Report for 2005OH27B: Technology Enhanced Participation for Watershed Planning

Publications

- There are no reported publications resulting from this project.

Report Follows

USGS WATERSHED FINAL GRANT REPORT
TECHNOLOGY ENHANCED PARTICIPATION FOR WATERSHED PLANNING

Introduction

Watershed management brings to bear a number of integrated issues related to land use, hydrology, biology, policy development, and political feasibility. The scope and diversity of a watershed further challenges the decision making environment. Watersheds often encompass multiple jurisdictions, ecosystems, and span both rural and urban land uses. Such a complex environment can be challenging for farmers and other land owners to understand the impacts of their own actions at the watershed level. Yet, these citizens are the key to watershed management implementation success.

Land use can significantly and negatively impact water quality. Agricultural activities introduce fertilizers, pesticides, and herbicides into the waterways. Traditional farming practices that abut waterways eliminate buffers thereby raising stream temperatures and increasing bank erosion which raises the sediment level in streams. Non-agricultural land uses also impact waterways. Traditional development increases impervious surfaces (e.g., rooftops, parking lots, roadways, sidewalks) resulting in increased amounts of water runoff leading to downstream flooding, and decreased amounts of water percolating into the soil for natural groundwater recharge. The quality of the runoff is degraded due to the emissions, litter, and other wastes that enter the water system as collected by the runoff. Development can also change the physical character of streams and other waterways through channelization and bank erosion.

Best management practices (BMPs) installed along waterways are important to mitigate negative impacts of development and agricultural practices. BMPs include planting along stream banks to curb erosion, establishing a buffer zone of non-activity along a stream, creation of artificial wetlands, and livestock exclusion. Implementation of these practices, however, has been voluntary and requires buy-in from farmers and land owners if BMPs are to be effective. Once BMPs are implemented, it is also critical to establish the relationship between implementation and the biological quality of the watershed. This relationship can not only reinforce the practices, but also to guide watershed plans and related policies.

Farmers and other land owners learn about BMPs through a variety of channels, including extension services and public meetings. Public meetings are also the typical forum in which input is received on watershed planning activities that may incorporate BMP implementation. Public meetings, however, have been characterized as an inefficient means for public learning on a complex topic such as watershed management. The framework of public meetings largely dictates the content and time frame within which participants can learn about issues and express opinions. This institutionalization of the participation process limits the time and depth to which an individual can learn about a complex public issue. Strategies to improve the participation experience through a technology-based, active learning approach have been investigated in the literatures addressing both public policy participation (citizen participation) (e.g., Al-Kodmany, 1999; Macpherson, 1999; Padgett, 1993) and classroom participation (e.g., McIntyre and Wolff, 1998; Oliver and Omari, 2001; Yazon et. al. 2002). Technology-based approaches include, for example, online discussions and resources, as well as computer aided visuals through Geographic Information Systems.

Active learning is an environment whereby knowledge is conveyed through direct experience such as writing, discussing, reading, or acting (Chickering and Gamson, 1987). The student is a participant in the process rather than simply a receiver of information imparted by a lecturer. The literature on active learning, both in general and technology based, typically has focused on an academic learning environment (e.g., McIntyre and Wolff, 1998; Oliver and Omari, 2001; Yazon et al., 2002). This literature provides relevant insights as a public meeting is similar to a classroom in that it is a forum to impart information, though on a condensed exposure scale and to a different audience. The classroom-based active participation literature suggests that an integration of traditional with technology-based participation methods would offer the most satisfying outcome for participants.

Problem and Research Objectives

The Upper Great Miami River Watershed is a fitting location for instituting technology-based active learning participation for watershed planning. The Upper Great includes 10 counties, primarily Shelby, Logan, and Miami. The land uses within the watershed are primarily agricultural, but it also has urbanized areas including Sidney in Shelby County. There are BMPs currently in place in the Upper Great Miami River Watershed. There is, however, no research regarding the relationship between their implementation and the biological quality of the watershed. Stream health ratings in the watershed range from very poor in some areas of Shelby and Logan Counties, to excellent those and other counties of the watershed. Further, the existing means by which to educate the public regarding BMPs and to gain input and insights for related watershed plans and policies is the public meeting which is often both inefficient and ineffective. This research effort attempted to address these issues in the Upper Great Miami River Watershed through the establishment of an online watershed planning participation venue.

There were two primary objectives of this project:

Objective 1: Establish the relationship between implemented BMPs and biological quality in the Upper Great Miami Watershed.

Best Management Practices are a critical means of watershed protection. They rely on typically farmers to establish stream corridor buffers, engage in no or low-tillage activities, and other practices to reduce negative impacts of farming on water quality. As noted previously, however, implementation of BMPs is voluntary. Therefore, it is crucial to understand the relationship that exists between implemented BMPs and biological quality within the watershed. This information can then be used to draft policies for watershed management.

Best Management Practices funding data for the Upper Great Miami Watershed will be used to classify the major areas of study in Logan and Shelby Counties. The data have been compiled by local watershed groups but have not been georeferenced. We undertook an initial classification of watershed areas that are in good condition based on biological data versus and those that are not. We then used land use and BMP data to provide insight into the cause and effect relationships. A preliminary assessment performed by a graduate planning class at OSU has already identified major areas where the quality has improved over the past decade and roughly correlated these trends with the implementation of BMPs (Gordon et al. 2002). The additional analysis should be able to confirm some of those effects as well as point out areas where further study is needed.

Objective 2: Inform public officials, land managers, and other watershed stakeholders of the management choices for their watershed through in person and online participation venues, examining the effectiveness of the integrative approach.

Community outreach is an essential component to any watershed management approach. It serves a number of purposes, primary of which are education and citizen input. Watersheds such as that of the Upper Great Miami in Ohio are complex areas to plan due to their scope and diversity. They encompass multiple jurisdictions, ecosystems, and span both rural and urban land uses. Providing citizens with scientific based pollution and BMP information can be challenging in the limiting format of a public meeting. Public meetings are limiting in who can attend and what can be covered in the time allocated. The intent of the outreach component of this proposal is to utilize a technology enhanced approach to improve the level of citizen participation both in terms of scope and understanding. The outreach will coordinate with established extension groups in the Upper Great Miami Watershed counties of Logan and Shelby.

The incorporation of technology into public planning processes represents an area of great promise to build better relationships between government and its citizenry. Information and communication technology (ICT) relaxes time and geographic constraints faced by citizens who want to participate (Kwan and Weber 2003). Citizens who choose to participate using ICT do so in the location and at the time of their choosing. Governments that harness ICT tools can potentially expand opportunities for citizen participation.

We used two primary forms of participation and education to advance knowledge of the watershed planning effort by stakeholders. First, we held traditional public meetings to introduce our project and gather user pre and post-test information, as well as to provide a training session for potential users of the online participation experience. Padgett (1993) noted that technically savvy citizens may welcome the GIS tool, while “those less knowledgeable will be difficult to convince” (516). Therefore, training sessions on the use of the website and the proposed online discussion tool (Elluminate through an agreement with the Ohio Learning Network Online Community) were deemed important to establish a comfort level with the technology enhanced participation experience. Elluminate provided online discussions and file sharing to allow citizens to continue the dialog begun at the public meeting without regard to the physical limits of time and space; online participants can post questions, suggestions, and the like at their convenience from their own home or wherever they may have access to an Internet connection. Elluminate also has the capacity for streaming video and audio which would allow remote citizen participation in watershed meetings.

Second, we attempted to provide informal education and discussion via the Internet. This technology enhanced participation approach will be used to improve education and awareness of the issues and management plan approaches for the Upper Great Miami Watershed and to test the efficacy of this approach. One of the principle technology enhanced component included a GIS-based decision support tool for education and outreach. This tool allowed users to gather accurate information about the current status of their watershed, as well as current land use and BMP practices and the impacts these have had on the watershed. The tool also provided users the ability to run a limited set of development / watershed management scenarios and graphically observe the anticipated outcomes in various time frames.

