Section

G

Evaluating Beneficial Use: Aquatic Life

G1. Background and Rationale

G1.1 Background

Ohio EPA has been evaluating streams using standardized biological field collection methods for over thirty-five years. Stream assessments are based on the experience gained through the collection of over 26,000 fish population samples, nearly 12,000 macroinvertebrate community samples and more than 100,000 water chemistry samples. Aquatic life use assessments for the 2012 Integrated Report are based on biological and chemical data collected from 2001-2010 at over 4,200 wadeable stream, large river, and Lake Erie shoreline sampling locations. Ohio's Credible Data Law states that all data greater than five years in age will be considered historical, but that it can be used as long as the Director has identified compelling reasons as to why the data are credible. In the case of biological monitoring data, the use of data older than five but ten or fewer years old is necessary. The use of historical data is necessary because not enough biological samples are gathered from enough locations each year to conduct a thorough assessment of aquatic life use status across the state. Owing to limited staff and budget resources, it generally takes over ten years to visit a sufficient number of assessment units and sufficiently monitor them to make aquatic life use assessments. A more complete picture of statewide aquatic life use health is presented when data are utilized based on the ten year timeframe. Since water resource quality in many watersheds in Ohio today are most susceptible to changing land use patterns that are often subtle, slow to evolve, and difficult to monitor and assess, the use of older data is justified.

Ohio's water quality standards (WQS) have seven subcategories of aquatic life uses for streams and rivers (see Ohio Administrative Code 3745-1-07, http://www.epa.ohio.gov/portals/35/rules/01-07.pdf). The WQS rule contains a narrative for each aquatic life use and the three most commonly assigned aquatic life uses have quantitative, numeric biological criteria that express the minimum acceptable level of biological performance based on three separate biological indices. These indices are the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb) for fish and the Invertebrate Community Index (ICI) for aquatic macroinvertebrates. A detailed description of Ohio EPA's biological assessment and biocriteria program including specifics on each index and how each was derived is available (see Biological Criteria for the Protection of Aquatic Life, http://www.epa.ohio.gov/dsw/bioassess/BioCriteriaProtAqLife.aspx).

Procedures established in a specially designed 1983-1984 U.S. EPA study known as the Stream Regionalization Project (Whittier et al. 1987) were used to select reference, or least impacted sites, in each of Ohio's five Level III ecoregions (Omernik 1987). Biological data from a subset of these sites in addition to supplemental data from other least impacted Ohio reference sites were used to establish the ecoregion-specific biocriteria for each aquatic life use. Note that some criteria vary according to stream size and some indices do not apply in certain circumstances. Ohio's WQS rule stipulates that "biological criteria… provide a direct measure of attainment of the warmwater habitat, exceptional warmwater habitat and modified warmwater habitat aquatic life uses" (OAC 3745-1-07(A)(6)). The numeric biological criteria based on IBI, MIwb, and ICI thresholds applicable to exceptional warmwater habitat (EWH), warmwater habitat (WWH), and modified warmwater habitat (MWH) waters are found in Table 7-15 of the WQS rule. Neither coldwater habitat (CWH) nor limited resource water (LRW) streams have numeric biological criteria at this time, so attainment status must be determined on a case-by-case basis. For sites and segments designated with these aquatic life uses, attainment status was determined by using biological data attributes (e.g., presence and abundance of coldwater

species in CWH streams) and/or interim assessment index benchmarks (LRW streams, Lake Erie lacustuaries) to assess consistency with the narrative aquatic life use definitions in the WQS.

G1.2 General Determination of Attainment Status

A biological community at an EWH, WWH, or MWH sampling site must achieve the relevant criteria for all three indices, or those available and/or applicable, in order to be in full attainment of the designated aquatic life use criteria. Partial attainment is determined if one criterion is not achieved while non-attainment results when all biological scores are less than the criteria or if poor or very poor index scores are measured in either fish or macroinvertebrate communities.

The chemical and physical data collected as part of Ohio EPA's comprehensive watershed evaluations are considered in gauging causes and sources of pollution and factor into the confirmation of impaired uses. To determine causes and sources of observed aquatic life use impairment based on biocriteria excursions, Ohio EPA relies on the most appropriate linkage and evidence from other available physical habitat and water and sediment chemistry data collected at the sampling location. These data, along with signals from the biology itself and other insights driven by the ecological setting (e.g., prevailing land use, hydrological/ climatological conditions), provide the basis to assign the most likely causes and sources. These will serve as the target parameters for future total maximum daily load (TMDL) development or regulatory program actions.

Adequate sampling is necessary to represent the aquatic life use attainment status for large river assessment units (LRAUs, each an average 32 miles in length) or watershed assessment units (WAUs, each an average 28 mi^2 in surface area); these assessment units are defined in Section G2 below and further detailed in Section J of this report. Despite Ohio EPA's significant biological sampling effort, about one-quarter of LRAUs and one-third of WAUs are precluded from this analysis because of insufficient data. While some data may be available for some of the assessment units (AUs), many have no water quality monitoring data or the scope of monitoring was judged to be too limited to adequately generate an assessment. Generally, at least two sample sites are minimally considered necessary for a WAU assessment, although under specific circumstances, a WAU may be evaluated with one site. Presently, Ohio EPA prefers that the principal investigators make informed decisions about the data relevance for a particular AU evaluation rather than institute specific guidance on minimum effort.

