Section I:

Considerations for Future Lists

2008 Ohio Integrated Report

As new ideas are introduced and in the general course of progress, it is natural for evaluation and reporting of water quality conditions to evolve. Since the introduction of the integrated report format in 2002, methods for evaluating the recreation use, the human health use (via fish contaminants), and public drinking water use have been systematically added to the traditional aquatic life use reporting.

This section identifies future reporting possibilities and the status of each. The potential future changes include reporting on more types of waters (wetlands, inland lakes), reporting on specific pollutants of interest (mercury), or reporting on a smaller geographic scale.

I1. Wetlands

Ohio EPA began developing tools to determine the beneficial use status of wetlands in 1995. In 1998, the State of Ohio adopted wetland water quality standards. The wetland water quality standards assign the "wetland" use to all wetlands and codify narrative criteria that protect wetland functions, including hydrology, biological diversity and recreational aspects of a designated wetland. A new rule package including wetland numeric biological criteria has been proposed that would establish benchmarks for attainment of a tiered, ecoregion-specific wetland aquatic life use system. These rules would allow the ecological integrity of a particular wetland to be evaluated using vascular plants and/or amphibians.

With hundreds of thousands of potential wetlands to be evaluated, methods to accurately characterize the overall status of wetlands in an assessment unit (which may include large numbers of undesignated wetlands) are being considered. A probabilistic and targeted evaluation of wetland quality was used to evaluate wetland condition in the Cuyahoga River watershed, and it is anticipated that this format will be used for other watershed-scale assessments. It is not possible at this time to project when wetlands assessments will appear in a future integrated report.

The results of a random study of wetlands in the Cuyahoga River watershed show that 9.1% were in poor condition, 13.2% in fair condition, 51.0% in good condition, and 26.7% in excellent condition. The study also demonstrated that wetlands with surrounding land uses of lower intensity were of higher quality. The most dramatic differences were noted when land uses varied within relatively narrow buffer distances from the wetlands (100 m and 250 m buffers). Additionally, wetland size was found to have a strong positive correlation with wetland quality. The abstract of the report is available below. A full copy of the report can be obtained at http://www.epa.state.oh.us/dsw/wetlands/CuyReportFinal_08Sept2007.pdf.

> We used an assessment approach combining the U.S. EPA EMAP probabilistic sampling design with existing Ohio wetland assessment tools, including the Ohio rapid assessment method (ORAM), the modified Penn State Stressor Checklist, the VIBI and the AmphIBI, along with a landscape analysis (the Landscape Development Intensity Index) to evaluate the ecological condition of wetlands in the 1,300 km^2 Cuyahoga River watershed. Sample sites were selected using the Generalized Random Tesselation Stratified (GRTS) survey design, which provides a geospatially balanced, stratified random sample. The Ohio Wetland Inventory was used as the sample frame for the population of wetlands in the watershed. We evaluated 366 mapped wetland sites and assessed 243 wetlands to determine condition and report on their response to surrounding land-use. Of the 366 sites, we determined that 243 points (66.4 %) were

wetlands while the remainder (16.4 %) were characterized as non-wetlands (n = 60) or duplicate points (n = 18). In 12.3 % of the cases (n = 45), field crews were denied site access by property owners.

For the wetlands sampled, ORAM scores were normally distributed with a minimum of 16.0, a maximum of 94.0, and a mean of 55.6 (± 14.5 SD). Across the entire watershed, 9.1% of wetlands were in poor condition, 13.2% in fair condition, 51.0% in good condition, and 26.7% in excellent condition. There was dramatic decline in the numbers of Category 3 (high quality) wetlands from the upper parts of the watershed in Geauga county (49.3% of all wetlands sampled), to the middle parts of the watershed in Portage (18.5%) and Summit (19.6%) counties, and the near disappearance of Category 3 wetlands in Cuyahoga county (8.3%). Using the Landscape Development Index (LDI), we evaluated the scale at which the effects of land-use are strongest over six buffer widths: 100, 250, 500, 1000, 2000, and 4000 m. ORAM scores were negatively correlated with increasing intensity of land use (high LDI scores) for depressional, riverine, and slope wetlands for each buffer width to a distance of 1000 m, with the strongest correlations for the 100 and 250 m buffer distances. For impoundments, land-use in the first three buffer distances through 500 m did not relate to ORAM score. Overall, land use intensity in the watershed can be characterized as in "low" to "moderately-low." Geauga County had significantly lower LDI scores across most buffer distances than wetlands in Cuyahoga, Summit, and Portage counties, particularly for the 1000 m, 2000 m, and 4000 m buffers. The predictive power of the level 1 LDI assessment at the individual site level for all wetlands was low (R^2 = 12-17%; $p < 0.05$) for 100 m to 1000 m buffer classes, and no significant correlations were found at the 2000 m or 4000 m distances. Classification and regression tree analysis indicates that wetland size is also a strong predictor of wetland condition, probably as a function of landscape fragmentation. The utility of the Level 3 data collected in this study was limited by insufficient sample size, restricting our ability to calibrate and validate the Level 1 and 2 protocols with Level 3 data. In particular the Level 3 vegetation data was absent for Category 1, poor condition wetlands. However, the VIBI distribution still had sufficient breadth in disturbance to be highly correlated with the Level 2 assessment tools. The limitation of small sample size was even more of a problem for amphibian data and prevented its use in validation. A secondary objective of this project was to explore key biogeochemical properties of the wetlands being assessed through soil analysis and the development of a soil spectral library. Soil samples were collected at 202 of the wetlands assessed. Soil data showed no consistent trends with condition category. We found depressions contained significantly higher nutrient concentrations (total nitrogen, total phosphorus and total carbon) than riverine sites, and attribute the difference to the accumulation of organic matter in the longer, more stable hydroperiod characteristic of depressional settings. This project demonstrates that the State of Ohio has developed the prerequisite tools required to successfully implement a statewide wetland-monitoring program using statistically-based water quality assessment approaches.

I2. Inland Lakes and Reservoirs

Ohio EPA's work to assess lakes began in 1989 with a Clean Water Act Section 314 Lake Water Quality Assessment grant that supported the evaluation of 52 lakes. Various additional grants enabled the evaluation of 89 more lakes through 1995. An analysis and determination of beneficial use status for 447 public lakes (greater than 5 acres in surface area) was presented in Volume 3 of the 1996 Ohio Water Resource Inventory (305(b) report). As part of the 1996 Section 305(b) report, Ohio EPA developed and applied the Lake Condition Index (LCI) to characterize overall lake health and to assess beneficial use status. From 1996 to the present, Ohio EPA has monitored 53 lakes, but LCI scores have not been calculated.

Although the LCI methodology was later revised to address changes in the interpretation of the threatened and full use attainment categories, the current implications of identifying a lake as impaired with the necessity of a TMDL were not anticipated. The historic Ohio LCI, developed by Ohio EPA between 1990 and 1996 to report on the status of lake condition in Ohio, became obsolete with the passage of the Credible Data Law. This law requires that all decisions on impairment for surface waters in the Integrated Report (streams, lakes, wetlands) can use only level 3 credible data, and the historic Ohio LCI assessment process included a combination of level 2 and level 3 credible data to make this determination. Therefore the LCI approach is no longer valid. Uncertainty exists about how a lake sampled in the early 1990s and characterized as "threatened" should be categorized under the present regulations and guidance on Section 303(d) listings.

The Ohio 2004 Integrated Report indicated that the Agency intended to include lakes in the 2006 reporting cycle. However, available resources continue to be inadequate to address this evaluation need.

In 2005, DSW convened a lakes committee to develop the Ohio EPA Lakes Monitoring Program Revitalization Project 2005 report, which outlined Inland Lakes Program implementation options. A second output of this 2005 effort was production of a Quality Assurance/Quality Control document to standardize how lake samples are to be collected.

In March 2006, a State Inland Lakes Team formed and outlined the foundation of the new Inland Lakes Program. Beginning with the 2008 field season, the Team will begin to evaluate and report on the condition of inland lakes to meet the reporting requirements by U.S. EPA. Thus far, the Team decided on goals and objectives, including a definition of a lake and lake designated uses. The Inland Lakes Program will identify impaired lakes to be added to the 303(d) list, and lake water quality improvements will then be addressed in a watershed context through the TMDL program. Because of limited resources for the Inland Lakes Program, it is expected that only five lakes will be reported in the 2010 Integrated Report and an additional ten lakes will be reported in the 2012 Integrated Report. The initial focus will be on public drinking water lakes in watersheds where TMDLs were recently completed or will be completed in the next five years.

