is committed to doing everything within its power to raise awareness and create interest among the watershed residents about the Honey Creek WAP as well as to promote implementation of the plan. When updates to the plan are necessary, the local planning partners will again be called upon to take part in a revision process. The plan should be revisited every three years or as necessary, which ever comes first, and revised accordingly. The Heidelberg College WQL will continue to seek funding to do water quality monitoring in the Sandusky River Watershed. The SRWC will use water quality information produced by the WQL to monitor progress and evaluate the need for revisions and updates to the WAP. Surface-water monitoring by the WQL is contingent upon available funding.

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Appendix 1.

Public Meetings for Honey Creek and Sandusky River Watershed WAP Development

Meetings with residents of the Honey Creek Watershed.....106
Minutes for meeting of February 19, 2004 106
Worksheets for meeting of March 17, 2004 108
Public input and discussion from March 17, 2004 meeting.....115

Meetings with Soil and Water Conservation District Supervisor.....116

Appendix 1. Public Meetings: Minutes and Action Plan Worksheets

Minutes: February 19, 2004
Honey Creek Public Meeting
Attica, Ohio

- Doors open @ 6:30 p.m., refreshments will be served
- Meeting format: questions are encouraged throughout the presentation

- Welcome and Introduction –Tia Rice, Seneca County Soil and Water Conservation District
  Statement describing purpose of meeting
  County SWCD plan vis-à-vis watershed planning
  Invite questions from the audience
  Introduce next speaker

- Sandusky River Watershed Coalition – Christopher Riddle, Watershed Coordinator
  Coalition mission statement
  Coalition accomplishments to date
  Membership: broadbased, invite others to join
  Directive to conduct watershed planning
  Invite questions from the audience
  Introduce next speaker

- Heidelberg College Water Quality Laboratory – Dr. Tim Loftus, Chairman, Sandusky River Watershed Coalition
  Introduce WQL
  Why watershed planning?
  What is a watershed action plan?
  The watershed planning process for Honey Creek
  Invite questions from the audience
  ?'s asked- Why did we choose these two watersheds? Who endorses the plan and what does it cost to write a plan?
  Introduce next speaker

- Heidelberg College Water Quality Laboratory – Dr. David Baker,
  Phase II: Nonpoint source pollution abatement in the Lake Erie Basin
  Introduce technical support study and TMDL report findings
  Use designation; use attainment, watershed scores
  Causes and sources of water quality impairment
  Invite questions from the audience

- **Open discussion moderated by Tia Rice**
  - Log jams in creek & money for removal
  - Sediment reduction vs fish
    - Which is more important?
  - Stream runs dry at times

- Housing development – more impervious surfaces.
- What is the effect of tile on groundwater recharge rate?
    - Landowner feels it is minimal.
- Can we do demonstration/research projects in the watershed?
- Water quality was good before the log jams were in the stream, so removing them shouldn't hurt water quality.
- Deep holes dug in maintained ditches has been done in other places
    - Refuge for fish during dry season
    - Collect sediment

- Coalition partners will be available (if possible) to continue to address questions, issues, and concerns.

Honey Creek Watershed: Action Plan Worksheet # 1.a.

Cause of Aquatic Life Impairments: 1.a. Elevated phosphorus concentrations in streams during low flow, warm weather periods. (See Attached Data Sheet)

Location of Impairments: Elevated phosphorus concentrations were observed at the following stations: 5, 6, and 7 with drainage areas greater than 20 squares miles; and at every station with drainage areas less than 20 square miles.

Sources of Impairment:

- Stations 5 and 6 are impacted by effluents from the Attica Wastewater Treatment Plant. This plant empties into Work Ditch, which enters Honey Creek at mile point 27.88, about 2.8 miles upstream from Station 6. The Attica WWTP appears to be the major source of phosphorus along the mainstem of Honey Creek.
- Station 5 may also be impacted by effluent from the Bloomville Wastewater Treatment Plant, which is carried by Griffin Ditch to Honey Creek at mile point 18.19 just upstream from Station 5 on Honey Creek.
- Effluent from the New Washington WWTP may be affecting Stations 10 and 17 on Brokenknife Creek.
- Failed septic tanks may also be affecting Brokenknife Creek at Station 17.

Quantitative Goal: Attain low flow target phosphorus concentrations of 0.10 mg/L for wadeable streams and 0.08 for headwater streams (Target values for WWH use designation).

Treatment/BMP Options:

- We will work with officials from Attica to investigate possible improvements in phosphorus removal at the Attica WWTP. (to be developed.)
- The Crawford County Health Department has targeted programs to replace failed septic tanks in the New Washington Area, that may be affecting Brokenknife Creek.
- We will conduct additional studies to see if effluents from the New Washington and Bloomville WWTPs are elevating phosphorus concentrations during low flow periods.

Public Meeting #2, March 17, 2004, Action Plan Worksheets____

Honey Creek Watershed: Action Plan Worksheet # 1.b.

Cause of Aquatic Life Impairments: 1.b. High phosphorus export from the Sandusky River and its subwatersheds to Sandusky Bay and Lake Erie.

Location of Impairments: Direct impairments to aquatic life from high phosphorus export during storm events are located in Sandusky Bay and Lake Erie. Indirect impairments are present throughout the drainage network in the form of sedimentation that impairs aquatic life in streams (see Worksheet #2). High phosphorus export also represents a loss of nutrients from agricultural lands. (Note: Since the high phosphorus concentrations during storm runoff occupies a relatively short time period during the year, these high phosphorus concentrations have minimal direct impacts on aquatic life in stream systems.)

Sources of Impairment:

In the Honey Creek Watershed, the OEPA estimates that 93% of the phosphorus exported from the watershed is derived from agricultural runoff (see TMDL Draft Report, Table 20, Unregulated Runoff). Within the Honey Creek Watershed, fields with high sheet and rill erosion rates (particularly for clay sized particles), high delivery of eroded sediments to streams, and high soil test levels for phosphorus contribute more phosphorus than fields lacking the above characteristics.

Quantitative Goal:

The OEPA has set a goal of achieving a 25% reduction in storm event related phosphorus export from all subwatersheds in the Sandusky Basin. (See Draft TMDL Report, page 80.

Discussion questions:

- What land management practices could be implemented to reduce phosphorus export from the Honey Creek Watershed?
- Where should such practices be targeted to achieve the most efficient reductions in phosphorus export?
- How could adoption of these practices be increased within the watershed?
- Can you think of any innovative practices that might help achieve reductions in phosphorus export from the Honey Creek Watershed?

Public Meeting #2, March 17, 2004, Action Plan Worksheets____

Honey Creek Watershed: Action Plan Worksheet # 2.

Cause of Aquatic Life Impairments: # 2 -- Sedimentation within the stream channels.

Location of Impairments: Sedimentation is reflected in OEPA studies by low substrate scores. At each station, substrate scores are determined as part of OEPA's Qualitative Habitat Evaluation Index (QHEI). The attached map of stream substrate scores (Draft TMDL, Appendix E-3) shows the general location of sedimentation problems in the Honey Creek Watershed. Good to Excellent substrate scores were found in Honey Creek from stations 1-5 but substrates deteriorated by station 6. Excellent substrate scores were also found on Buckeye Creek, Van Meter Creek, and Slee Ditch and good scores were found on the lower section of Broken Knife Creek. All other tributaries and remaining portions of Honey Creek were in poor to fair condition.

Sources of Impairments:

The sediments deposited in stream channels are related to the following:

6. Sheet, rill and gully erosion on cropland and construction sites.
7. Streambank erosion (a natural process but also aggravated by high peak discharges and large logjams).
8. Bedload transport of sediments from upstream channel deposits during runoff events.
9. Isolation of stream channels from floodplains that otherwise would be sites of sediment deposition.
10. Naturally low gradients of many area streams.
11. Low base flows in streams that are inadequate to provide "clean substrates."

Quantitative Goals: Attain the following target values for QHEI substrate scores -- 12.5 for WWH; 10 for MWH and 8 for LRW.

Discussion questions:

- What land management practices could be implemented to reduce sedimentation in the stream channels of the Honey Creek Watershed?
- Where should such practices be targeted to achieve the most efficient improvements in stream substrate quality?
- How could adoption of these practices be increased within the watershed?
- Can you think of any innovative practices that might help reduce sedimentation in the Honey Creek Watershed?

Public Meeting #2, March 17, 2004, Action Plan Worksheets____

Honey Creek Watershed: Action Plan Worksheet # 3a.