Recognizing the state's limited resources, one way to increase assessment unit coverage is to utilize all available relevant data. While Ohio EPA uses data from a variety of sources in its work, the data used to determine the aquatic life use status in this report were primarily collected by Ohio EPA. Some additional biological data were provided by the Ohio Department of Natural Resources (ODNR), Northeast Ohio Regional Sewer District, U.S. Geological Survey, Ohio State University, Heidelberg College, Ohio Northern University, Ohio University, Midwest Biodiversity Institute/Center for Applied Bioassessment and Biocriteria, and EnviroScience, Inc. Those interested in providing data to Ohio EPA for aquatic life use attainment status determinations must attend appropriate training provided by Ohio EPA or its designee (e.g., through the Voluntary Action Program Biocriteria Certification or Credible Data Program Level 3 Certification) and confirm competency in Ohio EPA biological sampling protocols. All data used to make attainment determinations are carefully reviewed for consistency with all Ohio EPA methods and guidance.

G2. Evaluation Method

G2.1 Rivers and Streams: Large River Assessment Units (LRAUs)

Decades of monitoring work by Ohio EPA have resulted in an extensive data set that includes recent data for 31 of the 38 large river assessment units in Ohio. The longitudinal sampling pattern (upstream to downstream and bracketing pollution sources and tributaries) used to measure fish community health, macroinvertebrate community condition and water chemistry allows WQS biocriteria attainment status to be fairly precisely estimated based on linear distances. The length of the large river deemed to be in full attainment, as described in the previous section, is divided by the total assessed length of the large river and multiplied by 100 to yield a value between 0 (no miles in attainment) and 100 (all miles in attainment). An LRAU is considered meeting its designated aquatic life use only if a score of 100 is reported. In other words, if all miles are not in full attainment of the designated aquatic life use, the entire LRAU is listed as impaired and placed in Integrated Report Category 4 or 5, depending on whether a TMDL is needed.

G2.2 Rivers and Streams: Watershed Assessment Units (WAUs)

Beginning with the 2010 IR, the aquatic life use assessment methodology defined the WAU as the U.S. Geological Survey 12-digit hydrologic unit code (HUC12) watershed, or HUC12 (1,538 HUCs averaging 28 mi^2 drainage areas), rather than the 11-digit HUC watershed (331 HUCs averaging 130 mi^2 drainage areas) used in prior Integrated Reports. Reporting on the HUC12 scale provides information on a finer scale and allows for better reporting of watershed improvements.

This dramatic reduction in assessment unit size requires consideration of what constitutes adequate sampling within each HUC12 WAU and appropriate evaluation of the sampling results. The relatively small drainage area of the HUC12 WAU requires that the sites evaluated adequately characterize the smaller watershed. For that reason, three scores will be determined for each WAU when sufficient data make this possible. A headwater assessment score that characterizes the aquatic community of the WAU 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 WAU. The wading stream score is necessary since a site between 20 mi^2 and 50 mi^2 characterizes the entire watershed upstream from the site, potentially two HUC12s, not just to the extent of the WAU 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. The table below represents this graphically.

WAU (HUC12)	**Headwater Assessment- HA (<20 mi^2)**			**Wading Assessment- WA (≥ 20 mi^2 <50 mi^2)**			**Intermediate Score (IS)**	**Principal Assessment- PA (≥ 50 mi^2 <500 mi^2)**			**WAU Score**
	Total Sites	# Sites Full	HA Score	Total Sites	# Sites Full	WA Score	$\frac{HA+WA}{2}$	Total Sites	# Sites Full	PA Score	$\frac{IS+PA}{2}$

In regard to the headwater assessment score, the smaller size of the HUC12 WAU 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 G-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 WAU.

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

Determining the wading stream and principal stream scores both involves a similar approach. The wading stream score is based on the number of wading stream sites (sites draining a watershed between 20 mi^2 and 50 mi^2) demonstrating full attainment of aquatic life use. The total number of wading stream sites in full attainment are divided by the total number of wading stream sites. 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 those sites in the WAU draining >50 mi^2.

An intermediate WAU score is calculated as the average of the headwater and wading stream scores. The overall WAU score is derived by averaging the intermediate score and the principal stream score. For HUC12s without principal streams, the intermediate stream score will represent the overall WAU 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 weighting is important in that full use or impairment within the principal streams reflects the overall condition of the much larger primary watershed. A WAU meets its aquatic life designated use only if a score of 100 is reported. In other words, if all sites are not in full attainment of the designated aquatic life use, the WAU is listed as impaired and placed in Integrated Report Category 4 or 5, depending on whether a TMDL is needed.

Additional synthesis of data was used to provide aggregate statewide statistics for Ohio's universe of assessed wading and principal streams and rivers (> 20 mi^2 drainage areas) and large rivers (> 500 mi^2 drainage areas). Baseline statistics generated from the last Integrated Report cycle (2010) were used along with the 2012 results to begin tracking trends of attainment levels across Ohio's watersheds and large rivers in an effort to quantify progress made in point and nonpoint source pollution controls and in meeting Ohio's goals of 80% full aquatic life use attainment by 2020 for assessed WAU wading and principal stream and river sites and 100% full aquatic life use attainment by 2020 for assessed LRAU miles.