Methodology

This project was undertaken in two phases corresponding with the objectives discussed previously. In the first phase, we focused on the relationship between funded BMPs and biological water quality data in the Great Miami Watershed. We began with an initial classification of watershed areas that are in good condition based on biological data versus and those that are not. This classification was based on biological data available through the Ohio EPA. We then correlated that information with existing land use data available through county auditors' websites and with BMP funding information. This information was provided in two online venues; first, a site we created dedicated to the BMP and participation elements of this study (http://uppergreat.knowlton.ohio-state.edu) as well as integrated into an existing website on watershed planning in Ohio (http://tycho.knowlton.ohio-state.edu).

The second phase of this project employed two technology based tools to enhance citizen participation for watershed planning. This phase used the BMP-water quality relationships and corresponding policies established during the first phase of the study. We held public watershed planning meetings in March and April of 2005 to introduce the project to potential participants in Logan and Shelby Counties. These groups were organized with the assistance of the extension offices in those counties; preliminary information was gathered from attendees and they remained on a contact list for the planned online introduction meeting. We then held meetings in both counties in September of 2005 to introduce the policies for consideration as part of a watershed planning effort. The September meetings also served as a training session on the use of the integrated online participation tools. The researchers and assistant demonstrated the technologies, including a step by step example of logging on; navigating pages in the GIS based tool; and utilizing discussion sessions in Elluminate™. Interested participants were given headsets for use with the future online sessions. The training session was intended to reduce technology anxiety that may inhibit use of the participation tools.

The online participation tools were made available in late September. Participants were encouraged to schedule one-on-one or small group online sessions with the researchers to become more comfortable using the online participation venues. A follow up meeting was planned for 6 weeks after the introductory meeting. However, due to the lack of participants for the online sessions, this meeting was never held.

Principal Findings and Significance

Though the funded portion of this project has been completed, the project itself is ongoing. Delays were encountered which prevented us from getting through the full scope of the participation and BMP mapping phases. Therefore, the discussion which follows provides findings at this point in the research.

BMP Relationship to Water Quality

The georeferenced BMP information was incorporated into GIS files with water quality data; primarily, IBI information. However, due to the timing of the BMP adoption versus that of the IBI sampling, it was not consistently possible to propose a relationship between the two. The most extensive recent sampling of the streams in our study area were done in 1994; BMP data was as recent as 1999. Analyses were done on a subwatershed, HUC 14 level. In some cases, BMP data did not exist in the subwatershed. Figure 1 below shows the HUC 14 subwatersheds in the Upper Great. More detailed information on those analyzed follows. This information is also provided at the project website: http://uppergreat.knowlton.ohio-state.edu/ (under Analysis of Watershed Conditions).

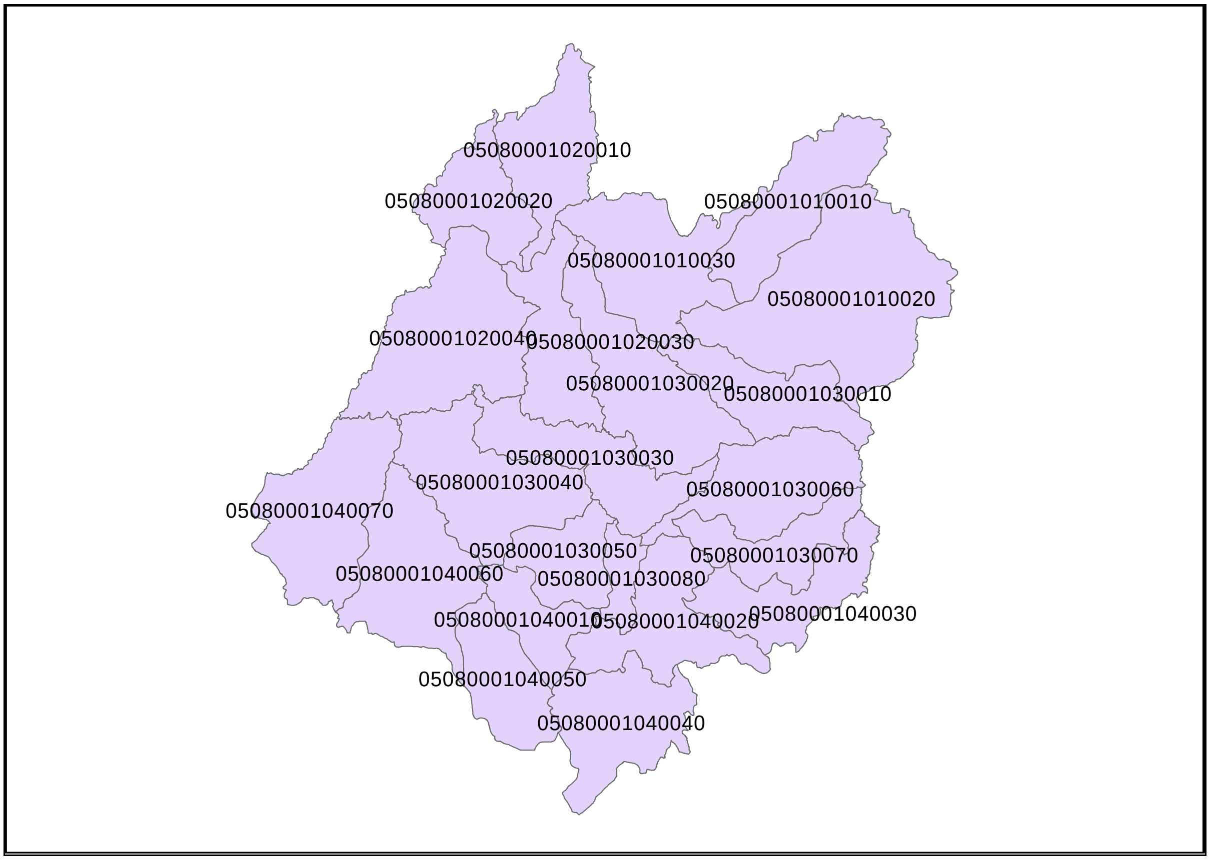


FIGURE I

As mentioned previously, the data used in the research is from a 1994 sampling of multiple streams in many of the HUC 14 drainage basins by Ohio EPA. This data has been analyzed to find possible reasons to explain fluctuations between different water quality indicators. These quality indicators include IBI, QHEI, temperature, chemical levels, oxygen levels, and substrate. Point sources were also analyzed in order to examine their effect on water quality. BMP data from as recent as 1999 has also been noted for possible future study.

The following scale was used to rate the IBI value of water quality:
- Exceptional 50-60
- Very good 42-49
- Good 34-41

- Fair 27-33
- Poor 17-26
- Very poor <17

Analysis
<u>10010</u>

The average IBI value for this sub-watershed is 28.33, which is considered fair but is below the EPA standard for warm water habitat. In other words, this subwatershed is substandard. The apparent cause of these problems here are related to land use and habitat. The average QHEI score of 39.33 is the lowest of any subwatershed in the Upper Great Miami. The 90-meter riparian zone land cover is 86% agricultural and only 12% forest. This sub-watershed also has a very low average DO Probe at 4.80 ppm (parts per million). A healthy stream would have a DO level above 6 ppm. The temperature is 21.75 C which is average for the watershed. None of the Best Management Practices (BMPs) that have been added to the watershed are in this area. There do not appear to be major point sources of pollution in this area. The main source of the problem appears to be habitat problems from the land cover in the 90-meter riparian zone. *Figure II and III compare the average IBI levels to forest land cover and agricultural land cover.*