Cause of Aquatic Life Impairments: 3.a. -- Poor Stream Habitat

Location of Impairments: Poor stream habitats, as measured by OEPA's Qualitative Habitat Evaluation Index (QHEI), are a major cause of impaired aquatic life throughout much of the Honey Creek Watershed. Only six stations in the watershed met the target habitat scores for their designated uses -- stations 1-4 on Honey Creek, and stations on Buckeye Creek and Van Meter Creek. Habitat conditions at all other stations fell below target values. The attached map of QHEI scores (TMDL Appendix D-1) shows the general distribution of habitat conditions in the watershed.

Sources of Impairments:

1. Channelization of previously natural streams (straightening, deepening, etc.)
2. Removal of woody riparian corridors.
3. Removal of root wads and woody debris from channels, as part of channel maintenance procedures.
4. Sedimentation within stream channels (already covered in worksheet #3)
5. Isolation of streams from floodplains.
6. Natural geological factors (gradients, soils, available rocky substrates
7. Altered streamflow regimes. (see Worksheet #4)

Quantitative Goals: TMDL Goal -- Attain the following target values for QHEI scores -- 60 for WWH; 45 for MWH and 30 for LRW.

Discussion questions:

- What land management practices could be implemented to improve stream habitats in the Honey Creek Watershed?
- Where should such practices be targeted to most efficiently attain QHEI targets for the watershed?
- How could adoption of these practices be increased within the watershed?
- Can you think of any innovative practices that might help achieve these improvements?

Honey Creek Watershed: Action Plan Worksheet # 3b.

Cause of Aquatic Life Impairments: 3.b. Poor condition of riparian corridors.

Location of Impairments: Riparian zone scores are an important subset of the QHEI scores. The attached map of riparian condition scores (TMDL, Appendix F-3) shows the location of poor riparian habitat in the Honey Creek Watershed. Poor riparian conditions are present in the portions of Honey Creek near station 5 and between stations 7-9. Poor to fair conditions are also present along Broken Knife Creek and the upper part of Buckeye Creek.

Sources of Impairments:

- Historical conversion of riparian corridors, floodplains, and associated wetlands to crop production.
- Removal of riparian vegetation associated with housing and other urban development on floodplains.
- Channelization of natural streams.
- Clearcutting of woods up to stream banks.

Quantitative Goals: Specific goals for riparian conditions have not been set for the riparian component of the QHEI. However, the goals for the combined QHEI scores, as set forth in the TMDL report, do apply -- (60 for WWH; 45 for MWH and 30 for LRW).

Discussion questions:

- What land management practices will improve riparian conditions along streams?
- Where should such practices be targeted to improve QHEI Scores and aquatic life in the Honey Creek Watershed?
- How could adoption of these practices be increased within the watershed?
- Can you think of any innovative practices that might help improve riparian corridors in the Honey Creek Watershed?

Honey Creek Watershed: Action Plan Worksheet # 4.

Cause of Aquatic Life Impairments: # 4. -- Altered streamflow regimes -- lower low flows during dry periods and higher peak flows during runoff events.

Location of Impairments:

- Reduced low flow volumes are a major source of aquatic life impairment in headwater streams (streams with drainage areas less than 20 square miles.) Under low flow conditions, stream temperatures undergo more extreme fluctuations, re-aeration rates are reduced, less water is present to dilute incoming wastes, and riffle habitats may dry up.
- Higher peak flows increase flood damage and stream bank erosion. Channel cross sections may increase, resulting in poorer low flow stream habitat. The effects are not limited to headwater streams but extend throughout the stream network.

Sources of Impairments:

- Extensive and continually increasing use of tile drainage to support profitable crop production on soils within the watershed.
- Soil conditions which speed surface runoff to streams and thereby reduce duration of time for water infiltration.
- Drainage network modifications to speed water movement to downstream areas.
- Any land use practices that lower groundwater levels.

Quantitative Goals: Quantitative goals have not been set relative to restoration of more natural streamflow regimes during either low flows or peak flows.

Discussion questions:

- What land management practices could help restore more natural flow regimes in the Honey Creek Watershed?
- Where should such practices be targeted to achieve the most efficient improvements in streamflow regimes?
- How could adoption of these practices be increased within the watershed?
- Can you think of any innovative practices that might help restore more natural flow regimes in the Honey Creek Watershed?

Public Meeting #2, March 17, 2004, Action Plan Worksheets____

Honey Creek Watershed: Action Plan Worksheet # 5.

Cause of Aquatic Life Impairments: **# 5. -- Problems associated with livestock production and manure applications.**

Location of Impairments:

- A fish kill was observed on Buckeye Creek on December 14, 2001. Manure applications were a suspected cause of the fish kill.
- Other impairments from livestock operations may be present.

Sources of Impairments:

- A major source of problems comes for liquid manure applications that enter tile drainage systems, delivering manure directly to streams.
- Limited manure storage facilities may result in manure applications under sub-optimal conditions.
- In some cases, livestock have direct access to stream systems and impact local stream habitats.
- Poor manure management can lead to excessive build-up of soil test phosphorus levels, resulting in increased phosphorus loading from the watershed.

Quantitative Goals: Quantitative goals have not been set relative to the avoidance of fish kills associated with manure application.

Discussion questions:

- What manure management practices could be implemented to reduce fish kills associated with manure application in the Honey Creek Watershed?
- Where should such practices be targeted within the watershed?
- How could adoption of these practices be increased within the watershed?
- Can you think of any innovative practices that might help reduce fish kills associated with manure application in the Honey Creek?

Honey Creek Meeting – March 17, 2004

Public Input & Discussion (as organized by worksheets)

Worksheet #1.b – Phosphorus export to Sandusky Bay & Lake Erie

What?

- No till
- Strip Till
- Conservation Tillage
- Buffer Strips
- Phosphorus Application
  - Soil Testing
  - Grid Sampling
- Better Manure Practices
- Subsurface Drainage
- Implementation
- Buffer Strips around roadside culverts and catch basins
- Grassed waterways
- Cover crops
- Rotations that include wheat, hay, and year-round cover

Where?

- Start with sewer plants
- Target fields that border surface water and use increased cost share
- Fields that have high P levels, and free soil testing
- Country springs, etc, should advise people to not overuse
- Target HEL
- Broken down tile
- Increase cooperation – No county assistance to erosion loss
- Increase soil sampling – grid vs. composite vulnerable areas
- Accelerated erosion to address specific wet areas

Worksheet #2 – Stream Sedimentation

What?

- Reconstruction of floodplains with cost share and similar buffer with that.
- Payment arrangement to leave existing floodplain: incentive for those not eligible for other programs
- Tax abatement for farmers who have already implemented 100%
- Address heavy rains into ditches
- Cost share program related to ditch maintenance
- Cost share property line filter strips- put filter strip back on property similar to field wind break
- Some willingness to restore wetlands if the price is right
- Education on stream channel erosion (ag-concrete slab misuse)

Where?

- Targets: livestock on areas near streams (should be removed)
- Target farther away areas with practices instead of just around impaired areas (HEL)

Worksheet #3.a – Stream Habitat Condition

- Focus on WWH and MWH, we are meeting criteria in LRW areas.
- Intensive management of forested buffers (removing mature trees to prevent log jams)
- Station 5 – cover – should we increase cover? To correct problem, you're at 58-60.
- Address limited gradient
- Incentives wetlands for non-crop ground, e.g.-exiting woodland, cost share on long-term set asides along ditches.

Worksheet #4 – Stream Flow Regime

- Smaller fields
- Retention on farms being converted
- Increase research/demonstration control drainage
- No-till farming
- Strip till farming in areas w/long, flat grades…corn/beans
- Government help comes from corn productions, equate to erosion small grains, incentive low now.
- Address houses and weather pattern changes
- Increase water holding capacity b/c organic matter
- Tradeoff with negative economic impacts to agriculture.
- Reservoir wetlands along stream to release more water
- Partial dams...slope in honey creek enough to do this?

Steering Committee meetings with local Soil and Water Conservations Districts and NRCS District Staff.