Ohio EPA is planning to have lake nutrient water quality criteria in place for the 2010 Integrated Report. Other activities include coordinating with the Volunteer Monitoring Program, developing a geographic information system (GIS) project to assist in prioritizing and summarizing lakes data and linking lakes data to a new integrated ambient data system being developed for the Division of Surface Water.

During the 2007 field season, Ohio EPA participated in the U.S. EPA-sponsored National Lakes Survey. Ohio was assigned 19 lakes that were selected through a probability-based random selection process. All five Ohio EPA district offices are involved in this major federal initiative. The effort served as a precursor for renewed lake sampling, and new sampling techniques used during this process may be applied to our established sampling protocol.

Depending on the availability of resources devoted to lake monitoring and assessment, the Inland Lakes Team intends to develop a more robust sampling program that will identify lake use impairments based on level 3 credible data. Long term objectives include expanding beyond drinking water lakes to include a broader variety of lakes in future integrated reports; exploring the use of remote sensing in the screening of water quality in lakes; and exploring the possibility of tracking water quality changes in lakes that might be attributed to 319 and other watershed water quality improvement efforts.

I3. Mercury Reduction at Ohio EPA

Mercury is a persistent bioaccumulative toxic metal that is widely used in many products. Once mercury is released into the environment its toxicity, persistence and ability to travel up the food chain are important issues for human health and the environment. Ohio has a statewide health advisory for mercury from fish consumption for sensitive populations: women of childbearing age and children fifteen years old or younger, issued by Ohio's Department of Health.

U.S. EPA is allowing states to identify waters for a special 303(d) list category devoted to mercury issues (5m). While moving in this direction would be preferable as a way to focus on this important pollutant, Ohio EPA has decided that such a move is not possible for this report. At the same time, Ohio EPA is taking action to decrease mercury pollution and these efforts are summarized here.

I3.1 Ohio Law

House Bill 443 was made law on January 4, 2007. The law has the mercury product regulations created initially in House Bill 583 and Senate Bill 323, establishing sales bans for certain mercury products. Public and private schools through high school shall not purchase mercury, mercury compounds or mercury-measuring devices for classroom use as of April 6, 2007. Mercury thermometers and mercury-containing novelty items will not be sold in Ohio as of October 6, 2007. The sale of novelty items that have mercury cell button batteries are banned in 2011. Mercury thermostats will not be sold or installed as of April 6, 2008. There are exemptions to the sales bans.

I3.2 Ohio Projects

Currently the Ohio EPA is working in several areas seeking to reduce mercury emissions and increase awareness:

- identification of air sources of mercury, including identification of waterbodies in the State impaired by mercury predominantly from atmospheric deposition, potential emissions sources contributing to deposition in the State, and adoption of appropriate State-level programs to address in-state sources

- identification of other potential multi-media sources of mercury, such as mercury in products and wastes, and adoption of appropriate State-level programs (note that mercury-containing products may be a source of mercury to the air and other media during manufacturing, use, or disposal)

- adoption of statewide mercury reduction goals and targets, including percent reduction and dates of achievement, for air and other sources of mercury, as well as reduction targets for specific categories of mercury sources where possible

- multi-media mercury monitoring, including water quality, air deposition, and air emissions monitoring

- standardizing reporting for all publicly owned treatment works with mercury variances in relation to submitting data for the annual Pollutant Minimization Program report

- investigating mercury in various types of wastewater, including
    - primary materials industries, including primary metal production, oil refining, and coal facilities
    - facilities processing steel scrap (continuous casting and steel foundries)
    - publicly-owned treatment works, which looks at indirectly discharging industries through the pretreatment program and facility Pollutant Minimization Plan
    - coal power plant wastewater from scrubbers
    - other industries in interactive allocation segments to get an accurate accounting of mercury in the segments

- public documentation of the State's mercury reduction program in conjunction with the State's Integrated Report, and public reporting of progress in carrying out the State's programs and reducing in-State mercury sources

- coordination across States, where possible, such as multi-State mercury reduction programs. Ohio EPA has representatives in several organizations that work toward this goal.

In addition, several specific projects are underway as described below.

Mercury Collection and Recycling
Mercury collection and recycling occurs at several facilities in Ohio. Names and contact information for these facilities are available on the Ohio EPA website (http://www.epa.state.oh.us/ocapp/p2/mercury_pbt/mercury/collect.html).

Ohio's Voluntary Mercury Switch Removal Program for Auto Recyclers
The Ohio mercury switch removal program for auto recyclers is sponsored in a partnership between Ohio EPA and the End of Life Vehicle Solutions (ELVS) as part of the National Vehicle Mercury Switch Recovery Program. Through the program, Ohio EPA is encouraging recycling and helping to reduce mercury releases to air, water and soil, which can endanger both the environment and public health.

This program is completely voluntary. Auto recyclers who do participate will receive $3.00 for every switch turned in for as long as program funding remains available. The initial funding for the program was $60,000. Funding for the program has been established through June 2009. As the program progresses, Ohio EPA will continue to look for additional funding to collect even more mercury switches.

Ohio Hospital Project
Ohio EPA works with The Ohio Hospital Association to reduce the generation of hospital waste, including mercury, which hospitals commonly have in thermometers, blood pressure monitors and other equipment. A formal agreement between the two organizations was signed as part of Ohio Pollution Prevention Week, September 20-24, 1999. The Ohio Healthy Hospitals Pollution Prevention Initiative is based on a federal agreement signed by U.S. EPA and the American Hospital Association. The goal of the program is to provide tools to support hospitals' continued efforts to minimize the production of pollutants and reduce the amount of waste generated.

Ohio Mercury Reduction Group
The Ohio Mercury Reduction Group (OMRG) works to reduce the use, release, and emission of mercury in Ohio; to evaluate relevant departmental mercury programs and regulations, collect and assess data, promote the use of mercury alternatives and the collection of retired mercury and products; and educate industry, government and the general public on ways to reduce the sources of mercury in Ohio. Its members include representatives from Ohio EPA, the Ohio Department of Health, the Ohio Department of Education, the Ohio Public Utilities Commission, and Bowling Green State University. The primary goal of OMRG is "to protect the environment and public health in Ohio against mercury exposure and the adverse effect of mercury."

The group was officially approved by the Director in May 2001. Some of the primary action items of OMRG include:

- assess the needs of participating Agencies with mercury issues and develop projects to address them
- educate homeowners, schools, medical facilities; manufacturers; trade associations, and others on mercury hazards
- review and maintain a Web page on mercury issues
- facilitate the collection of mercury and retired mercury-containing devices.

I3.3 Interagency Groups

Members of the Ohio EPA are involved in several collaborative groups with representatives from various organizations and agencies.

- Great Lakes Regional Collaboration (GLRC) – formed with members from the federal Great Lakes Interagency Task Force, the Council of Great Lakes Governors, the Great Lakes Cities Initiative, Great Lakes tribes and the Great Lakes Congressional Task Force. The group includes members from non-governmental organizations and other interests in the Great Lakes Region. The GLRC created a strategy (released in December 2005) to restore the Great Lakes basin. Most recently the GLRC released a draft document that describes a strategy to phase-down mercury in products within the Great Lakes drainage area, which includes a portion of northern Ohio.

- Binational Toxics Strategy Mercury Workgroup – The Binational Toxics Strategy Mercury Workgroup is comprised of representatives from state governments, the United States and Canadian federal governments, and several environmental groups. Its purpose is to set mercury reduction goals applicable to the aggregate of releases to the air nationwide and of releases to the water within the Great Lakes Basin.

- Quicksilver Caucus – The Quicksilver Caucus (QSC) was formed in May 2001 by a coalition of State environmental association leaders to collaboratively develop holistic approaches for reducing mercury in the environment. Caucus members who share mercury-related technical and policy information include the Environmental Council of the States (ECOS), the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), the National Association of Clean Air Agencies (NACAA), the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), the Association of State Drinking Water Administrators (ASDWA) and the National Pollution Prevention Roundtable (NPPR). The QSC's long-term goal is that State, Federal, and International actions result in net mercury reductions to the environment. The QSC is working collaboratively and in partnership in three priority areas:

- stewardship approaches for reducing mercury in the environment and managing safe, long-term storage of elemental mercury nationally and internationally
- multi-media approaches for a mercury-based TMDL taking into account the contributions of the air and waste program as well as using their statutes to craft solutions
- approaches to decrease the global supply and demand for mercury.