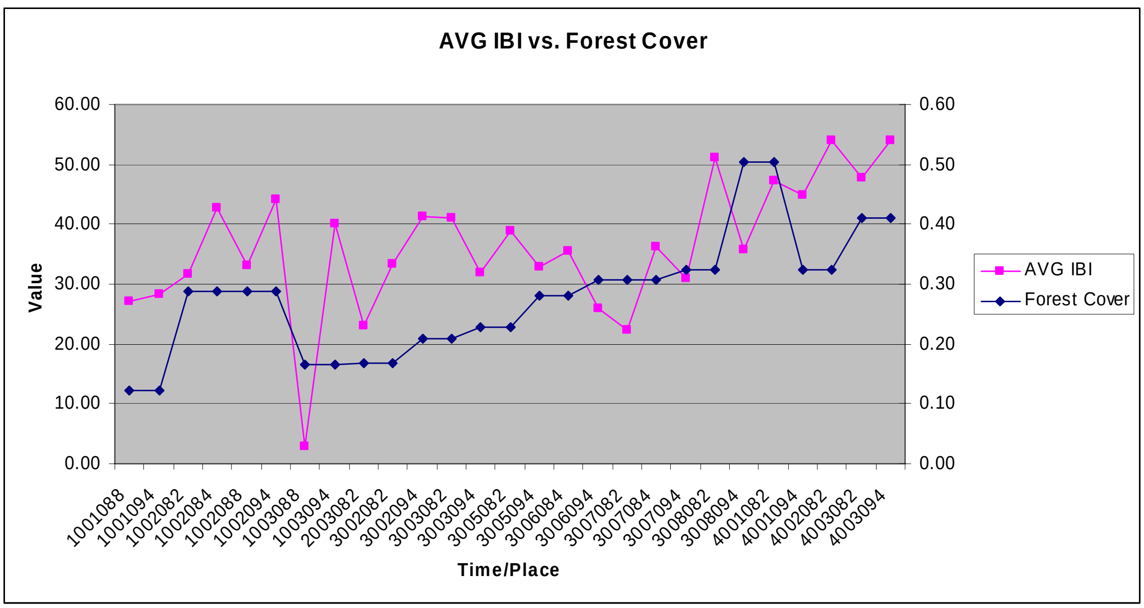


FIGURE II

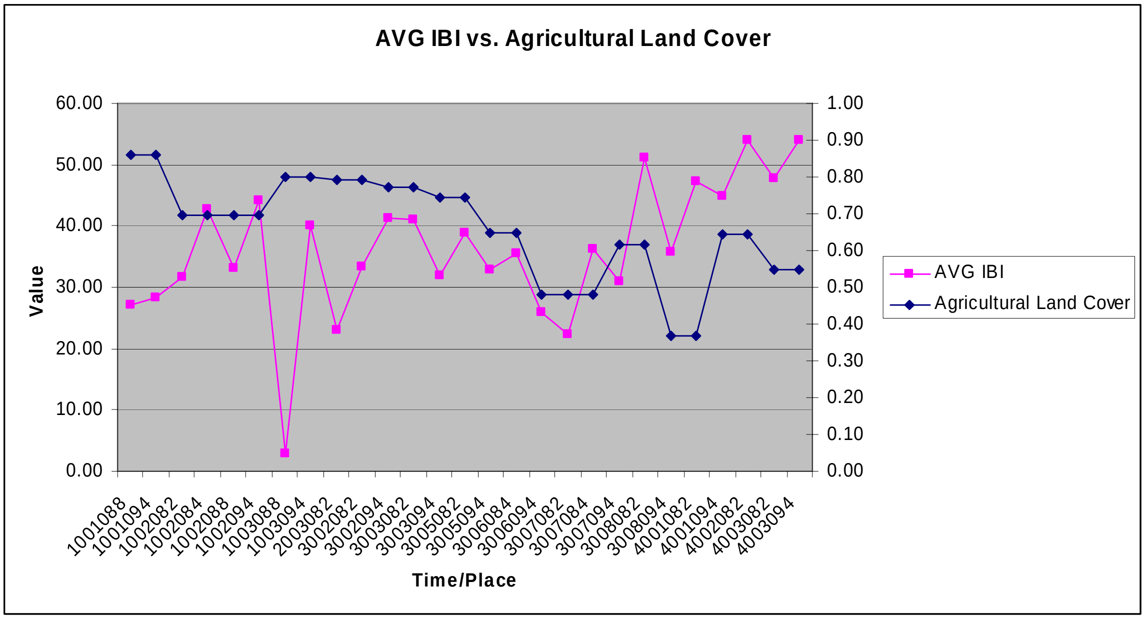


FIGURE III

This subwatershed has the worst average IBI and QHEI values in the entire watershed. However, these values are actually a slight improvement from the previous sampling in 1982. Average IBI increased from 27.00 to 28.33 and average QHEI increased from 31.00 to 39.00. The subwatershed has also experienced decline, as average substrate (an important component of the QHEI) dropped significantly from 13.00 to 8.33, as well as DO Probe from 7.79 to 4.80.

<u>10020</u>

The Great Miami River South Fork to Indian Lake has a very good water quality ranking with an average IBI of 44.25. Thus, this area meets the aquatic life use standard of EPA. This is an improvement from the last sampling data taken from 1988, when the IBI value was 33.14. The QHEI, last taken in 1984 decreased significantly from 71.00 to 49.40. The Ammonia, Biochemical Oxygen Demand (BOD5, a measure of organic waste), maximum Chemical Oxygen Demand (COD, another measure of how much oxygen might be consumed), and Nitrate N are all relatively low. The land cover here is 70% agricultural and 29% Forest. There is one point source on record, Northwood Stone and Asphalt. The increased amount of forest land seems to be helping to protect this area and the point source does not seem to have too great a negative impact. There are no records of BMPs put in place in this subwatershed.

<u>10030</u>

The Great Miami headwaters to above Cherokee Mans Run [except North & South Forks] subwatershed has an IBI value of 40 and is categorized as Good but below the standard. The QHEI in the subwatershed is low at 44.00. The temperature is higher than average at 22.13 C and increased significantly from the samples taken in 1982 (13.52 C). The average DO is low at 6.73 a decrease from the 1982 level of 10.10. There is a high level of agricultural land use in the 90-meter riparian zone at 80% while 1% is urban and 16% is forest. There are no records of BMPs or point sources in the subwatershed. It appears that the low percentage of forest cover in the riparian zone has a negative effect on the water quality.

<u>30020</u>

Basin 30020 is the only other subwatershed in our study area with a fair ranking. This subwatershed has had to deal with multiple point sources in the area including, Heartland of Indian Lake Reservoir, Indian Lake Local Schools, Indian Lake Sanitary Sewer District, Russells Point Water Plant, and Bellemar Parts Industries. Basin 30020, which is the Great Miami River below Cherokee Mans Run to above Munchinippi Creek, has shown great improvement between 1982 and 1994. The average IBI has increased from 23.11 to 33.33. Ammonia levels have dropped from 1.2 to .05. BOD 5 dropped from 3.78 to 2.70. Total Kjedhal N dropped from 1.90 to 1.20. One major reason for these improvements, as cited by the 1996 Upper Great Miami Watershed Report by the Ohio EPA, is that the Indian Lake WWTP was upgraded in 1985. This has helped reduce the ammonia-nitrate loads.

However, even with these improvements, the watershed still struggles. From 1982 to 1994, DO decreased from a low 5.43 to a lower 5.10. The 90-meter riparian zone has only 17% forest cover, as well as 2% urban cover. Figure IV below is an image of the average IBI at sampling points and the point sources in the sub-watershed. The point sources near the IBI sampling points undoubtedly affect the IBI values. The IBI sampling point away from the point sources is a much healthier 41. There are no BMPs on record in this subwatershed. Multiple Point sources could be affecting the area as well as the low percentage of forest (17%).