To explore areas of mutual concern and interest, the Steering Committee of the Sandusky River Watershed Coalition met with the Supervisors and staff of the Soil and Water Conservation Districts in counties of the Sandusky River Watershed. These were generally very productive meetings. The dates of these meetings are listed below:

Crawford SWCD - July 1, 2003
Seneca SWCD - November 13, 2003
Erie SWCD - December 17, 2003
Wyandot SWCD - March 11, 2004
Sandusky SWCD - April 8, 2004

Appendix 2

State Review of
Honey Creek Draft Watershed Action Plan
(dated March 2004)
and
Coalition Responses to the State Review

Cover Letter for comments from State Review Team.....118

Comments by State Review Team.....120

Itemized Coalition Responses to State Review Team Comments.....124

Sandusky River Watershed Coalition
Christopher Riddle, Watershed Coordinator
219 South Front Street, P.O. Box 590
Fremont, Ohio 43420

June 2, 2005

Dear Mr. Riddle and Coalition Steering Committee members,

Thank you for submitting a copy of the Honey Creek Watershed Action Plan covering HUC 04100011-080, located within the Sandusky River Watershed and dated March 2005 for our review. We sincerely appreciate the efforts the local watershed partners have made to complete this plan. We recognize that water resource restoration and protection cannot happen without the solid commitment of local groups such as the Sandusky River Watershed Coalition (SRWC).

Comments from your Area Assistance Team, Ohio EPA and ODNR central office staff are compiled and enclosed. Please share our comments with the watershed group leadership as appropriate. Once the specific plan comments contained in the attachment to this letter are incorporated into the plan, the plan can receive full endorsement.

Future 319 implementation grants will continue to focus on watersheds implementing recommendations from completed TMDL reports and endorsed watershed action plans. Therefore, with a state endorsed watershed action plan, the Honey Creek Watershed Partners will be eligible to compete for the limited 319 grant dollars that are available and potentially other funding sources as well.

Please let us know within 30 days of receipt of this letter whether you intend to address the comments and pursue state endorsement of your plan. If you do wish to pursue endorsement, please schedule a meeting with us so that we can discuss the intent of the comments in more detail. Among other things, a meeting will allow your organization, Ohio EPA and ODNR to agree on the scope and intent of needed plan revisions, so that you can proceed toward plan revision and re-submittal with confidence.

It is the State's intention to continue to be a very strong stakeholder and supporter of your efforts to protect and improve water resource quality in the Sandusky River watershed. As you continue planning in additional sub-watersheds and add new technical information and document implementation, your planning will be an ongoing process.

Ohio truly appreciates your efforts thus far, and we look forward to working with you in the future. If you have any questions, please contact Rosida Porter, Ohio Department of Natural Resources (ODNR) at 614-265-6647, Jocelyn Henderson, ODNR, Division of Soil and Water at (419) 424-5006, or Katie McKibben, Ohio Environmental Protection Agency (OEPA) at (419) 373-3013.

Sincerely,

Katie McKibben, OEPA
Division of Surface Water

Jocelyn Henderson, ODNR
Division of Soil and Water Conservation

Enclosure

CC: Timothy T. Loftus, Heidelberg Water Quality Laboratory
David B. Baker, Heidelberg Water Quality Laboratory

Review comments on your watershed action plan were provided by:
Rosida Porter, ODNR – DSWC, Columbus
Natalie Farber, Ohio EPA, Columbus
Dana Oleskiewicz, Ohio State University Extension, NEDO
Katie McKibben, Ohio EPA – Northwest District Office
Jeff DeShon, Ohio EPA – Ecological Assessment Section
Jocelyn Henderson, ODNR-DWSC, Findlay
Matt Adkins, ODNR-DSWC, Sandusky
Aaron Lantz, ODNR – DSWC, Columbus

General Plan Comments

The Honey Creek Watershed Action Plan provides an excellent executive summary accompanied by a thorough, but brief presentation of known information in the watershed. We appreciate your efforts to interpret the Ohio EPA Biological and Water Quality Study of the Sandusky River and Selected Tributaries, 2003, and the Upper Sandusky River Total Maximum Daily Load (TMDL) Report, 2004. The elements of the Guide to Local Watershed Action Plans with Appendix 8 update are very well addressed overall in this plan.

Throughout the plan and beginning with the Executive Summary, there appears to be confusion with regard to its reference of an Ohio EPA goal of 80% aquatic life use attainment by 2010 versus a watershed assessment unit score of 80 (out of 100). We are aware of correspondence on this topic between the plan authors and Ohio EPA Ecological Assessment Section staff this past winter, but we would like to re-state for clarity that the "80% by 2010" is simply an Agency administrative goal. It has changed over time, and is neither in rule nor statute. Watershed assessment unit (WAU) attainment scores, however, are based upon a total aquatic life use score of 100, as per the Clean Water Act. The ultimate goal for any WAU should be 100, which indicates all sites are fully meeting the designated aquatic life use.

Considerable effort is exerted in the plan to debate the merits of either a) meeting or exceeding the Agency 80% percent goal over the short term (by doing nothing about small streams and instead simply working with Ohio EPA to get more point source abatement, especially along the main stem, or b) boosting Honey Creek current 63.7 WAU score over long term to at least 80 (out of a 100) by focusing local efforts on installation of multiple Best Management Practices (BMPs) watershed-wide in small streams and primary headwaters.

If the consensus among Honey Creek watershed partners is achieving a WAU score of 80, that is a respectable place to begin their efforts. However, until the WAU score reaches 100, the watershed runs the risk of being 303d listed again when the next level 3 water quality assessment is conducted. We would welcome the opportunity to further discuss this concept of goal setting and how to measure progress and successful restoration for the subwatersheds in the Sandusky River basin.

The comments that follow should give the project sponsor ideas to provide some missing details from the inventory and help lead to an endorsable plan, and successful implementation. We also encourage the Coalition to follow a similar format when developing plans for the remaining subwatersheds in the Sandusky River watershed.

Project Strengths

1. Great introduction and background information on policies and goals for planning
2. Good agency and government involvement
3. Organization and display of TMDL assessment information is useful
4. Sandusky River Watershed Coalition has a good organizational structure, which will foster further development of the Honey Creek Watershed Partners.
5. A public involvement process for watershed plan development through a series of local meetings was utilized to involve stakeholders and develop solutions.
6. Evaluation with indicators for progress/success is well identified in the goals and objectives for each problem statement. There is also a detailed monitoring plan for evaluation of implementation progress.
7. Load reduction calculations are explained and presented in a usable table format in chapter 5.
8. Well organized tables with implementation strategies (who, what, when and where), for each goal are presented beginning on page 68.
9. Did a good job addressing soils and their limitations in the inventory chapter.

Plan Comments:

1. The livestock inventory is weak. While a map of individual locations and farm operators is not required, it would be useful to have a summary table of estimated livestock numbers by species in the watershed. The implementation strategy tables recommend exclusion fencing for 15 locations, and waste management facilities for 2 dairy and 8 hog operations. Does this represent all of the operations, or are the project goals based on an assessment of problems in the impaired segments of Honey Creek?
2. Information was omitted from the plan on a home sewage treatment system inventory. Please note in the plan that HSTS plans were developed and approved for all counties in the Honey Creek watershed. In Chapter 3 we recommend you make direct reference to the HSTS plans as an element of this plan. Perhaps the HSTS plans and statewide development of sewage rules could be included in Chapter 2, Policy Environment.
3. Please provide some information on groundwater occurrence and usage in the watershed. Ground water pollution potential maps are being prepared for each Ohio county using the DRASTIC mapping process. Currently the statewide aquifer maps, groundwater resource maps for all 88 counties, and pollution potential maps for just Seneca and Crawford

counties are available from ODNR Division of Water at the following website http://www.dnr.state.oh.us/water/pubs/ .