G2.3 Lake Erie Nearshore, Islands, and Lacustuaries

Aquatic life use determinations are predicated on a narrative description of the aquatic community associated with the relevant use tier. In the absence of numeric criteria, the narrative expectation provides the impairment determination. In 1997, Ohio EPA completed the document *Development of Biological Indices Using Macroinvertebrates in Ohio Nearshore Waters, Harbors, and Lacustuaries of Lake Erie in Order to Evaluate Water Quality* (Lake Erie Protection Fund Grant LEPF-06-94, undated draft). In 1999, the document *Biological Criteria for the Protection of Aquatic Life: Volume IV: Fish and Macroinvertebrate Indices for Ohio's Lake Erie Nearshore Waters, Harbors, and Lacustuaries* was produced (Ohio EPA, undated draft). The data analyses in these documents, including refinement of field sampling protocols and development of assessment indices, provide a foundation to establish numeric biocriteria for aquatic life use in Lake Erie along the Ohio shoreline and in lacustuary areas. The term "lacustuary" was coined to specify the zone where Lake Erie water levels have intruded into

tributary river channels. The aquatic life use status of a lacustuary is included as part of the assessment of the tributary river.

Excluding lacustuaries, the status of the Lake Erie nearshore is evaluated with three Lake Erie assessment units: Lake Erie Western Basin Shoreline (including Maumee Bay and Sandusky Bay), Lake Erie Central Basin Shoreline, and Lake Erie Islands Shoreline. All available data were collected from the nearshore, in this case meaning areas within 100 meters of the shoreline. Status of Lake Erie AUs was determined by the percentage of sites in narrative full attainment of biological expectations and where sufficient and current biosurvey data were available. Only a very limited amount of current data is available for the 2012 Integrated Report assessment of the three Lake Erie AUs. Most past data were collected in the mid-1990s and, since significant changes appear to be ongoing in Lake Erie, these data are no longer considered meaningful or relevant.

However, Ohio EPA was awarded a Great Lakes Restoration Initiative (GLRI) grant in 2010 to develop a comprehensive Lake Erie nearshore monitoring program. This 2011-2013 project includes a strategy to design and implement a monitoring program for the Ohio Lake Erie nearshore zone (including bays, harbors and lacustuaries) that can be maintained on an annual basis. It is anticipated that future Integrated Reports will include a revised and updated assessment methodology for the Lake Erie AUs based on the results of the study.

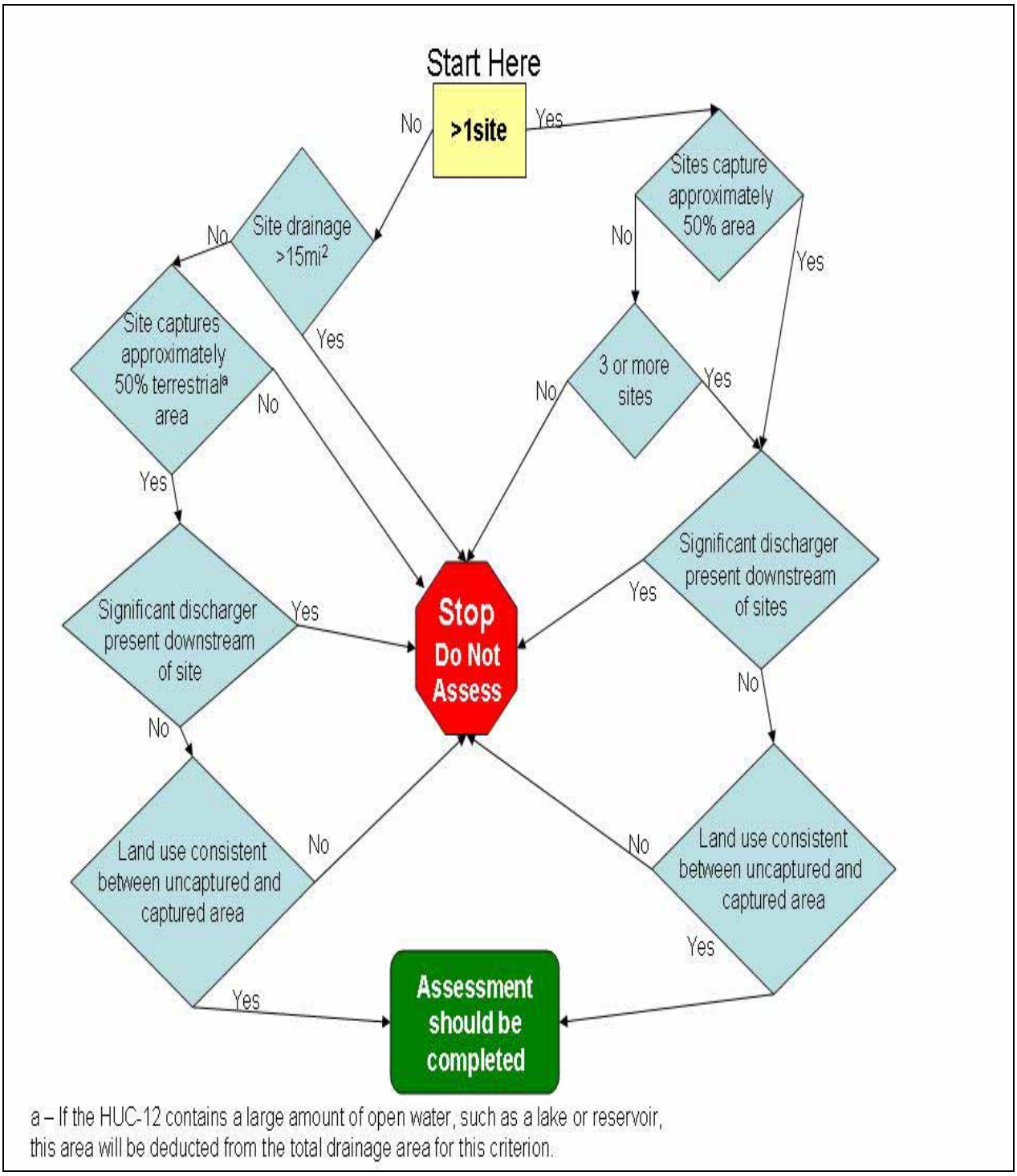

Figure G-1. Flowchart for determining if headwater assessment score can be derived based on available headwater sampling locations.