Ohio Sport Fish Consumption Advisory – The current Ohio Sport Fish Tissue Monitoring Program has monitored contaminants in sport fish since 1993. Three state agencies participate: the Ohio Department of Natural Resources (ODNR), the Ohio Environmental Protection Agency (Ohio EPA) and the Ohio Department of Health (ODH). Both ODNR and Ohio EPA collect fish throughout Ohio's jurisdictional waters. Ohio EPA analyzes the fish samples, reviews the data and issues fish consumption risk assessment evaluations. ODH releases fish consumption advisory issuance information to the public and provides fish consumption information to Ohio citizens as part of the Women's, Infant's and Children's (WIC) and the Help Me Grow (HMG) Programs' activities. Information is distributed where fishing licenses are sold, through pamphlets available in four languages, and via the Internet. See http://www.epa.state.oh.us/dsw/fishadvisory/.

I3.4 Ohio Resources

A number of videos, fact sheets, and presentations are available on the Ohio EPA website that relate to mercury. These include household mercury fact sheets, an introduction to mercury issues, a guide for dealing with mercury by school administrators, an informational sheet for building awareness of mercury in schools, information about mercury in industry, and suggestions for developing a community mercury reduction program.

I4. Reporting at a Smaller Scale and Other Issues: Preview of Potential 2010 Methodologies for All Uses

A significant change in the size of watershed assessment units is being contemplated for the 2010 Integrated Report. Since 1998, Ohio has defined watershed assessment units as the 331 11-digit hydrologic units in Ohio (see Figure D-2). These units, also known as HUC11, HUC10, or "5th level," average about 130 square miles (mi^2) in size. The proposal is to report on the next smaller size watershed to provide information on a finer scale and allow for better reporting of watershed improvements. The smaller watershed would be the 14-digit watershed ("6th level")—more than 1800 units in Ohio, averaging slightly less than 25 square miles.

There were two problems that prevented moving to the smaller units in the 2008 Integrated Report. First, the watershed boundaries are being updated by a consortium of several federal agencies. The objective of the update is to bring the current Ohio dataset into compliance with the national standards set by the Federal Geographic Data Committee (FGDC). Some smaller watersheds will be merged to create larger units, resulting in fewer total watersheds with a different coding scheme than what currently exists. When this effort is completed, there should be between 1,500 and 1,600 12-digit hydrologic units (HUC12s) in Ohio, with an average size of 26.3 square miles. Second, Ohio EPA is introducing a new ambient monitoring database and not enough older data have been migrated to allow for analysis of the Aquatic Life Use. In 2010, the boundary update should be complete and the database should have sufficient data to allow for analysis at a smaller scale.

Thus, in 2008, the larger watersheds are used for reporting and listing. This section previews for public review the methodology that may be used for the smaller watershed assessment units in 2010. A sampling of results for a few watersheds are compared to the results of the larger scale watershed.

For human health (fish consumption) and recreation, changes to water quality standards or federal guidelines could also affect the 2010 methods and results. These possibilities are also discussed to the extent possible.

I4.1 Human Health (Fish Contaminants)

I4.1.1 Evaluation Method

The 2010 Fish Contaminant and Human Health Criteria Methodology is expected to remain the same as the 2008 methodology, except as described below. The 2010 methodology may change somewhat if the U.S. EPA issues new guidance for the 2010 Integrated Report, but note that U.S. EPA may issue guidance that states do not have to follow (guidance that is not statute or rule).

Numeric thresholds that indicate impairment for the contaminants of concern have changed based on updates to the human health water quality criteria. For example, mercury for both the Lake Erie and Ohio River basins now has a threshold of 0.3 mg/kg in fish tissue to be considered impaired. The threshold for impairment for PCB contamination in fish tissue is 0.02 mg/kg for both basins.

Fish tissue data were analyzed according to trophic level. A table of which species were considered in which trophic levels will be included in the 2010 IR. Only fish that could be categorized as trophic level 3 or trophic level 4 were evaluated. Appendix B of the document "Trophic Level and Exposure Analyses for Selected Piscivorous Birds and Mammals, Volume III: Appendices" (U.S. EPA, 2002) was used to determine trophic levels. Any species with a fully grown adult with a trophic level of 2.5 or higher in at least one study was classified as trophic level 3. Any species with a fully grown adult with a trophic level of 3.5 or higher in at least one study was classified as trophic level 4. Species that were not specified in the appendix were assigned a trophic level based on the closest related species in the table. For example, saugeye were considered trophic level 4 because both sauger and walleye were placed in trophic level 4.

Three or more current samples (i.e., data no older than ten years) of species in the each trophic level were considered enough data to determine impairment status for a water body. A geometric mean was calculated for each species in each trophic level. The geometric means were then averaged. If the average for both trophic levels exceeded the threshold for the contaminant, the water body was considered impaired for that contaminant. If the average for neither water body exceeded the threshold for the contaminant, the water body was considered unimpaired. If the average for one but not both trophic levels exceeded the contaminant threshold, the following equations were applied to determine if impairment is indicated:

Ohio River basin = $C_{avg} = \frac{11.8 \times C_3 + 5.7 \times C_4}{17.5}$ Lake Erie basin = $C_{avg} = \frac{3.6 \times C_3 + 11.4 \times C_4}{15}$

This methodology is a modification of the methodology found in Chapter 4 of "Draft Guidance for Implementing the Methylmercury Water Quality Criterion" (U.S. EPA, 2006). Ohio EPA believes this methodology allows better utilization of the data collected to make determinations about the status of water bodies than the methodology used in the 2008 Integrated Report.

After all fish tissue data were analyzed, and water bodies were categorized, the results were parsed into 6th level units. Individual assessments of 6th level units were not practical for several reasons. First, fish are migratory and there is no way of determining whether a particular fish originated in the assessment unit (AU) in which it was caught, or how long it had spent in that AU. Second, Ohio EPA does not have the resources to sample all 6th level units in the state for fish contaminant data.

Owing to these two factors, extrapolations were made based on the available dataset. Sixth level units were placed into the same category as the water body associated with the unit, even in cases where data did not exist for the particular 6th level unit, or where the data for the 6th level unit were contrary to the data found elsewhere in the waterbody.

I4.1.2 Results

For the pilot 2010 Integrated Report assessment watersheds, data from 1997-2006 were used. The assessed water bodies were the Mahoning River from river mile 87.6 to river mile 50.6, and Walnut Creek from river mile 45.4 to the mouth. Only mercury and PCBs were analyzed, as those two contaminants account for the vast majority of contaminants found in fish in Ohio.

Under the 2008 IR methodology, both Walnut Creek and the Mahoning River are unimpaired for mercury. Both water bodies are impaired for PCBs. Using the methodology modifications described above for 2010, both streams were unimpaired for mercury (category 1), the Mahoning River was impaired for PCBs (category 5), and Walnut Creek was unimpaired for PCBs (category 1). In summary, by altering the methodology in 2010, Walnut Creek would go from being impaired for PCBs to unimpaired for PCBs.

I4.2 Recreation

I4.2.1 Evaluation Method

Besides the change to a smaller assessment unit, a revision to the applicable criteria is anticipated to be completed by the time the next Integrated Report is prepared. The anticipated criteria, which are based on *E. coli*, are used in this preview under the assumption that they will be adopted as currently envisioned. They are shown in Table I-1 below. The current methodology uses fecal coliform data. In addition, the geometric mean is expected to be expressed as a seasonal mean rather than a 30-day mean and there could be a slight extension of the recreation season from May 1st-October 15th to May 1st – October 31st.

Table I-1. Anticipated statewide numerical criteria for the protection of recreation use subcategories.

Subcategory	*E. coli* (colony count per 100 ml)	
	Geometric mean	Single sample maximum
Bathing water	126	235
Class A primary contact recreation	126	278
Class B primary contact recreation	161	523
Class C primary contact recreation	206	940
Secondary contact recreation	N/A	1400

Because multiple subcategories could exist within a particular HUC12 watershed, attainment of the recreation use will be judged based upon the geometric mean criterion for the Class B subcategory since this would be the subcategory applicable to the majority of water bodies sampled. However, assessment units containing a Class A water will be judged to be in non-attainment if the geometric mean criteria associated with the Class A subcategory is exceeded during the recreation season.

To illustrate how these changes may impact the 2010 integrated report, an analysis was performed on several HUC11 units using ambient data collected by Ohio EPA staff in recent intensive basin surveys. The results of the analysis are presented in the next section.

I4.2.2 Results

In the following tables, LRAU stands for large river assessment unit.