4. The plan appears to be an environmental government work plan without a diverse stakeholder involvement. Suggest you broaden the list of stakeholders to include other community entities such as municipalities, townships, schools, civic groups, libraries, nonprofits, etc. Allow opportunities, perhaps through workgroups, for all stakeholders to provide input for solutions and then take the lead on action projects.
5. The regulated entities such as municipal wastewater treatment plants and public water suppliers that will be affected by decisions and projects should be active Honey Creek Partners.
6. The SWCD, NRCS, and OSU are listed simultaneously as the lead on all activities in the implementation strategy tables in chapter 5. Please state a lead implementer for each cropland BMP. For example on Page 68, Table 5.2 - Seneca County SWCD, with assistance from OSU Extension and NRCS.
7. There is minimal reference to an educational outreach and fundraising plan. This should be a component of the plan per the watershed plan guidance.
8. Page 4 - Reference made that Coalition bylaws may be found on the web. To ease public review, and foster their use of the watershed plan, kindly add a web link to p. 4, and consider inserting bylaws into a Honey Creek WAP appendix.
9. Cultural Resources, p.26 - Revise typo reference of Table 3.9 to Table 3.10.
10. The Executive Summary, the Introduction on page 3, and the section on Watershed Scores on pages 49-51 all contain differing statements about the Agency administrative goal and the Ohio EPA protocol for evaluating Clean Water Act goal attainment in the subwatersheds. Please note the general comments above on the use of WAU scores. There appears to be a need for further discussion with Ohio EPA staff on this issue.
11. Tables and text, pp.49-51 - Several typos with numbers (or rounding?) Check and revise.
12. Page 69, Table 5.2 – When establishing streamside BMPs, such as buffers, they need to be put in systematically to affect water quality improvement. So, better targeting of the filter strips on not just first or second order streams, but named streams with an outreach plan to the landowners would be preferable.
13. The Chapter 3 watershed inventory does not include enough information on physical attributes of streams and floodplains. We request that the following be acknowledged as "unknown" or "scheduled for assessment" in the 2004-2006 (or later) work plans:
    - Agricultural tillage, grazing, crop rotation and chemical use patterns
    - Channel and floodplains conditions
    - How many miles of natural channel
    - How many miles of maintained channel
    - How many miles of stream in permanent protection (easement)
    - Floodplain connectivity
    - Riparian levees
    - Oxbow cutoffs
    - Length and severity of eroded banks
    - Assessment of wetland quality (ask Ohio EPA 401 Section for assistance on the Ohio Rapid Assessment Method for wetlands.)
14. In the following sentence in the soil inventory section, please add suggested text as noted in bold; *While local knowledge will play a key role in efforts to target BMPs, spatial*

analysis of a combination of soil attributes (e.g. hydrologic group, slope, **drainage, and the soil's physical properties**) *and/or other physical features of the landscape can also be employed to inform these efforts.*

15. Referring to the following sentence on page 20, *It is evident from Map 4 that soils information is not organized consistently between the four counties.* Make note that the Seneca, Wyandot, and Huron counties detailed soils layers will be available soon (within the next year) and at that time this information will even be more beneficial in prioritizing land for BMP implementation. In addition, Seneca County SWCD now has the updated spatial layer available at their office. Since most of the Watershed is in either Seneca or Crawford, this should be of help.
16. Under **Problem statement 1** in the narrative of the management plan, using GIS to delineate buffers (distance from streams), erodable soils, and locate agricultural fields is almost essential to conservation planning. The ease of access of digital information and the relative short time it takes to create a map that targets those areas that would benefit the most from having a BMP implementation makes GIS essential. The use of GIS is a watershed tool that saves time and increases the chances of getting the most water quality benefit for every dollar spent for implementation.
17. The same GIS tool should be applied for **Problem statement 2**.
18. The Honey Creek Watershed Action Plan must address each of the Coastal NPS Management Measures. This includes documentation of the applicability of each management measure and current programs or projects that have successfully implemented Coastal NPS Management Measures. The Honey Creek Watershed Action plan must describe how all applicable management measures will be implemented in the Honey Creek Watershed. It is not clear from the current plan which management measures besides hydromodification apply to the Honey Creek Watershed, and how the management measures will be implemented. The documentation must include information on the programs, projects, areas covered, contact agency, timeline, enforceability etc. An example of this format can be viewed in the Coastal Nonpoint Pollution Control Program Plan: http://www.dnr.state.oh.us/soilandwater/docs/CNPCP/Chapter%2003.pdf Refer to Chapter 3 - Management Measures for Agricultural Sources.
19. There are also grant opportunities through the Office of Coastal Management to fund planning and implementation of the Coastal NPS Management Measures at the local watershed level. Please contact Matt Adkins to further discuss these comments and get assistance for gaining endorsement of the Coastal NPS section of your local watershed action plan.
20. The Honey Creek Watershed Action Plan is encouraged to include all marinas in their inventory and encourage their participation in the Ohio Clean Marinas Program. The ODNR and OSU Sea Grant have implemented the Ohio Clean Marinas Program for all Lake Erie Marinas. *http://www.sg.ohio-state.edu/cleanmarina/* . For more information contact Gary L. Comer, Jr., Coordinator - Ohio Clean Marinas Program, Office of Coastal Management, at (419) 609-4120 or comer.29@osu.edu

Coalition Responses to Comments from the State Review Team

In response to the Comments received from the State Review Team (Area Assistance Team, Ohio EPA and Ohio DNR) and the discussions with State Review Team members at a meeting at Heidelberg College on June 13, 2005, the authors of the Honey Creek WAP have made numerous changes to the text, added additional GIS maps and enlarged all maps, and added two sections to the appendix.

To facilitate the final review of this WAP, the specific changes and edits we have made in response to each of the specific numbered plan comments by the State Review Team are presented below, **in bold face type**. The numbered plan comments, as well as the General Plan Comments are also repeated below.

General Plan Comments

The Honey Creek Watershed Action Plan provides an excellent executive summary accompanied by a thorough, but brief presentation of known information in the watershed. We appreciate your efforts to interpret the Ohio EPA Biological and Water Quality Study of the Sandusky River and Selected Tributaries, 2003, and the Upper Sandusky River Total Maximum Daily Load (TMDL) Report, 2004. The elements of the Guide to Local Watershed Action Plans with Appendix 8 update are very well addressed overall in this plan.

Throughout the plan and beginning with the Executive Summary, there appears to be confusion with regard to its reference of an Ohio EPA goal of 80% aquatic life use attainment by 2010 versus a watershed assessment unit score of 80 (out of 100). We are aware of correspondence on this topic between the plan authors and Ohio EPA Ecological Assessment Section staff this past winter, but we would like to re-state for clarity that the "80% by 2010" is simply an Agency administrative goal. It has changed over time, and is neither in rule nor statute. Watershed assessment unit (WAU) attainment scores, however, are based upon a total aquatic life use score of 100, as per the Clean Water Act. The ultimate goal for any WAU should be 100, which indicates all sites are fully meeting the designated aquatic life use.

Considerable effort is exerted in the plan to debate the merits of either a) meeting or exceeding the Agency 80% percent goal over the short term (by doing nothing about small streams and instead simply working with Ohio EPA to get more point source abatement, especially along the main stem, or b) boosting Honey Creek current 63.7 WAU score over long term to at least 80 (out of a 100) by focusing local efforts on installation of multiple Best Management Practices (BMPs) watershed-wide in small streams and primary headwaters.

If the consensus among Honey Creek watershed partners is achieving a WAU score of 80, that is a respectable place to begin their efforts. However, until the WAU score reaches 100, the watershed runs the risk of being 303d listed again when the next level 3 water quality assessment is conducted. We would welcome the opportunity to further discuss this concept of goal setting

and how to measure progress and successful restoration for the subwatersheds in the Sandusky River basin.

The comments that follow should give the project sponsor ideas to provide some missing details from the inventory and help lead to an endorsable plan, and successful implementation. We also encourage the Coalition to follow a similar format when developing plans for the remaining subwatersheds in the Sandusky River watershed.

Response to General Plan Comments. Much of the content of the General Plan Comments dealt with the Coalition's interpretation of OEPA's "80%" Watershed Attainment Goal. At the meeting of June 13,2005, a representative of the OEPA's Division of Surface Water (Jeff DuShon) confirmed that the Coalition's interpretation of the goal matched that of the current OEPA interpretation. Consequently, sections of the WAP related to the 80% goal were not in need of revision. This topic will also be addressed in our specific responses to the numbered plan comments.

Project Strengths

1. Great introduction and background information on policies and goals for planning
2. Good agency and government involvement
3. Organization and display of TMDL assessment information is useful
4. Sandusky River Watershed Coalition has a good organizational structure, which will foster further development of the Honey Creek Watershed Partners.
5. A public involvement process for watershed plan development through a series of local meetings was utilized to involve stakeholders and develop solutions.
6. Evaluation with indicators for progress/success is well identified in the goals and objectives for each problem statement. There is also a detailed monitoring plan for evaluation of implementation progress.
7. Load reduction calculations are explained and presented in a usable table format in chapter 5.
8. Well organized tables with implementation strategies (who, what, when and where), for each goal are presented beginning on page 68.
9. Did a good job addressing soils and their limitations in the inventory chapter.