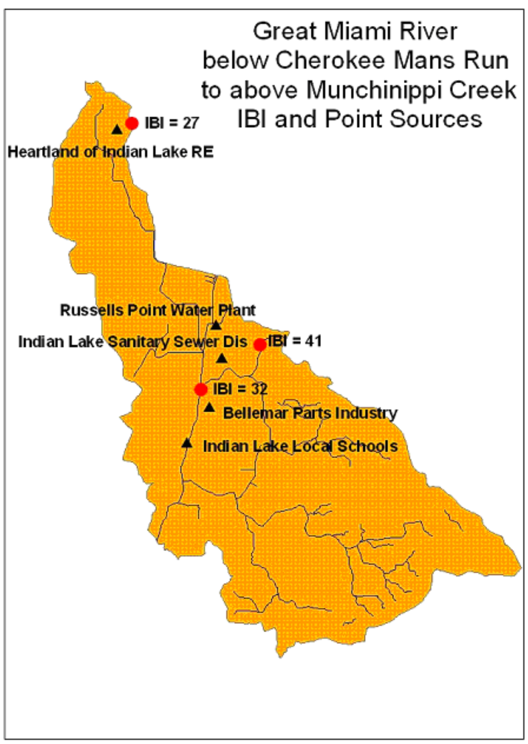


FIGURE IV

<u>30030</u>

With an average IBI of 41, this sub-watershed is considered good. Still the QHEI in this area is lower than average at 48. There is no point source data, but some BMPs are in place including Grass Filters and Livestock exclusion. There is a high level of COD hi (50.00) and a low DO Probe of 5.10. There is a high Residue Total non-filterable of 53.00; the average is 24.43.There is also a high level of Nitrate N at 0.04. There is 77% agricultural land cover in the region and 21% Forest cover. *Figure V shows the average level of Nitrate N in HUC 30030 compared to the average of Nitrate N in other HUCs.*

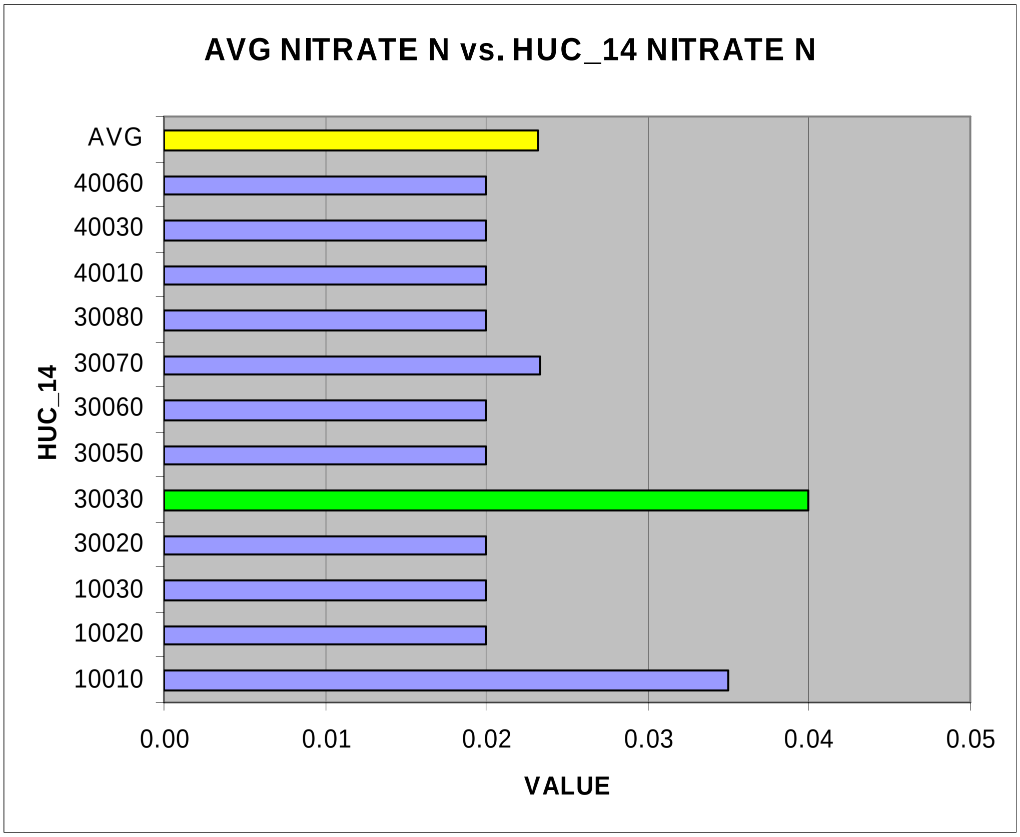


FIGURE V

<u>30050</u>

HUC 30050, the Great Miami River below Rum Creek to above Bokengehalas Creek, has an average IBI of 39. This subwatershed is considered good but does not quite meet the standards. It has a low QHEI of about 47 and a low average substrate of 2.00 out of possible score of 20. The BOD5 and maximum COD are much higher than the averages for other subwatersheds with BOD 5 at 4.00 and COD Hi at 58.00. This is an increase from the 1982 levels when BOD 5 was measured at 3.38 and COD Hi was 27.75 The DO is slightly lower than average at 6.30, a rise from 4.95 in 1982. Total residue (a measure of sediment) is also very high at 73.00 and the temperature is above the average. The area is 74% agricultural and 21% forest. There are BMPs in the area, but the habitat problems along with organic wastes seem to be the major causes of degradation.

Figure VI shows average IBI and average QHEI compared to the COD Hi levels in each HUC at different time periods. You can see the high level of COD Hi in 3005094. Figure VII shows Average IBI vs. Average Substrate and you can see the low level of substrate in HUC 30050.

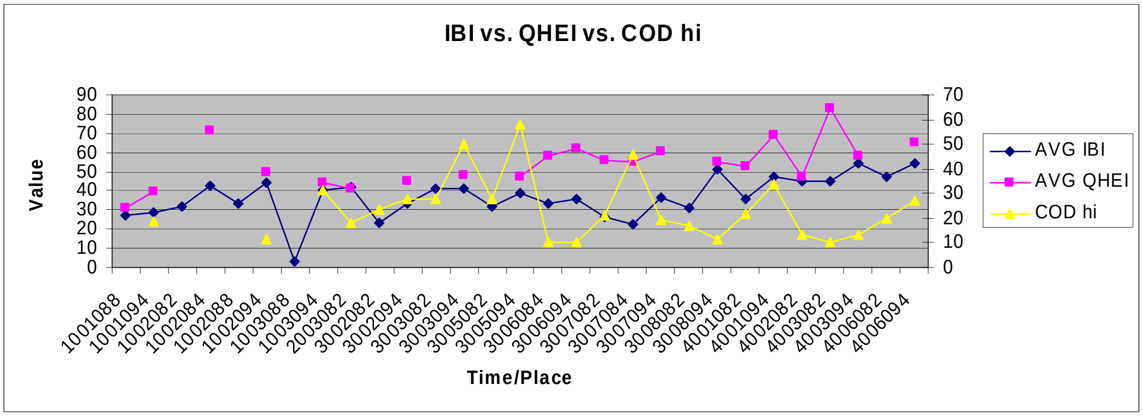


FIGURE VI

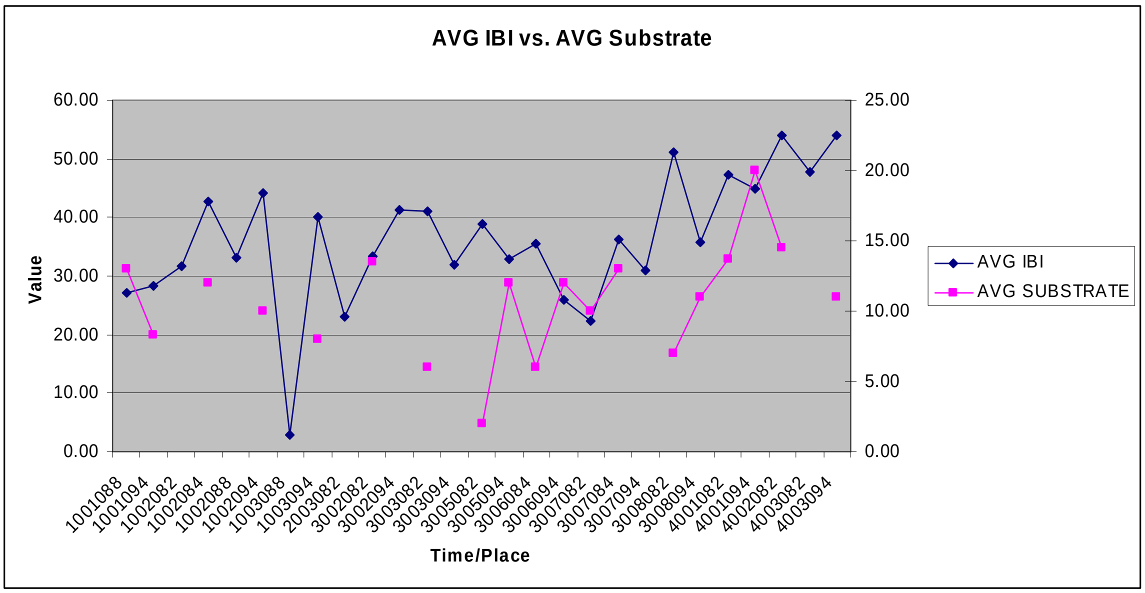


FIGURE VII

While analyzing the sub-watersheds with good water quality, a discrepancy was noticed between average IBI and average QHEI. Some sub-watersheds seemed to have strong QHEI values, but weak IBI values. Figure VIII below depicts the analysis.