Table I-2. Results of the upper Mahoning River watershed analysis. *Solid circles indicate attainment; hollow circles indicate impairment.*

	Fecal Coliform						*E coli*		
Assessment Unit (11) 05030103	# Sites	Amount Data	Geometric Mean	75th %ile	90th %ile	Assessment Unit (14) 05030103	# Sites	Amount Data	Geometric mean
010	20	96	856	○ 1600	○ 3750	010 010	6	24	○ 1030
						010 020	10	55	○ 819
						010 030	4	16	○ 809
020	12	70	556	○ 1700	○ 17000	020 010	3	18	○ 308
						020 020	2	13	○ 1071
						020 030	2	11	**● 81**
						020 040	5	26	○ 1584
030	25	125	452	○ 1500	○ 3340	030 010	5	29	**● 82**
						030 020	5	24	○ 696
						030 030	4	23	○ 586
						030 040	2	8	○ 948
						030 050	1	4	○ 1050
						030 070	2	8	○ 1880
						030 080	6	29	○ 329
040	16	73	524	**● 800**	**● 1760**	040 010	3	11	○ 401
						040 020	4	16	○ 460
						040 030	1	4	○ 410
						040 040	3	12	○ 951
						040 050	2	14	○ 553
						040 060	3	14	○ 540
LRAU	3	22	500	**● 775**	**● 1280**	LRAU	3	22	○ 538

Table I-3. Results of the Walnut Creek watershed analysis. *Solid circles indicate attainment; hollow circles indicate impairment.*

	Fecal Coliform						*E coli*		
Assessment Unit (11) 05060001	# Sites	Amount Data	Geometric Mean	75th %ile	90th %ile	Assessment Unit (14) 05060001	# Sites	Amount Data	Geometric mean
170	27	215	847	○ 2050	○ 4160	170 010	7	56	○ 735
						170 020	6	48	○ 246
						170 030	2	16	○ 236
						170 040	3	24	○ 393
						170 050	3	24	○ 612
						170 060	6	47	○ 361
180	28	222	746	○ 1375	○ 5680	180 010	4	32	○ 413
						180 020	4	32	○ 751
						180 030	11	87	○ 363
						180 040	2	16	○ 350
						180 050	4	31	○ 425
						180 060	2	16	○ 168
						180 070	1	8	○ 179

As can be seen in the previous examples, in most cases there was agreement in the attainment status both between indicators and between hydrologic unit sizes. For example, the Walnut Creek assessment using the HUC11s and the fecal coliform data resulted in the same conclusion as would an assessment using HUC14s and the *E. coli* indicator. Under either scenario, the entire watershed is impaired for the recreation use. However, results from the Mahoning River basin assessment do show that differences can occur. Two of the HUC11s were in attainment using the fecal coliform criteria, but none of the respective HUC14s components attained using the *E. coli* data. However, two of the HUC14s in other parts of the watershed did demonstrate attainment using the *E. coli* data, despite the larger HUC11 showing overall impairment of the recreation use based on fecal coliform data.

I4.3 Aquatic Life

I4.3.1 Evaluation Method

Since 1998, the Aquatic Life Use (ALU) assessment methodology has involved evaluating site data to determine attainment status of ALU designations at that location, and then aggregating the data into Watershed Assessment Units (WAUs) based on the HUC11 (average 130 mi^2 drainage area) hydrologic units. The 2010 Aquatic Life Use assessment methodology will utilize the HUC12 (average <25 mi^2 drainage area) scale rather than the previous HUC11 watershed size. Reporting on the HUC12 scale should provide information on a finer scale and allow for better reporting of watershed improvements. This dramatic reduction in assessment unit size requires consideration of what constitutes adequate sampling within each HUC12 and appropriate evaluation of the sampling results.

The relatively small drainage area of the HUC12 requires that the sites evaluated adequately characterize the smaller watershed. For that reason, three scores will be determined for each HUC12 when sufficient data makes this possible. A spatial assessment score that characterizes the aquatic community of the HUC12 by itself will occur by evaluating all sites with drainage area <20 mi^2 together. A wading stream score will be determined for all sites with drainage area between 20 mi^2 and 50 mi^2 that occur within the HUC12. The wading stream score is necessary since a site between 20 mi^2 and 50 mi^2 characterizes the entire watershed upstream from it, potentially two HUC12s, not just to the extent of the HUC12 boundary where the site resides. A principal stream score for sites >50 mi^2 will also be calculated, as these larger streams reflect a much greater land area than sites at a smaller drainage area. The final assessment unit score will be derived from these three scores.

In regard to the spatial assessment score, the smaller size of the HUC12 greatly reduces the number of headwater sites necessary to be assessed, but creates an emphasis on sampling location within the watershed. To ensure that decisions regarding adequate coverage are uniformly carried out, a flow chart for the process was created (Figure I-1). The flow chart takes into account the drainage area associated with a minimal number of sites, and incorporates questions as to spatial proximity of the sites within the watershed, land use consistency among sampling locations, and location of significant dischargers within the HUC12.

Once it is determined that sampling coverage is adequate to conduct a spatial assessment, the number of headwater sites demonstrating full aquatic life use attainment are divided by the total number of headwater sites within the HUC12. The quotient is then multiplied by 100 to provide the headwater score.

The wading stream scores and the principal stream score both involve a linear approach to determining the score. The wading stream score is based on the length of wading stream (stream miles draining a watershed between 20 mi^2 and 50 mi^2) demonstrating full attainment of aquatic life use. The total miles of wading streams in full attainment are divided by the total number of wading stream miles. The quotient is then multiplied by 100 to provide the wading stream score. The same methodology is used to produce the principal stream score, but the scoring is limited to areas >50 mi^2.

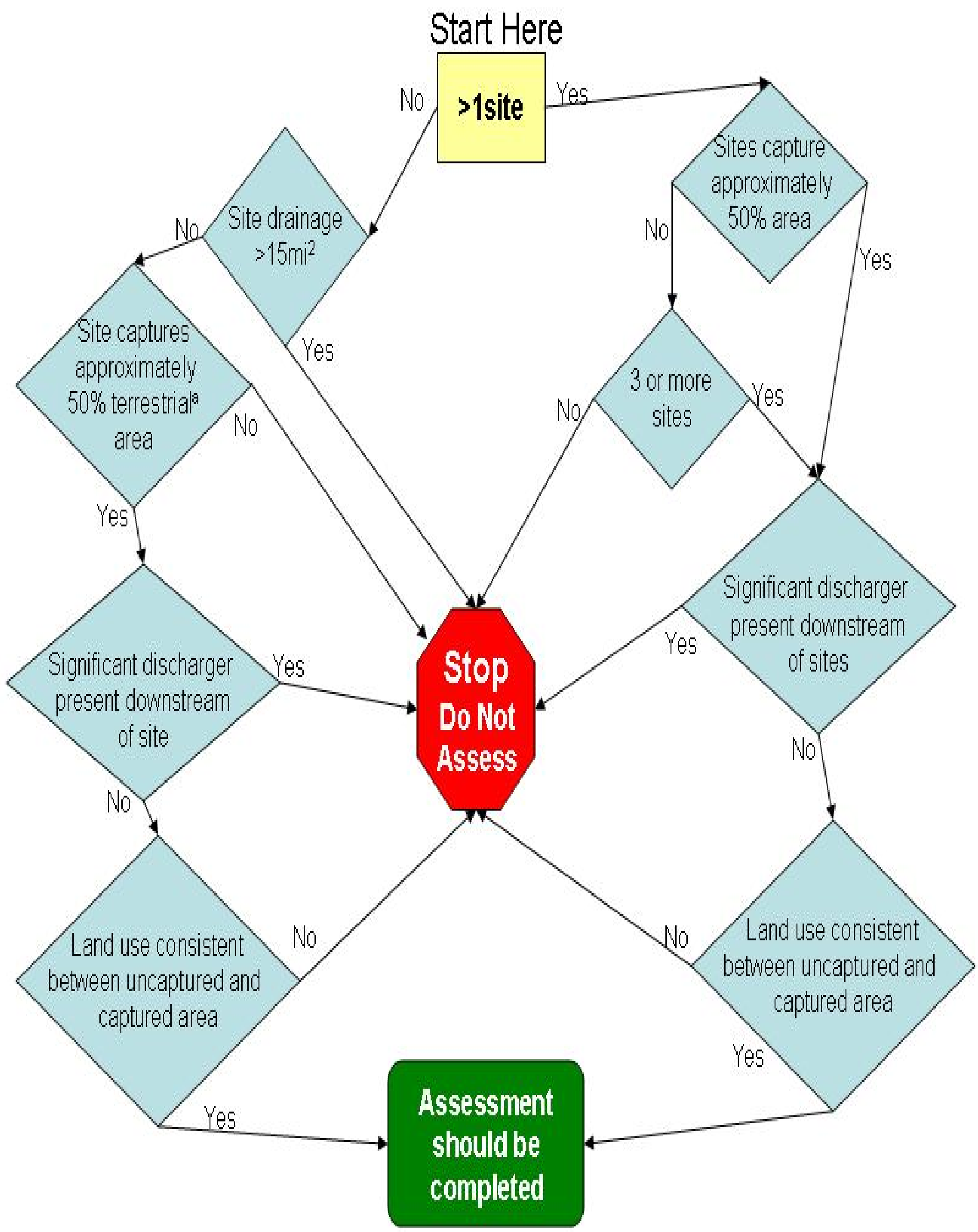
The spatial score is the average of the headwater and wading stream scores, multiplied by 100. The overall watershed score combines the spatial score and the principal stream score by averaging the spatial score and the principal stream score. The result is then multiplied by 100 to derive the overall watershed score. For HUC12s without any principal streams, the spatial stream score will represent the overall watershed score. This procedure provides some weighting to the assessment when principal stream miles are present (i.e., more influence on the final watershed score by principal streams). This is important in that full use or impairment within the principal streams reflects the overall condition of the much larger primary watershed.