Plan Comments:

1. The livestock inventory is weak. While a map of individual locations and farm operators is not required, it would be useful to have a summary table of estimated livestock numbers by species in the watershed. The implementation strategy tables recommend exclusion fencing for 15 locations, and waste management facilities for 2 dairy and 8 hog operations. Does this represent all of the operations, or are the project goals based on an assessment of problems in the impaired segments of Honey Creek?

A section has been added in Chapter 3 that discusses livestock. Table 3.11 has been added that provides estimates of livestock types/ numbers in the watershed derived two different ways, extrapolation from county level data and projections from staff of local soil and water conservation districts.

As for the implementation strategy table recommendations (Table 6.2), our numbers are based on expert assessment of the problems by John Crumrine, retired USDA NRCS Dist. Conservationist for Seneca County AND Mark Fritz, Manure Management Specialist for Seneca, Crawford, Wyandot, and Sandusky Counties. Thus, these numbers do not represent all of the operations.

2. Information was omitted from the plan on a home sewage treatment system inventory. Please note in the plan that HSTS plans were developed and approved for all counties in the Honey Creek watershed. In Chapter 3 we recommend you make direct reference to the HSTS plans as an element of this plan. Perhaps the HSTS plans and statewide development of sewage rules could be included in Chapter 2, Policy Environment.

A section that discusses "Ohio Household Sewage Treatment Regulations" has been added to Chapter 2. County Health Department HSTS Plans are referenced in Chapter 6 where some discussion of these plans is also found. Table 6.11 has been added to feature HSTS areas of concern within the Honey Creek Watershed. The Coalition, working with the county health departments has received a 319 grant to replace failing septic tanks. This grant includes addressing some of the failed systems in Honey Creek that are listed in the HSTS plans.

3. Please provide some information on groundwater occurrence and usage in the watershed. Ground water pollution potential maps are being prepared for each Ohio county using the DRASTIC mapping process. Currently the statewide aquifer maps, groundwater resource maps for all 88 counties, and pollution potential maps for just Seneca and Crawford counties are available from ODNR Division of Water at the following website http://www.dnr.state.oh.us/water/pubs/

A new section titled, "Ground Water" has been added at the end of Chapter 5. This section makes reference to ground water pollution potential maps and ground water resource maps for Seneca and Crawford Counties among other matters discussed.

4. The plan appears to be an environmental government work plan without a diverse stakeholder involvement. Suggest you broaden the list of stakeholders to include other community entities such as municipalities, townships, schools, civic groups, libraries, nonprofits, etc. Allow opportunities, perhaps through workgroups, for all stakeholders to provide input for solutions and then take the lead on action projects.

The Honey Creek WAP makes specific reference to those "partners" who were invited to join the process and agreed to do so. Please see Chapter 1. The section titled, "Honey

Creek Watershed Partners" has been expanded to include discussion of the regulated entities within the watershed and their participation in the process.

Two public meetings that were held in the watershed provided the opportunity for all stakeholders to participate in the process. Work sheets used at these meetings are included in Appendix A.

Finally, the section "Sandusky River Watershed Coalition" has been expanded to include information on a series of meetings that were held throughout the Basin prior to the preparation of the SRWC RIP. Those meeting were designed to attract participation from diverse groups in the planning process and subsequent management activities.

5. The regulated entities such as municipal wastewater treatment plants and public water suppliers that will be affected by decisions and projects should be active Honey Creek Partners.

See number 4 above. Additional information about regulated entities has been added to the section "Honey Creek Watershed Partners."

6. The SWCD, NRCS, and OSU are listed simultaneously as the lead on all activities in the implementation strategy tables in chapter 5. Please state a lead implementer for each cropland BMP. For example on Page 68, Table 5.2 - Seneca County SWCD, with assistance from OSU Extension and NRCS.

After conferring with a representative of the agricultural community, a lead entity has been designated for each of the BMPs. This lead is listed first and written in italics in the strategy tables.

7. There is minimal reference to an educational outreach and fundraising plan. This should be a component of the plan per the watershed plan guidance.

New sections titled, "Educational Outreach" and "Fundraising Plan" have been added to Chapter 6 to address this deficiency. It should also be noted that educational outreach activities will be included in grant applications for BMP implementation.

8. Page 4 - Reference made that Coalition bylaws may be found on the web. To ease public review, and foster their use of the watershed plan, kindly add a web link to p. 4, and consider inserting bylaws into a Honey Creek WAP appendix.

A web link that points the reader to the Coalition's bylaws has been added to Chapter 1, "Sandusky River Watershed Coalition", page 4.

9. Cultural Resources, p.26 - Revise typo reference of Table 3.9 to Table 3.10.

This error has been corrected.

10. The Executive Summary, the Introduction on page 3, and the section on Watershed Scores on pages 49-51 all contain differing statements about the Agency administrative goal and the Ohio EPA protocol for evaluating Clean Water Act goal attainment in the subwatersheds. Please note the general comments above on the use of WAU scores. There appears to be a need for further discussion with Ohio EPA staff on this issue.

We have discussed our understanding of these issues and potential for confusion with the State Review Team. Both parties are satisfied with discussion results and no edits are required.

11. Tables and text, pp.49-51 - Several typos with numbers (or rounding?) Check and revise.

All errors have been corrected.

12. Page 69, Table 5.2 – When establishing streamside BMPs, such as buffers, they need to be put in systematically to affect water quality improvement. So, better targeting of the filter strips on not just first or second order streams, but named streams with an outreach plan to the landowners would be preferable.

The information for "better targeting" is currently unknown. Furthermore, the Coalition is presently without the resources necessary to collect the data that will enable us to target as suggested. The Coalition will seek funding to develop a more sophisticated approach to establishing streamside BMPs. This is discussed on page xx, Chapter 6, in the section "Management Plan for Load Reduction."

13. The Chapter 3 watershed inventory does not include enough information on physical attributes of streams and floodplains. We request that the following be acknowledged as "unknown" or "scheduled for assessment" in the 2004-2006 (or later) work plans:
    - Agricultural tillage, grazing, crop rotation and chemical use patterns
    - Channel and floodplains conditions
    - How many miles of natural channel
    - How many miles of maintained channel
    - How many miles of stream in permanent protection (easement)
    - Floodplain connectivity
    - Riparian levees
    - Oxbow cutoffs
    - Length and severity of eroded banks
    - Assessment of wetland quality (ask Ohio EPA 401 Section for assistance on the Ohio Rapid Assessment Method for wetlands.)

We have made explicit reference to the need for additional data/information regarding these physical riverine system attributes in a new section titled, "Other Stream and Floodplain Attributes." (Chapter 3). We have noted that as planning progresses and funding is obtained, such data collection and analyses will follow.

14. In the following sentence in the soil inventory section, please add suggested text as noted in bold; *While local knowledge will play a key role in efforts to target BMPs, spatial analysis of a combination of soil attributes (e.g. hydrologic group, slope,* **drainage, and the soil's physical properties**) *and/or other physical features of the landscape can also be employed to inform these efforts.*

This information has been incorporated as suggested. Please see Chapter 3, page 20, under the section titled, "Soils".

15. Referring to the following sentence on page 20, *It is evident from Map 4 that soils information is not organized consistently between the four counties.* Make note that the Seneca, Wyandot, and Huron counties detailed soils layers will be available soon (within the next year) and at that time this information will even be more beneficial in prioritizing land for BMP implementation. In addition, Seneca County SWCD now has the updated spatial layer available at their office. Since most of the Watershed is in either Seneca or Crawford, this should be of help.

The new information referenced above has been obtained from the counties and incorporated into the soils maps (maps 6-8). Consequently the sentence noted above has been removed from the text.

16. Under **Problem statement 1** in the narrative of the management plan, using GIS to delineate buffers (distance from streams), erodable soils, and locate agricultural fields is almost essential to conservation planning. The ease of access of digital information and the relative short time it takes to create a map that targets those areas that would benefit the most from having a BMP implementation makes GIS essential. The use of GIS is a watershed tool that saves time and increases the chances of getting the most water quality benefit for every dollar spent for implementation.

In a discussion with the State Review Team, we made clear our belief in the value of applying a GIS. We have applied GIS to this planning process, producing a total of 13 GIS- based maps. We believe that properly integrating multiple layers of GIS information to support targeting of remedial measures requires the use of distributed parameter models. At this time, the Coalition lacks the resources to apply such a model to support targeting, although we hope to obtain such resources in the future. We also believe that locating individual fields for planning at the 11-digit watershed scale, such as Honey Creek is impractical. This 115,000 acre watershed contains thousand of individual fields. Using the existing GIS layers, we can indicate the general location within the watershed of fields that should be targeted, but we cannot map them individually. When developing conservation plans for individual farms, we note that the local SWCDs do plan at the level of individual fields and accompanying field level maps. The Coalition will also take advantage of other parties who generate data or GIS-based analyses that can be applied in the Sandusky Basin.