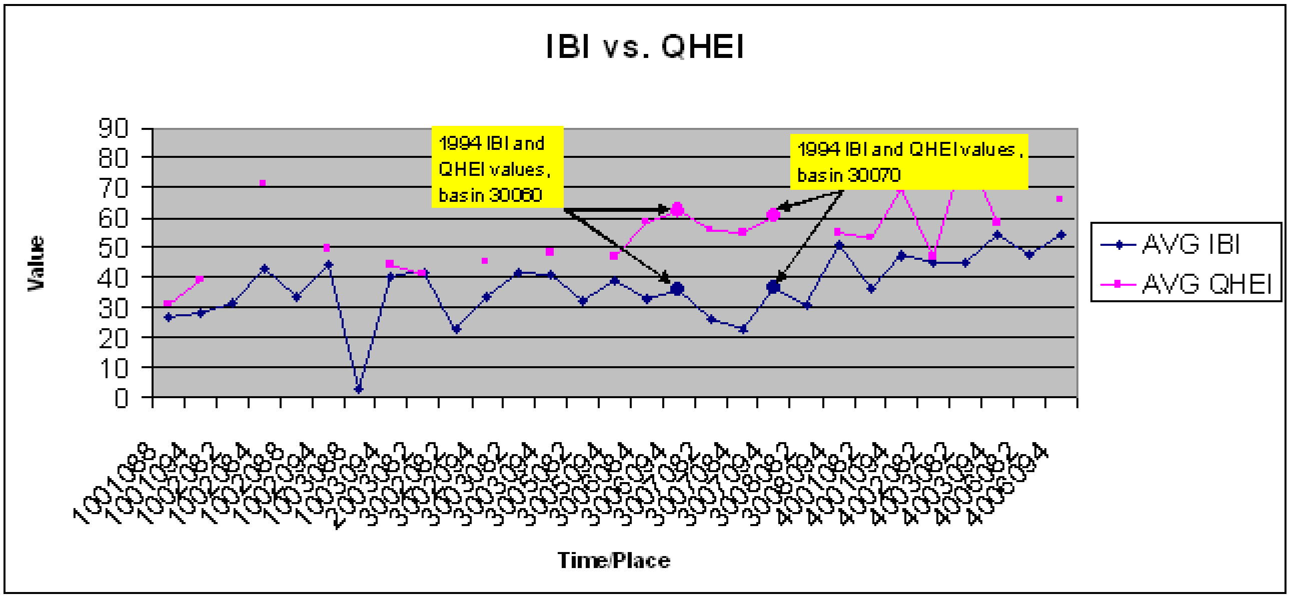
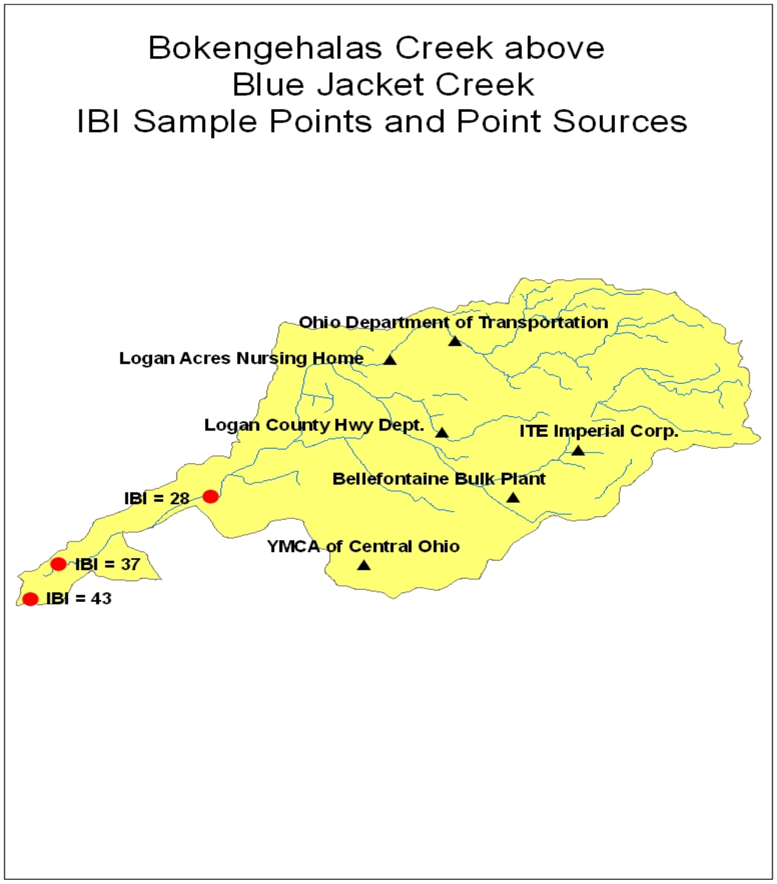


FIGURE VIII

Two sub-watersheds, HUC 30060 and 30070, were studied in an attempt to understand what caused the discrepancies. It was determined that both point sources and urbanization were the cause.

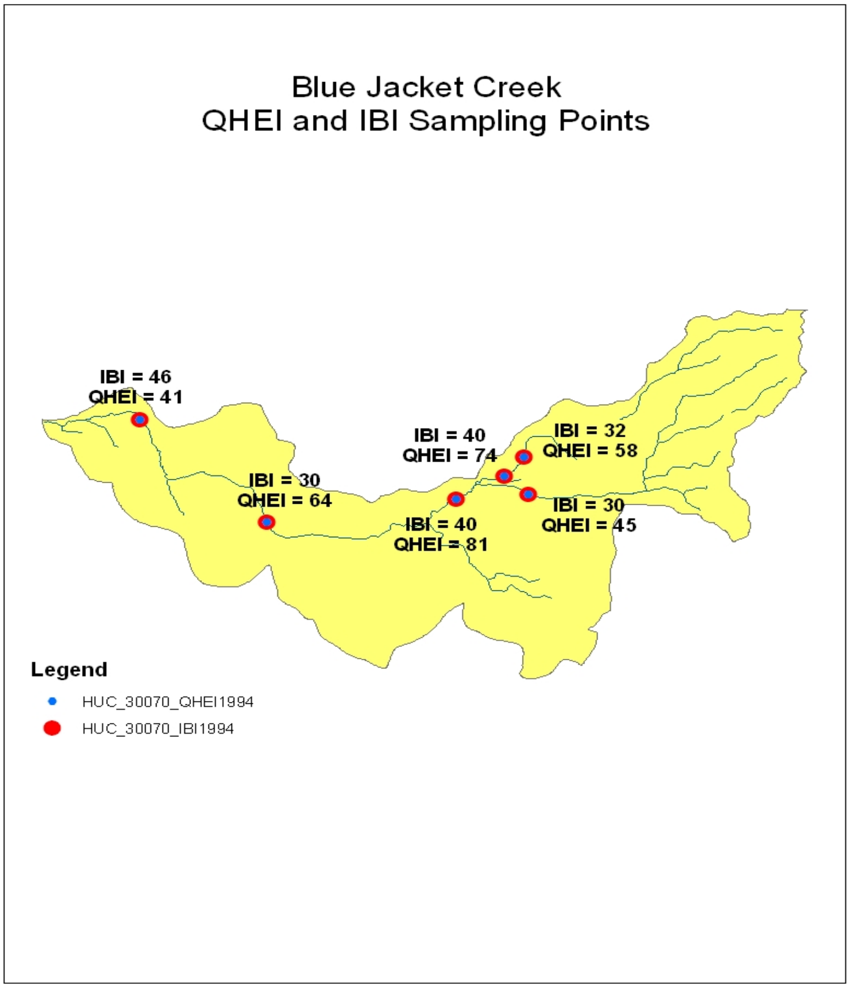
30060

Basin 30060, Bokengehalas Creek above Blue Jacket Creek, has seen a mild improvement from 1982 to 1994. Average IBI improved from 33.00 to 35.50 and QHEI improved from 58.50 to 62.00. The current QHEI is very healthy compared to the current IBI. Average substrate has declined from 12.00 to 6.00. Ammonia and Nitrate N levels have not changed. Average DO levels have improved from 7.95 to 9.40. The temperature in the watershed has also stayed cool; it has risen slightly from 15.5 C to 17.00 C. The 90-meter riparian zone helps the water quality with 28% forest cover. Urban and Agricultural cover are 5% and 65% respectively. Point sources in the subwatershed include including YMCA of Central Ohio, BP OIL Bellefontaine Bulk Plant, ITE Imperial Corp., Logan Co. HWY Dept., Ohio Dept. of Transportation, and Logan Acres Nursing home, which might explain why the IBI level is much lower than the QHEI level. The image below shows the improvement of IBI quality the further away it is from the point sources.