G3. Results

For the 2012 Integrated Report, new aquatic life data collected in 2009 and 2010 were incorporated into the assessment database. During this period, biosurvey data from over 800 sampling sites located in 226 HUC12 WAUs and nearly 110 sampling sites located in 11 LRAUs were available to completely or partially update previously assessed AUs or provide new assessments for AUs with unknown aquatic life status. Additionally, in the transition to using HUC12 watersheds as the basic assessment unit, 415 HUC12 watersheds were re-assessed based on data collected from 2001-2004. All data were collected by the Ohio EPA or Level 3 Qualified Data Collector external sources. Watersheds intensively monitored during 2009 and 2010 include the lower Sandusky River, Sandusky Bay tributaries, Killbuck Creek, central Ohio River tributaries (Captina Creek, Sunfish Creek, McMahon Creek, Cross Creek, Short Creek, and Wheeling Creek subwatersheds), upper Scioto River, middle Scioto River, middle Great Miami River, lower Great Miami River, southeast Ohio River tributaries (Pine Creek, Ice Creek, and Little Scioto River subwatersheds), upper Muskingum River/Walhonding River tributaries, Ottawa River (near Lima), and Sandy Creek basins. Large rivers intensively sampled included the Sandusky River (2 LRAUs), Cuyahoga River (1 LRAU), Scioto River (2 LRAUs), and Great Miami River (3 LRAUs) with an additional 3 LRAUs (Mahoning River, Muskingum River, and Stillwater River) revised based on a lesser amount of new data that were used to update portions of each assessment unit. Detailed watershed survey reports for many of the basins mentioned above are or will be available from the Ohio EPA Division of Surface Water (see Biological and Water Quality Report Index, http://www.epa.ohio.gov/dsw/document_index/psdindx.aspx).

A further examination of individual AUs was made to determine status changes caused by site data collected during 1999 and 2000 that now exceed the 10-year data threshold and have become "historical" since the 2010 Integrated Report. From this examination, it was determined that data from 63 HUC12 WAUs and 1 LRAU (Auglaize River) were now insufficient to provide adequate spatial coverage either due to (1) all data being age restricted, or (2) enough of the data are age restricted that the number of sites fell below the minimum needed to assess. These AUs are not being delisted if currently Category 5.

Summarized 2012 Integrated Report statistics for aquatic life assessments for large river, watershed, and Lake Erie AUs as well as the comparable statistics from the 2002-2010 Integrated Reports are tabulated in Table G-1. More detailed aquatic life use results and statistics for all 2012 AUs are provided at Ohio EPA web pages which can be accessed as follows.

LRAUs:	http://wwwapp.epa.ohio.gov/dsw/ir2012/lrau_list.php
WAUs:	http://wwwapp.epa.ohio.gov/dsw/ir2012/basin.php
Lake Erie AUs –	
Western Basin Shoreline:	http://wwwapp.epa.ohio.gov/dsw/ir2012/leau001.html
Central Basin Shoreline:	http://wwwapp.epa.ohio.gov/dsw/ir2012/leau002.html
Lake Erie Islands Shoreline:	http://wwwapp.epa.ohio.gov/dsw/ir2012/leau003.html

Detailed site information for many recent major basin monitoring and assessment projects, including summarized biological monitoring results, habitat quality scores, and raw chemical water quality data, can be accessed via interactive GIS maps linked at the following web site: http://www.epa.ohio.gov/dsw/gis/index.aspx.

G3.1 Large River Units

Large river assessment units in Ohio (38 AUs spanning 23 rivers with watersheds in excess of 500 square miles and totaling 1,227 river miles) reflected a slight decline in percent of monitored miles in full attainment compared to the same statistic reported in the 2010 IR (Table G-1, Figure G-2). Based on monitoring through 2010, the full attainment statistic now stands at 89.0% (793 of 852 assessed LRAU miles). The slight decline in full attainment across LRAUs between the 2010 and 2012 IR cycles (93.1% to 89.0%) is largely because of new intensive assessments of the following rivers:

- Sandusky River, 2009: 68% full attainment over 66 miles (2 LRAUs)
- Cuyahoga River, 2010: 77% full attainment over 24 miles
- Scioto River (middle), 2009/2010: 85% full attainment over 64 miles (2 LRAUs)
- Great Miami River (lower), 2009/2010: 80% full attainment over 81 miles (2 LRAUs)

Also contributing to the slight decline was the fact that the Auglaize River LRAU assessment was excluded because available data exceeded 10 years in age and were considered historical. While a relatively small LRAU (approximately 13 miles in length), historical sampling in 2000 documented full aquatic life use attainment.