17. The same GIS tool should be applied for **Problem statement 2**.

See response to number 16 above.

18. The Honey Creek Watershed Action Plan must address each of the Coastal NPS Management Measures. This includes documentation of the applicability of each management measure and current programs or projects that have successfully implemented Coastal NPS Management Measures. The Honey Creek Watershed Action plan must describe how all applicable management measures will be implemented in the Honey Creek Watershed. It is not clear from the current plan which management measures besides hydromodification apply to the Honey Creek Watershed, and how the management measures will be implemented. The documentation must include information on the programs, projects, areas covered, contact agency, timeline, enforceability etc. An example of this format can be viewed in the Coastal Nonpoint Pollution Control Program Plan: http://www.dnr.state.oh.us/soilandwater/docs/CNPCP/Chapter%2003.pdf Refer to Chapter 3 - Management Measures for Agricultural Sources.

A new section titled, "Ohio's Coastal Nonpoint Pollution Control Program: Management Measures" has been added to Chapter 6. In this section, each of the 16 applicable management measures is addressed.

19. There are also grant opportunities through the Office of Coastal Management to fund planning and implementation of the Coastal NPS Management Measures at the local watershed level. Please contact Matt Adkins to further discuss these comments and get assistance for gaining endorsement of the Coastal NPS section of your local watershed action plan.

The Coalition will work closely with the Office of Coastal Management to take advantage of all opportunities for planning and implementing Coastal NPS Management Measures. At the present time, the Coalition has received a planning grant from the Office of Coastal Management for planning in the Sandusky-Tiiffin HUC-11 (04100011-090).

20. The Honey Creek Watershed Action Plan is encouraged to include all marinas in their inventory and encourage their participation in the Ohio Clean Marinas Program. The ODNR and OSU Sea Grant have implemented the Ohio Clean Marinas Program for all Lake Erie Marinas. *http://www.sg.ohio-state.edu/cleanmarina/* . For more information contact Gary L. Comer, Jr., Coordinator - Ohio Clean Marinas Program, Office of Coastal Management, at (419) 609-4120 or comer.29@osu.edu

There are no marinas in the Honey Creek Watershed. Thus, no action is taken to address this suggestion.

APPENDIX 3

Ohio's Coastal Zone Nonpoint Pollution Control Management Measures: Additional Comments and Draft Implementation Plans

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Additional Comments on Coastal Zone Management Measures

Irrigation Water Management. The Farm Bureau is addressing this issue at the state level. Consequently, it is no longer necessary for the Coalition to address this issue within the Honey Creek WAP. However, it should be noted that irrigation agriculture was not implicated in the identification of contributing factors to water quality impairments in Honey Creek (OEPA 2004b). Furthermore, in a study of water use for irrigation agriculture in Ohio's Lake Erie Basin, Loftus and Richards (2005) did not find irrigation agriculture to be present at a level that would require a reporting of usage withdrawals to the State of Ohio. There is no reason to suspect, therefore, that irrigation agriculture is problematic in the Honey Creek Watershed. Based upon the weight of this evidence, it appears that this management measure is not applicable to the Honey Creek Watershed.

New Development Management Measure (Urban). Urban land use represents less than one percent (1%) of the Honey Creek Watershed. As noted in Table 3.9 above, the population in Seneca and Crawford counties has been declining since 1980 and is relatively stable in Wyandot County. Only Huron County is experiencing slow population growth and that is taking place mostly in the northern part of the county (e.g. Norwalk, Bellevue) outside of Honey Creek. The U.S. Census lists zero (0) households in Seneca County in urbanized areas (American Factfinder 2000). This combination of factors makes a strong case for exemption from urban management measures for not just Honey Creek, but for most of the Sandusky River Watershed, as the City of Tiffin, the second largest city in the entire watershed, is located within Seneca County.

True urban development is a non-factor within Honey Creek. Exemption from the Coastal Management Measures does not eliminate all residential and low-density urban issues from the scope of this plan. Best management practices and other activities for these areas within the watershed are still an important part of improving water quality.

Where new development does take place, there are guidelines available to minimize nonpoint source pollution. For example, the Rainwater and Land Development (1996) manual developed by the Ohio DNR, Division of Soil and Water Conservation along with the USDA NRCS, provides guidance for minimizing nonpoint source pollution from new development. Several chapters are being revised and are currently available in draft form (ODNR, 2005). Chapter 4 (draft), for example, addresses permanent runoff control by outlining post-construction storm water management practices for treating runoff from a development site after construction is final. A local implementation strategy will involve County Commissioners as the local authority and now responsible for issuing permits to landowners and developers who disturb one acre or more. Permit issuance by County Commissioners will require that new development incorporate the practices that are recommended in the ODNR Rainwater manual or other sources of BMP implementation guidance. Also, the Ohio Department of Transportation (ODOT 2000) has published a handbook for guiding the proper installation of sediment and erosion control items on road, highway, and bridge construction and maintenance projects.

Watershed Protection Management Measure (Urban). Much of the information listed above under the "New Development Management Measure" applies here as well. With this management measure, however, we can also reference the Seneca Regional Planning Commission (2001) and their plan for Seneca County. As discussed in Chapter 2 above, the

Seneca Plan, while not a watershed or basin plan per se, offers a vision for directing growth and development in a particular fashion. The Seneca Plan also discourages development within land areas identified as Critical Resources. Thus, the Seneca Plan is complementary to the strategies offered here in the Honey Creek WAP as both planning documents are designed to accomplish watershed protection program goals outlined under this management measure.

Site Development. In so far as this management measure is intended to provide controls and practices that are to be applied during the site planning and review process, guidance can be found in the Rainwater and Land Development (1996) manual including the five revised chapters that are currently available in draft form (ODNR, 2005) as discussed above. Regarding roads, highways, and bridges, the ODOT (2000) handbook is applicable here too.

Existing Development Management. Strategies listed in this Honey Creek WAP are designed to address this management measure. Since the Honey Creek Watershed is less than one percent urban, these strategies will be implemented throughout a predominantly rural landscape. This WAP, along with the Lake Erie Conservation Reserve Enhancement Program (CREP), emphasizes the creation of filter strips and restoration of riparian buffers.

New On-Site Disposal Systems. New county health department household sewage treatment system plans include guidance to meet the requirements of this management measure. This management measure also finds support in Sub. H.B. 231 (125th G.A.) discussed above in Chapter 2. Readers are encouraged to visit the Coalition's website and navigate to the Wastewater Committee's webpage to learn more including information about the home sewage treatment replacement program available here:
http://www.sanduskyriver.org/watershed/index.php?page=Committees/Waste+Water/Home+Sewage+Treatment+Systems/

Copies of household sewage treatment system plans are available from your local county health department, and are kept on file by the Coalition in its offices. Contact information for local health departments can be found on the "Links" page of the Coalition's website. Updates on state rules and Sub. H.B. 231 can be found on the Ohio Department of Health's website www.odh.ohio.gov.

Operating On-Site Disposal Systems. Regular inspection and maintenance of home sewage treatment systems is critical to proper operation and treatment of sewage. To comply with the Coastal Management Measures, it will be necessary for a professional to inspect each system in the watershed on a regular schedule. Current funding levels do not allow for such a process to take place. To remedy this situation, additional funding would be required from federal, state, and/or local sources or through the payment of annual maintenance fees by the homeowners. One of two potential strategies could be employed with these funds. The first is a regular, fixed interval schedule of inspections, which could be completed on a 5-10 year basis. A second method is for inspections to occur at the time of sale for homes with sewage treatment systems. During the interim, it is the goal of the Coalition to continue to educate homeowners on the maintenance of their systems as the only feasible method for addressing this issue.

An estimated cost for a fixed-interval maintenance program with annual inspections is $100 per system per year. Less frequent inspections of systems would allow for a reduced fee. In addition, there is the potential to increase annual fees through a conglomeration of homeowners.

These increased fees would be used to cover anything from basic maintenance to full replacement of failing systems, depending on the need. Spreading these payments out though an annual payment scheme would reduce the burden on a homeowner who is often unprepared to handle the cost of replacing a failing system. Additional details on plans that will satisfy this measure can be found in **Appendix 3**.