An example is provided to show the decision making process using the flowchart to determine if the watershed can be assessed, and then both the resultant spatial and principal stream scoring processes (Figures I-2 and I-3). Figure I-2 depicts sampling locations and assessment status within HUC12 12050600011704. The presence of multiple sites directs the path to the right on the flow chart. The drainage area for this HUC is 24 mi^2, and therefore the four headwater sites would hopefully capture at least 12 mi^2. The most downstream tributary encompasses 19 mi^2, and the upstream area has the remaining headwater sampling locations (Figure I-3). There are no significant dischargers downstream from the headwater sites, and land use is consistent between the captured and unsampled areas. Therefore, a headwater assessment may be completed.

Two of the headwater sites are in full attainment of their respective aquatic life use, one headwater site is in partial attainment of its aquatic life use, and the fourth is in non- attainment of its aquatic life use. The headwater assessment score would be 50.

A wading stream assessment is also possible as 2.5 miles of stream within the HUC12 drain >20 mi^2. Full attainment of the aquatic life use was determined for 1.2 miles, while the remaining 1.3 miles were found to be in partial attainment of the aquatic life use. The wading stream score would be 48. The resulting spatial score would be the average of these two scores (49) and since there are no principal streams miles within the assessment unit, the final watershed score would be 49.

An example following the path to the left on the flowchart is provided in Figures I-4 and I-5. HUC12 050301030406 has a total drainage area of 16.6 mi^2. The one spatial site encompasses only 4.4 mi^2, roughly 25% of the watershed size. Therefore, a headwater stream score cannot be determined for this assessment unit. There are no streams between 20 and 50 mi^2 present, so a wading stream score is also not possible. Without either a headwater stream score or a wading stream score, the spatial score is unknown. However, two sites were sampled with a drainage area > 50 mi^2, both reflected partial or non-attainment over roughly 8.5 stream miles. The principal stream score for the assessment unit was 0, and this becomes the final watershed score.



a – If the HUC-12 contains a large amount of open water, such as a lake or reservoir, this area will be deducted from the total drainage area for this criterion.

Figure I-1. Flowchart for determining if spatial assessment score can occur based on headwater sampling locations.

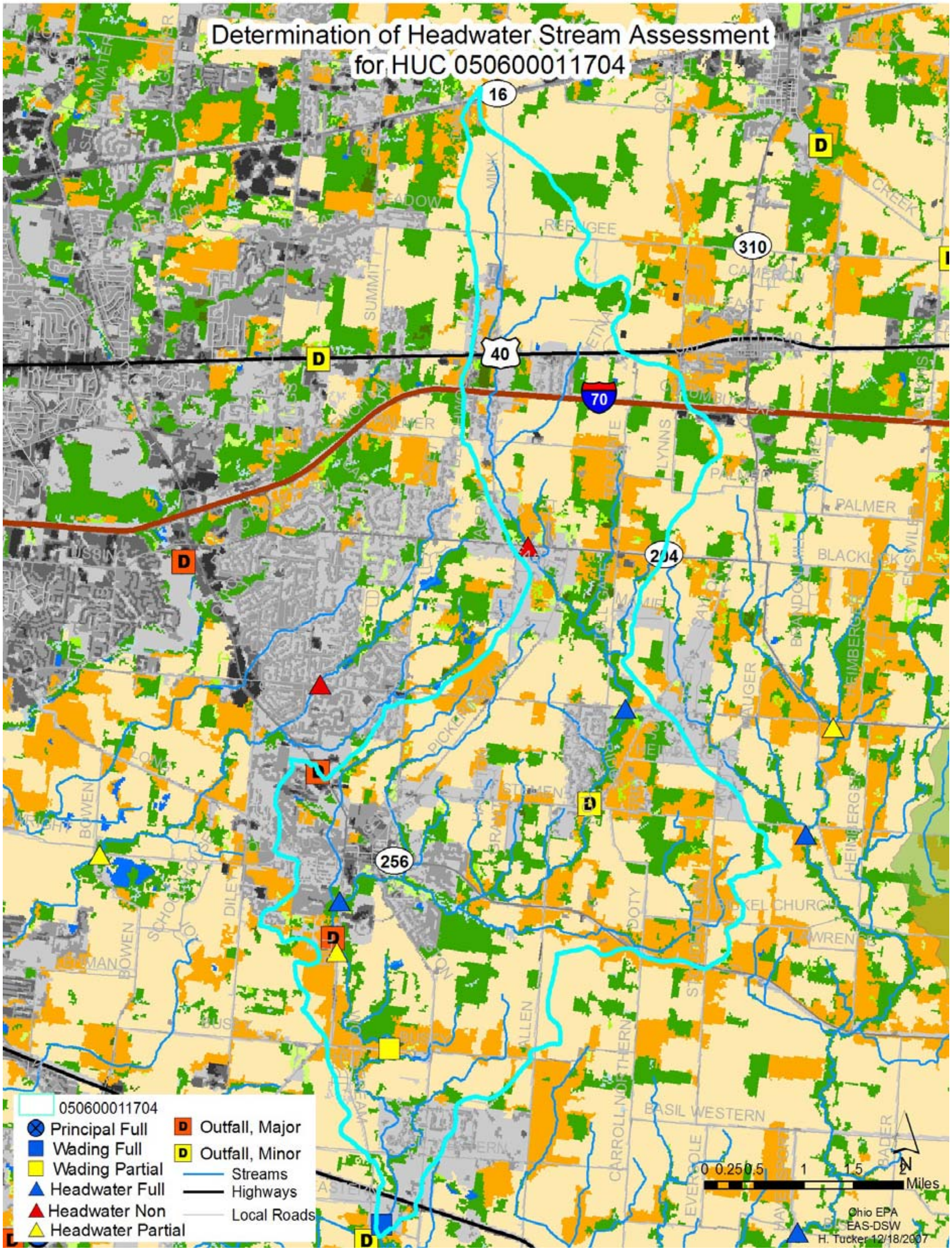


Figure I-2. Sampling sites by drainage area and attainment status for HUC12 2050600011704.