If the most recent data from all 38 LRAUs are used (including those from the historical LRAUs covering the Auglaize River, Maumee River, Tiffin River, Wills Creek, and Raccoon Creek), irrespective of age of data, the full attainment statistic stands at 79.9% full attainment for over 1,179 monitored miles (Figure G-2, far right bar).

Progress towards the “100% by 2020” aquatic life use goal for Ohio’s large rivers is depicted in Figure G-2. Between 2002 and 2012, the percentage of large river miles in full attainment has increased from 62.5% to 89.0%. Success in approaching the 100% full attainment threshold for all large river miles by 2020 will be dependent on continued resources allocated to monitoring LRAUs with an emphasis on those which are currently listed in the “historical data” category and those which will become historical between now and 2018 (the last year of data to be included in the 2020 goal assessment).

G3.2 Watershed Units

For the 2012 IR, the average HUC12 WAU score reflected a positive, but relatively minor, increase from the corresponding score reported in the 2010 IR (Table G-1, Figure G-3). Based on monitoring through 2010, the average HUC12 WAU score stands at 57.7, a 1.0 point increase from the 2010 IR. Included in Table G-1 and depicted in Figure G-3 is the corresponding average score based on the old HUC11 WAUs, which were tracked from 2002 through 2010 and were used to gage the progress of the “80 by 2010” aquatic life use goal (see Section B3 of the 2010 IR for details on final reporting of the 2010 goal). Table G-2 depicts the breakdown of site full attainment based on the watershed size category used to determine an individual watershed’s score based on available sites in the HUC12 WAU. As in previous reports, the results show that biological impairment is more likely at sites on small streams (nearly 1 in 2 sites are impaired) and that impairment lessens significantly as sites drain larger areas. This phenomenon correlates well with the most widespread causes associated with the aquatic life impairment in these watersheds.

Table G-3 lists the top five aquatic life use impairment causes for the period 2001 through 2010. For this time period, principal causes for HUC12 WAU impairments were those primarily related

to landscape modification issues involving agricultural land use and urban development. These types of impairments would be most manifest in smaller streams, a fact backed up by the numbers presented in Table G-2. It is important to note that between 36% and 60% of assessed HUC12 WAUs had at least one monitored site impaired by one of these individual causes and many WAUs had several sites affected by three or more of the five causes listed as responsible for the aquatic life use impairment. This would not be an unusual situation given the frequently close association between these impairment causes (e.g., nutrients, sedimentation/siltation, habitat modifications, and hydromodifications in rural/agricultural landscapes relying on channelization and field tiles for drainage). Also of note is the prevalence of HUC12 WAUs and LRAUs which are impaired by the generic organic enrichment/dissolved oxygen (DO) cause category; 52% of impaired WAUs show "sewage" related impairments such as high biochemical oxygen demand, elevated ammonia concentrations, and/or in-stream sewage solids deposition. Thirteen of 19 impaired LRAUs also note sewage related causes. These are higher percentages than in past IRs that tracked these cause statistics, which suggests that adequate treatment and disposal of human and animal wastes via wastewater treatment plants, home sewage treatment systems, and land applications of septage and animal manure are becoming more critical water quality issues in many Ohio watersheds.

Progress towards the new "80% by 2020" aquatic life use goal for Ohio's wading and principal stream and river sites (those monitored sites draining watersheds between 20 and 500 square miles) is depicted in Figure G-4. Contrasted with the 2010 IR statistic, when the 2020 goal benchmark was established, the percentage of qualifying sites in full attainment essentially remained unchanged with an increase from 61.4% to 61.6%. If this rate of change remains consistent over the next eight years, the statistic will not reach the goal by the time the 2020 IR is produced. It is readily apparent that more proactive implementation of watershed recommendations in TMDL reports and watershed action plans (WAPs) will be needed to recover impaired aquatic communities and protect those currently meeting aquatic life expectations in order to approach the 80% goal. It will also be critical that resources be directed to follow-up monitoring in areas with implemented restoration and protection projects so that success of efforts can be documented and reflected in future goal statistics. This latter effort is just beginning in survey areas with TMDLs approved and implemented beginning in the late 1990s and is an ongoing activity in support of the Ohio EPA Nonpoint Source Program.

G3.3 Lake Erie Units

Between the 2010 IR and 2012 IR, significant changes occurred in the aquatic life use status of all three Lake Erie assessment units because nearly one-third of the available data used in the 2010 IR are now considered historical. Data from sampling at 11 sites in 1999 and 2000 were excluded in the assessment for the 2012 IR. Only data collected in 2001 and 2002 at 23 sites remain available for assessment purposes (Table G-1). All three AUs remain Category 5 with significant impairment of sites due primarily to tributary loadings of nutrients and sediment, exacerbated by continued trophic disruptions caused by the proliferation of exotic species and blue-green algae blooms.

Of note for future Lake Erie assessments will be the collection of nearshore data for the National Aquatic Resource Survey (NARS) of coastal waters of the United States (the National Coastal Assessment - NCA) which was conducted during the summer of 2010. Fifty sites were randomly selected along the U.S. Lake Erie nearshore including 16 Ohio and Michigan sites in the Western Basin (including two each in Maumee Bay and Sandusky Bay and one site on the Lake Erie Islands shoreline) and 17 Ohio and Pennsylvania sites in the Central Basin. Coordinated by U.S. EPA in collaboration with Great Lake states, these one-visit snapshots of

lake water quality will be used to provide statistically valid national and regional assessments of Great Lakes resource condition. The NCA assessment is scheduled to be repeated in 2015. Additional information and 2010 NCA results, when available, can be found at the U.S. EPA NARS website (see National Aquatic Resource Surveys, http://www.epa.gov/OWOW/monitoring/nationalsurveys.html).