(Note the Coalitions responses to the following four Coastal Nonpoint Pollution Control Management Measures grouped into a single response.)

Planning, Siting, and Developing Roads and Highways (Local Ohio).
Bridges (Local Ohio).
Operation and Maintenance of Roads, Highways, and Bridges
Runoff Systems for Roads, Highways, and Bridges.

Management measures, as relating to *Runoff Systems for Roads, Highways, and Bridges; Operation and Maintenance of Roads, Highways, and Bridges; Bridges (local only);* and *Planning, Siting, and Developing Roads and Highways (local only),* all require the participation and cooperation of local county engineers. To facilitate this process, the Sandusky River Watershed Coalition submitted a letter to each of the county engineers within the Honey Creek Watershed in August of 2005, requesting their participation with this process. Follow-up phone calls were made, but without success in reaching the engineers. After consultation with ODNR Coastal Management staff, a second letter and a detailed survey were submitted to the county engineers in December 2005. This second letter and the follow-up phone calls were met with mixed results.

Wyandot and Crawford County Engineers have not responded to phone calls requesting a meeting to discuss the survey and their responses. Multiple calls have been made to these entities without success. The Seneca County Engineer has refused to participate in the process, and has submitted documentation to this effect to the Coalition. A meeting was held with the Huron County Engineer on January 19, 2006.

At this time, a strategy has been developed for a multi-phased effort to produce the necessary results within these counties. It is the opinion of the Coalition that additional, outside assistance from the Ohio Department of Transportation and the ODNR Division of Soil and Water Conservation, will be a necessary part of this process. The current stance of the county engineers is symptomatic of a larger issue, which is the need for continued investment in the watershed planning process, including education and public outreach.

After consultation with the Huron County Engineer, it is the opinion of the Coalition that the county is currently addressing all applicable management measures to the best of their ability. The single biggest concern that remains is the manner in which these practices are implemented. The county does not have a written policy that dictates many of these activities. To ensure continuation of their current practices, it would be necessary for the engineer's office to develop and implement a policy manual that is equivalent to, or exceeds ODOT guidance in regards to Coastal Management Measures. At this time, there does not seem to be interest within the county to develop a written policy, as there is no foreseen benefit to the county. Education on the importance of a written policy is necessary to change this situation. Due to this need, many of the educational efforts outlined below will apply to Huron County, barring the first step.

Step 1: An educational program must be put in place to educate county engineers on the importance of watershed planning, and their participation in the process. This would include education on the goals and impacts of watershed plans, the role of the Coastal Management Measures, and participation by ODOT representatives. One part of this process is currently underway. In June 2006, the Water Quality Laboratory will host a Sandusky River Symposium, to discuss all issues relating to the management of the Sandusky River Watershed. Local officials, including County Commissioners and County Engineers, will be invited to this event. To help facilitate the involvement of county engineers from across the Lake Erie Watershed, it is critical that their peers, namely ODOT officials, become involved in this education process. Work with the County Engineers Association within Ohio would be one method for developing a dialogue among Lake Erie Watershed counties regarding the Coastal Management Measures and watershed planning. The goal of this step is to develop an understanding of watershed planning and the importance of participation within the ranks of county engineers. This step is critical both to the development of detailed plans for addressing water quality and to the implementation of water quality objectives in the years to come.

Step 2: An inventory of current practices would need to be completed across the watershed. This process has been begun, but a lack of willingness to participate has made completion impossible at this time. Once engineers are educated regarding the advantages of and the need for participation, further action can be taken to develop an inventory. From this inventory, a list of new policies and procedures can be developed that, if implemented, would address all coastal management measures. Ideally the county engineers would each adapt a series of policies similar to those developed by ODOT.

Step 3: Implementation of the new policies would begin immediately upon their adoption. Those actions that could be taken immediately to improve management would be adopted first. Issues regarding the design and maintenance of roadways and bridges could not all be implemented at once due to the costs involved. Rather, a strategy would be developed in each county to address issues as maintenance and replacement of various roadways and bridges occurred. A 15 to 20 year implementation plan would likely be the best place to start this process. Regular review and revision of this plan would be necessary based on the amount of progress that is made towards determined objectives.

A budget for this process is expected as follows:

Step 1: Education

- Education of County Engineers through two watershed conferences and a workshop - $15,000
- Education of County Engineers Association of Ohio through a two-day workshop with ODOT and ODNR participation - $3,000

Step 2: Policy Adoption

- Development of new policies and procedures - $30,000
    - Cost includes legal review and staff time for the development of new policies.
- Adoption of new policies -$8,000
    - Cost is for $3,000 in public outreach in each county to gain political and popular support for new policies, as well as to educate the local residents on the benefits of new policies and approaches.

Step 3: Implementation of Policies

- Implementation costs will vary county to county, and will not be available until new policies have been developed and a full inventory has been conducted in each county.

(Note the Coalitions responses to the following three Coastal Nonpoint Pollution Control Management Measures grouped into a single response.)

Channelization and Channel Modification Management Measures.
Physical and Chemical Characteristics of Surface Waters.
Instream and Riparian Habitat.

Currently, the only inventory of channelization that exists in the Honey Creek Watershed is one of county ditch maintenance practices. These areas are noted on Map 4. To comply with the Coastal Management Measures, the Coalition will work with the local Soil and Water Conservation Districts to review the schedule of maintenance for these ditches as a first step. From this schedule, the Coalition will work with the Districts and landowners to explore funding opportunities that would allow the implementation of new technologies aimed at improving the physical and chemical characteristics of these streams. The implementation of these practices is dependent on multiple factors, not least of which is the buy-in of local landowners. Without their support, alternative practices will not be able to move forward.

A more complete inventory of channelization must be completed for the remainder of the Honey Creek Watershed (this inventory would include only streams, namely blue line streams as listed on topographic maps, that have been channelized, not drainage ditches that have been created by man). The Coalition would propose to complete this through the use aerial photos and expert analysis of stream channels. ODNR Division of Soil and Water Conservation staff will be an essential resource when developing a complete inventory. The cost for an inventory of Honey Creek is estimated at nearly $10,000. Once this information is gathered, the Coalition will work to provide educational materials to landowners about the potential for alternative practices on their properties. Again, the limiting factor for implementation will be first and foremost, the willingness of landowners to participate. The other major limiting factor is funding. To develop a two-stage channel, estimated costs are as high as $50 per lineal foot. To return to a natural channel design, estimates are as high as $100 per lineal foot. The Honey Creek Watershed has 242 miles of streams. It is likely that a majority of the miles have been impacted by some form of channelization. Additional, detailed plans for implementation projects can be found in **Appendix 3**.

Dams. There are three dams of consequence in the watershed. The first in at Mohawk Lake. This dam impounds Van Meter Creek, and provides a recreational lake for the community of homes that has built up around it. Mohawk Lake has been noted in the Seneca County HSTS Plan as an area of interest. Loading from failing septic systems has an impact on the water quality in the lake. The removal of this dam is not socially or politically possible at this time, as the community has developed around the lake because of the lake, and it is seen as a critical part of the property value of these homes. With time, the dam will age beyond repair, and will need replaced. The inability of the homeowners to fund the replacement of the dam is the only potential for removal of this dam at this time. If the dam is removed, then a stream restoration project could be implemented on the creek in that area. Redeveloping a channel and planting trees would be key parts of the project. A full plan would need developed based on the condition

of the stream and the circumstances under which the dam is removed, and cannot be accurately speculated on at this time.

The channel downstream form the dam at Mohawk Lake was not scored as a part of the TMDL process. The section is not mentioned in the TMDL at any time as a water quality concern. There is mention of Mohawk Lake in the Seneca County General Health District's HSTS Plan. The District considers Mohawk Lake a critical area for home sewage treatment improvements. The Coalition will continue to view the Mohawk Lake area as a critical area as well, and will promote any actions by the General Health District that would eliminate human health concerns and improve water quality for Mohawk Lake. An assessment of the downstream section of Van Meter Creek would need completed to determine the appropriate actions for improvement of the stream channel. Without accurate monitoring data a decision cannot be made on the appropriate actions for the downstream section, if any are even necessary.