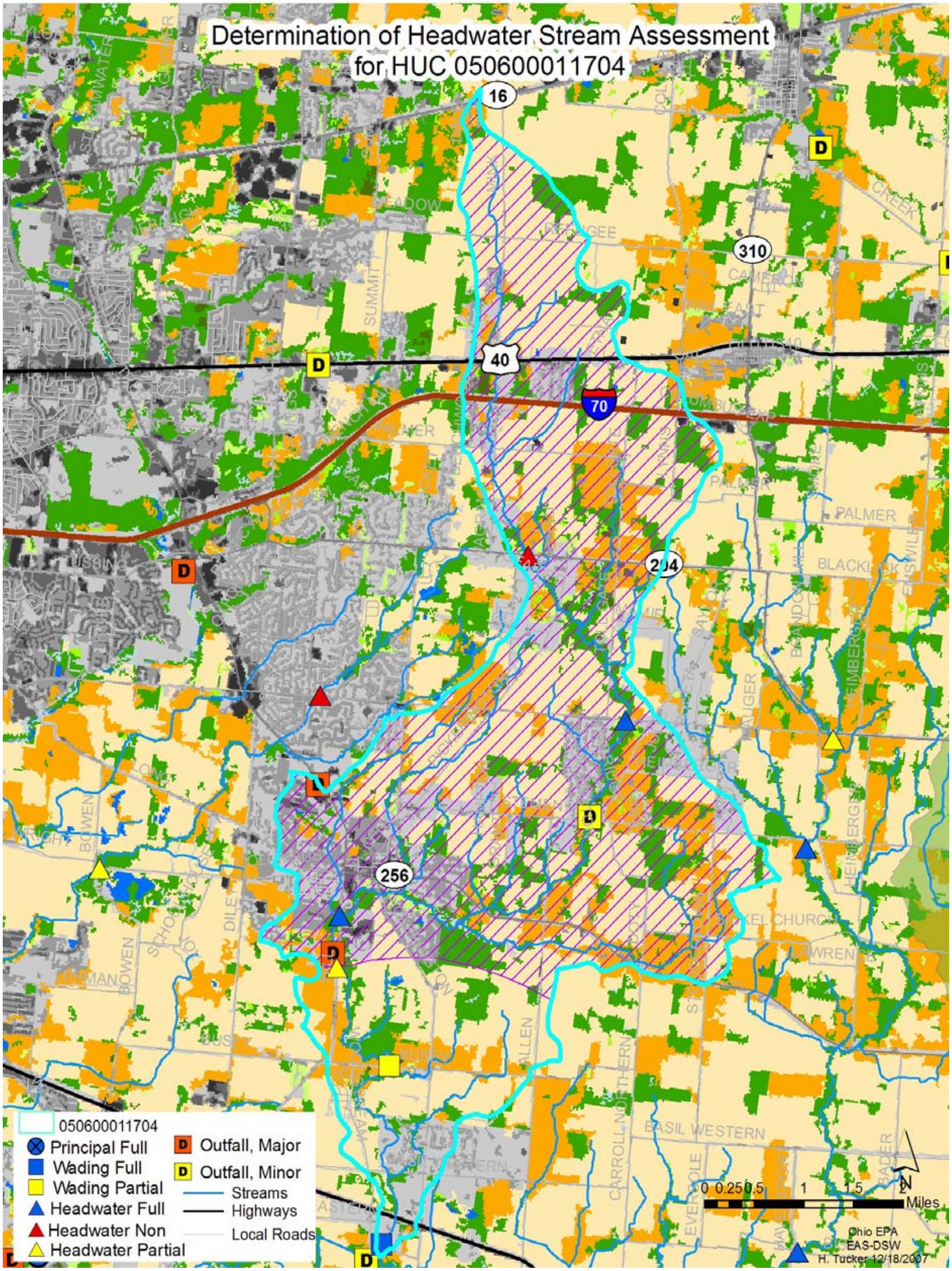


Figure I-3. Sampling sites by drainage area and attainment status overlain with the portion of the watershed captured by the headwater sites.

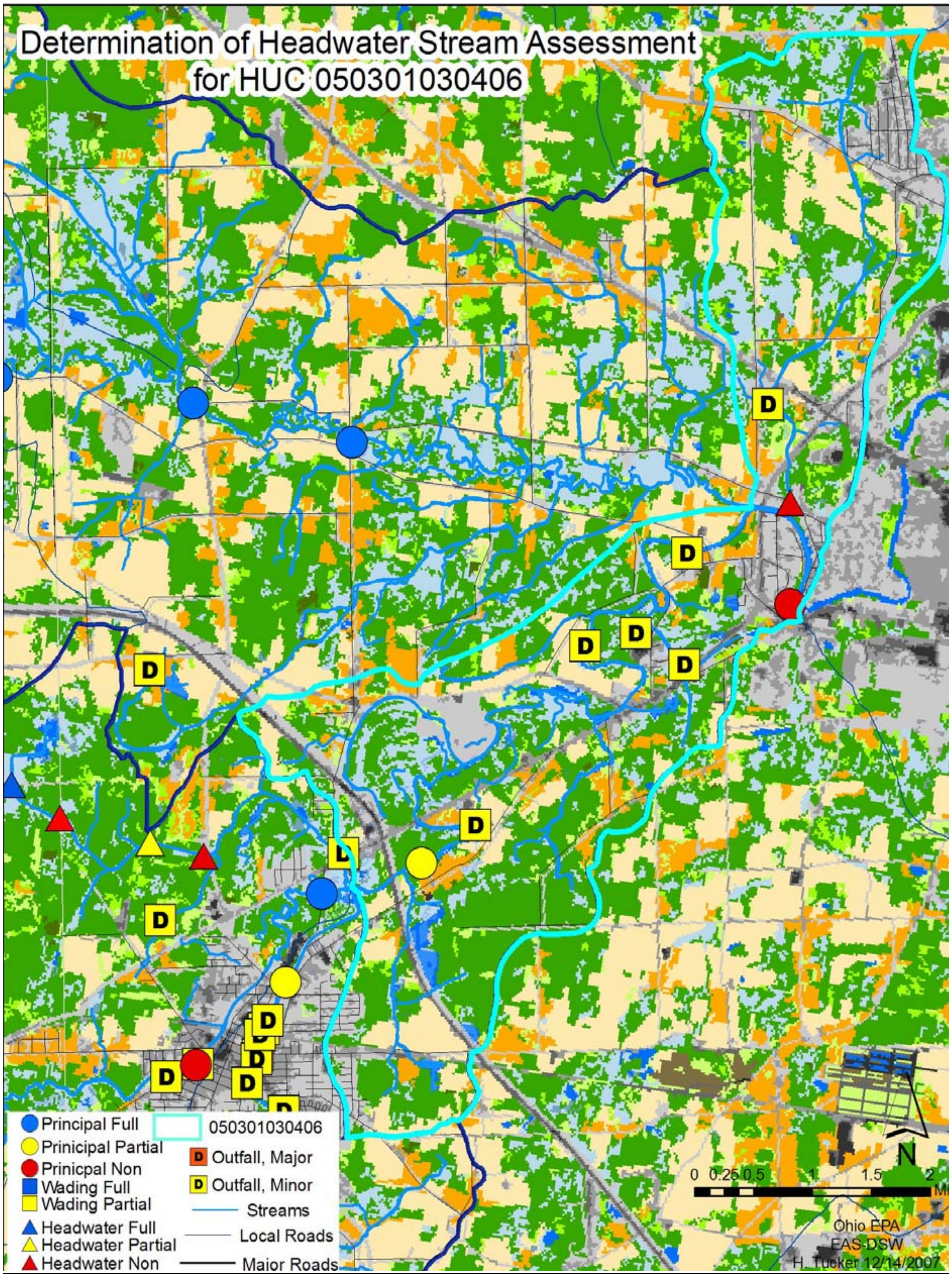


Figure I-4. Sampling sites by drainage area and attainment status for HUC12 050301030406.