As mentioned above, little physical, chemical or biological monitoring data are being collected in the Lake Erie nearshore area, bays or harbors. A project to implement such a monitoring program is underway funded by the recently-enacted federal Great Lakes Restoration Initiative. This is a collaborative effort between state agencies (Ohio EPA and ODNR) and major universities with Lake Erie basin research interests and expertise (Ohio State University-Sea Grant, University of Toledo and Heidelberg University). Physical, chemical, and biological parameters to be monitored from 2011-2013 will provide data to support long-term trend analysis, establish background conditions in selected areas, and conduct sampling related to the impacts of projects implemented in tributaries of the Lake Erie watershed. Data will be used to monitor the progress of implementation projects in Areas of Concern (AOCs) to restore beneficial uses, track implementation of WAPs, develop TMDLs for pollutants impairing beneficial uses, support Balanced Growth Initiative actions on the nearshore, and provide updated information for Integrated Reports, Lake Erie quality index updates, and updates to the Lake Erie Lakewide Management Plan (LaMP). More information about the Great Lakes Restoration Initiative and projects which have been proposed can be found at the Ohio Lake Erie Commission Web site (see Great Lakes Restoration Initiative, http://www.lakeerie.ohio.gov/GLRI.aspx).

Table G-1. Summary of aquatic life use assessment for Ohio's watershed[1], large river, and Lake Erie assessment units: 2002-2012 Integrated Report cycles.

IR Cycle	2002 (1991-2000)	2004 (1993-2002)	2006 (1995-2004)	2008 (1997-2006)	2010 (1999-2008)	2012 (2001-2010)
HUC11 Watershed AUs (331)						
No. AUs Assessed (% total)	224 (68%)	225 (68%)	212 (64%)	218 (66%)	221 (67%)	-
No. Sites Assessed	3272	3620	3785	4030	4200	-
Average AU Scores						
Full Attainment	**46.6**	**48.3**	**52.5**	**54.7**	**58.5**	**-**
Partial Attainment	25.2	23.6	22.6	22.4	21.2	-
Non-Attainment	28.2	28.1	24.9	22.9	20.3	-
HUC12 Watershed AUs (1538)						
No. AUs Assessed (% total)[2]	-	-	-	-	999 (65%)	908 (59%)
No. Sites Assessed	-	-	-	-	4200	3867
Average AU Score[3]	-	-	-	-	**56.7**	**57.7**
% Sites Full Attainment	-	-	-	-	55.1	57.0
% Sites Partial Attainment	-	-	-	-	20.0	21.6
% Sites Non-Attainment	-	-	-	-	24.9	21.4
Large River AUs (23 rivers/38 AUs totaling 1227.14 Miles)						
No. Rivers (AUs) Assessed	22	21	17	16	18 (30)	18 (31)
No. Sites Assessed	422	425	374	278	265	312
No. Miles Assessed (% miles)	905 (70%)	918 (71%)	873 (68%)	850 (66%)	852 (69%)	984 (80%)
% Miles Full Attainment	**62.5**	**64.0**	**76.8**	**78.7**	**93.1**	**89.0**
% Miles Partial Attainment	23.0	21.4	15.1	13.9	5.5	7.5
% Miles Non-Attainment	14.5	14.6	8.1	7.4	1.4	3.5
Lake Erie AUs (3)						
No. AUs Assessed	3	3	3	3	3	3
No. Sites Assessed	92	111	93	49	34	23
% Sites Full Attainment	**12.0**	**18.0**	**19.4**	**10.2**	**14.7**	**30.4**
% Sites Partial Attainment	13.0	14.4	16.1	22.4	17.7	30.4
% Sites Non-Attainment	75.0	67.6	64.5	67.4	67.6	39.2

[1] WAUs for the IR 2002-2010 cycles were based on HUC11s; WAUs transitioned to HUC12s for the IR 2010 and 2012 cycles.

[2] 2010 statistics based on direct assessment of HUC12 AUs with data collected between 2005 and 2008 (n=545) and HUC11 extrapolated assessment of HUC12 AUs with data collected between 1998 and 2004 (n=454). 2012 assessments based on direct assessment of HUC12 AUs with data collected between 2001 and 2010 (n=908).

[3] Statistic based on the average of available AU scores with current data, derived as explained in Section G2.2.

Table G-2. Breakdown by size category of sites in full attainment in monitored watershed assessment units (908 HUC12s) based on data collected from 2001-2010.

Watershed Size Category (mi^2)	Number of Sites	Number of Sites in Full Attainment (%)
0-20 (headwater)	2,343	1,212 (51.7)
20-50 (wading)	601	341 (56.7)
50-500 (principal)	923	598 (64.8)

Table G-3. Prevalence of the top five causes of aquatic life impairment in watershed and large river assessment units based on biological and water quality survey data collected from 2001-2010.