30070

The Blue Jacket Creek sub-watershed has experienced a great deal of improvement from 1982 to 1994. In 1982, the sub-watershed was rated poor with an average IBI of 22.33. Now, with an average IBI of 36.33 it is considered good. The QHEI did not improve much, but it did improve from 55.00 to 60.50. Again, the QHEI is much higher relative to the IBI. Ammonia levels in the area have dropped from 0.27 to 0.05. The BOD 5 levels dropped from 9.64 to 1.15. COD Hi dropped from 46.09 to 19.50. DO levels were good and improved slightly from 8.77 to 9.82. The riparian zone has good forest cover of 31%, but also deals with 18% urban land cover. The subwatershed also has two point sources which include Bellefontaine Municipal Treatment Plant and Westinghouse Electric Corp. According to the 1996 EPA Ohio Report, the Bellefontaine Plant went through two upgrades, one in 1988 and another in 1993, this contributed to the improvements in the sub-watershed. The impacts of urban land runoff continue to cause a problem in this subwatershed.



There are grass filters and septic upgrades in this sub-watershed.

<u>30070</u>

This watershed has a good IBI rating of 36.33. The QHEI is also above average at 60.50. The BOD 5, COD Hi, and Ammonia are all lower than average. The DO Probe is also a healthy 9.82. In this area there is a high amount of urbanization at 18%, forest cover makes up about 31% of the land. The temperature is lower than average at 19.10 C. BMPs are in place, including constructed wetland, septic upgrades, and strip till equipment. There are also point sources in the region including City of Bellefontaine Municipal Treatment Plant, and Westinghouse Electric Corp. Both the point sources and the urbanization undoubtedly affect the IBI levels.

<u>30080</u>

This sub-watershed has exceptional water quality with an IBI value of 51. The QHEI is also 55. The area has low BOD 5, COD hi, Ammonia, and Total Kjedhal N. The temperature is around the average at 20.95. There are BMPs in the area including Grass Filters. The area benefits from 32% forest land cover, however 4% of the land cover is urban and 62% is agriculture. There is no point source data. *Figure IX shows average IBI vs. average QHEI vs. average BOD 5, at*

HUC 30080 you can see the low BOD 5 and the high IBI.

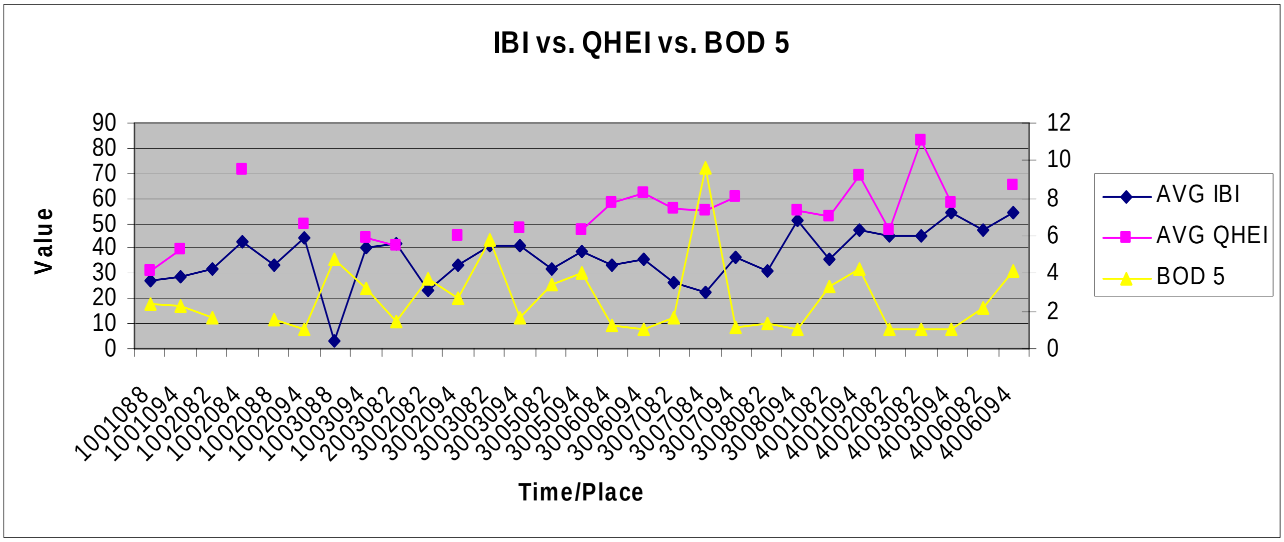


FIGURE IX

<u>40010</u>

This sub-watershed has an IBI level of 47.33 and is considered very good. The QHEI is one of the highest at 69.33. The BOD 5 and COD Hi seem high (4.27 BOD 5 and 33.67 COD Hi). The DO Probe is 11.17. This drainage basin has the highest level of Unlodized Ammonia in the watershed at 0.00739. There is 50% forest land cover in this sub-watershed as well as only 37% agricultural. There are septic upgrades in the area. There is one point source, Quincy STP, which might explain the high BOD 5, Unlodized Ammonia, and COD Hi levels. The point source could be keeping this area from reaching its highest potential. *Figure X compares the unlodized ammonia levels to average IBI and QHEI levels.*