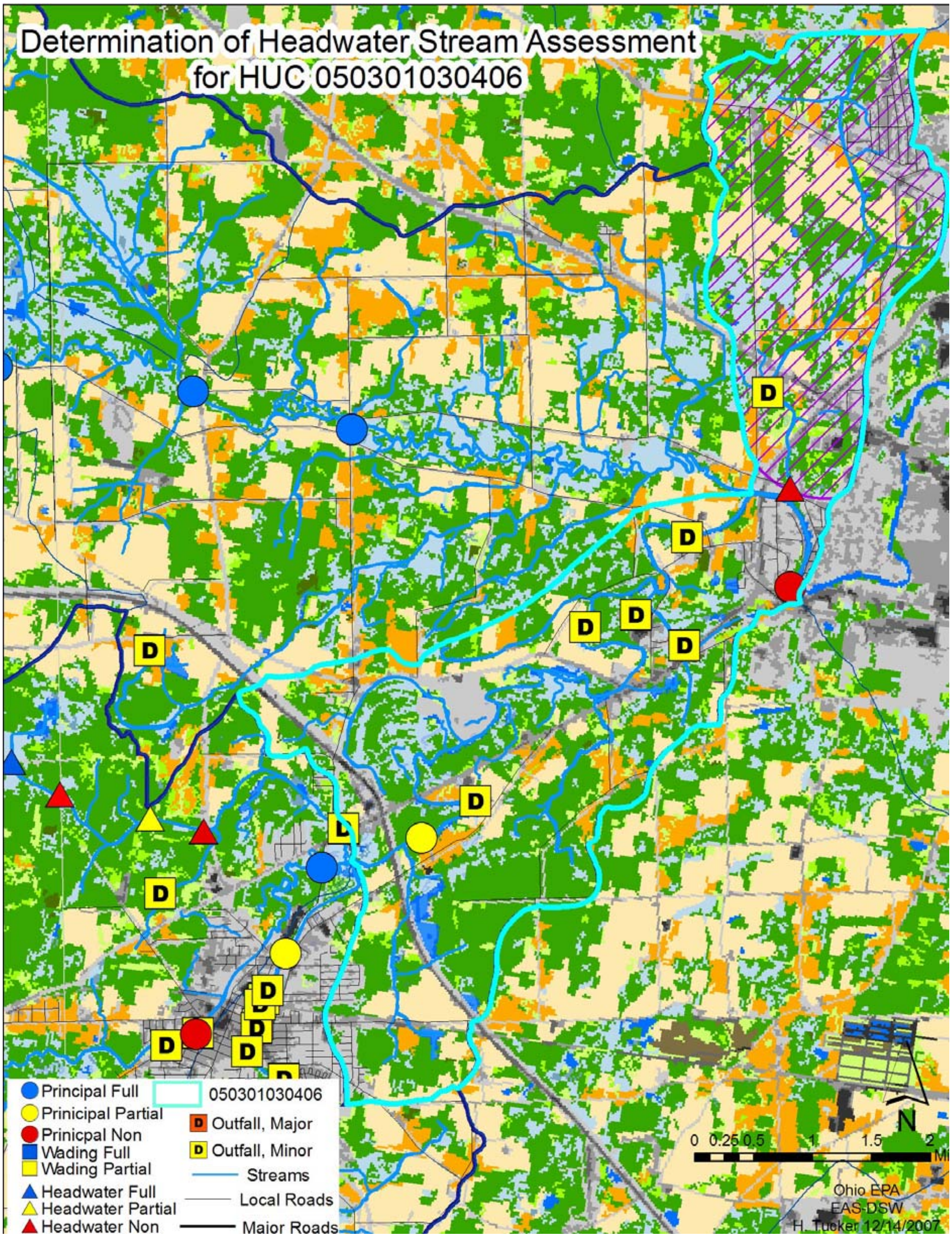


Figure I-5. Sampling sites by drainage area and attainment status overlain with the portion of the watershed captured by the headwater sites.

I4.3.2 Results

The results from using the above approach for the Walnut Creek and Upper Mahoning watersheds are provided in Tables I-4 and I-5. A watershed score was obtained for all the HUC12s except for HUC12 050301030204, Island Creek – Mahoning River. The Mahoning River flows into Berlin Lake upstream from this HUC12, and the dam for Berlin Lake coincides with the downstream boundary of the HUC12. All of the streams within the HUC12 drain directly into Berlin Lake and have portions inundated with backwaters from Berlin Lake. If possible, this HUC12 should be assessed according to the lake protocol in the future.

For the Walnut Creek basin, a simple average of the HUC12s within each HUC11 indicated a drop in score, specifically HUC11 05060001170 from 2008 IR score of 85 to a simple HUC12 average of 75.1, and HUC11 05060001180 from 2008 IR score of 94 to a simple HUC12 average of 86.1. While this may appear to indicate a drop in overall quality, it should not be interpreted as such. The simple averaging of the HUC12s equates all the HUC12s, when in actuality the amount of sampling effort within each HUC12 varied. For example, though only three sites were sampled within HUC12 050600011703, the score for it received the same weight as for HUC12 050600011701, which had five sites.

If each HUC12 were weighted to determine its proportion in regards to total sites, a comparison could still not be completed because of the criteria used to determine if a HUC12 is able to be assessed. The HUC11 scores were generated using all the data within the HUC11. However, as assessments proceed based on the HUC12 scale, the finer resolution requires assurance of adequate sampling. Therefore, data that were included in the HUC11 assessment may not include enough sites in the HUC12 approach, and the HUC12 is left unassessed. Therefore, a comparison between the two scoring methods is not possible.

Most importantly, the use of the HUC12 assessment units allows for a focus on where, within the HUC11, resources would best be directed to realistically alleviate impairment. Within the Upper Mahoning basin, HUC11 05030103010 contains three HUC12s. Impairment occurs primarily in the headwaters of each, except for the few miles affected by impoundments in the streams draining >50 mi^2. The six headwater sites within HUC12 050301030103 were all in non-attainment, while two out of five sites within HUC12 050301030101 were in partial attainment and the remaining three sites were in full attainment. If resources are limited, emphasis on the sites with partial attainment within HUC12 050301030101 may show improved results much sooner than if similar resources are dedicated to HUC12 050301030103. It is readily apparent that a far greater resource quality problem exists in HUC12 050301030103 that will require more intensive and costly “fixes” to restore the assessment unit’s streams and rivers.

Table I-4. Results for the Walnut Creek watershed using the proposed HUC12 methodology.

HUC11 HUC12 (drainage area in mi^2)	Headwater Sites (# sites)			Headwater Stream Score	Wading Stream (miles)			Wading Stream Score	Spatial Score[f]	Principal Stream (miles)			Principal Stream Score	Water-shed Score[g]
	Full	Partial	Non		Full	Partial	Non			Full	Partial	Non		
05060001170	Walnut Creek (headwaters to below Sycamore Creek)													
050600011701 (17.5)	4	1	0	80	0	0	0	N/A[a]	80	0	0	0	N/A[b]	80
050600011702 (42.5)	3	0	2	60	5.6	0	0	100	80	0	0	0	N/A[b]	80
050600011703 (17.4)	2	1	0	66.7	0	0	0	N/A[a]	66.7	0	0	0	N/A[b]	66.7
050600011704 (23.6)	2	1	1	50	1.2	1.3	0	48	49	0	0	0	N/A[b]	49
050600011705 (37.0)	2	0	0	Unknown[c]	0	0	0	N/A[a]	Unknown[e]	12.3	0	0	100	100
								2008 IR HUC 05060001170 Watershed Score						85
05060001180	Walnut Creek (below Sycamore Creek to Scioto River)													
050600011801 (14.6)	2	1	1	50	0	0	0	N/A[a]	80	0	0	0	N/A[b]	50
050600011802 (23.0)	2	0	0	Unknown[c]	0	0	0	N/A[a]	Unknown[e]	7.8	0	0	100	100
050600011803 (14.3)	3	1	0	75	0	0	0	N/A[a]	75	0	0	0	N/A[b]	75
050600011804 (29.7)	2	0	0	100	3.0	0	0	100	100	0	0	0	N/A[b]	100
050600011805 (52.1)	5	0	1	83.3	0	0	0	N/A[a]	83.3	15.7	0	0	100	91.7
050600011806 (13.9)	0	0	0	Unknown[d]	0	0	0	N/A[a]	Unknown[e]	5.5	0	0	100	100
								2008 IR HUC 05060001180 Watershed Score						94

a – There were no stream segments > 20 mi^2 and < 50 mi^2 within the HUC12.
b – There were no stream segments > 50 mi^2 within the HUC12.
c – The sampling locations did not meet criteria for assessment documented in Figure 1.
d – There were no sampling sites < 20 mi^2 within this HUC12.
e – Assessment is not possible due to limited sampling.
f – Average of Headwater and Wading Scores.
g – Average of Spatial and Principal Scores.
h – Though no sampling occurred at a site > 20 mi^2, one site was 19.8 mi^2 (full attainment), and the next site downstream in the next HUC12 was in full attainment. Therefore an extrapolation was conducted to obtain the stream miles in full attainment.
i – The portion of streams > 20 mi^2 and < 50 mi^2 within the HUC12 are backwaters or within a lake or reservoir.
j – The portion of streams > 50 mi^2 within the HUC12 are backwaters or within a lake or reservoir.

Table I-5. Results for the Upper Mahoning watershed using the proposed HUC12 methodology.