Assessment Unit (AU)	#	Number & Percentage of Monitored AUs with Impaired Aquatic Life Use Listed with a Top Five Cause of Impairment[1]				
		Siltation/ Sedimentation	Nutrients	Habitat Modification	Hydromodification	Organic Enrichment/ Dissolved Oxygen
Watershed	**1,538**					
Monitored 2001-2010	908	373 (58%)	377 (60%)	280 (45%)	226 (36%)	324 (52%)
Impaired aquatic life use	628					
No impairment	280					
Large River	**38**					
Monitored 2001-2010	31	4 (21%)	7 (37%)	10 (53%)	4 (21%)	13 (68%)
Impaired aquatic life use	19					
No impairment	12					

[1] Listed as an aquatic life use impairment cause for at least one stream within the watershed AU or one reach within the large river AU.

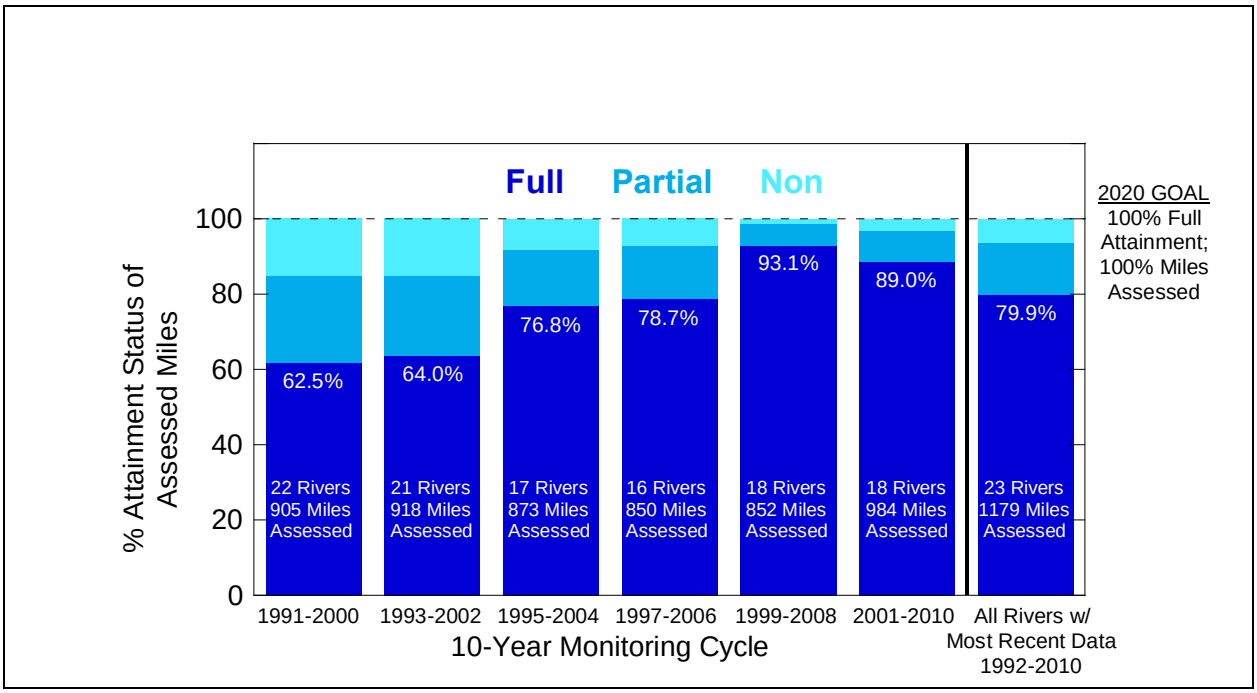

Figure G-2. Percent attainment status and goal progress ("100% by 2020") for assessed miles of Ohio's large river assessment units (23 rivers/38 AUs/1227.14 miles total).
Note: Data compiled over the last six 10-year Integrated Report cycles with the current 2012 cycle including data collected from 2001-2010. Bar on far right reflects the most current attainment status of all large rivers (96% of all large river miles) irrespective of age of data.