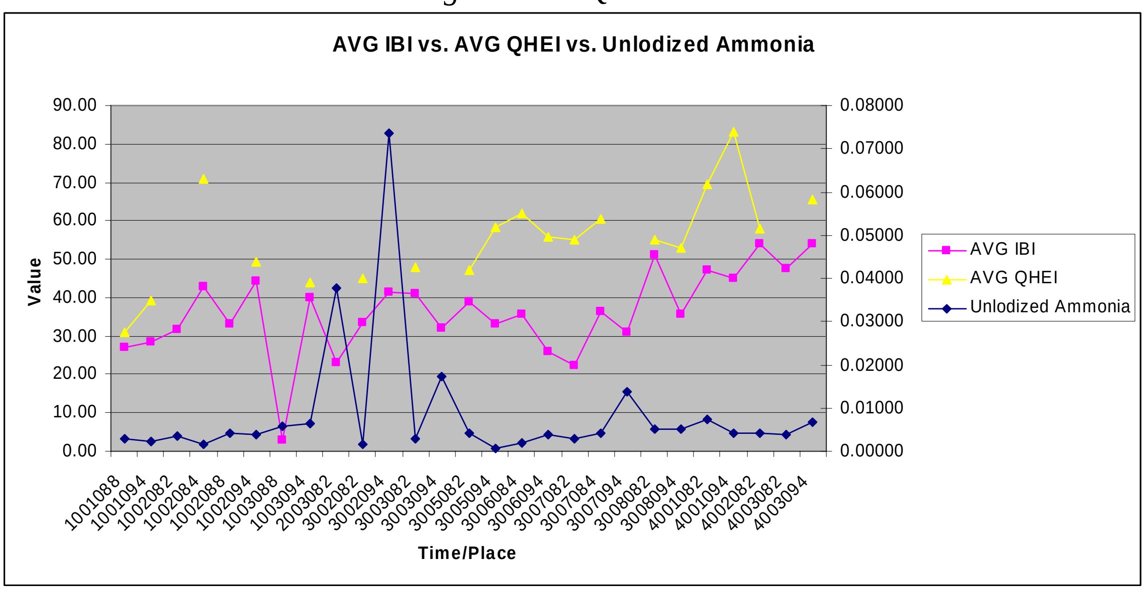
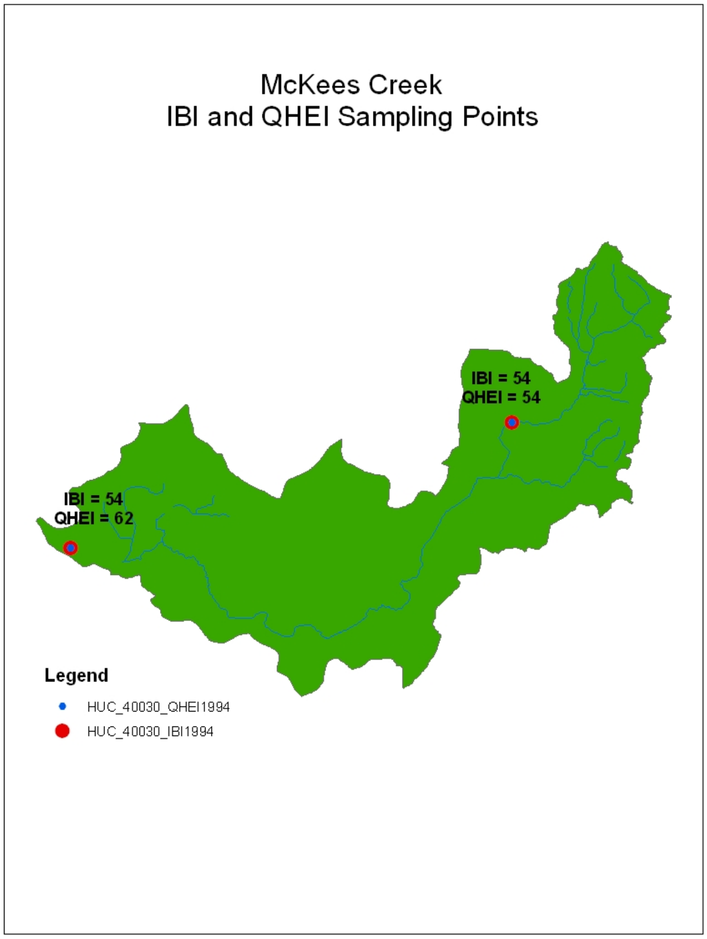


FIGURE X

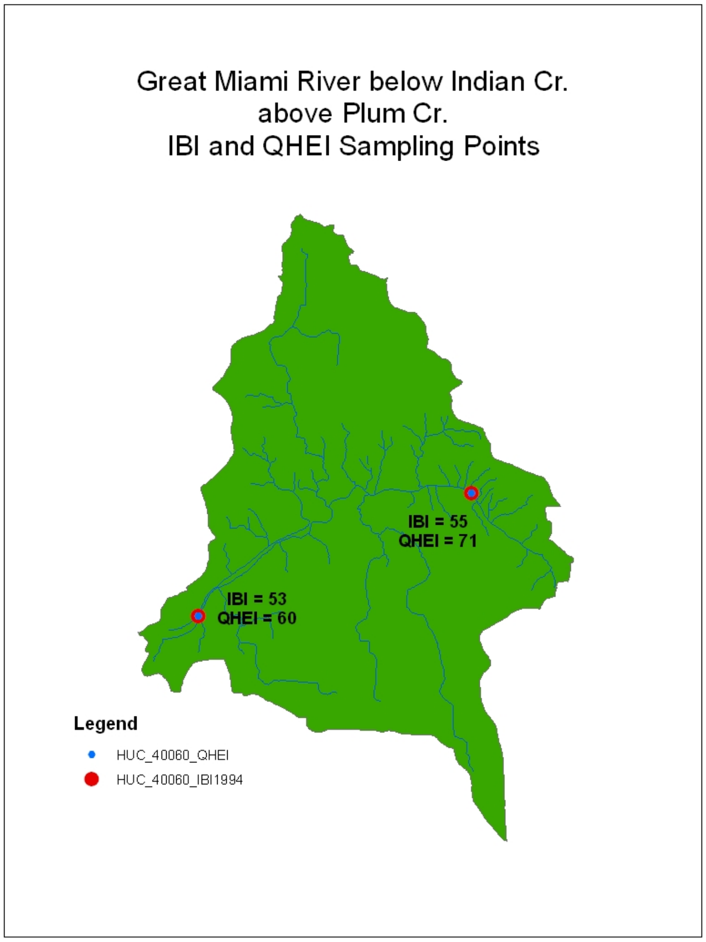
<u>40030</u>

McKees Creek sub-watershed also improved from a very good to an exceptional rating. From 1982 to 1994, the average IBI increased from 45.00 to 54.00. In the case of basin 40030, the QHEI decreased from 83.00 to 58.00. Substrate also decreased from 20.00 to 14.50. Ammonia, BOD 5, and COD Hi levels remained consistent. The temperature of the sub-watershed increased, but by only 1.7 degrees C from 18.00 C to 19.70 C. The 90-meter riparian land cover consists of 32% forest, 64% agricultural, and 1% urban.



40060

Basin 40060, the Great Miami River below Indian Creek and above Plum Creek has exceptional water quality with an IBI value of 54.00. The subwatershed improved from its 1982 rating of very good. In 1994, the QHEI was 65.50. BOD 5 increased from 2.15 to 4.10, and COD increased from 19.75 to 27.00. DO improved from 7.67 to 10.30. Like in many other of the sub-watersheds, the average temperature increased. The average temperature from samples rose almost four degrees from 19.25 to 23.00 C. The subwatershed benefits from 41% forest cover in the 90-meter riparian zone; only 55% of the riparian zone is agricultural. There are BMPs in place which include strip-til equipment and grass filters. *Figure XI shows the DO Probe levels over time and place compared to the average IBI and QHEI over time and place.*



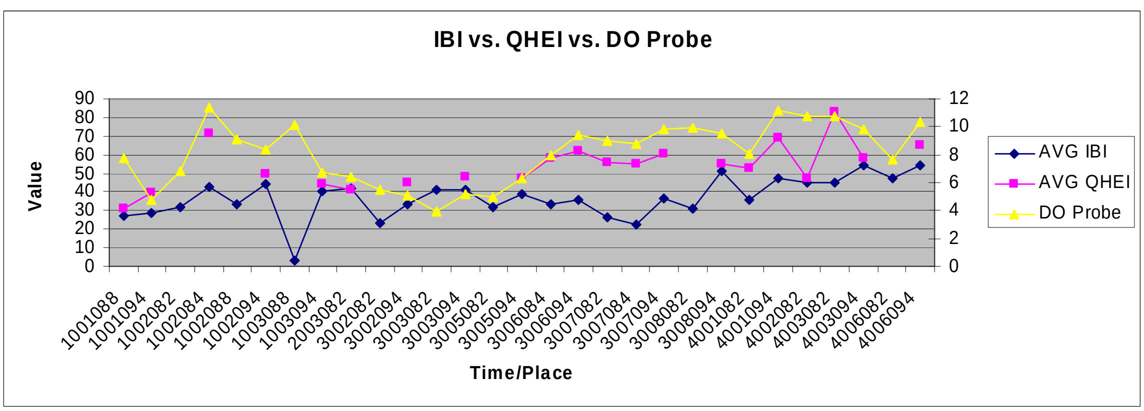


FIGURE XI

Summary of Water Quality Issues in the Subwatersheds

Based on the existing data available for the watershed, some parts of the watershed have improved in quality because of the installation of new sewage treatment plants. Other areas are still of substandard quality from a variety of possible causes. These causes include:

1. Destruction of the habitat in the riparian zone by using that land for urban and agricultural uses or otherwise altering the stream channel
2. Point source pollution from sewage treatment plants and other facilities
3. Non-point source runoff from agricultural and urban areas
4. Excess runoff causing bank erosion and stream sedimentation

The quality of the watershed as measured by the biological indicators is generally very good, but there are clearly some areas that could be improved in quality. In addition, the current data can guide the efforts that can protect the high quality areas from degradation. The issues the communities in the watershed need to discuss are what types of policies and programs are best suited to protect and improve the water quality in the Upper Great Miami Watershed. These discussions will be the subject of the future deliberations with watershed residents.