HUC11 HUC12 (drainage area in mi^2)	Headwater Sites (# sites)			Headwater Stream Score	Wading Stream (miles)			Wading Stream Score	Spatial Score[f]	Principal Stream (miles)			Principal Stream Score	Water-shed Score[g]
	Full	Partial	Non		Full	Partial	Non			Full	Partial	Non		
05030103010	Mahoning River (headwaters to below Beech Creek)													
050301030101 (40.9)	3	2	0	60	2.71[h]	0	0	100	80	0	0	0	N/A[b]	80
050301030102 (31.7)	2	0	2	50	0	0	0	N/A[i]	50	0	0	0	N/A[b]	50
050301030103 (56.6)	0	0	6	0	1.40	0	0	100	50	5.19	1.01	3.88	51.4	50.7
								2008 IR HUC 05030103010 Watershed Score						39
05030103020	Mahoning River (below Beech Creek to below Berlin Dam)													
050301030201 (38.3)	0	0	0	Unknown[d]	0	2.4	0	0	0	0	0	0	N/A[b]	0
050301030202 (19.3)	1	0	1	50	0	0	0	0	50	0	0	0	N/A[b]	50
050301030203 (32.3)	1	0	4	20	0	0	0	N/A[i]	20	0	0	0	N/A[b]	20
050301030204 (28.8)	0	0	1	Unknown[c]	0	0	0	N/A[i]	Unknown[e]	0	0	0	N/A[j]	Unknown[e]
								2008 IR HUC 05030103020 Watershed Score						42
05030103030	Mahoning River (below Berlin Dam to below West Branch)													
050301030301 (25.5)	0	2	2	0	0	4.0	0	0	0	0	0	0	N/A[b]	0
050301030302 (31.2)	2	1	0	66.7	2.55	0	0	100	83.4	0	0	0	N/A[b]	83.4
050301030303 (12.6)	1	1	0	50	0	0	0	N/A[a]	50	0	0	0	N/A[b]	50
050301030304 (37.1)	6	1	0	85.7	0	0	0	N/A[i]	85.7	0	0	0	N/A[j]	85.7
050301030305 (27.5)	1	2	4	14.3	0	0	0	N/A[a]	14.3	2.74	8.1	0.96	23.2	18.8
050301030306 (33.2)	0	0	0	Unknown[d]	0	0	0	N/A[a]	Unknown[e]	0	4.3	4.16	0	0
								2008 IR HUC 05030103030 Watershed Score						30
05030103040	Mahoning River (below West Branch to above Duck Creek)													
050301030401 (20.7)	2	0	1	66.7	0	0	0	N/A[a]	66.7	0	0	0	N/A[b]	66.7
050301030402 (26.3)	16	0	0	100	2.7	0	0	100	100	0	0	0	N/A[b]	100
050301030403 (26.6)	1	0	1	Unknown[c]	7.07	0	0	100	100	1.26	0	0	100	100
050301030404 (16.2)	0	1	2	0	0	0	0	N/A[a]	0	0	0	0	N/A[b]	0
050301030405 (20.5)	0	0	0	Unknown[d]	0	0	0	N/A[a]	Unknown[e]	10.92	0	0	100	100
050301030406 (16.6)	0	0	1	Unknown[c]	0	0	0	N/A[a]	Unknown[e]	0	6.17	2.47	0	0
								2008 IR HUC 05030103040 Watershed Score						73

a – There were no stream segments > 20 mi^2 and < 50 mi^2 within the HUC12.
b – There were no stream segments > 50 mi^2 within the HUC12.
c – The sampling locations did not meet criteria for assessment documented in Figure 1.
d – There were no sampling sites < 20 mi^2 within this HUC12.
e – Assessment is not possible due to limited sampling.
f – Average of Headwater and Wading Scores.
g – Average of Spatial and Principal Scores.
h – Though no sampling occurred at a site > 20 mi^2, one site was 19.8 mi^2 (full attainment), and the next site downstream in the next HUC12 was in full attainment. Therefore an extrapolation was conducted to obtain the stream miles in full attainment.
i – The portion of streams > 20 mi^2 and < 50 mi^2 within the HUC12 are backwaters or within a lake or reservoir.
j – The portion of streams > 50 mi^2 within the HUC12 are backwaters or within a lake or reservoir.

I4.4 Public Drinking Water Supply

I4.4.1 Evaluation Method

The 2010 Public Drinking Water Supply (PDWS) assessment methodology will remain the same as the 2008 methodology unless new indicators are added as described in Section H1. In 2010 the PDWS zones will be associated with the HUC12s (currently HUC14) instead of the currently used HUC11s. Since the PDWS use only applies to specific areas, this refinement of reporting units will more accurately reflect the statewide status of this use.

I4.4.2 Results

As a result of switching to the smaller HUC14s, the number of assessment units with the PDWS use will increase from 91 to approximately 122. The number of AUs with the PDWS use as a percentage of overall assessment units will decrease from over 25% to less than 1%. In order to demonstrate the potential impact of this shift to smaller assessment units, Figure I-6 shows how a HUC11 in the Great Miami River (GMR) watershed would be assessed using the HUC14s.

The current HUC11 would be split into eight HUC14s. The PDWS use would still apply to the GMR large river assessment unit for the Sydney and Piqua GMR intakes, but the Sydney Tawawa Creek intake and Piqua Swift Run intake would shift to separate assessment units. For the 2008 assessment, Swift Run is currently impaired because of elevated pesticides (atrazine) while there were insufficient data to assess the Tawawa Creek zone, resulting in the entire HUC listed as impaired. In 2010 using the HUC14s, only the unit with Swift Run would be impaired.

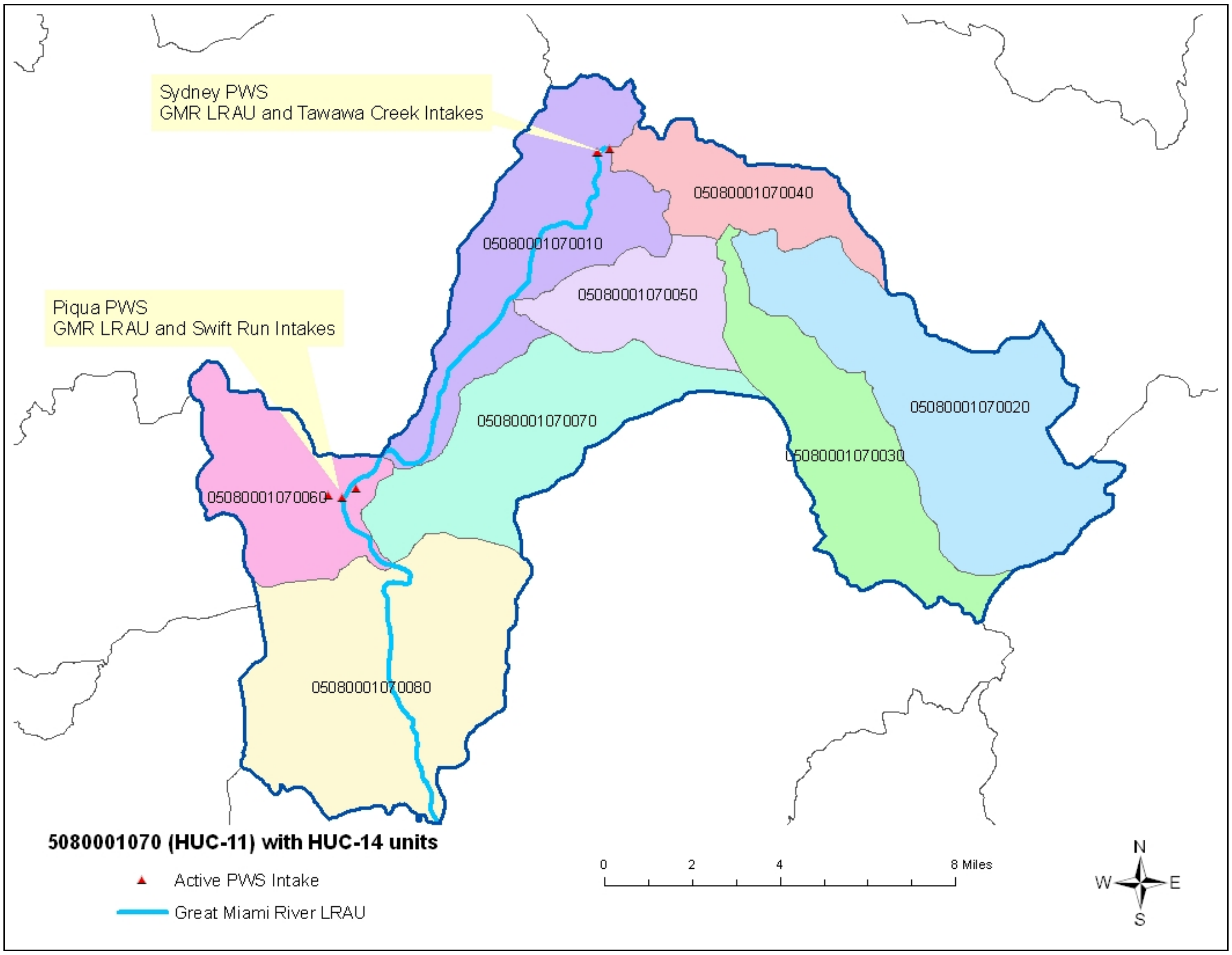


Figure I-6. HUC11 5080001070 Great Miami River (downstream Plum Creek to upstream Spring Creek; excluding GMR) shown with public drinking water supply intakes.