The second dam is located just outside of the Village of New Washington on Brokenknife Creek. The dam is14.9' high and has a storage capacity of 66.7 acre-feet. This dam is a necessary part of the water supply for New Washington. The dam has the potential to create a pool for the pumps used to fill the reservoir for the drinking water supply. It allows for the flow of water on a day-to-day basis, according to the staff at the treatment plant, as the sliding gates on the dam are rarely closed as such to block flow. Removal of the dam is not a priority as the watershed serving the water supply is only about 5,000 acres. It is important to note that the section of stream both upstream and downstream from the dam is in full attainment of water quality designated uses. Due to this full attainment status, the implementation of additional water quality measures are not necessary at this time. If the use attainment of the stream sections degrades, then management may become necessary.

The third dam is listed as a part of the Wastewater Treatment Plant. The dam is 13' high with a storage capacity of 132 acre-feet. According to the staff at the plant and the ODNR Division of Water, this dam is a part of the wastewater treatment lagoon, and is off stream as well. This dam does not impound waters in the stream, and is not impacted by this plan. All releases of water from this lagoon are monitored and regulated by Ohio EPA. Dam failure, a potential impact on the stream, should be prevented through the work of ODNR and the Village of New Washington, who are responsible for maintaining the dam. Brokenknife Creek both upstream and downstream from the dam is in full attainment of water quality use designations. Further management measures on this section of stream are not necessary unless there is a degradation of water quality in the future.

Eroding Streambanks and Shorelines. Similar to the "Instream and Riparian Habitat Restoration Management Measure" discussed above, the Coalition does not currently possess adequate data or information to quantify the extent of eroding streambanks. There are no shorelines within the watershed. Funding will be pursued to inventory streambank condition and other physical attributes of the stream network as pointed out in Chapter 3. In the meantime, strategies outlined above will be implemented, some of which will help to stabilize eroding streambanks.

Draft Implementation Plans for Satisfying Coastal Management Measures

Operation and Maintenance of Home Sewage Treatment Systems – A Sample Plan

There are a variety of potential methods for implementing an operation and maintenance program for rural home sewage treatment systems, as indicated in the body of this text. Below is a detailed example of how one such method could be implemented, if funded. This is not to suggest the below as either the best nor as the only method of implementation. The final decision on implementation is a matter that must be resolved by the Ohio Department of Health in cooperation with county health departments and any potential funding or legislative sources.

A basic service would include annual inspections and as-needed pumping of treatment systems. To implement such a system, and annual fee of $100 per homeowner would be assessed by the agency responsible for the maintenance; in this scenario a private contractor, whom is registered with the county health department, will assume this role.

The contractor will be responsible for conducting a general inspection of the system in compliance with any ODH or county health department regulations that may be in place. The contractor would maintain documentation of this inspection for 5 years. As well, when the system is in need of pumping (approximately every 5 years), the contractor will be responsible for contacting the appropriate entity as well as scheduling and paying for the pumping. The annual fee paid to the contractor by the homeowner would cover this payment. In the case where a system is determined failing, or in need of repair or replacement, the contractor would notify both the homeowner and the county health department. Follow-up on the repair or replacement would still be under the authority of the county health department.

Channelization and Channel Modification – A Sample Plan

There are a variety of potential methods for implementing a channelization and channel modification retrofitting program for streams in the watershed, as indicated in the body of this text. Below is a detailed example of how one such method could be implemented, if funded. This is not to suggest the below as either the best nor as the only method of implementation. The final decision on implementation is a matter that must be resolved by the Sandusky River Watershed Coalition, the county Soil and Water Conservation Districts, the State of Ohio Division of Soil and Water Conservation, the Ohio Environmental Protection Agency, and most importantly, but individual landowners. As a voluntary action, the buy-in of landowners is the most important part of the collaboration that is required to address this issue.

The following text outlines two strategies. The first is for the completion of an inventory of channelization in the watershed. The second is a strategy for implementing a demonstration project that would show both a two-stage ditch as well as natural channel design. These examples are broad estimates, as specific costs will depend upon many variables that cannot be calculated at this time. A variability of as much as 30% in the final cost is not impossible.

Development of an Inventory of Channelized Streams

Activity	Cost
Review of aerial photos (intern staff 300 hrs @ $10). - Gather photos – 2 weeks (60hrs) - Organize photos – 1 week (30 hrs) - Initial review – 2 week (60 hrs) - Field truth – 1 week (30 hrs) - Full review of photos – 3 weeks (90 hrs)	$3,000
Review of topographic maps & other sources of data (intern staff 100 hrs @ $10) - Gather topographic maps – 10 hrs - Research other potential records – 20 hrs - Initial review of data – 20 hrs - Truth versus aerial photos – 30 hrs - Additional review – 20 hrs	$1,000
Supervisory Staff (100 hrs @ $22). - Train intern – 20 hrs - Assist with initial review – 20 hrs - Field truth – 30 hrs - Assist with full review – 10 hrs - Develop GIS layer – 20 hrs	$2,200
Supervisor Benefits (29%)	$650
Travel Costs (500 miles at $.485)	$250
Copy, phone, computer, and related office costs	$1,000
Final map development and printing costs	$900
Fiscal Administration Costs (10%)	$1,000
Total Cost	$10,000

Demonstration Project – Two Stage Ditch and Natural Channel

Site Development Costs (two stage ditch, 3,000 feet @ $50/foot) - Engineering, planning, and construction.	$150,000
Site Development Costs (natural channel, 3,000 feet @ $100/foot) - Engineering, planning, and construction.	$300,000

Project Director (600 hrs @ $22 (200hrs per year or 10% time))	$17,028
- Project management	
- Communications	
- Reporting	
- Management of contractors and partners	
- Fringes @ 29%	
Property Costs (82 acres (300' buffers) @ $5,000/acre)	$410,000
- Easement - $3,500 per acre	
- Legal fees - $1,000 per acre	
- Surveyor fees - $500 per acre	
Public Outreach (Field Days) (6 days, 2 per year @ $500 ea.)	$3,000
Monitoring Program (Based on USGS stream gauge figures)	$60,000
- For 2 years of monitoring.	
Travel Costs (2,000 miles at $.485)	$970
Office Costs (phone, computer, copies, postage, etc.)	$3,000
Fiscal Administration Costs (10%)	$94,400
Total Project Cost (3 year program)	$1,038,398

Outline of Cost Estimates for Large-Scale Implementation

To restore even 20% of the total stream miles to a natural design, a fraction of what is likely needed, at $75 per lineal foot, the project would cost $19,166,400. It is also likely that easements would need to be purchased along these streams to permanently protect the newly designed channels. Permanent easements are unpopular in the watershed, but could be purchased if sufficient funds are made available. Based on local land values and discussions with landowners, these easements, in floodplain areas, could run in excess of $3,000-$5,000 per acre. This combination of expenses should provide a scenario conducive to natural channel design and the permanent protection of riparian areas in Honey Creek. Providing a minimal 100' wide buffer on 20% of the channel in Honey Creek would require the purchase of 5,754 acres into easements. At $3,000 an acre, this brings the total project cost to at least $36,428,400.

Realistically, active restoration is not an affordable option for many landowners. This is especially true when considering that many landowners have been paying to maintain straight channels for many years. Thus our likely best approach is to provide setbacks from stream channels, and to allow nature to do the majority of the work. Small projects could be completed to help direct the recovery process of streams. These could be completed for perhaps $10-$50 per lineal foot, depending on the amount of work to be completed). However, it is important to note that setbacks from streams are socially and politically difficult to promote in the watershed.

It is likely that per acre payments would be required to provide for the setbacks. A large investment has been made in drainage in the watershed. This investment has opened up immense tracts of land to agriculture use and residential development. Natural channel design and/or setbacks would be perceived as contrary to the actions taken for several generations in the watershed, and would be difficult to promote successfully.

One additional issue to consider is that of the use of levees in the watershed. Levees have been constructed along the main stem of Honey Creek in eastern Seneca County. These levees have served to open up land to agriculture and development for more than a generation. The lands which are in residential development are likely permanently lost. Those lands in agriculture could be regained as floodplains. To do so would require the destruction of the current levees, and the construction of new levees further from the stream. The new levees would be necessary to protect additional acres of farm ground and infrastructure during the highest of peak flows. The land that is used for floodplains would have to be purchased from the landowners. If this land is for sale, then current market value could be paid. Otherwise, it is likely the landowner sees a value in the land, such as a yearly income from crops, and that loss of income should be considered in any payments made for these lands. Partnerships with the Black Swamp Conservancy and other such organizations may provide opportunities for some lands to be entered into permanent easements, but for many local landowners, the tax incentives alone are not enough compensation for these grounds.