Technology Enhanced Participation

Preliminary meetings held in March and April of 2005 in the study area gave insight into both the level of interest and accessibility to online participation opportunities. Ohio State University Extension services in Shelby and Logan Counties organized the meetings through their watershed interest listings. Potential participants were notified through phone calls and public notices in the local papers and at Extension offices. Despite these efforts, a total of 15 persons attended the meetings; three people from Logan and twelve from Shelby attended the meetings. A preliminary survey was distributed asking about computing capacity, meeting availability and interest, and online forum topic interest. Of the total attendees, 14 said they would attend additional in person and online meetings. Online meeting interest ranged from weekly to monthly. Five participants said they would attend an online audio conference. All attendees noted access to the Internet from work and/or from home; connection types included dial up, DSL, high speed wireless, and cable modems. Topical interest for the online meetings included general BMP information, state and federal programs, and water quality. Despite the low attendance at these meetings, we felt the interest that did exist might be sufficient to have a core group for a first round of online meetings in the fall.

County level meetings were held again in September; this time period was suggested based on the availability of farming people in our study area. This meeting was to focus on both the mapping information that had been completed since the start of the study as well as to provide a tutorial for participants on Elluminate, the online discussion and meeting tool. Meetings were again organized with the County Extension offices. Unfortunately, turnout at these sessions was lower than the original sessions. When invitations were emailed for the online meetings, only five people registered to participate. The project could not move forward as intended with this number of participants. We contacted the Extension offices in both counties and decided to attempt sessions in the late winter or early fall of 2006. At this time, we discovered through discussions with extension contacts that feedback to the contacts indicated some hesitation on the part of potential participants with the technological aspects of the study. There was also some dissatisfaction with the scope of the study on the entire Upper Great Miami Watershed, rather than on smaller subwatersheds in the counties in question.

We also developed a mail survey instrument to better understand the participation motivation challenges at issue for this project. The survey instrument asked twenty-seven questions related to factors which influence participation (e.g., timing of decision making process, familiarity with topic, familiarity with attendees, type of meeting), as questions on typical meeting habits and demographic information. The mail survey was sent out in April of 2006 to 154 persons identified by County Extension contacts as having interest in watershed planning issues. This represented the same database of contacts used for the in person meetings in March/April and September of 2005. Thirteen surveys were returned due to address issues or, in one case, a deceased addressee. Thirty-two of the remaining 141 surveys (23%) were returned. Summaries of the responses are presented in the tables below (note: in some cases, the % totals do not sum to 100% because not all respondents answered these questions):

Table 1: Percent agreement with participation factors

I am more likely to participate if	Fully Agree 1	2	3	4	5	6	Do not agree at all 7
Comfortable with associated topic technical issues	19%	34%	22%	13%	6%	3%	0%
Meeting times are convenient	44%	31%	13%	6%	3%	0%	0%
Meeting topic is of significant personal concern	53%	25%	6%	0%	6%	3%	0%
There is a **concrete and action-oriented outcome**	47%	34%	16%	0%	3%	0%	0%
I can **influence the decision making process**	28%	38%	19%	9%	6%	0%	0%
Topic is a current crisis in the community	38%	38%	3%	9%	6%	6%	0%
It is **early in the decision making process**	3%	47%	25%	19%	3%	3%	0%
It is in **the middle of the decision making process**	0%	19%	31%	28%	13%	0%	0%
It is the **final decision of a decision making process**	9%	19%	28%	6%	9%	13%	16%
If I **personally know the meeting organizer**	9%	31%	25%	13%	13%	3%	6%
If I **personally know others planning to attend**	6%	47%	13%	13%	3%	6%	9%
It is an **opportunity to gain new information**	28%	34%	31%	3%	3%	0%	0%
It is an **opportunity to share personal knowledge**	16%	28%	31%	22%	3%	0%	0%
I receive **at least two weeks of advanced notice**	34%	31%	16%	6%	0%	13%	0%
The **meeting location** is convenient	25%	38%	19%	13%	3%	3%	0%
It is a **single meeting versus a series of meetings**	13%	25%	25%	22%	9%	0%	3%
There are a small number of committed participants rather than a larger number of folks not as interested.	9%	22%	22%	9%	9%	19%	3%

Table 2: Level of influence of meeting formats on likelihood to participate

Meeting Format	Significant Influence 1	2	3	4	5	6	No Influence at all 7
Traditional public meeting	6%	31%	28%	22%	3%	3%	3%
Online (Internet based) meeting	6%	3%	3%	25%	13%	19%	28%
Panel discussion	6%	16%	22%	25%	13%	9%	6%
"Town Hall" style meeting	9%	22%	31%	19%	3%	9%	3%
Participating on an advisory board	13%	47%	22%	3%	0%	9%	3%

Survey (mail, telephone, online)	0%	9%	34%	16%	13%	9%	3%
Email/phone call input	3%	6%	19%	16%	9%	28%	16%

In a summary follow on question, respondents noted that the three most important factors on their willingness to participate were topic knowledge, meeting time convenience, and topic immediacy (e.g., crisis). For the purposes of this study, the challenge existed that while most people stated they wanted to be involved early in the decision making process, that often is at odds with the immediacy issue. For example, watershed planning efforts in the Upper Great Miami are not currently at a crisis stage. The Ohio EPA has this watershed on its TMDL planning horizon for 2010. Therefore, even though decisions made now will be of value for the 2010 TMDL plans, it was still a challenge to get people to come to meetings to discuss related issues. Additionally, given that an online format had little to no influence on respondents' likelihood to participate in meetings, the anticipated convenience factor for this study did not materialize. An advisory board format, which may incorporate online aspects, may be a better approach based on survey responses.

When asked about extra factors that might positively influence likeliness to participate in a public meeting or similar opportunity, 14 of the 32 respondents provided input. Food (5 of 14) and other factors were the highest responses (6 of 14), while excused time (3 of 14) and nominal monetary incentive (4 of 14) were least selected. Other factors included "treated like my participation is needed" and "meetings that are two hours or less in length." The nominal monetary amount suggested ranged from $0 to $60; the mean was $10. Providing small incentives may have most appeal to those people who are "on the fence" with respect to participating in a public decision making opportunity.

Finally, when asked about the primary reasons respondents are unable to attend meetings, the two most frequent responses were that the meetings "do not address topics in which I am interested" (50%) and they were "unable to fit the meetings into my schedule" (38%). Interestingly, the intent of this project was to address each of these factors through the anticipated convenience of topic selection and personal online scheduling.

This survey will serve as the foundation for a journal submission in 2006.

Future Direction

Survey responses and discussions with county extension agents highlighted two ongoing challenges with this project. First, there remains a technology barrier with the online participation tool used in this study. We feel this barrier is not insurmountable and will be lessened with additional exposure to the tool, a broader participant pool, and enhanced online elements that make the participation process more convenient. One of the ways in which the online tools can be made more convenient to participants is through streaming live and archived video and audio recordings of traditional public meetings throughout the watershed. This would allow for interested participants to "virtually attend" meetings they could not attend physically. Equipment needed for this portion of the project (digital video recorder and accessories, digital audio recorder, and related software) has been purchased and will be utilized as watershed related meetings are scheduled for the fall and winter 2006/2007. Journal submissions based on this component of the study are anticipated in late 2007.

A second challenge with this project has been to generate interest across the entirety of the watershed. While the benefit of an online participation tool is that it can transcend jurisdictional boundaries, a reality encountered in this project is that many interested parties do not see the connection between their subwatershed issues and the larger watershed planning process. In conjunction with the lack of a planning imperative due to the distant Ohio EPA TMDL planning horizon, this lack of a "watershed perspective" has led to surprisingly low turnout for our meetings. We feel that the enhanced technological approach discussed above as well as an expanded participant recruiting effort throughout the watershed will help overcome this problem. Additionally, as the TMDL horizon nears and interested citizens in the watershed become aware of changes proposed in neighboring watersheds, there may be heightened interest in a preemptory planning effort.

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