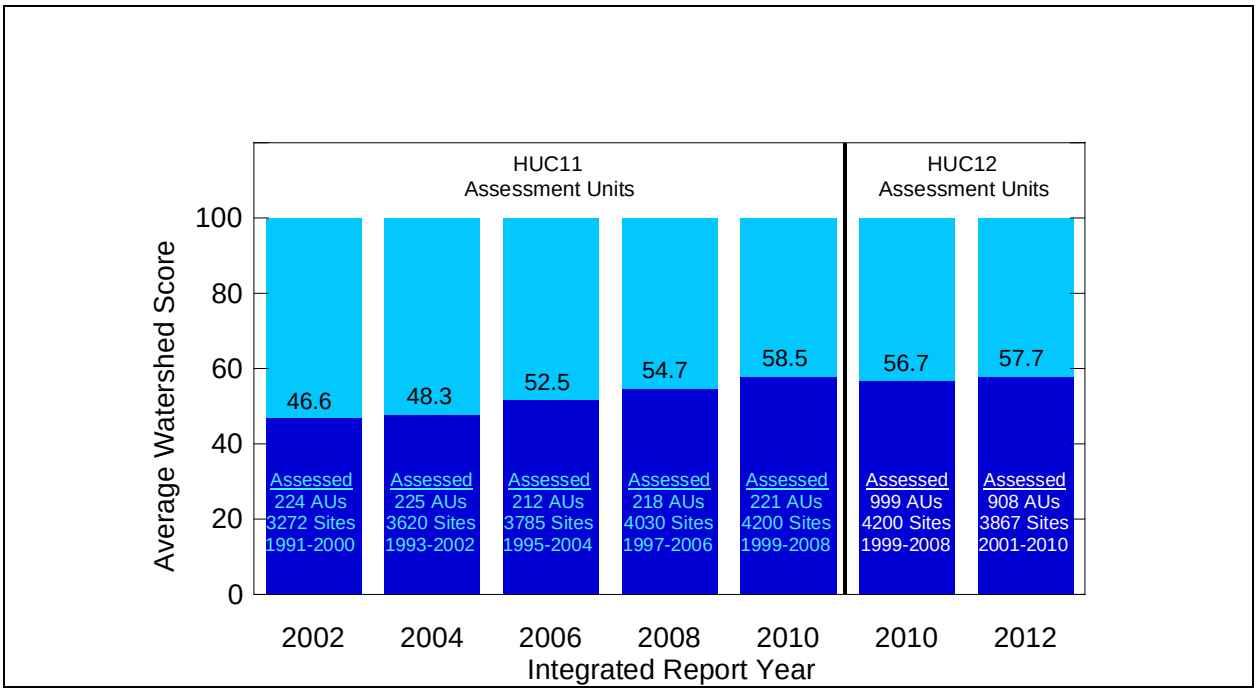

Figure G-3. Average full attainment watershed score for Ohio's HUC11 watershed assessment units (IR cycles 2002-2010) and HUC12 watershed assessment units (IR cycles 2010-2012).
Note: Data compiled over the last six 10-year Integrated Report cycles with the current 2012 cycle including data collected from 2001-2010.

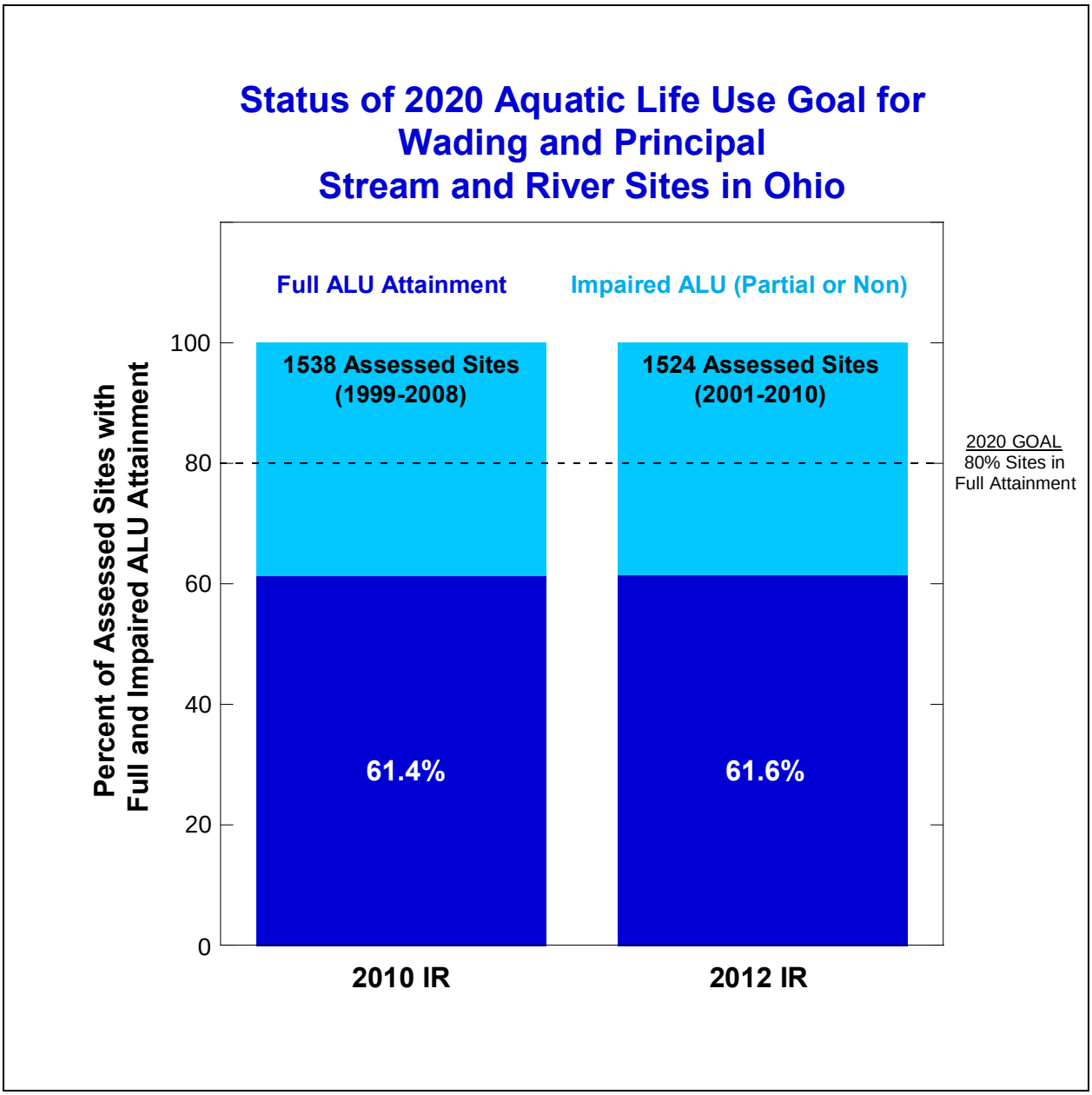

Figure G-4. Status and trend of aquatic life use "80% by 2020" goal for wading and principal stream and river sites in Ohio based on the last two Integrated Report cycles.